Anglers' Appraisals of the Risks of Eating Sport-Caught Fish from Industrial Areas: Lessons from Chicago's Calumet Region

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Abstract

We conducted a participant observation study of recreational fishing in the industrialized Calumet region of northwest Indiana and southeast Chicago to gage the extent of fishing for consumption and to learn about perceptions of the risks of eating contaminated fish. Of the 97 study participants who provided definitive information about their fish consumption habits, 70% reported ever eating fish from Calumet waters. When assessing pollution, anglers relied mainly on their senses, personal experiences, judgment, and/or information from friends, family, and other anglers rather than on written fishing guides, local officials, or the media. When considering consumption risks, they focused on four primary factors: the general environment, water quality, fish characteristics, and observable human health. Different anglers used different risk assessment cues. There were also differences in risk perceptions and fish consumption patterns across racial-ethnic lines. Finally, we consider the challenges of disseminating risk information to diverse urban populations.

Keywords: *urban angling/fishing, fish consumption, risk perception, ethnography, rustbelt landscapes*

Introduction

Consumption of sport-caught fish is an especially pressing social, economic, and public health issue in places where water and sediment quality are low or variable. The heavily urbanized and industrialized Calumet region of northwest Indiana and southeast Chicago is such a place. Once the center of steel-making in the Midwestern U.S. and one of the largest areas of heavy industry in the world, the Calumet region today is a patchwork of active industry; abandoned brownfields; closed landfills; water bodies; remnant wetlands, woodlands and prairie; transportation infrastructure; business districts, and residential neighborhoods. The region also has numerous public parks, forest preserves, and other open spaces both large and small that offer opportunities for recreation and experiences of nature. Water and sediment quality vary across the region's lakes, rivers, and ponds — and across different parts of the same water body — and people fish in many of them.

Our objectives in this ethnographic study were to uncover the fishing-related meanings and experiences of people who fish in the Calumet region: why they are fishing, what they do with the fish they catch, how they perceive and assess the risks of eating locally-caught fish, and how perceptions of

risk influence their behaviors. These questions were initially raised by land managers and other decision makers in the Calumet Initiative, a coalition of not-for-profit, government, education, and research partners working on environmental, economic and related social issues in the Calumet region. This article focuses on Calumet anglers' pollution assessment reasoning and their related perceptions of the risks of eating fish from Calumet waters. These findings supplement the existing — and largely quantitative — literature on anglers' perceptions of fish consumption risks and will help natural resource managers, policy makers, planners, and public health officials as they devise strategies to manage fishing sites and effectively communicate fish consumption risk information to diverse populations of urban anglers.

Urban Fishing and Risk

Managing specific behaviors to minimize personal risk is not easy for people to do. The wide variety of available information sources — including science and medicine, anecdotes, and popular culture — offer a range of often contradictory risk messages. These messages may also be encountered separated from their original source or context, making them even more difficult to understand and interpret. The result is a potentially confusing array of abstract risk assessment factors, suggestions, and cautions that individuals must sort through, consider, and choose from as they make decisions about their behaviors and their health.

Weinstein (1999) breaks down personal risk assessment into four basic elements: identification of possible outcomes, evaluation of the severity of the outcomes, assessment of the probability of harm, and assessment of an individual's relative probability of harm. There is subjectivity in the judgments and decisions made at each stage of the risk assessment process and there are seldom "right" or "wrong" conclusions except those that can be identified in hindsight. Weinstein (1999) also discusses "optimistic bias" whereby people at risk (in that study, it was smokers) minimize their perception of risk by taking an optimistic — often much too optimistic — view of their chances of harm from the risky behavior.

Assessing the risks of fish consumption means sorting through (or choosing not to sort through) the conflicting messages about the possible risks and benefits. The potential benefits of a fish-rich diet include reduced heart disease, lowered cholesterol, improved vision, and decreased risk of developing diseases and disorders like asthma, dementia, and various forms of cancer (Sidhu 2003; Verbeke et al. 2005). The potential risks of fish consumption are mainly linked to the ingestion of toxins (like mercury, polychlorinated biphenyls (PCBs) and pesticide residues) that may be present in fish tissues and may build up to harmful levels over time in humans or in developing fetuses (Knuth et al. 2003; Imm et al. 2005). A recent meta-analysis of the benefits and risks of eating fish found that the benefits generally outweigh the risks (Mozaffarian and Rimm 2006).

The scientific interpretation and general public dissemination of fish consumption risk information can also be inconsistent. Belton et al. (1986) found that two different risk calculation methods suggest considerably different conclusions about the degree of the risk of developing cancer from eating fish contaminated with PCBs. Information about the risks and benefits of fish consumption is also not necessarily evenly distributed throughout the population. In a Burger (2005) survey of New Jersey supermarket shoppers who ate either store-bought or sport-caught fish, 77% had heard warnings about fish consumption while 94% had heard information about the health benefits of eating fish; these percentages may vary widely with geography and across different segments of the population. Knuth et al. (2003) also found that anglers are more likely to weigh the relative risks of eating fish against the risks of eating *other* foods rather than weighing the risks and benefits of eating fish *per se*. As with all diet-related decisions, social and personal histories also influence consumption choices.

Research focusing on risk perception has found that anglers rely on many sources for information about fishing and fish consumption risks. Pflugh et al. (1999) reported that urban anglers in New Jersey looked to newspapers for general health risk information and for community news but turned to other anglers and bait shop employees for information about fishing. Burger et al. (1998) found that the majority of anglers and crabbers in their study who had heard warnings about seafood consumption cited newspapers and television as the main sources of information. Burger et al. (1999) note that an angler's ethnicity may influence which sources of consumption information they are most likely to turn to and trust; they found, for instance, that White anglers were more likely than Blacks or Latinos to get consumption advisory information from written sources like newspapers or on-site warning signs. Beehler et al. (2001) found that Black anglers sought fishing advice — though not necessarily risk information — mainly from other anglers, especially those who were older and more experienced. In another study, Beehler et al. (2003) found that state issued advisories were ineffective in reaching Latino anglers due to complicated wording and poor distribution.

Studies by Anderson et al. (2004), Belton et al. (1986), Burger (1998), Burger et al. (1998), Imm et al. (2005), and Tilden et al. (1997) have also reported that many anglers and other sport-fish consumers do not read, understand, retain, or rely on official fish consumption advisories or recommended consumption guidelines. According to Chess et al. (2005), the bland, official-sounding language used in advisories can be

boring, off-putting, and difficult to understand. Further, the lack of culturally-relevant outreach materials for minority populations in particular may compound environmental injustices that already disproportionately affect these populations. Burger et al. (1999) and Bienenfeld et al. (2003) recommend that when targeting low-income people who rely on fish they catch to supplement their diet, outreach about mitigating the risks of eating fish should focus on fish preparation techniques rather than on meal size and consumption frequency. Jardine (2003) strongly recommends involving lay people in the process of developing fish consumption advisories in order to get their advice about what information to include and how to present it.

Finally, several previous studies have also considered how anglers process advisory information and assess fish consumption risks in the real world. Beehler et al. (2001) interviewed African-American anglers who generally believed that fillets from sport-caught fish that appeared healthy were safe to eat regardless of species, size, waters of origin, and cooking technique. Burger et al. (1999) report that New Jersey anglers tended to generalize advisory information they had heard, deciding that the information did not necessarily apply to them or to their favorite fishing spot(s). Studies by May and Burger (1996) and Burger et al. (1998) found that anglers and crabbers tended to discount consumption advisories because they believed that the "fresh" fish and crabs they caught were, by definition, safe to eat. Belton et al. (1986) found that people catching fish and seafood for consumption in New Jersey explained away the risks "[t]hrough a variety of creative theories" like, for example, stating that the fish grew up in different, less polluted waters than the waters they were caught in.

