

AN EVALUATION OF BEST PRACTICES FOR EFFECTIVE PUBLIC  
OUTREACH IN GOVERNMENT-ISSUED METHYLMERCURY  
FISH CONSUMPTION ADVISORIES

A Thesis

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## ABSTRACT

Over the last two decades, the United States government agencies responsible for public health have expressed a desire for more research on how to improve risk communication within state and federal fish advisory programs. This charge to risk communication researchers led to the development of a variety of “best practices” that offer potential solutions to many of the major barriers to effective public outreach. However, numerous studies suggest that government agencies have been resistant to adopting the targeted, interactive risk communication strategies proposed by researchers and that these best practices may have a limited impact in shaping government policy. To date, little is known about the degree to which best practices from the risk communication literature are present in government-issued fish consumption advisories. Further, some health and environmental agencies have expressed that they would be more amenable to adopting the recommendations of risk communication researchers if they were practical and accessible. In order to address these issues, a list of 125 best practices for effective advisory design were compiled from the risk communication literature and adapted into a practical coding scheme that was used to evaluate a sample of 221 government-issued methylmercury advisories. The results of this evaluation revealed a series of gaps between risk communication research and agency practice that are largely driven by conflicting objectives and the inability of many risk communication studies to adequately define “effective” risk communication. Evaluation is discussed as a means to strengthen ties between risk communication researchers and agency fish advisory programs. Moreover, connections are drawn between the findings of this study and other risk contexts, raising the possibility that the “outsider” status of risk communication researchers is less problematic than originally thought.

## BIOGRAPHICAL SKETCH

James Williamson was born in Los Angeles, California in 1981. By 1984, his family moved to the Bay Area where he attended primary and secondary school. A nature enthusiast and avid fly-fisherman, James spent much of his childhood and adolescence outdoors. Over the course of his education, his love for the outdoors manifested itself in a passion for the biological sciences. In 2000, James was admitted to Whitman College, in Washington, where he majored in Biology and Environmental Science. He graduated in 2004 with an interest in understanding how experts communicate to public audiences about science, especially regarding public health risks. This same year, James was admitted into the Master's program in Communication at Cornell University, where he currently pursues his research interests in science and risk communication. At the culmination of his degree, James will return to the west coast to apply his knowledge of the life sciences and communication in a career as a medical writer for biotechnology/pharmaceutical company.

*To my family –  
Thank you for your unconditional love and support.*

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## CHAPTER 1

### INTRODUCTION

Over the last two decades, the U.S. government agencies responsible for public health have become increasingly concerned about the public response to fish consumption advisories. With the number of government-issued fish consumption advisories increasing by nearly 62% in the United States since 1993 (USEPA, 2005a), government agencies continue to question why many of the public audiences most at risk (e.g., pregnant women, subsistence fishermen) are not heeding these advisories (Knuth, 1995). Consequently, agencies have expressed a desire for more research on how to improve risk communication within state and federal fish advisory programs (Chess, Burger & McDermott, 2005).

This charge to researchers studying fish consumption risks parallels a larger movement in the risk communication discipline to find solutions to the major barriers to “effective” public outreach in government agencies (e.g., NRC, 1989, Covello, McCallum & Pavlova, 1989). A variety of “best practices” have emerged from this research that offer means to improving agency risk communication efforts. Unfortunately, numerous studies suggest that government agencies have been resistant to adopting the targeted, interactive risk communication approaches proposed by researchers and that these best practices may have a limited impact in shaping government policy (e.g., Chess & Salomone, 1992; Chess et al., 1995b; Tinker et al., 2000; Grunig et al., 2002; Chess, Burger & McDermott, 2005). This general concern is a potential barrier to effective risk communication that requires further consideration in government fish advisory programs. Understanding the constraints between research and practice in fish advisory programs may also enhance the current understanding of how best practices from the risk communication literature are implemented in other risk contexts that government agencies communicate about.

To date, little is actually known about the degree to which risk communication's best practices are implemented in government-issued fish consumption advisories. Perhaps fish advisory programs are applying many of the recommendations from the risk communication literature or perhaps they are unable to because risk communication research is not practical or accessible enough to be useful to government agencies. Best practices are scattered among a wide variety of publications, including books, journal articles, government documents, and conference proceedings. In addition, it may be difficult for agencies to glean best practices from these sources and implement them in a timely and cost-effective manner. Indeed, some health and environmental agencies have indicated that they would be more amenable to adopting risk communication recommendations if they were more practical and accessible (Chess et al., 1995b).

In order to address this issue, I attempt to synthesize a list of best practices from the risk communication literature and develop a practical evaluation tool to compare these recommendations for effective advisory design to the actual outreach materials that they are intended to improve. Therefore, one objective of this study is to build a list of best practices from the risk communication literature. The second objective is to develop a practical and reliable coding scheme from this list. And the third objective is to use the resulting coding scheme as an evaluation tool to examine areas of convergence and divergence between risk communication research and agency practice. State, tribal and federal advisories focusing on methylmercury were targeted for analysis, as methylmercury is the primary contaminant of concern in fish advisory programs, accounting for over 76% of all advisories issued in 2004 (USEPA, 2005a). Both U.S. government agencies and risk communication researchers could potentially benefit from the lessons learned from this analysis.

The remainder of this thesis is presented in four chapters. Chapter 2 situates the present study in the relevant literature, presents the research questions to be explored, and introduces a model for building a list of best practices. Chapter 3 discusses the methods used to build a list of best practices from the risk communication literature, to construct a practical coding scheme from the list, and to evaluate a representative sample of government-issued methylmercury advisories. The results of this evaluation are presented in Chapter 4, including a final list of best practices, coding schemes, and statistical summaries demonstrating how risk communication's best practices were implemented in the advisory sample. Lastly, Chapter 5 discusses the lesson learned from the present study, including key findings and implications, challenges and limitations, future research directions, and potential applications to other risk contexts.

## CHAPTER 2

### REVIEW OF LITERATURE

#### *2.1 Background on Government Fish Advisory Programs*

For the government agencies responsible for public health, fish consumption advisories are the most widely used method for communicating the risks associated with the consumption of contaminated fish to public audiences (USEPA, 2005a). Alternative methods are more regulatory in nature, including bans on possession of fish from contaminated waters and fishery closures. As defined by the National Research Council, risk communication is an interactive process of information exchange among multiple stakeholders, a process that involves multiple messages about the nature of risks (NRC, 1989). When designed effectively, fish consumption advisories can exemplify an interactive process of information exchange among individuals, groups, and institutions, where fish consumers ultimately decide how to respond to the risk messages presented to them, making a choice of whether or not to alter fish consumption behavior in compliance with advisory recommendations. When designed ineffectively, fish consumption advisories can create confusion, distrust, apathy, or even fear.

Since the mid-1970's, advisories have been released when the state, tribal, and local government agencies that monitor and assess U.S. watersheds find dangerous levels of chemical contaminants in the ambient water and local fish/wildlife (USEPA, 2005a). An advisory may be issued for the general public or it may be issued specifically for sensitive, high-risk subpopulations that consume more fish than the general population (e.g., pregnant women, nursing mothers, children, subsistence anglers). However, it should be noted that high-risk subpopulations have been the primary populations of concern in the issuing of fish consumption advisories (Moya, 2004).

The EPA 2004 National Listing of Fish Advisories (NLFA) indicates that forty-eight states, the District of Columbia, the U.S. Territory of American Samoa, and three tribes currently have fish consumption advisories in place, bringing the total number of active U.S. fish consumption advisories to 3,221 in 2004, an increase of nearly 62% since the NLFA was established in 1993 (USEPA, 2005a). Furthermore, the 3,221 listed advisories represent 35% of the nation's total lake acreage and 24% of the nation's total river miles. Although there are advisories in the United States for 36 chemical contaminants, almost 98% of advisories in effect in 2004 involved five bioaccumulative chemical contaminants: mercury, PCBs, chlordane, dioxins, and DDT. Of these contaminants, mercury is by far the primary focus of fish consumption advisories, accounting for 76% (2,362) of all advisories issued in 2004. The prevalence of mercury advisories is a result of a series of worldwide epidemiological studies documenting mild to severe neurological impairment and developmental disorders in humans resulting from exposure to methylmercury (MeHg), primarily through the consumption of fish and shellfish (e.g., Bakir, 1973; Skerfving, 1974; Harada, 1995; Myers et al., 1995; Grandjean et al., 1998).

Since the dissemination of fish consumption advisories is primarily the responsibility of state rather than federal governments, fish advisory programs have been developed independently by each state, although federal advisories do exist (USEPA, 2005a). The result has been a variety of different approaches to developing and communicating the advisories from state to state, and bodies of water that cross between adjacent states (e.g., those in the District of Columbia area), have experienced variation in advisories present throughout the watershed, sending mixed messages to consumers.

Despite this state-specific variation in the content of fish consumption advisories, the core message(s) of all fish consumption advisories falls into six general categories:

- 1) *No-consumption advisory for the general population*-Issued when levels of chemical contamination in particular fish species pose a danger to the general population of a particular region. The general population is advised to avoid eating certain locally-caught types of fish or wildlife.
- 2) *No-consumption advisory for sensitive subpopulations*- Issued when contaminant levels in fish or wildlife pose a health risk to sensitive subpopulations (such as children and pregnant women). Sensitive subpopulations are advised to avoid eating certain types of locally caught fish or wildlife.
- 3) *Restricted-consumption advisory for the general population* – Issued when contaminant levels in fish or wildlife may pose a health risk if too much fish or wildlife is consumed. The general population is advised to limit eating certain types of locally caught fish or wildlife.
- 4) *Restricted-consumption advisory for sensitive subpopulations*– Issued when contaminant levels in fish or wildlife may pose a health risk if too much fish or wildlife is consumed. Sensitive subpopulations are advised to limit eating certain types of locally caught fish or wildlife.
- 5) *Commercial fishing ban* – Issued when high levels of contamination are found in fish caught for commercial purposes. These bans prohibit the commercial harvest and sale of fish and shellfish from a designated body of water.
- 6) *Safe-eating guidelines*- Issued when specific water bodies have been tested for chemical contaminants, and the results have shown that specific species



of fish from these waters are safe to eat without consumption restrictions. Target populations are educated to make more informed decisions about the water bodies in which they fish, as well as healthier choices about the fish they choose to eat (USEPA, 2005a).

This advisory content is communicated through a variety of media, including radio, television, newspapers, brochures, fact sheets, signs posted near contaminated waters, and the Internet (Burger et al., 1999; Pflugh et al., 1999; Burger & Waishwell, 2001; Jardine, 2003). In addition, advisory information travels through social networks, and many public audiences receive fish advisory information by word of mouth. Newspapers, signs, television, and word of mouth were the most frequently cited sources of advisory information by the audiences who were surveyed and interviewed in the above studies.

Despite the vast amount of advisory information that is disseminated to public audiences, the public response to fish consumption advisories has become a cause for concern. With the number of government-issued fish advisories increasing by nearly 62% in the United States since 1993 (USEPA, 2005a), government agencies continue to question why many public audiences most at risk (e.g., pregnant women, subsistence fishermen) are not heeding these advisories (Knuth, 1995). Public non-compliance with fish consumption advisories can in part be explained by how government agencies have traditionally disseminated risk information to the public.

## *2.2 Guiding Epistemology*

Due to the complex, technical, and uncertain nature of the risks of chemical contaminants in fish, the U.S. government institutions responsible for public health have traditionally operated under the assumption that science is the only form of knowledge that can provide an objective perception of risk. For the public policy-maker, one of the great benefits of using scientific evidence in the risk assessment

process is that science quantifies risk; that is, science assigns probabilities to risks, giving uncertainties discrete numeric values. These risk assessments can then be translated into policy that is grounded in a standardized epistemology.

More specifically, the types of fish consumption advisories that are issued by state and federal government agencies are based primarily on the results of quantitative risk assessment (Reinert et al., 1991, 1996). Risk assessment is a complex process that attempts to quantify risk with scientific evidence (e.g., epidemiological studies, environmental toxicology research) and numerous value judgments about the “acceptability” of risk (Chess, Burger & McDermott, 2005, p. 274). Mathematical models derived from the risk assessment process are intended to provide conservative threshold estimates (e.g., methylmercury Reference Dose) of the “acceptable” daily intake of various contaminants for the general population over the course of a lifetime (USEPA, 2001b, p.3). For the government policy-maker, these threshold estimates are considered to be “action-levels” that are used to manage fish sales, fishing practices, and public consumption patterns in the locations under government jurisdiction (Bender & Williams, 2001, p.1). And because risk management is primarily dictated by “technocratic legislative mandate” (Hotchkiss, 1997, p.89), public values rarely receive a high priority among these complex decisions.

However, science does not possess inherent social meaning. It is assigned meaning by members of particular audiences, who seek, process, and respond to information in different ways. Therefore, without due consideration to key factors such as contextual social/cultural value-systems, risk perceptions, information access, source credibility, and scientific uncertainty, risk assessments and the resulting public advisories possess little meaning to the heterogenous public audiences they are intended to protect. Moreover, because threshold estimates for particular contaminants are generic default values, they do not necessarily relate to a specific population or to

any individual in that population (Marien & Stern, 2005, p. 258). Thus, the use of default values in the development of fish consumption advisories may result in underprotection or overprotection of public health in any given case.

With these issues (and others) in mind, government agencies have recognized that disseminating fish consumption advisories to public audiences is a process with multiple levels of complexity, and the top-down, linear transmission of scientific information from government agencies to an undifferentiated public is not an “effective” approach to communicating the risks (and benefits) of fish consumption to public audiences. However, defining “effective” risk communication has been problematic for government agencies and risk communication researchers because of competing and sometimes conflicting risk communication strategies. This is an issue that applies not only to fish advisory programs, but to any risk communication program seeking to accommodate multiple perspectives of risk.

### *2.3 Three Strategies for “Effective” Risk Communication*

As suggested in the previous section, the primary objective of any health advisory program is to protect public health. But depending upon the results of quantitative risk assessments, policy-makers determine that some populations require more protection than others. Therefore, two competing risk communication strategies have emerged: 1) *the regulatory strategy*, driven by the objective to reduce public health risks by imposing limits on fish consumption; and 2) *the educational strategy*, driven by the objective to enable informed decisions about the risks (and benefits) of fish consumption (Knuth, 1995; Connelly & Knuth, 1998; USEPA, 2001a). Both the regulatory and educational strategies assume one-way transmission of risk information from expert to public. A conceptual difference between them is that the success of regulatory strategies depends upon inducing public compliance with government regulations, while educational strategies are successful if audiences have enough

personally relevant information to make informed decisions (NRC, 1989; Bostrom, 1996). However, it is unclear in the literature whether or not the educational strategy is successful if public audiences decide not to follow fish consumption regulations. A third strategy, *the interactive strategy*, is driven by the objective to foster a “decision-making partnership” between government agencies and public audiences (NRC, 1989; USEPA, 1995; Bostrom, 1996). In contrast to both the regulatory and educational strategies, the interactive strategy assumes a two-way dialogue or exchange of information between experts and an empowered public. This approach was originally developed by risk communication researchers as a means to improve risk communication in government agencies (NRC, 1989). Unfortunately, the regulatory and educational strategies have traditionally been adopted more frequently by government agencies than the interactive strategy (Bostrom, 1996).

When government risk assessments reveal high levels of chemical contaminants in fish, agencies typically disseminate regulatory advisories (Reinert et al., 1991, 1996). No-consumption advisories, restricted-consumption advisories, and fishing bans are examples of regulatory messages. Regulatory messages target behavior, emphasizing that public audiences need to be protected by government regulations (Knuth, 1995; Bostrom, 1996). These messages often warn against or forbid certain fishing and/or fish consumption behaviors and tell/direct the audience to act in compliance with advisory recommendations (e.g., do not consume fish from a specific water body; do not exceed fish consumption limits) (Connelly & Knuth, 1998; USEPA, 2001a). Moreover, regulatory messages typically carry a commanding and authoritative tone and do not emphasize alternative fish consumption behaviors and personal choice. Such persuasive intentions can in part be explained by the strong beliefs held by government agencies regarding the accuracy and correctness of policy derived from scientific evidence.

Alternatively, when government risk assessments reveal that contaminant levels in fish are not a cause for concern, agencies are more likely to adopt an educational strategy (Bostrom, 1996; USEPA, 2001a). Safe-eating guidelines are often composed mostly of educational content. Educational messages are precautionary information sources that emphasize the voluntary nature of fish consumption and the value of awareness and knowledge in promoting self-efficacy (Knuth, 1995). Therefore, educational messages explain *why* specified target audiences are at risk and how risks can potentially be reduced. These messages often have an explanatory and cajoling tone and emphasize a range of alternative behaviors to reduce risk (Connelly & Knuth, 1998; USEPA, 2001a).

Lastly, in the interest of improving risk communication between government agencies and public audiences, the interactive strategy emphasizes public engagement in the risk communication process (NRC, 1989; Bostrom, 1996; USEPA, 1995). Examples of interactive communication approaches are interviews or focus groups intended to promote information exchange between experts and empowered citizens. Similarly, interactive messages include the government-issued announcements requesting public input in policy decisions and messages that facilitate public action in some way (e.g., encouraging information-seeking behavior or inviting public inquiry). Moreover, requesting public evaluation of fish consumption advisories is another prominent interactive risk communication approach employed by government agencies. As mentioned previously, this emphasis on sharing information stands in contrast to the one-way transmission of information from expert to public that is perpetuated by the regulatory strategy and to a lesser extent by the educational strategy (USEPA, 1995).

Although there are circumstances in which the above risk communication strategies are most prevalent, they are by no means mutually exclusive. In fact, risk

communication researchers support the simultaneous use of multiple risk communication strategies in order to meet the needs of diverse target audiences (USEPA, 1995, 2001a). For example, if a public health agency wants to issue a fish consumption advisory about high mercury levels in largemouth bass caught from a particular lake, simply posting a warning sign by the lake is unlikely to persuade a large percentage of local anglers to stop catching and eating fish from the lake. However, a warning sign posted by the lake, a brochure disseminated through local healthcare providers, and a public meeting about the contamination problem is likely to be more effective. Similarly, specific public outreach materials can also emphasize multiple communication paradigms simultaneously. For example, a message can explain the risks of methylmercury in fish, tell the public to limit their consumption of particular fish species, and encourage them to contact the agency for more information and talk to their local healthcare provider.

Depending upon the objectives of the government agencies involved in issuing fish consumption advisories, some strategies will be emphasized over others. When making such decisions, agencies need to establish clear, operational definitions of what constitutes an “effective” fish consumption advisory in a given risk context if the success or failure of the advisory program is to be evaluated (Chess et al., 1995b). For example, is effective risk communication defined by the transfer of knowledge, persuasion, or public engagement? Should the advisory result in a compliant public, an informed public, or an empowered public? Ultimately, target audiences will be the best judges of an effective risk message.

#### *2.4 The Status of Risk Communication in Government Agencies*

Since the mid-1980s, government agencies have expressed interest in moving away from the traditional one-way transmission of scientific information *to* the public in favor of more interactive, participatory methods of communicating *with* the public

(Chess et al., 1995b). At the first conference on risk communication in 1986, the EPA supported a “participatory democracy” in which public audiences would have the opportunity to voice their concerns and government officials would try to “elicit from people a response that is both sensible and consistent with their own interests” (Davies, Covello & Allen, 1987, p. 9). However, as noted by Chess and her colleagues (1995b), the EPA did not address what agencies would do if public participation did not lead to what agencies defined as “sensible” (p. 115).

After this seminal conference, agencies began to express considerable interest in risk communication activities, resulting in risk communication training for agency staff at the local, state, and federal levels (Chess et al., 1995a). The USEPA, ATSDR, and DOE are among the agencies that have participated in risk communication training programs. Furthermore, government agencies have charged risk communication experts with producing research that would help improve agency risk communication efforts (e.g. Slovic, 1986; Sandman, 1987; NRC, 1989; Covello, McCallum & Pavlova, 1989; Chess, Salomone & Sandman, 1991; USEPA, 1992; USDHHS, 1993; Tinker, 1996).

Yet, numerous studies suggest that agencies’ risk communication practices lag behind their claimed commitment to improving risk communication (e.g., Shaw & Johnson, 1990; Chess & Salomone, 1992; Fisher, Chitose & Gipson, 1994; Chess et al., 1995a; Chess et al., 1995b; Tinker et al., 2000; Grunig et al., 2002; Chess, Burger & McDermott, 2005). For example, Chess & Salomone (1992) found that despite state agencies’ claimed commitment to audience-oriented risk communication, their risk communication practices mostly involved responding to public inquiries. In addition, studies have found that agency staff and management consider risk communication to be a low priority (Shaw & Johnson, 1990; Chess & Salomone, 1992; Fisher, Chitose & Gipson, 1994).

In 1994, a national symposium of risk communication researchers and practitioners was held to discuss future steps to improve government agencies' risk communication practices. The symposium established three top priorities for future research: 1) involving communities in agency decision-making; 2) communicating with communities of different races, ethnic backgrounds, and incomes; and 3) evaluating risk communication (Chess et al., 1995b). In addition to these research priorities, the symposium participants recommended that the traditional research focus on public audiences should shift to government agencies. Rather than being concerned about the so-called "irrationality" of the public, symposium participants were more concerned with the resistance of government agencies to improving risk communication (p. 115).

While it may be tempting to assume that government resistance to audience-oriented risk communication stems from scarce resources or perhaps even ignorance, there is considerable evidence that agencies face a series of internal organizational problems (e.g., interagency conflict, conflicting agency mandates, conflicting risk assessments) that act as barriers to effective public outreach (e.g., Chess et al., 1995a; Chess et al., 1995b; NRC, 1996; Chess, Burger & McDermott, 2005). One important barrier to effective risk communication that has received little exploration is the resistance of government agencies to adopt the recommendations of risk communication researchers when communicating with public audiences. As discussed by Chess, Burger & McDermott (2005), this issue is particularly salient in fish advisory programs.

Following the general trend within government agencies, risk communication researchers have been urging agencies since the mid-1980s to take more targeted, interactive approaches to developing fish consumption advisories (Chess, Burger & McDermott, 2005). These approaches were developed to help government agencies



contextualize advisory content and involve target audiences and other relevant stakeholders in the production and evaluation of fish consumption advisories (e.g., Knuth, 1995; Connelly & Knuth, 1998; Burger et al., 1999; Pflugh et al., 1999; Burger, 2000; Burger et al., 2001; McDermott, 2003; Jardine, 2003; Burger et al., 2004; Moya, 2004). However, it is unfortunate that changes in risk communication protocol are often associated with whether risk communication researchers are members of the agency's power elite (Chess, Burger & McDermott, 2005). Many government agencies do not involve risk communication researchers in policy decisions, and therefore these communication professionals typically have limited power to effect change (p. 275).

### *2.5 Research Questions*

To date, little is actually known about the degree to which risk communication's best practices are implemented in government-issued fish consumption advisories. Perhaps fish advisory programs are applying many of the recommendations coming from the risk communication literature or perhaps they are unable to because risk communication research is not practical or accessible enough to be useful to government agencies. Indeed, some health and environmental agencies have indicated that they would be more amenable to adopting risk communication recommendations if they were more practical and accessible (Chess et al., 1995b).

In the present study, I attempt to synthesize a list of best practices from the risk communication literature and develop a practical evaluation tool to compare these recommendations for effective advisory design to the actual outreach materials that they are intended to improve. Therefore, one objective of this study is to build a list of best practices from the risk communication literature. The second objective is to develop a practical and reliable coding scheme from this list. And the third objective is to use the resulting coding scheme as an evaluation tool to examine areas of

convergence and divergence between risk communication research and agency practice. State, tribal and federal advisories focusing on methylmercury are targeted for analysis, as methylmercury is the primary contaminant of concern in fish advisory programs.

Based upon my review of the risk communication literature and stated research objectives, I ask the initial question:

RQ1: What are the best practices defined in the existing risk communication literature? Can a practical list of best practices be generated from the existing literature?

Assuming that a practical list of best practices can be generated from the existing literature, this list must be adapted into a coding scheme that can be used to evaluate government-issued methylmercury advisories. The results of this evaluation would allow me to address the following questions:

RQ2: What is the relative use of the regulatory, educational and interactive risk communication strategies in government-issued methylmercury advisories?

RQ3: Which best practices are most widespread in government-issued methylmercury advisories? Which best practices are implemented the least?

## *2.6 The Risk Communication Planning Model*

A conceptual model that could guide the evaluation of best practices in government-issued fish consumption advisories is known as the risk communication planning model (Springer, 1990; Velicer & Knuth, 1994). This framework has been most recently applied in the creation of an agency guidebook that contains one of the most comprehensive discussions to date of best practices for fish advisory risk communication programs within government agencies (USEPA, 1995). Perhaps this model can also offer a basic framework in which best practices from the risk

communication literature can be organized and applied to actual government-issued fish consumption advisories.

To illustrate, the risk communication planning model is composed of the following stages: 1) problem analysis; 2) audience identification and needs assessment; 3) communication strategy design; 4) communication strategy implementation; and 5) program evaluation. Inspired by the “interactive” risk communication paradigm (Scherer, 1991), this model emphasizes information exchange between government agencies and public audiences. Therefore, each stage of the model is interconnected, allowing for audience feedback and evaluation at each stage of the process.

The stage of the model that is most relevant to this analysis of government-issued fish consumption advisories is strategy design component of the model (see Figure 2.1). According to the USEPA (1995), fish advisory programs attempting to design an effective risk communication strategy should consider three primary factors: 1) style; 2) content; and 3) dissemination. Each of these factors is characterized by key considerations that have been examined in the risk communication literature.

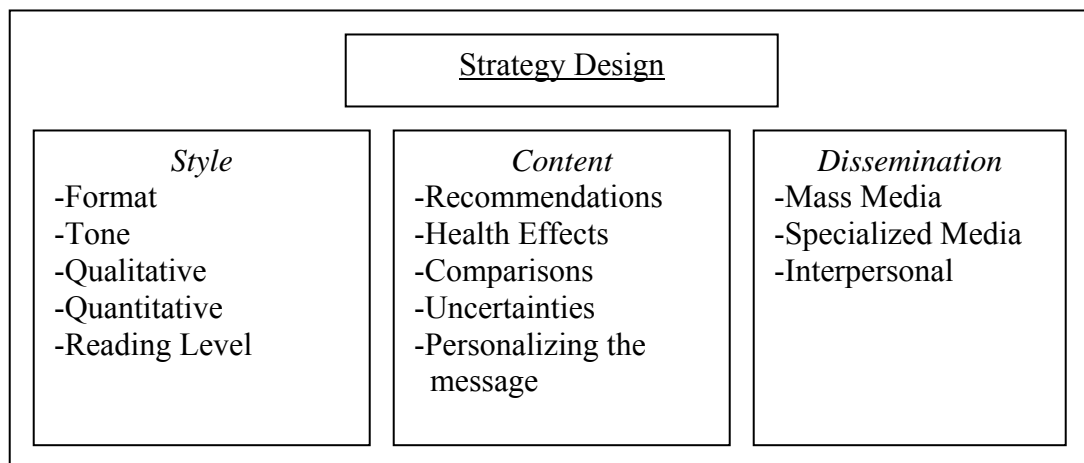


Figure 2.1 The strategy design stage of the risk communication planning model  
(adapted from USEPA, 1995)

From Figure 2.1, it is apparent that best practices derived from the risk communication literature could be organized into the above categories. This framework is applicable to the design of methylmercury advisories and can be adapted and expanded in the case that best practices emerge from the literature that do not relate to the categories defined above. Therefore, the risk communication planning model will be used as the basic framework for organizing the best practices that are drawn from the risk communication literature. It will also be useful in designing a coding scheme to evaluate government-issued methylmercury fish consumption advisories.

## CHAPTER 3

### METHODS

#### *3.1 Overview*

The approach used to address the above research objectives and related research questions consisted of three main phases: 1) selecting and organizing a list of best practices from the risk communication literature; 2) constructing a practical coding scheme from the list; and 3) using the coding scheme to evaluate a representative sample of government-issued methylmercury advisories. The research methods used in each of these phases will be systematically discussed in the sections that follow. It should be noted that the process of constructing a practical coding scheme required frequent revisions that occurred throughout the data collection/evaluation phase (phase 3).

#### *3.2 List of Best Practices*

Before selecting a list of best practices from the risk communication literature, it was first necessary to define a “best practice.” The notion of a best practice has traditionally been applied in business settings to streamline productivity through the standardization of specific techniques and strategies that have proven to be reliable and effective, establishing them as the “one best way” of doing something (Hoag & Cooper, 2006). As discussed in Chapter 2, risk communication experts publish a wide variety of message design strategies and techniques that are intended to provide reliable solutions to risk communication problems within government agencies, including agency fish advisory programs. These recommendations, typically based on empirical evidence, are discussed in a wide variety of sources, from books, to journal articles, to conference proceedings. A key concern is that government agencies are resistant to adopting the recommendations of risk communication experts and that

their suggested improvements have little impact on government policy (e.g., Chess, Burger & McDermott, 2005).

Perhaps government agencies would be more amenable to adopting these recommendations if they were more practical and accessible. Thus, the best practice concept was applied in this study to suggest that a more practical, uniform set of techniques and strategies should be developed to allow government agencies to consistently evaluate the effectiveness of their risk communication efforts within fish advisory programs. With this issue in mind, *a best practice was defined as a message design concept, strategy or technique pertinent to the design of fish consumption advisories that was recommended by a credible source as a means to improve risk communication.* This definition was posed under the assumption that the concepts, strategies, and techniques recommended by risk communication experts in fact provide practical and reliable improvements to the risk communication process within government agencies. Unfortunately, the success or failure of a given best practice in improving agency risk communication efforts could not be evaluated.

A total of 74 sources (see Appendix A), issued between 1989 and 2006 were selected as the sample from which to draw the list of best practices. Relevant sources were selected according to three criteria: 1) the source needed to present specific recommendations for the design of effective risk messages; 2) the source needed to discuss recommendations that were pertinent to the design of mercury fish consumption advisories; and 3) the source needed to have some form of credible foundation for their claims (i.e., empirical data supporting their recommendations, citing past research findings as support for recommendations, and/or consensus recommendations emerging out of a discussion among experts).

Relevant sources were initially gathered through online databases (e.g., Blackwell-Synergy, ISI Web of Knowledge), search engines (i.e., Google, Google

Scholar), and the Cornell Library catalog with search queries such as: “fish advisory risk communication” and “improving risk communication.” The results of these searches yielded a considerable body of relevant sources, which was expanded by locating other relevant publications that were cited in these sources. Relevant sources were also selected among the publications posted on the NLFA (National Listing of Fish Advisories) web site that is hosted by the United States Environmental Protection Agency.

