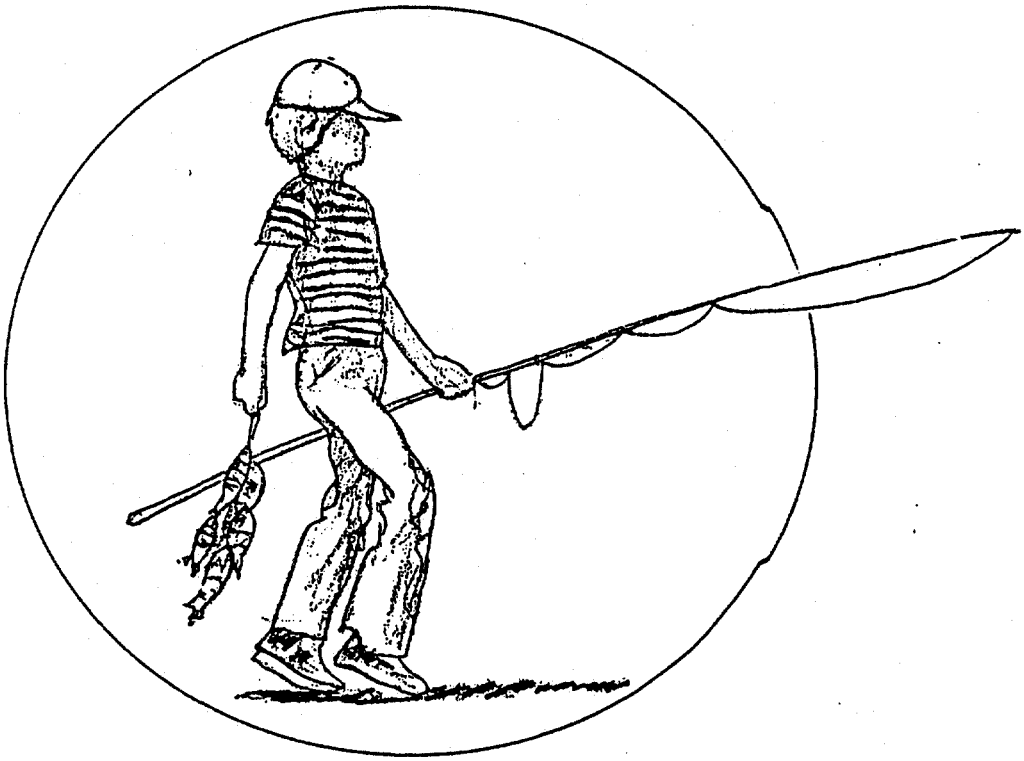
HUDSON RIVER

ANGLER SURVEY



HUDSON RIVER SLOOP CLEARWATER
MARCH, 1993

HUDSON RIVER

ANGLER SURVEY

A report on the adherence to fish consumption health advisories among Hudson River anglers.

Principal Investigator and Author

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Hudson River Sloop Clearwater, Inc.

Poughkeepsie, New York

March, 1993

Hudson River Sloop Clearwater, Inc. (Clearwater) is a non-profit, member-supported, environmental education and advocacy organization whose purpose is to work for the protection of the Hudson River and related waterways. Clearwater members own and operate the 106-foot sloop *Clearwater*, a replica of the Dutch work boats that plied the Hudson in the 18th and 19th centuries. Launched in 1969, the *Clearwater* serves as a "floating classroom" in which 18,000 people annually participate in environmental education programs. Clearwater staff and volunteers conduct an aggressive grass roots environmental action program to further our goal to clean up the Hudson. For over twenty-five years, Clearwater has been an effective voice for environmental protection.

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INTRODUCTION

Many Hudson River fish are contaminated with levels of PCBs that render them unsafe for unlimited human consumption, due primarily to General Electric's discharge of PCBs into the river at Ft. Edward, and the continual dispersal of those PCBs downstream throughout the river. While the extent of PCB contamination has been well documented since the mid 1970s, only limited remedial action has been taken. The lack of action can be attributed to a number of factors: the extensive cost of a comprehensive cleanup, the complexity of the technical issues involved, and the extent to which the issue has become the subject of sharply polarized and politicized debate.

While the debate over the appropriate course of action drags on, the potential threat to human health remains. In the absence of any comprehensive cleanup, efforts to prevent human exposure to PCBs, which occurs primarily through consumption of contaminated fish, have consisted of efforts to restrict fishing and fish consumption. On the upper Hudson River, where contamination levels are the highest, all fishing has been banned. Voluntary recreational fish consumption advisories have been issued for the Hudson River south of the Troy Dam.

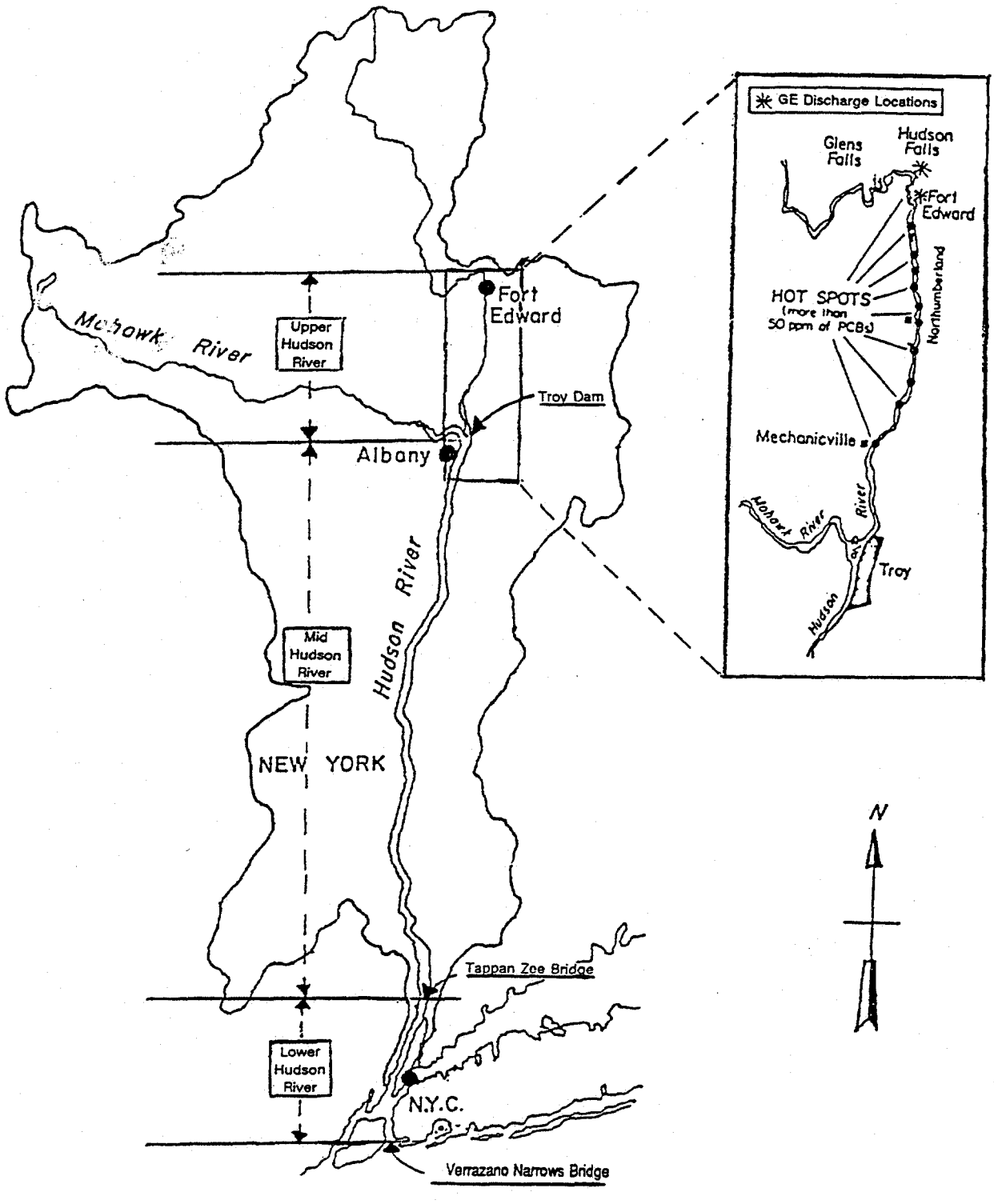
What constitutes an appropriate response to such an extensive potential threat to public health and the environment is an important scientific and public policy question. The extent to which human exposure to PCBs is actually occurring is a critical component of a decision (currently being evaluated by the federal Environmental Protection Agency) on whether and how the contamination of river sediments should be remediated. Whether voluntary fish consumption advisories or fishing bans are an adequate response by the State must be based on an ongoing evaluation of the effect those measures are having on fish consumption behavior.

Beyond anecdotal evidence of ongoing, unsafe fish consumption, inadequate information currently exists to allow a reasoned debate of this issue. Hudson River Sloop Clearwater, in its Hudson River Angler Survey, has sought to fill this void by generating information derived from direct interviews with shore-based anglers, as well as a review of other relevant studies, regarding the extent of fish consumption on the Hudson River, knowledge of advisories among the fishing public, and the extent to which advisories are influencing fish consumption behavior.

Finally, in order to participate in the debate over the appropriate response to PCB contamination of the Hudson, the public, and in particular groups such as anglers who are

directly affected, need to be fully aware of the nature, extent and implications of the contamination. Identifying gaps in public knowledge and understanding, and working to fill those gaps, will create a more informed and involved public constituency for the river.

Figure 1



BACKGROUND

PCB contamination is the most extensive toxic contamination problem affecting the Hudson River (NYS DEC, 1992a). Two General Electric plants at Fort Edward and Hudson Falls, New York, which used PCBs (polychlorinated biphenyls) in the manufacture of capacitors, discharged from 500,000 to 1.3 million pounds of these odorless, colorless toxins into the Hudson River over a thirty-year period (in part under State permits) before they were ordered by New York State to stop in 1976 (See Fig. 1). PCBs accumulated in the sediments on the river bottom near the discharge points. Natural erosion and scouring of these sediments have caused a continual dispersion of PCBs throughout the river. Today every part of the Hudson River system downstream of Glens Falls shows evidence of PCB contamination. River water, sediments, fish and other river dwelling creatures, wildlife and plants have all been affected by the river's pollution with PCBs (NYS DEC, 1980).

Because they are persistent and fat soluble, PCBs increase in concentration as they move up the food chain, a process called bioaccumulation. In the early 1970s, state and federal surveys found high levels of PCBs in many Hudson River fish. In 1976 the State banned all fishing on the upper Hudson, closed the commercial striped bass fishery, and issued extensive fish consumption advisories for the lower Hudson (south of the Troy Dam) (see Fig. 1).

Since the discovery of PCB contamination of the river there has been extensive and protracted debate over the appropriate response beyond the establishment of fishery bans, closures and advisories. The New York State Department of Environmental Conservation (DEC) first proposed in 1978 a project to dredge the most highly contaminated sediments from the upper Hudson. To date, the "Hot Spot Dredging Project" has not been implemented.

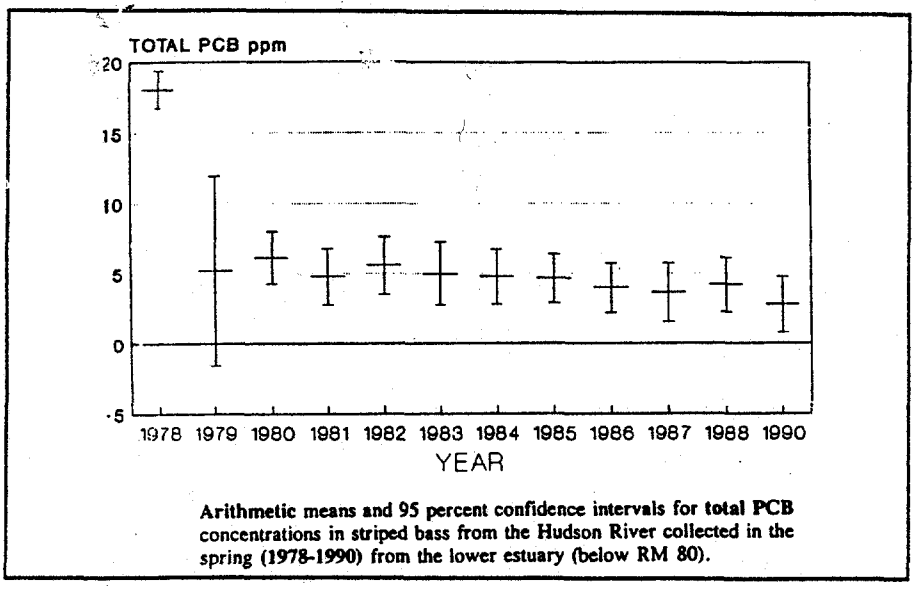
The Hudson River from Hudson Falls to the Battery was placed on the federal Environmental Protection Agency's (EPA) Superfund National Priority List in 1983, making this one of the largest Superfund sites in the nation. In 1984 EPA issued a Superfund Record of Decision (USEPA, 1984) which called for an "interim action" of capping exposed contaminated sediments on the river's shoreline, and recommended "no action" on contaminated river bottom sediments pending further review. This interim "no action" decision was based in part on findings that PCB levels in fish were declining towards the US Food and Drug Administration's

tolerance level of 5 parts per million for PCBs in fish flesh[1], and that fishing restrictions would provide a measure of public health protection until PCBs in fish declined to "safe" levels.

While PCB levels in fish declined substantially in the years after GE's discharges were halted, decreases in more recent years have been marginal (see Fig. 2). PCB levels in individual Hudson River fish vary with species and location sampled. On the upper Hudson the 1986-1988 average concentration of PCB in fish was 10.9 ppm. PCB levels as high as 370 ppm have been found in largemouth bass from the upper Hudson (USEPA, 1991).

On the Hudson River estuary (south of the Troy Dam) PCB levels in resident species and striped bass, a migratory species, gradually decrease with distance down river from the major known contamination source (Sloan, 1991). In 1990 the average PCB levels for striped bass were 6.9 ppm at the Albany/Troy area, 3.74 ppm at Poughkeepsie, 3.13 at Croton Point and 1.9 at the George Washington Bridge (Sloan, 1991). It is probable that the declines in these fish in the last decade are related to reduced downstream flow of PCBs from contaminated upriver areas. This reduction in PCB transport would be expected to follow the several years of low river flows that have recently occurred. It is possible that future flood events in the upper Hudson would increase the dispersion of PCBs downstream, and cause increases in PCB levels in lower river fish (NYS DEC, 1992b).

Figure 2: Striped Bass, Lower Hudson River, Spring 1978-90



Arithmetic means and 95 percent confidence intervals for total PCB concentrations in striped bass from the Hudson River collected in the spring (1978-1990) from the lower estuary (below RM 80).

[1] EPA used an outdated FDA tolerance level in this decision. The EPA ROD was signed 9/25/84. The new FDA tolerance level of 2 ppm went into effect 8/20/84.

Health Effects of PCBs

PCBs have long been regulated by the federal government as a "probable human carcinogen." Their carcinogenicity and ubiquitous presence in the environment have caused the National Academy of Sciences Committee on Evaluation of the Safety of Fishery Products (NAS, 1991) to state that "PCBs pose the largest potential carcinogenic risk of any environmental contaminant for which measurements exist."

Recent research has indicated that PCBs have other health effects that may be even more disruptive and prevalent than cancer (Colburn, 1991). Among these effects are developmental, reproductive, neurotoxicological and immunotoxicological effects (NAS, 1991; US GAO, 1991; Axelrod, 1990; World Wildlife Fund, in press). Of particular concern is the evidence that PCBs have the potential to impact not only the individuals who are exposed, but their offspring as well.

In January 1993, EPA adopted an Oral Reference Dose (RfD) value for the non-carcinogenic health effects associated with exposure to Aroclor 1016 (a commercial PCB mixture). EPA based this value on animal laboratory studies which found deleterious reproductive, developmental, neurological and immunological effects on a variety of species. EPA also considered the results of human health studies which showed decreased birthweights and behavioral dysfunction in children born to exposed women (USEPA, 1993).

Angling as a Route of Exposure

Though there are many economic and social benefits to be derived from angling[2], among them recreation, tourism and appropriate fish consumption, this activity also presents a serious potential health risk due to exposure to contaminants. While people can be, and are, exposed to PCBs in the air, water and foods in general, consumption of contaminated fish is considered the greatest route of exposure to PCBs (excluding occupational exposures). EPA has characterized exposure through fish consumption as the most significant pathway of human exposure to the PCBs which contaminate the Hudson River (USEPA, 1991a). A recent EPA survey of chemical residues in fish detected PCBs in fish from 91% of the sites sampled[3]. In fact, a white sucker from the upper Hudson, at 124 ppm, had the dubious distinction of having the highest detected level reported in this study (USEPA, 1992).

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[2] The term "angling" refers to any fishing activity not of a commercial nature. Thus angling can denote a purely recreational activity as well as fishing specifically to acquire needed food (subsistence angling).

[3] Of the 388 sites sampled, 315 were near known potential point or non-point pollutant sources.

