Case Studies

Water quality in southeastern coastal national parks

Is "fair" good enough?

By Eva M. DiDonato, Virginia D. Engle, and Lisa M. Smith

Figure 1. Timucuan Ecological and Historic Preserve was established in 1988. Approximately 70% of this 46,000-acre (18,630 ha) urban preserve is either open water or wetlands. Good water quality is critical to these ecosystems, and in turn critical to visitor experience at the park.

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WITH DEVELOPMENT OF THE 2006 Ocean Park Stewardship Action Plan and formation of the Ocean and Coastal Resources Branch in the Natural Resource Program Center, the National Park Service is focusing more effort on issues beyond park shorelines. Estuaries are one of the habitats of concern to resource managers in coastal parks (fig. 1). These areas are nursery grounds for many species of recreational and commercial importance and they contribute significantly to visitor experience (e.g., boating, fishing, wildlife viewing) at coastal parks. Compromised estuarine water quality often results from regional population growth and local development. Most stressors of coastal water quality originate from beyond park boundaries, so understanding the regional perspective is critical to successful management of park coastal waters.

Working with partners, the Ocean and Coastal Resources Branch has completed 30 Watershed Condition Assessments for ocean and Great Lakes parks and several more are under way (http://www.nature.nps.gov/water/watershed_reports/WSCondRpts.cfm). These reports provide an overview of coastal resource issues and identify potential sources of impairment for park coastal habitats and processes. In southeastern coastal parks, for example, water quality concerns include high nutrient loading, low dissolved oxygen, and excessive fecal bacteria, while sediment quality concerns include metals contamination (e.g., iron, copper, nickel, lead, mercury) and toxic compounds derived from industry, Superfund sites, and other sources. These issues can impact human and ecosystem health, resulting in beach swimming and fishery closures, seafood consumption advisories, alteration of seagrass habitat, algal blooms, and other habitat consequences.

This article presents an approach to understanding water quality in national parks by using data collected within and beyond park boundaries. Combining park and regional water quality data with national assessment criteria gives park managers a broader perspective on water quality issues in their parks and can help them identify potential management

