National Water Quality Inventory: Report to Congress

U.S. Environmental Protection Agency 10/29/2024

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Cover Photo: Willow Lake, White River National Forest, Silverthorne, Colorado. Sampled by Great Lakes Environmental Center.

Executive Summary

2022 marked the 50th anniversary of the Clean Water Act (CWA), a significant expansion of the first major U.S. law to address water pollution. One of many CWA successes to celebrate is the formation of unique partnership among EPA, states, and Tribes to report on water quality. Authorized under CWA Section 104 and in support of CWA Section 305, EPA, states, and Tribes implement the National Aquatic Resource Surveys (NARS), a cost-effective program to monitor and assess the condition of the nation's waters, to evaluate key stressors, and track changes over time. Whereas in the 1974 Report to Congress EPA reported on 22 major waterways, because of the NARS partnership this report now covers 1.5 million miles of rivers and streams, as well as lakes, coasts, and wetlands (EPA 1974).

This National Water Quality Inventory Report focuses on the findings of the statistically representative National Aquatic Resource Surveys. It also summarizes how site-specific assessment results are reported by the states in their Integrated Reports under Clean Water Act Sections 305(b), 303(d) and 314 and points to where results at the state and local scale can be found. While different in design, methods and goals, these two sources of information complement each other to support decision making at the national, state, and local level.

Summary of National Water Quality

National, statistically representative surveys provide assessments of water quality based on consistent sampling at randomly selected sites across the United States. Rotating among water body types, each of the national surveys are designed to address questions such as:

- What is the condition of the nation's waters?
- What are the most widespread problems?
- Are conditions improving or getting worse?

This report focuses on results at the national scale. The surveys use selected indicators to assess the biological, chemical, and physical condition of waters, as well as characteristics that pose risks to human health. EPA and its state and Tribal partners determined that the indicators align with the survey goals and are representative at a national scale. The following surveys are described in this report:

Rivers and Streams: The *National Rivers and Streams Assessment was conducted in 2018-2019*. Total extent of waters assessed was 1,543,290 river miles.

Lakes, Ponds, and Reservoirs: The *National Lakes Assessment* was conducted in 2017. Total extent of waters assessed was 224,916 lakes and reservoirs.

Wetlands: The *National Wetland Condition Assessment* was conducted in 2016. Total extent of waters assessed was 95,694,241 acres.

Coastal Estuaries: The *National Coastal Condition Assessment* was conducted in 2015. Total extent of estuarine waters assessed was 27,479 square miles.

Great Lakes Nearshore Waters: The Great Lakes were monitored as part of the *National Coastal Condition Assessment* that was conducted in 2015. Total extent of Great Lakes nearshore waters assessed was 7,118 square miles.

For regional results and more information on the national statistical surveys, visit the National Aquatic Resource Surveys Website.

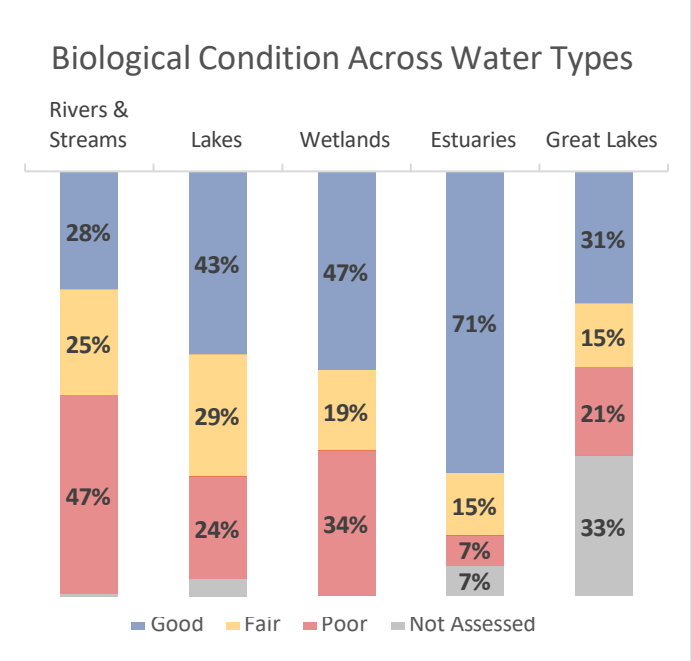

Figure 1. Using benthic macroinvertebrates, rivers and streams had the smallest percent of waters in good condition (30%) while 31% of Great Lakes nearshore area, 43% of lakes and 71% of estuarine square were also in good condition. 47% of wetland acres were in good condition based on vegetation.

Biological Indicators

The biology of a water body can be characterized by the presence, number, and diversity of macroinvertebrates, fish, vegetation, zooplankton and other organisms. These indicators provide information about the health and productivity of ecosystems.

To assess biological condition, each of the surveys used indicators applicable to the water body type. Based on information from the most recent reports in the NARS program the percent of waters in good biological condition ranged from 28% to 71% depending on the waterbody type and the indicator.

As part of NARS, the EPA, states, and Tribes also assessed fish communities in rivers and streams and zooplankton in lakes finding 35% and 54% were in good condition, respectively.

Poor biological condition is:

- Almost twice as likely in wetlands when heavy metals are present in soils at elevated concentrations, phosphorus is high, or natural vegetation in the surrounding area is altered.
- Almost two times more likely in lakes or rivers and streams when nutrients are high than in waters where nutrients are not high.

Additional analysis estimates that reducing these stressors could improve biological condition in 8 to 36% of waters currently in poor condition.

Chemical and Physical Indicators

In the aquatic environment, a stressor is anything that can adversely affect the community of organisms residing there. For NARS, specific chemical and physical stressor indicators were selected for sampling because the stressors are widespread, are of potential concern and can be cost-effectively measured. These indicators of stress were not intended to be all-inclusive.

NARS results indicate that nutrients and degraded habitat are pervasive issues impacting our waters across the country. Excessive levels of phosphorus are reported in 42% of river and stream miles, 45% of lakes and approximately 20% of coastal water square miles.

Habitat degradation is also widespread across the country with 36% of wetland acres, 29% of lakes and 27% of river and stream miles in poor condition.

Recreational and Human Health Indicators

NARS assessments also include information on microcystin a toxin that can be produced from cyanobacteria blooms. Recreational exposure is typically a result of skin contact or accidental ingestion. Health effects of exposure include skin rashes, eye irritation, respiratory symptoms, gastroenteritis, and in severe cases, liver or kidney failure and death. For NARS, microcystin results were compared to the EPA's recreational freshwater criteria and swimming advisory recommendation of 8 ppb. Microcystins were detected in 21% of lakes but at levels of concern in 2% of lakes, representing 4,400 lakes across the nation. NARS also found that microcystins were detected in 9% of river and stream miles, 8% of wetland acres, and 6% of coastal square miles but at levels of concern in <1% of these waters.

When contaminants enter the aquatic environment, they can accumulate in fish and may reach levels of concern for people who eat fish. Collection of whole fish composite samples in the Great Lakes nearshore waters and in rivers found all samples had detectable levels of mercury and polychlorinated biphenyls (PCBs), and more than 92% of the samples contained detectable levels of perfluorooctane sulfonate (PFOS). Fetal or early childhood exposures to mercury can lead to impaired neurological development, and long-term exposures among adults can lead to cardiovascular disease (EPA 2001). PCBs are classified as a probable human carcinogen and may also lead to

neurological effects in infants and young children, or liver disease or reproductive impacts in adults (EPA 1996). PFOS has been linked to immune, cardiovascular, hepatic (liver), and developmental health effects, as well as an increased risk of certain cancers (EPA 2024).

Mercury concentrations in fish fillet composite samples exceeded EPA's national recommended CWA section 304(a) fish tissue-based water quality criterion for methylmercury (300 ppb) in 13% of the 6,862 square miles of the assessed Great Lakes nearshore waters and 26% of the 41,099 river miles comprising the sampled populations. Fish fillet tissue sample results in this summary report are compared with the PCB screening level (12 ppb) for cancer effects associated with general fish consumers (those who eat one 8-ounce serving of fish per week). Exceedances of the EPA's PCB fish tissue screening level were identified in 45% of the sampled population of river miles and 79% of the Great Lakes sampled population. When compared to the PCB screening level of 2.8 ppb for cancer effects associated with high-frequency fish consumers, such as subsistence fishers or some recreational fishers, exceedances of this screening level were identified in 74% of the sampled population of river miles and 100% of the Great Lakes sampled population) (EPA 2023c and EPA 2021c).

Enterococci are bacteria that are used as indicators of possible fecal contamination from sources such as wastewater treatment plant discharges; leaking septic systems; stormwater runoff; animal waste; and runoff from pastures, feedlots, and manure storage areas. Results were compared to an EPA benchmark (1,280 calibrator cell equivalents per 100 milliliters) included in EPA's recommended recreational criteria document for protecting human health in ambient waters designated for swimming (U.S. EPA 2012). Nationally, enterococci levels were at or below the EPA benchmark in 99% of estuarine waters and Great Lakes nearshore waters, and 78% of rivers and streams.

For information on human health risks in specific waterbodies, people should check with state, Tribal or local governments before swimming, boating, or fishing.

State and Tribal Results

States and Tribes employ a range of approaches to monitor and collect water quality data to support protection and restoration decisions at the state, Tribal and local levels, including submission of water quality assessment reports to EPA. State and Tribal assessments are based on data collected using a variety of sampling methods and parameters, water quality standards, assessment methods, and time periods. As states submit their Integrated Reports and Tribes submit their assessment reports, the information is updated online at How's My Waterway. *How's My Waterway* was designed to make these assessment reports accessible to the public and present water quality information in an easy to navigate and interactive format. Water quality information is displayed on three scales in *How's My Waterway*; community, state and Tribal, and national.

Introduction

In recognition of the 50th Anniversary of the Clean Water Act (CWA), EPA, Congress and the public celebrated the many benefits of the nation's commitment to clean water. The CWA established an objective to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (CWA Sec 101).

Congress included mechanisms for monitoring and reporting on water quality as a fundamental component of the CWA. Two sections of the CWA were important for addressing the information gap: Section 305(b) and Section 104(a)(5). Section 305(b) calls for states to submit a "description of the water quality of all navigable waters; the extent to which all navigable waters of such State provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water." Section 104(a)(5) calls for the development of a national water quality monitoring and surveillance system designed to inventory and determine the quality of all navigable waters in the nation.

