

success stories. Other shorebirds have also experienced dramatic population increases.

The North American Waterfowl Management Plan Upper Mississippi River-Great Lakes Region Joint Venture updated its implementation plan in 1998, expanding partnerships into 10 upper Midwest states and revising its habitat and population objectives to include migrating waterfowl and nongame migratory birds. In addition to funding several projects, new partnerships have been initiated. Federal, Tribal, State and local governments, and nonprofit groups are collaborating in the Superior Coastal Wetland Initiative to protect sensitive coastal wetlands along Wisconsin's Lake Superior shoreline.

Saginaw Bay is a focus area for current efforts to restore waterfowl populations under the North American Waterfowl Management Plan. Through diverse partnerships involving Federal, State, and Provincial governments, corporations, private conservation organizations and others, key waterfowl habitats are identified and protected. Recently, Ducks Unlimited received funding from the North American Wetlands Conservation Act on behalf of its partners to conserve wetlands and associated habitats in the Saginaw Bay watershed. Thus far, almost 1,200 acres of wetlands and associated uplands have been acquired for public ownership, and over 2,600 acres of wetlands and associated uplands have been restored.

In 1991 the House of Representatives Committee on Appropriations for the Department of the Interior recommended an initial \$900,000 grant to fund the Circle of Flight (COF) Waterfowl Initiative to improve wetlands and manage waterfowl habitat on the reservations of 18 Tribes in the states of Michigan, Minnesota, and Wisconsin. From 1992 to 1998, the total acres of resource base for COF increased over 100 percent and the miles of rivers and streams included in the project management areas increased by 1,079 miles. This enhancement program has included the restoration of wetlands, restoration of grasslands, and enhancement of existing ecosystems. In FY 1997, 37 COF projects on 23 reservations and treaty ceded areas were funded with the \$600,000

appropriated for that year. Some of the projects funded are:

- wild rice seeding on the Bay Mills Reservation in upper Michigan;
- waterfowl management (wild rice seeding and the construction of nesting structures and floating docks) on four wetlands and impoundments located on the Keweenaw Bay Indian Community in upper Michigan; and
- trumpeter swan reintroduction on the Bad River Reservation in upper Wisconsin and at the Keweenaw Bay Indian community in Michigan.

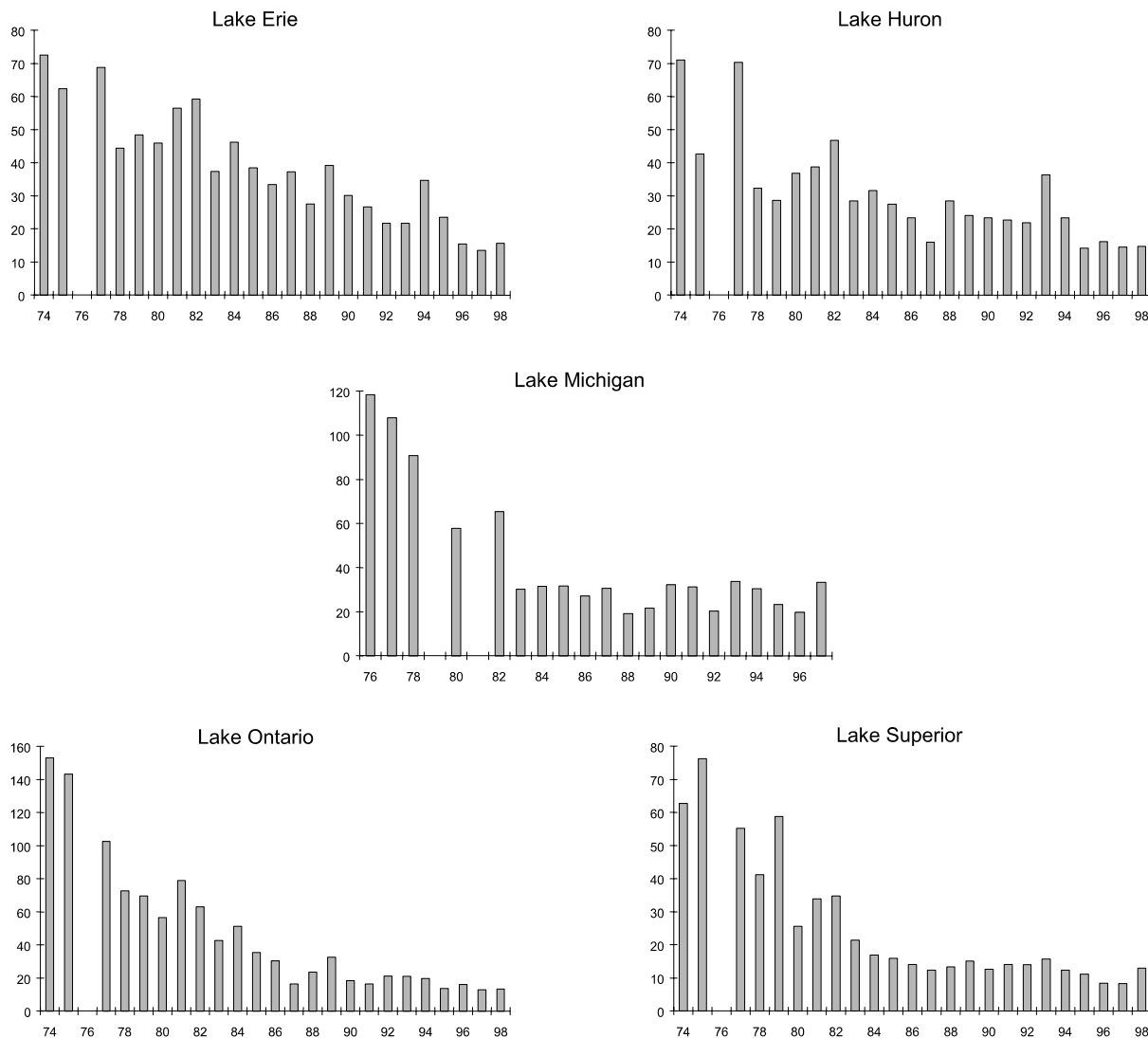
#### **North American Bird Conservation Initiative:**

