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Consumption Patterns and Why People Fish

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Recreational and subsistence fishing play major roles in the lives of many people, although their importance in urban areas is often underestimated. There are fish and shellfish consumption advisories in the New York–New Jersey harbor estuary, particularly in the waters of the Newark Bay Complex. This paper examines fishing behavior, consumption patterns, and the reasons that people fish in the Newark Bay Complex. I test the null hypotheses that there are no differences among Asians, Blacks, Hispanics, and Whites in consumption patterns for fish and crabs and in the reasons that they fish or crab. Most people either fished or crabbed, but not both. People who fish and crab ate more grams of crab than fish in a given meal; people who crab only consumed more grams of crab at a meal than those who fish only consumed of fish. Although 30% or more of the people who fished and crabbed in the Newark Bay Complex did not eat their self-caught fish or crabs 8–25% of the people ate more than 1500 g/month. Some people angling in the Newark Bay Complex are eating crabs at a rate well over 1500 g/month, and about 70% are eating crabs even though there is a total ban on both harvest and consumption because of the health risks from dioxin. Consumption patterns were negatively correlated with mean income and positively correlated with mean age. Most people rated relaxation and being outdoors the highest reasons for angling, although on an open-ended question they usually listed recreation. There were no ethnic differences in reasons for angling, although other studies have shown ethnic differences in consumption. Obtaining fish or crabs to eat, give away, trade, or sell were rated low, suggesting that consumption advisories fail partly because people are not primarily fishing for food.

Key Words: **risk management; fishing; consumption; ethnicity; perception; toxics.**

INTRODUCTION

On a daily basis, people make choices about the food that they eat, and some of these decisions involve eating self-caught fish or game. Yet, there is increasing concern about the safety of self-caught foods, particularly fish and shellfish. The U. S. Environmental Protection Agency (2002) reported that 28% of the nation's total lake acres and 14% of the nation's total river miles are under consumption advisories, in addition to all of the Great Lakes and their connecting waters. These levels nearly doubled from 1997 to 2001 (EPA, 1998, 2002). Mercury accounts for most of the advisories, but polychlorobiphenyls (PCBs), chlordane, dioxins, and dichlorodiphenyltrichloroethane are also important (EPA, 1996, 2002).

Risk assessors generally assume that, if given enough information, the public will act in a manner that is consistent with the relative risks of different activities. There are many cases where people rank risks differently from the experts (Slovic *et al*., 1979; Slovic, 1987, 1993; Kasperson *et al*., 1988). Choices may be a result of subjective judgements, intuition, and objective knowledge (Kamrin and Fischer, 1999). People overestimate negligible risks and underestimate significant ones (Slovic *et al*., 1979), underestimate risks they choose (Lowrance, 1976), and underestimate their own risk compared to those of others (Weinstein, 1984, 1989). These principles apply to diets. The problem is amplified with respect to self-caught food because fishing is enjoyable (Toth and Brown, 1997) and is often part of traditional cultures (Egeland *et al*., 1998; Harris and Harper, 1998; Berti *et al*., 1998). Further, anglers and fishery professionals may also differ in beliefs and attitudes (Connelly *et al*., 2000).

The public frequently views eating fish as posing a less serious hazard than does the scientist or environmental manager. There is a gap in perception of

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risk by some of the fish-consuming public and the agencies issuing the advisories (Belton *et al*., 1986; Fiore *et al*., 1989; EPA, 1989; Reinert *et al*., 1991, 1996; Ebert, 1996). People are aware of advisories, but some populations continue to consume the fish nonetheless (Reinert *et al*., 1991; Burger and Gochfeld, 1991; Burger *et al*., 1992, 1993, 1999a, 1999b; May and Burger, 1996). In other regions, health advisories have changed fish consumption patterns (Connelly *et al*., 1996).

From a risk reduction viewpoint, it is important to understand the variables that are correlated with consumption patterns, such as education, income, and ethnicity (Burger *et al*. 1999a; Pflugh *et al*., 1999), because they can be used in risk communication. Yet few risk assessors understand or evaluate the sociological reasons that people fish, which may be equally important. While many people fish to obtain protein, either because they like fish or are compelled by economic or health reasons to do so, others may fish for a variety of other reasons having little to do with eating fish (Toth and Brown, 1997; Harris and Harper, 1998). Fish consumption may be a by-product of catching fish, a desirable family and recreational activity in itself. Yet the reasons for fishing, and its role within a person's culture and tradition, are seldom examined within a study aimed at understanding fish consumption patterns.

In this paper I examine the consumption patterns and the reasons for fishing of people fishing in the Newark Bay Complex of the New York-New Jersey harbor. I was particularly interested in ethnic differences in the reasons for fishing that might be useful in understanding the dissonance between consumption advisories and consumption patterns.

