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# Gender Differences in Meal Patterns: Role of Self-Caught Fish and Wild Game in Meat and Fish Diets

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**The hypothesis that there are gender differences in consumption patterns of self-caught fish and wild game in the meat and fish diet was examined for 415 people attending the Palmetto Sportsmen's Classic in Columbia, South Carolina. Women were less likely to eat most types of wild fish and game than were men, although there were no gender differences in the percentage eating beef, chicken, pork, and restaurant and store-bought fish. Similarly, women consumed significantly fewer meals of wild-caught fish and game than did men, although the number of meals of most store-bought foods did not differ. Both men and women who ate more meals of fish ate a higher percentage of wild-caught fish than either store-bought or restaurant fish. People with low number of fish and meat meals ate mainly fish; people eating over 30 meals of meat and fish a month ate mainly meat. Only about 9% of those interviewed said that they changed their fish consumption patterns when they, or their spouse, were pregnant. These gender-specific data on protein consumption can be used for exposure assessment and risk management decisions regarding consumption advisories for wild-caught fish and game.** © 2000 Academic Press

## INTRODUCTION

Chemical contaminants, such as pesticides, dioxins, polychlorinated biphenyls (PCBs), and heavy metals, are found in the Nations's freshwater lakes, streams, and estuaries, as well as in terrestrial ecosystems (IOM, 1991; Sparks and Shepherd, 1994; ATSDR, 1996). For example, 15.8% of the Nation's lake acreage, an increase of 9% over the previous year, and 6.8% of the river miles were under fishing or consumption advisories in 1998 (EPA, 1999). Mercury accounts for half of the advisories; other contaminants of concern are PCBs, chlordane, dioxins, and DDT (EPA, 1999). Although some of the apparent increase may be due to increased monitoring, improved sensitivity, or a lowering of regulatory standards, there is still cause for concern.

For some populations, wild-caught fish and game are a major part of the diet and can be a significant pathway for exposure to toxics (Humphrey, 1987; Rifkin and LaKind, 1991; Ebert *et al*., 1994; Murray and Burmaster, 1994). To assess the potential of chemicals in aquatic ecosystems to adversely affect human health, it is essential to characterize exposure through different pathways. This involves identifying populations at risk, determining consumption patterns, and measuring the quantities of chemicals in the species consumed (Dourson and Clark, 1990; Ebert *et al*., 1994).

Consumption advisories often focus on women of child-bearing age because the developing fetus and infants are the most sensitive life stages. Chemicals in contaminated fish, such as PCBs, have the potential to cause adverse developmental effects (Jacobson *et al*., 1989, 1990; IOM, 1991; Sparks and Shepherd, 1994; ATSDR, 1996; Jacobson and Jacobson, 1996; Schantz, 1996). There is a relationship between mercury levels, fish consumption, and deficits in neurobehavioral development in children (Ratcliffe *et al*., 1996; Weihe *et al*., 1996), although the positive benefits of eating fish with respect to cardiovascular health must also be considered (Hunter *et al*. 1988; Wahlqvist *et al*., 1989; Horn, 1992; Anderson and Wiener, 1995; Egeland and Middaugh, 1997). Failure on the part of risk managers to place the risks from fish consumption in the context of the risks from consumption of other types of protein results in confusion by the public (Reinert *et al*., 1996). For public health, it is important to stress both the benefits and the risks of consuming fish,



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and the public is clearly interested in whether fish are safe to eat (Consumer Reports, 1992). Yet there are few data on the consumption patterns of wild-caught fish and game compared to other types of protein within the diet.

In this paper I examine the consumption patterns of white men and women that attended the Palmetto Sportsmen's Classic in South Carolina in 1998, concentrating on a variety of meats and fish, including wild-caught fish and game. I test the hypotheses that (1) there are no gender differences in the percentage of men and women that eat different species of fish and meat, (2) there are no gender differences in the average number of meals of different types of fish and meat, and (3) there are no gender differences in the relative percentage of fish meals in the overall diet. Since men and women usually eat together at home, I expected that there would be few gender differences in the percentage of people who ate different types of fish and meat and in the number of meals per month of each type.

I was also interested in determining whether people who ate fewer fish and meat meals per year also ate a higher proportion of fish meals than those who ate more meat and fish meals per month. That is, one could hypothesize that people who are health conscious and eat fewer meat and fish meals, also try to eat a higher proportion of them as fish (often presumed to be a healthy form of protein, see references above).