A North American initiative to coordinate regional action and plans for monitoring and protecting habitat has been launched. More than 120 conservationists established the North American Bird Conservation Initiative (NABCI), an umbrella organization of individuals, groups, agencies and programs. National committees are now choosing pilot regions in Canada, the United States, and Mexico where bird populations are most vulnerable. NABCI's efforts will be concentrated in these areas, where it will also be developing mechanisms for delivering conservation programs; it will be involved in hiring staff, assigning responsibilities, and raising volunteers and money to promote its work.

#### ***Monitoring Contaminants in Great Lakes Birds***

The Herring Gull Egg Contaminants Monitoring Program, run by the Canadian government, has produced the longest running, continuous data set for wildlife in the Great Lakes. Each year since 1974, concentrations of 76 organochlorine compounds such as DDT/DDE, PCBs, polychlorinated dibenzofurans/polychlorinated dibenzo-p-dioxin (PCDFs/PCDDs), and periodically some metals, are measured in the eggs of herring gulls from sites throughout the Great Lakes. Adult herring gulls nest on all the Great Lakes and the connecting channels and remain on the Great Lakes year round. Because the diet of herring gull colonies on islands is made





**Figure 23. Temporal trends of PCBs (mg/g - wet weight) in herring gull eggs from the Great Lakes, 1974 - 1998 (Source: Canadian Wildlife Service, 1999).**

Contaminant concentrations in most colonial nesting, fish eating birds are at levels where gross ecological effects such as eggshell thinning, reduced hatching and fledgling success and population declines are no longer apparent. Greater reliance for detecting biological effects of contaminants is being put upon physiological and genetic biomarkers.

Contaminant levels in almost all Great Lakes colonial waterbirds are significantly and substantively reduced from what they were 25 years ago. Now, in the 1990s, year-to-year differences in contaminant levels are quite small and detailed statistical analyses are needed to tell if a compound has “stabilized” and is undergoing non-significant fluctuations, or if it is still declining. These analyses show that most contaminants at most sites are continuing to decline at a rate similar to that over the last decade or two. Geographic differences among sites for a given compound are not as dramatic as they once were.



up primarily of fish (gulls are fairly opportunistic, consuming garbage in urban areas and mice and insects in agricultural areas), they are an excellent terrestrial nesting indicator of the aquatic community. Periodically, biological features such as clutch size, egg shell thickness, and hatching success are also measured. A database of chemical levels and biological measures is available. The data can be used to illustrate temporal trends and geographical patterns, showing all sites relative to one another (see Figure 23 on the next page). Tissues are archived to permit other assessments such as retrospective analyses when new chemicals are identified. Herring gull populations are fully recovered after having had significant reproductive problems due to PCBs and DDT.