The authors of the CWA understood that monitoring and reporting efforts were critical for knowing now and in the future how well we are doing to meet the CWA objective. Along with Sections 104 and 305, there are additional provisions for monitoring and reporting. For example, Section 106(e) requires states to implement monitoring programs as a prerequisite to receiving grants to administer water quality management programs; Section 303(d) requires lists of waters that do not meet state or Tribal water quality standards and do not have a Total Maximum Daily Load identifying pollutant reductions needed to meet standards; Section 314 calls for tracking the trophic state of lakes; and Section 319 includes monitoring of nonpoint sources of pollution.

Fifty years ago, even twenty years ago, we could not answer questions such as what extent of waters are healthy or degraded, how widespread are key stressors, is water quality getting better or worse, and are we investing effectively in protection and restoration?

Despite advances in monitoring and assessment programs, during the first 30 years of CWA implementation, it was widely recognized that the state Section 305(b) reports were too disparate to describe the condition of the Nation's waters. While the state water quality reports were, and continue to be, valuable for the individual states, numerous independent and internal reviews found the differences in methods across states prevented valid national level reporting.

Even the national newspaper, USA Today, called out the importance of having data available on the condition of the nation's environmental resources in article published September 26, 2002. It reported that EPA was able to demonstrate progress in improving air quality but lacked consistent and representative data to report on the condition of the nation's waters. They pointed out that "without such data, the public doesn't know when to celebrate environmental successes, tackle new threats, or end efforts that throw money down the drain."

One of many CWA successes to celebrate is the formation of unique partnership among EPA, states and Tribes in response to these critiques. Authorized under CWA Section 104 and in support of CWA Section 305, this partnership initiated the National Aquatic Resource Surveys, a cost-effective program to monitor and assess the condition of the nation's waters, to evaluate key stressors, and track changes over time. 50 years after the passage of the CWA, this report celebrates how far we have come to address the need for information on the quality of our waters.

Today, this document, the National Water Quality Inventory: Report to Congress, provides national level water quality conditions summarizing the results of statistically-representative, nationally consistent aquatic resource surveys conducted by the EPA in partnership with state and Tribal water quality agencies. The report describes the responsibilities of states and Tribes for monitoring and assessment reporting and provides links

to the How's My Waterway website. How's My Waterway contains summaries of the water quality assessment reports submitted to EPA and serves water quality data and information at the community level.

State and Tribal monitoring and assessment reports provide information needed to support management decisions under their jurisdictions. This includes setting water quality standards, monitoring and assessing water quality, permitting point source discharges, and developing plans to safeguard and restore water resources. Under the CWA, each state or Tribe sets its own water quality standards, including designated uses, narrative and numeric water quality criteria, and antidegradation policies. They develop assessment methodologies and monitoring strategies. These may differ among states and Tribes. Thus, the assessment decisions reported by states and Tribes and summarized in *How's My Waterway* apply to the individual states or Tribes. Because of differences across programs there are challenges associated with using state and Tribal assessment decisions to compare water quality conditions among states and Tribes and collectively they cannot be used for reporting national water quality conditions and trends

EPA, states, and Tribes along with other federal agencies, research organizations, and volunteer scientists employ a wide range of approaches to collect water quality information for a range of high priority needs. Much of these data are shared through the Water Quality Portal so data can be used beyond its initial purpose and strengthen decision making. The national surveys and the individual state and Tribal assessments have different goals and approaches, and each provides valuable information that contributes to our overall picture of nationwide water quality as called for in Section 305(b) of the CWA.

National Aquatic Resource Surveys

Known as the National Aquatic Resource Surveys (NARS), the statistical surveys summarized in this report sample monitoring sites using a stratified, randomized design to provide unbiased estimates of the condition of the broader population of waters (e.g., rivers and streams, lakes) throughout the nation. These nationally consistent surveys, conducted on a five-year cycle, report on the extent of waters that meet the CWA goals of supporting healthy biological communities and recreation. NARS also examines the prevalence of priority physical and chemical stressors. Detailed results and data from these surveys are available at National Aquatic Resource Survey's Website. The surveys are designed to:

- Assess the biological/recreational condition of the nation's waters at national and broad regional scales.
- Identify the most widespread stressors and rank them based on the relative associations between indicators of condition and indicators of stress.
- Track changes in water quality over time.

The statistical design of the national surveys allows EPA to extrapolate the results from the approximately 1,000 sites sampled each cycle to the entire population (estuarine waters, Great Lake nearshore waters, lakes and reservoirs, rivers and streams, and wetlands). This is a cost-effective means of generating national or statewide assessments. 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, water quality condition 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 progress in investments to protect and restore water quality at a broad scale.

The surveys use selected indicators to assess the biological, chemical, and physical condition of waters in the U.S., as well as characteristics that pose risks to

human health[1]. Although they do not include all indicators, EPA and its state and Tribal partners determined that those selected align with the survey goals and are representative at a national scale.

To assess water quality, NARS uses two types of assessment benchmarks. The first type consisted of fixed benchmarks applied nationally based on values in the peer-reviewed scientific literature, EPA published values, or EPA-derived screening levels. For example, EPA's recommended water quality criteria were used nationally to classify rivers and streams as above or below a criterion or benchmark for microcystins, cylindrospermopsin, enterococci, and mercury. Similarly, EPA fish tissue screening levels for PCBs, developed using information on human health risk and fish consumption rates, were applied for human health fish fillet tissue indicators. The second type consists of NARS-specific regional benchmarks.

The NARS assessment benchmarks are not equivalent to individual state water quality standards and have no legal effect on state assessment decisions. NARS condition categories may not correspond to the categories states and Tribes use when they assess water quality relative to their specific water quality standards under the Clean Water Act. For example, a rating of poor condition under NARS does not necessarily mean a site is "impaired" as defined by state and Tribal water quality standards and assessment protocols.

Throughout this report, percentages reported for a given indicator apply to the total extent of waters assessed for the most recent surveys (see Table 1) with exception of the human health fish fillet indicator, for which percentages reported apply to the sampled populations. For example, if wetland condition is described as poor for 10% of wetlands nationally, this means that the area estimated to be degraded for that indicator is 9,564,924 wetland acres.

Table 1. Total Waters Assessed for each waterbody.

Total extent of waters assessed in the National Aquatic Resource Surveys	
Estuaries (square miles)	27,479
Great Lakes Nearshore (square miles)	7,118
Lakes and Reservoirs (number of lakes)	224,916
Perennial Rivers and Streams (miles)	1,543,290
Wetlands (acres)	95,694,241

This report provides information on the quality of the nation's waters. It does not impose legally binding requirements on EPA, states, Tribes, other regulatory authorities, or the regulated community. This document does not confer legal rights or impose legal obligations upon any member of the public. This document does not constitute a regulation, nor does it change or substitute for any Clean Water Act (CWA) provision or EPA regulation. EPA could update this document as new information becomes available. EPA and its employees do not endorse any products, services, or enterprises. Mention of trade names or commercial products in this document does not constitute an endorsement or recommendation for use.

[1] Per the 2008 Federal Register notice, states and Tribes receive $8,000 per NARS site in their jurisdiction for field and laboratory work.

Rivers and Streams

Key Findings of the National Rivers and Streams Assessment 2018-2019

The National Rivers and Streams Assessment 2018-2019 (NRSA) was the third statistical survey of our nation's flowing waters undertaken by the EPA and its state and Tribal partners. It provides information on the ecological condition of the nation's rivers and streams and the key stressors that affect them, both on a national and an eco-regional scale.

During the summers of 2018 and 2019, sixty-one EPA, state and Tribal field crews sampled 1,851 randomly selected river and stream sites across the country, representing 1.5 million miles of rivers and streams. Using standardized field methods, they sampled waters as large as the Mississippi River and as small as mountain headwater streams for indicators of water quality, biological condition, habitat condition, and recreational suitability. To learn more about the NRSA, visit National Rivers and Streams Assessment Website.

Biological Indicators

Biological condition is the most comprehensive indicator of water body health: when the biology of a stream is healthy, the chemical and physical components of the stream are also typically in good condition. Of the nation's river and stream miles, less than one-third of our river and stream miles (28%) had healthy biological communities, based on an index that uses the abundance and diversity of benthic macro-invertebrates. Macro-invertebrates are bottom-dwelling aquatic organisms such as dragonfly and stonefly larvae, snails, worms, and beetles.

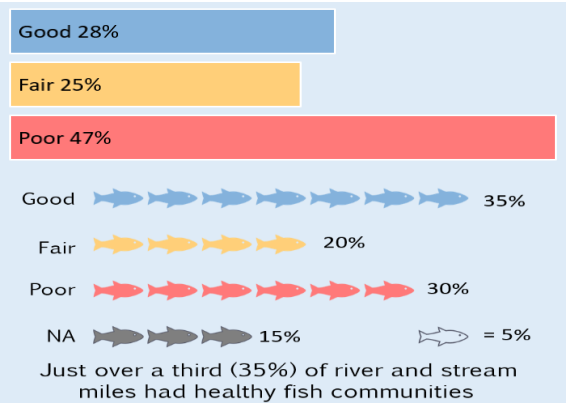

Figure 2. Biological condition based on macroinvertebrates and fish community.

NRSA INDICATORS

NRSA used 13 indicators to assess the quality of rivers and streams:

Biological
- Macroinvertebrates
- Fish

Chemical
- Phosphorous
- Nitrogen
- Salinity
-

Physical
- In-stream Fish Habitat
- Riparian Disturbance
- Riparian Vegetative Cover
- Streambed sediments

Human Health
- Enterococci
- Microcystin and Cylindrospermopsin
- Fish tissue contaminants

Quality for biological, chemical, and physical indicators is based on NRSA-specific regional benchmarks based on the distribution of indicator values from a set of river and stream reference sites. Human health indicator ratings are based on fixed benchmarks based on values in the peer-reviewed scientific literature or EPA published values.

Another index based on fish community scores found 35% of river and stream miles were rated good. Fish are sensitive indicators of physical and chemical habitat degradation, environmental contamination, migration barriers and overall ecosystem productivity. They need plants, insects and benthic macroinvertebrates to eat; in- stream and streambank cover for shelter; high-quality streambed substrate conditions for spawning; and overhanging vegetation to shade and cool the water. Fish can avoid some stressors, unlike macroinvertebrates.