The Newark Bay Complex and the New York–New Jersey harbor estuary is ethnically, economically, and culturally diverse and is one of the most polluted in the United States (Ayres and Rod, 1986; O'Connor and Ehler, 1991; Squibb, 1992). There are consumption advisories promulgated (NYSDOH, 1994; NJDEP, 1994). The contaminants of concern in the Newark Bay Complex are PCBs and dioxins. Recently Finley *et al*. (1997) examined the levels of PCBs in striped bass and other fish from the lower Passaic River; concentrations exceeded the National Oceanic and Atmospheric Administration benchmark level. Both states issue advisories for blue crabs (*Callinectes sapidus*), blue fish (*Pomatomus saltatrix*), striped bass (*Morone saxatilis*), and American eel (*Anguilla rostrata*), and New Jersey has advisories for white perch (*Morone americana*) and white catfish (*Ameiurus* [*Ictalurus*] *catus*). Advisories in the Newark Bay Complex range from "do not eat" (crab) to eat no more than once a month (pregnant women and those of child-bearing age, children) or "once a week" (all others) for the listed fish species. Pregnant and nursing women, and infants and children up to 15 years of age, are considered high-risk individuals (Hauge, 1993). New York State recently issued an advisory which stated that no women or children should eat striped bass (NYDOH, 2002).

Since some people do not follow consumption advisories, it is of public health policy interest to understand why people fish and what they eat. While our previous work has examined some of these questions (Burger *et al*., 1999a; Pflugh *et al*., 1999), these studies did not relate the reasons that people fish to their consumption patterns.

METHODS

Subjects

We interviewed 267 people angling at several locations in the Newark Bay Complex (Fig. 1). On a regular basis from 15 May until 15 September, we visited all sites and approached all people that were present. Sites were visited on weekdays and weekends and at all times of day. We alternated weekends and weekdays and randomly selected the sites each day so that times of day varied. Although we saw the same people at these locations from time to time, each person was interviewed only once. One of the interviewers was Hispanic and spoke Spanish fluently. Although the results of the study clearly represent those interviewed, there is no reason to

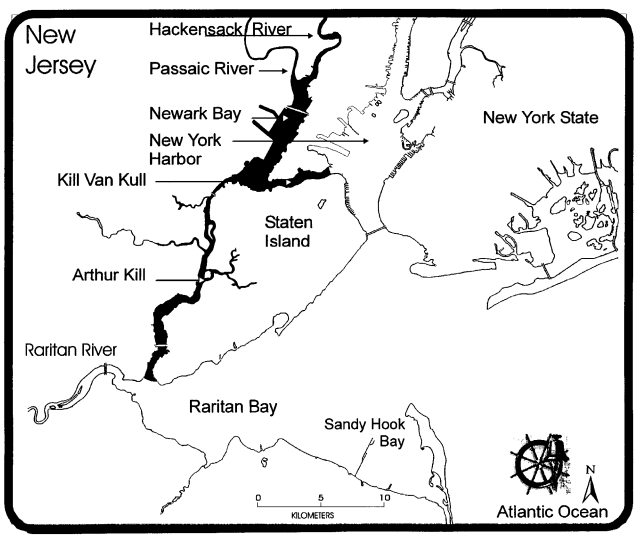

FIG. 1. Map of the Newark Bay Complex showing angling locations where people were interviewed in 1999.

assume that this does not represent the fishing public using this area because we interviewed nearly everyone present and sampled at all times of day, on both weekends and weekdays.

Interview Procedures

Subjects were interviewed individually while they fished or crabbed (hereafter called angling). The interviews were conducted by two interviewers who had conducted similar interviews in the past and were specifically trained for this project. All interviews were conducted during the day; people did not fish at night here. Once they reached an angling site, they interviewed everyone present. They first identified themselves as researchers from Rutgers University who were interested in fishing behavior, consumption, and reasons for angling. Demographic questions were deferred until the end of the interview when we explained more fully what we were doing. Most people were interested in the survey and inquired about how they could find out our results. Only eight people refused to be interviewed, saying they were leaving immediately; a 3% refusal rate is very low and is not sufficient to bias our results.

The questionnaire was divided into four parts dealing with demographics, consumption behavior (and information concerning serving size), knowledge of advisories (discussed elsewhere; see Burger, 2002), and reasons for angling. We did not ask them to report on household consumption, but only on their own consumption pattern. Consumption was determined by multiplying the number of meals (of fish and crabs) per month by portion size. Cues to portion size were given by providing subjects with a three-dimensional model of an 8-oz. fish fillet for comparison with their typical meals, and interviewers mentioned tuna cans as an additional prompt. The estimate, in ounces consumed, was converted to grams for this paper.

We asked them why they fished or crabbed in an open-ended question and then asked them to rate several reasons that they might angle on a scale of 1 (not a reason) to 5 (one of the main and most important reasons that they angled). The list that we provided them was derived partly from Toth and Brown (1997) and partly from local knowledge from previous surveys in the region (Burger *et al*., 1999a; Pflugh *et al*., 1999). Ratings were on a Likert scale of 1 (lowest value) to 5 (highest value).

