



Final Report to Michigan Sea Grant Submitted by:

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What are the Causes, Consequences and Correctives of fish contamination in the Detroit River AOC that cause health consumption advisories?

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CHAPTER 3:

FISH CONSUMPTION ADVISORIES: A REVIEW OF STATE-LEVEL APPROACHES

Abstract

In 2000, the US Environmental Protection Agency (USEPA) issued its most recent national guidelines for establishing fish consumption advisories (FCAs). While most states have adopted these recommendations, an assessment of current state practices indicates important inter-state variances in FCA protocols for polychlorinated biphenyls (PCBs). Some states, for example, use USEPA reference dose estimates for calculating non-cancer health risks, while other states still rely on US Food and Drug Administration action levels. The latter endpoint is no longer considered appropriate for setting recreational consumptions advisories. In comparison to other states, most of the Great Lakes states are consistent in their approach to FCAs and follow a 1993 regional protocol. Since this time, however, the literature about human health risks associated with PCBs has improved and analytical techniques for identifying congener-specific PCBs have advanced. These changes have occurred in the context of mostly declining state budgets that support fish contaminant monitoring program and outreach efforts. Some states have recently revisited their consumption advisory process, focusing on the following issues: 1) honing local consumption advice to adequately protect populations at most risk of PCB effects, either because they are more susceptible or because they consume more fish; 2) evaluating the latest science regarding PCBs, specifically with respect to non-cancer health effects; and 3) where appropriate, working with other states to assess interstate variations in fish advisory approaches when managing shared water resources. These efforts have direct relevance to Michigan's FCA process, as they can help support any efforts the state may undertake to update and improve its FCA process related to PCBs and to enhance their public outreach efforts by targeting communication materials to those most in need of specific consumption advice.

Introduction

Consumption advisories for recreational fish caught in US waters continue to be a major issue for local and state governments. As of 2006, 48 states have fish consumption advisories in place along with the District of Columbia, the U.S. territories of American Samoa and Guam, and 5 Indian tribes (U.S. EPA 2007). This has translated into 3,852 consumption advisories for recreational fish by the end of 2006. This number has been increasing over the years for a variety of reasons, including improved monitoring and surveillance for contaminants along with advances in the understanding of human health risks associated with existing and emerging contaminants of concern.

The current process for issuing fish consumption advisories related to PCBs comes largely from guidelines issued by the U.S. Environmental Protection Agency in 2000. Although the majority of states have adopted these guidelines, there are important variances that define individual states efforts. The Great Lakes states are differentiated from other states by their effort in the early 1990s to develop a uniform protocol for establishing fish consumption advisories across the different states. The protocol developed from this effort continue to guide FCAs in these states, despite recent advances in the science of PCB effects in humans, declining state revenue for FCA

monitoring and outreach, and changes in best practices for analyzing PCBs and associated congeners.

Federal role in fish consumption advisories

In the United States, the Environmental Protection Agency (USEPA) is responsible for assessing human health risks associated with the consumption of contaminated recreational fish. The USEPA's mandate in this area comes from the language of the 1972 Federal Water Pollution Control Act, now known as the Clean Water Act, with a stated primary objective to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33

U.S.C. §1251(a). A specific goal of this effort is to assure that all U.S. waters have adequate water quality that "provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water." This goal has been interpreted by the USEPA both as requiring the survival of fish in US waters as well as providing for fish that can be safely consumed from the waters (USEPA 2000, 2003).

The national criteria for contaminants in fish are promulgated through the Criteria and Standards Division of USEPA's Office of Water Regulation and Standards. Under Section 304(a) of the CWA, the USEPA is required to establish standards for the amounts of contaminants such as PCB that can be consumed by people without adverse health effects.

Over the years, the USEPA has worked to improve the way in which it assists state in implementing fish monitoring and consumption guidelines. One of the biggest changes occurred in the late 1980s, after the American Fisheries Society, at the request of the USEPA, completed a survey of state fish and shellfish consumption advisory practices. Surveys and responses were solicited from a range of state health departments, fisheries agencies, and water quality/environmental departments in all 50 states plus the District of Columbia (Cunningham et al. 1990). The results indicated that monitoring and risk assessment procedures implemented by states varied widely. States also identified specific requests for USEPA and other federal agencies including that they:

- 1) Provide a consistent approach for state agencies to use in assessing health risks from the consumption of contaminated fish;
- 2) Develop guidance on sample collection procedures;
- 3) Develop or endorse uniform, cost-effective analytical methods for quantifying contaminants;
- 4) Establish a quality assurance program that includes the use of certified reference materials for chemical analyses (Cunningham et al. 1990).

