Indicator: Contaminants in Herring Gull Eggs

Background

The herring gull (*Larus argentatus*) is a large omnivorous (i.e., it eats a wide range of food including fish, invertebrates, plants, and garbage) waterbird, about 64 cm (2 ft) from bill to tail (Figure 1). It is the most widely distributed gull in the Northern Hemisphere. In North America, it breeds across the northern third of the continent, including all of Ontario, and is found on all five of the Great Lakes. In the early 1900s, herring gull populations were nearly extirpated due to earlier persecution at nesting sites and the demand for bird feathers by the millinery trade during the late 1800s. During that time, herring gull populations on the Great Lakes were at an all-time low. The Migratory Bird Convention of 1916 placed the herring gull under protection from further persecution allowing populations to expand both their range and breeding numbers. On the Great Lakes, herring gull populations began to increase in the 1940s.

*Figure 1. Herring gull (*Larus argentatus*) (Photo credit: National Park Service, Indiana Dunes National Lakeshore).*

Herring gulls are social birds preferring to nest in colonies, usually on small islands, but always near a body of water. This makes them very easy to locate and study. Once birds reach breeding age at four years, they become established at a colony site where adult birds use the same nesting site year after year, many for as long as 10 to 20 years.

Adult herring gulls usually arrive at their breeding sites by early March, and by early to mid-May females have laid their three-egg clutch in a nest made of dead plant material. Females will generally lay additional eggs to replace any that are lost early in the nesting season. Eggs are normally incubated for 26-28 days. High mortality is normal among herring gull chicks and is mainly caused by food shortages and predation (usually by neighboring gulls). On average, only between one and two chicks per nest will survive and leave the colony. After about six weeks, young birds begin to fly, but may continue to be fed by their parents for several more weeks.

Status and Trends

The herring gull has been used by the Canadian Wildlife Service to track annual contaminant levels in the Great Lakes for more than 30 years (Weseloh et al. 1990; Hebert et al. 1999). It has many advantages over other species: as an adult, it is a year-round resident on the Great Lakes, feeds primarily on fish, has relatively high lipid content in its eggs, is a top food web predator, and is distributed in all five Great Lakes

(Mineau et al. 1984). Several lake-specific presentations of the monitoring data have appeared elsewhere (e.g., Weseloh et al. 1990; Ewins et al. 1992) and Great Lakes-wide data have appeared in various atlases and papers (Pekarik et al. 1998; Pekarik and Weseloh 1998; Jermyn-Gee et al. 2005).

Up to 13 fresh herring gull eggs were collected from both Fighting Island in the Detroit River and Middle Island in western Lake Erie during early incubation in late April to early May most years from 1974-2004. Eggs were analyzed individually from 1974 to 1986, but have been analyzed as site pools since 1987. PCB trends in herring gull eggs from Fighting and Middle Islands showed a significant decrease from the mid- to late 1970s to the early 1990s, but a nonsignificant trend from the early 1990s to the early 2000s (Figure 2). PCB levels in herring gull eggs have declined by 83% and 75% on Fighting and Middle Islands, respectively.

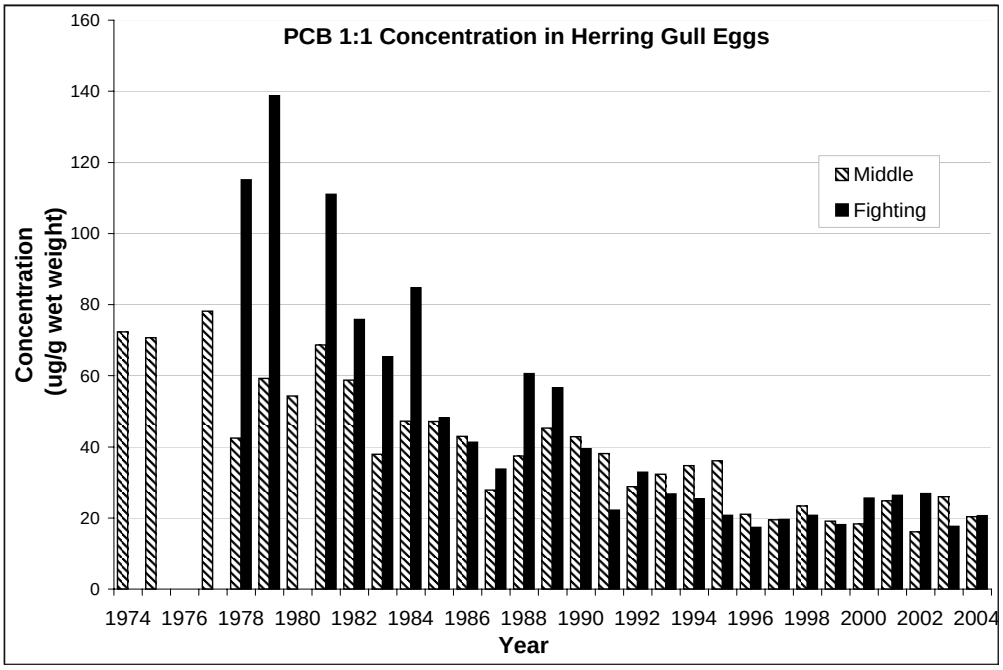

Figure 2. PCB 1:1 concentration in herring gull eggs on Fighting Island and Middle Island, 1974-2004 (data collected by Canadian Wildlife Service).