## RESTORING NATIVE WETLAND AND TERRESTRIAL SPECIES

Birds are among the most visible and diverse groups of wildlife in coastal Great Lakes wetlands. Because breeding wetland birds require an appropriate mix and density of vegetation, sufficient and safe food resources, and freedom from predation and other disturbances, their presence and abundance provides information that integrates the physical, chemical, and biological status of their habitats. The recent growth in nature-oriented recreation, particularly the sport of birding, has helped develop strong natural history and identification skills in a large proportion of the basin's citizens. The connections between wetland functions and breeding birds, and the potential for involving skilled citizens in monitoring present an important opportunity to gather information on the health of coastal Great Lakes wetlands.

**Recovery of the Peregrine Falcon:** The FWS removed the peregrine falcon from the list of endangered and threatened species, marking one of the most dramatic success stories of the Endangered Species Act. Hunting, nest destruction, DDT and other contaminants all played a role in their decline. The banning of DDT made the recovery of the peregrine falcon possible, but the protections provided by the Endangered Species Act and the extraordinary partnership efforts of the Service, state wildlife



The peregrine falcon has been removed from the endangered species list due in large part to the banning of DDT and to the restoration of vital breeding habitats.

agencies, and nongovernmental organizations accelerated the pace of recovery through captive breeding programs, reintroduction efforts, and the protection of nest sites during the breeding season. Similar efforts took place in Canada. Currently, there are at least 1,650 peregrine breeding pairs in the U.S. and Canada, well above the overall recovery goal of 631 pairs. The peregrine will continue to be protected by the Migratory Bird Treaty Act.

**Michigan Census Shows Kirtland's Warbler Population at Record High:** A recent census of Kirtland's Warbler populations in Michigan revealed a record high number of breeding pairs. The census, conducted by biologists, researchers, and volunteers, revealed 805 singing males. The 1998 census result is a remarkable increase from low numbers in 1987 when only 167 singing males were counted. This year's census results indicate that recovery efforts, including habitat management and



The reestablishment of the double-crested cormorant, after being near extinction, has been so successful that population control plans may be needed.



cowbird control, have been successful in helping recover the federally endangered Kirtland's Warbler.

**Double Crested Cormorant:** After being near extinction in the 1970s as a result of impacts from toxic chemicals, the Double Crested Cormorant population increased over 300-fold to more than 38,000 pairs from 1973 to 1993. Though the cormorant is now more numerous on the Great Lakes than at any time in its previously recorded history, the growth in cormorant populations seen in the early 1990s is no longer evident. Some interest groups in the Great Lakes Basin believe that the population of cormorants is having a significant impact on fish populations, but it does not appear that they have a significant impact on the fishery. Despite such conclusions, some individuals have chosen to take control of the rapid cormorant population growth into their own hands. In 1999, nine individuals were arrested and convicted for the killing of more than 1,000 double-breasted cormorants on Little Galloo Island in the eastern basin of Lake Ontario. The states of New York and Vermont have been granted permission from the FWS to control the double-crested cormorant populations by placing corn oil on eggs, which limits hatching success.

The FWS is also developing a comprehensive national cormorant plan in response to these increasing concerns about the possible effect of cormorant populations on recreational fishing, habitat and other migratory birds. The FWS hopes to complete an Environmental Impact



The endangered piping plover is being well-protected at Sleeping Bear Dunes National Lakeshore.

Statement, which addresses these questions, by Spring 2001.

**Piping Plover Populations make a home at Sleeping Bear Dunes:**

In 1998, 5 of the 24 nests of the endangered piping plover found in Michigan were located in Sleeping Bear Dunes National Lakeshore. Park staff attribute this high percentage of park nests to a recovery program that includes enclosure fences, beach closures, information programs, and volunteers. In 1986 the Great Lakes and Atlantic Coast piping plover populations were added to the Michigan and federal lists of endangered species. Sleeping Bear Dunes National Lakeshore began management to protect the piping plover nests. Each spring, all the suitable nesting beaches in the park are searched for breeding piping plovers. In 1997 and 1998, the park had two nesting piping plover pairs at Platte Point, the most popular swimming beach in the park. The park closed a portion of this beach to protect the plovers, which affected public use of the beach. To mitigate this user impact, resource management staff and volunteers were stationed at the point to protect the birds from disturbance and to explain the delicate habitat conditions to visitors. The staff set up spotting scopes and invited approaching visitors to view the birds from a safe distance outside the closed area.