This study was initially stimulated by comments from regulators about the need to understand the role of wild-caught fish and wild-caught game (such as deer) in the diets of local residents in South Carolina. The question arose because of the potential for people to consume deer shot on the Savannah River Site (SRS), doves hunted adjacent to the site, and fish caught from the adjacent Savannah River, where there are consumption advisories because of mercury and radionuclides (SCDHEC, 1996, 1999; Burger, 1999, Burger *et al*., 1998). The Department of Energy's Savannah River Site, located an hour and a half from Columbia, is a former nuclear production and research facility. This research is part of a larger study by the Consortium for Risk Evaluation with Stakeholder Participation to develop risk-based methodologies to aid in regulatory, remediation, and management decisions.

## SUBJECTS AND METHODS

People ($N = 457$) were interviewed while attending the Palmetto Sportsmen's Classic in Columbia, South Carolina (27–29 March 1998). The show was attended by about 60,000 people who visited the display and educational booths, food courts, and vendors. Columbia, the capitol of South Carolina, is the largest city in the region. Subjects were interviewed individually while they waited in lines, were eating, or were standing about.

We randomly selected a subject for interviewing, and upon completing that interview, asked another a few meters away, walking transects through the exhibit halls and grounds to ensure that people were interviewed from all areas of the show. We identified ourselves as researchers from Rutgers University who were interested in how much they ate of different types of meat and fish. Nearly everyone agreed to participate in our interview, and those who declined ($N = 12$) were in a hurry, caring for small children, or about to leave the show. Many people inquired how they could find out the results of our study. All interviewers were experienced with similar surveys.

The questionnaire was divided into two parts dealing with demographics and number of meals consumed of several different types of fish and meat by month. Demographic questions were deferred until the end of the interview, after which we explained more fully what we were doing. Information about the number of meals for each meat or fish type was placed in a table, and people were prompted for each type and for each month. Species of interest included wild-caught fish, store-bought fish, restaurant fish, deer, wild-caught quail, restaurant quail, dove, duck, rabbit, squirrel, raccoon, wild turkey, beef, chicken, and pork. This list of meat and fish was derived from interviews at a prior Sportsmen's Classic and from interviews of hunters and fisherman along the Savannah River (Burger *et al*., 1997, 1998, 1999; Sanchez and Burger, 1998). Respondents were asked if they ate any other wild game. Previous studies here and elsewhere indicated that a greater proportion of people eat wild-caught game than hunt or fish for themselves (Burger, 1999a, b), suggesting that direct information on consumption is the best exposure information.

Demographic information included ethnicity, gender, age, location of residence, occupation, and income. Demographic questions were asked last because of the delicate nature of the information, such as income. We also asked whether and where they had heard warnings about fish consumption, and whether they (or their wives) changed fish consumption patterns when they were pregnant. 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). Because of the low sample of black women interviewed, this paper focuses an qender differences among whites.

Since we asked about so many different food types, and the questionnaire was already sufficiently long, we chose to test internal consistency by asking at two different points in the questionnaire what percentage of each meat type was eaten as stew or as meat. The correlations for these two questions were over 0.9 for all the meat types.

Wilcoxon $\chi^2$ tests were used to determine whether there were differences as a function of gender (SAS 1994, 1996). Means and standard errors are given in the text.

## RESULTS

### *Demographics*

Most of the subjects were men (70%), reflecting attendance at the Palmetto Sportsmen's Classic. The mean age of subjects was 40 years and ranged from 15 to 74, and there were no significant gender differences (Table 1). There were also no significant differences in personal evaluations of health or in the percentage that smoked (Table 1). Income, however, varied significantly by gender, with men earning significantly more than women (Table 1). Most people (94%) never worked at SRS. Of those sampled, 19% lived in Richland, 19% lived in Lexington, and 8% lived in Aiken; we interviewed people from 38 of the 46 counties in South Carolina. Occupations included technical (21%), sales and service (18%), administrative and clerical (14%), professional (13%), retired (8%), government service (8%), and a variety of others.

### *Percentage of People Eating Different Types of Meat and Fish*

Although there were no gender differences in the percentage of people who ate commercial protein sources (beef, chicken, pork, restaurant fish, and store-bought fish), there were significant differences for most wild-caught meat and fish (Table 2). For all types for which there was a significant difference, a higher proportion of men than women ate wild-caught species.

### *Monthly Meals*

Not only did fewer women eat wild-caught foods, but generally they ate fewer meals of wild-caught foods than men (Table 3). There were gender-related differences in the mean number of meals consumed per month for all wild-caught foods except raccoon and quail, which few people ate. There were no significant gender differences in mean monthly meals of chicken, pork and restaurant fish. The relative distribution for all fish and meat meals indicates that men eat more meals of fish and meat overall, and more wild fish and game meals overall, than do women (Fig. 1). As might be expected, women ate smaller serving sizes of most types of meats and fish than did men (Table 3); these data are presented for comparative purposes with the literature.