Chemical Indicators

Four chemical indicators were assessed as part of the NRSA: nutrients (total phosphorus, total nitrogen), salinity, and acidification. Of these, phosphorus and

nitrogen are by far the most widespread: 42% percent of the nation's river and stream miles are rated poor because of excess levels of phosphorus and 44% are rated poor because of excess levels of nitrogen. For both phosphorus and nitrogen more river and stream miles were in poor condition than in good condition. The data collected indicate that a finding of poor biological condition based on benthic macroinvertebrates was almost twice as likely in rivers and stream miles rated poor for nutrients. biological condition could be improved if nutrient condition changed from poor to fair or good. Most river and stream miles were not acidic (98%) and in good condition for salinity (85%).

Physical Habitat Indicators

Four indicators of physical habitat condition were assessed nationally: in-stream fish habitat, excess streambed sediments, riparian vegetative cover (vegetation in the land corridor surrounding the river or stream), and riparian disturbance (human activities near the river or stream). Physical habitat indicator scores revealed that 68% of river and stream miles were rated good for in-stream fish habitat. In addition, 56% of river and stream miles had good ratings for riparian vegetation, however, 64% had moderate or high levels of riparian disturbance. NRSA found that streambed sediments were in good condition in 57% of river and stream miles. Human activities that disturb land can interfere with river and stream sediment balance by increasing the amount of fine sediment entering river and stream channels. Benthic macroinvertebrate condition was almost twice as likely to be rated poor when sediment levels were rated poor than when they were rated fair or good.

Human Health Indicators

The survey evaluated river and stream quality compared to six indicators that provide insight into potential risks to human health: two algal toxins (microcystins and cylindrospermopsin), the fecal contamination indicator enterococci, and contaminants in fish tissue (mercury, PCBs, and per- and polyfluoroalkyl substances (PFAS)).

Enterococci are bacteria that indicate fecal contamination. Enterococci exceeded EPA's benchmark in 20% of river and stream miles. Swimming and recreating in water contaminated with pathogens could make people ill.

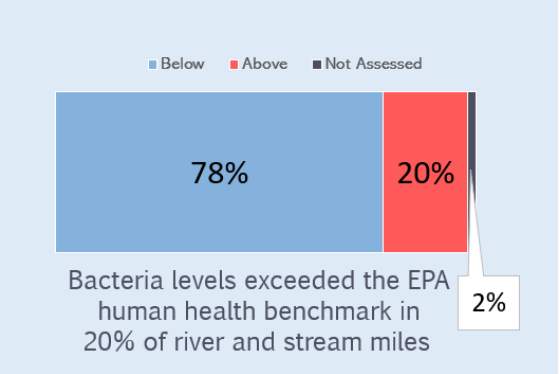

Figure 3. Enterococci bacteria are used as a human health indicator for recreation.

Cyanobacteria can produce a variety of toxins; the rivers and streams survey measured levels of microcystins and cylindrospermopsin. Algal toxins were present, but at very low levels, with minimal recreational human health concerns. Microcystins and cylindrospermopsin were detected in 9% and 10% of river and stream miles, respectively, but did not exceed EPA's criteria recommendation.

In an analysis of contaminants in rivers, mercury, PCBs and PFOS were detected in over 90% of fish tissue samples, with exceedances of screening levels varying by contaminant. Mercury concentrations in fish fillet composite samples (samples composed of fillet tissue from multiple fish) were detected in 100% of samples and concentrations exceeded EPA's recommended fish tissue-based water quality criterion in 26% of the 41,099 river miles comprising the sampled population for this indicator. Total PCB concentrations in fish fillet composite samples were detected in 100% of samples and concentrations exceeded fish tissue screening levels for the general consumer in 45% of the 41,099 river miles comprising the sampled population for this indicator. People should check for local health department advisories before eating fish they have caught.

Regional, State, and Local Results

Regional Results for all indicators can be found at:
Rivers and Streams Dashboard
Rivers and Streams Ecoregional Results
State, Tribal, and local water quality information:
How's My Waterway

Lakes, Ponds, and Reservoirs

Key Findings of the National Lakes Assessment 2017

The National Lakes Assessment (NLA) 2017 was the third statistical survey of the condition of our nation's lakes, ponds, and reservoirs undertaken by the EPA and its state and Tribal partners. It provides information on the ecological condition of the nation's lakes and the key stressors that affect them, both on a national and an eco-regional scale.
In the summer of 2017, field crews from EPA, states, Tribes, and other partners sampled 1,005 randomly selected lakes across the country. The survey results represent the state of nearly 225,000 natural and human- made lakes in the U.S. that are greater than 1 hectare in area and at least one meter deep. Lakes were sampled for indicators of water quality, biological condition, habitat condition, and recreational suitability. For more information on the NLA, visit the National Lakes Assessment Website.

Trophic Indicator

Trophic state is commonly used for classifying the biological productivity in lakes. Twenty four percent of lakes have the highest concentrations of chlorophyll *a* and are classified as most disturbed, or hypereutrophic; 45% are eutrophic; 20% are mesotrophic; and 11% have low levels of chlorophyll *a* and are classified as oligotrophic.

NLA INDICATORS

NLA used 15 indicators to assess the quality of lakes. These parameters are grouped into four categories: trophic state, biological, chemical, and physical.

Trophic State

Biological
- Chlorophyll *a*
- Benthic macroinvertebrates
- Zooplankton

Chemical
- Acidification
- Atrazine
- Algal toxin (Microcystins)
- Dissolved Oxygen
- Phosphorous
- Nitrogen

Physical
- Lake drawdown exposure
- Lake habitat complexity
- Lakeshore disturbance
- Riparian vegetation cover
- Shallow water habitat

Quality for biological, chemical, and physical indicators are based on NLA-specific regional reference conditions. For the algal toxin and atrazine indicators, analysts used nationally consistent benchmarks developed by EPA or EPA recommended water quality criteria.

Figure 4. Trophic status of lakes across the country. Nationally eutrophication was widespread, 24% of lakes were hypereutrophic and 45% were eutrophic. The clearest lakes in the oligotrophic and meso-trophic category made up 11% and 20% of lakes, respectively. The percentage of lakes in mesotrophic condition declined from 27% to 20%; this was the only statistically significant change in trophic state nationally. In the Upper Midwest ecoregion, statistically significant changes in trophic condition included a decline in lakes in mesotrophic condition (change from 47% to 31%) and an increase in hypereutrophic condition (change from 5% to 14%).

Biological Indicators

Overall, EPA found that 43% of lakes were in good condition based on benthic macroinvertebrates, 29% of lakes were in fair condition, and 24% were poor. For zooplankton (small animals in the water column), 22% of lakes had poor zooplankton communities and 23% of lakes had communities in fair condition. Chlorophyll *a*, which indicates the amount of microscopic algae and cyano-bacteria present, was in excess and rated poor in 45% of lakes. The percentage of lakes in good chlorophyll *a* condition decreased significantly, from 46% to 34% since 2012. Nationally, lakes where phosphorus was elevated, benthic macroinvertebrate communities (e.g., insect larvae, snails, and clams living on the lake bottom) were 2.3 times more likely to be in poor condition. In natural lakes (i.e., excluding reservoirs), this risk increased to 6.9.

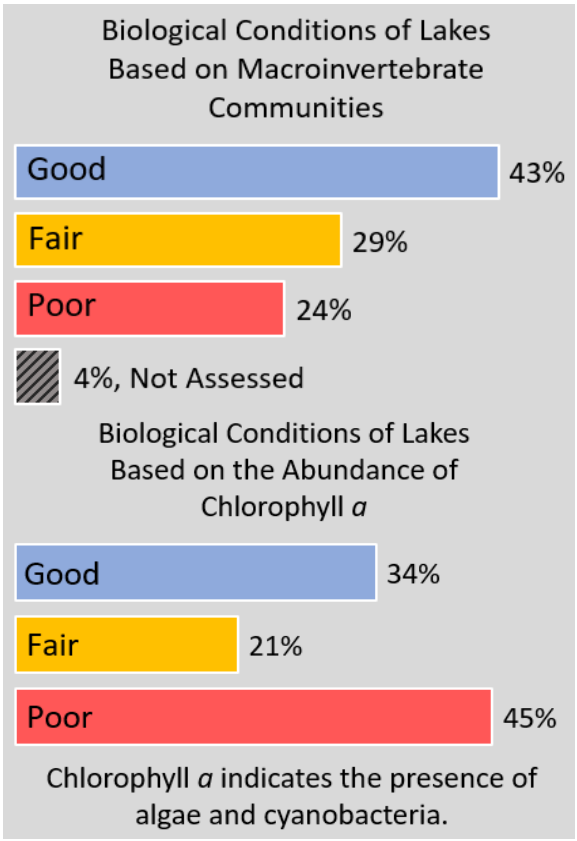

Figure 5. Biological condition can be characterized by the presence, number, and diversity of macroinvertebrates, algae, vascular plants, and other organisms.

Chemical Indicators

High nutrient levels are the leading problem in the nation's lakes. In many lakes, phosphorus is considered the limiting nutrient; small amounts can trigger rapid increases in algal growth. Across the country 45% of lakes had poor levels of phosphorus, and 46% had poor levels of nitrogen. Lakes with high levels of phosphorus are more than twice as likely to have poor conditions for benthic macroinvertebrates. Atrazine is an agricultural herbicide. It can affect plant growth and may be toxic to wildlife and humans. It was detected in 30% of lakes and measured at levels that exceed screening benchmarks in 0.5% of lakes (about 1,200 lakes). Nine percent of lakes have poor dissolved oxygen in surface waters, insufficient to support aquatic life (<3mg/L). Lakes with good ratings for dissolved oxygen in surface waters decreased by 12 percentage points compared to 2012.

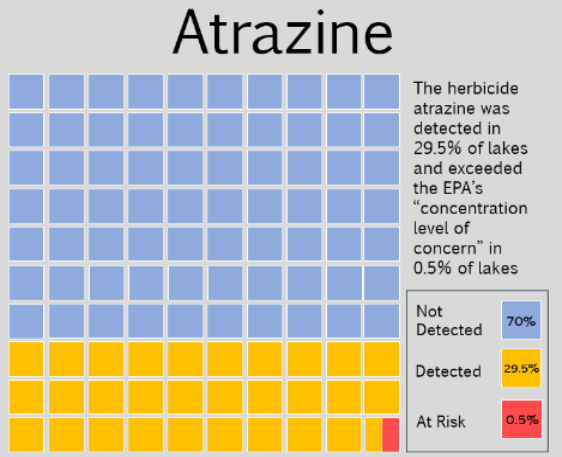

Figure 6. The herbicide atrazine can affect plant growth and may be toxic to wildlife.

