Great Lakes Fish Consumption Advisories: The Public Health Benefits and Risks

Report Prepared by the Health Professionals Task Force for the International Joint Commission

August 7, 2003

Draft
HEALTH PROFESSIONALS TASK FORCE

United States Section

Peter Orris, MD, MPH, FACP
Drew Brodkin, MD, MPH
Heraline Hicks, PhD
Mary Foley, MS, RN
John Dellinger, PhD
Judith Kaur, MD
Elwyn Grimes, MD, FACOG

Canadian Section

Alan Abelsohn, MD, CCFP, FCFP
Pierre Gosselin, MD, MPH
Brian Gibson, MD, CCFP
Margaret Sanborn, MD, CCFP
Irena Buka, MBChB, FRCPC
Morris Duhaime, MD
Tony Myers, PhD

Secretary: Jim Houston
U.S. Section Liaison: Kay Austin
Executive Summary

A literature review was conducted into consumption patterns of Great Lakes fish, fish contaminant levels for mercury and polychlorinated biphenyls, and their associated advisories. The Health Professionals Task Force (HPTF) also reviewed the current approaches being used to develop fish consumption advisories with the objective of providing guidelines to make fish consumption advisories more effective.

It is the opinion of the HPTF members that the International Joint Commission should support a more effective approach to the development of fish consumption advisories, through better protection of those people at-risk without deterring the majority of people from fish consumption. To develop such an approach environmental monitoring and exposure assessments (to track trends in persistent organic pollutants) are urgently needed). Dietary exposures and their associated risk factors can be accurately determined and communicated to appropriate at-risk populations.

While the HPTF focused on two of the four major pollutants (i.e., mercury and polychlorinated biphenyls) found in the Great Lakes members are also of the opinion that to adequately protect Great Lakes fish eaters there is a need to monitor a variety of other groups of chemicals.

Members of the HPTF believe in primary prevention, which demands that efforts are continued to reduce contaminant levels in all Great Lakes fish. Through better awareness and education about fish consumption advisories, improved public health could be achieved.
Introduction

This report was prepared by the Health Professionals Task Force (HPTF) of the International Joint Commission (IJC) to examine the public health issues arising from fish consumption advisories that exist in all jurisdictions throughout the Great Lakes basin. The HPTF also sought to provide guidelines to the IJC to improve the effectiveness of fish advisories particularly for at-risk populations. Fish consumption advisories are primarily generated as a result of concern about the health effects of ingesting fish contaminated by persistent organic pollutants such as mercury and polychlorinated biphenyls (PCBs). Information on current fish consumption advisories can be found in the US Environmental Protection Agency’s (EPA) fact sheet, “National Listing of Fish and Wildlife Advisories” (USEPA 2003). The fact sheet also includes information on Canadian advisories.

This report does not include an exhaustive review of the literature on all contaminants that have been identified in fish tissues, but focuses on two pervasive contaminants found in the waters of the Great Lakes, mercury and polychlorinated biphenyls (PCBs). For more complete reviews of the literature and the potential risks to human health, readers are directed to recent reports by the Agency for Toxic Substances and Disease Registry (ATSDR, 1999 and 2000) and the National Research Council (2000).

In preparing this report, the following observations were used by the HPTF to assist in the development of more effective fish consumption advisories:

1. Progress has been made in reducing many persistent organic pollutants such as the organochlorine compounds in the water and in fish commonly consumed though this reduction appears to have leveled off in recent years.

2. Mercury, a neurotoxin, continues to be a major concern in the Great Lakes basin. A majority of the fish consumption advisories for the Great Lakes and connecting waters focus on mercury contamination.

3. Evidence from past epidemiological outbreaks associated with well documented severe exposures to Mercury (e.g., Minimata, Grassy Narrows, and Iraq) indicate a human health risk is associated with consuming fish containing high or elevated (above background levels) concentrations of mercury and persistent organic pollutants (NRC 2000). Recent scientific evidence also suggests subtle effects also are occurring at low doses.
4. Certain sub populations, especially the developing fetus, are most susceptible to low dose exposures of methylmercury and PCBs with neurodevelopmental effects being perhaps the most sensitive adverse human health indicator from these exposures.