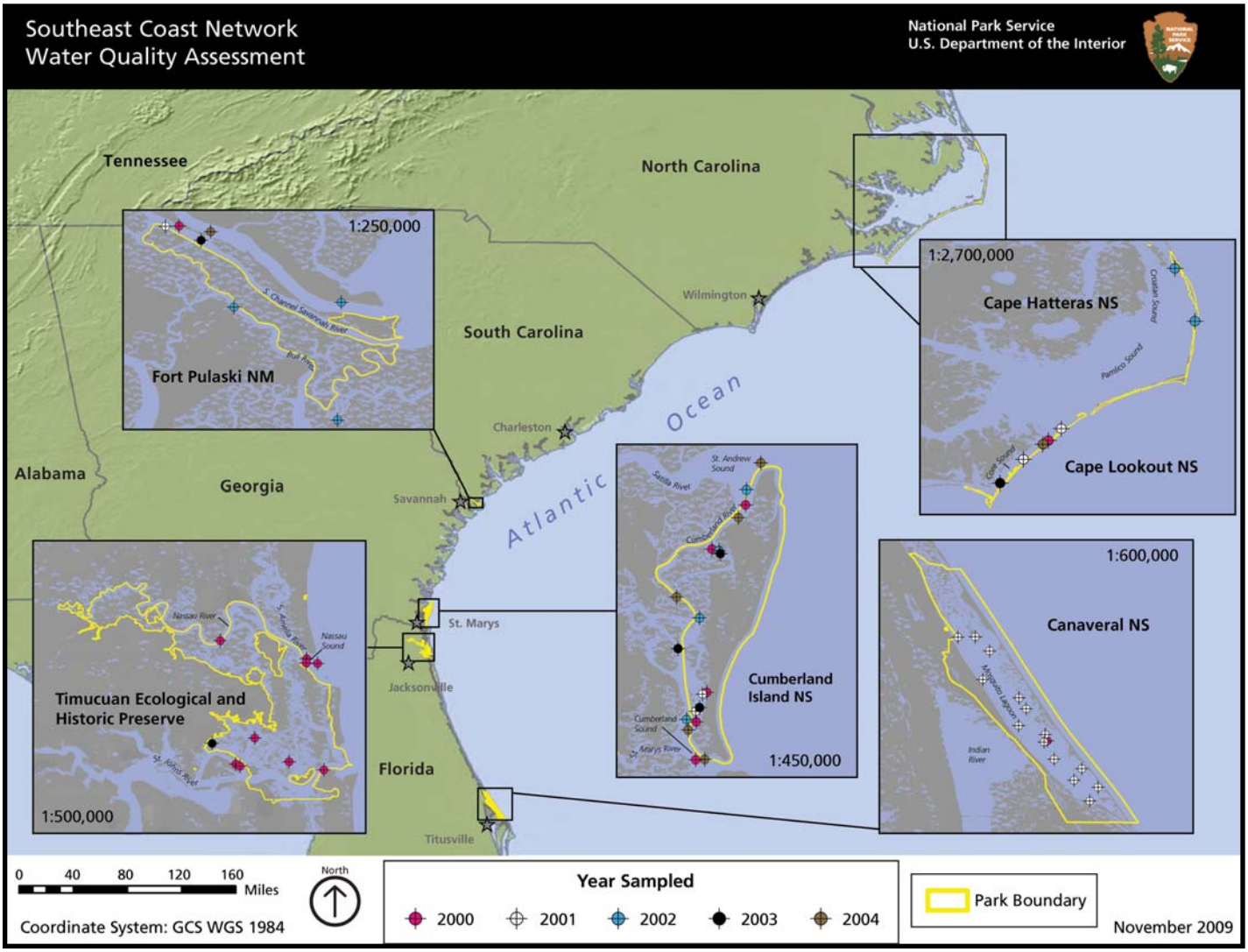

Figure 2. USEPA National Coastal Assessment sample sites in southeastern coastal national parks (2000–2004).

actions. The successful partnership with USEPA described in this article for southeastern coastal parks can serve as an example for future NPS efforts.

A partnership with USEPA

The U.S. Environmental Protection Agency's (USEPA) National Coastal Assessment (NCA) was initiated in 2000 as an integrated, comprehensive, coastal monitoring program across all U.S. coastal states and many of the island territories. The NCA survey design assesses spatially variable and geographically unique coastal and estuarine resources using multiple sampling intensities. Because the NCA uses an unbiased survey design and comparable sampling methods for all coastal resources regardless of spatial or temporal scale, the data provide an excellent baseline and can be used to interpret site-specific or local water quality monitoring efforts within a broader spatial context.

A study was conducted in southeastern coastal parks using existing NCA water quality data from 2000 to 2004 to determine the relative condition of park coastal waters (fig. 2). Water quality at sites inside and outside park boundaries was rated according to USEPA assessment criteria as good, fair, or poor (table 1). Within park boundaries, 34% of the sites had good water quality while 65% of sites were rated fair (table 2). Outside park boundaries, 18% of sites had good water quality, 65% had fair, and 16% had poor. The probability of a site within a park receiving a good water quality rating was significantly higher than that of a site located outside of a park.

Table 1. U.S. Environmental Protection Agency assessment criteria for water quality in the southeastern United States

Parameter	Good	Fair	Poor
Dissolved oxygen (mg/L)	>5	2–5	<2
Chlorophyll *a* (µg/L)	<5	5–20	>20
Dissolved inorganic nitrogen (mg/L)	<0.1	0.1–0.5	>0.5
Dissolved inorganic phosphorus (mg/L)	<0.01	0.01–0.05	>0.05
Water clarity (% surface light at 1 m [3.3 ft])			
Supporting SAV (submerged aquatic vegetation)	>40%	20–40%	<20%
Naturally turbid	>10%	5–10%	<5%
All other	>20%	10–20%	<10%

Table 2. Criteria used by the U.S. Environmental Protection Agency to determine the Water Quality Index Rating by site

Rating[1]	Criteria
Good	No component indicators rated poor; maximum of one rated fair.
Fair	One component indicator rated poor; or two or more indicators rated fair.
Poor	Two or more component indicators rated poor.

[1]Water quality components: dissolved inorganic nitrogen, dissolved inorganic phosphorus, chlorophyll *a*, water clarity, dissolved oxygen.

