National Water Quality Inventory: Report to Congress

U.S. Environmental Protection Agency

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Executive Summary

This National Water Quality Inventory Report summarizes the findings of four statistically-representative National Aquatic Resource Surveys and the site-specific assessment results reported by the states in their Integrated 305(b)/303(d) Reports submitted to the U.S. Environmental Protection Agency. While different in design and goals, these two sources of information complement each other and provide a valuable perspective on national water quality.

National, statistically-based surveys provide water quality baselines based on consistent sampling at randomly-selected sites across the U.S. They were developed in response to critiques about water quality monitoring and our ability to report on the condition of the nation's waters.

Rivers and streams: According to the *National Rivers and Streams Assessment 2008-09*, 46% of river and stream miles are in poor biological condition; phosphorus and nitrogen are the most widespread of the chemical stressors assessed.

Lakes, ponds and reservoirs: The *National Lakes Assessment 2012* finds that that 21% of the nation's lakes are hypereutrophic (i.e., with the highest levels of nutrients, algae and plants). Phosphorus and nitrogen are the most widespread stressors in lakes.

Coastal waters: According to the *National Coastal Condition Assessment 2010*, 18% of the nation's coastal and Great Lakes waters are in poor biological condition and 14% are rated poor based on a water quality index. Phosphorus is the leading stressor contributing to the poor water quality index rating.

Wetlands: The *National Wetland Condition Assessment 2011* finds that 32% of the nation's wetland area is in poor biological condition, with leading stressors including surface hardening (soil compaction) and vegetation removal.

For more information on the national statistical surveys, visit https://www.epa.gov/national-aquatic-resource-surveys.

Using targeted, site-specific monitoring needed to support local management decisions, states identified a wide range of assessed waters as not fully supporting at least one of their designated uses. This report represents a snapshot of the state submissions as of July 2016.

- Mercury (primarily in fish tissue), pathogens, nutrients, PCBs, sediment, and organic enrichment/oxygen depletion were all cited as leading causes of impairment in assessed waters.

- Leading known sources included atmospheric deposition and agricultural activities.

These findings are based on data collected using a variety of sampling methods and parameters, state water quality standards, methods of interpretation, and time periods. As states submit their Integrated Reports and EPA approves their lists of impaired waters, the information on site-specific assessments is updated online at https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains.

Introduction

This National Water Quality Inventory, prepared under Section 305(b) of the Clean Water Act (CWA), presents information on water quality conditions in the U.S. It draws from two complementary types of information on water quality. First, it summarizes the results of statistically-representative, national aquatic surveys conducted by the U.S. Environmental Protection Agency (EPA) in partnership with state and tribal water quality agencies. Second, it provides a tally of the local, site-specific assessment results reported by states in the Integrated 303(d)/305(b) Reports submitted to EPA. The surveys and the state assessments have different goals and approaches, and each provides valuable information that contributes to our overall picture of national water quality as called for in Section 305(b) of the CWA.

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 from these surveys are available at https://www.epa.gov/national-aquatic-resource-surveys.

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. The methods states use to monitor and assess their waters -- including what they monitor, how they monitor it, and how they report their findings to EPA -- vary from state to state and within individual states over time. This reflects the differing objectives and needs of site-specific water quality issues. As states submit water quality assessment decisions, the information is loaded into the ATTAINS database available at https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains.

States 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. They serve as a cost-effective approach to assess conditions statewide using a relatively small representative sample. The finer scale resolution of state-scale surveys help states evaluate priorities for additional site-specific monitoring to fully characterize waters that need special protection or to develop local restoration plans. Some state surveys are integrated enhancements of the national surveys, while others focus on state-specific water quality standards or assessment methods. States and EPA are working on updates to a module in ATTAINS for presenting state-scale survey results with site-specific assessments for a more complete story on water quality.

How do national statistical surveys and site-specific water quality assessments work together to present the best picture of water conditions nationwide? Fundamentally, the statistical survey design ensures that the data collected from a sample of waters represent the broader population of waters being surveyed. This is a cost-effective means of generating national or statewide estimates to track changes in water quality. The national surveys provide consistent environmental indicators of the condition of the nation's water resources, much as economic indicators report on the health of the nation's economy. Their consistent sampling methods ensure that results can be aggregated into regional and national indicators of the health of the resource. The survey results quantify, with documented confidence, how widespread water quality problems are across the country and estimate the extent of waters affected by key stressors. This helps set priorities for water resource protection and restoration. Nationally-consistent surveys provide a standardized measure for tracking changes in the condition of the nation's waters over time and for evaluating progress in investments to protect and restore water quality at a broad scale.

Site-specific monitoring efforts are an important complement to statistical surveys. By targeting specific waters that are of concern or interest to the state or tribe, these monitoring activities provide information needed to support management decisions at watershed and local scales for those individual waters that are monitored. The methods states use to monitor and assess their waters vary from state to state and within individual states over time. Under the CWA each state or tribe may set its own water quality standards, including designated uses, narrative and numeric water quality criteria, and antidegradation policies. These may differ among states and tribes. Thus, the state-reported assessment decisions reported in ATTAINS cannot be used to compare water quality conditions among states and tribes, identify trends in statewide or national water quality, or compare the impacts of specific causes or sources of impairment over time. The strength of the site-specific water quality assessment is that it provides information on localized water quality problems, supports the identification of specific waters not meeting water quality standards, and helps the state set priorities and implement actions for restoring these waters.