5. Fish is an important nutritional component of many people's diets and a good source of n-3 (Omega 3) fatty acids (McIvor, 2001). Fish are high in protein and low in saturated fats (Johnson et al., 1998).

6. Avoiding native fish and substituting fish oil supplements, grocery purchased fish or other protein sources may lessen health risks associated with some of the known contaminants. These alternative protein sources also have been shown to contain other contaminants of concern.


"...The Committee noted that fish makes an important contribution to nutrition, especially in certain regional and ethnic diets, and recommended that its nutritional benefits be weighed against the possibility of harm when limits on methyl mercury concentrations in fish or fish consumption are being considered." (page 93, World Health Organization, 1999)

Fish Consumption Advisories

Fish consumption advisories warn people about the risk of consuming contaminated fish. The objective of an advisory is to: 1) provide information about the

---

1 Omega 3 fatty acids are long-chain polyunsaturated fatty acids, important components of cell membranes and precursors of a variety of biologically active compounds. For normal growth, development and function of neural and visual function infants require polyunsaturated fatty acids, provided in breast milk (Health Canada, 2001). Fish, baked or broiled, is low in fat with the exception of Atlantic mackerel, salmon and lake whitefish. Fish is a dietary source of sodium, potassium, selenium, Vitamin A, folic acid and niacin (Health Canada, 2001).
chemical contaminants in sport fish; 2) educate consumers about methods to reduce their exposure; and, 3) indicate benefits of fish consumption (Johnson et al., 1998). Depending upon specific bodies of water and the species of concern, fish eating may be completely banned, or amounts eaten limited by specifying the maximum numbers of meals that may be safely consumed. Fish advisories often specify information on which parts of the fish should be avoided and what preparatory/cooking methods should be used to reduce exposure to contaminants of concern. Typically, advisories are stricter for women of childbearing years, for women who may be pregnant or nursing, or for very young children. For example, the Guide to Eating Ontario Sport Fish (“the Guide”, 2003) contains advice regarding cleaning and cooking of fish fillets. It clearly recommends not eating any organs, fat or skin of any fish. Included in the guide’s general recommendations is advice to: 1) eat smaller fish; 2) eat bass, pike, walleye, perch, and pan fish from the Great Lakes instead of fatty species such as salmon and trout; and, 3) allow fat to drip away when cooking fish.

Use of the Guide was studied by Health Canada between 1995 and 1997 (Grondin, J. and LaRue, R., 2000). When deciding whether to eat their catch, 38% of fish eaters surveyed used only formal sources of information, with media being the most often cited source. But when government sources were cited, fifteen percent of survey respondents used only the "Guide". Thirty-four percent of survey respondents used only informal sources of information, citing interpersonal contacts as the most commonly used source of information. The Health Canada study also found that the most credible informal information source for fish eaters were local experts such as bait shop owners.

The USEPA National Listing of Fish and Wildlife Advisories for 2001 (USEPA 2002) includes the contaminants of concern, fish species and its size, the year the advisory was introduced, the current status of the advisory (i.e., active or rescinded) and the advisory type. The five advisory types are: 1) no consumption for the general population; 2) no consumption for the sensitive sub-populations of children and pregnant women; 3) restricted consumption for the general population; 4) restricted consumption for sensitive sub-populations; and, 5) public fishing bans.

All the Great Lakes and their connecting waters are currently under advisories for one or more contaminants (Table 1, USEPA 2003). The four primary contaminants plus DDT (and its degradation products, DDE and DDD) were at least partly responsible for 96% of the total number of fish consumption advisories in effect in 2002 in the U.S. and 75% of all advisories issued are at least in part because of mercury contamination (USEPA 2003).
Table 1. Fish Advisories Issued for the Great Lakes

<table>
<thead>
<tr>
<th>Great Lakes</th>
<th>PCBs</th>
<th>Dioxins</th>
<th>Mercury</th>
<th>Chlordane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Superior</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lake Michigan</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lake Huron</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lake Erie</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Lake Ontario</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Groups of chemicals such as heavy metals, organochlorine pesticides, and other numerous chemical compounds including but not limited to creosote, mirex, polyaromatic hydrocarbons, hexachlorobenzene, and pentachlorophenol, make up the remaining 4% of all fish consumption advisories in the U.S. (USEPA, 2003). Of the remaining four percent a majority of these advisories are a result of a New York statewide advisory for the contaminant mirex.

