United States Environmental Protection Agency
Office of Water (4503F)
EPA 841-R-96-002
June 1996

Environmental Indicators of Water Quality in the United States

This report describes water quality in the United States using a set of 18 environmental indicators that measure progress toward national water goals and objectives.

The indicators were chosen through an intensive multi-year process involving public and private partners including EPA's Office of Water in collaboration with the Center for Marine Conservation; the Centers for Disease Control and Prevention; EPA's Office of Policy, Planning, and Evaluation and Office of Research and Development; the Intergovernmental Task Force on Monitoring Water Quality; Native American Tribes; the National Oceanic and Atmospheric Administration; The Nature Conservancy; the States; the U.S. Department of Agriculture; the U.S. Fish and Wildlife Service; and the U.S. Geological Survey.

Environmental Indicators of Water Quality in the United States

JUNE 1996

National Environmental Goals for Water

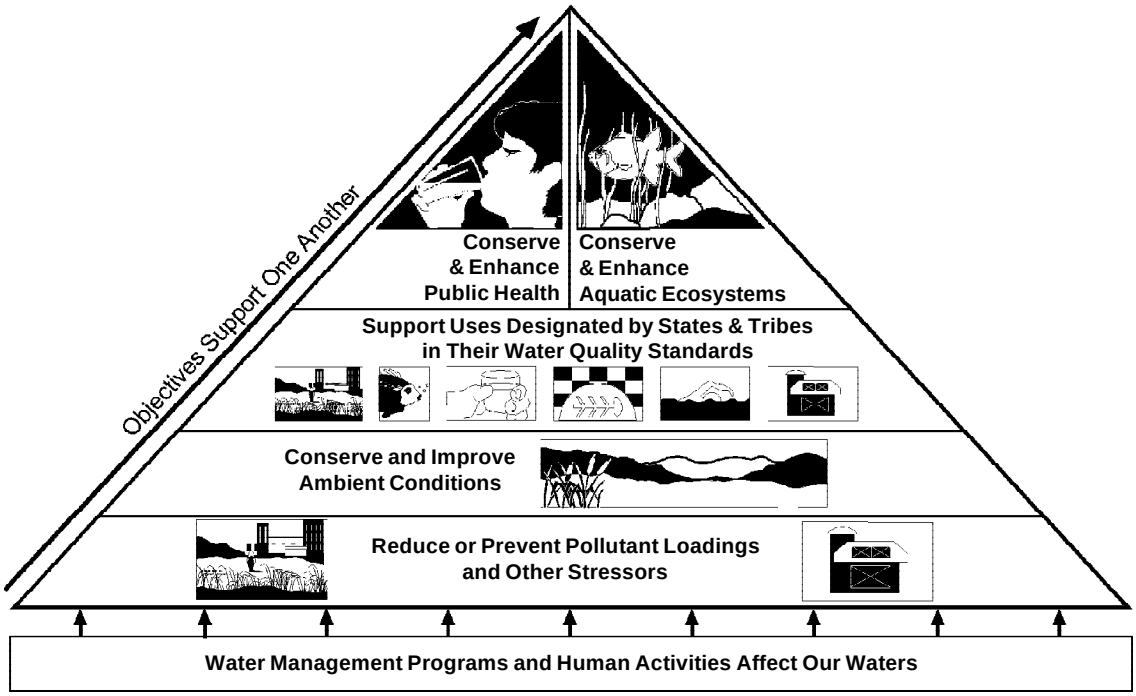
CLEAN WATERS: America's rivers, lakes, and coastal waters will support healthy communities of fish, plants, and other aquatic life, and will support uses such as fishing, swimming, and drinking water supply for people. Wetlands will be protected and rehabilitated to provide wildlife habitat, reduce floods, and improve water quality. Ground waters will be cleaner for drinking and other beneficial uses.

SAFE DRINKING WATER: Every American public water system will provide water that is consistently safe to drink.

Note: Goals taken from *Environmental Goals for America With Milestones for 2005: A Proposal from the Environmental Protection Agency.* Government Review Draft. EPA 230-D-96-002. Washington, DC: USEPA. In press.

Water Objectives to Meet These Goals

Objectives are measured by indicators presented in this report



The objectives adopted by EPA's Office of Water and its partners are shown above. These objectives are like building blocks in a pyramid, where success in reaching the goals at the top is dependent on successful attainment of those lower in the pyramid. For example, by reducing pollutant loads to waters, the overall quality, or ambient condition, of the water and sediment is improved. Consequently, the waters can support the uses designated for them by states and tribes in their water quality standards. Ultimately, the health of both the general public and aquatic ecosystems is protected.

Indicator Data Completeness

Indicators are used to show changes in environmental conditions and are only as good as the quality of the measurements that support them. The indicators presented in this report contain measurements of varying quality. These measurements might differ in precision, accuracy, statistical representativeness, and completeness. This comprehensive national report uses data from many agencies. While these data sources have undergone data quality assessment by their respective agencies, this first national report makes no attempt to describe data quality attributes other than completeness for the indicators. This report includes data of varying quality for two reasons: (1) the indicator describes an important, if as yet imperfect, way to measure a national objective, and (2) efforts are under way to improve indicator measurements in future reports. Further details on the data used to support each indicator are presented in individual fact sheets available from EPA in hard copy or on the Internet at the address at the end of this report . Each indicator graphic in this report shows the level of data completeness using the following symbols:

- ● Data consistent/sufficient data collected
- W Data somewhat consistent/additional data needed
- ○ Data need to be much more consistent/much additional data needed

Water Quality Objectives and Indicators

Objective I: Conserve and Enhance Public Health

1. *Population served by community drinking water systems violating health-based requirements*—Population served by drinking water systems with one or more violations of health-based requirements.
2. *Population served by unfiltered surface water systems at risk from microbiological pollution*—Population served by, and number of, systems that have not met the requirements to filter their water to remove microbiological contaminants.
3. *Population served by drinking water systems exceeding lead action levels*—Population served by, and number of, systems with lead levels in drinking water exceeding the regulatory threshold.
4. *Source water protection*—Number of community drinking water systems using ground water that have programs to protect them from pollution.
5. *Fish consumption advisories*—Percentage of rivers and lakes with fish that states have determined should not be eaten, or should be eaten in only limited quantities.
6. *Shellfish growing water classification*—Percentage of estuarine and coastal shellfish growing waters approved for harvest for human consumption.

Objective II: Conserve and Enhance Aquatic Ecosystems

7. *Biological integrity*—Percentage of rivers and estuaries with healthy aquatic communities.
8. *Species at risk*—Percentage of aquatic and wetland species currently at risk of extinction.
9. *Wetland acreage*—Rate of wetland acreage loss.

Objective III: Support Uses Designated by the States and Tribes in Their Water Quality Standards

10. *Designated uses in state and tribal water quality standards*
    a. *Drinking water supply designated use*—Percentage of assessed waterbodies that can support safe drinking water supply use, as designated by the states and tribes.
    b. *Fish and shellfish consumption designated use*—Percentage of assessed waterbodies that can support fish and shellfish consumption, as designated by the states and tribes.
    c. *Recreation designated use*—Percentage of assessed waterbodies that can support safe recreation, as designated by the states and tribes.
    d. *Aquatic life designated use*—Percentage of assessed waterbodies that can support healthy aquatic life, as designated by the states and tribes.

Objective IV: Conserve and Improve Ambient Conditions

11. *Ground water pollutants*—Population exposed to nitrate in drinking water. In the future, the indicator will report the presence of other chemical pollutants in ground water.
12. *Surface water pollutants*—Trends of selected pollutants found in surface water.
13. *Selected coastal surface water pollutants in shellfish*—The concentration levels of selected pollutants in oysters and mussels.
14. *Estuarine eutrophication conditions*—Trends in estuarine eutrophication conditions.
15. *Contaminated sediments*—Percentage of sites with sediment contamination that might pose a risk to humans and aquatic life.

Objective V: Reduce or Prevent Pollutant Loadings and Other Stressors

16. *Selected point source loadings to (a) surface water and (b) ground water*—Trends for selected pollutants discharged from point sources into surface water, and underground injection control wells that are sources of point source loadings into ground water.
17. *Nonpoint source loadings to surface water*—Amount of soil eroded from cropland that could run into surface waters. Future reports will include additional nonpoint source surface water pollutants as well as sources of nonpoint source ground water pollution.
18. *Marine debris*—Trends and sources of debris monitored in the marine environment.

I. Introduction

Our waters are one of our most valuable resources. They support human, plant, and animal life and the natural environment; promote economic opportunity; and provide beauty and enjoyment to us all.

The U.S. Environmental Protection Agency (EPA), working with other federal, state, tribal, regional, local, and nongovernmental groups, has proposed **national goals** for many aspects of environmental protection. These goals include Clean Waters and Safe Drinking Water. To check our progress toward the national goals, EPA developed a series of **milestones** for each goal that set a 10-year target to be reached by the year 2005. In addition, EPA's Office of Water and its partners have adopted five **objectives** for meeting the Clean Waters and Safe Drinking Water national goals and have developed a series of **indicators** to measure progress toward those objectives. The relationship among goals, milestones, objectives, and indicators is explained in Figure 1.

This report describes the indicators EPA and its partners have chosen to measure progress toward water quality objectives. The EPA-proposed national goals and milestones are described in detail in a separate report. This report is the first in a series that, taken together, will show trends over time. For some indicators, the data presented here currently provide a baseline for trends. For other indicators, improvements in data are needed to provide a baseline for trends in future reports. By documenting water quality status and trends, EPA will be able to determine whether national water programs are meeting their objectives and to adjust management strategies accordingly. This report will also provide the public with a better understanding of the condition of our waters, whether they meet the uses we wish to make of them, and what affects their quality.

Many people at all levels of government have been working together to choose and describe the indicators. In addition to EPA data, specific data from states, Native American tribes, the Centers for Disease Control and Prevention, the Center for Marine Conservation, The Nature Conservancy (TNC), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of Agriculture (USDA), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Geological Survey (USGS) are included. Many others were also integral to the development of the indicators through a series of public meetings and review comments.

The indicators in this first national report will improve if a strong partnership is maintained among the agencies working together to report water quality trends over time.

FIGURE 1 : Relationship of Water Quality Goals, Objectives, Milestones, and Indicators

National Goals : A set of 12 national environmental goals with supporting milestones is proposed by EPA in the draft report *Environmental Goals for America With Milestones for 2005: A Proposal from the United States Environmental Protection Agency*. Two of the goals from this report relate specifically to water:

(1) Safe Drinking Water - Every American public water system will provide water that is consistently safe to drink.

(2) Clean Waters - America's rivers, lakes, and coastal waters will support healthy communities of fish, plants, and other aquatic life, and will support uses such as fishing, swimming, and drinking water supply for people. Wetlands will be protected and rehabilitated to provide wildlife habitat, reduce floods, and improve water quality. Ground waters will be cleaner for drinking and other beneficial uses.

Milestones: EPA is proposing milestones as 10-year targets in its national goals report. They express how far the Nation will have progressed toward the national goals by the year 2005, starting from the baseline year of 1995. Each Clean Waters and Safe Drinking Water milestone uses a water quality indicator to measure progress toward the 2005 target. Most of the indicators have a related milestone in the national goals report.

Water Objectives : The Office of Water and its partners have adopted five water quality objectives that further specify how to meet the national goals. The objectives are to (1) conserve and enhance public health; (2) conserve and enhance ecosystems; (3) support uses designated by the states and tribes in their water quality standards; (4) conserve and improve ambient conditions; and (5) prevent or reduce pollutant loadings and other stressors.

Indicators : Indicators measure progress toward water quality goals, milestones, and objectives. Indicators provide information on environmental and ecosystem quality or give reliable evidence of trends in quality.

Environmental Indicators

Understanding the condition of our nation's water resources, identifying what causes problems, and determining how to solve these problems are essential but difficult undertakings. The natural water cycle is itself intricate, and the addition of human activities increases this complexity. Consequently, answering the basic question "How clean and safe is our water?" is not easy.

One way to present the condition of our water resources and the impacts of related human activities is to develop understandable measures, or indicators, that singly or in combination provide information on water quality. Managers and scientists can then use this information to develop effective solutions and make sound decisions to protect our water resources. In addition, all Americans can use this information to better understand the condition of our waters. It is important to note that environmental indicators can be used to measure a variety of phenomena. Indicators can present information on status or trends in the state of the environment, can measure pressures or stressors that degrade environmental quality, and can evaluate society's responses aimed at improving environmental conditions. The first two types of indicators (state of the environment and pressure) deal with information most closely associated with environmental results. The third type measures program and policy responses to environmental problems and is primarily administrative.

While all three types of indicators are valuable for measuring progress toward goals, this report concentrates on the actual condition of our water resources. Thus, the indicators presented are predominately state of the environment and pressure indicators. Societal responses to environmental problems are summarized in this report and included in the accompanying indicator fact sheets.

This report describes our nation's water resources, human activities and natural events and their effect on water quality, and the indicators that will be used to measure progress toward goals and objectives.

II. Water Resources

Water resources in the United States take many forms—running freely as rivers and streams; washing against coastlines and into estuaries; pooling as lakes, reservoirs, and wetlands; and moving under the land as ground water. We use these waters for many different purposes, including drinking, swimming, fishing, agriculture, and industry. Water resources are affected by many activities, both natural, such as rain, and human, such as water withdrawal and urbanization. Following is a brief description of our water resources and events that affect them.