The USEPA responded to this feedback by forming a working group to develop guidelines for using the most cost-effective and scientifically-sound methods for sampling and analyzing fish and shellfish tissue. This effort resulted in the publication of a series of guidelines to help states in developing, issuing, and communicating consumption advisories. In addition, the USEPA developed a national database of state-issued consumption advisories, known as the National Listing of Fish and Wildlife Advisories.

Since then, the USEPA has made at least two other important recommendations related to fish consumption advisories. The first of these occurred in 1995 when the USEPA¹ issued a supplementary advisory for PCB-contaminated fish targeted at women of reproductive age. This was in response to increased concern regarding the effects of PCBs on developing fetuses. The second major change came in 2007, when the USEPA and FDA specified that FDA Action Levels should no longer be used to issue fish consumption advisories. These action levels have been established for chemicals found in commercial products of food (fish, shellfish, etc.), but are not intended as cutoffs for issuing advisories for sport fish.

In developing its guidelines for states, the USEPA has used a risk-based approach for estimating health risks associated with PCBs. In this case, the USEPA has estimated a reference dose (RfD), which represents an estimate of a daily exposure to humans that is likely to be without appreciable risks of negative health effects over the course of a lifetime (USEPA 2004). The RfD explicitly includes uncertainty factors that can span several orders of magnitude and is conservative enough to apply to sensitive subgroups.

State-level approaches to issuing FCAs

An important characteristic of the CWA is its vision that states and the federal government form partnerships to improve the quality of the nation's water. As such fish consumption advisories and fish tissue monitoring programs constitute an important way in which state's can periodically assess the condition of their waters, as required by Section 305(b) reports of the CWA and in listing impaired water bodies under Section 202(d) of the CWA.

States are responsible for implementing a fish contaminant monitoring and testing program, including collecting fish samples, issuing FCAs when needed, and communicating to the public regarding FCAs. Individual states can set their own criteria and decide which where and when to sample.

States usually issue 5 different types of advisories: 1) A statewide no consumption advisory due to health risks for all populations; 2) a statewide no consumption advisory for sensitive subpopulations only; 3) an advisory that is specific to a given water body for a given populations; 4) an advisory that is specific to a given water body for all populations; and 5) a commercial fishing ban.

The Great Lakes States approach to FCAs

Great Lakes Uniform Protocol

In the Great Lakes region, work on a more uniform interstate approach to issuing FCAs began in the early 1990s. The Great Lakes Sport Fish Advisory Task Force ("Task Force") was made up of representatives from health and environmental or natural resource agencies from all eight of the Great Lakes states (i.e., Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin). The Task Force was charged with developing a uniform

¹ This recommendation was issued in conjunction with the Agency for Toxic Substances and Disease Registry (ATSDR).

approach and protocol for issuing FCAs in these states (see Anderson et al. 1993). Although not all states have adopted the protocol in its entirety, the resulting guidelines have been important in improving interstate consistency in FCAs.

Under the guidelines of the Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory (“Protocol”), most species collected for advisory purposes are scale- and skin-on fillets. The fillets are specified to include “all flesh from the back of the head to the tail, from the top of the back down to and including the belly flap area... [A]l fins, the tail, head, viscera, and major bones” should be removed. The primary exceptions to this are bullheads, channel catfish, flathead catfish, and burbot fillets, all of which should be skinned. The Protocol also cites a preference for the use of individual fillets for chemical analysis; however, if states opt to use composite samples, the guidelines are to use fish of a similar size, with the smallest fish being at least 90% as long as the largest fish.

Although the Protocol does not give specific preference to any PCB analytical method, it does give a minimum detection goal for PCBs of 0.5 mg/kg. It also specifies guidelines for 5 meal frequencies: unlimited, 1 meal per week, 1 meal per month, 6 meals per year, and do not eat.