Fish Contaminant Levels

Fish and other seafood have been reported as major dietary sources of mercury for humans (ATSDR, 1999). Mercury accumulates from ingestion of organic (methyl mercury) and inorganic forms of mercury in the water and in the prey upon which freshwater and marine fish feed. It accumulates in the tissues of the fish and is biomagnified in larger, older and predatory fish. In 1998, average tissue concentrations of mercury in Great Lakes predatory fish such as walleye, pike, bass, and chain pickerel were greater than 0.5 ppm with maximum levels exceeding 2 ppm (USEPA, 2001). It is also interesting to note that ocean species such as swordfish and shark may have tissue levels of methylmercury of 1 ppm or greater (ATSDR, 1999). The Canadian Food Inspection Agency (CFIA, 2002) reported average tissue concentrations for mercury at levels below 0.5 ppm in marine fish and shellfish, excluding swordfish, shark, and fresh or frozen tuna. More detailed information the maximum allowable on recommended levels of mercury and PCBs in fish for the U.S., Canada and by the World Health Organization can be seen in Appendix 2. Also examples of tolerable intake levels of mercury or methylmercury and PCBs are mentioned. Some states increase protection for sensitive populations by using a separate threshold to issue advisories for sensitive populations (Appendix 3).
PCB trends in lake trout and walleye have been reported for selected locations in the Great Lakes from the 1970's, including data through 1990 for Lake Superior, and data through 1992 for Lakes Michigan, Huron, Ontario and Erie (De Vault 1996). More recent data by the USEPA Great Lakes National Program Office that examined levels of PCBs in fish for site specific areas, showed an overall decrease in the PCB concentrations in the fish analyzed (Figures 1 to 5, Hellman, pers. comm.).

Figure 1. PCBs in Lake Ontario Whole Trout

![Figure 1](image1)

Figure 2. PCBs in Lake Huron Whole Lake Trout

![Figure 2](image2)

Figure 3. PCBs in Lake Michigan Whole Lake Trout

![Figure 3](image3)
As noted previously, fish consumption is not limited to Great Lakes fish alone. Consumers also may eat wild and farmed fish. Some marine fish can be a source of persistent environmental contaminants. For example, in a recent advisory issued by Health Canada, Canadians were advised to limit their consumption of fresh shark, swordfish and tuna. Mercury in these marine species has been found at levels in the range of 0.5 to 1.5 ppm (Health Canada, 2002).

**Understanding Who Is Eating Great Lakes Fish**

In a Health Canada study conducted between 1995 and 1997, Canadian Great Lakes sport fishers were surveyed for their fish consumption patterns, including their fishing habits, advisory compliance and knowledge (Grondin and LaRue, 2000). The results showed that sixty-six percent of respondents stated...
they primarily fished for pleasure, while only 6% fished for food. Respondents who ate their catch stated they liked the fish because it tasted good, but also expressed concerns about polluted water and contaminated fish. Results also showed that 52% of the fish eaters consumed less than 12 meals per year of fish they caught, 22% ate 12 to 25 fish meals per year, 21% ate 26 to 95 fish meals per year, while only 6% ate more than 96 fish meals per year. The study found that as fish consumption increased, so did the likelihood that parts other than fillets were consumed. The results also showed that those who did not eat their catch were younger, employed, and more likely to report an income of $60,000 or more. Younger respondents indicated the main reason for not eating the fish they caught was their belief that the water was polluted or the fish were contaminated.

Research by Velicer and Knuth (1994) assessed perceptions toward fish consumption and health advisories among opinion leaders, anglers, migrant farm workers, low-income individuals, and experts from fisheries and health care. Similar to that of the Health Canada study noted above, they found that the primary motive for fishing was for pleasure and not for food. Additionally, their results showed that migrant workers and low-income individuals were either non-eaters or frequent consumers of fish. Their results also found that opinion leaders, low-income individuals, and Hispanic migrants used more risk reducing preparation and cooking techniques than did African-American migrant workers. Opinion leaders and experts in fisheries and health had a greater awareness of advisories. Recent research by Velicer and Knuth (2000) showed that low-income individuals and migrant workers were less aware of advisories and were more likely to rely on mass media and friends for information about consumption advisories.