One fifth of the fish and shellfish consumed in the United States is harvested by recreational or subsistence anglers (NAS, 1991). Anglers face a high risk of exposure to toxic substances because they tend to fish from the same, often contaminated, water body repeatedly (Reinert, 1991; USEPA, 1991), and consume more fish than the national average (NAS, 1991). In addition, some of the fish species most commonly caught by anglers are highly contaminated. As a result, the National Academy of Sciences Committee on the Evaluation of the Safety of Fishery Products concluded that individuals who engage in recreational or subsistence fishing face a higher risk of experiencing negative health effects than do members of the public at large (NAS, 1991).

Angling Trends and Efforts on the Hudson River

Nationally, angling ranks as one of the most popular recreational activities. Angling has been consistently growing in popularity in New York State over the past twenty years (Dawson, 1990). This trend holds true for the Hudson River as well. In fact, while statewide angler surveys have shown a 25% increase in "angler days" fished between 1976 and 1988, angling effort on the Hudson doubled over this same period. In 1988 an estimated 26,800 state-licensed anglers spent 232,110 angler days fishing on the Hudson (NYS DEC, 1990). This is certain to be a substantial underestimate as it counts only licensed anglers, though no recreational fishing license is currently required on the main stem of the Hudson River south of the Troy Dam (Green, 1991).

Recreational fishing on the Hudson River has the potential to generate significant benefits to the economies of shoreline communities and the State in general. DEC has estimated that a recreational fishery on the upper Hudson, if unrestricted, could generate $4.8 million per year (in 1987 dollars). It has also been estimated that a fully restored recreational fishery on the estuary would generate an additional $19.8 million annually (in 1987 dollars) (Schupp, 1987).

Upper Hudson River Fishing Ban

Due to consistently high levels of PCBs in all species tested, recreational fishing on a forty mile stretch of the upper Hudson from Bakers Falls (in the Village of Hudson Falls) to the Troy Dam has been closed to all fishing since 1976 (see Fig.1). The ban was promulgated by DEC, pursuant to Article 11 of the NYS Environmental Conservation Law, and is included in the NYS Fishing Regulations Guide (Fishing Guide) which is given to those who purchase a state recreational fishing license. The fish consumption health advisory indicates "no fishing" in this

area. This stretch of river is the only water body in New York closed to all fishing due to toxic contamination.

Despite the fishing ban, aerial surveys (Kellar, 1988) and summonses issued by conservation enforcement officers (personal communication, Lieut. Charles Valadez, NYS DEC, 1993) demonstrate anglers are still utilizing the upper Hudson River. Inadequate enforcement may contribute to fishing in closed areas, as may a lack of local support for the ban. Most of the summonses issued by conservation officers are dismissed by local magistrates. Several local municipalities and angler groups have repeatedly petitioned DEC for a relaxation of the ban (NYS DEC, 1986).

Use of Advisories As a Means of Controlling Risks

The federal Food and Drug Administration (FDA) is responsible for regulating levels of contaminants in food products intended for interstate commerce, and does so through the promulgation of tolerance levels or action levels for specific contaminants. FDA has established a tolerance level of 2 ppm for PCBs in fish. Responsibility for dealing with contaminants in non-commercially harvested foods falls primarily with the states. Most states have chosen to address the problem through voluntary advisories on fish consumption by individuals. Currently there are over 2,000 fish consumption advisories in place in 37 states (US Dept. of Commerce, 1990).

In New York State, health advisories are the joint responsibility of the Department of Environmental Conservation (DEC) and the Department of Health (DOH). DEC is mandated to protect fishery resources and to provide beneficial uses of the environment without risk to human health or safety (NYS Environmental Conservation Law, Sect. 1-0101). The DOH is responsible for supervising the reporting and control of the "disease" of fish contamination, promoting education in the prevention and control of disease, and supervising the abatement of nuisances affecting public health (NYS Public Health Law, Sect. 1-2099).

According to the DEC's Policy on Contaminants in Fish (NYS DEC, 1985), the necessary data on contaminant levels in fish are collected by DEC and evaluated jointly by DEC and DOH. DOH is responsible for determining the nature of health advisories, in consultation with DEC. DEC publishes the advisories annually in the Fishing Guide, which is given to those who purchase a fishing license. Advisories are reevaluated yearly based on current data. DOH issues a press release annually and whenever any advisory is changed. Both agencies are responsible for taking other steps, as necessary, to inform the public about the health advisories.

NYS DOH has published a booklet on the health advisories which is distributed to sport-

fishing groups, bait and tackle shops, through the Sea Grant extension program and at public meetings. The booklet includes an "800" number at the Health Department through which interested individuals can get additional information[4]. In addition, DEC has published a booklet that describes fish cleaning and trimming techniques which can help reduce contaminants in prepared fish meals.

Unlike DEC, DOH has never formulated an official policy statement clarifying its role in establishing health advisories or the methodologies used to determine appropriate advisory levels. DOH primarily bases its health advisories on the FDA tolerance or action levels; when average contaminant levels in a fish species from a particular water body exceed the FDA level, DOH establishes a restrictive advisory for that species and water body (personal communication, Tony Forti, NYS DOH, 1992).

Specifically:

- If contaminant levels are greater than three times the FDA tolerance level, DOH advises no consumption.
- If levels are between one and three times the FDA level, DOH issues an advisory to eat no more than one meal per month.

Whenever elevated contaminant levels are found in a species DOH issues a general advisory that women of childbearing age and children under age fifteen avoid consumption of all species from that water body. The reason for this specific advisory is that chemicals can have a potentially greater impact on developing organs in young children or in the fetus. In addition, there has been a general statewide advisory in effect since 1971 to eat no more than one meal of fish per week from the state's fresh waters, the Hudson River estuary, or the New York City harbor area.

DOH has been participating with the Great Lakes Task Force (made up of representatives of health and environmental agencies from all the states bordering the Great Lakes and Canada) in developing a consistent approach for all Great Lake states in setting advisories. One of the approaches under consideration would involve more extensive use of risk assessment methods.

There are restrictive fish consumption advisories in place for 44 water bodies in New York (NYS DOH, 1992). Restrictive advisories for consumption of Hudson River fish are driven solely by PCB levels (except for blue crab, where cadmium is also a concern). On the lower Hudson, advisories range from the general "eat no more than one meal per week" through "eat

[4] The Environmental Health Information number is 1-800-458-1158.

Figure 3: New York State DOH 1992-93 Health Advisory pertaining to the Hudson River

* Eat no more than one meal (one half pound) per week of fish from the state's freshwaters, the Hudson River estuary, or the New York City harbor area (the New York waters of the Hudson River to the Verrazano Narrows Bridge, the East River to the Throgs Neck Bridge, the Arthur Kill, Kill Van Kull, and Harlem River), except as recommended below.

* Women of childbearing age, infants and children under the age of 15 should not eat fish with elevated contaminant levels. The fish species listed from the waters below have contaminant levels that exceed federal food standards and most fish taken from these waters contain elevated contaminant levels.

* Observe the following restrictions on eating fish from these waters and their tributaries to the first barrier impassable by fish:

Water	Species	Recommendation
Hudson River		
- Hudson Falls to Troy Dam	All species	No fishing.
- Troy Dam south to & including the lower NY Harbor	American eel, White perch, Carp, Goldfish White catfish	Eat none.
	Walleye, Rainbow smelt, Largemouth bass, Smallmouth bass, Atlantic Needlefish, Bluefish, Northern pike Tiger muskellunge	Eat no more than one meal per month.
	Blue crab	Eat no more than 6 crabs per week
	- hepatopancreas (mustard, liver or tomalley)	Eat none.
	- cooking liquid	Discard.
- Troy Dam south to Tappan Zee Bridge	Striped bass	Eat none.
- Tappan Zee Bridge south to & including lower NY Harbor	Striped bass	Eat no more than one meal per month.

no more than one meal per month" to an "eat none" recommendation, depending on the fish species and location. The current (1992-1993) advisory for the Hudson River is provided in Figure 3. The 1991-92 advisory, which differs with respect to consumption recommendations for several lower Hudson River species, is provided as an appendix.

Evaluating the Effectiveness of Health Advisories

The reliance on advisories in place of mandatory regulations limiting the taking of fish is based on the assumption that anglers are aware of the relevant advisories and understand the consequences of their decision to abide by or ignore them (Knuth, 1991). Unfortunately, there is a dearth of empirical evidence nationally to evaluate whether advisories are effective in protecting recreational or subsistence anglers from unsafe levels of exposure to toxics through fish consumption (NAS, 1991; US Dept. of Commerce, 1990).

Although there has long been ample anecdotal information indicating extensive fish consumption by anglers on the Hudson River, here, too, there has been a lack of effort to quantify this phenomenon and assess its significance as a public health threat. Several studies of angling which are relevant to the Hudson do confirm that there is cause for concern.

In 1985 the New Jersey Department of Environmental Protection released "A Study of Toxic Hazards to Urban Recreational Fishermen and Crabbers" (NJ DEP, 1985), a multidisciplinary study to determine bioaccumulation of PCBs and pesticides in fish, to correlate findings with models that demonstrate risks to humans from consumption of contaminated fish and to determine how anglers perceived these risks. The study was based on interviews with anglers at six locations around the lower Hudson River - Upper Bay - Newark Bay system. The results showed that there was significant rejection of health advisories and a high probability of excess cancers from lifetime consumption of several species of the recreationally caught fish.

The 1988 "New York Statewide Angler Survey" (NYS DEC, 1990), based on results of a survey mailed to 17,000 licensed anglers statewide, found extensive fishing activity and rates of fish consumption well above the national average. Another statewide survey, "Effects of the Health Advisory and Advisory Changes on Fishing Habits and Fish Consumption in New York Sport Fisheries" (Connelly, 1992), also based on a survey mailed to licensed anglers, found that while general awareness of advisories was high, knowledge of the general "eat no more than one meal per week" advisory for all New York waters was very low. This study found 20% of surveyed anglers reported fish consumption in excess of amounts recommended by the advisories.

"The Characterization of Angler Activity on the Hudson River Estuary" (Green, 1991)

reported on results of surveys conducted with 378 fishing parties, fishing from shore and from boats, on the Hudson River between Stuyvesant and Kingston. The study found that 78% of shore-based anglers were aware of advisories, and 33% of these anglers planned to eat their catch. Anglers fishing from boats were more likely to be aware of the advisories and less likely to eat their catch.

An ongoing research project, "The New York State Angler Cohort Study" (Vena, 1992), seeks to establish a cohort of anglers who consume sport-caught fish from Lake Ontario for ongoing epidemiological studies and to evaluate knowledge of the health advisories. The study is based on responses to a survey mailed to 30,000 licensed anglers living in 16 counties around Lake Ontario. This study also found extensive fish consumption occurring despite the existence of health advisories. While this study deals only with Lake Ontario, its results are of interest to the Hudson, as the two water bodies have comparable levels of PCB contamination in fish (due in both cases to accumulation of discharged contaminants in sediments), and are subject to similar consumption advisories.

When comparing results of these several studies to each other and the Hudson River Angler Survey, it must be remembered that there are important differences among them. The New Jersey study was based on surveys conducted nearly 10 years ago. Green's study included interviews with boat- and shore-based anglers along one particular reach of the Hudson River. The statewide survey (NYS DEC, 1990), Connelly (1992) and the Lake Ontario cohort study (Vena, 1992) were based on surveys mailed to licensed anglers. Different survey methodologies could yield different results and careful interpretation is required.

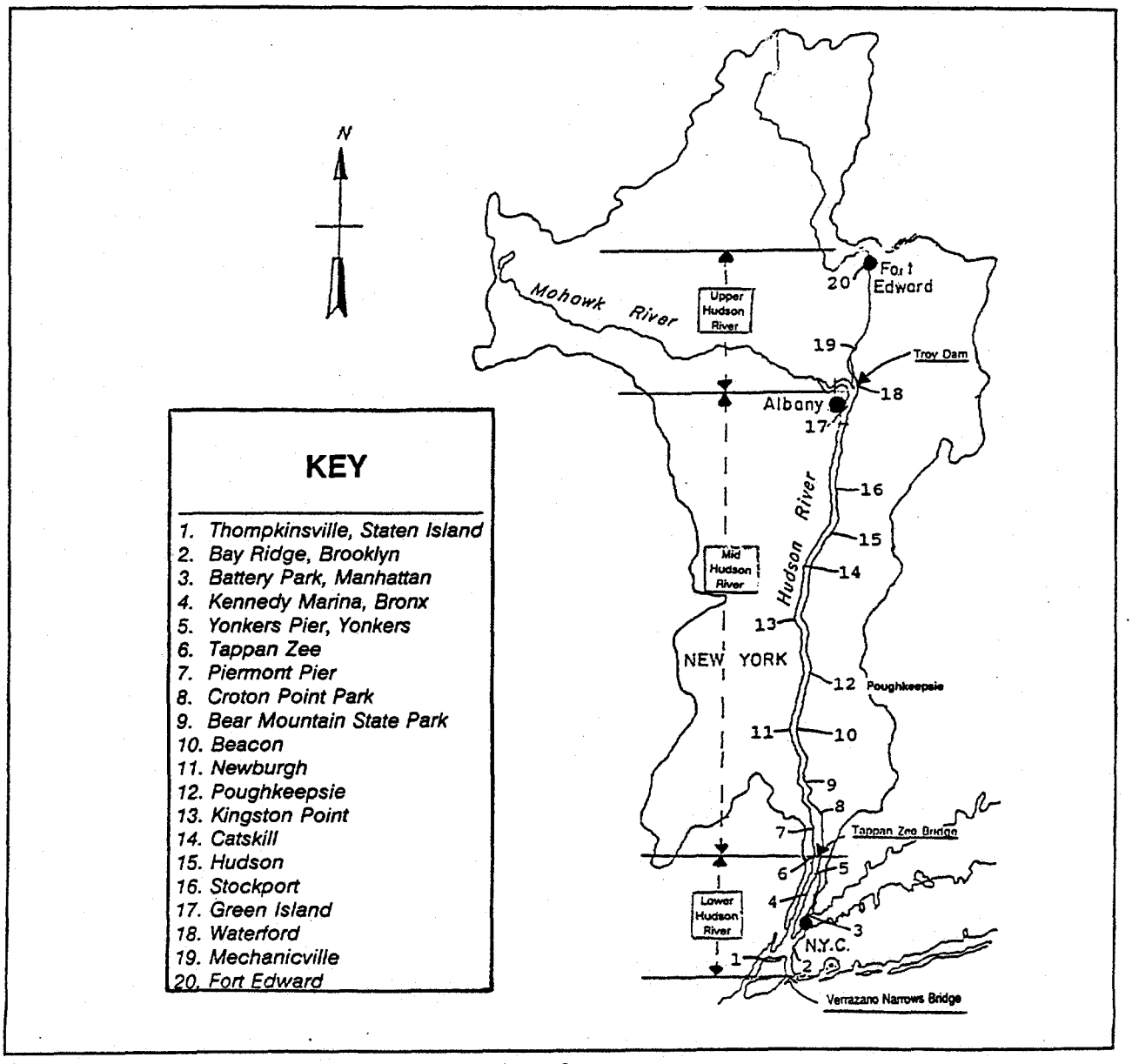
An understanding of anglers' knowledge of and attitudes towards contamination and associated health risks is critical to the success of efforts to influence anglers' behavior (Knuth, 1991; Reinert, 1991; NJDEP, 1985) The purpose of Clearwater's Hudson River Angler Survey is to provide more recent site-specific information regarding fishing and fish consumption habits, and perception of and adherence to consumption advisories, among Hudson River anglers, so that increased knowledge and understanding of these issues will lead to more effective risk communication and a reduction in exposure to PCBs.

METHODOLOGY

Clearwater's Hudson River Angler Survey was carried out through detailed interviews with shore-based anglers intercepted at known fishing access sites along the Hudson River in New York State, within the areas covered by health advisories and fishing bans (see Fig. 4).

Initial reconnaissance revealed that, while anglers utilize a major portion of the accessible waterfront, fishing activity tended to be heavily concentrated in certain areas. Final survey sites were screened and selected based on observations of use by anglers and legal accessibility. In this way, survey efforts could be maximized. This approach is similar to that used by other researchers seeking to interview anglers (Green, 1991; Heatwole, 1985; NJ DEP, 1985). The survey included upper Hudson, Mid-Hudson and lower Hudson sites, and sites that were both

Figure 4: Location of Hudson River Interview Sites



urban and rural in nature. Interviewers visited survey sites on weekends and weekdays and during morning, miday and evening periods.

Because the sample was not purposefully designed to interview anglers fishing from boats or from all river reaches, or fishing at all possible times, the results cannot be directly extrapolated to the entire population of Hudson River anglers. These data do, however, document the behavior and attitudes of representative anglers for the times and locations presented in this survey.

Anglers were questioned in detail about their fishing and fish consumption habits, perceptions of presence of contaminants in fish, perceptions of risks associated with consumption of recreationally caught fish, and awareness of, attitude towards, and response to fish consumption advisories or fishing bans. All questions were field-tested prior to use to validate clarity, and were designed to minimize interviewer bias. Many of the questions were taken from earlier published angler surveys. The survey methodology and questionnaire were reviewed by academic researchers familiar with risk perception and communication surveys, and especially with angler surveys. Other relevant studies where also reviewed in order to gain further insight into fishing, fish consumption and awareness of and adherence to consumption advisories among Hudson River anglers (Connelly, 1992; Vena, 1992; Green, 1991; NYS DEC, 1988; NJ DEP, 1985; Heatwole, 1983).