This *National Water Quality Inventory: Report to Congress* is a brief summary of the key findings of both the National Aquatic Resource Surveys and the state water quality assessment reports available in the ATTAINS website at https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains. The ATTAINS website contains more detailed and explanatory information about the state submissions; since it is updated as new reports arrive, it also contains more recent state-reported information. This report represents a snapshot of the state submissions as of July 2016.

Rivers and Streams

This section summarizes the findings of both the statistically-representative national rivers and streams survey and site-specific assessment results reported by the states in their Integrated 303(d)/305(b) Reports to EPA. While different in design and goals, these two sources of information complement each other and provide a valuable perspective on national water quality.

Key Findings of the *National Rivers and Streams Assessment 2008/2009*

The *National Rivers and Streams Assessment 2008–2009: A Collaborative Survey* (NRSA) presents the results of an unprecedented sampling effort 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. It also discusses change in water quality conditions in streams sampled for an earlier study, the *Wadeable Streams Assessment* of 2004.

During the summers of 2008 and 2009, more than 85 field crews sampled 1,924 river and stream sites across the country, representing 1.2 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. Sites were selected using a random sampling technique that uses a probability-based design. This design ensures that the results of the survey reflect the full variety of river and stream types and sizes across the U.S. To determine water quality conditions, sampling results were compared to regionally-relevant reference condition. Reference condition is developed from a set of least-disturbed sites in each ecological region and is used to select thresholds for good, fair and poor. Ratings of good, fair, and poor were applied to the findings; however, these categories have no regulatory implications. For a few indicators, such as the human health screening value for mercury in fish tissue, nationally-consistent thresholds were used.

The goals of the NRSA are to determine the extent to which rivers and streams support healthy biological condition and recreational uses, and the extent of major stressors that affect them. In addition, the survey supports a longer-term goal: to determine whether our rivers and streams are getting cleaner and how we might best invest in protecting and restoring them. To learn more about the NRSA, visit https://www.epa.gov/national-aquatic-resource-surveys/nrsa.

Biological Quality

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. Twenty-eight percent of the nation's river and stream length is in good biological condition,

25% is in fair condition, and 46% is in poor condition (Figure 1). These findings are based on a robust, commonly-used index that combines different measures of the condition of aquatic benthic macroinvertebrates (aquatic insects and other creatures such as crayfish).

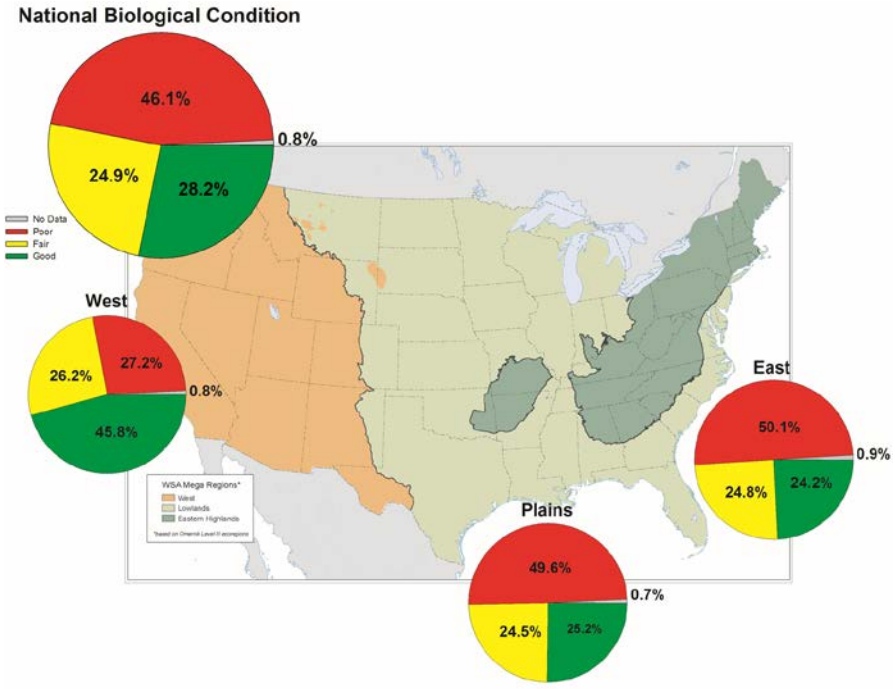

Figure 1. Biological condition of the nation's rivers and streams (Source: NRSA 2008/09)

Chemical Stressors

Four chemical stressors were assessed: total phosphorus, total nitrogen, salinity, and acidification. Of these, phosphorus and nitrogen are by far the most widespread. Forty-six percent of the nation's river and stream miles are rated poor because of excess levels of phosphorus and 41% are rated poor because of excess levels of nitrogen. Poor biological condition (for macroinvertebrates) is almost twice as likely in river and stream miles with excess levels of phosphorus and nitrogen.