The resulting sample was composed of three types of sources: 1) empirical; 2) theoretical; and 3) practical (see Appendix A). *Empirical sources* consisted primarily of journal articles that aimed to determine the most effective ways to convey fish advisory information to public audiences via target audience assessment and evaluation procedures. *Theoretical sources* were aimed at changing the ways risk communicators conceptualize target audiences and the risk communication process, often basing their conceptual approaches upon empirical findings from the risk communication literature or pressing policy issues. Lastly, *practical sources* consisted of journal articles, guidebooks, government guidance documents, and conference proceedings intended to improve agency risk communication efforts by providing solutions to risk communication challenges. Practical sources were also typically based upon empirical evidence and consistently yielded the most recommendations per source.

When best practices were identified in a given source, it was necessary to organize them into categories to identify common themes. To guide this process, the recommendations were initially grouped under the categories designated by the strategy design component of the risk communication planning model (USEPA, 1995) that was introduced in Chapter 2. More specifically, best practices were grouped under the following categories and subcategories when applicable: 1) Style (format, tone,

qualitative, quantitative, reading level); 2) Content (recommendations, health effects, comparisons, uncertainties, personalizing the message); and 3) Dissemination (mass media, specialized media, and interpersonal). Additional categories were added as topics/themes emerged that were not addressed in the model. These additions to the original model will be discussed further in subsequent sections of this chapter and in Chapter 5.

Counts were tallied each time a specific best practice was recommended by a given source. Individual sources often recommended multiple best practices and were counted once for each distinct recommendation they made. Also, the same best practices were often recommended by multiple sources. This did not affect their representation on the list. In other words, all best practices, whether mentioned once or by thirty different authors, were given equal weight on the list. This allowed a variety of risk communication perspectives to be represented that would have otherwise been excluded if only the most frequently mentioned recommendations were selected for the list. However, it could also be argued that the frequency of mention is what should distinguish a recommendation from a best practice. This potential limitation will be addressed further in Chapter 5.

Once all of the sources were analyzed, the initial list of best practices was reviewed for overlapping content. Recommendations that addressed concepts, strategies, or techniques that were judged to be essentially the same were combined. Whenever possible, recommendations were combined without altering the content of the originals. For example, one practice stated: “give people a sense of control and personal choice.” A second practice stated: “the advisory message should be presented in a way that provides solutions; present concrete actions that people can take to minimize risks and maximize benefits.” Because offering people concrete solutions in advisory messages is a practical way to give people a sense of control and personal



choice, these best practices were combined into one—“Give people a sense of personal control and personal choice. Design the advisory in a way that provides solutions; present concrete actions that people can take to minimize risks and maximize benefits.” The completion of this review/revision process resulted in a list of 125 best practices, which can be found in Appendix B.

### *3.3 Coding Schemes*

Two separate coding schemes were designed from the list of best practices (see Appendices C & D). The first coding scheme focused on the style and content of individual advisory messages, while the second coding scheme focused on the dissemination strategies of the advisory programs in each agency jurisdiction. In other words, these two coding schemes focused upon different types of best practices (i.e., how to design effective advisories vs. how to disseminate them effectively) with different units of analysis (i.e., individual advisories vs. all advisories in a given agency jurisdiction). Only the first coding scheme was applied in this study because I could not accurately assess the dissemination strategies of entire jurisdictions without a census of mercury advisories issued within those jurisdictions. Future studies may benefit from the dissemination coding scheme, but for the purposes of this thesis, only the first coding scheme (i.e., style and content) will be discussed from this point forward.

The overall objective of the style and content coding scheme was to capture a detailed summary of how government-issued methylmercury advisories compare to risk communication’s best practices for effective message design. Therefore, the coding scheme needed to measure the characteristics of the archetypal “effective” risk message, as defined in the risk communication literature. This task was pursued by structuring the coding scheme in three separate sections: 1) descriptive profile; 2) use of communication strategies; and 3) evaluation of best practices. The first section was

designed to provide a conceptual profile or map of the population sample of methylmercury advisories. A series of nominal and categorical variables were developed, including the advisory source, year of release, dissemination medium and others that will be discussed in section 3.5. The second section was intended to provide a general idea of how government fish advisory programs are planning their risk communication efforts by examining the relative use of the regulatory, educational, and interactive risk communication strategies discussed in Chapter 2. Lastly, the third section was intended to evaluate the use of the specific best practices derived from the risk communication literature, allowing for comparison between individual best practices and general risk communication strategies.

This process of developing an operational set of variables to represent the best practices (style and content) in Appendix B presented three main challenges: 1) to adapt the best practices so that they specifically pertained to methylmercury fish consumption advisories; 2) to develop concrete and unambiguous variables so that mercury advisories could be reliably evaluated by other coders; and 3) to ensure that advisory messages would always be evaluated under a relevant set of best practices.

The first challenge was initially addressed by examining a range of mercury advisories and making an assessment of how the best practices from Appendix B were operationalized in these different outreach materials. Many best practices could be assessed through manifest content in the advisory. For example, the behavioral alternative to “eat smaller and younger fish” was explicitly discussed in most messages. On the other hand, some best practices required the assessment of more latent message features. For example, to examine if an advisory discusses “the immediacy of the risk,” one needs to have a sense of how this variable is represented in a given advisory message. After examining actual mercury outreach materials, it became apparent that this practice was often addressed with a statement such as “there

are no known cases of illness from mercury poisoning in Illinois.” Overall, this preliminary assessment of the actual advisory materials helped to familiarize me with how specific best practices were manifested in mercury advisories and to provide me with practical examples of how more latent variables were used in messages.

The second challenge, ensuring that the variables in the coding scheme were concrete and unambiguous, required a series of key considerations. First of all, many of the best practices in Appendix B were posed at different levels of abstraction. For example, one best practice states: “Discuss the assumptions and uncertainties that form the basis for issuing fish consumption advisories.” This is statement posed at a relatively high level of abstraction. However, other best practices state specific assumptions and uncertainties (e.g., defining meal size, outlining fish sampling procedures, etc.) that should be included in advisory messages. Thus, the abstract practice encompasses the more concrete practices. In the coding scheme, this was represented by posing the more abstract practice as questions and including the practical, concrete practices as variables that measured whether or not this more general question was addressed. This way, both concrete and abstract practices could be included in the coding scheme and evaluated in mercury advisories.

Another key consideration was basic pragmatics. There were some practices that could not be reliably assessed in advisories. The most notable examples are the set of practices listed under the “simple vs. complex” subcategory related to the format of advisory messages. Because it was not possible to reliably assess the difference between a simple and complex message, these variables were not directly measured in the study. Fortunately, a relatively objective assessment of “reading level” was made that indirectly assesses the use of simple vs. complex message formats in the advisory sample. Overall, there were very few best practices were not pragmatic enough to be represented in the coding scheme.

The final practical consideration related to how individual variables were represented in the coding scheme. First of all, many best practices needed to be split into smaller components to be coded for. For example, one best practice stated: “describe the nature of the contaminant and how it accumulates in fish tissue and in the environment.” This practice includes three components. First, there was the abstract concept of describing the nature of the contaminant. As discussed previously, abstract issues were posed as questions that encompassed more specific practices. In this example, a question was posed at the beginning of the Contaminant Description section of the coding scheme: Does the message adequately describe the nature of methylmercury? Next, there were two specific practices mentioned in the above example: 1) the accumulation of the contaminant in fish tissue; and 2) the accumulation of the contaminant in the environment. These practices were represented as two separate variables that were included under the general question about the nature of the contaminant. In addition, many variables such as those from this example needed to be rephrased so that they specifically addressed methylmercury rather than an unspecified contaminant.

The third main challenge encountered in constructing a practical coding scheme was to ensure that advisory messages were always evaluated under a relevant set of best practices. This was addressed by structuring the best practices section of the coding scheme in the form of a dichotomous key. To illustrate, a series of qualifying questions represented by the symbol “Q” were used to direct coders to relevant categories. For example, the question Q2 asks: Are visuals (e.g., graphs, pictures, tables, diagrams) pertaining to methylmercury in fish used in this message? (No=0, Yes=1). If the coder answers “No,” then they are directed to skip the category about visuals and proceed to another qualifying question. However, if the coder answers “Yes,” then he/she is directed to complete the category about visuals. In this way, only

the categories that were relevant to a given advisory message were coded for in that message.

In sum, constructing a practical and reliable coding scheme was a trial-and-error process of coding advisory messages and making revisions as the data were collected. The second coder played an important role in the revision process during the intercoder reliability phase of the study (see section 3.6) by drawing attention to ambiguous variables and then discussing with me how they might be stated more clearly.

#### *3.4 Sampling Frame and Unit of Analysis*

The third major phase of this study was to use the style and content coding scheme to evaluate a representative sample of government-issued methylmercury advisories. Before discussing how this representative sample was obtained and subsequently analyzed, an operational distinction must be made between “public outreach materials” and “advisories.” In Chapter 2, it was noted that there are well over 2,000 mercury advisories currently in effect. That figure refers to site-specific advice (e.g., eat no more than 1 meal a week of bass from Lake Pillsbury) for particular water bodies, rather than the number of outreach materials that have been disseminated to public audiences. Often, multiple site-specific advisories are summarized in individual public outreach materials (e.g., brochures, fact sheets). For the purposes of this study, when the term “advisory” is used, it refers to the mercury public outreach materials disseminated by government agencies, rather than the site-specific advice often contained within them.

The sampling frame used in this study was *The National Listing of Fish Advisories (NLFA)*, an EPA website/database containing all publicly available fish advisory information (including site-specific advice) provided by the federal government, the 50 states, the District of Columbia, four U.S. territories, and Canada

(USEPA, 2005a). A convenience sample of 221 methylmercury advisories was downloaded from this website, spanning the period from 1989 to 2006. In other words, the sample consisted of all text-based public outreach materials related to methylmercury that were available through the NLFA website, including materials available through state and tribal agency websites that were linked to the NLFA site. A census of state, federal, and tribal methylmercury advisories was not possible because I only had access to the advisories that were posted on the Internet. While there have undoubtedly been other methylmercury advisories issued by government agencies since 1989, to my knowledge, there are no publicly available estimates of the total number that exist. Fortunately, there is considerable uniformity between advisories issued by state, tribal and federal agencies (USEPA, 2005a). Therefore, I am confident that the advisories gathered from the NLFA database are representative of the range of mercury advisories distributed by U.S. state, tribal and federal government agencies over the last two decades.

Three sources within the NLFA website provided the majority of the sample. The first source was an USEPA guidance document, entitled: *Guidance for Assessing Chemical Contaminant Data for Use in Fish Consumption Advisories*. This document, available under the “National Guidance” link, was published in 1995 and provided access to selected advisories published in the early 1990s (USEPA, 1995). The second source, available under the “Publications” link, is an archive of state and federal advisories that were originally compiled by the EPA, Society for Risk Analysis, and the Minnesota Department of Health for presentation and distribution at the 2001 National Risk Communication Conference (USEPA, 2001a). The third source, available under the “Where You Live” link, was an excellent source for accessing state advisories that are currently available on the state agencies’ web sites.

It is important to note that 25 of the advisories examined in this study were non-English versions of advisories that were also available in English. These non-English duplicates were not included in the overall sample, but were only included for the measurement of a few select variables. Because these non-English duplicate advisories were targeted towards ethnic minorities, they were important to include in the sample for the “cultural sensitivity” section of the content analysis. However, to avoid recording duplicate data for the other sections of the study, the duplicate messages were only coded for the “ethnicity” variable and the variables in the “cultural sensitivity” section. Thus, for these variables, the sample size was 246 rather than 221.

The unit of analysis for this study was the individual U.S. state, tribal and federal advisories that were available through the NLFA website; each advisory functioned as a separate unit. Moreover, all content pertaining to methylmercury was considered in the analysis, including text, visuals, titles, captions, etc. Advisories were often short, typically 3-5 pages in length. The key exceptions were formal reports, which often exceeded 50 pages in length. Discussion of methylmercury was not more likely to occur at the beginning, middle, or end of a particular advisory. However, parsing was necessary in advisories that discussed other contaminants in addition to methylmercury. For these hybrid messages, which accounted for about 50% of the sample, content that addressed general fish consumption issues (e.g., health benefits of eating fish) and methylmercury in particular was coded, while content specifically pertaining to contaminants other than methylmercury (e.g., PCBs) was excluded. Because these advisories were often organized into sections that were each devoted to a specific contaminant, it was usually quite simple to differentiate content pertaining to methylmercury from content pertaining to other contaminants. However, in some cases, knowledge of the contaminants themselves was necessary to make a distinction

between relevant and irrelevant content. For example, some advisories provided advice on properly cooking and cleaning fish. This advice applies to contaminants stored in the skin, fat, and viscera of fish, but not to mercury, which is bound tightly to muscle tissue and cannot be removed through cooking or cleaning. The following section provides additional information about the coding procedures used to evaluate government-issued methylmercury advisories.

### *3.5 Coding Procedures*

As discussed in section 3.3, the style and content had three main sections: 1) descriptive profile; 2) use of communication paradigms; and 3) evaluation of best practices. The coding procedures used in each of these sections are outlined below.

In the first section, each advisory was coded for a variety of descriptive variables, including the advisory source, general jurisdiction, specific jurisdiction, year of release, title, contaminant(s) of concern, targeted ethnic group, target audiences (first, second and third), and dissemination medium (see Appendix C). These were nominal and categorical variables that were explicitly represented in advisory messages and simply needed to be recorded.

The second section examined the relative use of the regulatory, educational and interactive strategies in each advisory message. A holistic rating was assigned to each advisory message on three separate scales that corresponded with the regulatory, educational and interactive communication strategies, respectively. Each scale had three possible ratings (0=absent; 1=minor; 2=major). Two distinct assessments were often necessary to make the final ratings: 1) assessing presence or absence; and 2) assuming presence, assessing the degree of presence (i.e., is the strategy minor or major?).

In order to assess the presence or absence of a particular communication strategy, evidence for the presence of each strategy was defined (see Appendix C). If



one or more pieces of evidence listed under a strategy were present in a given message, then the strategy was coded as present. If none of the evidence listed under a strategy was present, then the strategy was coded as absent. The operational definitions listed under each strategy were drawn from the risk communication literature (e.g., USEPA, 1995; Connelly & Knuth, 1998; USEPA, 2001a).

Assuming the presence of a communication strategy in a given advisory message, the *degree* of presence needed to be assessed (i.e., whether the strategy was minor or major). In order to make this assessment, three factors were considered: 1) the objective(s) of the message; 2) the central theme(s) addressed in the message; and 3) the proportion (roughly estimated) of the message devoted to the strategy of interest. Specific examples of how the communication strategies were coded for in methylmercury advisories can be found in Appendix C.

In the third section of the coding scheme, each advisory was coded to evaluate the implementation of risk communication's best practices in government-issued methylmercury advisories. As mentioned previously, this section was structured in the form of a dichotomous key to ensure that advisory messages were only coded under relevant categories of best practices. There were 14 categories, 8 subcategories and 90 variables in this section of the coding scheme (see Appendix C). Each category was defined by a common theme (e.g., health benefits), a guiding question (e.g., does the message explain specific health benefits of eating fish?), and a thematic set of variables that each measured a specific technique, strategy, or concept (e.g., discussion fetal development benefits). In addition, the categories in the coding scheme were organized in the same basic format as the risk communication planning model (Figure 2.1). The basic format of the coding scheme is depicted below.

### *Style*

- Format-visuals and text; visual clarity
- Tone-commanding vs. cajoling; positive
- Qualitative vs. Quantitative
- Reading Level

### *Content*

- Encouraging Audience Involvement
- Information-Seeking
- Core Recommendations
- Alternatives
- Health Effects-high risk groups; severity; health risks; health benefits
- Contaminant Description
- Comparisons
- Assumptions/Scientific Uncertainty
- Personalizing the Message
- Cultural Sensitivity

Assuming that a given category was relevant and qualified for analysis, variables were simply coded as present or absent for each advisory message. For example, if an advisory stated that fish are high in protein *and* low in fat, both of these variables would be coded as “present” under the *health benefits* subcategory of the coding scheme. The sole exception was the *reading level* section that required the coder to follow a link to a web site that calculated the Flesch Reading Ease and Flesch-Kincaid Grade Level for a text sample from each advisory. To maintain a degree of consistency between text samples, content describing the health effects of mercury or how it accumulates in fish tissue was selected from each message to compute the reading level.

### *3.6 Coder Training and Intercoder Reliability*

Given the many latent features of my coding scheme, a second coder was needed to assess the reliability of my findings. Before coding a simple random sample of methylmercury fish consumption advisories (25, or 11.3%) from the NLFA database, the second coder practiced with seven pilot advisories that were not from the specified set of advisories that he was assigned for actual analysis. After receiving verbal instructions and familiarizing himself with the codebook, the second coder attempted to code each pilot advisory without my assistance. I was there through this process to address questions and concerns. After the seven pilot advisories were coded, I made revisions to the codebook to clarify the problematic variables.

Following this pilot phase, both of us coded the same set of 25 advisories. I entered my data into an SPSS spreadsheet and the second coder entered his data into a Microsoft Excel spreadsheet, which was subsequently imported into SPSS. Directly entering the data into computerized spreadsheets eliminated the possibility for error that is present when entering data manually from paper-based coding schemes. In sum, 108 variables were assessed for intercoder reliability. The variables that were excluded from this analysis were mostly nominal or categorical variables with manifest content (i.e., identification number, advisory source, general advisory jurisdiction, specific advisory jurisdiction, year of release, title) (see Appendix C). In addition, two variables were excluded that could not be reliably assessed between coders: the second and third target audience. Because the second and third target audience both refer to a minor target audience in the advisory message, the designation of which target audience is coded as second versus third is completely subjective. Therefore, the results reported for these “minor target audience” variables should be taken with caution because no intercoder reliability assessments were made.

When we were finished jointly coding the 25 advisories, I made an initial assessment of intercoder reliability by copying the data from both coders into a single SPSS spreadsheet and running crosstabs between coder ratings for each variable. I then divided the total number of times in which we were in agreement by 25 to calculate the reliability coefficient for each variable. Percent agreement of 0.70 (70%) or more was considered acceptable for this study (Frey, Botan & Kreps, 2000). The first round of coding revealed that five variables had less than 70% agreement and needed to be recoded. After reviewing how these best practices were typically represented in methylmercury advisories, we recoded the problematic variables in the same set of 25 advisories. The reliability coefficients from this second coding session are reported in Appendix E. Percent agreement ranged from 72-100% for all 108 variable that were jointly coded, suggesting good reliability for the coding scheme.

Cohen's *kappa* ( $\kappa$ ) was also computed after the second coding session to control for the possibility of chance agreements between coders. Cohen's *kappa* has a normal range from .00 (chance agreement) to 1.00 (perfect agreement). A value of less than .00 indicates agreement less than chance (Neuendorf, 2002). As a general rule of thumb,  $kappa > .75$  is considered excellent agreement beyond chance;  $.40 \leq kappa \leq .75$  is considered fair to good agreement beyond chance; and  $kappa < 0.40$  is considered poor agreement beyond chance (Benerjee et al., 1999). For most variables, *kappa* ranged from .40 to 1.0, indicating fair to excellent agreement beyond chance (see Appendix E). However, *kappa* can only be calculated when both coders record values for the same categories. For example, if one coder codes all advisories as missing a particular variable and the second coder codes some advisories as having a value for the variable and others as missing a value, *kappa* cannot be calculated. Similarly, even if there is 100% agreement between coders, but the variable is coded as a constant value (e.g., all missing), then *kappa* cannot be calculated. A considerable

number of variables could not be calculated for one of these two reasons. Moreover, 6 out of the 108 variables received low *kappa* values ( $<.40$ ), and of these 6 variables, 2 had *kappa* coefficients less than 0. These *kappa* values seem puzzling, considering the high percent agreement between coders. However, there is an explanation for these disparate findings.

*Kappa* has been criticized in the statistics literature for being an overly conservative reliability estimate that penalizes extreme distributions (e.g., Perrault & Leigh, 1989; Potter & Levine-Donnerstein, 1999). To illustrate, the variable “InfoSeek2” was jointly coded in 25 advisories. The results revealed 92% raw agreement between coders. However, *kappa* was 0.46. The reason for this is that roughly 90% of advisories were coded as absent, while roughly 10% were coded as present. This uneven distribution between coding categories resulted in a highly conservative *kappa* value. Although this disadvantage has been recognized in the statistics literature, no alternative coefficient has gained popular support (Neuendorf, 2002). Despite these limitations, *kappa* should be considered as a second, albeit highly conservative estimate of intercoder reliability for the coding scheme.

## CHAPTER 4

### RESULTS

#### *4.1 List of Best Practices and Revised Coding Scheme*

In Chapter 2, I asked the initial research question: What are the best practices defined in the existing risk communication literature? Can a practical list of best practices be generated from the existing literature? The extensive process of selecting relevant sources (see Appendix A), gathering and organizing a list of best practices (see Appendix B) from the risk communication literature, constructing a practical coding scheme from the list, and using this coding scheme to evaluate a representative sample of government-issued methylmercury advisories is systematically discussed in Chapter 3. The revised coding scheme (style and content) that resulted from this evaluation process can be found in Appendix C. Thus, to address my initial research question, a practical list of best practices can not only be generated from the existing risk communication literature, but also adapted into a practical and reliable evaluation tool. However, this evaluation tool possesses some key limitations that will be addressed further in Chapter 5.

#### *4.2 Descriptive Profile of Sample*

This section presents the relative frequencies of the 10 descriptive variables examined in this study: 1) advisory source; 2) general advisory jurisdiction; 3) specific advisory jurisdiction; 4) year of release; 5) contaminant(s) of concern; 6) ethnicity; 7) first audience; 8) second audience; 9) third audience; and 10) dissemination medium. These variables were not intended to specifically address my research questions, but rather to provide a conceptual map of the sample (N=221).

The “advisory source” variable was a nominal variable intended to survey the types of agency departments that issue fish consumption advisories. The results indicate that the vast majority of methylmercury advisories were distributed by public

health and environmental protection departments, with the remaining advisories issued by fish and wildlife departments.

The “general advisory jurisdictions” categorical variable assessed if advisories were issued by state, federal, or tribal agencies. The results indicate that 207 (93.7%) of the sample were state advisories, 12 (5.4%) were federal advisories, and 2 (.9%) were tribal advisories (see Table 4.1). Also shown in Table 4.1, the “specific advisory jurisdictions” variable provided a more detailed breakdown of the advisory jurisdictions represented in the sample. Of the states, 5 states issued 40% of the advisories (California, Georgia, Minnesota, North Carolina, and Oregon). The two tribal advisories were from the Great Lakes tribes and Minnesota Chippewa tribes. And of the 12 federal advisories, the EPA issued 9, the FDA issued 2, and 1 was issued jointly by both agencies.

Table 4.1 Advisory jurisdictions represented in the advisory sample (N=221)

Jurisdiction	Frequency	Percent
<i>General</i>		
State	207.0	93.7
Federal	12.0	5.4
Tribal	2.0	0.9
Total	221.0	100.0
<i>Specific</i>		
Alabama	3.0	1.4
Alaska	2.0	0.9
Arizona	4.0	1.8
Arkansas	5.0	2.3
Colorado	5.0	2.3
California	31.0	14.0
Connecticut	6.0	2.7
Delaware	1.0	0.5
Federal-EPA/FDA	12.0	5.4
Florida	4.0	1.8
Georgia	9.0	4.1
Great Lakes Indian Tribes	1.0	0.5
Hawaii	1.0	0.5
Idaho	4.0	1.8
Illinois	7.0	3.2
Indiana	2.0	0.9
Iowa	1.0	0.5

Table 4.1 (Continued)

Jurisdiction	Frequency	Percent
Kentucky	1.0	0.5
Louisiana	3.0	1.4
Maine	3.0	1.4
Maryland	2.0	0.9
Massachusetts	2.0	0.9
Michigan	3.0	1.4
Minnesota	24.0	10.9
Minnesota Chippewa Tribe	1.0	0.5
Mississippi	3.0	1.4
Missouri	4.0	1.8
Montana	2.0	0.9
Nebraska	2.0	0.9
Nevada	1.0	0.5
New Hampshire	2.0	0.9
New Jersey	6.0	2.7
New Mexico	2.0	0.9
New York	4.0	1.8
North Carolina	9.0	4.1
North Dakota	1.0	0.5
Ohio	5.0	2.3
Oklahoma	5.0	2.3
Oregon	9.0	4.1
Pennsylvania	2.0	0.9
Rhode Island	2.0	0.9
South Carolina	3.0	1.4
South Dakota	2.0	0.9
Tennessee	1.0	0.5
Texas	1.0	0.5
Utah	1.0	0.5
Vermont	3.0	1.4
Virginia	1.0	0.5
Washington	6.0	2.7
West Virginia	3.0	1.4
Wisconsin	3.0	1.4
Wyoming	1.0	0.5
Total	221.0	100.0

The advisories in the sample were issued from 1989-2006 (see Figure 4.1). From Figure 4.1, it is apparent that the majority of the advisories in the sample were released in 2000 and 2005. This sampling bias can be explained by the fact that the two major sources from which I drew the sample were published in 2001 and 2005, respectively.



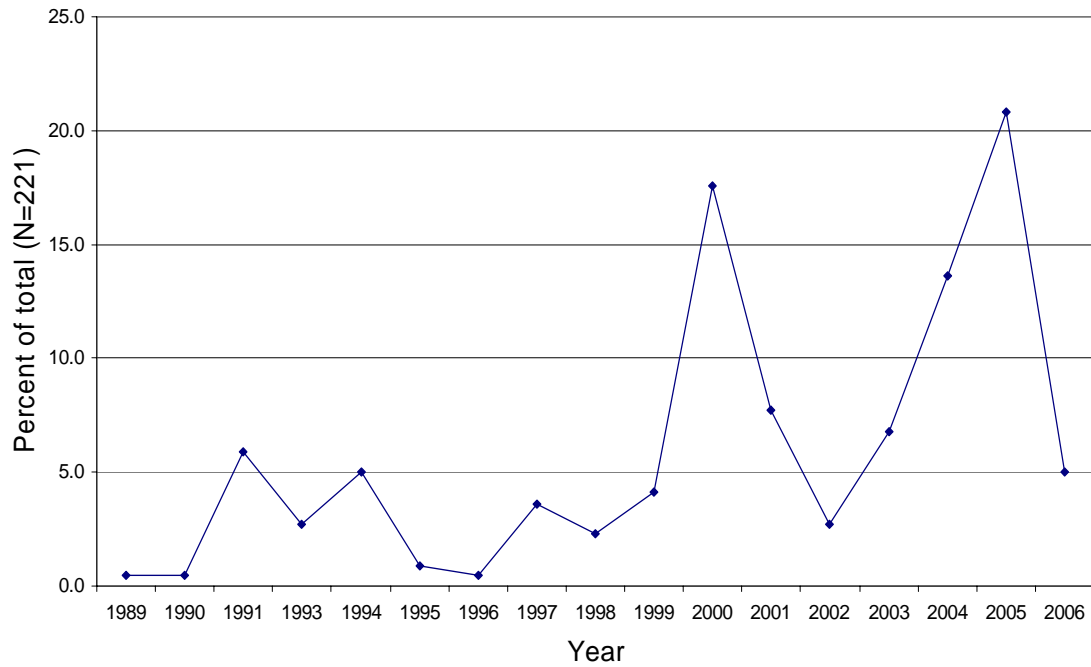


Figure 4.1 Years of release for advisory sample (N=221)

The “contaminant(s) of concern” variable measured the relative frequency of advisories that addressed methylmercury only compared to the number of advisories that addressed methylmercury and other contaminants (e.g., PCBs, dioxins). The results indicate that 50.2% of the sample addressed methylmercury only, while the remaining 49.8% addressed methylmercury and other contaminants.

The “ethnicity” variable recorded the target ethnicity of each advisory message. As discussed in the methods chapter, 25 non-English duplicates were included in the sample for this variable, bringing the total sample size to 246. The targeted ethnic groups for the sample can be seen in Table 4.2. Of the 246 advisories in the sample, 216 (87.8%) did not specify a target ethnicity, 16 (6.5%) targeted Hispanic or Latinos, 9 (3.7%) targeted Asians, 4 (1.6%) targeted American Indians or Alaska Natives, and 1 (0.4%) targeted Hawaiians.

Table 4.2 Targeted ethnic groups in advisory sample (N=246)

Ethnicity	Frequency	Percent
Unspecified	216.0	87.8
Hispanic or Latino	16.0	6.5
Asian-Pacific	9.0	3.7
American Indian or Alaska Native	4.0	1.6
Native Hawaiian or other Pacific Islander	1.0	0.4
Total	246.0	100.0

The target audience variables (first, second, and third) documented the major target audience of each advisory and up to 2 minor target audiences, when applicable. For example, advisories were sometimes targeted towards anglers but also included brief sections directed towards women and children. A summary of the major and minor target audiences in the sample of methylmercury advisories (N=221) are displayed in Figures 4.2 and 4.3, respectively.

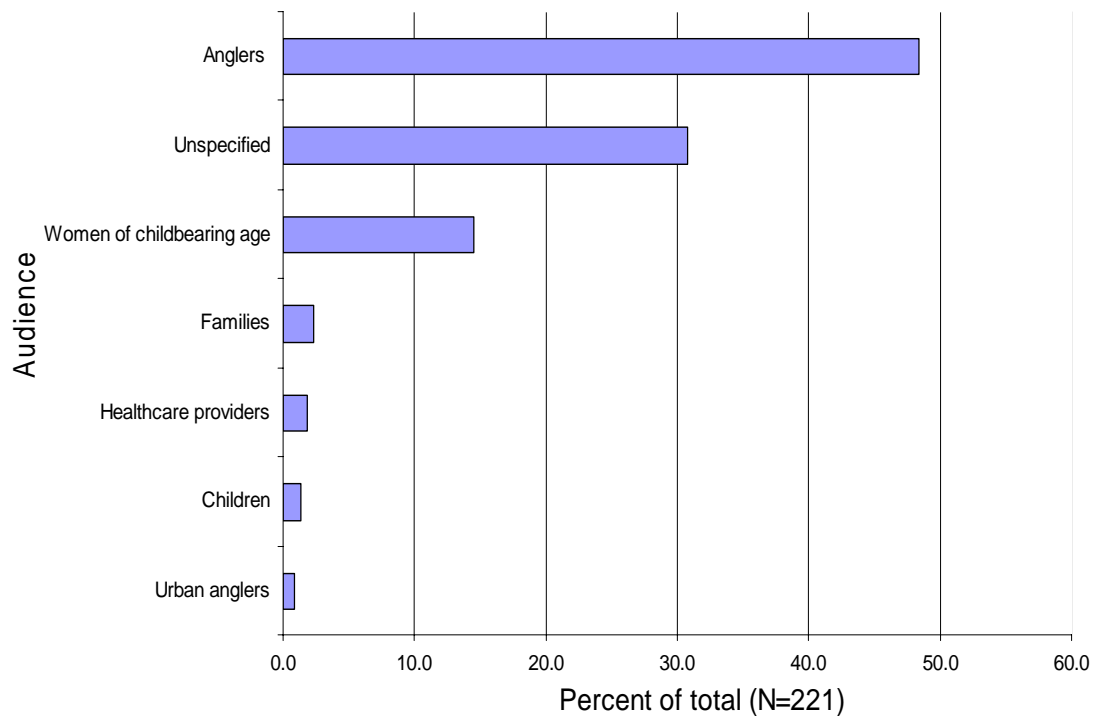


Figure 4.2 Major target audiences in advisory sample (N=221)

As seen in Figure 4.2, anglers were the most frequent major target audience (107; 48.4%), followed by unspecified audiences (68; 30.8%), women of childbearing age (32; 14.5%), families (5; 2.3%), healthcare providers (4.0; 1.8%), children (3.0; 1.4%), and urban anglers (2, 0.9%).

