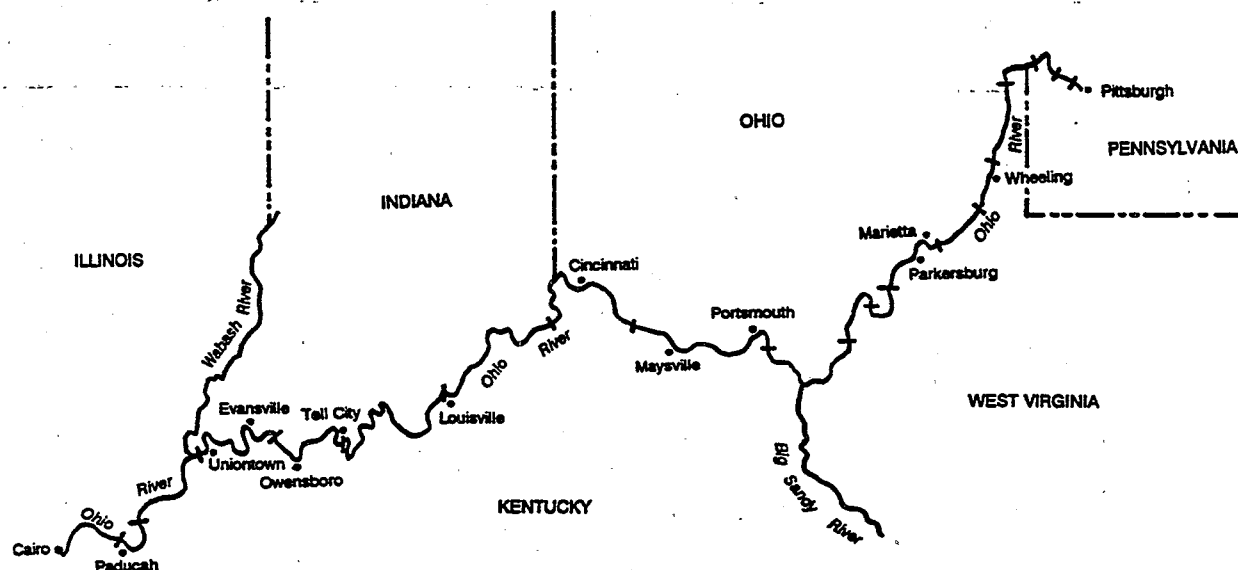


ANGLER ATTITUDES AND BEHAVIOR ASSOCIATED WITH OHIO RIVER HEALTH ADVISORIES

by

Barbara A. Knuth, Nancy A. Connelly, and Michael A. Shapiro



HDRU Series No. 93-6

July 1993



Human Dimensions Research Unit
Department of Natural Resources
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Fennow Hall, Cornell University, Ithaca, N.Y. 14853



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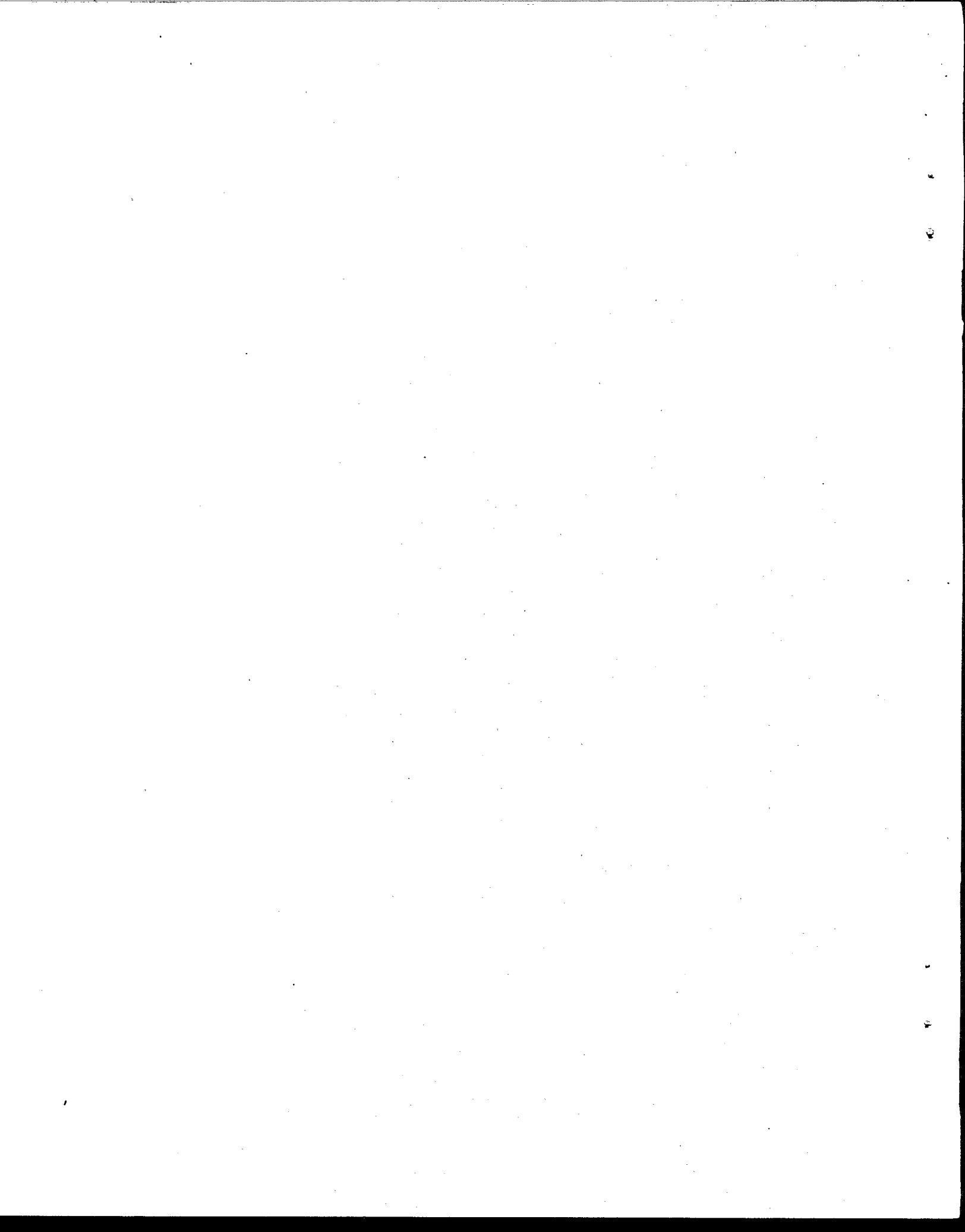
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ACKNOWLEDGMENTS

We thank C. Houseknecht, U.S. Environmental Protection Agency, for his support and assistance through all phases of this project. A. Vicory and J. Schulte, Ohio River Valley Water Sanitation Committee, provided useful insights at several stages of the project, including questionnaire development and report preparation. A. Greene and R. Hoffmann, USEPA, reviewed the draft questionnaire. We thank members of the Human Dimensions Research Unit (T. Brown, J. Enck, W. Siemer, R. Stout, H. Christoffel, C. Loker, B. Van Ornam, and M. Ackerblade) for reviewing the draft questionnaire, implementing the mail survey, conducting telephone interviews, and coding data. H. Christoffel also assisted with computer analysis and table preparation, and M. Ackerblade helped draw the sample for the mail survey. M. Peech provided able assistance typing names, addresses, and tables for this project. We thank each of the Ohio River states for providing access to their fishing license records. Comments of reviewers improved the report.

This project is a result of research sponsored by the U.S. Environmental Protection Agency under Assistance Agreement R 819571-01-0 through the Office of Water.

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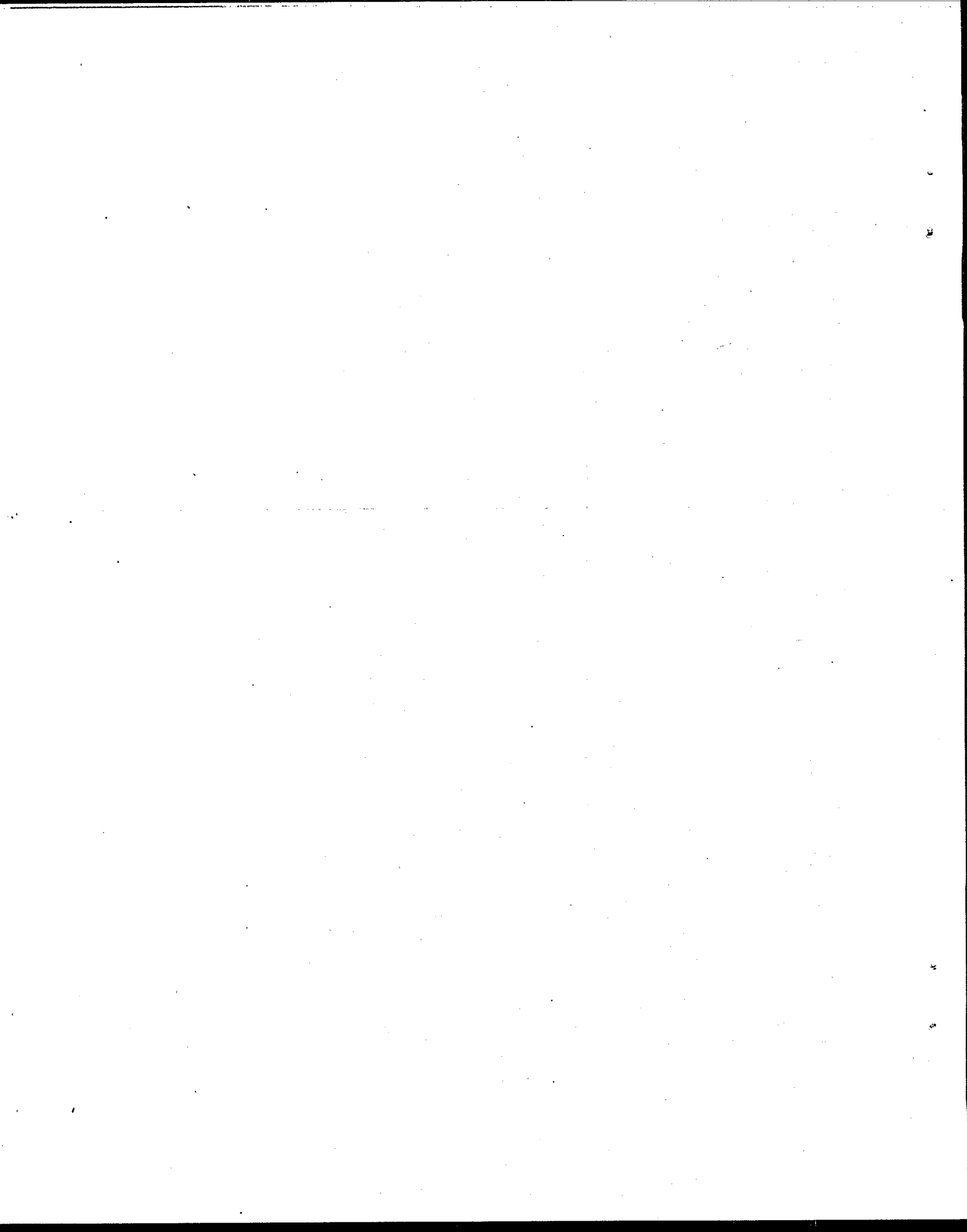
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EXECUTIVE SUMMARY

Fish consumption health advisories have been issued in the United States since the mid-1970's, and specifically in the Ohio River Valley since 1988, in response to concern over potential negative health consequences of consuming sport-caught fish. Issuing health advisories with recommendations about limiting consumption of fish and adopting other risk-reducing behaviors is the primary management strategy being implemented by Ohio River Valley states to address this problem (in addition to longer-term remediation and control activities).

Advisories issued by different states bordering the Ohio River have not necessarily contained the same recommendations, even for the same stretch of the River. Proliferation of different advisories and communication strategies raises questions about the impacts one or multiple advisories are having on the audiences of interest. Further, differences among agencies regarding objectives they seek to accomplish via health advisories may contribute to the differences in approaches used to develop and communicate advisories with the public.

The objectives of this study were to: (1) identify state and regional agency objectives associated with state fish consumption health advisories in the Ohio River Valley; (2) determine the impacts associated with Ohio River health advisories including (a) awareness of, attitudes, and opinions about health advisories held by Ohio River Valley anglers; (b) angler behavioral changes associated with advisories; and (c) effect of urban vs. rural residence, and recent vs. distant media attention relative to advisory awareness and behavior; and (3) summarize risk communication issues to consider when communicating health advisories to the public.



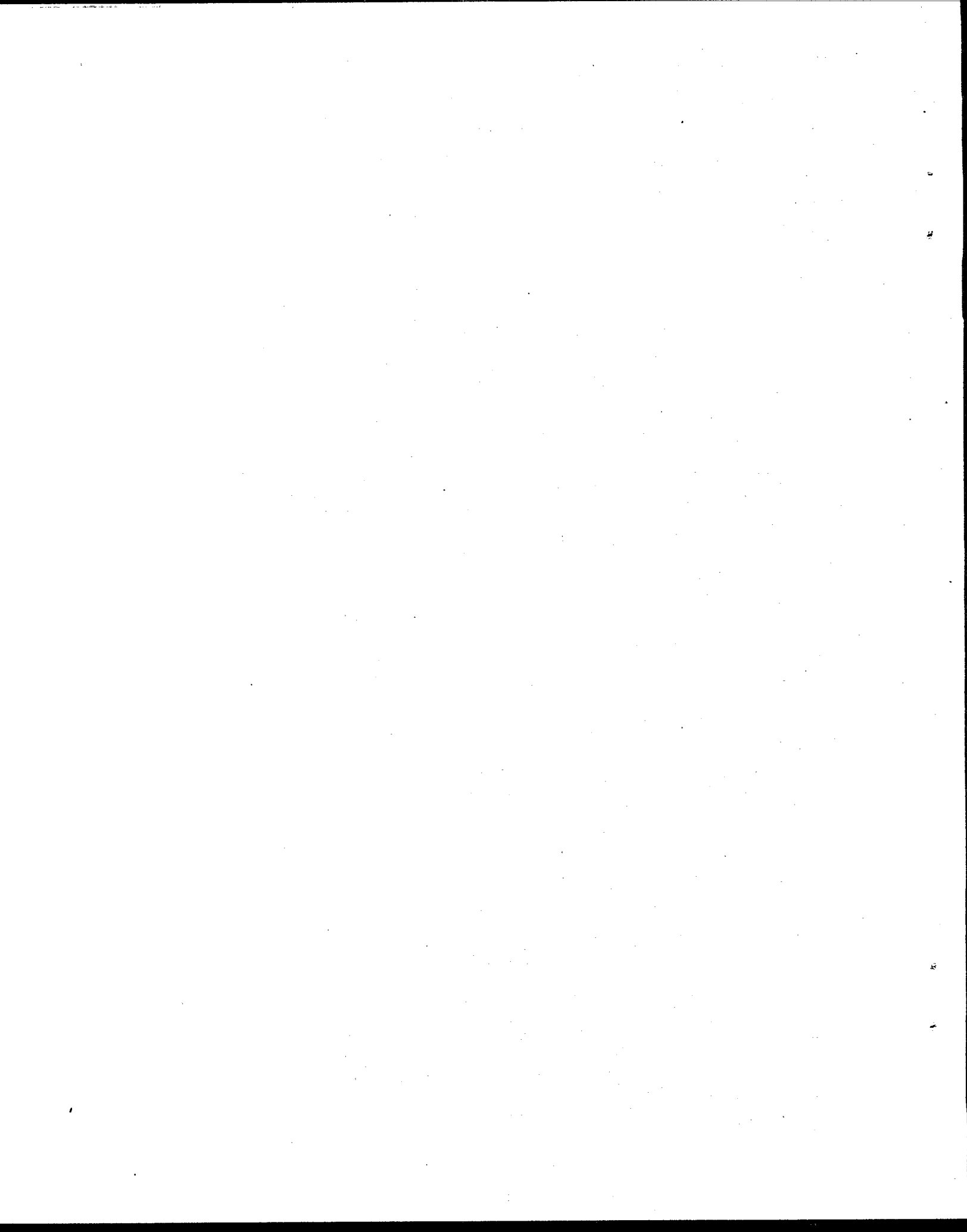
AGENCY OBJECTIVES ASSOCIATED WITH OHIO RIVER HEALTH ADVISORIES

We conducted telephone interviews with two or three individuals in each state who had major responsibilities associated with health advisories. Each telephone interview focused on perceived agency health advisory objectives and opinions about criteria for evaluating the success of health advisories.

We completed 15 telephone interviews with 5 fishery agency representatives, 5 health agency representatives, 4 environmental quality agency representatives, and 1 Ohio River Valley Water Sanitation Commission representative.

Of 20 potential objectives presented to agency representatives, the most important objectives for states overall included those focused on: (1) reducing health risks for particularly at-risk groups, the general public, licensed anglers, and subsistence fishers; and (2) helping people make their own informed decision about cleaning, cooking, and eating Ohio River fish. Differences exist in the importance placed on potential health advisory objectives by fishery and health/environmental quality agencies. Fishery agencies placed greater emphasis than the environmental quality agencies on objectives associated with public support and resource use, risk-reducing fish preparation methods, and enabling people to make their own informed decisions about fish consumption.

Nineteen potential health advisory evaluation criteria were presented to agency representatives. The most important criteria identified included: (1) advisory awareness; (2) use of risk-reducing fish preparation methods; (3) use of fishing behaviors (i.e., species targeted, size kept); and (4) fish consumption rates at or slightly below advisory recommendations. As with the rating of objectives, differences exist between fishery and health/environmental quality agencies in the importance placed on potential



health advisory evaluation criteria. Fishery agencies assigned greater importance than environmental agencies to evaluation criteria associated with angler behavior and angler awareness.

IMPACTS OF OHIO RIVER HEALTH ADVISORIES

The second objective of this study was to determine the impacts associated with Ohio River health advisories.

Methods

We implemented two mail surveys, one each in Spring and Fall, 1992, to assess the effect of timing of advisory communications on health advisory awareness and attitudes. Samples of 2,000 resident licensed anglers for the spring survey and 3,000 resident licensed anglers for the fall survey were obtained from the six states that border the Ohio River.

We used the results from the telephone interviews with agency personnel (discussed previously), and findings from other studies, to develop a mail questionnaire to be sent to the sample of licensed anglers. The questionnaire was designed to determine the awareness of, attitudes and opinions about, and behavioral responses to current Ohio River health advisories as well as identify potential improvements to the advisories from the perspective of Ohio River Valley anglers.

The spring survey was implemented in late April, 1992 and the fall survey in late September, 1992. Up to three follow-up mailings were sent to nonrespondents over the course of the following months.

A telephone follow-up to 151 nonrespondents to the spring survey was conducted in June, 1992 and another one to 100 nonrespondents to the fall survey in November, 1992 to provide an estimate of the degree to which nonrespondents to the mail surveys differed from respondents.

Results and Discussion: Health Advisory Impacts

For the spring survey, of the 2,000 questionnaires mailed, 142 were undeliverable and 841 completed questionnaires were returned. This resulted in an adjusted response rate of 45.3%. For the fall survey, of the 3,000 questionnaires mailed, 262 were undeliverable and 1,269 completed questionnaires were returned. This resulted in an adjusted response rate of 46.3%.

In this study, we sought to contact people with Ohio River fishing experience. We defined "Ohio River experience" as including only those respondents who had fished the Ohio River in the past five years or had eaten Ohio River fish in the past year. Respondents who had no Ohio River fishing experience accounted for 38% of our spring sample and 44% of our fall sample.

The majority of respondents did not fish the Ohio River because they preferred other locations or because they would not want to eat the fish due to contaminants. Respondents could check as many reasons for not fishing as they wished. Nineteen percent of respondents who had not fished the Ohio River in the past five years listed the presence of contaminants in fish or contaminants and river pollution as the only reasons for not fishing the river. Thus, contaminants appear to be the sole reason for dissuading a substantial portion of currently-licensed anglers from fishing the Ohio River.

Awareness. An estimated 83% of anglers (adjusted for nonresponse bias) who had fished the Ohio River in the past five years were aware of the health advisories. Approximately two-thirds of this group said they were aware of specific species or areas of the river listed in the advisories, whereas the remainder were only generally or vaguely aware of the advisories. Younger respondents (ages 15-29) and those with lower incomes were less likely to be

aware of the specifics of the health advisories. Women were more likely than men to be completely unaware of the health advisories. This is an important finding because women, especially those of childbearing age, incur higher potential risks if they eat contaminated fish, due to the possibility of transferring contaminants and their effects to offspring. Anglers residing in Kentucky, Indiana, and Ohio were most likely to be aware of specific advisory recommendations. Over 85% of anglers from Illinois, where there is no health advisory issued, said they were aware of the health advisories. This apparent contradiction could be attributed to the fact that Kentucky (which borders the Ohio River across from Illinois) and neighboring Indiana both have Ohio River health advisories. Illinois respondents could be familiar with the KY and/or IN advisories.

The most important source of health advisory information and the one used most frequently by respondents (adjusted for nonresponse bias) was the newspaper. Respondents who used the fishing regulations guide felt most informed about the safety of eating fish (3.6 on a scale of 5); those using friends felt the least informed (3.0). Although newspapers have been noted as a frequently used and important source of information for respondents, when asked about the best way to get information to them a plurality of respondents (43%) said the television or radio would be best.

Beliefs. Most respondents (67%) disagreed with the statement that eating any fish from the Ohio River is safe. Respondents were more likely to believe that eating some types of Ohio River fish is safe, but a majority (55%) either did not hold this belief or were unsure. Those fishing the Illinois and Indiana portions of the river from Cannelton to the river mouth were most likely to believe that eating some or any fish from the Ohio River

was safe. Respondents who ate species listed in the advisories were also more likely than other respondents to believe that eating some or any fish from the Ohio River was safe. Respondents who were aware of advisory specifics were more likely to believe that eating some types of fish was safe.

Most respondents believed that eating Ohio River fish posed some health risk for them. A majority of respondents believed that: (1) the health risks are greater than the health benefits (56%); (2) eating contaminated fish over many years increases their health risks (71%); and (3) Ohio River fish pose a health risk for them (58%).

Attitudes. Most respondents were concerned that eating Ohio River fish was a health risk (88%), and thought it was important to follow the health advisories (71%). On average respondents felt somewhat informed about the safety of eating fish, and found it relatively easy to follow the advisory recommendations. Those that were aware of advisory specifics felt more informed and found it easier to comply with advisory recommendations than those only generally aware of the advisory.

Behavioral Intentions. A plurality of respondents (45%) believed that they follow the advice in the health advisories. Reported fish consumption patterns for 91% of this group indicated they followed the advisory.

A majority of respondents (63%) would eat more Ohio River fish if health risks did not exist. Fish consumption suppression (actual consumption lower than desired consumption due to contaminants) therefore appears to exist among Ohio River anglers.

Fishing Satisfaction. Consumption was more important for a satisfying fishing experience for those eating listed species than for those who caught but did not consume listed fish. This follows from our finding that those

eating listed species were more likely to believe that following the advisory would limit their enjoyment of fishing. For these respondents, consumption appears to be an important part of the fishing experience, one perhaps not easily given up.

Fish Consumption. Most respondents (95%) who fished the Ohio River in the past year reported catching at least one fish from the river, but less than half of the respondents (43%) ate any Ohio River fish. On average, fish-consuming respondents ate 19 Ohio River fish meals annually. The most popular fish species for both catch and consumption was channel catfish. In fact, 92% of respondents who did not follow their state's advisory were consuming channel catfish. Thus this species seems to be the most popular and the one most often ignored based on the health advisory warnings.

Overall, 11% of respondents did not follow the recommendations of their respective state's advisory. An additional 42% caught species listed in the advisory but did not consume them in excess of the advisory recommendations; the remaining respondents did not catch or consume listed species. Respondents from Kentucky, especially those fishing near the Uniontown, Newburgh, and Cannelton locks and dams, were two to three times more likely to consume species listed in the advisory (primarily channel catfish) than other anglers. Respondents who fished this section of the river most frequently were more likely to hold a suite of beliefs and attitudes implying that they did not believe that the risk existed.

Fish Preparation Methods. Thirty-five percent of Ohio River anglers said they used all four risk-reducing cleaning techniques (remove back fat, remove belly fat, remove skin, fillet fish) for all fish meals they prepared. Most anglers use some of the risk-reducing cleaning techniques at least some

of the time. Those fishing the lower stretches of the river most often were also more likely to use risk-reducing cleaning techniques more frequently. Among anglers consuming listed species beyond advisory limits, the majority used risk-reducing cleaning techniques most of the time.

Use of risk-reducing cooking techniques was not prevalent, even among consumers of listed species beyond advisory limits. More popular cooking methods included generally non-risk-reducing methods such as pan frying or deep frying.

Changes in Behavior as a Result of the Health Advisory. Among respondents who were aware of the health advisories, 42% said they had reduced their fish consumption because of the advisory and 13% said they had stopped consuming Ohio River fish altogether. Respondents who consumed listed species beyond advisory limits were more likely than those who did not to say that because of the advisory they had changed their cleaning methods and were eating less fish.

Relationship of Behavior to Attitude Activation. Very early in the survey instrument used in this study, respondents who reported fishing on the Ohio River within the past 5 years were asked to "list all information you believe to be true about the safety of eating fish caught in the Ohio River" and to "list specific actions you have taken related to the safety of eating fish caught in the Ohio River." Respondents in the spring reported significantly more thoughts than in the fall (mean thoughts spring = 3.0; fall = 2.6; $t = 2.8$; $p < .01$). Given that the health advisories were issued in the spring just before the questionnaire was mailed, this trend was expected. However, it does indicate that the advisories may be cognitively somewhat less available by fall.

Conclusions and Recommendations Regarding Health Advisory Impacts

Recommendations for Agencies. Advisory awareness (as percent of respondents aware of advisory) was lowest among anglers purchasing licenses in states using mainly news releases to disseminate advisory information, and highest in those states in which the health advisory is printed in the fishing regulations guide. Although survey respondents did not choose the regulations guide as being the most effective means of communication, they did feel most informed about the safety of eating fish after reading the regulations guide. States should consider the merits of including health advisory information in the fishing regulations guide, as well as in news releases to printed, audio, and video media. Newspapers and posted warnings appeared to be particularly important in urban areas.

Most respondents used some risk-reducing cleaning techniques at least some of the time, but adoption of these methods was highest among respondents eating listed species beyond advisory limits and among those listing a high number of thoughts on the open-ended questions. The listed-species consumers also appeared to be more committed to fish consumption as an important lifestyle activity. Agencies should therefore consider emphasizing the importance of using risk-reducing cleaning techniques especially if anglers do not reduce fish consumption to recommended levels, because some anglers will be unwilling to forego fish consumption altogether. Further, because respondents listed more thoughts soon after advisories were issued than later in the year, advisory reminders later in the fishing season or posted at fishing areas may help anglers think more about the advisories.

Although almost all respondents who fished the Ohio River in the past year reported catching at least one fish, less than half ate any Ohio River

fish. Such relatively low consumption by anglers may be of concern to agencies whose objectives include maintaining fish consumption at or slightly below the levels recommended in the health advisory. Since the advisories pertain to only a portion of Ohio River species, it is possible the fishery resource is being underutilized in terms of human consumption. Only about 11% of respondents did not follow the recommendations of their respective state's advisory. In certain stretches of the River, however, noncompliance with the advisory recommendations was considerably higher (e.g., Cannelton to Uniontown), indicating targeted advisory communication efforts may be warranted in these locales.

Among anglers eating listed species above the advisory limits, fish consumption was an important component of a satisfying experience. These anglers were also more likely to believe that following the advisory would limit their enjoyment of fishing. For this group, warnings to reduce fish consumption for health reasons may not be sufficient to stimulate compliance with the advisory. Rather, behavioral alternatives that still allow this important personal activity (fish consumption) to occur may be needed, such as risk-reducing preparation techniques or emphasis on eating species not listed in the advisory.

If state and regional agencies seek to emphasize the positive aspects of Ohio River fish and fishing, catch-and-release fishing (already practiced by a substantial portion of respondents) could be emphasized. Much more concerted communication efforts would be needed to encourage consumption of the harvestable fish species in the Ohio River that are not subject to advisories, and would involve changing pervasive beliefs about the desirability and safety of Ohio River fish consumption.

Only about one-third of survey respondents believed the advisory provided them with enough information to make their own, informed, decision about fish consumption. A substantial portion of respondents indicated they felt they had insufficient information in the advisory to choose safer alternatives (e.g., safer fishing locations, types or sizes of fish with less contaminants, risk-reducing fish preparation methods). Although such information can be included in detail in news releases, it is limited in extent in the advisory news releases currently used by agencies. Further, agencies have little control over what the media chooses to include in articles or broadcasts stemming from the news release. The fishing regulations guide provides a more certain vehicle for including detailed advice about contaminant levels at different locations, species and sizes of fish less-affected by contaminants, and risk-reducing fish preparation methods.

Recommendations for Research. The anglers from the Cannelton locks and dam down to the river mouth were relatively different from other anglers in terms of higher fish consumption, stronger beliefs that health risks do not exist, and greater devotion to fish consumption as a part of the total fishing experience. Future studies might target this river reach to understand further the attitudinal, behavioral, and cultural factors influencing angler response to health advisories.

This study demonstrated an association between the use of risk-reducing cleaning techniques and lower levels of personal concern about the health risks associated with consuming Ohio River fish. Future research could test the hypothesis that anglers believe they do not have to follow the fish consumption advice (i.e., number of fish meals per species) in health

advisories if they use risk-reducing cleaning techniques such as filleting the fish or removing the fat. Testing this hypothesis is important for informed risk management decisions. Some contaminants (e.g., mercury) are not reduced through the use of such trimming techniques that reduce lipophilic compounds. Anglers might think they are reducing their exposure when in fact they are likely not.

A SUMMARY OF RISK COMMUNICATION CONCEPTS FOR COMMUNICATING HEALTH ADVISORIES

The third objective of this study was to summarize risk communication issues agencies should consider when designing health advisory communication programs for public audiences.

A Framework for Health Advisory Communication Programs

The Model. Health advisories are prepared, issued, and disseminated by a variety of agencies and organizations, and are targeted toward a variety of people--sport anglers, subsistence fishers, actual and potential fish consumers, high-risk groups, and many different sociodemographic groups of people. Sharing information, perceptions, and understanding among these various participants is critical to successful health advisory communication programs.

We suggest using a model containing five elements to guide development of health advisory communication programs: (1) problem analysis; (2) audience needs assessment; (3) communication strategy design; (4) communication strategy implementation; and (5) evaluation.

Problem Analysis: Objectives. Problem analysis includes consideration of the social, scientific, and political context of the fish contaminant issue, particularly specific articulation of the objectives to be accomplished through a health advisory communication program. Objectives identified for

health advisory communication programs include reducing human health risks, encouraging informed decisions among potential and actual fish consumers, fostering adoption of a variety of risk-reducing behaviors, encouraging support for clean-up of toxics in the environment, encouraging enjoyment of sport-fisheries, and informing people about the health and economic benefits of fish consumption. Agencies, other organizations, and target audiences should have a clear understanding of which objectives are to be achieved through a health advisory communication program. Without such understanding, it is virtually impossible to identify the "most appropriate" health advisory recommendations and communication programs.

Audience Needs Assessment. Audience needs assessment includes identification of potential target audiences who should participate in the health advisory communication program, and addresses what types of information and communication styles are appropriate for each audience.

Identifying target audiences. Identification of potential target audiences for health advisory communication programs should flow from the objectives articulated during problem analysis, and may include audiences such as licensed anglers, women of childbearing age, youth, urban anglers, or fish consumers among the general public. To achieve a variety of objectives or reach a variety of audiences, usually a variety of communication strategies is needed. The information needs of these audiences and the communication strategies used to convey that information may differ substantially.

Audience information and communication needs. Identifying the information needs and communication needs of the target audiences includes understanding what the target audiences initially know and believe about health advisories and fish consumption, how they behave relative to fish

consumption, and what information they desire. Previous studies have demonstrated that awareness of health advisories typically increases in a given population over time, but tends to be lower among certain audiences (e.g., women, youth, those with relatively low education or low income, non-whites). Depending on the health advisory objectives, reaching such low-awareness groups may take high priority for a communication program.

Perceptions of what is important to know about health advisories and fish consumption may differ considerably between target audiences and "expert" health advisory communicators. If communicators design communication programs based solely on their own beliefs about what audiences should know, it is likely audiences will not find the suite of information they believe they need to make an informed decision to follow or ignore the health advisory recommendations.

Types of information identified by potential target audiences as important for health advisories include: (1) specific comparisons of relatively safer/more dangerous fish species, sizes, and fishing locations; (2) description of negative health effects from eating fish; (3) health benefits of eating fish; (4) specific comparisons of health risks from fish consumption with other, particularly dietary, risks; (5) description of risk-reducing fish cleaning and cooking methods; (6) description of chemicals of concern and their effects.

Audience behavior. Behaviors of interest include fishing and fish-eating activities, as well as use of potential information sources (e.g., fishing regulations guides, newspapers, personal communications).

Understanding which information sources will be used by audiences to receive health advisory information is critical in designing a communication strategy.

Understanding what behaviors fish consumers engage in is necessary in deciding what current behaviors to reinforce or to change via health advisory messages.

Communication Strategy: Design and Implementation. Design and implementation of the communication strategy involves constructing health advisory recommendations appropriate to the needs of the target audiences, and sharing these recommendations using dissemination mechanisms that will reach each audience of concern.

Developing the advisory message. Depending on the target audience, health advisories may include information such as: (1) a description of a suite of risk-reducing behaviors beyond limiting or eliminating fish consumption (e.g., fish cleaning and cooking techniques); (2) explanations of how eating fish compares to other dietary risks; (3) description of the negative and positive health effects associated with fish consumption, with special emphasis on what groups of people are most endangered by or derive the most benefit from sport-caught fish consumption; and (4) explanation of the assumptions and uncertainty entering into the risk assessment-risk management process forming the basis for issuing health advisories. Decisions about what information to include in any advisory should reflect the self-identified needs of the target audiences as well as the objectives of the health advisory program.

Advisory dissemination mechanisms. Mechanisms by which potential fish consumers receive information about health advisories and contaminated fish consumption include interpersonal sources (e.g., friends, government agency professionals), mass media (e.g., newspapers, television), and specialized media (e.g., printed fishing regulations guide, health advisory brochure). Among licensed anglers, use of fishing regulations guides containing health

advisory recommendations has been associated with relatively high levels of advisory awareness, knowledge, and compliance with recommendations. The highest levels of health advisory knowledge have been associated with personal communication with "experts" (i.e., professionals from state health and fishery agencies). Other mechanisms accessible to many audiences of concern include newspapers, television, posted warnings at access sites or in urban areas, and specialized brochures distributed in areas used by the audiences of concern (e.g., maternal health brochures in clinics and physicians' offices).

Timing of advisory dissemination. The results of this study showed that advisory reminders throughout the fishing season may cause anglers to think more about health advisories, and lead to compliance with advisory recommendations.

Evaluating the Communication Program. Evaluation includes measurement of changes in knowledge, attitudes, and behavior among the audiences, as well as assessment of how well original health advisory objectives were met. Two basic types of evaluation are possible, formative and summative evaluations.

Formative evaluations of health advisory communication programs focus on the process of communication, assessing whether the communication program is being carried out as intended. Formative evaluation can be an ongoing process of monitoring implementation of the health advisory communication program, and can help identify necessary changes in program implementation.