It should be noted that many of the studies mentioned above stem from research on recreational fishing and crabbing *in the ocean*. One important difference between saltwater and freshwater fishing is that U.S. states require most adult anglers to have a special, annually-renewed license for freshwater fishing while no license is required for recreational ocean fishing.[2] The licensure process provides an intervention or outreach opportunity for states to communicate information, advice, and warnings to recreational freshwater anglers. But, as discussed above, advisories written in a dry, bureaucratic style and embedded in a fishing booklet cannot be counted on as an effective outreach mechanism.

Calumet Background and Indiana-Illinois Fish Consumption Advisories

The industrial legacy and natural features around the southwest shore of Lake Michigan are the backbone of the bi-state region known as Calumet. Rivers and lakes cross the Illinois-Indiana state line and both states have important wetlands, dune and swale remnants, and woodland habitat supporting species of conservation interest. Calumet also faces challenges of ecological degradation due to dumping, filling, dredging and other industrial legacies. Although bi-state, and despite the challenges this can create, the Calumet region is a distinct place, one for which many local residents have a strong attachment. Research, policy and planning for the Calumet region require considering issues across the state line.

On both sides of the Illinois-Indiana state line, the Calumet region has a rich history of diversity. Starting in the late 1800s waves of immigrants from Europe, the southern U.S., and Mexico arrived in search of industrial work. Today the region is home to people from many countries of origin as well as descendants of immigrants from past generations. There is a racial/ethnic mix of Blacks, Whites, and Latinos, although individual neighborhoods tend to be largely comprised of a single racial or ethnic group (Chicago Department of Planning and Development 2006; Chicago Fact Book Consortium 1995).

Between 1970 and 1990, the steel industry declined sharply in the U.S. and the Calumet region lost a massive number of jobs. Chicago's Calumet neighborhoods alone lost 40% of local jobs as mill closings had a ripple effect across the regional economy (Jones 1998). While not all Calumet communities are still in decline, census data indicate an ongoing struggle as many communities continue to lose population and the percentage of residents living in poverty continues to increase (Chicago Department of Planning and Development 2006; Chicago Fact Book Consortium 1995; Jones 1998).

Like most states, Illinois and Indiana publish booklets every year that summarize fishing regulations and provide fishing advice and information. These booklets (which are generally available where fishing licenses are sold) — along with the state public health, natural resource, and environmental management departments' websites — are also the state governments' main outreach tool for communicating fish consumption risk information to anglers.

During the study period, the "Illinois Fishing Information" booklet provided site-specific information about mercury, PCB, and chlordane advisories as well as an overview of the statewide mercury advisory. In the study area, PCB advisories pertained to carp, channel catfish, largemouth bass, black bass, yellow bass, and sunfish. There were no special water body-specific chlordane or mercury advisories for the study area (Illinois Department of Natural Resources 2002).

That same year (2002), Indiana's fishing guidebook provided specific amenity information by location (about, for example, the availability of boat ramps), and gave a general overview of consumption advisories and recommended

cleaning techniques. A shaded sidebar on the advisory page advised:

> *Don't stop eating sport-caught fish. It is a good source of protein and low saturated fat. You can maximize the benefits and minimize the risk of eating fish by making informed choices about:*
>
> * *What types of fish to eat*
> * *Where to fish*
> * *How to prepare the fish*
> * *How often and how much to eat* (Indiana Department of Natural Resources 2002).

Readers were then referred to the Indiana State Department of Health website for more detailed information to guide consumption choices. The website recommended limiting consumption of a long list of fish species from study area waters because of possible PCB contamination. This included a very strict "Do Not Eat" advisory for all carp and channel catfish plus large-sized fish of nine other species from Lake Michigan tributary waters and all fish from two study area water bodies (the Grand Calumet River and Indiana Harbor Canal). Both states' booklets also mentioned that women and children were the main targets of consumption warnings. The Illinois booklet stated that the consumption guidelines "may be over protective for women beyond child bearing age and adult men" (42).

People in search of water body-specific, fish species-specific, or even regionally-specific fish consumption risk information for Calumet were thus given mixed messages if they consulted the official, state-issued guidebooks. As discussed above, the complexity of interpreting and applying fish consumption risk information also complicates an individual's consumption risk interpretation. For public health officials, natural resource managers, environmental activists, and others, then, there is a real concern that local people may be ingesting contaminants in Calumet-caught fish at high enough levels to cause long-term or developmental health problems. In light of the economic and social diversity in the region, and the mix of anglers, sites, and messages, there is a real need to better understand Calumet fish consumption practices and the ways that anglers and others think about the risks of eating locally-caught fish.

Scope and Methods

Much of the existing literature on angling and perception of risk uses quantitative methods like systematic surveying of anglers along a waterway. In this study we used ethnographic methods in order to understand the perspectives of Calumet anglers. Our methodology provides rich qualitative data that compliments the information available from survey and other quantitative techniques.

Ethnographic methods are ideally suited to answer questions about motivations for complex behavior that happens within a larger context of social interactions and cultural processes. Our methods included participant observation and unstructured interviews. Participant observation provides researchers access to: 1) details forgotten or deliberately omitted from verbal descriptions; 2) actions so habitual that research participants are not aware of them; and 3) information about what happens when activities do not go "as usual" (Burroway 1991). Participant observation also helps researchers to better understand the experiences of participants, including their frustrations, challenges, and triumphs. Unstructured interviews allow participants to respond to questions at any length and take their responses in whatever direction they choose. In the process, participants identify categories of understanding that *they* use, rather than being confined to researchers' categories. The informal, nonhierarchical approaches of participant observation and unstructured interviewing builds trust between researchers and study participants, which can help elicit more information from participants and increase the likelihood that they will reveal sensitive information that one is generally less likely to share with a stranger such as incidents of trespassing or reliance on fishing for subsistence (Bernard 1994). This level of detail from participant observation and unstructured interviews provides a rich understanding of the issues important to a group, but it does not support statistical generalization.

Participant observation and interviews took place at 31 fishing sites in the Calumet Region. Sites were selected for extended or repeated visits based on the presence of anglers or evidence of recent fishing activity (like recreational fishing tackle debris). Research locations were also selected to: 1) draw data from both Illinois and Indiana; 2) include anglers from each of the major racial/ethnic groups observed fishing in the region (Blacks, Latinos, and Whites); and 3) include both officially-sanctioned fishing sites at places like parks and public boat launches and unsanctioned semi-public and private locations where public access was restricted. Some of the waters were regularly stocked with hatchery-raised fish but most were not. We deliberately avoided Lake Michigan and focused on other Calumet waters where resource managers generally know less about fishing activity. We also did not conduct interviews or encounter anglers along the two waterways with advisories that ban consumption due to contamination, but some research participants did tell us about occasionally seeing anglers at those sites.

The research data were collected between May and November 2002 and between March and July 2003. Research was conducted on weekdays and weekends at a variety of

times, but especially during early morning and evening hours, the most popular times for fishing. Fieldwork days often lasted from dawn to dusk, and so corroborated the basic understanding that fishing, like birding, is largely a morning and evening activity. Most locations were visited multiple times including during peak fishing periods.

Fieldwork was conducted primarily by an ethnographer from the Field Museum's Center for Cultural Understanding and Change (CCUC); other CCUC ethnographers working on related Calumet research provided additional data. Upon arriving at a fishing site, the primary ethnographer made an informal count of anglers and people accompanying them and then used purposeful sampling to select interviewees in roughly representative proportions in terms of age, ethnicity, and gender. Equipped with basic fishing gear, the ethnographer initiated interviews while fishing alongside anglers. The ethnographer's participation in the activity of fishing alters the power dynamic between researcher and study participants — both preserving the informality of the research activity and allowing the research participants to become teachers to the ethnographer as they share their expertise in how to fish a particular spot.