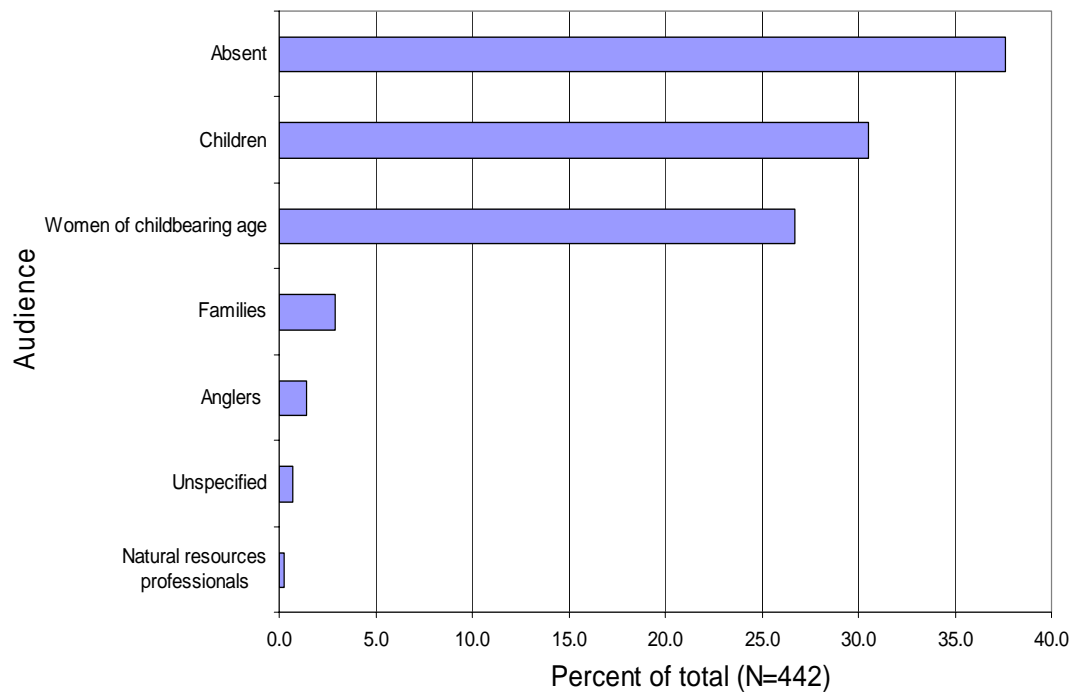


Figure 4.3 Minor target audiences in advisory sample (N=442)

\* This category reflects the combined results of two minor target audience variables that were coded for each case.

From Figure 4.3, it is apparent that many methylmercury advisories in the sample did not have minor target audiences (166; 37.6%). However, of the remaining advisories that did address minor target audiences, children were most frequent (135; 30.5%), followed by women of childbearing age (118; 26.7%), families (13; 2.9%), anglers (6; 1.4%), unspecified audiences (3; 0.7%), and natural resources professionals (1; 0.2%).

The last descriptive variable recorded the different dissemination media that comprised the advisory sample (N=221). Of the sample of 221 methylmercury

advisories, 6 media accounted for 76% of the sample (see Figure 4.4). Brochures were most frequent (44; 19.9%), followed by fact sheets (42; 19.0%), fish consumption regulations (26; 11.8%), advisory booklets (23; 10.4%), press releases (18; 8.1%), and web pages (15; 6.8%).

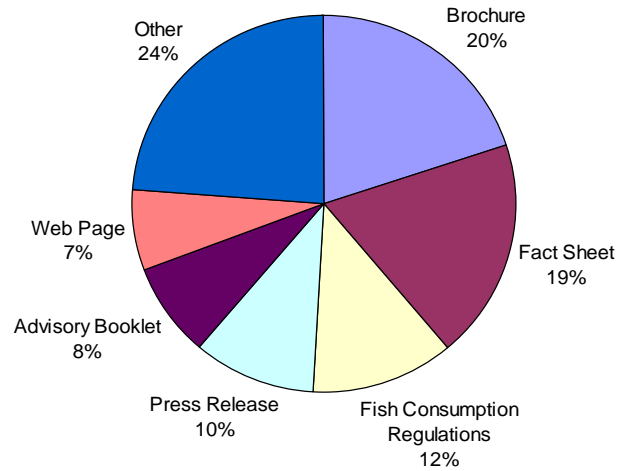


Figure 4.4 The six most frequent dissemination media in the advisory sample (N=221)

The remaining 24% of the sample, designated “other,” was composed of signs, formal reports, announcements to interested parties, fishing regulation guides, flyers, children’s books, letters to healthcare providers, magazine articles, maps, newspaper articles, posters and surveys (see Figure 4.5).

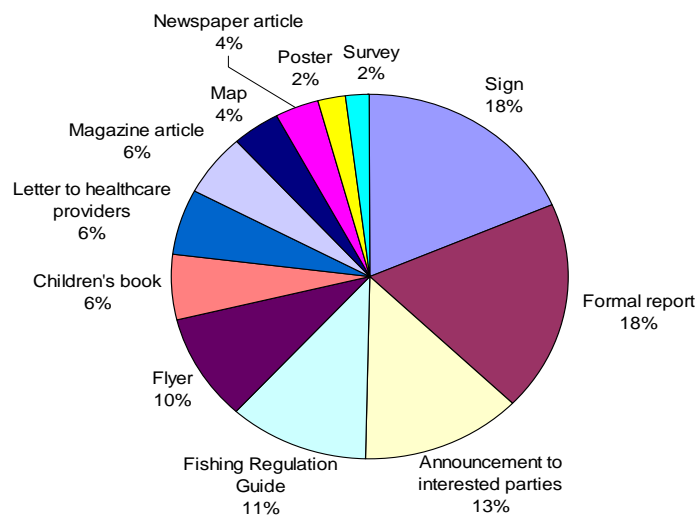


Figure 4.5 “Other” dissemination media used in the advisory sample (N=221)

### 4.3 Use of Communication Strategies

In Chapter 2, my second research question asked: What is the relative use of the regulatory, educational and interactive risk communication strategies in government-issued methylmercury advisories? The relative use of these three communication strategies in the advisory sample (N=221) can be found in Figure 4.6 below. These results provide a general indication of how government fish advisory programs are structuring their public outreach efforts regarding methylmercury contamination in fish.

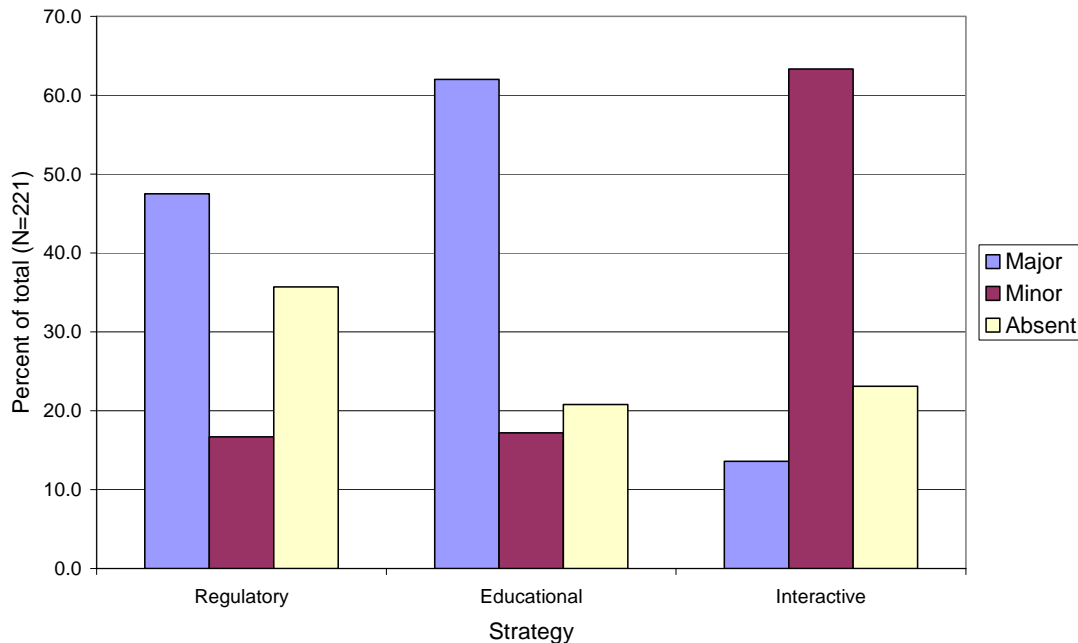


Figure 4.6 Presence of regulatory, educational, and interactive communication strategies in the advisory sample (N=221)

From Figure 4.6, it is apparent that the regulatory strategy was major in 47.5% of advisories, minor in 16.7% of advisories, and absent in 35.7% of advisories. The educational strategy was major in 62.0% of advisories, minor in 17.2% of advisories, and absent in 20.8% of advisories. And the interactive strategy was major in 13.6% of advisories, minor in 63.3% of advisories, and absent in 23.1% of advisories.

Stated differently, the educational strategy was most frequently major, followed closely by the regulatory strategy, and lastly by the interactive strategy. These results suggest that the vast majority of methylmercury advisories focus on informing public audiences and moderating their fish consumption patterns. In contrast, relatively few advisories focus on engaging public audiences. As it turns out, the interactive strategy was most frequently a minor focus in advisory messages, followed distantly by the educational and regulatory strategies. These results can be explained by the fact that most agencies included contact information and asked audiences to contact them with questions, concerns, or for more information. Although minor, agencies consistently made an effort to initiate contact with public audiences. Lastly, the regulatory strategy was most frequently absent, followed by the interactive and educational strategies. This finding indicates not only that the educational and interactive strategies were present more frequently than regulatory strategies in methylmercury advisories, but also that the regulatory strategy was usually a major focus of advisory messages or absent altogether.

In addition, a series of three non-parametric correlations were run with SPSS to determine the pairwise relationships between each of the communication strategies. Because the data were rank ordered, ordinal values (0, 1, 2), Spearman's *rho* was reported for each pairwise comparison (Neuendorf, 2002). As shown in Table 4.3, regulatory and educational strategies had a strong negative relationship, educational and interactive strategies had a moderate positive relationship, and interactive and regulatory strategies had a strong negative relationship. In other words, when the regulatory strategy was present in a given message, the educational strategy was often absent. When the educational strategy was present, the interactive strategy was sometimes present. And when the interactive strategy was present, the regulatory paradigm was often absent.

Table 4.3 Non-parametric, pairwise correlations between regulatory, educational, and interactive communication strategies (N=221)

Pairwise Comparison	N	Spearman's Rho	Sig. (2-tailed)
Regulatory-Educational	221	-.426	.000
Educational-Interactive	221	.127	.060
Interactive-Regulatory	221	-.329	.000

These results suggest that methylmercury advisories with regulatory content do not typically contain educational or interactive content. Conversely, advisories with educational or interactive content do not typically contain regulatory content. However, it is somewhat typical for advisories with educational content to also contain interactive content. The implications of these findings will be addressed in Chapter 5.

#### 4.4 Evaluation of Best Practices

The third research question addressed in this study was: Which best practices are most widespread in government-issued methylmercury advisories? Which best practices are implemented the least? As discussed in Chapter 3, a representative sample of government-issued methylmercury advisories was coded to evaluate the implementation of risk communication's best practices. Most of the best practices that were coded for applied to messages with descriptive, educational content. Results pertaining to the style of advisory messages will be reported first, followed by results pertaining to content.

The *format* category addressed the use of visuals in advisory messages. Within this category, two main questions were of interest: 1) does the text support the visuals?; and 2) do the visuals help clarify the message? From Table 4.4, it is apparent that 121 (54.8 %) of mercury advisories used visuals pertaining to methylmercury. Of these 121 messages, 93.4% had text that supported and explained the visuals. In order to assess if the visuals helped to clarify the advisory messages, advisories were coded

for 8 separate variables, each representing a particular type of visual that experts suggested would help to enhance message clarity. The most frequently used visuals were advisory tables (76.0%), followed distantly by maps (35.5%), labeled pictures of the fish species under advisory (24.8 %), pictures or graphs of mercury bioaccumulation (11.6%), labeled pictures of fish *with* safety ratings (10.7%), stoplights (2.5%), and thermometers (1.7%). Scorecards were not used in the advisory sample (see Table 4.4).

Table 4.4 The use of visuals in methylmercury advisories (N=221)

Variable name	Description	N	Present (%)	Absent (%)
VisualsQ2	Visuals pertaining to methylmercury <i>For outreach materials with visual aids pertaining to methylmercury:</i>	221	54.8	45.2
Visuals and Text	Text supports and explains the visuals	121	93.4	6.6
Visuals1	Pictures or graphs of mercury bioaccumulation	121	11.6	88.4
Visuals2	Labeled pictures of fish with safety ratings	121	10.7	89.3
Visuals3	Stoplight approach	121	2.5	97.5
Visuals4	Scorecard approach	121	0.0	100.0
Visuals5	Thermometer approach	121	1.7	98.3
Visuals6	Labeled pictures of the fish species under advisory	121	24.8	75.2
Visuals7	Maps	121	35.5	64.5
Visuals8	Advisory tables	121	76.0	24.0

It is important to note that the visuals that were most frequently used in the advisory sample (advisory tables, maps, labeled pictures of fish species under advisory) were all visuals used to clarify advisory regulations. For example, advisory tables are the typical way to present meal advice (e.g., eat no more than 1 meal a week of tuna and swordfish). Moreover, maps are a typical way to indicate which water bodies are under advisory. Similarly, labeled pictures of fish are used to clarify which species are under advisory.



In contrast, the visuals that were used less often are more educational in nature. For example, pictures and graphs of mercury bioaccumulation show audiences how mercury builds up in fish tissue or in their own bodies. Further, pictures of fish species with safety ratings, stoplight (red=do not eat; yellow=eat these fish occasionally; green=safe to eat often), thermometer (high temp=do not eat; middle temp=eat occasionally; low temp=safe to eat often), and scorecard (high score=do not eat; moderate score=eat occasionally; low score=safe to eat often) visuals are all intended to provide audiences with risk comparisons (e.g., high, moderate, and low risk) between different fish species. The limited use of these informative visuals is striking.

Non-parametric correlations between the three communication strategies and the visuals in Table 4.4 offer a different perspective on the use of visuals in government-issued methylmercury advisories. First of all, the visuals and text variable had significant positive correlations with both the educational ( $\rho=.267$ ,  $p<.01$ ) and interactive strategies ( $\rho=.215$ ,  $p<.05$ ) and a slight negative correlation with the regulatory strategy. This suggests that while educational and interactive content often includes visuals with supporting text, this practice is less common in regulatory content.

When considering the so-called regulatory visuals identified above (i.e., advisory tables, maps, labeled pictures of fish species under advisory), indeed advisory tables had a significant positive relationship with the regulatory strategy ( $\rho=.361$ ,  $p<.001$ ) and slight negative relationships with the educational and interactive strategies. However, maps had a slight negative relationship with the regulatory strategy and slight positive relationships with the educational and interactive strategies. Further, fish pictures had a significant negative relationship with the regulatory strategy ( $\rho= -.213$ ,  $p<.05$ ) and mild positive relationships with the

educational and interactive strategies. These findings suggest that government agencies may actually be using maps and labeled fish pictures as educational and interactive tools more often than for regulatory purposes.

With regard to the alleged educational visuals identified above (i.e., images of mercury bioaccumulation, labeled fish pictures with safety ratings, stoplights, thermometers, and scorecards), the bioaccumulation variable had a significant positive relationship with the educational strategy ( $\rho=.280$ ,  $p<.01$ ), a significant negative relationship with the regulatory strategy ( $\rho=.383$ ,  $p<.001$ ), and a slight negative relationship with the interactive strategy. In addition, fish pictures with safety ratings had small positive correlations with the educational and interactive strategies and a small negative correlation with the regulatory strategy. These are roughly the results that one would expect for an educational visual. However, the other visuals revealed more dissonant findings. Thermometer visuals had mild negative correlations with all three strategies, and the stoplight approach had a significant negative correlation with the educational strategy ( $\rho=-.213$ ,  $p<.05$ ) and mild positive correlations with the regulatory and interactive strategies. As mentioned previously, scorecards were not represented in the advisory sample. Overall, these findings suggest that while often used for educational purposes, the so-called educational visuals are accommodated into multiple communication strategies in advisory programs or in the case of the thermometer visual, additional strategies that were not addressed in this study.

The *tone* category addressed two primary questions: 1) does the message use a cajoling rather than a commanding tone?; and 2) is the message positive and upbeat? Only advisories containing descriptive content could be assessed for tone. Of the 221 advisories, 164 (74.2%) had descriptive, educational content. Of these 164 messages, 98.2 % had a cajoling tone and 64% had a commanding tone (see Table 4.5). In addition, out of 164 messages, 64.6 % avoided generic language, 82.3% avoided

arousing fear, 73.2 % discussed the benefits of fish consumption, and 26.2 % discussed the value/importance of fishing (see Table 4.6).

Table 4.5 Use of cajoling vs. commanding tones (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content <i>For outreach materials with descriptive, educational content:</i>	221	74.2	25.8
Cajole	Cajoling tone (explanatory, persuasive)	164	98.2	1.8
Command	Commanding tone (prescriptive, regulatory)	164	61.0	39.0

Table 4.6 Positive presentation style (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content <i>For outreach materials with descriptive, educational content:</i>	221	74.2	25.8
Positive1	Avoids generic language	164	64.6	35.4
Positive2	Avoids arousing fear	164	82.3	17.7
Positive3	Discussing benefits of fish consumption	164	73.2	26.8
Positive4	Discussing the value/importance of fishing	164	26.2	73.8

Because the set of advisories that was analyzed all contained descriptive, educational content, the prominence of the cajoling tone (explanatory, persuasive) is not surprising. However, many messages with descriptive, educational content also contain regulatory content (e.g., meal advice; fishing regulations). The commanding tone (e.g., do not eat these fish) was typically found in regulatory sections of advisories. These observations were supported by correlations with the three communication strategies. The commanding tone had a strong positive correlation with the regulatory strategy ( $\rho=.899$ ,  $p<.001$ ) and a strong negative correlation with the educational strategy ( $\rho=-.363$ ,  $p<.001$ ). The commanding tone also had a weak positive correlation with the interactive strategy, but this was essentially a neutral relationship. On the other hand, the cajoling tone was negatively correlated with the

regulatory strategy and positively correlated with the educational and interactive strategies. However, these correlations were not statistically significant.

With regard to positive presentation style, we see that most advisory messages avoid arousing unnecessary fear. Arousing unnecessary fear was defined by the use of strong warnings/imperatives. For example, advisories that directed the audience to stop eating fish immediately to avoid serious threats to their health qualified as arousing unnecessary fear. Avoiding unnecessary fear would be to tell the audience that fish from a particular water body are unsafe to eat, but to emphasize that there are healthy alternatives. In addition, a majority of the advisory sample avoided using generic language. Generic language was defined by the use of an impersonal, third-person writing style (e.g., pregnant women should avoid eating swordfish because of potential risks to the unborn fetus). In contrast, avoiding generic language was defined by the use of a personal, second-person writing style (e.g., you should not eat any swordfish because it has high levels of mercury that may pose a risk to your unborn baby). Avoiding generic language and unnecessary fear appeals are two best practices that government agencies seem to be well aware of. In addition, agencies frequently discussed the benefits of fish consumption, but they were less inclined to discuss the value/importance of fishing. This suggests that when emphasizing the benefits of fish, advisory programs choose to emphasize health benefits over the personal, social and/or cultural benefits of fishing.

The correlations between the different positive message characteristics and the three communication strategies offer some added insights. The results indicate that avoiding generic language had a significant negative correlation with the regulatory strategy ( $\rho = -.227$ ,  $p < .01$ ) and significant positive correlations with the educational ( $\rho = .308$ ,  $p < .001$ ) and interactive ( $\rho = .205$ ,  $p < .01$ ) strategies, respectively. Stated differently, regulatory content was significantly more likely to include generic

language than educational and interactive content. Similarly, avoiding fear had a weak negative correlation with the regulatory strategy, but had significant positive correlations with both the educational ( $\rho=.172, p<.05$ ) and interactive strategies ( $\rho=.192, p<.05$ ). Stated differently, regulatory content was more likely to include fear appeals (e.g., stop eating fish now to avoid potentially serious illness), while educational and interactive content typically avoided this type of information. Moreover, highlighting the benefits of fish consumption was negatively correlated with the regulatory strategy and positively correlated with the educational and interactive strategies, although these correlations were not statistically significant. Lastly, the value/importance of fishing was positively correlated with all three communication strategies, but had the strongest relationship with the interactive strategy ( $\rho=.17, p<.05$ ). In sum, these results suggest that regulatory content is more likely to use generic language and arouse fear, while educational and interactive content is more likely to highlight the benefits of fish consumption. Furthermore, interactive content may emphasize the importance of fishing more than regulatory or educational content.

The *qualitative vs. quantitative* category addressed the question: does the message use qualitative and quantitative risk comparisons? For example, a qualitative risk comparison may describe the comparative risks of eating different fish species as high, moderate or low. In contrast, a quantitative risk comparison may describe these same risks as 1 in 10, 1 in 100, and 1 in 1,000. Only 11 advisories out of the sample of 221 qualified for analysis. That is, only 11 advisories had both descriptive, educational content and risk comparisons. It should be noted that risk comparisons only occur in outreach materials with descriptive, educational content. Of these 11 advisories with risk comparisons, 63.6% made qualitative risk comparisons and 45.5% made quantitative risk comparisons (see Table 4.7).

Table 4.7 Use of qualitative vs. quantitative risk comparisons (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content	221	74.2	25.8
QualQuantQ4	Direct comparison of fish consumption risks and/or benefits	164	6.7	93.3
	<i>For outreach materials with descriptive, educational content and risk comparisons:</i>			
Qualitative	Qualitative risk comparisons	11	63.6	36.4
Quantitative	Quantitative risk comparisons	11	45.5	54.5

Because of the small sample size, the frequency of qualitative vs. quantitative risk comparisons is not particularly meaningful. For the same reason, no correlations were computed between the risk comparisons and three communication strategies. The most important finding in Table 4.7 is that very few (approximately 5%) methylmercury advisories included either qualitative or quantitative risk comparisons.

The final style category was intended to provide an objective measurement of *reading level*. The following question was addressed: is the reading level appropriate for the target audience(s)? As discussed in Chapter 3, a consistent sample was drawn from each advisory message and inserted into a web-based writing sample analyzer (Tyler, 1996), which produced the Flesch Reading Ease and Flesch-Kincaid grade level for each sample.

The Flesch score relies on the number of syllables and sentence lengths to determine the reading ease of the sample (Tyler, 1996). As a rough guideline, a Flesch score of 60 or higher is assumed to be plain English. For example, a score of 60-70 corresponds to a 8<sup>th</sup>/ 9<sup>th</sup> grade reading level. A score of 50 or lower is considered to be difficult reading. For example, a score of 50 corresponds to about a 12<sup>th</sup> grade reading level. Moreover, a score below 30 is at a college graduate reading level. The Flesch-Kincaid Grade Level indicates the grade level at which average student can read the text sample. This measure also relies upon sentence lengths and the number of syllables to calculate the final value.

The results of the reading level analysis are displayed in Table 4.8. Of the 164 advisories with descriptive content that could be analyzed, the mean Flesch score was 57.1 and the mean Flesch-Kincaid grade level was 9.6. From these values, it would seem that most methylmercury advisories are in plain English and could be comprehended by a lay audience. However, it is also important to consider the wide range of reading levels that are present in these advisories. For example, the Flesch-Kincaid value ranged roughly from a 3<sup>rd</sup> grade level to the reading level of a senior in college. This large degree of variation can be explained by the different audiences that government agencies target with methylmercury advisories. While some advisories are simple brochures in plain English, others are technical reports of the risk assessment process targeted towards scientifically literate audiences.

Table 4.8 Reading level summary of the advisory sample (N=164)

Variable name	Description	N	Range	Min	Max	Mean	Std. Dev.
<i>For outreach materials with descriptive, educational content:</i>							
Flesch	Flesch Reading Ease Scale	164	78.4	20.3	98.7	57.1	14.8
FleschKincaid	Flesch-Kincaid Grade Level	164	13.5	2.7	16.2	9.6	2.7

It is important to note that the Flesch values reported in Table 4.8 have received criticism for oversimplifying the reading level of a given message. For the purposes of this study, the Flesch Reading Ease and Flesch-Kincaid Grade Level are only intended to provide rough objective estimates of reading level in the advisory sample. It should also be noted that Pearson’s correlations were calculated between the reading level variables and the three communication strategies, but no significant relationships were found.

The first content category, *encouraging audience involvement*, was designed to address the following question: Does the agency request audience involvement in risk

assessment or risk management activities? The results of this assessment are presented in Table 4.9. Overall, agency attempts to involve audiences in risk assessment and/or risk management activities were minimal. Of 221 advisories, 6.3% requested audience feedback on advisory publications, 4.1% announced a public meeting/hearing, 3.2% encouraged audiences to help clean up or stop pollution in local waters, and none of the advisories requested involvement in an interview or focus group (see Table 4.9).

Table 4.9 Agency efforts to encourage audience involvement (N=221)

Variable name	Description	N	Present (%)	Absent (%)
AudienceInvolve1	Requesting involvement in an interview or focus group	221	0.0	100.0
AudienceInvolve2	Announcing a public meeting/hearing	221	4.1	95.9
AudienceInvolve3	Requesting audience feedback on outreach materials	221	6.3	93.7
AudienceInvolve4	Encouraging pollution remediation in local waters	221	3.2	96.8

The correlations between the types of audience involvement and the three communication strategies suggest that attempts to engage public audiences were typically found in interactive content. Announcing public meeting/hearings had significant negative correlations with the regulatory ( $\rho=-.25$ ,  $p<.001$ ) and educational strategies ( $\rho=-.275$ ,  $p<.001$ ), but had a significant positive correlation with the interactive strategy ( $\rho=.17$ ,  $p<.05$ ). Similarly, requesting feedback on outreach materials had a significant negative relationship with the regulatory strategy ( $\rho=-.174$ ,  $p<.01$ ), a negative relationship with the educational strategy, and a significant positive relationship with the interactive strategy ( $\rho=.455$ ,  $p<.001$ ). Encouraging pollution remediation in local waters had a weak negative correlation with the regulatory strategy, but significant positive correlations with both the educational strategy ( $\rho=.138$ ,  $p<.05$ ) and the interactive strategy ( $\rho=.317$ ,  $p<.001$ ), respectively. There were



no requests for involvement in interviews or focus groups in the sample, so correlations could not be computed for this variable.

The *information-seeking* category examined a more indirect form of public engagement. This category addressed the question: Does the message encourage information-seeking behavior? Of the 221 advisories in the sample, 77.4% asked target audiences to contact the issuing agency with questions, concerns, or for more information. However, only 4.5% asked target audiences to discuss fish consumption issues with their local healthcare providers (see Table 4.10). It should also be noted that government agencies typically did not refer audiences to non-government publications or documents that were not issued within their particular jurisdiction. A key exception is that most state agencies referred audiences to the federal methylmercury advisories issued by the EPA and FDA.

Table 4.10 Agency efforts to promote information-seeking behavior (N=221)

Variable name	Description	N	Present (%)	Absent (%)
InfoSeek1	Contact agency with questions, concerns, or for more information	221	77.4	22.6
InfoSeek2	Discuss fish consumption issues with local healthcare provider	221	4.5	95.5

In addition, correlations between the information-seeking variables and the three communication strategies suggest that interactive content, and to a lesser extent, educational content was most likely to promote information-seeking behavior. To illustrate, initiating contact with public audiences had a significant negative relationship with the regulatory strategy ( $\rho=-.234$ ,  $p<.001$ ) and significant positive relationships with the educational ( $\rho=.284$ ,  $p<.001$ ) and interactive strategies ( $\rho=.843$ ,  $p<.001$ ), respectively. Note the strong relationship with the interactive strategy. Further, redirecting audiences to their healthcare providers was negatively correlated with the regulatory strategy and positively correlated with both the educational and

interactive strategies, although none of these relationships were statistically significant.

*Core recommendations* were also assessed for the advisory sample (see Table 4.11). There were 5 main best practices for communicating core recommendations, most of which required the advisory to have descriptive, educational content. Of the sample of 221 advisories, 164 (72.2 %) had descriptive, educational content. Of these 164 messages with descriptive, educational content, 149 (90.9%) presented fish consumption recommendations. Therefore, 67.4% of the sample qualified for analysis.

Table 4.11 Presentation of core recommendations (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content	221	74.2	25.8
CoreRecsQ5	Fish consumption advice	164	90.9	9.1
<i>For outreach materials with descriptive, educational content that present fish consumption advice:</i>				
CoreRec1	Eating fish is part of a healthy diet if consumed in moderation	149	85.2	14.8
CoreRec2	Unambiguous description of the desired fish consumption behavior(s)	149	56.4	43.6
CoreRec3	The relative mercury levels of the different fish species under advisory	149	66.4	33.6
CoreRec4	The origins of the fish species under advisory	149	94.0	6.0
CoreRec5	Site-specific locations of the fish species referenced in the message or redirects to sources containing such information	149	90.6	9.4

Of the 149 relevant messages, the majority implemented all 5 best practices (see Table 4.11). The first practice was that all advisory programs need to convey that eating fish is part of a healthy diet if consumed in moderation. This general message was present in 85.2% of messages. The second practice required the advisory to offer unambiguous description of the desired fish consumption behavior(s). For example, if a message indicates that pregnant women should eat 2 meals per month of tuna, then a meal needs to be defined (e.g., 1 meal = ½ pound of fish before cooking). This practice was present in 56.4% of advisory messages. The third practice stated that

agencies should mention the relative mercury levels of the different fish species under advisory. For example, this practice would be present if the advisory mentioned that tuna is high in mercury, salmon has moderate levels of mercury, and that sardines are low in mercury. 66.4% of relevant advisories implemented this practice. The fourth practice stated that advisory messages should mention the origins (e.g., store-bought, sport-caught, commercial) of the different fish species under advisory. 94% of relevant advisories implemented this practice. Lastly, risk communicators recommended that agencies should provide the site-specific locations of the fish species referenced in the advisory or provide redirects to sources containing such information. 90.6% of relevant advisories implemented this practice.