Human Health Indicator

Algae and cyanobacteria are a natural part of freshwater ecosystems. However, some algae blooms, powered by high levels of nutrients and warm temperatures, can be harmful to people and animals. The NLA 2017 finds that an algal toxin, microcystin, was detected in 21% of lakes, but concentrations exceeded EPA's recommended recreational freshwater criteria in less than 2% of lakes.

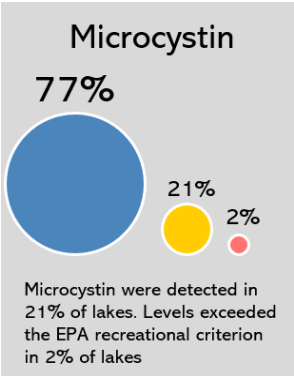

Figure 7. The percentage of lakes where microcystins were detected decreased, down from 37% in 2012.

Physical Habitat Indicators

For the NLA, physical habitat condition was assessed based on observation of five indicators: lake drawdown exposure, lake habitat complexity, lakeshore disturbance, riparian vegetation cover, and shallow water habitat. Healthy lakeshore habitat slows pollution runoff and provides varied and complex ecological niches for aquatic life. Only 25% of lakes were rated good for lakeshore disturbance, indicating shoreline alterations were present in 74% of lakes. Only 3% of lakes had poor (large) drawdown. The drawdown indicator measures water levels and their fluctuation. Shallow water habitat, riparian vegetative cover, and habitat complexity conditions were rated good in 51% to 65% of lakes. Lakes with good habitat complexity increased 13 percentage points in 2017.

Regional, State, and Local Results

Regional Results for all indicators can be found at:
National Lakes Assessment Dashboard
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State, Tribal, and local water quality information:
How's My Waterway

Wetlands

Key Findings of the National Wetland Condition Assessment 2016

The National Wetland Condition Assessment (NWCA) 2016 was the second statistical survey of the condition of our nation's wetlands. It provides information on the ecological condition of the nation's wetlands and the key stressors that affect them, both on a national and an eco- regional scale. To learn more about the benefits of wetlands and EPA activities to protect and restore these vital resources, visit EPA's wetlands page.

During the spring and summer of 2016, field crews from EPA, states, Tribes, and other partners sampled 967 randomly selected wetland sites across the country. The survey represents 95,694,241 acres of wetlands in the U.S. and encompasses all wetlands, from the tidal and non-tidal wetlands along our coasts to the forested swamps, prairie potholes and meadows of the interior plains. Wetlands were sampled for vegetation, soils, hydrology, algae, water chemistry, and potential stressors.

For more information on the NWCA, see the National Wetland Condition Assessment Website

Biological Indicators

In 2016, 47%, of wetland area was rated good based on the vegetation multimetric index. Using another biological indicator based on the occurrence and abundance of nonnative plants, EPA found condition to be good in 57% of wetland area. Nonnative plants are recognized as indicators of declining ecological condition. Vegetation is a major component of the biodiversity and structure of wetlands, and it provides habitat for microbes, insects, amphibians, reptiles, birds, and mammals.

NWCA INDICATORS

The NWCA uses categories of indicators to assess the conditions and stressors of wetlands.

Biological
- Vegetation Index
- Nonnative Plants

Chemical
- Soil Heavy Metals
- Water Chemistry (Phosphorous and Nitrogen)

Physical
- Vegetation Removal
- Vegetation Replacement
- Flow Obstruction
- Water Addition or Subtraction
- Soil Hardening
- Surface Modifications
- Physical Alterations

Human Health
- Microcystins

Biological, chemical, and physical indicators are evaluated based on reference conditions for regional, national, or wetland group. For human health indicators, EPA compared the numeric results to EPA recommended water quality criteria.

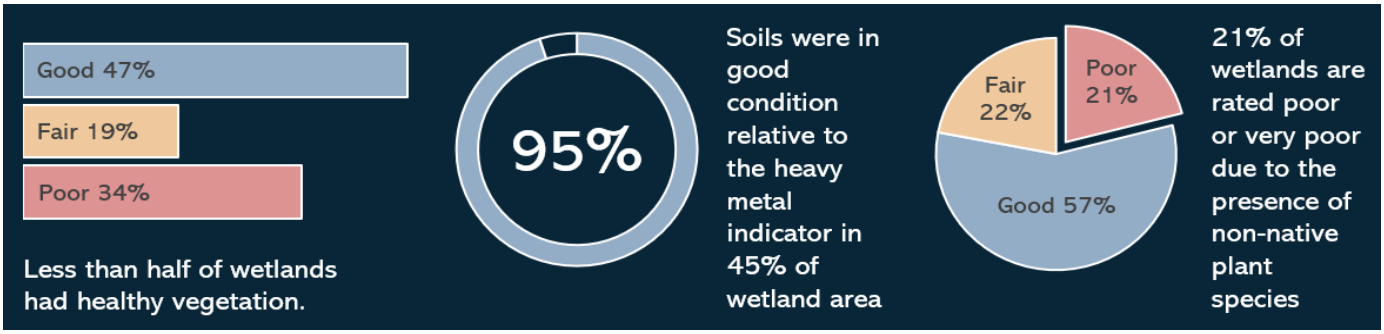


Figure 8. Non-native species are the most common problem, while measured concentrations of heavy metals were below background levels across most wetland area. The biological indicator for vegetation was a multi-metric index.

Chemical Indicators

For wetlands, a soil heavy metals indicator assessed concentrations of 12 different heavy metals which can negatively impact ecological function and health. Thresholds used reflect human disturbance to the site, not necessarily toxicity. The assessment indicated that 95% of wetland area across the U.S was in good condition relative to the heavy metals indicator. Nitrogen and phosphorus conditions were found to be poor (have excess levels) at 24% and 22% of wetland area, respectively. However, because many wetlands do not have surface water present during the NWCA sampling period, 40% of wetland area was not assessed for these two indicators. Wetlands that score poor for either of the chemical indicators are more likely to score poor for the vegetation index, than are wetlands that score fair or good for the chemical indicators.

Physical Indicators

The survey includes information on physical, human-caused alterations to wetlands that affect vegetation, hydrology (water levels and the flow of water), or soil. The NWCA also measures the presence of multiple alterations at each site using a cumulative indicator that combines the results of the six indicators. In 2016, the combined indicator showed that 36% of wetland area was in poor condition. Physical alteration indicators for soil hardening and water addition or subtraction were the most widespread of the individual physical indicator However, because many wetlands do not have surface water present during the NWCA sampling period, 42% of wetland area was not assessed.

Fifty-four percent and 50%, respectively, of wetland area was in fair or poor condition for these indicators. Most wetland area was rated good for surface modification (79%), flow obstruction (74%), vegetation replacement (69%), and vegetation removal (61%).

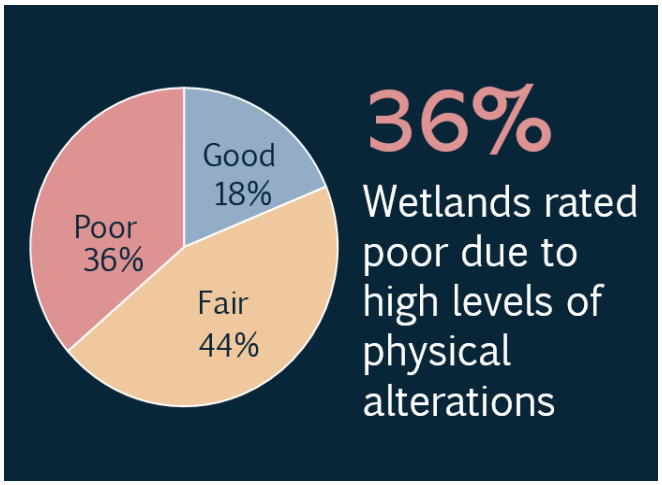
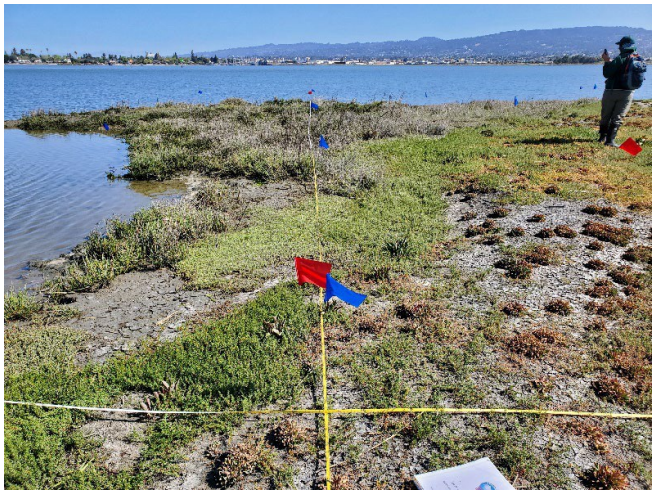


Figure 9. 36% of wetlands rated poor due to high levels of physical alterations such as soil hardening, vegetation replacement and water addition and subtraction.

Human Health Indicator

Microcystins were detected in 8% of wetland area. Microcystins in wetland waters exceeded the EPA's recommended recreational freshwater criterion in less than 1% of wetland area.



Regional, State, and Local Results

Regional Results for all indicators can be found at:
National Wetland Condition Assessment Dashboard
National Wetland Condition Assessment Ecoregional Results
State, Tribal, and local water quality information:
How's My Waterway

Coastal Estuaries

Key Findings of the National Coastal Condition Assessment 2015

The National Coastal Condition Assessment (NCCA) 2015 reports on the condition of our nation's coastal estuarine waters and Great Lakes (included in the following section). It provides information on the ecological condition of these coastal waters and the key stressors that affect them, both on a national and regional basis.

In the summer of 2015, EPA and its partners visited a total of 1,060 randomly selected sites in 28 coastal states (excluding Alaska and Hawaii) with 699 sites in estuaries representing about 27,479 square miles. Coastal waters were sampled for indicators of water quality, biological condition, prey fish contaminant effect on wildlife predators, sediment quality, and recreational suitability.

For more information on the NCCA, visit The National Coastal Condition Assessment Website.

Ecological Indicators

Biological condition was overall good, with 71% of estuarine area in good condition based on the benthic macroinvertebrate index. From 2005-06 to 2015, the percentage of area in good condition increased (from 51% to 71%), while "not assessed" area decreased by a similar margin. Sediment quality in estuaries was good, based on measures of chemical contaminants found in sediments and laboratory tests of toxicity. Seventy-six percent of estuarine area was rated good nationally, although low levels of metals and polycyclic aromatic hydrocarbons were widely detected. Sediments serve as critical indicators of estuarine condition because they can accumulate contaminants that may enter the food web via bottom-dwelling organisms.