Information for park managers

Most park sites (65%) were still fair, which raises the question: Is fair water quality acceptable for our coastal national parks? Given that national parks represent some of our nation's most outstanding coastal areas, the answer to this question is no! Especially as climate changes, resource managers are trying to reduce water quality stressors to increase the resilience and adaptability of coastal ecosystems (Hansen et al. 2003). Scientific information about park resources and partnership opportunities with federal, state, and local agencies are key components for park managers to meet this challenge.

At Timucuan Ecological and Historic Preserve (see fig. 1), Resource Management Specialist Richard Bryant took immediate action after learning the results of the southeastern pilot study:

> When we learned the water quality was only fair, we decided to increase our cooperation with local neighboring agencies who deal with water quality issues. . . . The park was one of the founding members of the Three River Conservation Coalition. This formal partnership with other land management agencies, regulatory agencies, and nonprofits has a primary mission to monitor water quality and actively work to improve water quality in the vicinity of [the preserve] by supporting low-impact developments, and by sharing efforts to ensure water quality information is collected [and reported] on a timely basis . . . so park managers can fully comprehend what is occurring inside and outside the park boundaries.

In 2000 the National Park Service implemented a Service-wide inventory and monitoring program to "improve park management through greater reliance on scientific knowledge" (NPS I&M 2008). The Southeast Coast Network (SECN) and Northeast Coastal and Barrier Network (NCBN) of parks monitor coastal water quality in part by using the USEPA's National Coastal Assessment protocols. These protocols permit complete park-wide water and sediment quality assessments (fig. 3). The Southeast Coast Network, for example, samples each coastal park using a spatially balanced random sampling design developed according to NCA standards once every five years on a rotating basis. John Stiner (personal communication), resource management specialist at Canaveral National Seashore in Florida, will use data from these surveys in the following ways:

- Identify water quality problem areas in the 40,000-acre (16,200 ha) Mosquito Lagoon that warrant intensified monitoring or a proactive management response.
- Track the disturbing increase in nutrient (nitrogen and phosphorus) levels in Mosquito Lagoon.
- Assess long-term effects of natural events on water quality, such as storms and weather patterns.
- Aid in tracking and quantifying pollutants and assessing the impacts of septic tank effluents in a hydrologic model of Mosquito Lagoon.

Beginning in 2010, the USEPA is surveying Great Lakes and estuarine waters nationwide every five years (http://www.epa.gov/owow/monitoring/nationalsurveys.html). Since the Southeast Coast Net-

Figure 3. A team from the University of Georgia, Marine Extension Office, collects sediment samples at Canaveral National Seashore in 2009. These samples are taken as part of the Southeast Coast Network monitoring program following USEPA protocols for water quality.

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work uses USEPA protocols, these data are directly comparable and can provide a regional perspective to park-specific assessments. In addition, under the current Great Lakes Restoration Initiative, the National Park Service is partnering with the U.S. Environmental Protection Agency to assess water quality in our Great Lakes parks (Apostle Islands, Indiana Dunes, Pictured Rocks, and Sleeping Bear Dunes national lakeshores; Grand Portage National Monument; and Isle Royale National Park). The National Park Service, Water Resources Division worked with the U.S. Environmental Protection Agency to develop sampling designs for Lake Superior and Lake Michigan parks (figs. 4 and 5, next pages), which will allow us to assess water and sediment quality within parks relative to coastal waters in each of the lakes. It is our hope that this partnership with USEPA will expand to other coastal regions, allowing interpretation of park water quality data within a regional perspective.

According to the U.S. Environmental Protection Agency (USEPA 2004, USEPA 2006, USEPA 2008), the Southeast has the best water quality in the continental United States (Alaska and Hawaii have good water quality). The overall condition of water quality inside, compared with outside, park boundaries in other regions is unknown, although this can be determined by an analysis similar to that conducted for the SECN parks. The Ocean and Coastal Resources Branch of the Water Resources Division recognizes pollution, water quality, and watershed management as priority issues. At a recent ocean and coastal park workshop, natural resource managers from across the country identified the need for legislative and regulatory revisions; partnerships with local, state, and federal agencies; and several operational solutions to help coastal parks better manage their water quality. Robust data from these regional surveys will assist the National Park Service as we focus more on coastal management and issues that transcend park boundaries.