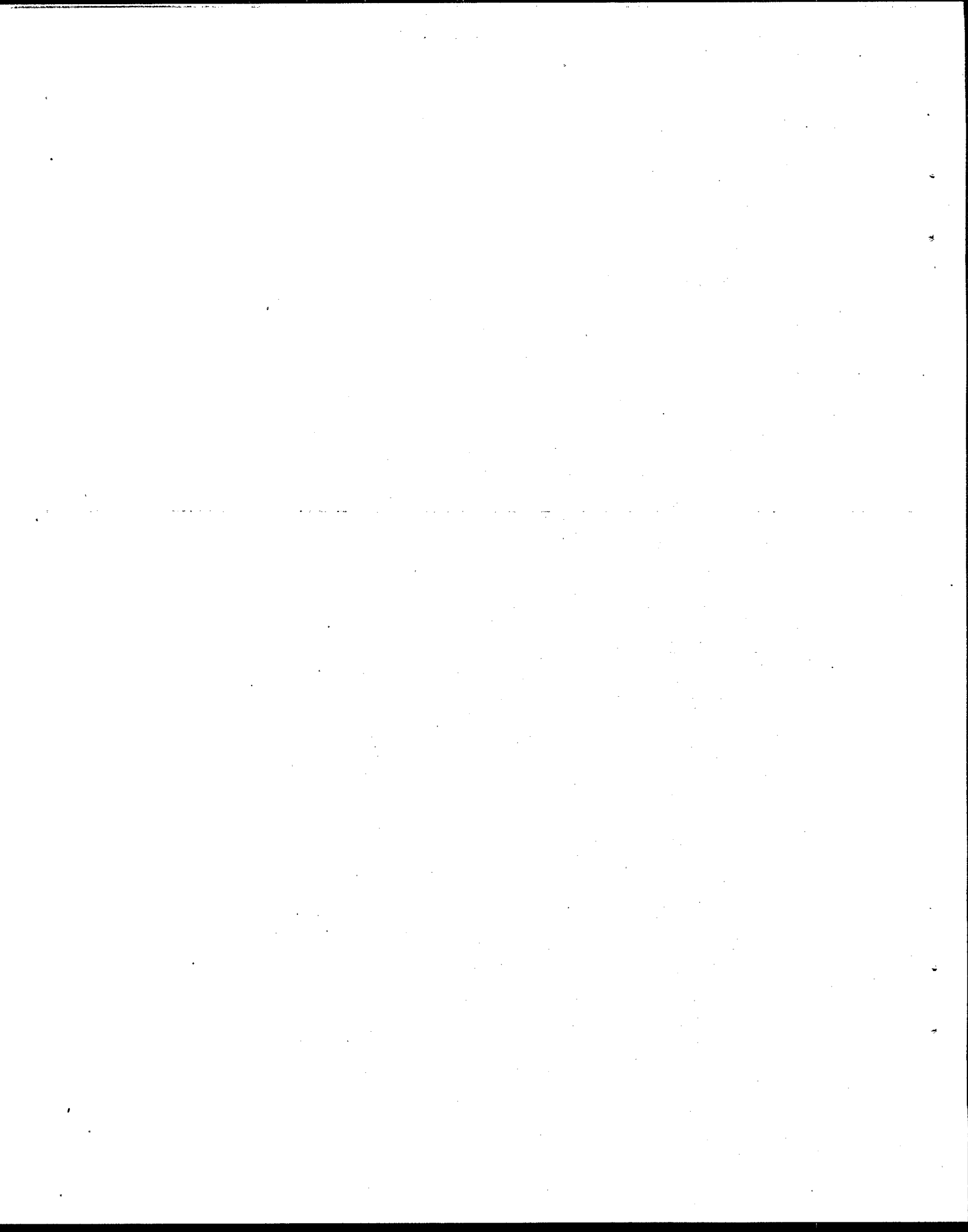
Summative evaluations of health advisory communication programs focus on the outcomes produced through the communication process. Evaluators assess whether or not objectives were achieved, or whether outcomes were accomplished that were prerequisite to objectives being achieved. Conducting summative evaluations over time builds an evaluation information base that helps the

communicator identify successes and areas needing improvement based on the measurement trends.

During the formative or summative evaluation processes, new communication issues or problems or previously unidentified audiences or audience needs may surface. When this happens, the health advisory communication program cycles back to the initial steps of the process, problem analysis and audience needs assessment. Revised communication strategies may result.

Summary

This and other studies of health advisory communication programs and response by fish consumers shed light on the relationships between information, knowledge, beliefs, and behavior. An important finding from each of these studies is that fish consumers do not belong to a monotypical audience. Variations in beliefs, behaviors, and abilities demand attention by communicators to specific target audiences. Communicators can gather original information specific to their local audience needs, or draw from the information on audience trends documented in studies of anglers, fish consumers, and health advisories conducted by the Human Dimensions Research Unit and others. The result should be improved health advisory communication programs, human health, and sport-fisheries.



INTRODUCTION

Fish consumption health advisories have been issued in the United States since the mid-1970's, and specifically in the Ohio River Valley since 1988, in response to concern over potential negative health consequences of consuming sport-caught fish. Some fish in the Ohio River have been found to contain elevated levels of several contaminants, including PCBs and chlordane (ORSANCO 1991). Issuing health advisories with recommendations about limiting consumption of fish and adopting other risk-reducing behaviors is the primary management strategy being implemented by Ohio River Valley states to address this problem (in addition to longer-term remediation and control activities).

Advisories issued by different states bordering the Ohio River have not necessarily contained the same recommendations, even for the same stretch of the River. For one large stretch of the River, one border state (KY) issues an advisory which is disseminated via news releases, posted access points, and the fishing regulations guide, whereas an adjoining border state (IL) issues no advisory. Kentucky bases its reasoning for issuing an advisory on fish tissue analysis for chemical contaminants collected throughout the Ohio River, and on the premise that fish will not remain at one location over their lifetime or even over a fishing season (J. Draper, Kentucky Dept. of Health Services, personal communication, June, 1993). Based on an 18th century agreement, KY has technical jurisdiction over the IL-KY stretch of the Ohio River up to the high water mark; therefore, since IL does not have jurisdiction for the Ohio River, it issues no health advisory (T. Long, Illinois Dept. of Public Health, personal communication, June, 1993). Proliferation of different advisories and communication strategies raises questions about the impacts one or multiple advisories are having on the audiences of interest. Further, differences among agencies regarding

objectives they seek to accomplish via health advisories may contribute to the differences in approaches used to develop and communicate advisories with the public (Knuth 1989, 1990; Knuth and Connelly 1991).

Evaluations of health advisory communication efforts have focused largely on whether anglers are aware of advisories, and have measured whether anglers have changed their fishing or fish consumption habits as a result of the advisory (Connelly et al. 1990; Fiore et al. 1989; Springer 1990). Connelly et al. (1990) and Springer (1990) assessed what types of information could lead to improved advisories from the perspective of anglers. Connelly et al. (1992) and Connelly and Knuth (1993) linked information content and presentation style of advisories to angler attitudes and behavior, and to management objectives. Diana et al. (1993) analyzed the relationship between angler beliefs about advisories and fishing-related behavior for a small cohort of New York anglers. Each of these previous studies focused on the Great Lakes, a region with a longer history of health advisories (7 to 15 years, depending on the Lake) compared with the Ohio River Valley (3 to 4 years).

Identifying improvements for health advisory communication programs requires first, understanding the objectives to be achieved through health advisories, and second, assessing the success or effectiveness of existing health advisory communication efforts. Agencies that issue or disseminate health advisories may hope to achieve multiple objectives with the advisories. These objectives may include: human health protection, encouraging continued use and enjoyment of fishery resources, protecting tourism-based economies from sudden changes, and/or gaining public support for programs to reduce or clean up pollution. Agencies sometimes vary in the types of objectives they

hope to accomplish with health advisories, and the attention they devote to creating, disseminating, and evaluating advisories (Knuth 1989; Knuth and Connelly 1991).

Strategies for disseminating health advisories vary among agencies. In some regions (e.g., Great Lakes), agencies commonly include the health advisory information as part of the fishing regulations guide distributed to anglers at the point of license purchase. In other regions, including the Ohio River Valley, the use of press releases at one or more key points in time is a primary advisory dissemination mechanism. To our knowledge, no one has yet tested empirically the question of timing of health advisories, particularly in situations in which advisories are not included in the fishing regulations guide but rather are publicized through intermittent or one-time-only news releases. Timing of the advisory news releases could be important if the impacts from the advisories (e.g., anglers attitudes, behaviors) are greatest shortly after media attention and then diminish over time as media attention fades.

The Ohio River Valley provides a useful setting for examining timing and type of dissemination mechanism. The five states issuing advisories coordinate their annual spring news releases (A. Vicory, ORSANCO, personal communication, October, 1991), with some states (PA, WV) relying on these releases as the primary mechanism for disseminating advisory information. A few states (IN, KY, OH) also include the advisory information within the state fishing regulations guide. (Pennsylvania began including the health advisory in its fishing regulations guide in December, 1992, after the data-gathering phase of this study had been completed [R. Frey, PA Bureau of Water Quality Management, personal communication, June, 1993.]) One state (KY) posts

advisory information at each of its Ohio River access sites. One state (IL) has no Ohio River advisory, but lists other state waters with advisories within the state fishing regulations guide.

Objectives

The objectives of this study were to:

- (1) identify state and regional agency objectives associated with state fish consumption health advisories in the Ohio River Valley;
- (2) determine the impacts associated with Ohio River health advisories including (a) awareness of, attitudes, and opinions about health advisories held by Ohio River Valley anglers; (b) angler behavioral changes associated with advisories; and (c) effect of urban vs. rural residence, and recent vs. distant media attention relative to advisory awareness and behavior; and
- (3) summarize risk communication issues to consider when communicating health advisories to the public.

This report is arranged into three major sections, one addressing each of the project objectives.

Conceptual Background

Two major theoretical frameworks and the empirical studies listed earlier provided the conceptual underpinnings for this study. Because the relationship between attitudes and behaviors is complex, both must be measured to evaluate the impacts of health advisories on anglers. The theory of planned behavior (Ajzen and Fishbein 1980; Ajzen 1989) provided the basis for an overall predictive and analytical model that guided research instrument development and analysis (Fig. 1). This theory holds that behavior is a

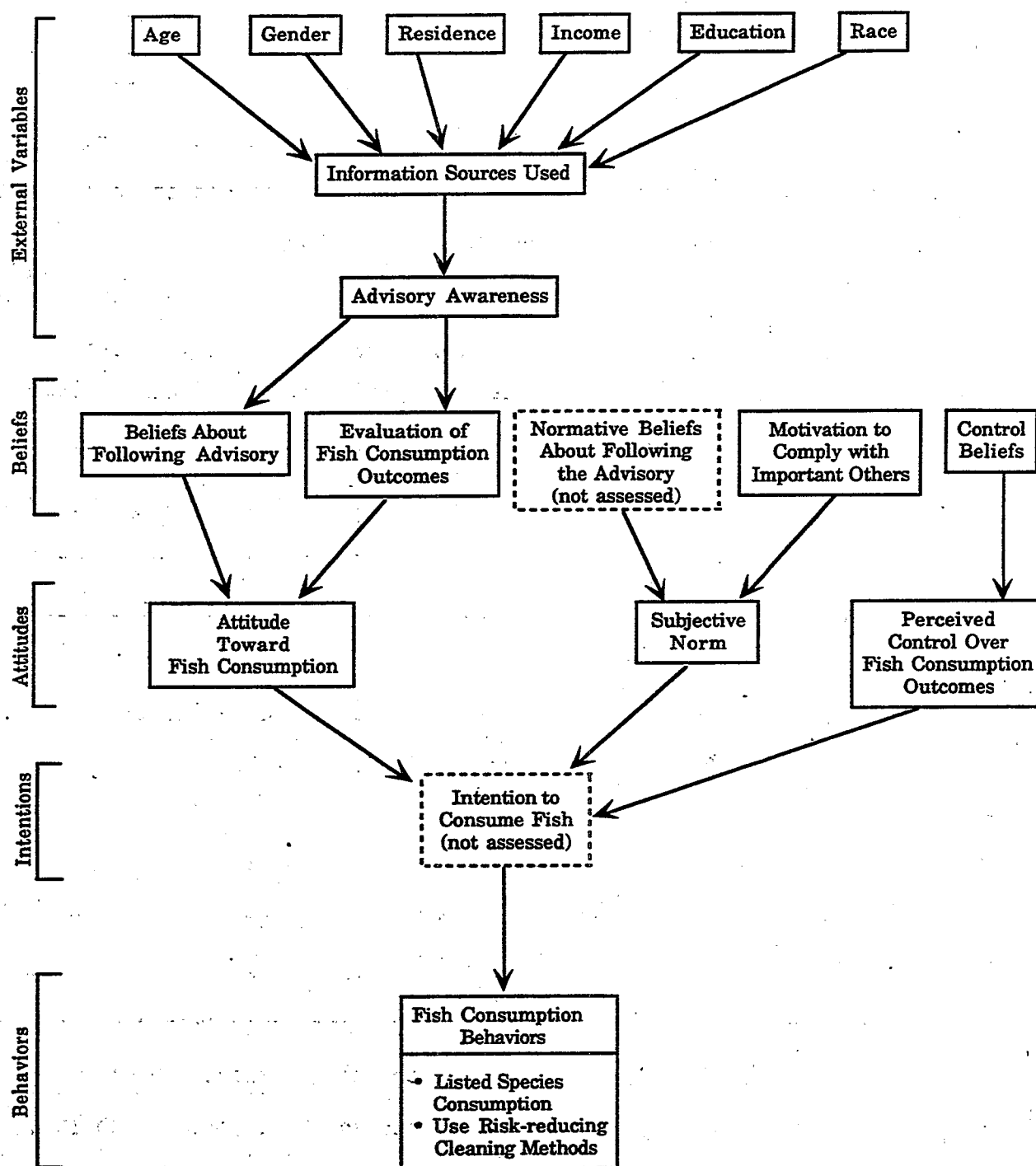


Figure 1. Conceptual diagram of social-psychological process determining response to health advisories, derived from the Theory of Planned Behavior (Ajzen 1989), and modified from Connelly et al. (1992).

result of several determinants, including a set of external variables, and a host of beliefs and attitudes. Connelly et al. (1992) used this theory to demonstrate that behavioral responses of potential fish consumers to recommendations in health advisories are a function of a set of external variables, beliefs, and attitudes. We operationalized each of these concepts in this study, although some more completely than others.

The theory of attitude activation (Fazio 1986; Shapiro 1991) guided our assessment of the effects of recent exposure to health advisory information on angler attitudes and behaviors. This theory holds that people have existing attitudes that can be activated (e.g., by media attention) to stimulate action (behavior). The importance of this approach is that it could help answer the question of when to activate an attitude for the most impact, i.e., when best to remind people of health advisory recommendations to result in the greatest adoption of risk-reducing behaviors.

The following sections describe the series of variables we measured, including external variables, beliefs and attitudes, and behaviors.

External Variables

Attitudinal and behavioral responses to health advisories may be influenced by several external variables. We included variables measuring socio-demographic characteristics of licensed anglers, the information sources they used to learn about health advisories, and their basic awareness of the advisories and knowledge about fish consumption-related issues, because these variables have been shown to influence attitudes and behaviors (Knuth 1990; Connelly et al. 1992; Connelly and Knuth 1993). Demographic and information-source variables may also be used to identify potential target audiences if health or fishery management agencies seek to develop a

communication program for specific groups of potential fish consumers. Variables measuring awareness, with the potential to influence behavior, were included because of the importance of agency objectives related to allowing people to make their own, informed decision about eating sport-caught fish (Knuth and Connelly 1991).

Beliefs and Attitudes

We measured several cognitive and affective factors with the potential to influence fish consumption-related behavior. These factors included: beliefs and attitudes about following the advisory; beliefs about the likely outcomes associated with following the advisory or eating sport-caught fish; beliefs and attitudes about an individual's ability to control their own behavior or risk level; and normative factors, such as the influence of other people's attitudes on a given angler's behavior. General beliefs and attitudes that may affect behavior have been described by Ajzen and Fishbein (1980) and Ajzen (1989). Connelly et al. (1992), Connelly and Knuth (1993), and Diana et al. (1993) demonstrated the importance of beliefs and attitudes in influencing fish consumption-related behaviors, particularly those related to advisory knowledge, beliefs about health risk, and perceived control over the potential health risk.

Behaviors

We measured a suite of behaviors related to sport-caught fish consumption, including days fished on the Ohio River, number of meals of Ohio River fish eaten, consumption of species listed in the health advisories, and use of risk-reducing fish cleaning and cooking procedures. Many of the primary objectives held by agencies involved in health advisory programs focus on fostering multiple behaviors that result in reduced human health risk, not

just limiting or eliminating consumption of certain species of fish (Knuth and Connelly 1991).

AGENCY OBJECTIVES ASSOCIATED WITH OHIO RIVER HEALTH ADVISORIES

Our first objective was to identify state and regional agency objectives associated with state fish consumption health advisories in the Ohio River Valley.

Methods

We conducted telephone interviews with two or three individuals in each state who had major responsibilities associated with health advisories. We chose one representative from each state health, environmental quality, and fishery management agency, as appropriate. We also interviewed one representative from the Ohio River Valley Water Sanitation Commission (ORSANCO), a regional agency involved in coordinating and conducting water quality-related research and management activities in the Ohio River Basin. State personnel from each agency type were those defined by the agency as having chief responsibility for the health advisory program. Interviewees held a variety of administrative and technical responsibilities within the agencies.

Each telephone interview focused on perceived agency health advisory objectives and opinions about criteria for evaluating the success of health advisories. Telephone interviews were conducted in May and June, 1991 for IL, IN, OH, and PA, and in March and April, 1992 for KY, WV, and ORSANCO. We made an initial call and up to four call-backs if the initial and subsequent contacts were inconvenient for the agency representative. If the individual indicated s/he no longer had health advisory responsibilities, we obtained the

name of the replacement and contacted that person. The interview lasted about 15 minutes and included closed- and open-ended questions.

Results and Discussion: Health Advisory Objectives and Evaluation Criteria

We completed 15 telephone interviews with 5 fishery agency representatives, 5 health agency representatives, 4 environmental quality agency representatives, and 1 ORSANCO representative.

Health Advisory Objectives

Of 20 potential objectives presented to agency representatives, the most important objectives for states overall included those focused on: (1) reducing health risks for particularly at-risk groups, the general public, licensed anglers, and subsistence fishers; and (2) helping people make their own informed decision about cleaning, cooking, and eating Ohio River fish (Table 1). Each of the five states issuing Ohio River health advisories (IN, KY, OH, PA, WV) include specific fish preparation guidance in their health advisories.

Objectives of moderate importance overall included those related to motivating people to become involved in Ohio River clean-up activities. Objectives of lowest importance included those focused on: (1) informing people about the health benefits of eating fish, (2) encouraging uses of sport-fishery resources, and (3) protecting local economies. Although these last objectives were of relatively low importance overall, about one-fourth of respondents judged each of these three objectives to be very important or extremely important (Table 1), indicating differences in health advisory program objectives among agency personnel.

We performed a factor analysis to examine the underlying relationships between objectives and reduce the large set of objectives to a smaller set of

Table 1. Objectives for health advisories identified by representatives from state health, fishery, and environmental quality agencies, and ORSANCO (n=15), including means, standard deviations, and frequencies of responses.

Objectives	Mean ¹	Standard Deviation	Not Imp.	Somewhat Imp.	Important Percent	Very Imp.	Extremely Imp.
To reduce health risks to special at-risk groups of people.	4.6	0.6	0.0	0.0	6.7	26.7	66.6
To reduce public health risks.	4.5	0.7	0.0	0.0	13.3	20.0	66.7
To reduce health risks to licensed sport anglers.	4.3	0.7	0.0	0.0	13.3	40.0	46.7
To reduce health risks to those people who rely on fish as a subsistence food resource.	4.3	0.8	0.0	0.0	20.0	26.7	53.3
To allow people to make their own, informed decision about eating Ohio River fish.	4.3	0.8	0.0	0.0	20.0	26.7	53.3
To help people select risk-reducing fish cleaning and cooking methods.	4.3	0.7	0.0	0.0	13.3	46.7	40.0
To reduce health risks to unlicensed anglers.	4.2	0.9	0.0	0.0	26.7	26.7	46.6
To help people select lesser contaminated species of fish to eat.	3.9	0.9	0.0	6.7	26.7	40.0	26.6
To reduce health risks to fish-eating, but not non-angling, recipients of "gift fish."	3.8	0.9	0.0	0.0	46.6	26.7	26.7

Table 1. (cont.)

<u>Objectives</u>	<u>Mean</u> ¹	<u>Standard Deviation</u>	<u>Not Imp.</u>	<u>Somewhat Imp.</u>	<u>Important Percent</u>	<u>Very Imp.</u>	<u>Extremely Imp.</u>
To inform people about the safe species and/or locations to fish along the Ohio River.	3.7	1.0	0.0	13.3	26.7	33.3	26.7
To motivate people to keep their consumption of sport-caught fish within the levels listed in the advisory.	3.6	1.2	7.1	7.1	35.8	21.4	28.6
To encourage public support for programs to reduce or clean up toxic contamination in the Ohio River.	3.4	1.4	14.3	14.3	21.4	21.4	28.6
To motivate people to take action to clean up or stop Ohio River pollution.	3.1	1.4	14.3	21.4	28.6	14.3	21.4
To encourage public support for Ohio River fishery management.	2.9	1.6	33.3	6.7	13.3	26.7	20.0
To meet legal mandates of government agencies.	2.9	1.4	20.0	20.0	20.0	26.7	13.3
To encourage beneficial uses of sport-fishery resources.	2.7	1.5	26.7	20.0	26.7	6.6	20.0
To inform people about the health benefits that may be associated with eating fish.	2.7	1.2	20.0	20.0	33.3	20.0	6.7
To encourage enjoyment of sport-fishery resources.	2.7	1.5	26.7	26.7	20.0	6.6	20.0
To protect tourism-based economies from sudden changes or losses.	2.3	1.2	33.3	33.3	6.7	26.7	0.0

Table 1. (cont.)

<u>Objectives</u>	<u>Mean¹</u>	<u>Standard Deviation</u>	<u>Not Imp.</u>	<u>Somewhat Imp.</u>	<u>Important Percent</u>	<u>Very Imp.</u>	<u>Extremely Imp.</u>
To discourage people from eating Ohio River fish.	1.5	0.9	73.3	13.3	6.7	6.7	0.0

¹Importance was measured on a 5-point scale where 1 = not at all important to 5 = extremely important.

factors accounting for the observed interrelationships in the data. We used a principal axis factoring procedure with varimax rotation (SPSS Inc. 1986). Three objectives were dropped from the analysis to improve reliability and the percent of variance explained (i.e., meet legal mandates of government agencies, inform people about health benefits from eating fish, discourage people from eating fish). The factor analysis explained 85.1% of the variance in the data. We assigned meaning to the four factors identified based on the types of objectives with the highest factor loadings on each factor (Table 2) as follows: public support and resource use; health risk reduction; risk reducing fish preparation methods; and informed individual decisions.

We performed a cluster analysis to group individual respondents into clusters based on their mean factor scores (SPSS Inc. 1986). Two clusters resulted. A majority (9/10) of health and environmental quality personnel (state and regional) grouped in one cluster; a majority (3/5) of fishery personnel grouped in the other cluster. As in the Great Lakes states (Knuth and Connelly 1991), differences exist in the importance placed on potential health advisory objectives by fishery and health/environmental quality agencies. Fishery agencies placed greater emphasis than the environmental quality agencies on objectives associated with public support and resource use, risk-reducing fish preparation methods, and enabling people to make their own informed decisions about fish consumption. No pattern of state-to-state differences was observed in the cluster analysis results.

Health Advisory Evaluation Criteria

Nineteen potential health advisory evaluation criteria were presented to agency representatives. The most important criteria identified included: (1) advisory awareness; (2) use of risk-reducing fish preparation methods; (3) use

Table 2. Major factors identified and factor loadings for 17 of 20 objectives rated according to importance. (Three objectives, which focused on meeting legal mandates of government agencies, discouraging fish consumption, and informing people about health benefits from eating fish were dropped from the analysis to improve reliability and percent of variance explained.)

<u>Objectives</u>	<u>Public Support and Resource Use</u>	<u>Health Risk Reduction</u>	<u>Risk Reducing Fish Preparation Methods</u>	<u>Informed Individual Decisions</u>
To reduce health risks to special at-risk groups of people.		.85		
To reduce public health risks.		.80		
To reduce health risks to licensed sport anglers.		.90		
To reduce health risks to those people who rely on fish as a subsistence food resource.		.93		
To allow people to make their own informed decision about eating Ohio River fish.				.85
To help people select risk-reducing fish cleaning and cooking methods.			.83	
To reduce health risks to unlicensed anglers.		.84		
To help people select lesser contaminated species of fish to eat.	.60			
To reduce health risks to fish-eating, but non-angling, recipients of "gift fish."				.80

Table 2. (cont.)

	Public Support and Resource Use	Health Risk Reduction	Risk Reducing Fish Preparation Methods	Informed Individual Decisions
To inform people about the safe species and/or locations to fish along the Ohio River.				.75
To motivate people to keep their consumption of sport-caught fish within the levels listed in the advisory.			.87	
To encourage public support for programs to reduce or clean up toxic contamination in the Ohio River.	.89			
To motivate people to take action to clean up or stop Ohio River pollution.	.89			
To encourage public support for Ohio River fishery management.	.87			
To encourage beneficial uses of sport-fishery resources.	.87			
To encourage enjoyment of sport-fishery resources.	.86			
To protect tourism-based economies from sudden changes or losses.	.66			

of fishing behaviors (i.e., species targeted, size kept); and (4) fish consumption rates at or slightly below advisory recommendations (Table 3). These evaluation criteria correspond to several of the highest-priority objectives noted above, specifically helping people make their own, informed decision, and reducing health risks. Evaluation criteria focused on fish consumption by children and women of childbearing age were rated slightly more important than those related to fish consumption by anglers in general, reflecting the highest-priority objective to reduce health risks to particularly at-risk groups of people. Two Ohio River states' (IN, KY) advisories include special recommendations for women of childbearing age and children. Lowest importance was assigned to evaluation criteria related to fishing activity and fishing license sales (Table 3).

We performed a factor analysis to examine the underlying relationships between evaluation criteria and reduce the large set of criteria to a smaller set of factors accounting for the observed interrelationships in the data. We used a principal axis factoring procedure with varimax rotation (SPSS Inc. 1986). One evaluation criterion was dropped from the analysis to improve reliability and the percent of variance explained (i.e., advisory awareness among general public). The factor analysis explained 83.1% of the variance in the data. We assigned meaning to the three factors identified based on the types of evaluation criteria with the highest factor loadings on each factor (Table 4) as follows: angler awareness and recommended consumption, angler behavior, and consumption far below advisory level.

We performed a cluster analysis to group individual respondents into clusters based on their mean factor scores (SPSS Inc. 1986). Two clusters resulted. A majority (7/9) of health and environmental quality personnel

Table 3. Importance of health advisory evaluation criteria based on responses from all state agency respondents and ORSANCO (n=15), including means, standard deviations, and frequencies.

Evaluation Criteria	Mean ¹	Standard Deviation	Not				Somewhat		Very		Extremely	
			Imp.		Imp.		Imp.		Imp.		Imp.	
					Percent							
Extent of awareness of the advisory among licensed anglers.	4.5	0.7	0.0	0.0	13.3	20.0	0.0	0.0	20.0	66.7		
Extent of angler use of fish cleaning and cooking methods that may reduce contaminants consumed.	4.3	0.7	0.0	0.0	13.3	40.0	0.0	0.0	46.7			
Extent to which anglers change the target species they fish for to avoid those species more likely to accumulate contaminants.	4.3	0.8	0.0	0.0	20.0	33.3	0.0	0.0	46.7			
Extent to which anglers are aware if they are fishing in a body of water with an advisory or not.	4.2	1.0	0.0	0.0	20.0	20.0	6.7	0.0	53.3			
Extent to which anglers are aware if they are fishing for a species with an advisory or not.	4.2	1.0	0.0	0.0	20.0	20.0	6.7	0.0	53.3			
Extent to which children maintain their fish consumption at or slightly below the levels in the advisory.	4.1	0.9	0.0	0.0	35.7	14.3	0.0	0.0	50.0			
Extent to which women maintain their fish consumption at or slightly below the levels in the advisory.	4.1	1.0	0.0	0.0	42.9	7.1	0.0	0.0	50.0			

Table 3. (cont.)

<u>Evaluation Criteria</u>	<u>Mean¹</u>	<u>Standard Deviation</u>	<u>Not Imp.</u>	<u>Somewhat Imp.</u>	<u>Important Percent</u>	<u>Very Imp.</u>	<u>Extremely Imp.</u>
Extent to which anglers practice catch-and-release fishing instead of keeping the fish to eat when fishing for species affected by contaminants.	4.1	0.8	0.0	0.0	26.7	40.0	33.3
Extent to which anglers change the size of the fish they keep to avoid larger fish more likely to have accumulated contaminants.	4.0	0.8	0.0	6.7	13.3	53.3	26.7
Extent to which anglers maintain their fish consumption at or slightly below the levels in the advisory.	4.0	1.0	0.0	0.0	50.0	0.0	50.0
Extent of awareness of the advisory among the general public.	3.8	0.9	0.0	6.7	33.3	33.3	26.7
Extent to which other fish consumers (non-anglers) maintain their fish consumption at or slightly below the levels in the advisory.	3.6	1.3	7.1	7.1	35.7	14.4	35.7
Extent to which anglers change the locations they fish to avoid contaminated waters.	3.6	1.1	0.0	19.9	26.7	26.7	26.7
Extent to which women reduce their fish consumption far below the levels in the advisory.	3.4	0.9	0.0	14.3	50.0	21.4	14.3

Table 3. (cont.)

<u>Evaluation Criteria</u>	<u>Mean¹</u>	<u>Standard Deviation</u>	<u>Not Imp.</u>	<u>Somewhat Imp.</u>	<u>Important Percent</u>	<u>Very Imp.</u>	<u>Extremely Imp.</u>
Extent to which children reduce their fish consumption far below the levels in the advisory.	3.3	0.8	0.0	14.3	50.0	28.6	7.1
Extent to which anglers reduce their fish consumption far below the levels in the advisory.	3.1	0.9	0.0	21.4	57.2	7.1	14.3
Extent to which other fish consumers (non-anglers) reduce their fish consumption far below the levels in the advisories.	3.0	1.1	7.1	21.4	50.1	7.1	14.3
Extent to which fishing license sales change due to advisories.	2.8	1.5	26.7	13.3	33.3	6.7	20.0
Extent to which anglers reduce their frequency of fishing.	2.5	1.5	33.3	33.3	6.7	6.7	20.0

¹Importance was measured on a 5-point scale where 1 = not at all important to 5 = extremely important.

Table 4. Major factors identified and factor loadings for 18 of 19 health advisory evaluation criteria rated according to importance. (One criterion, which focused on general public awareness of advisories, was dropped from the analysis to improve reliability and percent of variance explained.)

<u>Evaluation Criteria</u>	<u>Angler Awareness and Recommended Consumption</u>	<u>Angler Behavior</u>	<u>Consumption Far Below Advisory Level</u>
Extent of awareness of the advisory among licensed anglers.	.56		
Extent of angler use of fish cleaning and cooking methods that may reduce contaminants consumed.		.81	
Extent to which anglers change the target species they fish for to avoid those species more likely to accumulate contaminants.		.90	
Extent to which anglers are aware if they are fishing in a body of water with an advisory or not.	.85		
Extent to which anglers are aware if they are fishing for a species with an advisory or not.	.81		
Extent to which children maintain their fish consumption at or slightly below the levels in the advisory.	.86		
Extent to which women maintain their fish consumption at or slightly below the levels in the advisory.	.89		
Extent to which anglers practice catch-and-release fishing instead of keeping the fish to eat when fishing for species affected by contaminants.	.80		

Table 4. (cont.)

<u>Evaluation Criteria</u>	<u>Angler Awareness and Recommended Consumption</u>	<u>Angler Behavior</u>	<u>Consumption Far Below Advisory Level</u>
Extent to which anglers change the size of the fish they keep to avoid larger fish more likely to have accumulated contaminants.		.77	
Extent to which anglers maintain their fish consumption at or slightly below the levels in the advisory.	.89		
Extent to which other fish consumers (non-anglers) maintain their fish consumption at or slightly below the levels in the advisory.	.83		
Extent to which anglers change the locations they fish to avoid contaminated waters.		.81	
Extent to which women reduce their fish consumption far below the levels in the advisory.			.94
Extent to which children reduce their fish consumption far below the levels in the advisory.			.94
Extent to which anglers reduce their fish consumption far below the levels in the advisory.			.83
Extent to which other fish consumers (non-anglers) reduce their fish consumption far below the levels in the advisory.			.76
Extent to which fishing license sales change due to advisories.		.76	
Extent to which anglers reduce their frequency of fishing.		.66	

(state and regional) grouped in one cluster; a majority (3/5) of fishery personnel grouped in the other cluster. As with the rating of objectives (discussed above), differences exist between fishery and health/environmental quality agencies in the importance placed on potential health advisory evaluation criteria. Fishery agencies assigned greater importance than environmental agencies to evaluation criteria associated with angler behavior and angler awareness. No pattern of state-to-state differences was observed in the cluster analysis results.

IMPACTS OF OHIO RIVER HEALTH ADVISORIES

The second objective of this study was to determine the impacts associated with Ohio River health advisories, including (1) awareness of, attitudes, and opinions about health advisories held by Ohio River Valley anglers; (2) angler behavioral changes associated with advisories; and (3) effect of urban vs. rural residence, and recent vs. distant media attention relative to advisory awareness and behavior.

Methods

Mail Surveys

We implemented two mail surveys, one each in Spring and Fall, 1992, to assess the effect of timing of advisory communications on health advisory awareness and attitudes. Samples of 2,000 resident licensed anglers for the spring survey and 3,000 resident licensed anglers for the fall survey were obtained from the six states that border the Ohio River (Fig. 2). For the spring survey, 1,000 names were taken from licenses sold in Metropolitan Statistical Areas (MSA) counties (urban) and 1,000 from licenses sold in non-MSA counties (rural). (See Appendix Table A-1 for a listing of the

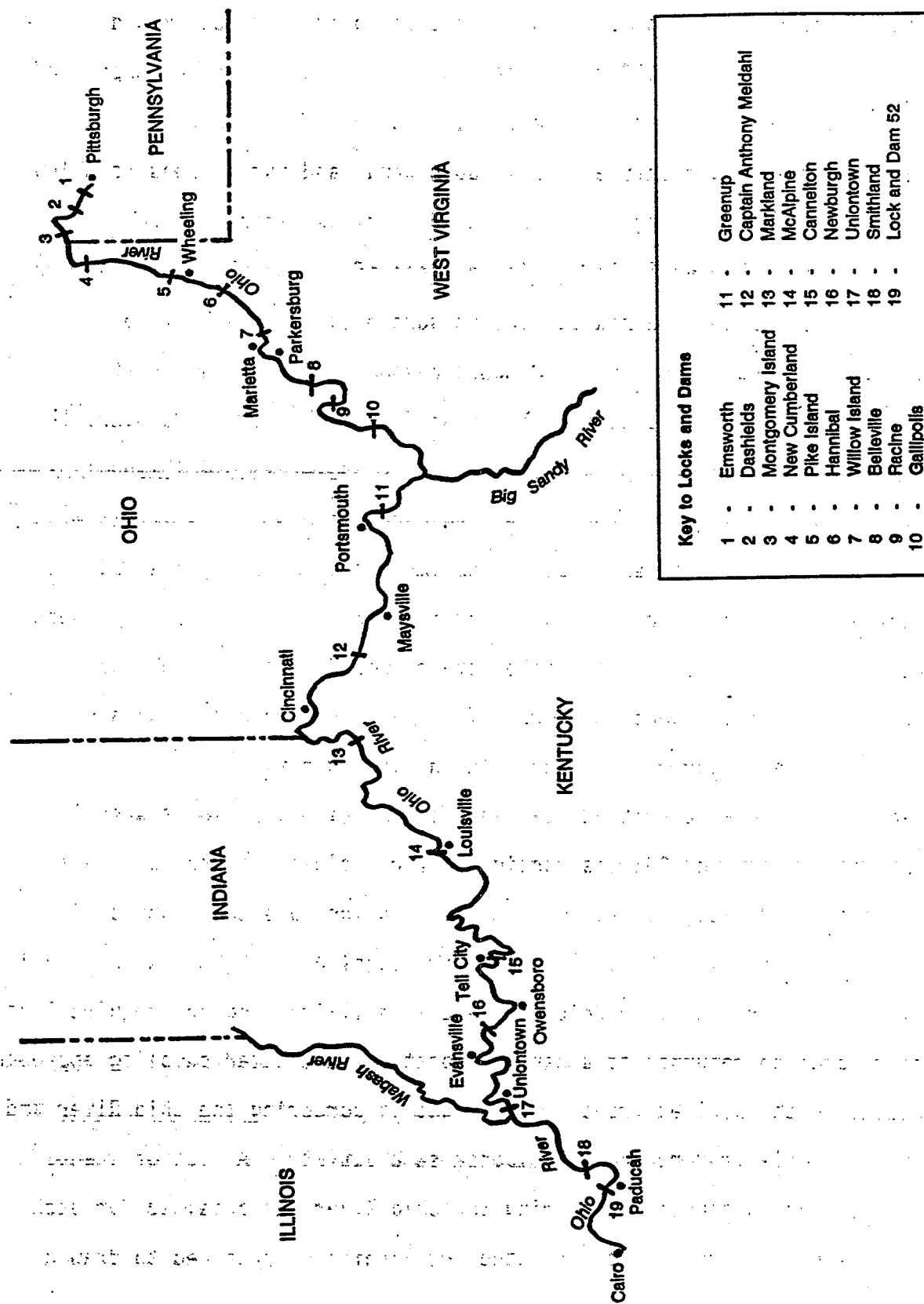


Figure 2. Map of study area.

counties.) The number of names sampled in each county was determined by the proportion of miles of Ohio River shoreline in that county. The purpose of this sampling strategy was to ensure a distribution of respondents along the river and a large enough sample size in both urban and rural areas to allow comparisons between them regarding health advisory awareness, sources of information, and other variables. The purpose of the sampling strategy for the fall survey was to obtain a sufficient sample size in each state so that statistical tests could be used to compare respondents from each state.

Originally, 500 names were to be drawn from each state. However, the number of licenses available to be sampled in Pennsylvania and Illinois was relatively small. Only 300 names were taken from each of these states with the remaining 400 names taken equally from among the remaining states. We anticipated that when the respondents from the spring and fall surveys were combined the sample size in the smaller states would be sufficient for statistical analysis. Names were drawn from each county in approximate proportion to the number of licenses sold in each county.

