

Potential Health Risks of Recreational Fishing in New York City

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Background.—Fish in the rivers around New York City are contaminated with polychlorinated biphenyls (PCBs) that have been increasingly associated with neurodevelopmental abnormalities. The New York State Department of Health has recommended that the consumption of fish from the rivers around New York City not exceed one meal per month and that no pregnant women or children less than 15 years of age eat any fish from these waters.

Design/Methods.—We systematically surveyed anglers at Manhattan fishing sites over a 3-month period to estimate the exposure of anglers, children, and women of childbearing age to PCB-laden fish.

Results.—One hundred sixty anglers completed the interview. Eighty percent of these anglers were unaware of any advisory to limit fish consumption in order to limit PCB exposure. Most anglers ate the fish they caught. Of the anglers who said that they took the fish home (72.5% of the total sample), 17.7% reported that children regularly eat the fish, and 15.4% reported that an individual had been pregnant while regularly eating the fish.

Conclusion.—Despite state advisories, New York City anglers report high rates of fish consumption by themselves, pregnant women, and children. Although determining the consequences of such consumption will require further study, this represents a worrisome environmental exposure.

KEY WORDS: environmental health; polychlorinated biphenyls; public health

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Public health officials are deeply concerned about the toxic effects of the industrial pollutant, polychlorinated biphenyls (PCBs). PCBs are a family of over 200 related synthetic organochlorine compounds that were used as electrical equipment insulators from the time of their discovery in 1927 until Congress banned their manufacture, sale, and distribution in 1977.¹⁻³ PCBs are highly soluble in fat and are resistant to chemical and biological breakdown. In bodies of water in which they are discharged, they tend to accumulate in bottom sediment.⁴ They are ingested by microorganisms, which, in turn, are consumed by fish. PCBs bioaccumulate in fatty tissues, and their tissue concentrations are magnified in carnivorous animals through ingestion of PCB-laden fats.⁵

Epidemiological studies have produced considerable evidence that the consumption of contaminated fish by pregnant and lactating women can impair nervous system development and cognitive function, especially attention and memory, in the children of these women. These effects have been reported more often following exposure in utero rather than via breast milk.⁶⁻¹² One study has even suggested that long-term exposure from fish consumption before pregnancy is more significant than consumption during pregnancy.¹³

Departments of Health in many states have published

advisories to limit exposure to PCBs. However, 2 surveys in the Great Lakes states found that most people who ate fish, including those who fished, were unaware of their states' published advisories.^{14,15} A recent study of New Jersey fishermen also found that most anglers were either unaware of state advisories or, if they knew of the warnings, ignored them.¹⁶ The New York State Department of Health recommends that adults avoid eating more than one serving of fish per month from fish caught in contaminated waters and that pregnant women and children under the age of 15 years altogether avoid eating any such fish. However, a 1993 survey found that 65% of people fishing in New York City believed the fish were safe to eat, despite the existence of advisories to the contrary.¹⁷

For approximately 30 years, until 1977, the Hudson River in New York was a sink for discharge of PCBs from 2 General Electric (GE) electrical capacitor plants in Hudson Falls and Fort Edward, NY. It is estimated that these 2 plants discharged between 500 000 and 1.5 million pounds of PCBs into the Hudson River and that over 300 000 pounds remain in river sediment. The spread of the PCBs downstream resulted in the designation of a 200-mile stretch of the river (from Hudson Falls to Battery Park in Manhattan) as a Superfund site by the United States Environmental Protection Agency in 1983.