Rivers and Streams

There are 3.5 million miles of rivers and streams in the country. About one-third of these flow all the time, and two-thirds flow only periodically and are dry during a portion of the year. Figure 2 shows selected major U.S. river systems. Rivers and streams supply water for drinking, agriculture, industrial processes, and irrigation and support aquatic habitats, fishing, and recreation. Rivers and streams are impacted by pollution discharged directly into the water, as well as by pollution generated by activities occurring on land, which rainwater or snowmelt carries into these waterways in the form of runoff.

FIGURE 2: Selected Major Rivers of the United States

Source: U.S. EPA

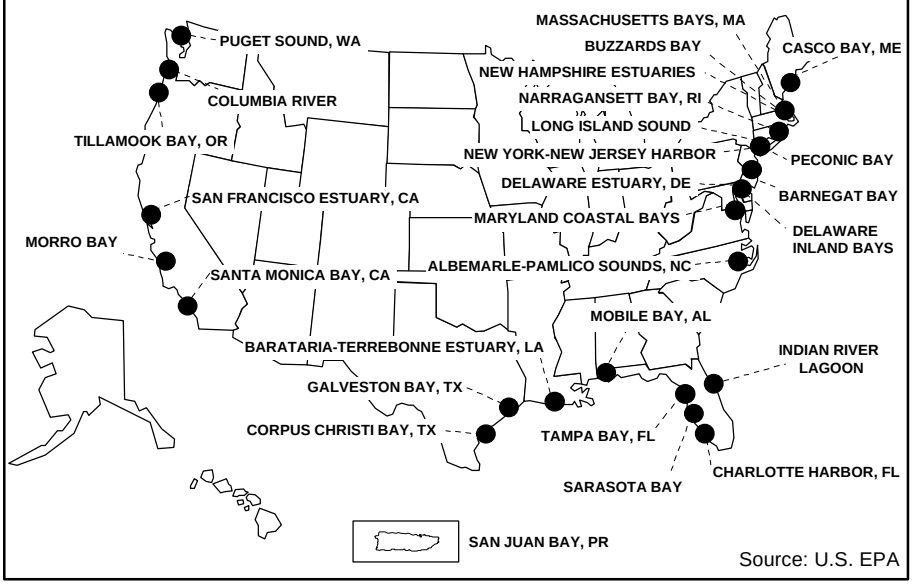
Lakes and Reservoirs

There are 41 million acres of lakes and reservoirs in the country. Lakes and reservoirs support the same uses as rivers and streams and are affected by the same types of pollution. These impacts, however, can be more severe because lakes and reservoirs do not have the natural flushing process characteristic of flowing streams and rivers.

Estuaries

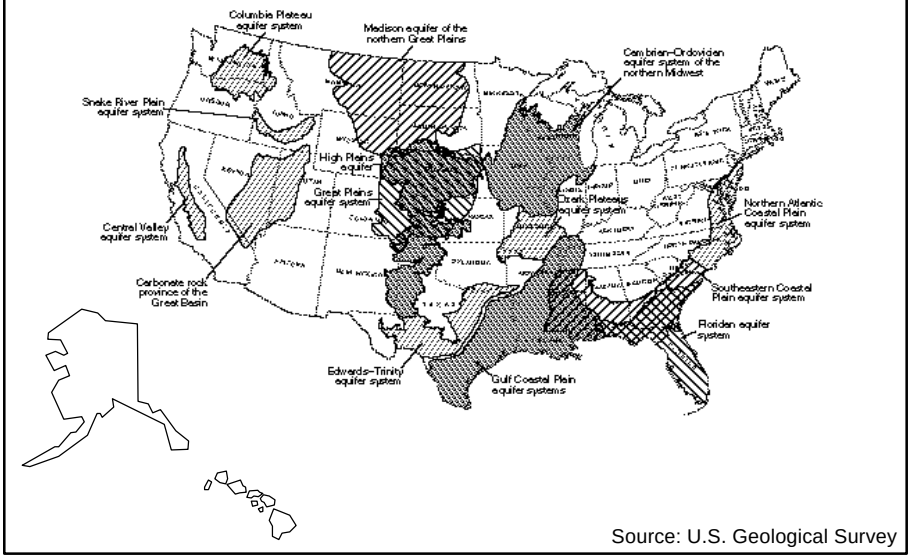
Estuaries are coastal waters where the tides mix fresh river water with ocean salt water. For example, the Chesapeake Bay is a large estuary that receives freshwater flow from several rivers in Virginia and Maryland and connects with the Atlantic Ocean. There are many other smaller estuaries all along the coastline of the United States—in total, over 34,000 square miles of estuaries. Estuaries are noted for their unique aquatic habitats, as well as for the fishing, shellfishing, and other recreational and economic opportunities they provide. Estuaries are in increasing danger of pollution considering that almost half the U.S. population now lives in coastal areas, many on estuaries. Figure 3 shows the location of the estuaries identified by EPA and states under the National Estuary Program (NEP). An NEP designation recognizes the national significance of these estuaries and initiates a consensus- based, comprehensive management process to protect these resources.

FIGURE 3: Estuaries Designated by EPA and States Under the National Estuary Program



Source: U.S. EPA

FIGURE 4: Principal Ground Water Aquifers of the United States



Source: U.S. Geological Survey

Ground Water

Because ground water flows beneath the earth's surface, it is hard to map the aquifers in which it resides or to know the overall quality of ground water in the United States. Figure 4 shows the estimated location of the principal ground water aquifers of the United States. Ground water flows are usually slower than surface waters and are replenished by interaction with streams, rivers, and wetlands and by precipitation that seeps through the soil. Ground water also can replenish other waterbodies by maintaining base flow to streams, rivers, and wetlands. Ground water provides almost

one-fourth of all water used in the country, serving agricultural, industrial, and drinking water needs. Waste disposal, contaminated runoff, and polluted surface waters can degrade ground water quality.

Wetlands

Wetlands include swamps, marshes, tundra, bogs, and other areas that are saturated with water for varying periods of time. Under normal circumstances, these areas support plants specifically adapted to saturated conditions. Seeping water from wetlands can recharge ground water supplies. Unaltered wetlands in a floodplain can reduce flooding. The natural water filtration and sediment control capabilities of wetlands help maintain surface and ground water quality. More than 200 million acres of wetlands existed in the lower 48 states during colonial times. Less than half remain today, however, largely due to conversion to agricultural, urban, or suburban land. Wetland water quality can be impacted by many of the same sources that affect other surface water resources.

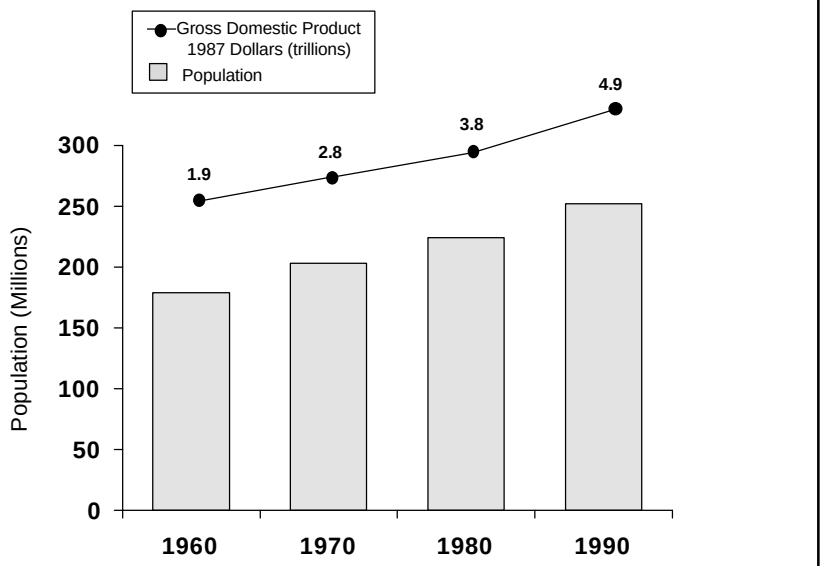
III. Human Activities and Their Effect on Water Quality

Human activities have a profound effect on our water resources. The population in the United States has grown from approximately 30 million in 1860 to 260 million in 1990. At the same time, the U.S. economy has expanded. Figure 5 shows both population and economic growth over the last four decades. Although economic growth can occur hand-in-hand with environmental protection and restoration, it can alter both our land and water. As a result, it is important that we work to understand these effects in order to capitalize on beneficial changes and prevent or minimize harmful ones.

Urbanization, dams, forestry practices, and agricultural development all impact the quality of our waters. Rainfall and snowmelt runoff from urban areas—those areas dominated by paved roads, parking lots, rooftops, and other similar impervious surfaces where pollution collects—can alter stream characteristics and habitats, increase pollutant loads and water temperature, and reduce the diversity of aquatic life. As the percentage of imperviousness in an area increases, the quality of adjacent or receiving waterbodies decreases. Highly developed commercial and business districts are estimated to be 85 percent impervious, while even our least developed urban areas—suburban residential districts with 1-acre lots—are considered to be about 20 percent impervious. Distinct water quality problems are observed at relatively low levels of imperviousness (10 to 20 percent).

Similarly, agriculture and forestry practices can lead to water quality problems. Clear-cutting forests and removing streambank vegetation result in increased erosion rates, as well as more severe and frequent flooding, as the natural runoff storage capacity in vegetation, wetlands, and soil is reduced. Figure 6, from the U.S. Department of Agriculture's National Resources Inventory, depicts the amount of surface area in the United States that is developed land (urban), agricultural land, forest land, or a mix of these uses, and federal land. Each land use type results in different im-

FIGURE 5: U.S. Population and Economic Growth 1960 - 1990



Source: U.S. Census and U.S. Department of Commerce

pacts that must be addressed by appropriate federal, state, tribal, local, and individual efforts to improve and conserve the quality of our waters.

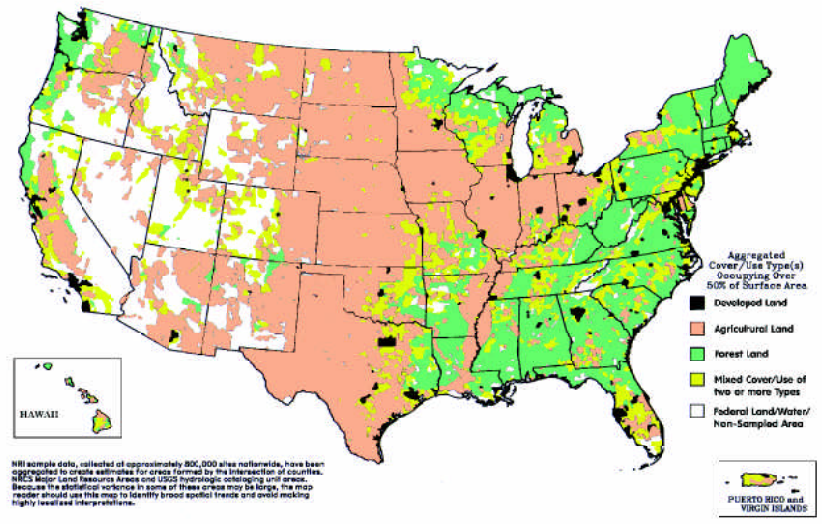
IV. Water Quality Objectives and Indicators

In the following section, indicators of water quality are discussed according to how they measure their respective water quality objectives: public health, ecosystem health, designated uses, ambient conditions, and pollutant loadings. Although the indicators are presented on a national level, they also can be used at a state or watershed level. These indicators could provide a consistent core set of data to be used at all geographic levels. Managers at the state and watershed levels, however, will probably want to add specific indicators of their own.

Objective I: Conserve and Enhance Public Health

We use many of our waters to supply drinking water and fish and shellfish for human consumption, as well as for recreation. There are times, however, when poor water quality limits these uses.

FIGURE 6: Dominant Cover/Use Types, 1992



Source: U.S. Department of Agriculture

Reducing the risk of drinking contaminated water has been a priority for public health agencies and EPA for many years. Public water systems manage surface and ground water supplies across the country to make them safe to drink. Most Americans can safely drink their tap water, although the number of water systems continuing to violate health standards and posing a risk to public health remains too high. Figure 7 shows the number of community water systems in each state that are regulated by EPA and the states under the Safe Drinking Water Act. Although most of these systems use ground water as their principal water supply source, approximately 63 percent of the population served is provided water from systems using surface water.

Fish and shellfish have become more widely used as a source of low-fat, high-quality protein foods. Consumption of contaminated fish and shellfish, however, can pose a risk to human health. As fish prey on the species below them in the food chain, concentrations of chemical contaminants can increase, reaching levels many times greater than those found in the water and increasing the risk to humans and other animals higher in the food chain. Also, microbial contamination of shellfish remains a problem.

We sometimes take for granted that our favorite beaches and swimming holes are safe for swimming, water-skiing, and boating. However, waters that become polluted can pose a health risk to people who choose to play in them. At times, states or towns are forced to close beaches due to high levels of bacterial contamination. These closures are undertaken as precautionary measures to prevent the outbreak or spread of disease resulting from swimming in polluted waters.

State health departments track the number of disease outbreaks from swimming in all kinds of waters. EPA is encouraging states to report information on beach closures and disease outbreaks to obtain a national perspective on these issues

In the future, EPA would like to add nationwide indicators on the quality of our recreational waters.

Such information is available from individual states and tribes, but not on a consistent nationwide level. In the meantime, state and local health departments should be contacted for information on conditions in particular areas.

