Fish Consumption Advisories in Tributaries to the Chesapeake Bay:
Improving the Communication of Risk to Washington, DC Anglers

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ABSTRACT

Fish consumption advisories are increasingly being issued by state and municipal governments with concerns about pollution in local waterways. These advisories are developed to inform the public about the potential dangers of consuming excessive amounts of locally caught fish. They are not enforceable limits, however, and are only guidelines and suggestions on what are considered safe meal sizes, safe meal frequencies, and species fit for consumption. As a result, few efforts are made to determine how well these advisories are being followed. In order to determine the efficacy of such urban advisories, anglers are interviewed in Washington, DC on the Potomac and Anacostia Rivers. Anglers are asked a number of questions pertaining to their fishing and consumption habits, advisory knowledge, and risk perceptions. The results suggest that several improvements can be made to better implement advisory efforts. Most importantly, minority anglers—particularly African-Americans—appear to be receiving the message in advisories, but are failing to comply with advisory recommendations. Cultural beliefs and influences, as well as information dissemination inadequacies, are cited as possible reasons for this failure. Lastly, strategies are presented that health and fisheries planners can use to better understand angler risk perception and better educate anglers about the risks of ignoring advisory recommendations.

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APPENDICES

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CHAPTER I: INTRODUCTION

The Chesapeake Bay is North America's largest estuary, and its watershed extends to parts of six states and the District of Columbia (CBP, 2004). The Bay's complex ecosystem, unique habitats, and beautiful scenery make it an important ecological and economic entity. For these reasons, the human population in many areas surrounding the Chesapeake Bay has risen steadily for the past 300 years (Mertz, 2003). Several large cities such as Baltimore, Washington, DC, and Norfolk have developed along its shores, and they owe a substantial portion of their economies to the resources of the Chesapeake Bay and its tributaries.

One such resource is an abundance of recreational opportunities, the most prominent of which is sport fishing (VA Gen. Asm., 2000). Anglers on non-commercial fishing boats navigate the bay and its tributaries daily, and dozens of public parks and piers also give access to shore anglers. Many of these fishermen practice catch and release fishing methods, but state regulations allow anglers to keep a limited number of certain fish each day. These per-day limit regulations, along with similar size restrictions, primarily seek to help preserve the fish population for future recreational use (Potomac River Fisheries Commission, 2002).

However, as the human population has increased in the region, so too has the pollution in the tributaries of the Chesapeake Bay. Degraded waterways often increase the contaminant levels in fish, which can be harmful to humans who ingest them. In response, some states issue health advisories that recommend limitations on the consumption of certain fish caught from the bay. These fish consumption advisories inform the public of the potential dangers of consuming the fish that they catch from

contaminated waters. The advisories act as guidelines to notify the public about which areas, species, meal sizes, and meal frequencies can pose threats to human safety.

Much literature exists about the increased risk certain populations face from eating fish that have accumulated certain contaminants in their bodies. Mercury, Kepone, and polychlorinated biphenyls (PCBs) are three of the most widespread and pertinent of these pollutants found in the Chesapeake Bay's tributaries. High mercury levels can disrupt nervous system function in children and the elderly (EPA, 2001), and fetuses can incur brain damage from maternal ingestion of foods containing elevated levels of PCB and mercury (EPA, 1999). Kepone, a synthetic chemical found in abundance in the James River, is believed to have neurological and carcinogenic effects (Spectrum, 2004). Any contaminated fish has the ability to transmit dangerous toxins through ingestion, and the risk is believed to increase as the quantity consumed increases.

The data collection for this study was supervised by the author and collected by the author and other employees of Conservation Management Institute (CMI), a natural resources research institution within Virginia Polytechnic Institute and State University (Virginia Tech). The project was funded by a grant from the Chesapeake Bay Program (CBP), a multi-jurisdictional watershed restoration partnership between the District of Columbia, the state governments of Virginia, Maryland, and Pennsylvania, the federal government (Environmental Protection Agency) and participating citizen advisory groups (CBP, 2004).

Anglers were surveyed in some of the more contaminated areas of the Chesapeake Bay, namely the major urban areas on tributaries to the Bay. The survey was intended to identify possible areas where advisories could be improved based on the interview

responses of anglers in these regions. The regions included Baltimore, Maryland and its surrounding areas, Washington, DC and its surrounding areas, and the Tidewater area of Virginia around the mouth of the James River. Due to budgeting and temporal constraints, certain aspects of the CMI project were limited, including the depth of data-analysis in each region.

The scope of this paper is more focused geographically. This paper centers only on angler interviews conducted in the Washington, DC region of concern and elaborates on the data analysis. This region is affected by several contaminants pervasive in the Anacostia River, Potomac River, and Rock Creek, including Polychlorinated Biphenyls (PCBs), inorganic metal compounds, and pesticides.

The current DC fish consumption advisories were issued in November, 1994, and have therefore been in effect for over a decade. Fish tissue monitoring in the area (the scientific basis by which advisories are issued) last took place in 2000, and the data at that time did not warrant a change in the recommendations listed in local advisories. The next set of fish tissue monitoring samples is slated for collection in 2005, with any necessary advisory adaptations to occur thereafter. One of the goals of this paper is to provide the District of Columbia with information that may be helpful in the issuance and implementation of future advisories.

Research Question

What trends in fishing and consumption habits and advisory knowledge can be identified among anglers in the Washington, DC region of concern that will help planners and

managers to improve the effectiveness of fish consumption advisories in order to improve public health?

Specifically:

1. What are the demographic characteristics of the typical recreational angler in Washington, DC?

2. Can one or more demographic populations of anglers from Washington, DC be identified as being more at-risk for the ill effects of contaminated fish consumption than others?

3. Are there effective communication tools that can/should be directed to these and other populations of anglers?

4. How effective are current fish consumption advisories at reaching at-risk and other angler populations?

5. What reasons can be given for increased risk among certain populations (i.e., cultural, lack of information, negligence)?

6. What limitations exist in the current system?

7. How can this study be applied to improve overall planning for public health in Washington, DC?

Thus the objective of this paper is to identify in one of the Chesapeake Bay watershed's "regions of concern" those populations of anglers that are at the greatest risk of consuming contaminated fish based on their demographic information. The nature of the associated risks is assessed, and the methods by which the Washington, DC region's fisheries and health planners disseminate advisory information to anglers will be analyzed to identify both areas of success and opportunities for improvement.

By identifying the socioeconomic and demographic populations most likely to consume self-caught fish or provide it to their families, and combining that information with data on successful angler communication methods, public health officials and natural resource planners can develop or improve fish consumption advisories in areas

with polluted waters. Developing a better knowledge of the communities and people most threatened by contaminated fish can help managers better educate those communities through more effective public health risk communication.

The remainder of this thesis is presented in five chapters. Chapter II presents a review of relevant literature and discusses past studies and their findings. Chapter III provides the methods used to approach data collection and analysis for this thesis. General results from the survey are presented in Chapter IV, and Chapter V presents these results based on demographic information, particularly race. Chapter VI discusses the implications of these data, presenting advisory implementation strategies and areas for further research.

CHAPTER II: BACKGROUND ON ADVISORY DEVELOPMENT AND IMPLEMENTATION

Chapter II presents information collected in a review of literature. This chapter includes (1) a review of risk communication tools and previous projects examining advisories; (2) studies related to risk assessment and target audience identification, including an imperative section on ethnic and socioeconomic risk assessment; and (3) information on the contaminants pervasive in Washington, DC waterways.

Risk Communication

Fish Consumption Advisories

Fish consumption advisories are the most widely utilized method for communicating the risks associated with contaminated fish and shellfish consumption to target audiences. Issued by state, tribal, and local governments, they inform people about the potential hazards involved in eating contaminated fish. Advisories are released when the state and local government agencies that monitor waterbodies find dangerous levels or types of contamination. Advisories often convey limitations, like safe portion sizes and suggested quantities and frequencies of fish meals. Advisories can also suggest restrictions on specific fish and shellfish species and can discourage eating fish from particular waterbodies (EPA, 1994).

Since the issuance of fish consumption advisories is primarily the responsibility of state rather than federal governments, fish advisory programs have been developed independently within each state jurisdiction (EPA, 1994). The result has been several different approaches to developing and administering the advisories from state to state. Inconsistencies also exist between adjacent states, meaning that some interstate

waterbodies, like those in the District of Columbia area, experience variation in the advisories present on their tributaries and throughout their watersheds.

Cunningham et. al. (1994), after compiling nationwide data on fish consumption advisories, produced a list of five general types of fish and shellfish consumption advisories and bans present throughout the United States (Table 1). The current advisories in most states, including those in Washington, DC, fit into one or several of these categories.

Table 1. Five common advisory categories in the United States, developed by Cunningham et al. (1994).

Advisory Type	*Description*
Commercial Fishing Ban	Prohibits commercial harvest/sale of some or all species
General Population No-Consumption	No consumption of certain species or in certain areas; applies to general public
General Population Restricted Consumption	Limited consumption of certain species or in certain areas; applies to general public
Subpopulation No-Consumption	No consumption of certain species or in certain areas; applies to certain groups
Subpopulation Restricted Consumption	Limited consumption of certain species or in certain areas; applies to certain groups

Commercial fishing bans prohibit the commercial harvest and sale of some or all species, and their issuance, development, and enforcement may involve both state and federal agencies since interstate commerce issues may be a concern. The rest of the advisories, however, are primarily administered by state governments.

General population no-consumption advisories recommend that the broad public not consume any fish or shellfish from a state, region, or waterbody. These can also be applied exclusively to certain species. *General population restricted consumption advisories* suggest that people only limit the consumption of fish, or certain species of

fish, rather than eliminate them entirely from their diets. They often involve limits on the number of meals and size of meal portions consumed per unit time.

Subpopulation no-consumption advisories resemble general population no-consumption advisories, but the recommendations in these advisories apply only to sensitive subpopulations, such as pregnant women, nursing mothers, and children. *Subpopulation restricted consumption advisories* are consumption restrictions that apply only to sensitive groups, and they limit rather than prohibit the intake of fish.

Consumption advisories can apply to any waterbody from which fish are caught and consumed, but nationally, consumption advisories are most often issued for lakes (Cunningham et. al.1994). As of 2001, 16% of all freshwater lakes in the United States were under some sort of fish consumption advisory. Therefore lake-filled states like Illinois, Wisconsin, Michigan, and Minnesota often experience the greatest number of advisories in effect at any one time.

This study, however, focuses only on rivers leading to an estuary, where a significant number of advisories also exist. The EPA believes that 7% of rivers in the US are under some type of fish consumption advisory. Also, Cunningham et. al (1994) determined that seven fish species account for almost 90% of all advisories. Some of these are found in the waters of the District of Columbia, including carp, bluegill, and bass. Three of the four contaminants described in this study (mercury, PCBs, and chlordane) are also responsible for a large portion of the advisories currently in effect in the US. Another—Kepone—is limited to the waterways in the state of Virginia as a result of isolated releases occurring there in the 1960's and 1970's.

Advisory Development and Communication

Risk communication is the basis for advisory development among health and fisheries professionals. As stated by Knuth (1990), it is the framework for developing and distributing advisories. The message being sent to anglers is one that conveys the risks in consuming contaminated fish, and this message and the mechanisms used in its distribution make up the framework of risk communication. Risk communication is an interactive process of information exchange among individuals, groups, and institutions, where the angler decides how he will respond to the information presented to him and whether he should eat a particular fish (Knuth, 1990).

Fish consumption advisories are developed independently by state governments, therefore inconsistencies exist in the way they are defined and disseminated by states and in the criteria states use for issuing them (Cunningham et. al., 1994). Some research has been conducted on dissemination methods, including the best formats used for risk communication.

Fish fact sheets are one of the most commonly utilized methods for state advisory issuance. These fact sheets have been evaluated in comparison to classroom lessons on the risks of fish consumption (Burger et. al., 2003). The instruments, tested on women of child-bearing age (a high-risk population), have been found to be successful in imparting basic advisory information to most women. Both instruments can be provided in English and Spanish, but often classroom lessons work better for non-English speaking anglers. Women exposed to a classroom lesson often have a better understanding of risk than those only reading the brochure (Burger et. al, 1990). In New Jersey, 96% of women

who experienced the classroom lesson understood the risks associated with eating fish from the port, while 72% who read the brochure understood them (Burger et. al, 1990).

Results favoring the classroom lesson have been thought to be the products of time factors (it took less time to view the short presentation than read the brochure), the use of multiple modalities (the presentation used oral commentary, written text, and visual images), the engagement of interest resulting from a "live" presenter, and the interactive format of the classroom mode in which questions and information were exchanged (Burger et. al, 1990).

Some disadvantages to this method are also evident, however. A classroom lesson must have a suitable venue, and audiences must be recruited for the lesson, whereas brochures may be either actively or passively distributed. Conducting classroom lessons is also much more expensive, and it places limits on the number of receptors and the geographic extent of the information being disseminated. The researchers in the project concluded that the best method for communicating advisories was to have both of these instruments available to the public (Burger et. al, 1990). The lesson provides an in-depth discussion of the problem to those who can attend, while the brochure provides a written and less intrusive reference that may be taken home.

Burger and Waishwell (2001) have also examined the efficacy of a fish fact sheet advisory along the Savannah River in South Carolina and Georgia. They wanted to find out several aspects of this advisory instrument: the awareness of it among anglers, the message obtained from it, perceptions of the audience at which the sheet was aimed, who was most at risk, and what the best method was for disseminating such information. The

fact sheet was basically an abbreviated version of the longer, more detailed state consumption advisories.

The results indicate that most anglers along had not seen the fish fact sheet, but that half were aware of consumption advisories. Interest in the fish fact sheet was also undeniable. Ninety-nine percent of all anglers approached agreed to read the sheet and answer questions—a half-hour process—indicating that interest in learning about advisory information was high. Most anglers even asked for additional fact sheets for their families and friends (Burger and Waishwell, 2002).

The majority of anglers also obtained the intended messages from the fact sheet. These sheets, and their direct distribution to anglers, could be a strong asset for states in addition to the state-issued advisory signs since they provide quick, easily accessible information that may be more likely to reach anglers than state-issued advisories. As with classroom lessons (Burger et. al 1993), one of the more effective components of the fact sheet appears top be the element of personal contact and interaction that accompanies fact sheet distribution. This further illustrates the importance and effectiveness of such communication in advisory dissemination.

Even in the Savannah study, however, many anglers were unaware of the advisories. Reasons for the lack of angler knowledge have been a subject of discussion among many fisheries and health managers and researchers. Knuth (1995) believes that anglers are often not familiar with advisories because advisory developers do not understand many of the specific information needs of their audiences. Awareness of advisories varies among target populations, which emphasizes the need for implementing communication strategies specific to each target audience. Furthermore, even when

anglers are aware of the advisory, compliance is not always guaranteed (Knuth, 1995). Several factors go into angler response to an advisory; one model developed by Knuth et. al. (1993) shows a diagrammatic representation of these factors (Figure 1).

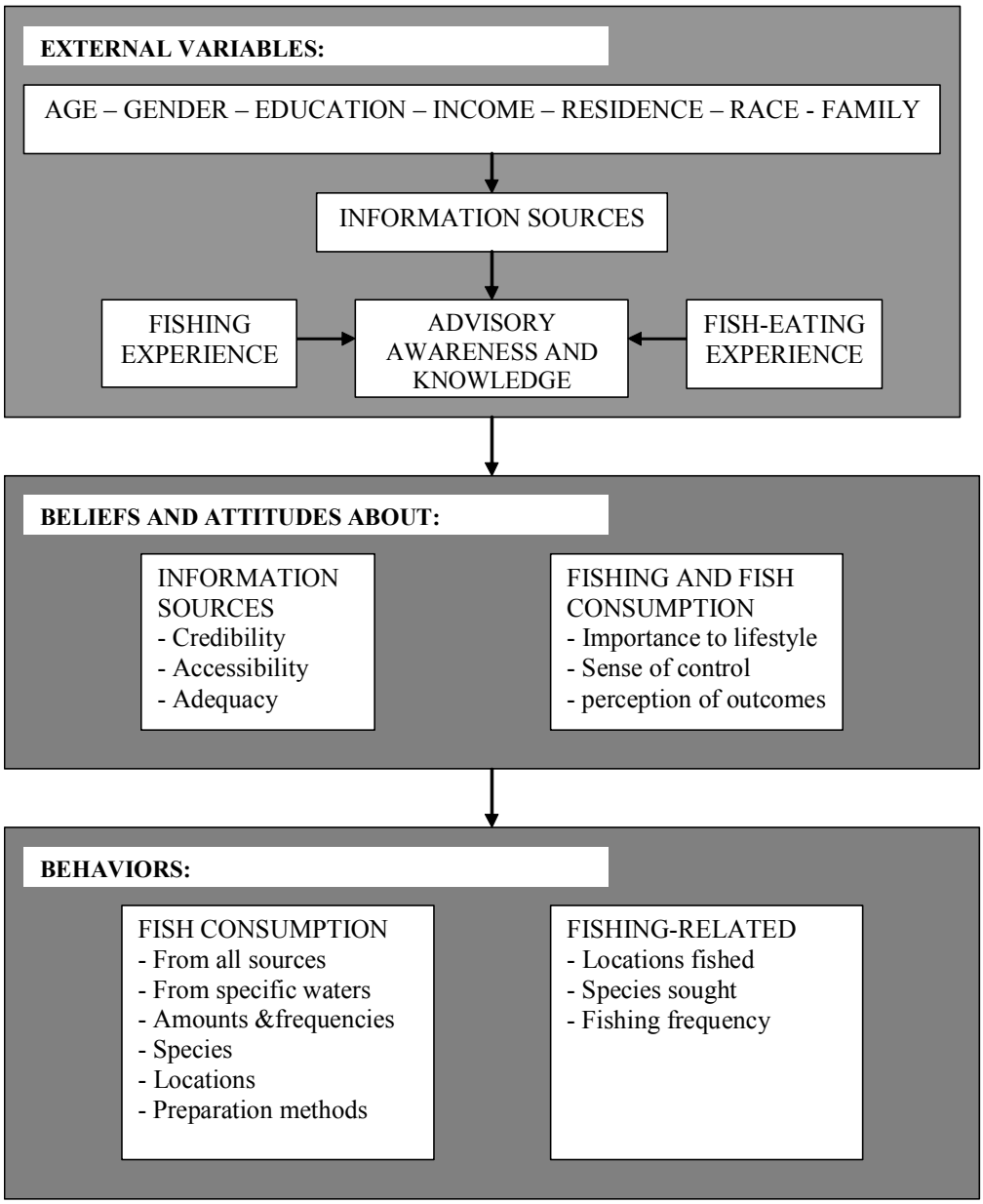

Figure 1. Conceptual Diagram of the social-psychological process determining response to fish consumption health advisories (based on Knuth, et. al., 1993)

Several external factors, beliefs and attitudes about advisories and fish consumption, and various behaviors combine to form a response by an individual angler.

Many of the factors in Figure 1, particularly external factors and beliefs, are examined among Washington, DC anglers in this paper.

Some suggestions have been made for a more unified, universal approach to advisory development. This has been a difficult task since so many uncertainties must be considered in advisory development. Contamination concentrations vary for different fish species and regions, as do cleaning and cooking habits, and other uncertainties in the risk of exposure must be accounted for. However, health and fisheries planning professionals recognize that although difficult, there is a need for successful implementation of a unified and cohesive approach (Dourson and Clark, 1990).