In terms of human health risks, the Protocol used a weight-of-evidence approach to designate a Health Protective Value (HPV) concentration of 0.05 µg total PCBs/kg/day. The HPV was developed in consideration of both cancer and reproductive and neurodevelopmental risks. Using the assumptions provided below, this leads to an ingestion rate of 0.22 mg per week of total PCBs in raw fish as the upper risk limit to trigger an “eat no more than once per week” advisory. Total PCB ingestion rates that range between 0.22 to 1.0 mg per week in raw fish would trigger an “eat no more than one meal for month” advisory (Table 1).

Table 1. PCB concentrations in fish that trigger consumption advisories for fish, as outlined in the Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory (Anderson et al. 1993).

Group	PCB conc. (ppm)†
Unrestricted consumption	0 – 0.5
1 meal/week	0.06 – 0.2
1 meal/month	0.21 – 1.0
6 meals/year	1.1 – 1.9
No consumption	> 1.9

†In parts-per-million (mg/kg) wet weight and for raw skin-on fish fillets.

In order to translate raw fish PCB levels to human health risks, the Protocol uses several assumptions that are generally consistent with USEPA recommendations. These include assuming an average meal size of 227 g (or one-half pound) of uncooked fish, a weight of 70 kg for an adult consumer, and a 70-year lifetime duration of exposure.

Finally, the Protocol recommends that states consider both state-wide and site specific consumption advisories, depending on the circumstances. In terms of the latter, site-specific advisories allow agencies the ability to highlight waterbodies that might house fish with either higher or lower contaminant loads, thereby tailoring health recommendations. In most cases, this is the model followed by most Great Lakes' states.

Michigan

In the state of Michigan, three different agencies collaborate in the FCA process: The Department of Natural Resources (MDNR) is responsible for collecting the fish, the Department of Environmental Quality (MDEQ) is responsible for running the PCB analysis, and the Department of Community Health (MDCH) is responsible for issuing and publishing advisories. In general, Michigan follows the guidelines of the Great Lakes Uniform Protocol. To monitor contaminant loads in fish, the MDNR collects fish every 2-5 years from specified bodies of water. They generally aim to collect 10 fish for each species monitored, including species of bottom-feeders and top predators. Although the MDCH prefers to have a data set of at least 10 fish samples before either establishing or modifying an advisory, occasionally best professional judgment must be used in evaluating smaller data sets.

PCB concentrations are analyzed for individual fish and are not composited. FCAs are then based on an evaluation of the relationship between contaminant concentrations and trigger levels across the range of fish collected usually by employing a linear regression analysis to predict concentrations at lengths not collected. When linear regression cannot be used², MDCH will use either median concentrations or the percentage of samples exceeding the trigger level, in order to establish an advisory (see Bohr and Zbytowski 2009 for details).

When issuing consumption advisories for the general public, MDCH uses the FDA's 2.0 ppm action level. When concentrations in more than 10% of the samples from a fish species exceed the trigger level, the MDCH advises the general population to eat no more than 1 meal per week. When PCB concentrations in more than 50% of the samples exceed the trigger level, the MDCH advises the general population against eating any of these fish from a given water body.

Since 1998, the MDCH has been issuing separate advisories for women of child-bearing age and children less than 15 years old.

² Although linear regression is the preferred approach, alternative methods are sometimes required either because the underlying assumptions of the statistical model are not met or the regression does not produce a statistically significant line.

Additional details about consumption advisories issued by MDCH and others states are provided in Table 2.

Table 2. Summary information for PCB consumption advisories for U.S. states. Some states are not listed, as there was not adequate information about their advisory process. Those states with an N/A do not issue advisories related to PCBs.