Physical Habitat Stressors

Four indicators of physical habitat condition were assessed for the NRSA: excess streambed sediments, riparian vegetative cover (vegetation in the land corridor surrounding the river or stream), riparian disturbance (human activities near the river or stream), and in-stream fish habitat. Of these, poor riparian vegetative cover and high levels of riparian disturbance are the most widespread stressors. Twenty-four percent of river and stream miles are rated poor because of poor riparian vegetative cover, and 20% are rated poor because of high levels of riparian disturbance. However, excess levels of streambed sediments, reported in 15% of river and stream length are found to have a somewhat greater impact on biological condition. Poor biological condition is about twice as likely in rivers and streams with excessive levels of streambed sediments.

Human Health Indicators

Two indicators that provide insight into potential risks to human health were assessed: mercury in fish tissue and enterococci (bacteria). Human health screening values for mercury in fish tissue are exceeded in 13,144 miles of U.S. rivers (streams were not evaluated). In 23% of river and stream miles, samples exceed an enterococci threshold level for protecting human health.

Key Findings of the State Site-Specific Assessments – Rivers and Streams

States assessed 1,107,002 of the nation's 3.5 million miles of rivers and streams. Of these assessed miles, 614,153 were identified as impaired (e.g., unable to support one or more of the uses designated for them by the states, such as fishing or swimming). Another 487,299 assessed miles were rated good (e.g., fully support all uses), and 5,550 were considered threatened (e.g., support their uses but exhibit a deteriorating trend).

The top causes of pollution associated with impairment in assessed rivers and streams were:

- Pathogens—bacteria which indicate possible fecal contamination that may cause illness in people;
- Sediment, which can smother stream beds, suffocate fish eggs and bottom dwelling organisms, and interfere with drinking water treatment and recreational uses; and
- Nutrients such as phosphorus and nitrogen, which at excess levels can stimulate the growth of undesirable algae and aquatic weeds and lead to reduced levels of dissolved oxygen.

Updated and detailed state information on assessed river and stream miles is available from the ATTAINS website at https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains.

In many cases, states cannot always confidently identify sources of pollution when making assessment decisions; as a result, sources are often reported as unknown or unspecified. Where states identified probable sources of pollution, the most common included:

- Agricultural activities such as crop production, grazing, and animal feeding operations;
- Atmospheric (air) deposition, the settling of airborne pollution from many diverse sources such as factory or auto emissions; and
- Hydrologic modifications such as water diversions, channelization, and dams that alter the natural circulation or distribution of water.

It is important to note that some river and stream segments are impaired by more than one cause or source.

Lakes, Ponds, and Reservoirs

This section summarizes the findings of both the statistically-representative national lakes survey and site-specific assessment results reported by the states in their Integrated 303(d)/305(b) Reports to EPA. While different in design and goals, these two sources of information complement each other and provide a valuable perspective on national water quality.

Key Findings of the *National Lakes Assessment 2012*

In the summer of 2012, 1,038 lakes were sampled for the *National Lakes Assessment (NLA) 2012*. This was the second statistical survey of the condition of our nation's lakes, ponds, and reservoirs. The survey results represent the state of nearly 112,000 natural and man-made lakes in the U.S. that are greater than 1 hectare in area and at least one meter deep. Lakes were sampled for their water quality, biological condition, habitat condition, and recreational suitability. The goals of the NLA are to generate scientifically-valid information on the condition of the nation's lakes, establish baseline information for future trends assessment, and assist states and tribes in enhancing their lake monitoring and assessment program.

Field crews used the same methods at all lakes to ensure that results were nationally comparable. To determine water quality conditions, sampling results were compared to regionally-relevant reference condition. Reference condition is developed from a set of least-disturbed sites in each ecological region and is used to select thresholds for evaluation. Ratings of least disturbed/moderately disturbed/most disturbed were applied to the findings; however, these categories have no regulatory implications. For the algal toxin indicator, analysts used thresholds developed by the World Health Organization.

Trophic Condition

Based on nationally-consistent chlorophyll-*a* concentrations, the NLA estimated the trophic condition, or biological productivity, of lakes. Twenty-one percent of lakes have the highest concentrations of chlorophyll-*a* and are classified as most disturbed, or hypereutrophic; 34% are eutrophic; 35% are mesotrophic; and 10% have low levels of chlorophyll-*a* and are classified as oligotrophic.

Biological Condition

The NLA 2012 developed two new research indicators as indicators of biological condition: benthic macroinvertebrates and zooplankton. The survey finds that 31% of lakes have macroinvertebrate communities in most disturbed condition; in 21% of lakes, communities of zooplankton are in most disturbed condition.

Chemical Condition

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. About 40% of U.S. lakes are in most disturbed condition for phosphorus, 15% are in a moderately disturbed condition, and 45% are in least disturbed condition (Figure 2). Lakes with high levels of phosphorus are more than twice as likely to have poor conditions for benthic macroinvertebrates. While there has been no detectable change in the proportion of lakes in each condition category since 2007, additional analysis of NLA data indicates that significant increases have occurred in the concentration of phosphorus in previously low phosphorus lakes (see Stoddard et al, 2016).