Risk Assessment and Target Audience Identification

Risk Perception and Assessment

Angler perceptions of the risks they face by consuming self-caught and possibly contaminated fish has been examined at length in the literature. Knowing the audience's perception of risk is important to fisheries and health planners because successful advisory dissemination depends on the ability to target information to the correct audience in the most appropriate manner. An examination of the risk perceptions of recreational fishermen is particularly critical because they have a greater likelihood than non-fishermen to consume large quantities of fish (Burger et. al., 1999).

One common focus in past studies has been on the identification of specific subpopulations that consume self-caught fish, as well as those that are wary of consumption because of information received from health advisories. In a New York estuary with fish consumption advisories present, most people ignored consumption

advisories, believing the self-caught fish to be "fresher" than store bought fish and therefore healthier and safer (May and Burger, 1996). Simply issuing fish consumption advisories and trusting the public to heed the warnings fails to increase the awareness of contamination and adverse health risks.

The importance of targeting an audience was echoed by Velicer and Knuth (1993) on Lake Ontario, where most recreational anglers were successfully reached with advisory information, but outreach efforts failed to inform migrant farm workers. Success in reaching women of child-bearing age, an important and highly vulnerable subpopulation, also proved limited.

One common recommendation is that advisory content and formats be adapted to better suit the specific angler audiences at hand (Velicer and Knuth, 1993). Specifically, the inclusion of information on cooking and cleaning methods that can reduce contaminant exposure is often recommended (Velicer and Knuth, 1993; Pflugh et.al., 1990). To ensure that all socioeconomic audiences are reached, integrating health care and social service workers into advisory education techniques is also important (Velicer and Knuth, 1993). These groups could help to reduce exposure among some of the populations that are exposed to contaminated fish most often: low-income and subsistence anglers.

Urban anglers are likely to have unique attitudes toward risk, advisory knowledge, belief in advisories, perception of safety, and other environmental factors (Pflugh et. al., 1999). Fishermen interviewed in the highly industrialized Newark Bay Complex show that more than half of the anglers had heard of local advisories. However, most either did not believe the information or were unconcerned with the potential health

effects resulting from contaminated species. Clinch River (Tennessee) anglers in a far less urbanized but still contaminated setting responded that they, too, had heard of local advisories, but half still felt that the fish were safe to eat without limit (Campbell et. al., 2002).

Fisheries and health planners must attempt to understand the origins of these beliefs so that considerations for them can be incorporated into the development of warnings. The Washington, DC region includes both urban and semi-urban areas, so identifying these attitudes about risk perception is integral in developing approaches for risk communication modes and methods.

Perceived hazard is a theme that arises in many studies similar to the project in Washington, DC. The perception of risk has been found to affect whether or not anglers consume the fish that they catch (Campbell et. al., 2002, Pflugh et. al., 1999) or whether or not they consume certain species (Burger et. al., 1999). Perceptions also significantly effect the locations where anglers choose to fish (Jakus and Shaw, 2003).

Empirical determinations have found that an angler's belief in potential hazards negatively influence his site choice for fishing, especially when the angler plans on keeping the fish (Jakus and Shaw, 2003). The decisions for keeping and eating fish are connected to the perceived severity of contamination at the sites. One indicator explaining some perceived hazards is angler experience—more experienced anglers appear not to react as strongly to expert-assessed risk warnings as less experienced anglers (Jakus and Shaw, 2003). This again is critical information for health and natural resources managers, since more than 15% of Americans over the age of sixty participate in recreational fishing (RBFF, 2003)

Another matter that must be considered in approximating angler risk perception is increased consumption due to the known nutritional value of fish. Understanding angler perception of this value is imperative because it has the potential to promote consumption among some anglers despite contamination warnings. The benefits of eating fish have been acknowledged extensively by health professionals, government agencies, and others (USA Today, 2003).

For example, the American Heart Association (2003) recently reported that eating fish regularly could significantly reduce the risk of heart disease in diabetic women. Information related to women is especially important in the realm of risk perception because most fish and health advisories specify that women, particularly those of child-bearing age, are at the greatest risk of incurring the harmful effects of contaminated fish consumption. Benefits must be weighed against these risks when anglers consider eating or feeding their families self-caught fish from potentially contaminated waters.

Fishermen on Lake Ontario were significantly influenced in their decisions to eat fish by balancing fish health benefits with risks (Knuth et. al., 2003). When the contamination hazards were elevated, anglers consumed less fish regardless of the benefit level, but when risks were low, consumption rates were found to correlate with the benefit level of eating fish. Angler knowledge of and reliance on current claims of the nutritional benefits of fish must be examined when perceptions of risk are being assessed.

Ethnic and Socioeconomic Risk Assessment

Identifying the trends in socioeconomic and ethnic risk perception is a prevalent theme in much literature examining angler behavior and consumption. Past studies have

found several consistencies, including increased risks among minority and immigrant populations (Burger, et al., 1990; Burger et. al, 2001; Campbell et. al., 2002; Beehler, 2001).

African-Americans on South Carolina's Savannah River have been found to fish more often, eat self-caught fish more frequently, and consume larger portion sizes than Whites (Burger et al, 1999). Education and income among minorities contribute to these variations in fishing and consumption behavior. Low income anglers were found to eat fish more often while anglers with less education eat fish more often *and* prepare fish with fewer risk-reducing methods than anglers with higher levels of education.

Considering the fact that a higher percentage of low income anglers in the study were African-Americans, African-Americans had a disproportionately high exposure to contaminants compared to Whites. This finding was reinforced by data that concluded that African-Americans ate more self-caught fish than Whites regardless of their education levels (Burger et al, 1999).

A later study further confirmed this tendency by developing a hazard index to analyze ethnic differences in hazards involving mercury from fish consumption (Burger et. al., 2001). The index measured the degree of risk facing a population. The study determined that minorities had both higher hazard indexes and higher consumption rates than Whites. It also found that African-Americans and Hispanic-Americans were less likely to know about health advisories and the information contained in them than Whites.

Similar trends arose among anglers interviewed on the Clinch River in Tennessee (Campbell et. al., 2002). The findings suggest that advisories often do not reach the

demographic audiences that need them most, and that risk education for minorities should become more of a priority in advisory dissemination.

One critical consideration in racial and socioeconomic risk assessment is the fact that some anglers' awareness of health risks originate from sources other than official advisories. This inclination towards the utilization of sociocultural belief structures has been notably observed in several minority populations, including urban anglers.

A study involving risk knowledge and perception conducted in western New York focused on contaminated fish consumption threats within the context of the cultural aspects of African-American sport fishing (Beehler, 2001). These fishermen were not subsistence fishermen; they were fishing for relaxation, socialization, and other motivations rather than as a means for obtaining food, although most stated that they ate their catch at least occasionally. Most participants stated that they were unaware of or intended not to use advisory information, but the study stressed that they did not necessarily eat fish without discretion.

Instead, they adhered to what were described as cultural or "folk" notions of pollution, including information obtained from other anglers and personal perceptions of the waters they were fishing. Taste was also a big determining factor for cleanliness. If certain species from specific locations did not taste good, anglers tended to believe that they likely came from bad water and therefore should not be eaten (Beehler, 2001).

Similarly, the methods these anglers used to clean fish often reduced contaminant exposure not because they were the methods suggested in the advisory information but because they were the methods that maximized the taste of the fish. African-American anglers largely believed themselves to have a comprehensive and intuitive understanding

of the natural environment that was not captured in officially-issued advisories (Beehler, 2001).

This notion that not all ethnic populations perceive or respond to risks equivalently was again explored in the Great Lakes states (Beehler and McGuiness, 2003). Although these cultural perceptions of fish safety were also well-established in the Latino community of the Great Lakes states, the specific information from advisories was not reaching Hispanic-Americans. The findings are critical for Washington, DC because they stress that although advisories do not always reach target audiences, there are still risk perception value systems in place in urban areas that can effectively have an impact on compliance without successful health advisory communication.

The social value of sport-caught fish consumption is high among minority anglers, especially in more urbanized settings (Cartledge, 2002; Corburn, 2002; Burger, 2000). In many cases, that value is high enough to render state-issued advisories ineffective. As an alternative to classic advisory issuance, unconventional approaches have been developed that address these external social forces (McDermott, 2004). These programs of risk communication rather than simple advisory issuance involve identification of target audiences, consultation and personal contact with those populations, and a continual process of testing and refining the resultant program.

It has been suggested that the sociocultural institutions that can lead to discounting consumption advisories can substantially increase risk among certain populations. Since the nature of adverse health effects from consumption is delayed over many years, disregard for hazard warnings may be heightened (Burger, 2000).

Some evidence, however, suggests that advisories sometimes succeed in communicating health information to targeted ethnic or socioeconomic groups, and that no ethnic differences exist in fishermen who know of advisories or understand the message of advisories (Fitzgerald et. al., 2003; Burger and Waishwell, 2001). Some of these same studies, however, suggest ethnic differences in how people feel risk could be reduced—Whites believe that the rivers should be improved, while African-Americans think that more people should be provided with educational materials, such as a fish fact sheet (Burger and Waishwell, 2001).

Another study maintained that non-Whites in New Jersey were just as willing to adhere to advisory warnings as were Whites, but that the targeting and communication efforts involved with those advisories were inadequate, leading to decreased compliance in minority populations (Burger et. al, 1999). Risk-reduction strategies must take into account these urban and ethnic differences in information sources, perceptions about safety and health risks, and consumption patterns in order to successfully communicate warnings to target audiences (Burger et. al, 1999).

The executive branch of the federal government has also shown concern over the demographic differences in policy implementation with respect to hazard communication. The Presidential Executive Order on Environmental Justice stressed the importance of examining the effects of fish and wildlife consumption on certain subpopulations, especially those considered to be subsistence populations (Clinton, 1994). The order states that federal agencies must "collect, maintain, and analyze information on the race, national origin, income level and other…information for areas surrounding…sites

expected to have a substantial environmental, human health, or economic effect on surrounding populations."

This statement applies directly to that subpopulation of anglers considered to be subsistence anglers. Subsistence anglers are normally defined as anglers who catch fish for the purposes of personal or familial consumption as a financial necessity or with the intent of reducing expenses for food. Such fishermen are expected by most professionals to be more at-risk than recreational, non-subsistence fishermen due to the necessary nature of their consumption of fish or provision of it to their families for consumption (Burger, 2001).

However, though researchers often admit that there is a greater exposure risk inherent among subsistence anglers, risk is nonetheless involved with any population that consumes fish. Often, the difference between subsistence and recreational fishermen is considered effectively arbitrary, and that it clouds the issue of risk (Burger, 2001). From a risk assessment perspective, what matters is how much of which species containing what contaminant load is consumed, not whether someone is eating the fish or feeding it to his family out of necessity (Burger, 2001). In other words, although these fishermen may be more likely to consume the fish that they catch, non-subsistence anglers may be just as inclined to consume dangerous species at high volumes.

Contaminant Information

Many contaminants are found in fish and shellfish from the Potomac and Anacostia Rivers. These contaminants have been detected in fish tissue monitoring conducted by the District of Columbia's Department of Health, and are the reasons fish

consumption advisories are issued. The major contaminants in District of Columbia waters are PCBs, but they also contain toxic metals and pesticides.

Polychlorinated biphenyls (PCBs) are the most pervasive chemical contaminant in Washington, DC's surface waters with respect to fish contamination. Although there are no known natural sources, PCBs remain in nature because of their previous widespread use and persistence in the environment (EPA, 1999). PCBs bioaccumulate in the fish food chain so that over time, predatory fish at the top of the food chain—species such as pike and bass in the case of freshwater streams—can amass a concentration of the contaminant up to ten million times greater than the surrounding water (EPA Fact Sheet, 1999). Consumption of fish and shellfish is the greatest source of human PCB exposure.

Table 2. Contaminants in DC waterways and relevant information in advisory development.

Contaminant	*Production Ban*	*Bioaccumulation*	*Other*
PCBs	Yes	Yes	Most prevalent among DC's contaminants; banned in 1979; persistent in environment; fish consumption is the greatest source of human exposure
PAHs	No	Yes	Form during fossil fuel burning; persistent in environment; probable human carcinogen
Arsenic	No	Yes	Used as a pesticide in wood preservation; inhalation can increase lung cancer risk; probable human carcinogen.
Chlordane	Yes	Yes	Insecticide banned in 1988 with a few exceptions; causes damage to central nervous system and organs in long run.
DDT	Yes	Yes	Insecticide banned in 1973; probable human carcinogen.
Mercury	No	Yes	Addressed in fish consumption advisories more often than any other substance; especially harmful to fetuses and young children.

Since most PCBs accumulate in the fatty tissues of fish (belly and subcutaneous fat, the lateral line region, dark muscle, and internal organs), the proper removal of skin and internal organs prior to cooking can significantly reduce the amount of contamination in a fish (EPA, 1999). PCB *no-consumption* advisories are still issued by some states for women who are pregnant or nursing, since they are considered the most sensitive

population to PCB toxicity due to the harmful developmental and neurological effects of the chemical (EPA, 1999).

Polycyclic Aromatic Hydrocarbons (PAHs) are a group of chemicals formed during the burning of fossil fuels, garbage, and other substances. They can enter the air and water as releases from forest fires, burning coal, automobile exhaust, and discharges from industrial and wastewater treatment plants (ASTDR, 1996). Like many contaminants, PAHs can also bioaccumulate in fish and human side effects include difficulties with the reproductive system (including birth defects) and the ability to fight disease. The Department of Health and Human Services (DHHS) has also determined that some PAHs may reasonably be expected to be carcinogens (Delta Institute, 2000).

Arsenic is a naturally occurring element widely distributed in the earth's crust but is most often used for wood preservation or as a pesticide, primarily on cotton plants (ASTDR, 2003). The chemical generally bioaccumulates in fish in a less harmful organic form, but high levels in food or water can be fatal. Arsenic ingested from fish .damages many types of tissues including nerves, intestines, and skin.

Chlordane is a viscous, colorless liquid insecticide that was once used on citrus, vegetables, lawns, and roadsides. Commercial use of chlordane and related products has been banned since 1988, and was initiated as an attempt to protect drinking water supplies (EPA Consumer Fact Sheet, 1999). Health effects of chlordane include central nervous and blood system effects in the short term and organ damage in the long term (EPA Consumer Fact Sheet).

DDT (dichlorodiphenyltrichloroethane) is a pesticide used in the 1950s and 1960s until it was found to be harmful to other forms of life (Trent, 2004). The pesticide was

banned from widespread use in 1973 because it "posed unacceptable risks to the environment and potential harm to human health" (EPA Press Release, 1972). DDT bioaccumulates in human, animal, and fish tissue and human exposure is normally a result of contaminated fish consumption. The U.S. Environmental Protection Agency and the DHHS have identified DDT as a probable human carcinogen based on laboratory studies (Delta, 2000)

Mercury is addressed in fish consumption advisories more often than any other substance; almost eighty percent of advisories nationwide involve warnings about mercury. The element is found naturally in the environment in air, water, and soils, but human activity has significantly added to those natural levels. In the United States, 87% of mercury emissions originate from solid waste incineration and fossil fuels combustion facilities.

In freshwater rivers like the Potomac and Anacostia, ninety to one hundred percent of the mercury found in fish tissue is an organic form called methylmercury. Methylmercury binds to the proteins in fish muscle, which is problematic for humans consuming the fish because skinning and trimming often do not significantly reduce the mercury concentration (EPA Fact Sheet, 2001). The most common source of mercury exposure to humans is dietary, and fish and shellfish can contain up to ten thousand times more mercury than other foods.

The populations believed to be most vulnerable to hazards from mercury consumption are young children and women who are pregnant or nursing, and for this reason many states issue "no consumption" advisories for these groups. Since

bioaccumulation occurs in humans as well as fish, women can pass accumulated mercury on to fetuses through ingestion and to infants through nursing (EPA Fact Sheet, 2001).

CHAPTER III: THE WASHINGTON, DC CASE STUDY

Chapter III presents an introduction to the Washington, DC-area case study constituting the focus of this thesis. First, advisories and dissemination practices currently utilized in Washington, DC are discussed. Next, hypotheses are formulated and presented based on past studies, current Washington, DC angler advisory actions, and a review of related literature. Lastly, the methods for conducting the data collection and data analysis for the Washington, DC-area case study are presented.

Current Advisories and Outreach Methods

A fish consumption advisory is in effect for the Washington, DC region that includes sites in Washington, DC and parts of Northern Virginia (see Appendix A for a copy of the advisory). The DC Department of Health is responsible for the development and dissemination of this advisory. The advisory applies to fish caught in the Potomac and Anacostia rivers and their tributaries, including Rock Creek, within the boundaries of the District of Columbia (Table 3).

Table 3. Summary of Washington, DC advisory content.

Waterbodies Under Advisory	▪ Anacostia River ▪ Potomac River (including Rock Creek)
Contaminants Involved	▪ PCBs and other contaminants
No-Consumption Advisories	▪ All catfish ▪ All carp ▪ All eel
Limited-Consumption Advisories	▪ ½ lb/month of largemouth bass ▪ ½ lb/week of sunfish or other fish
Commercial Fishing Ban	▪ Effective for all DC waters
Additional Information	▪ Preparation instructions: Always skin the fish, trim away fat, and cook fish to drain away fat because chemical contaminants tend to concentrate in the fat of the fish ▪ The practice of catch and release is encouraged ▪ Report fish kills

The advisory lists suggested serving limitations and names likely contaminants for potentially hazardous species in applicable waterbodies. The advisory specifically names PCBs and other chemical contaminants and encourages the recreational fishing practice of catch and release. Also, some risk-reducing food-preparation methods are named, such as trimming away fat prior to cooking or draining it during cooking, since chemicals often concentrate in fish fat.

The advisory also notes that these recommendations do not apply to fish sold in markets, grocery stores, or restaurants since no commercial fishing is allowed in DC rivers. Finally, it specifies that elevated PCB or pesticide levels have not been found in other species not listed in the advisory. An addendum to the advisory asks the public to report fish kills if seen in the DC area, an indication of contaminant or toxic releases.

Dissemination methods for Washington, DC region advisories vary. Advisories are issued by the DC Department of Health and its Fisheries and Wildlife division whenever new data become available. The public can obtain copies of printed advisory materials from the health department, state fisheries office, and businesses that issue fishing licenses.

No formal protocol exists, but several commonly used outreach methods exist. These modes of dissemination include posting signs, occasional and infrequent press releases to media sources, internet press releases, information in regulations booklets, printed pamphlets and fact sheets, and proving information on the backs of fishing licenses. The DC Department of Health has most of these materials available in English and in Spanish.

Hypotheses

1. Minority and low-income anglers are more likely to be exposed to the risks of contaminated fish.

2. Anglers in Washington, DC are generally not aware of and do not adhere to fish consumption advisories.

3. Public health officials and planners can target communication efforts at certain populations based on their habits with respect to advisory knowledge.

4. Further development of current Washington, DC dissemination practices will be needed in order to achieve successful risk communication and resulting compliance with public health warnings.

5. Efforts for overall and equitable improvement of public health in the case study area may not be successful in meeting their goal of sustained protection from environmental health hazards.

Methods

Survey Instrument

Numerous fish consumption and risk assessment studies have been performed in the past in other regions, utilizing a variety of data collection methods, including mail surveys, on-site interviews, and focus groups. Mail surveys have been the traditional data collection format for the New York State Angler Cohort Study (Connelly et al, Knuth et al., and McGuiness et al.) and have also been used for fish consumption studies performed in Minnesota and North Dakota (Benson et al. 2001).

On-site interviews have been conducted by a variety of researchers including Burger et al. (New York Harbor, Newark Bay, and surrounding areas; Savannah River, SC; Clinch River, TN) and Russel et al. (San Francisco Bay). Occasionally, a study group performs a telephone survey of a sample identified either through a preliminary mail survey (as in Delaware, with the KCA Research Division, 1994) or as part of a creel

survey (a type of survey estimating recreational fishing intensity, such as the National Marine Recreational Fishery Statistics Survey).

