Cover photos: Landsat 7 satellite image of western Lake Erie Basin and Detroit River corridor provided by USGS Landsat Project; Upper left: angler with walleye (*Sander vitreus*) by Jim Barta; Middle left: lake sturgeon (*Acipenser fulvescens*) by Glenn Ogilvie; Lower left: *Hexagenia* by Lynda Corkum; Center: lake whitefish (*Coregonus clupeaformis*) by James Boase/U.S. Fish and Wildlife Service; Lower right: juvenile peregrine falcon (*Falco peregrinus*) by Craig Koppie/U.S. Fish and Wildlife Service; Bottom left: bald eagle (*Haliaeetus leucocephalus*) by Steve Maslowski/U.S. Fish and Wildlife Service.

State of the Strait

Status and Trends of Key Indicators

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STATE OF THE STRAIT
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Based on the Detroit River-Western Lake Erie Indicator Project, a three-year U.S.-Canada effort to compile and summarize long-term trend data, and the 2006 State of the Strait Conference held in Flat Rock, Michigan

Suggested citation: Hartig, J.H., M.A. Zarull, J.J.H. Ciborowski, J.E. Gannon, E. Wilke, G. Norwood, and A. Vincent, eds. 2007.
State of the Strait: Status and Trends of Key Indicators.
Great Lakes Institute for Environmental Research, Occasional Publication No. 5,
University of Windsor, Ontario, Canada.
ISSN 1715-3980

Report also available at:
www.StateoftheStrait.org
www.epa.gov/med/grosseile_site/indicators/index.html

2.0 Introduction

The Detroit River and western Lake Erie are located at the heart of the Great Lakes basin ecosystem (Figure 1). The Detroit River is a channel linking the upper Great Lakes to the lower Great Lakes. It provides 90% of the water flow to Lake Erie. The Detroit River is an important migration corridor for many species of fish and birds. It also provides critical habitat for fish, birds, and benthic organisms, and is an important source of potable water to bordering communities (Upper Great Lakes Connecting Channels Study 1988).

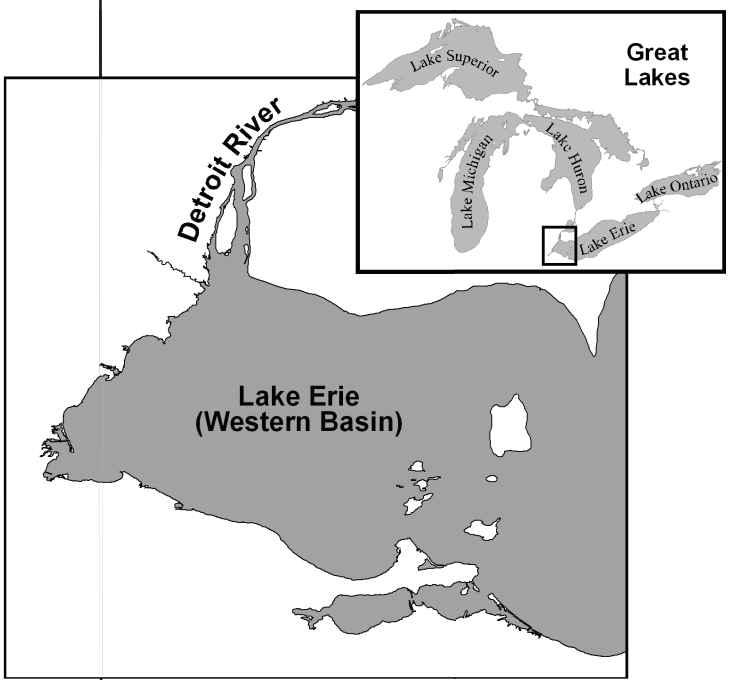

Figure 1. The Detroit River and western Lake Erie.

Lake Erie is the smallest of the Great Lakes (483 km^3) by volume and next to the smallest in surface area (25,700 km^2). It is also the southernmost Great Lake. The lake is naturally divided into three basins. The western basin is shallow (mean depth = 7 meters), fully mixed, and is separated from the central basin by a ridge running southeast from Point Pelee. About one-third of the total human population of the Great Lakes basin resides within the Lake Erie watershed. Of all the Great Lakes, Lake Erie is exposed to the greatest stress from urbanization, industrialization, and agriculture. Reflecting the fact that the Lake Erie basin supports the largest population, it surpasses all the other Great Lakes in the amount of effluent received from wastewater treatment plants (Dolan 1993). Intensive agricultural development, particularly in southwest Ontario and northwest Ohio, contributes huge sediment loads to the lake. The Detroit River also delivers sediment from the actively eroding shoreline of southeastern Lake Huron and Lake St. Clair. The western basin is generally the shallowest, most turbid region of the lake, and much of its sediment load eventually moves into the central and eastern basins.

The Detroit River and western Lake Erie have been recognized for their biodiversity in the North American Waterfowl Management Plan, the United Nations Convention on Biological Diversity, and the Western Hemispheric Shorebird Reserve Network, and

as a Biodiversity Investment Area by the U.S. Environmental Protection Agency's and Environment Canada's State of the Lakes Ecosystem Conference.