Since fish are one of the main potential sources of risk from consumption of wild-caught foods, judging by the number of consumption advisories nationwide for fish (EPA, 1999) and the advisories in South Carolina (SCDHEC, 1996,1999), I examined the relative proportion of wild-caught fish meals in the fish diet (Fig. 2). In general, the percentage of wild-caught fish meals decreased initially, but then

**TABLE 1**
**Gender Differences in Demographic (White Only) Factors and Percentage That Were Aware of Advisories**

| | Female | | Male | | |
|---|---|---|---|---|---|
| | Range | Mean | Range | Mean | Wilcoxon $\chi^2(P)$ |
| Sample | 137 | | 278 | | |
| Age | 14–68 | 38.7 ± 1.01 | 11–74 | 40.8 ± 0.79 | 2.12 (NS) |
| Self health rating | 1–5 | 4.19 ± 0.07 | 1–5 | 4.10 ± 0.05 | 0.76 (NS) |
| Income | 0–300,000 | 23,700 ± 2,990 | 0–210,000 | 35,500 ± 1,570 | 38.4 (0.0001) |
| Percentage that had heard advisories | | 69.7 | | 75.3 | 1.57 (NS) |
| Percentage that said that they or spouse changed fish consumption habits during pregnancy | | 11.0 | | 10.2 | 0.04 (NS) |
| Percentage that said that they smoke | | 22.5 | | 24.7 | 0.24 (NS) |

*Note.* NS, not significant.

**TABLE 2**
**Gender Differences in the Percentage of White People Eating Different Types of Fish and Meat**

| | Percentage that ate some wild fish/game | | | |
|---|---|---|---|---|
| | All respondents | Female | Male | Wilcoxon $\chi^2(P)^a$ |
| Sample size | 415 | 127 | 278 | |
| Beef | 94.7 | 92.6 | 95.7 | 1.90 (NS) |
| Chicken | 98.0 | 98.7 | 97.7 | 0.47 (NS) |
| Deer | 78.7 | 68.7 | 83.4 | 12.9 (0.001) |
| Dove | 47.1 | 29.9 | 55.4 | 25.8 (0.001) |
| Duck | 25.8 | 17.1 | 29.9 | 8.46 (0.004) |
| Fish, restaurant | 74.1 | 69.8 | 76.1 | 2.10 (NS) |
| Fish, store | 41.2 | 41.2 | 41.2 | 0.00 (NS) |
| Fish, wild-caught | 78.8 | 73.2 | 81.5 | 4.18 (0.04) |
| Pork | 71.5 | 77.3 | 69.0 | 1.03 (NS) |
| Quail, wild-caught | 24.5 | 20.8 | 26.3 | 1.64 (NS) |
| Quail, restaurant | 13.6 | 8.90 | 15.8 | 3.99 (0.05) |
| Rabbit | 28.4 | 15.1 | 34.9 | 19.0 (0.001) |
| Raccoon | 10.5 | 8.72 | 11.4 | 0.74 (NS) |
| Squirrel | 26.2 | 16.4 | 30.9 | 10.7 (0.001) |
| Turkey, wild | 40.1 | 32.6 | 43.5 | 4.75 (0.03) |

*Note*. NS, not significant.
[a]This test compares male and female resondents.

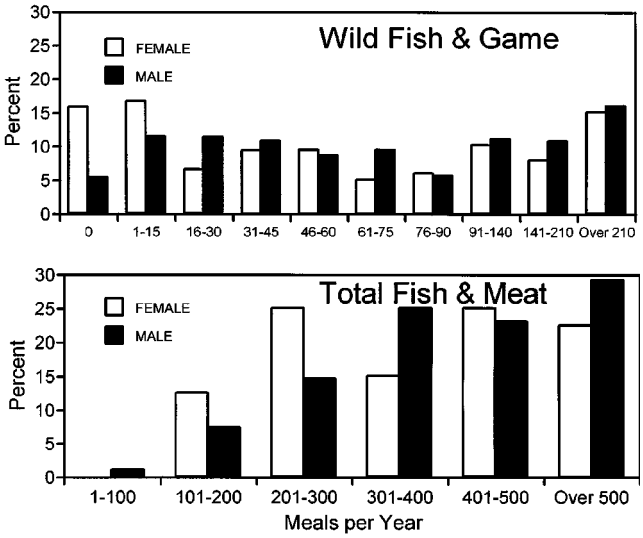


**FIG. 1.** Total meals eaten per year of all wild-caught fish and wild game (top) and total fish and meat meals per year (bottom) as a function of gender.

increased with the number of total fish meals per month. This was true for both men and women.