This study involves a combination of on-site interviews for data collection and focus groups for discussion of preliminary results. On-site interviews were selected as the primary data collection tool because of the desire to collect information on a relatively unknown population in specific geographic areas. Some studies estimate that as many as 25% of anglers—especially urban subsistence anglers—do not obtain licenses to fish (EPA, 1990). Since these anglers are of particular interest in assessing the risk of contaminated fish consumption, it was critical the survey method chosen be able to reach this population.

On-site interviews are effective in this regard because mailing addresses from fishing license registers are not needed. In addition, barriers such as literacy and language are more easily overcome using on-site interviews since the respondent is not required to read the survey. Even when interviews are unsuccessful due to a language barrier between respondent and interviewer, the magnitude of this barrier within the population can be better estimated than would be possible in a mail survey.

The accuracy of fish consumption estimates is also expected to be higher in personal interviews than in mail or telephone surveys because appropriate visual aids can be used, and the interviewer can clarify unclear questions. Finally, the response rate of on-site interviews (>80%) is usually far greater than typical general population mail (~25%) or telephone (~45%) surveys.

The disadvantages of personal interviewers from a data quality standpoint are twofold: 1) the number and complexity of survey questions must be somewhat limited in

order to ensure interview completion and 2) fish consumption is difficult to estimate. To reduce the number of questions, it was ensured that each question provided valuable data and that the interviewer was trained in conducting the survey in the most efficient manner possible. In order to address the second issue, angler respondents are provided with visual aids to help them accurately report both the species they are catching and consuming and the meal sizes they and members of their household typically consume.

On-site interviews generally solicit more questions, and more complex questions, than telephone interviews, but interview length still remains a concern. Therefore, a balance was required between getting the most imperative information and keeping the interview short enough that the response rate was sufficient. The Washington, DC Region had a customized survey instrument based on the nature of its existing advisories. A copy of the survey instrument is included in Appendix B.

Site Identification

The Chesapeake Bay has more than 11,000 miles of shoreline, not including its major tributaries, therefore practicality requires that potential angler interviews in the Bay be strategically focused on specific regions. The most populous areas in the bay would likely yield the greatest return for surveys, and they also contain the Bay tributaries that suffer from some of the worst pollution. Three of these areas were selected for the CMI project based on several factors, including water quality, population, sportfishing activity, suspected contaminant exposure, and advisory status. The regions identified include the Baltimore, Maryland region, the Tidewater, Virginia region, and the Washington, DC

region that is the focus of this study. Figure 2 illustrates the location of the Washington, DC region of concern in relation to the Bay.

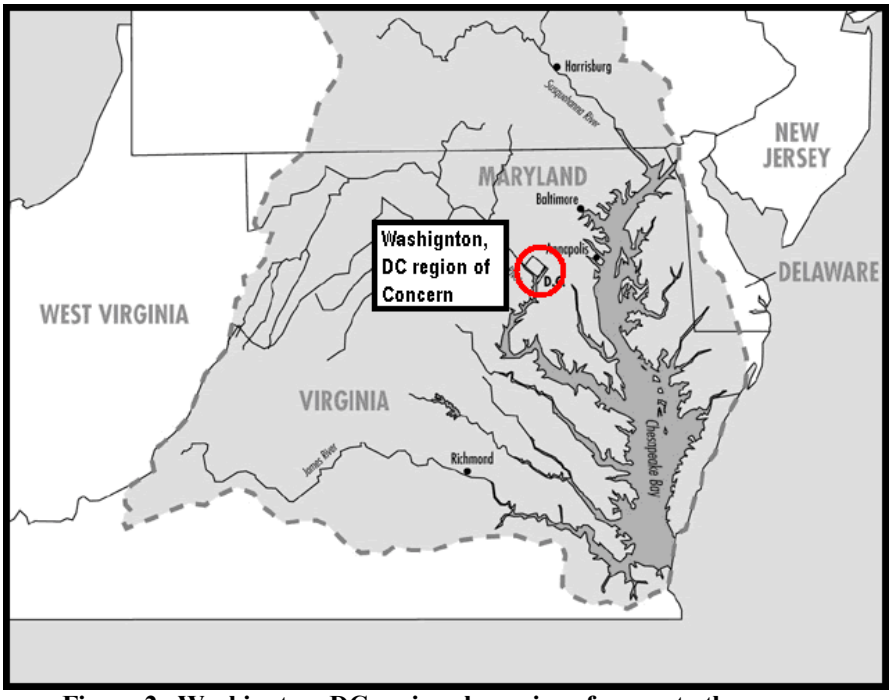

Figure 2. Washington, DC region shown in reference to the Chesapeake Bay. The shaded area within the dashed line surrounding the bay signifies the approximation of the Chesapeake Bay watershed.

The geographic area covered in the study is shown in Figure 3. The table in Figure 3 also shows the sites corresponding to the map items. A detailed map, including site names, is included in Appendix C.

Within the Washington, DC region, several sites were identified as potential areas where angler interviews would be conducted. These sites were initially selected under the consultation of fisheries managers in Washington, DC. Site visits were then conducted to personally assess each location with respect to likely angler activity, types of fishing modes present (i.e. boats vs. shore), and geographic distribution with respect to other sites in the region.

Ultimately, nine sites were selected from the region based on these factors. The distribution is such that sites are located on or very near each of the two above mentioned polluted waterways (the Potomac River and the Anacostia River). Attempts were made to ensure that both predominantly boat- and shore-fishing sites were sampled and that both high- and low-use sites were sampled.

MAP KEY	SITE NAME
1	Fletcher's Boat House
2	Theodore Roosevelt Island
3	Lady Bird Johnson Park/Columbia Island Marina
4	Gravelly Point/Roaches Run
5	East Potomac Park/Haines Point
6	Monument Tidal Basin
7	Water Street Marina Area
8	Dangerfield Island/Washington Sailing Marina
9	Anacostia Park South

Figure 3. Map and table showing the Washington, DC region and the sites (1-9) on the Potomac and Anacostia Rivers where interviews were conducted.

Survey Pretest

A pretest of the survey instrument was conducted May 18-19, 2004. In each region, all access points predetermined as probable interview sites were visited by CMI employees. The purpose of the pretest site visits was to:

(A) Visually assess the individual sites and make observations on the degree of interviewer safety, general characteristics of the sites, and directions for reaching the sites;

(B) Test the survey instrument and survey protocol on as many anglers as possible (the target being at least 5 in each region), noting any problems that arise during interviews, including problems with survey wording, survey content, or interviewing protocol; and

(C) Make an assessment of each site regarding the likely intensity of angler activity, the likely success in completing multiple angler interviews during the course of an 8-hour time span, and anticipated fishing modes.

Due both to temporal constraints and lack of angler activity during the week, three interviews were conducted in the Washington, DC region during the pretest trip rather than the proposed five. The effort was sufficient, however, to formulate several changes to the wording and format of the original survey instrument, as well as modifications to the interviewing protocol, in order to increase the quality of data collected from individual interviews. The final interviewing protocol is included here as Appendix D.

Site Schedule Design

After the survey pretest trip, a final determination was made on the sites that would be sampled. Sites with a low likelihood of angler activity, those that were closed,

or those for which insufficient information was available were eliminated. As was previously stated, nine sites were ultimately selected in each region (see Appendix C).

In order to capture as wide a range of anglers as possible, the interviewing site schedules were designed so that interview teams would be on site during one of two eight-hour shifts: 6:00am-2:00pm ("morning shift") or 12:00pm-8:00pm ("afternoon shift"). Ideally, these time periods would incorporate both boaters and shore anglers active in morning or evening hours while maximizing interviewer safety. The schedule for sampling sites was intended to capture temporal variation in angler activity. An attempt was made to sample each site during at least two weekdays and two weekend days and during both morning and afternoon time shifts. A total of forty sampling days were completed.

In order to better allocate sampling effort, three strategies outlined by Stanovick and Nelson (1991) were considered. The first was a uniform effort, in which each site is sampled evenly. The second improves efficiency by increasing sampling effort in areas where an increased angling effort exists. The third uses the opinion of experts to formulate quantitative scores and use them as the basis for establishing sampling schedules.

This survey used a modified version of the second method mentioned by Stanovick and Nelson, including some elements of the third. Sites were sampled more intensely where angling activity was expected to be concentrated. This expected intensity, however, was a result of a combination of conversations with fisheries site managers and visual observations. Those sites believed to be most heavily frequented by anglers were weighted for additional sampling days. Rained out and/or sick days were

rescheduled later in the summer at the same site, same shift, and same period (weekday or weekend). The site schedule for the Washington, DC survey team is included in Appendix E; these site schedules reflect actual site visits after the necessary revisions were made throughout the summer. Interviews were conducted June 2nd through August 8th, 2004.

Interviewer Training

Initial interviewer training took place in Blacksburg, Virginia, on May 27 and 28, 2004. The interview teams from each region of concern were introduced to the interview protocol, and interview materials were distributed to them. Mock angler interviews were conducted, and reviews were made of the interviewers' techniques and faults were corrected in order to improve the degree to which each interviewer followed the established protocol. This initial training helped interviewers to become familiar with the survey instrument and protocol and allowed them to gain experience in oral survey techniques and ways to ensure data quality in the oral survey process.

On-site interviewer training was conducted June 1-3, 2004 in Washington, DC, prior to the start of sampling days. The purpose of the on-site training sessions was to acclimatize interview teams to the interview protocol in real interview situations, further ensuring quality data collection. Each interviewer applied the training received in previous instruction sessions to several actual angler interviews in Washington, DC. The interview teams were also familiarized with each of the nine sites while under observation. These practice interviews were taped for a detailed review of interview technique. After conducting these practice surveys, interviewers were again briefed on ways to improve their methods for interviewing anglers.

Interview Protocol

A copy of the Survey Protocol used by each survey team in the field while conducting interviews is attached as Appendix D. The protocol contains all information pertinent to interviewing and data collection procedures. This includes: information on choosing a location within the sites for setup; an inventory of materials required for each interview; strategies for approaching anglers; instructions for recording data; guidelines for reporting daily data; safety precautions; and a comprehensive guide that addresses how each survey question should be posed to anglers.

Each interviewer in the field was instructed to become very familiar with the protocol and to review the protocol occasionally throughout the angler sampling period. Changes to the interview protocol during the course of the summer were minimal and were only implemented to either streamline the interview process or encourage an increase in completed interviews.

Data Entry and Quality Control Protocol

Data entry was completed using Apian SurveyPro and KeyCollect software. Initial data entry was accomplished using only the survey instrument without consulting taped interviews. Contact records were summarized in a spreadsheet as a means of determining interview rejection rates and rejection causes.

A quality control check was completed for 20% of the surveys from the Washington, DC region. These quality checks were conducted for individual survey respondents by inspecting the completed survey instrument for that interview while referencing an audio tape of the interview being conducted. Thus data quality was

ensured for both the angler interviewer and the data enterer. The error rate from both sources was low enough to proceed with the data analysis ($^{+}$/- 5%).

Data Analysis

Data was analyzed using a combination of programs and approaches. SurveyPro, KeyCollect, Microsoft Excel, and SPSS were all utilized for the purposes of data organization and analysis. After overall summaries and analyses were conducted with respect to certain topics, additional analyses were carried out. These included demographic, site-specific, and other breakdowns that were aimed at demonstrating trends present among different groups of angers.

CHAPTER IV: GENERAL RESULTS

Chapter IV is an introduction to the data and results from Washington, DC angler interviews. These data reflect overall trends and preferences among the entire population of anglers as well as some subpopulations (e.g., anglers familiar with advisories). This chapter also presents information on overall demographics, fishing intensity, and consumption and fishing habits.

Location

A total of 247 surveys were collected from Washington, DC sampling sites, with a response rate of 86% (i.e., of all unique anglers approached, 14% declined to be interviewed). A few anglers contacted had been already been interviewed during the course of the summer (9% of all contacts). These anglers were not interviewed again. Since one member of the interview team was bilingual, 6% of the surveys were administered in Spanish. Besides those surveys, 5 refusals (<2% of all contacts) were due to language barriers, and the rest were anglers who either did not have time or otherwise declined the interview.

Table 4. Distribution of anglers interviewed by survey site (See Site Map, Appendix C).

Survey Sites	% of all Interviews
East Potomac Park/Hains Point	31
Fletcher's Boat House	24
**Gravelly Point/Roaches Run	14
Anacostia Park South	13
**Lady Bird Johnson Park/Columbia Island Marina	8
Monument Tidal Basin	4
Water Street Marina Area	4
**Dangerfield Island/Washington Sailing Marina	2
Theodore Roosevelt Island	0
TOTAL	100

**Sites located outside Washington, DC, in Northern Virginia.

Most interviews in the Washington, DC area were collected along the Potomac River (Table 4), the most actively sampled sites being East Potomac Park/Hains Point (32%) and Fletcher's Boat House (24%). Anacostia Park South (13%) was the most active site on the Anacostia River. Only one site, Theodore Roosevelt Island, yielded no surveys.

Overall Angler Demographics

Table 5 shows general demographic results for all DC-area anglers. The average age of anglers interviewed in Washington, DC was around 45. Half (50%) of the anglers interviewed were African-American, and about a third were White (33%); 16% were either Hispanic or Asian. Four other ethnicities were also reported by anglers, including Bosnian, African, Caribbean, and Arab-American, with one respondent each. About half (49%) of the anglers interviewed reported having a high school education or less. Household income for 70% of Washington, DC anglers amounted to $40,000 or more per year.

Table 5. Overall demographic summary of DC anglers.

Gender	▪ 91% Male ▪ 9% Female
Race	▪ 50% African-American ▪ 33% White ▪ 10% Hispanic ▪ 6% Asian
Income	▪ 9% Less than $20,000/yr ▪ 21% $20,000-$40,000/yr ▪ 31% $40,000-$80,000/yr ▪ 39% $80,000/yr
Age	▪ Mean = 45
Education	▪ 16% Less than High School ▪ 33% HS Graduate ▪ 26% Some College ▪ 12% College ▪ 10% Masters ▪ 3% PhD/MD

Fishing and Consumption Habit Results

The most common motivations for fishing were relaxation (93% said very important), spending time outdoors (92% said very important), and experiencing the challenge or sport of fishing (63% said very important). Slightly over 35% considered providing their family with a fresh fish dinner to be either very or somewhat important, but only 16% responded that reducing family food expenses was either very or somewhat important.

Warmer months were most popular for eating self-caught fish (April-September) and 53% of anglers ate fish 1-3 times per month during these months. No one reported that they ate fish 3 or more times per week and 20% said they ate fish once or twice per week. November through February was the least popular time for eating fish, and 69% of anglers who ate their catch said they ate no self-caught fish during that time. On average, anglers estimated that annually they ate self-caught fish less than once per month (44%) or between one and three times per month (29%). Only 2% of anglers ate self-caught fish 3 or more times per week.

When preparing self caught fish, most anglers punctured or removed the skin (61%), trimmed the fish fat (59%), filleted (61%), and/or fried (77%) their fish most of the time. Most (68%) also answered that they never ate the fish whole (including the skin and fat), ate the fish raw (94%), steamed/poached/boiled their catch (60%), or made soup or chowder (67%). About 73% claimed that they canned or froze their catch for later at least some of the time.

Although 37% of Washington, DC anglers reported eating their catch, more than half (54%) said they gave away the fish they caught to be consumed by others.

Furthermore, 50% of the anglers who stated that they *did not* consume fish from Washington, DC waters themselves reported that they gave away at least some of the fish that they caught.

Table 6. Reasons given by Washington, DC anglers for not consuming self-caught fish.

Reasons for Not Eating Their Catch	% of Non-Consuming Anglers
Pollution	59
Fish for Fun	10
Don't Know	6
Listen to Advisory	6
Dislike Taste	5
Other	4

The most common reasons given for not consuming self-caught fish are shown in Table 6. Most non-consuming anglers considered DC-area waters to be too polluted to consume fish (59%) with only 6% stating explicitly that they were adhering to advisory warnings. Some of the anglers who were adhering to advisories may have been captured in the "water pollution" responses since DC-area advisories mention poor water quality and contaminants among their warnings. Another 10% said they did not eat their catch because they only fished for fun.

Most recreational anglers in the Washington, DC region of concern reported that they did not eat the fish that they caught from DC waters (63%). The rest (37%) stated that they did consume self-caught fish at least some of the time.

Table 7 summarizes the consumption of DC-region anglers according to the species they named and the frequency at which these species were consumed. Considering consumption with respect to species is important because Washington, DC advisories are issued by fish species. Catfish was the fish most commonly named fish, with 59 different instances of catfish consumption. This category is broken down into

other species further down the chart, including channel, white, blue, brown bullhead and "general" catfish responses. The subcategories of catfish are included to show which species of catfish are being consumed more frequently, but the DC advisory actually groups them into one broad category that includes all catfish.

Table 7. Species consumption and frequency chart showing instances of exceeded consumption. Cells shaded in gray are consumption frequencies that exceed the limitations suggested in DC advisories for certain species.

Fish Species	5 + Times/Week	3-4 Times/ Week	1-2 Times/ Week	1-3 Times/ Month	Less Than Once/ Month	*TOTAL INCEDENTS OF EXCEEDED CONSUMPTION*
CATFISH (ALL)	0	2	7	17	33	**59**
Stripers/Rockbass	0	0	2	9	24	**2**
Largemouth Bass	0	2	2	1	17	**5**
Crappie	0	0	2	4	14	**2**
Catfish (general)	0	0	1	6	12	**19**
Channel Catfish	0	1	2	5	11	**19**
Bluegill	1	1	1	6	9	**3**
White Perch	0	0	0	4	8	**0**
White Catfish	0	1	4	4	3	**12**
Yellow Perch	1	0	0	4	5	**1**
Perch (general)	0	0	0	3	6	**0**
Blue Catfish	0	0	0	2	6	**8**
Smallmouth Bass	0	1	0	4	3	**1**
Carp	0	0	0	0	3	**0**
Bass (general)	0	0	0	2	0	**0**
Croaker	0	0	0	1	0	**0**
Spot	0	0	0	1	0	**0**
Trout	0	0	0	0	1	**0**
Brown Bullhead	0	0	0	0	1	**1**
Walleye	0	0	0	0	1	**0**
TOTAL INCEDENTS OF EXCEEDED CONSUMPTION	**2**	**8**	**21**	**35**	**69**	**132**

All the fish in Table 7 are included in DC-region advisories. Catfish, carp, largemouth bass and sunfish are mentioned by name, while all other fish caught from DC waters are included under a general limited-consumption advisory. The most commonly consumed species were types of catfish, which were included in Washington, DC's no-consumption advisory. Carp, another of the no-consumption species, was eaten in only

three instances, and the last banned species, eel, was not consumed by any DC anglers. Largemouth bass were limited to one half-pound per month in the advisory, and the majority of anglers appeared to have obeyed this recommendation. However, a blanket advisory of sunfish and other fish that applied to the Potomac and its tributaries (which suggested a limitation of one half-pound per week) was followed with varying degrees of compliance, depending on the species.

Table 7 shows advisory compliance by species. The shaded cells represent the consumption frequencies for a particular species that exceeded those that were recommended in DC advisories. All instances of catfish and carp consumption exceeded the no-consumption recommendations of advisories. As a result, catfish consumers exceeded advisories more often than consumers of any other fish.

The frequencies in Table 7 considered to be in excess of advisory recommendations are based on 8-ounce meal sizes. The question from the angler survey instrument corresponding to this data refers to the number of meals in certain time periods, while DC consumption advisories are issued according to the number of ounces per time period. These exceedences are approximations based on a general 8-oz meal size assumption, meaning the actual advisory exceedence rate may be higher or lower, depending on meal sizes.