DDE (the product that results from the breakdown of DDT) in herring gull eggs from Fighting and Middle Islands showed a significant decrease from the late 1970s to the mid-1990s, but no significant change has been found between the mid-1990s and early 2000s (Figure 3). DDE levels in herring gull eggs from Fighting and Middle Islands have declined by approximately 90% over the period of record.

Dioxin (2,3,7,8 TCDD) trends in herring gull eggs from Fighting and Middle Islands show a general pattern of lower concentrations in the late 1990s and early 2000s compared to the period spanning the mid-1980s to the mid-1990s, with the exception of an elevated dioxin concentration on Fighting Island in 2003 (Figure 4).

In general, these trend data show that levels of persistent toxic contaminants decreased substantially from the high levels reported in the 1970s. Reproductive success has improved and visual abnormalities in birds are seldom seen (Gilbertson 1988).

Herring gull eggs from Fighting Island have significantly higher levels of PCB and DDE than other monitoring locations in the Great Lakes; however, the populations have comparable productivity levels to other colonies throughout the Great Lakes. There was a statistical correlation between contaminant levels and location of colony, meaning herring gulls are indicators of regional contamination in the Great Lakes (Weseloh et al. 1990).

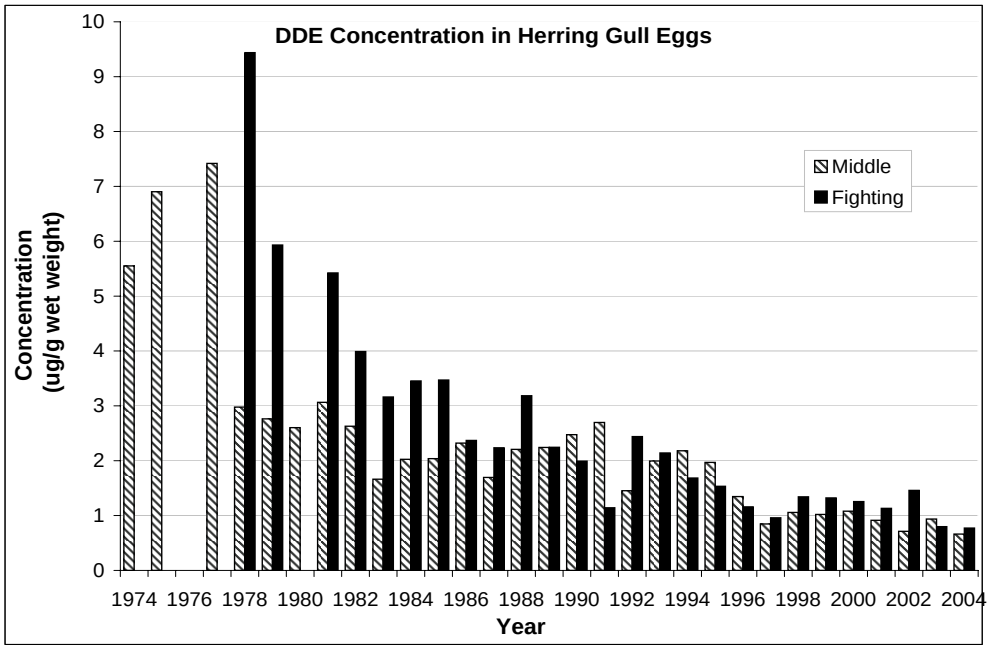

Figure 3. DDE in herring gull eggs on Fighting Island and Middle Island, 1974-2004 (data collected by Canadian Wildlife Service).