Tilden et al. (1997) surveyed adults of the eight U.S. Great Lakes states to determine demographics, fish consumption patterns, and sport fish consumption advisory awareness. They found that although half of the Great Lakes sport fish consumers they questioned were aware of the health advisories, awareness was especially low among women and minorities. Their work also showed that awareness was greater in Caucasians, those individuals having college degrees, and those consuming more than 23 meals per year of Great Lakes sport fish. In an earlier study, Connelly and Knuth (1995) found similar results: awareness of consumption advisories was lower among younger anglers, those with lower incomes, and non-Caucasians. They also noted that 40% of respondents thought that the health risks from eating contaminated sport fish were minor compared to other risks.
Lastly, Johnson et al. (1998) concluded that populations at risk for exposure to mercury, PCBs, and other persistent organic pollutants included aboriginal people, subsistence and sport anglers, elderly people, women of childbearing years (including those pregnant or nursing), and children.

**Human Behavior and Risk Perceptions Toward Fish Consumption Advisories**

In its review of available information, the HPTF noted that despite public concerns about consuming contaminated fish, many sub-populations in North America desire to catch and consume fish from their native habitats for esthetic purposes (e.g. fishing is fun), social interactions (e.g. encourages family activity), or due to economic reasons (e.g., more affordable than supermarket fish). Wheatley and Wheatley (2000) noted that each of these desires reflects benefits that must be weighed against the risk of consuming contaminated fish. An earlier study of Canadian Indigenous People (Wheatley and Paradis, 1996) suggested that indirect effects of environmental contaminants on human health may lead to social/culture disruption, change of life style, socioeconomic damage and change of diet leading to increasing incidences of diabetes, substance abuse and violent behavior.

Understanding basis for fishing practices, consumption patterns, and compliance with fish advisories is dependent upon knowledge of widely different ethnic, cultural, and socioeconomic factors. There are many aspects that need to be taken into consideration in developing the appropriate message for a targeted population/audience. Fish Advisories need to take into consideration not only site-specific data (e.g. contaminant loads, fish species, and fish size), but also cultural and socioeconomic factors (e.g. cultural habits and language barriers).

Of equal importance, if fish consumption advisories are to reach their intended audience and incite the needed change in fish consumption behavior, distribution of the advisory (targeted populations), advisory design (contents and format), and the use of the advisories (public outreach) are critical factors, which must be addressed (Burger, 2001).
Current Approaches To Developing Fish Advisories

Many experts involved in the development of fish consumption advisories have observed the need to improve their effectiveness (Johnson et al. 1998). One approach has been to issue advisories for the general population, as well as for certain (targeted) segments of the population that may be at higher risk. These advisories have tended to advise avoidance of consuming Great Lakes fish, particularly for women of childbearing age. Alternatively, another approach promotes how to reduce the toxic exposure when eating Great Lakes fish so one can obtain the health benefits of eating traditional fish diets while minimizing the health risk from exposure to contaminants in fish.

In evaluating these approaches, The Health Professionals Task Force reviewed epidemiological studies done in the Great Lakes and other parts of the world and found that:

a) Neurobehavioral effects in newborns, infants, and children from prenatal exposure to PCBs at past and current levels from consumption of Great Lakes fish (Fein et al. 1984; Jacobson et al. 1990; Jacobson et al. 1996; Lonky et al. 1996; Stewart et al. 2000);

b) Maternal consumption of Lake Ontario Great Lakes fish increases the risk of prenatal exposure to PCBs (Stewart et al. 1999);

c) Exposure to PCBs was associated with lower scores on several measures of memory and learning in older adult fish eating cohort (Schantz et al. 2001);

d) Serum PCB levels and consumption of Great Lakes fish were significantly associated with changes in thyroid hormones in women and men (Persky et al. 2001);

e) Mercury was related to neuropsychological dysfunction in children of the Faroe Islands using various tests including language, attention, memory, and to a lesser extent visiospatial, and motor functions (Granjean et al. 1997, 1998).
f) Suboptimal neurodevelopment in Dutch neonates was related to high levels of PCBs, chlorinated dibenzo-p-dioxins (CDDs), and chlorinated dibenzofurans (CDFs) in breast milk and increased hypotonia (decreased muscle control) was associated with high levels of coplanar PCBs in breast milk (Huisman et al. 1995).