Demographic information included ethnicity, gender, age, location of residence, occupation, and income. Ethnicity was by self identification. Due to small sample sizes, American Indians are not considered further. Because of the potential delicate nature of the demographic information such as income, these questions were asked last. The entire survey took about 20 min to complete, although some people lingered longer to ask questions about our research. The length of the survey is within the guidelines suggested for dietary surveys (Block *et al*., 1986) and followed Frey and Oishi (1985). In general, people were interested and volunteered information about fishing, consumption, and why they fished.

I computed consumption by multiplying, for both crabs and fish, the average number of meals eaten by the average serving size. The edible portion of a crab was assumed to be 70 g, based on studies conducted by the New Jersey Department of Environmental Protection. I computed a monthly consumption rate and multiplied this monthly rate by the number of months that people ate self-caught fish or crabs. Thus yearly consumption was computed for each person individually. Unlike previous studies, I divided the data into those who crabbed only, those who fished only, and those who did both because otherwise it is difficult to compute risk from consumption. Most studies examine only fish consumption and do not consider shellfish consumption. Yet if people are consuming both, this information is essential for risk assessments.

Statistical Analysis

For analysis, the data were divided by age classes: 32 years and under, 33–45 years, and 46 years and over; income was divided as up to and including $20,000, over $20,000 to $30,000, and over $30,000, mainly for consistency with other, previous studies (Burger *et al*., 1999a; Pflugh *et al*., 1999). For some analyses, the unit was municipality to allow a correlation with income or age and consumption patterns, partly because signage, information, and other risk management is handled by municipality. That is, the data from this paper will be useful to municipalities in planning their risk management and risk communication programs.

Kruskal–Wallis X^2 and Contingency tests were used to determine whether there were differences as a function of race, age, and income (SAS, 1994). Kendall tau correlations were also used to examine relationships. Means and standard errors are given in the text.

RESULTS

Demographics

Of the 267 people interviewed, 13% were Asian, 21% were Hispanic, 23% were Black, and the rest

TABLE 1
Demographics (Mean ± SE) of Anglers Interviewed in the Newark Bay Complex (1999)

	African American	Asian	Hispanic	White	Kruskal–Wallis χ^2
Age	41 ± 2.2 A	44 ± 2.6 A	40 ± 2.2 A	47 ± 2.0 A	5.76 (NS)
Years of schooling completed	12 ± 0.4 B	14 ± 0.5 A	13 ± 0.4 A,B	13 ± 0.3 A,B	9.33 (0.03)
Annual income ($K)	15 ± 2.4 A,B	20 ± 3.8 A	12 ± 2.4 B	11 ± 1.4 B	6.52 (0.09)

Note. The values associated with different letters indicate significant differences across categories.

were White (Table 1). There were no ethnic differences in age, annual income, or health ratings, although Blacks had significantly less schooling than Asians (Table 1). Although income did not differ significantly by ethnicity, Asians tended to have higher incomes than others.

Consumption

There were no ethnic differences in the percentage of people (or of only women) who fished, crabbed, or did both. Of the people interviewed, 44% fished only, 44% crabbed only, and the rest did both. There were no differences in the number of times/month people ate crabs or fish when they only crabbed or fished (Table 2). However, people who both fished and crabbed ($N = 33$) ate fish and crabs over six times a month, compared to four or fewer for others. There were significant differences in the serving size for fish and crabs; people who fish and crab ate more grams of crab than fish in a given meal (Table 2). People fished during more months of the year than they crabbed, partly because crabs are less active than fish when the water is cold (Table 2).

Consumption, a function of the number of meals per month, serving size, and number of months angled, varied also (Table 2). For risk assessments, it is useful to know the distribution of the consumption patterns (Fig. 2). More than 30% of the people who fished and crabbed in the Newark Bay Complex did not eat their self-caught fish or crabs. However, 8–25% of the people ate more than 1501 g/month (Fig. 2), the level considered subsistence by some state agencies (see Burger *et al*., 1999b).