Any license that permitted resident fishing (i.e., resident annual, resident short-term) in 1991 was considered for inclusion in the sample (in Pennsylvania, 1990 licenses had to be used). To increase the chances of contacting anglers who fished the Ohio River, sampling was limited to counties bordering the river. Because Ohio, Indiana, and Illinois do not require that license records be returned to a central location, a cluster sampling approach was needed, which involved traveling to counties bordering the Ohio River and drawing the sample from records at license sale outlets. A list of agents selling licenses in counties bordering the Ohio River was obtained for each state. A sample of agents was contacted and permission obtained to draw a

sample from their 1991 records. For Pennsylvania, West Virginia, and Kentucky the licenses were returned to a central location and thus the entire license pool from each county could be used in selecting the sample.

We used the results from the telephone interviews with agency personnel (discussed previously), and findings from other studies, to develop a mail questionnaire to be sent to the sample of licensed anglers. The questionnaire was designed to determine the awareness of, attitudes and opinions about, and behavioral responses to current Ohio River health advisories as well as identify potential improvements to the advisories from the perspective of Ohio River Valley anglers. The questionnaire was reviewed by staff from Cornell University, USEPA, and ORSANCO. Slight modifications were made to the fall questionnaire after the spring survey was implemented. (See Appendix B for exact content and wording of both questionnaires.)

The spring survey was implemented in late April, 1992 and the fall survey in late September, 1992. Up to three follow-up mailings were sent to nonrespondents over the course of the following months. Returned questionnaires were coded and entered onto the computer using the SPSS Data Entry II software package.

Nonrespondent Follow-up

A telephone follow-up to 151 nonrespondents to the spring survey was conducted in June, 1992 and another one to 100 nonrespondents to the fall survey in November, 1992 to provide an estimate of the degree to which nonrespondents to the mail surveys differed from respondents. Previous research showed that nonrespondents fish much less than respondents and are less likely to be aware of health advisories (Brown and Wilkins 1978, Connelly et al. 1990, Connelly et al. 1992). Nonrespondents who were contacted by

telephone were considered to be representative of all nonrespondents. When respondents to the fall and spring surveys were similar, the results of the nonrespondent/respondent comparisons were pooled to increase the sample size. Thus differences that might not have been significant for the fall or spring survey were significant in the pooled sample.

Statistical Analysis

Analysis was done using the SPSSX computer program (SPSS Inc. 1986). Chi-square, t-tests, and Scheffe's test were used to test for statistically significant differences at the $P < .05$ level. Principal components factor analysis with varimax rotation and tests of reliability (Cronbach's alpha) were used to create several scales. Path analysis, a form of causal analysis, was used to test the strength of the relationships hypothesized in Fig. 1. Path analysis involves conducting a series of ordinary least squares regressions on each dependent variable in the causal diagram (Blalock 1985). The standardized regression coefficients provide a comparable measure of the strength of each hypothesized relationship.

During the printing of the spring questionnaire, 8% of the questionnaires were assembled improperly so that one page was out of order. Before analysis of the data was undertaken comparisons were made between respondents whose questionnaires had pages in the correct order and those whose questionnaires did not. A significant difference was found for three variables, so these variables from the incorrectly-ordered questionnaires were dropped from further analysis.

The fall questionnaire included an experiment with question order performed as part of a regional research methods project in which the Human Dimensions Research Unit (HDRU) is involved (Brown 1991): Analysis showed no

difference in the results based on change in question order, so no adjustments were made to the data to compensate for this experiment.

Using respondents' reported Ohio River fish catch and consumption by species, a classification system of Ohio River fish consumption based on respondents' adherence to health advisory recommendations was created. Since recommendations for consumption vary by state, the state of license purchase was used to determine the applicable health advice for each individual. A respondent was placed in the most restrictive consumption group possible. The definition of each group is outlined below:

1. "Neither Caught Nor Consumed Listed Fish". The respondent did not catch or eat any of the species listed as unsafe in the health advisory for their state of license purchase.
2. "Caught But Did Not Consume Listed Fish Above Recommended Limits". The respondent caught listed fish but did not eat them in excess of the limits recommended in the health advisory.
3. "Consumed Listed Fish Above Recommended Limits". The respondent ate at least one meal of listed fish in excess of the limits recommended in the health advisory.

Classification of respondents into these consumption categories was based on their reported behavior compared with the health advisory in effect at the time of the surveys. Briefly, the Ohio River health advisories were generally as follows (all state advisories also included recommendations for risk-reducing fish cleaning and cooking techniques):

IL: No advisory for Ohio River fish. Therefore, IL anglers were not grouped into consumption categories 2 and 3 above.

IN: Advisory recommended no consumption of Ohio River channel catfish greater than 19" length; no consumption of any channel catfish or carp for women of childbearing age; no more than 1 meal/week of channel catfish less than 19" or carp for adult men and women not of childbearing age. We did not collect data on length of fish consumed; therefore, channel catfish consumption was treated as category 3 (exceeding advisory limit) only if it exceeded 52 meals/year for men and women not of childbearing age, or if any channel catfish consumption occurred for women of childbearing age.

KY: Advisory recommended no consumption of Ohio River channel catfish, carp, white bass, paddlefish, and paddlefish eggs. Any consumption of these species was treated as category 3 above.

OH: Until Spring, 1992, the advisory recommended no consumption of channel catfish and carp caught near lock and dam areas from Greenup upstream, and no consumption of channel catfish and white bass from the Mill Creek area in Cincinnati. After Spring, 1992, the advisory recommended no consumption of channel catfish and carp from the entire river (pools and dams) from Greenup dam upstream. Because the fishing location data available from the survey was limited to the name of the lock and dam closest to the river reach fished, we treated any consumption of channel catfish and carp from Greenup upstream as category 3 above. We could not identify consumption of fish from an area as specific as Mill Creek.

- PA: Advisory recommended no consumption of carp from the Ohio River, and no consumption of channel catfish from Montgomery and Dashields locks and dams areas. We treated as category 3 above any carp consumption, and any consumption of channel catfish if the area most frequently fished was either of these two dams.
- WV: Advisory included channel catfish and carp from the Ohio River. Any consumption of these species was treated as category 3 above.

Results and Discussion: Health Advisory Impacts

Survey Response

For the spring survey, of the 2,000 questionnaires mailed, 142 were undeliverable and 841 completed questionnaires were returned. This resulted in an adjusted response rate of 45.3%. The response rate was higher in urban (MSA) counties than rural (non-MSA) counties (Table 5). For the fall survey, of the 3,000 questionnaires mailed, 262 were undeliverable and 1,269 completed questionnaires were returned. This resulted in an adjusted response rate of 46.3%. Response rate differed by state of license purchase with Kentucky being the highest and Illinois and West Virginia the lowest (Table 5).

Adjustments for Nonresponse Bias

Results of nonresponse bias comparisons confirm the conclusions of previous research (Brown and Wilkins 1978; Connelly et al. 1990, 1992) that nonrespondents fish less than respondents and are less likely to be aware of health advisories (see Appendix C). Fishing activity at locks and dams was higher among respondents than nonrespondents for the spring survey, and higher among respondents than nonrespondents for fishing activity in pools between dams for the fall survey.

Table 5. Response rates for fall and spring surveys.

	<u>Initial Sample Size</u>	<u>Undeliverables</u>	<u>Adjusted Sample Size</u>	<u>Completed Returns</u>	<u>Response Rate</u>
Spring '92	2000	142	1858	841*	45.3
Urban	1000	85	915	437	47.8
Rural	1000	57	943	402	42.6
Fall '92	3000	262	2738	1269**	46.3
Pennsylvania	300	31	269	123	45.7
West Virginia	600	47	553	233	42.1
Ohio	600	74	526	250	47.5
Indiana	600	45	555	265	47.7
Kentucky	600	47	553	278	50.3
Illinois	300	18	282	119	42.2
TOTAL	5000	404	4596	2110***	45.9

*Includes 2 responses for which the ID# was removed, so residence area could not be determined.

**Includes 1 response for which the ID# was removed, so state of purchase could not be determined.

***Includes 3 responses for which the ID# was removed, so residence area or state of purchase could not be determined.

Respondents were more likely to use a variety of sources to obtain health advisory information compared to nonrespondents. These sources included newspapers, magazines, fishing regulations guides, and friends. In the spring survey, respondents were more likely than nonrespondents to list Ohio River contaminants as a reason for not fishing the Ohio River. Respondents to the spring and fall surveys were more likely than nonrespondents to say they had taken fewer fishing trips to the Ohio River because of the health advisories, but the two groups did not differ in the percentage who had fished the Ohio River in the past five years. Based on past research, we expected that nonrespondents would have been more likely not to have fished the Ohio River, accounting for their nonresponse. However, our

follow-up mailings to slow responders stressed the importance of responding even if an angler had not fished the Ohio River, and emphasized the ease with which an angler could respond if s/he had not fished (i.e., they only had to answer a few questions). Stressing those points in the reminder mailings may account for the lack of expected difference between respondents and nonrespondents for this variable. Respondents and nonrespondents did not differ in their attitudes toward safety or risk involved with Ohio River fish consumption, or in socio-demographic characteristics. (Detailed comparisons can be found in Appendix C.)

We made adjustments for nonresponse bias to population-level estimates for the variables: awareness of the health advisory and sources of health advisory information (detailed in Appendix C). These results are presented later in the sections of the report where health advisory awareness and information sources are discussed in detail.

Determining the Population

In this study, we sought to contact people with Ohio River fishing experience. However, it was neither practical nor economically feasible to conduct a creel survey and draw a sample of only those anglers who had fished the Ohio River. Thus, some anglers with no knowledge or experience on the Ohio River were included in the sample using the license record method outlined above. It is also possible that some anglers had dropped out of Ohio River fishing because of contaminants, and we sought to determine the extent to which that occurred. To more clearly identify these two populations, we defined "Ohio River experience" as including only those respondents who had fished the Ohio River in the past five years or had eaten Ohio River fish in

the past year. Respondents who had no Ohio River fishing experience accounted for 38% of our spring sample and 44% of our fall sample.

We discuss briefly the characteristics of this group and reasons for not fishing the Ohio River below. However, the majority of the report focuses on respondents who had fished the Ohio River in the past five years or eaten Ohio River fish in the past year (62% of spring, 56% of fall respondents). Very few respondents (1%) ate Ohio River fish but did not actually fish the Ohio River; for simplicity we refer to this entire group as respondents who fished the Ohio River in the past five years.

Respondents Who Had Not Fished The Ohio River In The Past Five Years

These respondents were more likely to be older anglers and/or women than respondents who had fished the Ohio River in the past five years (detailed socio-demographic comparisons can be found in tables in Appendix D). The phenomenon of not fishing the Ohio River was greater among respondents living in Pennsylvania or Indiana, implying that anglers who live in counties bordering the river in PA and IN are less likely to fish the Ohio River than anglers in border counties in other states (Appendix Table D-1).

The majority of respondents did not fish the Ohio River because they preferred other locations or because they would not want to eat the fish due to contaminants (Table 6). Additionally, many respondents did not fish the river because they believed it is too polluted. For women and residents of Indiana (who were more likely to have not fished the Ohio River), the reason checked most frequently was that they would not want to eat the fish due to contaminants (Appendix Table D-2). Middle-aged respondents (ages 30-49) and residents of Kentucky and Ohio were also more likely to be concerned about contaminants and pollution than other respondents. For the oldest group of

Table 6. For those who have not fished the Ohio River in the past five years, percent of respondents checking various reasons for why they have not fished the Ohio River in the past five years. Respondents could check more than one reason.

<u>Reasons for not fishing the Ohio River in the past five years</u>	<u>Percent</u>
Prefer to fish other locations	58.9
Due to contaminants, wouldn't want to eat the fish	58.7
Believe the Ohio River is too polluted to fish in ^a	46.7
Don't have the necessary boat or equipment	27.9
Don't think the Ohio River has good fishing opportunities	6.9
Not interested in types of fish available	4.7
Not interested in sizes of fish available	1.7
Other	12.0

^aQuestion asked only in the fall survey.

respondents and Pennsylvania residents (also more likely not to have fished the Ohio River), concern about contaminants was checked less frequently than by other respondents. Respondents from Illinois (where no health advisory exists) were far less likely to indicate that contaminants or pollution were reasons for not fishing the river, although these were important reasons for about one-third of Illinois respondents.

Respondents could check as many reasons for not fishing as they wished. Nineteen percent of respondents who had not fished the Ohio River in the past five years listed the presence of contaminants in fish or contaminants and river pollution as the only reasons for not fishing the river. Thus, contaminants appear to be the sole reason for dissuading a substantial portion of currently-licensed anglers from fishing the Ohio River. We do not have information about potential anglers who have not purchased a fishing license due to concerns about contaminants.

Respondents Who Fished The Ohio River In The Past Five Years

Using the model developed from the Theory of Planned Behavior as a guide, the following sections focus first on the external variables of socio-demographic characteristics, information sources, and advisory awareness, then address issues of beliefs and behaviors (Fig. 1).

External Variables

Awareness. An estimated 83% of anglers (adjusted for nonresponse bias) who had fished the Ohio River in the past five years were aware of the health advisories. Approximately two-thirds of this group said they were aware of specific species or areas of the river listed in the advisories, whereas the remainder were only generally or vaguely aware of the advisories. As in other studies of health advisories (Connelly et al., 1990, 1992, 1993), awareness differed by socio-demographic characteristics. Younger respondents (ages 15-29) and those with lower incomes were less likely to be aware of the specifics of the health advisories (Table 7). Women were more likely than men to be completely unaware of the health advisories. This is an important finding because women, especially those of childbearing age, incur higher potential risks if they eat contaminated fish, due to the possibility of transferring contaminants and their effects to offspring.

State of residence was related to advisory awareness. Anglers residing in Kentucky, Indiana, and Ohio were most likely to be aware of specific advisory recommendations. At the time of this study, these three states were the only Ohio River states to publish their Ohio River advisory in the state fishing regulations guide in addition to using news releases. Kentucky also uses posted warnings at Ohio River access sites. Anglers residing in Pennsylvania were either aware of the specifics or not aware at all compared

Table 7. For respondents who fished the Ohio River in the past five years, percent who were aware of the health advisories—overall, by socio-demographic characteristics, state of residence, and time of survey.

	Aware of Health Advisories		
	No	Generally Aware Percent	Aware of Specifics
Overall	13.1	33.2	53.7
Age			
15-29	19.2	46.7	34.1*
30-39	14.4	34.4	51.2
40-49	10.6	26.0	63.4
50+	8.1	25.5	66.4
Education			
Grades 1-11	11.3	30.6	58.1
Grad. High School	14.7	30.5	54.8
Some College	13.1	38.1	48.8
Grad. College	14.8	37.0	48.2
Some Post Grad.	6.8	24.7	68.5
Income			
≤ \$20,000	15.5	34.7	49.8*
\$21,000-\$34,000	13.0	36.9	50.1
\$35,000-\$50,000	11.1	34.4	54.5
≥ \$51,000	11.3	23.3	65.4
Sex			
Male	11.4	33.4	55.2*
Female	22.8	32.8	44.4
Race			
White	12.8	33.4	53.8
Other	24.4	34.1	41.5
Residence Area			
Urban	13.5	33.0	53.5
Rural	12.8	34.0	53.2
State of Residence			
Pennsylvania	20.7	25.9	53.4*
West Virginia	19.6	35.2	45.2
Kentucky	7.7	30.7	61.6
Illinois	12.6	42.3	45.1
Indiana	10.3	34.2	55.5
Ohio	13.8	31.2	55.0
Time of Survey			
Spring '92	13.1	34.5	52.4
Fall '92	13.1	32.3	54.6

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

with anglers from other states. At the time of this study, Pennsylvania and West Virginia relied primarily on news releases to disseminate the health advisory recommendations. Over 85% of anglers from Illinois, where there is no health advisory issued, said they were aware of the health advisories. This apparent contradiction could be attributed to the fact that Kentucky (which borders the Ohio River across from Illinois) and neighboring Indiana both have Ohio River health advisories. Illinois respondents could be familiar with the KY and/or IN advisories.

Advisory awareness did not differ by urban versus rural residence. We hypothesized that awareness would be higher in the spring than in the fall, following the annual spring surge of media attention, but advisory awareness did not differ based on timing of the survey. Additionally, responses regarding how recently an angler had read or heard about the safety of eating Ohio River fish did not differ between the spring and fall surveys.

Sources of Information. The most important source of information and the one used most frequently by respondents (adjusted for nonresponse bias) was the newspaper (Table 8). It is the source whose use is correlated most highly with advisory awareness. Those using the newspaper as a source of information were more likely older, had higher incomes, and attained a higher level of education than those not using the newspaper (Appendix Table D-3). Path analysis indicated that age and income are the two significant predictors of use of newspapers (Fig. 3, Table 9). (Education was not included in this analysis because of its high correlation with income.)

Mentioned less frequently as sources of information, but still used by a plurality of respondents (adjusted for nonresponse bias) were television or radio and friends (Table 8). Friends were mentioned more frequently and

Table 8. The percent of respondents using each source of health advisory information and the mean importance of that source.

Information Sources Used to Learn About Health Advisories	Respondents	Percent Checked ^a	Mean Importance ^b
		Adjusted for Nonresponse Bias	
Newspaper article or editorial	70.2	63.0	3.5
Television or radio	60.1	NS	3.2
Friends	51.8	37.6	3.1
Fishing regulations guide	21.6	14.5	3.1
Magazine article	16.7	12.1	2.6
Warnings posted at fishing sites	10.3	NS	2.8
Newsletters from fishing clubs	4.1		2.1
Health advice brochures from government agencies	2.8		2.2
Charterboat operators or guides	2.1		1.8
Newsletters from environmental interest groups	---		2.2
Personal physician	---		2.0

^aQuestion asked only on the spring survey. Newsletters and physician were not included on the list in this questionnaire. Percents add to more than 100% because more than 1 source of information could be checked.

^bQuestion asked only on the fall survey. Importance was measured on a scale where 1 = not at all important to 5 = extremely important.

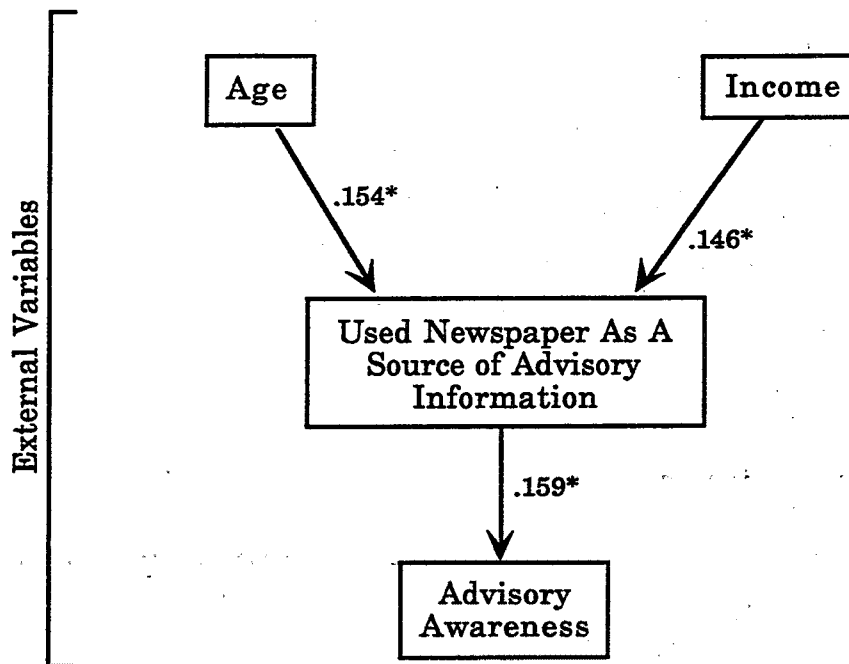


Figure 3. Path diagram of relationships between external variables, with standardized regression coefficients from an ordinary least squares regression. Asterisks indicate significant values ($p = .05$).

Table 9. Angler path analysis regression results for Fig. 3.

<u>Dependent Variable</u>	<u>Adjusted R-square</u>	<u>Independent Variable</u>	<u>N</u>	<u>Beta</u>	<u>P</u>
advisory awareness	.053	newspaper as a source of information	936	.159	.000
		constant		.300	.000
newspaper as a source of information	.046	age	823	.154	.000
		income		.146	.000
		constant		.049	.145

considered a more important source of information by younger respondents (Appendix Tables D-3 and D-4). All major sources of information except friends were more strongly associated with awareness of specific advisory information rather than general awareness, but use of friends as an information source was associated more strongly with general (not specific) advisory awareness.

Sources of information used differed by state of residence. Newspapers were cited more frequently in West Virginia, Kentucky, and Indiana than in other states (Appendix Table D-3). Television or radio was mentioned most often by Illinois residents. The fishing regulations guide was used most frequently by Ohio residents, and somewhat frequently by residents of Indiana, Kentucky, and Illinois (the IL guide includes advisories for other IL waters but not for the Ohio River). Posted warnings at fishing sites were used most frequently by Kentucky residents, but rated very important by Pennsylvania residents. Newspapers and posted warnings were considered more important sources of information in urban areas than in rural areas (Appendix Table D-4).

Respondents who used the fishing regulations guide felt most informed about the safety of eating fish (3.6 on a scale of 5); those using friends felt the least informed (3.0) (Appendix Table D-5).

Beliefs, Attitudes, and Behavioral Intentions

In this section of the report we describe how the beliefs and perceptions of Ohio River anglers relate to health advisories and fish consumption. We do not present detailed data based on socio-demographic characteristics, except where important differences were found. Detailed socio-demographic comparisons are available in Appendix D.

Beliefs. A slight majority of respondents (54%) believed that following the advisory would limit the amount of Ohio River fish they consumed, but for the majority of anglers (55%) not the enjoyment they get from Ohio River fishing (Table 10). Those fishing the Cannelton to Uniontown section of the river (see Fig. 2 for map location) were more likely to believe that following the advisory would limit their enjoyment of fishing (Appendix Table D-6).

Most respondents (59%) believed that government agencies do not really know how much contaminants are in Ohio River fish. Comparatively, 44% of respondents to a Great Lakes Basin health advisory study held a similar belief about government agencies (Connelly and Knuth 1993). This belief was more widely held among less educated respondents than those with a college degree or post graduate education, and among low to moderate income groups (Appendix Table D-6).

Most respondents (67%) disagreed with the statement that eating any fish from the Ohio River is safe. Respondents were more likely to believe that eating some types of Ohio River fish is safe, but a majority (55%) either did not hold this belief or were unsure (Table 10). The percentage of those believing that eating some types of fish was safe was highest among older respondents, males, and non-whites (Appendix Table D-7). Residents of Illinois were more likely than residents of other states to believe that eating some or any fish from the Ohio River was safe (Table 11). Illinois issues no Ohio River health advisory, although it does issue advisories for other waters in the state. Those fishing the Illinois and Indiana portions of the river from Cannelton to the river mouth were most likely to believe that eating some or any fish from the Ohio River was safe. Respondents who ate species listed in the advisories were also more likely than other respondents

Table 10. Beliefs about following the advisory and eating Ohio River fish.

<u>Beliefs About Following the Advisory and Eating Ohio River Fish</u>	<u>Agree</u>	<u>Neutral</u>	<u>Disagree</u>	<u>Don't</u>
		Percent		Know
Following Advisories Would Limit My Enjoyment of Ohio River Fishing	23.5	13.1	54.7	8.7
Following Advisories Would Limit Amount of Fish I Eat	53.8	13.0	23.2	10.0
Don't Think Government Agencies Know How Much Contaminants Are In Fish	59.2	15.9	15.0	9.9
Eating Any Fish From the Ohio River Is Safe	6.8	9.3	66.6	17.3
Eating Some Types of Fish From the Ohio River is Safe	29.5	15.9	35.9	18.7

Table 11. Opinions about whether eating some or any fish from the Ohio River is safe by state of residence, advisory awareness, timing of the survey, location fished most frequently, and fish consumption groups.

	Eating Some Types of Fish From the Ohio River				Eating Any Fish From the Ohio River			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
	Is Safe				Is Safe			
	Percent				Percent			
State of Residence								
Pennsylvania	20.7	15.5	31.0	32.8*	5.4	14.3	51.5	26.8*
West Virginia	21.8	13.5	47.2	17.5	7.1	5.3	71.2	16.4
Kentucky	30.8	18.3	34.8	16.1	7.6	12.2	68.0	12.2
Illinois	45.4	21.3	12.0	21.3	12.8	20.2	44.1	22.9
Indiana	36.2	16.2	33.0	14.6	9.8	7.6	65.2	17.4
Ohio	25.8	13.6	39.4	21.2	2.0	5.7	73.4	18.9
Aware of Health Advisories								
No	16.8	13.3	39.1	30.8*	4.9	10.4	56.9	27.8*
Generally Aware	27.4	18.4	33.6	20.6	7.3	10.3	63.4	19.0
Specifically Aware	33.9	15.6	36.1	14.4	6.1	8.2	73.1	12.6
Time of Survey								
Spring '92	25.1	18.7	37.3	18.9*	7.1	9.3	68.5	15.1
Fall '92	32.8	13.8	34.8	18.6	6.6	9.3	65.2	18.9
Location Fished Most Frequently								
Pittsburgh to Gallipolis	26.2	14.4	39.4	20.0*	5.1	6.6	72.0	16.3*
Greenup to McAlpine	28.5	16.6	39.9	15.0	5.5	8.7	69.2	16.6
Cannelton to Uniontown	43.0	16.0	26.4	14.6	11.2	15.4	59.4	14.0
Smithland to Cairo	46.2	20.4	10.8	22.6	10.9	18.5	45.8	25.0
Don't Know	21.1	16.4	40.1	22.4	7.5	11.0	63.0	18.5

Table 11. (cont.)

Fish Consumption Groups	Eating Some Types of Fish From the Ohio River				Eating Any Fish From the Ohio River			
	Is Safe				Is Safe			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
	Percent				Percent			
Catch/Eat No Listed Fish	32.9	14.1	34.7	18.3*	5.0	9.6	66.5	18.9*
Catch/Eat Listed Fish Within Limits	23.4	14.6	41.7	20.3	6.1	7.0	71.1	15.8
Eat Listed Fish Above Limits	42.1	27.7	19.3	10.9	15.1	16.8	53.0	15.1

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

to believe that eating some or any fish from the Ohio River was safe. Respondents who were aware of advisory specifics were more likely to believe that eating some types of fish was safe. Respondents to the fall survey also were more likely to believe that eating some types of fish was safe.

Most respondents believed that eating Ohio River fish posed some health risk for them. They expressed this in their responses to a series of questions asking them to evaluate the outcome of their decision to follow the advisory or to consume fish (Table 12). A majority of respondents believed that: (1) the health risks are greater than the health benefits (56%); (2) eating contaminated fish over many years increases their health risks (71%); and (3) Ohio River fish pose a health risk for them (58%). Respondents were more evenly split over whether health risks from eating fish were minor compared with other risks, although 51% either disagreed or were unsure. Many respondents never had positive thoughts and often had negative thoughts about the safety of eating Ohio River fish (Table 12).

All of the variables listed in Table 11 were considered for inclusion in a scale that measures a respondent's overall evaluation of outcomes associated with following the advisory and eating Ohio River fish. The concept of outcome evaluation is a component of the Theory of Planned Behavior. Four of the six variables, identified in Table 12, formed a single factor that explained 51% of the variance and had a reliability coefficient (Cronbach's alpha) of 0.67. These four variables were combined into one variable called the "evaluation of outcomes" scale, for which 1="health risks exist and are greater than benefits" and 5="health risks do not exist". The perception that health risks do not exist was held more strongly by older, less educated, and

Table 12. Evaluation of outcomes associated with following the advisory and eating Ohio River fish.

Evaluation of Outcomes Associated With Following the Advisory/Eating Ohio River Fish	<u>Agree</u>	<u>Neutral</u>	<u>Disagree</u>	<u>Don't</u>
	Percent			<u>Know</u>
The Health Benefits of Eating Ohio River Fish Are Greater Than the Health Risks ^a	8.0	15.9	56.0	20.1
The Health Risks From Eating Contaminated Ohio River Fish is Minor Compared With Other Risks ^a	28.1	20.8	36.5	14.6
I Don't Believe Ohio River Fish Pose A Health Risk for Me ^a	20.7	11.5	58.1	9.7
Eating Contaminated Fish Over Many Years Increases My Health Risks	71.1	7.4	8.7	12.8
	<u>Very Often or Often</u>	<u>Somewhat Often</u>	<u>Seldom</u>	<u>Never</u>
	Percent			
Had Positive Feelings About the Safety of Eating Ohio River Fish ^a	15.5	13.9	29.4	41.2
Had Negative Feelings About the Safety of Eating Ohio River Fish	43.9	12.6	23.5	20.1

^aVariable used in constructing "evaluation of outcomes" scale.

non-white respondents and respondents who live in Illinois or who responded to the fall survey (Appendix Table D-8).

Evaluation of outcomes and the belief that eating some types of fish is safe were correlated highly with both advisory awareness and concern that eating fish could be a health risk (Fig. 4). Path analysis showed that the more aware people were of the advisory the more likely they were to believe that health risks exist and that eating some types of fish is safe (Table 13).

The majority of respondents (73%) were not concerned about what others would think of them if they followed the advisories (Appendix Table D-9). Motivation to comply with important others was therefore not a strong factor in predicting advisory-related behaviors (as measured in this study) (Table 13).

Respondents were asked about a variety of factors that might have made it difficult for them to follow the advice in the health advisory. These factors included control beliefs, such as being unable to tell from the advisory which species or sizes of fish would be less affected by chemical contaminants. Six control beliefs important to a plurality of respondents were combined into one scale factor (Table 14). Each of these beliefs related to having insufficient information in the advisory to choose safer alternatives (e.g., safer locations, types or sizes of fish with less contaminants, risk-reducing fish preparation methods). Based on principal components factor analysis, the factor explained 58% of the variance and had a reliability coefficient (Cronbach's alpha) of 0.85. The variable created from the factor was compared with socio-demographic characteristics of respondents but no significant differences were found (Appendix Table D-10). One item in the factor, "couldn't tell from the advisory which types of fish have less chemicals," differed between fall and spring implementations of the survey,

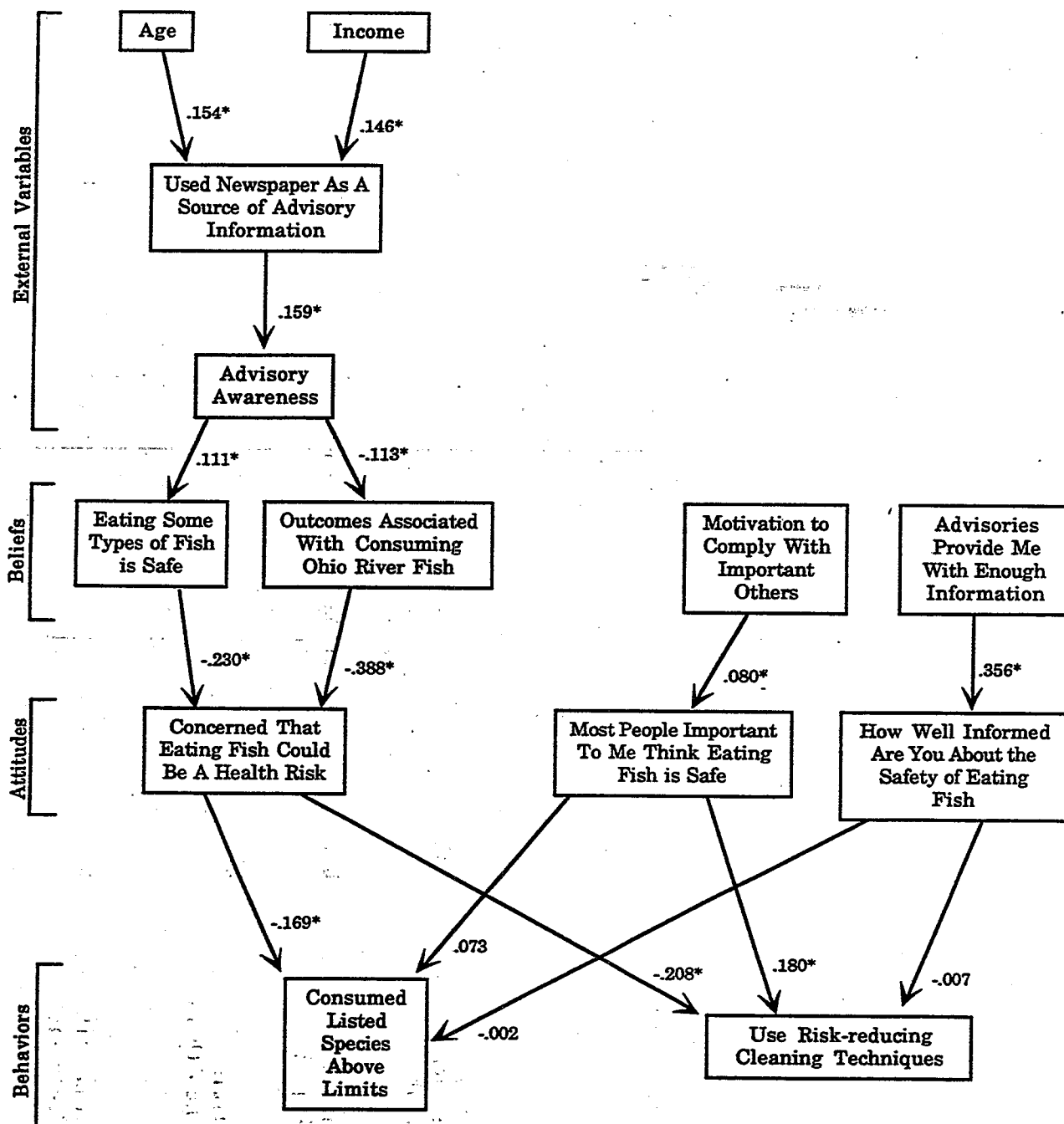


Figure 4. Path diagram of social-psychological process determining response to health advisories, with standardized regression coefficients from an ordinary least squares regression. Asterisks indicate significant values ($p = .05$).

Table 13. Angler path analysis regression results for Fig. 4.

Dependent variable	Adjusted R-square	Independent variable	N	Beta	P
consumed listed species above limits	.036	concerned that eating fish could be a health risk	847	-.169	.000
		most people important to me think eating fish is safe		.073	.052
		how well informed are you about the safety of eating fish		-.002	.952
		constant		.023	.502
use risk-reducing cleaning techniques	.101	concerned that eating fish could be a health risk	488	-.208	.000
		most people important to me think eating fish is safe		.180	.000
		how well informed are you about the safety of eating fish		-.007	.865
		constant		-.075	.092
how well informed are you about the safety of eating fish	.135	advisories provide me with enough information	932	.356	.000
		constant		.145	.000
most people important to me think eating fish is safe	.005	motivation to comply with important others	758	.080	.032
		constant		.014	.698
concerned that eating fish could be a health risk	.312	outcomes associated with consuming Ohio River fish	791	-.388	.000
		eating some types of fish is safe		-.230	.000
		constant		-.015	.598
outcomes associated with consuming Ohio River fish	.010	advisory awareness	915	-.113	.001
		constant		.028	.390

Table 13. (cont.)

<u>Dependent variable</u>	<u>Adjusted R-square</u>	<u>Independent variable</u>	<u>N</u>	<u>Beta</u>	<u>P</u>
eating some types of fish is safe	.010	advisory awareness	903	.111	.001
(see Table 9 for external variables)		constant		.004	.905

Table 14. Control belief reasons for not following the recommendations in the health advisories.

<u>Control Belief Reasons for Not Following the Advisory</u>	<u>Agree</u>	<u>Neutral</u> Percent	<u>Disagree</u>	<u>Don't Know</u>
Couldn't Tell From the Advisories Which Locations Would Have Safer Fish	41.7	17.1	21.9	19.3
Couldn't Tell From the Advisories Which Types of Fish Have Less Chemicals	38.1	13.8	33.2	14.9
Don't Know How to Catch the Types of Fish With Less Chemicals	19.4	14.9	48.6	17.1
Couldn't Tell From the Advisories What Sizes of Fish Have Less Chemicals	40.1	16.0	25.2	18.7
Couldn't Tell From the Advisories How to Clean Fish to Reduce Chemicals	39.8	16.3	23.7	20.2
Couldn't Tell From the Advisories How to Cook Fish to Reduce Chemicals	39.0	16.6	23.1	21.3

with 29% more respondents in the spring having trouble telling which species were less affected by chemicals than in the fall.

A second measure of control beliefs was a question asking if the health advisory provided the respondent with enough information to make his/her own decision about fish consumption. Approximately one-third of respondents felt the advisory provided them with enough information; one-third felt the advisory did not provide them with enough information, with the remaining one-third being either unsure or neutral. A higher percentage of men, older respondents, and nonwhites believed the advisory provided them with enough information (Appendix Table D-10). Recall that these were the same socio-demographic characteristics associated with a belief that eating some types of Ohio River fish is safe, and similar to the characteristics of those holding stronger beliefs that health risks do not exist. Respondents to the fall survey were also more likely to agree that the advisory provided them with enough information compared with spring respondents.

Attitudes. Most respondents were concerned that eating Ohio River fish was a health risk (88%), and thought it was important to follow the health advisories (71%). Respondents to the spring survey were on average more concerned that eating fish was a health risk than respondents to the fall survey. Similarly, those who caught listed species but did not consume them were more concerned than those who ate or never caught listed species (Appendix Table D-11). As expected, residents of Illinois (which issues no Ohio River health advisory) were less concerned about the health risks than residents of other states.