g) Levels of PCBs and other organochlorines in the Great Lakes fish and wildlife populations have decreased substantially (DeVault, 1996 and USEPA 2002).

h) Body burdens of mercury in exposed populations of fish consumers in the Great Lakes basin do not demonstrate that large percentages are at risk [fixed this reference for mercury, authors did PCBs] (Gerstenberger et al., 1997 and 2000). Rather, the evidence shows that methylmercury exposures in excess of the Reference Dose (RfD) or those needed to produce whole blood mercury concentrations exceeding 6 micrograms/L (Fg/L) in women of childbearing age is a rare event even among frequent fish consumers like the Ojibwe tribe of the upper Great Lakes. The average mercury concentration in the fish consumed by the Ojibwe fisheaters is less than 0.5 ppm (Dellinger, 2003[check with John, maybe more recent reference according to Heraline]).

i) The average concentration of mercury in commercially caught fish is 0.17 ppm (U.S. Food and Drug Administration – FDA, see Appendix 1). While fish provides many essential nutrients in the diet, especially Omega 3 fatty acids, recent evidence suggests that the presence of mercury could mitigate the positive cardiac effects of these Omega 3 fatty acids (Guallar et.al., 2002).

j) Alternative diets including hamburgers, fried chicken, and dairy products, have been found to contain significant levels of dioxins and other persistent contaminants (Schecter A. and Li L. 1997).

Examples of Health Advisories include:

New York State Department of Health Advisory for Women, Infants and Children, 2003

Health advice is also given for infants, children under the age of 15 and women of childbearing age. Department of Health in the State of New York recommends that groups not eat any fish from the specific water bodies listed in
the advisory. The reason for this specific advice is that chemicals may have a
greater effect on developing in young children or in the fetus. They also build up
in women’s bodies and are often passed on in mothers’ milk. Waters that have
specific advisories have at least one species of fish with an elevated contaminant
level, which means that a contamination source is or was in or near the water.

Mercury maps produced by the Great Lakes Indian Fish and Wildlife Commission
(GLIFWC)

These maps may be viewed at www.glifwc.org. The Geographic Information
System (GIS) maps identify which freshwater lakes have the lowest levels of
mercury contamination in the fish. Through the use of color codes, two maps are
produced; one map for women of childbearing age and children, and the other
map for men and women beyond childbearing years. Using these maps one can
choose areas that are known to have fish with lower levels of contaminants and
thereby minimize the health risks to the individual fish eater and their family
(Figure 6, (GLIFWC, 2003 and LeCapitaine, 2002)).

The HPTF believes that these examples of fish consumption advisories have their
respective merits. However, neither approach sufficiently addresses the needs of all
consumers of Great Lakes fish (i.e. sport and, subsistence fishers and at-risk populations).
A more effective approach to reducing exposure to contaminants in fish needs to be
developed that considers identifying a window of opportunity in which advice that is
given maximizes the benefits and minimizes the risk of consuming Great Lake’s fish. To
do so requires site-specific data, consideration for socioeconomic factors and the
identification of any cultural barriers when communicating the risks and benefits of fish
consumption to local populations.
Figure 6 Sample GIS Mercury Map (GLIFWC, 2003 and LeCapitaine M., 2002)
Recommended Guidelines For Effective Fish Advisories

The HPTF believes that fish consumption advisories:

1) Must be simple to permit effective communication and retention in the targeted population. Advice must:
   - Utilize the precautionary principle to reduce exposures based on a likelihood of harm, which has been, clearly demonstrated for the Great Lakes fish pollutants including methyl mercury and PCBs;
   - Indicate that fish is a significant dietary source of protein for many including aboriginal and immigrant populations and avoid implying support for alternative protein sources with equivalent or higher risk to human health; and,
   - Be widely distributed with targeted messages so that individuals can exercise their personal judgment about the risks to themselves or to their offspring from consuming contaminated fish.

2) Regulations, recommendations, and advisories developed to protect the public health, must be science based and rely on animal studies, toxicological assessments, as well as occupational and epidemiological studies.

3) At current exposure levels fish consumption advisories should be targeted to at risk populations specifically to women expecting to become or currently pregnant and young children

4) Advisories should contain information concerning the comparative benefits and disadvantages of consuming fish and/or other protein sources in clear terms to the general population.