Overall, the best practices pertaining to *core recommendations* were not implemented in a high percentage of methylmercury advisories. The most frequently implemented practice, CoreRec4, was present in 63.3% of the overall sample. The least frequently implemented practice, CoreRec2, was only present in 38% of the overall sample. However, most relevant in this evaluation is that of the advisories that did present fish consumption advice, the majority implemented all five best practices.

Additionally, correlations with the communication strategies suggest that core recommendations are predominantly discussed in regulatory and educational content and rarely discussed in interactive content. Also, certain recommendations occur more frequently in regulatory content, while others occur more frequently in educational content. To illustrate, the general recommendation that fish is part of a healthy diet if consumed in moderation was negatively correlated with the regulatory strategy, but had a significant positive relationship with the educational strategy ( $\rho=.187$ ,  $p<.05$ ) and a weak positive relationship with the interactive strategy. Unambiguous discussion of the desired fish consumption behavior had a significant positive relationship with the regulatory strategy ( $\rho=.257$ ,  $p<.01$ ) and weak negative relationships with the

educational and interactive strategies. Discussion of the relative mercury levels in fish species under advisory was positively correlated with all three communication strategies, but the relationships were not statistically significant. In addition, discussion of the origins of the fish species under advisory had a significant positive relationship with the regulatory strategy ( $\rho=.286$ ,  $p<.001$ ), a weak negative relationship with the educational strategy, and a weak positive relationship with the interactive strategy. Lastly, mention of the site-specific location of the fish species under advisory was positively correlated with the regulatory, educational, and interactive strategies, but none of these relationships was statistically significant.

Another important aspect of presenting fish consumption recommendations is to offer alternatives. The *alternatives* category addressed the question: does the advisory discuss alternative solutions to the fish contamination problem? A total of 7 alternatives were coded in the sample of 221 methylmercury advisories (see Table 4.12). Identical to the previous category, only 149 (67.4%) advisories qualified for analysis. Of these 149 advisories, 67.8% suggested eating smaller and younger fish; 63.1% told audience to avoid or limit consumption of large, predatory fish; 68.2% identified safer species, sizes, and/or locations; 20.9% promoted catch and release fishing; 93.9% suggested reducing meal size or frequency of fish consumption; 31.1% suggested eating a variety of fish species; and 4.7% identified alternative protein sources (see Table 4.12).

Table 4.12 Presentation of alternative solutions to the fish contamination problem  
(N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content	221	74.2	25.8
CoreRecsQ5	Fish consumption advice	164	90.9	9.1
<i>For outreach materials with descriptive, educational content that present fish consumption advice:</i>				
Alternative 1	Eat smaller and younger fish	149	67.8	32.2

Table 4.12 (Continued)

Variable Name	Description	N	Present (%)	Absent (%)
Alternative2	Limit consumption of large, predatory fish	149	63.1	36.9
Alternative3	Identifying safer species, sizes, or locations	149	68.2	31.8
Alternative4	Promoting catch and release fishing	149	20.9	79.1
Alternative5	Reduce meal size and frequency	149	93.9	6.1
Alternative6	Eat a variety of fish species	149	31.1	68.9
Alternative7	Identifying alternative protein sources	149	4.7	95.3

Overall, these findings indicate that a considerable portion (36.7%) of the advisory sample did not present solutions to the mercury contamination problem. And of the 63.3% of advisories that did offer solutions to mercury contamination in fish, the following *general* solutions were advocated most frequently: 1) limit consumption of contaminated fish; and 2) eat fish low mercury. Very few advisories recommended catch and release fishing or substituting meals of fish with other healthy protein sources (e.g., chicken).

In addition, certain alternatives were more regulatory in nature, while others were more educational and interactive. To illustrate, the alternative of eating smaller and younger fish was negatively correlated with the regulatory strategy, but had significant positive relationships with the educational strategy ( $\rho=.183$ ,  $p<.05$ ) and interactive strategy ( $\rho=.239$ ,  $p<.01$ ), respectively. Moreover, the alternative to reduce consumption of large, predatory fish had a significant negative relationship with the regulatory strategy ( $\rho=-.249$ ,  $p<.01$ ) and significant positive relationships with both the educational strategy ( $\rho=.202$ ,  $p<.05$ ) and the interactive strategy ( $\rho=.253$ ,  $p<.01$ ). In contrast, discussion of safer species, sizes, or locations was positively correlated with all three strategies, but was significantly correlated with the interactive strategy ( $\rho=.193$ ,  $p<.05$ ). As another difference, the catch and release alternative was positively correlated with the regulatory and interactive strategies and negatively correlated with the educational strategy. Not surprisingly, reducing meal size and frequency had a significant positive relationship with the regulatory strategy ( $\rho=.250$ ,  $p<.01$ ). This

alternative was also negatively correlated with the educational strategy and had a weak positive correlation with the interactive strategy. Lastly, the alternatives that recommend eating a variety of fish species and choosing alternative protein sources were both negatively correlated with the regulatory strategy and positively correlated with the educational and interactive strategies, although none of these correlations were statistically significant.

Similar to providing public audiences with alternatives, discussing the potential health effects of eating contaminated fish is also necessary in order to enable informed decisions about fish consumption. The *health effects* category focused on the following questions: 1) does the message identify high risk groups and indicate why they are at risk?; 2) Does the message address the severity of the risk, including the likelihood of personal illness and the immediacy of negative health effects?; 3) Does the message describe specific adverse health effects of eating fish contaminated with methylmercury?; and 4) Does the message explain specific health benefits of eating fish?

Of 221 advisories, 164 (74.2%) had descriptive, educational content. Of these 164 advisories, 157 (95.7%) mentioned health risks and/or benefits of fish consumption. Therefore, 157 (71%) methylmercury advisories qualified for analysis (see Table 4.13). Regarding *high risk groups*, 98.7% of the 157 valid advisories addressed who was most at risk, while only 68.8% addressed why specified groups are most at risk. Regarding the *severity of the risk*, 49.0% of valid advisories addressed the likelihood of illness and 46.5% addressed the immediacy of illness. When discussing *specific health risks* pertaining to the central nervous system and kidneys, 37.6% of advisories addressed mild neurological damage, 28.0% addressed general neurological damage, 34.4% addressed severe neurological damage, and 28.7% addressed kidney damage. When discussing potential health risks pertaining to pregnant women, infants

and young children, 74.5% of advisories addressed developmental disorders in infants and young children, 88.5% addressed high mercury sensitivity in pregnant women, infants, and young children, and 44.6% addressed the transfer of mercury from mother to fetus or child. Regarding mercury bioaccumulation and retention in the body, 49.0% addressed accumulation of mercury in the body and 44.6% addressed the extended retention of methylmercury in the body. Lastly, with regard to *health benefits*, 65% of valid advisories addressed that fish is high in protein, 56.1% addressed that fish is low in fat, 38.9% addressed cardiovascular benefits of fish, and 14.0% addressed fetal development benefits of fish consumption (see Table 4.13).

Table 4.13 Description of health effects (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content	221	74.2	25.8
HealthEffectsQ6	Mention of health risks and/or benefits of fish consumption	164	95.7	4.3
<i>For outreach materials with descriptive, educational content that mention health effects:</i>				
<i>High Risk Groups</i>				
HighRisk1	Who is most at risk	157	98.7	1.3
HighRisk2	Why specified group(s) are most at risk*	157	68.8	30.6
* 1 advisory was not applicable (N/A)--message did not identify who is most at risk.				
<i>Severity</i>				
Severity1	The likelihood of illness	157	49.0	51.0
Severity2	The immediacy of illness	157	46.5	53.5
<i>Health Risks</i>				
Risks1	Mild neurological damage	157	37.6	62.4
Risks2	Neurological damage (unspecified)	157	28.0	72.0
Risks3	Severe neurological damage	157	34.4	65.6
Risks4	Developmental disorders in infants or young children	157	74.5	25.5
Risks5	Extended retention of mercury in the body	157	44.6	55.4
Risks6	High mercury sensitivity in pregnant women, infants, or young children	157	88.5	11.5
Risks7	Transfer of mercury from mother to fetus/infant	157	44.6	55.4

Table 4.13 (Continued)

Variable Name	Description	N	Present (%)	Absent (%)
Risks8	Accumulation of mercury in the body	157	49.0	51.0
Risks9	Kidney damage	157	28.7	71.3
<i>Health Benefits</i>				
Benefits1	High protein	157	65.0	35.0
Benefits2	Low fat	157	56.1	43.9
Benefits3	Cardiovascular benefits	157	38.9	61.1
Benefits4	Fetal development benefits	157	14.0	86.0

Overall, these data indicate that 71% of the sample discussed health effects. Of those messages that did discuss health effects, the audiences most at risk were typically identified, but an explanation of why specified groups are at risk was considerably less common. Moreover, the likelihood and immediacy of risk was not typically discussed. When addressing specific health risks, risks pertaining to pregnant women, infants, and young children were predominantly addressed, while discussion of health risks pertaining to the central nervous system/kidneys and the accumulation and retention of mercury in the body were relatively uncommon. Furthermore, when discussing health benefits, the majority of advisories mentioned, often in a sentence, that fish are high in protein and low in fat, but did not typically discuss cardiovascular benefits or fetal development benefits that can accrue through fish consumption.

Correlations between the different health effects issues and the communication strategies offer some added insights. Discussion of who was most at risk was positively correlated with the educational strategy and negatively correlated with the regulatory and interactive strategies, although none of these relationships were statistically significant. However, discussion of *why* high risk groups were most at risk had significant positive correlations with both the educational strategy ( $\rho=.341$ ,  $p<.001$ ) and the interactive strategy ( $\rho=.216$ ,  $p<.01$ ) and was negatively related with the regulatory strategy. This result makes intuitive sense in that educational content is



informative by nature and is supposed to explain why the target audience is at risk; the relationship with the interactive strategy is most likely related to the fact that interactive content and educational content often occurred in the same messages.

We also see that discussion of the likelihood of illness is negatively related with the regulatory strategy, but has significant positive correlations with both the educational strategy ( $\rho=.257$ ,  $p<.001$ ) and the interactive strategy ( $\rho=.174$ ,  $p<.05$ ), respectively. Following a similar trend, discussion of the immediacy of illness is negatively correlated with the regulatory strategy, is positively correlated with the educational strategy, and has a significant positive relationship with the interactive strategy ( $\rho=.173$ ,  $p<.05$ ). Once again, it appears that discussion of the severity of the risk of methylmercury poisoning in fish is most common in educational content and the interactive content that often accompanies it.

Advisory content pertaining to the specific health risks of methylmercury poisoning followed a relatively consistent trend: discussion of health risks was negatively correlated with regulatory strategies and positively correlated with educational and interactive strategies. The sole exception was discussion of high mercury sensitivity in women and young children, which had weak negative correlations with all three communication strategies. None of the health risk correlations were statistically significant.

Similar to the health risk correlations, health benefits were often discussed in educational and interactive content and were not typically discussed in regulatory content. The exception was discussion of fetal development benefits, which had a weak positive correlation with the regulatory strategy and weak negative correlations with the educational and interactive strategies. Again, none of these correlations were statistically significant.

Another key issue to assess in methylmercury advisories is the nature of the contaminant itself. The *contaminant description* category addressed the question: Does the message adequately describe the nature of methylmercury? Of sample of 221 methylmercury advisories, 164 (74.2%) had descriptive, educational content and 151 (92.1%) of these descriptive messages had descriptive content about methylmercury. Thus, 68.3% of the sample qualified for analysis (see Table 4.14). Of the 151 valid advisories, 89.4% addressed bioaccumulation of mercury in fish tissue, 73.5% addressed the origins of methylmercury in the environment, 53.0% mentioned that methylmercury cannot be removed through cooking or cleaning, and 23.2% addressed the visibility of mercury in fish (e.g., mercury in fish cannot be seen, smelled, or tasted) (see Table 4.14).

Table 4.14 Descriptions of methylmercury (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content	221	74.2	25.8
ContaminantDescQ7	Descriptive content about methylmercury	164	92.1	7.9
	<i>For outreach materials with descriptive, educational content about methylmercury:</i>			
ContaminantDesc1	Bioaccumulation in fish tissue	151	89.4	10.6
ContaminantDesc2	Origins in the environment	151	73.5	26.5
ContaminantDesc3	Cannot be removed through cooking or cleaning	151	53.0	47.0
ContaminantDesc4	Visibility in fish	151	23.2	76.8

Overall, 31.7% of the advisory sample did not include any description of methylmercury. Of the 68.3% of the sample that did, the vast majority discussed mercury bioaccumulation in fish tissue and the origins of methylmercury in the environment. Risk communication experts suggest that these are important issues to address when informing public audiences about the nature of methylmercury. Moreover, a majority of relevant messages also mentioned that mercury cannot be removed through cooking or cleaning. Unlike contaminants that are stored in fat (e.g.,

PCBs), methylmercury is tightly bound to the muscle tissue of fish (i.e., the part we eat), and cannot be removed through cooking or cleaning. This is a critical distinction that many advisory programs seem to be addressing. However, relatively few advisories addressed the visibility of mercury in fish, which many risk communication experts suggest is a critical factor in shaping public risk perceptions about chemical contaminants in fish.

Correlations with the communication strategies indicate that discussion of the nature of methylmercury is most common in educational content, somewhat common in interactive content, and relatively rare in regulatory content. To illustrate, discussion of the origins of mercury in the environment had a significant positive relationship with the educational strategy ( $\rho=.305$ ,  $p<.001$ ), a weak positive relationship with the interactive strategy, and a weak negative relationship with the regulatory strategy. Similarly, conveying that methylmercury cannot be removed through cooking or cleaning had a significant positive relationship with the educational strategy ( $\rho=.175$ ,  $p<.05$ ), a weak positive relationship with the interactive strategy, and a weak negative relationship with the regulatory strategy. The visibility of mercury in fish also had a significant positive relationship with the educational strategy ( $\rho=.182$ ,  $p<.05$ ), a weaker positive relationship with the interactive paradigm, and a weak negative relationship with the regulatory strategy. Lastly, in contrast to the other three topics, discussion of the bioaccumulation of mercury in fish had a small positive relationship with the educational strategy and nearly neutral relationships with the regulatory and interactive strategies. This finding suggests that discussion of mercury bioaccumulation is sometimes used in educational content, but is seldom used in either regulatory or interactive content

The next category, *risk comparisons*, addressed the question: Does the message present comparative risk and/or benefit scenarios? Among risk

communication experts, presenting comparative risk scenarios in fish advisories is a widely supported best practice for making complex risks more understandable to lay audiences (e.g., Knuth, 2002). Of the 221 advisories in the sample, 164 (74.2%) had descriptive, educational content. And of the 164 messages with descriptive, educational content, only 11(6.7%) messages directly compared fish consumption risks and/or benefits. Therefore, only 5% of the total sample qualified for analysis (see Table 4.15). Of these 11 relevant messages, 72.7% compared the risks of fish consumption with other health risks, 9.1% compared the risks of fish consumption with other dietary health risks (e.g., eating red meat, eating fried foods), 45.5% compared the risks of fish consumption with other voluntary health risks (e.g., smoking, drinking, driving), 27.3% compared the risks and benefits of fish consumption, and 9.1% compared the benefits of fish consumption with other dietary health risks (see Figure 4.15).

Table 4.15 Risk comparisons (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content	221	74.2	25.8
ComparisonsQ8	Direct comparison of fish consumption risks and/or benefits	164	6.7	93.3
<i>For outreach materials with descriptive, educational content and risk comparisons:</i>				
Comparison1	Comparing the risks of fish consumption with other health risks	11	72.7	27.3
Comparison2	Comparing the risks of fish consumption with other dietary health risks	11	9.1	90.9
Comparison3	Comparing the risks of fish consumption with other voluntary health risks	11	45.5	54.5
Comparison4	Comparing the risks and benefits of fish consumption	11	27.3	72.7
Comparison5	Comparing the benefits of fish consumption with dietary health risks	11	9.1	90.9

Because of the small sample size, no generalizable claims can be made about the use of different risk comparisons in methylmercury advisories. Rather, the small

number of relevant advisories (N=11) is the most interesting finding for this category—only 5% of advisories used any form of direct risk or benefit comparison. This is a surprising finding considering that risk communication experts have published numerous studies touting the merits of risk comparisons as an effective way for target audiences to balance the risks and benefits of fish consumption in their daily lives.

In the spirit of a “participatory democracy,” risk communication experts strongly encourage agencies to discuss the assumptions and scientific uncertainty that underlie risk assessment and risk management practices (e.g., NRC, 1989; Reinert et al., 1996). The “uncertainty” category addresses this issue with the following question: Does the message discuss the assumptions and/or uncertainties that form the basis for issuing mercury advisories? Of the 221 advisories in the sample, 164 (74.2%) had descriptive, educational content. Because discussion of assumptions and scientific uncertainty can only occur in messages with descriptive, educational content, only 164 messages qualified for analysis (see Table 4.16).

A series of risk assessment/risk management *assumptions* were coded for in the relevant advisories. Out of 164 messages, 7.9% discussed dose/response models, 17.7% addressed body weight assumptions (e.g., meal size computed for an 150-pound adult), 42.1% defined meal size (e.g., 1 meal=1/2 pound of fish), 26.2% addressed fish sampling procedures (e.g., recommended meal limits are based upon mercury concentrations found in the fillets of 25 northern pike caught from Lake Ontario), 17.1% noted that Rfd (reference dose) estimates are conservative, 9.8% discussed social and/or economic considerations in issuing mercury advisories (e.g., how the commercial fishing industry is negatively impacted by fish consumption regulations) and none of the sample addressed agency limits on public participation. Moreover, with regard to *scientific uncertainty*, 22.6% of the relevant advisories

mentioned that advisories are subject to change or interpretation and only 10.4% addressed data strengths and/or weaknesses in underlying risk assessments (see Table 4.16).

Table 4.16 Discussion of risk assumptions and scientific uncertainty (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content	221	74.2	25.8
<i>For outreach materials with descriptive, educational content:</i>				
<i>Assumptions</i>				
Uncertainty1	Dose/response models	164	7.9	92.1
Uncertainty2	Body weight	164	17.7	82.3
Uncertainty3	Defining meal size	164	42.1	57.9
Uncertainty4	Fish sampling procedures	164	26.2	73.8
Uncertainty5	Conservative Rfd estimates	164	17.1	82.9
Uncertainty6	Social and economic considerations	164	9.8	90.2
Uncertainty7	Limits of public participation	164	0.0	100.0
<i>Scientific Uncertainty</i>				
Uncertainty8	Advisories subject to change or interpretation	164	22.6	77.4
Uncertainty9	Discussing data strengths and weaknesses	164	10.4	89.6

Overall, these results indicate that very few advisory messages address risk assessment/risk management assumptions or scientific uncertainty. Of those that do, meal size is the only assumption that is consistently discussed in relevant messages. Discussing assumptions and scientific uncertainty are fundamental to adequately informing public audiences about the risks of methylmercury contamination in fish. The limited attention that these issues receive in the advisory sample is a potential cause for concern that will be addressed further in Chapter 5.

When risk assessment/risk management assumptions and scientific uncertainties were discussed, they were often positively correlated with the educational strategy and negatively correlated with regulatory and interactive strategy (i.e., dose/response, conservative Rfd estimates, social and economic considerations, advisories subject to change and interpretation, and discussing data strength and weaknesses). This finding indicates that risk assessment/risk management assumptions

and scientific uncertainty are primarily discussed in educational content. However, there were some exceptions to this general trend. Body weight assumptions and fish sampling procedures were positively correlated with both the educational and regulatory strategies and negatively correlated with the interactive strategy. And the most notable deviation from the general trend was that defining meal size had a significant positive correlation with the regulatory strategy ( $\rho=.331$ ,  $p<.001$ ) and negative relationships with both the educational and interactive strategies. Because regulatory content often includes meal limits, definitions of meal size are most likely to be found in regulatory content.

Another key element of effective risk communication is balance in the presentation of advisory information. The *balance* category addressed the following question: Does the message offer different perspectives on the fish consumption issue? The two main variables assessed in this category were: 1) balanced discussion of risks and benefits; and 2) pros and cons of risk assessment/risk management assumptions. A balanced message was assessed by the rough proportion of each advisory message that focused on risks versus benefits and pros versus cons, respectively. If this proportion was roughly equivalent, then the message was balanced. Of the sample of 221 advisories, 164 (74.2%) had descriptive, educational content and qualified for analysis. Of these 164 relevant advisories, 25% had a balanced discussion of risks and benefits and 8.5% had balanced discussion of the pros and cons of risk assessment and/or risk management assumptions (see Table 4.17).

Table 4.17 Balance in the presentation of advisory information (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content	221	74.2	25.8
<i>For outreach materials with descriptive, educational content:</i>				
Balance1	Balanced discussion of risks and benefits	164	25.0	75.0
Balance2	Pros/cons of risk assumptions	164	8.5	91.5

The above findings suggest that methylmercury advisories do not offer balanced perspectives about fish consumption. In the advisory sample, risks were typically emphasized over benefits and the pros and cons of risk assessment and risk management assumptions were seldom discussed at all. However, it is important to note that the balanced messages in the advisory sample tended to be educational in nature. To illustrate, balanced discussion of risks and benefits had a significant positive correlation with the educational strategy ( $\rho=.225$ ,  $p<.01$ ), a significant negative correlation with the regulatory strategy ( $\rho=-.228$ ,  $p<.01$ ), and a weak positive correlation with the interactive strategy. In addition, balanced discussion of risk assumptions and scientific uncertainty was positively correlated with the educational strategy and negatively correlated with the regulatory and interactive strategies.

Another key issue in designing effective fish consumption advisories is targeting advisory content to address the needs and concerns of the target audience. The *personalize* category addressed the question: Does the message address the needs and concerns of the target audience? Of the 221 advisories in the sample, 164 (74.2%) had descriptive, educational content and qualified for analysis. Of the 164 relevant advisories, 53.7% acknowledged audience-specific activities or behaviors (e.g., consuming whole fish in some Asian communities), 58.5% addressed fish contamination issues pertaining to specific geographical regions, 55.5% addressed frequently asked questions, 80.5% discussed unique health concerns or advice for high risk groups, 47.0% discussed what agencies are doing to address the contamination problem, and 11.6% addressed if/when the fish species under advisory will be safe to eat (see Table 4.18).



Table 4.18 Evidence of personalized advisory content (N=221)

Variable name	Description	N	Present (%)	Absent (%)
ContentQ3	Descriptive, educational content <i>For outreach materials with descriptive, educational content:</i>	221	74.2	25.8
Personalize1	Acknowledging audience-specific activities or behaviors	164	53.7	46.3
Personalize2	Addressing regional fish contamination issues	164	58.5	41.5
Personalize3	Addressing frequently asked questions	164	55.5	44.5
Personalize4	Discussing unique health concerns or advice to high risk groups	164	80.5	19.5
Personalize5	Indicating what agencies are doing to address the contamination problem	164	47.0	53.0
Personalize6	Indicating if/when the fish under advisory will be safe to eat	164	11.6	88.4

From Table 4.18 it is apparent that discussing unique health concerns or offering advice to high risk groups was the most frequent form of personalized content in the advisory sample, accounting for 59.7% of the total sample. The high risk groups that were typically addressed in these messages were pregnant women and young children. Addressing regional contamination issues, frequently asked questions, and audience-specific behaviors were also present in a considerable portion of the total sample (approximately 40% each). The least common forms of personalized content in the sample were statements indicating what agencies are doing to address the contamination problem (34.9% of the total sample) and statements indicating if/when the fish under advisory will be safe to eat (8.6% of the total sample).

Educational and interactive strategies had the strongest correlations with personalized advisory content, although results did vary between the different types of personalized content. Acknowledging audience-specific activities and behavior had a weak negative correlation with the regulatory strategy, a weak positive correlation with the educational strategy, and a relatively strong positive correlation with the interactive strategy ( $\rho=.209$ ,  $p<.01$ ). Addressing regional fish consumption issues had

a weak positive correlation with the regulatory strategy, a relatively strong positive correlation with the educational strategy ( $\rho=.276$ ,  $p<.001$ ), and a weak positive association with the interactive strategy. Addressing frequently asked questions had a significant negative correlation with the regulatory strategy ( $\rho=-.175$ ,  $p<.05$ ), a strong positive correlation with the educational strategy ( $\rho=.376$ ,  $p<.001$ ), and a significant positive correlation with the interactive strategy ( $\rho=.174$ ,  $p<.05$ ). Discussion of unique health concerns was positively correlated with all three communication strategies, but none of these relationships were statistically significant. Indicating what agencies are doing to solve the contamination problem was positively correlated with both the regulatory and educational strategies and was negatively correlated with the interactive strategy. Once again, none of these correlations were statistically significant. Lastly, indicating if/when fish will be safe to eat was negatively correlated with the regulatory strategy and positively correlated with the educational and interactive strategies.

Similar to personalized advisory content, culturally sensitive messages must address the needs and concerns of particular cultural and ethnic groups. The importance of cultural sensitivity has been increasingly recognized in the risk communication literature as integral to an effective advisory program, especially because many cultural/ethnic minorities are often high risk groups as well. Thus, the cultural sensitivity category focused on the question: Is the message sensitive to cultural tradition, needs, and concerns? Of the 246 advisories in the overall sample, 221 (89.8%) were in English and 25 (10.2%) were non-English. Of the 189 advisories with descriptive content (including non-English messages), only 30 (15.9%) targeted a cultural/ethnic minority group and qualified for analysis (see Table 4.19).

Of these 30 advisories, 100% were communicated in the native language of the target audience and 53.3% used visual aids to clarify the text. In addition, 10%

mentioned the value of fishing as a social or cultural tradition, 26.7% addressed the visibility of mercury in fish, 3.3% discussed the efficacy of culturally-specific fish cooking, cleaning, or consumption practices, 10% mentioned the value of fish consumption as a social or cultural tradition, 3.3% mentioned alternative protein sources available at low cost, 0.0% discussed the relationship between local pollution and the health of the ecosystem, 6.7% referred to the past relationship of the polluter with the target community, and 16.7% referred to the past relationship of the issuing agency with the target community (see Table 4.19).

Table 4.19 Evidence of cultural sensitivity in advisory messages (N=246)

Variable name	Description	N	Present (%)	Absent (%)
EnglishQ1	English	246	89.8	10.2
CSQ9	Descriptive messages targeting a cultural/ethnic minority group (including non-English messages) <i>For outreach materials targeting a cultural/ethnic minority group, including non-English messages.</i>	189	15.9	84.1
Language	Communicating in the native language of the target audience(s)	30	100.0	0.0
VisualsCS	Visuals aids	30	53.3	46.7
CS1	Mentioning the value of fishing as a social or cultural tradition	30	10.0	90.0
CS2	Addressing the visibility of mercury in fish	30	26.7	73.3
CS3	Discussing the efficacy of culturally-specific cooking, cleaning and/or fish consumption practices	30	3.3	96.7
CS4	Mentioning the value of fish consumption as a social or cultural tradition	30	10.0	90.0
CS5	Offering alternative protein sources available at low cost	30	3.3	96.7
CS6	Discussing the relationship between local pollution and the overall health of the ecosystem	30	0.0	100.0
CS7	Referring to the past relationship of the polluter with the target community	30	6.7	93.3
CS8	Referring to the past relationship of the issuing agency with the target community	30	16.7	83.3

All of the issues listed in Table 4.21 were recommended by risk communication experts as important elements of a culturally sensitive advisory message. However, the results indicate that very few advisories in the sample were

targeted towards cultural/ethnic minority groups. Of the messages that were targeted toward cultural/ethnic minorities, very few displayed evidence of cultural sensitivity.

## CHAPTER 5

### DISCUSSION

#### *5.1 Overview*

This chapter synthesizes the results presented in Chapter 4 and discusses them within the context of the existing literature on improving risk communication in government agencies, with an emphasis on agency fish advisory programs. Areas of convergence and divergence between risk communication research and agency practice are discussed, as are possibilities for using evaluation as a means to strengthen ties between risk communication researchers and government policy-makers. Further, the limitations of the present study are noted, in addition to some areas for future research. But before discussing these important issues, this chapter opens with a summary of the topics covered thus far.

#### *5.2 Research Summary*

Chapter 2 opened with a discussion of the structure and function of government fish advisory programs, offering a background perspective on how state and federal agencies have traditionally communicated to public audiences about the risks of chemical contaminants in fish. This review indicated that many public audiences are not heeding advisory recommendations despite the proliferation of agency public outreach materials over the last two decades (e.g., Knuth, 1995). The science-driven epistemology of fish advisory programs was targeted as an underlying source of this perceived problem, coupled with the failure of government agencies to define “effective” risk communication. Three risk communication strategies (i.e., regulatory, educational and interactive) were discussed as posing competing and often conflicting definitions of advisory success (e.g., NRC, 1989, USEPA, 2001a).

Chapter 2 then explained that in the last two decades, government agencies have increasingly recognized that the top-down, linear dissemination of risk

information to the public is not effective and have charged risk communication experts with developing strategies to improve their public outreach efforts (e.g., Davies, Covello & Allen, 1987; Chess et al., 1995b). Responding to this charge, risk communication researchers published a wide variety of message design strategies and techniques intended to provide reliable solutions to risk communication problems within government agencies, including agency fish advisory programs (e.g., Slovic, 1986; NRC, 1989; Covello, McCallum & Pavlova, 1989; USEPA, 1992; USDHHS, 1993; USEPA, 1995; Connelly & Knuth, 1998; Tinker, 1996; Jardine, 2003). Chapter 2 notes that these recommendations, typically based on empirical evidence, are discussed in a wide variety of sources, from books, to journal articles, to conference proceedings. The key concern addressed in this study is that government agencies, including agency fish advisory programs, are resistant to adopting the recommendations proposed by risk communication researchers and that these suggested improvements have little impact on government policy (e.g., Chess, Burger & McDermott, 2005).

As discussed in Chapter 2, the present study operates under the assumption that government agencies would be more amenable to adopting risk communication recommendations if they were more practical and accessible. Thus, the concept of a “best practice” was applied to suggest that a more practical, uniform set of techniques and strategies should be developed to allow government agencies to consistently evaluate the effectiveness of their risk communication efforts within fish advisory programs. Furthermore, little is known about the extent to which risk communication’s best practices are implemented in government-issued fish consumption advisories.