For purposes of some comparisons the survey area was divided into three separate geographic regions: the upper Hudson (Ft. Edward to the Troy Dam), the mid-Hudson (south of the Troy Dam to the Tappan Zee Bridge) and the lower Hudson (south of the Tappan Zee Bridge to the Verrazano Narrows). The boundaries used coincide with boundaries cited in the health advisories. During the time interviews were being conducted, the health advisories were revised and consumption recommendations for a number of lower Hudson River species were relaxed. Unless otherwise specified, evaluations of anglers' knowledge of or adherence to health advisories were based on the advisories in place at the time the angler was interviewed.

RESULTS AND DISCUSSION

Demographic Data

Clearwater conducted interviews with 336 anglers at twenty shorefront locations along the Hudson River from Fort Edward to the New York Harbor in New York State). All surveys were conducted between June and November of 1991 and April and July of 1992. Just over half (52%) of anglers were interviewed on week-end days. Interviewers experienced very little suspicion or unwillingness to participate on the part of anglers; interviews were completed with 95% of all anglers approached.

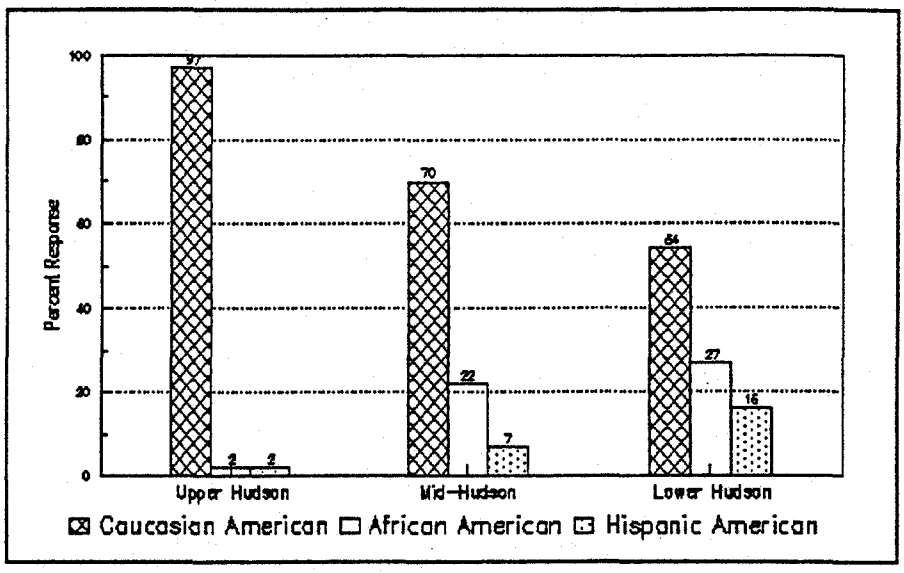
Figure 5: Socio-Demographic Characteristics of Respondents

Geographic Distribution	Upper Hudson	18%
	Mid Hudson	35%
	Lower Hudson	48%
Age Distribution	< 14	3%
	15-29	26%
	30-44	35%
	45-59	23%
	> 60	12%
Annual Household Income	< $10,000	16%
	$10 - 29,999	41%
	$30 - 49,999	29%
	$50 - 69,999	10%
	$70 - 89,999	2%
	> $90,000	3%
Ethnic Background	Caucasian American	67%
	African American	21%
	Hispanic American	10%
	Oriental American	1%
	Native American	1%

Demographic data are summarized in Figure 5. Survey respondents were predominantly male (92%) and between the ages of 15 and 59. More than half of the anglers interviewed had an annual household income of less than $30,000. The average reported household size was 3.1 people. The dominant ethnicity of the sample (67%) was Caucasian American, but this

percentage became progressively smaller in going from the upper Hudson to the mid-Hudson region and the lower Hudson (see Fig. 6). The most common reason given for fishing was for recreation or enjoyment.

Figure 6: Ethnic Background of Anglers by Region



Targeted Species

Almost one-fifth of the anglers who eat their catch (18%) indicated they were trying to catch crabs. A somewhat larger number (23%) indicated they were not trying to catch any specific type of fish. Of those trying to catch a specific species of fish other than crab (70% of all anglers who eat their catch), striped bass was mentioned most frequently, followed by bluefish, white perch and white catfish[5].

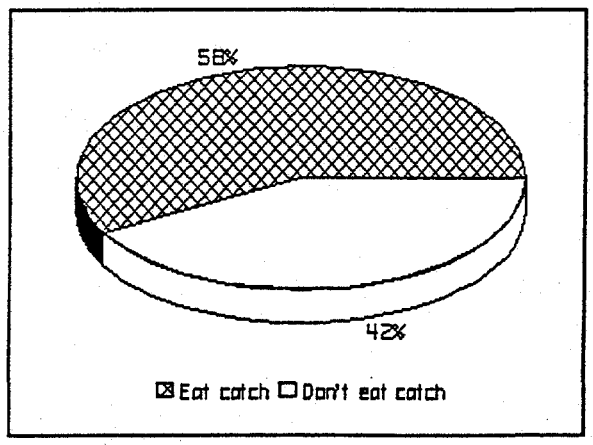
Those species that were most popular among anglers are subject to specific consumption advisories on the Hudson. For white perch and white catfish the recommendation is to "eat none"; the advisories recommend eating no more than one meal per month of bluefish and no more than 6 crabs per week; for striped bass the advisory varies from "eat none" from the Troy Dam south to the Tappan Zee Bridge, to "eat no more than one meal per month" from the Tappan Zee south[6].

[5] Total does not add to 100% because some anglers were fishing for both crabs and a specific fish species.

[6] In the 1991-92 health advisory the recommendation was to eat no striped bass from anywhere on the Hudson River.

Fish Consumption

Figure 7: Fish Consumption by Anglers

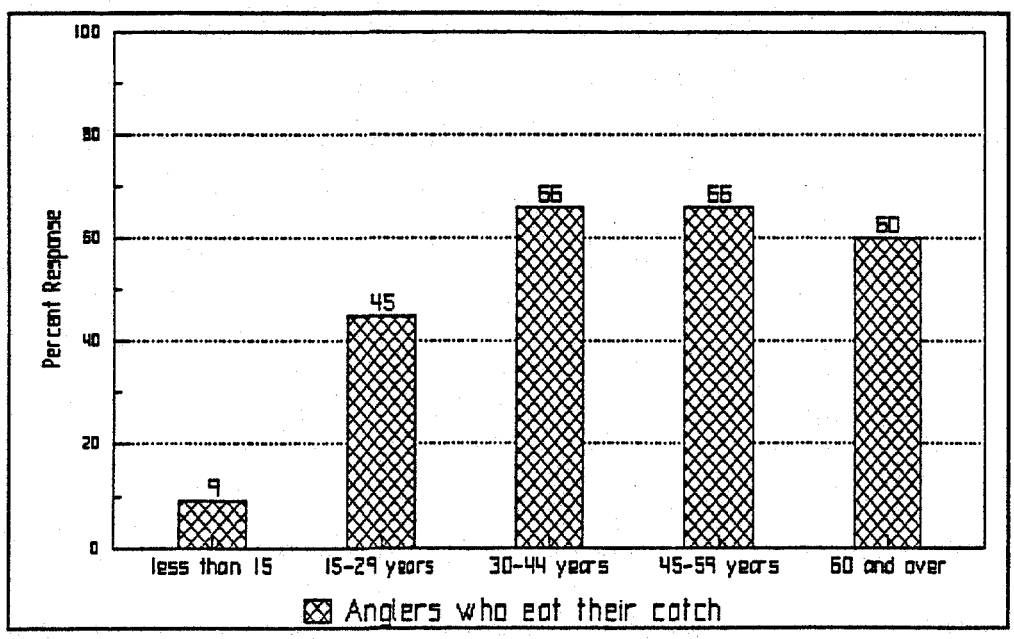


Over 58% of those surveyed indicated that they eat their catch (see Fig. 7). Of those anglers who eat their catch 48% report being aware of advisories. Of all anglers surveyed, 72% report eating their catch and/or giving it away to others whom they believe are eating it. Of those who indicated they do not eat their catch, 24% did so in the past. The most common reasons that anglers do not eat their catch are contamination (67%), including PCBs specifically, and dislike of fish (22%).

Sociodemographic Factors

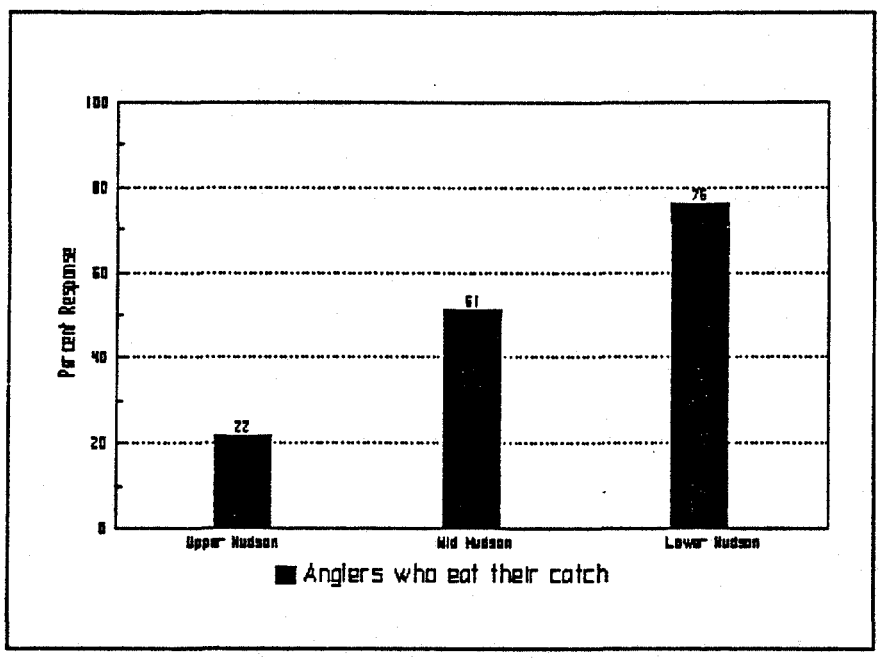
The anglers' age, location and ethnicity all appear to influence fish consumption behavior. Anglers over 30 are much more likely to eat their catch than those under 30 (see Fig. 8).

Figure 8: Fish Consumption by Age Group



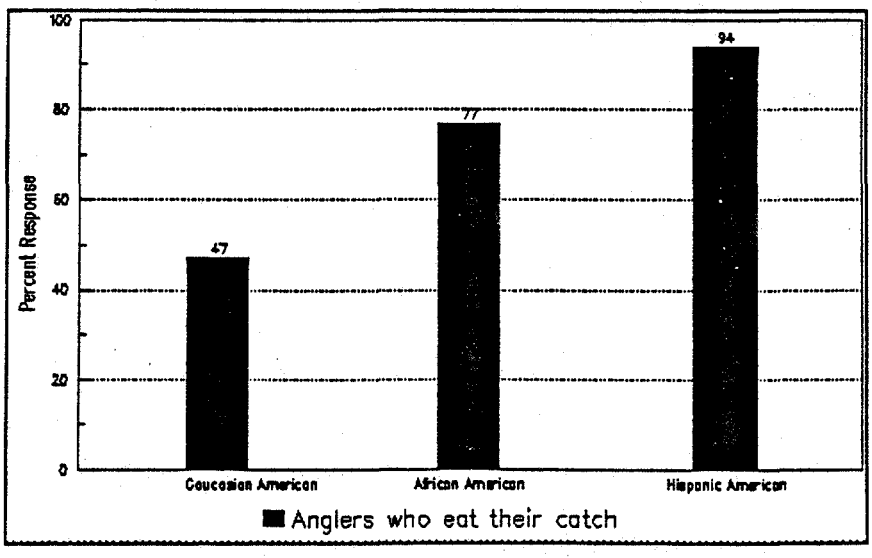
The results show a distinct geographic difference in fish consumption behavior, with those on the upper Hudson, above the Troy Dam, being least likely, and those on the lower Hudson being most likely, to eat their catch (see Fig. 9).

Figure 9: Fish Consumption by Geographic Range



Ethnicity was also found to be an important factor influencing fish consumption, with Caucasian Americans followed by African Americans being least likely, and Hispanic Americans being most likely, to eat their catch (see Fig. 10). Very few Asian Americans and Native Americans were interviewed in this survey.

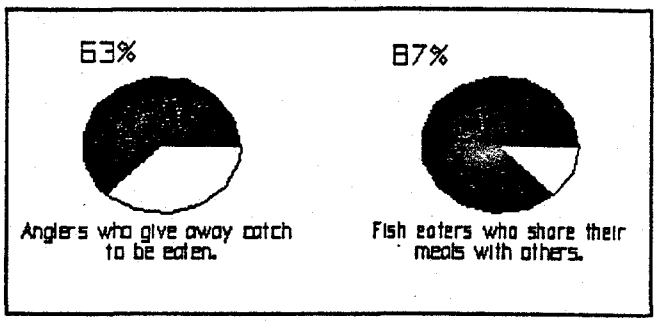
Figure 10: Fish Consumption by Ethnic Group



Secondary Consumption

Of those who eat their catch, 87% were also likely to share the fish meals they eat with others (see Fig. 11). To the extent that such data were available, at least 58% of those sharing their fish meals do so with women of childbearing age and children under the age of fifteen. Furthermore, a significant amount of recreationally caught fish is being given away to be consumed by someone other than the angler -- fully 63% of all anglers report giving away at least some of their catch to be eaten by others.

Figure 11: Extent of Secondary Consumption



Frequency of Fish Consumption

The average frequency of fish consumption reported was just under one (0.9) meal over the previous week and three meals over the previous month. Over half (55%) of those anglers who reported eating their catch had not done so within the last week, 23% had eaten one meal and 22% had eaten more than one meal. Over two-thirds (69%) of those anglers who reported eating their catch had done so within the last month, and almost half (48%) had eaten sport-caught fish more than once in the last month.

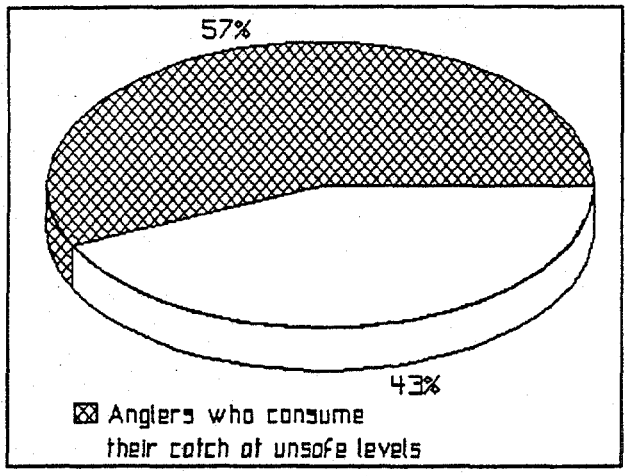
Unsafe Fish Consumption

For the purposes of this study, consumption levels are considered to be unsafe if they are in excess of the amounts recommended by the New York State health advisories. This definition includes any consumption of fish caught between Hudson Falls and the Troy Dam, any consumption by women of childbearing age or children under the age of fifteen, or consumption beyond the general advisory recommendation to eat no more than one meal per week. By this definition, at least 35% of all anglers who are eating their fish do so unsafely.

For nine lower Hudson River species there is a restrictive advisory recommending consumption of no more than one meal per month[7]. When those anglers are considered who

[7] These include bluefish, walleye, largemouth and smallmouth bass, rainbow smelt, atlantic needlefish, northern pike, tiger muskellunge and striped bass caught below the Tappan Zee Bridge, according to the 1992-93 advisory.

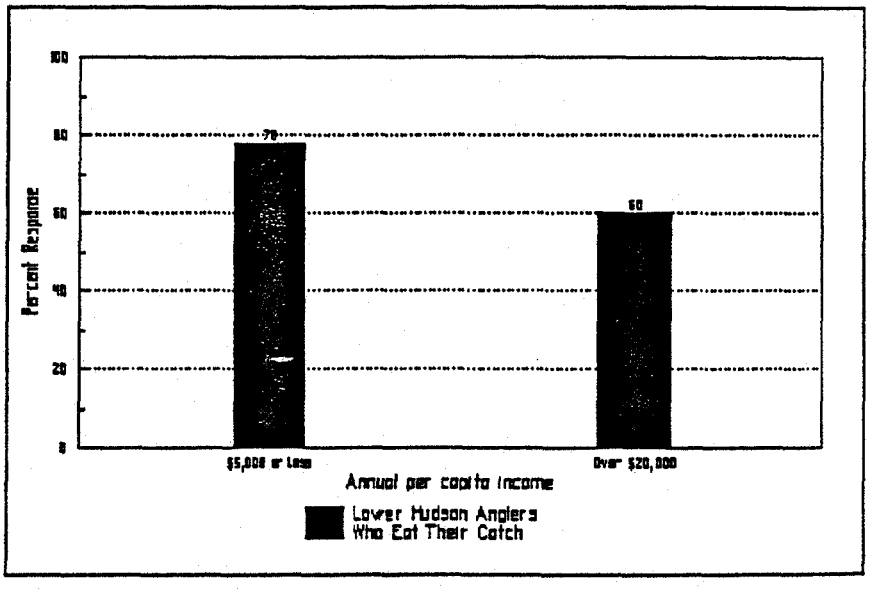
Figure 12: Extent of Consumption at Unsafe Levels



reported eating more than one fish meal per month, over 57% of anglers who eat their catch may be doing so unsafely (see Fig. 12). These may be conservative estimates, since they do not include the consumption of those lower Hudson species for which the state recommendation is "eat none."[8] It should be noted that we did not draw any conclusions regarding the specific fish species anglers consumed based on what they were trying to catch, or had caught at the time of their interview. As noted earlier, there is additional unsafe fish consumption occurring when anglers share fish meals with, or give away their catch to, women of childbearing age and children under the age of fifteen.