State	Non-cancer risk source	Exposure durations (yrs)	Cooking loss (%)	Sensitive subpop	Use TEQs for PCBs
Alaska	N/A				
Arizona	N/A				
Arkansas	FDA	70	50	Yes	Yes
California	EPA RfD	30	0	Yes	?
Colorado	N/A				
Connecticut	GL HPV	70	50	Yes	?
Delaware	EPA RfD	30	0	Yes	Yes
Florida	EPA RfD	--	0	Yes	Yes
Georgia	EPA RfD	30	0	Yes	?
Hawaii	N/A				
Idaho	N/A				
Illinois	GL HPV	70	50	Yes	No
Indiana	GL HPV	70	50	Yes	
Iowa	GL HPV & EPA RfD	70	0	Yes	No
Kansas	EPA RfD	70	0	No	Yes
Maine	EPA RfD	70	0	Yes	Yes
Maryland	EPA RfD	30	30	Yes	
Massachusetts	½ FDA action level	70	0	Yes	
Michigan	GL HPV and FDA	70	50	Yes	
New Hampshire	EPA RfD	70	0	Yes	
New Jersey	EPA RfD	70	0	Yes	
New Mexico	N/A		0	No	Yes
North Carolina	EPA RfD	70	50	Yes	
North Dakota	N/A				
Ohio	GL HPV	30	50	No	No
Oklahoma	N/A				
Oregon	EPA RfD	70	50	Yes	Yes
Pennsylvania	GL HPV	--	50	No	No
Rhode Island	FDA		0	Yes	
South Carolina	EPA RfD		50	Yes	No
South Dakota	EPA RfD	70	50		No
Tennessee	FDA	--	0	No	Yes
Virginia	EPA RfD	30	0	Yes	
Washington	EPA RfD	30	0	Yes	Yes
Wisconsin	GL HPV	70	50	No	No

Illinois

Fish consumption advisories in Illinois are issued by the Illinois Fish Contaminant Monitoring Program (IFCMP), which consists of staff from the Illinois Emergency Management Agency, the

Illinois Environmental Protection Agency, and the Departments of Agriculture, Natural Resources, and Public Health. IFCMP has been analyzing fish from Illinois water bodies since 1974.

As part of the IFCMP, fish samples are collected at river basin stations and analyzed for 14 different chemical contaminants. These samples are collected each year from approximately 50 stations through Illinois' rivers and streams. In order for Illinois to issue a consumption advisory, samples must be collected two years in a row to add, change, or remove a consumption advisory from the published list.

Indiana

The state of Indiana follows the Protocol's guidelines for major assumptions regarding PCB consumption and human health effects. Indiana issues advisories when contaminant levels in fish fillets exceed the HPV of 0.05 µg per kilogram of bodyweight per day over the course of a lifetime. To accommodate variations in body weight as they related to meal size, Indiana recommends that consumers subtract or add one ounce of fish for every 20 pounds of body weight in order to scale proportionally to the consumption rate advice (IDEM 2006). In addition, Indiana follows the 50% contaminant reduction assumption per the Protocol, but also uses a 35% reduction factor for samples that are analyzed as skin-off fillets (such as catfish).

The Indiana Interagency Fish Consumption Advisory Workgroup is responsible for deciding on consumption advisories. This workgroup consists of participants from the Indiana Department of Environmental Management, the Indiana State Department of Health (ISDH) and the Indiana Department of Natural Resources. This working group has been responsible for assessing consumption advisories in the state since the early 1970s. The Consumption Advisory booklet is issued annually through the Indiana State Department of Health.

Minnesota

Three different agencies oversee Minnesota's FCA process: the Minnesota Pollution Control Agency (MPCA), the Department of Natural Resources (MDNR), and the Department of Health (MDH). The MPCA is responsible for developing state water standards and monitoring water quality, while the MDNR enforces fishing regulations and assists with analyzing fish for contaminants. The MDH develops guidelines for safe fish consumption and publishes state-wide and site-specific advisories for both the general population and sensitive subpopulations (children and women of child-bearing age).

Minnesota also provides advice on consumption amounts. The state also relies on the Protocol's average body weight for issuing the advisory, the state's advisory suggests reducing for amount for those lighter than 70 kg (or 150 lbs) or increasing for those who weigh more.

New York

In New York State, FCAs are based on contaminant information gathered by the Department of Environmental Conservation (NYDEC). In most years, NYDEC collects fish from water bodies

around the state. The agencies sampling approach focuses on water bodies with known or suspected contamination, water bodies susceptible to mercury contamination, popular fishing waters and waters where trends in fish contamination are being monitored. After the contaminant data are analyzed, the New York Department of Health (NYDOH) reviews the contaminant results for fish and game to determine if an advisory should be issued or revised for a given water body or fish or game species. When reviewing the data, NYDOH compares testing data to federal marketplace standards (when available) for a contaminant and considers other factors such as potential human exposures and health risks; location, type and number of samples. For sensitive groups, NYDOH issues “do not eat” advisories for entire water bodies when fish are sampled with contaminant levels of concern³.