Similarly, I examined the percentage of fish meals in the total fish and meat diet (Fig. 3). For both men and women, the percentage of fish in the meat and fish diet decreased with increasing consumption of meat and fish overall. That is, people who limited their animal protein intake had a higher percentage of fish in their diets than people who ate more meat and fish (some over 30 meals a month).

One key question is whether women of child-bearing age eat more of different kinds of meat and fish

**TABLE 3**
**Comparison of Mean (±Standard Error) Monthly Meals and Mean Serving Size of Meat Only between White Men and Women Interviewed at the Palmetto Sportsman's Classic in March 1998**

| | Mean monthly meals | | | Mean serving size (g) | | |
|---|---|---|---|---|---|---|
| Meal type | Female | Male | Wilcoxon $\chi^2$ ($P$) | Female | Male | Wilcoxon $\chi^2$ ($P$) |
| Sample size | 137 | 278 | | 137 | 278 | |
| Beef | 7.18 ± 0.55 | 9.42 ± 0.55 | 4.98 (0.03) | 192 ± 10.1 | 272 ± 10.1 | 57.9 (0.0001) |
| Chicken | 9.03 ± 0.56 | 9.28 ± 0.46 | 0.04 (NS) | 192 ± 10.1 | 242 ± 10.1 | 35.0 (0.0001) |
| Deer | 4.13 ± 0.57 | 4.68 ± 0.36 | 6.53 (0.01) | 161 ± 10.1 | 282 ± 10.1 | 43.4 (0.0001) |
| Dove | 0.14 ± 0.03 | 0.38 ± 0.04 | 27.4 (0.0001) | 80.6 ± 20.2 | 121 ± 10.1 | 24.0 (0.0001) |
| Duck | 0.05 ± 0.01 | 0.16 ± 0.03 | 8.99 (0.003) | 30.2 ± 10.1 | 101 ± 10.1 | 8.79 (0.003) |
| Fish, restaurant | 1.01 ± 0.10 | 1.32 ± 0.11 | 1.73 (NS) | 181 ± 10.1 | 232 ± 10.1 | 8.97 (0.003) |
| Fish, Store | 0.80 ± 0.12 | 0.71 ± 0.08 | 0.22 (NS) | 111 ± 10.1 | 131 ± 10.1 | 0.06 (NS) |
| Fish, wild-caught | 1.52 ± 0.20 | 2.24 ± 0.20 | 9.44 (0.02) | 232 ± 20.2 | 373 ± 20.2 | 30.6 (0.0001) |
| Pork | 3.61 ± 0.62 | 3.37 ± 0.56 | 1.35 (NS) | 141 ± 20.2 | 161 ± 20.2 | 0.10 (NS) |
| Quail, restaurant | 0.06 ± 0.02 | 0.10 ± 0.03 | 4.72 (0.03) | 20.2 ± 10.1 | 50.4 ± 10.1 | 4.81 (0.03) |
| Quail, wild-caught | 0.10 ± 0.02 | 0.15 ± 0.03 | 2.03 (NS) | 50.4 ± 10.1 | 90.7 ± 10.1 | 3.16 (0.08) |
| Rabbit | 0.03 ± 0.01 | 0.16 ± 0.03 | 20.4 (0.0001) | 20.2 ± 10.1 | 90.7 ± 10.1 | 16.2 (0.0001) |
| Raccoon | 0.01 ± 0.00 | 0.02 ± 0.01 | 0.89 (NS) | 10.1 ± 0.00 | 20.2 ± 10.1 | 0.61 (NS) |
| Squirrel | 0.05 ± 0.01 | 0.15 ± 0.02 | 10.8 (0.001) | 30.2 ± 10.1 | 80.6 ± 10.1 | 12.7 (0.0004) |
| Turkey, Wild | 0.16 ± 0.05 | 0.19 ± 0.03 | 4.95 (0.03) | 70.6 ± 10.1 | 151.2 ± 30.2 | 7.65 (0.006) |

*Note.* Serving size was determined after subjects viewed models of known amount. NS, not significant.