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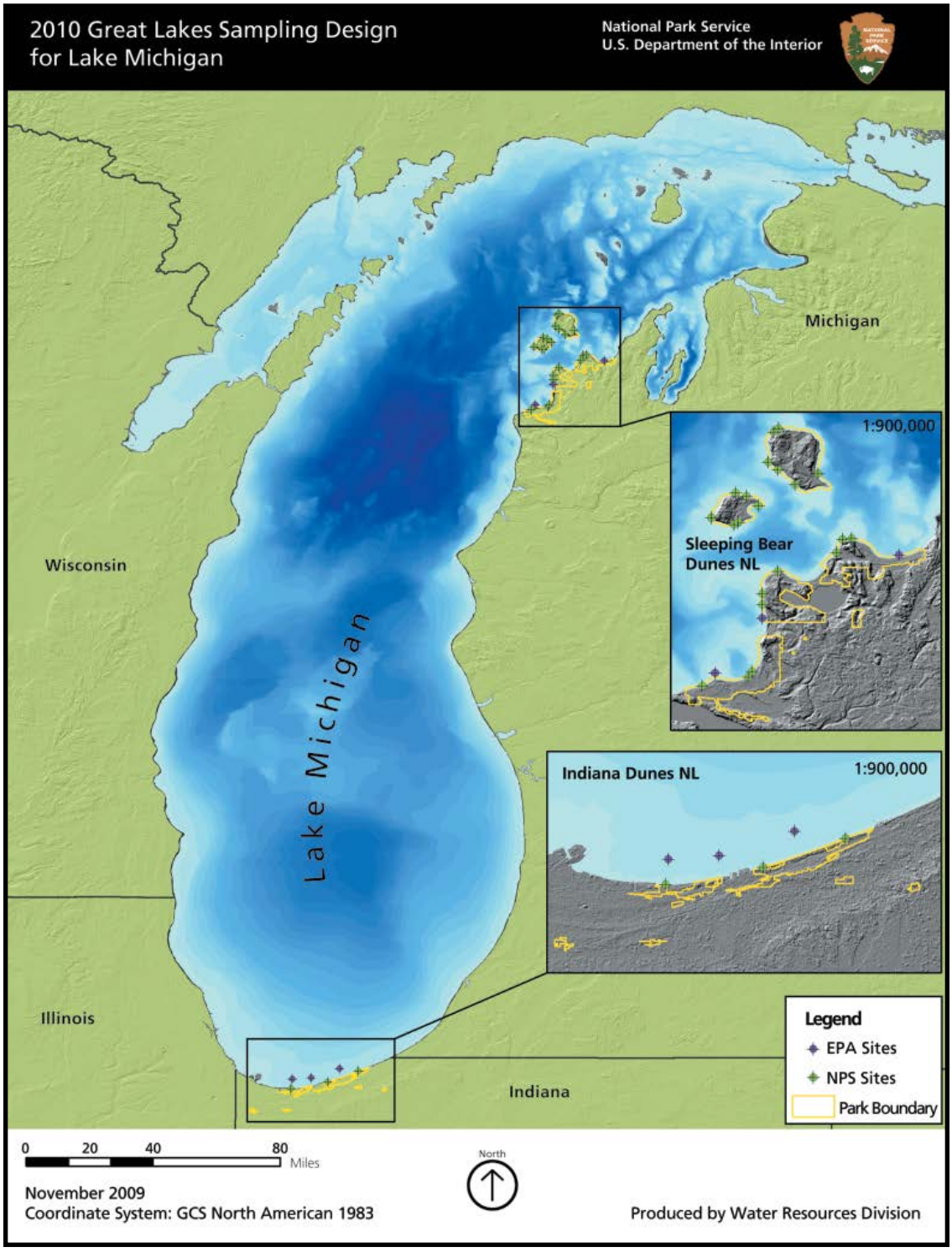

Figure 4. 2010 Sampling design for Lake Michigan. Sites shown within park insets will be used as part of the NPS assessment for Lake Michigan parks. This design will allow the National Park Service to assess and compare water and sediment quality inside and outside park boundaries.