Respondents were asked about their perceptions of the opinions of important others (e.g., family and friends) regarding the respondent's fish

consumption and whether they followed the health advisory. These questions were intended to measure the subjective norm (see Fig. 4). The majority of respondents believed that these important others thought that they should follow the advisory (54%) and that eating fish from the Ohio River was not safe (56%). As expected, residents of Illinois and respondents who consumed species listed as unsafe were more likely to believe that important others thought eating fish was safe (Appendix Table D-12). Respondents who were aware of the advisory were more likely to think that important others thought they should follow the advisory. Men were also more likely than women to believe that important others thought they should follow the advisory.

The respondent's perceived control over his/her ability to follow the advisory was measured by two questions: (1) how informed are you about the safety of eating fish, and (2) how easy is it for you to follow the advisory recommendations. On average respondents felt somewhat informed about the safety of eating fish, and found it relatively easy to follow the advisory recommendations (Appendix Table D-13). Older respondents and men were more likely to feel informed regarding the safety of eating fish. Those that were aware of advisory specifics felt more informed and found it easier to comply with advisory recommendations than those only generally aware of the advisory.

Behavioral Intentions. A plurality of respondents (45%) believed that they follow the advice in the health advisories. Reported fish consumption patterns for 91% of this group indicated they followed the advisory. Older respondents and men were more likely to believe they followed the advice in the advisory (Appendix Table D-14). Those who were aware of advisory specifics were twice as likely as those who were generally aware or not aware to have said that they followed the advisory.

A majority of respondents (63%) would eat more Ohio River fish if health risks did not exist. Those who were aware of the health advisories were more likely to say they would eat more fish if health risks did not exist (Appendix Table D-14). Fish consumption suppression (actual consumption lower than desired consumption due to contaminants) therefore appears to exist among Ohio River anglers. We did not measure the magnitude of fish consumption suppression in this study.

A plurality of respondents (46%) disagreed with the statement that if the advisories said that only larger fish were unsafe they would eat smaller fish. Many respondents who currently catch but do not eat listed fish (56%) still would not eat the fish if the advisory said smaller fish were safe to eat. Apparently, changing the advisory to distinguish relative safety based on size of fish would not change the consumption pattern of many of those who currently practice catch and release of listed species. However, Illinois residents more than residents of any other state would be amenable to eating smaller fish if they had an advisory that said larger fish were unsafe (Appendix Table D-15).

Fishing Satisfaction. Respondents were asked to rate a list of items in terms of the importance of each item to a satisfying fishing trip, not necessarily on the Ohio River (Table 15). Over half of the respondents reported the following two items as being essential for a really satisfying fishing trip: being with friends or family (55%) and catching at least one fish (51%). The items that were least important were to catch the most fish of anyone in the group or to try out new fishing gear.

The items on the satisfaction scale were subjected to factor analysis to investigate groupings or dimensions of fishing satisfaction. Five factors

Table 15. Importance of scale items for respondents' satisfaction with a fishing trip.

<u>Factors/Items</u>	<u>Essential</u>	<u>Important</u>	<u>Somewhat Important</u> Percent	<u>Not Very Important</u>	<u>No Concern At All</u>	<u>Mean Score^a</u>	<u>Factor Loading</u>
Catching Fish							
Catching several fish	27.8	40.0	21.1	8.2	2.9	2.8	.833
Catching at least 1 fish	50.6	27.6	12.9	6.0	2.8	3.2	.754
Catching a large fish	17.4	39.1	26.9	12.7	4.0	2.5	.726
Catching the most fish	11.0	10.3	13.5	27.4	37.9	1.3	.443
Mastering Skills							
Mastering fishing skills	21.5	31.5	23.9	13.9	9.2	2.4	.848
Trying out new gear	10.2	24.1	29.9	23.8	12.0	2.0	.810
Catching a particular type of fish	17.9	30.9	20.8	15.2	15.1	2.2	.404
Eating Fish							
Fish in areas where fish are safe to eat	38.8 14.9	21.9 22.7	16.6 16.8	8.5 17.4	14.2 28.2	2.6 1.8	.851 .831
Appreciative/Affiliative							
Be with friends or family	55.3	28.7	9.3	3.7	3.0	3.3	.851
Be where scenery is pleasant	44.9	34.6	12.9	4.1	3.5	3.1	.810
Solitude/Exploration							
Fish where there are few people	19.1	36.2	24.9	12.3	7.5	2.5	.912
Explore new fishing areas	23.4	37.6	26.5	9.0	3.6	2.7	.574

^aMeasured on a scale where 4 = essential for a satisfying trip to 0 = of no concern at all.

were identified through factor analysis that explained 65.7% of the variance and had a reliability estimate of 0.75 (Cronbach's alpha). The items which loaded highest under each factor are shown in Table 15. For example, the first factor, which we named "Catching Fish," contains items related to the importance of different types of catch (e.g. catch at least one fish, several fish, large fish).

This same scale was used in a study of New York anglers in 1988 and almost identical factors were identified (Connelly et al. 1990). For New York anglers, fishing in areas where the fish are safe to eat and catching fish to eat were more important for a satisfying trip than for Ohio River anglers. For Ohio River anglers, catching a few fish was very important, but consuming them was not as important (Table 15).

Fish consumption was more important for a satisfying experience for anglers from Kentucky and Illinois and for anglers with a high school or less education (Appendix Table D-16).

As would be expected from our earlier analysis of beliefs, consumption was more important for those eating listed species than for those who caught but did not consume listed fish. This follows from our earlier finding that those eating listed species were more likely to believe that following the advisory would limit their enjoyment of fishing. For these respondents, consumption appears to be an important part of the fishing experience, one perhaps not easily given up.

Advisory-related Behaviors

Fishing Activity and Location. Most respondents appear to fish the Ohio River on a consistent basis, with 93% of those fishing the river in the past five years also fishing the river in 1991-92. (No differences were found

between respondents to the spring and fall survey implementations in terms of fishing activity even though the dates on the questions were different. Respondents from both surveys were combined because the time frame on each was a one-year period.) On average, anglers fished 31 days per year (range 1-350 days). Sixty-one percent of the days were spent in pools or river areas between dams; the remainder at or near locks and dams. About 60% of the days were attributed to fishing from shore; the remainder from boats of some type. No difference was found between urban and rural residents regarding days fished (Appendix Table D-17). Respondents from Illinois and Ohio fished the Ohio River most frequently; Kentucky residents fished least frequently.

The majority of those who were not aware of the health advisory fished the Ohio River 10 days or less in 1991-92. Fifty-nine percent of those that fished 26 days or more said they were aware of the advisory specifics. The advisory therefore appears to be somewhat successful in getting information out to those who need it most (i.e., most frequent anglers).

Anglers were sampled from the entire length of the Ohio River so it is not surprising that the percent of anglers as measured by the lock and dam fished most frequently was distributed evenly along the length of the river, with somewhat lower participation at each end of the river. This distribution was an intentional part of the sampling process and thus we cannot make any statements about the relative level of angling effort at different locations along the river.

Fish Consumption. Most respondents (95%) who fished the Ohio River in the past year reported catching at least one fish from the river, but less than half of the respondents (43%) ate any Ohio River fish. On average, fish-consuming respondents ate 19 Ohio River fish meals annually. How this

consumption was partitioned between listed species and unlisted species is discussed later in the report. The most popular fish species for both catch and consumption was channel catfish (Table 16). Channel catfish, carp, white bass, and paddlefish are listed species in at least one state's health advisory. The latter three species, however, were either caught infrequently or caught but not consumed. In fact, 92% of respondents who did not follow their state's advisory were consuming channel catfish. Thus this species seems to be the most popular and the one most often ignored based on the health advisory warnings.

Overall, 11% of respondents did not follow the recommendations of their respective state's advisory. An additional 42% caught species listed in the advisory but did not consume them in excess of the advisory recommendations; the remaining respondents did not catch or consume listed species. The latter respondents were more likely middle-aged or elderly (Table 17). Respondents from Kentucky, especially those fishing near the Uniontown, Newburgh, and Cannelton locks and dams, were two to three times more likely to consume species listed in the advisory (primarily channel catfish) than other anglers. These areas are characterized by relatively good fishing access on one or both sides of the river, which may contribute to higher catch and consumption of channel catfish (J. Schulte, ORSANCO, per. comm., May 1993; D. Bell, KYDFW, per. comm., May 1993). The ratio of number of fish meals eaten to number of fish caught was not substantially different for this river reach compared to other sections of the river, indicating the source of the high consumption of listed species is likely from sport-caught fish rather than through commercial sources (e.g., fish markets). Respondents who fished this section of the river most frequently were more likely to hold a suite of beliefs and

Table 16. Respondents' annual catch and consumption of Ohio River fish species (1991-1992).

Species	Catch by Respondents			Consumption by Respondents	
	% catching at least 1 fish	Mean # fish caught	% who caught but did not consume fish	% eating at least 1 fish meal	Mean # of fish meals eaten
Channel catfish	72.8	17.6	66.9	24.1	1.68
Largemouth bass	48.5	10.5	74.1	12.6	0.80
Sauger	39.1	14.8	67.8	12.6	0.90
Striped bass	38.8	11.5	74.0	10.1	0.48
Flathead catfish	37.9	4.0	72.6	10.4	0.42
Carp	37.3	4.1	93.1	2.6	0.11
Smallmouth bass	36.2	6.2	80.2	7.2	0.22
White bass	33.5	18.9	80.9	6.4	0.41
White crappie	30.8	9.8	49.4	15.6	0.97
Freshwater drum	29.2	4.1	93.2	2.0	0.17
Striped bass hybrids	28.7	9.4	80.5	5.6	0.29
Walleye	20.3	3.4	72.0	5.7	0.37
Spotted bass	14.7	2.4	79.6	3.0	0.09
Smallmouth buffalo	7.3	0.5	87.7	0.9	0.01
American eel	5.1	0.2	84.4	0.8	0.03
Paddlefish	3.7	0.2	67.6	1.2	0.03
Silver redhorse	1.8	<0.1	88.9	0.2	0.01
Other species	16.1	4.0	73.3	4.3	0.31
TOTAL	94.6	109.6	55.0	42.6	6.98

Table 17. Respondents' catch and consumption of listed species—overall, by socio-demographic characteristics, state of residence, time of survey, advisory awareness, days fished, location fished, and major sources of information.

	Fish Consumption Groups		
	Catch/Eat No Listed Fish	Catch/Eat Listed Fish	Eat Listed Fish
		Within Limits Percent	Above Limits
Overall	46.7	42.2	11.1
Age			
15-29	37.7	50.0	12.3*
30-39	41.7	45.0	13.3
40-49	54.6	36.3	9.1
50+	54.9	36.1	9.0
Education			
Grades 1-11	50.4	35.8	13.8
Grad. High School	45.8	42.2	12.0
Some College	44.3	44.5	11.2
Grad. College	45.3	52.0	2.7
Some Post Grad.	58.2	34.3	7.5
Income			
≤ \$20,000	44.5	42.3	13.2
\$21,000-\$34,000	44.0	44.3	11.7
\$35,000-\$50,000	46.1	43.9	10.0
≥ \$51,000	45.0	47.3	7.7
Sex			
Male	47.8	41.7	10.5
Female	40.7	44.9	14.4
Race			
White	46.0	42.8	11.2
Other	63.4	26.8	9.8
Residence Area			
Urban	46.1	44.0	9.9
Rural	47.2	40.4	12.4
State of Residence			
Pennsylvania	28.3	69.8	1.9*
West Virginia	18.5	74.9	6.6
Kentucky	21.6	42.3	36.1
Illinois	100.0	0.0	0.0
Indiana	23.5	71.7	4.8
Ohio	86.1	12.2	1.7

Table 17. (Cont.)

	Fish Consumption Groups		
	Catch/Eat No Listed Fish	Catch/Eat Listed Fish	Eat Listed Fish
		Within Limits Percent	Above Limits
Time of Survey			
Spring '92	47.8	44.9	7.3*
Fall '92	45.4	38.4	16.2
Aware of Advisories			
No	51.5	43.3	5.2
Generally Aware	48.1	40.5	11.4
Specifically Aware	44.4	44.0	11.6
Total Days Fished			
1-10	48.7	44.6	6.7*
11-25	42.8	42.8	14.4
26+	43.2	43.5	13.3
Location Fished Most Frequently			
Pittsburgh to Gallipolis	38.8	56.8	4.4*
Greenup to McAlpine	44.4	41.8	13.8
Cannelton to Uniontown	26.1	50.7	23.2
Smithland to Cairo	82.4	5.5	12.1
Don't Know	52.3	38.4	9.3
Sources of Information		Percent Checked ^a	
Newspapers	40.4	40.7	18.9
Fishing Regulations	52.4	29.3	18.3
Posted Warnings	41.5	26.8	31.7*
Television or Radio	40.8	37.8	21.5
Sources of Information		Mean Importance ^b	
Newspapers	3.5	3.7	3.1
Fishing Regulations	3.1	3.0	3.1
Posted Warnings	2.7	3.0	2.6
Television or Radio	3.1	3.4	2.9

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

^aQuestion asked on the spring survey only. Respondents could check more than one source of information.

^bQuestion asked on the fall survey only. Importance was measured on a scale where 5 = extremely important to 1 = not at all important.

attitudes implying that they did not believe that the risk existed. For example, they were less concerned about the personal risks associated with listed species consumption (Appendix Table D-11), more likely to think important others thought eating fish was safe (Appendix Table D-12), and more likely to believe that health risks do not exist (Appendix Table D-8). As noted earlier, these respondents were also more likely than others to believe that following the advisory would decrease their enjoyment of fishing.

Respondents to the spring survey were twice as likely to consume listed species as those responding to the fall survey. Although both surveys assessed annual fish consumption (but for different dates), it is possible that the spring survey respondents exhibited better recall for spring-caught species. White bass is the primary spring-caught listed species. We found no significant differences in species-specific fish consumption between spring and fall surveys, however, indicating such a possible recall bias likely did not occur. We are not aware of any events that would contribute to a lower annual consumption of listed species during Fall 1991 - Fall 1992 compared with Spring 1991 - Spring 1992.

Respondents eating listed fish beyond the limits recommended in the advisory were more likely to also eat unlisted fish species compared to respondents keeping their consumption within advisory limits (Table 18). Fish consumption as an activity appears to be important to anglers who exceed the advisory recommendations, as discussed earlier (see Appendix Table D-16), whether or not the species consumed is listed in the advisory.

Average annual consumption of listed fish species was about 11 meals/year compared with about 16 meals/year for unlisted fish species (Appendix Table D-18). Among respondents consuming listed species, men

Table 18. Percent of respondents in each fish consumption group eating unlisted species and for those eating unlisted species the average number of unlisted fish meals by fish consumption group.

<u>Fish Consumption Groups</u>	<u>% Eating Unlisted Fish</u>	<u>Average # Meals of Unlisted Fish</u>
Catch/Eat No Listed Fish	42.8*	17.4
Catch/Eat Listed Fish Within Limits	27.1	13.3
Eat Listed Fish Above Limits	80.8	17.8

*Statistically significant difference between those eating and not eating unlisted fish at $P \leq .05$ using Chi-square test.

exhibited significantly higher annual consumption of listed species than women (12.2 vs. 4.8 meals/year), and those fishing more than 25 days showed significantly higher annual consumption of listed species than anglers fishing less frequently (Appendix Table D-18). Although not statistically significant, relatively high annual consumption of listed species occurred for the oldest age group, the lowest income group, and those respondents fishing two locations most frequently (Greenup to McAlpine, Cannelton to Uniontown) (Appendix Table D-18). Among respondents consuming unlisted species, those fishing more than 25 days exhibited significantly higher annual unlisted species consumption than anglers fishing less frequently (Appendix Table D-18), indicating frequent fishers tend to be the most frequent fish consumers. Annual consumption of unlisted fish species varied little among each of the socio-demographic and behavioral categories examined.

Consumption of listed species was related via path analysis to a series of variables measuring outcome evaluations and behavioral beliefs (Fig. 4). For example, one path with significant relationships suggests that (1) older

anglers were more likely to use the newspaper as a source of health advisory information, (2) those using newspapers were more likely aware of advisory specifics, (3) those aware of advisory specifics were more likely to believe that health risks exist, (4) those believing that health risks exist were more likely to be concerned that eating fish could be a health risk, and (5) those who were concerned that eating fish could be a health risk were less likely to consume listed species above the limit. No significant relationships were found between consumption of listed species and control beliefs or normative beliefs (Table 13).

Fish Preparation Methods. Certain cleaning and cooking techniques can be used to reduce the health risks associated with contaminated fish consumption. Thirty-five percent of Ohio River anglers said they used all four risk-reducing cleaning techniques (remove back fat, remove belly fat, remove skin, fillet fish) for all fish meals they prepared. Most anglers use some of the risk-reducing cleaning techniques at least some of the time (Appendix Table D-19). Those fishing the lower stretches of the river most often were also more likely to use risk-reducing cleaning techniques more frequently. Among anglers consuming listed species beyond advisory limits, the majority used risk-reducing cleaning techniques most of the time. Those catching but not consuming listed species beyond advisory limits were the least likely to use risk-reducing cleaning techniques; since these anglers are not consuming listed species, use of these techniques is not as important from a health protection standpoint.

Use of risk-reducing cleaning techniques was related to both attitudes about the safety of eating fish and motivation to comply with important others (Fig. 4, Table 13). Concern that eating fish could be a health risk decreased

as the use of risk-reducing cleaning techniques increased, indicating personal behavior (i.e., adopting cleaning techniques) is related to magnitude of health risk concerns. Overall, as noted above, those who eat listed species beyond advisory limits are more likely to use the risk-reducing cleaning techniques than those who do not eat fish beyond the advisory limits. The magnitude of concern about the safety of eating Ohio River fish only makes a difference for those who do not eat listed fish beyond the advisory limits (Table 19). For this consumption group, those who were high in concern used fewer risk-reducing cleaning techniques than those who were lower in concern. This interaction should be investigated further in the future. One possibility is that among those who stay within the guidelines, the high concern group has done so purposely to reduce risk and sees no need to adopt other risk-reducing behavior. On the other hand, the low concern members of that group may be there more by chance than by purposely trying to avoid eating too many proscribed fish. Those who felt that important others thought eating fish was safe were more likely to use risk-reducing cleaning techniques. Control beliefs (as measured in this study) were not related to use of risk-reducing cleaning techniques.

Use of risk-reducing cooking techniques was not prevalent, even among consumers of listed species beyond advisory limits. More popular cooking methods included generally non-risk-reducing methods such as pan frying or deep frying.

Consumption of sport-caught fish, including listed species, may occur over a span of time, not just at the time the fish is caught. Over 80% of anglers who ate listed species at least sometimes freeze or can their fish for later use. This behavior may support the use of certain risk assessment

Table 19. Mean use of risk-reducing cleaning techniques for respondents exhibiting low and high concern about the safety of eating Ohio River fish by whether or not they consumed fish above advisory limits.

<u>Level of concern about the safety of eating Ohio River fish</u>	<u>Do not eat fish above advisory limits</u>	<u>Eat fish above advisory limits</u>
Low Concern	3.9 ^a	4.0
High Concern	3.0	3.9

^aUse of risk-reducing cleaning techniques was measured on a 5-point scale where 5 = all meals to 1 = no meals.

models that assume fish consumption is distributed throughout the calendar year.

Changes in Behavior as a Result of the Health Advisory. Among respondents who were aware of the health advisories, 42% said they had reduced their fish consumption because of the advisory and 13% said they had stopped consuming Ohio River fish altogether (Table 20). Taking fewer fishing trips, changing fishing location or species fished for were mentioned by one-quarter to one-third of respondents. Just over 20% said they changed cleaning methods. Use of the fishing regulations guide was associated with respondents taking fewer fishing trips and changing fishing locations (Appendix Table D-20). Over half of the respondents from Kentucky who were aware of the health advisories took fewer fishing trips because of the advisories.

Respondents who consumed listed species beyond advisory limits were more likely than those who did not to say that because of the advisory they had changed their cleaning methods and were eating less fish (Appendix Table D-20). Those who were catching but not consuming listed species beyond

Table 20. Changes made in response to the health advisories for those who were aware of the advisories.

<u>Changes Made</u>	<u>Agree</u>	<u>Neutral</u>	<u>Disagree</u> <u>Percent</u>	<u>Don't Know</u>
Take Fewer Fishing Trips	37.3	14.6	41.2	6.9
Changed Fishing Location	26.3	16.2	45.4	12.1
Changed Species of Fish ^a	26.0	17.1	43.2	13.7
Changed Cleaning Methods	22.6	16.9	38.9	21.6
Changed Sizes of Fish Eaten	17.2	18.3	46.2	18.3
Changed Cooking Methods	13.3	20.4	44.8	21.5
Eat More Fish	12.9	17.5	54.6	15.0
Take More Fishing Trips	9.0	21.6	57.8	11.6

	<u>Yes</u>	<u>No</u>
	<u>Percent</u>	
Eat Less Fish	41.8	58.2
Stopped Eating Fish	13.3	86.7

^aQuestion asked only on the fall survey.

advisory limits were more likely to say the advisory had caused them to stop consuming Ohio River fish. Almost three-quarters of those who had changed cleaning methods were using risk-reducing cleaning methods for all fish meals compared with one-third to one-half for other respondents who had not changed cleaning methods (Appendix Table D-21). Conversely, those who said they had changed cooking methods in response to the advisory were more likely to pan fry or deep fry their meals, although the Ohio River advisories recommend baking, roasting, grilling, or broiling fish and advise against frying.

Relationship of Behavior to Attitude Activation. In part, this study was intended to extend previous experimental results about attitude availability and accessibility to a more complex field situation. Previous laboratory research and theory have posited that people have existing

attitudes that can be activated to stimulate certain actions or behaviors. For example, in one relevant experiment the more environmental preservation-related beliefs and experiences a subject recalled, the more that subject's behaviors corresponded to earlier expressions of belief about environmental issues (Kallgren and Wood 1986). Other studies have also found greater consistency between attitudes and behavior when a relevant attitude about an issue is more available or accessible in memory (Snyder and Kendzierski 1982).

Very early in the survey instrument used in this study, respondents who reported fishing on the Ohio River within the past 5 years were asked to "list all information you believe to be true about the safety of eating fish caught in the Ohio River" and to "list specific actions you have taken related to the safety of eating fish caught in the Ohio River." This technique is similar to that used in several experimental studies (Wood 1982, Kallgren and Wood 1986, Wood et al. 1985).

Respondents in the spring reported significantly more thoughts than in the fall (mean thoughts spring = 3.0; fall = 2.6; $t = 2.8$; $p < .01$). Given that the health advisories were issued in the spring just before the questionnaire was mailed, this trend was expected. However, it does indicate that the advisories may be cognitively somewhat less available by fall. For the first "belief" question, about half the respondents overall listed no more than one thought; for the second "action" question, almost half reported no actions. For further analysis, responses to these two questions were summed as the total number of thoughts.

The ability of these thoughts to mediate the relationship between attitude ("concern that eating could be a health risk") and several behaviors was examined. Using a technique suggested by Snyder and Kendzierski (1982),

the correlation or point-biserial correlation between attitude and behavior was computed separately for the high and low thought groups. This analysis indicated that the greatest differences were between those who reported no thoughts and those who reported at least some thoughts. For three of the four behaviors (consumption of listed species, ceasing to eat Ohio River fish, and use of risk-reducing cleaning techniques), the magnitude of the correlation between concern and behavior for those who reported at least some thoughts was greater than those who reported no thoughts (Table 21). However, the interaction term in multiple regression indicated that this difference was only significant for the relationship between concern and adoption of risk-reducing cleaning techniques.

As discussed earlier, the more concerned the respondent, the less meals were reported for which recommended cleaning techniques were used. However, the more total thoughts the person had about beliefs and/or actions, the more likely they were to use the risk-reducing cleaning techniques ($r = .15$; $p < .001$). Earlier in this report, adoption of these cleaning techniques was noted to be highest among respondents eating listed species beyond advisory limits. A multiple regression indicated that concern, total thoughts and eating listed species beyond advisory limits were each significant independent predictors of using the recommended cleaning techniques; however, the only significant interaction was that between concern and eating listed species beyond advisory limits (see earlier section on fish preparation methods).

As in a previous experimental study (Wood 1982), respondents were asked "how well informed are you about the safety of eating fish caught in the Ohio River." Although those who wrote more "belief" and "action" thoughts were somewhat more likely to consider themselves well informed than those who had

Table 21. Correlation coefficients of four behavioral variables with concern that eating fish could be a health risk, for two thought-recall groups.

<u>Thought-recall Groups</u>	<u>Consumption of listed species</u>	<u>Ceasing to eat Ohio River fish as a result of advisories</u>	<u>Eating less Ohio River fish as a result of advisories</u>	<u>Use of risk- reducing cleaning techniques</u>
		<u>Correlation (significance)</u>		
No thoughts recalled	-.1002 (P=.192)	.1977 (P=.010)	.2691 (P<.001)	-.0979 (P=.188)
Thoughts recalled	-.2236 (P<.001)	.2418 (P<.001)	.1100 (P=.001)	-.3160 (P<.001)

few thoughts, the relationship was not great ($r = .11$, $N = 1136$; $p < .001$). In addition, a greater number of thoughts was weakly but significantly related to a greater frequency of negative feelings about the safety of eating fish caught in the Ohio River ($r = .08$, $N = 1101$; $p < .01$).

Interest in Pollution Control. For almost two-thirds of respondents the Ohio River health advisories have had the side benefit of increasing their interest in water pollution control and cleanup efforts. This was particularly true for Kentucky and Indiana residents, and those who felt newspapers were an important source of information (Appendix Table D-22). This sentiment was also significantly higher in the Cannelton to Uniontown stretch of the river, the section that exhibited the highest levels of listed species consumption beyond the advisory limits.

Communication Strategies

Although newspapers have been noted earlier in this report as a frequently used and important source of information for respondents, when asked about the best way to get information to them a plurality of respondents (43%) said the television or radio would be best. Only 26% indicated newspapers would be the best means of communication. However, preferences did differ by age: 40% of respondents age 50 or over preferred newspapers, whereas younger respondents (44-51%) preferred television or radio. The fishing regulations guide and posted warnings were mentioned less frequently by respondents (20% and 8%, respectively) as the best way to communicate health advisory information. Note, however, that respondents who used the fishing regulations guide felt most informed about the safety of eating fish, as discussed earlier.

Respondents regarded most sources of information with a relatively high degree of believability (Table 22). Those rated most believable in terms of providing information about health risks were the state fishery management agencies and the respondent's physician. No differences were found between states in terms of believability.

Conclusions and Recommendations Regarding Health Advisory Impacts

Recommendations for Agencies

As noted in an earlier section of this report, the most important objectives state/regional agencies hold for health advisories are reducing health risks and helping people make their own informed decisions about cleaning, cooking, and eating Ohio River fish. The most important evaluation criteria identified by these agencies included advisory awareness, adoption of risk-reducing fishing behaviors and fish preparation methods, and fish consumption rates at or slightly below advisory recommendations. The results from this study indicate the health advisory program has achieved success on some, but not all, of these measures.

Health advisory awareness. Awareness of the advisory among licensed anglers was generally high (83%) throughout the Ohio River valley. This level of awareness is comparable to that in the Great Lakes Basin (Connelly and Knuth 1993), although the Great Lakes health advisories (for some Lakes) have existed for over 15 years compared to the 5-year history of Ohio River advisories. Differences in advisory awareness among certain populations, however, may indicate improvements in advisory communication are warranted.

Advisory awareness (as percent of respondents aware of advisory) was lowest among anglers purchasing licenses in states using mainly news releases to disseminate advisory information, and highest in those states in which the

Table 22. Believability of sources of information regarding the potential health risks from eating Ohio River fish.

<u>Sources of Information</u>	<u>Believability</u> <u>Mean^a</u>
State fishery management agency	3.6
Your own physician	3.5
State department of health	3.3
State environmental protection agency	3.3
U.S. Environmental Protection Agency	3.3
Sportsmen's associations	3.3
Friends or family	3.1
Television reports	3.1
Environmental interest groups	2.8
Newspaper reporters	2.8
Charter boat operators	2.6

^aMeasured on a scale which ranges from 5 = extremely believable to 1 = not at all believable.

health advisory is printed in the fishing regulations guide. Those who used newspapers as an information source, however, were more likely to claim awareness of specific elements of the advisory than respondents using other sources. Although survey respondents did not choose the regulations guide as being the most effective means of communication, they did feel most informed about the safety of eating fish after reading the regulations guide. States should consider the merits of including health advisory information in the fishing regulations guide, as well as in news releases to printed, audio, and video media. Newspapers and posted warnings appeared to be particularly important in urban areas.

As a group, women were less aware of the health advisory than men. Because women are potentially at greater risk than men due to negative reproductive and developmental impacts of consuming contaminated fish, increased outreach to female anglers may be warranted. These efforts could

include increased emphasis regarding the reasons for concern about female consumption of some Ohio River fish, and different information distribution methods to target women specifically (e.g., women's health care clinics).

Adoption of risk-reducing behaviors. A suite of risk-reducing behaviors is available to potential fish consumers, including modifying the number of fish meals eaten, choosing less-contaminated fishing locations, species, or sizes of fish, and adopting contaminant-reducing fish cleaning and cooking methods. Most of the Ohio River advisories do not include recommendations based on the size of the fish, but rather present consumption advice for entire species of fish. The majority of respondents indicated they would not eat smaller fish if the advisory said only larger sizes had elevated contaminant levels. Apparently, an advisory that distinguishes edibility based on size of the fish would not change the fish consumption patterns of many of those who currently practice catch-and-release of listed species.

Most respondents used some risk-reducing cleaning techniques at least some of the time, but adoption of these methods was highest among respondents eating listed species beyond advisory limits and among those listing a high number of thoughts on the open-ended questions. The listed-species consumers also appeared to be more committed to fish consumption as an important lifestyle activity. Agencies should therefore consider emphasizing the importance of using risk-reducing cleaning techniques especially if anglers do not reduce fish consumption to recommended levels, because some anglers will be unwilling to forego fish consumption altogether. Further, because respondents listed more thoughts soon after advisories were issued than later in the year, advisory reminders later in the fishing season or posted at fishing areas may help anglers think more about the advisories. Since a

greater number of thoughts was related to greater consistency between attitudes and behaviors, stimulating such thoughts through reminders may make risk-reducing behavior more likely.

Use of risk-reducing fish cooking techniques was not prevalent, even among those who ate listed species. More attention to the benefits of using such cooking techniques, as well as instructions about the techniques may be warranted in health advisory information. Among anglers eating fish listed in health advisories in other regions, prevalent adoption of risk-reducing cleaning techniques and infrequent adoption of risk-reducing cooking techniques is not unusual (Connelly et al. 1992, Connelly and Knuth 1993).

Fish consumption patterns. Although almost all respondents who fished the Ohio River in the past year reported catching at least one fish, less than half ate any Ohio River fish. Such relatively low consumption by anglers may be of concern to agencies whose objectives include maintaining fish consumption at or slightly below the levels recommended in the health advisory. As discussed above, since the advisories pertain to only a portion of Ohio River species, it is possible the fishery resource is being underutilized in terms of human consumption. Of those eating Ohio River fish, total annual consumption was 19 meals/year, and average annual consumption of listed fish species was less than that for unlisted species (11 vs. 16 meals/year). Only about 11% of respondents did not follow the recommendations of their respective state's advisory. In certain stretches of the River, however, noncompliance with the advisory recommendations was considerably higher (e.g., Cannelton to Uniontown), indicating targeted advisory communication efforts may be warranted in these locales.

Among anglers eating listed species above the advisory limits, fish consumption was an important component of a satisfying experience. These anglers were also more likely to believe that following the advisory would limit their enjoyment of fishing. For this group, warnings to reduce fish consumption for health reasons may not be sufficient to stimulate compliance with the advisory. Rather, behavioral alternatives that still allow this important personal activity (fish consumption) to occur may be needed, such as risk-reducing preparation techniques or emphasis on eating species not listed in the advisory.

Ability to make an informed decision. The Ohio River health advisories pertain to only a portion of the harvestable fish species in the river. However, the presence of chemical contaminants in fish was an important reason for not fishing the Ohio River for over half of the respondents who had not fished the river in the past five years, and the only reason for 19% of respondents who did not fish the river. In the Great Lakes Basin, only 3% of respondents to a similar survey indicated contaminants were the sole reason for not fishing the Great Lakes (Connelly and Knuth 1993). Among respondents who fished the Ohio River, a majority did not believe eating even some Ohio River fish was safe, although this belief was held more widely among those who were familiar with the specific recommendations within the health advisory. Few respondents ever had positive thoughts about eating Ohio River fish. If state and regional agencies seek to emphasize the positive aspects of Ohio River fish and fishing, catch-and-release fishing (already practiced by a substantial portion of respondents) could be emphasized. Much more concerted communication efforts would be needed to encourage consumption of the harvestable fish species in the Ohio River that are not subject to advisories,

and would involve changing pervasive beliefs about the desirability and safety of Ohio River fish consumption. A majority of respondents (63%), however, indicated they would eat more Ohio River fish if health risks did not exist. It is possible that communicating the relatively low level of health risks associated with eating some types of Ohio River fish would result in some of these anglers harvesting and eating more of the available fishery resource.

Only about one-third of survey respondents believed the advisory provided them with enough information to make their own, informed, decision about fish consumption. A substantial portion of respondents indicated they felt they had insufficient information in the advisory to choose safer alternatives (e.g., safer fishing locations, types or sizes of fish with less contaminants, risk-reducing fish preparation methods). Although such information can be included in detail in news releases, it is limited in extent in the advisory news releases currently used by agencies. Further, agencies have little control over what the media chooses to include in articles or broadcasts stemming from the news release. The fishing regulations guide provides a more certain vehicle for including detailed advice about contaminant levels at different locations, species and sizes of fish less-affected by contaminants, and risk-reducing fish preparation methods. Diagrams depicting risk-reducing fish cleaning methods can be included in the fishing regulations guide.

Recommendations for Research

This study helped advance understanding of the social-psychological process determining response to health advisories among licensed anglers, building on Connelly et al. (1992). Several questions related to this process emerge, however.

First, Connelly and Knuth (1993) suggested that analyzing angler behavior for the "extremes" of fish consumers (i.e., highest consumers of listed species, former consumers who have ceased eating fish) would be productive in advancing behavioral models. This study demonstrated that for the highest fish consumers, fish consumption is an important and valued part of the total fishing experience. In addition, high consumption of listed species was associated with an array of attitudinal items, including attitudes about risks from fish consumption. Future research could expand understanding of these relationships, testing the behavioral response of high-consuming anglers if health advisory recommendations include an array of behaviors that still allow some consumption to occur. For example, if informed about the health risks associated with species a high-consuming angler normally catches, will information about the relatively low risks associated with other catchable species reduce consumption of the high-risk species but still allow the angler to benefit from the totality of the fishing experience? Advisories commonly include information about what species to avoid, but rarely include detailed information about safer locations and species of fish.

The Ohio River presents a useful subpopulation of anglers for such research. The anglers from the Cannelton locks and dam down to the river mouth were relatively different from other anglers in terms of higher fish consumption, stronger beliefs that health risks do not exist, and greater devotion to fish consumption as a part of the total fishing experience. Future studies might target this river reach to understand further the attitudinal, behavioral, and cultural factors influencing angler response to health advisories.

Second, this study demonstrated an association between the use of risk-reducing cleaning techniques and lower levels of personal concern about the health risks associated with consuming Ohio River fish. Future research could test the hypothesis that anglers believe they do not have to follow the fish consumption advice (i.e., number of fish meals per species) in health advisories if they use risk-reducing cleaning techniques such as filleting the fish or removing the fat. Testing this hypothesis is important for informed risk management decisions. Some contaminants (e.g., mercury) are not reduced through the use of such trimming techniques that reduce lipophilic compounds. Anglers might think they are reducing their exposure when in fact they are likely not. Further, some agencies (e.g., in Great Lakes states) are considering adopting a health advisory protocol that would assume at least some risk-reducing cleaning procedures are used when calculating contaminant exposure estimations. Ohio River agencies would potentially be affected by this protocol, since four of these agencies (IL, IN, OH, PA) also have jurisdiction for the Great Lakes and would be unlikely to institute two different protocols for fish advisory programs within the same state. Testing this hypothesis would help confirm or refute the validity of this assumption for risk management decisions.

Third, this study demonstrated that a significant portion of Ohio River anglers do not eat Ohio River fish due at least in part to their belief that the fish in the river are too contaminated to eat. The Ohio River health advisories do little to communicate the benefits of fish consumption (e.g., health, economic), even though relatively few of the Ohio River fish species are covered by the health advisories. Agencies could test the effects of communicating the relatively low risks and associated benefits of eating some

types of Ohio River fish to determine if such information results in higher harvest and greater consumption of the available fishery resource.

Other topics for future research on communication and health advisory awareness emerge from this study. Advisory awareness was highest in those states that published the health advisory in the fishing regulations guide. Pennsylvania began including its health advisory in the guide in December, 1992, after the data-gathering phase of this study was concluded. Changes in health advisory awareness among Pennsylvania anglers could be monitored to assess the effects of including this information in the regulations guide.

As in other studies, health advisory awareness and understanding differed among socio-demographic groups. Of particular concern are women and younger anglers, since these groups are likely at most risk from consuming contaminated fish due to development and reproductive problems associated with child-bearing, and due to the length of time younger anglers will experience the effects of elevated body burdens of contaminants. Agencies could implement and evaluate specific communication programs targeted to such audiences. For example, women of childbearing age could be reached through gynecological and obstetrical medical services, including both private and public clinics. Younger anglers could be reached through schools (e.g., middle and high schools, community colleges) and through social programs available to this age group. Beyond the advisory dissemination mechanism, the information in the advisory should be written specifically to appeal to the needs and interests of the target audiences.