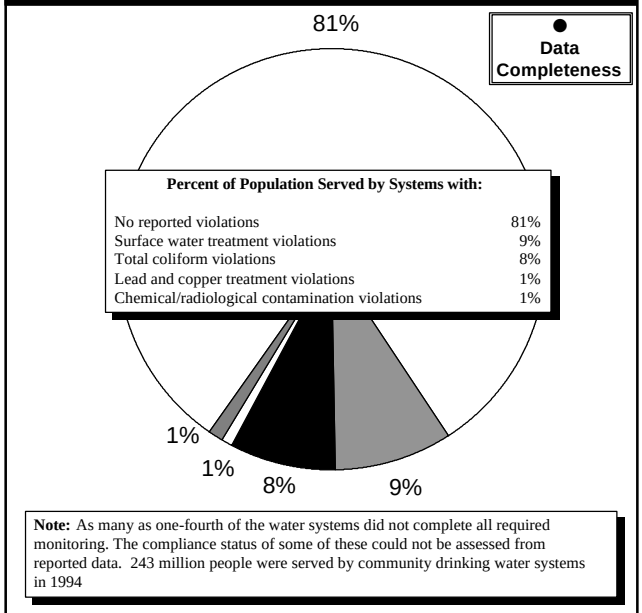
INDICATOR 1: Population served by community drinking water systems violating health-based requirements

EPA and the states regulate approximately 200,000 public drinking water systems that serve over 240 million people. (Public water systems are defined as systems that provide piped water for human consumption to at least 15 service connections or serve an average of at least 25 people for at least 60 days each year. Approximately 60,000 of these water systems are known as community drinking water systems—systems that provide water to the same population year-round. The remaining 120,000 are non-community water systems that provide drinking water for non-residential use (e.g., workplaces, schools, restaurants)).

The concentration of contaminants in drinking water systems is strictly controlled by health-based requirements established to minimize or eliminate risk to human health. These health-based requirements address several areas including surface water treatment, total coliform, lead and copper treatment, and chemical/radiological contamination. When violations of these requirements occur, water systems must remove the contaminants and notify the public or face severe penalties under EPA and state regulatory programs.

This indicator displays the population served by community drinking water systems in 1994 that violated one or more health-based requirements. More than 80 percent of the population is served by community drinking water systems that reported no violations of these requirements during the past year. Indicators 2 and 3 show more detailed information on two of the health-based requirements, filtration treatment and lead in drinking water.

INDICATOR 1: Population Served by Community Drinking Water Systems Violating Health-Based Requirements



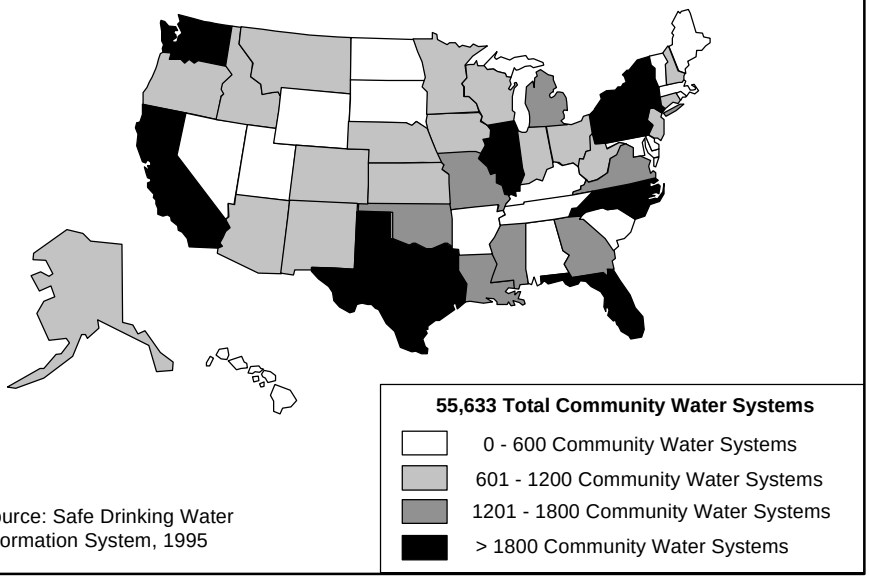
Note: As many as one-fourth of the water systems did not complete all required monitoring. The compliance status of some of these could not be assessed from reported data. 243 million people were served by community drinking water systems in 1994

Source: State data in EPA Safe Drinking Water Information System, 1994

Proposed Milestone: By 2005, the population served by community water systems in violation of health requirements will be reduced from 19 to 5 percent.

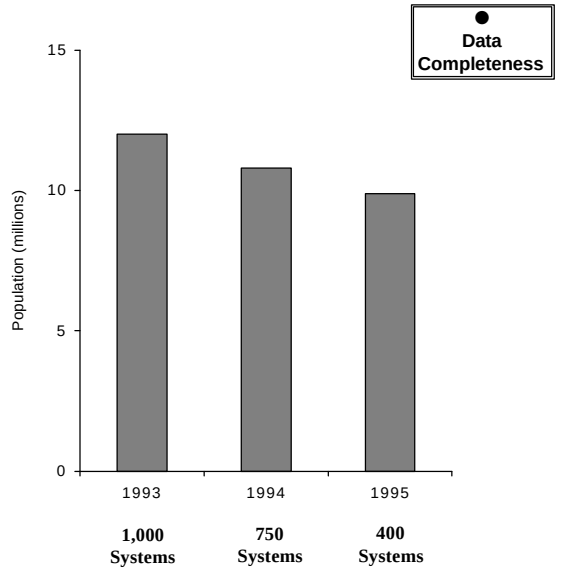
Note: Related Milestone-The U.S. Department of Health and Human Services (HHS) in its *Healthy People 2000* report has established a similar target for the year 2000 that complements the EPA milestone related to Indicator 1. The HHS target is: [By 2000,] Increase to at least 85 percent the porportion of people who receive a supply of drinking water that meets the safe drinking water standards established by EPA.

FIGURE 7: Number of Community Drinking Water Systems by State



Source: Safe Drinking Water Information System, 1995

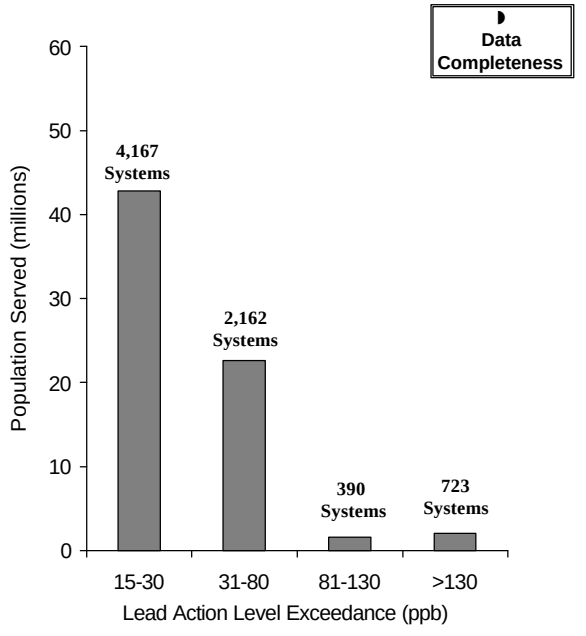
INDICATOR 2: Population Served by Unfiltered Surface Water Systems at Risk from Microbiological Pollution



Source: State data in EPA Safe Drinking Water Information System, 1994

Proposed Milestone: By 2005, every person served by a public water system that draws from an unprotected river, lake, or reservoir will receive drinking water that is adequately filtered.

INDICATOR 3: Population Served by Community Drinking Water Systems Exceeding Lead Action Levels



Source: State data in EPA Safe Drinking Water Information System, 1995

INDICATOR 2: Population served by unfiltered surface water systems at risk from microbiological pollution

Drinking water systems supplied by surface waters can sometimes withdraw water that contains harmful levels of disease-causing microbiological contaminants, such as *Giardia lamblia*, *Legionella*, and viruses. Under the Surface Water Treatment Rule (SWTR), EPA and the states require all inadequately protected drinking water systems using surface water sources to disinfect and install filtration treatment to remove these microbiological contaminants from the drinking water. Compliance with the rule will dramatically reduce the probability of human exposure to harmful levels of microbiological contaminants from surface water sources.

This indicator displays the population provided water by unfiltered community water systems that did not comply with the SWTR in 1993. In 1993, over 12 million people were provided drinking water from more than 1,000 unfiltered community water systems not in compliance with the SWTR. Through aggressive action by EPA, the states, and the water systems, the risk of human exposure to microbiological contaminants is being reduced. By the end of fiscal year 1995, the number of water systems not complying with the SWTR was reduced from 1,000 to 400, with most of the progress being made in small and medium water systems. However, the population at risk has not dropped as dramatically—from 12 million to 9.9 million—primarily because of the time needed for completing infrastructure improvements.

INDICATOR 3: Population served by community drinking water systems exceeding lead action levels

EPA estimates that 20 percent of human exposure to lead is attributable to lead in drinking water. Lead enters drinking water through pipes in the distribution system, service lines, and household plumbing, including faucets and other fixtures. Lead in drinking water is controllable through actions taken by water systems and their customers.

EPA, under its Lead and Copper Rule (LCR), requires that water systems follow a series of steps to reduce the likelihood of lead entering the drinking water from distribution system materials. Water systems are re-

quired to monitor for lead in their distribution systems, and to take action when lead in more than 10 percent of the samples taken at the tap exceeds the regulatory action level of 15 parts per billion (ppb). Depending on the size and type of the system, remedial actions range from establishing a public education program to implementing corrosion control treatment or replacing lead pipes. EPA requires large systems to install lead controls regardless of sampling results.

This indicator measures the population provided water by community water systems that have exceeded lead action levels and are required to take corrective action. It is not a precise predictor of the risk of exposure to the general population provided water by the targeted water systems. The monitoring results reflect the situation in only the worst portions of the distribution system and represent only the relative probability of risk for consumers who rely on those targeted water systems.

Based on the results of lead monitoring through fiscal year 1995, 69.1 million people were provided drinking water by water systems that exceeded the action level of 15 ppb at least once. Of that number, 42.8 million people were provided water by systems where sampling results showed lead levels between 15 and 30 ppb, and 26.3 million people received water from systems where sampling results showed lead levels over 30 ppb, which EPA views as a significant exceedance. About 2.1 million people received water from water systems where sampling results showed lead levels greater than 130 ppb. Higher exceedances increase the probability that people consuming water are at risk.

INDICATOR 4: Source water protection

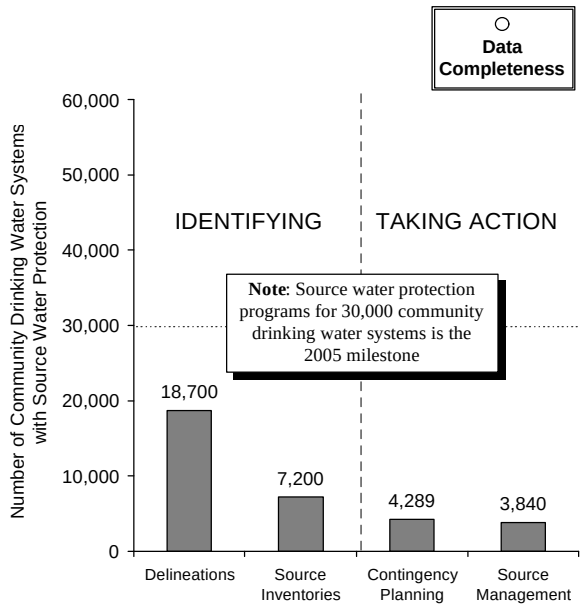
To protect our sources of drinking water even before water is withdrawn by a drinking water supplier, EPA, states, and tribes have instituted the Source Water Protection Program. EPA also continues to promote ground water protection efforts through legislation, grants, and partnerships for state programs. Currently, EPA's focus in the Source Water Protection Program is on protecting ground water used for drinking water. The resulting Wellhead Protection Program covers four principal activities: (1) delineating a wellhead protection area (the protected area around a drinking water supply well), (2) identifying potential sources of contamination, (3) developing a contingency plan in case of a threat to the drinking water source, and (4) developing a source management plan to control potential sources of contamination. In the future, the Source Water Protection Program will be extended to surface waters.

This indicator shows that approximately 18,700 of almost 60,000 surface and ground water community drinking water systems (31 percent) have initiated the Source Water Protection Program and 3,800 systems (6 percent) are covered by all four parts of the ground water protection program. EPA has established a milestone for 60 percent of the population, which corresponds to 50 percent (30,000) of all community drinking water systems, to have source water protection programs in place by 2005.