Today there is considerable debate over the best way to reduce the danger of the PCBs in the Hudson River, but there is widespread agreement that exposure is a health risk. Children are most at risk, especially those exposed in utero, because of the numerous effects of PCBs on development. Previous studies assessing risk perception, fishing practices, and sport fish consumption have not addressed the potential exposure to children or women of childbearing age. Because recreational fishing is common in the waters around Manhattan, this study attempted to

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TABLE 1. Demographic Characteristics of Anglers (n = 160)*

Characteristic	Result
Mean age (yrs)	46.3 (± 14.9)
Ethnicity	n (%)
Latino	100 (64.9)
African-American	42 (27.3)
White, non-Latino	9 (5.8)
Asian	1 (0.6)
Other	2 (1.3)
Spanish-speaking	43 (26.9)
Male	155 (96.9)
Education level	
8th grade or below	44 (27.2)
Attended high school	72 (47.7)
Any college	38 (25.2)
Annual family income	
<\$15 000	40 (29.4)
\$15 001-\$25 000	25 (18.4)
\$25 001-\$35 000	18 (13.2)
\$35 001-\$45 000	17 (12.5)
>\$45 000	19 (14.0)
Didn't report	17 (12.5)

*Denominator changes due to variation in participant response.

make an initial assessment of the frequency with which pregnant women and children are eating the fish that anglers catch.

METHODS

A systematic survey of recreational fishermen in New York City was conducted between May and November 1999 by the first author. He circled the Manhattan waterfront on several occasions and determined that there were 6 favored fishing sites. He spoke with anglers at each of these sites to try to identify other sites, but none were described. These 6 sites became the locations for the interviews.

A 50-item questionnaire was administered to all anglers to elicit information on their fishing and fish-eating practices. The days and times of survey administration were varied across fishing sites to try to obtain a more representative sample. Visits to the 6 sites were made until there was at least one visit to each site during each of 3 interview periods (morning, afternoon, and evening) on each day of the week. When a group of anglers was encountered, each angler was interviewed separately. The interviewer introduced himself by name as a medical student from the Albert Einstein College of Medicine and explained that he was interested in learning more about fishing in New York City. He told each angler he encountered that the interview would take less than 10 minutes and assured the angler of anonymity and confidentiality and explained that the angler was under no obligation to answer. Since the interviewer is bilingual, anglers were interviewed in Spanish if they preferred, and this group was defined as Spanish speaking. For anglers unwilling to complete the questionnaire, the interviewer attempted to acquire at least 4 key data elements (age, ethnicity, level of education, and whether the angler brought the catch home).

Descriptive statistics and the chi-square test were used

TABLE 2. Anglers' Opinions and Knowledge of Limitations on Fish Consumptions*

Opinion or Knowledge	Results (%)
Of river as fishing site	
Safe	102 (69.9)
Fairly safe	19 (13.0)
Not safe	25 (17.1)
Aware of any limit on fish consumption	65 (43.9)
Aware of any recommendation to limit fish consumption in order to avoid PCB† exposure	29 (19.6)

*Denominator changes due to variation in participant response.

†PCB indicates polychlorinated biphenyls.

to describe population characteristics and fish consumption patterns. Frequencies and group comparisons were performed using EpiInfo (CDC) version 6.04. Following the New York State Department of Health definitions, childbearing age was defined arbitrarily as falling between 18 and 35 years. Additionally, poverty-level income was defined as a family income below \$15 000. An angler's responses were included in the analysis if the angler answered any portion of the survey. The Committee on Clinical Investigations at the Albert Einstein College of Medicine approved the study.

RESULTS

Two hundred ten anglers were approached. There were no significant differences in age, ethnicity, level of education, or whether they brought their catch home between the 50 anglers who refused to be interviewed and the 160 who were surveyed. Table 1 summarizes the demographic data on the 160 anglers who completed the interview. Nearly all anglers surveyed were male, and the majority were Latino.

Table 2 summarizes the anglers' opinions of the safety of the river as a fishing site and their knowledge of any recommended limits on fish consumption. Despite the existence of New York State Department of Health advisories, 70% of the anglers reported that they thought the Hudson River was a safe fishing site. More than one half of the anglers were unaware of any limit on fish consumption, and more than 80% were unaware of any limits to avoid exposure to PCBs. Despite the existence of state advisories, the interviewer did not observe any posted signs warning anglers about fish consumption at any fishing sites.