Very early in each initial interview, the ethnographer stated that he was from the Field Museum and was doing research on fishing in the area, asking if the angler would be willing to talk with him about fishing. With their consent, he then asked questions drawn from a general interview guide, touching on each of three areas of interest: 1) fish consumption patterns; 2) knowledge and perception of consumption risks; and 3) strategies for mitigating consumption risks. Interviewees largely directed the conversations, following their own chain of ideas and introducing themes or topics that related to fish consumption risks in their own minds.

Follow-up interviews were held with seven key informants, experienced anglers who provided extensive information in their initial interviews and routinely fished at the same locations. These interviews allowed the ethnographer to test emerging ideas from the research, fill in gaps in original interviews, and add depth to the overall picture about anglers' assessments of risk in Calumet. Supplemental interviews sought information from others in the community including bait shop owners, environmental educators, municipal employees, and guests at a fish fry.

The ethnographer took handwritten notes before and during interviews and made supplemental audio recordings immediately following long interviews and extended periods of participation. Both written and audio-recorded data were converted to typed field notes within 24 hours, as is standard practice in ethnographic field work (Fontana and Frey 1994; Lofland and Lofland 1995).

Two databases were created. The first included all field notes, covering interactions with anglers and other participants, observational data, site descriptions, weather issues and other details. This data set was created in Atlas.ti. The ethnographer consulted with other CCUC ethnographers to identify relevant categories for analysis and elaboration in the preliminary analysis. After the preliminary analysis, the first three authors worked through the data and findings together, until each was satisfied that the findings were soundly grounded in the data. In this way, two of the authors served as second readers of the full dataset and re-analyzed the data searching for negative evidence (Miles and Huberman 1994). The primary categories were easily agreed upon; where there was disagreement we discussed the issues until we reached consensus about the topic or the example in question.

The second database included only data from anglers and their companions who participated in the study (that is, interviews with non-anglers like bait shop owners, site descriptions, and other supplemental data were not in this database). This database was created in NVivo7 by two of the authors to facilitate data display of angler responses. Intercoder checks were conducted to achieve 90% or greater concurrence on the data coding (Miles and Huberman 1994; Westphal 2000).

Results

In this section we start with a description of the research participants: the number interviewed, who ate their catch, and meaningful differences among the participants. Following this, we discuss the primary categories of findings: how participants defined and detected "pollution," including site selection and assessing the environment, assessing the water, assessing the fish, and assessing human health; angler's attitudes about fish consumption risks; participants' sources of information about consumption risk; mitigation strategies and communicating with anglers about risk; and ethnic differences in Calumet's angling community. In each section, we provide a figure with quotes and excerpts from the field data to support the results. We also indicate the number of study participants that offered insights in each major category, but we do not provide numbers for the smaller-grained subcategories. The reader is cautioned not to over interpret the numbers. They indicate the number of research participants whose data we used in our analysis. The numbers do not indicate the number of Calumet anglers we spoke with that hold a particular opinion, and cannot be generalized to Calumet or industrial-area anglers.

The Participants

Roughly 170 people were interviewed in the course of the ethnographic research, including 127 anglers and their companions (Figure 1). The rest of the participants were af-

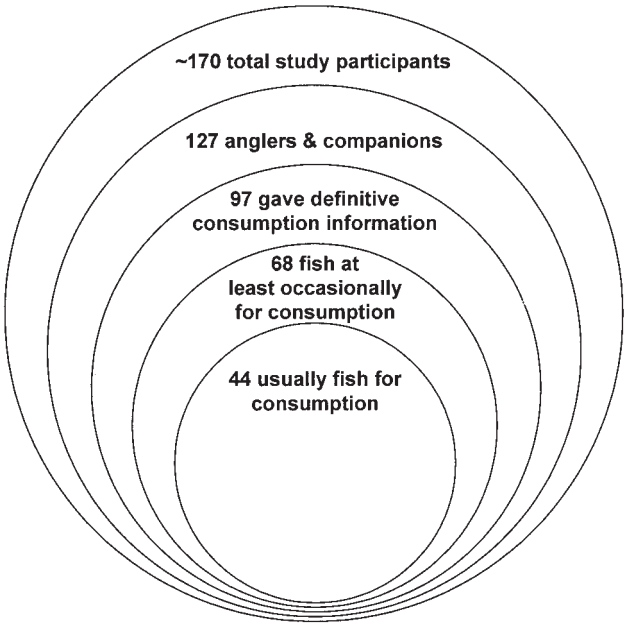

Figure 1. Number of interview participants and their fish consumption habits

filiated with Calumet fishing and/or fishing sites including bait shop owners, site managers, municipal employees, educators, fish-fry attendees, meeting attendees (e.g., Friends of ABC Lake), and other site users. Of the 127 anglers and associates, 97 gave definitive responses about whether or not they fish for consumption in Calumet. Of these 97 anglers, 68 (70.1%) indicated that they fish *at least occasionally* for consumption and 44 (45.4%) said that they *usually* do. There was also a strong tendency — among both fish eaters and non-eaters — to give away unwanted caught fish (either surplus fish or species they did not want) to others on site. Observational data corroborates the interview findings. There is evidence that a significant number of people are eating fish caught in Calumet waters, although the precise extent of this cannot be determined through our methods.

There were notable differences in fish consumption patterns among the three main ethnic groups represented in the study (Table 1). About 93% of Blacks, 78% of Latinos, and 57% of Whites reported at least *occasionally* fishing for consumption in Calumet; 68% of Blacks, 50% of Latinos, but only 20% of Whites said that they *usually* fished for consumption. It should be noted that other Calumet research (Jones 1998) found a tendency for White residents to underreport unemployment and financial difficulty. Some of the responses we got suggest there may be a similar pattern of underreporting consumption, perhaps indicating a reluctance to report relying on self-caught fish as a source of food. At the same time, we also have evidence of White anglers aligning themselves with a conservation norm of catch and release and minimizing the extent to which they kept their catch. Therefore, the percentage of White anglers who reported usually fishing for consumption *might* be low.

People who generally did *not* eat locally sport-caught fish offered one or more explanations for this decision: they simply did not eat fish at all; they practiced catch and release for conservation or environmental reasons; or they did not want the trouble of cleaning and preparing their own fish or did not know how. Other anglers told us they *did* eat fish — but not fish from local waters because of concerns about pollution.

Table 1. Reported fish consumption among anglers and their companions by race/ethnicity

Anglers and companions by race/ethnicity	% who had *ever* eaten Calumet fish	% who fished specifically *for consumption*
Blacks	93	68
Latinos	78	50
Whites	57	20

Participant #15 said that people ask him to bring them back fish to cook and giving them away is not a problem for him – catching food is not why he is out here. At the same time, he would eat anything he catches today "if it is big enough to keep." He does not know of any kind of fish he would not eat, or any fishing spots he would deliberately avoid. He also is not aware of there being any pollution problems with any particular fishing locations.

I asked if they would have eaten anything that they might have caught. [Participant #41] answered in a lower, grave tone that no, they wouldn't. I asked why. She asked rhetorically, "Can't you see all the factories around here? There is too much pollution." She added that they were just out for the enjoyment.

Ethnographer: Do you eat the fish you catch?

#19: Oh yeah. I'm a catch and eat man. I don't do any of that catch and release stuff. I like to catch fish, but I love to eat them. I was going to have a fish fry for my wife's birthday at [the end of this month]. But my son didn't notice the freezer got unplugged. I got home and all that fish was spoiled. Now I'll have to buy fish for the fry. [Makes an exasperated sound.]

I was emphasizing the consumption aspect of the study and Participant #68 quickly came back with "I don't eat fish." I was taken completely by surprise. I said, "Really, and you are coming to a pay lake, why's that?" He said, "Just to be out here," and connected it to "the pleasure."