INDICATOR 5: Fish consumption advisories

States issue fish consumption advisories to alert anglers of risks associated with eating fish from rivers and lakes that are contaminated by chemical pollutants. Some tribes also use state advisories on their own waters. A fish consumption advisory can involve one or more of the following warnings: (1) do not eat any fish

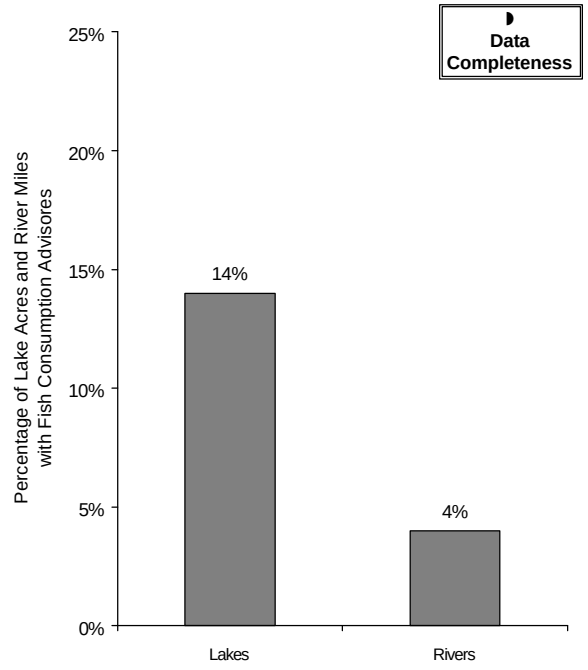
INDICATOR 4:
Source Water Protection



Source: State Biennial Wellhead Reports to EPA, 1993

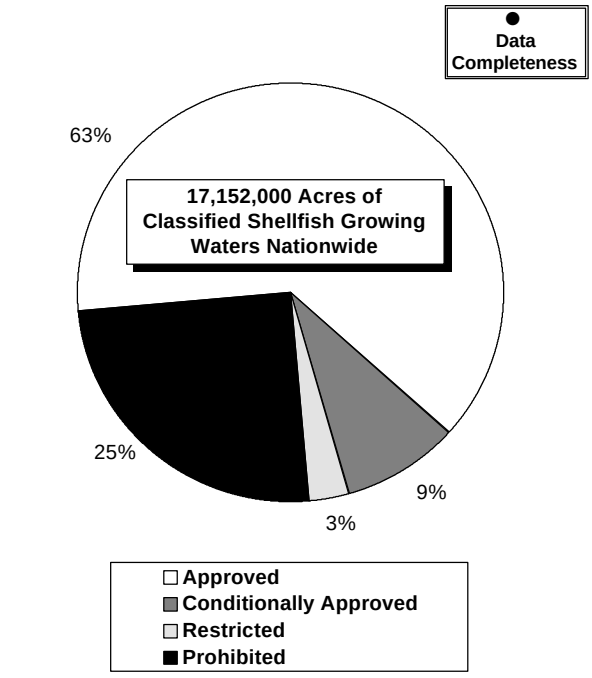
Proposed Milestone: By 2005, 60 percent of the population served by community water systems will receive their water from systems with source water protection programs in place.

INDICATOR 5:
Fish Consumption Advisories



Source: State data reported to EPA's Office of Science and Technology, 1994

INDICATOR 6:
Shellfish Growing Water Classification



Source: National Oceanic and Atmospheric Administration, 1990

caught in a certain area; (2) eat only a specified limited amount of fish, particularly if you are in a high-risk group (e.g., pregnant women or young children); or (3) eat fish only after special preparation.

States and tribes report that 14 percent of total lake acres and 4 percent of total river miles have one or more fish consumption advisories. EPA is working with state and tribal agencies to link fish consumption advisory information with assessments of the fish and shellfish consumption designated use set by state water quality standards.

INDICATOR 6: Shellfish growing water classification

Shellfish growing waters are classified by individual states using the guidelines set forth in the National Shellfish Sanitation Program (NSSP) manuals of operation. These manuals are written and periodically updated by the Interstate Shellfish Sanitation Commission (ISSC), which includes representatives from the states, the shellfishing industry, and the federal government.

Every 5 years, the National Oceanic and Atmospheric Administration, in cooperation with the ISSC and EPA, produces the *National Shellfish Register of Classified Estuarine Waters*. The *Register* reports the classifications of all coastal and estuarine shellfish growing waters. These waters are classified as one of the following: (1) approved (harvest is allowed at all times), (2) conditionally approved (harvest is allowed at certain times depending on environmental conditions), (3) restricted (harvest is allowed if shellfish undergo a cleansing or purification process), (4) conditionally restricted (harvest is allowed at certain times depending on environmental conditions and whether the shellfish undergo a cleansing or purification process, or (5) prohibited (harvest is not allowed at any time). The *Register* also reports on the actual and potential sources of pollution that cause a shellfish growing water to be classified as anything other than approved.

In 1990, there were 17 million acres of classified shellfish growing waters in U.S. coastal areas, with 63 percent approved for shellfish harvest—a 6 percent decline from 1985. Of the other 37 percent, 9 percent were conditionally approved for harvest, 3 percent were classified as restricted, and 25 percent were classified as prohibited.

EPA and NOAA are considering how NOAA's shellfish growing waters data can be correlated with state assessments of attainment of the fish and shellfish consumption designated use set by state water quality standards (see Indicator 10b).

Objective II: Conserve and Enhance Aquatic Ecosystems

Clean water is also critical to the health and survival of most plant and animal species. Water quality encompasses not only the chemical composition of the water, but also its physical and biological properties. Impaired aquatic habitats can cause a severe decline or even extinction of an aquatic species and aquatic-dependent wildlife. The quality of the biological communities can be used as an indicator of the cumulative effect of all chemical and physical stressors on the waterbody.

Sometimes the conditions in a waterbody might appear suitable for aquatic life, but the absence of healthy and diverse aquatic life might indicate water quality problems that have gone undetected. Assessing the ability of the waterbody to support aquatic life is the first step in ensuring healthy biological communities, referred to as "biological integrity." The next step is determining the kind and abundance of plants and animals found in the waterbody, referred to as "biological diversity." Aquatic plant and animal habitats that are degraded or modified can also be indicators of poor water quality.

INDICATOR 7: Biological integrity

Assessing a waterbody for healthy biological communities is a complex process, and the science to do so is newer than that used in chemical monitoring. Biological integrity can be measured using fish, macroinvertebrates, or plants, including algae. The Intergovernmental Task Force on Monitoring Water Quality recommends that at least two of these three assemblages be used together to make an accurate assessment. The extent of biological integrity is determined by comparing the monitored site against a "reference site" that exhibits the desired characteristics. Assessing waterbodies for biological integrity is important because it takes into account the cumulative effects of a wide variety of stressors.

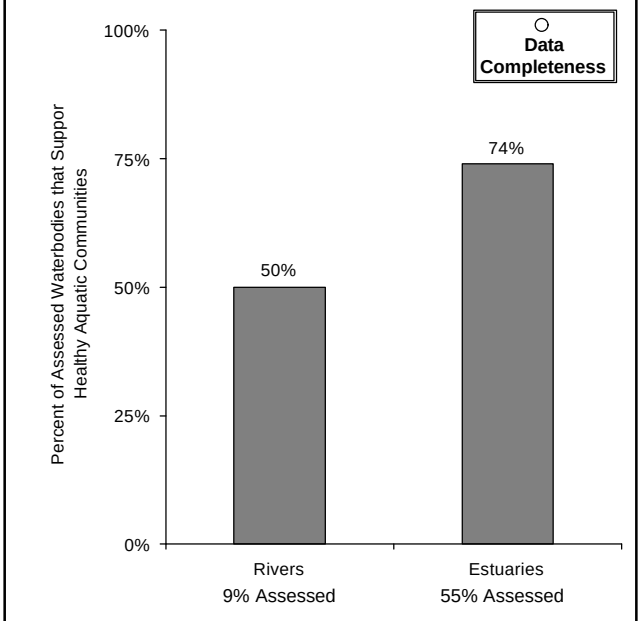
This indicator shows data from (1) 31 states that currently have comprehensive biological monitoring programs in streams and wadeable rivers and (2) EPA's Environmental Monitoring and Assessment Program (EMAP), which uses biological monitoring to evaluate estuaries. States were able to assess only 9 percent of their rivers for biological integrity; of those, 50 percent were found to have healthy aquatic communities. EMAP assessed 50 percent of the Nation's estuaries using a statistically representative sampling design and found that 74 percent of estuaries have healthy aquatic communities.

Methods for biological monitoring in lakes are under development; consequently, there are not enough data yet to confidently report the number of lakes that support healthy aquatic life. EPA and its partners are working together to strengthen biological monitoring programs, assess more waters in this fashion, and gather better data for supporting this indicator.

INDICATOR 8: Species at risk

In assessing the biological diversity and integrity of a waterbody, it is important to determine whether the aquatic species that should naturally exist in the waters are actually there and at the expected population size.

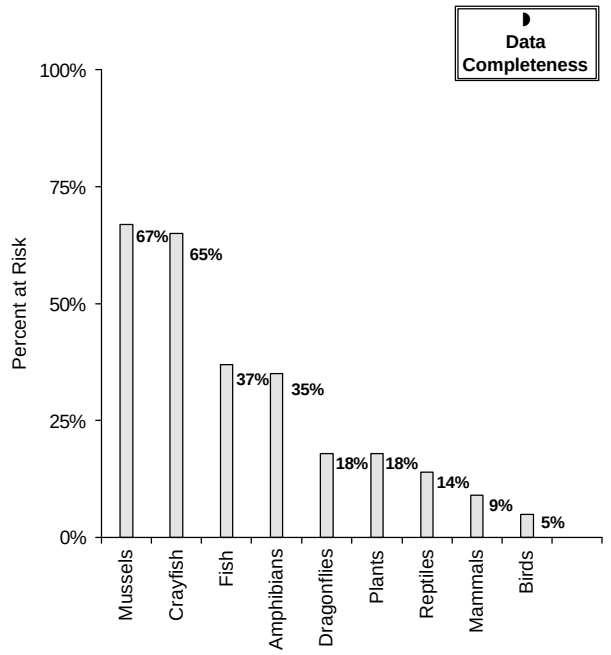
INDICATOR 7:
Biological Integrity



Source: EPA EMAP, 1994, and state biological monitoring data, 1992-1994

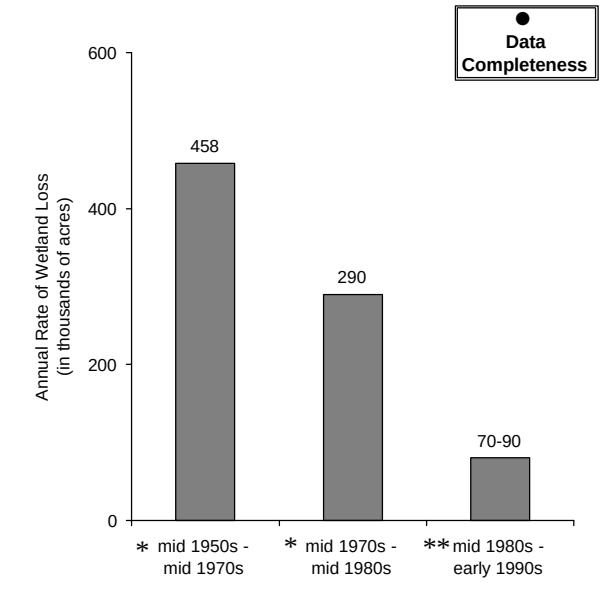
Proposed Milestone: By 2005, 80 percent of the Nation's surface waters will support healthy aquatic communities.

INDICATOR 8:
Aquatic and Wetland Species at Risk



Source: The Nature Conservancy and State Natural Heritage Data Centers, 1996

INDICATOR 9:
Wetland Acreage



Source: * U.S. Fish and Wildlife Service, 1990 (Data includes federal lands)
** U.S. Department of Agriculture, 1992 (Data excludes federal lands)

Proposed Milestone: By 2005, there will be an annual net increase of at least 100,000 acres of wetlands, thereby supporting valuable aquatic life, improving water quality, and preventing health- and property-damaging floods and drought.

Oftentimes, declines in natural aquatic species can be attributed to factors such as poor water quality and habitat loss.

Both The Nature Conservancy (TNC) and the U.S. Fish and Wildlife Service (USFWS), in cooperation with states and tribes, keep data that show which native plant and animal species are at risk (TNC) or are legally listed as endangered (USFWS). This indicator uses data from TNC and the state Natural Heritage Network and shows the proportion of species dependent on freshwater aquatic or wetland habitats that are at risk. Currently, the groups of animals at greatest risk overall are those dependent on aquatic systems. More than 60 percent of freshwater mussels and crayfish are at risk, the highest imperilment ratio documented for any group of plants and animals in the United States.

INDICATOR 9: Wetland acreage

Wetlands are especially important habitats for many different kinds of aquatic species. An estimated 80 percent of the Nation's coastal fisheries and one-third of its endangered species depend on wetlands for spawning, nursery areas, and food sources. Wetlands are home to millions of waterfowl and other birds, plants, mammals, and reptiles. Protecting the quantity and quality of wetlands is important to the continued abundance of healthy and diverse aquatic species.

This indicator shows historical wetland loss, which has been significant. The average annual rate of wetland loss, however, has slowed to less than 90,000 acres per year. Ultimately, there will be a net increase in wetland acreage.

Objective III: Support Uses Designated by the States and Tribes in Their Water Quality Standards

The Clean Water Act requires states and, if authorized, Native American tribes to adopt water quality standards that include uses they designate for their waterbodies or waterbody segments. These designated uses reflect the way we want to use our waterbodies and include such things as supplying clean drinking water, providing fish and shellfish safe for human consumption, allowing safe swimming and other forms of recreation, and supporting healthy aquatic life. State/tribal water quality standards

establish the goals of and provide the requirements for the Nation's water quality-based improvement programs.

Section 305(b) of the Clean Water Act requires that states survey, assess, and report on the degree to which their surface waters support the designated uses. Some Native American tribes also submit this information. The results of the assessments are reported to EPA every 2 years. Data from the reports are then aggregated to form the *National Water Quality Inventory Report to Congress* (the national 305(b) Report), which portrays the status of the Nation's waters assessed during that period.

Most states cannot assess all their waters in a 2-year period. As a result, EPA is working with the states to change the 305(b) Report to a 5-year report that describes national, state, and tribal waters comprehensively. For the 2-year period reported in the 1994 305(b) report, states and tribes assessed 42 percent of lakes and reservoirs, 78 percent of estuaries, and 17 percent of all rivers and streams, usually targeting their monitoring efforts to areas of particular interest. The assessment figure for rivers and streams rises to 48 percent if the intermittent waters that are dry during portions of the year are excluded.