TABLE 2
Consumption Patterns for People Surveyed in the Newark Bay Complex in 1999

	People that crab only	People that fish only	People that both crab and fish		Kruskal–Wallis χ^2
			Crab values	Fish values	
Sample	110	111	33	33	
Times a month that they eat self-caught crabs/fish	3.39 ± 0.42	4.06 ± 0.76	2.96 ± 0.45	3.56 ± 0.66	1.45 (NS)
Serving-size number of self-caught crabs	6.15 ± 0.85		7.27 ± 0.91		
self-caught fish or crabs (g)	439 ± 61.2 B	331 ± 42.1 BC	509 ± 63.8 A	428 ± 57.6 B	42.1 (0.0001)
Monthly consumption of self-caught fish or crabs (g)	1,980 ± 561 A	1,410 ± 266 B	1,620 ± 330 AB	1630 ± 358 AB	19.6 (0.0002)
Month per year that they go fishing or crabbing	3.31 ± 0.13 C	4.92 ± 0.33 B	3.50 ± 0.37 C	7.24 ± 0.74 A	27.0 (0.0001)
Yearly consumption of self-caught fish or crabs (g)[a]	5,760 ± 1,360 B	8,120 ± 2,040 AB	6,230 ± 1,790 B	13,600 ± 3,480 A	29.1 (0.0001)

Note. Given are means ± SE . Nor consumption values, sample does NOT include those that just catch and release. The values associated with different letters indicate significant differences across categories.

[a]Crab values based on average weight of meat from crab of 70.0g.

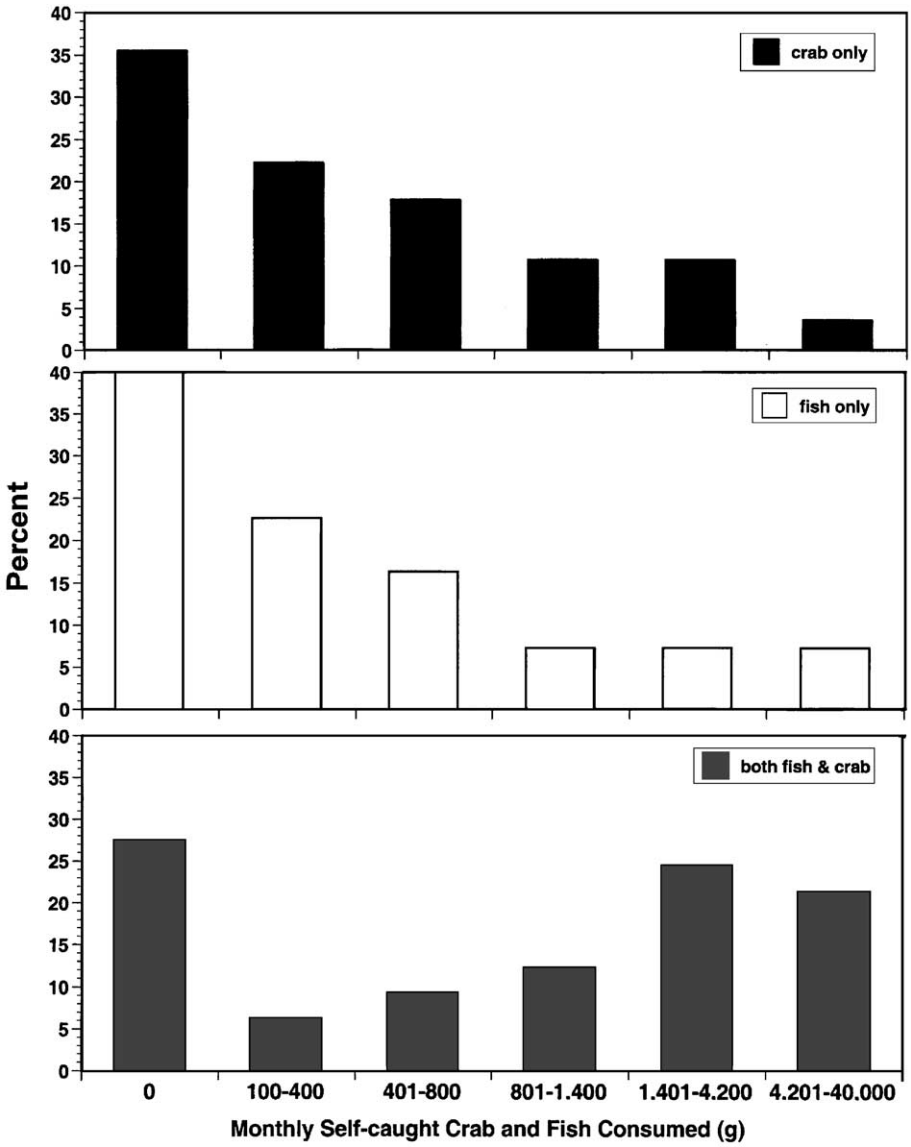

FIG. 2. Consumption patterns for all people interviewed who only crabbed (black bars on top graph), only fished (white bars on middle graph), or both fished and crabbed (light bars on bottom graph). People were interviewed in the Newark Bay Complex in 1999. Shown are percentage of people in each category.

Consumption patterns were negatively correlated with mean income ($r = -0.70$, $P < 0.01$) and positively correlated with mean age ($r = 0.53$, $P < 0.05$), when municipalities are the unit examined (Fig. 3). These relationships held when the incomes of all individuals are considered for consumption of crab ($r = -0.35$, $P < 0.0001$), but not for consumption of fish ($r = -0.12$, not significant) (ns)). Age was positively correlated with fish consumption ($r = 0.27$, $P < 0.003$), but not with crab consumption ($r = 0.07$, ns). Thus, people of all ages are eating crabs, not just older people.