Finally, in this study we assumed that the advisories themselves made relevant beliefs, attitudes, and behaviors more available and accessible. This increased availability and accessibility was seen as making consistency

between attitudes and behaviors more likely. However, making a behavioral decision comes relatively late in mental processing. Rather than measuring beliefs and behaviors just after anglers are informed of advisories (e.g., our first mail survey in the spring after release of the new year's advisory), future research could include a longitudinal design. Such a design would measure beliefs and behaviors in anglers prior to either (a) learning about an advisory or (b) learning about an updated advisory (as in the Ohio River study), and again after exposure to the advisories. Experimental results from other studies suggest that mentally stored beliefs and actions may influence an early stage of mental processing (e.g., Wood 1982), such as interpretation of the advisories when they are first encountered. Such a longitudinal research design would likely be most effective in situations for which new or substantially different health advisories are being released.

A SUMMARY OF RISK COMMUNICATION CONCEPTS FOR COMMUNICATING HEALTH ADVISORIES

The third objective of this study was to summarize risk communication issues agencies should consider when designing health advisory communication programs for public audiences. This section reflects the results of health advisory-related research and evaluation conducted by the HDRU over the past six years. A more comprehensive guidance document for health advisory risk communication is being prepared at the time of this writing. That document, available in July, 1994, can be requested by contacting the HDRU.

A Framework for Health Advisory Communication Programs

The Model

Communicating health advisories is a form of risk communication, a process of sharing information about perceived and potential dangers

associated with a risk. In this case, the risk is that of potentially impaired health due to consumption of fish tissue with elevated contaminant levels. The concept of "sharing" is emphasized in risk communication programs, particularly in health advisory communication programs. Health advisories are prepared and issued by a variety of government agencies, mostly health, environmental quality, and fishery management agencies at the state level, but involving other federal, tribal, regional, and local government offices (Reinert et al., 1991). Health advisory recommendations and advice are disseminated by these same agencies, by other government-affiliated groups such as Cooperative and Sea Grant Extension services, by non-government interest and advocacy groups, and through various news media. Health advisory recommendations are targeted toward a variety of people--sport anglers, subsistence fishers, actual and potential fish consumers, high-risk groups, and many different sociodemographic groups of people. Sharing information, perceptions, and understanding among these various participants is critical to successful health advisory communication programs.

Springer (1990) proposed a model that could be used to guide development of health advisory communication programs. Essentially, the model contains five elements: (1) problem analysis; (2) audience needs assessment; (3) communication strategy design; (4) communication strategy implementation; and (5) evaluation. Problem analysis includes consideration of the social, scientific, and political context of the fish contaminant issue, particularly specific articulation of the objectives to be accomplished through a health advisory communication program. Audience needs assessment includes identification of potential target audiences who should participate in the health advisory communication program, and addresses what types of information

and communication styles are appropriate for each audience. Design and implementation of the communication strategy involves constructing health advisory recommendations appropriate to the needs of the target audiences, and sharing these recommendations using dissemination mechanisms that will reach each audience of concern. Evaluation includes measurement of changes in knowledge, attitudes, and behavior among the audiences, as well as assessment of how well original health advisory objectives were met.

Problem Analysis: Objectives

Health advisories are issued by state agencies (and other organizations) for a variety of purposes. The fundamental problem driving this process is the presence of elevated levels of chemical contaminants in the tissue of some fish. How each agency or organization decides to respond to and issue recommendations about contaminated fish reflects the mandates, goals, and objectives of each agency or organization. Health advisory communication programs should be designed and evaluated with these specific objectives in mind.

A variety of objectives have been identified for health advisory communication programs (see earlier section of this report; also Knuth and Connelly 1991), including reducing human health risks, encouraging informed decisions among potential and actual fish consumers, fostering adoption of a variety of risk-reducing behaviors, encouraging support for clean-up of toxics in the environment, encouraging enjoyment of sport-fisheries, and informing people about the health and economic benefits of fish consumption. Some of these objectives may appear to be contradictory (or at least difficult to balance), such as limiting consumption of contaminated fish while encouraging people to derive the health and economic benefits associated with eating

sport-caught fish. Agencies, other organizations, and target audiences should have a clear understanding of which objectives are to be achieved through a health advisory communication program. Without such understanding, it is virtually impossible to identify the "most appropriate" health advisory recommendations and communication programs. Communicators and target audiences alike should be aware that not all participants in health advisory programs will share the same set of objectives they are hoping to achieve, leading at times to confusion or conflict.

Audience Needs Assessment

Identifying target audiences. Identification of potential target audiences for health advisory communication programs should flow from the objectives articulated during problem analysis. Audiences may include, for example, the general public if the objective is to stimulate concern for clean-up of contaminated waters, or women of childbearing age if the objective is to reduce health risks among populations most at-risk from the effects of chemical contaminants. To achieve a variety of objectives or reach a variety of audiences, usually a variety of communication strategies is needed, as described in the next section. The information needs of these audiences and the communication strategies used to convey that information may differ substantially.

For example, potential audiences may differ in the ease in which health advisory communicators can identify (and therefore contact) individual members. For some groups, such as licensed recreational anglers, individual members are identified easily and the means to reach those individuals are relatively straightforward. Licensed anglers, for example, can be contacted at the point of license purchase or by telephone or mailing address if such

information is gathered at the time the license is sold. In contrast, individuals in other groups, such as unlicensed subsistence fishers, may be very difficult to identify. Personal observation of fishing access sites or local fishing areas may be needed to assure identification of these potential fish consumers.

Assessing the information needs of only licensed anglers will be inadequate for some health advisory objectives such as those related to the general public, but will also be inadequate for objectives related to reaching the entire population of actual or potential anglers and fish consumers. In some states, for example, licenses are not required for anglers above or below certain ages, anglers with certain types of physical impairments, or anglers fishing in areas under specific private ownership. In some cases, these anglers (e.g., youth) may be among the high-risk audiences identified in health advisory program objectives. In addition, fish caught by licensed anglers may be shared with non-angling family members or friends. Care must be given during audience needs assessment to first identify the universe of target audiences necessary to reach, considering both the objectives of the health advisory communication program and the range of behavioral and sociodemographic groups of people implied by those objectives.

Audience information and communication needs. Whether information about a particular target audience is collected via a sampling of individuals within that group or observations of the group as a whole, health advisory communicators should not only identify who the target audiences are relative to the objectives to be achieved, but also what the information needs and communication needs of those audiences are. This process includes understanding what the target audiences initially know and believe about

health advisories and fish consumption, how they behave relative to fish consumption, and what information they desire. For example, awareness of existing health advisories typically increases in a given population over time, but tends to be lower among certain audiences (e.g., women, youth, those with relatively low education or low income, non-whites). Knowledge of specific health advisory concepts is variable among audiences, but has typically been highest regarding negative health effects associated with eating contaminated fish, and lowest regarding special recommendations for women of childbearing age and children. Depending on the health advisory objectives, reaching such low-awareness groups or targeting areas of generally low knowledge may take high priority for a communication program's new initiative.

Perceptions of what is important to know about health advisories and fish consumption may differ considerably between target audiences and "expert" health advisory communicators (such as health and fishery agency professionals) (Springer 1990). If communicators design communication programs based solely on their own beliefs about what audiences should know, it is likely audiences will not find the suite of information they believe they need to make an informed decision to follow or ignore the health advisory recommendations.

Types of information identified by potential target audiences as important for health advisories include the following, based on a series of studies of licensed and unlicensed anglers conducted by the HDRU: (1) specific comparisons of relatively safer/more dangerous fish species, sizes, and fishing locations; (2) description of negative health effects from eating fish; (3) health benefits of eating fish; (4) specific comparisons of health

risks from fish consumption with other, particularly dietary, risks; (5) description of risk-reducing fish cleaning and cooking methods; (6) description of chemicals of concern and their effects. In designing a health advisory communication program, communicators should assess which of these (or other) information needs are most important to their own audiences of concern.

Audience behavior. Finally, assessment of behavior among audiences of concern is necessary. Behaviors of interest include fishing and fish-eating activities, as well as use of potential information sources (e.g., fishing regulations guides, newspapers, personal communications). Understanding which information sources will be used by audiences to receive health advisory information is critical in designing a communication strategy. Understanding what behaviors fish consumers engage in is necessary in deciding what current behaviors to reinforce or to change via health advisory messages.

The series of studies by the HDRU have demonstrated a range of behavioral responses to health advisories, but most commonly these changes include eating less (or no) sport-caught fish, changing fish preparation methods, and changing species sought and locations fished. Adoption of risk-reducing cooking methods is much less prevalent among anglers. In each population studied, the likelihood of changing behavior in response to advisories is relatively lower among females, low-income anglers, young anglers, and less-educated anglers. Adherence to advisory recommendations has ranged from 80% to 47% of licensed anglers abiding by existing health advisory advice. For those who eat in excess of health advisory recommendations, fish consumption has been associated with relatively lower knowledge about the negative health effects of eating contaminated fish, certain beliefs about the severity of potential health risks associated with contaminated fish

consumption, and the use of risk-reducing fish cleaning methods.

Understanding the linkages between fish consumption behaviors, knowledge, and beliefs is important for communicators in designing a health advisory message and determining how best to send that message so it is received by specific target audiences.

Communication Strategy: Design and Implementation

Developing the advisory message. As noted above, a variety of information may be included in a health advisory beyond the specific recommended fish consumption limits. Depending on the target audience, health advisories may include information such as: (1) a description of a suite of risk-reducing behaviors beyond limiting or eliminating fish consumption (e.g., fish cleaning and cooking techniques); (2) explanations of how eating fish compares to other dietary risks; (3) description of the negative and positive health effects associated with fish consumption, with special emphasis on what groups of people are most endangered by or derive the most benefit from sport-caught fish consumption; and (4) explanation of the assumptions and uncertainty entering into the risk assessment-risk management process forming the basis for issuing health advisories. Decisions about what information to include in any advisory should reflect the self-identified needs of the target audiences as well as the objectives of the health advisory program.

Styles for presenting advisory information. Only one major study has assessed angler preferences in depth for different styles of presenting advisory information (Connelly and Knuth 1993). A clear preference was shown among Great Lakes licensed anglers for advisory information presented in a cajoling rather than a commanding tone, implying anglers wish to feel they are making the choice about fish consumption rather than being required to adopt

the health advisory advice. Other results from that study indicated a combination of text and diagrams (rather than one or the other) is likely most effective for communicating some advisory information by printed means (e.g., fish cleaning methods), and that anglers desire at least some quantitative information about the relative risks of fish consumption rather than only qualitative descriptions. Again, presentation styles should cater to the needs and abilities of the target audiences.

Advisory dissemination mechanisms. A variety of mechanisms exist by which potential fish consumers receive information about health advisories and contaminated fish consumption. These include interpersonal sources (e.g., friends, government agency professionals), mass media (e.g., newspapers, television), and specialized media (e.g., printed fishing regulations guide, health advisory brochure). This and other studies by the HDRU have demonstrated an association between the use of fishing regulations guides containing health advisory recommendations and relatively high levels of advisory awareness, knowledge, and compliance with recommendations. The highest levels of health advisory knowledge have been associated with personal communication with "experts" (i.e., professionals from state health and fishery agencies). The majority of these studies, however, have been conducted with licensed anglers.

Fishing regulations guides appear to be an effective means of disseminating health advisory recommendations to licensed anglers (although some licensed anglers do not use them), but other mechanisms are required to reach other audiences. Mechanisms accessible to other audiences of concern include newspapers, television, posted warnings at access sites or in urban areas, and specialized brochures distributed in areas used by the audiences of

concern (e.g., maternal health brochures in clinics and physicians' offices). Using mechanisms other than fishing regulations guides and brief press releases may require that agencies become more actively involved in working with mass media communicators to ensure the full thrust of a health advisory message is actually included in the newspaper or television feature. Personal contacts may be required to reach some audiences not exposed to guides or mass media, and as noted above, have been the most effective mechanism for achieving high levels of advisory knowledge and adoption of risk-reducing fish cleaning techniques.

Timing of advisory dissemination. Timing the release of health advisory recommendations will depend in part on what dissemination mechanism is chosen. For example, health advisory recommendations to be printed in the fishing regulations guide must be available at the time the guide is printed. The results of this study, however, showed that advisory reminders throughout the fishing season may cause anglers to think more about health advisories, and lead to compliance with advisory recommendations. Anglers who consult their fishing regulations guide regularly receive these ongoing reminders. For other audiences, ongoing features about fish consumption and contaminants during the fishing season may stimulate more awareness and therefore more compliance with advisory recommendations.

Evaluating the Communication Program

As noted earlier, the means used and information collected when evaluating a health advisory communication program should reflect, at least in part, the health advisory program objectives for which the communication program was designed. Two basic types of evaluation are possible, formative and summative evaluations.

Formative evaluations of health advisory communication programs focus on the process of communication, assessing whether the communication program is being carried out as intended. Questions addressed include, for example: (1) Do the dissemination mechanisms being used match the needs identified for each audience?; (2) Are the media contacts planned actually being used and maintained?; (3) Is the information intended for the health advisory actually included in the various advisory dissemination mechanisms? Formative evaluation can be an ongoing process of monitoring implementation of the health advisory communication program, and can help identify necessary changes in program implementation.

Summative evaluations of health advisory communication programs focus on the outcomes produced through the communication process. Health advisory program objectives serve as a basis for this evaluation. Evaluators assess whether or not objectives were achieved, or whether outcomes were accomplished that were prerequisite to objectives being achieved. As noted earlier, summative evaluation may include a range of measurements of awareness, knowledge, beliefs, and behaviors among fish consumers, depending on the program objectives. Measurements should be collected for each of the audiences of concern to assess the success of the communication program in meeting the program objectives for each of the audiences. What constitutes "success" in summative evaluations may change over time. For example, a 50% level of advisory awareness may be quite acceptable following the first year an advisory is issued, but undesirable after an advisory has been in effect for several years. Conducting summative evaluations over time builds an evaluation information base that helps the communicator identify successes and areas needing improvement based on the measurement trends.

During the formative or summative evaluation processes, new communication issues or problems or previously unidentified audiences or audience needs may surface. When this happens, the health advisory communication program cycles back to the initial steps of the process, problem analysis and audience needs assessment. Revised communication strategies may result.

Summary

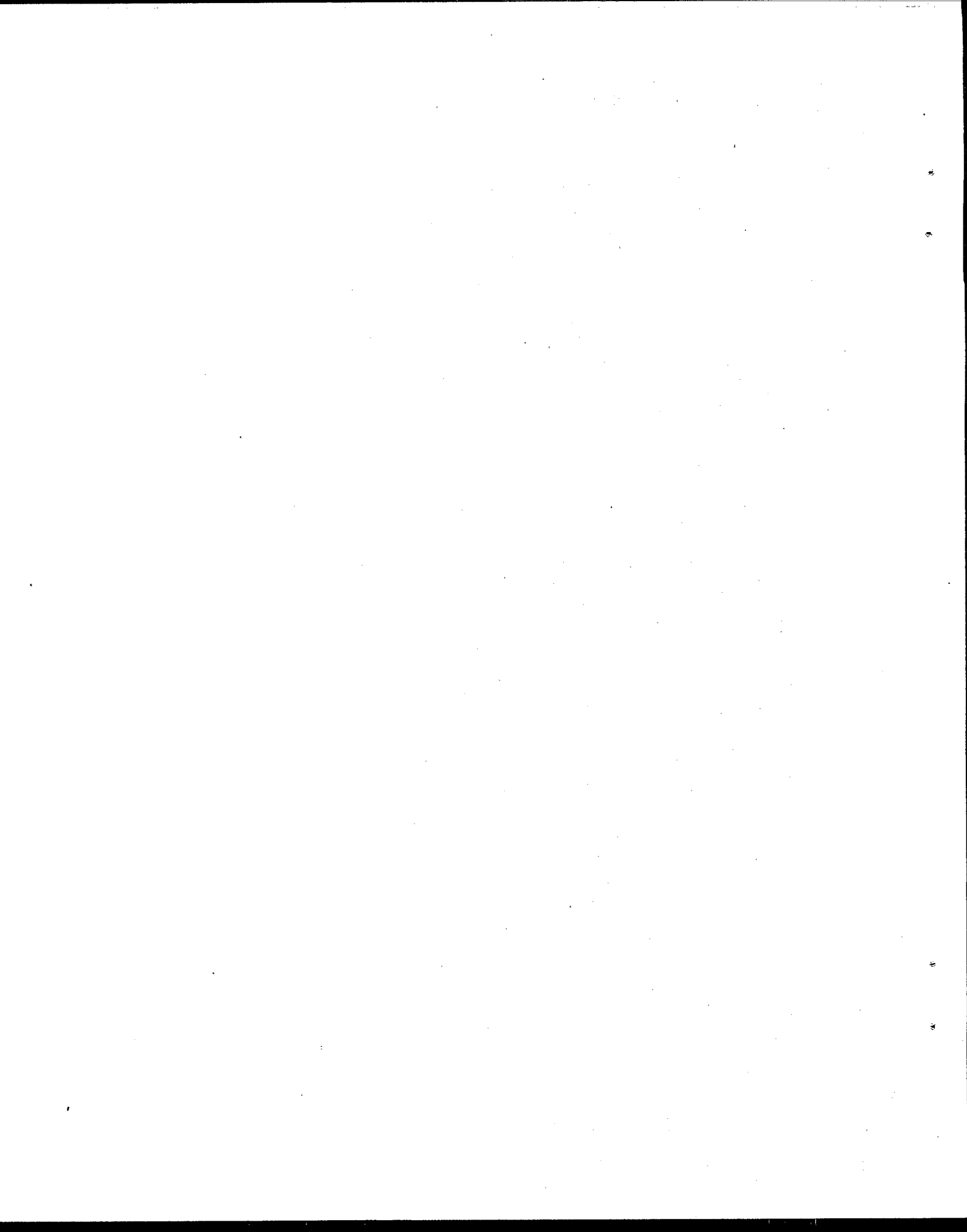
This and other studies of health advisory communication programs and response by fish consumers shed light on the relationships between information, knowledge, beliefs, and behavior. An important finding from each of these studies is that fish consumers do not belong to a monotypical audience. Variations in beliefs, behaviors, and abilities demand attention by communicators to specific target audiences. Communicators can gather original information specific to their local audience needs, or draw from the information on audience trends documented in studies of anglers, fish consumers, and health advisories conducted by the HDRU and others. The result should be improved health advisory communication programs, human health, and sport-fisheries.

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APPENDIX A:**Listing of MSA and non-MSA counties**

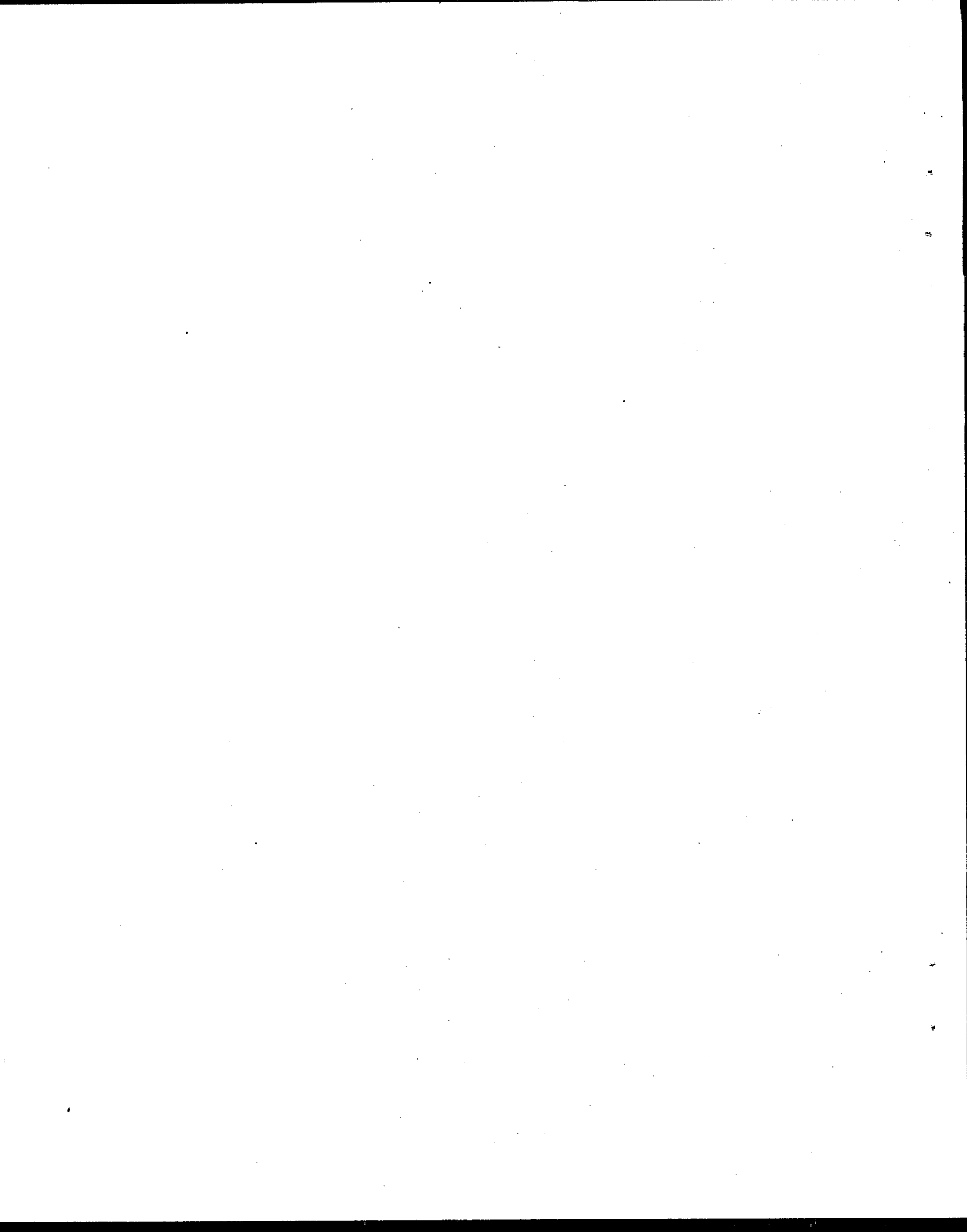


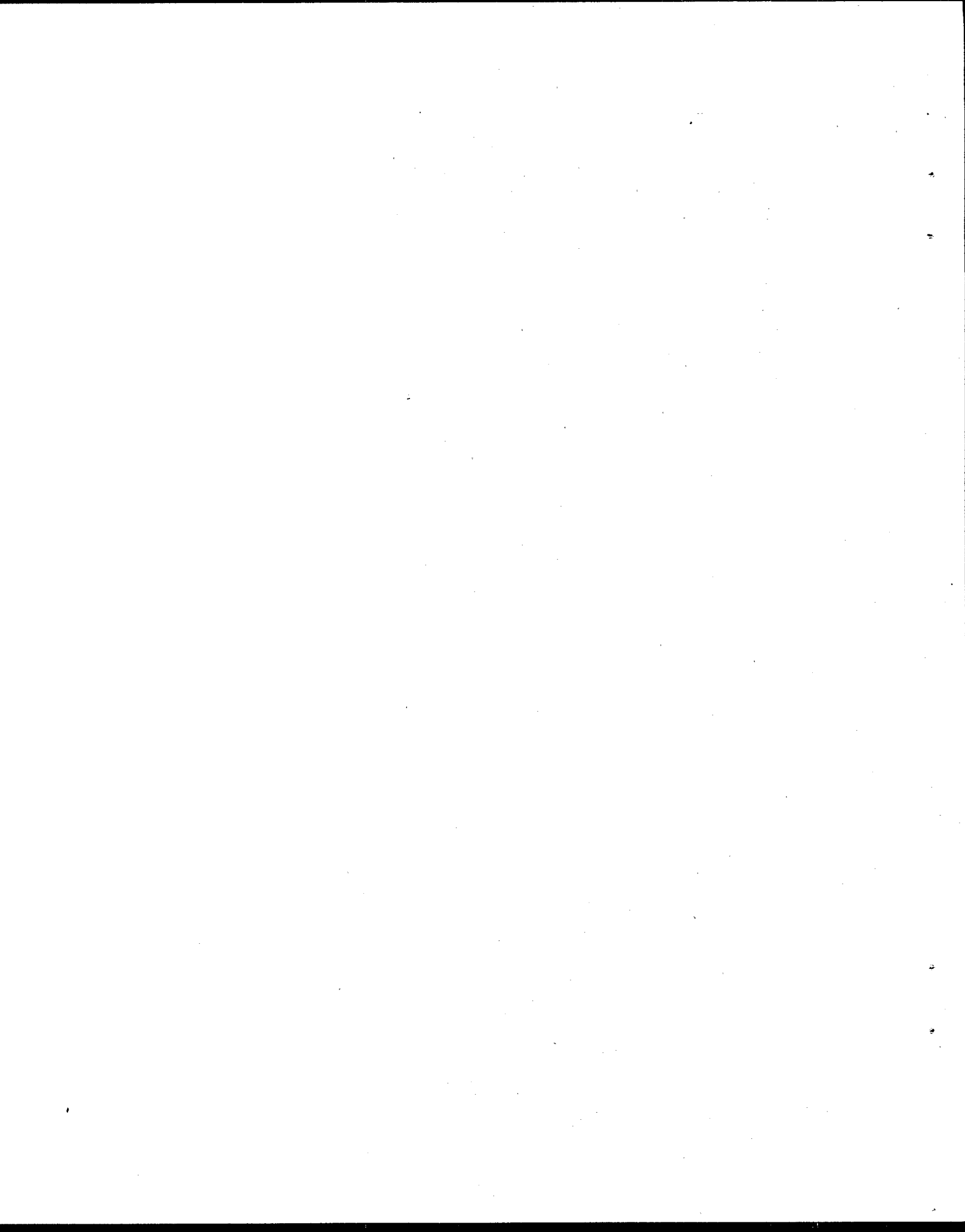
Table A-1. Listing of MSA and non-MSA counties by state, used in spring sample selection procedure.

<u>State</u>	<u>MSA Counties</u>	<u>non-MSA Counties</u>
Pennsylvania	Allegheny Beaver	
Ohio	Jefferson Belmont Washington Lawrence Clermont Hamilton	Columbiana Monroe Athens Meigs Gallia Scioto Adams Brown
Indiana	Dearborn Clark Floyd Harrison Warrick Vanderburgh Posey	Ohio Switzerland Jefferson Crawford Perry Spencer
Illinois		Gallatin Hardin Pope Massac. Pulaski
Kentucky	Henderson Daviess Bullitt Jefferson Oldham Boone Kenton Campbell Greenup Boyd	Ballard McCracken Livingston Crittenden Union Hancock Breckinridge Meade Trimble Carroll Gallatin Pendleton Bracken Mason Lewis

<u>State</u>	<u>MSA Counties</u>	<u>non-MSA Counties</u>
West Virginia	Wayne Cabell Wood Marshall Ohio Hancock	Mason Jackson Pleasants Tyler Wetzel Brooke

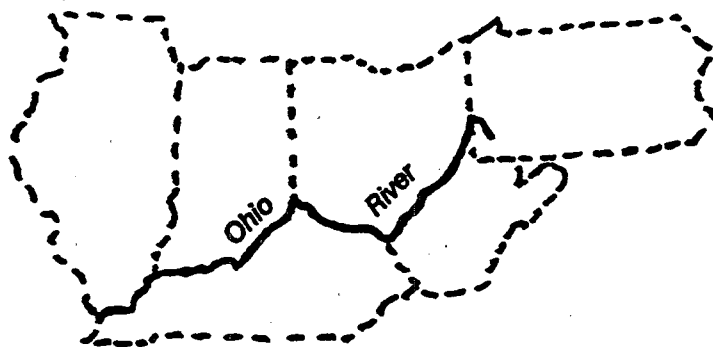
APPENDIX B:

Spring and Fall Mail Questionnaires



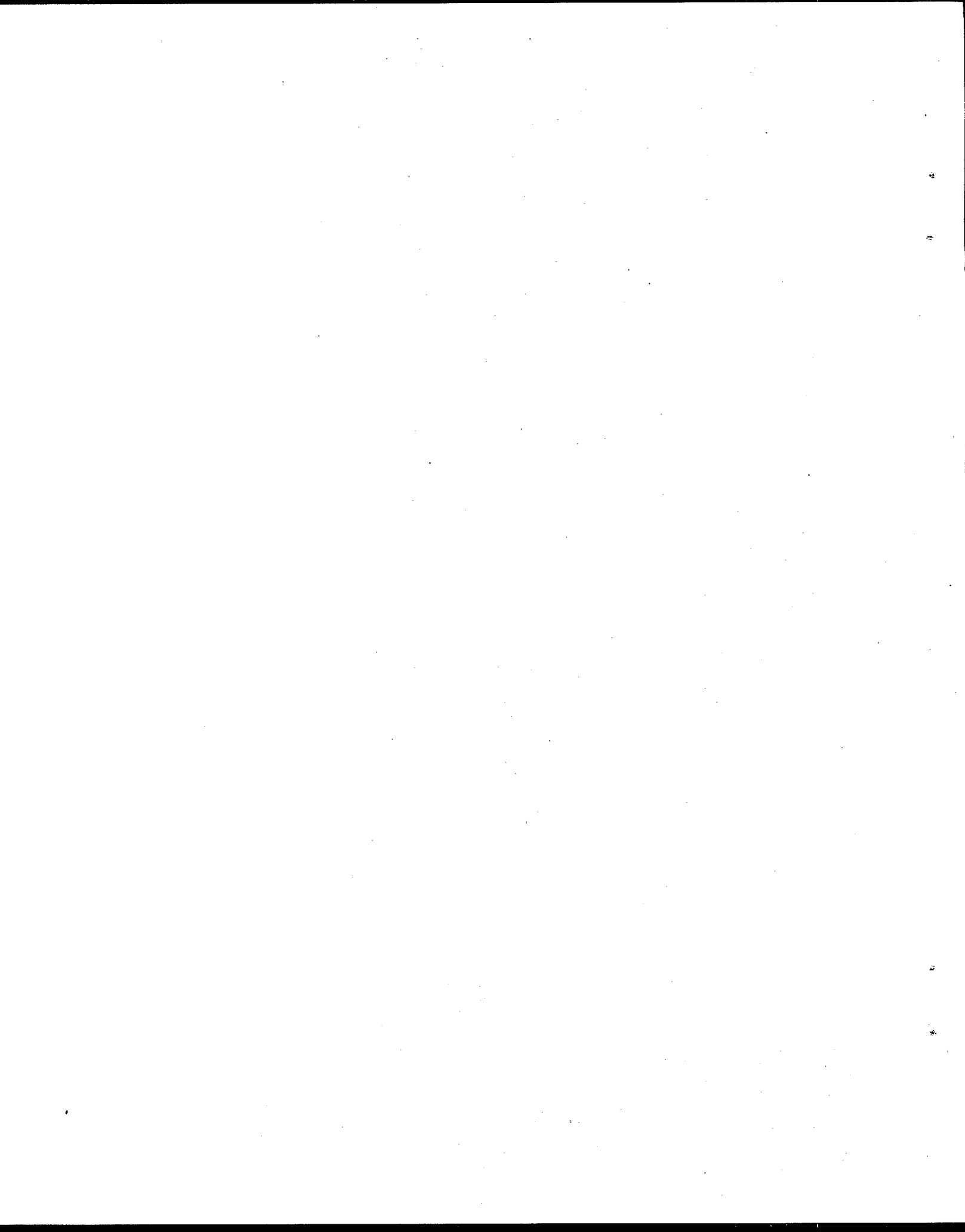
SPRING SURVEY INSTRUMENT

**A SURVEY OF
OHIO RIVER VALLEY
ANGLERS**



Human Dimensions Research Unit
Department of Natural Resources
College of Agriculture and Life Sciences
Cornell University, Ithaca, NY 14853





A SURVEY OF

OHIO RIVER VALLEY ANGLERS

Research conducted by the
Human Dimensions Research Unit
In the Department of Natural Resources

College of
Agriculture and Life Sciences
Cornell University

Sponsored by the United States Environmental
Protection Agency

In cooperation with the
Ohio River Valley Water Sanitation Commission (ORSANCO)

The purpose of this survey is to learn more about freshwater fishing along the Ohio River. We are interested in the activities and opinions of anglers related to fishing and eating fish from the Ohio River. Your answers will help improve the process of advising anglers about the safety of eating freshwater fish taken from the Ohio River.

Please complete this questionnaire at your earliest convenience, seal it, and drop it in any mailbox (no envelope is needed). Return postage has been provided. Your responses will remain confidential and will never be associated with your name.

THANK YOU FOR YOUR ASSISTANCE!



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1. Have you gone fishing on the Ohio River within the past 5 years?
(Check one)

___ Yes (SKIP TO QUESTION 2A)

___ No → Why not? (Check any important reason; you may check more than 1 reason):

- ___ I do not have the necessary boat or equipment
- ___ I would not want to eat the fish due to contaminants
- ___ I do not think the Ohio River has good fishing opportunities
- ___ I am not interested in the sizes of fish available to be caught
- ___ I am not interested in the types of fish available to be caught
- ___ I prefer to fish other locations
- ___ Other (Please list: _____)

If you have not fished the Ohio River in the past 5 years and have not eaten Ohio River fish in the past year, please SKIP TO QUESTION 19.

2a. How many days did you fish each of the following areas of the Ohio River between April 1, 1991 and March 31, 1992? (Count any part of a day as a whole day; Write 0 for those areas you did not fish.)

I fished pools or river areas between dams about _____ days.
I fished at or near locks and dams about _____ days.

If you did not fish the Ohio River between April 1, 1991 and March 31, 1992, SKIP TO QUESTION 3.

2b. Which lock and dam on the Ohio River is closest to the location where you did most of your Ohio River fishing between April 1, 1991 and March 31, 1992? (Write the name or location of the lock and dam.)

_____ Check here if you don't know

- 2c. How many days did you fish from shore or from a boat on the Ohio River between April 1, 1991 and March 31, 1992? (Count any part of a day as a whole day.)

I fished from shore (or a pier or dock) about ____ days.
I fished from a boat (or canoe or raft) about ____ days.

3. On the chart below, please list the number of Ohio River fish you personally caught and/or ate this past year (April 1, 1991 to March 31, 1992). In the first column, list how many of each fish you caught. In the second column, list how many fish meals you ate whether you or someone else caught the fish. (If you can't remember the number, but know you caught or ate some put a "?" on the appropriate line.)

	Number Caught	Number of Fish Meals
American eel	_____	_____
Carp	_____	_____
Channel catfish	_____	_____
Flathead catfish	_____	_____
Freshwater drum	_____	_____
Largemouth bass	_____	_____
Paddlefish	_____	_____
Sauger	_____	_____
Silver redbreast	_____	_____
Smallmouth bass	_____	_____
Smallmouth buffalo	_____	_____
Spotted bass	_____	_____
Striped bass	_____	_____
Walleye	_____	_____
White bass	_____	_____
White crappie	_____	_____
Other	_____	_____

For the next 2 questions, you will be asked to write down some thoughts. If you find that more than about 20 seconds pass without thinking of anything, go on to the next question. It is okay to leave space blank if you don't think of anything. There are no right or wrong answers. Once you've gone on to another question, please do not go back to these questions even if you think of more. We are interested in what you think about without any further prompting.

4. On the lines below, please list all information you believe to be true about the safety of eating fish caught in the Ohio River. Write your ideas down in any order. Some people write a lot of thoughts, some people very few. If more than about 20 seconds pass without thinking of anything, go on to the next question. Please write only one idea on each line. If there are more lines than you need, leave some blank. Once you've gone on to the next question, please do not return to this item even if you think of more.

Remember, please do not turn back to these questions once you have gone on to Question 6.

8. How often are your household's Ohio River fish meals prepared or cooked in the following ways? Circle one number for each item to best describe how your household prepares or cooks Ohio River fish meals. SKIP TO QUESTION 7 if your household does not eat fish caught in the Ohio River.

1=No meals; 2=Few meals; 3=Some meals; 4=Most meals; 5=All meals

	No meals	All meals
a. Remove the strip of fat along the back of the fish	1	2
b. Remove belly fat	1	2
c. Remove the skin	1	2
d. Eat whole, gutted fish	1	2
e. Fillet the fish	1	2
f. Pan fry	1	2
g. Deep fry	1	2
h. Make fish soups or chowders	1	2
i. Bake, roast, broil, or grill fish	1	2
j. Microwave fish	1	2
k. Reuse oil or fat from cooking fish	1	2
l. Eat frozen or canned fish caught at an earlier time	1	2

7. Some Ohio River states issue fish consumption health advisories. The advisories let people know how to limit their exposure to chemical contaminants by limiting the amount of some types of fish they eat. Only some types of fish and some areas of the River are affected by health advisories.

Prior to this survey, were you aware of health advisories issued for fish caught from the Ohio River? (Check one.)

_____ **YES, aware of advisories for certain types of fish and/or areas of the River**

_____ **YES, generally or vaguely aware**

NO (SKIP TO QUESTION 12)

8a. Which of the following information sources made you aware of the health advisories? (Please check all that apply.)