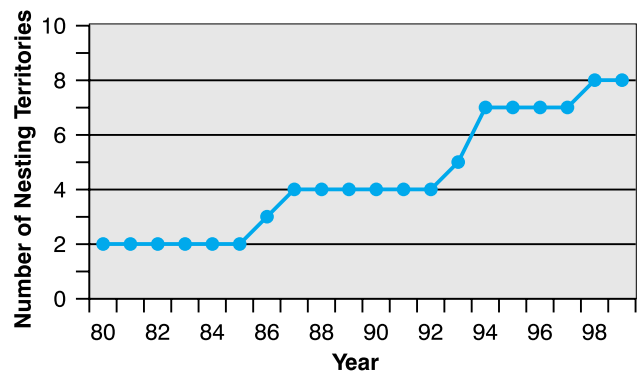
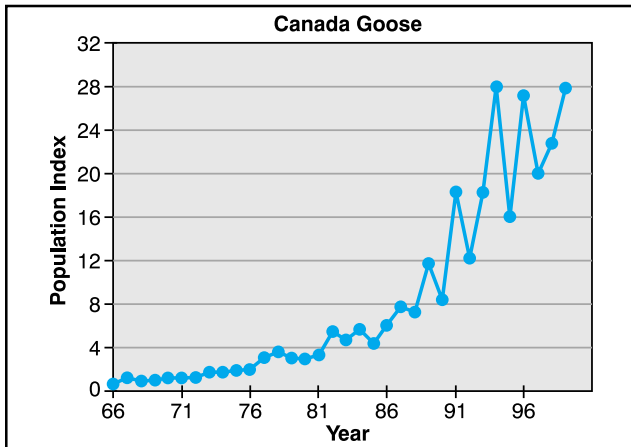


Figure 24. Number of established bald eagle nesting territories within New York's Lake Ontario Basin (Source: Peter Nye, NYSDEC, Personal Communication, 2000).

**Gradual Recovery of Bald Eagle:** Bald eagle habitat has been steadily improving throughout the Great Lakes. In the Lake Ontario Basin, bald eagle nesting territories have steadily grown from two nests in 1984 to eight nests in 1999.



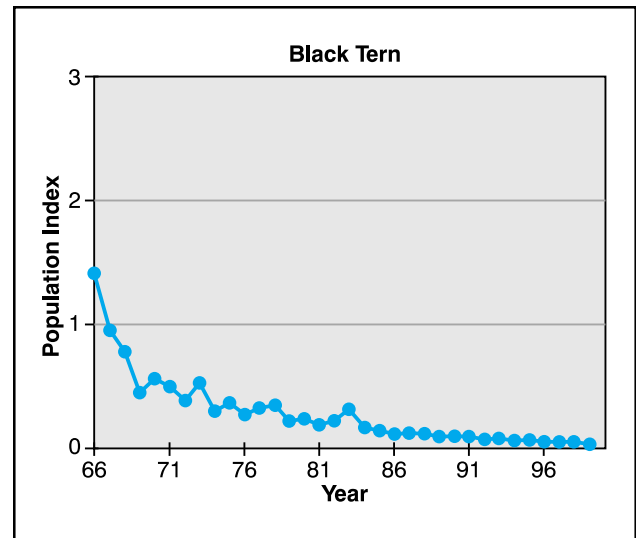
**Canada Goose Recovery:** For several decades prior to 1962, the Giant Canada Goose was thought to be extinct. Its rediscovery that year began a rapid restoration of the subspecies throughout its previous range. While many municipalities in the Great Lakes now consider this species a nuisance, its restoration is actually considered a success story. The geese are well adapted to living in populated and urbanized areas and goose-human conflicts are increasing. Figure 25 shows the dramatic increase in Canada



**Figure 25. Canada Geese populations have staged a remarkable recovery in the Great Lakes (Source: Sauer, J.R., J.E. Hines, I. Thomas, J. Fallon, and G. Gough, 2000. The North American Breeding Bird Survey, Results and Analysis, 1966-1999, Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD).**

Goose populations in the Great Lakes. In response to the high goose populations, regulatory agencies are implementing hunting regulations to increase the kill of Giant Canada Geese, while protecting other subspecies of migrant Canada Geese. Some communities are also getting involved in goose capture and relocation projects, while others are now considering the use of border collies to scare geese from areas such as airport runways and golf courses.

**Trumpeter Swans:** On May 5, 1999, a female trumpeter swan made the 730-mile return journey from Muscatatuck National Wildlife Refuge to Sudbury, Ontario, Canada. The trumpeter was one of four swans that followed an ultra-light aircraft last winter in an effort to teach the birds to migrate between summer nesting grounds and a new wintering area. These efforts will hopefully establish a new migratory flock.