Subsistence Angling

Figure 13: Evidence of Subsistence Fishing on the Lower Hudson



More low-income anglers than upper-income anglers eat their catch, particularly among lower Hudson anglers (see Fig. 13). Almost 10% of all respondents said that "food" was the primary reason they fish, and another 26% said it was one of the reasons they fish. Those who fish primarily for food are more likely to be in the lowest per capita income group (39% v. 12% in the highest per capita group).

[8] This includes american eel, white perch, carp, goldfish, white catfish and striped bass caught above the Tappan Zee Bridge, according to the 1992-93 advisory. In addition to these species, the 1991-92 advisory also recommended no consumption of brown bullhead, largemouth bass, pumpkinseed, walleye and striped bass caught below the Tappan Zee Bridge.

General Discussion

Findings among Hudson River anglers were largely consistent with results of other fish consumption surveys in New York and New Jersey. Statewide, 89% of anglers eat sport-caught fish. While the percentage of Hudson River anglers who eat their catch is significantly lower than this, the statewide survey probably would have included anglers who generally fish in less contaminated waters. The statewide survey reported average fish consumption of 45.2 meals per year, which exceeds the national average by 50% (NYS DEC, 1990).

Connelly (1992) found that 20% of anglers statewide reported eating their catch at levels that exceeded the health advisory recommendations, compared to 35% to 57% (depending on the assumptions made) of Hudson River anglers who reported eating their catch at "unsafe levels" in this survey.

Other surveys have found, as did the Hudson River Angler Survey, that consumption increases with age, and that low-income and minority anglers are the most likely to eat their catch (Connelly, 1992; Vena, 1992; NYS DEC, 1990). This higher incidence of fish consumption among low-income anglers, and the greater likelihood that they are fishing primarily for food, indicates that some part of the fish consumption on the Hudson River derives from subsistence, as opposed to recreational, fishing.

Special note should be made of the significant amount of secondary consumption that occurs when anglers give away their catch or share fish meals with others. Because many of these secondary consumers may not be anglers themselves, they may not receive information on health advisories through means that primarily target anglers (e.g., publication in the Fishing Guide). Little effort has been made to evaluate to what extent this group is at risk. Of particular concern is the large proportion of women of childbearing age and children among the secondary consumers, despite the advisory recommendation that these individuals eat no fish from the Hudson River (or any other water body with elevated contamination levels).

Any effective effort to communicate health risk information to anglers should acknowledge ethnic and cultural differences among anglers and the existence of subsistence fishing (Knuth, 1990). Studies have shown that minority and subsistence anglers are more likely to consume greater amounts of fish and are more likely to eat whole or untrimmed fish that have higher levels of contamination (Knuth, 1991; Reinert, 1991; Heatwole, 1983). Due to language or other cultural barriers, minority anglers may be harder to reach with advisory information. Subsistence anglers are likely to be more resistant to advice to limit their consumption because

they probably perceive a greater benefit derived from consumption of their catch than does the purely recreational angler.

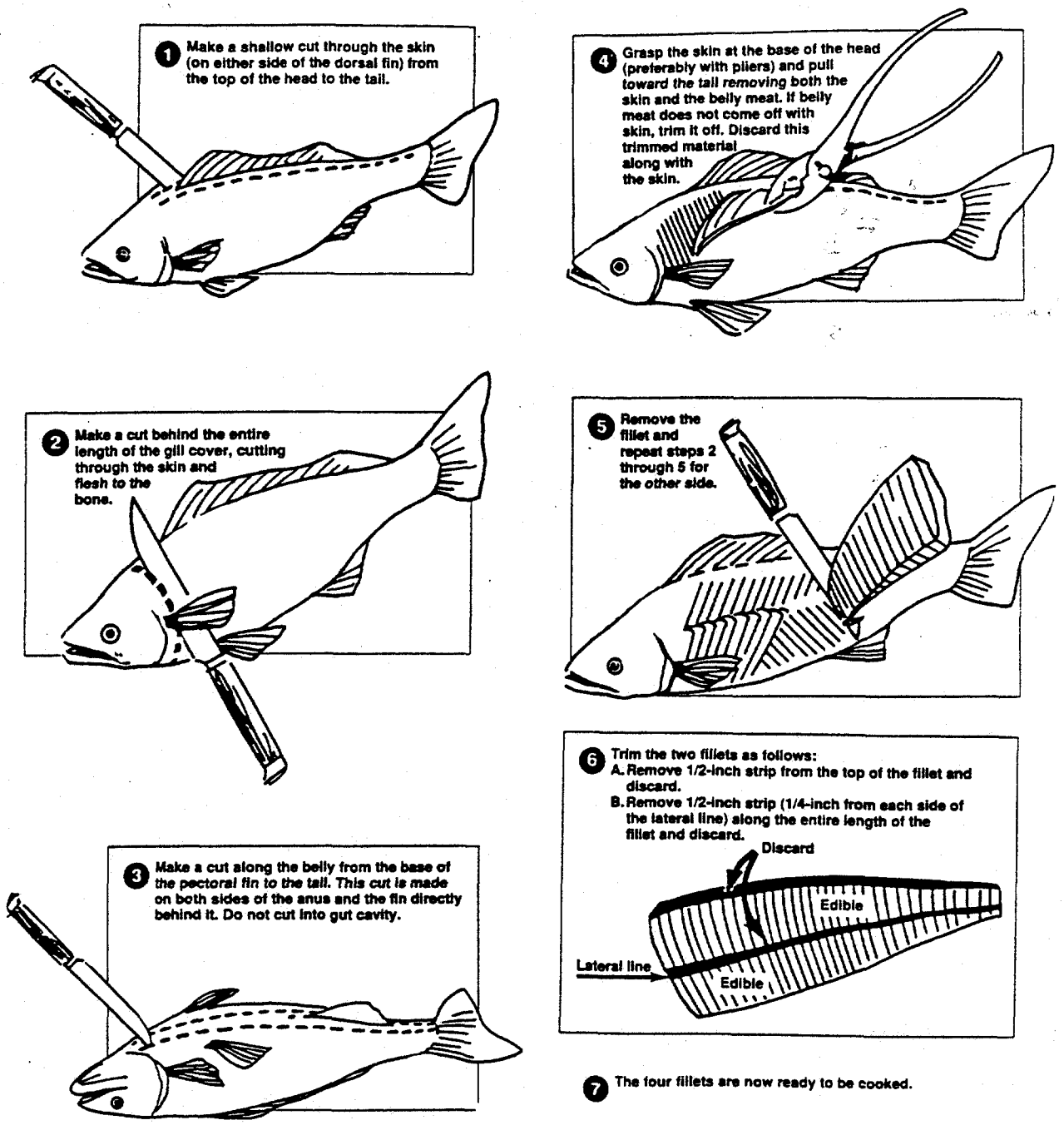
An encouraging note is the finding that those who do not eat their catch are much less likely to give away their catch to others. Any efforts which result in better communication of advisories to anglers should have some benefits among secondary consumers as well. However, the survey did find some anglers (a total of 23) who do not eat their catch due to concern over contamination, but still report giving away their catch to be eaten by others.

Use of Risk-Reducing Cooking and Cleaning Techniques

New York State health advisories recommend to anglers the use of certain cleaning and cooking techniques, such as removing the skin, filleting fish, trimming back fat and belly meat, and baking, barbecuing or poaching, to reduce the amount of fat in the finished meal (see Fig. 14). This advice is based on the fact that many environmental contaminants, including PCBs, are fat-soluble. Reducing the amount of fat will, therefore, reduce the amount of contamination in the meal. Conversely, other cooking and cleaning methods, such as eating the fish whole, pan frying, making soup or chowder or reusing oil or fat from cooking fish, are not recommended, as these will retain the majority of fat and contaminants.

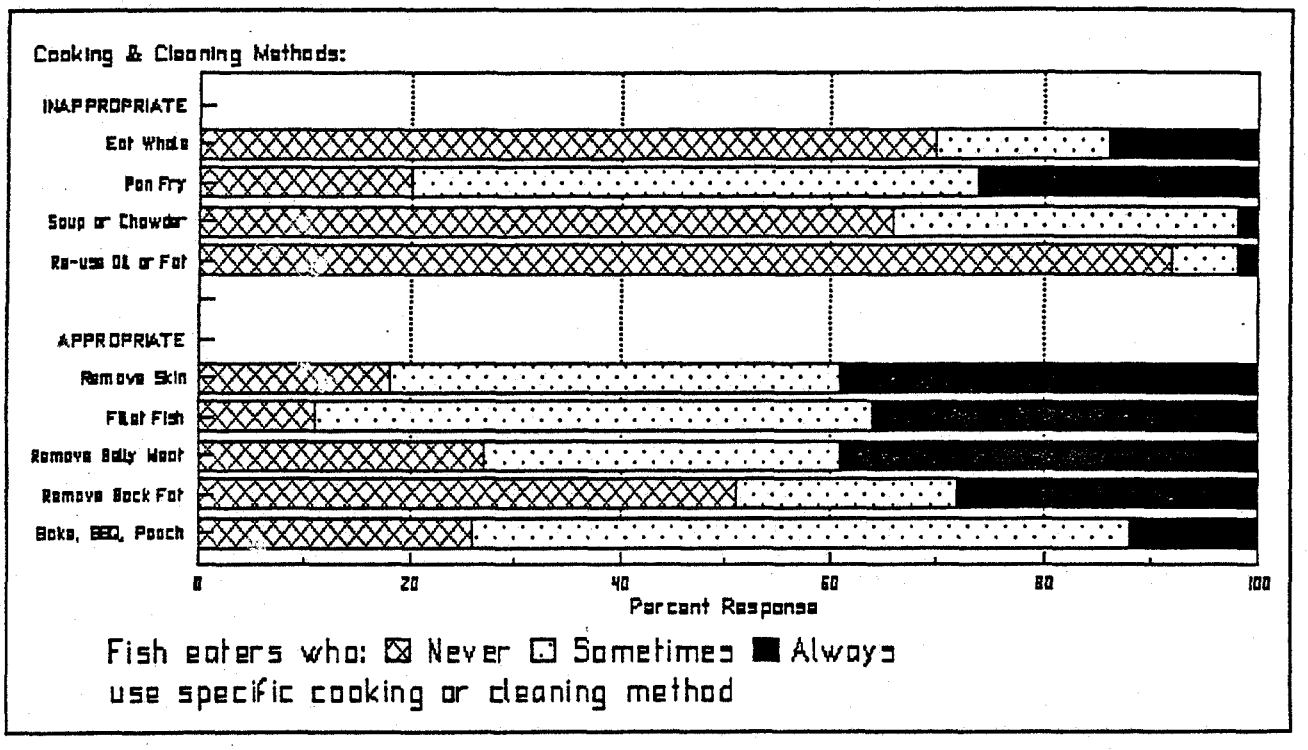
While less than half of all anglers (44%) believe there are things that can be done to make their catch safer to eat, many of these anglers (44%) obviously interpreted this question as pertaining to food spoilage and gave examples of actions that are irrelevant to the issue of toxic contamination (e.g., "keep fish cold"). Less than a third (28%) of those who believe there are actions that can make fish safer to eat identified methods that do, in fact, reduce contaminant levels (e.g., "remove skin and fat"), while an equal number of respondents gave examples of cooking or cleaning techniques that would not be effective in reducing contaminant levels in the finished meal. The most commonly cited "ineffective" method was the idea of soaking the fish in a variety of substances (i.e., beer, water, lemon juice or vinegar), mentioned by 19% of anglers who provided a response.

Figure 14: Fish Trimming Techniques (Voiland, 1990)



Significant numbers of anglers who eat their catch are using cleaning or cooking methods that are not recommended, particularly pan frying, which was used by 80% of anglers who eat their catch. Less than 40% of those who are eating their catch are consistently using risk-reducing methods (see Fig. 15).

Figure 15: Prevalence of Different Cooking and Cleaning Methods



General Discussion

There is clearly a great deal of misinformation among anglers as to how fish can be made safer to eat. The idea of soaking the fish (in beer, water, lemon juice, vinegar, etc.) was repeated with disturbing frequency, and is indicative of fundamental misunderstanding about the nature of chemical contaminants found in fish.

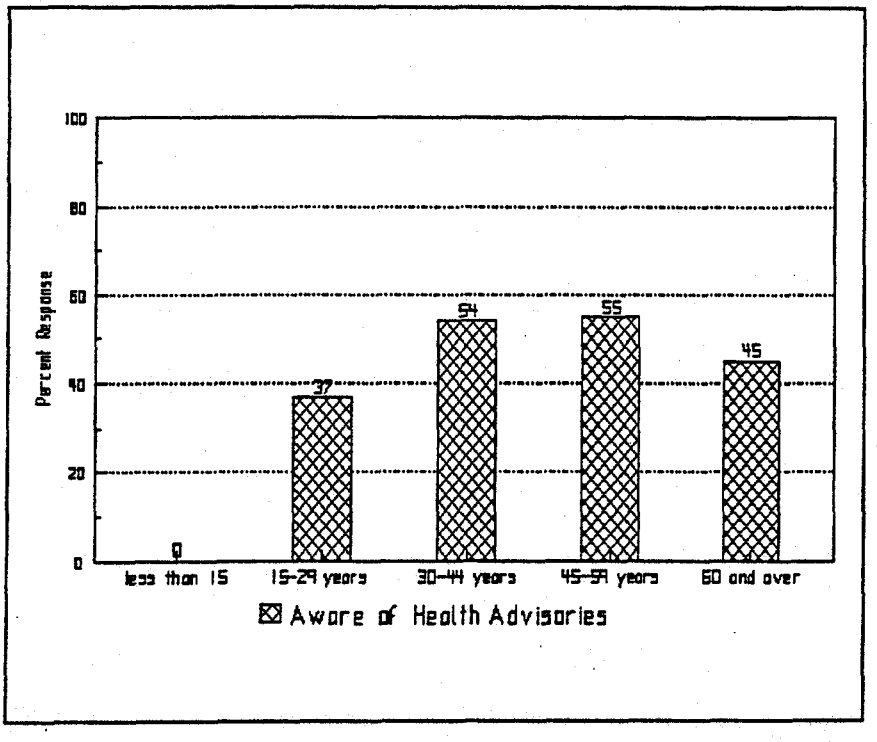
The relatively small proportion of anglers who provided examples of risk-reducing cooking and cleaning methods was consistent with the small proportion of anglers who reported actually using those methods. The common reported use of some cooking and cleaning methods (such as removing skin, filleting fish, baking) may be as much due to food preferences as concern about contaminants. Those techniques that appear least related to matters of taste or aesthetics (such as trimming back fat or belly meat) were least likely to be used.

Use of certain cooking and cleaning methods has been shown to reduce contamination levels in fish meals (Voiland, 1990), but does not necessarily render fish safe for unlimited consumption. A recent study on the effect of cleaning techniques (Voiland, 1990) found that reductions in PCB levels were significant, but varied widely (from 29% to 63%). As fish increase in size, condition (or fatness) and age, the PCB levels in the "edible" portion of fish increase, making contamination reduction techniques less effective. The study went on to suggest that this indicates the importance of following the recommendations to preferentially select younger, smaller fish for consumption.

An important concern, about which little information exists, is to what extent anglers are successful in accurately implementing the recommended cleaning techniques, and what actual contaminant reduction levels they are achieving.

Awareness of and Effectiveness of Health Advisories

Figure 16: Awareness of Health Advisories by Age Group



Level of Awareness

Less than half (48%) of all the anglers interviewed are aware of the State health advisories or fishing bans. Those under 30 are less likely to be aware of the advisories (see Fig. 16), as are those fishing on the Lower Hudson (see Fig. 17). Caucasian Americans are more likely than minority group members to be aware of the advisories (see Fig. 18).