The limited consumption recommendations in the DC advisories span from *3-4 times per week* to non-consumption. The largest proportion of anglers in the DC area stated that they ate self-caught fish *less than once per month* (44%). Only 2% of anglers responded that they consumed fish *more than twice per week* on average throughout the year.

The Washington, DC advisory uses 8 oz. meals in its restrictions, and 61% of anglers ate that amount or more at each meal. The largest number of anglers (38%) ate 8 oz. servings of self-caught fish at meals.

Many anglers refrain from consuming recreationally-caught fish due to perceptions about their safety or cleanliness. Table 8 shows angler responses regarding whether they believed local fish were safe to eat.

Table 8. Angler perception of fish safety, by percent.

Do You Consider the Fish here Safe to Eat?	% Total
Yes	30
No	39
It Depends	14
Uncertain	17

Only 30% believed that fish were safe for consumption, while 39% explicitly stated that they believed area fish to be unsafe. Another 14% responded "it depends"—possibly a result of angler familiarity with the information found in DC-area advisories—and the rest were unsure.

Advisory Knowledge Results

Fishing mode can influence site selection, and comparing this to advisory awareness can help planners evaluate the effectiveness of certain dissemination practices. Proportionally, boaters were slightly more aware of advisories than were shore anglers, but both proportions were comparable to the overall total.

Fishing experience varied among anglers familiar and unfamiliar with DC advisories. Thirty-six percent of anglers who had fished for less than a year were aware of DC advisories, compared to 59% who had fished the area for more than a year. Knowledgeable and non-knowledgeable anglers also displayed different tendencies with

respect to fishing frequency. Generally, anglers who fished on a regular basis were more aware of advisories than those who did not. Of anglers who fished less than 10 times a year, 40% were familiar with area advisories, while 74% of those fishing more than 10 times in the past year were familiar. These results show that regular fishermen are more familiar with advisories than infrequent fishermen.

Only 31% of the fishermen not aware of advisories ate the fish they caught, compared to 43% of those who were aware of advisories. However, nearly half (46%) of fishermen aware of DC advisories explicitly believed that fish from DC waters were unsafe for consumption, while only 31% of non-knowledgeable fishermen believed so. When anglers were reasons for their feelings about the safety of fish consumption, their most frequent answer involved pollution. Most anglers responded that the water was "too dirty".

Advisory Content and Dissemination Results

Advisory content and mode of dissemination are two critical contributors to advisory effectiveness. Figure 4 shows how recently anglers heard or saw consumption advisories. Anglers could name multiple modes, therefore responses are not mutually exclusive.

The largest number of anglers (45) reported that they had seen their most recent advisory over a year ago. However, 40 anglers reported seeing advisories in the last month and a total of 65 said they had seen an advisory within 3 months.

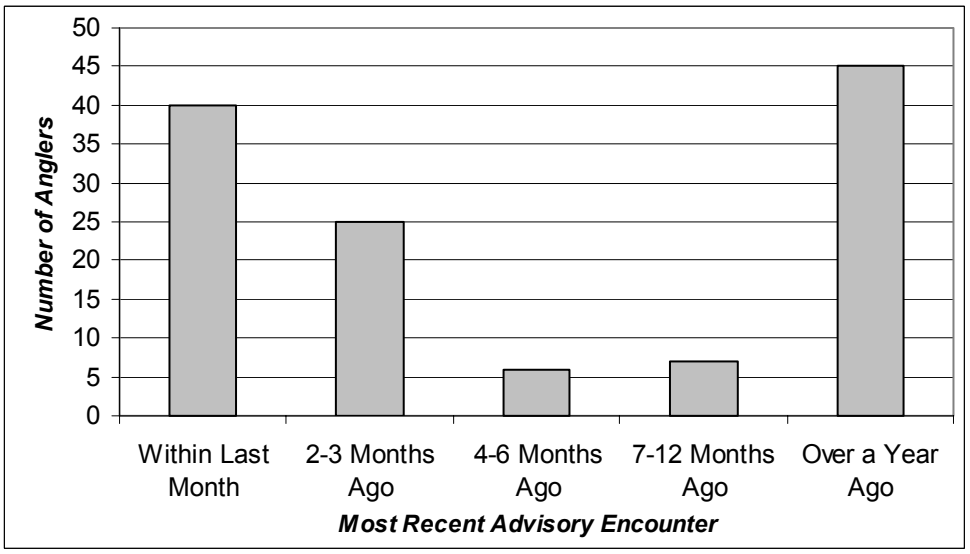

Figure 4. Time last advisory was encountered by anglers.

Figure 5 shows the modes by which anglers became aware of fish consumption advisories. Anglers were able to list as many advisories as they had seen, so these numbers are also not mutually exclusive.

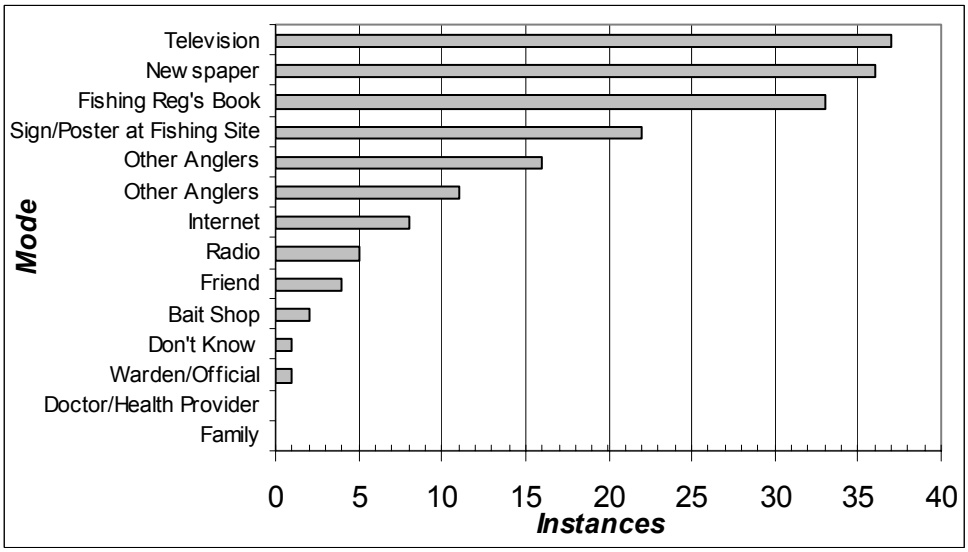

Figure 5. Distribution of anglers with respect to their most recent encounter with a consumption advisory.

Television, newspapers, fishing-regulation books, and signs were the three most popular modes for issuing advisories. Some of these are modes currently utilized by

health and environmental managers in the DC region, while others (such as media sources) are often the result of news stories picked up by local media outlets.

Table 9 expresses the effectiveness of advisory dissemination modes by determining how often a particular mode caused anglers to change their fish-eating habits. Conversations with a game warden and radio announcements seemed to be most effective (6 total responses). However, of the more common modes of advisory dissemination, fishing regulations booklets and signs at fishing sites caused changes in eating habits more frequently. Regulations books prompted 31% of anglers who saw them to change their eating habits, and 29% of those seeing signs or posters changed their eating habits.

Table 9. Mode of advisory dissemination compared to what proportion of anglers gaining awareness of advisories through that mode changed their eating habits as a result.

Mode by Which Advisory Info Reached Anglers	n	% That Changed Eating Habits
Warden/ Other Official	1	**100**
Radio	5	**40**
Fishing Reg's Book	32	**31**
Sign/Poster at Sites	21	**29**
Other Angler	11	**27**
Friend	4	**25**
TV	37	**22**
Newspaper	35	**20**
Other	13	**15**
Internet	8	**13**
Bait Shop	2	**0**

The only mode of dissemination that failed to prompt any change in angler eating habits was learning of advisories from bait shops, a category that included only two responses.

One question in the Washington, DC survey asked anglers who knew about advisories to suggest improvements to advisory content or dissemination modes (Table

10). Thirty-six percent (36%) of anglers believed that improvements could be made to the advisories.

Table 10. Suggested improvements to advisories. These responses are not mutually exclusive since anglers were able to name several improvements.

Suggested Improvements	% Total
Include More Specifics	18
Publicize more and release advisories more often	18
Provide advisories in different languages	16
Signs: Post more, improve	13
Improve/include more pictures	7
Simplify the advisories	7
Be more forceful about warnings	4
OTHER	18

The most common responses regarding improvements included the desire for more specifics in the advisory, a need to publicize and release advisories more often, suggestions to provide the advisories in a variety of languages, and improvements or increases in the number of signs. Other anglers felt that more pictures would be helpful, particularly those who also mentioned providing the advisories in additional languages. Some felt that the advisories should be simplified, while other thought that a more forceful approach may inspire a greater degree of compliance.

All anglers were asked about their preferred modes for receiving advisory information. These modes are listed in Table 11. Sign postings, television notices, newspaper announcements, and personal contact with anglers were among the most popular methods suggested. Some of the other methods currently utilized by officials in Washington, DC were less popular with anglers, such as internet and fishing regulations book dissemination.

Table 11. Preferred dissemination methods among all anglers.

Preferred Dissemination Modes	Counts
Post Signs at Fishing Locations	94
Television	50
Newspaper	44
Talk to Anglers at Fishing Locations	42
Radio	25
Signs or Brochures at Bait Shops	23
Provide Info When Purchasing License	16
Put it in the Fishing Reg's Book	9
Internet	9
Don't Know	7
Have a Doctor/Health Care Provider Give Info	4
Direct Mail	3

Anglers often commented that it would be valuable to talk with officials at fishing sites who could answer their questions concerning fish health and consumption hazards. Many also felt that an increase in the presence of figures and illustrations, both of fish in the advisory and of waterways that should be avoided or limited, would help with the compliance of anglers from different educational and ethnic backgrounds. Many also noted that advisories needed to be provided in different languages, believing that the inclusion of illustrations may eliminate the need to cater to the varied ethnic population of DC fishermen.

CHAPTER V: DEMOGRAPHIC RESULTS

This chapter analyzes several components of the surveys with respect to race, income, and education. Most attention is given to race. Site distribution, fishing and consumption habits, and risk perception and advisory knowledge data are presented for each race. Throughout the racial analysis portion of Chapter V, racial comparisons are made by contrasting the behaviors of Whites to the behaviors of specific minorities as well as non-Whites as a whole.

Race

Table 12 shows the racial distribution of anglers in the Washington, DC region of concern. One half of all anglers were African-Americans, 33% were Whites, 10% were Hispanics, and 6% were Asians.

Table 12. Summary of Washington, DC anglers according to race, including a count of anglers and the distribution by percent.

Angler Race/Ethnicity	Number of Anglers	*PERCENT TOTAL*
African-American	121	**50**
White	79	**33**
Hispanic	23	**10**
Asian	14	**6**
Other	4	**2**
TOTAL	**241**	**100**

Race: Site Distribution

Site distribution among ethnic groups is important to fisheries and health planners who want to target advisories or advisory dissemination methods to populations of anglers known to frequent specific sites. Table 13 reports the number of anglers interviewed at various DC-area sampling sites, along with the proportional representation of each race at each site.

The shaded cells highlight the ethnic group most prevalent at each DC sample site, in each case either Whites or African-Americans. The largest proportion of Hispanics was found at Fletcher's Boat House, and Asians were represented most at Fletcher's Boat House and the Monument Tidal Basin.

Table 13. Angler survey site distribution by race—grey figures indicate the largest race, proportionally, at each site.

SITES	TOTAL INTERVIEWS	% White	% African-American	% Hispanic	% Asian	TOTAL %
East Potomac Park/Haines Point	**74**	7	84	5	4	**100**
Fletcher's Boat House	**58**	43	19	28	10	**100**
Gravelly Point/Roaches Run	**33**	88	9	0	3	**100**
Anacostia Park South	**30**	3	93	3	0	**100**
LBJ Park/Columbia Island Marina	**18**	72	17	6	6	**100**
Monument Tidal Basin	**9**	11	56	11	22	**100**
Water Street Marina Area	**9**	0	89	0	11	**100**
Dangerfield Isl/Wash. Sailing Marina	**6**	83	17	0	0	**100**
Theodore Roosevelt Island	**0**	0	0	0	0	**0**

Hains Point and Fletcher's Boat House constituted more than half of the total population of sampled DC-region anglers, and each of these sites also consisted of more than 50% minority anglers.

Race: Demographics

The average ages of anglers in the Washington, DC region varied somewhat between races; African-Americans were 2 years older than the population mean while Hispanic anglers were more than eight years younger (Table 14). Age can be significantly affected by risk perception. Older anglers, regardless of race, tend to put less importance in advisories than

Table 14. Mean angler age, by race.

Race	Mean Angler Age	Std. Deviation
White	43.6	13.7
African-American	47.2	12.9
Hispanic	36.4	10.5
Asian	40.6	14.2
Overall	***44.6***	***13.3***

younger anglers.

An analysis of income categories shows considerable racial discrepancy (Table 15). White anglers tended to have higher household incomes than other races. Most White anglers (65%) had household incomes of more that $80,000 a year, and Whites had the smallest proportion of anglers under $20,000 (3%). Only 24% of non-Whites reported incomes over $80,000 a year, and 41% made less than $40,000 a year. African-Americans had the highest proportion of anglers with incomes under $20,000 (15%), but Hispanics had the greatest proportion of anglers earning $40,000 or less (53%).

Table 15. Angler income distribution by race.

Race	Less than $20,000/year	$20,000-$40,000/year	$40,000-$80,000/year	More than $80,000/year
White	3%	9%	23%	65%
Non-White	13%	28%	35%	24%

Education differences between ethnic groups were also apparent (Table 16). Whites and Asians were more likely to have completed college and less likely to have not finished high school than African-Americans and Hispanics. Hispanics were the least educated group, with more than half (57%) not finishing high school. Overall, minorities were more likely to have no education beyond high school.

Table 16. Angler education level distribution, by race.

Race	% High School or Less	% Some College	% Bachelor or More
White	28	30	42
African-American	61	28	12
Hispanic	79	9	13
Asian	43	21	36

Race: Fishing Habits

Trends in fishing habits by race varied considerably, especially between Whites and all minorities. Whites were the only race in which anglers fishing from boats

constituted the majority of the group. Only 35% of White anglers were fishing from the shore, while most African-Americans (96%), Hispanics (100%), and Asians (86%) were fishing from the shore. Table 17 shows angler fishing mode distributions in Washington, DC within each race.

Table 17. Fishing mode distribution in Washington, DC by race.

Fishing Mode	Whites	African-Americans	Hispanics	Asians	*ALL ANGLERS*
SHORE	*35%*	*96%*	*100%*	*86%*	***75%***
BOAT	*65%*	*4%*	*0%*	*14%*	***25%***

Considerable differences in fishing experience were evident between ethnic groups. Many more African-Americans (71%) had fished in the Washington, DC region more than 10 years as opposed to Whites (53%), Asians (36%), or Hispanics (9%). Also, a greater proportion of Asians (36%) and Hispanics (35%) had fished in DC for less than a year than Whites and African-Americans (both 12%). Fishing frequency (number of times per year) also contributes to experience. African-Americans fished most often (25% fished more than 50 times in the last year) followed by Whites and Asians (17% and 14%).

Race: Consumption Habits

More than one-third (36%) of anglers in DC consumed their self-caught fish or crabs. Overall consumption in the region by race is shown in Table 18. Whites were the ethnic group least likely to consume their fish (30%) while Hispanics and Asians were most likely to consume (43% and 64%, respectively).

Table 18. Washington, DC angler self-caught fish consumption by race.

Consumption	Whites	African-Americans	Hispanics	Asians	*ALL ANGLERS*
Do Eat Self-Caught Fish	30%	36%	43%	64%**	**37%**

** Statistically significant difference from total population at .05 confidence level (difference of proportions test).

The figures in Table 18 echo responses given when anglers were asked about their motivating factors for fishing (Table 19). Minorities were generally more likely than Whites to consider a fresh fish dinner to be a motivating factor for fishing. Twenty-six percent of Hispanics stated that reducing family food expenses was a very important motivation for fishing, while 12% of African-Americans, and 1% of Whites. Reducing family expenses motivated no Asians to fish.

Table 19. Motivations for fishing among Washington, DC area anglers. These figures represent those anglers who responded that these reasons were "very or somewhat important" motivations.

Motivation	Whites	Non-Whites
Provide Fresh Fish Dinner	21%	40%
Reduce Food Expenses	5%	21%

Advisory adherence data can show what groups of anglers are heeding the advisory messages received. Table 20 shows that ethnic differences in advisory adherence with respect to species consumption are evident, but not necessarily strong. The table addresses two of the DC-area species mentioned in the fish consumption advisory and their consumption rates among Whites and non-Whites. Differences were small, but non-Whites consumed advisory species more often than Whites in each case.

Table 20. Angler species consumption, by race.

Race	% Consuming Catfish	% Consuming Largemouth Bass
White	22	5
Non-white	26	11

Nearly a quarter of all anglers surveyed are consuming catfish, the only species strictly prohibited in area advisories due to high PCB concentrations. Similarly, 23% of all anglers who consume largemouth bass are doing so more frequently than is recommended by advisories (see Table 7). This lack of compliance, though occurring more regularly among non-Whites, occurs among all anglers regardless of race.

One question from the survey addressed average consumption for all species. Whites who consumed their catch did so less frequently than most minorities, indicating lower risk exposure relative to non-Whites. Washington, DC advisories also recommend eating no fish species more frequently than one 8-oz. meal per week. However, 17% of all minority anglers who consume their catch and nearly one in four African-Americans anglers (23%) eat just at or beyond maximum recommended levels (Table 21).

Table 21. Angler consumption frequency, by race.

Race	% Anglers Consuming 1-2 Times/Week per Yr. or more
Whites	5
African-Americans	23
Hispanics	10
Asians	0
Non-Whites	17

Table 22 contains a summary of information concerning fish preparation methods. Distinct racial trends were evident in some of the risk-reducing methods for fish cleaning and preparation. Whites were more likely than non-Whites to undertake preparation methods that reduce risk most of the time, while various minorities were more likely to prepare fish in ways that do not reduce the concentrations of contaminants in fish.

African-Americans (27%) and Hispanics (20%) were most likely to eat fish whole, without skin and fat removal, thus increasing contaminant intake. Similarly, Asians (63%) and Whites (76%) were more likely than African-Americans (53%) and

Hispanics (60%) to puncture or remove fish skin before cooking. The DC-region advisory specifically mentions skinning and trimming fish as a way to reduce contaminants.

Table 22. Comparison by race of typical fish and crab cooking and preparation methods. The percentages represent the proportion of anglers from each race answering "most of the time" to each of the preparation and cooking methods. Safe/suggested practices are shaded, and potentially harmful practices are left unshaded.

	Percent Responding "Most of the Time"				
Fish Preparation Methods	**Whites**	**All Non-Whites**	**African-Americans**	**Hispanics**	**Asians**
Puncture or Remove Skin	**76%**	**55%**	53%	60%	63%
Trim Fat/Belly Meat	**77%**	**65%**	46%	70%	75%
Filet Fish	**77%**	**56%**	58%	50%	57%
Eat Whole Fish, Including Skin and Fat	**9%**	**22%**	27%	20%	0%
Pan or Deep Fry	**76%**	**83%**	83%	90%	75%
Eat Fish Raw**	**0%**	**7%**	0%	10%	38%
Freeze or Can for Later	**27%**	**27%**	28%	30%	13%
Re-Use Fat	**0%**	**10%**	10%	0%	25%

** Percentages for this category include only those anglers with responses of "Sometimes" rather than "Most of the Time"

Pan- and deep-frying fish locks in contaminants more readily than other cooking methods, and anglers from all races said that they regularly fried their catch. However, very few anglers actually re-used the oil and fat used in frying, an act that normally increases the contaminant intake from fried fish. Most anglers in all groups did not eat their fish raw, although Asians were more likely than others to do this.