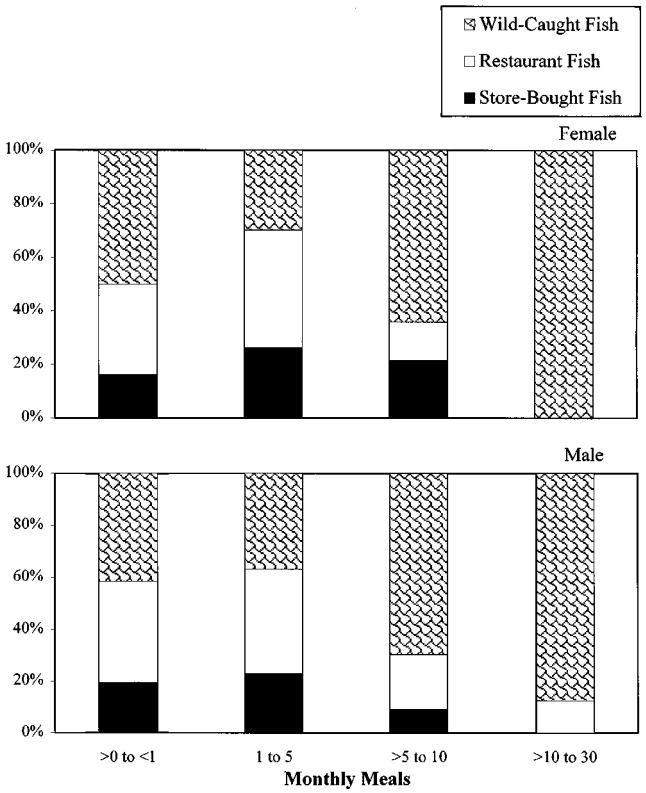


**FIG. 2.** Percentage of monthly meals of fish of different types as a function of the number of monthly meals of fish.

than older women. Table 4 indicates that there were few significant differences as a function of age. Further, there were no significant difference for fish.

*Risk Perception*

There were no gender differences in the percentage of people who had heard consumption advisories about eating wild-caught fish, nor were there differences in the percentage who smoked (Table 1). Only about 9% of the people said that either they or their spouse changed their fish consumption patterns when they were pregnant (Table 1).

## DISCUSSION

*Methodological Considerations*

One difficulty with this analysis is that it involves only people who identified themselves as white, largely because the diversity of other people at the event was low, and because few black women were interviewed (or present at the show). From a risk assessment perspective, however, black men ate significantly more meals of self-caught fish and other wild game than did whites (Burger and Gochfeld, unpublished), suggesting that exposure of black women would also be higher than reported in this paper for white women, but this requires additional field data.

Since the interviewers moved through the show in a systematic fashion, covering all areas equally, and interviewing the first person encountered after moving 3–5 m, those interviewed are representative of those attending the show. Further, the show was attended by 60,000 people, and interviews were conducted on all days, assuring equal coverage.

The choice of food items to include in the questionnaire was derived from experience interviewing hunters and anglers in South Carolina (Burger, 1997, 1998; Burger *et al.*, 1997, 1999). Although the survey seemed to include all protein sources, since no one mentioned any other food item, it should be noted that the survey did not include lamb or frogs. Further, when we used the prompt of pork, we assumed pork included ham. When anyone asked, we answered yes.

Dietary recall studies have been criticized because of (1) reliability over time and (2) recall bias. However, even if recall bias occurred, there is no reason

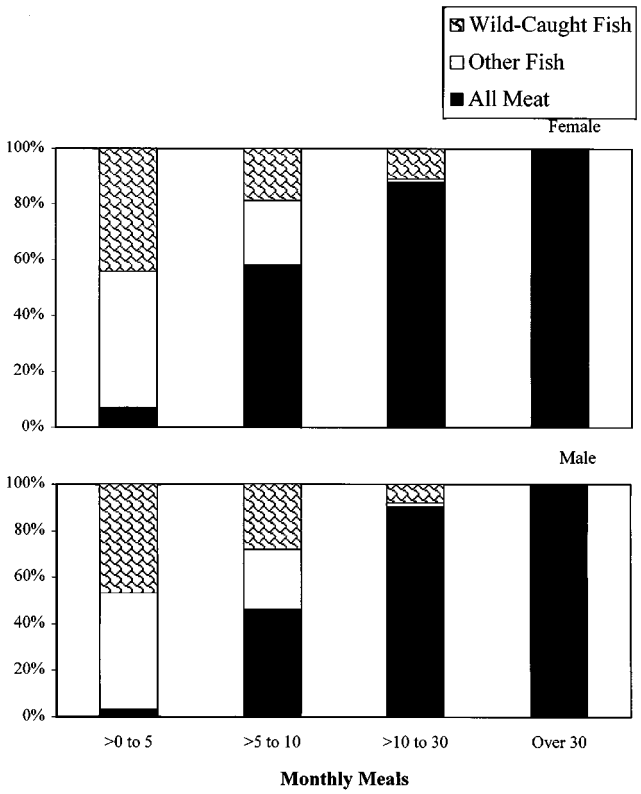


**FIG. 3.** Percentage of monthly meals of wild-caught fish, other fish (restaurant and store-bought), and all meat as a function of the number of total fish and meat meals per month.