Ohio

The state of Ohio adopted the Protocol’s guidelines for issuing FCAs in 1994. Consistent with the Protocol’s approach, Ohio uses five consumption advisory categories and issues both statewide and water-body specific advisories. The advisory process is handled by the Ohio Environmental Protection Agency, Division of Surface Water (ODSW), and the Ohio Department of Health (ODH). The ODSW is responsible for calculating the fish consumption risk assessment while the ODH is responsible for releasing this information to the public.

Beginning in January 2003, all fish consumption advisory calculations for all jurisdictional waters use the Protocol’s HPV of 0.22 mg Total PCBs in raw fish for “eat no more than one meal per week upper limit.”

In 2007, Ohio modified its fish consumption advisory calculations. Prior to this date, Ohio relied on the FDA’s PCB action level of 2.0 ppm when calculating contaminant concentrations exceeded this level⁴. Ohio made this change given FDA’s position on the inappropriateness of action levels for recreational fish.

Ohio uses fillet composite samples of most sport fish and analyzes them as scaled, skin-on samples (although per the Protocol, catfish and bullhead composite fillets are analyzed with skin off). Fat is not trimmed and the percent lipid is analyzed and reported for all fish tissue samples. All fillet composites are based on samples from 2-5 fish of the same species, with the smallest fish in the composite being within 10% of the total length of the largest fish in the sample.

Pennsylvania

The state of Pennsylvania has been monitoring contaminant levels in fish since 1979. The process became formalized in the mid-1980s, when three separate state agencies signed an agreement to participate in the state advisory process. A fourth agency, the Department of

³ The impetus for this more conservative approach assumes that if sampled fish have a given level of body burden of PCBs, methylmercury, etc., that other fish in the water are likely also affected.

⁴ At this time, ODH made a second change to its FCA process for mercury, by adopting the April 2006 Mercury Addendum to the Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory, which added a “two meals per week” category to those originally proposed in the Protocol, but only for mercury.

Agriculture (PADOA), was later added to the program. Today, the Department of Environmental Protection (PADEP), the Department of Health (PADOH), the Pennsylvania Fish and Boat Commission (PFBC) and the PADOA participate in a two-tiered system for advisory decisions and issuance. A Fish Consumption Advisory Policy Workgroup oversees the program and makes management decisions, with activities coordinated through the Governors Policy Office. There is also a Fish Consumption Advisory Technical Workgroup, which coordinates the routine program activities through sampling site identification and provides recommendations to the policy workgroup for advisory issuance or removal.

For FCAs related to PCBs, Pennsylvania follows the Uniform Protocol's trigger levels and consumption rate categories. For its advisory process, Pennsylvania normally collects 10 scaled, skin-on fillets from a composite of 5 individuals of the target species (although channel catfish and bullhead samples are skinless fillets). Fish used in the composite samples are of the same approximate size, with the smallest being at least 75% of the length of the largest.

Once contaminant levels in fish have been assessed, DEP staff evaluates the data in advance of a meeting of the Interagency Fish Consumption Advisory Technical Work Group. The data are compared with trigger levels to assess the need for an advisory for particular water bodies or water segments. Once advisories are set, the official advisory is sent to the PFBC to be included in fishing regulations booklets for the next calendar year. Public press releases are then issued in late Fall to inform the public of these advisories.

In contrast to other states, Pennsylvania does not issue separate advisories for sensitive subpopulations. The state has, however, issued a general statewide advisory for recreationally caught sport fish – advising all of the population to eat no more than one half-pound meal per week of sport fish taken from the state's waterways.

Wisconsin

The state of Wisconsin uses a complex fish consumption advisory system for waters containing PCBs. The advisories vary by species and size and have four severity levels, ranging from "eat no more than one meal a week" to "do not eat." In general, Wisconsin has several statewide advisories for inland lakes.