INDICATOR 10a: Drinking water supply designated use

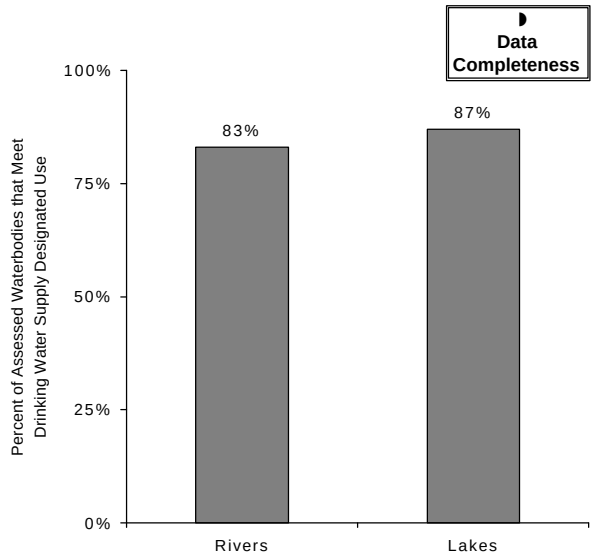
States and tribes evaluate the quality of their waters as sources for drinking water supplies. This does not mean that the water is safe to drink directly from the source, but rather that with conventional treatment the water can be safely distributed for public consumption. In the EPA guidance to the states for the fiscal year 1996 305(b) Report, EPA defines conventional treatment as disinfection and filtration treatment only.

This indicator shows that of the rivers and lakes assessed and reported on for the 1994 305(b) Report, 87 percent of the lake acres and 83 percent of the river miles that supply drinking water systems support this use.

INDICATOR 10b: Fish and shellfish consumption designated use

Just as the states and tribes report to EPA on the quality of their waters for supplying drinking water systems,

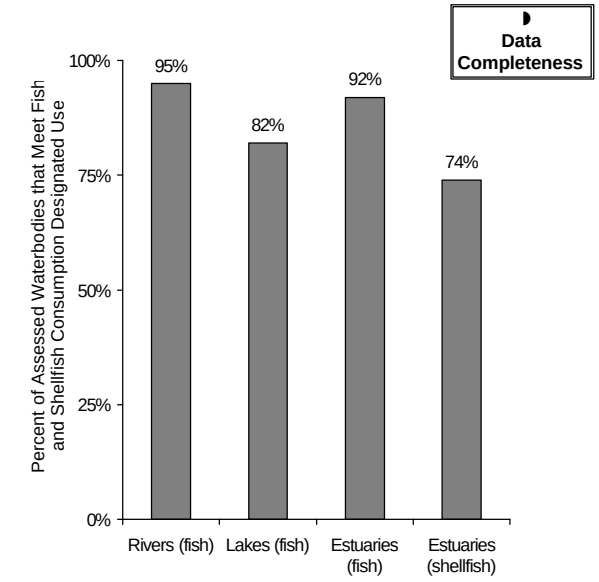
INDICATOR 10a: Drinking Water Supply Designated Use



Source: *National Water Quality Inventory: 1994 Report to Congress* , 1995; 17 percent of all river and stream miles (48 percent of constantly flowing miles), 42 percent of lake and reservoir acres, and 78 percent of estuarine square miles were assessed.

Proposed Milestone: By 2005, 90 percent of the Nation's rivers, streams, lakes, and reservoirs designated as drinking water supplies will provide water that is safe to use after conventional treatment.

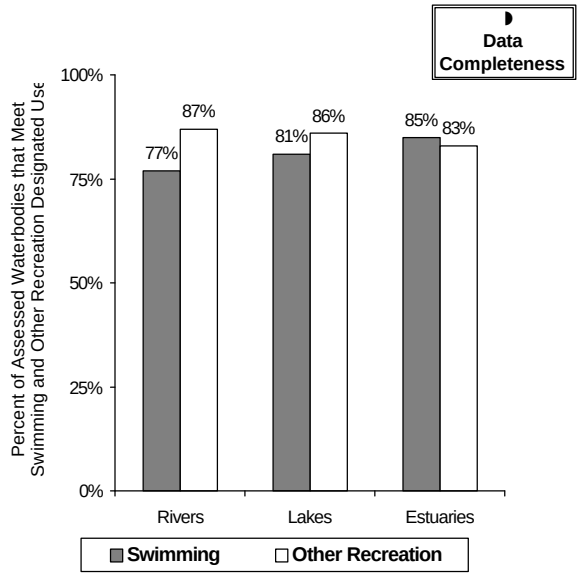
INDICATOR 10b: Fish and Shellfish Consumption Designated Use



Source: *National Water Quality Inventory: 1994 Report to Congress* , 1995; 17 percent of all river and stream miles (48 percent of constantly flowing miles), 42 percent of lake and reservoir acres, and 78 percent of estuarine square miles were assessed.

Proposed Milestone: By 2005, 90 to 98 percent of the Nation's fish and shellfish harvest areas will provide food safe for people and wildlife to eat.

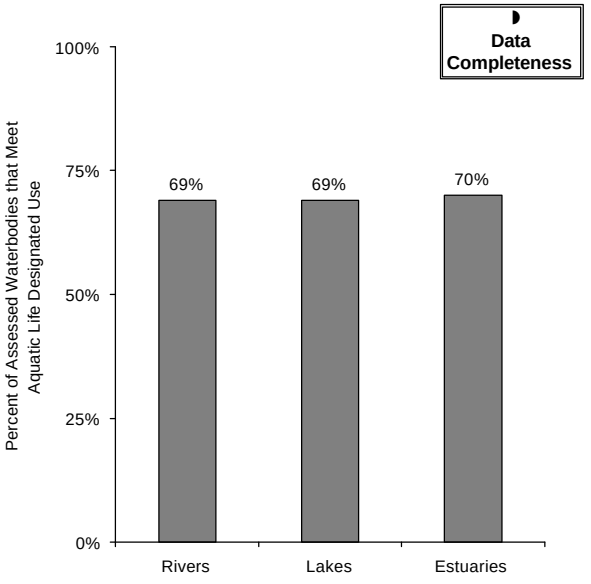
INDICATOR 10c:
Recreation Designated Use



Source: *National Water Quality Inventory: 1994 Report to Congress* , 1995; 17 percent of all river and stream miles (48 percent of constantly flowing miles), 42 percent of lake and reservoir acres, and 78 percent of estuarine square miles were assessed

Proposed Milestone: By 2005, 95 percent of the Nation's surface waters will be safe for recreation.

INDICATOR 10d:
Aquatic Life Designated Use



Source: *National Water Quality Inventory: 1994 Report to Congress* , 1995; 17 percent of all river and stream miles (48 percent of constantly flowing miles), 42 percent of lake and reservoir acres, and 78 percent of estuarine square miles were assessed

Proposed Milestone: By 2005, 80 percent of the Nation's surface waters will support healthy aquatic communities.

they also report on the quality for fish and shellfish consumption. This indicator shows that 74 percent or more of all assessed river miles, lake acres, and estuarine square miles are safe for fish and shellfish consumption. EPA is working with the state agencies that issue fish consumption advisories (Indicator 5) to link advisory information with fish and shellfish consumption designated use data.

INDICATOR 10c: Recreation designated use

States and tribes also report to EPA how many of their waters support recreational uses, especially swimming and boating. Currently, 77 percent or more of all river miles, lake acres, and estuarine square miles that the states and tribes have assessed are safe for all forms of recreation.

INDICATOR 10d: Aquatic life designated use

The states and tribes also provide EPA with information on whether their waters can support their aquatic life designated use. Approximately 70 percent of the Nation's assessed river miles, lake acres, and estuarine square miles can support the designated aquatic life use.

Objective IV: Conserve and Improve Ambient Conditions

Measures of ambient water quality evaluate the overall impacts of various sources and causes of pollution and other stressors. Measures of ambient conditions in ground water, surface water, and wetlands—both in the water column and in sediments—cover a range of physi-

Note: Related Milestones - The U.S. Department of Health and Human Services (HHS) in its *Healthy People 2000* report has established targets for the year 2000 that complement the EPA milestones related to Indicators 10b and 10c. The HHS targets are: [By 2000,] reduce potential risks to human health from surface water, as measured by an increase in the proportion of assessed rivers, lakes, and estuaries that support beneficial uses. For recreation use, from 1992 to 2000 the percentages would improve as follows: Rivers (from 71 percent to 85 percent), Lakes (from 77 percent to 88 percent), and Estuaries (from 83 percent to 91 percent). For consumable fishing use the improvement would be: Rivers (from 89 percent to 94 percent), Lakes (from 64 percent to 82 percent), and Estuaries (from 94 percent to 97 percent).

cal, chemical, and biological characteristics of the waterbody. These measures provide critical information about potential risk to human and ecosystem health (Objectives I and II) and often are evaluated to determine the degree to which there is impairment of a waterbody's designated use (Objective III). By providing the link to causes and sources of pollution and pollutant loadings (Objective V), ambient water quality indicators complete the picture of how the water objectives support and build on one another (see page ii).

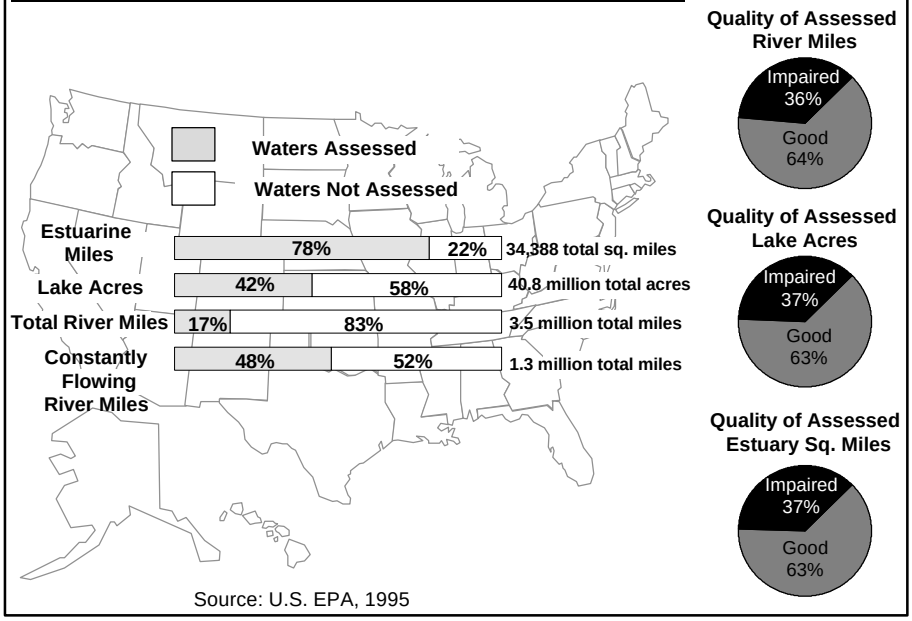
The United States does not have a linked national ambient water quality monitoring network that can produce a statistically valid picture of all our waters. In lieu of a complete and representative national data set on ambient conditions, several sources of information taken together can provide a national picture of water resource conditions.

States and some tribes report to EPA the leading pollutants and other stressors they find in the ambient waters they assess, and the leading sources that produce these stressors. EPA publishes this information in the 305(b) report. Figure 8 shows the percent and quality of waterbodies assessed, and Figures 9a and 9b show the leading stressors and sources of impairment in assessed rivers, streams, lakes, reservoirs, and estuaries reported by states in 1994.

This report uses several sets of these data as indicators. Using these data, we can summarize and evaluate trends for selected parameters (Indicators 12, Surface Water Pollutants, and 13 and 14, Pollutants in Coastal Waters and Estuaries). In some cases, only a 1-year baseline is presented (Indicators 11, Ground Water Pollutants, and 15, Contaminated Sediments), with trends to be established at a later date.

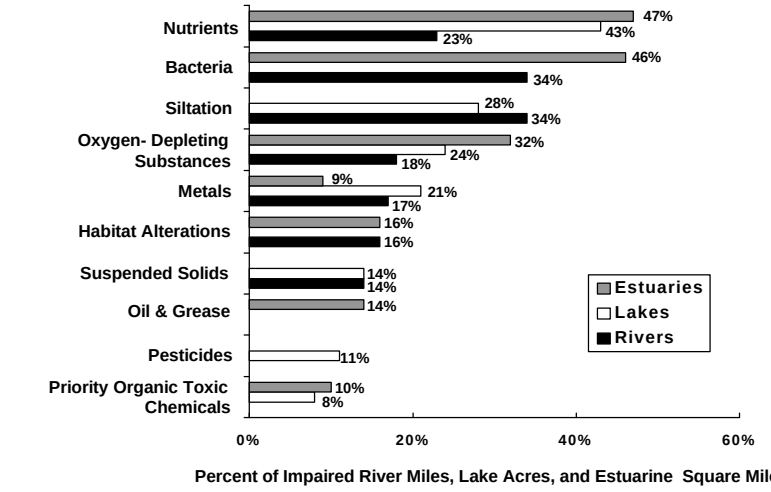
Based on discussions at the last national water indicators workshop in June 1995, potential parameters were selected to express national ambient water quality. Many of the parameters are presented in these indicators. Participants in these discussions expressed the importance of tracking both ambient water quality and

FIGURE 8: Percent and Quality of Waterbodies Assessed



Source: U.S. EPA, 1995

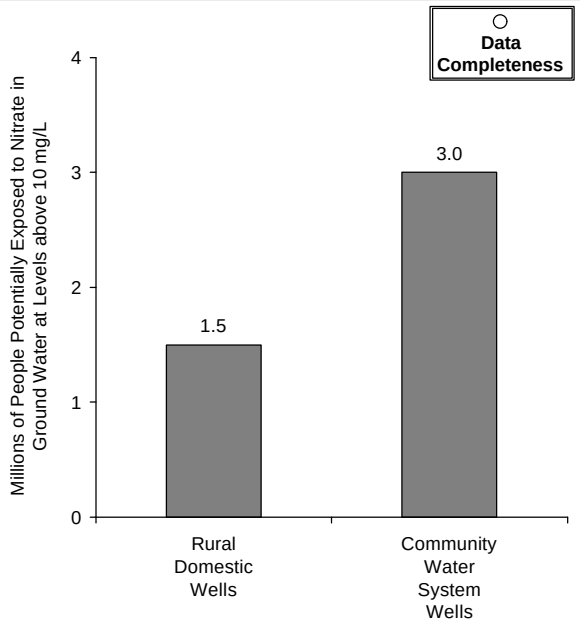
FIGURE 9a: Leading Stressors Causing Water Quality Impairment



Note: This graph shows the percentage of river miles, lake acres, and estuarine square miles that are affected by a particular stressor. The affected waters include only those which have been assessed by states and tribes and identified as impaired (see Figure 8).