**TABLE 4**
**Comparison of Mean (±Standard Error) Monthly Meals of Different Meats of White Women Interviewed at the Palmetto Sportsman's Classic in March 1998**

| | 32 and Under | 33 to 45 | Over 45 | Wilcoxon $\chi^2$ ($P$) |
|---|---|---|---|---|
| Sample | 47 | 50 | 39 | |
| Beef | 8.17 ± 1.10 | 7.85 ± 0.89 | 5.15 ± 0.77 | 5.19 (0.05) |
| Chicken | 9.87 ± 0.98 | 9.68 ± 1.04 | 7.24 ± 0.81 | 3.68 (NS) |
| Deer | 3.79 ± 0.86 | 3.65 ± 0.87 | 5.03 ± 1.28 | 0.47 (NS) |
| Dove | 0.06 ± 0.02 | 0.22 ± 0.06 | 0.14 ± 0.06 | 5.98 (0.08) |
| Duck | 0.05 ± 0.02 | 0.04 ± 0.01 | 0.07 ± 0.03 | 0.06 (NS) |
| Fish, restaurant | 0.84 ± 0.13 | 1.15 ± 0.19 | 1.06 ± 0.23 | 0.29 (NS) |
| Fish, store | 0.81 ± 0.23 | 0.87 ± 0.19 | 0.69 ± 0.22 | 0.45 (NS) |
| Fish, wild-caught | 1.23 ± 0.3 | 1.75 ± 0.4 | 1.61 ± 0.33 | 3.66 (NS) |
| Quail, wild-caught | 0.07 ± 0.04 | 0.13 ± 0.04 | 0.11 ± 0.04 | 3.35 (NS) |
| Pork | 3.00 ± 1.21 | 4.94 ± 1.08 | 2.73 ± 0.86 | 2.86 (NS) |
| Quail, restaurant | 0.05 ± 0.03 | 0.12 ± 0.05 | 0.01 ± 0.00 | 3.44 (NS) |
| Rabbit | 0.03 ± 0.02 | 0.05 ± 0.02 | 0.02 ± 0.01 | 5.08 (NS) |
| Raccoon | 0.00 ± 0 | 0.02 ± 0.01 | 0.01 ± 0.01 | 3.56 (NS) |
| Squirrel | 0.01 ± 0.01 | 0.07 ± 0.03 | 0.05 ± 0.03 | 4.51 (NS) |
| Turkey, wild | 0.06 ± 0.02 | 0.25 ± 0.13 | 0.15 ± 0.05 | 0.16 (NS) |

*Note.* Serving size was determined after subjects viewed models of known amount. NS, not significant.

to believe that there would be gender differences in recall. Further, Smith (1993) reported that in cognitive studies subjects had excellent relative judgements of frequency, although such studies need to address absolute frequency judgements. In short-term studies of dietary intake, there is a fairly high and significant correlation in recall (repeated measures averaged correlations of 0.7 to 0.8 for fish and meat; Jarvinen *et al.*, 1993). Foods that are never eaten are easy to remember (Krall *et al.*, 1988), and foods which are eaten regularly are recalled reliably (Nomura *et al.*, 1976). The difficulty lies mainly with foods that are eaten infrequently (Jarvinen *et al.*, 1993). However, content cues are one of the important factors in ensuring accurate recalling of foods eaten, rather than length of the reference period (Smith 1993), and in this study many cues were given, particularly for the less-commonly eaten wild game types.

We provided respondents with cues for all types of meat and game that they might have consumed. Further, they were prompted with questions about whether they ate specific game during hunting or fishing seasons or froze the items for later consumption. For example, people reported eating raccoon only during the fall and winter months and ate wild turkey only during the fall hunting season. Further, people reported eating more fish during the summer months when they fished more often. I suggest that foods that were eaten less often, such as some species of wild game, were recalled accurately because content cues were given, and they were foods associated with a specific hunting season, thus making them easier to recall. Respondents were required to think only about how often they ate each type in a month.

Finally, the results of this study apply to people who are interested in hunting and fishing, as they were attending a sportsmen's show aimed at this audience. Thus, their consumption rates for wild-caught fish and game might be higher than for the overall population. However, since a high percentage of people in South Carolina and many other states are hunters and fishermen (U.S. Fish and Wildlife Service, 1996), it is a significant proportion of the public worth considering in exposure assessments.