**Figure 26. Some species continue to decline, such as the black tern; perhaps due to the loss of vital coastal marsh habitats (Source: Sauer, J.R., J.E. Hines, I. Thomas, J. Fallon, and G. Gough, 2000. The North American Breeding Bird Survey, Results and Analysis, 1966-1999, Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD).**

**Black Tern Population in Decline:** While some breeding bird populations are thriving throughout the basin, others are experiencing a decline. One such species is the marsh-nesting species, the Black Tern. The Black Tern is still considered locally common in some areas, although its range has declined significantly over the past decades. It is currently considered endangered in Pennsylvania, Ohio, and New York, threatened in Ontario, and a species of special concern in Michigan. The exact reasons for decline are not known, but habitat loss in coastal marshes is an important issue. The Black Tern nests in marshes that have the ratio of open water to emergent vegetation of about 50:50. Extreme changes in Great Lakes water levels can significantly influence the proportion of the two habitats in coastal wetlands.

## RESTORING NATIVE TERRESTRIAL SPECIES

**Wolf Comeback Continues in Upper Peninsula, Michigan:** Results of the 1998 to 1999 winter wolf survey conducted by the Michigan DNR confirmed the presence of at least 74 wolves, in at least 30 packs, scattered across the Upper Peninsula. Last year's count was 140 wolves. No wolves were confirmed in the Lower



Peninsula. Wolves have increased in the Upper Peninsula from near extinction in the 1970s to their present numbers. It is believed all wolves now in Michigan either are descendants of Michigan breeding wolves or the result of immigration from Wisconsin, Minnesota, and Ontario, Canada. Currently, the U.S. Department of the Interior is considering a proposal to delist wolves in the Great Lakes states.

## INVASIVE SPECIES

During the past 200 years, at least 141 invasive species (also referred to as exotic, non-indigenous, or non-native species) have entered the Great Lakes. Approximately 10 percent of these species have profoundly affected the populations of native wildlife and plants species. Of the invasive species introduced (either intentionally or unintentionally) to the Lakes since 1810, about one-third have appeared since 1960. This increased pace is largely due to greater transoceanic shipping traffic on the Great Lakes since completion of the St. Lawrence Seaway in 1959. Ballast water accounts for about 30 percent of exotic introductions and almost all of the new introductions over the past 10 years. The other principal vectors are deliberate introductions, range extension, and accidental/incidental introductions.

The Great Lakes sport and commercial fishing industry, valued at almost \$4.5 billion annually, is at risk due to growing numbers of invasive mussel and fish species, including the zebra and quagga mussels, sea lamprey, Eurasian ruffe, and round goby. Native lake trout, walleye, yellow perch and whitefish populations are threatened by the establishment of these invasive species. Because new invasive species are still being found in the Basin, there is an ongoing concern that all sources of introduction have not been fully controlled.

The U.S. Congress Office of Technology Assessment found that the U.S. is spending hundreds of millions, if not billions of dollars trying to repair the damage caused by invasive species. The cost to North Americans of repairing and

combating damage by zebra mussels alone to municipal and industrial water intakes is estimated at \$3.3 billion over the past 10 years. Large Great Lakes water users, such as industry and larger municipalities, pay on average \$360,000 per year to control zebra mussels. Nuclear power plants face a average yearly cost of \$825,000 per plant. Small municipalities pay about \$20,000 per year.

In response to the rapidly spreading zebra mussel infestation and other concerns about nonindigenous aquatic species introductions, the Nonindigenous Aquatic Nuisance Prevention and Control Act was enacted in 1990 and amended by the National Invasive Species Act (NISA) of 1996. It provides an intergovernmental mechanism for the development of a cooperative national program to:

- reduce the risk of or prevent the unintentional introduction and dispersal of nonindigenous aquatic species that may be nuisances;
- ensure prompt detection of the presence of and monitor changes in the distribution of nonindigenous aquatic species; and
- control established aquatic nuisance species in a cost-effective, environmentally sound manner.

The States of Michigan and Ohio announced the completion and submission of a *Nonindigenous Aquatic Nuisance Species State Management Plan* to a National Task Force in fulfillment of the requirements of NISA. The plans emphasize prevention as the key for long-term protection of state waters from harmful invasive species.

To continue the focus on invasive species, President Clinton signed an Executive Order on February 3, 1999, which is raising the profile on invasive species prevention and control efforts in the Great Lakes Basin. The Executive Order aims to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. This executive order features:



- a requirement that all relevant Federal agencies use their programs and authorities to prevent the introduction of invasive species, detect and respond to new populations, restore natives species in affected ecosystems, and promote public education;
- establishment of a federal multi-agency Invasive Species Council; and
- development of an Invasive Species Management Plan to detail and recommend performance-oriented goals and objectives.