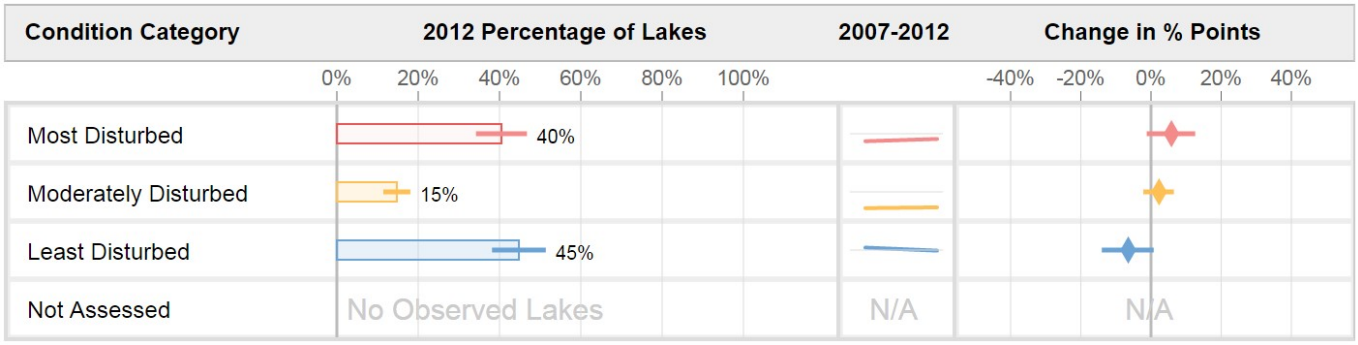

Figure 2 National condition estimates for phosphorus in lakes, with change from 2007 (Source: NLA 2012)

Physical Habitat Condition

For the NLA, physical habitat condition was assessed based on observation of four indicators: riparian (lakeshore) vegetation cover, shallow water habitat, lake habitat complexity at the land-water interface, and lakeshore human disturbance. Healthy lakeshore habitat slows pollution runoff and provides varied and complex ecological niches for aquatic life. The 2012 survey finds that 28% of U.S. lakes are in most disturbed condition for vegetation along the lakeshore and 29% are in most disturbed condition for lake habitat complexity.

Recreational Condition

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 2012 finds that an algal toxin, microcystin, is detected in 39% of lakes, but concentrations reach World Health Organization levels of concern in less than 1% of lakes.

For more information on the NLA, visit https://www.epa.gov/national-aquatic-resource-surveys/nla.

Key Findings of the State Site-Specific Assessments - Lakes

States assessed 18,513,899 of the nation's 41.7 million acres of lakes, ponds, and reservoirs (excluding the Great Lakes). The states identified 13,009, 273 acres as impaired (e.g., unable to support one or more of the uses designated for them by the state, such as fishing or swimming). Another 5,470,004 assessed acres were rated good (e.g., fully support all uses), and 34,621 acres were considered threatened (e.g., support their uses but exhibit a deteriorating trend).

The top causes of pollution associated with impairment in assessed lake acres were:

- Mercury, which has been widely detected in fish tissue where it may pose a health risk to people and animals who eat fish;
- Nutrients such as phosphorus and nitrogen, which at excess levels can disrupt lake ecosystems by stimulating growth of undesirable algae and aquatic weeds and lead to reduced levels of oxygen; and
- Polychlorinated biphenyls (PCBs), which are toxic chlorinated chemicals of industrial origin that are persistent in fish tissue or sediments.

In many cases, states cannot always confidently identify sources of pollution when making assessment decisions; as a result, sources are often reported as unknown or unspecified. Where states identified probable sources, the most common included:

- Atmospheric deposition from both local and long-range sources, primarily of toxic substances such as mercury, PCBs, and metals;
- Agricultural activities such as crop production, grazing, and animal feeding operations.
- Natural sources such as internal nutrient recycling, drought or waterfowl.

It is important to note that some lake acres can be impaired by more than one cause or source.

Updated and detailed state information on assessed lake and reservoir acres is available from the ATTAINS website at https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains.

Coastal Waters - Bays and Estuaries and the Great Lakes

This section summarizes the findings of both the statistically-representative national coastal survey and site-specific assessment results on bays and estuaries, the Great Lakes, coastal shorelines, and ocean and near coastal waters reported by the states in their Integrated 303(d)/305(b) Reports to EPA. While different in design and goals, these two sources of information complement each other and provide a valuable perspective on national water quality.

Key Findings of the *National Coastal Condition Assessment 2010*

The *National Coastal Condition Assessment 2010* (NCCA 2010) is the fifth in a series of reports assessing the condition of the coastal waters of the United States, including a vast array of productive estuarine, Great Lakes and coastal embayment waters. The NCCA 2010 addresses questions such as: What is the condition of the nation's coastal and Great Lakes nearshore waters, and is that condition getting better or worse? What is the extent of the stressors affecting them?