5) Guidelines should be updated regularly and based on continued monitoring and surveillance for both Canada and the United States.

6) Advisories for the public should be written in clear, simple terms, using informal native language of the targeted population. They should be culturally specific and designed to reach minority communities within each region.

7) Advisories should not only be well publicized and made easily accessible to the public but also should recommend actions or steps that can be accomplished by the affected communities.
Fish and Shellfish With Much Lower Mercury Levels  
**Source:** U. S. Food and Drug Administration (May 2001)

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>MEAN (PPM)</th>
<th>RANGE (PPM)</th>
<th>NO. OF SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grouper (Mycteroperca)</td>
<td>0.43</td>
<td>0.05-1.35</td>
<td>64</td>
</tr>
<tr>
<td>Tuna (fresh or frozen)</td>
<td>0.32</td>
<td>ND-1.30</td>
<td>191</td>
</tr>
<tr>
<td>*Lobster Northern (American)</td>
<td>0.31</td>
<td>0.05-1.31</td>
<td>88</td>
</tr>
<tr>
<td>Grouper (Epinephelus)</td>
<td>0.27</td>
<td>0.19-0.33</td>
<td>48</td>
</tr>
<tr>
<td>*Halibut</td>
<td>0.23</td>
<td>0.02-0.63</td>
<td>29</td>
</tr>
<tr>
<td>*Sablefish</td>
<td>0.22</td>
<td>ND-0.70</td>
<td>102</td>
</tr>
<tr>
<td>*Pollock</td>
<td>0.20</td>
<td>ND-0.78</td>
<td>107</td>
</tr>
<tr>
<td>*Tuna (canned)</td>
<td>0.17</td>
<td>ND-0.75</td>
<td>248</td>
</tr>
<tr>
<td>*Crab Blue</td>
<td>0.17</td>
<td>0.02-0.50</td>
<td>94</td>
</tr>
<tr>
<td>*Crab Dungeness</td>
<td>0.18</td>
<td>0.02-0.48</td>
<td>50</td>
</tr>
<tr>
<td>*Crab Tanner</td>
<td>0.15</td>
<td>ND-0.38</td>
<td>55</td>
</tr>
<tr>
<td>*Crab King</td>
<td>0.09</td>
<td>0.02-0.24</td>
<td>29</td>
</tr>
<tr>
<td>*Scallop</td>
<td>0.05</td>
<td>ND-0.22</td>
<td>66</td>
</tr>
<tr>
<td>*Catfish</td>
<td>0.07</td>
<td>ND-0.31</td>
<td>22</td>
</tr>
<tr>
<td>*Salmon (fresh, frozen or canned)</td>
<td>ND</td>
<td>ND-0.18</td>
<td>52</td>
</tr>
<tr>
<td>*Oysters</td>
<td>ND</td>
<td>ND-0.25</td>
<td>33</td>
</tr>
<tr>
<td>*Shrimps</td>
<td>ND</td>
<td>ND</td>
<td>22</td>
</tr>
</tbody>
</table>

*Fish and shellfish among the most consumed of the domestic seafood market
### Appendix 2. Examples of maximum allowed or recommended levels of mercury (Hg) and polychlorinated biphenyls (PCBs) in fish in the United States / Canada and by the World Health Organization (WHO)