Figure 17: Awareness of Health Advisories by Region

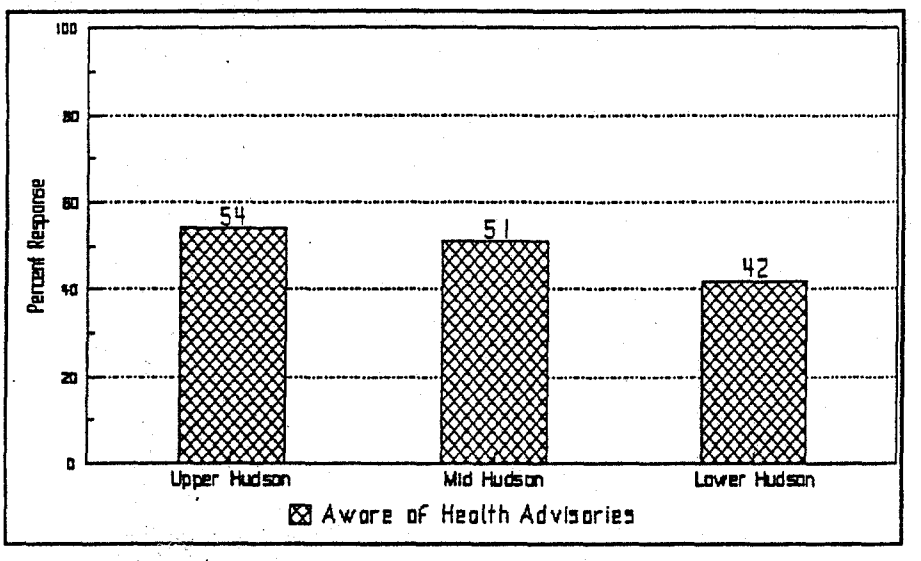
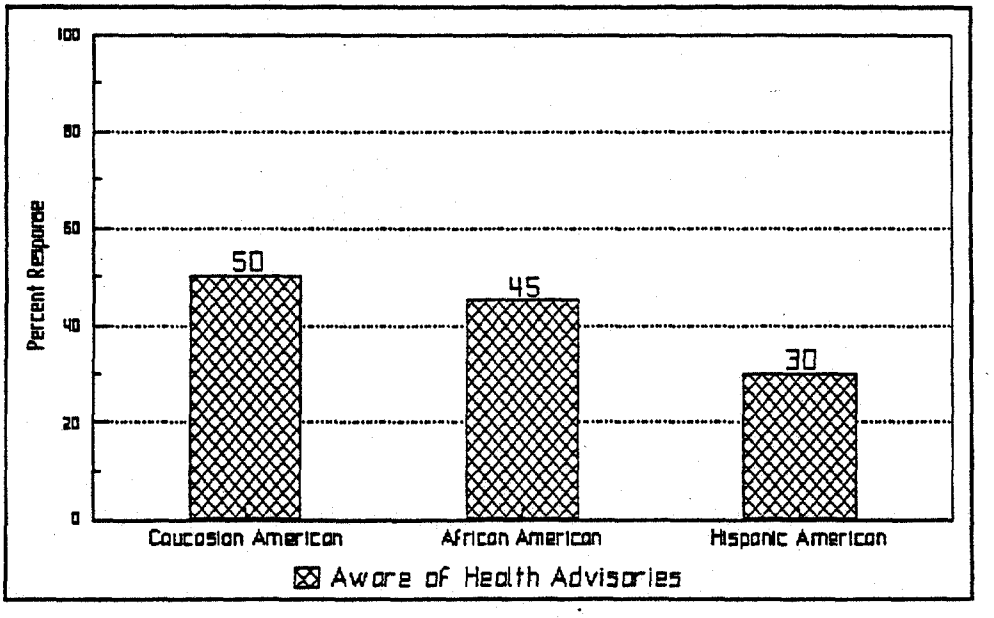


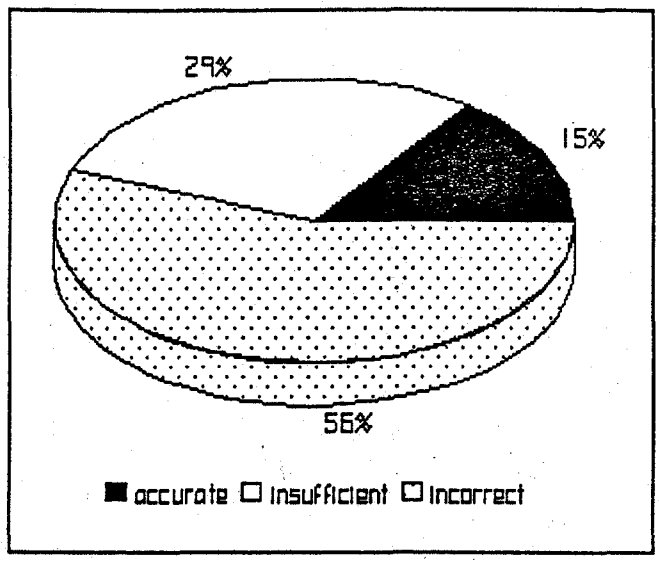
Figure 18: Awareness of Health Advisories by Ethnic Group



Accuracy of Knowledge

In addition to a minority of anglers being aware of advisories, only 15% of them could accurately describe the advisories of which they are aware. Most of the responses from aware anglers were either factually incorrect (more than half), or reflected insufficient knowledge with respect to their area or the fish they were trying to catch (see Fig. 19). Thus, of all anglers surveyed, less than 7% have accurate knowledge of the fish consumption advisories.

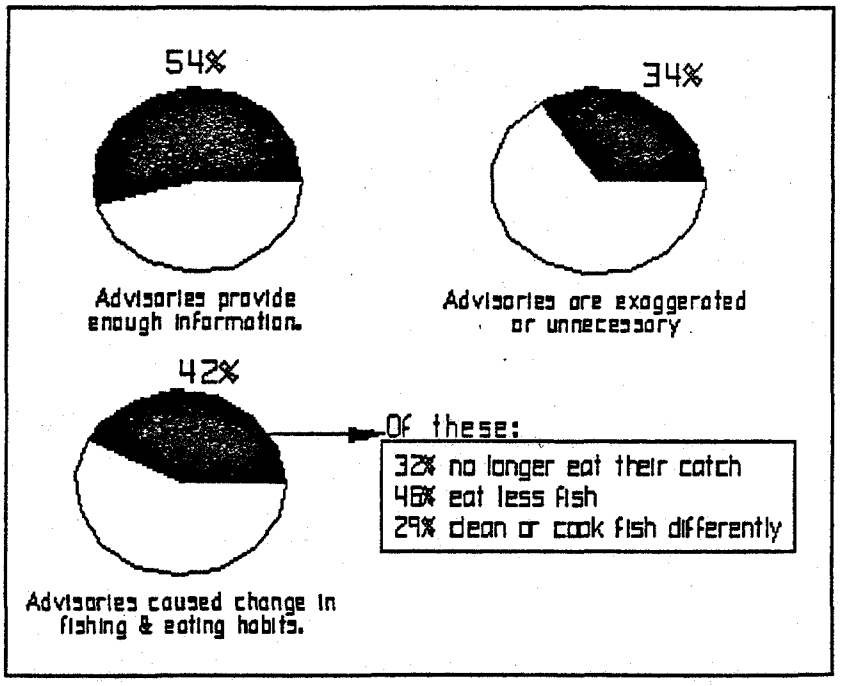
Figure 19: Accuracy of Knowledge of Health Advisories Among Aware Anglers



Response to Advisories

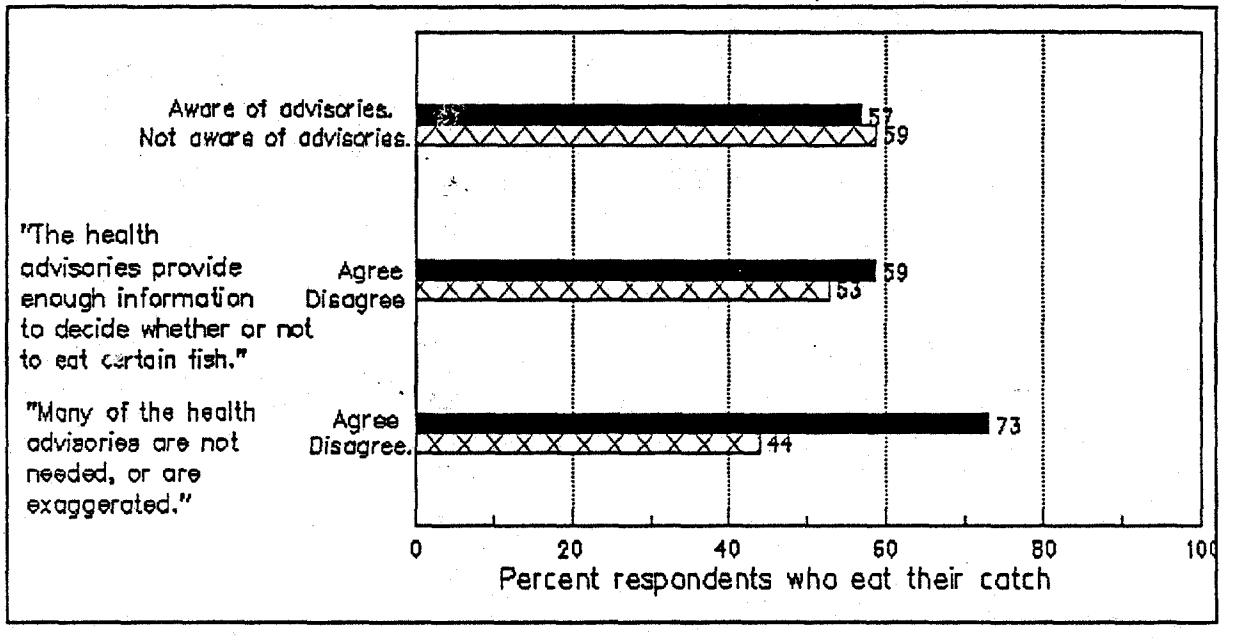
Only 42% of these aware anglers said they have changed their fishing habits or fish consumption habits as a result of the advisories. The most common change made was to eat less fish (See Fig. 20). Just over half (54%) of those who are aware of advisories believe that they provide enough information for them to decide whether to eat certain fish. Fully one-third (34%) believe the advisories are exaggerated or unnecessary.

Figure 20: Perception of Health Advisories



Survey responses indicate that those who are aware of advisories are not appreciably less likely than those not aware to eat their catch: 57% of those who are aware and 59% of those who are not aware eat their catch (see Fig. 21). Nor is there a substantial difference in the amount of fish meals consumed per week between anglers who are aware of advisories and those who are not. With respect to the likelihood of giving away their catch to be eaten, again, anglers do not seem to be influenced by awareness of advisories: 63% of aware anglers and 61% of unaware anglers give away their catch to be eaten.

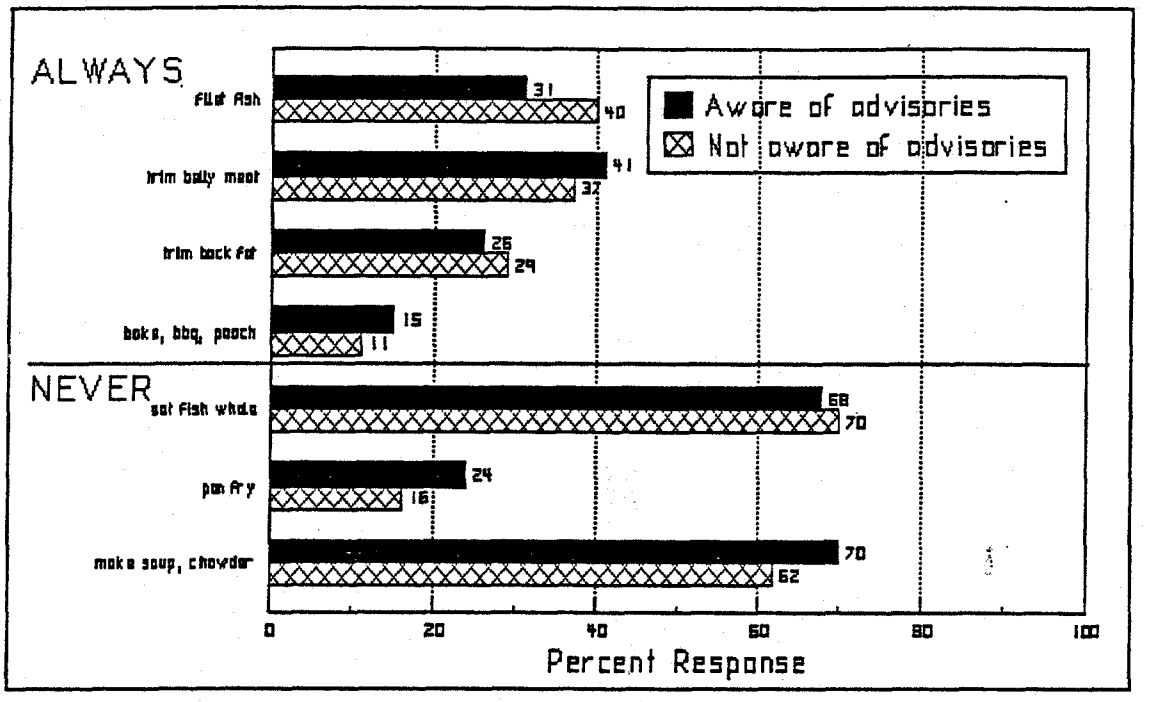
Figure 21: Effect of Health Advisory Perceptions on Fish Consumption



There is little difference in likelihood of fish consumption between those who believe the health advisories provide enough information and those who do not believe so (59% v. 53%). Anglers who think advisories are unnecessary or exaggerated are much more likely to eat their catch (73% v. 44% - see Fig. 21).

While those who are aware of advisories are more likely to state accurately what steps could be taken to make fish safer to eat after they are caught (40% v. 12%), the two groups do not substantially differ in their actual use of appropriate cooking and cleaning methods (see Fig. 22).

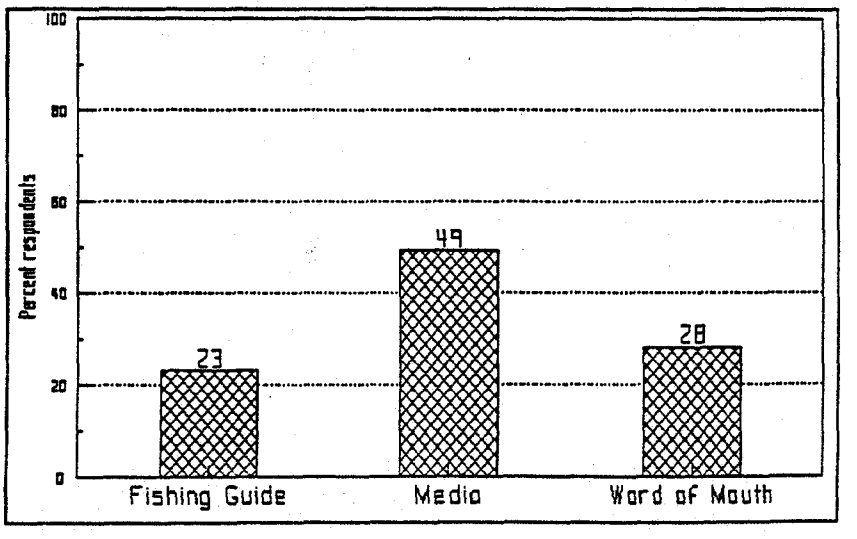
Figure 22: Influence of Health Advisories on Cooking and Cleaning Methods



Source of Health Advisory Information

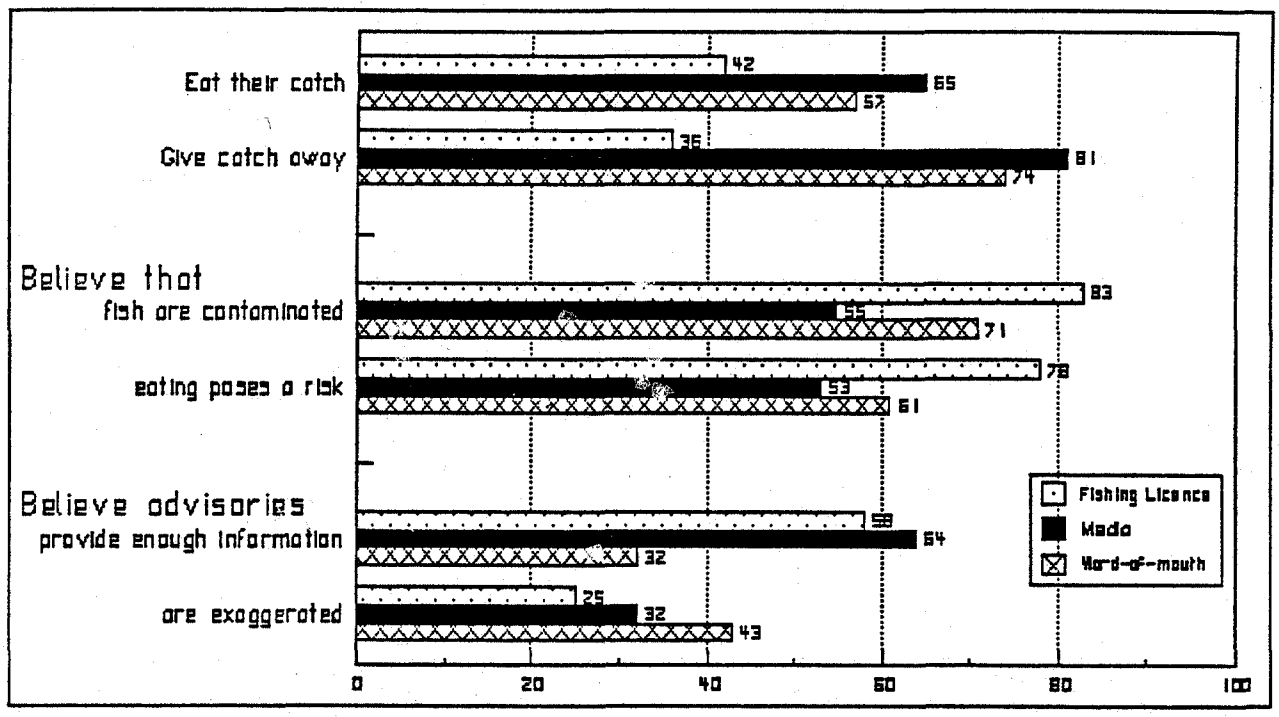
Anglers reported learning of the advisories through a number of sources: the media (49%), word of mouth (28%) and the Fishing Guide (23%) (see Fig. 23). Although there are "No Fishing" signs posted along the upper Hudson, only three anglers (all from the upper Hudson sites) mentioned signs as their source of information.