This report is based on an analysis of indicators of ecological condition and key stressors in the coastal waters of the Northeast Coast, Southeast Coast, Gulf Coast, Great Lakes, and West Coast regions of the conterminous United States.

In the summer of 2010, EPA and state, tribal, and federal partners monitored 1,104 sites representing 35,400 square miles of U.S. coastal and Great Lakes nearshore waters. Of this total, 405 sites representing 6,700 square miles were Great Lakes nearshore or embayment waters. They used the same methods at all sites to ensure that results were nationally comparable. This report examines four indices as indicators of U.S. coastal condition: a benthic index, a water quality index, a sediment quality index, and an ecological fish tissue contaminants index. Figure 3 summarizes the findings for these indices.

Biological Quality

Fifty-six percent of the nation's coastal and Great Lakes nearshore waters are rated good for biological quality based on the benthic macroinvertebrate index; 10% are rated fair and 18% are rated poor. Data are incomplete or missing for 15% of waters.

Within these results but specific to the Great Lakes, 20% of nearshore and embayment square miles are rated good, 12% are rated fair, and 18% are rated poor. Half of the Great Lakes area could not be assessed for various reasons, including unsuitable substrate conditions.

Water Quality

Water quality is rated good in 36% of coastal and Great Lakes nearshore waters, fair in 48% and poor in 14% based on the water quality index. Components of the water quality index include phosphorus, nitrogen, water clarity, chlorophyll *a*, and dissolved oxygen. The three indicators contributing most to the

poor index rating are phosphorus (found at high levels and rated poor in 21% of waters), water clarity (rated poor in 16%), and chlorophyll *a* (found at high concentrations and rated poor in 12%).

Within these results but specific to the Great Lakes, the NCCA finds that 60% of nearshore area is rated good for water quality, 22% is rated fair, and 18% is rated poor. Water clarity contributes most to the fair and poor water quality scores for the region, and is rated poor in 31% of nearshore area. Other components of the water quality index include phosphorus, rated poor in 10% of area; dissolved oxygen, rated poor in 1% of area; and chlorophyll *a*, rated poor in 18% of area.

Sediment Quality

Overall, the NCCA 2010 sediment quality index finds that 55% of coastal and Great Lakes nearshore waters have good sediment quality, 21% have fair quality, and 13% have poor sediment quality. Data are incomplete or missing for an additional 11% of waters. This index is based on two component indicators: sediment toxicity and sediment contaminants. Overall, 79% of coastal and Great Lakes waters are rated good based on low levels of sediment contaminants and 57% of waters are rated good for sediment toxicity.

Within these results but specific to the Great Lakes, the sediment quality index for the nearshore coastal region shows that 51% of nearshore area is in good condition, 21% is in fair condition, and 2% is in poor condition. About a quarter of the area could not be assessed due to unsuitable substrate conditions. The sediment quality index is based on two component indicators: sediment toxicity and sediment contaminants. Overall, 56% of the Great Lakes area is rated good based on low levels of sediment contaminants and 65% is rated good for sediment toxicity.

Ecological Fish Tissue Contaminants

Overall, less than 1% of coastal and Great Lakes nearshore waters are rated good based on levels of contaminants in fish tissue, 26% are rated fair, and 49% are rated poor, i.e., fish tissue demonstrates one or more contaminants exceeding "low effects" ecological guidelines. Data are incomplete or missing for an additional 24% of waters. It is important to note that fish tissue contamination findings are based on ecological guidelines designed to evaluate whether concentrations of contaminants in fish tissue pose a potential risk to fish and wildlife. Fish contaminant levels were *not* compared to human health thresholds because this survey analyzed the whole fish, not the fillet portion generally consumed by humans. Screening values are based on impacts to the most sensitive freshwater or saltwater fish, birds, and wildlife species.

Within these results but specific to the Great Lakes, less than 1% of nearshore area is rated good based on levels of contaminants in fish tissue, 20% is rated fair, and 38% is rated poor, i.e., fish tissue demonstrates one or more contaminants exceeding "low effects" ecological guidelines. Data are incomplete or missing for an additional 42% of area.

More information on the NCCA 2010 is available at https://www.epa.gov/national-aquatic-resource-surveys/ncca.