Figure 2. Calumet anglers on eating their catch (based on comments from 97 participants)

Consumption-oriented anglers sometimes said or implied that *not* eating sport-caught fish would have been a waste of effort and of perfectly good, high quality, healthy food that would be costly to buy in a restaurant or store. They talked about sharing fish with friends and family as one of the social aspects of fishing, as part of being a good neighbor, and/or as part of being a good provider. For example, 14 participants had held summer fish fries with family and friends; these important social events were made even better — or sometimes made possible or more affordable — by successful fishing in local waters.

Defining and Detecting "Pollution"

We found that study participants, when asked, were able to articulate reasoned assessments of the health risks of eating local fish based mainly on beliefs and perceptions about whether or not the sites were polluted. Most of the people who talked about pollution indicated that they expected to be able to detect and identify pollutants in the water or fish with their senses. They pointed to a number of observable factors about the surrounding environment, the water, or the fish in support of their beliefs that the water was polluted or that it was not, that the fish were contaminated or they were not, and that it was safe to eat the fish or not. Anglers in our study would also point to observable impacts on human health as a part of their decision criteria. These categories frame our discussion of participants' assessments of pollution and its potential impacts.

[Participants #77 and #78] both said they would not eat fish from here, they wouldn't trust it to be safe because of possible pollution. They didn't read or hear that this water is polluted but said they could infer possible risk just by looking around, and they pointed out the trash by the shore, stuff that was thrown in the water, and where we were (i.e. in the city). One of them explained that it is like the episode of "The Simpsons" when they catch the three-eyed catfish from the nuclear plant cooling lake: you just know by its being by the nuclear plant, and that they caught a three eyed fish, that it was not a good idea to eat any of the fish. It is the same here.

In the exchange that followed I explained [to Participant #12] that I had heard that the stream could support fish again because they were oxygenating it, but I had also heard that undisinfected effluent was still going into the river, so I was not sure it was cleaner. He said it looked dirty like sand, and that definitely everything including the bull frogs had died, but now the fish and everything were back, "so it had to be cleaner."

At some point Participant #79 said that he used to work at U.S. Steel. They would use high-powered hoses to clean off the floors and all that oil and stuff would go down the sewer and "where do you think that all goes?" (i.e. into Lake Michigan and the Grand Calumet River). He was citing this as a reason not to eat fish from those water bodies and he made it clear that he does not fish there.

Figure 3. Calumet anglers on assessing the environment and ecology (based on comments from 36 participants)

Site Selection and Assessing the Environment and Ecology of a Site

This section draws on information from 36 anglers. In discussions about pollution concerns, interviewees often made comments about the general condition of the environment around a fishing site and/or the presence of other anglers or people using the site for different kinds of recreation. Some anglers looked at the debris in and around the fishing area for clues about levels of contamination. For them, excessive garbage, dumping, and litter were signs of a degraded environment and potential pollution. So, too, were densely developed urban locations, particularly ones with obvious industry nearby. Generally anglers believed that any nearby industry would be a polluting one. Some had worked at nearby facilities, or knew people who had, and their concerns were based on knowledge of actual practices at the facilities, while others believed local stories about which industries were polluting.

When it came to observations about ecology, several interviewees pointed to a diversity of fish and plant species or the re-emergence of lost species as indicators of general ecological health and therefore as an indicator of good water quality. Anglers that mentioned species diversity felt that more fish species meant that it was safer to eat fish caught at that location because water quality was good. Study participants occasionally meant that the predominance of carp in a water body indicated that the water was polluted.

In discussing the chances of catching contaminated fish from a specific water body, a few anglers said in effect that active management (i.e. on-site presence of game wardens or park rangers) and promotion of specific locations for fishing should mean that fish caught there were safe for consumption. The reverse was also believed to be true: officials would not let people fish in places where the fish were not safe to eat. Some anglers said that they most often fished for consumption at "pay lakes" (where anglers paid a fee to fish for the day and the lakes were stocked regularly with specific game species). Unless they were visibly injured, fish from pay lakes were considered safe to eat because anglers presumed the fish had been raised elsewhere in clean waters and had only been in local waters for a short time. A variant on this belief was that ponds or lakes were stocked with prey species or small fish that provided clean food for wild or larger fish. At locations where frequency and dates of stocking were not posted, anglers did not seem to consider the possi-

bility that stocked fish may have been present for a long time or that they might be catching wild fish. Finally, in about seven instances, anglers said they believed that public waters had been stocked even though there were no posted signs saying so. However, in these cases, the anglers were divided on whether or not stocking made it safe to eat the fish they caught.

Assessing the Water Itself

Water quality issues were explicitly raised by 25 anglers. In assessing the water at particular sites, interviewees cited clarity, movement, and volume, all of which were thought to be indicators of good water quality. Water clarity and lack of debris in the water were particularly important and, in fact, some anglers stated that local waters were "cleaner than they used to be" based mainly on improved water clarity. Moving water was understood to be constantly self-flushing and less likely than still water to accumulate contaminants over time. A large water body was thought to be cleaner than a small one because of dilution effects provided by the extra water volume.

While these beliefs about water quality are reasonable, anglers in some cases used their observations to draw inaccurate conclusions or conclusions that over-reached their observations. For example, anglers often made inferences about water quality based on the presence or condition of debris when, in fact, debris is not a reliable indicator of either good or poor water quality. For example, in one instance, an angler explained that he believed the pond he was fishing at was clean because a tire in the water was still intact and not degraded or disintegrating.

Anglers generally did not seem to be aware of the potential for contaminants to bioaccumulate up the food chain from sediments to plants to fish. Several anglers indicated that bottom feeding fish were low quality or inedible because they consumed "garbage." One person discussed the impacts of deep drafting commercial boats that stirred up sediments from the bottom of a river. On the occasions that the ethnographer explained the basics of the bioaccumulation process, anglers often showed great interest in learning more in order to increase their safety in consuming the fish.

Eleven study participants expressed the belief that "spring-fed" water bodies were clean (or cleaner than others in the area). When pressed for an explanation about why spring-fed waters would be cleaner, study participants said that springs added water, thereby diluting contaminants and/or that spring water is clean because it is groundwater that has been filtered or is out of reach of contaminants. Most of these participants also believed that fish from waters understood to be spring-fed were safe to eat. Several participants were aware of the possibility that contaminants could enter a spring-fed water body, including via groundwater. Nonetheless the anglers that mentioned springs generally felt that a spring led to cleaner water.

Later [Participant #51] talked about another place where people had dumped semi [truck] parts in the water. He explicitly contrasted it with [the pond we were standing next to], saying that people have not only dumped stuff in here but the water is cloudy. There the water is clear – you can even see the semi parts, so the pollution has settled out. Since it has, you can actually eat the fish you catch there.

I asked Participant #59 if the quarries he goes to are safe places to eat the fish out of. He said definitely, some are 50 or 60 years old, spring fed, and you can see 30 feet down in the clear water.

I asked [Participant #81] about the dump across the water, if it deters him? He said it hasn't. We got into a conversation about the pollution in the Calumet River system. In a back and forth I established that he either thought the pollution that gets into the fish is in the water or didn't know where it comes from. I explained that one major way it gets into fish is by getting into the plants at the bottom from the sediments they grow in, then fish eat the plants, and fish eat these fish, and these larger fish that eat smaller fish include bass and other fish that are not bottom feeders. I asked if he had ever heard that explanation before. He said, "I have not known anything until now." I asked if he would like to know the specific recommendations for this river. He was definitely interested, so I showed him the [recommended fish consumption limits] chart in the Illinois DNR [guide] book.