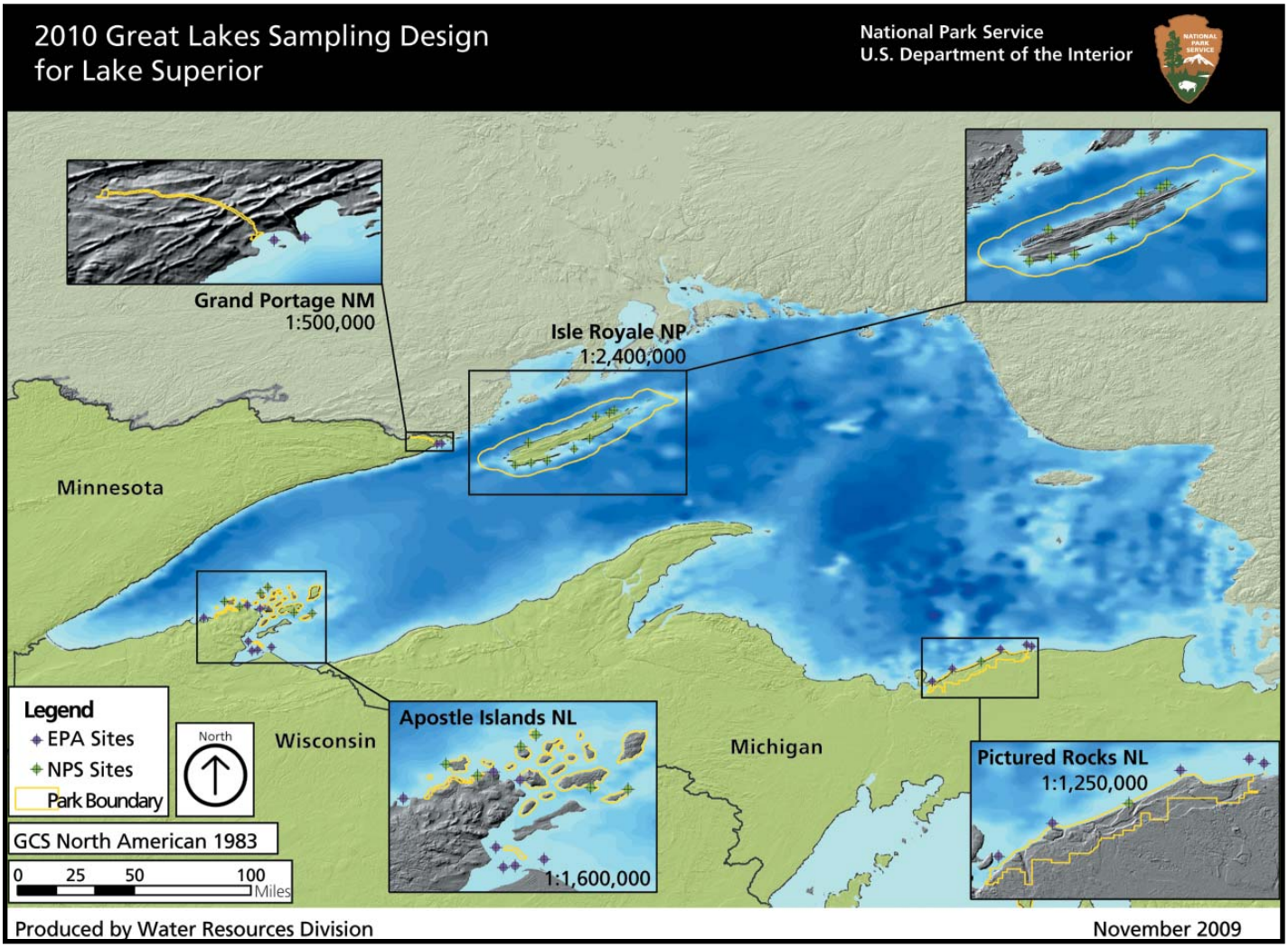

Figure 5. 2010 Sampling design for Lake Superior. Sites shown within park insets will be used as part of the NPS assessment for Lake Superior parks. This design will allow the National Park Service to assess and compare water and sediment quality inside and outside park boundaries.

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