In order to address these issues, an evaluation of best practices in government-issued fish consumption advisories was proposed. State, federal, and tribal advisories focusing on methylmercury were targeted for analysis, as methylmercury is the

primary contaminant of concern in fish advisory programs, accounting for over 76% of advisories issued in 2004 (USEPA, 2005a). Towards the end of Chapter 2, three main research objectives were presented: 1) to build a list of best practices from the risk communication literature; 2) to develop a practical and reliable coding scheme from this list; and 3) to use the resulting coding scheme as an evaluation tool to examine areas of convergence and divergence between risk communication research and agency practice. The results of this evaluation were intended to address the following three research questions: a) Can a practical list of best practices be generated from the existing literature?; b) What is the relative use of the regulatory, educational and interactive risk communication strategies in government-issued methylmercury advisories?; and c) Which best practices are most widespread in government-issued methylmercury advisories and which best practices are implemented the least? The latter two research questions were posed under the assumption that a useful list of best practices could be generated from the risk communication literature. Chapter 2 concluded by introducing the risk communication planning model (Springer, 1990; Velicer & Knuth, 1994), which was used in this study as a framework to organize best practices drawn from the risk communication literature.

Chapter 3 discussed the methods used to address each of the above research objectives and related questions, outlining the procedures used to develop a list of best practices, develop a practical coding scheme from the list, and apply this coding scheme to a representative sample of government-issued fish consumption advisories. An initial step in building a list of best practices was to operationalize a “best practice.” Thus, *a best practice was defined as a message design concept, strategy or technique pertinent to the design of fish consumption advisories that was recommended by a credible source as a means to improve risk communication.* This

definition was applied to select a set of relevant sources and organize the best practices drawn from these sources into the categories outlined by the risk communication planning model. Additional categories were added as topics/themes emerged that were not addressed in the model. Moreover, best practices were added to the list regardless of their frequency of mention, although frequencies were recorded. By giving best practices equal weight on the list, this allowed a variety of risk communication perspectives to be represented that would have otherwise been excluded if only the most frequently mentioned recommendations were selected for the list. On the other hand, it was also acknowledged that the frequency of mention could be a key criterion in defining a best practice. As a final step in developing the list of best practices, Chapter 3 noted that best practices were revised to minimize vague and redundant content.

The second research step addressed in Chapter 3 was the process of developing a practical coding scheme from the list of best practices. Three main challenges were discussed: 1) to adapt the best practices so that they specifically pertained to methylmercury fish consumption advisories; 2) to develop concrete and unambiguous variables so that mercury advisories could be reliably evaluated by other coders; and 3) to ensure that advisory messages would always be evaluated under a relevant set of best practices. Overall, it is noted that constructing a practical and reliable coding scheme was a trial-and-error process of coding advisory messages and making revisions as the data were collected. Further, the second coder played an important role in the revision process during the intercoder reliability phase of the study by drawing attention to ambiguous variables and then discussing with me how they might be stated more clearly.

The final step discussed in Chapter 3 was the process of selecting a representative sample of government-issued methylmercury advisories and evaluating



these advisories with the coding scheme. The USEPA National Listing of Fish Advisories website was accessed to obtain a convenience sample of 221 advisories. It was noted that advisories could only be obtained that were available through this website or related links, but that the uniformity of government-issued advisories helped to secure the representativeness of the sample (USEPA, 2005a). The process of analyzing the advisories was subsequently discussed, including the unit of analysis (i.e., content in individual, text-based outreach materials pertaining to methylmercury or general advisory information) and the specific coding procedures related to the three major sections of the style and content coding scheme: 1) descriptive profile; 2) use of communication strategies; and 3) evaluation of best practices. Chapter 3 concluded with a description of how intercoder reliability was assessed for the study; percent agreement was used as the primary indicator of reliability and Cohen's *kappa* was used as a secondary indicator due to statistical limitations created by the sample.

Chapter 4 presented the results of the evaluation of best practices in government-issued methylmercury advisories, including a final list of best practices, a revised coding scheme, and statistical summaries demonstrating how risk communication's best practices were implemented in the advisory sample. The following section provides an in-depth discussion of the key findings of this study in relation to my research questions. Some possible implications of these findings for both risk communication researchers and government agencies are also noted.

### *5.3 Key Findings and Implications*

To address my initial research question, a practical list of best practices was not only generated from the existing risk communication literature, but also adapted into a practical and reliable evaluation tool (see Appendix C). Moreover, the categories that were added to the strategy design component of the original risk communication planning model offer a more complete depiction of how risk

communicators conceptualize “effective” risk communication regarding the design of advisory messages (see Figure 5.1).

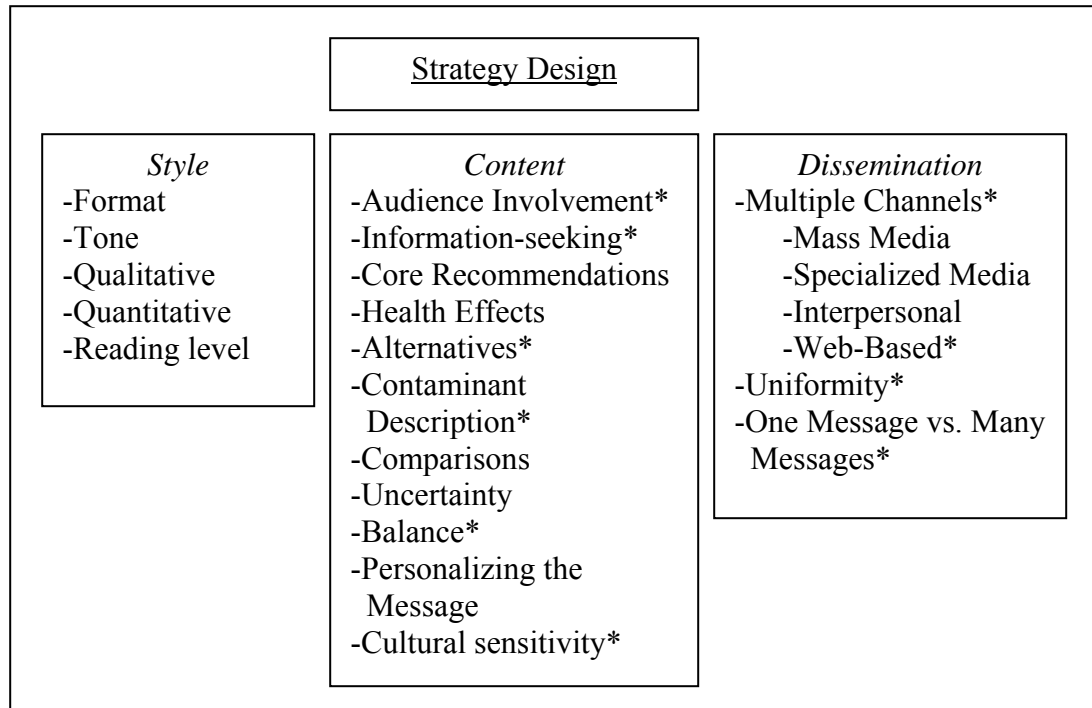


Figure 5.1 Revisions to the strategy design stage of the risk communication planning model (USEPA, 1995).

\* Categories added to the original model.

From Table 5.1 it is apparent that the original model addressed the major categories of best practices pertaining to the style of advisories. In comparison with the other components of the model, best practices pertaining to the style of advisories were the least frequent in the risk communication literature. This finding is most likely explained by the fact that few studies have been conducted that test target audience preferences for different message presentation styles. Regarding the dissemination component of the model, the categories that were added were mostly composed of best practices pertaining to how agency jurisdictions should structure and coordinate their public outreach efforts. In addition, web-based outreach was suggested by researchers

as a complimentary dissemination mechanism to mass media, specialized media, and interpersonal contacts. Although dissemination was not evaluated in this study, risk communication researchers have placed considerable emphasis on improving the dissemination of risk messages, suggesting that agency dissemination mechanisms should be evaluated in future studies. Lastly, most of the categories that were added to the original model pertained to the content of advisory messages. This finding can be explained by the large emphasis in the risk communication literature on enabling informed decisions by providing access to a wide range of risk information that addresses audience needs and concerns. Best practices pertaining to the content of advisory messages were also the most concrete and practical to implement.

On the other hand, it should be noted that a considerable portion of the list of best practices were posed at a high level of abstraction and were directed more towards the advisory design process, than the risk message itself. Moreover, in the process of making best practices “practical,” one may question the extent to which they retain their intended meaning. Also, as mentioned previously, there is the issue of how a best practice was defined and subsequently selected from the risk communication literature, in addition to research constraints that prevented me from evaluating the effectiveness of specific best practices in government-issued methylmercury advisories. The above research limitations will be discussed further in section 5.4.

My second research question pertained to the relative use of the regulatory, educational, and interactive communication strategies in government-issued methylmercury advisories. Evaluating the overall communication strategies used in advisory messages provided an indication of how government fish advisory programs are structuring their outreach efforts related to methylmercury in fish and an indication of how agencies are defining “effective” risk communication in these outreach efforts.

Moreover, knowledge of the communication strategies used in advisory messages allowed for direct comparisons with best practices that were applied in the same messages. These correlations provided important information about how risk communication's best practices have been accommodated into different agency risk communication strategies.

The results of the evaluation indicate that the educational strategy was most frequently the major emphasis of the advisory sample, followed by the regulatory strategy, and lastly by the interactive strategy. As noted in Chapter 4, these results suggest that most advisories focus on informing public audiences, and to a lesser extent, moderating their fish consumption patterns. This finding is corroborated by the descriptive profile of the sample, which indicated that brochures and fact sheets (educational materials) were most commonly used dissemination media, followed by fishing consumption regulations and advisory booklets (regulatory materials). In contrast, relatively few advisories focused on engaging public audiences as the primary objective. However, the interactive strategy was most frequently a minor focus in advisory messages, followed distantly by the educational and regulatory strategies. These results can be explained by the fact that most agencies included contact information in their outreach materials and asked audiences to contact them with questions, concerns, or for more information. Although minor, agencies consistently made an effort to initiate contact with public audiences. Lastly, the regulatory strategy was most frequently absent, followed by the interactive and educational strategies. Overall, these findings suggest that 1) educational strategies are used most frequently in the advisory sample; 2) interactive strategies are consistently a minor advisory focus typically manifested in the form of requests to contact the issuing agency; and 3) the regulatory strategy is used least frequently in the advisory sample, but when it is used, it is typically a major advisory focus.

To help clarify these findings, correlations between the different communication strategies indicate that when the regulatory strategy was present in a given message, the educational and interactive strategies were often absent. However, the educational and interactive strategies often occurred together in advisory messages. The most notable implications of these correlations are that: 1) they correspond with the objectives of each risk communication strategy; and 2) they provide face validity for the operational definitions of each strategy. As discussed in Chapter 2, the main objective of the regulatory strategy is to reduce public health risks by advocating behavior change. By definition, this objective often conflicts with the objectives of the educational and interactive strategies, which are to enable informed decisions and foster “a communication partnership,” respectively. We see from these results that this is in fact the case in agency fish advisory programs; agencies typically avoid combining regulatory content with educational and interactive content. And we also see that to some extent, enabling informed decisions and engaging public audiences are compatible objectives in fish advisory programs. Moreover, from this strong correspondence between the conceptual objectives of each strategy and their actual representation in advisory messages, it is apparent that the operational definitions of the communication strategies carry a degree of face validity. Added validation for the strategies was found with the consistent correspondence between specific strategies and best practices that were logically congruent with these strategies (e.g., the regulatory strategy and the alternative to limit fish consumption behaviors).

The third research question asked: Which best practices are most widespread in government-issued methylmercury advisories and which best practices are implemented the least? Addressing this question required an in-depth statistical analysis of the frequency each best practice was represented in the advisory sample. An added layer of analysis looked at how each best practice related to the general

communication strategies applied in the advisory sample. The results from the evaluation of best practices are presented and discussed in the order of their thematic groupings in the coding scheme (Appendix C).

The first set of best practices evaluated in the coding scheme related to the use of visuals in advisory messages. The central assumption driving these recommendations is that visuals provide support for and enhance the clarity of risk information that is notoriously complex and difficult to understand (e.g., USEPA, 2001a). The results indicate that visuals are used in the majority of the sample and that when they are used, they almost always help support and explain the advisory text. With regard to the use of specific visuals recommended by risk communication experts, the most frequently used visuals in the advisory sample (e.g., advisory tables, maps) were used to clarify advisory regulations. In contrast, the visuals that were used less often are more educational in nature (e.g., pictures and graphs of mercury bioaccumulation in humans and fish, stoplight safety ratings, thermometer safety ratings). However, when these visuals were correlated with the three communication strategies, the results indicated that the specific visuals were applied in a variety of communication strategies, with no clear trends in the data. Overall, these findings suggest that government agencies are consistently applying many of the visuals recommended by risk communication researchers and that these visuals are used for multiple purposes in government fish advisory programs. Therefore, it is important for risk communication researchers to be more clear about what they intend specific visuals to accomplish in advisory programs (e.g., enabling informed decision independent of advisory recommendations) if their implementation is to be evaluated in actual advisories.

The second set of best practices evaluated in the coding scheme related to the tone of advisory messages. Best practices under this category related to the use of the

commanding versus cajoling tone and positive presentation style. Regarding the use of the commanding versus cajoling tone, the risk communication literature suggests that public audiences tend to prefer a cajoling (explanatory, persuasive) over a commanding tone (prescriptive, regulatory), and thus a cajoling tone should be favored by fish advisory programs (e.g., Connelly & Knuth, 1998; USEPA, 1995). The results indicate that most of the advisory sample used a cajoling rather than a commanding tone. Moreover, the commanding tone was positively correlated with the regulatory strategy, while the cajoling tone was positively correlated with the educational and interactive strategies. These findings suggest that government fish advisory programs are preferentially using a cajoling tone, but that this decision is primarily driven by their communication strategies and objectives. Thus, risk communication researchers need to be more specific about the circumstances in which a cajoling tone should be used in advisory programs if its effective implementation is to be assessed.

Best practices pertaining to positive presentation style are aimed at fostering a sense of personal relevance, self-efficacy, and well-being in targeted audiences—the underlying assumption being that positive advisories will help induce compliance, while negative advisories may induce inappropriate actions (e.g., not eating any fish) (e.g., Cartledge, 2002; Smith & Sahyoun, 2005). The four style components measured in this study were avoiding generic language, avoiding fear appeals, health benefits of fish consumption, and the value/importance of fishing. The results indicate that most advisory messages avoid generic language and fear appeals. In addition, agencies frequently discussed the health benefits of fish consumption, but rarely discussed the value/importance of fishing. From these results, it appears that fish advisory programs are frequently using a personal, non-threatening tone with target audiences and tend to emphasize the health benefits of fish consumption over the value/importance of

fishing. Correlations with the communication strategies add some further insights. Regulatory content is more likely to use generic language and arouse fear, while educational and interactive content are more likely to highlight the health benefits of fish consumption. Once again, the use of a positive tone is driven by the objectives of the issuing agency, a reality that is not accounted for in best practices for positive presentation style.

The reading level of risk messages is another style consideration discussed in the risk communication literature. The best practice is that risk messages should be targeted to the reading level of the target audience (e.g., Covello et al., 1989; NRC, 1989; Connelly & Knuth, 1998). In order to do this, researchers recommend conducting readability tests and adapting risk messages accordingly. As discussed in Chapter 3, a readability test was conducted on a text sample drawn from each mercury advisory in the sample. The results suggest most methylmercury advisories are in plain English and could be comprehended by a lay audience who reads at approximately a 10<sup>th</sup> grade level. If this mean is taken at face value, a 10<sup>th</sup> grade reading level surpasses the reading abilities of the average American citizen. However, it is also important to consider the wide range of reading levels that are present in these advisories. For example, the Flesch-Kincaid value ranged roughly from a 3<sup>rd</sup> grade level to the reading level of a senior in college. This large degree of variation can be explained by the different audiences that government agencies target with methylmercury advisories. While some advisories are simple brochures in plain English, others are technical reports of the risk assessment process targeted towards scientifically literate audiences. From these results, it appears that government agencies are adjusting the reading levels of their messages to accommodate the reading levels of different target audiences. Also, it seems that government agencies could easily implement this best practice by using a reading level analyzer like the one used in this study (Tyler, 1996).



However, it should be noted that reading level algorithms have been criticized for oversimplifying the readability of a message. To gain a more accurate assessment of readability, agencies would need to consult target audiences directly.

The first set of best practices pertaining to the content of advisory messages addressed the audience involvement efforts of government agencies (Knuth, 1990; Chess et al., 1995b; USEPA, 1995; Tinker, 1996; USEPA, 2001a). Experts suggested the following techniques: 1) requesting audience feedback on advisory publications; 2) announcing a public meeting/hearing; 3) encouraging audiences to help clean up or stop pollution in local waters; and 4) requesting involvement in an interview or focus group. The results of the evaluation indicate that agency efforts to involve audiences in risk assessment and/or risk management activities were minimal (less than 6% of the sample for all best practices). It is likely that some agency outreach messages intended to involve audiences in policy decisions were not included in the advisory sample, but nonetheless, these findings suggest that public engagement is a low agency priority in fish advisory programs. The correlations between the types of audience involvement and the three communication strategies suggest that attempts to engage public audiences were typically found in interactive content. As discussed previously, the interactive strategy was rarely a major advisory focus.

Encouraging information-seeking behavior is another form of audience involvement that was examined in this study (e.g., USEPA, 1995; Burger, Stern, & Gochfeld, 2005). Two approaches were recommended by researchers for encouraging information-seeking behavior: 1) requesting for audiences to contact the issuing agency; and 2) redirecting the audience to their local healthcare providers. The results indicate that fish advisory programs consistently request audiences to contact the issuing agency, but rarely redirect them to their local healthcare providers. It should also be noted that government agencies typically did not refer audiences to non-

government publications or documents that were not issued within their particular jurisdiction. A key exception is that most state agencies referred audiences to the federal methylmercury advisories issued by the EPA and FDA. Thus, it appears that agencies frequently refer target audiences to a limited set of government resources, but do not encourage audiences to seek outside perspectives. In addition, correlations between the information-seeking variables and the three communication strategies suggest that interactive content, and to a lesser extent, educational content was most likely to promote information-seeking behavior. These findings are in correspondence with the objectives of the educational and interactive strategies. However, if agencies intend to enable informed decisions and engage public audiences in risk communication issues, they need to expose audiences to a wider range of perspectives and make this information readily available. The websites run by state, tribal, and federal advisory programs are a strong step in the right direction, but even these websites need to offer a wider range of perspectives.

In an effort to make fish consumption advice as clear and accurate as possible, risk communication researchers also proposed a series of best practices for presenting core recommendations (e.g., USEPA, 2005b). These practices included: 1) conveying the message that eating fish is part of a healthy diet if consumed in moderation; 2) providing unambiguous description of the desired consumption behavior(s); 3) indicating the relative mercury levels of the different fish species under advisory; 4) discussing the origins of the fish species referenced in the message; and 5) providing site-specific locations of the fish species referenced in the message. Of the advisories that discussed fish consumption recommendations, all five core recommendations were discussed in the majority of cases. Thus, agencies appear to be frequently implementing the best practices for presenting core recommendations. Although the regulatory strategy was not strongly correlated with all of the above core

recommendations, perhaps agencies are frequently implementing these best practices because they pertain to the presentation of fish consumption guidelines.

According to many risk communication researchers, presenting the audience with alternative solutions to the fish contamination problem enables target audiences to make fish consumption decisions that are appropriate for them (e.g., Reinert et al., 2001; Burger & Waishwell, 2001). Seven alternatives were evaluated in this study: 1) eat smaller and younger fish; 2) avoid or limit consumption of large, predatory fish; 3) identifying safer species, sizes, or locations; 4) promoting catch and release fishing; 5) reducing meal size or frequency; 6) eating a variety of fish species; and 7) alternative protein sources. The results indicated that the majority of advisories presented alternatives, but that some alternatives were offered more than others.

The following two *general* alternatives were advocated most frequently: 1) limit consumption of contaminated fish; and 2) eat fish low in mercury. Very few advisories recommended catch and release fishing or substituting meals of fish with other healthy protein sources (e.g., chicken). In addition, one alternative had a positive correlation with the regulatory strategy (i.e., reduce meal size and frequency), while others had positive correlations with the educational and interactive strategies (i.e., eat smaller and younger fish; avoid large, predatory fish; identifying safer, species, sizes, and/or locations). If the goal of providing alternatives is to educate, then it seems that the emphasis of providing alternatives should not be to impose regulations of any kind (e.g., to impose meal limits). Furthermore, it is apparent that government agencies are implementing many of the specific alternatives suggested by risk communication experts, but there is still the general issue of whether or not these alternatives are providing target audiences with adequate solutions to the fish contamination problem. From the descriptive profile of the sample, we see that the major target audiences of methylmercury advisories are anglers, women, and children. If government agencies

were to interact with members of these demographics directly, then acceptable alternatives could most likely be found through collaboration.

The next set of best practices relates to the discussion of health effects in risk messages (e.g., USEPA, 2001a; Burger et al., 2003b). Experts have identified a series of key health considerations that they believe audiences should know to make informed decisions about fish consumption. Overall, the vast majority (71%) of the sample discussed health effects. Of those messages that did discuss health effects, the audiences most at risk were typically identified, but an explanation of why specified groups are at risk was considerably less common. Moreover, the likelihood and immediacy of risk were not typically discussed. When addressing specific health risks, risks pertaining to pregnant women, infants, and young children were predominantly addressed, while discussion of health risks pertaining to the central nervous system/kidneys and the accumulation and retention of mercury in the body were relatively uncommon. Furthermore, when discussing health benefits, the majority of advisories mentioned, often in a sentence, that fish are high in protein and low in fat, but did not typically discuss cardiovascular benefits or fetal development benefits that can accrue through fish consumption. The above health effects issues were primarily discussed in educational content. From these results, it is apparent that government agencies are not frequently addressing many of the health risk and benefit issues advocated by risk communication researchers. The limited implementation of this fundamental risk/benefit information suggests that agencies are discussing health effects (risks and benefits) to the extent that they justify advisory recommendations, but are not providing the depth or breadth of information that audiences need to truly understand the benefits of fish consumption or how methylmercury in fish can impact their health or the health of those around them.

Describing the nature of the contaminant (methymercury) is an additional educational strategy advocated by experts (e.g., May & Burger, 1996; Roe, 2003). Considerable research suggests that many public audiences (e.g., subsistence anglers, nursing mothers) have misguided perceptions about environmental contaminants. For example, according to May & Burger (2006), a group of subsistence anglers believed that fish from highly contaminated estuary were safe to eat because the fish had migrated from cleaner waters. The results of this evaluation suggest that a majority (68.3%) of the sample included some description of methylmercury. Of these messages, the vast majority discussed mercury bioaccumulation in fish tissue and the origins of methlymercury in the environment. Risk communication researchers suggest that these are important issues to address when informing public audiences about the nature of methylmercury. Moreover, a majority of relevant messages also mentioned that mercury cannot be removed through cooking or cleaning. This is a critical distinction that many advisory programs seem to be addressing. However, relatively few advisories addressed the visibility of mercury in fish, which many risk communication experts suggest is a critical factor in shaping public risk perceptions about chemical contaminants in fish. Correlations with the communication strategies indicate that discussion of the nature of methylmercury is most common in educational content, somewhat common in interactive content, and relatively rare in regulatory content. Thus, it appears that description of contaminants in fish is being used by agencies as an educational tool and that advisories are implementing some of the best practices related to this issue. Nevertheless, without assessing the risk perceptions of target audiences, agencies will always be guessing what their audiences really need to know.

The next set of best practices related to the use of risk comparisons in advisory messages. Risk comparisons provide a sense of how the risks of fish consumption may

compare to other health risks and/or benefits. Risk communication researchers typically support the use of risk comparisons as a tool to enable target audiences to make informed decisions about the acceptability of the risks of fish consumption relative to other risks that they may encounter in their lives (e.g., smoking, drinking) (e.g., NRC, 1989; Knuth, 2002). The following best practices were evaluated in the advisory sample: 1) comparing the risks of fish consumption with other health risks; 2) comparing the risk of fish consumption with other dietary health risks, including other protein sources; 3) comparing the risks of fish consumption with other voluntary health risks, including drinking, driving, smoking etc.; 4) comparing the risks and benefits of fish consumption; and 5) comparing the benefits of fish consumption with dietary health risks, including other protein sources. The results of the evaluation show that only 5% of the advisory sample implemented any of the risk comparisons that were evaluated in this study. Considering the vast amount of risk communication literature touting the merits of risk comparisons, the limited use of these important educational tools is surprising. A possible reason for the near absence of risk comparisons in government-issued mercury advisories may be that they do not provide any clear fish consumption guidelines. Because the primary objective of most fish advisory programs is to protect public health, agencies may see it as their duty to recommend safe eating behaviors rather than let audiences decide for themselves. Whatever the reasons may be, this large disconnect between risk communication research and agency practice regarding the use of risk comparisons should be examined in future efforts to improve risk communication in fish advisory programs.

A further set of best practices stressed the open and honest discussion of risk assessment/risk management assumptions and scientific uncertainty (Covello et al., 1989; Jardine, 2003). Best practices related to the discussion of assumptions and uncertainty promote public understanding of the underlying risk assessment and risk

management processes that form the basis for issuing fish consumption advisories. The following assumptions were evaluated: 1) dose/response models; 2) body weight assumptions; 3) defining meal size; 4) fish sampling procedures; 5) Rfd estimates; 6) social or economic considerations; and 7) limits of public participation. In addition, discussion of scientific uncertainty was evaluated according to the following two practices: 1) discussion of data strengths and weaknesses; and 2) acknowledgement that advisories are subject to change and interpretation. The results of the evaluation show that very few advisory messages address risk assessment/risk management assumptions or scientific uncertainty. Of those that do, meal size is the only assumption that is consistently discussed in relevant messages, often within the context of presenting meal limits. When risk assessment/risk management assumptions and scientific uncertainties were discussed, they were often positively correlated with the educational strategy and negatively correlated with the regulatory and interactive strategies, with the exception of defining meal size, which was positively correlated with the regulatory strategy. From these findings, it appears that open and honest discussion of risk assessment/risk management assumptions and scientific uncertainty is a low agency priority. However, government agencies do make such information available to interested parties in a limited set of technical publications. Making such information available to a wider range of audiences would require considerable translation of complex information into lay terminology, but would contribute to building public trust in government agencies and confidence in advisory recommendations.

Related to the discussion of assumptions and uncertainty, presenting a fair and balanced perspective about fish contamination issues is strongly recommended by risk communication researchers to build trust and enable informed decisions (Burger et al., 2003; Anderson et al., 2004). Two characteristics of a balanced message were

evaluated: 1) balanced discussion of risks and benefits; 2) pros and cons of risk assessment and/or risk management assumptions. The results indicated that methylmercury advisories did not offer balanced perspectives about fish consumption. In the advisory sample, risks were typically emphasized over benefits and the pros and cons of risk assessment and risk management assumptions were seldom discussed at all. The few balanced messages in the advisory sample tended to be educational in nature. If agencies are intending to enable informed decisions with advisory messages, then presenting a balanced perspective on the fish contamination issue should be a key component of their strategy. Moreover, balanced messages are more credible because audiences feel as if they are receiving a more objective perspective on the fish contamination issue.

Personalizing advisory messages to address the needs and concerns of the target audience is one of the most prominent themes discussed in the risk communication literature (e.g., Vaughn, 1995; Pflugh et al., 1999; McDermott, 2003). The assumption underlying this approach is that by addressing the specific circumstances of target audiences in advisory messages, audiences are more likely to trust the issuing agency, understand the advisory content, and make more informed choices about the risks and benefits of fish consumption. The following best practices were evaluated in the advisory sample: 1) acknowledging audience-specific activities or behaviors; 2) addressing regional fish contamination issues; 3) addressing frequently asked questions; 4) discussing unique health concerns and advice to high risk groups; 5) discussing what agencies are doing to address the contamination problem; and 6) if/when the fish under advisory will be safe to eat. Although most of the above best practices were addressed in advisory messages, the results of the evaluation indicate that less than the majority of the sample included personalized content. Considering that personal relevance is one of the key predictors of advisory



compliance, one might expect that agencies would be more invested in targeted risk communication strategies. And of the considerable number of advisories that did include personalized content, the main question that remains is how well these forms of personalized content are addressing audience needs and concerns? Although all of these types of personalized content are attempts at targeted risk communication, none require in-depth target audience assessment and may ignore important issues that are not among those that agencies decided audiences *should* know. Moreover, agencies are not consistently addressing two of the key concerns that fish consumers have expressed in past risk communication studies. Namely, agencies are not telling target audiences what they are doing to address the mercury contamination problem or providing audiences with an indication of *when* the fish species under advisory might be safe to eat. Many consumers do not want to be told that the solution to pollution is to eat less fish. Rather, they want to see agencies take initiative to protect their health by removing the source of pollution and making fish safe to eat again (USEPA, 2001a). Educational and interactive strategies had the strongest correlations with personalized advisory content, although results did vary between the different types of personalized content. Once again, if agencies want to promote informed decision-making and engage audiences in fish consumption issues, they need to directly assess their needs and concerns.

The final set of best practices evaluated in this study relates to cultural sensitivity in advisory messages (e.g., Knuth, 1990; Chess et al., 1995a). The importance of cultural sensitivity has been increasingly recognized in the risk communication literature as integral to an effective advisory program, especially because many cultural/ethnic minorities are often high risk groups as well (e.g., Cartledge, 2002). A culturally sensitive advisory message is characterized by social/cultural relevance to the target audience—taking into account social/cultural

traditions, needs, and concerns. The following best practices were evaluated: 1) the value of fishing as a social and/or cultural activity; 2) the visibility of mercury in fish; 3) the efficacy of culturally-specific cooking, cleaning and/or consumption practices; 4) the value of fish consumption as a social or cultural tradition; 5) presenting alternative protein sources available at low cost; 6) clarifying that fish consumption advisories do not indicate a larger imbalance in the ecosystem; 7) discussing the past relationship of the polluter with the target community; and 8) discussing the past relationship of the issuing agency with the target community. The results of the evaluation indicate that very few advisories in the sample were targeted towards cultural/ethnic minority groups. Of the messages that were targeted toward cultural/ethnic minorities, very few displayed evidence of cultural sensitivity. Thus, there appears to be a significant gap between risk communication research and agency practice concerning the issue of cultural sensitivity. Furthermore, it appears that relatively few agency resources are devoted to generating advisories targeted towards cultural/ethnic minority groups. The descriptive profile of the sample suggests a similar trend in government-issued methylmercury advisories. Only about 10% of the advisory sample addressed any cultural/ethnic minority. Considering that many cultural/ethnic minority groups are also the most at risk of exposure to harmful contaminants, agencies need to invest more resources in targeting these important, yet hard-to-reach audiences.