The relative representativeness of the sample bears comment. The Palmetto Sportsmen's Classic was selected because the attendees represent hunters and fishermen in the region. This sample was selected to obtain information on the segment of the population that might be expected to be most at risk from consumption of wild fish and game. Because most similar studies examine only fish consumption, potential risk from consumption of other wild meats is never considered. Further, there is little information on consumption of these other wild foods. Thus, there is little available information for determining the representativeness of these foods. However, such information is available for fish consumption. White men who fish along the Savannah

River eat an average of 2.88 fish meals/month, and they reported eating almost no fish in restaurants (Burger *et al.*, 1999), which is equivalent to the 2.95 fish meals/month reported by men in this study. Thus, the white men surveyed at the Palmetto are similar to white fishermen in the general region.

### *Hunting/Fishing Rates and Consumption of Wild Fish and Game*

It is important to distinguish between hunting/fishing rates and consumption patterns for wild-caught fish and game. Some people who hunt and fish do not eat their catch, while others who do not hunt and fish regularly eat wild-caught game provided by relatives and friends (see Burger, 1997; Toth and Brown, 1997). Indeed, some people who did not hunt and fish said that half or more of the total meat that they ate was deer meat given to them by friends. Toth and Brown (1997) found that a significant number of fisherman fished so that they could provide friends and family with fish. This is also true for South Carolina, as many people told us that they never hunted, but ate deer meat all year, courtesy of friends and family. Thus, assuming that the potential risk to consumers from wild-caught game is equal to the number of hunting participants in any given geographical region may be erroneous. Further, site-specific information on both hunting and fishing rates, and consumption rates, is essential for exposure assessment because rates of hunting (17%) and fishing (14%) for the United States overall are much lower than in places such as South Carolina (Burger, 1998) and Idaho (U.S. Fish & Wildlife Service, 1996; Burger, 1999a,b). Thus, the assumption that hunting and fishing rates, both for a specific region and for the country overall, can be used as a measure of consumption for exposure assessment underestimates the potential exposure of local populations.

There are several aspects of gender differences that bear discussion: (1) differences in the percentage of women who consume different species of wildlife, (2) differences in the average number of meals, and (3) trade-offs in consumption of different types of protein (such as fish). Each will be discussed below.

### *Gender Differences in Percentage Consuming Wild Game*

In a previous study of attendees at a general interest event (Mayfest) in Columbia, Burger (1997) found that significantly more men (51%) than women (26%) fished and significantly more men (20%) than women (4%) hunted. Although there were significant differences in this study in the percentage of men and women that ate wild-caught fish (82% vs 73%) and deer (83% vs 69%), the differences were not great. These differences may be partly due to men eating some meat and fish during hunting and fishing trips, as well as to preferences. Further, single men may have more time to hunt and fish and may eat more than single women, although this needs to be examined in detail (we did not ask about marital status).

Further, a higher percentage of people (over 75%) ate wild-caught fish and deer than participated in hunting or fishing in South Carolina (Burger *et al.*, 1997; Burger, 1997; this study). In part this latter finding is age-related; some older people may no longer hunt, but still receive game from friends and relatives. Not everyone hunts, and some people volunteered that they could not hunt themselves, but relied on friends for their deer meat. There is a very long hunting season in South Carolina, with few bag limits (Sanchez and Burger, 1998), and it is easy for an avid hunter to kill many deer for friends. Further, the fishing season in this southern state is relatively long because it is warm enough to enjoy fishing and for the fish to be active.

The lack of a gender difference in percentage of people consuming commercial fish, beef, pork, and chicken is not surprising, since presumably these meats and fish are cooked at home for the whole family. There were, however, gender difference in the percentage of people who ate most other types of wild fish and game (except quail and raccoon, refer to Table 2). This may relate to personal preferences, as many women said that they did not like the taste of wild game, or to men eating some wild fish and game while on hunting trips.

### *Gender Differences in Consumption Patterns*

Overall consumption patterns are a function of meals consumed and serving sizes. There were significant gender differences in the number of meals consumed of all types of wild fish and game (except quail and raccoon). Although this may partly reflect that men eat some meals during hunting trips, and some single men eat high numbers of wild-caught fish and game, it must also reflect preferences, since the differences were quite consistent. The lack of a difference in the mean number of meals per month for all types of commercial meats and fish (except beef) suggests that the consumption differences in wild game, rather than all meat, are valid.

Presumably this finding reflects the fact that men and women eat most meals together and thus eat the same number of meals each month.