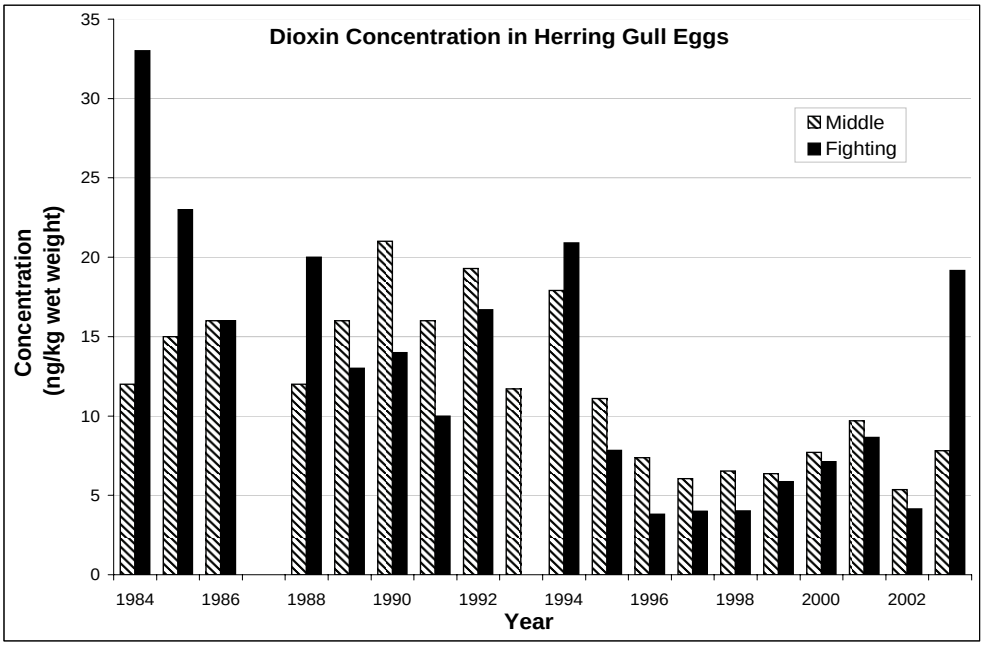

Figure 4. Dioxin (2,3,7,8 TCDD) in herring gull eggs on Fighting Island and Middle Island, 1984-2003 (data collected by Canadian Wildlife Service).

Management Next Steps

Control of contaminants at their source remains the primary imperative for action. Responsible agencies in the U.S. and Canada must remain strongly committed to virtual elimination of persistent toxic substances as defined in the Canada-U.S. Great Lakes Water Quality Agreement. Both the Detroit River Remedial Action Plan (RAP) and the Lake Erie Lakewide Management Plan (LaMPs) should:

- Identify and quantify remaining sources;
- Identify schedules for reduction targets to achieve virtual elimination; and
- Identify action plans to further reduce loadings and fully restore uses as called for in the RAPs and LaMPs.

Further, hot spots of contaminated sediment remain and are contributing to beneficial use impairments; sediment remediation must continue to be a priority to fully restore all beneficial uses.

Research/Monitoring Needs

Research indicates that levels of persistent toxic chemicals in the Great Lakes have been substantially reduced over the past 25 years. Although this stands as a major achievement, there is still a long way to go to restoring the Great Lakes ecosystem to a healthy state. Current contaminant trends indicate a sustained contaminant load to the Great Lakes. Even though these contaminant levels are much lower than in the 1970s, levels of dioxins, PCBs and other related chemicals in the Great Lakes are still present due to undetected sources, atmospheric deposition and release from contaminated bottom sediments.

Fish-eating birds such as the herring gull continue to be good sentinels of aquatic food web contamination and associated biological abnormalities occurring in animals living in the Great Lakes basin. By monitoring contaminant levels in the eggs, researchers can detect the presence of biologically significant concentrations of chemicals in the Great Lakes that may, for example, interfere with the normal development of embryos or cause other subtle reproductive effects. These contaminants would be expected to occur in the tissues of any species, including humans, that eat a large number of fish from the Great Lakes basin.

Obviously there are differences between birds and human beings, so the exact health effects found in the birds are not necessarily indicators of the same health impacts in humans. However, studies of infants of mothers who ate large amounts of highly contaminated Great Lakes fish indicate that some developmental effects can occur in the children. Assessment of potential effects of contaminants in human populations is usually based on the available information, including the results of toxicological studies in other mammals, studies of highly exposed populations, and the degree of exposure. The effects of long-term exposure to small concentrations of contaminants should remain the focus of research on wildlife and human health.

The incidences of dead embryos in eggs, and deformities and biochemical changes in birds in the Great Lakes, should not be taken lightly. They are indicators of something amiss in the ecosystem and are linked to the emerging issue of chemicals and endocrine disruption. Other top-predator species in the Great Lakes have demonstrated similar

responses, including humans. The Great Lakes must be clean enough for all species to live and reproduce normally. The challenge of restoring the Great Lakes ecosystem must be met in the future by the whole global community if virtual elimination of contaminants is to be achieved.

References

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Links for More Information

Sustainable development indicators: http://www.sdi.gov/Curtis/Pollut_Trends.html

Evaluating ecosystem results of PCB control measures within the Detroit River-western Lake Erie basin: http://www.tellusnews.com/art/pfd/PCB_Final_ReportUEF.pdf

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