To summarize the results of the evaluation of best practices, Figure 5.2 presents areas of convergence and divergence between research and practice, noting some important caveats that emerge from the above discussion. The symbols “R” and “P” are used to indicate that certain caveats are targeted towards researchers, agency practitioners, or both (R/P). Convergent categories were defined according to the following criteria: 1) the category was relevant in greater than 50% of advisories; and

2) most constituent variables were present in greater than 50% of relevant advisories. Categories that did not meet these criteria were considered divergent. Keep in mind that this is a tentative distinction intended to separate categories of best practices that were implemented frequently from those that were implemented less frequently. In addition, reading level was listed as a convergent category based upon the broad range of reading levels found in the advisory sample, suggesting that agencies were making efforts to adjust the reading level of advisory messages to the reading abilities of their target audiences. Part of the difficulty in separating convergent from divergent practices was that few studies adequately defined what specific best practices were intended to accomplish in advisory programs. This issue will be discussed further in sections 5.4 and 5.5.

<i>Convergent Practices</i>	<u>Caveats (Researchers/Practitioners)</u>
Strategic functions: Regulatory/Educational	- N/A
• Cajoling tone	- unclear objectives (R)
• Positive tone	- unclear objectives (R)
• Reading level	- audience consultation needed (P)
• Core recommendations	- unclear objectives (R)
• Alternatives	- audience consultation needed (P)
• Contaminant description	- audience risk perceptions not assessed (P)
 <i>Divergent Practices</i>	
Strategic functions: Educational/Interactive	- N/A
• Format-visuals	- unclear objectives (R)
• Encouraging audience involvement	- audience involvement minimal* (R/P)
• Encouraging information-seeking behavior	- need to offer outside perspectives (P)
• Health effects	- insufficient risk/benefit information (P)
• Assumptions/scientific uncertainty	- need to increase information access (P)
• Balance	- multiple perspectives needed (P)
• Risk comparisons-qualitative and quantitative	- minimal use of risk comparisons* (R/P)
• Personalizing the message	- audience consultation needed (P)
• Cultural sensitivity	- ethnic minorities rarely addressed* (R/P)

Figure 5.2 Areas of convergence and divergence between risk communication research and agency practice with caveats for researchers and practitioners.

\* Denotes a large gap between research and practice

As shown in Figure 4.8, convergent practices were primarily driven by regulatory/educational strategies. These two strategies are combined to suggest that convergent practices often integrated components of both educational and regulatory strategies. In other words, agencies often used information as a means to justify and explain fish consumption limits. Similarly, the tone of advisory messages typically reflected the severity of the assessed risk; the use of positive and cajoling tones were simply an indication that the assessed risk was often low. It is important to note that the manner in which convergent practices were implemented by agencies may run contrary to how researchers intended them to be used.

On the other hand, divergent practices were primarily driven by educational/interactive strategies. These strategies are combined to suggest that divergent practices were often applied in messages with both educational and interactive content. The divergent practices required targeted risk communication approaches, open access to a wide variety of risk/benefit information, and efforts to engage public audiences in risk communication issues. Three especially large gaps between research and practice pertained to audience involvement, risk comparisons, and cultural sensitivity. These are high priority issues in the risk communication literature that need to be integrated into agency fish advisory programs through collaborative efforts. Further discussion of the lessons to be retained from this evaluation can be found in section 5.5.

#### *5.4 Challenges and Limitations*

As discussed in Chapter 2, a national symposium of risk communication researchers and agency practitioners was held in 1994 to discuss future steps to improve government agencies' risk communication practices. A key topic addressed in the symposium was the rift between researchers' definitions of "valid research" versus agencies' definitions of "useful research" (Chess et al., 1995a, p. 118). According to symposium participants, many risk communication researchers were interested in

understanding the underlying processes and effects of risk communication with rigorous research methods, while agencies tended to be interested in finding quick and easy solutions to immediate risk communication problems (Chess et al., 1995b, p. 134). In this debate, the burden of proof always lies with risk communication researchers to demonstrate the effectiveness of their research in an agency setting.

But in the process of translating risk communication research into advice that is practical enough for quick and easy use, researchers claimed that the advice was no longer supported by their original research, nor could it be used to resolve complex risk communication issues encountered by government agencies (Chess et al., 1995a, p. 134). Furthermore, relatively few “successful” risk communication outcomes have been documented in the literature, in addition to the fact that risk managers typically do not support the evaluation of agency risk communication efforts (Chess, Burger & McDermott, 2005). Even in the event that a longitudinal evaluation of agency risk communication is conducted, establishing a link between process and outcome is a very difficult task.

The present evaluation faced a similar set of challenges. In the process of gathering a practical list of recommendations from the risk communication literature, I was struck by a paucity of decisive recommendations that could be applied unambiguously to agency outreach efforts. Many studies failed to define what objectives their recommendations were intended to accomplish, nor did they define what constituted “effective” risk communication outcomes. This stems primarily from the scarcity of theory-driven research in the risk communication field, which has been a consistent criticism that the field has faced since its inception (Chess et al., 1995b). In the cases where objectives were defined for specific recommendations, the definitions were often vague. A prominent example is the concept of “enabling informed decisions about fish consumption.” This is a frequently cited objective of

many risk communication recommendations, yet for an agency fish advisory program, this objective has little practical significance. Does “enabling informed decisions” mean that agencies should persuade audiences to follow fish consumption guidelines, or should they be given a variety of different perspectives from which to make their own decisions, independent of agency fish consumption guidelines? Without a clear indication of what the majority of recommendations were intended to accomplish in fish advisory programs, it was difficult to evaluate whether or not a particular recommendation had been *effectively* implemented in agency outreach materials.

A closely related limitation was the inability to evaluate the effectiveness of specific best practices in an applied context, or to gain access to more than a few sources containing such information. While an evaluation of this magnitude was well beyond the scope and resources allotted for this study, the latter issue reflects a more fundamental problem in risk communication research as a whole. As mentioned at the beginning of this section, very few “successful” risk communication efforts have been documented. In other words, very few studies have defined specific risk communication objectives, operationalized the objectives in the form of targeted risk communication practices, implemented them in applied settings, and evaluated their effectiveness. Studies such as this are necessary to convince agencies that they would benefit from adopting specific practices in their fish advisory programs.

Another challenge was encountered in defining a “best practice.” As discussed previously, the concept of a best practice was applied in this study to suggest that a more practical, uniform set of techniques and strategies should be developed to allow government agencies to consistently evaluate the effectiveness of their risk communication efforts within fish advisory programs. The main difficulty was in distinguishing a recommendation from a best practice. A possible criterion that could be used in making this distinction would be to base the decision upon the frequency of

mention. According to this approach, one would establish a cutoff point for the numbers of sources that needed to recommend a particular practice; if this boundary was surpassed, then the practice would be designated a “best practice.” However, this process excludes recommendations that do not qualify as best practices, potentially resulting in an evaluation that does not cover important, yet infrequently addressed risk communication issues. An alternative possibility, which was selected for this study, was to consider all recommendations “best practices,” under the conditions that they pertained to the design of fish consumption advisories, were presented by a credible source, and were presented as a means to improve risk communication. By giving best practices equal weight on the list, this allowed a variety of risk communication perspectives to be represented in the evaluation instrument, creating a more well-rounded set of measures for evaluating agency risk communication efforts. Of course, the main limitation of this approach was that there were few gatekeeping mechanisms for ensuring that recommendations were substantiated by valid empirical findings.

Another important challenge/limitation encountered in this study was developing a practical evaluation tool from the list of best practices. Indeed, the evaluation tool itself is a practical and reliable instrument that could be applied by government agencies in evaluating their methylmercury public outreach materials. However, in the process of making best practices “practical,” one may question the extent to which they retain their intended meaning. Moreover, as discussed above, the intended meaning was not always clear from the beginning. There were mechanisms in place to group best practices into thematic categories and to help ensure that advisories were evaluated under a relevant set of best practices, but the question of whether the variables in the coding scheme measured what the original authors intended was in many cases, uncertain.

An additional limitation pertains to the representativeness of the advisory sample. As discussed in Chapter 3, the sample size was limited according to the state, tribal, and federal outreach materials that were available through the EPA National Listing of Fish Advisories website. Without knowledge of the complete set of active government-issued fish consumption advisories in circulation, it cannot be stated with certainty that the sample indeed represented the complete range of methylmercury outreach materials available to the public. Moreover, one would also need to have a national descriptive profile, similar to the one generated in this study, in order to determine if the sample represented the population of available mercury advisories. Ideally, one would have direct access to the set of public outreach materials distributed by each agency, but securing such access would be an arduous task that would require resources beyond the capacity of this study.

A final limitation is related to the scope of analysis. This study examined the final product of the advisory design process—the advisory message. However, much of the literature on improving risk communication in government agencies, including agency fish advisory programs, is concerned with the entire risk communication process, from risk characterization through message dissemination. Therefore, the communication strategies and some of the best practices that pertained to both process and product could be evaluated only to the extent that they were manifested in the content of advisory messages. For example, the interactive strategy is defined by building “decision-making partnerships” between experts and public audiences throughout the risk communication process. The successful implementation of this strategy in fish advisory programs could not be directly assessed through advisory messages. Rather, this study relied upon content suggesting that interactive communication strategies were taking place (e.g., announcements of public meetings, requests for feedback on advisory drafts). This leaves a considerable gap between



agency efforts to promote public engagement and my ability to identify the actual outcomes of these engagement efforts. On the other hand, advisory messages do provide some indication of the types of public engagement efforts that are taking place in advisory programs and the extent to which they are attempted. Knowledge such as this could be a useful starting point for researchers seeking to evaluate the advisory design process at a more holistic level.

### *5.5 Lessons to be Retained*

In light of the key findings and implications of this study and the above challenges and limitations, there are a few important lessons to be retained not only for fish advisory researchers and practitioners, but for the risk communication discipline as a whole. The evaluation identified a series of gaps between risk communication research and agency practice that are largely driven by conflicting objectives and the inability of many risk communication studies to adequately define “effective” risk communication.

As discussed in Chapter 2, the national risk communication symposium held in 1994 established three top priorities for improving risk communication in government agencies: 1) involving communities in agency decision-making; 2) communicating with communities of different races, ethnic backgrounds, and incomes; and 3) evaluating risk communication (Chess et al., 1995b). From the results of this study, we can infer that not much has changed in the last 12 years. In agency fish advisory programs, efforts to encourage audience involvement in agency decision-making were minimal and few efforts were made to expose audiences to outside perspectives beyond those supported by agency themselves. In addition, few efforts were made to reach out to cultural/ethnic minority groups, the audiences who are often at high risk of exposure to the harmful contaminants in fish. Furthermore, there was no clear indication that agencies had personalized advisory messages based upon target

audience assessment procedures. Rather, most of the best practices that were implemented by agencies were either directly or indirectly related to the presentation of fish consumption guidelines.

This observation is explained primarily by the institutional mandate of fish advisory programs to protect public health based upon the results of quantitative risk assessment. As discussed in Chapter 2, when risk assessments reveal that contaminant levels in fish are a cause for concern, agencies primarily use regulatory strategies to stress the importance of following prescribed fish consumption limits. However, when risk assessments reveal that contaminant levels in fish are not a cause for concern, agencies are more likely to use educational strategies as precautionary measures to inform audiences of potential health risks, to offer safe eating guidelines to limit exposure to contaminants, and to discuss the benefits of eating fish as part of a healthy diet. From the results of this study, we see that the educational strategy, and to a lesser extent, the regulatory strategy were the prominent components of agency outreach.

While it may be tempting to assume that agencies are supporting the educational objective to enable informed decisions, there are a few important caveats. First, for agency fish advisory programs, enabling informed decisions carries with it the expectation of public compliance with advisory recommendations. Second, educational materials are rarely disseminated purely for the purpose of increasing knowledge and understanding of fish contamination issues; they are usually presented to provide a context/justification for fish consumption guidelines. Thus, for agency fish advisory programs, enabling informed decisions translates into using information as a means to persuade audiences to take actions that agencies deem “appropriate” for the assessed public health risk; this assessment is primarily driven by scientific evidence. The prominence of the educational strategy in the advisory sample is simply

an indication that in most states, methylmercury in fish is not a major cause for concern.

In contrast to the rigid agency mandate to protect public health with science-driven policies, risk communication researchers support the use of targeted, interactive risk communication strategies, with the ultimate objective to address the needs and concerns of diverse target audiences. Thus, risk communication researchers primarily rely upon target audiences to shape the meaning of “effective” risk communication. These empirical findings are then synthesized into recommendations for how to improve risk communication. However, the needs and concerns of target audiences vary, making it difficult to develop theories of “effective” risk communication that apply across multiple contexts. In other words, risk communication researchers often recognize that certain strategies work in certain circumstances, but they are unable to consistently define an intended outcome. For example, the educational strategy to enable informed decisions typically translates into an objective to enhance knowledge and promote self-efficacy. Yet, there is no indication of what this will ultimately accomplish in a practical setting. If the average fish consumer knows more about the risks of eating fish from a contaminated body of water, should they eat more fish, less fish, or make any decision that they feel appropriate? Moreover, the interactive strategy has been championed by researchers as a means to bring outside perspectives into agency decision-making, allowing agencies and public audiences to shape appropriate responses to public health risks through collaborative discourse. But once again, predicting the outcomes that can be expected from these public engagement efforts in a given situation is a difficult task.

This inability of many risk communication studies to define “effective” risk communication was one of the major challenges encountered in evaluating the implementation of risk communication recommendations in agency settings.

Furthermore, the divergent risk communication objectives supported by agencies and risk communication researchers are primarily responsible for the gaps that were observed between research and practice in the evaluation of government-issued methylmercury advisories.

The crucial factor to consider when trying to bridge the gaps between risk communication research and agency practice is that government agencies ultimately control the design and dissemination of fish consumption advisories. Therefore, it is important for there to be considerable overlap between the objectives and risk communication strategies favored by government agencies and those favored by risk communication researchers if risk communication research is to be considered “feasible” or “appropriate” to implement by government agencies.

A possible route to collaboration that some studies have taken (e.g., Connelly & Knuth, 1998; Burger et al., 2003) is to carefully define research objectives that are meaningful in fish advisory programs and risk communication research (e.g., using a focus group to test angler preferences for advisories presented in different formats) and to evaluate these research efforts to reveal decisive risk communication outcomes (e.g., compared to text alone, diagrams and text increased angler comprehension of fish consumption guidelines by 40%). By evaluating these efforts over time and establishing a history of success, risk communication researchers can begin to consistently convince fish advisory programs that audience-oriented risk communication strategies can effectively co-exist with existing agency mandates.

In conclusion, it must be reiterated that the general risk communication challenges (e.g., defining clear objectives, building public engagement mechanisms, evaluating risk communication efforts) discussed in this study are faced by most researchers and practitioners who communicate about health risks. Moreover, the specific methodological considerations (e.g., defining a “best practice”) and results

(e.g., the style and content coding scheme) of this evaluation could be applied in a variety of risk contexts. In searching for similar risk contexts in which to apply the findings of this study, the risk perception factors defined by Slovic (1992) offer some initial points of comparison.

To illustrate, consider another dietary health risk, the risk of consuming genetically modified foods. Similar to eating mercury-containing fish, eating genetically modified foods is a voluntary risk with an uncertain balance of risks and benefits. In addition, both risks are non-carcinogenic (as far as we know), non-addictive, and are not readily observable to the naked eye. Moreover, both risks relate to foods that are familiar and enjoyed. Perhaps the only point of contrast between the two risks is that potential health consequences of consuming genetically modified foods are far more uncertain. Comparisons could also be made with non-dietary health risks such as antibiotics, flu vaccines, and birth control medications, all of which are voluntary, familiar risks with an uncertain balance of risks and benefits.

Perhaps a more effective way to identify similar risk contexts is compare the fundamental questions that drive respective risk communication efforts. To illustrate, one of the most urgent questions in fish advisory research is why “high risk” individuals who are aware of fish consumption advisories continue to believe that fish are safe to eat? (May & Burger, 1996). This same basic question applies in a variety of risk contexts. For example, why do “high risk” individuals who are deluged with anti-smoking advertisements continue to smoke? Why do “high risk” individuals who are aware of harmful STDs continue to have unprotected sex? The underlying expectation behind these questions is that public audiences should share the perception of the risk communicator (i.e., that a particular risk is harmful) and should attempt to reduce their risk through actions that the risk communicator deems appropriate.

Beyond making comparisons between risk contexts, the above exercises are reminders of a simple truth. Namely, risk communication is the link between the situated risk perceptions of experts and public audiences. As discussed by Slovic (1992), most people make subjective judgments about health hazards that may differ notably from the scientifically determined “facts” defined by experts. From an agency perspective, risk communication is often an effort to persuade the public to adapt their perceptions and behaviors in correspondence with policy. In contrast, public audiences often communicate about risks within their relevant social networks and make decisions about risk based upon their social and cultural value systems, risk perceptions, trust in institutions, and additional needs and concerns that they encounter in their daily lives.

The role of risk communication researchers in this relationship is that of a mediator. On the one hand, researchers draw much of their funding from government agencies, who are often concerned with assessing public compliance with agency policies and who require quick and practical methods for communicating about very complex risks. On the other hand, researchers seek to understand how public audiences perceive risk and make decisions about risk in their daily lives. Moreover, researchers develop rigorous empirical studies to find solutions to risk communication challenges and to engage and empower public audiences in risk communication programs.

With these considerations in mind, perhaps the “outsider” status of risk communication researchers is less of a problem than was originally thought. In other words, risk communication researchers offer a privileged perspective that comes from an understanding of how both agencies and public audiences think about risk. As mediating agents between experts and public audiences, risk communication researchers play a key role in educating these groups about each other. However, the

challenge still remains of how researchers can convince agencies to heed their advice. Moreover, garnering public interest in risk communication issues is a notoriously difficult task that will require research to be translated into lay terminology that is readily accessible, personally relevant and credible to a variety of audiences. Although solutions to these challenges are far from imminent, efforts to address them will surely lead to a more collaborative, participatory risk communication process.

## APPENDICES



APPENDIX A  
SOURCES FOR LIST OF BEST PRACTICES

Source	Title
<i>Empirical</i>	
1. Anderson, H. A., et al. (2004)	The role of sport-fish consumption in mercury risk communication: a 1998-1999 12-state survey of women age 18-45
2. Burger, J. (1998)	Fishing and Risk Along The Savannah River: Possible Intervention
3. Burger, J. (2000b)	Gender Differences in Meal Patterns: Role of Self-Caught Fish and Wild Game in Meat and Fish Diets
4. Burger, J. (2004)	Fish consumption advisories: knowledge, compliance and why people fish in an urban estuary
5. Burger, J., et al. (1999a)	Factors in Exposure Assessment: Ethnic and Socioeconomic Differences in Fishing and Consumption of Fish Caught along the Savannah River
6. Burger, J., et al. (1999b)	Fishing in Urban New Jersey: Ethnicity Affects Information Sources, Perception, and Compliance
7. Burger, J., et al. (2001)	Science, Policy, Stakeholders, and Fish Consumption Advisories: Developing a Fish Fact Sheet for the Savannah River
8. Burger, J., et al. (2003)	Evaluating Risk Communication about Fish Consumption Advisories: Efficacy of a Brochure versus a Classroom Lesson in Spanish and English
9. Burger, J., et al. (2004).	Fish availability in supermarkets and fish markets in New Jersey
10. Burger, J., Johnson, B. B. Shukla, S., & Gochfeld, M. (2003)	Perceptions of Recreational Fishing Boat Captains: Knowledge and Effects of Fish Consumption Advisories
11. Burger, J., & Gochfeld, M. (2001)	Ethnic Differences in Risk from Mercury among Savannah River Fishermen
12. Burger, J., Stern, A. H., & Gochfeld, M. (2005)	Mercury in Commercial Fish: Optimizing Individual Choices to Reduce Risk
13. Burger, J., & Waishwell, L. (2001)	Are we reaching the target audience? Evaluation of a fish fact sheet
14. Chess, C., & Salomone, K. L. (1992)	Rhetoric and Reality: Risk Communication in Government Agencies
15. Connelly, N. A., & Knuth, B. A. (1998)	Evaluating Risk Communication: Examining Target Audience Perceptions About Four Presentation Formats for Fish Consumption Health Advisory Information

## Appendix A (Continued)

Source	Title
16. Connelly, N. A., Knuth, B. A., & Brown, T. L. (1996)	Sportfish Consumption Patterns of Lake Ontario Anglers and the Relationship to Health Advisories
17. Gibson, J. C. (2005)	Fish Consumption Advisories in Tributaries to the Chesapeake Bay: Improving the Communication of Risk to Washington, DC Anglers
18. Imm, P., et al. (2005)	Fish Consumption and Advisory Awareness in the Great Lakes Basin
19. Jardine, C. G. (2003)	Development of a Public Participation and Communication Protocol for Establishing Fish Consumption Advisories
20. Laliberte, C., Grodin, J., & LaRue, R. (2000)	Environmental Risk Perception And Decision-Making: The Example Of Sportfish Consumption In Quebec
21. May, H., & Burger, J. (1996)	Fishing in a Polluted Estuary: Fishing Behavior, Fish Consumption, and Potential Risk
22. Moya, J. (2004)	Overview of Fish Consumption Rates in the United States
23. Pflugh, K. K., et al. (1999)	Urban anglers' perception of risk from contaminated fish
24. Shubat, P. J., Raatz, K. A., & Olson, R. A. (1996)	Fish consumption advisories and outreach programs for Southeast Asian immigrants
25. Springer, C. M. (1990)	Risk Management And Risk Communication Perspectives Regarding Lake Ontario's Chemically Contaminated Sport Fishery
26. Tinker, T. L., Collins, C. M., King, H. S., & Hoover, M. D. (2000)	Assessing risk communication effectiveness: perspectives of agency practitioners
27. Velicer, C. M., & Knuth, B. A. (1994)	Communicating contaminant risks from sport-caught fish: The importance of target audience assessment
<i>Theoretical</i>	
28. Anderson, P. D., et al. (2002)	Framework and Case Studies [Comparative Dietary Risk Framework]
29. Arnold et al. (2005)	Human Biomonitoring to Optimize Fish Consumption Advice: Reducing Uncertainty When Evaluating Benefits and Risks
30. Bostrom, A. (1996)	Vaccine Risk Communication: Lessons from Risk Perception, Decision Making and Environmental Risk Communication Research

Appendix A (Continued)

Source	Title
31. Burger, J. (2000a)	Consumption advisories and compliance: The fishing public and the deamplification of risk
32. Burger, J., & Gochfeld, M. (1996)	Fish Advisories: Useful or Difficult to Interpret?
33. Cartledge, D. (2002)	Sociocultural Considerations of Fish Consumption
34. Chess, C., Burger, J., & McDermott, M. H. (2005)	Speaking Like a State: Environmental Justice and Fish Consumption Advisories
35. Daviglus, M., Sheeshka, J., & Murkin, E. (2002)	Health Benefits from Eating Fish
36. Dourson, M., Price, P., & Unrine, J. (2002)	Health Risks from Eating Contaminated Fish
37. Egeland, G. M., & Middaugh, J. P. (1997)	Balancing Fish Consumption Benefits with Mercury Exposure
38. Hotchkiss, J. K. (1997)	Chemical Risks in Foods: An Editorial Viewpoint
39. Jakus, P., McGuinness, M., Krupnick, A. (2002)	The Benefits and Costs of Fish Consumption Advisories & for Mercury
40. Knuth, B. A. (1990)	Risk Communication: A New Dimension of Sport-Fisheries Management
41. Knuth, B. A. (1995)	Fish consumption health advisories: Who heeds the advice?
42. Knuth, B. A. (2002)	Using and Communicating the Comparative Dietary Risk Framework
43. Knuth, B. A., Connelly, A. N., Sheeshka, J., & Patterson, J. (2003)	Weighing Health Benefit and Health Risk Information When Consuming Sport-Caught Fish
44. Leiss, W. (1989)	Prospects and Problems in Risk Communication
45. Patterson, J. (2002)	Introduction--Comparative Dietary Risk: Balance the Risk and Benefits of Fish Consumption
46. Patterson, J., & Dourson, M. (2002)	Conclusions and Research Needs [Comparative Dietary Risk Framework]
47. Reinert, R., Knuth, B., Kamrin, M., & Stober, Q. (1996)	A Review of the Basic Principles and Assumptions Used to Issue Fish Consumption Advisories
48. Reinert, R. E., Knuth, B. A., Kamrin, M. A., & Stober, Q. J. (1991)	Risk Assessment, Risk Management, and Fish Consumption Advisories United States

Appendix A (Continued)

Source	Title
49. Roe, A. (2003)	Fishing for Identity: Mercury Contamination and Fish Consumption among Indigenous Groups in the United States
50. Shimshack, J. P., Ward, M. B., & Beatty, T. K. M. (2005)	Are Mercury Advisories Effective? Information Education, and Fish Consumption
51. Slovic, P. (1992)	Perception of Risk: Reflections on the Psychometric Paradigm
52. Smith, K. M., & Sahyoun, N. R. (2005)	Fish Consumption: Recommendations Versus Advisories, Can They Be Reconciled?
52. Vaughan, E. (1995)	The Significance of Socioeconomic and Economic Diversity for the Risk Communication Process
<i>Practical</i>	
55. Balch, G. I., & Sutton, S. M. (1995)	Putting the First Audience First: Conducting Useful Evaluation for a Risk-Related Government Agency.
56. Chess, C., Salomone, K. L., & Hance, B. J. (1995a)	Improving Risk Communication in Government: Research Priorities
57. Chess, C., Salomone, K. L., Hance, B. J., Saville, A. (1995b)	Results of a National Symposium on Risk Communication: Next Steps for Government Agencies
58. Covello, V. T., McCallum, D. B., Pavlova, M. T. (1989)	Effective Risk Communication: The Role and Responsibility of Government and Nongovernment Organizations
59. CSPP. (2005)	Making Sense of State Fish Advisories: A Policy-Maker's Guide to Mercury, Fish and Public Health
60. Lipkus, I. M., & Hollands, J. G. (1999)	The Visual Communication of Risk
61. Lundgren, R. E., & McMakin, A. H. (1998)	Risk Communication: A Handbook for Communicating Environmental, Safety, and Health Risks
62. McDermott, M. H. (2003)	Communicating a Complex Message to the Population Most at Risk: An Outreach Strategy for Fish Consumption Advisories
63. NRC. (1989)	Improving Risk Communication
64. NRC. (1991)	Seafood Safety

Appendix A (Continued)

Source	Title
65. NRC. (1996)	Understanding risk: Informing decisions in a democratic society.
66. Tinker, T. L. (1996)	Recommendations to Improve Health Risk Communication: Lessons Learned from the U.S. Public Health Service
67. USDHHS. (1993)	Recommendations to Improve Health Risk Communication. A Report on Case Studies in Health Risk Communication
68. USEPA. (1992)	Seven Cardinal Rules of Risk Communication
69. USEPA. (1995)	Guidance For Assessing Chemical Contaminant Data For Use in Fish Advisories: Risk Communication
70. USEPA. (1999)	Conference Proceedings: American Fisheries Society Forum on Contaminants in Fish
71. USEPA. (2001a)	Conference Proceedings: National Forum on Contaminants in Fish
72. USEPA. (2002)	Conference Proceedings: National Forum on Contaminants in Fish
73. USEPA. (2004)	Conference Proceedings: National Forum on Contaminants in Fish
74. USEPA. (2005b)	Conference Proceedings: National Forum on Contaminants in Fish

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\*Full citations for the above sources can be found in the References section.

APPENDIX B  
LIST OF BEST PRACTICES

## List of Best Practices

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### STYLE

#### Format

##### *Visuals & Text*

1. Use a combination of visuals and text-- use clear and simple visuals (including graphs, tables, and diagrams) to capture audience attention and complement the text; also, use the text to explain the visuals.

##### *Visual Clarity*

2. Use pictures and icons to show how contaminants accumulate in humans and fish.
3. Show the fish species under advisory and label the fish that are safe and are not safe to eat
4. A stoplight approach (i.e., green=safe, yellow=caution; red=do not eat) is effective especially for audiences who do not speak or read English.
5. Use a scorecard approach to highlight safe vs. unsafe fish species, sizes or locations.
6. A thermometer approach is useful for highlighting safe vs. unsafe fish species.
7. Include pictures of the fish species the advisory pertains to.
8. Use detailed maps that highlight the different waterbodies under advisory--this approach is also effective when the advisory is intended to show target audiences safer locations to fish.
9. Use advisory tables to highlight fish consumption advice.

##### *Simple vs. Complex Messages*

10. Both simple, explanatory messages and more detailed, technical/prescriptive messages are needed to address the information needs of diverse target populations.
11. When dealing with different audiences, messages must be presented in a range of formats from simple to complex.
12. Use simple, nontechnical language in explanatory messages; avoid unnecessary jargon and relate technical terms to common sense concepts.

##### *Production Quality*

13. The message must look professional.
14. The format must be appropriate for the intended dissemination medium
15. The message must be translated into terminology that the target audience can understand

#### Tone

##### *Commanding vs. Cajoling*

16. Use a cajoling rather than a commanding tone.

##### *Positive*

17. The text should be positive and upbeat.
18. The message should avoid arousing fear and anxiety.
19. Benefits should be used to discourage over-reaction to the risk.
20. Avoid distant, abstract, and unfeeling language.
21. The message should emphasize the value/importance of fishing

##### Qualitative vs. Quantitative Risk Comparisons

22. Present a combination of qualitative and quantitative risk information (e.g., severity of comparative risks, degree of contaminant exposure in fish species).
23. Provide a qualitative list of specific health risks and benefits to help consumers to determine how acceptable the risk is to them.
24. Quantitate risks and benefits--how many fish meals can an individual safely consume and still obtain the benefits of fish consumption?

#### Reading Level

25. Target the reading level of the message to the reading abilities of the target audience; conduct readability tests and adapt messages accordingly
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## Appendix B (Continued)

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### CONTENT

26. The challenge to risk communicator is to develop health advisory content so that it is relevant to the variety of target audiences who will be reached and characterized by clarity, balance, and accuracy.
27. The content of the message should contain the following information: 1) on the nature of the risk; 2) on the nature of the benefits that might be changes if risk were reduced; 3) on the available alternatives; 4) on uncertainty in knowledge about risks and benefits; and 5) on management issues.

### Encouraging Audience Involvement

28. Encourage public involvement in risk assessment and/or risk management activities whenever possible and as early as possible.
29. Request input and feedback from the target audience to evaluate the effectiveness of different types of messages; good evaluations must occur throughout the advisory program.
30. Develop mechanisms to involve individuals potentially at risk who are not typically involved in the decision- making process.
31. When discussion risk issues with the public, it is better to emphasize small, informal meeting (e.g., interviews and focus groups) rather than large formal ones such as public hearings.
32. Encourage target audiences to support advisory programs or take action to clean up or stop pollution in local waters.
33. Encourage shared ownership of fish consumption issues--build partnerships with diverse at-risk communities and other relevant stakeholders by engaging them in the risk assessment, management, and communication processes.
34. Encourage a two-way dialogue with target audiences--initiate contact, rather than waiting to respond to requests.