Yearly consumption is difficult to compute. In most cases, researchers merely multiply monthly consumption times 12. However, Table 2 provides information on the number of months that people fish or crab. On the basis of this information, yearly consumption is highest for people who both fish and crab. For this group, mean consumption of fish and crabs (19,830 g/year) is over the level considered subsistence by some state agencies (Burger *et al.*, 1999b).

Ethnic Differences in Consumption Patterns

One objective of the study was to determine whether there were ethnic differences in consumption patterns for those who consumed their catch

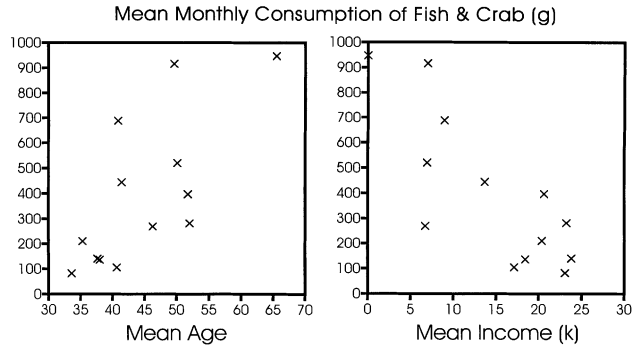

FIG. 3. Consumption patterns (for both fish and crabs) for people interviewed in the Newark Bay Complex as a function of mean age and mean income. Each X represents the mean for each municipality where people lived. The correlations were similar when all people are considered individually.

(Fig. 4). There was wide variation in consumption patterns within each ethnic group, making it essential to examine the frequency distribution of consumption. I include the number who did not eat fish or crabs because it is the angling public that is often targeted for risk information.

When total consumption patterns are considered, there were ethnic differences in the percentage that did not eat their catch ($X^2 = 14.6$, $P < 0.005$; Fig. 5). Overall, 49% of Whites did not eat their catch, while this percentage was 40% for Hispanics, 24% for Asians, and 22% for Blacks.

There were ethnic differences also in high-end consumption (over 1401 g/month) for fish ($X^2 = 5.8$, $P < 0.02$; Fig. 5), but not for crab. However, when the total consumption is considered once for each person, whether they ate fish, crabs, or both, there is an ethnic difference ($X^2 = 8.4$, $P < 0.05$). Over 28% of Blacks interviewed, and 20% of Hispanics, ate more than 1401 g/month compared to only 17% of whites and 12% of Asians.

Reasons for Angling

The reasons that people engage in angling were examined in two ways: by an open-ended question (why do you go fishing or crabbing?), and by rating a list of possible reasons. On the open-ended question, most people of all ethnicities said they fished (63%) or crabbed (68%) for recreation. Very few people said that they angled to obtain food (4%). There were no ethnic differences in reasons for fishing, so data are presented for the whole population.

When rating various reasons for angling, ratings fell into four general categories: high ranking (average values over 4.5), intermediate (values of 3 to 4), low (values of 2 to 3), and very low (below 2). Most people rated relaxation and being outdoors the highest. Crabbing or fishing for socials, to sell, or to trade were rated very low (Table 3).

Consumption and Reasons for Fishing and Crabbing

One objective of the study was to determine whether people who eat more fish or crabs have different reasons for fishing or crabbing (Table 3). People who were in the top third of consumption of crabs rated relaxation, communing with nature, to eat, and to give away higher than those who were in the bottom third of consumption. However, the top third for fish consumption rated family recreation and trading lower than those in the bottom third. People who eat the most fish or crabs rate to obtain fish/crabs for eating higher than other people. Overall, these data indicate that people who consume more fish and crabs rate most reasons for doing so higher (or equal) than do others.

DISCUSSION

Although there were ethnic differences in consumption patterns, there were no ethnic differences in why people fish. Moreover, people rated "angling to obtain food" relatively low as a reason for going fishing. Below I discuss the importance of examining fish and crab consumption separately, ethnic differences, the reasons for angling, and risk management.

Importance of Examining Fish and Crab Consumption Separately

In many studies fishermen are asked either how often they fish or how often they eat fish or both. People go fishing for a variety of reasons and do not necessarily eat fish as often as they go fishing, either because they do not catch any fish or because they choose not to eat them. While a nutritionist or doctor may be interested in total fish consumption, from a risk perspective, it is important to know how much fish is consumed from local (potentially contaminated) waters, compared to the fish bought in a supermarket.