Figure 23: Source of Health Advisory Information



Those anglers who learned of the advisories through the Fishing Guide are the least likely to eat their catch and the least likely to give their catch away to be eaten. They are also more likely to believe that the fish are contaminated and that there is a health risk from eating the fish (see Fig. 24).

Figure 24: Anglers' Beliefs and Practices as a Function of Source of Health Advisory Information



Those who learned of the advisories through word of mouth are the least likely to believe that the advisories provide enough information to decide whether to eat certain fish, and most likely to believe advisories are exaggerated or unnecessary. There is no appreciable difference in whether anglers made changes in fishing or fish consumption patterns depending on whether they learned of advisories from the Fishing Guide (39%) or the media (38%).

General Discussion

Reliance on voluntary advisories to manage the health risks associated with consumption of contaminated sport-caught fish assumes anglers are aware of advisories and understand the consequences of their actions to follow or disregard those advisories (Knuth, 1991). Therefore it is important to assess the level of awareness and understanding among anglers.

There is a substantial lack of awareness and accurate knowledge regarding health advisories among Hudson River anglers surveyed. Some groups -- the youngest and oldest anglers, members of minority groups, and lower Hudson anglers -- are particularly unlikely to be aware of advisories. With respect to age, geographic and ethnic distribution, those least likely to be aware of health advisories are also most likely to eat their catch.

The statewide angler survey (NYS DEC, 1990) and Connelly (1992) similarly found lower levels of awareness among certain groups, in particular, low income, less educated, non-white and women anglers. Ethical concerns have been raised about the appropriateness of relying on health advisories if they are not protective of groups that are potentially at higher risk but who have less political clout (West, 1990).

In general, based on the knowledge, attitudes and responses of anglers to the advisories, the Fishing Guide (distributed with purchase of a fishing license) appears to provide a more effective vehicle than does the media or word of mouth for communicating health advisory information. This is consistent with findings of both Connelly (1992) and the statewide survey (NYS DEC, 1990). Connelly (1992) also found that anglers who learned of advisories through personal contact with an expert exhibited the most accurate knowledge of the advisories.

The finding that there was no difference in whether anglers made changes in fishing or fish consumption patterns depending on the source from which they learned of the advisories seems to contradict other survey results which indicate the efficacy of the Fishing Guide as a means of communication. The apparent contradiction may be in part due to the fact that anglers who learned of advisories through the Fishing Guide are less likely to eat their catch and therefore less likely to report making any changes.

Our study found a much lower level of awareness among Hudson River anglers than was found in either the statewide survey (NYS DEC, 1990), Connelly (1992) or the Lake Ontario study (Vena, 1992): 82%, 85% and 92% of anglers, respectively, are aware of advisories. Connelly, (1992) also found more consistent use than was found in the Hudson River Angler Survey of risk-reducing cooking and cleaning methods. Each of these three studies was based on surveys mailed to licensed anglers. However, since no recreational fishing license is required for the Hudson, many of the Hudson River anglers interviewed may not be licensed. Results for the Hudson River were more consistent with results of the New Jersey angler survey (NJ DEP, 1985) (53% aware of advisories), which was also based on intercept interviews with anglers. This disparity in results between the two sets of studies supports the contention that Fishing Guide is an important, though less than perfect, means of communicating health advisories.

While the media does not appear to be the most effective mode of communicating advisories, they are the source that Hudson River anglers, as well as those anglers surveyed in the statewide survey (NYS DEC, 1990), rely on the most for information. Other studies have confirmed the importance of the media in communicating advisory information (NJDEP, 1985; Reinert, 1991; Connelly, 1992).

Clearwater's Angler Survey found the responses of anglers who learned of advisories through word of mouth were for the most part the same as those of anglers who learned of advisories through the media. But, not surprisingly, anglers who learned of advisories by word of mouth had the least confidence in the information they received.

Connelly (1992) did find significant differences in the sources from which individuals learned of health advisories, based on certain sociodemographic characteristics. Those anglers in the lowest income group were least likely to have learned of the advisories through the Fishing Guide. While few anglers overall reported using posted warnings as a source of information, non-white anglers, those in the lowest income group and households with children under fifteen were more likely than other groups to cite them as a source. This information can be used to better target efforts to communicate advisory information.

While the lack of awareness of advisories is clearly a problem, it appears that simple knowledge of advisories is not enough to prevent unsafe fish consumption behavior, as evidenced by the fact that just as many aware anglers as unaware anglers report eating their catch. Similarly, awareness of recommended cooking and cleaning techniques did not appear to result in a significant increase in their use.

Green (1991) found a higher level of awareness of advisories (78% of shore-based anglers), but similarly found no significant difference in fish consumption among aware and unaware anglers. Connelly (1992) found that those anglers who exceed the recommended consumption levels are just as aware and knowledgeable about the advisories as other anglers.

The relatively large numbers of anglers aware of advisories who did not change fishing or fish consumption habits (58%) is consistent with findings of the Lake Ontario study (Vena, 1992), the statewide survey (NYS DEC, 1990) and Connelly (1992): 60%, 39% and 46% of anglers, respectively, made no changes. While "eat less fish" was the most common change anglers identified in all four studies, Hudson River anglers aware of advisories did not report eating their catch less frequently than did those anglers not aware of advisories.

The ineffectiveness of advisories may be a result of several factors beyond a general lack of awareness. Even aware anglers clearly have insufficient knowledge and understanding of

advisories, as evidenced by the high number of inaccurate responses given when anglers were asked to give specific information on advisories, and the large numbers of anglers who feel that the advisories do not give them enough information to decide whether to eat certain fish.

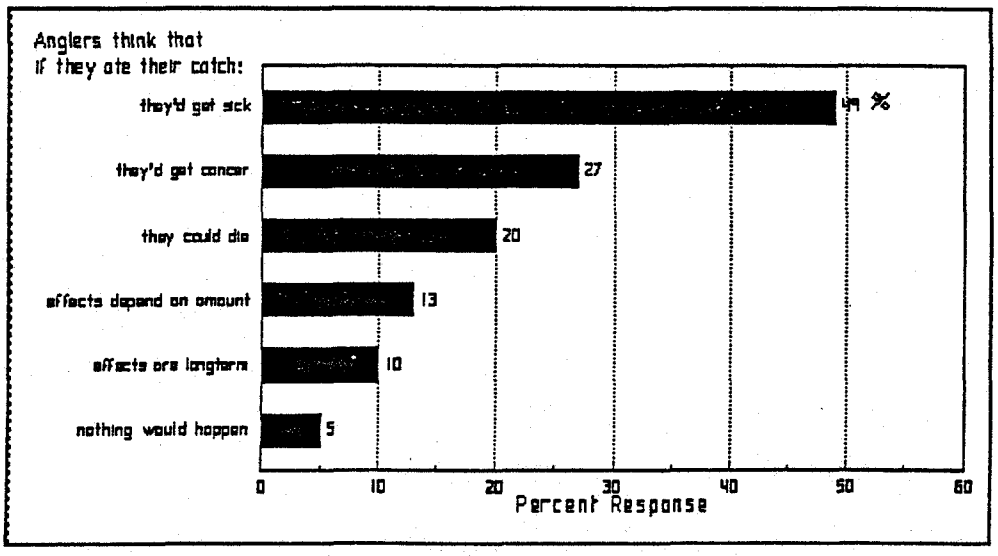
Connelly (1992) found that, while 85% of the licensed anglers surveyed are aware of advisories, 35% are only "generally" aware and are not aware of specific species or waterbodies covered by advisories. Only half of the aware anglers know of the general advisory that women of childbearing age and children under fifteen eat no fish from listed waters. Less than one third of aware anglers know of the general advisory recommendation to limit consumption to one meal per week of fish from any New York waters.

Anglers' attitude towards the advisories clearly influences their fish consumption behavior, as evidenced by the large difference in fish consumption depending on whether the angler believes the advisories are exaggerated or unnecessary. Other studies have found that an angler's confidence in the agency responsible for establishing the advisories, and by extension the advisories themselves, is an important determinant in the angler's decision to follow or disregard the advisory (Knuth, 1990; US Dept. of Commerce, 1990).

Perceptions of Risks; Influence on Fish Consumption

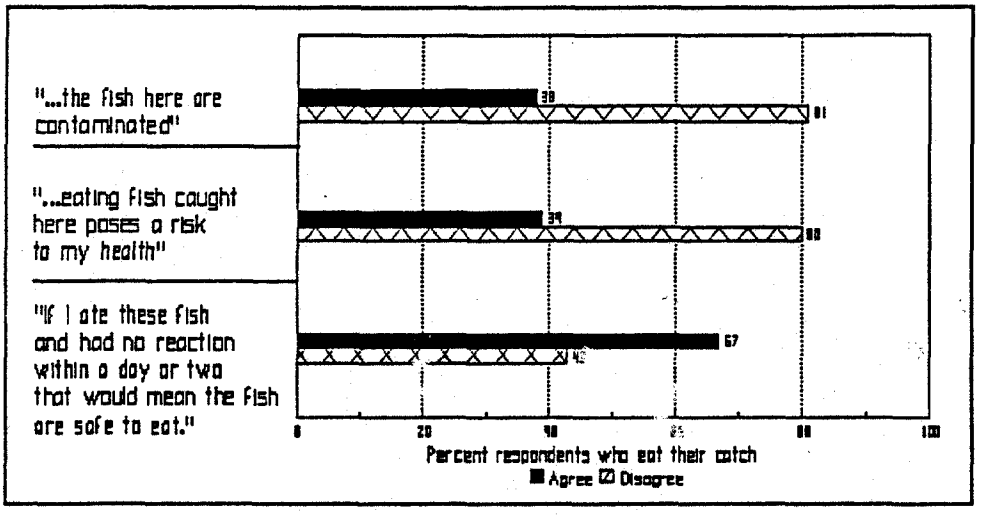
Half of the anglers interviewed (51%) believe some of the fish caught "here" are unsafe. The majority of these (87%) believe this is because of contamination. Almost half of the anglers who believe some fish are unsafe also believe they could get sick from eating the fish, while very few think nothing would happen (see Fig. 25).

Figure 25: Expected Consequences of Eating Fish Perceived as Unsafe



About one in five (19%) of those anglers who think some fish caught "here" are unsafe believe that if they ate fish and had no reaction in a day or two, it would mean the fish are safe to eat. Anglers who believe this are much more likely to eat their catch than those who do not. (see Fig. 26).

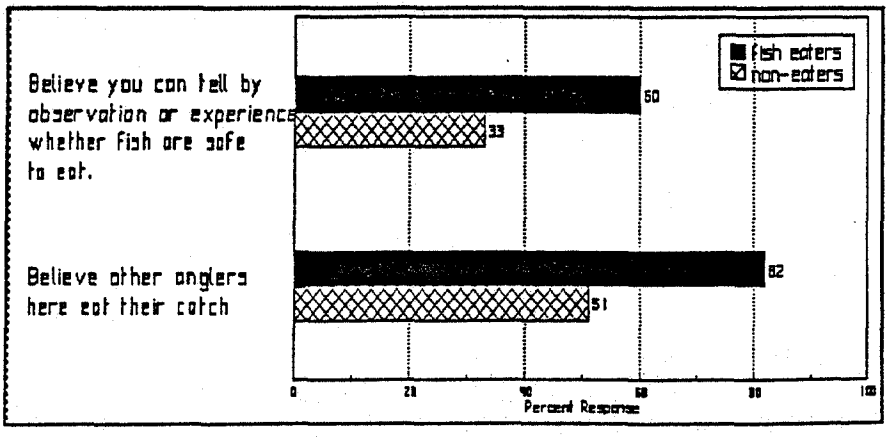
Figure 26: Fish Consumption as a Function of Risk Perception



Those who believe the fish caught "here" are contaminated are much less likely to eat their catch than those who believe the fish are not contaminated. Anglers who believe eating fish caught "here" would pose a risk to their health are also much less likely to eat their catch (see Fig. 26).

Nearly half (49%) of all anglers interviewed believe they can tell by observation or experience whether the fish are safe to eat. Only a third (33%) think one cannot tell, or can only tell by lab tests, if fish are unsafe. Those who eat their catch are almost twice as likely as those who do not to believe they can tell by observation or experience if a fish is safe to eat. Fish consumers are also more likely than non-consumers to believe that other anglers are eating their catch (see Fig. 27).

Figure 27: Anglers' Beliefs as a Function of Fish Consumption



Anglers were asked to assess the level of water quality (not polluted, slightly polluted, or quite polluted) and the level of risk of eating fish (no risk, slight risk, or serious risk). Those anglers who eat their catch are more likely to believe the water is not polluted, and to believe there is no risk associated with fish consumption. Those who do not eat their catch are more likely to believe the water is quite polluted and to believe there is a serious risk associated with fish consumption (see Figures 28 and 29).

Figure 28: Anglers' Assessment of Water Quality

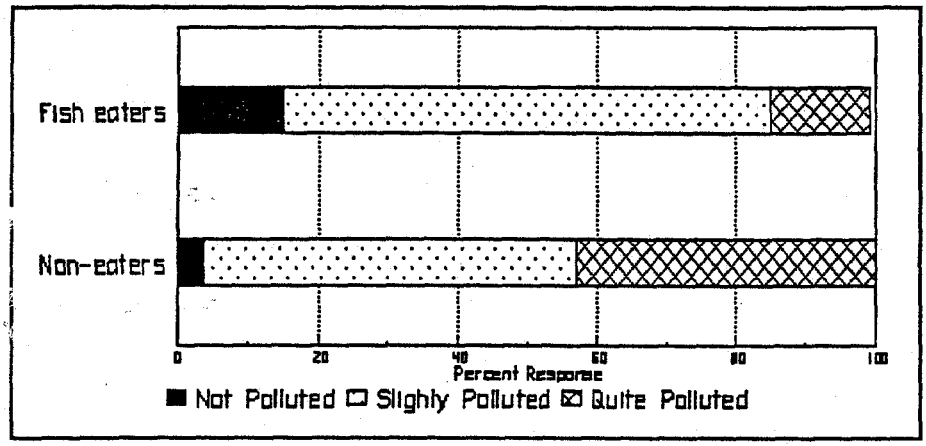
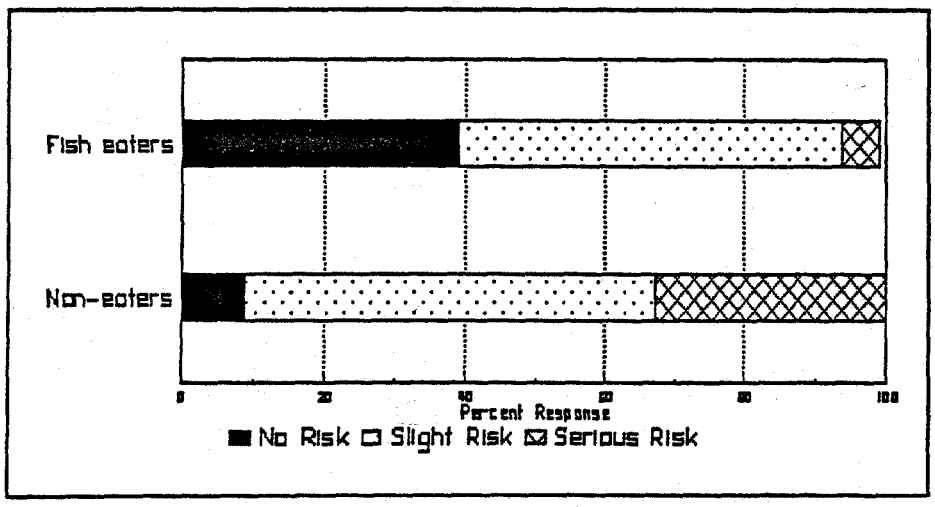


Figure 29: Anglers' Assessment of Risk from Eating Fish



General Discussion

These survey results support the view that anglers' perception and understanding of the risks associated with consumption of their catch is an important determinant of consumption behavior (Reinert, 1991; Weinstein, 1984). Connelly (1992) similarly found that, while those anglers whose fish consumption exceeded advisory recommendations were no less aware of advisories than others, they were more likely to believe the risks associated with fish consumption to be relatively minor.