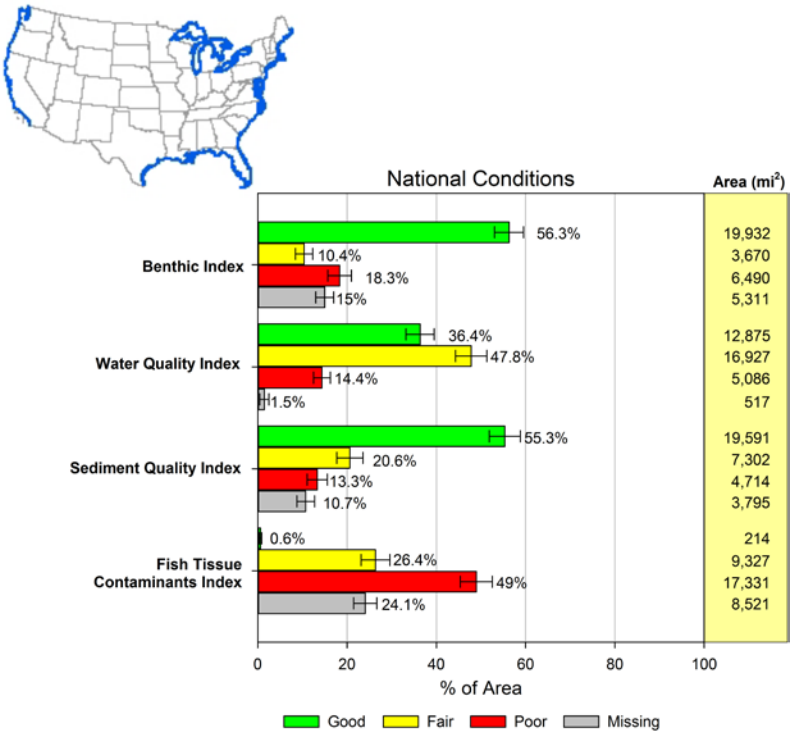

Figure 3. Percentage of coastal area achieving each condition ranking for all indices (Source: NCCA 2010).

Key Findings of the State Site-Specific Assessments – Coastal Waters

Bays and Estuaries

States assessed 35,094 of the nation's total 87,791 square miles of bays and estuaries. (Note that Great Lakes, coastal shoreline miles, and ocean and near coastal square miles were assessed separately by the states, and are reported below). The states identified 27,483 square miles as impaired (e.g., unable to support one or more of the uses designated for them by the state, such as fishing or swimming). Another 7,611 square miles were rated good (e.g., fully support all uses).

The top causes of pollution associated with impairment in assessed bay and estuarine square miles were:

- Mercury, most common in fish tissue;
- PCBs, toxic chemicals which, though no longer produced in the U.S., persist in sediments and fish tissue and may be released via spills, leaks, and from poorly maintained hazardous waste sites or the incineration of some wastes; and
- Pathogens, bacteria which indicate possible fecal contamination that may cause illness in people.

Since states cannot always confidently identify sources of pollution when making assessment decisions, they often report sources as unknown or unspecified. Where they identified probable sources, the most common included:

- Atmospheric deposition, which can transport airborne pollutants such as mercury and PCBs from industrial and urban centers; and
- Municipal discharges/sewage, which includes sewage treatment plants, septic systems, and wet weather sewer overflows.
- Other sources, such as those outside the state's boundaries or jurisdiction.

It should be noted that some bay or estuary square miles can be impaired by more than one cause or source.

Great Lakes Shoreline and Open Waters

States assessed 4,431 of the nation's 5,000 miles of Great Lakes shoreline miles. Of these assessed miles, 4,353 were reported as impaired for one or more designated use. The leading causes of impairment included PCBs, dioxins, and pesticides. The leading probable sources of impairment were atmospheric deposition, legacy/historical pollution – primarily contaminated sediment – and agriculture.

States also assessed 53,332 of 60,500 total U.S. square miles of Great Lakes open waters. Of these, all but 62 square miles were reported as impaired for one or more designated use. PCBs, dioxins, and mercury were identified as leading causes of impairment, with leading probable sources including atmospheric deposition, legacy/historical pollution, and urban-related runoff/stormwater.

Updated and detailed state information on assessed Coastal and Great Lakes waters is available from the ATTAINS website at https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains.

Wetlands

This section summarizes the findings of both the statistically-representative national wetlands survey and site-specific assessment results on wetlands reported by the states in their Integrated 303(d)/305(b) Reports to EPA. While different in design and goals, these two sources of information complement each other and provide a valuable perspective on national water quality.

Key Findings of the *National Wetland Condition Assessment 2011*

The *National Wetland Condition Assessment 2011* (NWCA) is the first national evaluation of the ecological condition of U.S. wetlands. It 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. The NWCA uses a statistical survey design to examine the chemical, physical and biological integrity of wetlands through a set of commonly-used and widely-accepted indicators, and begins to address some of the gaps in our understanding of wetland health.

During the spring and summer of 2011, more than 50 field crews sampled 1,179 wetland sites across the country. Each crew used standardized field protocols to sample vegetation, soils, hydrology, algae, water chemistry, and potential stressors at each site. Most sites were selected using a random sampling technique that ensures that the results of the survey reflect the range of wetlands in the target population across the U.S. Data collected at these randomly selected sites are used to produce national and regional estimates of wetland condition.

Biological Condition

Plant presence, abundance and trait information – e.g., invasive or native status, tolerance to disturbance – are used to assess biological condition. Vegetation is a particularly good indicator of wetland condition because of its ability to integrate different wetland processes and because plants respond to physical, chemical, and biological disturbances at multiple temporal and spatial scales. Using field-collected data and plant trait information, a national Vegetation Multimetric Index (VMMI) was developed.

The NWCA finds that 48% of wetland area nationally has healthy plant communities and is in good condition, 20% is in fair condition and 32% is in poor condition (Figure 4). Poor biological condition can adversely affect fish and wildlife species, reduce recreational opportunities, and lead to diminished water quality and flood retention benefits.