More importantly, risk from self-caught foods includes both fish and shellfish, and these are often not examined in such a manner as to understand total consumption. In this study, I asked each person about both fish and crabs and obtained data on individual consumption patterns for both. Remarkably, most people either fished or crabbed, and few engaged in both activities. Regardless of the mix

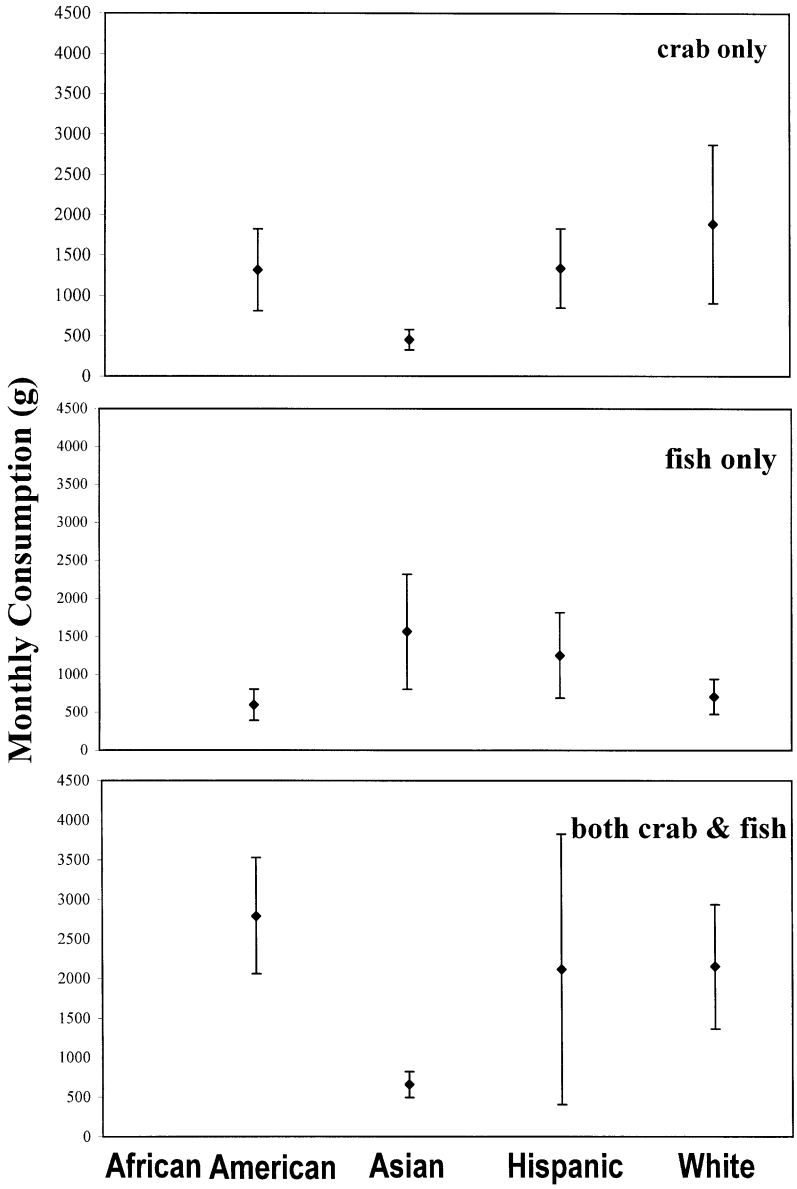

FIG. 4. Mean (± SE) consumption as a function of ethnicity for people interviewed who consume only crab, consume only fish, or consume both self-caught fish and crabs in Newark Bay Complex in 1999.

between these activities, it is important to understand these relationships to compute risk, communicate risk, and manage risk. Often the contaminants in shellfish (in this case, crabs) differ from those in fish; the risks are thus different, and the strategy used to communicate risk or change behavior might differ between people who fish and those who crab. Further, this study indicated that there are three kinds of people in this region: those who fish only, those who crab only, and those who do both. Because the angling patterns differ, and the risk differs depending upon whether people are consuming fish or crabs, it is essential to target risk communication separately to these two groups. This might entail different strategies to reach people: for example, fishermen often visit bait shops while crabbers often use chicken on a string, bypassing bait shops, making such shops less useful for risk communication to crabbers.

Fish consumption is usually determined on a daily or monthly basis and then extrapolated to the whole year. Yet, in most regions of the country, people fish or crab more during some months than others. Although they may freeze fish for consumption at a later time (Burger, 2000), highest levels of fish consumption are undoubtedly duing the fishing