- ☐ a. Newspaper article or editorial
☐ b. Magazine article
☐ c. Fishing regulation booklet distributed with fishing license
☐ d. Newsletters from fishing clubs
☐ e. Warnings posted on waters that I fish
☐ f. Health advice brochures available by special request
☐ g. Friends
☐ h. Television or radio
☐ i. Charterboat operators or guides

8b. If your state government decided to make a greater effort to let people know about Ohio River health advisories, which one of the sources listed above would be the best one to use to get information to you?

_____ Please write one letter from the list above.

9. Below are some changes you may have made since learning about the Ohio River health advisories. Please indicate how strongly you agree or disagree with each statement. (Circle one number for each item.)

- 1=Strongly agree
 2=Agree
 3=Neutral
 4=Disagree
 5=Strongly disagree
 6=Don't know

- | | Strongly Agree | Strongly Disagree | Don't Know |
|---|----------------|-------------------|------------|
| a. I eat more Ohio River fish now because I feel more confident that I can choose the safer fish. | 1 | 2 3 4 5 | 6 |
| b. I have changed the ways I clean Ohio River fish before eating them. | 1 | 2 3 4 5 | 6 |
| c. I have changed the ways I cook Ohio River fish before eating them. | 1 | 2 3 4 5 | 6 |
| d. I have changed fishing locations because of the advisories. | 1 | 2 3 4 5 | 6 |

Strongly Agree

Strongly Disagree

Don't Know

- e. I take fewer Ohio River fishing trips since learning about the advisories. 1 2 3 4 5 6
 f. I take more Ohio River fishing trips now because I can choose areas with less serious contaminant problems. 1 2 3 4 5 6
 g. I have changed the sizes of Ohio River fish I eat because of the advisories. 1 2 3 4 5 6

10. For each type of fish, please circle the number that best describes the change you made in the amount of Ohio River fish you eat because of the advisories. Circle 5 if you have never eaten that type of Ohio River fish.

	Stopped Eating	Decreased Amount	No Change	Increased Amount	Never Ate
American eel	1	2	3	4	5
Carp	1	2	3	4	5
Channel catfish	1	2	3	4	5
Fathead catfish	1	2	3	4	5
Freshwater drum	1	2	3	4	5
Largemouth bass	1	2	3	4	5
Paddlefish	1	2	3	4	5
Sauger	1	2	3	4	5
Silver redhorse	1	2	3	4	5
Smallmouth bass	1	2	3	4	5
Smallmouth buffalo	1	2	3	4	5
Spotted bass	1	2	3	4	5
Striped bass	1	2	3	4	5
Walleye	1	2	3	4	5
White bass	1	2	3	4	5
White crappie	1	2	3	4	5

11. Below are some reasons that may have made it difficult for you to follow the recommendations in the Ohio River health advisories. Please indicate how strongly you agree or disagree with each statement. (Circle one number for each item.)

1=Strongly agree
2=Agree
3=Neutral
4=Disagree
5=Strongly disagree
6=Don't know

	Strongly Agree	Strongly Disagree	Don't Know
a. I have never eaten very many Ohio River fish.	1	2 3 4 5	6
b. I don't believe Ohio River fish pose a health risk for me.	1	2 3 4 5	6
c. I couldn't tell from the advisories which locations would have safer fish in them.	1	2 3 4 5	6
d. I couldn't tell from the advisories which types of fish have less chemicals in them.	1	2 3 4 5	6
e. I don't know how to catch the types of fish that have less chemicals in them.	1	2 3 4 5	6
f. I couldn't tell from the advisories what sizes of fish have less chemicals in them.	1	2 3 4 5	6
g. I couldn't tell from the advisories how to clean my fish in a way that reduces chemicals in them.	1	2 3 4 5	6
h. I couldn't tell from the advisories how to cook my fish in a way that reduces chemicals in them.	1	2 3 4 5	6
i. I'm concerned about what other people might say or think about me if I followed the advisories.	1	2 3 4 5	6

12. Please rate how believable you think each of the following is as a source of information about the potential health risks from eating Ohio River fish. (Circle one number for each information source.)

	Not At All Believable	Moderately Believable	Extremely Believable
a. U.S. Environmental Protection Agency	1	2	3 4 5
b. State Departments of Health	1	2	3 4 5
c. State Departments of Environmental Protection	1	2	3 4 5
d. State Departments of Fisheries Management	1	2	3 4 5
e. Sportsmen's associations or clubs	1	2	3 4 5
f. Charter boat operators or guides	1	2	3 4 5
g. Environmental interest groups	1	2	3 4 5
h. Newspaper reporters or writers	1	2	3 4 5
i. Television reports	1	2	3 4 5
j. Your own physician	1	2	3 4 5
k. Friends or family	1	2	3 4 5


13. How well informed are you about the safety of eating fish caught in the Ohio River? (Circle one number.)

Very well Informed	Somewhat Informed	Slightly Informed	Not At All Informed
1	2	3	4 5

14. In the last month, how often have you: (Circle one number for each item.)

	Very Often	Somewhat Often	Seldom	Never
a. Thought about the safety of eating fish caught in the Ohio River?	1	2	3	4 5
b. Had positive feelings about the safety of eating fish caught in the Ohio River?	1	2	3	4 5
c. Had negative feelings about the safety of eating fish caught in the Ohio River?	1	2	3	4 5

15. Before receiving this questionnaire, when was the last time you did each of the following? (Check the most recent box for each item.)

When was the last time you 	In the past two days	In the past week	In the past month	In the past 3 months	More than 3 months ago	Never
Went fishing in the Ohio River?						
Went fishing somewhere other than the Ohio River?						
Made plans to fish in the Ohio River?						
Shopped for fishing gear for the Ohio River?						
Ate fish from the Ohio River?						
Read or heard about the safety of eating fish caught in the Ohio River?						
Talked with others about the safety of eating fish caught in the Ohio River?						

16. How concerned are you personally that eating Ohio River fish could be a health risk to you or members of your immediate family? (Circle one number.)

Very Concerned Somewhat Concerned Slightly Concerned Not at All Concerned Don't Know

1 2 3 4 5

17. Think of the type of fishing trip you enjoy the most. (It does not have to be a trip on the Ohio River.) How important are the following factors to making the fishing trip a really satisfying experience for you? (Circle one number for each item.)

0 = Of no concern at all
 1 = Not very important
 2 = Somewhat important
 3 = Important but not essential
 4 = Essential for a really satisfying trip

	No Concern				Essential			
a. Catching several fish	0	1	2	3	4			
b. Catching a large fish	0	1	2	3	4			
c. Catching at least one fish	0	1	2	3	4			
d. Catching a particular type of fish	0	1	2	3	4			
e. Being with friends or family	0	1	2	3	4			
f. Being where the scenery is pleasant	0	1	2	3	4			
g. Fishing in areas where I know the fish are safe to eat	0	1	2	3	4			
h. Trying out new fishing gear	0	1	2	3	4			
i. Mastering fishing skills	0	1	2	3	4			
j. Catching the most fish of anyone in my group	0	1	2	3	4			
k. Catching fish to eat	0	1	2	3	4			
l. Fishing where there are few other people	0	1	2	3	4			
m. Exploring new fishing areas	0	1	2	3	4			

18. Please indicate how strongly you agree or disagree with the following statements. (Circle one number for each item.)

- 1=Strongly agree
2=Agree
3=Neutral
4=Disagree
5=Strongly disagree
6=Don't know

	Strongly Agree	1	2	3	4	5	6	Strongly Disagree	Don't Know
a. The Ohio River health advisories provide me with enough information to decide whether or not to eat certain fish.		1	2	3	4	5	6		
b. The Ohio River health advisories have increased my interest in water pollution control and cleanup efforts.		1	2	3	4	5	6		
c. Eating some types of fish caught in the Ohio River is safe.		1	2	3	4	5	6		
d. Eating any fish caught in the Ohio River is safe.		1	2	3	4	5	6		
e. The health benefits of eating Ohio River fish are greater than the health risks.		1	2	3	4	5	6		
f. The health risk from eating contaminated Ohio River fish is minor when compared with other risks I'm exposed to.		1	2	3	4	5	6		
g. Eating contaminated fish over many years increases my health risks.		1	2	3	4	5	6		
h. I would eat more Ohio River fish if health risks from chemical contaminants did not exist.		1	2	3	4	5	6		
i. I follow the advice in the Ohio River health advisories.		1	2	3	4	5	6		
j. Most people who are important to me think eating fish from the Ohio River is safe.		1	2	3	4	5	6		
k. I don't think government agencies really know how much chemical contaminants are in fish.		1	2	3	4	5	6		
l. Most people who are important to me think I should follow the health advisory recommendations about eating fish caught in the Ohio River.		1	2	3	4	5	6		

19. In what year were you born? 19 ____

20. Are you male or female? ____ Male ____ Female

21. Which of the following best describes the area where you currently live? (Check one)

- ☐ Rural town or village (under 5,000 population)
☐ Small city of 5,000 to 24,999 population
☐ City of 25,000 to 99,999 population
☐ Large city of 100,000 population or over

22. How many years of school did you complete, counting 12 years for high school graduation, and 1 year for each additional year of college, technical, or vocational training?

____ years

23. Please circle your approximate 1991 TOTAL HOUSEHOLD INCOME before taxes, in thousands of dollars:

- 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 22 24 26 28 30 32 34 36 38 40 45 50 55
60 65 70 75 80 More than 80

24. What is your race?

- ☐ White, not of Hispanic origin
☐ White, of Hispanic origin
☐ Black or African American
☐ Asian or Pacific Islander
☐ Native American Indian
☐ Other

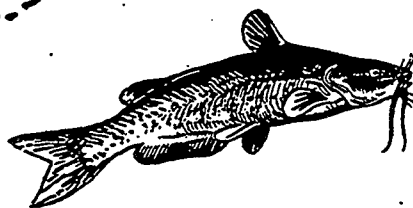
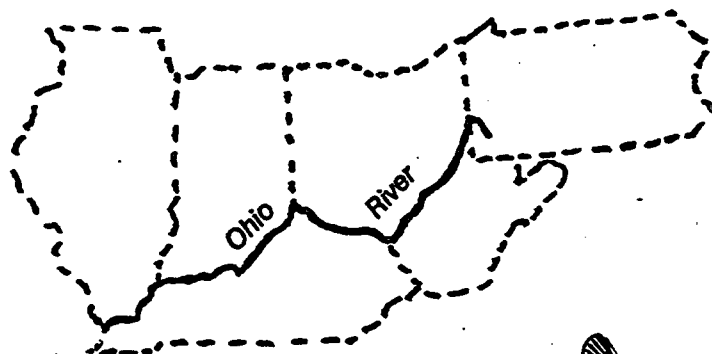
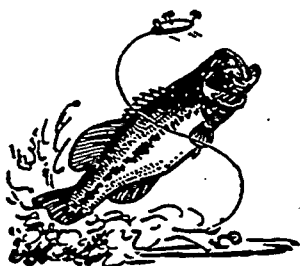
Please use the space below for any additional comments you may wish to make.

Thank You For Your Time and Effort!

To return this questionnaire, simply seal it (postage has been provided) and drop it in the nearest mailbox.

FALL SURVEY INSTRUMENT

**A SURVEY OF
OHIO RIVER VALLEY
ANGLERS**



Human Dimensions Research Unit
Department of Natural Resources
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Research conducted by the
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Please complete this questionnaire at your earliest convenience, seal it, and drop it in any mailbox (no envelope is needed); return postage has been provided. Your responses will remain confidential and will never be associated with your name.

THANK YOU FOR YOUR ASSISTANCE!



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1. Have you gone fishing on the Ohio River within the past 5 years?

___ Yes (SKIP TO QUESTION 2A)

___ No → Why not? (Check any important reason; you may check more than 1 reason):

- ___ I do not have the necessary boat or equipment
___ I believe the Ohio River is too polluted to fish in
___ I would not want to eat the fish due to contaminants
___ I do not think the Ohio River has good fishing opportunities
___ I am not interested in the sizes of fish available to be caught
___ I am not interested in the types of fish available to be caught
___ I prefer to fish other locations
___ Other (Please list: _____)

If you have not fished the Ohio River in the past 5 years and have not eaten Ohio River fish in the past year, please SKIP TO QUESTION 19.

2a. How many days did you fish each of the following areas of the Ohio River between October 1, 1991 and September 30, 1992? (Count any part of a day as a whole day; Write 0 for those areas you did not fish.)

I fished pools or river areas between dams about _____ days.
I fished at or near locks and dams about _____ days.

If you did not fish the Ohio River between October 1, 1991 and September 30, 1992, SKIP TO QUESTION 3.

2b. Which lock and dam on the Ohio River is closest to the location where you did most of your Ohio River fishing between October 1, 1991 and September 30, 1992? (Write the name or location of the lock and dam.)

_____ Check here if you don't know

- I fished from shore (or a pier or dock) about _____ days.
I fished from a boat (or canoe or raft) about _____ days.

For the next 2 questions, you will be asked to write down some thoughts. If you find that more than about 20 seconds pass without thinking of anything, go on to the next question. It is okay to leave space blank if you don't think of anything. There are no right or wrong answers. Once you've gone on to another question, please do not go back to these questions even if you think of more. We are interested in what you think about without any further prompting.

3. On the chart below, please list the number of Ohio River fish you personally caught and/or ate this past year (October 1, 1991 to September 30, 1992). In the first column, list how many of each fish you caught. In the second column, list how many fish meals you ate whether you, or someone else caught the fish. (If you can't remember the number, but know you caught or ate some put a "?" on the appropriate line.)

4. On the lines below, please list all information you believe to be true about the safety of eating fish caught in the Ohio River. Write your ideas down in any order. Some people write a lot of thoughts, some people very few. If more than about 20 seconds pass without thinking of anything, go on to the next question. Please write only one idea on each line. If there are more lines than you need, leave some blank. Once you've gone on to the next question, please do not return to this item even if you think of more.

☐ Check here if you do not have anything to write, and go on to Question 5.

	<u>Number Caught</u>	<u>Number of Fish Meals</u>
American eel	_____	_____
Carp	_____	_____
Channel catfish	_____	_____
Flathead catfish	_____	_____
Freshwater drum	_____	_____
Largemouth bass	_____	_____
Paddlefish	_____	_____
Sauger	_____	_____
Silver redhorse	_____	_____
Smallmouth bass	_____	_____
Smallmouth buffalo	_____	_____
Spotted bass	_____	_____
Striped bass	_____	_____
Striped bass hybrids	_____	_____
Walleye	_____	_____
White bass	_____	_____
White crappie	_____	_____
Other	_____	_____

5. On the lines below, please list specific actions you have taken related to the safety of eating fish caught in the Ohio River. Write them down in any order. Some people write a lot of things, some people very few. If more than about 20 seconds pass without thinking of anything, go on to the next question. Please write only one action on each line. If there are more lines than you need, leave some blank. Once you've gone on to the next question, please do not return to this item even if you think of more.

☐ Check here if you do not have anything to write, and go on to Question 6.

Remember, please do not turn back to these questions once you have gone on to Question 6.

6. How often are your household's Ohio River fish meals prepared or cooked in the following ways? Circle one number for each item to best describe how your household prepares or cooks Ohio River fish meals. SKIP TO QUESTION 7 if your household does not eat fish caught in the Ohio River.

	No meals				All meals			
a. Remove the strip of fat along the back of the fish	1	2	3	4	5			
b. Remove belly fat	1	2	3	4	5			
c. Remove the skin	1	2	3	4	5			
d. Eat whole, gutted fish	1	2	3	4	5			
e. Fillet the fish	1	2	3	4	5			
f. Pan fry	1	2	3	4	5			
g. Deep fry	1	2	3	4	5			
h. Make fish soups or chowders	1	2	3	4	5			
i. Bake, roast, broil, or grill fish	1	2	3	4	5			
j. Microwave fish	1	2	3	4	5			
k. Reuse oil or fat from cooking fish	1	2	3	4	5			
l. Eat frozen or canned fish caught at an earlier time	1	2	3	4	5			

7. Some Ohio River states issue fish consumption health advisories. The advisories let people know how to limit their exposure to chemical contaminants by limiting the amount of some types of fish they eat. Only some types of fish and some areas of the River are affected by health advisories.

Prior to this survey, were you aware of health advisories issued for fish caught from the Ohio River? (Check one.)

- ☐ YES, aware of advisories for certain types of fish and/or areas of the River
☐ YES, generally or vaguely aware
☐ NO (SKIP TO QUESTION 12)

8. How important have the following information sources been to help you learn about health advisories for Ohio River fish? (Circle one number for each information source.)

1=Not At All Important 4=Very Important
2=Somewhat Important 5=Extremely Important
3=Important

	Not at all Important		Extremely Important		
a. Newspaper article or editorial	1	2	3	4	5
b. Magazine article	1	2	3	4	5
c. Fishing regulation booklet distributed with fishing license	1	2	3	4	5
d. Newsletters from fishing clubs	1	2	3	4	5
e. Newsletters from environmental interest groups	1	2	3	4	5
f. Warnings posted at fishing access sites	1	2	3	4	5
g. Health advice brochures available by special request from government agencies	1	2	3	4	5
h. Friends or family	1	2	3	4	5
i. Television or radio	1	2	3	4	5
j. Charterboat operators or guides	1	2	3	4	5
k. My physician	1	2	3	4	5

9. Below are some changes you may have made since learning about the Ohio River health advisories. Please indicate how strongly you agree or disagree with each statement. (Circle one number for each item.)

1=Strongly agree 4=Disagree
2=Agree 5=Strongly disagree
3=Neutral 6=Don't know

	Strongly <u>Agree</u>		Strongly <u>Disagree</u>		Don't <u>Know</u>	
a. I eat more Ohio River fish now because I feel more confident that I can choose the safer fish.	1	2	3	4	5	6
b. I have changed the ways I clean Ohio River fish before eating them.	1	2	3	4	5	6
c. I have changed the ways I cook Ohio River fish before eating them.	1	2	3	4	5	6

	Strongly <u>Agree</u>		Strongly <u>Disagree</u>		Don't <u>Know</u>	
d. I have changed fishing locations because of the advisories.	1	2	3	4	5	6
e. I have changed the types of fish I fish for to try to catch safer fish	1	2	3	4	5	6
f. I take fewer Ohio River fishing trips since learning about the advisories.	1	2	3	4	5	6
g. I take more Ohio River fishing trips now because I can choose areas with less serious contaminant problems.	1	2	3	4	5	6
h. I have changed the sizes of Ohio River fish I eat because of the advisories.	1	2	3	4	5	6

10. For each type of fish, please circle the number that best describes the change you made in the amount of Ohio River fish you eat because of the advisories. Circle 5 if you have never eaten that type of Ohio River fish.

	Stopped Eating	Decreased Amount	No Change	Increased Amount	Never Ate
American eel	1	2	3	4	5
Carp	1	2	3	4	5
Channel catfish	1	2	3	4	5
Flathead catfish	1	2	3	4	5
Freshwater drum	1	2	3	4	5
Largemouth bass	1	2	3	4	5
Paddlefish	1	2	3	4	5
Sauger	1	2	3	4	5
Silver redbreast	1	2	3	4	5
Smallmouth bass	1	2	3	4	5
Smallmouth buffalo	1	2	3	4	5
Spotted bass	1	2	3	4	5
Striped bass	1	2	3	4	5
Striped bass hybrids	1	2	3	4	5
Walleye	1	2	3	4	5
White bass	1	2	3	4	5
White crappie	1	2	3	4	5

11. Below are some reasons that may have made it difficult for you to follow the recommendations in the Ohio River health advisories. Please indicate how strongly you agree or disagree with each statement. (Circle one number for each item.)

- 1=Strongly agree 4=Disagree
2=Agree 5=Strongly disagree
3=Neutral 6=Don't know

	Strongly Agree	1	2	3	4	5	6	Strongly Disagree	Don't Know
a. I have never eaten very many Ohio River fish.	1	2	3	4	5	6			
b. I don't believe Ohio River fish pose a health risk for me.	1	2	3	4	5	6			
c. I couldn't tell from the advisories which locations would have safer fish in them.	1	2	3	4	5	6			
d. I couldn't tell from the advisories which types of fish have less chemicals in them.	1	2	3	4	5	6			
e. I don't know how to catch the types of fish that have less chemicals in them.	1	2	3	4	5	6			
f. I couldn't tell from the advisories what sizes of fish have less chemicals in them.	1	2	3	4	5	6			
g. I couldn't tell from the advisories how to clean my fish in a way that reduces chemicals in them.	1	2	3	4	5	6			
h. I couldn't tell from the advisories how to cook my fish in a way that reduces chemicals in them.	1	2	3	4	5	6			
i. I'm concerned about what other people might say or think about me if I followed the advisories.	1	2	3	4	5	6			
j. I don't think it is important to follow the advisories.	1	2	3	4	5	6			
k. Following the advisories would limit my enjoyment of Ohio River fishing.	1	2	3	4	5	6			
l. Following the advisories would limit the amount of fish I eat.	1	2	3	4	5	6			

12. How well informed are you about the safety of eating fish caught in the Ohio River? (Circle one number.)

Very well Informed	Somewhat Informed	Slightly Informed	Not At All Informed	
1	2	3	4	5


13. How easy is it for you to follow the recommendations in Ohio River health advisories? (Circle one number.)

Very Easy	1	2	3	4	5	6	Very Difficult

14. In the last month, how often have you: (Circle one number for each item.)

	Very Often	Often	Somewhat Often	Seldom	Never
a. Thought about the safety of eating fish caught in the Ohio River?	1	2	3	4	5
b. Had positive feelings about the safety of eating fish caught in the Ohio River?	1	2	3	4	5
c. Had negative feelings about the safety of eating fish caught in the Ohio River?	1	2	3	4	5

15. Before receiving this questionnaire, when was the last time you did each of the following? (Check the most recent box for each item.)

When was the last time you 	In the past two days	In the past week	In the past month	In the past 3 months	More than 3 months ago	Never
Went fishing in the Ohio River?						
Went fishing somewhere other than the Ohio River?						
Made plans to fish in the Ohio River?						
Shopped for fishing gear for the Ohio River?						
Ate fish from the Ohio River?						
Read or heard about the safety of eating fish caught in the Ohio River?						
Talked with others about the safety of eating fish caught in the Ohio River?						

16. How concerned are you personally that eating Ohio River fish could be a health risk to you or members of your immediate family? (Circle one number.)

Very Concerned Somewhat Concerned Slightly Concerned Not at All Concerned Don't Know

1 2 3 4 5

17. Think of the type of fishing trip you enjoy the most. (It does not have to be a trip on the Ohio River.) How important are the following factors to making the trip a really satisfying experience for you? (Circle one number for each item.)

0 = Of no concern at all
 1 = Not very important
 2 = Somewhat important
 3 = Important but not essential
 4 = Essential for a really satisfying trip

	No Concern	Essential
a. Catching several fish	0 1 2 3 4	
b. Catching a large fish	0 1 2 3 4	
c. Catching at least one fish	0 1 2 3 4	
d. Catching a particular type of fish	0 1 2 3 4	
e. Being with friends or family	0 1 2 3 4	
f. Being where the scenery is pleasant	0 1 2 3 4	
g. Fishing in areas where I know the fish are safe to eat	0 1 2 3 4	
h. Trying out new fishing gear	0 1 2 3 4	
i. Mastering fishing skills	0 1 2 3 4	
j. Catching the most fish of anyone in my group	0 1 2 3 4	
k. Catching fish to eat	0 1 2 3 4	
l. Fishing where there are few other people	0 1 2 3 4	
m. Exploring new fishing areas	0 1 2 3 4	

18. Please indicate how strongly you agree or disagree with the following statements. (Circle one number for each item.)

- 1=Strongly agree 4=Disagree
2=Agree 5=Strongly Disagree
3=Neutral 6=Don't Know

Strongly Agree Strongly Don't Disagree Know

- a. The Ohio River health advisories provide me with enough information to decide whether or not to eat certain fish. 1 2 3 4 5 6
- b. If the Ohio River advisories said that only larger fish were unsafe to eat, I would catch and eat the smaller fish. 1 2 3 4 5 6
- c. The Ohio River health advisories have increased my interest in water pollution control and cleanup efforts. 1 2 3 4 5 6
- d. Eating some types of fish caught in the Ohio River is safe. 1 2 3 4 5 6
- e. Eating any fish caught in the Ohio River is safe. 1 2 3 4 5 6
- f. The health benefits of eating Ohio River fish are greater than the health risks. 1 2 3 4 5 6
- g. Eating contaminated fish over many years increases my health risks. 1 2 3 4 5 6
- h. The health risk from eating contaminated Ohio River fish is minor when compared with other risks I'm exposed to. 1 2 3 4 5 6
- i. I would eat more Ohio River fish if health risks from chemical contaminants did not exist. 1 2 3 4 5 6
- j. I follow the advice in the Ohio River health advisories. 1 2 3 4 5 6
- k. Most people who are important to me think eating fish from the Ohio River is safe. 1 2 3 4 5 6
- l. I don't think government agencies really know how much chemical contaminants are in fish. 1 2 3 4 5 6
- m. Most people who are important to me think I should follow the health advisory recommendations about eating fish caught in the Ohio River. 1 2 3 4 5 6

19. In what year were you born? 19 ____

20. Are you male or female? ____ Male ____ Female

21. Which of the following best describes the area where you currently live? (Check one.)

- ____ Rural, town, or village (under 5,000 population)
____ Small city of 5,000 to 24,999 population
____ City of 25,000 to 99,999 population
____ Large city of 100,000 population or over

22. How many years of school did you complete, counting 12 years of high school graduation, and 1 year for each additional year of technical, or vocational training?

____ years

23. Please circle your approximate 1991 TOTAL HOUSEHOLD INCOME before taxes, in thousands of dollars:

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 22 24 26 28 30 32 34 36 38 40 45 50 55
60 65 70 75 80 More than 80

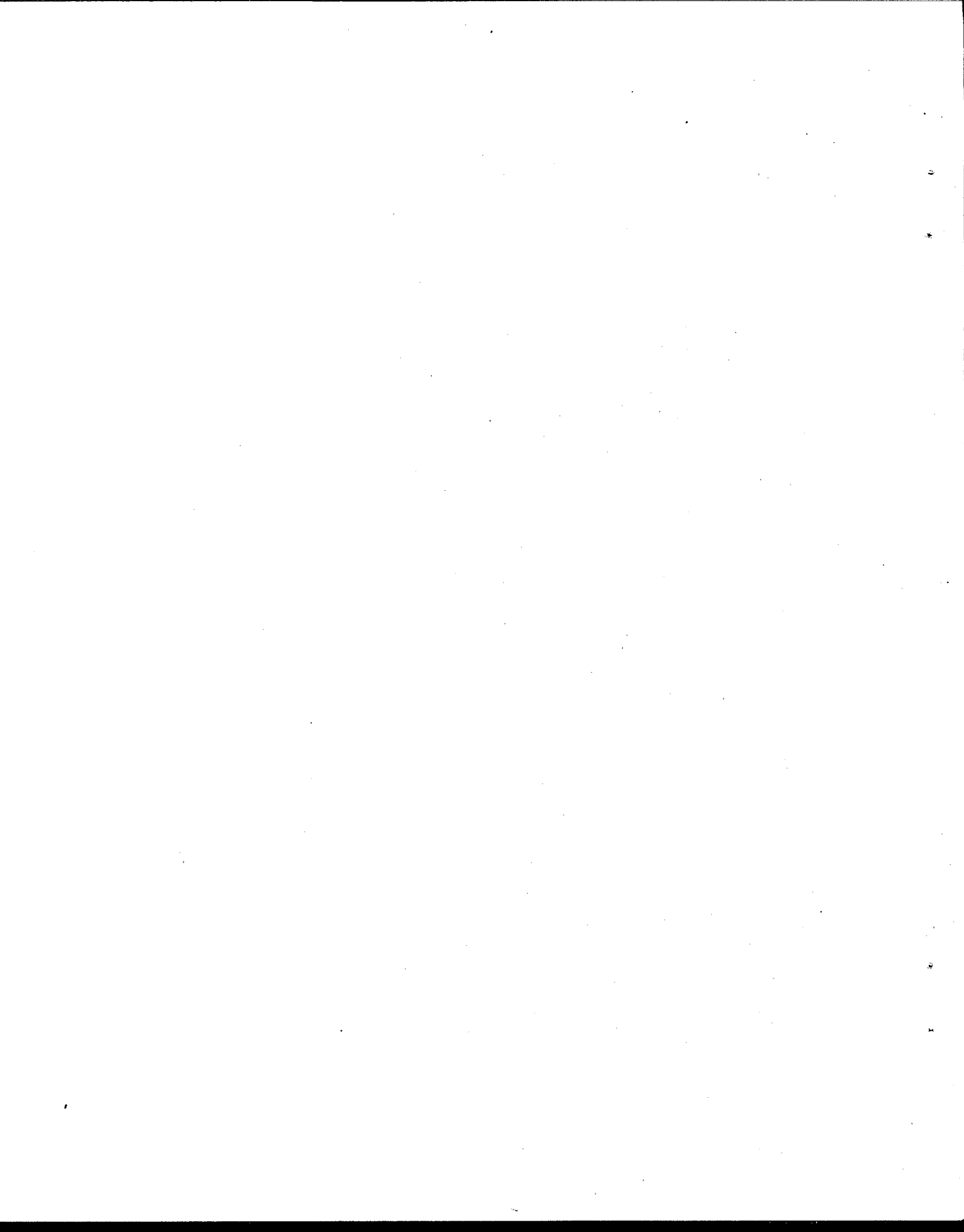
24. What is your race?

- ____ White, not of Hispanic origin
____ White, of Hispanic origin
____ Black or African-American
____ Asian or Pacific Islander
____ Native American Indian
____ Other

Please use the space below for any additional comments you may wish to make.

Thank You For Your Time and Effort!

To return this questionnaire, simply seal it (postage has been provided) and drop it in the nearest mailbox.



APPENDIX C:**Tests for Nonresponse Bias and
Calculations for Nonresponse Adjustments**

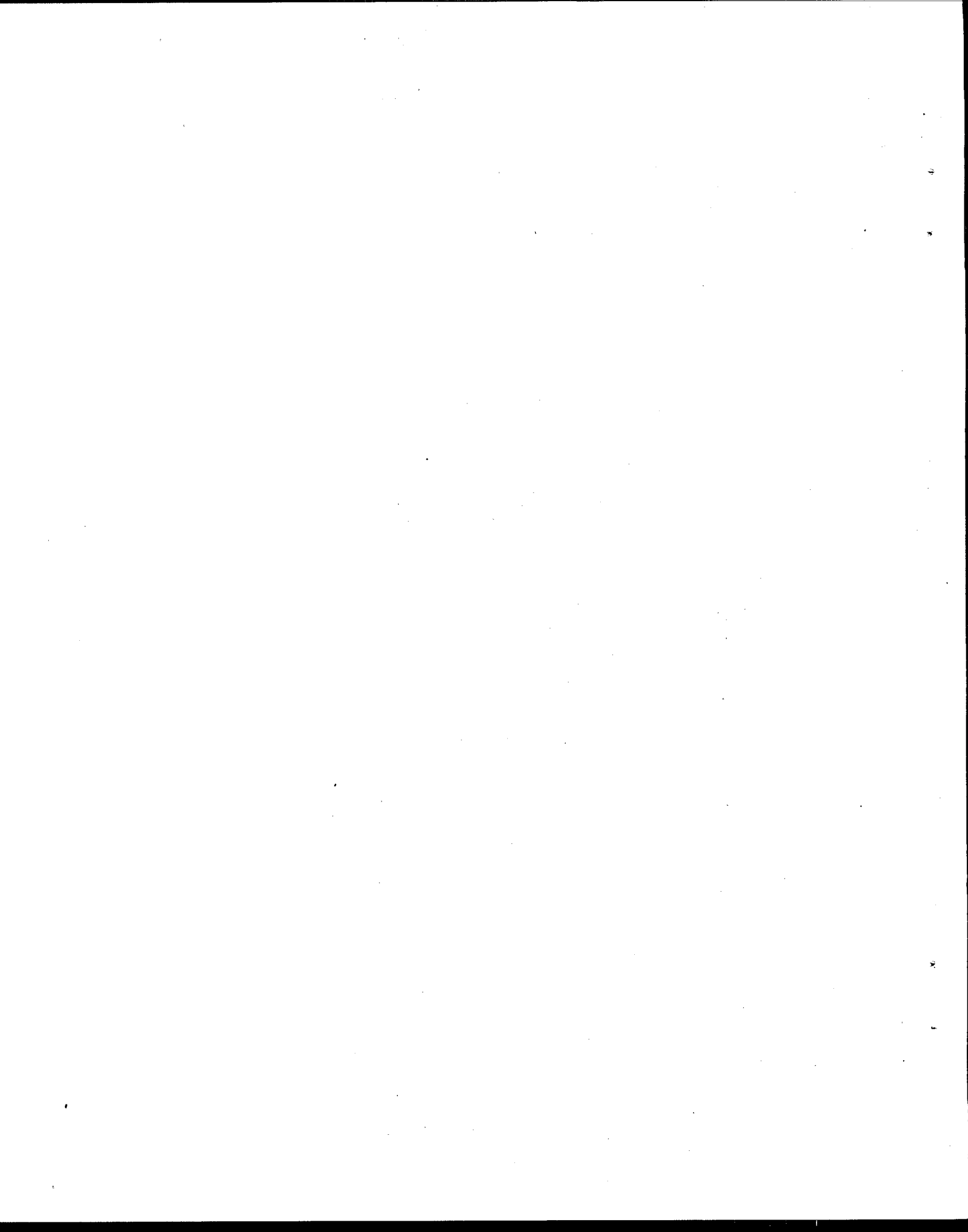


Table C-1. Tests for nonresponse bias.

Questions	Spring Survey		Fall Survey		Fall and Spring Combined	
	Respondents Percent	Nonrespondents n	Respondents Percent	Nonrespondents n	Respondents Percent	Nonrespondents n
Fish Ohio River Within Past 5 Years?						
No	40.1	336	44.7	566	42.9	902
Yes	59.9	502	55.3	701	57.1	1203
		NS		NS		NS
Didn't Fish Because Didn't Have Necessary Boat or Equipment?						
No	71.8	239	72.3	396	72.1	635
Yes	28.2	94	27.7	152	27.9	246
		NS		NS		NS
Didn't Fish Because of Contaminants?						
No	37.8	126	43.4	238	41.3	364
Yes	62.2	207	56.6	310	58.7	517
	($\chi^2 = 4.0$, df = 1, p = .05)			NS		NS
Didn't Fish Because You Prefer Other Locations?						
No	38.7	129	42.5	233	41.1	362
Yes	61.3	204	57.5	315	58.9	519
		NS		NS		NS
Last Ate Fish From Ohio River?						
Past month	15.9	76	15.8	99	15.8	175
More than 1 year ago	42.0	202	42.6	268	42.4	470
Never	42.1	202	41.6	261	41.8	463
	($\chi^2 = 9.6$, df = 2, p = .05)			NS		($\chi^2 = 12.0$, df = 2, p = .05)
Aware of Health Advisories?						
No	13.1	63	13.1	87	13.1	150
Yes	86.9	418	86.9	578	86.9	996
		NS		NS		($\chi^2 = 4.9$, df = 1, p = .05)
Use Newspapers As a Source of Info?						
No	29.8	130	10.8	59	---	---
Yes	70.2	306	89.2	488	---	---
	($\chi^2 = 5.6$, df = 1, p = .05)		($\chi^2 = 5.9$, df = 1, p = .05)			

Table C-1. (Cont.)

Questions	Spring Survey				Fall Survey				Fall and Spring Combined			
	Respondents Percent	n	Nonrespondents Percent	n	Respondents Percent	n	Nonrespondents Percent	n	Respondents Percent	n	Nonrespondents Percent	n
Use Magazines As a Source of Info? ^a												
No	83.3	363	92.6	63	32.5	151	83.7	41	---	---	---	---
Yes	16.7	73	7.4	5	67.5	313	16.3	8	---	---	---	---
	$(\chi^2 = 4.0, df = 1, p = .05)$				$(\chi^2 = 49.5, df = 1, p = .05)$							
Use Fishing Regulations Booklet As a Source of Info? ^a												
No	78.4	342	92.6	63	24.6	119	79.6	39	---	---	---	---
Yes	21.6	94	7.4	5	75.4	365	20.4	10	---	---	---	---
	$(\chi^2 = 7.5, df = 1, p = .05)$				$(\chi^2 = 64.5, df = 1, p = .05)$							
Use Posted Warnings As a Source of Info? ^a												
No	89.7	391	97.1	66	38.6	182	95.9	47	---	---	---	---
Yes	10.3	45	2.9	2	61.4	290	4.1	2	---	---	---	---
	NS				$(\chi^2 = 59.3, df = 1, p = .05)$							
Use Friends As a Source of Info? ^a												
No	48.2	210	76.5	52	16.2	78	16.3	8	---	---	---	---
Yes	51.8	226	23.5	16	83.8	404	83.7	41	---	---	---	---
	$(\chi^2 = 18.9, df = 1, p = .05)$				NS							
Use TV or Radio As a Source of Info? ^a												
No	39.9	174	51.5	35	19.4	98	49.0	24	---	---	---	---
Yes	60.1	262	48.5	33	80.6	407	51.0	25	---	---	---	---
	NS				$(\chi^2 = 22.7, df = 1, p = .05)$							
Eat Less Fish Due to Advisories? ^a												
No	57.0	243	57.4	39	59.0	347	69.4	34	58.2	590	62.4	73
Yes	43.0	183	42.6	29	41.0	241	30.6	15	41.8	424	37.6	44
	NS				NS				NS			
Fewer Trips Due to Advisories? ^a												
No	48.1	155	63.2	43	52.0	207	77.6	38	50.8	362	69.2	81
Yes	51.9	167	36.8	25	47.1	184	22.4	11	49.2	351	30.8	36
	$(\chi^2 = 5.1, df = 1, p = .05)$				$(\chi^2 = 10.7, df = 1, p = .05)$				$(\chi^2 = 13.8, df = 1, p = .05)$			

Table C-1. (Cont.)