High contaminant levels in prey fish could pose a risk for the food web. Fifteen percent of estuarine area was rated good, 20% was rated fair, and 55% was rated poor (10% of the area was not assessed). This indicator evaluates the extent of water where levels of contamination in fish might lead to lethal or nonlethal ecological effects such as reduced reproductive success in predators. This indicator does not imply risk to people.

NCCA INDICATORS

The NCCA uses four ecological and three human health indicators to assess the conditions in estuaries and bays.

Ecological Indicators
- Biological Condition
- Eutrophication
- Sediment Quality
- Ecological Effects of Fish Tissue Contamination

Human Health Indicators
- Enterococci
- Microcystin
- Mercury in Fish Fillet Plugs

Ecological indicators are evaluated based on NCCA-specific index score. Eutrophication is based on a water quality index. Sediment is based on a quality condition score. For human health indicators, EPA compared the numeric results to human health benchmarks.

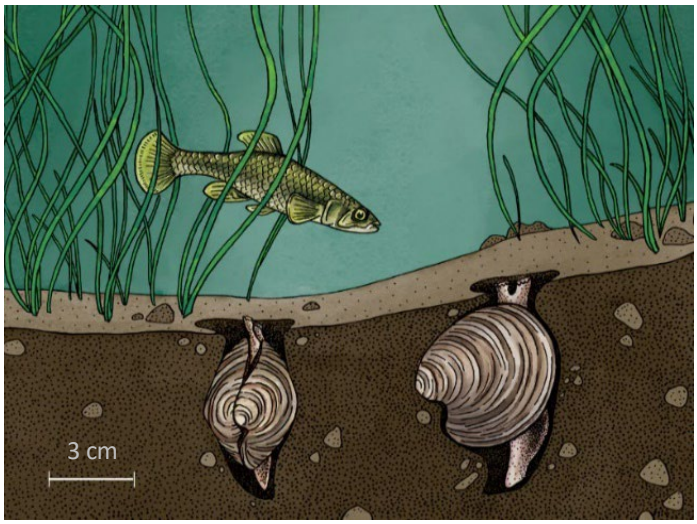


Figure 10. In estuaries, 71% are healthy based on their biological communities. A healthy waterbody supports aquatic communities – such as worms, snails, and clams – that are sensitive to changes in their environment. 76% of estuaries have good quality sediments. When present, contaminants can negatively impact organisms living in sediments.

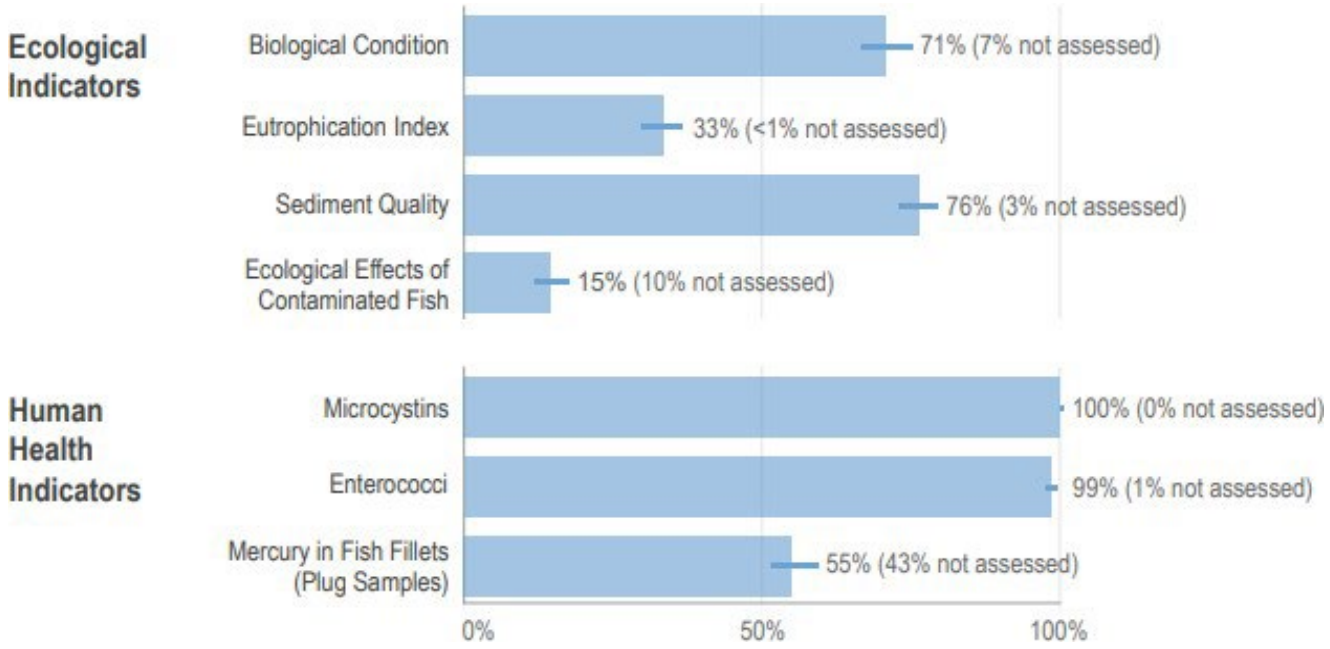


Figure 11. The percent of estuarine area in good condition for NCCA 2015 indicators.

Eutrophication is the most widespread problem in estuaries. Only 33% of estuarine area was rated good. Conditions were worst in the Gulf of Mexico region, where 18% of area was rated good; and best on the West Coast, where 76% of the area was rated good. Components of the water quality index include phosphorus, nitrogen, water clarity, chlorophyll *a*, and dissolved oxygen. Low levels of dissolved oxygen and high nutrient levels associated with eutrophication can stress or even kill fish and other aquatic organisms.

Human Health Indicators

Conditions pose little risk to human health in most estuaries. Human health indicators were assessed for the first time in 2015. In most estuaries, recreational users faced a low risk of exposure to fecal indicator bacteria (enterococci) and cyanotoxins (microcystins); enterococci samples rarely exceeded benchmarks, and microcystins did not at all. Note that results for microcystins do not mean there are never problems—harmful algal blooms can be short-lived and may develop and produce toxins quickly, and other toxins not measured as part of the NCCA may be present.

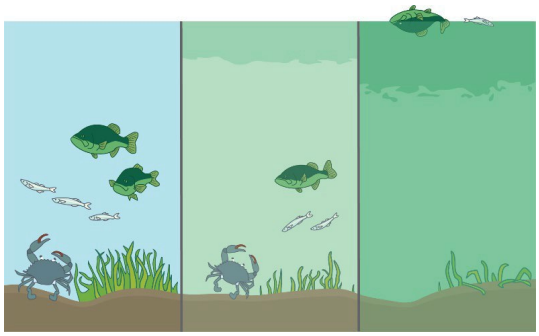


Figure 12. In almost all coastal waters, eutrophication poses the greatest environmental threat. High levels of nutrients can contribute to algal blooms which affect recreation and wildlife.

The NCCA also assessed mercury in plug samples taken from fish fillet tissue. Mercury was detected in all estuarine fish fillet plug samples collected but was above EPA's recommended fish tissue-based water quality criterion in only 2% of the area. However, 43% of estuarine area was not assessed due in part to inability to catch fish of the correct species or size. People should check for local health department advisories before participating in aquatic recreation or eating fish they have caught.

Regional, State, and Local Results

Regional Results for all indicators can be found at:
National Coastal Condition Assessment Dashboard
National Coastal Condition Assessment Ecoregional Results
State, Tribal, and local water quality information:
How's My Waterway

Great Lakes Nearshore

Key Findings for the Great Lakes Nearshore Waters NCCA 2015

The National Coastal Conditions Assessment (NCCA) 2015 was the second statistical survey of the condition of our nation's Great Lakes (and coastal embayment waters included in the previous section). It provides information on the ecological condition of the Great Lakes nearshore waters and the key stressors that affect them, both on a system and lake basis.

In the summer of 2015, EPA and its partners visited a total of 361 randomly selected sites in the Great Lakes, representing about 7,118 square miles of nearshore waters. The Great Lake nearshore sites were sampled for indicators of water quality, biological condition, prey fish contaminant effect on wildlife predators, sediment quality, and recreational suitability. For more information on the NCCA, visit the National Coastal Condition Assessment Website.

Ecological Indicators

In 2015, 31% of Great Lakes nearshore area was in good biological condition; it should be noted a similar proportion was not assessed for this indicator. Sediments are critical indicators of condition because they can accumulate contaminants and may enter the food web via bottom-dwelling organisms. Almost two-thirds of the nearshore area in the Great Lakes was in good condition based on sediment quality. Overall, 62% of nearshore area was in good condition for sediment quality, with 21% of area not assessed. Difficulty in collecting samples for analysis of biological condition and sediment quality was a problem in the Great Lakes. Areas with hard lake bottoms or invasive mussel colonies often prevented crews from collecting a sample, limiting the ability to determine condition in many areas.

High contaminant levels in prey fish in the Great Lakes could pose a risk for the food-web. The levels of contaminants in prey fish in 66% of the Great Lakes nearshore area could lead to adverse ecological effects, such as stunted growth or reduced reproduction, in sensitive fish and wildlife that eat them. This indicator assesses contaminants that at low levels may cause effects in predators. It does not imply risk to people.

NCCA INDICATORS for the Great Lakes

Four ecological and three human health indicators to assess the conditions in the Great Lakes nearshore.

Ecological Indicators
- Biological Condition
- Eutrophication
- Sediment Quality
- Ecological Effects of Fish Tissue Contamination

Human Health
- Enterococci
- Microcystin
- Contaminants in Fish Fillet

Ecological indicators are evaluated based on NCCA-specific index score. Eutrophication is based on a water quality index. Sediment is based on a quality condition score. For human health indicators, EPA compared the numeric results to human health benchmarks.