### *Trade-offs in Consumption of Wild-Caught versus Other Fish*

There are potentially many trade-offs in the decisions about which sources of protein to eat and how many meals of each to consume. One of the key risk-balancing decisions involves the consumption of wild fish and game, more notably fish because of the potential for contamination (EPA, 1999). The major concern for eating fish is the potential for exposure to mercury, PCBs, and other contaminants. This concern is borne out by the large number of water bodies with consumption advisories, which are often directed toward pregnant women and other vulnerable populations (EPA, 1999).

Given the media campaign about the health benefits of eating fish, in terms of reduction in heart disease and a number of other ailments (Hunter *et al*., 1988; Wahlqvist *et al.*, 1989; Anderson and Wiener, 1995; Egeland and Middaugh, 1997), it is not surprising that people would choose to eat an abundance of fish. The data indicate two trade-offs: (1) for people who eat fish, the proportion of wild-caught fish increases with the number of fish meals that they eat per month; and (2) people (both men and women) who eat few meals of meat and fish eat mainly fish, and those who eat meat and fish every day eat mainly meat (refer to Figs. 2 and 3).

Wild-caught fish is thus the most important component of the fish diet of people who consume over 10 fish meals a month. The data on the proportion of wild-caught compared to commercial fish is important in balancing the risk from contaminants in wild-caught versus other fish, such as tuna. For fisherman in South Carolina, the risk from contaminants in wild-caught fish is real, particularly if they are fishing along the Savannah River, where South Carolina issued consumption advisories (SCDHEC, 1996, 1999). The risk assumption used in their studies was that fishermen would normally not eat more than 19 kg a year, which they consider "recreational fishing." Yet in this study, men, on average, approached this level (mean of 16.3 kg) for wild-caught fish alone. Further, as fish consumption increased, the percentage of wild-caught fish in the diet increased, further increasing risk.

The data from this study indicate that the percentage of wild-caught fish in the diet of men and women varies as a function of how much fish they eat. Most studies merely report the percentage of all fish eaten that are wild-caught. For example, Connelly *et al.* (1996) found that 28% of fish eaten by Lake Ontario anglers was wild-caught, while Stern *et al*. (1996) reported that only 5% of fish eaten by New Jersey residents was wild-caught. In the present study of anglers in South Carolina, the percentage of wild-caught fish eaten varied by how much fish they ate; it increased with increasing consumption of fish. This suggests that risk, if it exists for wild-caught fish, is disproportionately higher for heavy fish consumers.

The data also indicate that people who eat few fish and meat meals eat mostly fish, suggesting that they are health-conscious people or vegetarians who are mostly limiting animal protein to fish. While there is considerable data that there are gender differences in risk perception (Gustafson, 1998), which might lead to fish making up a larger percentage of the diet of women, there were no gender differences in the proportion of fish in the protein diet this study (refer to Fig. 2). At the other end of the spectrum, people who eat a lot of animal protein eat much less fish and thus experience few of the benefits derived from fish.

## CONCLUSIONS

In a survey of 415 white people attending the Palmetto Sportsmen's Classic in Columbia, South Carolina, there were gender-related differences in the percentage of people who consumed various species of wild-caught fish and game, in the average number of meals consumed per month of wild-caught fish and game, and in the amount of wild fish and game consumed. There were also gender-related differences in the total consumption of all types of meat and fish.

The potential risk from the consumption of wild fish and game varies, of course, depending not only on consumption patterns but also on the concentrations of contaminants in each type. Current fish consumption advisories in South Carolina are largely based on mercury (SCDHEC, 1996, 1999). Remarkably, only about 9% of the people said that they, or their spouses, changed their fish consumption patterns when they were pregnant, even though about 75% of the people reported knowing about consumption advisories. The advisories specifically state that pregnant women and young children should eat less fish from certain waters (SCDHEC, 1996, 1999). The data from this study suggests that people are aware of the advisories, but are not changing their behavior during pregnancy. Unfortunately, we did not ask them about their understanding of the advisories; so, it is unclear whether they

realize that the advisories are more stringent for pregnant women. Evaluating consumption advisories is an important aspect of risk communication (Connelly and Knuth, 1998) and requires more extensive study. The data further suggest that it is not only people who are fishing along an important water body, such as the Savannah River (Burger *et al*., 1999), that consume considerable quantities of fish, but that there is a group of recreational fishermen who are consuming large quantities of fish.

Overall, the data indicate a high rate of self-caught fish consumption for both men and women from South Carolina. Further, wild fish and game contribute significantly to the overall protein diet of the people interviewed. Wild fish and game are not simply foods that are eaten sporadically, but they are part of the regular diet of a significant proportion of the people in every month of the year. Further, the people who consume the most fish per year have the greatest proportion of wild-caught fish in their diet.

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