Source: U.S. EPA, 1995

INDICATOR 11:
Ground Water Pollutants: Nitrate

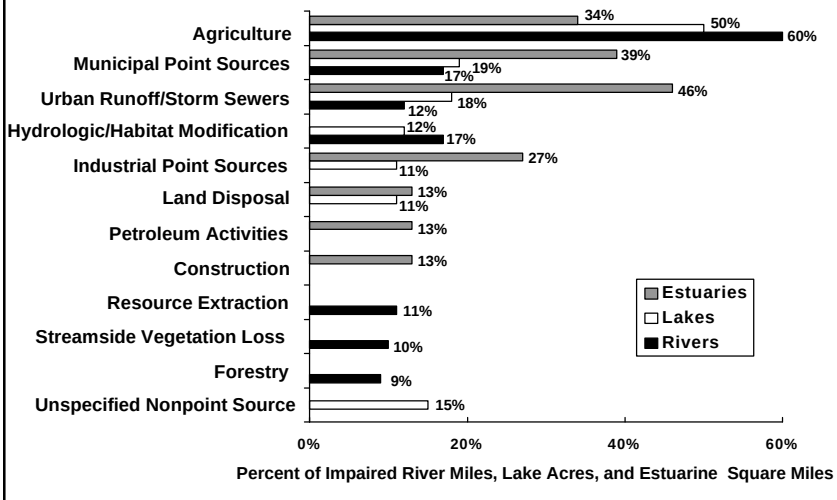


Source: *National Survey of Pesticides in Drinking Water Wells,* 1990.

Proposed Milestone: By 2005, the number of Americans served by community and rural water wells containing high concentrations of nitrate, which can cause illness, will be reduced.

pollutant loadings (the amount of a pollutant delivered to a waterbody) from both point and nonpoint sources (see Objective V). Future efforts will continue to enhance and expand ambient monitoring coverage to include key parameters and define methods for summarizing data for national reporting.

FIGURE 9b: Leading Sources of Water Quality Impairment



Note: This graph shows the percentage of river miles, lake acres, and estuarine square miles that are affected by a particular source. The affected waters include only those which have been assessed by states and tribes and identified as impaired (see Figure 8).

Source: U.S. EPA, 1995

INDICATOR 11: Ground water pollutants: Nitrate

Many contaminants in ground water are naturally occurring. Some, however, are from human activity. Because ground water monitoring is expensive, information on ground water quality is usually obtained from the monitoring of known or suspected contaminated sites or from specific studies designed to monitor for various contaminants in limited areas. Available data, therefore, do not always provide a complete and accurate representation of ambient ground water conditions or the extent and severity of ground water contamination problems.

In the meantime, one of the best available sources of ground water data is studies of drinking water supplies. Indicator 11 uses information from rural wells and community water systems to determine the number of people exposed to nitrate in ground water. According to the *National Survey of Pesticides in Drinking Water Wells* , a total of 4.5 million people are estimated to be exposed to elevated levels of nitrate in drinking water wells (approximately one-third from rural domestic wells and two-thirds from community water system wells). The survey also found nitrate to be the most widespread agricultural contaminant in drinking water wells.

Nitrate is a human health concern because it can cause methemoglobinemia or “blue-baby syndrome." Nitrate is also an environmental concern as a potential source of nutrient enrichment of coastal waters. Nitrate contamination of ground water can result from the inappropriate application of fertilizers to cropland, where excess nitrate filters down into the ground during rainfall; from the misuse of septic systems; and from the improper disposal of wastewater.

Improved understanding of the natural and human-induced factors affecting ground water quality will come about only through research at the federal, state, and private levels. Research is needed to better understand what

activities affect changes in ground water conditions, to guide monitoring and management priorities, and to evaluate the effectiveness of land and water management practices and programs. The results of such research will be more cost-effective monitoring and a significant expansion and improvement in the information that can be used for decision making.

EPA and other federal, state, and local agencies continue to promote ambient ground water monitoring to characterize the existing condition of the Nation's aquifers. Many recent monitoring studies, especially from the U.S Geological Survey, have focused on nitrate as an indicator for the presence of other contaminants. In addition, many studies have targeted other contaminants as indicators of specific types of land use or industrial activities. EPA plans to review all of these studies and use them as a follow-up to the information currently covered by this indicator. Thus, in the future, this indicator will provide a more accurate picture of overall ground water quality by including other contaminants, such as pesticides or industrial contaminants, and uses other than drinking water supply.

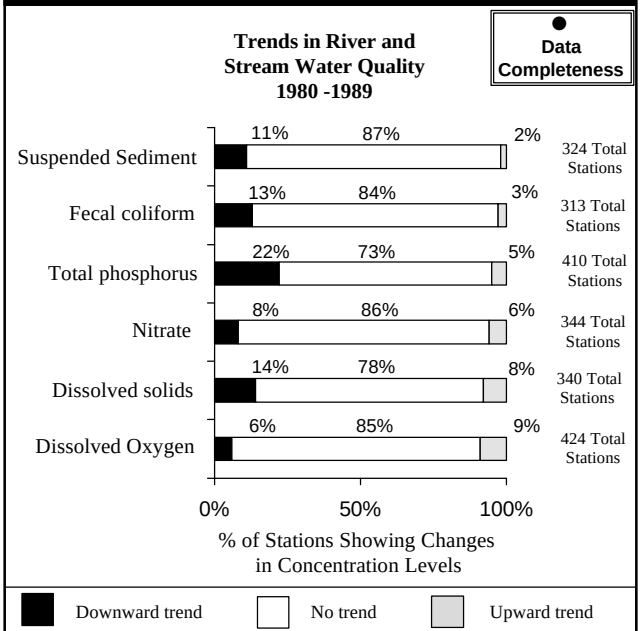
INDICATOR 12: Surface water pollutants

EPA and its partners have chosen to track a few of the many constituents that have significant effects on our surface waters. This indicator currently presents the change in concentration levels of six constituents, including dissolved oxygen, dissolved solids, nitrate, total phosphorus, fecal coliform, and suspended sediments. Data from the U.S. Geological Survey on ambient surface water quality are the best current representation for this indicator. These data show trends in the concentration levels of the six constituents from 1980 to 1989. Increases in the concentration level of dissolved oxygen, which is necessary for fish and aquatic plant life, indicate an improvement in ambient water quality. In contrast, increases in the concentration level of all of the other constituents reflect a decrease in ambient water quality. In the future, trends of other constituents might be added to improve this indicator.

INDICATOR 13: Selected coastal surface water pollutants in shellfish

Pollution in coastal areas is of particular concern given the population concentration in coastal regions and the

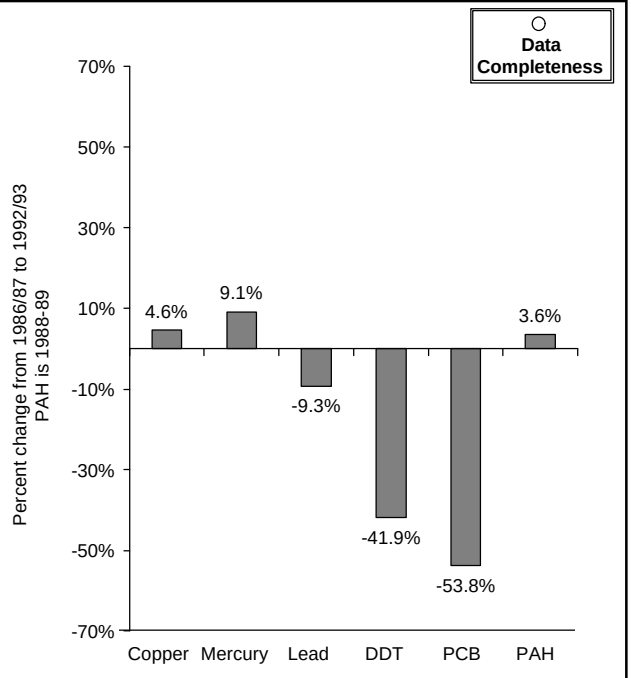
INDICATOR 12: Surface Water Pollutants



Note: The presence of an upward trend indicates an increase in the concentration of a particular constituent while a downward trend indicates a decrease in the concentration. Analyses were made on data from USGS National Stream Quality Accounting Network stations. Trend data for phosphorus are from 1982-1989.

Source: U.S. Geological Survey, 1990

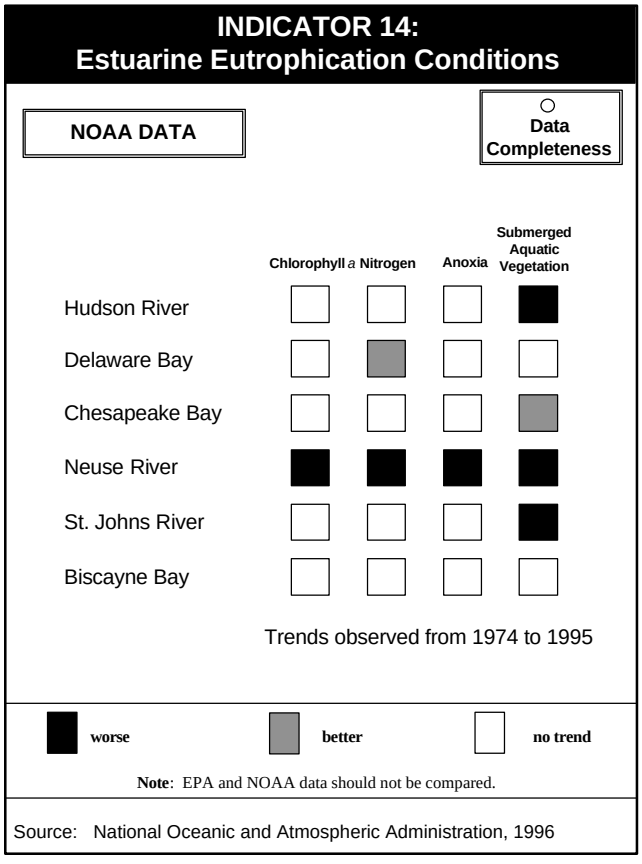
INDICATOR 13: Selected Coastal Surface Water Pollutants in Shellfish



Source: National Oceanic and Atmospheric Administration, 1995

importance of coastal waters as nurseries for aquatic life. NOAA collects data on the concentration and effect of persistent pollutants in the coastal waters of the United States. This indicator shows the average concentration levels of six pollutants in shellfish (oysters and mussels) collected from about 140 locations around the Nation's coastline. Shellfish serve as good indicators because they filter water as they feed and tend to accumulate pollutants.

The pollutants shown are six of the toxic chemicals of greatest concern in terms of their effects on fish and other organisms in U.S. estuaries. Three metals and three groups of organic chemicals are included. The metals copper, mercury, and lead are commonly used in our society for many purposes. The use of two of the organic chemicals, the DDT pesticides and the industrially important polychlorinated biphenyls (PCBs), was very common until about 20 years ago. Although these chemicals are now banned, they can still be found in the environment. The carcinogenic polycyclic aromatic hydrocarbons (PAHs) are common constituents of oil and are also produced by the burning of coal and wood.



INDICATOR 14: Estuarine eutrophication conditions

This indicator shows changes in specific constituents related to water quality that together can be used to assess the extent of eutrophication within an estuary, and thus assess its health and condition. Eutrophication is a process by which a body of water begins to suffocate from receiving more nutrients, such as nitrogen and phosphorus, than it can handle. The excess nutrients fuel the heavy growth of microscopic aquatic plants. As these plants die and decompose, the supply of dissolved oxygen in the water is depleted. Oxygen is then no longer available to other aquatic organisms, especially those which live on the bottom. Symptoms of eutrophication include low levels of dissolved oxygen, extensive algal blooms, fish kills and reduced populations of fish and shellfish, high turbidity in the water, and diebacks of seagrasses and corals. Estuarine and coastal waters are monitored to determine if they are receiving too many nutrients and becoming eutrophic. Parameters that are monitored include chlorophyll *a*, nitrogen, other nutrients, dissolved oxygen, and the spatial coverage of seagrassess (or submerged aquatic vegetation).

This indicator shows trends in eutrophication-related conditions from the 1960s to 1995 in selected estuaries throughout the country as measured by two different data sets. The nationwide framework for the indicator of estuarine eutrophication is NOAA's *National Estuarine Inventory*. The 129 estuaries contained in the inventory represent a consistent and complete framework for characterizing the Nation's estuarine resource base. NOAA is collecting information on 16 eutrophication-related water quality parameters for each estuary in the inventory through a knowledge-based consensus process with over 400 estuarine scientists. In 1990, NOAA estimated that nearly half the Nation's estuaries were susceptible to eutrophication. In 1992, NOAA initiated its *National Estuarine Eutrophication Survey* to evaluate which estuaries had problems in the following regions: North Atlantic (16 estuaries), Mid-Atlantic (22 estuaries), South Atlantic (21 estuaries), Gulf of Mexico (36 estuaries), and the West Coast (34 estuaries).