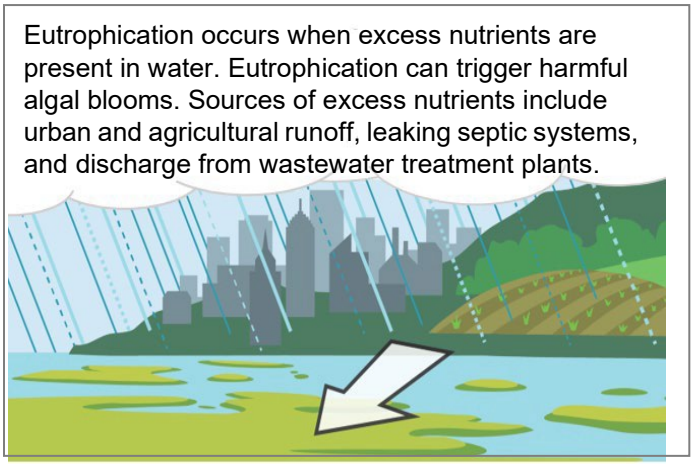


Figure 13. Twenty-four percent of Great Lakes waters have excess nutrients. While nutrients are important, having too many nutrients can lead to problems that reduce fishing, recreational, and tourism opportunities.

Eutrophication is a persistent problem in the Great Lakes with 46% of the nearshore area in fair or poor condition; Lake Erie experienced the most eutrophication, with 77% of the nearshore waters in fair or poor condition. Reduced water clarity and elevated total phosphorus were the drivers behind poor condition.

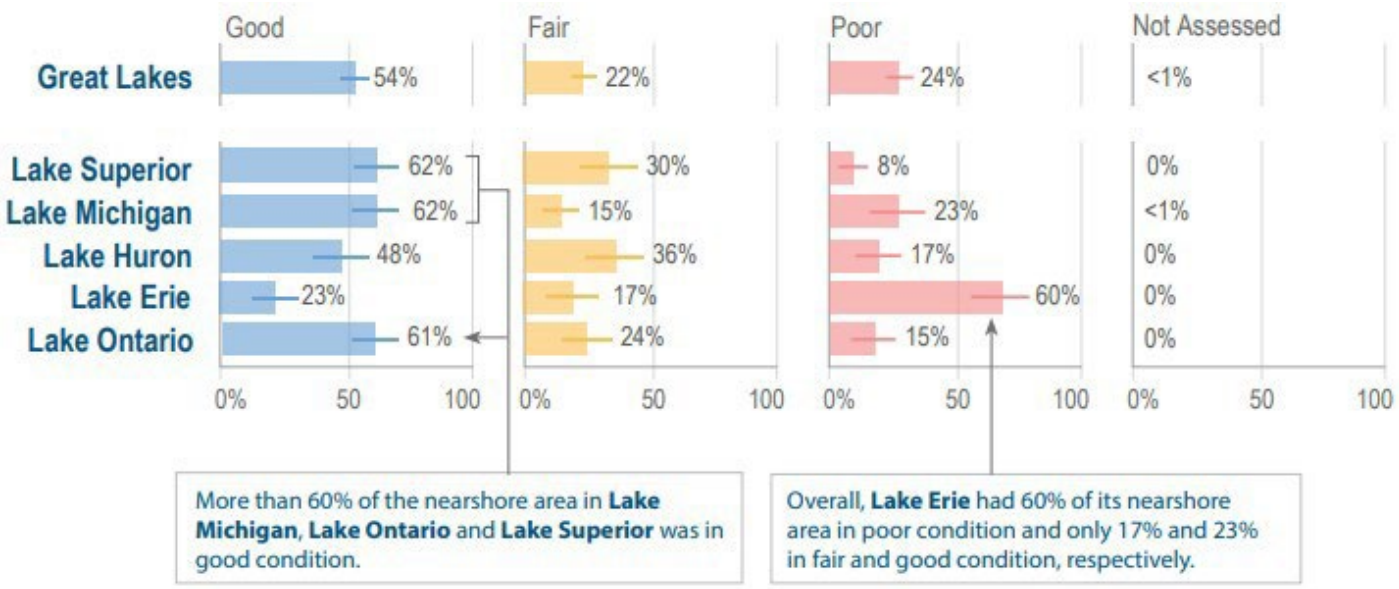


Figure 14. Eutrophication occurs when excess nutrients are present in water. Eutrophication can trigger harmful algal blooms. Sources of excess nutrients include urban and agricultural runoff, leaking septic systems, and discharge from wastewater treatment plants.

Human Health Indicators

At the time of sampling in 2015, human health indicators indicated low risk in most of the Great Lakes. Enterococci concentrations in 2015 were below the EPA's recommended benchmark in 99% of the Great Lakes nearshore area.

In the Great Lakes, an analysis of mercury, PCBs and PFOS indicated that all were present in all composite fish fillet tissue samples, with exceedances varying by contaminant. Mercury concentrations in fish fillet composite samples exceeded EPA's recommended fish tissue-based water quality criterion in 13% of the 6,862 square miles comprising the sampled population for this indicator. Total PCB concentrations in fish fillet composite samples exceeded the fish tissue screening level for cancer effects for the general consumer in 79% of the sampled population for this indicator. People should check for local health department advisories before eating fish they have caught.

Microcystins were detected in 31% of nearshore area. All microcystin samples but one (in Lake Erie) were at concentrations below the EPA's recommended recreational freshwater criterion.

Regional, State, and Local Results

Regional Results for all indicators can be found at:
National Coastal Condition Assessment Dashboard
National Coastal Condition Assessment Ecoregional Results
State, Tribal, and local water quality information:
How's My Waterway

Comparisons Across the National Aquatic Resource Surveys

Each of these assessments includes information on biological, chemical, and physical indicators. While the specific indicators chosen are those most suited to each waterbody type and are not exactly the same, looking across these assessments provides a broad picture of the overall health of waters across the country.

Biological Indicators

Benthic macroinvertebrates are widely used in the U.S. and globally to assess biological condition. Each of the national surveys for rivers and streams, lakes, estuaries, and Great Lakes nearshore waters used benthic macroinvertebrate indices appropriate to the aquatic resource types. The wetlands survey used a vegetation index to assess biological condition. Figure 15 compares information from the most recent reports in the NARS program. Estuarine waters had the most area in good condition at 71%, followed by wetlands with 47%, and lakes with 43%.

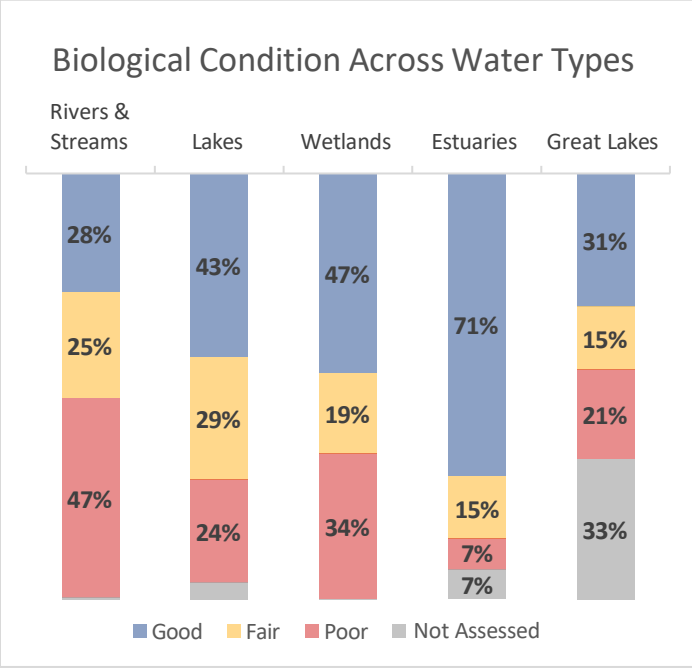


Figure 15. Biological condition for coastal waters, lakes, rivers, and streams is based on benthic macroinvertebrates; for wetlands based on plants. For the Great Lakes, it is important to note the large percent of unassessed waters. Data Source: NARS 2015-2019.

Chemical Indicators

Nutrient Pollution

NARS reports all present information about nutrient concentrations in the nation's waters, although the benchmarks for good, fair, poor vary by resource type and region of the country. The rivers and streams, lakes, and wetlands surveys compare nutrient levels to regional reference conditions. The NCCA reports on nitrogen and phosphorus separately and includes them as two of four parameters that comprise regional eutrophication indices. All the surveys found nutrients to be a widespread stressor, with less than half scoring good for nitrogen or phosphorus. Results for the eutrophication index find that 33% of estuarine

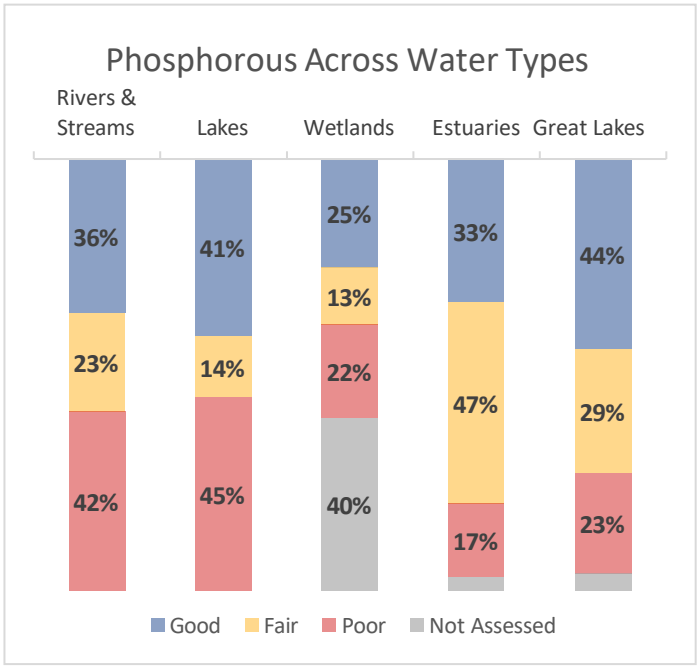


Figure 16. Phosphorus is an essential nutrient in the environment, but excess phosphorus is widespread in rivers, streams, and lakes. Data Source: NARS 2015-2019

waters and 54% of Great Lakes nearshore waters were in good condition.

In appropriate quantities, phosphorus is necessary for healthy, productive ecosystems. However, in excess quantities, phosphorus can lead to water quality problems such as eutrophication and harmful algal growth. Some aquatic resources, such as wetlands, naturally serve as sinks for phosphorus found in sediments or dissolved in water. Since phosphorus

generally occurs in small quantities in the natural environment, even small increases can negatively affect water quality and biological condition. Figure 16 compares results for phosphorus across surveys. Results for total phosphorus find that 44% of the Great Lakes nearshore and 41% of lakes score good followed by estuaries, wetlands and rivers and streams.