On average, our anglers reported that they had fished 3 times per week, 6 months a year, for 25 years and had caught 7 fish per outing. When asked which fish they usually catch, 100% specified white perch and rainbow smelt, whereas 95% said they usually catch American eel, 78% mentioned striped bass, and 57.4% mentioned bluefish.

Nearly 75% (n = 116) of the anglers said that they take home the fish they catch. Table 3 summarizes the fish consumption practices reported by this group. Among those who said that others eat the fish they catch, 74.7% reported that others eat more than the recommended limit of one fish meal per month, and 35.4% reported that either pregnant women, women of childbearing age, or children

TABLE 3. Fish Consumption Practices Among Anglers Who Take Fish Home (n = 116)*

Practice	N (%)
No. of fish meals eaten per month	
0-1	39 (34.5)
>1	74 (65.5)
Reported others eat the fish	81 (71.1)
Among this group	
Reported others eat more than 1 fish-meal/month	59 (74.7)
Reported that others eat the fish while:	
Of childbearing age	27 (23.9)
Pregnant	12 (15.4)
<15 years of age	20 (17.7)

*Denominator changes due to variation in participant response.

eat the fish they bring home. Although only anglers who reported that they take the fish home were asked who eats the fish, this represents 26.5% of all the anglers surveyed.

Compared to anglers who had completed high school, those who had not completed high school were significantly more likely to report that women of childbearing age eat the fish they catch (39.3% vs 20.3%, $P < .05$) and tended to report that they eat more than one fish meal per month (78.6% vs 60.8%, $P = .09$) and that pregnant women eat the fish they catch (22.7% vs 7.7%, $P = .07$). Compared with English-speaking anglers, those who spoke Spanish tended to report that they eat more than one fish meal per month (78.1% vs 60.5%, $P = .08$).

DISCUSSION

Like previous surveys of recreational anglers in the New York State area,^{16,17} we found that persons fishing in the waters surrounding Manhattan are generally unaware of state advisories limiting fish consumption due to PCB contamination. There was no evidence that advisories were posted to warn anglers against proscribed practices. What is more, more than one quarter of all the anglers we surveyed (over one third of those who take fish home) reported that those who are at greatest risk from PCB exposure—children, pregnant women, or women of childbearing age—regularly eat the fish they catch.

There are several limitations to our study. The number of anglers who fish in New York City is not known, so we cannot specify the precise scope of the problem and the affected population. Also, our study did not include measurement of serum PCB blood levels in surveyed anglers or any past medical history that could indicate deleterious effects of PCB ingestion. An extensive interview and request for a blood sample would have deterred participation by the anglers.

At the same time, our survey results should serve as a red flag. Investigators have found that sport fishermen's exposure to PCB-laden fish is associated with their serum PCB levels,¹⁸ and high levels of PCBs in fish in the rivers surrounding Manhattan continue to be documented. A 1996 survey of the New York-New Jersey harbor estuary found that PCB concentrations per fish exceeded the 2000 ng/g tolerance in the 5 fish species that our anglers reported that they usually catch (white perch, rainbow smelt,

American eel, striped bass, and bluefish).¹⁹ This 1996 report also noted that state advisories with respect to PCB consumption are, if anything, too lax. Moreover, our use of the New York State Department of Health's conservative definition of childbearing age probably led to underestimation of the extent of exposure in women who might have children.

Our findings indicate that the hazards associated with the consumption of PCB-laden fish are largely unrecognized by New York City anglers, that consumption patterns may be putting many people, especially children, at risk, and that the present advisory system is inadequate to safeguard public health. A first, simple step would be to post warnings at recreational fishing sites. Beyond this, there is need for an educational campaign addressed toward anglers and toward health providers. If pediatricians are made aware of the dangers, they can play an important role in alerting their patients' families to this environmental hazard.

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