### Controlling the Spread of Established Species

#### *Protecting a \$4.5 Billion Fishery from Sea Lamprey Predation*

The sea lamprey is a parasitic invasive species native to the Atlantic Ocean that is able to spawn and live entirely in fresh water. It was first found in Lake Ontario in 1835, made its way to Lake Erie by 1921, and then spread quickly into the upper Great Lakes. The sea lamprey is still found in great abundance in Lakes Michigan and Huron. This aggressive species feeds on bodily fluids of

Great Lakes fish, often resulting in the scarring and/or subsequent death of the host individual.

Control measures coordinated by the Great Lakes Fishery Commission (GLFC), conducted by the FWS, and supported by Federal, Provincial, State and Tribal governments have brought the lamprey population under control in most areas. Methods of control include introduction of sterile males in order to decrease spawning success, lampricide treatments, and barriers in streams to prevent the species from reaching the lake. The program has allowed the re-emergence of some of the fish species thought to have previously disappeared from the Great Lakes. In Lake Michigan, sea lamprey numbers are currently 10 percent of their maximum populations in the 1950s.

Recent efforts have focused on reducing populations in the St. Mary's River, which contains the largest uncontrolled sea lamprey population in the Great Lakes Basin. The integrated control program began in 1997 and continued in 1999.

This program consists of trapping and removing spawning lampreys, stocking sterile male lampreys, and treatment of larval concentrations with granular Bayluscide. Approximately 24,000 sterile male lampreys have been released into

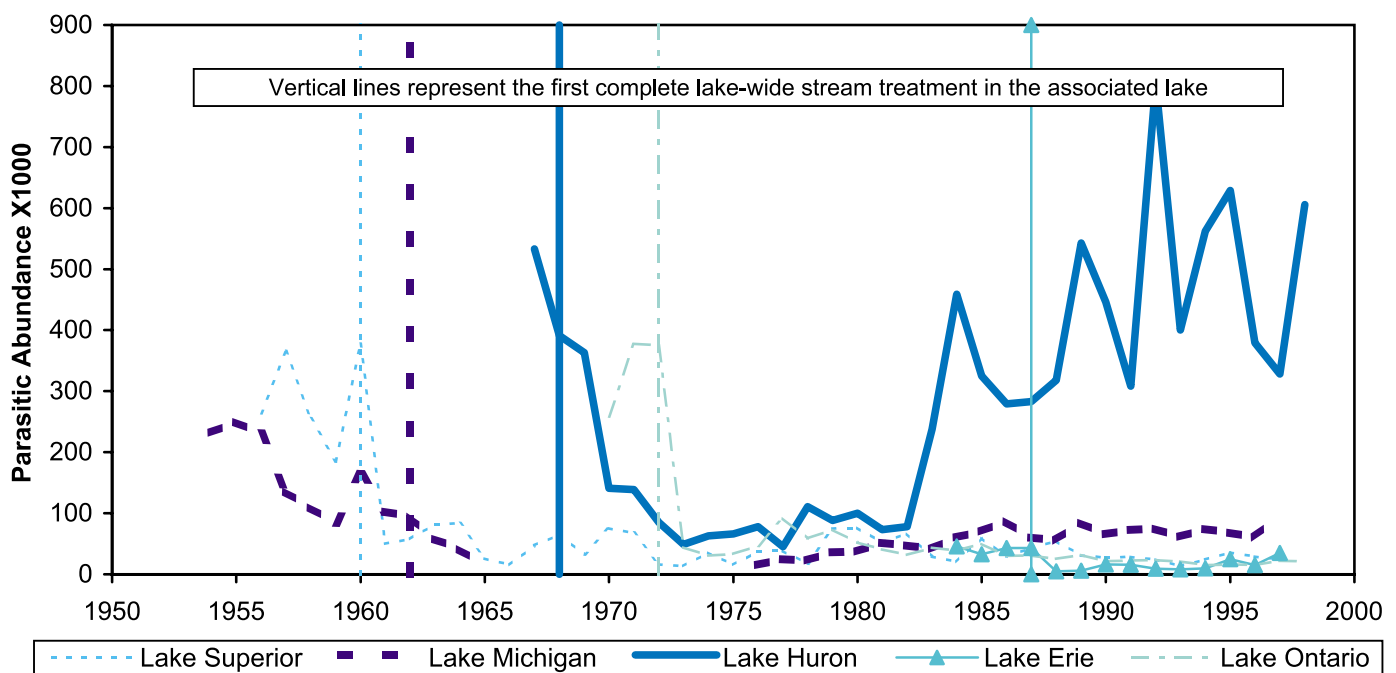


Figure 27. Sea lamprey control has achieved varying levels of success in the Great Lakes Basin (Source: Great Lakes Fishery Commission, 1999).