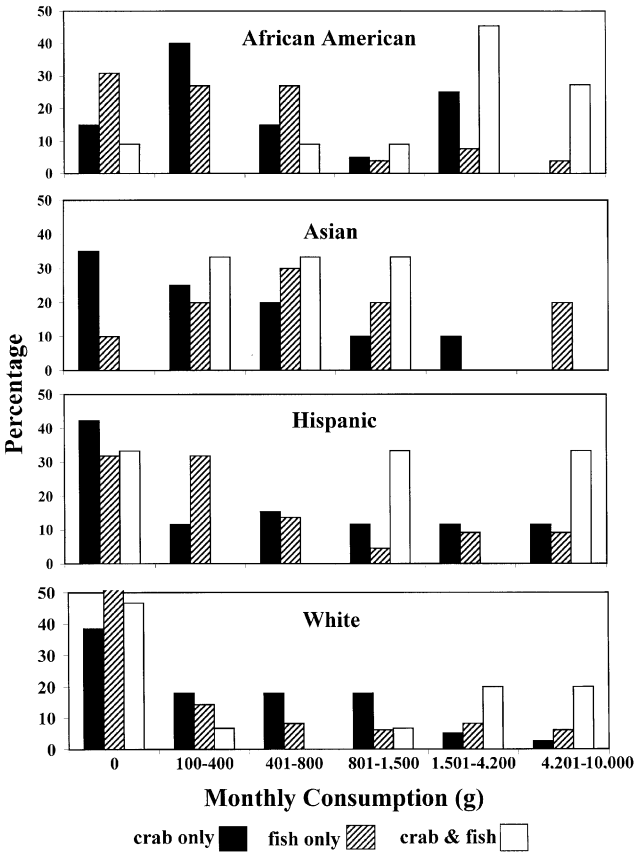

FIG. 5. Percentage of people interviewed within each consumption category who crab only, fish only, or do both, as a function of ethnicity.

season. Yet most studies do not ask what months people fish or eat fish. The data in this study suggest that obtaining information on the months that people fish and the months that they crab is essential for determining risk and for designing a risk communication strategy.

Ethnic Differences in Fishing Behavior and Consumption Patterns

Interest in seafood safety and in the role of self-caught fish in the diets of Americans has recently come to the fore (IOM, 1991). There has been attention devoted to differences between White and Black populations, particularly with respect to fish consumption and fishing rates (Toth and Brown, 1997; Burger, 1998, 1999; Burger *et al*., 1999b). In South Carolina, Blacks fishing along the Savannah River consumed significantly higher quantities of fish than Whites and were less likely to know about advisories (Burger *et al*., 1999b). Fishing plays an important social role within some Black communities (e.g., Mississippi Delta; Toth and Brown, 1997), making it critical to understand consumption behavior of Blacks in a variety of communities to develop an overall risk management strategy.

There has been relatively little attention given to other ethnic groups, such as American Indian (Harris and Harper, 1998; Burger, 1999) and Hispanic (Burger *et al*., 1999a; Pflugh *et al*., 1999) populations. Previous work in the Newark Bay Complex in 1995 showed that Hispanics ate a higher percentage of their crab catch than others, and Blacks ate a higher percentage of bluefish and bass than others, but overall consumption rates were not computed (Burger *et al*., 1999a). Hispanics knew the least about consumption advisories, and Whites knew the most. However, at that time, a higher percentage of the fishing population was

TABLE 3

Ratings (Mean ± SE) Given by People Angling in the Newark Bay Complex When Asked Why They Go Angling

	Crab	Fish	Kruskal–Wallis χ^2
Sample	143	144	
Relaxation	4.58 ± 0.05 (A)	4.62 ± 0.06 (A)	1.05 (NS)
To be outdoors	4.64 ± 0.05 (A)	4.54 ± 0.07 (A)	0.28 (NS)
Get away from demand	3.73 ± 0.10 (BC)	3.87 ± 0.12 (B)	2.13 (NS)
Challenge or sport	3.41 ± 0.12 (DE)	3.79 ± 0.11 (B)	5.08 (0.02)
Commune with nature	3.81 ± 0.11 (B)	3.72 ± 0.11 (BC)	0.24 (NS)
To be with friends	3.51 ± 0.10 (CD)	3.56 ± 0.11 (BC)	0.13 (NS)
Recreation	3.64 ± 0.12 (BCD)	3.45 ± 0.13 (C)	0.76 (NS)
To eat	3.18 ± 0.13 (E)	2.74 ± 0.13 (D)	5.88 (NS)
To give away	2.34 ± 0.11 (F)	2.34 ± 0.13 (E)	0.05 (NS)
For fries or socials	1.28 ± 0.07 (G)	1.29 ± 0.08 (F)	0.06 (NS)
To sell	1.40 ± 0.07 (G)	1.30 ± 0.07 (F)	1.53 (NS)
To trade	1.46 ± 0.08 (G)	1.25 ± 0.06 (F)	5.13 (0.02)

Note 1, not as important; 5, very important reason for angling. Letters read down and indicate that those associated with different letters differ significantly from one another, using the Duncan multiple range tool.

White, and far fewer were Asian (Burger *et al*., 1999a).