Figure 4. Calumet anglers on assessing the water (based on comments from 25 participants)

Selecting and Assessing the Fish

This section draws on data from 21 anglers. While there were some references to looking out for obvious mutations and gross deformities, a few of the more experienced anglers we spoke with brought an understanding of species morphology to their assessments of the fish they caught. They described examining external features on the fish (including eye position, skin color, skin tone [including shininess or sheen], and color patterns on the skin) and/or internal characteristics like the color of the meat and the condition of the yellow layer of fat. They also looked for evidence of injury (like sores or flesh wounds) or illness (like dark spots in the flesh). These anglers believed that contaminated fish would be impaired or that the meat would be damaged in some observable way.

Most anglers reported that family and community traditions guided their decisions about which fish species to catch, keep, and eat. Many also believed that deliberate selection of targeted species was a way to avoid pollution. Carp and cat-

[Participant #48 was holding up the fish and] he kept saying it was a nice fish and "clean" fish because the side of it was light colored and "clear." In his view, the skin would be darker and spotted if the water were polluted. The side of the fish was very light most of the way up, silver giving way to green only near the dorsal surface. He contrasted this [pond's] clean water with that at Oxbow, saying the fish there are darker because Oxbow is more polluted than here. I asked where he learned how to tell this; he said it was what he has been told by other fishermen.

I asked if there are certain kinds of fish that are less safe to eat compared to other kinds. [Participant #70] said the scavengers are less safe to eat. I asked which those are, and she said like carp and catfish. I asked if they ever eat carp. She said they throw them back, "we won't eat them." I asked why. She asked me, as though thinking out loud expressing hesitation, "Can I tell you this?" And then she told me "very few Black people will eat carp."

I asked Participant #87 if he has any way to tell from looking at a fish if it is good to eat or bad. He said "not that I know of. But you can go to a bait shop and they will cut it up and tell you what it has been eating."

Figure 5. Calumet anglers on assessing the fish (based on comments from 21 participants)

fish were mentioned most frequently as species to avoid, but the response to catfish and carp varied across ethnic groups. White anglers almost uniformly spoke of carp as "junk" or "garbage" fish that live in and eat from the bottom of lakes and rivers; they frequently expressed visceral disgust at the thought of eating carp. Black anglers who discussed carp were divided in their views. About half said that they did eat carp when they caught them; several mentioned removing the "mud vein" (a swath of dark-colored flesh) when cleaning the fish as a way to remove contaminants and/or to preserve the flavor of the lighter meat. The other half of Black anglers did not eat carp because they thought it was a junk fish or because they did not know how to clean or cook the fish; they did not, however, express disgust at the idea of eating carp. The small sample of Latino anglers who mentioned carp mostly shared Whites' perceptions of carp as disgusting and inedible although one Latino angler reported enthusiastically that he enjoys consuming carp he caught with family and friends.

Catfish inspired similarly divided views but without the expressions of visceral disgust. For Blacks and Latinos, catfish was frequently the most desired target species for consumption. White anglers, on the other hand, were about evenly divided between those who kept catfish for consumption and those who did not. Among the non-eaters, some said that catfish were undesirable for consumption because they were bottom-feeding fish and some said they did not target catfish because the fish's spines made them tricky or dangerous to handle.

At the time of the research, carp and catfish were the most frequently-named species in Calumet area consumption advisories but study participants almost never mentioned advisories when they talked about their feelings and beliefs in favor or against eating catfish and/or carp. A handful of anglers from each of the three ethnic groups did say that they had heard from the media or other anglers (or that it was just common knowledge) that people should limit their consumption of salmon or large bass caught in the Calumet area. This roughly corresponds with official advisories from that time.

Assessing Human Health

This section is based on data from 20 anglers. Assessments about human health took place on two levels: a general level related to the popularity of local waters for recreation, and a more specific level connected to the angler's own health or the health of family members and other anglers they knew. On the general level, anglers reported that people swimming, windsurfing, or fishing in the area (especially if other anglers were taking fish with them for consumption) in-

[Participant 31] added that he has never heard of anyone getting sick from eating fish from these places and it was a long time ago, like when he was about four, when he heard about pollution. I asked if pollution would stop him from eating fish he catches. He said no, he would eat catfish if he caught it. He'd been hearing about pollution since he was a kid, but does not know anyone who has ever gotten sick from eating the fish and never heard that anyone died from the pollution. His brother eats the fish all the time and he is real healthy and so are his kids.

I asked Participant #1 if he did anything special in preparing the fish he catches. He said he cuts, guts and throws them in the grease. He is not aware of any special preparation processes but, "If I thought it was detrimental to my health, I would not be out here. No way."

I asked Participant #40 if he had ever heard of anyone getting sick from pollution in a fish. He said he knew a woman who said her son had gotten a fungus from eating a fish they caught. He qualified his answer, saying he didn't know if she was right (in her diagnosis) or what the circumstances were, but that is what she told him.

I asked if being assured of getting fish was the main reason to go to a pay lake. They said it was, so I explained that I am interested in knowing if people go to them to avoid water pollution. Participant #20 said, "People eat the fish here. This lake is clean, people swim in it, you see them all the time."

Figure 6. Calumet anglers on assessing human health (based on comments from 20 participants)

dicated that the waters were clean and the fish were safe — a safety-in-numbers, or "we-can't-all-be-wrong" assessment technique.

Anglers who ate their catch could be more specific, and they often made comments about how eating locally-caught fish in the past (and/or over time) had not adversely impacted their own health or the health of their family members, friends, or other anglers (especially older anglers). Interviewees sometimes stated or implied that they were healthier than other people *because* they had fish in their diets. Their repeated experiences of eating locally-caught fish and not seeming to get sick reinforced their belief that local fish were safe to eat. They expected any adverse health impacts to be observable and directly attributable to the fish consumption. This was clear from a dozen interviewees who talked about pollutants in fish as infectious agents that you could "catch" directly from the fish and that caused illnesses like food poisoning. Among these participants, there was a general lack of awareness or concern about the kind of chemical or metal toxins that scientific experts are most likely to warn about — i.e. those that could bioaccumulate over time and cause long-term or developmental health problems.

I asked if [Participant #57] had ever heard about anywhere he should not catch and eat the fish because they are not safe. He said he watches the news quite regularly but he just does not know what to believe. They say one thing one week and then the next week say that is not true. "What are you supposed to believe? You hear things like you shouldn't eat X because it 'causes cancer.' Fish is supposed to be good for you. If you can't eat it, what are you supposed to eat?!" "What are you supposed to eat" was a kind of refrain for him in responding to this question. He didn't seem angry or annoyed, just kind of exasperated with food safety info. Finally he talked about trusting God and that God will decide how long he is supposed to live.

Participant #29: Sometimes I've heard about pollution here. You read it in the paper. I don't care.

Ethnographer: Now you are saying you don't care, why is that?

Participant #29: Pollution is everywhere. The air is polluted; everything is polluted. If you live in the country, it would probably be better. Here in the city, if you think about it [pollution], you would not eat anything.

#71 said with farm raised fish it is the responsibility of the hatchery/farm to make sure the fish are safe. They have to check the fish for toxins to make sure that they don't exceed a certain level. She went on to add emphatically, "So yeah, I do feel safer at a pay lake."

Figure 7. Calumet anglers attitudes about fish consumption risks (based on comments from 23 participants)

Anglers' Attitudes about Fish Consumption Risks

Twenty-three study participants discussed risk (and fish consumption risk in particular) in more depth, sharing explicit beliefs about which information is useful in risk assessment, which is not, and what people can or should do to control risk. Of these 23, many said that there was simply no way to know for sure which fish consumption risk information to believe or trust. For some, dire warnings about the potential hazards of eating fish from Calumet waters did not match up with their positive personal experiences of having done so. Several interviewees said that just being in a city meant being constantly exposed to pollution — i.e. a little pollution exposure through eating fish was the same as getting it from anywhere else. There were also subscribers to the "something's-got-to-kill-me" school of thought; they believed that the pleasure of eating the fish they caught outweighed vague concerns about long-term impacts on health. Several people also asked some variation of the question, "If not fish, then what are you supposed to eat?" They felt that there were no absolutely safe food consumption choices.