Because of this region's early European settlement (Detroit was founded in 1701), rapid development into a major metropolitan area (approximately five million people live in the U.S. portion of the Detroit River watershed and over 500,000 live in the Canadian portion), and long history of industrial manufacturing, many long-standing environmental and natural resource problems have existed. As the Detroit metropolitan area developed into an industrial manufacturing center, the automobile capital of the world, and a major steel producer, and as Detroit mobilized to become the "Arsenal of Democracy" during World War II, industrial pollution led to massive winter duck kills due to oil pollution. Indeed, one major oil spill in 1948 resulted in the death of 11,000 ducks and geese in the Detroit River (Hartig and Stafford 2003). The public outcry over this one event is credited with being the catalyst for the industrial pollution control program in Michigan.

During the 1960s, increasing inputs of phosphorus to Lake Erie led to excessive algal growth, oxygen depletion, and fish kills. This pollution of Lake Erie was prominently featured in many national magazines, including *Time* magazine on August 20, 1965 (*Time* 1965). The media coverage that "Lake Erie is dead" and the resultant public awareness became the major catalyst for the 1972 U.S.-Canada Great Lakes Water Quality Agreement that called for a comprehensive phosphorus control program for the Great Lakes.

In 1970 the entire fishery from Lake Huron to Lake Erie, including the Detroit River, had to be closed because of mercury contamination (Hartig 1983). It came to be known as the "Mercury Crisis of 1970" when industrial inputs of mercury from Sarnia, Ontario and Wyandotte, Michigan resulted in widespread mercury contamination. Eventually, chemical plants had to undergo process changes to eliminate mercury from their waste discharges.

The many long-standing environmental and natural resource problems noted above, and the resultant public awareness of the problems in this major urban area, spurred substantial efforts in pollution prevention and control, and resulted in a long history of Canada-U.S. cooperation in investigating and monitoring the Detroit River-western Lake Erie corridor. Indeed, both the Detroit River Remedial Action Plan and the Lake Erie Lakewide Management Plan have a long 20-year history of identifying actions to restore impaired beneficial uses. The Comprehensive Conservation Plan for the Detroit River International Wildlife Refuge guides conservation efforts. The Lake Erie Committee of the Great Lakes Fishery Commission oversees fishery management planning, including goals, objectives, and implementation strategies. Each of these planning initiatives calls for monitoring to track changes and measure progress toward goals and objectives. In addition, many nongovernmental organizations and conservation groups practice citizen science through bird and plant surveys. Indeed, it is often said that "if you can't measure it, you cannot manage it." Monitoring is essential for effective, defensible management.

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The State of the Strait Conference is a Canada-U.S. conference held every two years that brings together government managers, researchers, students, members of environmental

and conservation organizations, and concerned citizens to assess ecosystem status and provide advice to improve research, monitoring, and management programs for the Detroit River and western Lake Erie. The 2004 Conference focused on monitoring for sound management and recommended that a binational indicator report be prepared to improve accessibility, science translation, and communication of long-term trends (Eedy et al. 2005). In addition, the 2004 Conference recommended that greater emphasis be placed on ensuring that volunteer monitoring data have sufficient quality control, that management agencies sanction these efforts and agree to use the data for management purposes, and that the data become broadly disseminated and used.

An indicator is a measurable feature or features that singly or in combination provides useful information about status, quality, or trends. Indicators can be used to quantify the status for a whole array of factors from the state of the economy to the environment. Indicators should quantify information to make their significance apparent and convey it in a meaningful way to policy- and decision makers. The Binational Executive Committee (BEC) recognized this in creating the State of the Lakes Ecosystem Conference (SOLEC) to develop and report on indicators of the condition of the Great Lakes as a whole. But many indicators, which have local relevance, greatly complement the general indicators needed to describe basinwide trends.

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Most of the detailed summaries presented in this document describe the history and status of important elements of the study area. But they are not indicators, in the strict sense of the term, since quantitative "targets" that represent ideal conditions have not been decided upon. However, the summaries provide valuable information on status and trends over time, and thus they may eventually serve as the basis for establishing management benchmarks. Those reports are perhaps better called "trend data" rather than indicators per se.

Policymakers and decision makers at all levels need timely, reliable, and relevant information on indicators for management purposes. Indicators can be used to measure progress toward management goals and objectives. From a management perspective, particular emphasis needs to be placed on quantifying targets and endpoints for management programs.

As a result of the recommendation from the 2004 State of the Strait Conference and the need for communication of status and trends of key indicators, the Detroit River-Western Lake Erie Indicator Project was initiated in 2005 (http://www.epa.gov/med/grosseile_site/indicators/index.html). The purpose of this project is to:

- compile and interpret long-term databases for 50 potential indicators from the Detroit River and western Lake Erie;
- translate the information into understandable terms for policymakers and managers; and
- make these data and their time trends readily available via the website above.

On December 5th, the 2006 State of the Strait Conference was convened in Flat Rock, Michigan (Appendix A). Over 300 people participated in reviewing the available trend data, recommending management next steps and research needs, and laying the foundation for a comprehensive and integrative assessment of the state of the Detroit River and western Lake Erie ecosystem. This report represents an initial attempt at preparing a comprehensive and integrative assessment of the state of the Detroit River and western Lake Erie ecosystem based on available environmental trend data and information. The addition of other long-term data sets currently unavailable to this project (e.g., shorebirds, air emissions) and more complete geographic coverage of other data on both sides of the border (e.g., population, land use, transportation) is an ongoing task that will improve our diagnostic capacity. This initial comprehensive and integrative assessment will lay the foundation for future assessments, undertaken within the philosophy of adaptive management, whereby ecosystem status is assessed, management priorities are set, and management actions are implemented in an iterative fashion to foster continuous improvement.