Of the four major ecoregion-based units reported on by NWCA, the West has the lowest percentage of wetland area in good condition (21%). The Coastal Plains, Eastern Mountains and Upper Midwest, and Interior Plains have a range of 44% to 52% of wetland area in good condition.

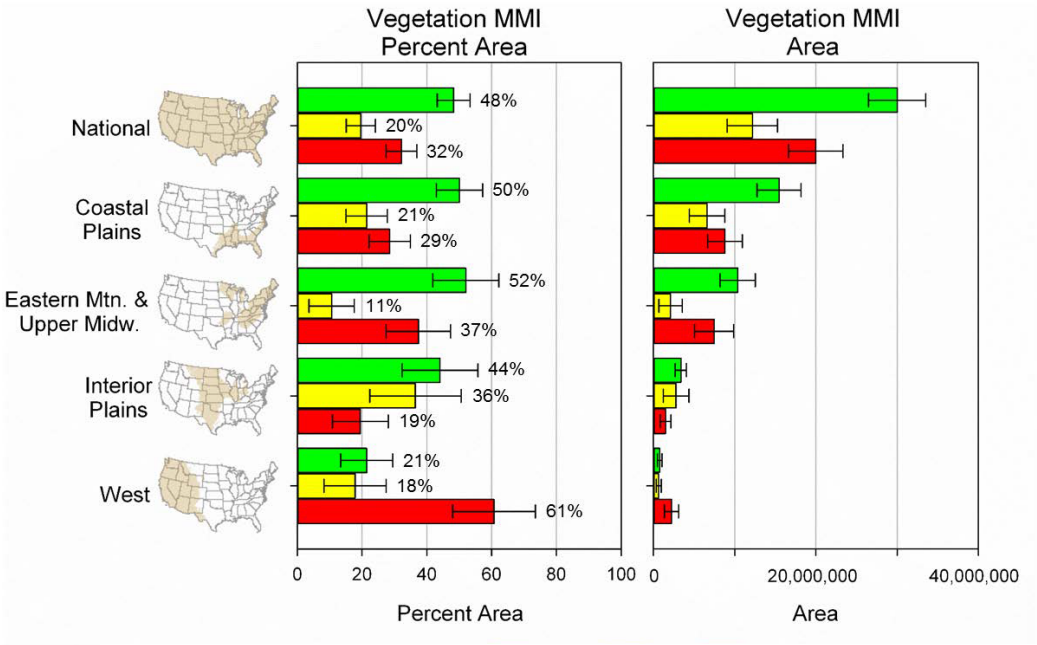

Figure 4. Estimated extent of wetland biological condition by condition classes (good, fair, poor) based on the VMMI. (Source: NWCA 2011). Results are reported for the nation and by NWCA Aggregated Ecoregion.

Physical Disturbance

Nationally, 27% of wetland area has high occurences of activities related to surface hardening (e.g., soil compaction, roads). These activities affect how water flows in and out of wetlands and the amount of water that enters and stays within wetlands, potentially affecting plant productivity, nutrient cycling, and overall physical habitat.

An equal percentage of wetland area nationally (27%) has high occurrences of activities related to vegetation removal. Removal or loss of vegetation due to activities such as grazing, mowing, and forest clearing may increase sediment, nutrient, and pollutant loads entering and staying in a wetland.

Nearly one quarter of wetland area nationally (23%) has high occurrences of ditching. Ditching affects how water flows in and out of wetlands, potentially affecting plant productivity, nutrient-cycling, and physical habitat.

Nonnative plants are abundant in 19% of wetland area. Nonnative plants replace native plants, resulting in loss of biodiversity and habitat for fish and wildlife species.

Chemical Indicators

Two chemical indicators of stress were assessed for NWCA using soil data: Heavy Metal Index and soil phosphorus concentration. Stressor levels for both of these indicators are low for the majority of wetland area nationally. However, stressor levels for the Heavy Metal Index are moderate for 47% of wetland area in the West and 31% of wetland area in the Eastern Mountains and Upper Midwest. Stressor levels for soil phosphorus are high for 13% of wetland area in the Eastern Mountains and Upper Midwest.

NWCA conducted the first national study of algal toxins in wetlands. Microcystin, a chemical toxin that can harm people, pets, and wildlife, is detected in 12% of wetland area nationally. However, based on recreational exposure risk levels established by the World Health Organization, very little wetland area (<1%) poses either moderate or high risk levels.

Key Findings of the State Site-Specific Assessments – Wetlands

States assessed 1,232,559 of the nation's estimated 107,700,000 wetland acres. Of these, 657,653 acres were reported as impaired for at least one designated use and 574,907 acres were reported in good condition (i.e., fully support all of the uses designated by the states).

The top causes of impairment in assessed wetland acres were:

- Organic enrichment/oxygen depletion, occurring when high levels of organic materials use up oxygen when they degrade;
- Mercury, a toxic metal most commonly found in fish tissue; and
- Metals other than mercury, such as arsenic and selenium.