Sources of Information about Fish Consumption Risks

Thirty-nine anglers spoke about their sources of information about fish consumption risk. They almost never referred to state-issued guidebooks or websites as sources for fish consumption advisories. At the same time, we found that many interviewees were familiar with some of the information that can be found in the official guides and advisories — they had gotten it second-hand from other anglers, media reports, or television programs about fishing. For example, anglers often want to catch big fish ("trophy fish") as part of the thrill of the sport. But when it comes to consumption, official guides generally advise eating smaller (younger) fish of many species since they would have had less time to ingest or absorb pollutants from their environment and from their food. While only two of the study participants reported learning this from an official source, others seemed to view the idea as common sense. Official guidebooks also generally recommend minimizing meals of predator fish because they tend to build up toxins in their tissues when they eat smaller fish that are carrying those toxins. No study participants specifically referred to this food chain-related bioaccumulation process.

Those who *had* read about local pollution or consumption advisories typically said that "it was a long time ago" and/or they could not remember the specific source of the information. About 15 anglers reported getting information about fishing risks from newspapers, fishing publications, or television. However, they also complained about the lack of site-specific advisory information in the media; this was corroborated by the ethnographer's informal check of fishing-focused newspaper columns and television programs during the study period.

I asked [Participant #80] where he learned about contamination. He said probably the TV. He watches "Illinois Outdoors" and [another fishing show]. He went on to explain that his [sportsman's] club has their meetings just south of here in the park and they have speakers from [Illinois Department of Natural Resources] come and talk to tell them all the regulations. I asked if they tell the club about mercury and lead. He said yes, all that stuff. I asked, what about zebra mussels. He said Oh, yeah, zebra mussels, gobies, and all those junk fish.

I asked Participant #70 if she had seen anything on fish safety in the guide that you get when you buy your license. She half corrected me, saying the guide is optional when you buy a license and she does not always bother to get one because she does not always read it. She said when she does pick it up she mostly uses it to see what fish are in what areas and where people have caught trophy fish.

Participant #63 has never fished here at night, but people have told him it is the best time to fish because the fish are not as afraid to bite (as during the day). When I asked him what his source of this info was…he responded, "People who know," saying it with conviction. I backtracked…explaining that I have been getting info on night fishing from cops and other non-fishers, so I was just trying to narrow down who his sources were, and were they anglers. He said yes, anglers.

I asked Participant #90 if there were any lakes or waters he wouldn't fish in this area. He said yes, "Over there by [Lake] Calumet, there is a place where you can see the steel mills. There is a sign that says 'Do not fish: the water is polluted.' So I didn't."

Figure 8. Calumet anglers sources of information about fish consumption risks (based on comments from 39 participants)

Instead of official or media sources, the vast majority of study participants reported relying on informal social networks — primarily friends and family and secondarily fellow anglers and bait and tackle salespeople — for all fishing-related information. Their accounts demonstrate that information, misinformation, and advice about site selection, target species selection — all of which influence individuals' decisions to consume or not consume locally-caught fish — spread through the angling community along these informal social networks.

Stories about how anglers first came to fish for consumption at specific locations were particularly revealing. Whether they had begun to fish as children or had taken up fishing in adulthood, the majority of anglers had learned about particular fishing spots by accompanying more experienced anglers. A few anglers who fished for consumption reported continuing to avoid locations that they were first told to avoid as children because of pollution. Even more anglers acknowledged fishing for consumption at locations that they were taught were safe many years ago; over time, they never questioned the safety of consuming fish from those locations.

We found that Calumet anglers also relied heavily on personal knowledge gained from experience and observation when making decisions about fishing and assessing fish consumption risks. In fact, many anglers in our study trusted their own observations and judgment over warnings or information from all other sources. This suggests that assumptions, deductions, and beliefs about fish, fishing, pollution, the local environment, particular water bodies, and health strongly influence fishing behaviors and fish consumption decisions.

Pollution Mitigation Strategies

Some guidebooks and advisories offer advice on techniques for cleaning and cooking fish so that if toxins are present they can be minimized or eliminated. These include eating only the fillets of the meat, removing belly fat where tox-

I asked Participant #32 if he had heard about pollution here or in the area. He said he heard about the mercury here in the fish. I asked if it affected his consumption. He returned to saying he does not keep the fish out here when he catches one or two. But if his friends come back from "up north", "I figure I can eat those. If they clean them up and fry them hard enough, or cook them long enough, I figure that would kill anything. It's like meat. You just have to cook them long enough."

I asked [Participant 42] if they ever eat the fish they catch here. He said occasionally they eat them, but not usually. I asked why and he said because of the pollution, the mercury and the PCP. (He means PCBs.) We continued to discuss pollution and without my prompting he offered that it is the bigger fish and bottom feeders you have to worry about, not "pan fish" like the bluegill he was getting off his hook, which he described as not having belly fat. In his view it is the belly fat on the bigger fish that you had to get rid of. "If you cut that [belly fat] off on a big Coho, then you can eat it. That is where the PCP and mercury are and you get rid of it." He went on, saying that you are not supposed to eat fish out here any more than "three or four times a week, but we don't eat them anywhere near that often."

Ethnographer: Do you have any special way you prepare your fish?

#3: Skin, gut it, and cut off its head. Then bake, fry, or broil.

Ethnographer: Do you do anything to get toxins out?

#3: Here the fish are stocked.

Ethnographer: So you don't worry then about pollution?

#3: I wash my fish. That is it, nothing to get out toxins.

Figure 9. Calumet anglers on pollution mitigation strategies (based on comments from 44 participants)

ins may accumulate, using cooking techniques like grilling or broiling that allow the fat to drain off, avoiding stewing fish because toxins may simply move from the fish into the stew broth, and avoiding deep frying which can seal toxins in the flesh.

Forty-four anglers provided information about how they prepare and cook the fish they catch. Only four of them described their usual fish preparation and cooking methods with explicit references to how these measures might remove chemical toxins, mitigate their effects, or otherwise render the meat safer to eat; they talked about deliberately cutting off belly fat, cutting spots out of the meat, or throwing away all parts of the fish except the fillets. The other 40 respondents did not explicitly connect fish preparation/cooking with reducing the toxin exposure risk — or they were not concerned about contamination in the fish and so did not take special contaminant-removal precautions. Four of the study participants who talked about fish consumption risks in terms of infectious agents also mentioned using cooking techniques to, as one person put it, "kill about anything" in the fish. For them and likely for others, food safety was about bacteria and germs and the key to making fish safe was to cook it thoroughly or to a particular temperature. Generally people who ate carp said that they removed the "mud vein" (a swath of dark colored flesh in the meat) before cooking the fish. Most considered it unpleasant-tasting flesh that was removed to improve the taste of the remaining meat; some referred to the mud vein as a potential source of stored toxins that could ruin the fish for eating.

One mitigation technique anglers used was to fish Calumet waters for sport (catch and release), and to fish more rural areas for fish to eat; 12 anglers made such comments. Generally fish caught in Wisconsin, Michigan, Minnesota, or in rural Illinois and Indiana were considered safe to eat, especially compared to fish caught in urban waters. Anglers did not refer to potential contamination problems in rural waters with the exception of "farm ponds" where agricultural chemicals might degrade water quality.