In the present study, 13% of the fishing population identified themselves as Asian, compared to 3% in 1995 (Burger *et al*., 1999a). The population in the three counties abutting the Newark Bay Complex (Union, Sussex, Hudson) generally has an Asian population of just under 4% (US. Census Bureau, 2002, data for 2000). Asians were significantly different from the others in having a higher income and more years of schooling. More Whites than other groups did not eat their catch and they had lower consumption rates. Blacks had the highest consumption rates, followed by Hispanics. Thus this study confirms previous work that shows that non-Whites are more at risk than Whites. Blacks and Hispanics made up a higher percentage of the people at the high end of consumption. The ethnic differences in knowledge, consumption, and reasons for angling suggest that targeted risk communication is required to reach all of the angling public. This could be done through ethnically oriented community and health groups.

Differences in Reasons for Angling

Systematic analysis of ethnic differeneces in the factors or values that influence fishing behavior patterns are notably lacking (Toth and Brown, 1997). In urban areas, Blacks view angling more for its contribution to household consumption than do Whites (Burger, 1999a), although in some places Blacks and Hispanics are mainly concerned with socializing while fishing (West *et al*., 1989). The most extensive analysis for Black and White anglers was conducted by Toth and Brown (1997) in the Mississippi Delta. They reported that there were more similarities than differences in the meanings among anglers, but there were ethnic differences. Subculture highlighted the role of race in creating meaning for leisure time devoted to fishing.

Angling is often considered one activity, regardless of the quarry. In this study I separated crabbing and fishing because the majority of people did one or the other, but not both. Since the contaminant levels in fish and crabs are different, with bans on the consumption of any crabs, it is important to determine how much of each type that people are consuming. In previous studies (May and Burger, 1996) it was difficult to determine the total consumption patterns for both fish and crabs or even the relative number of people engaged in each activity. Thus consumption was determined for fish and crabs separately in the present study.

In this study, there were no ethnic differences in the reasons that people angled. People self-reported that recreation was the main reason that they fished and crabbed, followed by relaxation, and the reasons for fishing and crabbing were similar. Only 3–4% of the people listed obtaining food as a reason for fishing or crabbing in the Newark Bay Complex. However, when asked to rate different reasons for fishing, people rated relaxation significantly higher than recreation. They also rated being outdoors, getting away from demands, and communing with nature higher than recreation. Obtaining fish to eat, sell, give away, or use for fish fries were rated very low.

Taken altogether these data indicate that people in the Newark Bay Complex go fishing largely to relax, be outdoors, commune with nature, and for recreation, rather than primarily as a source of food. Over 30% of the people who fish and crab do not eat their catch. This information is useful in planning an intervention plan (see below) because it means that people might be amenable to capture and release. It should be pointed out that there is a ban in this region for both harvesting and consuming any crabs, so capture and release is a viable strategy only with fish. Setting the legalities aside, however, it might be wise for risk managers to undertake an educational campaign for catch and release of crabs, given the high risks from consuming them and the relative pleasure people seem to place on crabbing.

Although there were differences in the ratings for reasons to fish or crab as a function of consumption, the differences were not great. Nonetheless, people who consumed more generally rated the reasons higher than those who consumed less. The group of high consumers, who are more at risk from contaminants, clearly enjoy the activity for a wide range of reasons and not just because they are obtaining fish to eat, sell, or give away.

The findings in this study differ from those of Toth and Brown (1997) who reported that obtaining fish for fish fries and to give away was an important part of their fishing culture. In the Newark Bay Complex, people fished or crabbed to relax, recreate, and to get away from demands. The differences may partly lie in the urban industrial habitat where the people in this study lived, compared to the more natural and less industrialized south where they did their study.

Risk Management

The results of this study have implications for risk management, both on a municipality and on a state level, and are generalizable to other urban areas. In

New Jersey, and in many other regions, both state and local officials and agencies deal with information and signage relative to fishing and consumption. That is, it may be more useful for individual municipalities to provide much of the risk communication information to the public through local community and health organizations. Each municipality could then target the appropriate audience.

The majority of people interviewed mainly fished or mainly crabbed, suggesting that some information that is targeted to each activity should be developed. Understanding the community that is fishing is an important aspect of risk management. Since consumption increased with age of the angler, and decreased with income, thus suggests that information should be directed toward people in this category. Further, Asians ate few crabs and mainly fish, while the other ethnic groups ate mainly crabs (which have a No Consumption advisory in the region). This suggests that information about crabs is not penetrating to the public.

Finally, this research indicates that there are many reasons that people angle in this urban region. They do not angle just to obtain food. Since they are angling to relax, be outdoors, and get away from demands, these reasons should be recognized and encouraged, while discouraging the consumption of crabs and some fish, especially for populations at risk. The fact that it is forbidden to crab or consume crabs from this region, yet people do so without either legal constraints or getting obviously sick, suggests that this issue requires more public information and education. More attention should be paid to the importance of angling in the lives of this population, while explaning the risks to at-risk populations.

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