Unfortunately, angler responses indicated critical gaps in information and prevalent misconceptions about the nature of contaminants in fish and the risks involved in consuming them. While most of those who believe fish are unsafe to eat believe something would happen if they ate those fish, the majority were very vague in their response ("get sick" being the most common response). Very few identified resultant health effects as being long term effects and dependent upon the amount eaten. No angler mentioned the potential for effects in the offspring of exposed individuals. A similar finding was made in the New Jersey angler survey (NJ DEP, 1985).

A fairly substantial number of anglers believe consumption of unsafe fish would result in effects within one or two days. Anglers who believe this are much more likely to eat their catch than those who do not believe it. These findings are important, as other studies have found that people will perceive and respond to risks differently if instances of negative outcomes are easy to recall or imagine. On the other hand, people will not heed warnings if they see no negative results (Knuth, 1990; NAS, 1991; Slovic, 1979). "My Aunt and Grandmother always eat these fish and they are in their nineties," said one angler who reported eating his catch.

In addition to poor understanding of the effects of chronic exposure to carcinogens and reproductive and developmental toxicants such as PCBs, many anglers appear to be uninformed regarding some of the basic chemical and biological factors involved. For example, some anglers believe that "fish have a system to clean themselves out."

When asked to characterize the level of risk associated with fish consumption and the quality of the water, only 3% of anglers rated the risk of eating fish greater than the level of water quality (e.g., the risk of eating fish is serious and the water is not, or is only slightly polluted). One third of anglers believed the risk of eating fish to be less serious than the degree of pollution of the water. The very small number of anglers who believe the level of risk of eating fish could be worse than the level of water quality may indicate a lack of awareness of the processes of bioaccumulation and biomagnification, by which fish can become contaminated

at concentrations hundreds of times higher than concentrations found in the surrounding water.

Some anglers may put too much stock in the fact that migratory fish are generally contaminated at lower levels than resident fish. While this is true for some species found in the Hudson (e.g., bluefish and shad), striped bass, a migratory fish which many anglers try to catch, does contain significant concentrations of PCBs.

This survey also found evidence of an unrealistic optimism that has been found in other studies of risk perception and response (Slovic, 1979; Weinstein, 1984; Knuth, 1990), particularly when future vulnerability is extrapolated from past experience (Weinstein, 1987). The statement that "I've been eating these fish for years and have never gotten sick," and variations on that response, were common among anglers who reported eating their catch. This response is also evidence of the lack of understanding of chronic exposure to toxicants.

Optimism regarding an individual's ability to control the level of risk involved in fish consumption appears to be a factor. Those who eat their catch are much more likely to believe (erroneously) that they can select by observation only those fish that are safe to eat (e.g., "fish that swim fast are safe to eat," and "don't eat fish with white spots on their heads"). Fish eaters are also much more likely to believe they can take action to make the fish safer to eat after it is caught.

Connelly (1992) found similar gaps in anglers' knowledge and understanding of fish contaminant issues. Anglers showed generally weak knowledge of the effects of fish consumption, what the potential health effects are, and the time frame over which effects occur. Connelly also found that, even among anglers aware of advisories, less than half knew that chemically contaminated fish do not taste odd nor behave abnormally.

Comparison of the Upper Hudson and the Estuary

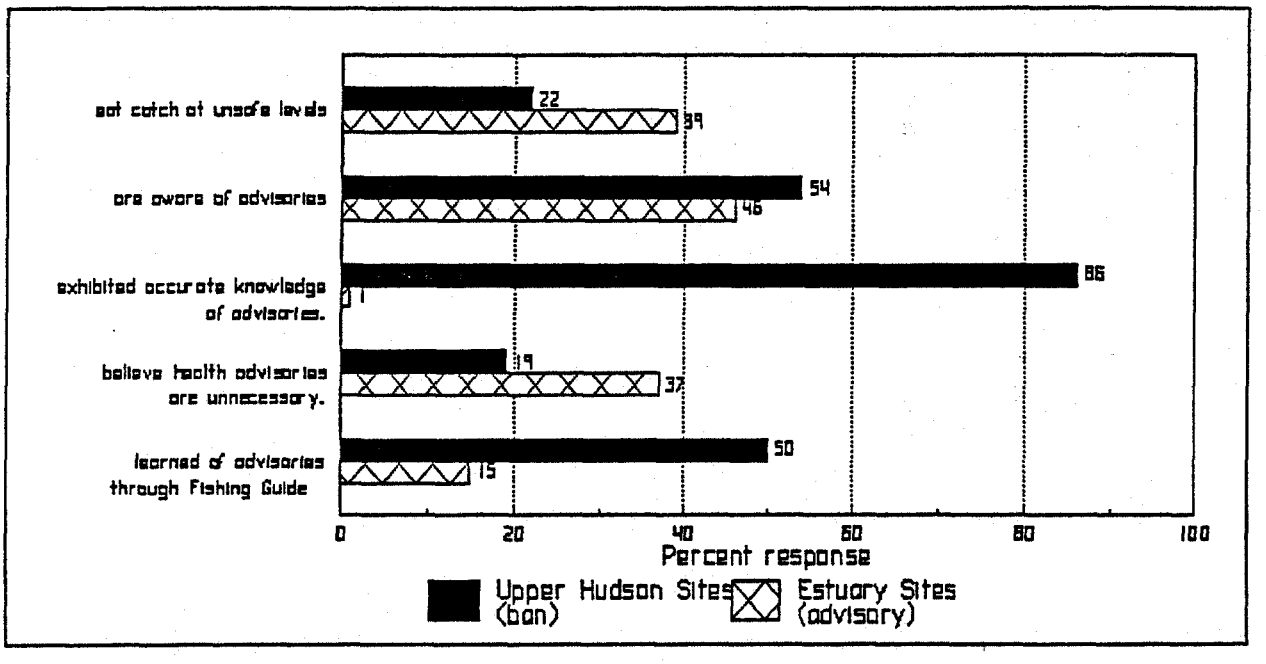
As discussed earlier, there is an important difference between the upper Hudson and the estuary (from the Troy Dam south to the Verrazano Narrows Bridge) in terms of state action to manage the risks associated with consumption of recreationally caught fish. The upper Hudson is subject to a fishing ban and a "no fishing" advisory, but voluntary advisories have been issued for the estuary. Therefore, an effort was made to evaluate whether the fishing ban is effective in preventing unsafe fish consumption, and whether the difference in management approach produced different results in terms of fishing and fish consumption.

Despite a legal ban on all fishing on the upper Hudson and a "no fishing"

recommendation in the advisories, our survey did find anglers utilizing this stretch of the river, and 22% of them report eating their catch, while 25% report giving their catch away to be eaten. Just over half (54%) of upper Hudson anglers are aware of fishing bans and advisories, and the vast majority (86%) were able to state those advisories accurately. Half of the upper Hudson anglers learned of the advisory or ban through the Fishing Guide.

Upper Hudson anglers are less likely than anglers fishing the estuary to eat their catch (22% vs. 66%), and less likely to eat their catch at unsafe levels (see Fig. 30). Upper Hudson anglers are also much less likely to give away their catch (25% v. 79%).

Figure 30: Comparison of Upper Hudson Anglers and Estuarine Anglers



While the difference in awareness of advisories between upper Hudson and estuarine anglers is relatively small, there is a tremendous difference in the ability of upper Hudson versus estuarine anglers to state those advisories accurately.

There is no difference in whether upper Hudson and estuarine anglers believe the advisories provide them enough information (53% v. 54%). But upper Hudson anglers are much less likely to believe that the closures or advisories are exaggerated or unnecessary.

Upper Hudson anglers were much more likely than anglers fishing the estuary to have learned of the advisories through the Fishing Guide. Upper Hudson anglers are also much more likely than estuarine anglers to believe the fish are contaminated (73% and 42% respectively), and are more likely to think there is a serious risk associated with their consumption (32% and 13%, respectively).

General Discussion

Despite a legal ban on all fishing and a "no fishing" recommendation in the advisories, our survey did find anglers utilizing this stretch of the river, and eating their catch. This indicates that even a total fishing ban is not fully effective in preventing unsafe fish consumption.

There was, however, substantially less unsafe consumption reported on the upper Hudson than on the estuary. The disparity in knowledge, attitude and behavior between upper Hudson anglers and those fishing on the estuary may be indicative of a greater efficacy of legal bans as opposed to voluntary advisories, but could be the result of a number of different factors as well. Developing a better understanding of this issue is particularly important in light of the ongoing pressure on the State to revoke the fishing ban for the upper Hudson.

Information is available to upper Hudson anglers through additional means which are not a factor on the lower Hudson. As a result of the fishing ban, this section of the river is posted with "No Fishing" signs. In addition, State law requires a fishing license for the upper Hudson, as it does for all inland freshwaters.

The fact that upper Hudson anglers exhibited much more accurate knowledge of recommended fish consumption levels may be a result of better communication channels. But it may also be a function of the simplicity of the message "no fishing," compared to the more complicated consumption advisories for the estuary, which vary with area being fished, type of species sought, and sex and age of the angler. Nevertheless, this in and of itself says something about the greater effectiveness of a straightforward ban.

The upper Hudson is the site of the former point source discharges of PCBs that are the primary cause of contamination in fish, and PCB levels in the water, sediments and fish are higher here than downriver. Because the upper Hudson has been more heavily impacted by PCBs, it is likely that the population in general (including anglers) is more aware of the overall issue of PCB contamination. This is borne out by the fact that upper Hudson anglers are more likely to believe the fish are contaminated and that their consumption poses a serious risk.

FURTHER DISCUSSION

Adequacy of New York State Health Advisories

Any effort to evaluate the effectiveness of health advisories in preventing unsafe levels of exposure to contamination through fish consumption should also consider whether the advisories themselves are adequately protective.

New York, along with 34 other states, currently uses the federal Food and Drug Administration (FDA) tolerance levels for contaminants in food as a basis for its health advisories (Reinert, 1991). However, because of the assumptions used in the development of the FDA levels, advisories based on those levels may not be adequately protective of the health of anglers who consume their catch (NAS, 1991; USEPA, 1989). In fact, FDA has clearly stated that its tolerance levels are not intended to protect recreational and subsistence anglers (FDA, 1990).

Increasingly, states are developing advisories based on an EPA-recommended risk assessment approach (Reinert, 1991; USEPA, 1989). As noted earlier, DOH, in conjunction with the Great Lakes Task Force, is evaluating the usage of a risk assessment approach in establishing advisories. Advisories based on the EPA approach are generally much more protective of human health than the FDA tolerance level-based advisories (NAS, 1991; Reinert, 1991; USEPA, 1989).

There are several reasons a risk assessment approach may be preferable to using the FDA levels as a basis for advisories. Because the FDA values are developed to protect the average consumer of commercial fish, they are based on national levels of fish consumption, which are significantly lower than consumption levels of recreational or subsistence anglers (NAS, 1991; Reinert, 1991; USEPA, 1989). Anglers are also at greater risk because they tend to fish from the same, often contaminated, water body repeatedly (Reinert, 1991; USEPA, 1991).

When assessing the risk associated with a certain level of exposure to a particular contaminant, EPA relies on information from more recent studies than those used by FDA (NAS, 1991), and uses different assumptions when extrapolating from animal studies to likely effects in humans (NAS, 1991; Knuth, 1989; USEPA, 1989). As a result, EPA estimates a six to ten-fold greater risk than FDA for a given level of exposure (Reinert, 1991).

FDA's tolerance levels are not purely health risk-based; they are modified based on projected economic impacts on the commercial food industry. In fact, when developing a tolerance level for PCBs in fish, FDA chose a 2 ppm versus a 1 ppm tolerance level because of

the incremental economic costs associated with the more stringent standard (Groth, 1992).

The National Academy of Sciences Committee on the Evaluation of the Safety of Fishery Products specifically criticized FDA's adoption of the 2 ppm PCB standard as being based on "reasoning that was questionable at the time and has been rendered obsolete by more recent scientific information" (NAS, 1991). One reason for their criticism was FDA's failure to consider health effects other than cancer.

Recent studies have linked PCB exposure to neurotoxicological, immunotoxicological and respiratory effects, reduced male fertility, reproductive disorders and birth defects (including decreased gestational age and birth weight and neurobehavioral disorders) (Colburn, 1991; Jacobson, 1988 and 1990; Tilson, 1990; Swain, 1988).

A 1991 World Wildlife Fund study (World Wildlife Fund, in press) focusing on effects of organochlorines (a class of chemicals which includes PCBs) found that they have the ability to disrupt the hormonal systems of developing organisms, resulting in behavioral and physiological disorders. Documented effects on wildlife offspring include thyroid disorders, decreased fertility, gross birth deformities, metabolic abnormalities, immune system disorders and disrupted sexual development. Because of the mechanism by which these chemicals act, mimicking the natural hormones that control development, the report concluded that even a single, minute exposure could severely harm the offspring. The report's findings compelled one author to state that "diverse alterations in the development of offspring resulting from maternal exposure to chemicals that bioaccumulate in fish are more probable and socially devastating than cancer" (Colburn, 1991).

A 1991 report by the federal General Accounting Office (US GAO, 1991) identified PCBs as a reproductive and developmental toxicant, based on a consensus among scientific experts. The GAO criticized federal agencies (including EPA and FDA) for not adequately considering reproductive and developmental effects, and found that actions aimed at controlling cancer risks alone provided, at best, uncertain protection against reproductive and developmental health impacts.

The federal EPA, in January of 1993, adopted an oral Reference Dose (RfD) for the demonstrated non-carcinogenic health effects associated with Aroclor 1016 (a lightly chlorinated commercial PCB mixture). The RfD, an estimate of the daily level of human exposure that is expected to be without an appreciable risk of causing deleterious, non-cancer health effects, is 7×10^{-5} mg of chemical per kg of body weight of the exposed individual, per day (mg/kg-d) (USEPA, 1993).

In order to keep exposure levels at or below this recommended level, fish contaminated at 2 ppm (the FDA tolerance level for PCBs) should be eaten only once every three months. Fish contaminated at 6 ppm should be eaten only once every nine months.[9] According to the current DOH advisories, in general, fish contaminated at 2 to 6 ppm of PCBs (with no other organochlorine contaminants present at significant levels) can be eaten once per month (except by women of childbearing age and children under fifteen, who are advised to eat no fish).

New York State does recognize concerns regarding these non-cancer health effects. The NYS Department of Health has petitioned FDA to consider a downward revision of its tolerance level for PCBs in fish, citing studies showing evidence of non-cancerous health effects (Axelrod, 1990). State health advisories do include a general recommendation that anglers eat no more than one meal per week of sport-caught fish, and that women of childbearing age and children of less than fifteen years avoid consumption of any Hudson River fish (as well as fish from any other water body for which there are specific advisories). There is cause for concern, however, that this specific information is not getting out.

In this survey, of all anglers asked about the advisories of which they were aware, none reported knowledge of the additional advisory for women and children. The statewide survey (NYS DEC, 1990) and Connelly (1992) found that women are less likely than men to be aware of advisories. Connelly (1992) also found that only one half of those anglers aware of advisories were aware of this additional advisory. If in fact the Fishing Guide is the most effective means of communicating advisory information, as survey results have indicated, women are at a disadvantage; statewide, 85% of licensed anglers are men (NYS DEC, 1990). Yet, as discussed earlier, a significant proportion of secondary consumers are women of childbearing age and children.

Agency Roles in Developing and Disseminating Health Advisories

Unlike DOH, DEC faces certain difficulties in advocating health advisories related to the potential conflict between promoting use of the State's recreational fishing resources and urging voluntary action to limit consumption (Knuth, 1990). DEC is responsible for enforcing State fishing regulations, and is therefore viewed as an adversary by some anglers. This may negatively affect anglers' confidence in advisories they see DEC promoting.

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[9] These calculations assume an average body weight of 70 kg (154 lbs.) and consumption of 1/2 lb. of fish per meal.

DEC currently derives program funding from fishing license revenues, a revenue source which could diminish if significant numbers of anglers elect not to fish as a result of increased awareness of pollution problems. Size restrictions, placed on possession of various species in order to influence the size structure of fish populations and/or to protect spawning stocks, generally direct anglers towards larger fish, in contradiction to the general recommendation to preferentially consume smaller (and therefore less contaminated) fish.

These issues are not insurmountable -- for example, advocating catch-and-release fishing satisfies both program objectives. Nor do these issues justify a decreased role for DEC in promoting advisories. In fact, DEC's fishery management responsibilities give the agency greater knowledge of and access to angling populations (Knuth, 1989). These issues are, however, something to which the DEC should give due consideration.

CONCLUSIONS

As noted earlier, results of this study cannot be directly extrapolated to all Hudson River anglers. However evidence from this and other studies indicates that fishing bans and health advisories are having only limited success in preventing unsafe levels of exposure to PCBs through consumption of Hudson River fish. Survey results indicate that, among anglers interviewed, substantial proportions of sport-caught fish from the Hudson River are being eaten by the anglers, those with whom they share fish meals, and those to whom they give their catch. Significant numbers of anglers appear to be exceeding the recommended consumption levels.