Ethnic Differences in Calumet's Angling Community

We found that Calumet's Blacks, Whites, and Latinos formed mostly separate angling communities with largely distinct social networks. The one exception was bait shops which drew a diverse clientele. At some of the most popular *un*official fishing locations in the region, shore anglers were exclusively or almost exclusively anglers of color, most often Blacks. Some of these sites were on water bodies that had the strictest advisories in the region (but not outright bans) and the anglers there tended to be fishing — often successfully — for consumption. At other popular locations, both unofficial and state sanctioned, there were shore anglers from all three ethnicities but groups of people fishing or socializing together tended to be racially or ethnically homogeneous. At all locations, anglers in boats were overwhelmingly White.

When asked about fishing spots used almost exclusively by anglers of color, White anglers would often say they did not know anyone who fished those spots, but that they did see people fishing there sometimes. Some White anglers also expressed a definite disinterest in fishing at locations used by anglers of color because Whites generally preferred not to fish for carp or catfish, which they believed were the main target species at these locations. White anglers also believed that most of these sites were too polluted to yield fish that were safe to consume.

Several Latino and Black anglers offered stories about being treated arbitrarily or unfairly in the context of fishing regulation enforcement, while White anglers never reported mistreatment. One Latino angler reported getting a ticket for inadvertently casting his line into Indiana waters (for which he did not have a fishing license) while he stood on Illinois land. He felt that the state line was poorly marked and that the warden should have let him off with a warning. Another Latino angler described being scolded by a game warden for keeping an undersized fish. Even though the angler insisted that it was an honest mistake, the warden forced him to throw back both the undersized fish and a legal-sized fish, threatening to confiscate the angler's fishing gear if he did not comply. Like other anglers of color, these two believed that enforcement officials knowingly cited Black and Latino anglers on technicalities and took pleasure in doing so. Although this issue was raised only a few times in the course of our interviews, stories like these were always connected to strong negative feelings and it is worth noting that these accounts were offered voluntarily to a non-Hispanic White ethnographer.

In another instance, this distrust of authority was applied directly to anglers' assessments of fish consumption safety. During the study period, a sign posted by a stocked lake said that herbicide had been applied to the lake and that no fishing should take place there for three days. In discussing this with the ethnographer, a Black angler described how the sign had been interpreted by others as a "ploy" on the part of the lake managers to keep people from fishing right after the lake was stocked. He and other Black anglers, while not dismissing the sign, still expressed distrust of lake managers and expressed the belief that deceptive practices could occur.

By contrast, a few White anglers (but no anglers of color) described positive interactions that they had had with natural resource managers in other contexts. For example, one White angler who belonged to a large, long-standing, local sportsman's club said that natural resource professionals conducted water quality tests at preferred local fishing sites or spoke at club meetings about a range of subjects in-

cluding the risks of eating local fish. The clubs thus allowed anglers to interact with resource managers in settings where their role was to provide information or expertise, not enforce fishing regulations or other laws. These encounters allowed White anglers, individually or by association as members of the group, to build positive relationships with resource managers or at least to see them as well-meaning professionals. Only one angler of color reported belonging to a club of anglers; this informal group went fishing together but did not have membership meetings, visiting speakers, or a club facility.

Discussion

Anglers' Reasoning about Fish Consumption Risks

In general we found that, when it came to evaluating the risks of eating locally-caught fish, anglers and other interviewees sometimes misunderstood basic scientific principles about pollution, misapplied their own knowledge in order to justify their fishing and fish eating habits, or selectively disregarded cautionary information they had heard about contamination in local waters. Anglers also generally weighed information from a variety of sources against their own biases, preferences, beliefs, and personal histories.

Study participants who ate fish from Calumet waters were usually able to explain how this practice was consistent with their personal beliefs. For example, one of the most basic and widespread chains of reasoning was: 1) people can detect pollution with their senses — and, conversely, an apparent lack of pollution means that there is no pollution; 2) it is safe to eat fish from water that does not seem polluted; and 3) eating fish and then not seeming to get sick from it reinforces the belief that the water is not polluted enough to be dangerous and that the fish are therefore safe to eat. All along this chain of reasoning there is evidence of an optimistic bias reflected in the generally positive water quality and fish consumption safety assessments offered by people who planned to eat the fish they caught in Calumet. The risk literature helps us understand this finding, especially the anti-risk optimistic bias evident in many decisions based on personal risk perception (Weinstein 1999). Because the risk of immediate adverse health impacts from eating Calumet fish is relatively low, because the pleasures and benefits of eating fish are relatively high for many people, and because there is no equivalent of a dose-response curve that would allow individuals to pre-determine the potential health effects of consuming Calumet fish, there is little to deter people from eating sport-caught fish if they are already inclined to do so.

At the same time, we also noted something of a "pessimistic bias" among study participants who generally *do* eat fish but refused to eat *any* fish caught in the Calumet region. Their very strong concerns about excessive contamination in Calumet fish are generally *not* supported by state testing of Calumet fish as reflected in the state-issued, site-specific consumption advisories. This is also true of the Calumet Initiative members who requested this research; they were concerned that regular consumption of even small amounts of fish from Calumet waters could pose a serious health risk. An inverse pessimistic bias is also reflected in some participants' beliefs that fish caught in rural areas are automatically cleaner and safer than Calumet-caught fish. In fact, at the time of the research, many rural water bodies within a few hours' drive of Calumet had fish consumption advisories similar to those found in Calumet.

As outlined above, Weinstein (1999) provides a useful analytical framework for how people assess their personal risk in four steps: 1) identification of possible outcomes; 2) evaluation of the severity of the outcomes; 3) assessment of the probability of harm; and 4) assessment of an individual's relative probability of harm. The participants in this study generally fell into one of three categories in assessing their own personal fish consumption risks. One group of people willingly and readily ate sport-caught fish from Calumet. A second group absolutely did not eat Calumet fish. The third group who reported occasionally eating fish from Calumet offered a more ambivalent assessment.

With regard to identification of possible outcomes (Weinstein's Step 1), people who chose to eat Calumet fish generally identified bacteria or contamination with other infectious agents as a possible negative consequence of fish consumption but were generally not aware of the threat of bioaccumulated toxins. They therefore tended to think of the most severe possible outcome (Step 2) as immediate illness rather than long-term and substantially more severe concerns like life-threatening diseases and learning disabilities. Those who chose to eat locally-caught fish also considered the probability of harm both in general (Step 3) and for themselves (Step 4) to be very low. Further, they believed that by detecting and avoiding contamination in fish and in the water, they could lower their own probability of harm. Therefore, their overall perception of risk was low. Also missing from this risk perception assessment was a general understanding of how some populations — including the young, the very old, pregnant women, and or people with existing illnesses or chronic health conditions — could be especially vulnerable to harm caused by chemical or metal contaminants in fish. The second group of participants, people who did not eat any Calumet fish, generally did not specify the severe outcomes that they expected. Their complete avoidance of Calumet fish implies that they perceive a high probability of harm in general and to themselves. According to the state-issued advisories and fish consumption guidelines, these people were

generally *over*estimating their risk. The third group reported low levels of fish consumption from Calumet waters and expressed various levels of concern about local pollution based on a variety of assessment cues. What was largely missing among study participants' discussions of fish consumption risks, however, was a stance based on accurate knowledge of the potential impacts of pollutants balanced with the expected positive health impacts of having fish in one's diet.

Another perspective from the risk literature is the amplification and deamplification of risk (Burger 2000). In an amplified risk message, the perception of risk among lay people is significantly higher than expert opinion supports; those anglers that shunned eating *any* Calumet fish may have tuned into an amplified risk message. But risk can also be deamplified as the messages spread from experts to the general public. Burger (2000) suggests that fishing is an excellent example of this, where expert opinions of the risks of eating contaminated fish are minimized by the angling public so that they can continue to participate in an enjoyable (and possibly economically necessary) activity. Respondents in our research that ate their catch may have shown a deamplified response to the fishing risks, but not all. For example, when the topic of pollution mitigation was raised, some anglers earnestly queried the ethnographer for details about recommended fish preparation techniques and other risk minimizing strategies.