Questions	Spring Survey		Fall Survey		Fall and Spring Combined	
	Respondents Percent	Nonrespondents n	Respondents Percent	Nonrespondents n	Respondents Percent	Nonrespondents n
Which Portion of the Ohio River Did You Fish the Most?						
Upper to Meldahl Dam	46.4	198	48.8	295	47.8	493
Lower	35.8	153	38.0	229	37.0	382
Don't Know	17.8	76	13.4	81	15.2	157
		NS		NS		NS
Informed About Safety of Eating Fish?						
Well Informed	32.8	161	37.0	246	35.3	407
Somewhat Informed	34.9	171	31.2	207	32.7	378
Slightly or Not Informed	32.3	159	31.8	211	32.0	370
		NS		NS		NS
Concerned About Health Risk of Eating Fish?						
Concerned	75.8	364	72.1	472	73.6	836
Slightly or Not Concerned	23.2	112	25.2	165	24.4	277
Don't Know	1.0	5	2.7	18	2.0	23
		NS		NS		NS
Residence Area						
Rural	53.0	435	48.4	593	50.2	1028
Urban	47.0	387	51.6	631	49.8	1018
		NS		NS		NS
Race						
White	96.9	796	96.5	1176	96.7	1972
Other	3.1	26	3.5	42	3.3	68
		NS		NS		NS
Sex						
Male	79.2	661	81.2	1000	80.4	1661
Female	20.8	174	18.8	231	19.6	405
		NS		NS		NS

Table C-1. (Cont.)

Questions	Spring Survey			Fall Survey			Fall and Spring Combined			
	Respondents	Nonrespondents		Respondents	Nonrespondents		Respondents	Nonrespondents		
	Mean	n	Mean	n	Mean	n	Mean	n	Mean	n
Average # Days Fished At Locks/Dams	10.9 (t = 2.6, df = 557, p = .05)	477	6.3 82	10.6	655	7.2 57	10.7	1132	6.7	139
Average # Days Fished Between Dams	18.1	476	16.8 82	19.2 (t = 3.4, df = 709, p = .05)	654	9.6 57	18.7	1130	13.9	139
Age	40.6	831	39.0 149	41.1	1227	40.6 100	40.9	2058	39.7	249
Years of Education	12.9 (t = 2.0, df = 961, p = .05)	814	12.5 149	13.0	1216	13.3 100	13.0	2030	12.8	249

*Question was asked differently in respondent versus nonrespondent surveys in fall implementation only.

^bQuestion was asked differently on fall versus spring surveys so results could not be pooled.

^cQuestion was asked differently in respondent versus nonrespondent surveys in both the fall and spring implementation.

Calculations to Account for Nonresponse Bias

From the original sample of 5,000, 404 were undeliverable, 2110 responded, and the rest (2,486) were nonrespondents. From the nonrespondents, 251 were interviewed by telephone (151 from the spring sample, 100 from the fall). We assume that those interviewed by telephone are representative of all nonrespondents. Undeliverable surveys will be dropped from the analysis here because we know nothing specific about their fishing behavior and we assume that they are similar to the general angling public.

The following calculations were made to estimate the percentage of the survey population (respondents and nonrespondents) responding in each category. For those fishing the Ohio River in the past five years:

	<u>n</u>	x	<u>Percent Aware of Health Advisory</u>	=	<u>n Aware of Health Advisory</u>
Respondents	1,203		86.9		1,045
<u>Nonrespondents</u>	<u>1,389</u>		<u>80.1</u>		<u>1,113</u>
Total	2,592		83.3		2,158

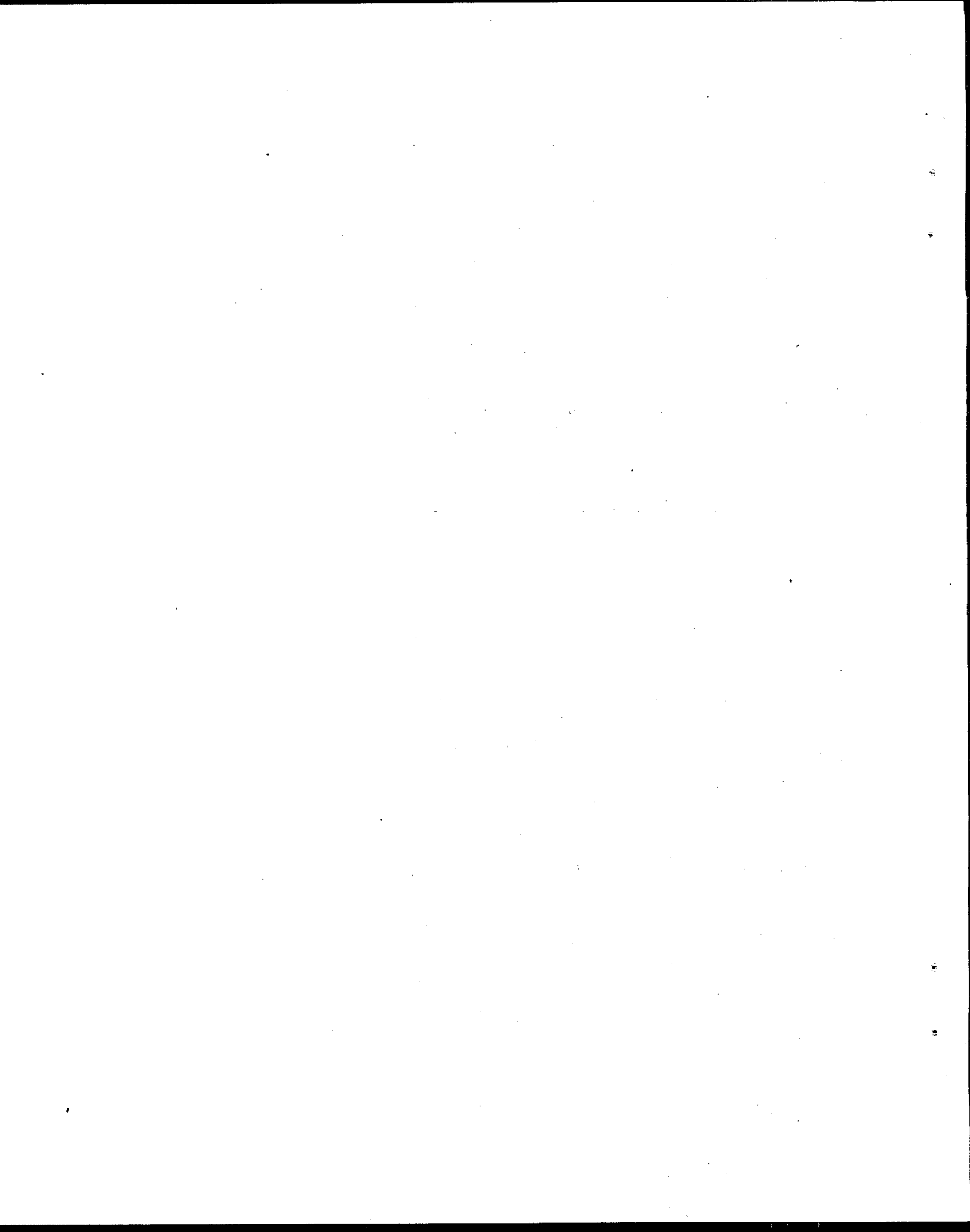
For those aware of health advisories and surveyed in the spring sample:

	<u>n</u>	x	<u>Percent Using Newspapers as a Source of Info</u>	=	<u>n Using Newspapers as a Source of Info</u>
Respondents	436		70.2		306
<u>Nonrespondents</u>	<u>442</u>		<u>55.9</u>		<u>247</u>
Total	878		63.0		553

	<u>n</u>	x	<u>Percent Using Magazines as a Source of Info</u>	=	<u>n Using Magazines as a Source of</u>
<u>Info</u>					
Respondents	436		16.7		73
<u>Nonrespondents</u>	<u>442</u>		<u>7.4</u>		<u>33</u>
Total	878		12.1		106

	<u>n</u>	x	<u>Percent Using Fishing Regs. Guide as a Source of Info</u>	=	<u>n Using Fishing Regs. Guide as a Source of Info</u>
Respondents	436		21.6		94
<u>Nonrespondents</u>	<u>442</u>		<u>7.4</u>		<u>33</u>
Total	878		14.5		127

	<u>n</u>	x	<u>Percent Using Friends as a Source of Info</u>	=	<u>n Using Friends as a Source of Info</u>
Respondents	436		51.8		226
<u>Nonrespondents</u>	<u>442</u>		<u>23.5</u>		<u>104</u>
Total	878		37.6		330



APPENDIX D:**Detailed Tables**

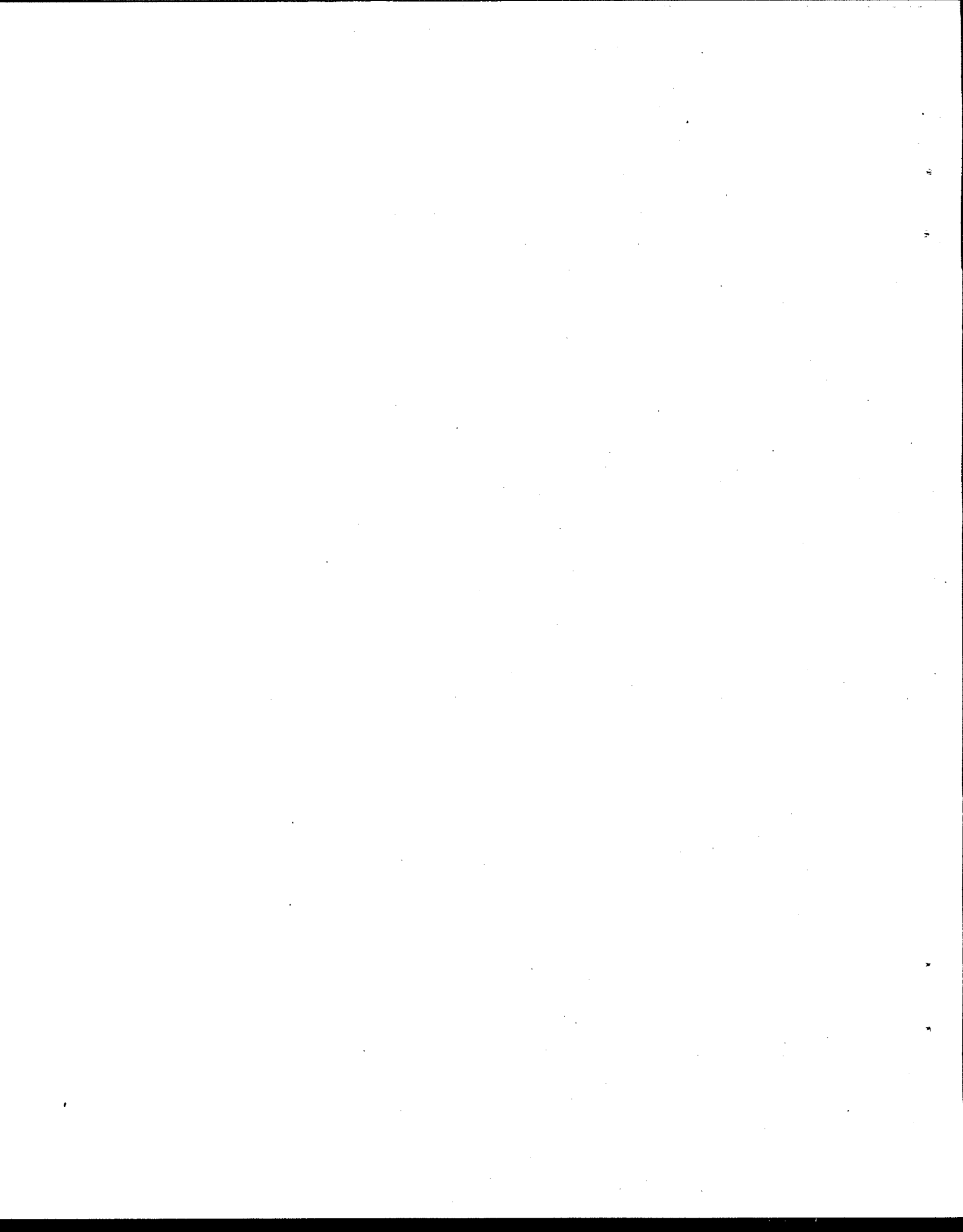


Table D-1. Percent of respondents who had fished the Ohio River in the past five years—overall, by socio-demographic characteristics, and by state of residence.

	Fished Ohio River Within Past Five Years	
	No	Yes
	Percent	
Overall	42.9	57.1
Age		
15-29	31.7	68.3*
30-39	40.5	59.5
40-49	45.4	54.6
50+	49.2	50.8
Education		
Grades 1-11	43.8	56.2
Grad. High School	41.0	59.0
Some College	40.5	59.5
Grad. College	50.0	50.0
Some Post Grad.	45.3	54.7
Income		
≤ \$20,000	39.9	60.1
\$21,000-\$34,000	42.0	58.0
\$35,000-\$50,000	43.3	56.7
≥ \$51,000	46.4	53.6
Sex		
Male	39.5	60.5*
Female	54.1	45.9
Race		
White	42.6	57.4
Other	34.3	65.7
Residence Area		
Urban	43.3	56.7
Rural	40.9	59.1
State of Residence		
Pennsylvania	63.9	36.1*
West Virginia	34.5	65.5
Kentucky	47.7	52.3
Illinois	32.3	67.7
Indiana	54.4	45.6
Ohio	29.2	70.8

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-2. Reasons for not fishing the Ohio River--overall, by socio-demographic characteristics, and by state of residence.

	Major Reasons For Not Fishing The Ohio River			
	Prefer to fish other locations	Due to Contaminants wouldn't want to eat the fish	Believe the Ohio River is too polluted to fish in	Don't have the necessary boat or equipment
Overall	58.9	58.7	46.7	27.9
Age				
15-29	54.3	55.1*	47.0	24.4
30-39	57.6	60.8	44.9	29.2
40-49	60.5	65.9	49.6	26.8
50+	61.2	52.7	46.5	30.0
Education				
Grades 1-11	57.6	64.6	55.6	23.2
Grad. High School	58.9	58.0	45.9	28.1
Some College	58.8	60.3	48.8	30.5
Grad. College	69.0	50.0	42.9	26.2
Some Post Grad.	53.2	54.8	30.8	30.6
Income				
≤ \$20,000	59.1	57.1	47.5	29.6
\$21,000-\$34,000	58.7	59.6	46.1	28.7
\$35,000-\$50,000	58.6	58.1	43.7	30.4
≥ \$51,000	67.5	55.8	46.8	22.5
Sex				
Male	60.1	56.1	45.2	30.3*
Female	56.0	67.0	52.4	22.0
Race				
White	59.5	58.6	46.6	28.4
Other	47.8	60.9	46.7	26.1

Table D-2. (Cont.)

	Major Reasons For Not Fishing The Ohio River			
	Prefer to fish other locations	Due to Contaminants wouldn't want to eat the fish	Believe the Ohio River is too polluted to fish in	Don't have the necessary boat or equipment
		Percent Checked ^a		
Residence Area				
Urban	60.3	60.7	50.2	27.3
Rural	58.7	56.3	43.4	29.3
State of Residence				
Pennsylvania	62.1	33.0*	13.2*	26.2*
West Virginia	55.3	52.0	46.2	22.0
Kentucky	56.6	65.5	56.4	25.2
Illinois	52.8	35.8	31.6	50.9
Indiana	60.7	70.3	57.0	30.1
Ohio	64.5	61.3	52.1	27.4

^aPercent does not add to 100 because more than 1 reason could be checked.*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-3. The percent of respondents using each source of health advisory information—overall, by socio-demographic characteristics, and by state of residence (spring survey audience only).

	Sources of Information					
	Newspaper Articles	TV or Radio	Friends	Fishing	Magazine Article	Posted Warnings
				Regulations Guide		
			Percent	Checked		
Overall	70.2	60.1	51.8	21.6	16.7	10.3
Age						
15-29	51.5*	51.5	70.3*	20.8	17.8	10.9
30-39	67.4	63.6	52.7	24.8	17.8	10.1
40-49	78.7	63.9	46.3	20.4	16.7	11.1
50+	83.9	61.3	36.6	19.4	14.0	9.7
Education						
Grades 1-11	50.0*	57.1	50.0	19.0	7.1	9.5
Grad. High School	72.0	59.3	55.0	18.5	17.5	11.6
Some College	68.4	63.9	48.9	24.8	18.0	9.0
Grad. College	89.3	57.1	57.1	28.6	21.4	7.1
Some Post Grad.	75.0	53.1	43.8	25.0	15.6	9.4
Income						
≤ \$20,000	61.1*	61.8	58.0	17.6	14.5	8.4
\$21,000-\$34,000	69.2	66.3	54.8	21.2	16.3	13.5
\$35,000-\$50,000	75.3	61.0	44.2	27.3	22.1	10.4
≥ \$51,000	89.3	50.0	48.3	20.7	15.5	5.2
Sex						
Male	70.2	59.9	51.1	22.6	18.0	9.7
Female	70.0	61.7	55.0	15.0	8.3	15.0
Race						
White	70.6	60.0	52.8	21.9	17.1	9.4
Other	58.3	58.3	25.0	16.7	16.7	16.7

Table D-3. (Cont.)

	Sources of Information					
	Newspaper Articles	TV or Radio	Friends Percent Checked	Fishing Regulations Guide	Magazine Article	Posted Warnings
Residence Area						
Urban	70.1	56.3	55.3	20.8	15.2	12.7
Rural	70.4	63.1	48.9	22.3	18.0	8.6
State of Residence						
Pennsylvania	---	---	---	---	---	---
West Virginia	71.4	73.4*	48.6	7.1*	10.0*	2.9*
Kentucky	71.3	59.6	55.9	20.6	16.9	20.6
Illinois	55.6	77.8	44.4	18.5	3.7	0.0
Indiana	76.1	61.2	50.7	20.9	20.9	1.5
Ohio	65.3	50.8	48.4	30.6	18.5	9.7
Health Advisory Awareness						
Generally Aware	55.2*	54.0*	60.1*	12.9*	12.3*	5.5*
Specifically Aware	80.4	64.9	44.9	27.8	20.0	13.5

---Insufficient sample size.

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-4. Mean importance of sources of health advisory information—overall, by socio-demographic characteristics, and by state of residence (fall survey audience only).

	Sources of Information				
	Newspaper Articles	TV or Radio	Friends Mean Importance*	Fishing Regulations Guide Mean Importance*	Magazine Article Posted Warnings
Overall	3.5	3.2	3.1	3.1	2.6 2.8
Age					
15-29	3.1 ^b	2.7 ^b	3.5 ^a	3.0	2.6 2.4 ^b
30-39	3.6 ^a	3.3 ^a	3.1	3.0	2.6 2.9
40-49	3.7 ^a	3.4 ^a	2.8 ^b	3.1	2.6 2.9
50+	3.6	3.4 ^a	3.0	3.2	2.6 3.2 ^a
Education					
Grades 1-11	3.2	3.5	3.0	3.6	2.6 3.2
Grad. High School	3.5	3.1	3.1	3.0	2.6 2.9
Some College	3.6	3.2	3.0	3.0	2.5 2.7
Grad. College	4.0	3.6	3.3	3.3	3.0 3.0
Some Post Grad.	3.7	3.3	3.0	2.6	2.3 2.4
Income					
≤ \$20,000	3.3 ^b	3.2	3.2	3.1	2.4 3.0
\$21,000-\$34,000	3.6	3.3	3.2	3.0	2.8 2.9
\$35,000-\$50,000	3.7	3.3	3.0	3.1	2.8 2.8
≥ \$51,000	4.0 ^a	3.2	3.2	3.1	2.6 2.5
Sex					
Male	3.6	3.2	3.1	3.1	2.6 2.8
Female	3.3	3.4	3.3	2.9	2.5 2.9
Race					
White	3.5	3.2	3.1	3.0	2.6 2.8
Other	3.5	3.1	3.7	3.3	3.1 3.3

Table D-4. (Cont.)

	Sources of Information					
	Newspaper Articles	TV or Radio	Friends Mean	Fishing Regulations Guide	Magazine Article	Posted Warnings
Residence Area						
Urban	3.6 ^a	3.3	3.2	3.2	2.6	3.0 ^a
Rural	3.4 ^b	3.2	3.0	2.9	2.6	2.6 ^b
State of Residence						
Pennsylvania	4.2 ^a	3.8	3.5	3.5	2.9	3.7 ^a
West Virginia	3.6 ^a	3.1	3.4	2.5 ^{b,d}	2.5	2.7
Kentucky	3.7 ^a	3.5	3.1	3.3 ^c	2.7	2.9
Illinois	2.8 ^b	3.0	2.7	2.5 ^b	2.1	2.2 ^b
Indiana	3.3	3.2	2.9	3.2	2.5	2.9
Ohio	3.7 ^a	3.0	3.2	3.5 ^a	2.8	2.9
Health Advisory Awareness						
Generally Aware	3.1 ^b	3.0 ^b	3.2	2.8 ^b	2.3 ^b	2.7
Specifically Aware	3.8 ^a	3.4 ^a	3.1	3.2 ^a	2.8 ^a	2.9

*Importance was measured on a scale where 1 = not at all important to 5 = extremely important.

^{a,b}Mean of group a is statistically significantly larger than group b at P = .05 using t-test or Scheffe's test where appropriate.

^{c,d}Mean of group c is statistically significantly larger than group d at P = .05 using t-test or Scheffe's test where appropriate.

Table D-5. For respondents to the spring survey, how informed they felt about the safety of eating fish by the sources of information they used.

<u>Source of Information Used</u>	<u>How Informed Are You About The Safety of Eating Fish?</u> Mean ^a
Newspaper Article or Editorial	3.3
Television or Radio	3.2
Friends	3.0
Fishing Regulations Guide	3.6
Magazine Article	3.4
Warnings Posted at Fishing Sites	3.5

^aMeasured on a scale where 5 = very well informed to 1 = not at all informed.

Table D-6. Beliefs about following the health advisory and opinions about government agencies' knowledge—overall, by socio-demographic characteristics, state of residence, advisory awareness, timing of survey, location fished most frequently, and fish consumption groups.

	Following Advisories Would Limit My Enjoyment of Ohio River Fishing ^a				Following Advisories Would Limit Amount of Fish I Eat ^a				Following Advisories Would Don't Think Government Agencies Know How Much Contaminants Are In Fish			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
	Percent				Percent				Percent			
Overall	23.5	13.1	54.7	8.7	53.8	13.0	23.2	10.0	59.2	15.9	15.0	9.9
Age												
15-29	12.8	17.9	59.0	10.3	45.6	21.6	21.6	11.2	59.3	17.6	13.2	9.9
30-39	23.5	11.4	58.5	6.6	53.9	11.5	26.1	8.5	61.6	15.3	14.5	8.6
40-49	27.6	12.9	52.6	6.9	61.5	9.4	19.7	9.4	55.2	15.8	18.1	10.9
50+	29.6	10.4	48.9	11.1	54.8	9.6	25.2	10.4	59.8	14.8	14.8	10.6
Education												
Grades 1-11	26.6	6.3	51.5	15.6*	49.2	7.7	27.7	15.4	65.0	9.8	12.2	13.0*
Grad. High School	23.2	10.8	55.7	10.3	55.7	13.8	20.2	10.3	58.3	14.5	15.6	11.6
Some College	25.0	16.8	51.7	6.5	53.6	11.6	24.3	10.5	62.5	16.8	13.9	6.8
Grad. College	14.0	14.0	72.0	0.0	62.7	14.0	23.3	0.0	53.1	27.7	10.8	8.4
Some Post Grad.	25.7	14.3	60.0	0.0	39.9	22.9	34.3	2.9	45.9	21.6	25.7	6.8
Income												
≤ \$20,000	22.6	16.1	48.4	12.9*	48.0	15.2	24.8	12.0	59.7	13.3	15.0	12.0*
\$21,000-\$34,000	26.7	13.3	52.0	8.0	53.4	14.4	19.9	12.3	61.0	13.9	14.2	10.9
\$35,000-\$50,000	22.5	13.2	60.4	3.9	58.0	14.0	23.3	4.7	52.6	24.7	14.2	8.5
≥ \$51,000	22.6	11.3	66.1	0.0	53.2	9.7	32.3	4.8	50.7	17.9	25.0	6.4
Sex												
Male	23.4	13.8	54.5	8.3	54.0	12.3	24.5	9.2	59.5	15.7	15.6	9.2
Female	25.0	7.9	56.6	10.5	53.9	15.8	17.1	13.2	57.4	16.9	12.0	13.7
Race												
White	24.0	12.4	55.3	8.3	54.2	12.8	23.3	9.7	58.9	16.2	15.0	9.9
Other	20.0	25.0	45.0	10.0	36.8	15.8	36.9	10.5	62.5	7.5	17.5	12.5

Table D-6. (Cont.)

	Following Advisories Would Limit My Enjoyment of Ohio River Fishing ^a				Following Advisories Would Limit Amount of Fish I Eat ^a				Following Advisories Would Don't Think Government Agencies Know How Much Contaminants Are In Fish			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
	Percent				Percent				Percent			
Residence Area												
Urban	24.1	11.9	56.2	7.8	55.8	12.0	24.0	8.2	60.4	15.9	16.2	7.5*
Rural	22.7	14.2	53.1	10.0	52.1	13.8	22.2	11.9	57.7	16.0	13.9	12.4
State of Residence												
Pennsylvania	15.6	15.6	56.3	12.5	56.3	12.5	15.6	15.6	54.2	11.9	10.2	23.7
West Virginia	16.0	15.1	58.5	10.4	55.6	12.3	23.6	8.5	57.8	13.9	18.3	10.0
Kentucky	32.2	5.8	53.7	8.3	58.9	9.2	21.8	10.1	60.8	16.4	15.7	7.1
Illinois	25.4	19.4	47.7	7.5	44.1	16.2	29.4	10.3	56.4	19.1	11.8	12.7
Indiana	28.4	14.8	48.8	8.0	61.4	10.2	18.2	10.2	59.1	19.1	13.1	8.7
Ohio	19.0	13.5	59.6	7.9	46.4	17.6	26.4	9.6	61.0	14.2	15.2	9.6
Aware of Health Advisories												
No	---	---	---	---	---	---	---	---	54.1	14.6	12.5	18.8*
Generally Aware	24.1	14.4	49.7	11.8	48.9	14.8	23.5	12.8	62.6	18.7	10.6	8.1
Specifically Aware	23.7	12.3	57.5	6.5	57.5	12.1	22.0	8.4	58.5	14.9	18.1	8.5
Time of Survey												
Spring '92	---	---	---	---	---	---	---	---	57.8	15.6	16.6	9.0
Fall '92	---	---	---	---	---	---	---	---	61.0	16.2	12.8	10.0

Table D-6. (cont.)

Location Fished Most Frequently	Following Advisories Would Limit My Enjoyment of Ohio River Fishing ^a				Following Advisories Would Don't Think Government Agencies Know How Much Contaminants Are In Fish							
	Disagree		Don't Know		Disagree		Don't Know					
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know				
Percent												
Pittsburgh to Gallipolis Greenup to McAlpine Cannelton to Uniontown Smithland to Cairo Don't Know	17.2	13.8	62.7	6.3*	55.8	16.9	20.3	7.0	59.3	15.6	15.9	9.2
	29.5	10.7	50.8	9.0	58.1	7.4	23.0	11.5	61.5	15.9	14.3	8.3
	31.9	17.4	49.3	1.4	55.1	14.5	24.6	5.8	57.1	21.1	16.2	5.6
	25.0	17.3	48.1	9.6	49.1	17.0	22.6	11.3	57.9	20.0	11.6	10.5
	13.3	13.3	56.7	16.7	43.3	11.7	30.0	15.0	58.7	11.3	15.3	14.7
Fish Consumption Groups												
Catch/Eat No Listed Fish	22.0	13.1	57.3	7.6	49.4	12.2	28.3	10.1	58.9	15.9	13.8	11.4
Catch/Eat Listed Fish Within Limits	22.5	14.0	53.6	9.9	56.4	14.1	19.0	10.5	58.8	16.2	16.0	9.0
Eat Listed Fish Above Limits	35.7	14.3	40.5	9.5	57.1	14.3	16.7	11.9	60.0	17.5	15.0	7.5

^aQuestion was asked on fall survey only.*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-7. Opinions about whether eating some or any fish from the Ohio River is safe—overall and by socio-demographic characteristics.

	Eating <u>Some</u> Types of Fish From the Ohio River				Eating <u>Any</u> Fish From the Ohio River			
	Is Safe				Is Safe			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
Overall	29.5	15.9	35.9	18.7	6.8	9.3	66.6	17.3
Age								
15-29	20.6	16.9	40.4	22.1*	7.4	6.3	68.6	17.7
30-39	28.1	15.6	38.8	17.5	4.5	10.0	69.6	15.9
40-49	32.3	16.0	30.4	21.3	8.1	12.0	64.4	15.5
50+	37.1	15.7	32.6	14.6	7.8	8.6	63.2	20.4
Education								
Grades 1-11	29.0	12.1	32.3	26.6	10.3	9.5	46.9	33.3*
Grad. High School	28.4	15.0	37.8	18.8	6.6	8.5	68.3	16.6
Some College	28.1	18.1	37.0	16.8	6.6	9.8	69.2	14.4
Grad. College	37.4	12.0	36.1	14.5	6.1	8.5	78.1	7.3
Some Post Grad.	34.2	21.9	28.8	15.1	4.1	10.8	70.2	14.9
Income								
≤ \$20,000	27.3	16.0	37.4	19.3	9.8	10.2	59.7	20.3*
\$21,000-\$34,000	31.4	15.2	35.2	18.2	9.4	7.7	65.8	17.1
\$35,000-\$50,000	32.9	16.9	33.7	16.5	3.3	9.5	74.7	12.4
≥ \$51,000	35.0	20.0	29.3	15.7	4.3	10.8	68.4	16.5
Sex								
Male	30.7	16.6	35.8	16.9*	6.2	9.5	68.0	16.3
Female	22.4	12.6	36.6	28.4	9.4	7.7	60.8	22.1
Race								
White	28.8	15.9	36.7	18.6*	6.6	8.7	67.5	17.2
Other	46.3	12.2	19.5	22.0	12.5	17.5	50.0	20.0

Table D-7. (Cont.)

Residence Area	Eating Some Types of Fish From the Ohio River				Eating Any Fish From the Ohio River			
	Is Safe				Is Safe			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
Urban	28.3	16.6	36.2	18.9	5.8	9.7	67.0	17.5
Rural	30.5	15.5	35.9	18.1	7.7	9.0	66.4	16.9

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-8. Evaluation of outcomes scale variable—overall and by socio-demographic characteristics, state of residence, timing of the survey, advisory awareness, location fished most frequently, and fish consumption groups.

	<u>Evaluation of Outcomes Scale</u> <u>Mean*</u>
Overall	2.3
Age	
15-29	2.1 ^b
30-39	2.2 ^d
40-49	2.3
50+	2.5 ^{a,c}
Education	
Grades 1-11	2.7 ^a
Grad. High School	2.2
Some College	2.2 ^b
Grad. College	2.2
Some Post Grad.	2.2 ^b
Income	
≤ \$20,000	2.4
\$21,000-\$34,000	2.3
\$35,000-\$50,000	2.3
≥ \$51,000	2.2
Sex	
Male	2.3
Female	2.2
Race	
White	2.3 ^b
Other	2.8 ^a
Area of Residence	
Urban	2.3
Rural	2.3
State of Residence	
Pennsylvania	2.2 ^b
West Virginia	2.1 ^b
Kentucky	2.3 ^b
Illinois	2.9 ^a
Indiana	2.3
Ohio	2.1 ^b
Time of Survey	
Spring '92	2.2 ^b
Fall '92	2.3 ^a

Table D-8. (Cont.)

	<u>Evaluation of Outcomes Scale</u>	
	<u>Mean*</u>	
Aware of Health Advisories		
No		1.9 ^b
Generally Aware		2.3 ^a
Specifically Aware		2.2 ^a
Location Fished Most Frequently		
Pittsburgh to Gallipolis		2.1 ^b
Greenup to McAlpine		2.2 ^b
Cannelton to Uniontown		2.7 ^a
Smithland to Cairo		2.8 ^a
Don't Know		2.3 ^b
Fish Consumption Groups		
Catch/Eat No		
Listed Fish		2.3 ^{a,d}
Catch/Eat Listed		
Fish Within		
Limits		2.1 ^{b,d}
Eat Listed Fish		
Above Limits		2.8 ^c

*Measured on a scale where 1 = health risks exist and are greater than benefits to 5 = health risks do not exist.

^{a,b}Mean of group a is statistically significantly higher than group b at P = .05 using t-test or Scheffe's test where appropriate.

^{c,d}Mean of group c is statistically significantly higher than group d at P = .05 using t-test or Scheffe's test where appropriate.

Table D-9. Was respondent concerned about what others might think of them if they followed the advisory—overall and by socio-demographic characteristics, state of residence, timing of the survey, advisory awareness, and fish consumption groups.

	Concerned About What Others Might Think Of Me If I Follow Advisories			
	Agree	Neutral	Disagree	Don't Know
	Percent			
Overall	5.9	10.6	73.5	10.1
Age				
15-29	6.0	10.6	72.3	11.1
30-39	7.4	9.2	75.6	7.8
40-49	4.7	11.8	72.2	11.3
50+	5.0	10.1	73.9	11.0
Education				
Grades 1-11	9.3	8.2	61.9	20.6*
Grad. High School	7.0	11.4	70.4	11.2
Some College	4.9	11.1	76.8	7.2
Grad. College	3.1	7.7	84.6	4.6
Some Post Grad.	3.1	6.3	89.1	1.6
Income				
≤ \$20,000	9.4	11.5	65.6	13.5*
\$21,000-\$34,000	5.2	7.6	77.2	10.0
\$35,000-\$50,000	4.6	12.2	77.6	5.6
≥ \$51,000	3.4	9.4	79.5	7.7
Sex				
Male	6.4	10.5	73.5	9.6
Female	3.1	9.2	74.7	13.0
Race				
White	5.6	10.3	74.4	9.7
Other	13.3	10.0	60.0	16.7
Residence Area				
Urban	6.3	9.6	74.0	10.1
Rural	5.5	11.1	73.4	10.1
State of Residence				
Pennsylvania	10.3	10.3	66.6	12.8
West Virginia	4.7	9.4	71.3	14.6
Kentucky	4.5	8.5	80.9	6.1
Illinois	3.2	18.3	67.7	10.8
Indiana	5.9	6.5	78.4	9.2
Ohio	8.6	12.9	67.8	10.7
Time of Survey				
Spring '92	5.9	9.9	74.5	9.7
Fall '92	5.8	11.0	72.7	10.5

Table D-9. (Cont.)

	Concerned About What Others Might Think Of Me If I Follow Advisories			
	<u>Agree</u>	<u>Neutral</u>	<u>Disagree</u>	<u>Don't Know</u>
	Percent			
Aware of Health Advisories				
Generally Aware	5.2	11.3	72.2	11.3
Specifically Aware	6.6	10.2	74.5	8.8
Fish Consumption Groups				
Catch/Eat No Listed Fish	7.0	11.4	70.7	10.9
Catch/Eat Listed Fish Within Limits	6.1	10.0	73.9	10.0
Eat Listed Fish Above Limits	1.8	9.1	81.8	7.3

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-10. Respondents' control beliefs regarding whether: (1) the advisories provide them with enough information to make their own decisions; and (2) they could tell from the advisory specific aspects of risk-reducing behavior—overall, by socio-demographic characteristics, state of residence, time of survey, advisory awareness, and fish consumption groups.

	Advisories Provide Me With Enough Information To Make Own Decisions			Could Not Tell Risk- reducing Behavior (Scale)	
	Agree	Neutral	Disagree	Don't Know	Mean ^a
Overall	31.7	16.8	34.4	17.1	3.1
Age					
15-29	23.2	12.9	42.1	21.8*	3.1
30-39	27.1	20.8	33.8	18.3	3.2
40-49	36.1	18.3	31.2	14.4	3.1
50+	42.5	13.6	30.3	13.6	3.1
Education					
Some High School	34.2	15.1	31.7	19.0	3.4
Grad. High School	33.1	15.2	32.8	18.9	3.1
Some College	28.0	18.1	39.0	14.9	3.1
Grad. College	28.9	21.7	28.9	20.5	3.0
Some Post Grad.	41.1	15.1	31.5	12.3	3.0
Income					
≤ \$20,000	31.6	16.6	33.2	18.6	3.2
\$21,000-\$34,000	30.4	17.3	36.6	15.7	3.1
\$35,000-\$50,000	33.4	15.0	32.5	19.1	3.1
≥ \$51,000	36.2	23.4	29.1	11.3	2.9
Sex					
Male	33.2	17.1	34.5	15.2*	3.1
Female	23.8	14.9	33.7	27.6	3.3
Race					
White	31.4	16.7	35.0	16.9*	3.1
Other	42.8	11.9	16.7	28.6	3.3

Table D-10. (Cont.)