Non-Great Lakes States

California

The state of California has recently changed its method for evaluating human health risks associated with consumption of contaminated fish, and has identified two different goals with respect to fish consumption advice. The first are fish contaminant goals (FCGs), which are estimates of contaminant levels in fish that pose no significant health risk to individuals consuming sport fish at a standard consumption rate of eight ounces per week (32 g/day), prior to cooking, over a lifetime. These FCGs were developed by the Office of Environmental Health Hazard Assessment (OEHHA) to assist other agencies, which want to use fish tissue contamination as one end goal in developing pollution mitigation or elimination. OEHHA

developed these goals in order to prevent consumers from being exposed to more than the daily RfD for non-carcinogens or to a risk level greater than 1×10^{-6} for carcinogens (i.e., not more than one additional cancer case in a population of 1,000,000 people consuming fish at the given consumption rate over a lifetime).

The OEHHA has also developed advisory tissue levels (ATLs), which are exposure levels that are meant to pose no significant individual health risks but balanced with an explicit recognition that fish consumption confers health benefits. OEHHA has calculated ATLs using the same general formulas as those used to calculate FCGs, with some adjustments to incorporate the benefits of fish consumption. This is accomplished by decreasing (or offsetting) the mortality and/or cancer risk(s) associated with eating contaminated fish. For ATLs, OEHHA provides consumption advice that prevents consumers from being exposed to more than the average daily reference dose for non-carcinogens or to a risk level greater than 1×10^{-4} for carcinogens (not more than one additional cancer case in a population of 10,000 people consuming fish at the given consumption rate over a lifetime).

The non-cancer and cancer critical values used to evaluate PCBs in fish for the development of consumption guidelines will be 2×10^{-5} mg/kg-day and 2.0 (mg/kg-day)⁻¹, respectively.

In developing these guidelines, OEHHA makes many standard assumptions regarding fish consumption including an average adult weight of 70 kg and a fish serving size of 8 oz per week (32 g/day)⁵. The OEHHA also assumed an exposure duration averaging time of 30 years over a 70 year lifespan (based on the 95th percentile of U.S. residence time). Also, for the FCGs, contaminant loss through cooking is assumed to be 30% (based on Anderson et al. 1993; Zabik et al. 1996; Santerre 2000 and others). Finally, OEHHA has developed these advisories for fish consumed with skin-off; however, site-specific data from sites including the San Francisco Bay indicate that a considerable number of fishers cook and consume their fish with the skin on (SFEI 2000⁶). OEHHA has indicated that this may affect how they issue future advisories, as the agency may consider using skin-on fillet data in issuing their advisories.

Washington

In Washington State, the Department of Health (WADOH) is responsible for overseeing fish consumption advisories. In evaluating risks, WADOH assesses fish consumption rates for anglers, tribal members, additional high-consuming populations, and other citizens. To do this, the agency tries to use both the mean and 90th (or 95th) percentile population-specific consumption rates. In addition, for those sites in which fish have body burdens of more than one chemical, WADOH will calculate meal limits based on exposure to more than one chemical to

⁵ In the California OEHHA report, the more recent average US weight for females is 75 kg and for males is 87 kg (see Ogden et al. 2004), which is higher than when the original 70 kg average weight was introduced. In terms of serving sizes, the Institute of Medicine and American Heart Association considers one serving of fish to be 3 oz and that National Health and Nutrition Examination Study indicate that those who eat fish consume approximately 3 oz/day. Although CA considered changing this, responses from focus groups interviewed by the CA Dept Public Health indicate that sport fishers typically consume larger portion size than the general public.

⁶ In a study of San Francisco Bay anglers, it was found that up to 30% of fishers (predominately African Americans and Asians) were consuming their fish with the skin on.

account for additive toxicological effects (Selecky et al. 2006). For non-cancer risks, WADOH calculates the estimated dose for each contaminant and compares this to USEPA's oral reference dose. A hazard quotient approach⁷ is then used to determine when consumption of a specified population may be exceeding levels protective of human health.

The fish consumption advisory process in the state of Washington has recently updated their FCA process to more specifically account for the consumption habits of sustenance consumers, primarily tribal consumers. Thus the WA Department of Ecology now considers fish consumption rates for Native American tribal populations and other high exposure groups when "developing site-specific cleanup levels under the MTCA and the Sediment Management Standards (SMS) rules."

Of potential interest: USEPA exposure guidance materials include exposure parameters based on tribal exposure scenarios. The USEPA Exposure Factor Handbook recommends, for tribal exposure scenarios, an average ingestion rate of 70 g/day and a 95th percentile ingestion rate of 170 g/day. For children, the USEPA Child-Specific Exposure Factors Handbook identifies weighted average (21 g/day), 90th percentile (60 g/day) and 95th percentile (78 g/day) values, respectively, for the tribal exposure scenario.