Implications for Land Managers and Policy Makers: Thinking Outside the Guidebooks

If sorting through the scientific data to provide fish consumption advisory information and guidelines is complicated, conveying this information to the fish-eating public is an even bigger challenge. First, advisory information needs to be both general (sorted, for example, by county or river system) and specific (applicable to particular at-risk populations and pertaining to particular small water bodies and specific fish species). Second, choosing a method (or methods) for disseminating the information to a diverse population is complex and can require different outreach strategies for different targeted groups; this can be further complicated by the need to choose outreach strategies that will build trust and strengthen relationships between anglers and site managers or law enforcement officials. Third, as noted by Burger (2000) and Chess et al. (2005), there is an inherent conflict between the many agencies and organizations that promote recreational fishing and the public health agencies and organizations that want to provide fish consumption warnings.

The existing fish consumption advisory information in the Indiana and Illinois fishing regulation booklets has a number of weaknesses. Not wanting to discourage people from fishing all together, these booklets try not to be alarmist about consuming contaminated fish. The resulting messages are ambiguous and sometimes seem to dismiss the advisories they are trying to convey. Emphasis on warnings to women and children also makes it sound as if the information does not apply to other populations while experts suggest that frequent consumers of sport-caught fish from Calumet (as well as many other places) should consider the potential effects of contaminant exposure over time.

This research makes it clear that existing advisories and detailed fish consumption risk information is failing to reach Calumet's angling community. Some organizations have tried to produce outreach materials that avoid the shortcomings of state-issued consumption advisories. For example, Illinois-Indiana Sea Grant offers a range of pamphlets and fact sheets designed to communicate advisory information to the general public in plain language and with simple graphics. Two of their publications, "The ABCs of PCBs: Know Your Catch" and "Contaminants in Fish and Seafood: A Guide to Safe Consumption for Illinois [or Indiana] Consumers" are available in multiple languages. Like other printed materials, they will not overcome all language and literacy barriers but they are easy-to-understand and provide a good overview of the problem of contaminated fish and what people can do to mitigate their own risks. Also, because the consumption and advisory information has been separated from promotional literature about fishing, these pamphlets are appropriate for non-anglers who eat fish from stores or restaurants. Jardine's (2003) previously-mentioned advice about involving the public in the development of fish consumption advisories may also be valuable for helping to produce effective outreach materials for diverse communities like those in Calumet.

Site managers and public health officials may also want to re-think, re-target, or simplify the messages they are trying to communicate. In both sanctioned and unsanctioned fishing areas where high contamination levels are a particular concern, frank signs that state that it is unsafe to eat the fish may be effective. In parks, forest preserves, and other actively managed public sites, officials have a range of outreach options. In places where contamination levels raise concerns about even low levels of fish consumption, managers could promote catch and release, emphasizing the fun, relaxing, and/or social aspects of fishing while discouraging consumption. In places where consumption risks are lower and/or where people are known to be fishing for consumption, on-site fishing workshops could teach people how to clean fish, focusing on the need to remove fat and discard the head, tail, and organs. On-site displays or live demonstrations could also teach that cooking methods like broiling and grilling are more likely than frying or stewing to remove contaminants from a fish meal. Outreach efforts to anglers of both genders and all ages could emphasize that pregnant women and young children are some of the more at-risk fish consumers.

It is also important to keep in mind that Black and Latino anglers in this study were much more likely than Whites to be consuming local fish, to be consuming fish species named in advisories (such as catfish and carp), and to be consuming fish from specific water bodies named in advisories. This suggests that anglers of color in Calumet — both individually and as a population — are likely to be disproportionately affected by contaminated fish. At the same time, Blacks and Latinos were much *less* likely than Whites to belong to fishing groups or to have positive relationships with resource managers and regulation enforcement officials. Therefore, disseminating fish consumption risk information to the diverse audience of anglers in Calumet (and other areas as well) requires reaching out beyond fishing-oriented groups into the local community and overcoming perceptions of mistreatment that are held by some Black and Latino anglers. For example, other research (Westphal et al. 2004) has found that Blacks and Latinos in Calumet belong to church groups, kinship networks, and other formal and informal groups that natural resource managers could meet with to spread the word about contamination concerns.

Another suggestion for reaching out to Calumet anglers in a non-traditional way is to create a "Master Angler" certification program modeled on the successful "Master Gardeners" program managed by the Cooperative Extension Service. "Master Anglers" could recruit experienced anglers and offer them classes in fish- and fishing-related subjects including local fish consumption risk information. Like Master Gardeners, Master Anglers would then share their expertise with others in both formal and informal settings. The great advantage of such a program is that it provides a mechanism for disseminating information along the proven and trusted informal social networks that already exist in recreational fishing communities.

A "Master Anglers" program could also address several areas of concern raised in our research and in other research on communicating risk of eating sport caught fish. If anglers of color were interested in the program, then this mechanism could also help address environmental justice issues by creating new routes to share risk information, including mitigation strategies, with anglers and their families. Master Anglers could also review outreach materials for clarity for different cultural groups. The need for such review is well-documented: simply translating from English to other languages is not sufficient, nor can managers count on their message being understood by sub-cultures speaking the same language. An example from Deborah Chavez's (2001) research on trail use provides an interesting example. Managers noticed that few Latinos used an otherwise popular trail. A translated sign turned out to be the problem. What read in English as a caution about mountain lion presence in the area read in Spanish as an imminent threat of death from mountain lions hiding along the trail. Master Anglers could help bridge these cultural divides and assist managers in providing useful information that can be assimilated and used by the intended audience.

It is also important to be realistic about the level of knowledge people will likely ever have about the potential risks of eating contaminated fish. Weinstein et al. (2005), for example, describes smokers' surprising level of ignorance about the health effects of smoking which are, of course, serious (e.g., cancer, emphysema, cardiovascular illness) and have been well-documented and well-publicized for a long time. Many smokers are still apparently unaware of the risks to their health and they develop mental strategies to reduce their perceptions of their own risk. Compare this with fishing and fish consumption. Unlike fish, cigarettes carry warning labels that describe their known health risks. Even infrequent smoking can have detrimental health effects while eating fish can be a healthy diet choice. And while smoking is a costly habit, fishing is relatively inexpensive, relaxing, enjoyable, and can provide food. Finally, the risks posed by eating contaminated fish are real, but are in the distant future, or are difficult to untangle from other contributing factors. All of these factors complicate efforts to effectively and accurately communicate the health risks of eating sport-caught fish.

In addition, people who believe in the relative safety of eating Calumet fish are not necessarily wrong. Many official sources including the state-issued fishing regulation guidebooks recommend *limiting* consumption of fish from waters that are known to be contaminated but none of the sources we found suggest *avoiding* Calumet fish all together. The one exception is sport-caught fish from the Indiana Harbor Canal and Grand Calumet River which have a strict "do not eat" advisory. Local officials may therefore want to concentrate on communicating avoidance of the highest risk areas, and encourage better species, size, and preparation choices at safer sites.

Fishing in urban areas is a popular activity, and this is certainly true in Calumet. Natural resource managers face the challenge of providing for this activity while also providing the necessary information for anglers to assess the risk and benefits of eating and sharing their catch. Outreach through new channels, providing information aimed at minimizing risk through preparation techniques, and providing information in accessible formats are all important steps in this process.

Endnotes

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2. See www.fishingworks.com/licenses/index.cfm

Acknowledgements

The authors wish to sincerely thank the reviewers for their collegial suggestions that greatly enhanced the paper.

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