Freezing or canning fish is considered a potentially hazardous action because it extends the period of the year in which anglers can consume their self-caught fish. Even in months with low angling activity (as in winter), those who can and freeze fish have the potential to consume fish from DC waters. A little more than one-fourth (27%) of all anglers froze their catch, and the distribution was even among Whites and non-Whites.

Nursing and expectant mothers are vulnerable to the ill effects of contaminated fish, but those who can potentially become pregnant and young children, are also a concern. Asians (50%) and Hispanics (39%) were more likely to provide self-caught fish to their families or other household members than African-Americans (28%) and Whites (25%), but no ethnic group appeared to have considerably more individuals from these at-risk subpopulations in their households than others. Very few women in angler households were pregnant or nursing at the time of survey administration, and anglers reported that none of them consumed self-caught fish.

Race: Risk Perception and Advisory Matters

Washington, DC advisories mentioned the existence of contaminants such as PCBs in fish from DC waters. Angler perception of the risks from such contaminants can strongly effect decisions to consume or provide for consumption self-caught fish. Overall, 29% of DC-region anglers believed the fish caught from Washington, DC waters were safe to eat, with 39% believing that the fish were not safe to eat. The rest either responded "not sure" or "it depends".

Comparisons to these overall averages can help to determine trends among each ethnic group. Whites were slightly more skeptical of fish from DC waters than the average (23% believed them to be safe for consumption), and African-Americans were slightly less skeptical (30% considered them safe). Hispanics (43%) and Asians (50%) had a much more positive perception of the water's cleanliness than the overall average. Only 26% of Hispanics and only 29% of Asians believed fish from DC waters were unsafe, while 42% of Whites and 41% of African-Americans believed this.

The reasons anglers gave for their perceptions of fish safety varied by race. Table 23 includes the proportions of each race who gave certain responses. The most popular responses referenced water pollution and contaminants. Proportionally, more Whites were distrustful of DC water quality than minorities. One notable trend involved anglers who were less skeptical about the water quality. Many Hispanics (19%) and African-Americans (18%) believed that since they and no one they knew had experienced any undesirable effects from consuming fish, the fish were more than likely safe. Fewer Whites (8%) and no Asians believed this notion.

Table 23. The reasons given by anglers for why they believed fish to be safe or unsafe, by percentage.

Reasons for Fish Safety Perceptions	% Whites	% African-Americans	% Hispanics	% Asians
Too much pollution	51	37	38	31
Depends on the species	18	9	0	0
Don't trust the fish	8	10	10	0
Never experienced/heard of ill effects from eating	6	18	19	8
Advisory adherence	4	8	5	0
Water is clean	4	6	0	8
Don't know	3	1	5	8
Other	3	5	14	15
No Advisories	1	2	0	15
Depends on prep methods	1	3	5	8

Eight percent or less of each racial group, and only 6% of the overall population of anglers, stated that their major reason for considering the fish to be safe or unsafe was observance of advisory information. However, even though many anglers did not specifically state that they relied on advisories to formulate their perception of fish safety, many of the responses listed in Table 23 (i.e., pollution, species-dependent, preparation methods, etc.) could have originated from the information in fish consumption advisories.

A little more than half of DC anglers (55%) were aware of advisories issued for Washington, DC. African-Americans were the group most often aware of advisories

(59%), followed by Whites (52%), and Hispanics and Asians (each 50%). While African-Americans saw the advisories most recently (35% had seen it in the last month) while most Whites had not seen advisories in over a year (42%).

Nearly all anglers who saw advisories felt the information was easy to understand, but only 26% of the overall population changed their eating habits as a result. African-Americans most commonly changed their consumption habits after seeing advisories (27%). Additionally, African-Americans placed the most importance in following fish advisories, with 89% believing that following consumption advisories was "very important". The reasons given for not changing eating habits did not vary considerably among racial groups, but the main response was "I did not eat self-caught fish prior to seeing the advisory, and I still do not."

Most anglers from each race did not believe that DC advisories needed to be improved. Among those who did, the only considerable trends in suggested improvements existed among Whites and African-Americans. Many Whites believed that signs should be posted more often and in more areas, and that posting signs in multiple languages would be very helpful. African-Americans mostly believed that advisories should be publicized or promoted more, and that released advisories (including posters and signs) should include more specifics.

Thirty percent of all anglers said they had referred back to advisories to make a decision about whether or not to keep and eat a fish. This figure was slightly higher among African-Americans and Hispanics (both 33%) and slightly lower among Whites (25%) and Asians (14%). These figures contrast with their perceptions about the

importance of following fish consumption advisories: all races overwhelmingly felt that following the advice in health consumption advisories was "very important".

Table 24 shows the most popular modes by which anglers who knew of advisories actually found out about them. Small samples sizes necessitated inclusion of only Whites and African-Americans. Interestingly, television was the most popular mode among African-Americans, but the informal procedure by which DC DOH disseminates advisories does not include television communications. Most effort is focused on fishing regulations books (not among the most popular modes for either of the two largest races) and sign postings. Signs were relatively effective among each race in communicating advisories, but newspaper and television ads were far more prevalent.

Table 24. Angler advisory communication modes of Whites and African-Americans (other races excluded due to low response rate).

Common Modes by Which Anglers Learned of Advisories	**% Whites**	**% African-Americans**
Signs at Fishing Sites	9	18
Newspaper	25	17
Television	11	28
Internet	10	1
Preferred Advisory Communication Modes	**% Whites**	**% African-Americans**
Signs at Fishing Sites	25	25
Newspaper	16	11
Television	8	17
Interpersonal Modes	10	15

The bottom half of Table 24 indicates the advisory modes *preferred* by anglers. Although nearly no anglers reported learning about advisories through interpersonal modes—such as social workers, healthcare providers, or game officials—a substantial portion of each race mentioned them as preferred communication modes. Aside from sign postings, African-Americans preferred interpersonal modes of communication and

television notices most while Whites preferred newspaper releases along with interpersonal contact.

Other Demographics: Income

A few income-related trends were evident among Washington, DC anglers. Most anglers in the Washington, DC region were willing to provide income information to interviewers (87%).

Table 25 shows the household income distribution of Washington, DC anglers. The greatest number of anglers reported combined household incomes of more than $80,000/year (39%), and there were fewer anglers in each of the succeeding lesser income levels. Thus, the lowest income category (less than $20,000/year) was also the least frequent among anglers (9%).

Table 25. Income distribution of Washington, DC region anglers.

Annual Household Income	% Total
Less than $20,000	9%
$20,000-$40,000	21%
$40,000-$80,000	31%
More than $80,000	39%

Site choice by DC anglers was related to income with respect to both proximity and fishing mode. Anglers with lower incomes generally traveled shorter distances than anglers with higher incomes. This trend may have been related to the presence or absence of a boat ramp. All anglers in the lowest income category were shore fishermen. In the highest income category, 51% fished from boats. The proportion of boating fishermen was increased with other household income categories as well.

As may be expected, the motivations for fishing varied among different income categories. When asked about the importance of providing a fresh fish dinner to self or family, responses were mixed. However, lower income anglers did express considerable importance in fishing as a way to reduce food expenses compared to higher income groups. About one angler in four (23%) making $40,000 or less said saving money was at least a somewhat important motivator for fishing, while 9% making more than $40,000 said this.

Furthermore, an analysis of general consumption with respect to income yields a slight trend. Table 26 shows the percentage of anglers in each income category that consume at least some of the fish they catch. Although a minimal difference, the lowest income groups (less than $40,000) consumed more often than higher income groups.

Table 26. Percent of each Washington, DC area income category that consumed self-caught fish at least occasionally.

Income Categories	% Consuming Self-Caught Fish
Less than $40,000	41
More than $40,000	34

The relationship between angler income and DC-region advisory awareness proves interesting. An analysis of the data shows that advisory awareness was negatively correlated with household income. More anglers with incomes in the *less than $20,000/year* group were aware of advisories than any other group (63%). Conversely, there were fewer anglers aware of DC advisories in the highest income category (*more than $80,000/year*) than any other income level (50%).

Other Demographics: Education

Table 27 displays the distribution of anglers in the Washington, DC region with respect to their education levels. Nearly half (47%) had not finished high school, and another quarter (26%) had completed high school only. The remaining anglers (27%) had completed some college or more.

Table 27. Distribution of education level among anglers in the Washington, DC area.

Education Level	Percent of Total
Less than High School	47
High School	26
Some College	16
Bachelors/Equivalent	6
Masters/Equivalent	4
PhD/MD/Equivalent	1

Site choice did not appear to be affected by education. Boat fishermen were not necessarily more common in certain education groups, and there was also no strong relationship between education level and number of miles traveled to reach a fishing site. Results for fishing motivations among anglers with different education levels were mixed. The importance of having a fresh fish dinner varied between education groups, and no correlations were evident. However, there was a tendency for less educated anglers to fish in order to reduce food expenses more often than educated anglers.

Table 28. Percent of Washington, DC area anglers who considered recreational fishing to by very or somewhat important in the reduction of family food expenses.

Education Level	Percent Responding that Fishing as a means of Reducing Food expenses was "Very" or "Somewhat" Important
High School of Less	26
Some College	8
Bachelors/Equivalent	3
Masters/Equivalent	4
PhD/MD/Equivalent	0

Table 28 shows that more anglers with a high school education or less considered fishing to be at least somewhat important in supplementing household food more often than anglers with higher education levels.

CHAPTER VI: IMPLICATIONS

Chapter VI synthesizes the data presented from Washington, DC and discusses it in the context of the research question and hypotheses. The successes and shortcomings of Washington, DC risk communication efforts are discussed, as are potential strategies for improving those efforts. The implications for planning listed in this section present steps for remedying the less effective components of public health warning disseminations in DC. Areas for further research are also noted.

Advisories in the Washington, DC region of concern have existed in some form for more than 15 years. This presents a unique opportunity for reviewing current outreach methods, identifying effective actions, and improving on areas needing attention because unlike other tributaries to the bay, advisories on DC waterbodies have been in place for a substantial period of time. This chapter discusses the results and their implications for Washington, DC anglers and fisheries planners.

The respondent sample size for the Washington, DC case study is 247. During subpopulation analyses, the number is lower. Very few results from the study show statistical significance in a difference of proportions test. Conclusions in this chapter are drawn by examining patterns consistently present in specific populations of anglers.

Prior to presenting analyses of angler data, attention should be given to findings that suggest personal interview responses are not guaranteed to be entirely accurate. Particularly in personal interview surveys, respondents often reply in the manner they believe is expected, even if these responses are not accurate. This is called prestige or social desirability bias (Fisher, 1993). For example, some of those claiming to have

heard of advisories could not recall any specific information from them, and may have in fact not known about them at all.

The same can be said for responses to fish consumption questions. Anglers who may feel ashamed or nervous about admitting to an interviewer that they eat fish from DC waters may instead claim to not eat any self-caught fish, thus providing inaccurate data. However, most anglers appeared to provide interviewers with accurate responses, and were overall willing and inquisitive participants. Furthermore, many trends in DC echo results from previous studies performed by risk assessment and other professionals on anglers in urban watersheds.

However, far fewer anglers (37%) fishing on the Potomac and Anacostia Rivers are consuming their catch than in the other regions of the Bay (91% in Tidewater, VA; 56% in Baltimore, MD) (Gibson and McClafferty, 2005). Most anglers report that they do not consume their catch because they believe the Anacostia and Potomac Rivers are too dirty, therefore fish from the rivers are unsafe for consumption. Very few (6%) cite adherence to advisories as a reason for not consuming their catch. This result may indicate that advisories are not being accepted or trusted (Beehler, 2001).

Like past studies (Burger et. al, 1999; Burger et. al., 2001; Campbell et. al., 2002; Beehler and McGuiness, 2003), differences in White and non-White consumption habits are apparent in Washington, DC. Although often not as overt as the results from previous advisory studies, and often statistically insignificant, consumption results consistently suggest an increased health risk among minority populations, particularly African-Americans. This increased risk results from increased overall consumption, frequency of consumption, banned-species consumption, and harmful cooking methods.

In many cases, an increased likelihood of consumption can be traced to fishing effort. Non-Whites fish more often and have fished the Potomac and Anacostia Rivers for more years than Whites. Also contributing to heightened minority risk exposure is the fact that minorities provide their catch to their families more often than Whites.

One example of successful advisory communication but unsatisfactory advisory implementation involves African-Americans. African-Americans claim to more often change their eating habits as a result of advisory adherence, are more aware of advisories, and have seen advisories more recently than any other race. Familiarity, however, does not translate into adherence. African-Americans also consume fish more regularly, have higher consumption rates, and usually fail to participate in risk-reducing behaviors as often as Whites. African-Americans are not unique. Other minorities show similar tendencies.

Minorities consistently fail to comply with advisories as often as Whites (although there are exceptions) even though they claim a better overall knowledge of advisories, particularly in the case of African-Americans. This is in direct conflict with results from past angler interview efforts that found minorities less likely to know about advisories (Burger et. al., 2001).

These realities present problems for environmental planners because, although many anglers place a high level of importance in advisories (85% of all anglers indicate that it is very important to follow advisories) and often minorities are more aware of advisories than Whites, many are still not complying with advisory suggestions. Even in cases where advisories are reaching minority anglers, they are often being either ignored or discounted for some other reason.

The results validate past studies by Beehler (2001) that contend that advisory value reaches only so far, and that other factors play significant roles in an angler's decision to consume fish. Most of the anglers who had not seen consumption advisories still believed the water was too polluted to contain healthy fish, as did many of those who had encountered advisories. This tendency illustrates that certain perceptions of risk are inherent regardless of advisory presence, and knowing the environmental and other indicators that produce these perceptions prove valuable to managers in the development and dissemination of future advisories. Advisory efforts cannot always replace folk fishing notions about the suitability of fish for consumption (Beehler, 2001). This may be the case in the District of Columbia as well.

For instance, African-Americans are more likely to avoid or consume fish based on the actions of their friends and relatives than any other ethnic group. Many African-American non-consumers also regularly believe catfish are bottom-dwellers, while many fish consumers from the race concentrate on certain species for consumption, like catfish, based on their taste or on other culinary traditions. Many other minorities similarly adhere to their own beliefs of cultural origin that often supersede advisory suggestions.

The problem is that in many of the studies referencing this notion (Beehler, 2001; Beehler and McGuiness, 2003) there was more overall compliance than currently exists in Washington, DC. Regardless of folk-notion origin, the fact remains that excessive contaminated fish are being consumed by DC-area minorities, perhaps as a result of these cultural beliefs.

Sport-caught fishing and fish consumption, as an important part of culture, serves many economic, social and ceremonial functions. It solidifies social ties among ethnic

groups, and is often part of the groups' tradition and identity. As a result, it may be difficult for members of these groups to conceive of these foods as "hazardous", particularly if there are no immediate, identifiable effects (Cartledge, 2002). This may be responsible for increased consumption and general hazard exposure among minority anglers.

However, some studies also suggest that great care must be taken with certain risk communication practices. It is important not to disrupt cultural institutions by infusing advisory limitations onto populations in a manner that changes their behavior in an unintended manner, such as encouraging compliance by eliminating sport-caught fish and thus a culturally-important tradition (Cartledge, 2003).

One additional portion of the survey aimed to determine the prevalence of subsistence angling in the DC area. Subsistence anglers normally catch fish for the purposes of personal or familial consumption as a financial necessity or with the intent of reducing expenses for food. These fishermen are expected to be more at-risk than recreational, non-subsistence fishermen due to the necessary nature of their consumption of local fish (May, 1996). Although determining subsistence proved difficult in personal interviews, data from this question gives an idea of some of the populations that may be more inclined to consume their catch out of necessity.

This means that minority anglers place more importance in fishing for food *and* to supplement their grocery needs. These differences insinuate that non-White anglers, on the whole, are consuming self-caught fish at a higher rate than Whites, and that more are also doing it as an attempt to save money on food. Meal frequency data supports this. This normally signifies an amplification of risk among these populations. However, it is

difficult based on data from this survey to identify one demographic population that contains a disproportionate amount of *genuinely* subsistence anglers.

Many anglers in the District of Columbia region decline to eat the fish they catch, but those who do often surpass the recommended limits in advisories. In fact, more than half (51%) of all instances of consumption are in excess of the advisory-recommended amounts.

Additionally, despite a sustained presence over many years, fish consumption advisories in the District of Columbia are familiar to just over half of the anglers interviewed (56%). Many had seen the advisories within the last month, but the largest group of anglers who are aware of the advisories had not seen them for over a year. This lack of familiarity holds the potential to be problematic, and may contribute to the low rate of compliance among consuming fishermen.

Regardless of race, catfish (a no-consumption species according to DC advisory recommendations) is eaten by more anglers than any other recreationally-caught fish. In addition to its popularity, many anglers who consume various catfish species do so at least once per month or more. Largemouth bass, another fish with strict limitations in advisories, is also popular in relation to other species. These results indicate that the message in advisories is either not being received by all anglers or is being ignored by many of those who do receive the message.

Portion sizes are another area where an increased risk of exposure exists. Meal recommendations in Washington, DC advisories are based on 8-ounce meal sizes, which many anglers (38%) reported as normal. However, many more anglers eat meals above 8

ounces than below, suggesting that anglers (on average) are eating more than 8-ounces of self-caught fish at meals. This trend warrants further explanation before future advisories are issued, perhaps through occasional creel surveys conducted by the Department of Health.

The fact that experienced fishermen (i.e., those that fish many times a year and that have fished the area for many years) express greater awareness of advisories than infrequent fishermen proves heartening. Since low-income anglers fish more regularly and could come in contact with sign postings and other anglers more regularly, the results suggest that the word is getting out to those who fish on a regular basis, including lower-income anglers. Findings also show that many of the people who do not know about advisories fish only irregularly.

African-Americans' increased awareness relative to other groups may also result from their more frequent fishing. More than a quarter fished at least 50 times in the last year. However, familiarity fails to translate into compliance in all instances.

The number of anglers who give away their catch in DC is also evident other areas of the Bay (Gibson and McClafferty, 2005). More than half of the anglers in this study (54%) gave away the fish that they caught, and this included half of the group of anglers who did not eat self-caught fish themselves. The recipients of these hand-outs are unknown consumers of sport-caught fish. These anglers were not captured in this report, yet their numbers appear substantial. Additional data on these people are needed so that fisheries planners can learn how best to communicate risk to them without relying on anglers to provide the message.

The mode of advisory dissemination most effective at reaching anglers was television, which is interesting since the DC Department of Health does minimal outreach through television outlets. Major television communications are often news stories picked up by local stations. Commercials and public service announcements are not used. Since so many anglers learn about advisories through the limited exposure the advisories receive on television, commercial issuance on TV and radio is a possible avenue of increased focus in future advisory communications aiming to increase advisory awareness, especially if the focus is on creating widespread awareness. The same holds true for newspaper information, the next most common mode for informing anglers.

However, although television and newspapers appear to reach great numbers of people, these modes are not as effective as others at actually changing angler behavior. The DC fishing regulations booklet is the most effective mode in that regard. Signs are next, followed by information received from other anglers.

The efficacy of these modes may rely on their accessibility. Posted signs and regulation booklets are easily accessible by anglers, while modes like television and radio cannot be as conveniently reproduced or recalled by anglers for use as a reference. The effectiveness of these modes in changing behavior should be considered when new advisories or dissemination procedures are being developed.