	Advisories Provide Me With Enough Information To Make Own Decisions			Could Not Tell Risk- reducing Behavior (Scale) Mean ^a
	Agree	Neutral	Disagree Don't Know Percent	
Residence Area				
Urban	30.8	17.1	34.8	3.1
Rural	32.3	16.4	34.5	3.1
State of Residence				
Pennsylvania	33.9	15.3	28.8	3.3
West Virginia	31.9	11.4	36.2	3.1
Kentucky	35.3	20.4	30.0	3.2
Illinois	19.3	21.1	37.6	3.2
Indiana	31.5	17.4	38.1	3.0
Ohio	32.5	15.7	34.8	3.0
Time of Survey				
Spring '92	28.1	17.5	38.7	3.2
Fall '92	34.4	16.2	31.2	3.1
Aware of Health Advisories				
No	13.9	12.5	27.1	---
Generally Aware	15.5	19.8	44.9	3.0
Specifically Aware	45.8	15.6	30.3	3.4
Fish Consumption Groups				
Catch/Eat No Listed Fish	30.2	16.6	33.3	3.1
Catch/Eat Listed Fish Within Limits	33.4	16.1	34.5	3.1
Eat Listed Fish Above Limits	31.7	19.2	36.7	3.1

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

^aMeasured on a scale where 5 = agree to 1 = disagree.

Table D-11. Attitudes toward eating Ohio River fish and following the health advisory—overall, by socio-demographic characteristics, state of residence, advisory awareness, location fished most frequently, time of survey, and fish consumption groups.

	How Concerned Are You That Eating Ohio River Fish Is A Health Risk?				I Don't Think It's Important To Follow Advisories ^a			
	Very Concerned	Somewhat or Slightly Concerned	Not At All Concerned	Don't Know	Agree	Neutral	Disagree	Don't Know
Overall	52.8	35.4	9.8	2.0	9.6	12.0	70.7	7.7
Age								
15-29	54.5	34.1	9.8	1.6	4.3	10.3	75.1	10.3
30-39	55.6	35.0	7.4	2.0	7.4	13.5	71.1	8.0
40-49	51.8	35.9	10.4	1.9	11.3	10.4	73.1	5.2
50+	48.9	36.4	12.4	2.3	15.0	12.0	65.5	7.5
Education								
Grades 1-11	51.2	29.8	14.9	4.1*	16.1	14.5	53.3	16.1*
Grad. High School	55.0	32.3	11.0	1.7	10.3	11.3	70.5	7.9
Some College	53.8	38.4	6.2	1.6	8.2	12.1	73.2	6.6
Grad. College	50.6	34.6	14.8	0.0	2.3	9.3	86.1	2.3
Some Post Grad.	45.2	45.2	8.2	1.4	5.9	11.8	82.3	0.0
Income								
≤ \$20,000	57.2	29.0	11.0	2.8*	8.2	13.9	68.1	9.8
\$21,000-\$34,000	50.8	36.7	9.2	3.3	14.8	11.4	68.4	5.4
\$35,000-\$50,000	52.3	42.1	4.7	0.9	4.7	11.7	75.8	7.8
≥ \$51,000	49.3	38.8	11.2	0.7	5.1	13.6	79.9	3.4
Sex								
Male	52.7	36.2	9.4	1.7	9.1	11.5	71.5	7.9
Female	53.9	30.9	11.8	3.4	10.7	13.3	69.3	6.7
Race								
White	53.3	35.7	9.2	1.8*	9.3	11.3	72.0	7.4
Other	47.7	21.4	23.8	7.1	10.5	21.1	52.6	15.8

Table D-11. (Cont.)

	How Concerned Are You That Eating Ohio River Fish Is A Health Risk?			I Don't Think It's Important To Follow Advisories ^a			
	Very Concerned	Somewhat or Slightly Concerned	Not At All Concerned	Don't Know	Agree	Neutral	Disagree
Residence Area	Percent						
Urban	53.7	35.0	9.1	2.2	12.1	10.6	70.1
Rural	52.6	34.9	10.7	1.8	6.6	13.5	71.4
State of Residence							
Pennsylvania	56.1	26.3	14.0	3.5*	16.1	---	74.2
West Virginia	65.6	30.0	3.1	1.3	6.6	11.3	75.5
Kentucky	51.3	34.5	12.0	2.2	7.6	11.9	74.6
Illinois	26.1	46.0	22.5	5.4	13.4	23.9	55.2
Indiana	41.9	47.5	9.5	1.1	10.3	13.8	66.7
Ohio	60.9	30.4	7.3	1.4	9.6	8.0	73.6
Aware of Health Advisories							
No	56.6	23.4	15.9	4.1*	---	---	---
Generally Aware	52.8	37.6	7.4	2.2	6.7	15.9	68.2
Specifically Aware	52.0	37.2	9.4	1.4	11.2	9.0	73.3
Location Fished Most Frequently							
Pittsburgh to Gallipolis	62.4	30.1	6.1	1.4*	8.6	9.8	75.9
Greenup to McAlpine	51.4	35.8	9.5	3.3	8.3	13.2	70.2
Cannelton to Uniontown	38.5	46.1	14.0	1.4	13.2	19.1	60.3
Smithland to Cairo	30.9	46.8	19.1	3.2	11.5	21.2	57.7
Don't Know	55.9	31.0	10.3	2.8	8.6	10.3	69.0
Time of Survey							
Spring '92	57.1	32.8	9.1	1.0*	---	---	---
Fall '92	49.8	37.3	10.2	2.7	---	---	---

Table D-11. (Cont.)

	How Concerned Are You That Eating Ohio River Fish Is A Health Risk?				I Don't Think It's Important To Follow Advisories ^a			
	Very Concerned	Somewhat or Slightly Concerned	Not At All Concerned	Don't Know	Agree	Neutral	Disagree	Don't Know
Fish Consumption Groups								
Catch/Eat No Listed Fish	50.6	35.8	10.9	2.7*	11.4	11.4	69.1	8.1*
Catch/Eat Listed Fish Within Limits	61.0	32.8	4.6	1.6	8.8	9.7	73.7	7.8
Eat Listed Fish Above Limits	31.6	43.9	22.8	1.7	4.8	28.6	57.1	9.5

^aQuestion was asked on fall survey only.

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-12. Respondents' perceptions of what important others think about their following the advisory and eating fish—overall, by socio-demographic characteristics, state of residence, advisory awareness, location fished most frequently, time of survey, and fish consumption groups.

	People Important To Me Think Eating Fish Is Safe				People Important To Me Think I Should Follow Advisory			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
	Percent				Percent			
Overall	15.4	17.4	55.5	11.7	54.0	19.8	10.4	15.8
Age								
15-29	11.0	16.2	62.9	9.9*	49.4	19.7	10.8	20.1
30-39	11.4	19.4	57.5	11.7	54.5	21.1	8.4	16.0
40-49	18.0	16.9	50.2	14.9	56.3	17.0	11.6	15.1
50+	22.5	16.8	50.8	9.9	57.1	20.7	11.1	11.1
Education								
Grades 1-11	29.8	10.5	42.8	16.9*	51.7	16.4	13.9	18.0
Grad. High School	14.9	15.9	58.7	10.5	55.2	17.9	10.9	16.0
Some College	12.4	21.3	55.5	10.8	53.2	22.3	8.8	15.7
Grad. College	13.1	17.9	60.7	8.3	53.0	24.1	7.2	15.7
Some Post Grad.	13.5	16.2	54.1	16.2	59.7	18.1	11.1	11.1
Income								
≤ \$20,000	19.0	16.7	50.3	14.0	52.8	18.9	13.1	15.2
\$21,000-\$34,000	15.5	17.8	53.8	12.9	53.7	17.2	12.9	16.2
\$35,000-\$50,000	12.0	19.8	61.6	6.6	54.8	24.3	7.9	13.0
≥ \$51,000	15.1	17.3	56.1	11.5	58.9	21.6	5.8	13.7
Sex								
Male	14.6	18.0	56.5	10.9	56.7	19.3	10.2	13.8*
Female	19.1	14.8	50.8	15.3	40.7	22.5	11.5	25.3
Race								
White	14.9	17.4	56.1	11.6	54.3	19.7	10.6	15.4
Other	23.1	10.3	51.2	15.4	47.5	17.5	10.0	25.0

Table D-12. (Cont.)

	People Important To Me Think Eating Fish Is Safe				People Important To Me Think I Should Follow Advisory			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
	Percent							
Residence Area								
Urban	14.5	17.4	56.8	11.3	55.5	19.1	9.7	15.7
Rural	16.2	17.0	54.7	12.1	52.5	20.3	11.0	16.2
State of Residence								
Pennsylvania	13.8	19.0	44.8	22.4*	47.3	15.8	5.3	31.6*
West Virginia	10.5	13.5	64.6	11.4	54.8	18.0	14.5	12.7
Kentucky	15.5	17.3	57.1	10.1	56.6	20.4	9.5	13.5
Illinois	33.4	25.2	27.9	13.5	36.4	33.6	13.6	16.4
Indiana	18.1	22.5	46.2	13.2	52.2	19.8	12.1	15.9
Ohio	11.3	13.9	64.9	9.9	59.8	16.4	7.0	16.8
Aware of Health Advisories								
No	8.5	16.9	57.7	16.9	35.2	19.7	9.9	35.2*
Generally Aware	13.9	17.7	55.4	13.0	49.3	22.5	9.3	18.9
Specifically Aware	16.8	17.6	56.2	9.4	61.6	17.8	10.8	9.8
Time of Survey								
Spring '92	15.8	17.2	56.0	11.0	54.3	16.1	11.3	18.3*
Fall '92	15.1	17.5	55.2	12.2	53.7	22.6	9.8	13.9
Location Fished Most Frequently								
Pittsburgh to Gallipolis	11.3	15.8	61.9	11.0*	57.1	18.1	9.0	15.8*
Greenup to McAlpine	11.1	13.8	65.2	9.9	59.6	21.0	7.3	12.1
Cannelton to Uniontown	27.1	27.8	36.8	8.3	48.6	28.5	12.5	10.4
Smithland to Cairo	32.6	26.3	25.3	15.8	43.0	25.8	15.1	16.1
Don't Know	15.4	16.8	54.4	13.4	50.4	16.3	12.9	20.4

Table D-12. (Cont.)

	People Important To Me Think Eating Fish Is Safe				People Important To Me Think I Should Follow Advisory			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
	Percent							
Fish Consumption Groups								
Catch/Eat No Listed Fish	17.0	18.2	53.2	11.6*	52.5	21.5	9.1	16.9
Catch/Eat Listed Fish	11.5	16.3	61.1	11.1	56.8	17.1	10.5	15.6
Within Limits	28.3	20.8	40.8	10.1	46.2	27.7	13.4	12.7
Eat Listed Fish Above Limits								

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-13. Respondents' perceptions about how informed they are regarding health advisories and how easy it is to follow the advisory—overall, by socio-demographic characteristics, state of residence, advisory awareness, time of survey, and fish consumption groups.

	How Informed Are You About Safety of Eating Fish? Mean ^b	How Easy Is It to Follow Advisory Recommendations? ^a Mean ^c
Overall	3.0	5.2
Age		
15-29	2.8 ^e	5.1
30-39	2.9 ^e	5.0
40-49	3.2 ^d	5.4
50+	3.3 ^d	5.3
Education		
Grades 1-11	2.9	4.7
Grad. High School	3.1	5.1
Some College	3.0	5.2
Grad. College	3.1	5.8
Some Post Grad.	3.1	5.5
Income		
≤ \$20,000	3.0	4.8
\$21,000-\$34,000	3.0	5.1
\$35,000-\$50,000	3.1	5.4
≥ \$51,000	3.2	5.6
Sex		
Male	3.1 ^d	5.2
Female	2.9 ^e	4.8
Race		
White	3.0	5.2
Other	3.0	5.3
Residence Area		
Urban	3.1	5.2
Rural	3.0	5.1
State of Residence		
Pennsylvania	3.1	5.5
West Virginia	3.0	5.2
Kentucky	3.1	5.4 ^d
Illinois	2.9	4.3 ^e
Indiana	3.1	5.0
Ohio	3.0	5.4 ^d
Time of Survey		
Spring '92	3.0	---
Fall '92	3.1	---

Table D-13. (Cont.)

	How Informed Are You About Safety of Eating Fish? Mean ^b	How Easy Is It to Follow Advisory Recommendations? ^a Mean ^c
Aware of Health Advisories		
No	2.1 ^e	4.4 ^e
Generally Aware	2.7 ^{d,g}	4.7 ^d
Specifically Aware	3.5 ^{d,f}	5.5 ^{d,f}
Fish Consumption Groups		
Catch/Eat No Listed Fish	3.0	5.1
Catch/Eat Listed Fish		
Within Limits	3.1	5.2
Eat Listed Fish Above Limits	3.1	4.8

^aQuestion was asked on the fall survey only.

^bMeasured on a scale where 5 = very well informed to 1 = not at all informed.

^cMeasured on a scale where 7 = very easy to 1 = very difficult.

^{d,e}Group d is statistically significantly higher than group e at $P = .05$ using Scheffe's test and t-test where appropriate.

^{f,g}Group f is statistically significantly higher than group g at $P = .05$ using Scheffe's test or t-test where appropriate.

Table D-14. Respondents' behavioral intentions regarding following the advisory and fish consumption suppression—overall, by socio-demographic characteristics, state of residence, advisory awareness, time of survey, and fish consumption groups.

	I Follow The Advice In The Advisories				I Would Eat More Fish If Health Risks Didn't Exist			
	Percent			Don't Know	Percent			Don't Know
	Agree	Neutral	Disagree		Agree	Neutral	Disagree	
Overall	45.4	25.8	11.4	17.4	63.2	12.9	14.7	9.2
Age								
15-29	36.2	29.5	12.5	21.8*	61.8	12.2	19.3	6.7
30-39	43.5	28.0	11.6	16.9	65.1	13.1	12.3	9.5
40-49	45.4	25.4	12.3	16.9	60.6	13.9	15.0	10.5
50+	59.0	18.9	8.7	13.4	64.2	12.5	13.2	10.1
Education								
Grades 1-11	40.5	24.8	11.6	23.1	58.4	10.8	12.5	18.3*
Grad. High School	48.6	25.6	9.7	16.1	62.3	10.8	17.5	9.4
Some College	42.0	28.1	12.8	17.1	64.8	14.2	13.9	7.1
Grad. College	50.0	19.5	9.8	20.7	68.7	18.1	6.0	7.2
Some Post Grad.	50.0	21.6	14.9	13.5	63.5	16.2	13.5	6.8
Income								
≤ \$20,000	40.6	26.3	14.0	19.1	64.9	10.1	15.9	9.1
\$21,000-\$34,000	46.1	24.1	11.4	18.4	56.6	16.1	17.1	10.2
\$35,000-\$50,000	49.2	28.7	9.0	13.1	66.0	14.2	10.1	9.7
≥ \$51,000	50.7	22.8	11.8	14.7	67.0	16.5	11.5	5.0
Sex								
Male	47.8	25.6	10.7	15.9*	64.2	12.8	14.7	8.3
Female	33.7	26.4	14.6	25.3	57.8	13.7	14.8	13.7
Race								
White	45.8	25.9	11.6	16.7*	63.6	12.5	14.8	9.1
Other	42.5	17.5	5.0	35.0	55.3	18.4	7.9	18.4

Table D-14. (Cont.)

	I Follow The Advice In The Advisories				I Would Eat More Fish If Health Risks Didn't Exist			
	Agree	Neutral	Disagree	Don't Know	Agree	Neutral	Disagree	Don't Know
	Percent							
Residence Area								
Urban	46.0	24.0	11.3	18.7	64.7	12.1	15.0	8.2
Rural	45.2	27.3	11.4	16.1	61.7	13.6	14.2	10.5
State of Residence								
Pennsylvania	46.5	19.6	7.1	26.8*	59.6	21.1	8.8	10.5
West Virginia	45.0	20.9	15.0	19.1	64.6	10.6	15.5	9.3
Kentucky	49.9	22.7	12.6	14.8	66.7	11.0	15.2	7.1
Illinois	22.0	40.3	13.8	23.9	50.9	18.2	18.2	12.7
Indiana	48.6	28.2	8.3	14.9	61.8	14.2	15.8	8.2
Ohio	47.9	26.7	9.7	15.7	64.9	12.4	12.7	10.0
Time of Survey								
Spring '92	44.1	24.9	13.4	17.6	65.0	11.4	15.6	8.0
Fall '92	46.4	26.4	10.0	17.2	61.7	14.1	14.0	10.2
Aware of Health Advisories								
No	22.9	23.6	12.9	40.6*	49.6	16.1	18.2	16.1*
Generally Aware	29.3	34.2	13.2	23.3	66.1	11.5	14.2	8.2
Specifically Aware	60.5	21.1	10.4	8.0	65.7	13.3	13.8	7.2
Fish Consumption Groups								
Catch/Eat No Listed Fish	44.2	27.1	10.5	18.2*	60.5	15.0	13.6	10.9
Catch/Eat Listed Fish	48.2	23.6	9.9	18.3	66.1	12.0	13.8	8.1
Within Limits	37.3	30.5	22.9	9.3	63.0	9.2	20.2	7.6
Eat Listed Fish Above Limits								

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-15. Respondents' perceptions of whether they would eat small fish if the advisory said only larger fish were unsafe—overall, by socio-demographic characteristics, state of residence, advisory awareness, time of survey, and fish consumption groups.

	Would Eat Small Fish If Advisories Said Only Larger Fish Were Unsafe ^a			
	<u>Agree</u>	<u>Neutral</u>	<u>Disagree</u> Percent	<u>Don't Know</u>
Overall	25.5	16.2	45.8	12.5
Age				
15-29	22.8	16.6	50.3	10.3
30-39	19.1	15.8	50.7	14.4
40-49	32.4	12.7	42.2	12.7
50+	30.8	19.5	38.4	11.3
Education				
Grades 1-11	26.9	12.8	44.9	15.4
Grad. High School	25.0	12.7	47.3	15.0
Some College	25.9	19.7	45.2	9.2
Grad. College	22.4	18.4	53.1	6.1
Some Post Grad.	26.8	17.1	41.5	14.6
Income				
≤ \$20,000	28.7	14.0	45.3	12.0
\$21,000-\$34,000	25.4	17.7	45.9	11.0
\$35,000-\$50,000	23.2	18.1	47.1	11.6
≥ \$51,000	30.8	15.4	39.7	14.1
Sex				
Male	25.4	16.1	46.5	12.0
Female	26.5	17.6	42.2	13.7
Race				
White	25.2	16.3	45.9	12.6
Other	36.0	4.0	48.0	12.0
Residence Area				
Urban	24.6	17.4	44.8	13.2
Rural	25.9	15.4	46.7	12.0
State of Residence				
Pennsylvania	16.3	16.3	48.8	18.6*
West Virginia	14.5	12.4	59.3	13.8
Kentucky	25.7	15.4	44.2	14.7
Illinois	46.0	23.7	21.1	9.2
Indiana	31.5	18.5	43.5	6.5
Ohio	24.1	15.2	47.4	13.3

Table D-15. (Cont.)

	Would Eat Small Fish If Advisories Said Only Larger Fish Were Unsafe ^a			
	<u>Agree</u>	<u>Neutral</u>	<u>Disagree</u>	<u>Don't Know</u>
	<u>Percent</u>			
Aware of Health Advisories				
No	21.7	10.8	50.6	16.9
Generally Aware	28.4	16.7	44.6	10.3
Specifically Aware	24.2	17.7	46.3	11.8
Fish Consumption Groups				
Catch/Eat No				
Listed Fish	31.5	18.0	38.4	12.1*
Catch/Eat Listed Fish				
Within Limits	18.6	11.7	56.2	13.5
Eat Listed Fish				
Above Limits	30.4	32.6	26.1	10.9

^aQuestion was asked on fall survey only.

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-16. Importance of factors related to satisfaction with a fishing trip—overall, by socio-demographic characteristics, state of residence, time of survey, and fish consumption groups.

	Factors That Make A Fishing Trip Satisfying				
	Catching Fish	Mastering Skills	Eating Fish	Appreciative/ Affiliative	Solitude/ Exploration
Overall	2.5	2.2	2.2	3.2	2.6
Age					
15-29	2.6 ^a	2.2	2.1	3.2	2.7
30-39	2.4 ^b	2.2	2.1	3.2	2.5
40-49	2.3 ^b	2.2	2.4	3.2	2.6
50+	2.5	2.2	2.4	3.2	2.5
Education					
Grades 1-11	2.6	2.3	2.5 ^{a,c}	3.1	2.7
Grad. High School	2.4	2.2	2.2 ^a	3.2	2.6
Some College	2.5	2.2	2.2	3.2	2.6
Grad. College	2.4	2.1	2.0 ^d	3.3	2.5
Some Post Grad.	2.4	2.2	1.8 ^b	3.3	2.5
Income					
≤ \$20,000	2.5	2.2	2.2	3.2	2.6
\$21,000-\$34,000	2.5	2.2	2.2	3.3	2.6
\$35,000-\$50,000	2.4	2.3	2.2	3.2	2.5
≥ \$51,000	2.4	2.2	2.0	3.1	2.5
Sex					
Male	2.5	2.3 ^a	2.2	3.2	2.6
Female	2.4	1.8 ^b	2.3	3.2	2.6
Race					
White	2.5	2.2	2.2	3.2	2.6
Other	2.4	2.2	2.3	2.9	2.5

Table D-16. (Cont.)

	Factors That Make A Fishing Trip Satisfying				
	Catching Fish	Mastering Skills	Eating Fish	Appreciative/ Affiliative	Solitude/ Exploration
Mean Importance*					
Residence Area					
Urban	2.5 ^a	2.2	2.3	3.2	2.6
Rural	2.4 ^b	2.2	2.3	3.2	2.6
State of Residence					
Pennsylvania	2.4	2.2	2.0 ^b	3.2	2.7
West Virginia	2.4	2.1	2.0 ^b	3.2	2.5
Kentucky	2.5	2.3	2.5 ^{a,c}	3.1	2.6
Illinois	2.3	2.2	2.5 ^{a,c}	3.3	2.6
Indiana	2.4	2.1	2.3	3.2	2.6
Ohio	2.6	2.2	2.0 ^d	3.3	2.6
Time of Survey					
Spring '92	2.4	2.2	2.2	3.2	2.6
Fall '92	2.5	2.2	2.2	3.2	2.6
Fish Consumption Groups					
Catch/Eat No Listed Fish	2.5	2.3 ^a	2.2 ^b	3.2 ^a	2.6
Catch/Eat Listed Fish Within Limits	2.4	2.1 ^b	2.1 ^b	3.2 ^a	2.6
Eat Listed Fish Above Limits	2.3	2.2	2.6 ^a	3.0 ^b	2.5

*Importance was measured on a scale where 4 = essential for a satisfying trip to 0 = of no concern at all.

^{a,b}Group a has a statistically significantly higher importance score than group b at $P = .05$ using Scheffe's test and t-test where appropriate.

^{c,d}Group c has a statistically significantly higher importance score than group d at $P = .05$ using Scheffe's test and t-test where appropriate.

Table D-17. Days fished the Ohio River in 1991-92 by residence area, state of residence, and advisory awareness.

	Mean	Days Fished Ohio River in 1991-92		
		1-10 Days	11-25 Days Percent	26+ Days
Residence Area				
Urban	31.6	40.7	23.8	35.5
Rural	27.1	39.7	24.3	36.0
State of Residence				
Pennsylvania	28.8	34.6	30.8	34.6*
West Virginia	29.7	35.3	27.5	37.2
Kentucky	22.6	50.2	19.5	30.3
Illinois	31.9	36.0	23.0	41.0
Indiana	30.2	48.4	23.9	27.7
Ohio	34.2	33.6	23.7	42.8
Aware of Health Advisory				
No	23.3	49.6	22.0	28.3*
Generally Aware	23.7 ^b	42.3	25.0	32.7
Specifically Aware	33.6 ^a	36.8	24.0	39.2

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

^{a,b}Mean of group a is statistically significantly larger than group b at $P = .05$ using Scheffe's test.

Table D-18. For those consuming listed fish, the average number of listed fish meals and for those consuming unlisted fish, the average number of unlisted fish meals—overall and by socio-demographic characteristics, state of residence, timing of survey, advisory awareness, days fished, and location fished most frequently.

	For Those Consuming Listed Fish: Average Consumption of Listed Fish	For Those Consuming Unlisted Fish: Average Consumption of Unlisted Fish
	Mean Meals/Year	
Overall ¹	10.7	16.3
Age		
15-29	5.8	15.3
30-39	6.7	16.4
40-49	13.1	16.5
50+	22.6	16.9
Education		
Grades 1-11	8.7	19.8
Grad. High School	14.0	14.3
Some College	4.4	16.9
Grad. College	--- ^a	19.2
Some Post Grad.	--- ^a	
Income		
≤ \$20,000	17.1	19.4
\$21,000-\$34,000	5.0	17.1
\$35,000-\$50,000	9.4	15.8
≥ \$51,000	--- ^a	13.9
Sex		
Male	12.2 ^b	16.3
Female	4.8 ^c	16.5
Race		
White	10.9	15.1
Other	--- ^a	33.7
Residence Area		
Urban	13.3	16.0
Rural	8.8	16.6
State of Residence		
Pennsylvania	--- ^a	--- ^a
West Virginia	--- ^a	14.2
Kentucky	12.8	15.0
Illinois	0.0	19.8
Indiana	--- ^a	13.6
Ohio	--- ^a	17.0

Table D-18. (Cont.)

	For Those Consuming Listed Fish: Average Consumption of Listed Fish	For Those Consuming Unlisted Fish: Average Consumption of Unlisted Fish
	Mean Meals/Year	
Time of Survey		
Spring '92	9.0	15.1
Fall '92	13.8	17.2
Aware of Advisories.		
No	--- ^a	21.2
Generally Aware	5.7	15.0
Specifically Aware	10.5	15.2
Total Days Fished		
1-10 Days	2.7 ^c	8.9 ^c
11-25 Days	5.6	14.8
26+ Days	20.9 ^b	22.9 ^b
Location Fished Most Frequently		
Pittsburgh to Gallipolis	3.0	19.6
Greenup to McAlpine	16.3	14.4
Cannelton to Uniontown	12.4	15.5
Smithland to Cairo	7.4	16.2
Don't Know	7.7	19.0

¹Overall mean fish consumption for all fish consumers was 19 meals/year of Ohio River fish. Total consumption for a respondent consuming both listed fish and unlisted fish is included in both columns of this table, partitioned between listed fish consumption and unlisted fish consumption.

^aInsufficient sample size.

^{b,c}Group b is statistically significantly higher than group c at $P = .05$ using Scheffe's test and t-test where appropriate.

Table D-19. Fish preparation methods used—overall and by fish consumption groups.

Fish Preparation Methods	Overall	Fish Consumption Groups		
		Catch/Eat No	Catch/Eat	Eat Listed
		Listed Fish	Listed Fish	Fish Above
			Within Limits	Limits
			Percent	
<u>Risk-reducing</u>				
<i>Remove fat along back</i>				
No meals	50.1	49.8	59.7	31.0*
Few to most meals	11.8	9.1	9.9	21.8
All meals	38.1	41.1	30.4	47.2
<i>Remove belly fat</i>				
No meals	40.5	40.6	52.0	17.0*
Few to most meals	10.8	11.5	8.0	14.8
All meals	48.7	47.9	40.0	68.2
<i>Remove skin</i>				
No meals	32.1	31.6	42.6	11.8*
Few to most meals	10.4	8.9	9.0	16.1
All meals	57.5	59.5	48.4	72.1
<i>Fillet fish</i>				
No meals	25.1	24.0	37.2	4.8*
Few to most meals	23.9	24.4	15.1	35.6
All meals	51.0	51.6	47.7	59.6
<i>Bake, roast, broil or grill</i>				
No meals	67.9	69.3	72.0	60.7
Few to most meals	28.3	28.2	22.3	34.8
All meals	3.8	2.5	5.7	4.5
<u>Not Risk-reducing</u>				
<i>Eat whole fish</i>				
No meals	80.5	82.7	87.3	70.1*
Few to most meals	15.3	12.8	11.5	24.1
All meals	4.2	4.5	1.2	5.8
<i>Pan fry</i>				
No meals	37.4	38.5	49.7	13.4*
Few to most meals	32.7	32.6	22.2	52.6
All meals	29.9	28.9	28.1	34.0
<i>Deep fry</i>				
No meals	42.7	38.6	55.7	24.7*
Few to most meals	29.4	26.8	23.9	48.3
All meals	27.9	34.6	20.4	27.0

Table D-19. (Cont.)

<u>Fish Preparation Methods</u>	<u>Overall</u>	<u>Fish Consumption Groups</u>		
		<u>Catch/Eat No Listed Fish</u>	<u>Catch/Eat Listed Fish</u>	<u>Eat Listed Fish Above</u>
			<u>Within Limits</u>	<u>Limits</u>
			<u>Percent</u>	
<i>Make fish soup</i>				
No meals	96.1	97.5	97.0	90.7
Few to most meals	2.9	1.5	2.4	7.0
All meals	1.0	1.0	0.6	2.3
<i>Microwave</i>				
No meals	95.0	93.0	98.6	91.8
Few to most meals	4.0	5.5	0.7	7.1
All meals	1.0	1.5	0.7	1.1
<i>Reuse fish oil</i>				
No meals	83.7	79.8	89.4	82.6
Few to most meals	13.6	15.8	8.8	16.3
All meals	2.7	4.4	1.8	1.1
<u>Other Methods</u>				
<i>Freeze or can for later use</i>				
No meals	41.1	40.4	54.6	16.3*
Few to most meals	52.0	54.4	38.3	71.7
All meals	6.9	5.2	7.1	12.0

*Statistically significant difference between consumption groups at $P \leq .05$ using Chi-square test.

Table D-20. Percent of respondents aware of the health advisories who made each of the specific changes in response to the health advisory—by source of information, residence area, time of survey, state of residence, and fish consumption group.

Sources of Info	Take Fewer Fishing Trips	Changes Made			Eat Less Fish Percent Yes
		Changed Fishing Location	Changed Species of Fish ^a	Changed Cleaning Methods	
Newspapers	40.2	26.4	---	26.3	46.2
TV or Radio	40.3	26.7	---	26.6*	56.7
Friends	35.6	24.6	---	20.9	39.2
Fishing Regulations	49.4*	39.7*	---	32.9	51.6
Magazines	47.6	31.7	---	34.5	41.4
Posted Warnings	58.5	41.5	---	26.3	47.7
Residence Area					
Urban	39.5	29.7	26.1	22.8	44.3
Rural	35.8	23.4	24.8	22.8	39.5
Time of Survey					
Spring '92	39.4*	26.9	---	23.2	43.0
Fall '92	35.7	25.9	26.0	22.2	41.0
State of Residence					
Pennsylvania	27.0*	30.6	22.2	25.7*	27.7*
West Virginia	31.5	27.6	24.7	15.7	44.8
Kentucky	51.7	29.3	26.2	24.2	46.9
Illinois	24.5	18.1	16.7	31.9	39.4
Indiana	41.1	29.5	27.6	31.0	45.5
Ohio	30.8	23.3	31.6	15.5	35.8
Fish Consumption Groups					
Catch/Eat No Listed Fish	33.8	24.2*	27.5	20.1*	39.2*
Catch/Eat Listed Fish	39.8	28.4	24.3	22.7	41.5
Within Limits					
Eat Listed Fish Above Limits	36.9	28.2	21.1	36.1	57.4

^aQuestion was asked on fall survey only.

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-21. For respondents aware of the health advisory, the fish preparation methods used by whether the respondent had changed cleaning or cooking methods in response to the health advisory.

<u>Fish Preparation Methods</u>	<u>Changed Cleaning Method</u>	
	<u>Yes</u>	<u>Other^a</u>
	<u>Percent</u>	
<u>Cleaning Methods</u>		
<i>Remove Fat on Back</i>		
No Meals	20.3	58.8*
Few to Most Meals	14.3	11.8
All Meals	65.4	29.4
<i>Remove Belly Fat</i>		
No Meals	13.0	47.1*
Few to Most Meals	15.2	9.0
All Meals	71.8	43.9
<i>Remove Skin</i>		
No Meals	8.7	36.2*
Few to Most Meals	13.4	10.6
All Meals	77.9	53.2
<i>Eat Whole, Gutted Fish</i>		
No Meals	80.9	78.7
Few to Most Meals	15.9	16.4
All Meals	3.2	4.9
<i>Fillet</i>		
No Meals	6.4	27.1*
Few to Most Meals	27.7	26.1
All Meals	69.9	46.8

Table D-21. (Cont.)

<u>Cooking Methods</u>	<u>Changed Cooking Method</u>	
	<u>Yes</u>	<u>Other^a</u>
	<u>Percent</u>	
<i>Bake, Roast, Broil, Grill</i>		
No Meals	53.9	67.4
Few to Most Meals	41.5	28.8
All Meals	4.6	3.8
<i>Microwave</i>		
No Meals	93.5	94.6
Few to Most Meals	6.5	4.2
All Meals	0.0	1.2
<i>Reuse Oil or Fat</i>		
No Meals	80.9	82.4
Few to Most Meals	15.9	14.9
All Meals	3.2	2.7

^a"Other" refers to respondents who said disagree, neutral, or don't know.

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

Table D-22. Opinions about whether the health advisory has increased respondents' interest in water pollution control and cleanup efforts—overall, and by socio-demographic characteristics, state of residence, time of survey, days fished, location fished, fish consumption groups, and major sources of information.

	Health Advisories Have Increased my Interest in Pollution Control and Cleanup Efforts			
	<u>Agree</u>	<u>Neutral</u>	<u>Disagree</u> Percent	<u>Don't Know</u>
Overall	63.7	14.9	12.5	8.9
Age				
15-29	54.9	17.6	17.6	9.9*
30-39	62.9	15.2	11.9	10.0
40-49	65.6	13.6	12.1	8.7
50+	73.2	12.1	7.9	6.8
Education				
Grades 1-11	60.9	14.1	12.5	12.5
Grad. High School	64.7	14.0	11.3	10.0
Some College	63.8	15.9	13.0	7.3
Grad. College	59.0	13.3	16.9	10.8
Some Post Grad.	64.8	20.3	10.8	4.1
Income				
≤ \$20,000	64.2	15.2	11.3	9.3
\$21,000-\$34,000	63.5	15.3	12.7	8.5
\$35,000-\$50,000	62.4	14.3	14.3	9.0
≥ \$51,000	66.7	16.3	9.2	7.8
Sex				
Male	65.2	14.7	11.7	8.4
Female	57.5	15.5	16.0	11.0
Race				
White	63.5	15.2	12.5	8.8
Other	61.9	9.5	14.3	14.3
Residence Area				
Urban	64.3	14.7	12.8	8.2
Rural	62.9	15.2	12.5	9.4
State of Residence				
Pennsylvania	59.3	10.2	16.9	13.6*
West Virginia	61.1	12.2	16.2	10.5
Kentucky	69.7	12.5	12.1	5.7
Illinois	62.7	20.9	5.5	10.9
Indiana	67.2	14.5	11.8	6.5
Ohio	59.4	18.0	12.1	10.5
Time of Survey				
Spring '92	62.6	15.9	13.1	8.4
Fall '92	64.6	14.2	11.9	9.3

Table D-22. (Cont.)

	Health Advisories Have Increased my Interest in Pollution Control and Cleanup Efforts			
	Agree	Neutral	Disagree	Don't Know
	Percent			
Location Fished Most Frequently				
Pittsburgh to Gallipolis	62.5	15.7	12.3	9.5*
Greenup to McAlpine	64.5	11.7	16.4	7.4
Cannelton to Uniontown	75.9	13.1	6.2	4.8
Smithland to Cairo	62.8	20.2	6.4	10.6
Don't Know	55.3	19.1	15.1	10.5
Fish Consumption Groups				
Catch/Eat No Listed Fish	61.7	17.2	10.5	10.6*
Catch/Eat Listed Fish				
Within Limits	65.8	13.6	13.0	7.6
Eat Listed Fish Above Limits	70.0	13.3	14.2	2.5
Source of Information	Percent Checked ^a			
Newspaper	70.3	14.9	10.2	4.6
Fishing Regulations Guide	68.5	17.4	8.7	5.4
Posted Warnings	57.8	20.0	22.2	0.0*
TV or Radio	68.7	14.3	12.0	5.0
Sources of Information	Mean Importance ^b			
Newspaper	3.6 ^c	3.4	3.6	3.0 ^d
Fishing Regulations Guide	3.2	2.8	2.9	2.5
Posted Warnings	2.9	2.8	2.7	2.3
TV or Radio	3.3 ^c	3.3	3.3	2.5 ^d

^aQuestion asked on the spring survey only. Respondents could check more than one source of information.

^bQuestion asked on the fall survey only. Importance was measured on a scale where 5 = extremely important to 1 = not at all important.

^{c,d}The mean of group c is statistically significantly higher than group d at $P = .05$ using Scheffe's test.

*Statistically significant difference between groups at $P \leq .05$ using Chi-square test.