Other Regional FCA Management Efforts

Upper Mississippi River management

States that border the upper Mississippi River (UMR) basin are also working on ways to standardize resource management in the river, including better coordination on FCAs. Similar to the Great Lakes region prior to the adoption of the Protocol, the UMR consists of different states that monitor different fish species using a range of different techniques to assess human health risks. This has resulted in interstate variations in FCAs for similar segments of the river and has led to public confusion regarding guidelines for safe fish consumption along the river.

Interstate Workgroup for Atlantic Coastal Advisories

In 2000, a working group was formed to evaluate variations in state protocols for issuing PCB FCAs for recreationally caught striped bass and bluefish (see Eastern Coastal Advisory Workgroup 2008). This effort brought together 13 states with striped bass and bluefish fisheries and evaluated the potential health risks associated with PCB in these two species and assessed the potential for a coordinated health advisory process. To this end, four subgroups assessed the state of the science in the following areas: 1) data on PCB concentrations in striped bass and bluefish along the Atlantic coast; 2) biology and ecology of Atlantic coast striped bass and bluefish; 3) recent toxicological information on the health effects of PCBs; and 4) consumption advisory methods and protocols for bluefish and striped bass for all of the Atlantic coastal states.

⁷ The equation for this relationship is: Hazard quotient = Estimated dose (mg/kg - day)/RfD (mg/kg - day)

Canadian Approach to FCAs – Province of Ontario⁸

The province of Ontario issues FCAs biennially⁹. The Ministry of Natural Resources and the Ministry of the Environment collect the fish, which are analyzed for a range of contaminants by a Ministry of the Environment Lab. The results from this contaminant analysis are then used to develop the advisory tables for the FCA guide. The advisories are based on health protection guidelines that have been developed by the Food Directorate of Health Canada. Since 2005, FCAs have been provided separately for the general population and for sensitive population of women of child-bearing age and children under 15.

The consumption advice is based on the assumptions of an average meal size of 227 grams (8 oz) and an average adult weight of 70 kg (154 lbs). Contaminant samples are taken from skinless and boneless dorsal fillets. When possible, the FCAs are based on 10 or more fish with a range of lengths and weights from each species of interest.

The sampling schedule for sites is as follows: areas with elevated contaminant levels or where contaminant levels have changed significantly are sampled ever one to three years; areas that show no signs of substantial changes in contaminant levels, but are frequented by anglers, are retested every 5 years; and all other areas, which are usually remote locations, are retested approximately every 10-15 years.

For PCBs, Food Directorate of Health Canada has 2 guidelines, one based on total PCBs present in a sample and the other based on a select few PCBs with toxicological properties similar to dioxins. The ministry derives two sets of consumption restriction values from Health Canada's two guidelines for PCBs and adopts the lower value. Thus, consumption restrictions for total PCBs begin at 0.105 ppm with complete restriction advised for levels above 0.211 ppm for sensitive population and 0.844 ppm for the general population.

There are 12 forms of PCBs that are "dioxin-like" PCBs and possess toxicological properties similar to toxic forms of dioxins. The Ontario Ministry of the Environment monitors the 12 dioxin-like PCBs in sport fish. These are then multiplied by an equivalency factor to convert it to a number referred to as a toxic equivalent, which represents its toxicity relative to the most toxic form, 2,3,7,8-TCDD. Consumption restrictions for sport fish begin at levels of 2.7 ppt, with a total restriction advised for levels above 5.4 and 21.6 ppt for toxicity equivalents TCDD for the sensitive and general population, respectively.

In 2007-2008 guide, there was a change in toxic equivalency factors for dioxins, based on recommendations of an expert panel of the WHO. Toxicity of dioxin-like-compounds were found to be less than originally estimated for some of the compounds, with the results that overall dioxin toxicity in fish is approximately 20% less than previously estimated.

⁸ Additional information on the Ontario Province approach for setting FCAs is further covered in Appendix D: Environmental Justice and Fish Consumption Advisories on the Detroit River Area of Concern (Kalkirtz et al. 2008).