Sign posting, a dissemination mode used regularly by DC Department of Health, is another effective and popular method among interviewed anglers. In fact, some of the most commonly suggested improvements among anglers involved using more signs, indicating that local anglers view that method favorably. One popular suggestion is an increase in the visual graphics on signs and brochures. This recommendation suggests

that seeing pictures of fish and meal sizes is more helpful to many anglers than writing them. The inclusion of illustrations on signs may eliminate some of the difficulties inherent in catering to a diverse ethnic and linguistic population among DC fishermen. Although advisories are currently available in Spanish, most anglers were not aware of this service.

Many anglers of all races and backgrounds prefer interpersonal modes of advisory communication, such as talking to anglers at fishing sites. This tendency arose in each of the Chesapeake Bay's regions of concern. Interestingly, however, only one angler included in this study appeared to have gained any of their personal knowledge of consumption advisories through contact with game wardens or health officials (see Figure 5). This suggests a potentially effective approach for future outreach that could impact angler compliance.

Interpersonal modes (like site visits by health or game officials) are not the most financially or labor-efficient ways to communicate advisories, but some integration of interpersonal contact at popular fishing spots are an effective tool in future dissemination protocol improvements (Burger et. al., 2003). One way to implement interpersonal modes is to have health and fisheries officials visit community gatherings, organization meetings, or neighborhoods in general. This method ensures that people in certain, targeted locales or areas of interest (such as watershed organizations or women's health groups) are aware of advisories and ways to learn more about them. In this way, a whole community of communicators can be developed, and those who attend such meetings or events can then pass the information on to other anglers they encounter.

Although anglers with a high school education or less appear to place more importance in fishing in order to reduce food expenses, few other consistent correlations exist among education groups. Education cannot be included as an indicator of advisory adherence or contaminated fish consumption without additional study and a larger angler sample size.

However, a few interesting correlations exist with respect to angler income. Reducing food expenses proved much more important for lower income anglers, but according to the data, this motivation does not translate into significantly higher rates of recreational fish consumption. Low-income anglers are also more aware of advisories in DC, probably because they went fishing more often that higher-income anglers and would encounter signs and other anglers more often.

Implications for Planning, Risk Avaoidance, and Public Health

Environmental planners deal often with issues of hazard mitigation and risk management (Randolph, 2004). In the case of fish consumption advisories, the chief hazards are the potential health effects from the presence of contaminated fish, while the most prevalent risks involve an increased potential for harm from these hazards brought on by either a cultural predisposition or a financial necessity of consuming contaminated fish. Based on the data presented herein, however, cultural predispositions appear to be more prevalent in the decision to consume sport-caught fish.

This analysis examining the state of current Washington, DC advisories has generated a framework for environmental planners in Figure 6. This guide should prove useful to for stakeholders in the administration of public health programs in Washington,

DC, including natural resources and health planners in various public agencies, citizen representatives of watershed associations, and city planners concerned with social equity and environmental justice.

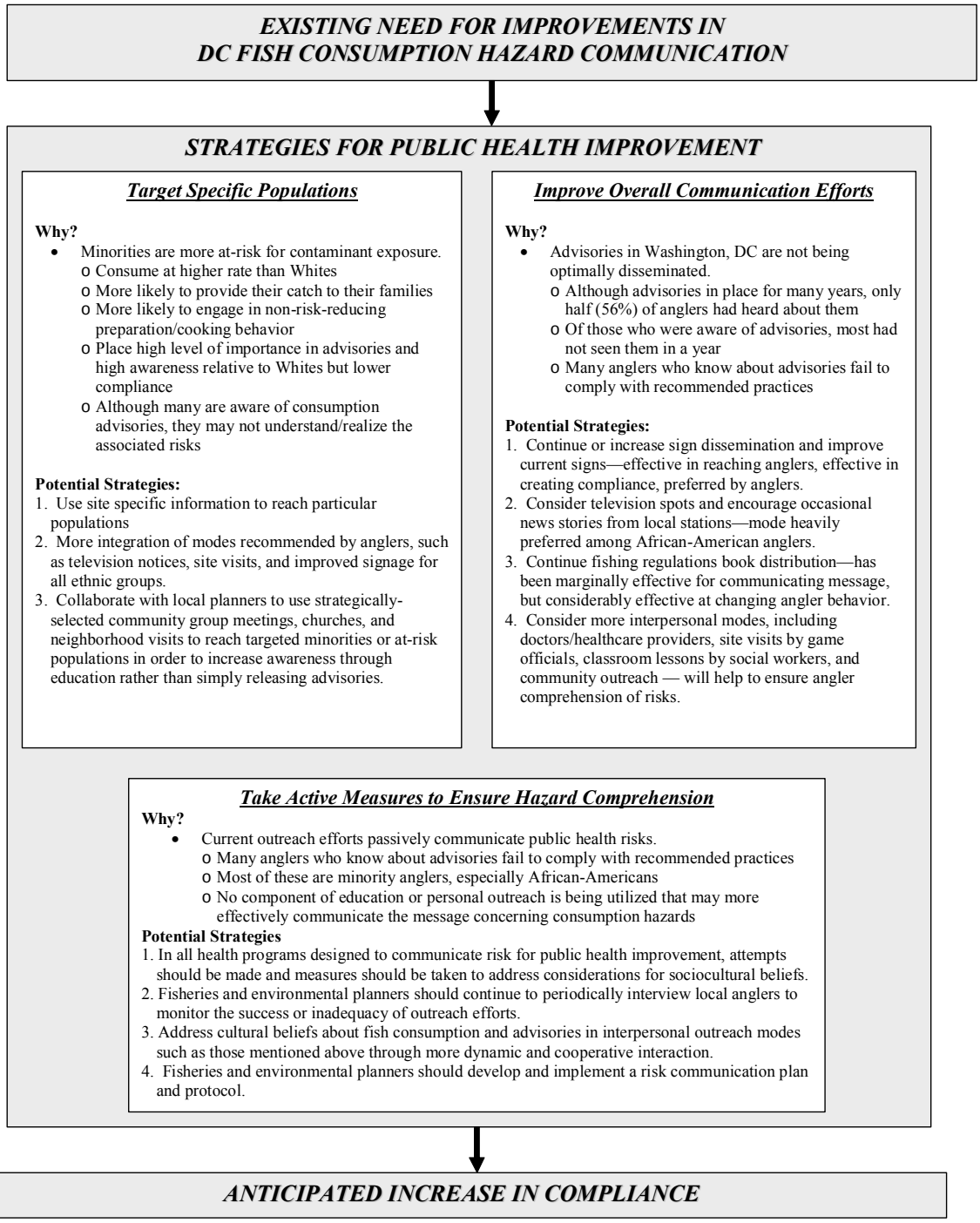

Figure 6. Strategic framework for planners involved with dissemination and implementation of Washington, DC fish consumption advisories.

The strategies in Figure 6 involve a continuation of some current outreach efforts as well as an expansion of communication actions. They address findings from this paper that illustrate that perfect advisory information and communication of that information alone does not translate into angler compliance and protecting public health. In order to ensure the greatest degree of protection of public health, expanded and alternative efforts must be explored. In other words, advisories, although they are often reaching at-risk anglers, are not communicating risk to many anglers and therefore are unsuccessful in their goals of promoting public health. Unconventional methods may be required to more successfully protect the health of area anglers and their families.

Targeting specific populations of anglers, improving communication efforts to those and other angler populations, and taking steps to address the shortcomings of passive advisory dissemination are among the topics addressed. The strategies focus on utilizing the information derived from the survey data presented in this paper.

Planners should focus on educating certain populations, particularly minorities, about the hazards of contaminant exposure. Although the differences are often not as pronounced as literature would lead one to expect, the results from this study are consistently tilted toward a greater risk of contaminated fish consumption among minorities and even some low-income anglers. A more specialized allocation of resources can ensure that specific strategies have been developed for at-risk populations and thus ensure the best possible efforts of risk communication.

Informing minority anglers of the risks of contaminated fish consumption can be accomplished by combining some current outreach practices with alternative and unconventional ones. Communication can be enhanced by continuing the effective

existing advisory communication practices (i.e., those successful at *reaching* anglers). However, simple information presentation has been successful in the past—it is comprehension and compliance that are desired from a more integrated program. Supplementing successful communication strategies with additional approaches for more intensive angler education can address some of the barriers encountered with conventional advisory practices.

Interpersonal communication modes like those from Burger et. al. (2003) are accounted for in Figure 6 as a means of active risk communication. The ethnic diversity of DC anglers and the city itself demand such unconventional modes as this for advisory dissemination. The strategies above adapt approaches suggested by Velicer and Knuth (1993), which integrate social and healthcare workers to capture many minorities, particularly non-English speaking anglers and their families.

One way environmental planners can approach each of the strategies in Figure 6 is by initiating policy change and improvement. Washington, DC health and wildlife agencies currently have no formal protocol for the dissemination of public health advisory information. Although specific practices are regularly utilized, no official plan for risk communication or ensuring the effectiveness of those warnings currently exists. The development of a protocol for improving risk communication, incorporating the strategies from Figure 6, can be helpful as an integrated component of Washington, DC public health programs.

One critical component to the development of a risk communication program protocol is a consideration for increased education. Many anglers in Washington, DC who ate their catch while familiar with advisories simply did not believe the risks or were

unconcerned with potential hazards, an occurrence not uncommon in similar angler surveys (Pflugh et. al., 1999). Communication of these hazards must be enhanced to include credible evidence against consuming too much fish that can be accepted by at-risk populations.

Lastly, initiating a more integrated, collaborative, and active public health program may more effectively address some of the cultural biases that appear to be hindering public compliance with health warnings. Although additional research is needed on this topic to more thoroughly identify the origins and true effect of such biases, an infusion of alternative, interactive information dissemination techniques may address those populations that are not adhering to the messages put out by more conventional advisory outreach methods.

The recommended limitations on fish consumption in advisories are just that: voluntary recommendations. It is impossible for planners to ensure by legal or regulatory means that anglers and their families are adhering to advisory suggestions. In order to convey these messages successfully, more extensive and multifaceted management approaches are needed, and this paper presents some suggestions based on literature and survey results. The program changes presented here reference strategies by McDermott (2003). Several facets of risk communication are addressed rather than relying on passive communication and omitting a component of education and continual research

Opportunities for Further Research

A portion of the survey from this project was designed to uncover Washington, DC angler perceptions about the safety of consuming local fish and the legitimacy of

advisories. Subsequent studies might expand upon not only these perceptions but also the specific reasons they are embraced by certain anglers. Specifically, the notion that cultural influences may be contributing to advisory noncompliance should be explored, particularly among minority angler populations.

The questions raised in this paper concerning cultural beliefs are addressed in similar studies (McDermott, 2003; Cartledge, 2002). An adaptation of the Washington, DC survey instrument and a refocusing of study objectives and research questions has the potential to vastly expand the knowledge about ethnic biases as they relate to sport-caught fishing and fish consumption, advisory perception, and public health issues.

Some data from this project also yielded inconclusive results due to small sample sizes. Expansion of this data can occur with an increased interviewing effort or time frame. Additional data will allow a more thorough analysis of demographic characteristics such as education and race to see whether these qualities also contain evidence of disproportionate risk.

Summary

Current Washington, DC advisories have been successful in some aspects, but are failing in many others. Most anglers in the Washington, DC region of concern refrained from eating fish from the Potomac and Anacostia Rivers, but it was usually a result of their reservations about water cleanliness, not advisory adherence. This fact, of course, translates into overall compliance in the region, but among the anglers who *do consume* their catch, many are doing so at hazardous frequencies and meal sizes.

Some improvements can be made to current risk communication efforts. Advisories being issued by DC natural resource and health planners are not optimal at protecting the health of Washington, DC citizens in their current form. Although the goals of such advisories are to protect public health and welfare, additional steps must be taken in order to ensure this goal is legitimately pursued.

Adapting the current DC advisory efforts to into a more developed program of risk communication can actively communicate risk to the region, enhances effective dissemination practices, and incorporate more angler education as a way of addressing possible cultural barriers to advisory compliance. Targeting minority anglers is very possible but must be accomplished through enhanced outreach efforts. These recommendations should present an opportunity for increasing the efficacy of fish advisories and communicating risks to targeted populations.

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Appendix A
DC Fish Consumption Advisory

http://dchealth.dc.gov/services/administration_offices/environmental/services2/fisheries_wildlife/licensing_phealthadvisory.shtm

Fisheries and Wildlife
Environmental Health Administration

Public Health Advisory
"DC Department of Health urges limited consumption of Anacostia and Potomac river fish."

PCBs and other chemical contaminants have continued to be found in certain fish species caught in the Potomac and Anacostia rivers and their tributaries, including Rock Creek, within the boundaries of the District of Columbia. Because of these findings, the Department of Health advises the general public to limit consumption of fish from all DC waters, as follows:

- **Do not eat**: Catfish, carp, or eel.
- **May eat**: One-half pound per month of largemouth bass, or one-half pound per week of sunfish or other fish.
- **Choose to eat**: Younger and smaller fish of legal size.
- **The practice of catch and release is encouraged.**

Always skin the fish, trim away fat, and cook fish to drain away fat because chemical contaminants tend to concentrate in the fat of the fish.

These recommendations do not apply to fish sold in fish markets, grocery stores, and restaurants, since commercial fishing is prohibited in DC waters; thus fish from these venues will not be from the Potomac or Anacostia Rivers.

"The Department of Health also notes that other species of fish found in the District's waters not identified above did not have elevated levels of PCBs or pesticides."

Reporting a Fish Kill
Anglers and the general public are asked to report a fish kill. If you see 50 or more dead fish floating on the surface of the water, please contact the DC Fisheries and Wildlife Division at (202) 535-2260 with the following information: exact location of the floating fish, date, time, and the extent of the fish kill.

Appendix B
Survey Instrument

DC Area Angler Survey Instrument – Final

Surveyor Name:
Survey Location:
Date:
Day of Week:
Observed Sex:

SURVEY NUMBER: Time Begin: Time End: Length of Interview:

Fishing Mode? . . . . Shore Pier Boat

IF APPROACHING:

ON ARRIVAL: **Hi - It's a nice (or rough) day for fishing today. Do you think anything will be biting?**

WHILE FISHING: **Hi - how's the fishing today? Is anything biting?**

ON DEPARTURE: **Hi - how was the fishing today? Did you pull in a good catch?**

My name is _____ (first name). I'm with Virginia Tech and the Chesapeake Bay Program. We're talking to people who fish here to learn about how the Washington D.C. area is used by recreational fishermen, so that the fishery managers can better meet your needs. Can I have about fifteen minutes of your time to ask you some questions?

IF SKEPTICAL: **We aren't here to enforce any regulations. All of your answers will be confidential - I won't ask your name and no one will know who you are. If you don't want to answer a question, we can skip that question.**

IF YES: **Great! Before we start, I just want to make sure that you haven't been already interviewed by our team sometime this summer. Have you been interviewed by one of us before?**

IF YES, TERMINATE INTERVIEW. IN NO, CONTINUE

FOR ALL QUESTIONS: UNLESS OTHERWISE NOTED, READ RESPONSE OPTIONS **ONLY** IF RESPONDENT HAS TROUBLE ANSWERING.

1. Is it ok if I tape the interview so that we don't miss anything? (If skeptical, point out that taped interviews usually go faster) . . . . . . Yes (Taped) No (Paper Only)

Tape ID#:

2. About how many miles did you have to travel to get here today?

10 miles or less 11-25 miles 26-50 miles 51-100 miles more than 100 miles

2a. How long have you fished or crabbed in the Washington DC area?

This is my first time (SKIP to Q3)
Less than one month
More than a month, less than a year
1-2 years
3-4 years
5-9 years
10 years or more

2b. In the past year, how many times would you say that you have fished or crabbed in the Washington DC area?

1-2 times 3-10 times 11-25 times 26-50 times more than 50 times

3. I'm going list some possible motivations for why people go fishing or crabbing. Could you tell me whether each one is Very Important, Somewhat Important, or Not at all Important to you? (READ OPTIONS)

Very Important
Somewhat Important
Not at all Important

How important is being able to...

a. Treat yourself or your family to a fresh fish or crab dinner?
b. Relax?
c. Spend time outdoors?
d. Reduce your family food expenses?
e. Experience the challenge or sport?

--FISH CONSUMPTION PATTERNS--

The next group of questions will ask you about how much self-caught fish you eat from this area.

4. Do you, personally, eat any of the fish or crabs that you catch in the Washington DC area?

Yes (SKIP to Q5) No (CONTINUE)

If NO, why not? (then SKIP TO Q13):

5. What types of self-caught fish or crabs do you, personally, most often eat, and how often would you say you eat them over the course of a year? You can list up to four, and you may choose from those pictured here or any others that you regularly eat. ***(show visual aid - species)***

1)_____
2)_____
3)_____
4)_____

Frequencies for each: 5 or more times per week
3-4 times per week
1-2 times per week
1-3 times per month
Less than once per month

6. Are there any kinds of self-caught fish or crabs that you won't eat or purposefully eat less of? This can include certain types, certain sizes, or anything else that you purposefully avoid.

Yes (CONTINUE) No (SKIP TO Q12)

If yes, what kind, and why do you avoid them?

7. During which months of the year would you say that you, personally, eat the *MOST* fish or crabs caught in the Washington DC area? Please consider ONLY the fish and crabs that you catch and either eat fresh or freeze or can for later - DO NOT consider those that you buy in a market. (Check all that apply)

January – February – March – April – May – June – July – August – September – October – November - December
All months the same (SKIP TO Q8) - Don't Know (SKIP TO Q9)

7a. During these months *(repeat months checked above)*, how frequently do you eat fish or crabs that you caught in this area?

5 or more times per week
3-4 times per week
1-2 times per week
1-3 times per month
Less than once per month
Don't eat fish then

8. During which months of the year would you say that you, personally, eat the LEAST fish or crabs caught in the Washington DC area? Again, consider ONLY the fish and crabs that you caught and eat eat fresh or freeze or can for later. (check all that apply)

January – February – March – April – May – June – July – August – September – October – November - December
Don't Know (SKIP TO Q9)

8a. During these months (repeat months checked above), how frequently do you eat fish or crabs that you caught in this area?

5 or more times per week
3-4 times per week
1-2 times per week
1-3 times per month
Less than once per month
Don't eat fish then

9. How frequently would you say that you eat the fish or crabs you catch in this area on average throughout the year?

5 or more times per week
3-4 times per week
1-2 times per week
1-3 times per month
Less than once per month
Don't Know

10. How much self-caught fish do you, personally, typically eat during a meal? You can pick one of these categories or indicate something in between. ***(show visual aid - 4, 8, & 12 ounce portion sizes)***

<4 oz 4 oz 4-8 oz 8 oz 8-12 oz 12 oz >12 oz

11. How many self-caught crabs, do you, personally, typically eat during a meal?

Don't eat 1-2 crabs 3-5 crabs 6-9 crabs 10-15 crabs more than 15 crabs

12. Next I'm going to read you a series of cleaning and cooking methods for fish and crabs. Can you please tell me how often you use each of these methods for the self-caught fish or crabs that you eat?
READ OPTIONS!
Most of the time - Sometimes - Never - N/A
How do you typically clean your fish or crabs? Do you...
a. Eat the mustard from crabs
b. Eat the whole fish, including skin and fat?
c. Puncture/remove skin from fish before cooking
d. Trim fat from fish before cooking
f. Filet the fish
g. Eat the fish or crabs raw
How do you typically cook your fish or crabs? Do you...
h. Pan fry or deep fry
i. Re-use fat or oil from cooking
j. Steam, poach, or boil
k. Broil, grill, bake, or roast
l. Make soup or chowder
m. Freeze or can it for later

--HOUSEHOLD MEMBERS--
In addition to yourself, we are also interested in knowing how much fish others in your household eat.
13. Do any other members of your household eat any of the fish or crabs that you catch in the Washington DC area?
Yes (CONTINUE) No (SKIP TO Q16)

14. How many total people are there in your household, including adults and children? Include yourself in this count:
a. How many children aged 5 or younger are there?
b. How many children between the ages of 6 and 15 are there?
c. How many adults aged 60 or older are there?
d. How many women are there between the ages of 18 and 45?
IF GREATER THAN ZERO... Are any of these women currently pregnant or nursing or were within the last year?
Do you place yourself in any of these categories? If yes, Which one?