This indicator also uses data from EPA's National Estuary Program (NEP). Currently, there are 28 estuaries around the country in the NEP. In many of these estuaries, state and local managers have identified eutrophi-

cation and excess nutrients as critical problems. NEPs are collecting historical and baseline monitoring information to assess the effectiveness of corrective actions being undertaken. Taken together, the NOAA and EPA efforts will provide the most comprehensive and complete information base possible for the foreseeable future.

INDICATOR 15: Contaminated sediments

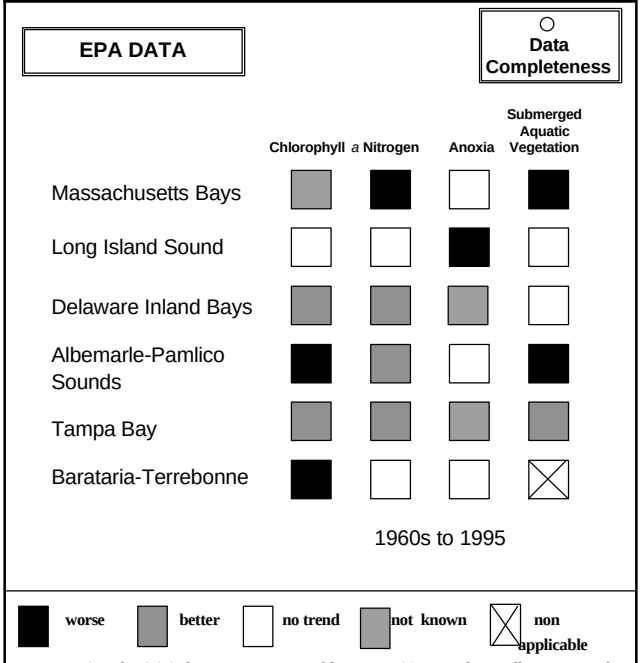
Certain types of chemicals in water tend to bind to particles and collect in sediment. Chemicals often persist longer in sediment than in water because conditions might not favor natural degradation. When present at elevated concentrations in sediment, pollutants can be released back to water. Pollutants can also accumulate in bottom-dwelling organisms and in fish and shellfish and move up the food chain. In both cases, excessive levels of chemicals in sediment might become hazardous to aquatic life and humans.

This indicator shows the percent of measurements of contaminated sediments that indicate potential risk to ecological and human health by chemical or chemical group. Of the 37 percent of measurements that detected contaminant levels, 14 percent exhibited a potential risk to human or ecological health due to substances such as mercury, pesticides, PCBs, and PAHs. These levels of concern are based on field surveys, laboratory toxicity tests, and studies of the behavior of chemicals in the environment and in living fish tissue. EPA collects and analyzes sediment and fish tissue data from state, EPA region, and other monitoring programs as part of the National Sediment Inventory (NSI). The goals of the NSI are to survey data regarding sediment quality nationwide, identify locations that are potentially contaminated, and describe the sources of contaminants.

The Importance of Habitat

Habitat is an additional indicator that measures ambient conditions. Without healthy habitat, plants and animals cannot survive. Habitat is the area where living and nonliving factors interact to provide at least minimal life support for a given species. Habitat important to water quality begins instream (factors such as water flow rate), includes the riparian zone (habitat bordering water), and extends into dry-land habitats where

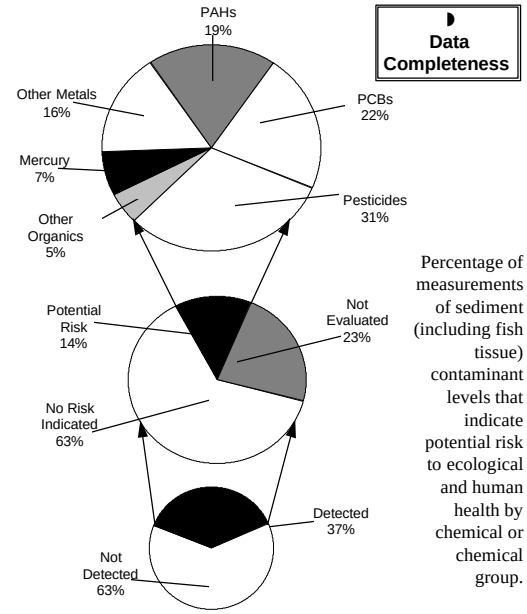
INDICATOR 14:
Estuarine Eutrophication Conditions



Note: EPA and NOAA data are not comparable. For EPA's NEP data, collection periods varied from 15 to 30 years, seasonal or short-term trends are not reflected, and individual NEPs are not comparable.

Source: Data from EPA's National Estuary Program, 1996

INDICATOR 15:
Contaminated Sediments



Percentage of measurements of sediment (including fish tissue) contaminant levels that indicate potential risk to ecological and human health by chemical or chemical group.

Source: National Sediment Inventory from EPA's Office of Science and Technology, 1993

Proposed Milestone: By 2005, point sources of contamination will be controlled in 10 percent of the watersheds where sediment contamination has been determined to be widespread.

rainwater and snowmelt carry pollutants over land into water.

Although healthy habitat is a key link in understanding our water resources, we are currently unable to report on habitat quality nationally. It is important, however, to use habitat as an indicator regionally. EPA hopes to be able to include a national habitat quality indicator in future reports. To fill this information gap, EPA and its partners are placing increased emphasis on supporting habitat quality assessments and developing a habitat quality indicator.

One of the first documents issued by EPA encouraging states to assess habitat quality is *Rapid Bioassessment Protocols for Use in Streams and Rivers*. The Rapid Bioassessment Protocols evaluate the quality of the riparian corridor habitat by comparing the monitored stream to a "reference condition" that expresses the desired condition of the water. Habitat data, together with traditional chemical and toxicity data, enable researchers to evaluate biological monitoring data and understand the environmental stressors to the aquatic ecosystem.

Some habitat quality stressor information is reported in the *National Water Quality Inventory Report to Congress*. According to the 1994 305(b) Report, states and tribes ranked hydromodification and habitat alteration as a leading source of water quality impairment in assessed waters (see Figure 9b).

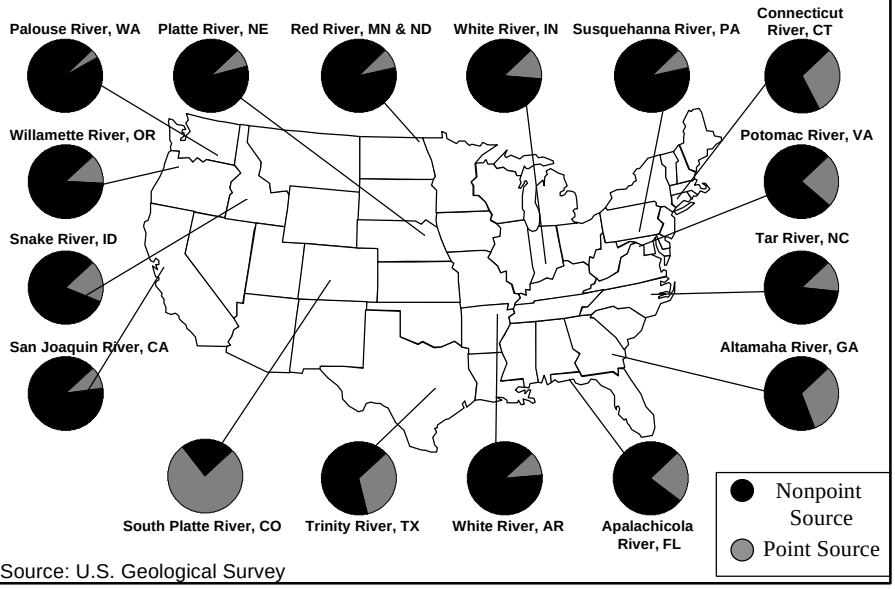
Objective V: Reduce or Prevent Pollutant Loadings and Other Stressors

Water is affected by stressors from both natural and human activities. Habitat alteration, for instance, can cause major water quality degradation. However, determining where the stressors come from is not always easy. Stressor indicators are the link between management programs, which are usually designed to prevent or reduce stressors, and the condition of the environment. The following indicators present information on the sources of pollutant loads for selected pollutants. A pollutant load is the mass of a pollutant (e.g., tons of sediment) delivered to the waterbody.

Sources of pollution to surface and ground waters are characterized as point and nonpoint. Point source pollution usually enters waters through a specific point, such as a pipe. Ground water can be contaminated by point source pollution through underground injection of waste. Nonpoint source pollution typically is carried in rainwater and snowmelt runoff over and through land to surface water, or in water that seeps through soils to underground aquifers.

Major accomplishments of the past several decades include controlling industrial discharges, providing adequate wastewater treatment to a growing population, and protecting drinking water supplies from underground injection of waste. EPA uses regulations and permit limits to control these point source discharges. The sections that follow present indicators to measure our progress in controlling both point and nonpoint source pollution, which continue to persist. To demonstrate the relative contribution of point and nonpoint sources, Figure 10 illustrates

FIGURE 10: Estimated Share of Nitrogen Delivered to Streams by Point and Nonpoint Sources



Source: U.S. Geological Survey

how the mix of point and nonpoint sources of nitrogen entering our streams varies across the Nation.

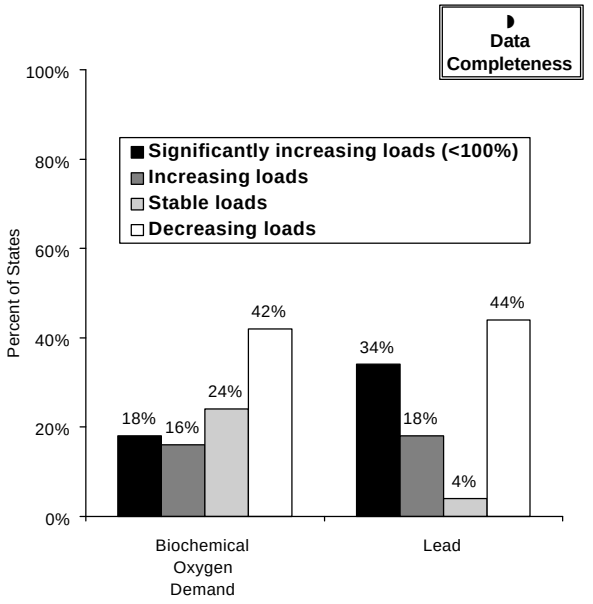
INDICATOR 16a: Selected point source loadings to surface water

For surface waters, the major point sources of pollution are sewage treatment plants, industrial facilities, and "wet weather" sources like combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), and storm water sewers. Sewage treatment plants treat and discharge wastewater from homes, public buildings, commercial establishments, some storm water sewers, and some industries. Many industrial facilities treat and discharge their own wastewater, either directly to nearby waters or to sewage treatment plants. Combined sewers combine storm water and sewage in one system and, during periods of intense rainfall, can overflow directly to nearby waters without treatment. Figure 11 illustrates the annual amount of pollution discharged by these sources.

Many pollutants have been identified as a priority or of particular concern. EPA and other agencies with point source loading information have identified a group of toxic and conventional pollutants to track as indicators of progress toward reducing point source pollution in surface waters. Information about these pollutants is contained in EPA's Permit Compliance System (PCS). EPA is working to improve the quality of data entered into PCS in order to extract more useful information for each state on whether the amount of these contaminants being discharged is increasing, decreasing, or remaining stable. EPA is working with other federal agencies like NOAA and USGS to improve the tracking of point source loadings nationwide. Improvements will include the ability to project expected loadings from sources not covered in national databases like PCS.

For illustrative purposes, the graph above presents data extracted from PCS on two pollutants to be tracked under this indicator—biochemical oxygen demand (BOD) and lead. BOD is a measure of pollution expressed in terms of the amount of oxygen needed by micro-organisms to break down waste material. A high level of BOD in-

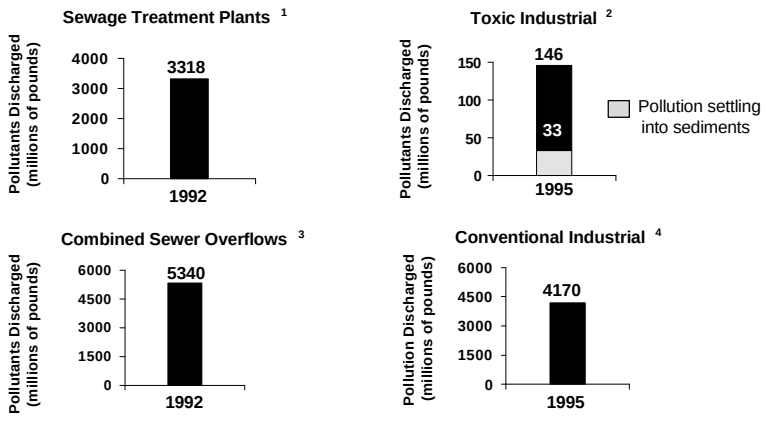
INDICATOR 16a: Selected Point Source Loadings to Surface Water



Source: Permit Compliance System, 1995

Proposed Milestone: By 2005, annual pollutant discharges from key point sources that threaten public health and aquatic ecosystems will be reduced by 3 billion pounds, or 28 percent.