the river to date. Control crews completed the application of granular Bayluscide to approximately 2,000 acres of larval habitat. After this extraordinary international effort, the GLFC announced in December 1999 that preliminary assessments showed significant reductions in sea lamprey larvae populations in the St. Mary's River. Data indicate that the lampricide treatment eliminated nearly half of the sea lampreys in the St. Mary's River and it also achieved a significant increase in trapping and sterile male release. The integrated lampricide, trapping, and sterile male release puts the GLFC on track to eliminate 92 percent of the sea lampreys produced in the river, thereby achieving the goal of reducing parasitic lampreys in Lake Huron and northern Lake Michigan by 85 percent over the next 15 years. Such a reduction will allow for the resumption of other fishery rehabilitation efforts in Lake Huron. The FY 2000 Federal budget includes an additional \$1 million for Great Lakes sea lamprey control, largely to address the sea lamprey problem on the St. Mary's River. The federal increase, coupled with funds provided by the State of Michigan, will allow the GLFC to reign in the last remaining out-of-control population of sea lampreys in the Great Lakes.

***“We spend several million dollars a year sterilizing, catching, poisoning, putting up barriers to suppress the sea lamprey. Well, it's still there. And it may never go away. But for every dollar we invest, the Great Lakes earn \$30.25 in increased fisheries revenue. Your stock portfolio should perform as well.”***

***— “Launching a Counterattack Against the Pathogens of Global Commerce” Prepared Remarks of Secretary of the Interior Bruce Babbitt First National Conference on Marine Bioinvasions Massachusetts Institute of Technology, Sea Grant College, January 26, 1999.***

### ***Understanding the Impacts of Zebra Mussels***

Zebra mussels are believed to have been transported to the Great Lakes through ballast

water from the Caspian Sea. Discovered in 1988, they have spread rapidly to all of the Great Lakes. Zebra mussels, accidentally transported by recreational boaters, are now turning up in inland waters in all eight Great Lakes states. Because they rapidly reproduce, they have clogged up water and drain pipes at municipal water supplies and industries, they have displaced native freshwater mussels, and they have drastically altered the food chain.

### ***Ecosystem Response to Zebra Mussels***



**Zebra mussels attached to a native species.**

Zebra mussels continue to profoundly affect the Great Lakes ecosystem. This prolific mollusk filters microscopic algae from the water column, diverting nutrients from open water to lake bottom systems, thus favoring bottom-feeding fish and their predators over those that feed in the open water, traditionally lake trout, lake herring (cisco), and chubs. Aquatic rooted plants and their communities (e.g., large mouth bass) thrive in water cleared by zebra mussels, while habitat is reduced for species adapted for turbid waters (e.g., walleye).

Results from a 3-year study designed to compare the structure and productivity of the lower food webs across the Great Lakes documented unprecedented changes in the flow of nutrients in the lower food web of Lakes Ontario and Erie. Nutrient concentrations in the lower lakes are approaching those in the upper lakes and the biological community appears to be in transition, as present communities are very different from those previously documented.





Native Unionids (clams), the largest and longest-lived invertebrates in the Great Lakes Basin, are key players in the movement of organic and inorganic particulate matter between the sediment layer and overlying water column. Native Unionid populations are generally highly vulnerable to impact and even extirpation by invading zebra mussels. The species diversity and density of Unionids has severely declined in Lake Erie, the Detroit River, and Lake St. Clair since the arrival of zebra mussels in the mid-1980s.

In some areas of the lakes, such as Saginaw Bay, the growth of zebra mussels may be leveling off. A 7-consecutive-year study by NOAA's GLERL covering the period before, during, and after the peak invasion of zebra mussels has shown that the abundances and biomass of zebra mussels have not changed since 1993. This may indicate that the population in Saginaw Bay has assumed an equilibrium with the altered environment.

### **Ongoing Contaminant Pathway Studies**

Because of the huge volumes of water they filter and their high body-fat content, zebra mussels can accumulate about 10 times more PCBs and other toxic contaminants than native mussels. These contaminants are transferred up the food chain to waterfowl and fish. This potential to significantly affect contaminant cycling is of concern in the Great Lakes, where health advisories already exist for consumption of some species of fish, and is the subject of several ongoing investigations.