15. Compared to you.... *i(nsert applicable categories below)* ?
How often do the _____ eat your self-caught fish or crabs?
More often than me
About the same
Less often than me
Don't eat at all
(Not Applicable)

How much do they typically eat in a meal?
(SHOW VISUAL AID)
<4 oz - 4 oz - 4-8 oz - 8 oz - 8-12 oz - 12 oz - >12 oz - *(N/A)*
a. Children 5 or younger
b. Children 6-15
c. Adults 60 or older
d. Pregnant/nursing women
e. Other women 18-44

16. Do you give away any of the fish or crabs that you catch? . . . . . . Yes No

READ OPTIONS! ---->

--ADVISORY AWARENESS--

17. Have you heard of any health benefits from consuming fish? Yes (CONTINUE) No (SKIP TO Q18)
If Yes, do you eat more self-caught fish than before as a result of this information? Yes No

18. Would you say that the fish you catch here are safe for you and your family to eat? Yes No It Depends Uncertain
Why do you think this?

19. Have you ever seen, heard, or read about health advisories that some states issue to limit consumption of locally caught fish? Yes No

20. Are you aware of any such warnings that have been issued for the Washington DC area?
Yes (CONTINUE) No (SKIP TO Q28)

21. If yes, how did you learn about it? ***(Check all that apply. Don't read options.)***
Other angler - Family - Friend - Doctor or health provider - Warden or other official - Fishing Regulations book - Sign/Poster at fishing site - Bait shop - Internet - Newspaper - Radio - Television - Don't Know - Other:

21a. When did you last see or hear about the advisory?
within the last month
2-3 months ago
4-6 months ago
7-12 months ago
more than a year ago

22. Would you say that the information you got was easy to understand?
I had no problems understanding it.
I had some difficulties, but got the main points.
I had a lot of trouble understanding it.

23. What did the advisory say? (*Don't read options, but check answers that closely match what the angler says. Check all that apply.)*
Don't eat any fish from the Washington DC waters
Don't eat fish from certain Washington DC waters
Don't eat certain kinds of fish from Washginton DC waters
Don't eat more than a certain amount of fish from Washington DC waters
Certain people should eat less fish from Washginton DC waters
Pregnant women or children should eat less fish from Washginton DC waters
Beware of certain toxins in some Washington DC-caught fish
The Washington DC waterways are polluted
Don't Know
Other:

Specifics about species, amounts, certain people, etc. mentioned by angler... (don't prompt)

24. From the pictures shown here, which types of fish did the advisory you saw for this location apply to? ***(Show visual aid - species)***
Blue crab - Channel catfish - Blue catfish - White catfish - Brown bullhead - Carp - American eel - Bluegill - Largemouth Bass - Smallmouth bass - Striped bass - Crappie - Yellow perch - White perch - Other:

25. Has any of the information from the fish consumption advisories cause you to change your eating habits? . . . . . . Yes (GO TO 25a) No (GO TO 25b)
25a. How did you change your eating habits? Is there anything else that you did? ***(Don't read options, Check all that apply, add notes as needed)***
I stopped eating all self-caught fish
I stopped eating all self-caught fish from this area
I changed the sizes of fish that I eat
I changed the species of fish that I eat
I limit the amounts of fish I eat from this area
I limit the amounts of certain kinds of fish I eat from this area
I started fishing somewhere else
I release more of the fish that I catch
I changed the species that I fish for
I cook and/or clean the fish I catch differently
Other:

25b. Why didn't you change your eating habits? ***(Don't read options, Check all that apply, add notes as needed)***

I didn't eat it before, and I still don't
I didn't eat very much fish to begin with
I already eat within the recommended guidelines
I don't think the warning is accurate
I don't think the warning is important
I didn't understand the warning or recommendations
People have been eating the fish caught here for years and they aren't sick
I need the fish I catch to feed myself or my family
Other:

26. Are there any ways you can think of that would make the advisory easier to understand and follow? . . . . . Yes No

If YES, what improvements would you suggest?

27. Have you ever referred back to the advisory information to make a decision about keeping and eating your fish? . . . . . Yes No

28. How important do you think it is to follow health advisories about what kinds of fish and how much fish is safe for people to eat? (READ CHOICES)

Very Important - Somewhat Important - Not at all important

29. What do you think would be the best way for us to reach people fishing in this area with information about fishing and health? CHECK ALL THAT APPLY, UP TO THREE

Have doctor or health provider give information - Talk to anglers at fishing locations - Put it in the Fishing Regulations book - Post signs at fishing locations - Signs or brochures at bait shops - Provide information when purchase license - Direct mail - Newspaper - Radio - Television - Internet - Don't Know - Other:

DEMOGRAPHICS

This last couple of questions will help us collect some background information about you and understand who we are talking to today. Remember, that all your answers are entirely confidential and anonymous.

30. How old are you?

31. How would you describe your race or ethnicity? ***(Ask only if not clear from observation. May check more than one)*** White - African American - Hispanic - Asian - American Indian - Other:

32. What is the highest level of education that you've completed?

Less than high School
High School
Some College (including Associates)
Bachelor's or equivalent
Master's or equivalent
PhD, M.D. or equaivalent

32a. How about the other adults in your household? (Check all that apply)

Less than high School
High School
Some College (including Associates)
Bachelor's or equivalent
Master's or equivalent
PhD, M.D. or equivalent

33. The last question is about your yearly household income, before taxes.

Is your household income less than $40,000 per year?
Yes No
Is it less than $20,000 per year?
Yes No
Is it less than $80,000 per year?
Yes No

END OF INTERVIEW.

THANK RESPONDENT. IF HE/SHE ASKS FOR MORE INFORMATION ABOUT ADVISORIES, HAND OUT CONTACT INFORMATION FOR OBTAINING ADVISORY INFORMATION.

Appendix C
Detailed Site Map

WASHINGTON, DC REGION
ANGLER SAMPLING SITES

MAP KEY	SITE NAME
1	Fletcher's Boat House
2	Theodore Roosevelt Island
3	Lady Bird Johnson Park/Columbia Island Marina
4	Gravelly Point/Roaches Run
5	East Potomac Park/Haines Point
6	Monument Tidal Basin
7	Water Street Marina Area
8	Dangerfield Island/Washington Sailing Marina
9	Anacostia Park South

Appendix D
Interviewing Protocol

Handbook for Angler Interviewers

Emergency Phone Numbers:

Josh Gibson (cell phone): 540-320-4593
CMI (Karen Hockett): 540-231-9605
CMI Main Office (Shelia Ratcliffe): 540-231-7348

DC Team cell phone (Lily & Marc): 540-357-0238
Baltimore Team cell phone (Ryan and Meaghan): 540-357-0261
VA Team cell phone (Melanie and Peter): 540-357-0338

Interviewing protocol:

Each day, you will have a set access point to which both interviewers should report at a specific time. On some days, there may be more than one site to visit. To help ensure statistically valid results, it is important that you be at the designated access points during the designated times. Many factors that define the angling population can vary significantly between weekends and weekdays and mornings and afternoons/evenings. The access point schedule provided to you considers this, and if your visits vary from this schedule, the representative nature of the data you collect data may be in jeopardy. It is critical that the balance of weekends and weekdays and mornings and evenings be maintained! If for some reason (e.g., poor weather), one or more site visits need to be canceled, notify Josh Gibson immediately so he can schedule an appropriate time to make up those visits.

When you arrive at the designated access point, decide on the method of surveying. Choose from one of these two options:

1) Select a location to set up such as a parking lot, picnic area, boat launch area (do NOT set up ON a pier or boat dock). Feel free to set out lawn chairs or make use of nearby picnic tables.
2) If this will be a roving shore survey, gather necessary supplies and carry them with you. A backpack or fanny pack will be helpful.

NOTE: At some access points, particularly in Baltimore, there will signs posted containing information about the fish consumption advisories in effect there. DO NOT set up your survey station in front of or near these signs, as it may bias angler responses to many questions and we may then get an overestimate of the knowledge of and

compliance with advisories among the fishing public. Try to set up as far as possible from these signs. If, at the end of the interview, the angler asks for information about the advisory, you may give them a copy of the Advisory Contact Information and direct them to the sign.

At many sites, you will likely be doing both types of surveys, and it may be best if one interviewer stayed at the boat dock to catch boaters while the other walks the shore to intercept shore anglers. In either case, make sure you have:

- Blank survey forms - both Spanish and English
- Contact record sheet
- Tape recorder w/ spare batteries
- Blank tapes (4 interviews/tape)
- Extra pens
- Folders for completed surveys
- Clipboards for surveys and contact records
- Fish species visual aid
- Serving size visual aid
- Local and regional map visual aids
- Sunscreen and water for interviewers

If you are running out of any items, please call Josh Gibson, or if the need is urgent, purchase the necessary supplies yourself and provide Josh with the receipts and your social security number for reimbursement at his next site visit.

In case of inclement weather, interviewers will need to make a judgment call on whether to make site visits that day. If in doubt, call Josh Gibson for consultation. Keep in mind that "weathered-out" assignments will need to be rescheduled as much as possible later on. In general, if the weather is such that there will be no anglers, do not attempt the assignment. If there are small craft warnings, do not attempt assignments in places where only boating anglers would be intercepted. If an assignment is "weathered out", call Josh Gibson immediately so the assignment can be re-scheduled.

The same situation holds true if you are sick. If you need to cancel an interview day due to illness, notify your teammate (no one is to do an assignment alone!), and notify Josh Gibson immediately so the assignment can be re-scheduled.

When performing interviews, you should **always be wearing your nametag** that identifies you as working with Virginia Tech. This will help to lend credibility to your request and give the angler a point of reference throughout the interview.

When interviewing boating fishermen: As they arrive or leave the site, approach them and use the appropriate greeting from the survey instrument. If there are picnic tables nearby, you may invite him/her to sit down if they agree to the interview.

When interviewing shore anglers: Walk the shoreline, approaching anglers while they fish. Be sure to not approach a shore angler while he/she is baiting or reeling in a line. Wait until they are relaxed, and then approach them using the appropriate greeting from the survey instrument. If they agree to the interview, you may ask to sit down beside them. NOTE - at some sites, all "shore" fishing may be done from piers, jettys, bridges, etc. In cases where there is a prominent point of egress (parking lot, etc), the interviewer may set up there. However, for many shore surveys, it may be most productive for the interviewer to canvass or rove the shore, walking up and down to approach anglers. This can often be done during the "down" times for the boat ramps on site (which are busiest first thing in the morning and later in the afternoons).

To start out with, approach every angler you encounter (adults only, age 18 or older – ask if you aren't sure), recognizing that some will inevitably be missed while other interviews are being conducted. If interviews are completed at a rate faster than anticipated after the first couple of weeks (more than 8 per day on average), then the field supervisor may make the decision to start approaching every other angler or use another similar sampling scheme. For groups of anglers, try to interview one person within the group. Approach one of the group members and ask if someone would be willing to participate. If more than one angler wants to participate, stress that you can only interview one person within the group.

Be friendly and helpful, and let the anglers know that you value their input and hope they will complete the survey. Recognize, also, that many anglers love to talk about fishing, and this is a great way to break the ice and ensure a successful interview. However, once the tape recorder is running, try to keep to the survey as much as possible. If needed, explain to the angler that you'd be more than happy to talk after the interview is completed and the tape is no longer running. You do not need to memorize the greetings, but keep the gist in mind when you make the initial contact with the anglers.

If an angler that you approach for an interview does not appear to comprehend English, ask him or her: "*Habla Espanol?*" If he or she responds "*Si*" or nods affirmatively, then hand him or her the Spanish language version of the paper survey with the clipboard and pen. If he/she begins to speak to you in Spanish tell him/her "*No habla Espanol,"* and point to the survey again. Alternatively, if one of the interviewers speaks Spanish, then direct that interviewer to conduct the interview in Spanish. If the angler does not appear to understand either English or Spanish, you may approach another adult member of that group. If none of these options is feasible, simply record it on the contact record as a language barrier, identifying as well as possible the language which was needed.

Record of Survey Contacts: The record of angler contacts is a very important record keeping tool. It tells us how effective our protocol is in initiating interviews, what barriers exist interviewing certain populations of people, and helps us determine how representative our data is of the general angling public in the end. You play an essential role in data quality control and establishing a response rate for this survey, which are steps that are required of us by our quality assurance plan in file with the EPA. It is critical that you record ALL angler contacts on this sheet, whether they result in a

completed interview or not. Instructions for completing this form after every contact appear on the Record of Survey Contacts form.

During an interview: Follow the survey instrument carefully (see page 6). If anglers have any problems understanding or answering the questions that you ask them, note that on the survey instrument and ask them to answer the best that they can.

Answer any questions from the anglers that you can or provide a clear point of contact for questions you are unable to answer. You will be provided with copies of contact information on where anglers can get more information about existing advisories. To avoid biasing future interviews through angler socialization, DO NOT hand out copies of the advisory or attempt to explain the contents of the advisory to anyone. If respondents ask questions about the advisories and appear interesting in learning more about them, 1) explain to them that you cannot give them the information they want and 2) give them a copy of the contact information so that they can get the information on their own.

If the anglers have any questions about why the survey is being conducted or how the information will be used, explain that we are collecting information to help the management agencies learn more about who is fishing at these locations and how much fish is being eaten from these waters. The information will be used to help agencies better manage the resource and meet the needs of the anglers. If other questions arise, have them contact the project manager, Julie McClafferty at Virginia Tech (540-231-8709 or jmcclaff@vt.edu).

At the end of each interview: Thank the angler, and say goodbye. Once alone:

1. Record the interview end time, and complete the top part of the survey form if not done already,
2. Review the data sheet to clarify any marks that you made and add any notes you deem necessary,
3. Ensure that responses are legible and accurate.
4. If the interview was taped, make sure the tape is numbered accurately and that this number is recorded on the survey instrument.
5. Record the interview on the contact record.

NOTE ABOUT NUMBERING: All materials (contact records, completed survey forms, and audio tapes) should be coded with a region code and a sequential number. Please ensure that this numbering scheme is upheld throughout the project to make data compilation possible. For example, DC surveys would be coded DC-1, DC-2, etc. and DC tapes would be coded DC-1, DC-2, etc. These numbers do not need to correspond, but the survey number should be recorded on the interview contact record, and the tape number should be recorded on the survey data sheet. To ensure that surveys are not double-numbered, each team member should be assigned even or odd numbers for the duration of the data collection period. Gaps in numbers are fine, but NO numbers should be used twice for the same type of form. Regional Codes are:

DC: All DC Team Materials
BC: All Baltimore Team Materials
VA: All VA Team Materials

At the end of each day/site visit: review all data sheets from that day to make sure they are numbered and dated appropriately, labeled with the site name, and referenced to the corresponding tape. Pack up supplies and make sure supplies are sufficient for the next site visit. Before leaving for the day, call Josh Gibson to report the number of completed interviews and any issues that arose during the day. Turn all data sheets, contact records, and taped interviews in to Josh at his next site visit.

At the end of the summer, get a UPS account number and billing reference number from Shelia Ratcliffe (540-231-7348) and mail any remaining supplies (recorders, tapes, completed surveys and contact records, supply bins, etc.) back to Josh Gibson at:

Josh Gibson
Conservation Management Institute
1900 Kraft Drive, Suite 250
Blacksburg, VA 24061

Instructions for the Survey Instrument Items
Once the angler has agreed to participate in the interview, and it has been determined that the angler has NOT been interviewed for this project before, then the interview may begin.

Clerical Information:
The top portion of every survey instrument requests information that is CRITICAL to our data management and data quality standards. This portion can be completed at the beginning of OR at the end of the interview (except for the "Time Begin" field which should be completed at the start of the interview), but it MUST be completed in it's entirety for each interview. Instructions for specific fields follow:

Surveyor Name:	Record YOUR name as the interviewer
Survey Location:	Record the name of the access point you are currently visiting, as it appears on the summer schedule
Date:	Record the current date - month, day, and year
Day of Week:	Record the current day of the week
Survey Number:	Record the survey number. This should be a sequential number that follows in order from all previous surveys done in that region. DO NOT restart the numbering each day, but continue with sequential numbers through the summer. Each interviewer should be assigned even or odd numbers to prevent number duplication.
Time Begin:	Record the time that the interview starts, to the nearest minute.
Time End:	Record the time that the interview ends, to the nearest minute.
Length of Interview:	Calculate the length of time that the interview took by subtracting the begin time from the end time. Record the number of minutes.
Observed Sex:	Record the observed sex of the angler (male or female)
Fishing Mode:	Record whether the angler is fishing from a boat, off a pier (while standing/sitting on a pier) or from the shore (includes wading in water). Ask the angler if this mode is not clear.

General Survey Instructions

1. Wording - The questions to put to the angler are written out in full for a purpose. Methodological studies have shown that even the slightest change in wording

(e.g., "should" vs. "could") drastically influence item response. Please, read each item exactly as it is written

2. Provide Definitions, not Answers - If the angler asks for your opinion about an item, you may provide a brief definition, but do not supply an actual response. For instance, if the angler asks questions about the advisories during that part of the survey, you may explain what advisories are/do in general, but do NOT say whether or not there are/are not advisories in place or what they recommend.

3. Notes - Room for notes is left for many questions so that the interviewer can expand upon the choices given. We have tried to cover what most of the responses will be, but if the angler's response to these questions does not fit in any of the choices, please use the notes sections.

4. Refused Question - Leave the response section blank and write "RF" in the left hand margin next to the question for any question that the angler refuses to answer. This lets the data entry person know that the question was skipped for a reason, not out of interviewer error.

5. Best Use of Time - There will be times during the day when you will seemingly have little to do. This time can be used to review, editing, and "clean-up" completed survey forms and organize data sheets/supplies.

Item-by-Item Instructions

Many survey items are self-explanatory. Items where special instructions are needed are included below.

NOTE: DO NOT read the response options for any question unless it is either noted on the survey to do so (e.g., for Item 3) OR the angler has trouble answering the question otherwise.

Question 1: Taped Interview? If the angler declines the taped interview, mark this on the survey form and make sure the angler sees you put the recorder away in the "off" position. If the angler agrees to a taped interview, 1) Record the tape number on the survey and 2) start the interview by recording onto the tape the survey number (Say something like "Begin Interview Number 32" into the recorder) before asking any more questions.

Question 2: Fishing history. If the angler has trouble answering any part of this question, ask for a best estimate.

Question 3: Reasons for fishing. **Make sure to read the options to the angler for this question.**

CONSUMPTION PATTERNS: READ the introduction to this section!

Question 4: Personally Eat? Ask all anglers if they, personally, eat what they catch. If their family eats it but the angler doesn't, then the answer to this question is "NO" (skip to Q14). (NOTE: If this is the angler's first time fishing in the area (Q2a), ask if they PLAN to eat the fish or crabs that they catch. Then, for Question 5, ask what they hope to catch, and for Question 6, ask if there is anything they would not eat. Then skip to Q14.)