Physical Habitat Indicators

Sediment and Soil Quality

Soil and sediment quality is measured in the wetlands, coastal, and Great Lakes surveys. The NCCA found that the majority of estuarine and Great Lake nearshore sediments were in good condition (76% and 62%, respectively) based on measures of chemical contaminants found in sediments and laboratory tests of toxicity. Additionally, the wetlands assessment found concentrations of heavy metals were below background levels across most wetland area. The assessment indicated that 95% of wetland area across the U.S was in good condition, 3% was in fair, and 2% was in poor.

Vegetation and Disturbance

The disturbance indicators reflect the extent and intensity of direct human alteration of the lakeshore, riparian area, or wetland itself. These disturbances

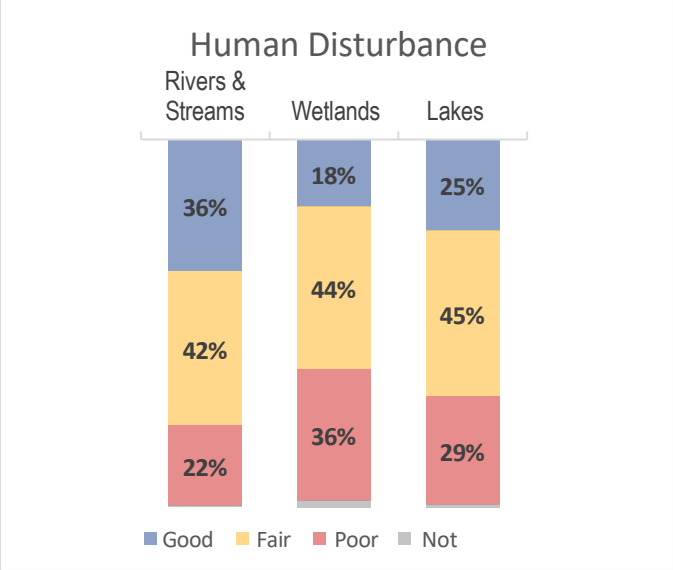


Figure 17. Indicators of Human Disturbance. The disturbance indicator reflects the extent and intensity of direct human alteration. Examples of human disturbance in the riparian area include roads, pavement and cleared lots, buildings, pipes, parks or maintained lawns, trash, pastures and rangeland, row crops, dams, and logging or mining operations. This indicator was not assessed for the NCCA. Data Source: NARS 2016-2019.

can range from minor changes, such as the removal of a few trees to develop a picnic area, to major alterations, such as the construction of a large residential complex or mining operations. The effects of development on water quality include excess erosion and sedimentation, flow alteration, increased temperature, loss of native plants, alteration or loss of vegetation structure and complexity, and modifications to sediment types. These impacts can negatively affect fish, wildlife, and other aquatic communities. They can diminish recreational opportunities and pose public health risks where there is increased potential for flooding or formation of harmful algal blooms. Figure 17 compares results for extent and intensity of human disturbance across the surveys. For lakes, 25% were rated good (had low levels of human disturbance), 45% were in fair condition, and 29% were in poor condition. Results were similar for rivers and streams with, 36%, 42%, and 22% rated good, fair, and poor, respectively. For wetlands, 18% of wetland area were rated good, 44% were in fair, and 36% were in poor condition.

Healthy, multilayered vegetation in the riparian corridor can provide a buffer from the effects of human disturbance in several ways: by slowing runoff; filtering nutrients and sediments; reducing streambank erosion; providing shade, which keeps water cool and reduces algae growth; and supplying leaf litter, branches, and logs that serve as food, shelter, and habitat for fish and other aquatic organisms. Analysts assessed riparian vegetative cover by summing the amount of cover provided by three layers of vegetation: the ground layer, woody shrubs, and canopy trees. Just over half of lakes (51%) had high (good) levels of riparian vegetation cover; 26% had low (poor) cover. For rivers and streams, 56% of river and stream miles were rated good, 17% were rated fair, and 24% were rated poor for riparian vegetative cover.

Human activities can also interfere with river and stream sediment balance by increasing the amount of fine sediment entering river and stream channels, filling in the spaces between cobbles and rocks which is an important benthic habitat. NRSA scientists analyzed the extent to which excess fine sediments occurred in rivers and streams, focusing on conditions indicating lower-than- expected streambed stability and higher excess sedimentation. In 2018-19 streambed sediments

were in good condition in 57% of river and stream miles, fair condition in 23%, and in poor condition in 20%.

Human Health Indicators

Human health indicators generally indicated more coastal waters were in good condition than other types of water- bodies. Enterococci data from the NCCA showed that 99% of both estuary and Great Lakes nearshore area were below the EPA criterion for recreational exposure. For river and stream miles 78% were below the criterion in the 2018-19 survey, a 13-point improvement from 2013-14.

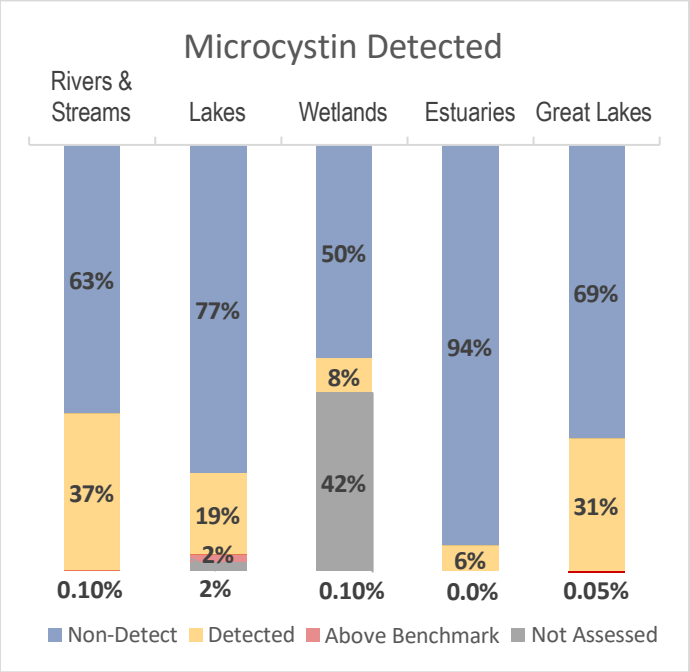


Figure 18. Microcystin Detections Across Water Body Types. Microcystins (algal toxins) results were compared to the EPA's recreational water quality criterion and swimming advisory recommendation of 8 ppb (U.S. EPA 2019). Data Source: NARS 2015-2019.

All the NARS reports assessed waters for microcystins, one class of cyanotoxins. Health effects of exposure include skin rashes, gastroenteritis and in severe cases, liver or kidney failure and death. Microcystins were detected below benchmark levels in 6% of estuarine area, 8% of wetland area, 21% of lakes, 31% of nearshore Great Lakes waters, and 9% of river and stream miles. When values are compared to EPA' recreational freshwater criterion of 8 ppb, exceedances of the microcystins criterion were rare across all waters. Lakes had the highest exceedance rate with about two percent, or 4,400 lakes exceeding the microcystins criterion.

Two of the NARS reports assessed fish tissue contaminants for human health using both fish fillet plugs and composite fish fillet tissue. Mercury was detected at low levels in all fish fillet plug samples, exceeding EPA's recommended fish tissue-based water quality criterion in 2% of estuarine area, 6% of the Great Lakes nearshore area, and 7% of river and stream miles. However, a lot of waters were unassessed because fish were not present or too small to collect plug samples (65% of river and stream miles, 43% of estuarine area, and 29% of Great Lakes nearshore area). In addition to mercury, the composite fish fillet tissue analysis included PCBs and PFOS. There was no statistically significant decrease in the extent of rivers with PCBs in fish tissue above the EPA screening level for cancer effects between these two river surveys nor was there a statistically significant change in the extent of rivers with mercury in fish tissue above the EPA recommended criterion for methylmercury.

There was a statistically significant decrease in the Great Lakes nearshore area with PCBs in fish tissue above the EPA screening level between the 2010 and 2015 Great Lakes surveys. There were no statistically significant changes in the extent of Great Lakes nearshore area with mercury in fish tissue above the EPA criterion.

Key Stressors Associated with Poor Biological Integrity

Restoring water quality requires not only an understanding of current condition and change over time, but also of stressors associated with degraded biological condition and the extent to which reducing those stressors can improve conditions. This knowledge can help decision makers prioritize stressors for reduction.

To address these questions at the national and regional level, EPA performed three calculations for each stressor.

1. First, EPA determined the extent of waterbodies in poor condition for each stressor. This is the relative extent.
2. Then, EPA evaluated the extent to which

poor biological condition was more likely when a stressor or indicator was rated poor. This is the relative risk.

3. Lastly, EPA combined the relative extent and relative risk values for each indicator into a single value that provides an estimate of the potential improvement that could be achieved by reducing or eliminating the stressor. This is the attributable risk.

For benthic macroinvertebrates in rivers and streams, salinity was the stressor with the highest relative risk estimate nationally (1.8). That is, rivers and streams with salinity in poor condition were 1.8 times more likely to rate poor for benthic macroinvertebrates than waters that weren't poor for salinity. Phosphorus and nitrogen showed relative risks of 1.7 and 1.5, respectively, indicating rivers and streams rated poor for nutrients were more likely to rate poor for biological condition.

Combining the relative extent and relative risk values for each indicator into a single value provides us with attributable risk. Attributable risk analysis for rivers and streams shows that reducing nutrients could result in the greatest benefit to biological condition at the national scale. If poor condition were improved to fair or good for nutrients, the percentage of river and stream miles with poor benthic macroinvertebrate condition could be reduced by approximately 20%.

For lakes, total phosphorus was the stressor with the highest relative risk estimate nationally (2.3). That is, lakes with poor ratings for phosphorus were about 2.3 times more likely to have poor benthic macroinvertebrate condition. Atrazine detection, dissolved oxygen, total nitrogen, and shallow water habitat had relative risks of 2.0 or greater. Calculating attributable risk, EPA found that reducing phosphorus and nitrogen could result in the greatest benefit to benthic macroinvertebrate condition nationally. If poor phosphorus condition were improved to fair or good, a 36% reduction in poor benthic macroinvertebrate condition could occur. For nitrogen, the improvement in poor benthic macroinvertebrate condition could be 32%.