<table>
<thead>
<tr>
<th>Country/Organization</th>
<th>Fish Type</th>
<th>Mercury</th>
<th>PCBs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>United States</strong></td>
<td>Fish, shellfish and other aquatic animals (FDA)</td>
<td>1 ppm methylHg</td>
<td>The Food and Drug Administration (FDA) requires that infant eating fish and shellfish, contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food.</td>
</tr>
<tr>
<td>States, tribes and territories are responsible for issuing fish consumption advise for locally-caught fish; Trigger level for many state health departments</td>
<td>0.5 ppm methylHg</td>
<td>US EPA reference dose: 0.1Fg methyl Hg/kg body weight per day</td>
<td>ATSDR- Minimal Risk Level (MRL) 0.03Fg/kg body weight/day</td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td>All fish except shark, swordfish or fresh or frozen tuna (expressed as total mercury in the edible portion of fish).</td>
<td>0.5ppm total Hg</td>
<td>Provisional Tolerable Daily Intake: 047Fg Hg/kg body weight per day for most of the population and 0.2Fg Hg/kg for women of childbearing age and young children</td>
</tr>
<tr>
<td>States, tribes and territories are responsible for issuing fish consumption advise for locally-caught fish; Trigger level for many state health departments</td>
<td>0.2ppm total Hg</td>
<td>2 ppm</td>
<td></td>
</tr>
<tr>
<td><strong>WHO</strong></td>
<td>All fish except predatory fish</td>
<td>0.5 mg methyl Hg/kg</td>
<td>JECFA provisional tolerable weekly intake: 3.3 Fg methylHg/kg body weight per week.</td>
</tr>
<tr>
<td>Predatory fish (such as shark, swordfish, tuna, pike and others)</td>
<td>1 mg methylHg/kg</td>
<td>0.47 ug/kg/day</td>
<td></td>
</tr>
<tr>
<td><strong>WHO</strong></td>
<td>PTMI 70pg/kg bw</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Units as used in references “mg/kg” equals Fg/g and ppm (parts per million. It is assumed here that fish limit values not mentioned as “wet weight” or “wet flesh” are most likely also based on wet weight, as this is normally the case for analysis on fish for consumers.

(2) PTMI - Provisional Tolerable Monthly Intake

(3) Using an alternative approach, the US ATSDR developed its current Minimal Risk Level (MRL) of 0.3Fg/kg body weight/day for methylmercury and 0.03Fg/kg body weight/day for PCBs.
# Appendix 3

## Survey of Fish Advisory Systems by Great Lakes State, Noting Threshold Levels for Sensitive populations

<table>
<thead>
<tr>
<th>State</th>
<th>Threshold General Population (ppm)</th>
<th>Threshold Sensitive Populations (ppm)</th>
<th>Consumption Recommendations – Sensitive Populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>0.50</td>
<td>0.50</td>
<td>No consumption</td>
</tr>
<tr>
<td>Indiana</td>
<td>0.16</td>
<td>0</td>
<td>Ranges from four 8-ounce meals per month to consumption (0.65 ppm) depending on level of mercury contamination; statewide advisory recommends one 8-ounce meal per month (all freshwaters not under a specific advisory)</td>
</tr>
<tr>
<td>Michigan</td>
<td>0.50</td>
<td>0.50</td>
<td>On 8-ounce meal per month; no consumption at 1.5 ppm; statewide advisory recommends one 8-ounce meal per month of eight species from all inland lakes</td>
</tr>
<tr>
<td>Minnesota</td>
<td>0.16</td>
<td>0.038</td>
<td>Ranges from unlimited consumption to no consumption (at 2.8 ppm) depending on level of mercury contamination; statewide advisory recommends the same range</td>
</tr>
<tr>
<td>New York</td>
<td>1.00</td>
<td>1.0*</td>
<td>No consumption; statewide advisory recommends four 8-ounce meals per month</td>
</tr>
<tr>
<td>Ohio</td>
<td>0.05</td>
<td>0.05</td>
<td>Ranges from four 8-ounce meals per month to no consumption (at 1.0ppm) depending on level of mercury contamination; statewide advisory recommends four 8-ounce meals per month for waters not under a specific advisory</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>0.13</td>
<td>0.13</td>
<td>Ranges from four 8-ounce meals per month to no consumption of species</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Statewide advisory recommends four 8 ounce meals per month of six species and one 8-ounce meal per month of other sport fish, no consumption at 1.0 ppm</td>
</tr>
</tbody>
</table>

* consumption limits more stringent for sensitive populations

Source: The State PIRGs (In: Brain Food, What women should know about mercury contamination of fish), April 2001, written by The Environmental Working Group, a nonprofit environmental research organization based in Washington, D.C.
References


LeCapitaine, M. (Personal Communication with J. A. Dellinger) Permission to Cite Bad River’s Mercury Maps Granted by Mark LeCapitain at Bad River Tribal Health Clinic, June 2002.


U. S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Office of Seafood, May 2001 (Table 2), Website:  http://vm.cfsan.fda.gov/~frf/sea-mehg.html


WHO, 1999. TR-896; This Technical Report was also published as a monogram by IPCS (International Programme on Chemical Safety) as WHO - Food Additive Series 44, ISBN 92 4 166044