Question 5: Species most often eaten. Show visual aid of fish species. Ask angler to list the four species he/she most often consumes from his/her catch. Make it clear that the fish listed by the angler may be ones shown in the visual aid OR any others that the angler mentions. List the species name and check the frequency with which the angler eats it.

Question 6: Avoided fish. If the angler responds "Yes" to this question, ask them to indicate what it is they avoid, and why they avoid it. Write the responses in the space provided.

Questions 7-9: Seasonal Patterns. Make it clear that we are only interested in sport-caught fish from the surrounding area, NOT fish bought in a market. For seasonal questions, mark as many months as the angler mentions. If the angler simply says "summer" or "winter", prompt him/her to clarify which months he means (e.g. "Does that mean June, July, and August? Would you include September in that?")

Question 10: Meal size. Show visual aid of serving sizes. Ask angler to indicate the photo that best represents the amount of fish they eat in a meal. They may either select one of the photos (4, 8, or 12 ounces) OR they may indicate that the most accurate answer is somewhere between two of the photos (e.g., less than 4, 4-8, 8-12, or more than 12). Mark the appropriate response.

Question 11: Meal size - crabs.

Question 12: Preparation Methods. You may ask this question in a variety of ways. Experiment during the training session. Perhaps start with "How do you typically clean your fish or crabs?" And then ask how frequently they do each item (Most of the time, Sometimes, Never). If angler does not mention all the items on the list, prompt them (e.g., do you ever eat the skin on the fish? Do you ever freeze your fish for later? Do you ever eat your fish raw?) Make sure to fill out a response for each item, even if the angler says it doesn't apply to them (e.g., they don't eat crabs) – just mark N/A in this case. **Make sure to read the options to the angler for this question.**

HOUSEHOLD MEMBERS: READ the introduction to this section!
Question 13: Household consumption.

Question 14: Household composition. Include the angler in the total people count. After asking about each category, indicate if the angler places him/herself in any of them.

Question 15: Household consumption patterns. Show visual aid of serving sizes. Only ask about the categories they indicated in Question 14. Ask angler to indicate how often each category of people in their household eats the fish that they catch (READ response options!!!) AND to indicate the serving size photo that best represents the amount of fish that each category eats in a typical meal. They may either select one of the photos (4, 8, or 12 ounces) OR they may indicate that the most accurate answer is somewhere between two of the photos (e.g., less than 4, 4-8, 8-12, or more than 12). Mark the appropriate responses on BOTH scales for all applicable household member categories. Ask only about the categories that the angler responded as being greater than zero in Q15. For all other categories, mark "Not Applicable" or "N/A" in the response scales.

Question 16: Give away fish?

ADVISORY AWARENESS
(NOTE: the starred items do not appear in the VA survey. Numbers in parenthesis represent item numbers for the VA survey from this point on.)

Question 17: (17) Health Benefits.

Question 18: (18) Perceived Safety. If the angler responds "Yes", "No", or with some form of "It Depends" (e.g., "Sometimes", "Most of the time", etc.), ask them why they think this way and write their response in the space provided. If the respondent answers "Uncertain", "Not Sure", "Don't Know" etc., mark the "Uncertain" box and skip to question 19.

Question 19: (19) Advisory alertness.

**Question 20:Local Advisory awareness.

**Question 21:Source of Advisory info. Don't read options, but let angler tell you where he heard of it. After he answers, prompt further with "Did you see or hear about it anywhere else?" When done, move to next question.

**Question 21a:Time of last info.

**Question 22:Ease of Understanding.

**Question 23:What did the Advisory say? DON'T READ OPTIONS. Mark the responses (all that apply) that most closely matches the angler's definition. If the angler cannot give any definition, then mark "Don't Know". If the angler gives a definition that is not reflected by the options listed, or part of his/her definition is not listed, then mark "Other" and write in the appropriate response. NOTE - it is acceptable to mark both the listed options (one or more than one) AND the "Other" category if the angler's definition has multiple parts. The important thing here is to capture, as closely as possible, what the angler says, while helping us to categorize his/her knowledge.

Question 24: Species under advisory. **Show species visual aid! The angler may select any species shown in the picture OR any other species. Check all that apply. If the angler lists species NOT shown in the picture, then Mark "Other", and write in the response in the space provided.

**Question 25:Advisory effects on angler. If yes to Q25, go to 25a. If NO to Q25, go to 25b. For both 25 a and b, do NOT read response options. Mark the responses (all that apply) that most closely matches the angler's response. If the angler gives a response that is not reflected by the options listed, or part of his/her response is not listed, then mark "Other" and write in the appropriate response. NOTE - it is acceptable to mark both the listed options (one or more than one) AND the "Other" category if the angler's response has multiple parts. The important thing here is to capture, as closely as possible, what the angler says, while helping us to categorize his/her behavior.

**Question 26:Suggested improvements.

**Question 27:Advisory referencing.

Question 28: (20) Perceived advisory importance. READ response options.

(21) Potential advisory effects. (Appears ONLY in VA survey)

Question 29: (22) Media options. Don't read response options, but check up to three. If angler give only one, prompt with "Are there any other ways that would effectively reach local fishermen?" If the angler still gives only one or two, that's fine.

DEMOGRAPHICS: READ the introduction to this section!
Question 30: (23) Age.

Question 31: (24) Ethnicity. If angler ethnicity/race is obvious, mark it down without asking. Otherwise, ask this question and read options only if angler has trouble answering. If angler gives more than one category (e.g., White and Hispanic), check all that apply.

Question 32: (25) Education. Ask for anglers education level and then ask him what levels of education the other adults in his household have attained (part a) – check all that apply.

Question 33. (26) Income. We are dividing up income into three categories, and the way we ask it here should minimize the refusal rate. Make sure to follow the diagram careful when asking about the right categories. However, many still will not answer this question. Record a refusal as an RF in the left margin.

END OF INTERVIEW.

Thank the respondent. If he/she asks for more information about the local advisories, hand out the contact information sheet so they can obtain that information at their leisure. If they continue to ask you questions, explain to them that they need to talk to a member of the local Health Department (the contact info on the sheet) to get that information and that you do not have the advisory specifics.

Logistical Concerns

Payroll and time sheets:
Wage employee hours must be submitted to Josh Gibson by the 15th and 30th of each month. All interviewers will be provided with time sheets for recording their hours throughout the summer. This form can be faxed directly to Shelia (540-231-7019) if access to a fax machine is available. Otherwise, call Josh (540-231-7348) by the 15th and 30th of each month and tell him your hours, and he will turn them in to Shelia within 2 business days.

Pay dates are on the 1st and 16th of each month, therefore there will be a 2 week lag time between when hours are claimed and when they are paid. All employees are required to take direct deposit of paychecks and any reimbursements - your pay will be automatically deposited into your bank account. Please check on the first couple of deposits to make sure they are being processed correctly.

Use of cell phones:
Each team will be provided with a University cell phone. This phone is under a specific plan that allows a certain number of minutes. This phone is only to be used 1) in the case of emergencies during interview assignments, and 2) to speak with the field supervisor (***Josh Gibson, 540-320-4593***). If there are occasional personnel related questions that Josh is unable to answer or obtains answers for, you may call Shelia Ratcliffe (540-231-7348) using the cell phone. Any other calls should be made on personal phones - including calls between team members regarding late arrivals, etc. Each cell phone bill will be reviewed closely and questionable numbers will be checked carefully with the interview team. One member of each interviewer team will be charged with being responsible for keeping up with the cell phone and charging the battery each night. These people are:

DC Team: Lily Whitesell
VA Team: Peter Moody
Baltimore Team: Ryan Bell

Travel and purchase reimbursements:
All interviewers should have completed an Authorization form for direct deposit of travel and supply purchase reimbursements. If not, see Julie McClafferty or Shelia Ratcliffe to do so immediately. Before any travel is undertaken (including the trip for orientation), a travel approval form must be filled out and signed by the traveler and submitted for signatures to Shelia Ratcliffe. It is critical that this form be on file, as it is submitted along with the reimbursement request. After traveling, all lodging receipts, travel dates, starting points and destinations, and mileage (if using a private car) to and from the destination should be sent to Shelia Ratcliffe for travel reimbursement processing. Travelers will need to sign this reimbursement form, and reimbursement will then be deposited into your bank account within 3-4 weeks. ***At this time, the only travel

expenses authorized for reimbursement are the expenses for traveling to and from Blacksburg for orientation May 27-28.

NOTE - for the orientation trip, all this paperwork will be taken care of before you leave Blacksburg. However, you will need to fill out the direct deposit authorization form (because it requires your bank's signature) before arriving in Blacksburg so that the payment can be processed.

We are trying to provide ample supplies at the beginning of the summer. However, if supplies run low, contact the field supervisor and he will bring more next time he visits. If the need is urgent, you may find it necessary to purchase field supplies (e.g., more copies of survey, batteries, or blank tapes) yourself. In this case, keep the receipts and submit them to ***Josh Gibson*** for reimbursement during his next site visit.

Health and safety precautions:
It is CMI policy that the health and safety of our staff is paramount in all work performed. It is impossible to address all risks in all situations, but we expect our staff to plan for and address potential hazards. We expect our staff to pay attention to potentially hazardous situations and avoid risks to themselves and others. All staff are expected to take responsibility for keeping themselves safe.

Risks to interviewers addressed in this plan include:

- Sunburn, overexposure to sun, and heat illness,
- Trips, slips, or falls due to wet, slippery pavement at fishing access points,
- Potential threats to personal security, and
- Exposure to hazardous weather.

Policies for minimizing these risks are as follows:

1) Wear proper clothing.
   a. No bathing suits.
   b. Long pants are preferred. If shorts are worn, See # 2.
   c. All clothing must stay on at all times (this means you cannot take off your shirt to cool off).
   d. Rubber soled sneakers are preferable to other types of shoes. Open-toed shoes/sandals are strongly discouraged (See #2 and #5).
   e. Always bring and wear a hat - wide-brimmed preferred.
   f. Always wear sunglasses with UV protection.

2) Apply SPF30 or higher sunscreen (provided) liberally to all exposed skin at the beginning of each assignment and every two hours during peak sun exposure hours (10AM-4PM).

3) Always bring an amply supply of water and drink it frequently to stay hydrated. Bring more (and drink more) water than you think you need.

4) If shaded picnic areas or other similar area is available at the assignment, you are encouraged to set up there for the day. You may also choose to bring an umbrella to sit under.

5) Take care when walking, particularly on gravel surfaces or wet access areas. These present slipping/tripping hazards and could result in injury.

6) A basic first aid kit will be supplied to each team in case you need one.

7) Seek shelter during hazardous weather. If hazardous weather occurs while you are on assignment (e.g., lighting storms strikes), seek shelter in the nearest covered location (e.g., your car, covered pavilion) until the situation passes.

8) Abide by basic personal safety guidelines:

    a. No interviewer should be on assignment alone. If one interviewer must step away for a few minutes, this should NOT occur before 8am or 6pm, and such instance should be kept as brief as possible. The buddy system is a critical part of maintaining personal security.
    b. Each team will have a cell phone for use in case of emergencies.
    c. Interviewers are advised to always let someone off-site know where they will be each day and what time they will return.

9) Note that ear plugs (for DC team who has two sites adjacent to an airport) and bug spray have been provided to increase your comfort level at certain sites. Feel free to use them as needed.

Appendix E
Interviewer Site Schedule

JUNE

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	*2* ***4pm-???*** ***Meet at Site #5*** *(E. Potomac/Haines Point)*	*3* ***8am-4pm***	*4*	*5*
6 WEEK 1	*7*	*8* ***12pm-8pm*** ***Site 9:*** *Anacostia Park*	*9* ***12pm-8pm*** ***Site 7:*** *Water Street Marinas*	*10* ***12pm-8pm*** ***Site 3:*** *Lady Bird Johnson Park*	*11* ***12pm-8pm*** ***Site 4:*** *Gravelly Point/Roaches Run*	*12* ***12pm-8pm*** ***Site 7:*** *Water Street Marinas*
13 WEEK 2 ***12pm-8pm*** ***Site 1:*** *Fletcher's Boat House*	*14*	*15*	*16* ***6am-2pm*** ***Site 5:*** *E. Potomac Park/Haines Point*	*17* ***6am-2pm*** ***Site 6:*** *Monument Tidal Basin*	*18* ***6am-2pm*** ***Site 2:*** *Theodore Roosevelt Island*	*19* ***6am-2pm*** ***Site 3:*** *Lady Bird Johnson Park*
20 WEEK 3 ***6am-2pm*** ***Site 4:*** *Gravelly Point/Roaches Run*	*21*	*22*	*23* ***6am-2pm*** ***Site 8:*** *Daingerfield Island*	*24* ***6am-2pm*** ***Site 1:*** *Fletcher's Boat House*	*25*	*26*
27 WEEK 4	*28*	*29*	*30* ***12pm-8pm*** ***Site 5:*** *East Potomac Park/Haines Point*			

JULY

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 ***12pm-8pm*** ***Site 6:*** *Monument Tidal Basin*	*2* *12pm-8pm* ***Site 1:*** *Fletcher's Boat House (resched. From 8/13)*	*3*
4	*5*	*6* ***12-8pm*** ***Site 5:*** *East Potomac Park/Haines Point (resched. From 8/12)*	*7*	*8*	*9*	*10* ***12pm-8pm*** ***Site 8:*** *Daingerfield Island (resched. From 8/14)*
11 WEEK 5 ***12pm-8pm*** ***Site 6:*** *Monument Tidal Basin*	*12*	*13* ***12-8pm*** ***Site 7:*** *Water Street Marinas*	*14* ***12-8pm*** ***Site 8:*** *Gravelly Point (site change from Site 8)*	*15* ***12-8pm*** ***Site 9:*** *Anacostia Park*	*16* ***12pm-8pm*** ***Site 1:*** *Fletcher's Boat House*	*17* ***12-8pm*** ***Site 5:*** *East Potomac Park/Haines Point*
18 WEEK 6 ***12pm-8pm*** ***Site 9:*** *Anacostia Park*	*19*	*20*	*21* ***6am-2pm*** ***Site 5:*** *Haines Point (site change from* ***Site 2)***	*22* ***6am-2pm*** ***Site 3:*** *Lady Bird Johnson Park*	*23* ***6am-2pm*** ***Site 4:*** *Gravelly Point/Roaches Run*	*24* ***6am-2pm*** ***Site 7:*** *Water Street Marina*
WEEK 7 ***6am-2pm*** ***Site 1:*** *Fletcher's* ***(site change from Site 8)***	*26*	*27*	*28* ***6am-2pm*** ***Site 9:*** *Anacostia Park*	*29* ***6am-2pm*** ***Site 7:*** *Water Street Marina*	*30* ***6am-2pm*** ***Site 6:*** *Monument Tidal Basin*	*31* ***6am-2pm*** ***Site 1:*** *Fletcher's Boat House*

Sun	Mon	Tue	Wed	Thu	Fri	Sat
WEEK 8 ***6am-2pm*** ***Site 5:*** *East Potomac Park/Haines Point*	*2*	*3*	*4* ***12pm-8pm*** ***Site 9:*** *Anacostia Park* ***(site change from Site 2)***	*5* ***12pm-8pm*** ***Site 4:*** *Gravelly Point/Roaches Run*	*6* ***12pm-8pm*** ***Site 3:*** *Lady Bird Johnson Park*	*7* ***12pm-8pm*** ***Site 9:*** *Anacostia Park*
8 ***6am-2pm*** ***Site 2:*** *Theodore Roosevelt Island*	*9*	*10*	*11*	*12* ***12pm-8pm*** ***Site 5:*** *East Potomac Park* *(resched to 7/6)*	*13* ***12pm-8pm*** ***Site 1:*** *Fletcher's Boat House* *(resched to 7/2)*	*14* ***12pm-8pm*** ***Site 8:*** *Daingerfield Island* *(resched to 7/10)*
15	*16*	*17*	*18*	*19*	*20*	*21*
22	*23*	*24*	*25*	*26*	*27*	*28*
29	*30*	*31*				

V I T A

J O S H U A C . G I B S O N
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(540)-819-9543 • jogibso1@vt.edu

OBJECTIVE Complete my Program of Studies in Urban and Regional Planning.

EDUCATION **Virginia Tech, Blacksburg, Virginia** - Candidate, Master of Urban and Regional Planning
University of Virginia, Charlottesville, Virginia - B.A., Environmental Sciences awarded May, 2001.

EXPERIENCE

Conservation Management Institute*, Human Dimensions Assistant,* Blacksburg, Virginia. Supervised the operation of and took part in planning a project in the Chesapeake Bay aimed at improving fish advisories and health advisory awareness among at-risk angler populations. Coordinated data collection, entry, and analysis for this project. Contributed to other projects in CMI's Human Dimensions division, including the development of the Mid-Atlantic Information Node (MAIN) and other projects. Project available for retrieval online. Current employer.

Waynesboro Public Schools*, Earth Science Teacher,* Waynesboro, Virginia. Taught Earth Science at Waynesboro High School, a fully accredited high school in Waynesboro, Virginia. Duties included lesson plan preparation for one of only three science courses with End of Course Standards Of Learning (SOL) tests, as well as committee and supervisory responsibilities. 2002-2003.

Earth Environmental Consultants*, Environmental Technician,* Rocky Mount, Virginia. Served as a field technician, taking part in such activities as Phase I and II environmental site assessments, Aggressive Fluid Vapor Recoveries, SPCC reports, and tank and spill cleanup actions. Worked extensively with WordPerfect and DesignCAD with data reports. Spring/Summer, 2002.

Yellowstone National Park - Aquatics Program, *Intern.* YNP, Wyoming. Assisted with operations of Yellowstone National Park fisheries department. Duties included assistance with native cutthroat trout preservation and restoration projects; lake and stream inventory and monitoring for fish, macroinvertebrates, and water quality; research on effects of invasive exotic species; assistance with data entry and verification. Fall, 2001.

The Nature Conservancy - Clinch Valley Program, *Stewardship Intern*, Abingdon, Virginia. Worked with non-profit agency to study and preserve rare species of freshwater mussels in rivers of the Clinch River drainage. Helped install and supervise mussel culture facility, collect field data, and assist with preserve management duties in an area with some of the highest biodiversity in the U.S. Summer, 2001

Philmont Scout Ranch - Assistant Camp Director/*Program Counselor,* Cimarron, New Mexico**.** Supervised and was responsible for several co-workers. Lived interpretively in remote areas of Sangre de Cristo Mountain Range. Presented informative talks and demonstrations on general and natural history of Philmont Ranch and day to day Western life and lore. Implemented creative outdoor recreational activities for youth and managed and organized visitation for the over 10,000 hikers to the ranch. Summer, 1999.

ACTIVITIES / HONORS

- Currently taking part in internship with New River Land Trust, a community NGO for land conservation in the New River Valley of Virginia
- Presented thesis to 61st Annual Northeast Fish and Wildlife Conference in Virginia Beach, VA
- Participant in studio project developing Elliston-Lafayette Village Plan for Montgomery County Planning Office
- Participant in studio project developing watershed management plan for the North Fork Roanoke River
- Recipient of VAPA Outstanding First-Year Graduate Planning Student Award.
- Recipient of Eagle Scout Award

OTHER SKILLS

- Experience with GIS software ArcView and ArcInfo, proficient in all applications of the Microsoft Office Suite, Adobe Photoshop, Survey Pro and its applications, SPSS, MATLAB, DesignCAD, others
- Windows 95, 98, 2000, XP, and UNIX operating systems; Internet browsers and resources
- Strong interpersonal, public speaking, organizational, and communication skills
- Knowledgeable outdoor sports enthusiast and licensed SCUBA diver
- Experience with March Global Positioning Systems (GPS)