Certain groups of anglers appear to be at particular risk of experiencing deleterious health effects. Among anglers interviewed, non-whites, anglers with lower income levels, older anglers and anglers on the lower Hudson are most likely to be eating their catch. The likely occurrence of subsistence fishing presents a difficult problem. While their consumption habits subject subsistence anglers to significant health risks, they probably perceive a greater benefit associated with consumption of their catch.

Women of childbearing age and children under fifteen are also at risk because of the potentially greater impacts that PCBs (and other contaminants) can have on developing organs in young children and fetuses. While these latter groups make up a small proportion of anglers interviewed, they appear to comprise a substantial proportion of the secondary consumers.

This and other studies found that those same individuals who are at greatest risk due to their fish consumption habits and/or increased susceptibility to deleterious effects are also least likely to know of the health advisories. These anglers appear to be particularly insusceptible to traditional health risk messages and communication methods.

A lack of awareness of bans and health advisories is common among Hudson River anglers surveyed. But even among those anglers aware of these measures, adherence to the recommendations and restrictions contained therein is deficient. Although the fishing ban on the upper Hudson is apparently more effective than the voluntary advisories, illegal fishing and unsafe fish consumption along this stretch of river remain a concern.

The lack of response to health advisories may be due, in part, to a generally poor level of knowledge regarding the specific recommendations contained therein. In addition, common misconceptions regarding the nature of contamination in fish, and the risks associated with their consumption, may prevent many anglers from accurately understanding the consequences of a decision to disregard the advisories and bans.

Fish consumption habits do seem to be strongly influenced by the anglers' perceptions and beliefs, regardless of their veracity, regarding the risks associated with fish consumption. And anglers appear no different from the public at large in exhibiting a capacity for unrealistic optimism regarding risky personal behavior.

Research in the area of risk perception has shown that individuals are very confident in their judgement regarding their personal level of risk. These beliefs change slowly and are persistent despite contrary evidence (Slovic, 1979). Therefore, risk communication efforts should go beyond providing information and strive to ensure that anglers are accurately incorporating this information into their own risk perceptions (Weinstein, 1987).

The Fishing Guide, which accompanies a fishing license, appears to be more effective than other means in communicating health advisory information and fishing bans. But establishing a marine fishing license requirement for the whole estuary in order to disseminate the guide is not a panacea. The fishing license and guide appears to be particularly ineffective in reaching some of those angler groups (especially low income anglers) who may be most at risk. In addition, difficulty in enforcing a marine recreational fishing license, and vocal opposition to a license requirement from sport-fishing groups, may make this option infeasible.

While the media do not appear to have provided a particularly effective means of communication, they are nonetheless important because of the number of anglers who indicate using the media as a source of information.

Some anglers are going to eat their catch even if fully aware of the advisories and their implications. Subsistence anglers may well fall into this group. This is an inherent component of a risk management strategy that relies on voluntary action. These anglers may, however, be receptive to information regarding ways to reduce the risks associated with fish consumption. Identification of less contaminated water bodies, ways to select less contaminated fish, and information on cooking and cleaning methods which reduce contaminant levels, are all examples of measures which could reduce the actual exposure levels of those who eat their catch. Studies have shown that risk communication is more effective if the intended audience perceives the risks to be real but controllable (NJDEP, 1985; Beck, 1981).

The only certain way to prevent exposure to unsafe levels of PCBs through fish consumption is to take action to reduce the high levels of PCBs in Hudson River fish. In the interim, it is imperative that action be taken to improve the fishing public's awareness and understanding of, and adherence to, the State health advisories and fishing bans.

RECOMMENDATIONS

These recommendations are based on the results of Clearwater's Angler Survey and on a review of other relevant studies of fish consumption and awareness of, and adherence to, State health advisories (Connelly, 1992; Vena, 1992; Green, 1991; NYS DEC, 1990; NJDEP, 1985).

1. DEC should increase enforcement of the fishing ban currently in place for the upper Hudson from Hudson Falls to the Troy Dam. In light of the limited effectiveness of advisories in preventing unsafe fish consumption, the fishing ban should be maintained.

2. Additional methods of communicating health advisories to anglers should be identified by DEC and DOH. The greater the variety of sources the better, as different channels will reach different groups of anglers:
   - Health advisories and information regarding recommended cooking and cleaning methods could be posted at popular public fishing access sites.
   - "Health Advisory Educators" could frequent popular public fishing access spots to provide one- on-one communication with anglers.
   - County Health Departments could disseminate health advisory information for the water bodies within their boundaries.
   - Expanded efforts could be made to work with recreational fishing groups, environmental groups and other outdoor-oriented groups to foster increased awareness of advisories among their members.
   - Expanded efforts could be made to distribute health advisories through marina operators and sporting goods and bait and tackle stores.

3. DEC and DOH should target efforts towards those sub-populations which appear to be most at risk (i.e., lower Hudson and minority anglers, low income anglers who may be engaging in subsistence fishing, and women of childbearing age and children):
   - Health advisories should be published in additional languages.
   - Advisories should be reformatted to give greater emphasis to the "eat none" advisory for women of childbearing age and children (see example in appendices).

- DEC and DOH could identify and work with media outlets that target minority communities.
- Advisories could be posted in medical facilities that service lower income, minority and urban populations, and health care workers could be trained in disseminating health advisory information.
- Advisories could be distributed through schools and community recreation centers.
- Advisories could be distributed through senior citizen centers and organizations.

4. DOH should provide health advisory education materials and related information to state employees most likely to come in contact with anglers (particularly DEC ECOs, State Park Rangers, and NYS Thruway employees responsible for operation of the State canal locks).

5. DEC and DOH should work with major media outlets to ensure that they are aware of their importance as a source of information on health advisories, and to encourage more detailed and accurate coverage of advisories.

6. DEC and DOH should produce regional or waterbody-specific advisories for general public distribution so that anglers could more easily access the information that pertains to the waterbodies they fish.

7. DEC should include health advisories in all publications pertaining to recreational fisheries. DEC should aggressively promote catch and release fishing on the estuary and educate the public to its full range of benefits.

8. DEC should consider instituting a low-cost estuarine fishing license system as one means of increasing distribution of the fishing regulations guide and advisories contained therein.

9. Efforts to influence fish consumption behavior should provide basic information regarding the nature of contamination in fish, and what types of health effects, including multi-generational effects, over what period of time, are associated with consumption of contaminated fish. Strong connections should be drawn between individual actions and the resultant risks.

10. Advisories should address some of the common misconceptions anglers appear to have regarding the nature of contamination in fish. For example:

- describe the process of bioaccumulation by which fish can be contaminated at levels significantly above contaminant concentrations in water;
- explain that fish can contain high levels of contamination but appear unaffected (you can't tell by looking if the fish are safe to eat);
- correct the misconception that soaking fish (in beer, lemon juice, vinegar, etc.) reduces contaminant levels; and
- explain why the lack of immediate, short-term effects from exposure to contaminants is not indicative of a lack of long-term effects.

11. Greatly expanded efforts should be made by DEC and DOH to educate anglers on a range of actions that can be taken to reduce or eliminate risks (e.g., different areas to fish, selection of different sizes and types of fish, and reduced frequency of fish consumption). In particular, expanded efforts should be made to educate fish consumers regarding risk-reducing cooking and cleaning methods. This information should be targeted specifically towards subsistence anglers, who may not be willing to completely forego consumption of their catch.

12. DOH should evaluate as soon as possible whether an increased level of protection would be provided by advisories based on a risk assessment approach which incorporates non-cancerous health risks associated with PCB exposure.

13. DEC and DOH should commit to ongoing efforts to gather information on anglers' fish consumption habits as well as awareness of, and adherence to, fishing bans and consumption advisories, so that the effectiveness of various messages and communication methods can be assessed annually and necessary improvements made.

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APPENDIX A

Hudson River Angler Survey Questionnaire

QUESTIONNAIRE - HUDSON RIVER ANGLER SURVEY

Interviewer: _____

Date: ____/____/____ Day of week: _____
mo. day yr.

Time Started: _____ Time Ended: _____

Site: _____

Sex of person being interviewed: M F

1) I am taking a survey of fishing activity along the Hudson River and New York Harbor, sponsored by the Clearwater Foundation. Could I ask you some questions?

___ Yes
___ No - **(THANK PERSON AND TERMINATE INTERVIEW)**

2) Have you already been interviewed by Clearwater about recreational fishing?

___ Yes **(END INTERVIEW)**
___ No

3) What types of fish are you trying to catch here today?

4) What fishing or crabbing equipment are you using today?
(READ ALL CHOICES)
___ hook and line
___ trap
___ net
___ other; _____

5) Have you caught anything here today, and if so, what?

Type of fish	Number caught

6) How many times have you fished or crabbed on the Hudson River in the last seven days (that is from _____ until today)?

7) How many times have you fished or crabbed on the Hudson River in the last month (that is from _____ until today)?

8) What is the main reason you fish or crab?

9) What other reasons do you fish or crab?

(RECORD IN ORDER GIVEN)

10) We would like to know what you do with the fish or crabs that you catch. Do you do any of the following with your catch often, sometimes, rarely or never?

(READ FROM LIST BELOW, CHECK EACH APPLICABLE ANSWER)

	Often	Sometimes	Rarely	Never
Eat;				
Toss back;				
Use for fertilizer;				
Use for bait;				
Throw in trash;				
Give away;				

If you ever give them away, what do the people you give them to do with them?

Eat; _____
Fertilizer; _____
Bait; _____
Other; _____ (what)
Don't know; _____

Sell; Often Sometimes Rarely Never

If you ever do sell them, what do the people you sell them to do with them?

Eat; _____
Fertilize _____
Bait; _____
Other; _____ (what)
Don't know; _____

Anything else; _____ (what)

11) What do you think most people here do with their catch? **(RECORD IN ORDER GIVEN)**

(IF RESPONDENT DOES NOT EAT CATCH, CONTINUE. IF THEY DO EAT CATCH, SKIP TO QUESTION 17)

12) Have you ever eaten fish or crabs from here in the past?

yes _____ **(SKIP TO QUESTION 14)**
no _____

13) Why don't you eat your catch?

(SKIP TO QUESTION 21)

14) What kind of fish or crab did you eat?
(RECORD ALL ANSWERS GIVEN)

15) How often during the fishing season did you used to eat these fish or crabs? **(READ ALL CHOICES)**

4 or more times a week _____
2 or 3 times a week _____
once a week _____
2 to 3 times a month _____
once a month _____
less than once a month _____

16) Why did you stop eating them?

(SKIP TO QUESTION 21)

(RESUME QUESTIONS HERE IF RESPONDENT <u>DOES</u> EAT THEIR CATCH)

17) How many times in the last week (that is from _____ until today) did you eat fish or crab from the Hudson River?

_____No. of meals **(EMPHASIZE NO. OF MEALS, NOT FISH)**

18) How many times in the last month (that is from _____ until today) did you eat fish or crabs from the Hudson River?

_____ No. of meals **(EMPHASIZE # OF MEALS, NOT FISH)**

19) Who besides yourself eats the fish or crabs you catch from this area? **(FOR EACH PERSON LISTED, RECORD THE FOLLOWING)**

-Relation to respondent,
-Age,
-What kind of fish or crab they eat?
-Whether they eat more, the same, or less fish or crab than respondent.

Relation	Age	type of fish/crab	amount (more, same, less)

20) I am going to read you a series of cleaning and cooking methods for fish and crabs. Could you please respond if you Always, Sometimes or Never use each of these methods:
(READ EACH, RECORD APPROPRIATE RESPONSE)

Method	Always	Sometimes	Never
Eat whole fish or crab			
Puncture or remove skin			
Fillet the fish			
Trim off belly meat			
Trim off the strip of fat along the back of fish			
Pan fry or deep fry			
Make soup or chowder			
Bake, barbecue or poach			
Reuse oil or fat from cooking			

(RESUME QUESTIONING HERE WITH ALL RESPONDENTS)

21) Are there any fish or crab <u>that people catch here</u>, that are not safe to eat?

yes ____
no ____ **(SKIP TO QUESTION 27)**
no opinion/don't know ____ **(SKIP TO QUESTION 27)**

22) What fish or crabs that people catch here are not safe to eat?

23) Is it the whole fish or crab that is not safe to eat, or just parts of them?

24) Why are they not safe to eat?

25) What would happen if you ate them?

26) If you ate these fish or crabs and had no reaction within a day or two, would that mean the fish or crab are safe to eat?

yes ____
no ____
don't know ____

27) How can you tell if the fish or crabs caught here, or their parts, are safe to eat?

28) Is there any way to make the fish or crab that are caught here safer to eat after they have been caught?

no _____
If yes, what are they;

29) For the fish or crab <u>you catch here</u>, would you say that eating them;
(READ ALL CHOICES)

poses no risk at all _____
poses a slight risk _____
poses a serious risk ____

30) Would you say the water here is: **(READ ALL CHOICES)**

not at all polluted ____
slightly polluted ____
quite polluted ____

31) **(IF RESPONDENT BELIEVES WATER IS MORE POLLUTED THAN FISH)** If the water is slightly/quite polluted, why does eating the fish pose no risk/a slight risk?

32) Please answer yes, no or don't know for each of the following questions;

	yes	no	don't know
Do you think that the fish you catch here are contaminated?			
Do you believe that eating fish caught at this site would pose a risk to your health?			
Would you like more information about the potential risks from eating fish that are contaminated?			
Would you like more information about how you can control the risks from eating contaminated fish?			

33) Do you happen to know if there are any official health warnings about eating fish that are caught here?

yes _____
no _____ **(SKIP TO QUESTION 40)**
don't know _____ **(SKIP TO QUESTION 40)**

34) What warnings are you aware of?

35) How did you originally learn about them?

36) Do you happen to know who makes these health advisories?
(READ ALL CHOICES)

federal government	____
state government	____
county	____
town	____
other	____
don't know	____

37) Do you agree, disagree, or have no opinion about the following statements:

	Agree	Disagree	No Opinion
The health advisories provide me with enough information to decide whether or not to eat certain fish.			
Many of the health advisories are not needed or are exaggerated.			

38) Since you learned about the health advisories have you made any changes in either your fishing habits or in eating the fish you catch?

yes ____
no ____ **(SKIP TO QUESTION 40)**

39) What changes have you made since you learned of the health advisories? Do you;
(READ, CHECK EACH THAT APPLIES)

no longer eat the fish you catch	____
eat less of the fish you catch	____
eat more of the fish you catch	____
clean or cook the fish differently	____
fish in different locations	____
fish less often	____
fish more often	____
change the type of fish you try to catch	____

other:

40) What age group are you in? **(READ)**

under 10	____	40 - 44	_____
10 - 14	____	45 - 49	_____
15 - 19	____	50 - 54	_____
20 - 24	____	55 - 59	_____
25 - 29	____	60 or up	_____
30 - 34	____		
35 - 39	____		

41) What is your race or ethnic background?

42) In what range is your total yearly household income, before taxes? **(READ CHOICES)**

less than $10,000	____
$10,000 - $29,999	____
$30,000 - $49,999	____
$50,000 - $69,999	____
$70,000 - $89,999	____
$90,000 or over	____

43) What is the number of people in your household?

Thank you very much for your time and cooperation.

APPENDIX B

1991-1992 New York State Health Advisory

1991-1992 NYS DOH Health Advisory
Specific Restrictions for the Hudson River

Water	Species	Recommendation
Hudson Falls to Troy Dam	All species	No fishing
Troy Dam south to/including lower NY harbor	American eel, white perch, carp, goldfish, brown bullhead, largemouth bass, pumpkinseed, white catfish, striped bass, walleye	Eat none
	Black crappie, rainbow smelt, Atlantic needlefish, northern pike, tiger muskellunge, bluefish	Eat no more than one meal per month
	Blue crab	Eat no more than six per week
	hepatopancreas	Eat none
	cooking liquid	Discard

APPENDIX C

Reformatted Health Advisory
for the Hudson River

SPECIAL ADVISORIES

Observe the following restrictions on eating fish from these waters and their tributaries to the first barrier impassable by fish.

Water	Species	Recommendation Women of child-bearing age and Children under fifteen	Others
Hudson River			
-Hudson Falls to Troy Dam	All Species	No fishing	No fishing
-Troy Dam south to and including the lower N.Y. Harbor	American eel, White perch, Carp, Goldfish, White catfish	Eat none	Eat none
	Walleye, Rainbow smelt, Largemouth bass, Smallmouth bass, Atlantic needle-fish, Bluefish, Northern pike, Tiger muskellunge	Eat none	Eat no more than one meal per month
	Blue crab	Eat none	Eat no more than 6 crabs per week
	-hepatopancreas (mustard, liver or tomalley)	Eat none	Eat none
	-cooking liquid	Discard	Discard
-Troy Dam south to Tappan Zee Bridge	Striped bass	Eat none	Eat none
-Tappan Zee Bridge south to & including Lower New York Harbor	Striped bass	Eat none	Eat no more than 1 meal per month