Since states cannot always confidently identify sources of pollution when making assessment decisions, they often report sources as unknown or unspecified. Where states identified probable sources, the most common included:

- Agricultural activities such as crop production, grazing, and animal feeding operations; and
- Atmospheric deposition, the settling of airborne pollution from many diverse sources (both near and far) such as factory or auto emissions.
- Industry, primarily petroleum and natural gas production activities.

It should be noted that the same wetland segments can be impaired by more than one cause or source.

Updated and detailed state information on assessed wetland acres is available from the ATTAINS database at https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains.

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Appendix: Causes and Sources of Impairment

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

Table 1. Major Impairment Cause Categories Used in this Report

Category	Examples
Cause Unknown – Impaired Biota	Impairment or degradation of the biological community (e.g. fish, macroinvertebrates) due to unknown/unidentified cause
Dioxins	Highly toxic, carcinogenic petroleum-derived chemicals that are persistent in the environment and may be found in fish tissue, water column, or sediments.
Fish Consumption Advisory	Contaminated fish tissue (contaminant unspecified)
Flow Alterations	Changes in stream flow due to human activity; includes water diversions for purposes such as irrigation.
Habitat Alterations	Modifications to substrate, streambanks, fish habitat; barriers.
Metals	Substances identified only as “metals,” such as selenium, lead, copper, arsenic, manganese, others. (NOTE: may, in some include mercury)
Mercury	A toxic metal with neurological and developmental impacts found in fish tissue, water column, or sediments.
Nuisance Exotic Species	Non-native fish, animals, or plants such as Eurasian milfoil, Hydrilla, or zebra mussels which choke out native species and alter the ecological balance of waters.
Nutrients	Primarily nitrogen and phosphorus; in excess amounts, nutrients over-stimulate the growth of weeds and algae and can lead to oxygen depletion.
Organic Enrichment/Oxygen Depletion	Low levels of dissolved oxygen; high levels of biochemical oxygen demanding substances (organic materials such as plant matter, food processing waste, and sewage) that use up dissolved oxygen in water when they degrade.
Pathogens	Bacteria and pathogen indicators, E. coli, Enterococci, total coliforms, fecal coliforms, used as indicators of possible contamination by sewage, livestock runoff, and septic tanks.
Polychlorinated Biphenyls (PCBs)	A toxic mixture of chlorinated chemicals that are no longer used but are persistent in the environment; used originally in industry and electrical equipment), primarily found in fish tissue or sediments.
Pesticides	Substances identified only as “pesticides;” also, chlordane, atrazine, carbofuran, and others. Many older pesticides are persistent in the environment.
Sediment	Excess sediments, siltation; affects aquatic communities by altering and suffocating habitat and clogging fish gills.
Toxic Organics	Chemicals identified only as “toxic organics;” also, priority organic compounds, non-priority organic compounds, polycyclic aromatic hydrocarbons (PAH), others; often persistent in the environment.

Where possible, the states, tribes and other jurisdictions identify the sources of those pollutants associated with water quality impairment. Point sources discharge directly into surface waters from a conveyance such as a pipe; nonpoint sources deliver pollutants from diffuse origins, such as fields and streets. Table 2 identifies the source categories cited in this report.

Table 2. Major Pollutant Source Categories Used in this Report

Category	Examples
Agriculture	Crop production, feedlots (including concentrated animal feeding operations), grazing, manure runoff
Atmospheric Deposition	Airborne pollution from many diverse sources (such as factory and automobile emissions and pesticide applications) that settles to land or water
Construction	Residential development, bridge and road construction, land development
Habitat Alterations (not directly related to hydromodification)	Riparian and in-stream habitat modification and loss, filling and draining of wetlands, removal of riparian vegetation, streambank erosion
Hydromodification	Pond construction, channelization, dam construction, dredging, flow alterations from water diversions, flow regulation, hydropower generation, stream bank destabilization and modification, upstream impoundments
Industrial	Factories, industrial and commercial areas, cooling water intake structures, mill tailings
Land Application/Waste Sites/Tanks	Salt storage piles, land application of biosolids, land disposal, landfills, leaking underground storage tanks
Legacy/Historical Pollutants	Brownfield sites, contaminated sediments, in-place contaminants
Municipal Discharges/Sewage	Septic systems, sewage treatment plants, domestic sewage lagoons, sanitary sewer overflows, municipal dry and wet weather discharges, unpermitted discharges of domestic wastes, combined sewer overflows, septage disposal
Natural/Wildlife	Flooding, drought-related impacts, waterfowl
Recreation and Tourism	Golf courses, marinas, turf management, boat maintenance
Resource Extraction	Abandoned mining, acid mine drainage, coal mining, dredge mining, mountaintop mining, petroleum/natural gas activities, surface mining
Silviculture (Forestry)	Forest management, forest fire suppression, forest roads, reforestation, woodlot site clearance
Spills/Dumping	Accidental releases/spills, pipeline breaks
Unknown	Source of impairment is unknown
Unspecified Nonpoint Source	Source of impairment is identified as nonpoint, but no further information available
Urban-related Runoff/Storm Water	Discharges from municipal separate storm sewers (MS4), parking lot and impervious surfaces runoff, highway and road runoff, storm sewers, urban runoff, permitted stormwater discharges