### Information-Seeking

35. Encourage the audience to engage in information-seeking behavior (e.g., redirect information or links on the internet)
36. Initiate contact with target audiences--ask them to contact advisory programs with questions or concerns, and provide timely reponses that express interest and understanding.
37. Make use of community healthcare organizations as a source of advisory information—establish partnerships with these organizations and encourage audiences to contact their healthcare providers for advisory information.

### Core Recommendations

38. The key message to get across to consumers is that fish is part of a well-balanced, healthy diet if consumed in moderation.
39. Exposure information is best expressed in terms of meal limits per time period.
40. Describe the desired behaviors (i.e., practical strategies to reduce risk) in a clear and unambiguous manner.
41. Make it clear that advisory messages are not intended to provide an acceptable solution to pollution.
42. Provide information about the fish species that are both high and low in mercury with corresponding risk estimates.
43. Distinguish between mercury levels in store-bought vs. commercial fish species in advisories.
44. Present the site-specific locations of the fish species under advisory.
45. Discuss behavioral issues such as how to buy, store, and cook fish, as well as which fish to eat at restaurants.

### Alternatives

46. Give people a sense of personal control and personal choice. Whenever possible, present the message in a way that provides solutions--present concrete actions that people can take to minimize risks and maximize benefits. Requests for behavior change should be simple, easy, convenient, and understandable, not difficult.
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## Appendix B (Continued)

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47. Encourage the audience to choose fish low in mercury: 1) eat smaller and younger fish; 2) avoid fish that are high on the food chain (e.g., shark, tuna, swordfish).
48. Identify "safer" fish species, fish sizes, or fishing locations.
49. Promote catch and release fishing.
50. Encourage the audience to eat a variety of fish species from less contaminated waters.
51. Identify a variety of alternative protein sources, including foods that are accessible and affordable for low income individuals.

### Health Effects

52. Provide information on a holistic approach to diet including the risks and benefits of fishing and fish consumption

### *High Risk Groups*

53. Be clear who is most at risk, who is least at risk, and why.
54. Identify worst-case scenarios and identify a range of health estimates when applicable.

### *Severity*

55. Address key risk perception factors in the message, including: 1) the likelihood people will become ill; 2) and the immediacy of the risks of fish consumption.

### *Health Risks*

54. Describe the potential adverse health effects of consuming fish contaminated with methylmercury for adults, children, and/or unborn children.
55. Describe how health risks are likely to change as more or less fish are consumed.
56. Explain how mercury can affect fetuses, infants, and young children
57. Explain mercury is retained in the body for a long time and that mercury consumed now will be in the body 10 or 20 years later.
58. Explain how mercury accumulates in humans and fish.
59. Explain how mercury is transferred from mother to fetus (placenta) and from mother to infant (breast milk).

### *Health Benefits*

60. Explain the main health benefits of eating fish: 1) high protein; 2) low fat; 3) cardiovascular benefits (low cholesterol, omega-3 fatty acids); 4) and fetal development benefits (omega-3 fatty acids).

### Contaminant Description

61. Describe the nature of the contaminant and how it accumulates in fish tissue and the environment.
62. Be clear that mercury is not visible to the naked eye—it cannot be seen, smelled, or tasted.
63. State that mercury concentrates in the muscle tissue of fish and cannot be significantly reduced through cooking or cleaning.

### Comparisons

64. Compare the risks of fish consumption with other health risks.
  65. Compare the risks of fish consumption with other dietary health risks, including other protein sources.
  66. Compare the risks of fish consumption with other voluntary health risks such as driving, drinking, and smoking.
  67. Compare the risks and benefits of fishing and fish consumption.
  68. Compare the benefits of fish consumption with other dietary health risks, including other protein sources.
  68. Present a range of risk-benefit estimates (e.g., comparing estimates for different species, sizes, and/or fishing locations) and enable target audiences to select acceptable substitutions for themselves.
  69. Consider context when communicating risk-benefit information--especially to populations with no alternatives. Clearly identify goals of what the target audience should do.
  70. Avoid comparing voluntary and involuntary risks.
-

## Appendix B (Continued)

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71. Use risk comparisons only if :1) they are targeted to a specific audience; 2) they take into account target audience needs, concerns, and levels of knowledge; 3)they are specific in their intent; 4) they acknowledge and discuss all assumptions and uncertainties in the calculation of comparative data and caution against drawing unwarranted conclusions; 5) they present different measures of risk to illustrate the effects of alternative ways of expressing comparative risk data; 6) they are targeted to substances, products, or activities that are similar or related; 7) they respect distinctions that people consider important in evaluating risks; and 8) they do not attempt to preempt or prejudge decisions by individuals and communities about the acceptability of the risk being compared.

### Uncertainty

72. Be open and honest with the target audience--explain the risk assessment (e.g., dose/response models, body weight, meal size, fish sampling procedures) and risk management (e.g., social and economic considerations, conservative Rfd estimates) assumptions and uncertainties that form the basis for issuing advisories.
73. Discuss data strengths, weaknesses, and uncertainties.
74. Admit mistakes.
75. Tell people what you can and cannot do and why.
76. To avoid misunderstanding, the limits of participation should be made known to the target audience from the outset.
77. Acknowledge that advisories are subject to change and interpretation.

### Balance

78. Present a fair and balanced message that offers different perspectives on the fish consumption issue (e.g., risks and benefits; pros and cons of different risk assessment and/or risk management assumptions).

### Personalizing the Message

79. Tailor the fish consumption recommendations to address the information needs, risk perceptions, and concerns of the target audience.
80. Discuss the health characteristics, nutritional choices, and fish consumption patterns of the target audience and how they relate to advisory recommendations
81. The message should be presented by credible, trustworthy sources who adequately allow audiences to make a choices among alternatives.
82. Use vivid metaphors and similes that directly apply to the circumstances of the target audiences.
83. For women, be sure to convey the health benefits of fish consumption, especially during pregnancy; also convey that the benefits of nursing outweigh the risks and that women should limit fish consumption but continue breastfeeding.
84. Develop the message recognizing the political, economic, and cultural context.
85. Target the audiences most at risk (e.g., pregnant women, subsistence anglers) with messages that address their needs and concerns.
86. Agencies should separate the activity of fishing from the risk of fish consumption when communicating with fishermen.
87. Describe what agency efforts are being made to solve the contamination problem.
88. Address if/when fish from contaminated bodies of water will ever be safe to eat.

### Cultural Sensitivity

89. Tailor the message so that it is socially/culturally relevant to the target audience.
  90. Communicate with target audiences in their native language; bilingual messages can also be appropriate, especially when communicating with immigrants and their English-speaking children.
  91. Use visual-oriented messages with minimal explanatory text, preferably in the audience's native language, to communicate with communities who do not speak or read English.
  92. Many people need to eat fish (e.g., native americans, subsistence anglers). Don't tell them that they can't eat fish; say what is being done to solve the problem and what people can do to reduce risk.
  93. When communicating with targeted ethnic/cultural groups, discuss fish consumption recommendations within the context of the norms, traditions, practices, and customs related to fishing and fish consumption that the audience is familiar with.
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## Appendix B (Continued)

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94. For Native American communities, explain that contaminants in fish do not necessarily indicate a larger imbalance in the ecosystem.
95. Be sure to target communities as discrete populations--don't generalize.
96. Mention that contaminants in fish are not visible to the naked eye—they cannot be seen, smelled, or tasted.
97. Relevant cultural factors to discuss in advisory messages: 1) the importance of fish and fish consumption for local communities, either economically or for social networks; 2) the importance of fish in the diet, either as a convenient and inexpensive protein source, or for religious and spiritual significance; 3) the relationship of the agency with the target community, including the degree of trust and credibility in agencies; 4) the relationship of the polluter or chemicals of concern to the local community.

### DISSEMINATION

#### Multiple Channels

98. Increase effectiveness of advisory messages by using multiple dissemination channels that target subpopulations who may not have access to traditional channels used by government.
99. Deliver advisory messages in the preferred communication style(s) of the target audience.

#### Consistency/Uniformity

100. Work with other agencies, interpersonal contacts, and the mass media to ensure that target audiences are receiving consistent, unified messages--not mixed messages.

#### Mass Media

101. Adapt the message to meet the needs of the mass media; ensure press releases are uncomplicated, interesting, and accurate.
102. Mass media (e.g., television, radio, newspapers) are effective resources for informing large and diverse audiences; but the message(s) must address audience needs and concerns.
103. Television, newspaper, magazines, and radio are important sources of information for fish consumers; risk communicators must use these media to inform anglers of fish consumption guidelines and information.

#### Specialized Media

104. Specialized media should be designed and disseminated to reach targeted demographics, with the needs and abilities of the target audience in mind.
105. Water-body specific media should be used to highlight the characteristics of particular fisheries and the advisories for those locations.
106. Newsletters are effective in developing ongoing relationships with target audiences and can be effective in reaching opinion leaders such as health practitioners.
107. Fact sheets should be used to target specific components of advisory programs in detail that may be of interest to audiences seeking more information, but are not as effective for general distribution.
108. Posters are effective advertizing tools for alerting audiences about advisory programs or advisory warnings.
109. Postcards are an effective way to make additional outreach materials available to target audiences.
110. Post mercury warning signs is supermarkets to inform customers.

#### Interpersonal Contacts

111. An audience-oriented risk communication program will require a variety of dissemination techniques in addition to written outreach materials.
  112. Ensure the the sender(s), messages, and dissemination channels and media are credible to target audiences.
  113. Especially for low income groups and ethnic minorities, build partnerships with opinion leaders and credible community members that target audience(s) trust; train them to support and reinforce advisory messages.
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## Appendix B (Continued)

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- 114. Educate at-risk audiences and ask them to pass advisory information to their friends and family.
- 115. To get the message across to women and children, integrate advisory information into the science curriculum at elementary, junior high, and high schools.
- 116. Teach classroom lessons that target particular audiences and address their needs and concerns.

### Web-Based

- 117. Use web sites to provide target audiences with user-friendly access to a wide variety of outreach materials that address their needs.
- 118. Icons of fish or maps are good ways to steer individuals to additional information.
- 119. An internet clearinghouse of available advisories and publications would help increase accessibility to advisory materials.
- 120. Use new technologies for citizen involvement (e.g., interactive software, electronic town meetings, bulletin boards, email).

### One Message vs. Many Messages

- 121. If using one message, ensure the message is appropriate for all audiences under consideration.
  - 122. If there is one message, it needs to push people to find out more.
  - 123. A single outreach material should focus on a small number of message components/ themes in order to optimize message comprehension.
  - 124. Different media are needed that range from simple to complex, site-specific to geographically generalized.
  - 125. Redundancy helps get the message out. Reinforce messages several times by presenting them in several formats.
-

APPENDIX C  
CODING SCHEME: STYLE AND CONTENT

V1. IDENTIFICATION NUMBER (ID):

V2. ADVISORY SOURCE (Source)-specify agency department(s)

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V3. GENERAL ADVISORY JURISDICTION (Jurisdiction 1)-choose one

1. State
2. Federal
3. Tribal

V4. SPECIFIC ADVISORY JURISDICTION (Jurisdiction 2)-choose one

- |                            |                              |                    |
|----------------------------|------------------------------|--------------------|
| 1. Alabama                 | 21. Louisiana                | 41. Oregon         |
| 2. Alaska                  | 22. Maine                    | 42. Pennsylvania   |
| 3. Arizona                 | 23. Maryland                 | 43. Rhode Island   |
| 4. Arkansas                | 24. Massachusetts            | 44. South Carolina |
| 5. Colorado                | 25. Michigan                 | 45. South Dakota   |
| 6. California              | 26. Minnesota                | 46. Tennessee      |
| 7. Connecticut             | 27. Minnesota Chippewa Tribe | 47. Texas          |
| 8. Delaware                | 28. Mississippi              | 48. Utah           |
| 9. District of Columbia    | 29. Missouri                 | 49. Vermont        |
| 10. Federal-EPA/FDA        | 30. Montana                  | 50. Virginia       |
| 11. Florida                | 31. Nebraska                 | 51. Washington     |
| 12. Georgia                | 32. Nevada                   | 52. West Virginia  |
| 13. Great Lakes Indian F&W | 33. New Hampshire            | 53. Wisconsin      |
| 14. Hawaii                 | 34. New Jersey               | 54. Wyoming        |
| 15. Idaho                  | 35. New Mexico               |                    |
| 16. Illinois               | 36. New York                 |                    |
| 17. Indiana                | 37. North Carolina           |                    |
| 18. Iowa                   | 38. North Dakota             |                    |
| 19. Kansas                 | 39. Ohio                     |                    |
| 20. Kentucky               | 40. Oklahoma                 |                    |

V5. YEAR –year of release

V6. TITLE:

V7. CONTAMINANT(S) OF CONCERN (Contaminants)

1. Methylmercury only
2. Multiple Contaminants-Methylmercury + others (PCBs, Chlordane, Dioxin, DDT etc.)

V8. ETHNICITY (Ethnicity)-targeted ethnic group

1. Unspecified

2. American Indian or Alaska Native
3. Asian-Pacific (origins from Japan, China, Taiwan, Korea, Cambodia, Vietnam, the Philippines etc).
4. Black or African American
5. Native Hawaiian or other Pacific Islander
6. Hispanic or Latino

V9. FIRST AUDIENCE (Audience 1)-primary target audience

1. Anglers (unspecified)
2. Licensed Anglers
3. Unlicensed Anglers
4. Urban Anglers
5. Nursing mothers/pregnant women/women of childbearing age
6. Children
7. Consumers of Commercial Fish
8. Families
9. Healthcare Providers
10. Natural Resources/Environmental Professionals
11. Commercial Boat Captains
12. Commercial Fishermen
13. Unspecified Public Audience

V10. SECOND AUDIENCE (Audience 2)-audience who receives minor focus

1. Anglers (unspecified)
2. Licensed Anglers
3. Unlicensed Anglers
4. Urban Anglers
5. Nursing mothers/pregnant women/women of childbearing age
6. Children
7. Consumers of Commercial Fish
8. Families
9. Healthcare Providers
10. Natural Resources/Environmental Professionals
11. Commercial Boat Captains
12. Commercial Fishermen
13. Unspecified Public Audience

V11. THIRD AUDIENCE (Audience 3)-audience who receives minor focus

1. Anglers (unspecified)
2. Licensed Anglers
3. Unlicensed Anglers
4. Urban Anglers
5. Nursing mothers/pregnant women/women of childbearing age
6. Children
7. Consumers of Commercial Fish



8. Families
9. Healthcare Providers
10. Natural Resources/Environmental Professionals
11. Commercial Boat Captains
12. Commercial Fishermen
13. Unspecified Public Audience

#### V12. DISSEMINATION MEDIUM (Medium)

1. Press Release
2. Newspaper Article
3. Magazine Article
4. Brochure
5. Fact Sheet
6. Fishing Regulation Guide
7. Sign
8. Survey
9. Poster
10. Map
11. Flyer
12. Evaluation Tool
13. Formal Report
14. Advisory Booklet
15. Web Page
16. Children's Book
17. Letter to Healthcare Providers
18. Announcement to Interested Parties
19. Fish Consumption Regulations

#### COMMUNICATION STRATEGIES

*Instructions:* Provide a holistic rating of each advisory message on each of the three scales below. Each scale corresponds with one of three communication strategies—regulatory, educational, and interactive. In addition, each scale has three possible ratings (0=absent; 1=minor; 2=major). Two distinct assessments may be necessary to make the final ratings: 1) assessing *presence or absence*; and 2) assuming presence, assessing the *degree* of presence (i.e., is the strategy minor or major?).

1) The following pieces of evidence should be used as *general guidelines* for assessing the presence or absence of each communication strategy in the advisory message. If one or more of the pieces of evidence listed under a strategy is present in the message, then the strategy is present. If none of the pieces of evidence listed under a strategy are present in the message, then the strategy is absent. Do not make your assessment of degree (i.e., if the strategy is minor or major) based upon how many pieces of evidence are present in the message.

### *Evidence for presence*

#### A. Regulatory (prescriptive)

- \* The message warns against or forbids certain fishing and/or fish consumption behaviors.
- \* The message *tells/directs* the target audience(s) to behave in particular ways (e.g., do not consume fish from a specific water body; do not exceed fish consumption limits).
- \* The tone of the message is commanding and authoritative.
- \*The message does not emphasize alternative behaviors or personal choice.

#### B. Educational (explanatory)

- \*The message *explains* why the target audience(s) should alter fishing and/or fish consumption behavior and explains how this can be accomplished (e.g., mercury can cause these health effects in unborn children; if you follow these guidelines, you can protect your child from the harmful effects of mercury).
- \*The message aims to promote awareness, knowledge, and/or self-efficacy (message offers solutions)
- \*The tone of the message is explanatory and cajoling (persuasive).
- \*The message emphasizes alternative behaviors and personal choice.

#### C. Interactive (audience engagement/empowerment)

- \*The message is designed to promote interaction/involvement in risk-related issues or policy decisions.
- \*Public audiences are asked to provide feedback on advisory content or evaluate the advisory program in some way.
- \*Public audiences are encouraged to contact agency staff with questions, concerns or for more information.
- \*The tone, style, and content of the message facilitate public action.
- \*Public audiences are asked to exchange information with experts in a formal setting (e.g., public meeting).

2) Assuming the presence of a given strategy in the message, consider the following issues to assess degree (i.e., whether the strategy is minor or major). Please note that the presence of all or one of the pieces of evidence listed under each strategy (see above) could result in the same overall rating for the message depending upon your answers to the questions below.

### *Assessing degree of presence*

A. What are the objective(s) of the message? In other words, what (if anything) does the source indicate to the reader they are trying to accomplish?

B. What central theme(s) are addressed in the message?

C. What proportion (roughly estimated) of the message is devoted to the strategy of interest?

*Ratings*

V13. REGULATORY (Strategy 1)

- 0. Absent: regulatory strategy *is not* present in the message
- 1. Minor: regulatory strategy is present but not dominant in the message
- 2. Major: regulatory strategy is dominant in the message

V14. EDUCATIONAL (Strategy 2)

- 0. Absent: educational strategy *is not* present in the message
- 1. Minor: educational strategy is present but not dominant in the message
- 2. Major: educational strategy is dominant in the message

V15. INTERACTIVE (Strategy 3)

- 0. Absent: interactive strategy *is not* present in the message
- 1. Minor: interactive strategy is present but not dominant in the message
- 2. Major: interactive strategy is dominant in the message

*Examples*

*Example 1:* “Attention Anglers: McGee Creek” This sign was issued by the Oklahoma Department of Environmental Quality to warn anglers of the risks of consuming largemouth bass from the creek. The regulatory strategy is dominant in this message.

- 1) Are the regulatory, educational or interactive strategies present?
  - 1a) All four pieces of evidence for the regulatory strategy are present: The message strictly warns against consumption of largemouth bass for pregnant women/children and for the general public (esp. anglers); the message tells/directs the target audiences to behave in particular ways (no consumption for women and children, 2 meals per month for the general public); the tone of the message is commanding and authoritative; and the message does not emphasize alternative behaviors or personal choice.
  - 1b) No evidence is present for the educational strategy.
  - 1c) No evidence is present for the interactive strategy.
- 2) Given the presence of the regulatory strategy, to what degree is it present in the message?
  - 2a) The objective is to restrict fish consumption in McGee Creek to protect human health.

2b) The main theme of this message is a strong warning. The message also provides contact information in the form of a phone number, but there is no explicit encouragement for audience to contact the agency with questions, concerns or for more information.

2c) Approximately 98% of the sign is dedicated to the regulatory warning.

*Final Rating: Regulatory=2, Educational=0, Interactive=0*

*Example 2: “Mercury and Fish in Arkansas: What you should know.”* This brochure is disseminated to the general public in Arkansas, but also specifically addresses high risk audiences. This is primarily an educational outreach material, but contains some interactive content as well.

1) Are the regulatory, educational or interactive strategies present?

1a) No evidence is present for the regulatory strategy.

1b) All four pieces of evidence for the educational strategy are present: the message explains why the audience should alter fish consumption behavior and how this can be accomplished; the message promotes awareness, knowledge and self-efficacy; the tone of the message is explanatory and cajoling; and the message emphasizes alternative behaviors and personal choice.

1c) One piece of evidence for the interactive strategy is present: the audience can contact the agency for more information or for a copy of the mercury brochure.

2) Given the presence of the educational and interactive strategies, to what degree are they present in the message?

2a) The objective is to educate the audience about mercury risks and about how to safely eat fish from Arkansas waters.

2b) The message emphasizes six themes: 1) mercury in the environment; 2) pictures of fish high and low in mercury; 3) mercury bioaccumulation; 4) health effects of mercury, especially for high risk audiences; 5) how to eat fish safely; and 6) offering additional information and encouraging the audience to contact the agency.

2c) Approximately 95% of the brochure is dedicated to educational content. The remaining five percent is contact information for individuals who want to request a copy of the mercury brochure or receive additional information.

*Final Rating: Regulatory=0, Educational=2, Interactive=1*

*Example 3: “Sanchez Reservoir: Attention Anglers.”* This sign was issued by the Colorado Department of Health to warn anglers and their families about high mercury levels detected in Sanchez Reservoir. All three communication strategies are present in this message.

1) Are the regulatory, educational or interactive strategies present?

1a) Three elements of the regulatory strategy are present: the message does not emphasize alternative behaviors or personal choice; the message directs the audience

to follow the recommendations listed in the advisory; and part of the message has a commanding tone.

1b) Three elements of the educational strategy are present: the message provides some explanation of why anglers should alter their fish consumption behavior and how this can be accomplished; the message increases awareness; and part of the message has a cajoling tone.

1c) The interactive strategy is present in that the audience is encouraged to contact agency staff with questions about mercury risks and/or advisory recommendations.

2) Given the presence of the regulatory, educational and interactive strategies, to what degree are they present in the message?

2a) The main objectives of the message are to increase awareness of mercury contamination and to reduce risk for pregnant women, children and the general public (esp. anglers).

2b) The message has three themes: 1) reasons for the advisory; 2) presentation of recommended consumption frequencies; 3) encouraging the audience to contact the agency.

2c) The interactive strategy takes up less than 5% of the message content; the remainder of the document is taken up by educational and regulatory content, with an emphasis on regulatory content.

*Final Rating: Regulatory=2, Educational=1, Interactive=1*

*Example 4: “Brochure Evaluation: Mercury in Fish Notice.”* This evaluation tool represents the interactive strategy.

1) Are the regulatory, educational or interactive strategies present?

1a) No evidence is present for the regulatory strategy.

1b) No evidence is present for the educational strategy.

1c) Two of the four elements of the interactive strategy are present in the message: the message encourages audience feedback; and the tone/style/content of the message facilitate public action.

2) Given the presence of the interactive strategy, to what degree is it present in the message?

2a) The objective of the message is to receive audience feedback on a mercury brochure in order to assess audience understanding of the message and the intentions of the audience to comply with the recommendations outlined in the brochure.

2b) Three main themes are emphasized in the evaluation: 1) brochure understanding; 2) intention to comply with recommendations; 3) intention to share advisory information with others.

2c) The interactive strategy accounts for 100% of the message.

*Final Rating: Regulatory=0, Educational=0, Interactive=2*

## ANALYSIS OF BEST PRACTICES

*General Instructions:* Consider each individual outreach message in relation to the best practices below. Use the qualifying questions represented with the symbol “Q” to guide you through the process. This analysis applies primarily to outreach materials with descriptive, educational content.

V16. *Q1:* Is the message presented in English? (No=0, Yes=1)

*If no, complete the “Cultural Sensitivity” section and STOP analysis.*

*If yes, proceed.*

## ENCOURAGING AUDIENCE INVOLVEMENT

V17-V20. *Audience Involvement:* Does the agency request audience involvement in risk assessment or risk management activities?

Assess the presence or absence of the following audience involvement efforts:

0=Absent

1=Present

- |      |   |   |  |
|------|---|---|--|
| V17. | 0 | 1 | requesting involvement in an interview or focus group (Audience Involve 1)                 |
| V18. | 0 | 1 | announcing a public meeting/hearing (Audience Involve 2)                                   |
| V19. | 0 | 1 | requesting audience feedback on outreach materials (Audience Involve 3)                    |
| V20. | 0 | 1 | encouraging audience(s) to clean up or stop pollution in local waters (Audience Involve 4) |

## INFORMATION-SEEKING

V21-V22. *Information-Seeking:* Does the message encourage information-seeking behavior?

Assess the presence or absence of the following content:

0=Absent

1=Present

- |      |   |   |   |
|------|---|---|---|
| V21. | 0 | 1 | message provides contact information <u>and</u> mentions that audiences can contact the advisory program (or affiliated programs) with questions, concerns or for more information (Info-Seek1) |
| V22. | 0 | 1 | message mentions that audiences should discuss fish consumption issues with their local healthcare providers (Info Seek2)   |

STYLE

FORMAT

V23. Q2: Are visuals (e.g., graphs, pictures, tables, diagrams) pertaining to methylmercury in fish used in this message? (No=0, Yes=1)

*If No, skip to the Q3.*

*If Yes, proceed.*

V24. *Visuals and Text*: Does the text support the visuals?

Assess the presence or absence of the following:

0=Absent

1=Present

V24. 0 1 the text refers to visuals and explains them (Visuals and Text)

V25-V32. *Visual Clarity*: Do the visuals help to clarify the message?

Assess the presence or absence of the following clarifying visuals:

0=Absent

1=Present

V25. 0 1 pictures or graphs of mercury accumulation in humans or fish (Visuals1)

V26. 0 1 labeled pictures of fish with safety ratings (Visuals 2)

V27. 0 1 a stoplight approach (i.e., green=safe, yellow=caution; red=do not eat) (Visuals3)

V28. 0 1 scorecard of safe/unsafe species, sizes, and/or locations (Visuals 4)

V29. 0 1 thermometer icons indicating safety levels of different fish species (Visuals5)

V30. 0 1 labeled pictures of fish species the advisory pertains to (Visuals6)

V31. 0 1 maps of different water bodies under advisory or safer locations to fish (Visuals 7)

V32. 0 1 advisory tables (Visuals 8)

TONE

V33. Q3: Does the message contain descriptive, educational content? (No=0, Yes=1)

*If No, STOP here.*

*If Yes, proceed.*

V34-V35. *Commanding vs. Cajoling*: Does the message use a cajoling rather than a commanding tone?

Assess the presence or absence of the following:

0=Absent  
1=Present

- V34. 0 1 cajoling tone (Cajole)-explanatory, persuasive  
Example: you should limit consumption of tuna to two meals a week because...
- V35. 0 1 commanding tone (Command)-prescriptive, regulatory  
Example: eat no more than two meals a week of tuna

V36-V39. *Positive*: Is the message positive and upbeat?  
Assess the presence or absence of the following positive message characteristics:  
0=Absent  
1=Present

- V36. 0 1 avoids generic language (Positive1)  
V37. 0 1 avoids arousing unnecessary fear (Positive2)  
V38. 0 1 highlights health benefits of fish consumption (Positive3)  
V39. 0 1 emphasizes the value/importance of fishing (Positive4)

#### QUALITATIVE VS. QUANTITATIVE RISK COMPARISONS

V40. *Q4*: Does the message directly compare different fish consumption risks and/or benefits? (No=0, Yes=1)  
*If No, skip to the Reading Level section.*  
*If Yes, proceed.*

V41-V42. *Qualitative vs. Quantitative Risk Comparisons*: Does the message present qualitative or quantitative risk comparisons?  
Assess the presence or absence of the following risk comparison presentation styles:  
0=Absent  
1=Present

- V41. 0 1 qualitative risk comparisons (Qualitative)  
Example: describing the severity of comparative risks as high, moderate or low and describing the health effects that may occur at different levels of consumption.
- V42. 0 1 quantitative risk comparisons (Quantitative)  
Example: describing the severity of comparative risks as 1 in 10, 1 in 100 and 1 in 1,000 and describing the health effects that may occur at different levels of consumption with numerical ratings.

#### READING LEVEL

V43-V44. *Reading Level*: Is the reading level appropriate for the target audience(s)?

V43. Flesch Reading Ease Scale: (Report Value)



V44. Flesch-Kincaid Grade Level: (Report Value)

<http://resources.aellalei.com/tools/writer/sample.php>

## CONTENT

### CORE RECOMMENDATIONS

V45. Q5: Does the message discuss fish consumption recommendations? (No=0, Yes=1)

*If no, skip to the Health Effects section.*

*If yes, proceed.*

V46-V50. *Core Recommendations:*

Assess the presence or absence of the following core recommendations:

0=Absent

1=Present

- |      |   |   |  |
|------|---|---|--|
| V46. | 0 | 1 | eating fish is part of a healthy diet if consumed in moderation (Core Rec. 1)  |
| V47. | 0 | 1 | unambiguous description of the desired consumption behavior(s) (Core Rec.2)<br>Example: 1 meal/month of Tuna for pregnant women; 1 meal=1/2 pound of fish (before cooking) |
| V48. | 0 | 1 | relative mercury levels of different fish species under advisory (Core Rec. 3)<br>Example: tuna=high mercury; salmon=moderate mercury; sardines=low mercury                |
| V49. | 0 | 1 | the origins of the fish species referenced in the message (Core Rec. 4)<br>Examples: store-bought, sport-caught, commercial  |
| V50. | 0 | 1 | site-specific locations of the fish species referenced in the message <u>or</u> redirects to sources containing such information (Core Rec. 5)                             |

### ALTERNATIVES

V51-V57. *Alternatives:* Does the message discuss alternative solutions to the fish contamination problem?

Assess the presence or absence of the following alternatives:

0=Absent

1=Present

- |      |   |   |  |
|------|---|---|--|
| V51. | 0 | 1 | eat smaller and younger fish (Alternative 1)                     |
| V52. | 0 | 1 | avoid or limit consumption of large, predatory fish (Alternative |

			2)
V53.	0	1	identifying safer species, sizes and/or locations (Alternative 3)
V54.	0	1	promoting catch and release fishing (Alternative 4)
V55.	0	1	reduce meal size or frequency (Alternative 5)
V56.	0	1	eat a variety of fish species (Alternative 6)
V57.	0	1	alternative protein sources (Alternative 7)

## HEALTH EFFECTS

V58. *Q6*: Does the message mention the health risks of fish consumption? (No=0, Yes=1)

*If no, skip to the Contaminant Description section.*

*If yes, proceed.*

V59-V60. *High Risk Groups*: Does the message identify high risk groups and indicate why?