For wetlands, the indicators for heavy metals in soils, phosphorus, vegetation removal and vegetation replacement had relative risks of 2.0. That is, wetlands rated poor for these stressors or indicators were twice as likely to have poor vegetation condition. Calculating attributable risk at the national scale EPA found that reducing total phosphorus in wetland waters could result in the greatest benefit to biological condition. If wetland areas rated poor for phosphorus were improved to fair or good condition, a 27% reduction in poor vegetation condition could occur. Reductions in nitrogen could reduce poor vegetation condition by 23%.

State 305(b) Assessment and Reporting

States, territories, and Tribes have primary responsibility to implement the CWA to protect waters in their state. This includes setting water quality standards, monitoring and assessing water quality, permitting point source discharges, and developing plans and taking action to safeguard and restore water resources.

Targeted, site-specific monitoring and assessments provide information states need to support management decisions at watershed and local scales (e.g., whether a specific water meets its water quality standards, what the sources contributing to degradation are, etc.) for the individual waters that are monitored. Site-specific water quality assessment helps the state set local priorities and implement actions for restoring degraded waters. States also incorporate statistical survey designs into their monitoring programs as a complement to their site-specific monitoring. While site-specific monitoring focuses on waters that are priorities either for protection or restoration, state surveys provide broader context of the condition of all state waters.

The methods states use to monitor and assess their waters - including what they monitor, how they monitor, and how they interpret and report their findings - vary from state to state and within individual states over time. Thus, the assessment decisions reported by states and Tribes and summarized in How's My Waterway while valuable for each state and Tribe individually, cannot be used to compare water quality conditions among states and Tribes or be combined to report national water quality conditions and trends or compare the impacts of specific causes or sources of impairment over time.

Under the CWA, each state or Tribe sets its own water quality standards, including designated uses, narrative and numeric water quality criteria, and antidegradation policies. After assembling monitoring data from all available sources, states compare monitoring results to their water quality standards and make assessment decisions on the status of their waters. Good waterbodies are those that fully support the water quality standards and designated uses assessed.

Regional Highlight: Vermont's Lakes

The nationally consistent, statistically representative NARS provide unique data sets to look for patterns across the country. One pattern that emerged, was the loss of high-quality waters, specifically waters with the lowest levels of nutrients, across the US. These findings, published in Stoddard et al 2016, prompted scientists working at Vermont Department of Environmental Quality to take a new look at the state and volunteer monitoring long- term data sets. When they looked at their long-term phosphorus trends, sorting by the rate of the change since 1980, they saw a strong pattern of increasing phosphorus in the highest quality oligotrophic and mesotrophic lakes. The data, presented in Figure 18, also showed encouraging trends for decreasing phosphorus in some many eutrophic lakes, an indication that investments in nutrient controls at lower quality lakes were paying off.

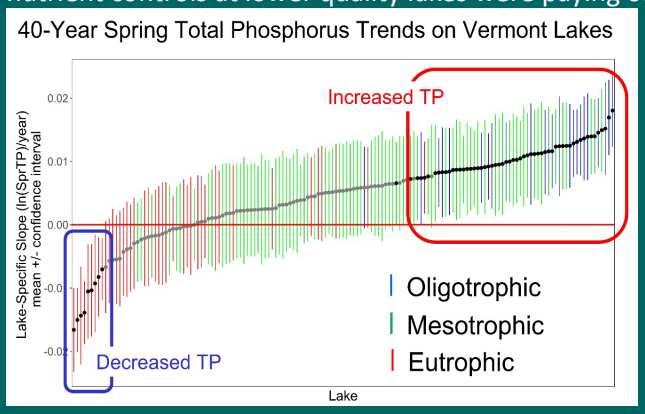


Figure 19. Trends in total phosphorous (TP) and trophic state of lakes in Vermont.

The state also examined the data they collected for statewide lakes assessment survey in partnership with the NARS National Lakes Assessment in 2007 and 2012 The results presented in Figure 19 show a statistically significant loss of lakes in the highest quality 'good' category of lakes with low levels of phosphorus. This was accompanied by increases in the fair and poor categories.

The data demonstrating that lakes experiencing the greatest increases in nutrients are the higher quality, clear water oligotrophic and mesotrophic lakes is informing analysis of options to protect these lakes across the state. One challenge for lake managers is that the nutrient concentrations in many of the lakes are well within the state water quality standards, which means conditions could continue to deteriorate before triggering corrective action.

Threatened waterbodies support the standards but may exhibit a deteriorating trend. Impaired waterbodies are unable to support one or more of the water quality standards.

The following are broad categories of Designated Uses that states and Tribes may include in their water quality standards. These are used to summarize state 305(b) reports and Tribal assessment reports in *How's My Waterway.*

Swimming: EPA, states, and Tribes monitor and assess water quality to keep you safe while swimming, wading, or boating.

Eating Fish: EPA, states, and Tribes monitor and assess water quality to determine if fish and shellfish are safe to eat.

Aquatic Life: EPA, states, and Tribes monitor and assess water quality to determine the impact of impairments on plants and animals living in the water.

Drinking Water: EPA, states, and Tribes assess drinking water quality and compare to state and national drinking water metrics.

As states submit water quality assessment decisions in their Integrated 303(d)/305(b) Reports, the information is loaded into the *How's My Waterway* database which presents state-scale survey results with site-specific assessments for a more complete story on water quality. Use the links provided on the map in Figure 19 to see the most recent water quality assessment results submitted by states under Clean Water Act Section 305(b).

Regional Highlight: Vermont's Lakes (Continued)

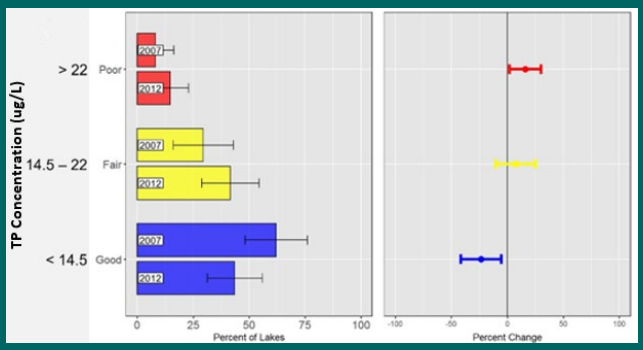


Figure 20. Change in Vermont Lakes' Total Phosphorous (TP) Conditions from 2007 to 2012 based on Statewide NARS Data and Northern Appalachian Region Thresholds.

These analyses compelled a number of lake associations on the oligotrophic lakes with declining water quality to petition the state to upward reclassify them to A1 waters. If reclassified, these lakes would be held to the most stringent nutrient standards in Vermont's nutrient criteria, public policy makers in Vermont to pursue revisions to water quality standards that will increasing protections for these waterbodies and ensure ensuring their ability to provide for healthy aquatic communities and support recreational activities for future generations.

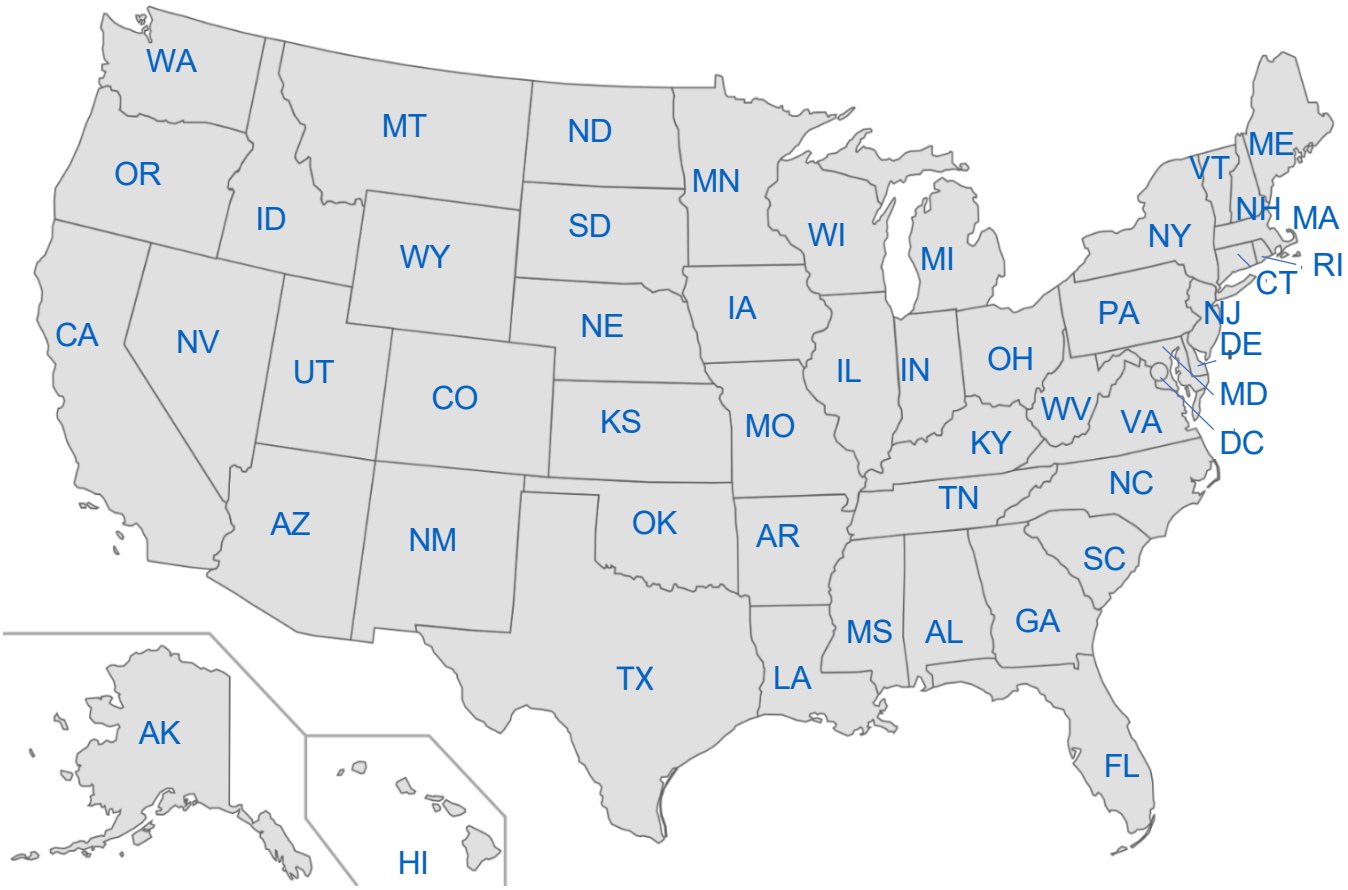


Figure 19. Links to state 305(b) water quality inventory results.

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