FIGURE 11: Annual Amount of Pollution Discharged by Selected Point Sources



1. The indicator pollutant is biochemical oxygen demand (BOD), the degradable organics typically controlled by discharge permits.
2. Pollutants include priority pollutants (e.g., PCBs, lead, mercury) defined by the CWA and some nonconventional pollutants (e.g.. chlorine).
3. Pollutants include total suspended solids, BOD, total nitrogen, orthophosphate, metals, and toxic volatile organics.
4. Pollutants include oil and grease, total suspended solids, and BOD.

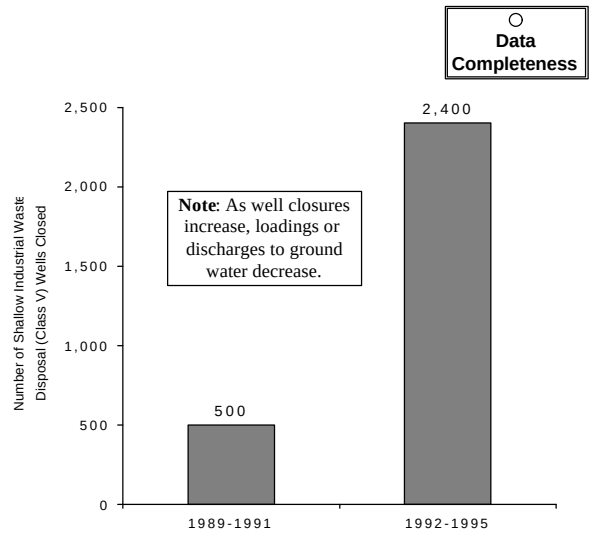
Source: U.S. EPA, 1995

dicates that there will be lower levels of oxygen available for fish and other aquatic life. A high BOD also indicates possible bacterial contamination from sewage released into the waterbody. In 1995, 66 percent of the states reported BOD as either decreasing or stable, while 34 percent reported increasing or significantly increasing BOD levels. In addition, 48 percent of the states reported either decreasing or stable lead levels, while 52 percent reported increasing or significantly increasing lead levels.

INDICATOR 16b: Sources of point source loadings through class V wells to ground water

Major sources of pollution to ground water are septic systems, cesspools, or dry wells used to dispose of industrial and commercial wastewater. Businesses in strip malls and industrial parks and areas that are not served by municipal sewer systems are likely to dispose of industrial and commercial wastewater in shallow wells or in septic systems that are designed to treat only sanitary wastes. EPA studies show that approximately 10 percent of the 10 billion gallons of this wastewater contains chemicals, such as ethylene glycol. These chemicals can pass through septic systems unchanged and eventually enter ground water aquifers while still toxic. As much as 1 billion gallons of untreated chemicals, therefore, have the potential to degrade the water resources of 60,000 community water systems and half the U.S. population.

INDICATOR 16b: Sources of Point Source Loadings Through Class V Wells to Ground Water



Source: EPA Office of Ground Water and Drinking Water, 1995

Proposed Milestone: By 2005, wellhead protection areas and vulnerable ground water resources will no longer receive industrial wastewater discharges from septic systems.

One million new septic systems are constructed every year. The number of these systems that will be used for disposal of industrial and commercial wastewater is not known. Stopping the misuse of these systems is best left in the hands of the public health agencies or other local government agencies that regulate them.

Through the Underground Injection Control (UIC) Program, EPA works with other federal agencies, states, tribes, and local governments to address this major point source of pollution. Aside from technical and financial assistance to regulators, the UIC program will provide compliance assistance to commercial and industrial operations as part of source water protection programs that will be developed for 30,000 community water supplies by the year 2005. EPA will collect annual reports from states that describe the number of septic systems no longer used for industrial waste disposal (Class V well closures). In the future, EPA expects to report reductions in specific point source pollutants to ground water as this indicator is further developed.

INDICATOR 17: Nonpoint source sediment loadings from cropland

Nonpoint source pollution is a diffuse source that is difficult to measure and is highly variable due to different rain patterns and other climatic conditions. In many areas, however, nonpoint source pollution is the greatest source of water quality degradation. Presently, states and tribes identify nonpoint source pollution from cropland and livestock, urban runoff, and storm sewers as the greatest water quality threat to the Nation's surface waters. Other nonpoint sources of pollution to surface water include runoff from roads, construction sites, mining, and logging; drainage from waste disposal sites and landfills; and airborne pollutants that settle in the water.

In the absence of direct national measures of nonpoint source pollution, national figures can only be estimated. The U.S. Department of Agriculture (USDA) estimates soil erosion with field measurements and statistical models, such as the universal soil loss equation. USDA

tracks and reports progress in reducing erosion rates from the Nation's agricultural lands through the National Resources Inventory.

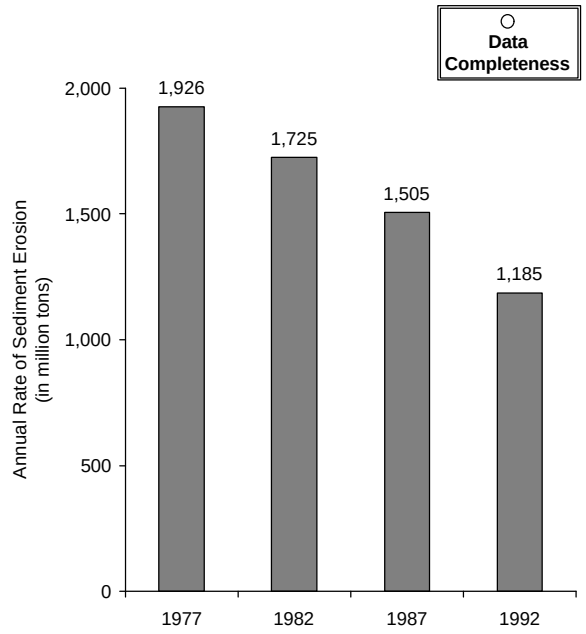
This indicator shows the amount of erosion from agricultural cropland. Cropland erosion is often, but not always, associated with the delivery of sediment, nutrients, and pesticides to receiving waters. Other national measures for nonpoint source loadings are under consideration and may be developed as more national data become available.

INDICATOR 18: Marine debris

Marine debris includes trash left behind by visitors to the beach, discarded from boats, carried by inland waterways to the coast, or conveyed by overflowing sewer or storm systems. As an indicator, marine debris can be useful in ascertaining (1) early warning signs of possible human health risk associated with pollution, (2) biological health risk such as entanglement or ingestion by wildlife, (3) limits on coastal recreation and fishing, (4) the effectiveness of programs to control or prevent marine debris, (5) the aesthetic value of a coastal area and the economy it supports, (6) ambient conditions, and (7) human health risks through entanglement injury or exposure to medical waste.

EPA chairs an interagency workgroup on marine debris that includes representatives from the National Oceanic and Atmospheric Administration, the U.S. Park Service, the U.S. Coast Guard, and other organizations. The workgroup has developed a statistically valid methodology for monitoring the trends and sources of marine debris. This monitoring effort will begin in 1996, and data from that year will be used as the baseline for this indicator. Past data, although not collected using a statistically designed protocol, are presented in this report to give an indication of the problem.

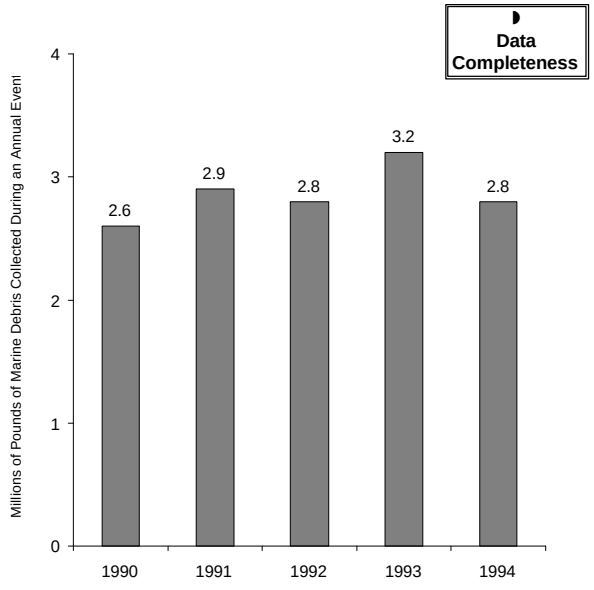
INDICATOR 17: Nonpoint Source Sediment Loadings from Cropland



Source: USDA, National Resource Inventory, 1992

Proposed Milestone: By 2005, the annual rate of soil erosion from agricultural croplands will be reduced 20 percent from 1992 levels to a total of 948 million tons per year.

INDICATOR 18: Marine Debris



Note: Data in this graph are variable by number of beaches cleaned, number of volunteers participating, and weather conditions on the day of cleanup.

Source: Center for Marine Conservation, 1995.

V. Water Quality Monitoring and Information Management

Water quality monitoring supplies the data and information that are the backbone of each of the indicators described in this report. Each indicator is supported by a monitoring network and data systems that provide and store the data. In some cases, we need better, more efficient monitoring, easier ways to access and understand data, and better programs to analyze and present water quality information.

Many public and private organizations, states, tribes, and federal agencies are working to improve monitoring programs across the country to provide better information to measure these indicators. The Intergovernmental Task Force on Monitoring Water Quality (ITFM) has already adopted a nationwide water quality monitoring strategy that, when fully implemented, will provide better data for many of the indicators presented in this report.

VI. Conclusion

The indicators presented here are keys to answering the question "How clean is our water?" Although we know water resources in this country have improved considerably since the formation of EPA in 1970, the passage of the Clean Water Act and Safe Drinking Water Act, and as a result of the hard work of many public and private partners, we still have problems to address. All levels of government and public and private entities need to work together closely to improve our understanding of the environment and our ability to protect and enhance it. A critical part of that process is improving the collection and assessment of data. The steps we are taking to improve the indicators are described in individual fact sheets for each indicator, available from EPA at the address on the inside back cover.

As the indicators are improved, we should be able to more precisely track changes, both positive and negative, in water quality. The status and trends indicator data will be invaluable for targeting resources and for managing and improving key water quality programs that protect and enhance public health and the environment.

VII. References

Objective I: Conserve and Enhance Public Health

Indicator 1

U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water. 1994. Data extracted from the Safe Drinking Water Information System on the population served by community drinking water systems in violation of health-based requirements.

Indicator 2

U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water. 1994 Data extracted from the Safe Drinking Water Information System on drinking water systems and population served by these systems not meeting filtration requirements.

Indicator 3

U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water. 1994. Data extracted from the Safe Drinking Water Information System on drinking water systems and population served by these systems exceeding lead action levels.

Indicator 4

U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water. 1993. Data from *State Biennial Wellhead Reports* on the number of states with source water protection programs.

Indicator 5

U.S. Environmental Protection Agency, Office of Science and Technology. 1994. *National Listing of Fish Consumption Advisories*. Geo-referenced data of state-issued fish consumption advisories.

Indicator 6

National Oceanic and Atmospheric Administration. 1990 Data extracted from the *1990 National Shellfish Register of Classified Estuarine Waters* on the number of estuaries providing shellfish approved, conditionally approved, and not approved for human consumption.

Objective II: Conserve and Enhance Aquatic Ecosystems

Indicator 7

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Indicator 8

The Nature Conservancy. 1994. Data extracted from the Heritage Program Database on the percent of selected aquatic species at risk of extinction, critically imperiled, and apparently secure.

Indicator 9

Dahl, T.E. 1990. *Wetlands Losses in the United States 1780s to 1980s*. U.S. Department of the Interior, Fish and Wildlife Service. Data on the amount of wetland acreage loss from 1780 to mid-1980s.

U.S. Department of Agriculture, Soil Conservation Service. 1992. *Summary Report National Resources Inventory*. Data on the amount of wetland loss from mid-1980s to mid-1990s.

Objective III: Support Uses Designated by the States and Tribes in Their Water Quality Standards

Indicator 10a - 10d

U.S. Environmental Protection Agency, Office of Water. 1995. *National Water Quality Inventory: 1994 Report to Congress.* 1994 data on the percent of assessed rivers, streams, lakes, reservoirs, and estuaries that can support (1) drinking water supply, (2) fish and shellfish consumption, (3) swimming and recreation, and (4) aquatic life. EPA-841-R-94-001.

Objective IV: Conserve and Improve Ambient Conditions

Indicator 11

U.S. Environmental Protection Agency. Office of Drinking Water and Office of Pesticide Programs. 1990. *National Survey of Pesticides in Drinking Water*. Data on the potential number of people drinking water with high levels of nitrate and pesticides.

Indicator 12

U.S. Geological Survey. 1993. *National Water Summary 1990-1991, Hydrologic Events and Stream Water Quality.* U.S. Geological Survey Water Supply Paper 2400. Data on trends of selected pollutants found in surface water.

Indicator 13

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Indicator 14

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Indicator 15

U.S. Environmental Protection Agency, Office of Science and Technology. 1993 Data from National Sediment Inventory on the percentage of sites with sediment contamination that might pose a risk to humans and aquatic life.

Objective V: Prevent or Reduce Pollutant Loadings and Other Stressors

Indicator 16a

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Indicator 16b

U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water. 1995. Data from underground injection control state reporting forms on the number of shallow (Class V) injection wells closed annually.

Indicator 17

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Indicator 18

Center for Marine Conservation. 1995. *1994 U.S. National Coastal Cleanup Results*. Data on the amount of marine debris annually collected from cleanup events from 1990 to 1994.

Figures

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Comments and requests for indicator fact sheets should be sent to the address below:

Water Environmental Indicators
EPA Office of Water
Mail Code 4503F
401 M Street, SW
Washington, DC 20460
Internet: http://www.epa.gov/OW/indic