⁹ In years in which the advisory is not normally published, major changes in consumption advice are made public by the Ministry of the Environment through the Public Information Centre (and on the Ministry website, and via media notices).

Summary and Conclusions

As is demonstrated in the above section, states use a variety of methods in establishing FCAs within their jurisdictional waters. In most cases, the overall methodology for PCBs has become more uniform, since the USEPA issued specific guidelines in 2000. Some of the most important areas of inter-state variability are how states address sensitive subpopulations and the tissue trigger level used in considering human health endpoints. Of equal importance to the FCA process in Michigan, are the differences in how the Canadian province of Ontario issues these advisories. These differences, in particular, may have tangible effects for human health and may affect the perception of the safety of fish consumption on the different sides of the international border.

Summary of the Great Lakes States

Prior the USEPA guidelines, the Great Lakes states had already completed their own initiative to streamline, standardize, and coordinate states approaches to FCAs for PCBs. This document, the Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory, was a hallmark effort at coordinating regional efforts related to contaminated fish. Importantly, the Protocol adopted a Health Protective Value for PCBs of 0.05 µg/kg/day. This value is now used in some capacity by all of the Great Lakes' states in setting their advisories, and has even been adopted by other states.

While most of the Great Lakes' states closely follow the Protocol's advice for advisories, there are some important variations. These variations are highlighted primarily because they can provide important insight into current FCA protocols. One of the most important variances concerns how advisories address sensitive subpopulations. The majority of Great Lakes' states have modified their consumption advice for women of childbearing age and children under the age of 15. For these groups, most of the states issue meal advice based on a more conservative effect level (in this case, the HPV). Another approach is that adopted by the state of New York, which advises that "infants, children under the age of 15 and women of childbearing age" not eat any fish from specific waterbodies listed in the advisory. Finally, the state of Pennsylvania does not target consumption advice towards sensitive subgroups, but instead have issued a statewide general meal advice for all populations (do not eat more than one meal per week of recreationally caught fish from the state's waterways).

State-to-State Comparisons

Since the Protocol was finished in 1993, several other states have looked at similar coordination efforts for FCAs. One important and recent example comes from the coastal Atlantic states. This working group (the Eastern Coastal Advisory Workgroup) evaluated several issues related to PCB-driven fish consumption advisories. Two of these have potentially important implications for Michigan's FCA process. The first is that the workgroup found that most Atlantic states (although not all) felt that for striped bass and bluefish "new evidence regarding neurodevelopmental effects in children are compelling enough to recommend no consumption for sensitive populations."¹⁰ This recommendation came from a sub-workgroup's assessment of

¹⁰ The workgroup based their conclusions on the Oswego study (Stewart et al. 2000), in which the concentrations

more recent longitudinal prospective epidemiological studies that were published in the past 20 years (since 1988).

Of note, this workgroup reached the following conclusion regarding the state of science of PCB toxicity:

The current toxicological bases for developing advisories based on PCBs consist of FDA's tolerance for commercial fish, USEPA's Reference Dose, ATSDR's Minimum Risk Level, or the Great Lakes Health Protection Value. All these values are outdated and do not take into account the effects observed in the several longitudinal prospective epidemiological studies published in the last 20 years¹¹.

Another finding of note concerns dioxin-like PCBs. The workgroup found that two states (Delaware and Maine) now explicitly recognize that some PCBs congeners act as dioxin-like compounds (referred to as coplanar PCBs or dioxin-like PCBs). In this method, dioxin-like PCBs are subtracted from total PCBs and, using a TEF scheme based on the World Health Organization's 2005 guidelines, combined with dioxin measurements to develop risk based decision criteria.

In addition to these trends, other states are investigating additional ways to improve their FCA process. One general trend is that states are looking more closely at their high risk subgroups and tailoring risk messages to work to decrease exposure in these consumers. The state of Alaska, for example, is using human biomonitoring of Inuit groups in order to optimize fish consumption advice (Arnold et al. 2005). By assessing existing body burdens in these high risk groups, risk assessors can better gauge the potential health risks versus benefits of consuming certain fish species.

found to cause deleterious effects in children are close to the body burdens of PCBs in the U.S. population, indicating there is little remaining margin of safety for women who may become pregnant.

¹¹ Eastern Coastal Working Group, 2008, page 168.

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