### **Zebra Mussels and Toxic *Microcystis* Algae Blooms**

A particular emphasis of GLERL's nonindigenous species research from 1995 to 1997 has been examining the role of the zebra mussel in promoting nuisance blooms of the potentially toxic blue-green algae *Microcystis* in Saginaw Bay, and the effects of these blooms on the ecosystem and the mussels themselves. *Microcystis* blooms have also been recently experienced in Lake Michigan and Lake Erie. These blooms are associated with taste and odor problems in drinking water. Experiments at GLERL with water



**Figure 28.** These maps illustrate the remarkable rate of expansion of the zebra mussels from isolated areas in June 1988 to a large area distribution by February 1998 (Source: National Zebra Mussel & Aquatic Nuisance Species Clearinghouse).

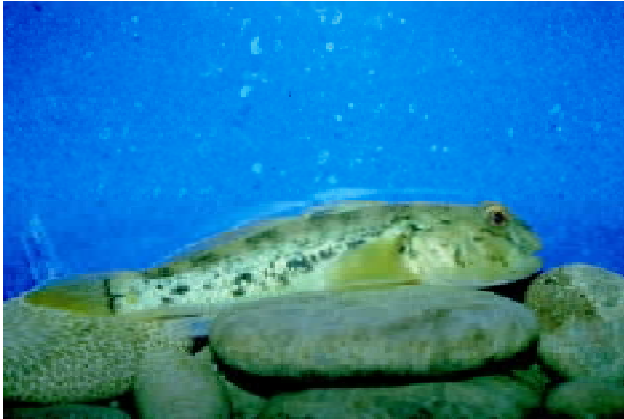
from Saginaw Bay and Lake Erie have shown that zebra mussels selectively filter and reject phytoplankton so as to promote and maintain *Microcystis* blooms. Using special video equipment, GLERL showed that mussels filter the water whether or not *Microcystis* are present, but they expel *Microcystis* back into the water while, at the same time, eating other algae.

### **Round Goby Dispersal Barrier for the Chicago Sanitary and Ship Canal**

The round goby, first found in the St. Clair River in 1990, has already spread to all the Great Lakes. This small, bottom-dwelling, aggressive exotic



fish, which feeds on zebra mussels, found an abundant food supply in the Great Lakes, thus fueling their rapid expansion throughout the



**The aggressive round goby is competing with and often replacing native species sharing their habitat.**

system. Unfortunately, they also compete with and can replace native species sharing their habitat. They have already extirpated the native mottled sculpin in several areas. It is now well positioned to invade the Mississippi River basin via the Calumet Sag Channel and the Sanitary and Ship Canal near Chicago. To control the short-term spread of the goby, a barrier consisting of an electric field appears to be the best approach to control the downstream spread of the goby. The goby dispersal barrier will be located downstream from farthest point of the goby's range. Federal funding through the Corps (\$500,000) and EPA (\$250,000) will support the design and construction of the dispersal barrier.

### **Ongoing Monitoring of the Eurasian Ruffe**



**The Eurasian ruffe is another unwelcome visitor to our lakes, competing with native trout and perch.**

The Eurasian ruffe, a spiny fish with minimal food value, continues to pose a major threat to the Great Lakes ecosystem. Native species such as trout and perch have trouble competing with the prolific ruffe. Introduced to Duluth Harbor in the early 1980s, the ruffe has spread much more gradually than the zebra mussel.

In western Lake Superior, the ruffe has become the predominant fish species in bays and estuaries. The ruffe has now extended its range from Lake Superior to northern Lake Huron and poses a threat to native species, especially yellow perch.

### **New Exotic Species Found in the Great Lakes**

***Cercopagis pengoi* is the latest exotic crustacean to invade the Great Lakes (Source: M. Rosenberg, IKI, Finland).**



*Cercopagis pengoi* is the latest exotic crustacean to invade the Great Lakes. This predatory cladoceran was first identified by Canadian scientists in Lake Ontario in early August of 1998. *Cercopagis* is indigenous to the Caspian, Azov, and Aral Seas. It is unknown at this point how long *Cercopagis* has inhabited the Great Lakes before first being reported, and what future impacts it may have. Given the linkages between Lake Ontario and the other lakes, it is likely that this animal will spread throughout the lakes in time. Given the high densities observed during the summer of 1998, it is possible that predation pressure by *Cercopagis* on smaller cladocerans can affect both the size and composition of phyto-