Assess the present or absence of the following information:

0=Absent

1=Present

V59.	0	1	who is most at risk (High Risk 1) Examples: pregnant women, infants, children, frequent consumers
V60.	0	1	why high risk groups are especially sensitive to mercury toxicity (High Risk 2)

V61-V62. *Severity*: Does the message address the severity of the risk, including the likelihood of personal illness and the immediacy of negative health effects?

Assess the presence or absence of the following information

0=Absent

1=Present

V61.	0	1	the likelihood of illness (Severity 1) Example: there are no known cases of illness from mercury poisoning in Illinois
V62.	0	1	the immediacy of the risk (Severity 2) Example: It may take many months or even years to get sick from eating fish with mercury.

V63-V71. *Health Risks*: Does the message describe specific adverse health effects of eating fish contaminated with methylmercury?

Assess the presence or absence of the following risk topics:

0=Absent

1=Present

V63.	0	1	mild neurological damage (Risks 1)
V64.	0	1	neurological damage-unspecified (Risks 2)

V65.	0	1	severe neurological damage (Risks 3)
V66.	0	1	developmental disorders in infants or young children (Risks 4)
V67.	0	1	extended retention in the body (Risks 5)
V68.	0	1	high mercury sensitivity in pregnant women or young children (Risks 6)
V69.	0	1	transfer of mercury from mother to fetus or child (Risks 7)
V70.	0	1	accumulation of mercury in the body (Risks 8)
V71.	0	1	kidney damage (Risks 9)

V72-V75. *Health Benefits*: Does the message explain specific health benefits of eating fish?

Assess the presence or absence of the following benefit topics:

0=Absent

1=Present

V72.	0	1	high protein (Benefits 1)
V73.	0	1	low fat (Benefits 2)
V74.	0	1	cardiovascular benefits (Benefits 3)
V75.	0	1	fetal development benefits (Benefits 4)

#### CONTAMINANT DESCRIPTION

V76. Q7: Does the message provide descriptive content about Methylmercury? (No=0, Yes=1)

*If no, skip to the Comparisons section.*

*If yes, proceed.*

V77-V80. *Contaminant Description*: Does the message adequately describe the nature of Methylmercury?

Assess the presence or absence of the following topics of discussion:

0=Absent

1=Present

V77.	0	1	bioaccumulation of methylmercury in fish tissue (Contaminant Desc. 1)
V78.	0	1	origins of methylmercury in the environment (Contaminant Desc. 2)
V79.	0	1	mercury in fish <u>cannot</u> be removed through cooking or cleaning (Contaminant Desc.3)
V80.	0	1	visibility of mercury in fish (Contaminant Desc. 4) Example: fish contaminated with methylmercury cannot be seen, smelled or tasted

## COMPARISONS

V81. Q8: Does the message directly compare different fish consumption risks and/or benefits? (No=0, Yes=1)

*If No, skip to the Uncertainty section.*

*If Yes, proceed.*

V82-V86. *Comparisons*: Does the message present comparative risk and/or benefit scenarios?

Assess the presence or absence of the following comparisons:

0=Absent

1=Present

V82.	0	1	comparing the risks of fish consumption with other health risks (Comparison 1)
V83.	0	1	comparing the risks of fish consumption with other dietary health risks, including other protein sources (Comparison 2)
V84.	0	1	comparing the risks of fish consumption with other voluntary health risks, including drinking, driving, smoking etc. (Comparison3)
V85.	0	1	comparing the risks and benefits of fish consumption (Comparison 4)
V86.	0	1	comparing the benefits of fish consumption with dietary health risks, including other protein sources (Comparison 5)

## UNCERTAINTY

V87-V95. *Uncertainty*: Does the message discuss assumptions and/or uncertainties that form the basis for issuing mercury advisories?

Assess the presence or absence of the following topics of discussion:

0=Absent

1=Present

V87.	0	1	dose/response models (Uncertainty 1)
V88.	0	1	body weight assumptions (Uncertainty 2)
V89.	0	1	defining meal size (Uncertainty 3)
V90.	0	1	fish sampling procedures (Uncertainty 4)
V91.	0	1	Rfd estimates (Uncertainty 5)
V92.	0	1	social or economic considerations (Uncertainty 6)
V93.	0	1	limits of public participation (Uncertainty 7)
V94.	0	1	advisories are subject to change and/or interpretation (Uncertainty 8)
V95.	0	1	data strengths/weaknesses (Uncertainty 9)

V96-V97. *Balance*: Is the message balanced? In other words, does the message offer different perspectives on the fish consumption issue?

Assess the presence or absence of the following characteristics of a balanced message:

0=Absent

1=Present

- |      |   |   |   |
|------|---|---|---|
| V96. | 0 | 1 | balanced discussion of risks and benefits (Balance 1)                           |
| V97. | 0 | 1 | pros and cons of risk assessment and/or risk management assumptions (Balance 2) |

## PERSONALIZING THE MESSAGE

V98-V103. *Personalize*: Does the message address the needs and concerns of the target audience?

Assess the presence or absence of the following personalized content:

0=Absent

1=Present

- |       |   |   |   |
|-------|---|---|---|
| V98.  | 0 | 1 | acknowledging audience-specific activities or behaviors (Personalize 1)         |
| V99.  | 0 | 1 | addressing regional fish contamination issues (Personalize 2)                   |
| V100. | 0 | 1 | addressing frequently asked questions (Personalize 3)                           |
| V101. | 0 | 1 | discussing unique health concerns or advice to high risk groups (Personalize 4) |
| V102. | 0 | 1 | what agencies are doing to address the contamination problem (Personalize 5)    |
| V103. | 0 | 1 | if/when the fish under advisory will be safe to eat (Personalize 6)             |

## CULTURAL SENSITIVITY

V104. *Q9*: Is the message targeted towards a cultural/ethnic minority group? (No=0, Yes=1)

Examples: Blacks, Latinos, Asians, Native Americans etc.

*If no, STOP analysis.*

*If yes, proceed.*

0=No

1=Yes

- |       |   |   |   |
|-------|---|---|---|
| V105. | 0 | 1 | Is the message communicated in the native language of the target audience? (Language)   |
| V106. | 0 | 1 | Does the message use explanatory visual aids pertaining to mercury? (VisualsCS)<br>Example: diagram of how mercury ingested by pregnant women is transferred to the fetus |

V107-V114. *Cultural Sensitivity*: Is the message sensitive to cultural traditions, needs and concerns?

If an English version of the message exists, assess the presence or absence of the following topics of discussion:

0=Absent

1=Present

V107.	0	1	the value of fishing as a social or cultural tradition (Cultural Sensitivity 1)
V108.	0	1	the visibility of mercury in fish (Cultural Sensitivity 2)
V109.	0	1	the efficacy of culturally-specific cooking, cleaning and/or consumption practices (Cultural Sensitivity 3)
V110.	0	1	the value of fish consumption as a social or cultural tradition (Cultural Sensitivity 4)
V111.	0	1	offering alternative protein sources available at low cost (Cultural Sensitivity 5)
V112.	0	1	discussing the relationship between local pollution and the overall health of the ecosystem (Cultural Sensitivity 6)
V113.	0	1	the past relationship of the polluter with the target community (Cultural Sensitivity 7)
V114.	0	1	the past relationship of the issuing agency with the target community (Cultural Sensitivity 8)

APPENDIX D  
CODING SCHEME: DISSEMINATION

*Instructions:* Complete this section only after analyzing all of the individual outreach materials for all advisory programs within a given jurisdiction (state, tribal or federal). Consider the overall advisory jurisdiction (e.g., the complete set of outreach materials for all advisory programs in Minnesota) as the unit of analysis when answering the following questions.

#### V1. SPECIFIC ADVISORY JURISDICTION

- |                            |                              |                    |
|----------------------------|------------------------------|--------------------|
| 1. Alabama                 | 21. Louisiana                | 41. Oregon         |
| 2. Alaska                  | 22. Maine                    | 42. Pennsylvania   |
| 3. Arizona                 | 23. Maryland                 | 43. Rhode Island   |
| 4. Arkansas                | 24. Massachusetts            | 44. South Carolina |
| 5. Colorado                | 25. Michigan                 | 45. South Dakota   |
| 6. California              | 26. Minnesota                | 46. Tennessee      |
| 7. Connecticut             | 27. Minnesota Chippewa Tribe | 47. Texas          |
| 8. Delaware                | 28. Mississippi              | 48. Utah           |
| 9. District of Columbia    | 29. Missouri                 | 49. Vermont        |
| 10. Federal-EPA/FDA        | 30. Montana                  | 50. Virginia       |
| 11. Florida                | 31. Nebraska                 | 51. Washington     |
| 12. Georgia                | 32. Nevada                   | 52. West Virginia  |
| 13. Great Lakes Indian F&W | 33. New Hampshire            | 53. Wisconsin      |
| 14. Hawaii                 | 34. New Jersey               | 54. Wyoming        |
| 15. Idaho                  | 35. New Mexico               |                    |
| 16. Illinois               | 36. New York                 |                    |
| 17. Indiana                | 37. North Carolina           |                    |
| 18. Iowa                   | 38. North Dakota             |                    |
| 19. Kansas                 | 39. Ohio                     |                    |
| 20. Kentucky               | 40. Oklahoma                 |                    |

#### MULTIPLE CHANNELS

V2-V4. *Multiple Channels:* Does the advisory jurisdiction use a variety of dissemination channels (i.e., mass media, specialized media and interpersonal contacts) to reach target audiences?

Assess the presence or absence of the following channels:

0=Absent

1=Present

- |     |   |   |   |
|-----|---|---|---|
| V2. | 0 | 1 | mass media (1-3 for V12 in Coding Scheme 1)               |
| V3. | 0 | 1 | specialized media (4-16 for V12 in Coding Scheme 1)       |
| V4. | 0 | 1 | interpersonal contacts (17-21 for V12 in Coding Scheme 1) |



## CONSISTENCY/UNIFORMITY

V5-V7. *Consistency/Uniformity*: Are agency programs within the same jurisdiction delivering consistent messages to target audiences? Are agency programs with advisories for the same water bodies delivering consistent messages to target audiences?

Assess the presence or absence of the following:

0=Absent

1=Present

- |     |   |   |  |
|-----|---|---|--|
| V5. | 0 | 1 | joint advisories issued within government jurisdictions                          |
| V6. | 0 | 1 | joint advisories issued between government jurisdictions                         |
| V7. | 0 | 1 | joint advisories issued between government jurisdictions for the same water body |

## MASS MEDIA

V8. *Q1*: Did the advisory jurisdiction issue press releases? (No=0, Yes=1)

*If no, skip to the Specialized Media section.*

*If yes, proceed.*

V9-V11. *Mass Media*: Do press releases issued within the advisory jurisdiction meet the following needs of the mass media?

Assess the presence or absence of the following message characteristics:

0=Absent

1=Present

- |      |   |   |  |
|------|---|---|--|
| V9.  | 0 | 1 | uncomplicated-simple and easy to understand                      |
| V10. | 0 | 1 | interesting-press releases capture the reader's attention        |
| V11. | 0 | 1 | accurate-provide evidence and explanations to support assertions |

## SPECIALIZED MEDIA

V12. *Q2*: Did the advisory jurisdiction use specialized media channels? (No=0, Yes=1)

*If no, skip to the Interpersonal Contacts section.*

*If yes, proceed.*

V13-V14. *Specialized Media*: Do the specialized media used by the advisory jurisdiction target specific and general audience demographics?

Assess the presence or absence of the following:

0=Absent

1=Present

- |      |   |   |   |
|------|---|---|---|
| V13. | 0 | 1 | specified audience demographics<br>Examples: anglers, pregnant women, children, families etc. |
| V14. | 0 | 1 | general public (unspecified audience)   |

#### INTERPERSONAL CONTACTS

V15-V20. *Interpersonal Contacts*: Does the advisory jurisdiction attempt to build partnerships with opinion leaders and other community members?

Assess the presence or absence of the following:

0=Absent

1=Present

- |      |   |   |  |
|------|---|---|--|
| V15. | 0 | 1 | asking audiences to pass information to their friends and families                               |
| V16. | 0 | 1 | working with local schools to integrate advisory information into the science curriculum         |
| V17. | 0 | 1 | attempting to train volunteers to teach classroom sessions targeted towards particular audiences |
| V18. | 0 | 1 | asking health practitioners to pass on advisory information to their patients                    |
| V19. | 0 | 1 | asking seafood clerks to deliver advisory information to customers                               |
| V20. | 0 | 1 | asking boat captains or commercial fishermen to pass advisory information to clients             |

#### WEB-BASED

V21-V23. *Web-Based*: Does the advisory jurisdiction have at least one web site to provide user-friendly access to available outreach materials?

Assess the presence or absence of the following web site features:

0=Absent

1=Present

- |      |   |   |  |
|------|---|---|--|
| V21. | 0 | 1 | icons and links to steer individuals to multiple sources of advisory information   |
| V23. | 0 | 1 | database of available state, tribal and/or federal advisories and additional publications  |
| V23. | 0 | 1 | new technologies for citizen involvement (e.g., interactive software, electronic town meetings, bulletin boards, chat sessions, email) |

#### ONE MESSAGE VS. MANY MESSAGES

V24-V25. *One Message*: Does each individual message within the advisory jurisdiction meet the following criteria?

Assess the presence or absence of the following criteria:

0=Absent

1=Present

V24. 0 1 encourages the audience to find out more

V25. 0 1 focuses on a small number of message components/themes

V26-V29. *Many Messages*: Do all outreach materials (i.e., the complete set of coded messages) issued within the advisory jurisdiction meet the following criteria?

Assess the presence or absence of the following criteria:

0=Absent

1=Present

V26. 0 1 use redundant/overlapping advisory content presented in multiple formats

V27. 0 1 messages range from simple to complex

V28. 0 1 messages range from site-specific to geographically generalized

V29. 0 1 targeted towards specific and general audiences

APPENDIX E  
FINAL INTERCODER RELIABILITY (N=25)

Variable name	P.A.	Kappa
Contaminants	100%	1
Ethnicity	96%	*
Audience1	72%	*
Medium	96%	*
Paradigm1	76%	0.65
Paradigm2	92%	0.83
Paradigm3	92%	0.81
AudienceInvolve1	100%	*
AudienceInvolve2	100%	1
AudienceInvolve3	100%	1
AudienceInvolve4	100%	*
InfoSeek1	92%	0.63
InfoSeek2	92%	0.46
VisualText	96%	0.92
Visuals1	92%	*
Visuals2	96%	0.65
Visuals3	96%	0.65
Visuals4	88%	*
Visuals5	100%	*
Visuals6	96%	0.83
Visuals7	96%	0.65
Visuals8	92%	0.80
Cajole	96%	0.88
Command	80%	0.59
Positive1	80%	0.59
Positive2	76%	0.47
Positive3	96%	0.92
Positive4	96%	0.87
Qualitative	96%	*
Quantitative	100%	*
CoreRec1	76%	0.55
CoreRec2	84%	0.69
CoreRec3	80%	0.6
CoreRec4	88%	0.75
CoreRec5	80%	0.61
Alternative1	92%	0.83
Alternative2	84%	0.68
Alternative3	76%	0.51
Alternative4	100%	1
Alternative5	92%	0.80
Alternative6	76%	0.41
Alternative7	96%	0.78
HighRisk1	96%	0.91
HighRisk2	92%	0.84
Severity1	76%	0.48
Severity2	84%	0.57
Risks1	80%	0.53
Risks2	80%	0.17
Risks3	88%	0.75

Appendix E (Continued)

Variable Name	P.A.	Kappa
Risks4	76%	0.54
Risks5	72%	0.39
Risks6	88%	0.74
Risks7	88%	0.69
Risks8	92%	0.83
Risks9	88%	0.6
Benefits1	92%	0.84
Benefits2	80%	0.53
Benefits3	88%	0.6
Benefits4	92%	0.62
ContaminantDesc.1	92%	0.82
ContaminantDesc.2	96%	0.92
ContaminantDesc.3	96%	0.92
ContaminantDesc.4	92%	0.47
Comparison1	100%	1
Comparison2	100%	*
Comparison3	96%	*
Comparison4	96%	*
Comparison5	100%	*
Uncertainty1	100%	1
Uncertainty2	100%	1
Uncertainty3	96%	0.92
Uncertainty4	96%	0.83
Uncertainty5	92%	0.47
Uncertainty6	80%	-0.07
Uncertainty7	100%	*
Uncertainty8	84%	0.43
Uncertainty9	88%	0.36
Balance1	92%	0.46
Balance2	88%	0.34
Personalize1	72%	0.45
Personalize2	72%	0.44
Personalize3	92%	0.84
Personalize4	96%	0.91
Personalize5	84%	0.65
Personalize6	84%	-0.06
Language	96%	0.65
VisualsCS	100%	*
CulturalSensitivity1	100%	*
CulturalSensitivity2	100%	*
CulturalSensitivity3	100%	*
CulturalSensitivity4	100%	*
CulturalSensitivity5	100%	*
CulturalSensitivity6	96%	*
CulturalSensitivity7	100%	*
CulturalSensitivity8	100%	*

\* Kappa statistic could not be calculated because the coded values were not balanced or because the coded values were constants

## REFERENCES

- Anderson, H. A., et al. (2004). The role of sport-fish consumption in mercury risk communication: a 1998-1999 12-state survey of women age 18-45. *Environmental Research*, 95, 315-324.
- Anderson, P. D., et al. (2002). Framework and Case Studies. *Comments on Toxicology*, 8(4-6), 431-502.
- Arnold, S. M., Lynn, T. V., Verbrugge, L. A., & Middaugh, J. P. (2005). Human Biomonitoring to Optimize Fish Consumption Advice: Reducing Uncertainty When Evaluating Benefits and Risks. *American Journal of Public Health*, 95(3), 393-397.
- Bakir, F., et al. (1973). Methylmercury Poisoning in Iraq. *Science*, 181, 230-241.
- Balch, G. I., & Sutton, S. M. (1995). Putting the First Audience First: Conducting Useful Evaluation for a Risk-Related Government Agency. *Risk Analysis*, 15(2), 163-168.
- Banerjee, et al. (1999). Beyond kappa: A review of interrater agreement measures. *The Canadian Journal of Statistics*, 27(1), 3-23.
- Bender, M., & Williams, J. (2001). *The One That Got Away: FDA Fails To Protect Public From High Mercury Levels In Seafood: Mercury Policy Project California Communities Against Toxics*.
- Bostrom, A. (1996). *Vaccine Risk Communication: Lessons from Risk Perception, Decision Making and Environmental Risk Communication Research*: Institute of Medicine.
- Burger, J. (1998). Fishing And Risk Along The Savannah River: Possible Intervention. *Journal of Toxicology and Environmental Health*, 55(6), 405-419.
- Burger, J. (2000a). Consumption advisories and compliance: The fishing public and the deamplification of risk. *Journal of Environmental Planning and Management*, 43(4), 471-489.
- Burger, J. (2000b). Gender Differences in Meal Patterns: Role of Self-Caught Fish and Wild Game in Meat and Fish Diets. *Environmental Research*, 83(2), 140-149.
- Burger, J. (2004). Fish consumption advisories: knowledge, compliance and why people fish in an urban estuary. *Journal of Risk Research*, 7(5), 463-479.

- Burger, J., et al. (1999a). Factors in Exposure Assessment: Ethnic and Socioeconomic Differences in Fishing and Consumption of Fish Caught along the Savannah River. *Risk Analysis*, 19(3), 427-438.
- Burger, J., et al. (1999b). Fishing in Urban New Jersey: Ethnicity Affects Information Sources, Perception, and Compliance. *Risk Analysis*, 19(2), 217-229.
- Burger, J., et al. (2001). Science, Policy, Stakeholders, and Fish Consumption Advisories: Developing a Fish Fact Sheet for the Savannah River. *Environmental Management*, 27(4), 501-514.
- Burger, J., et al. (2003). Evaluating Risk Communication about Fish Consumption Advisories: Efficacy of a Brochure versus a Classroom Lesson in Spanish and English. *Risk Analysis*, 23(4), 791-803.
- Burger, J., et al. (2004). Fish availability in supermarkets and fish markets in New Jersey. *Science of the Total Environment*, 333, 89-97.
- Burger, J., C., D., Boring, S. C., & Gochfeld, M. (2003). Effect of Deep-Frying Fish on Risk from Mercury. *Journal of Toxicology and Environmental Health*, 66(11), 817-828.
- Burger, J., & Gochfeld, M. (1996). Fish Advisories: Useful or Difficult to Interpret? *RISK: Health, Safety & Environment*, 7, 23.
- Burger, J., Johnson, B. B., Shukla, S., & Gochfeld, M. (2003). Perceptions of Recreational Fishing Boat Captains: Knowledge and Effects of Fish Consumption Advisories. *Risk Analysis*, 23(2), 369.
- Burger, J., K.F., G., & Gochfeld, M. (2001). Ethnic Differences in Risk from Mercury among Savannah River Fishermen. *Risk Analysis*, 21(3), 533-534.
- Burger, J., Stern, A. H., & Gochfeld, M. (2005). Mercury in Commercial Fish: Optimizing Individual Choices to Reduce Risk. *Environmental Health Perspectives*, 113(3), 1-6.
- Burger, J., & Waishwell, L. (2001). Are we reaching the target audience? Evaluation of a fish fact sheet. *The Science of the Total Environment*, 277(1), 77-86.
- Cartledge, D. (2002). Sociocultural Considerations of Fish Consumption. *Comments on Toxicology*, 8(4-6), 421-430.



- Chess, C., Burger, J., & McDermott, M. H. (2005). Speaking Like a State: Environmental Justice and Fish Consumption Advisories. *Society and Natural Resources*, 18(3), 267-278.
- Chess, C., & Salomone, K. L. (1992). Rhetoric and Reality: Risk Communication in Government Agencies. *Journal of Environmental Education*, 23(3), 28-33.
- Chess, C., Salomone, K. L., & Hance, B. J. (1995a). Improving Risk Communication in Government: Research Priorities. *Risk Analysis*, 15(127-135).
- Chess, C., Salomone, K. L., Hance, B. J., & Saville, A. (1995b). Results of a National Symposium on Risk Communication: Next Steps for Government Agencies. *Risk Analysis*, 15(2), 115-125.
- Chess, C., Salomone, K. L., & Sandman, P. M. (1991). Risk communication activities of state health agencies. *American Journal of Public Health*, 81(4), 489-491.
- Connelly, N. A., & Knuth, B. A. (1998). Evaluating Risk Communication: Examining Target Audience Perceptions About Four Presentation Formats for Fish Consumption Health Advisory Information. *Risk Analysis*, 18(5), 649-659.
- Connelly, N. A., Knuth, B. A., & Brown, T. L. (1996). Sportfish Consumption Patterns of Lake Ontario Anglers and the Relationship to Health Advisories. *North American Journal of Fisheries Management*, 16, 90-101.
- Covello, V. T., McCallum, D. B., & Pavlova, M. T. (Eds.). (1989). *Effective Risk Communication: The Role and Responsibility of Government and Nongovernment Organizations* (Vol. 4). New York: Plenum Press.
- CSPP. (2005). *Making Sense of State Fish Advisories: A Policy-Maker's Guide to Mercury, Fish and Public Health*. Washington, D.C.: Center for Science and Public Policy.
- Davies, J. C., Covello, V. T., & Allen, F. W. (1987). *Proceeding on the National Conference on Risk Communication*, Washington, D.C.
- Daviglus, M., Sheeshka, J., & Murkin, E. (2002). Health Benefits from Eating Fish. *Comments on Toxicology*, 8(4-6), 345-374.
- Dourson, M., Price, P., & Unrine, J. (2002). Health Risks from Eating Contaminated Fish. *Comments on Toxicology*, 8(4-6), 399-419.

- Egeland, G. M., & Middaugh, J. P. (1997). Balancing Fish Consumption Benefits with Mercury Exposure. *Science*, 278(5345), 1904-1905.
- Fischhoff, B. (1995). Risk Perception and Communication Unplugged: Twenty Years of Process. *Risk Analysis*, 15(2), 137-145.
- Fisher, A., Chitose, A., & Gipson, P. S. (1994). One Agency's Use of Risk Assessment and Risk Communication. *Risk Analysis*, 14, 207-212.
- Foulke, J. E. (1994). Mercury in Fish: Cause For Concern? *FDA Consumer Magazine*, 1-6.
- Frey, L. R., Botan, C. H., & Kreps, G. L. (2000). *Investigating communication: An introduction to research methods* (2nd ed.). Boston, MA: Allyn & Bacon.
- Gibson, J. C. (2005). *Fish Consumption Advisories in Tributaries to the Chesapeake Bay: Improving the Communication of Risk to Washington, DC Anglers*. Virginia State University, Blacksburg, VA.
- Ginsberg, G. L., & Toal, B. F. (2000). Development of a Single-Meal Fish Consumption Advisory for Methyl Mercury. *Risk Analysis*, 20(1), 41-48.
- Grandjean, P., Weihe, P., White, R. F., & Debes, F. (1998). Cognitive Performance of Children Prenatally Exposed to "Safe" Levels of Methylmercury. *Environmental Research*, 77, 165-172.
- Grunig, L. A., Grunig, J. E., & Dozier, D. M. (2002). *Excellent public relations and effective organizations: A study of communication management in three countries*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Harada, M. (1995). Minimata Disease: The Methylmercury Poisoning in Japan Caused by Environmental Pollution. *Critical Reviews in Toxicology*, 25(1), 1-24.
- Hoag, B. & Cooper, C.L. (2006). *Managing Value-based Organizations: It's Not What You Think*. Northampton, MA: Edward Elgar Publishing.
- Hotchkiss, J. K. (1997). Chemical Risks in Foods: An Editorial Viewpoint. *Food Technology*, 51(5), 9.
- Imm, P., et al. (2005). Fish Consumption and Advisory Awareness in the Great Lakes Basin. *Environmental Health Perspectives*, 113(10), 1325-1329.
- Jakus, P., McGuinness, M., & Krupnick, A. (2002). *The Benefits and Costs of Fish Consumption Advisories for Mercury*. Washington D.C.: Resources for the Future.

- Jardine, C. G. (2003). Development of a Public Participation and Communication Protocol for Establishing Fish Consumption Advisories. *Risk Analysis*, 23(3), 461-471.
- Knobeloch, & Anderson. (2005). Human Biomonitoring to Optimize Fish Consumption Advice. *American Journal of Public Health*, 95, 1304.
- Knuth, B. A. (1990). Risk Communication: A New Dimension of Sport-Fisheries Management. *North American Journal of Fisheries Management*, 10, 374-381.
- Knuth, B. A. (1995). Fish consumption health advisories: Who heeds the advice? *Great Lakes Research Review [Great Lakes Res. Rev.]*, 1(2), 36-40.
- Knuth, B. A. (2002). Using and Communicating the Comparative Dietary Risk Framework. *Comments on Toxicology*, 8(4-6), 503-515.
- Knuth, B. A., Connelly, A. N., Sheeshka, J., & Patterson, J. (2003). Weighing Health Benefit and Health Risk Information when Consuming Sport-Caught Fish. *Risk Analysis*, 23(6), 1185-1197.
- Laliberte, C., Grodin, J., & LaRue, R. (2000). *Environmental Risk Perception And Decision-Making: The Example Of Sportfish Consumption In Quebec (Canada)*. Retrieved October 8, 2005, from [www.slv2000.qc.ca/plan\\_action/phase3/sante\\_humaine/etudes\\_scientifiques/pdf/aff\\_pechesport\\_a.pdf](http://www.slv2000.qc.ca/plan_action/phase3/sante_humaine/etudes_scientifiques/pdf/aff_pechesport_a.pdf)
- Leiss, W. (Ed.). (1989). *Prospects and Problems In Risk Communication*. Waterloo, Ontario, Canada: Institute for Risk Research.
- Lipkus, I. M., & Hollands, J. G. (1999). The Visual Communication of Risk. *Journal of the National Cancer Institute Monographs*(25), 149-163.
- Lundgren, R. E., & McMakin, A. H. (1998). *Risk Communication: A Handbook for Communicating Environmental, Safety, and Health Risks* (2nd ed.). Columbus, Ohio: Battelle Press.
- Lynn, F. M., & Busenberg, G. J. (1995). Citizen Advisory Committees and Environmental Policy: What We Know, What's Left to Discover. *Risk Analysis*, 15(2), 147-162.
- Marien, K., & Stern, A. H. (2005). An examination of the trade-offs in public health resulting from the use of default exposure assumptions in fish consumption advisories. *Environmental Research*, 98, 258-267.

- May, H., & Burger, J. (1996). Fishing in a Polluted Estuary: Fishing Behavior, Fish Consumption, and Potential Risk. *Risk Analysis*, 16(4), 459-471.
- McDermott, M. H. (2003). Communicating a Complex Message to the Population Most at Risk: An Outreach Strategy for Fish Consumption Advisories. *Applied Environmental Education and Communication: an International Journal*, 2(1), 39-48.
- Moya, J. (2004). Overview of Fish Consumption Rates in the United States. *Human and Ecological Risk Assessment*, 10(6), 1195-1211.
- Myers, G. J., et al. (1995). Main Neurodevelopmental Study of Sechellois Children Following *in utero* Exposure to Methylmercury from a Maternal Fish Diet: Outcome at Six Months. *NeuroToxicology*, 16(4), 653-664.
- Neuendorf, K. A. (2002). *The Content Analysis Guidebook*. Thousand Oaks, CA: Sage Publications.
- NRC. (1989). *Improving Risk Communication*. Washington, D.C.: National Academy Press.
- NRC. (1991). *Seafood Safety*. Washington, D.C.: National Academy Press.
- NRC. (1996). *Understanding risk: Informing decisions in a democratic society*. Washington, D.C.: National Academy Press.
- Patterson, J. (2002). Introduction--Comparative Dietary Risk: Balance the Risk and Benefits of Fish Consumption. *Comments on Toxicology*, 8(4-6), 337-343.
- Patterson, J., & Dourson, M. (2002). Conclusions and Research Needs. *Comments on Toxicology*, 8(4-6), 517-525.
- Perreault, W. D., & Leigh, L. E. (1989). Reliability of nominal data based on qualitative judgments. *Journal of Marketing Research*, 26, 135-148.
- Pflugh, K. K., et al. (1999). Urban anglers' perception of risk from contaminated fish. *The Science of the Total Environment*, 228(2), 203-218.
- Potter, J. W., & Levine-Donnerstein, D. (1999). Rethinking validity and reliability in content analysis. *Journal of Applied Communication Research*, 27, 258-284.
- Reinert, R., Knuth, B., Kamrin, M., & Stober, Q. (1996). *A Review of the Basic Principles and Assumptions Used to Issue Fish Consumption Advisories*. Paper presented at the American Fisheries Society Symposium 16, Chattanooga, TN.

- Reinert, R. E., Knuth, B. A., Kamrin, M. A., & Stober, Q. J. (1991). Risk Assessment, Risk Management, and Fish Consumption Advisories in the United States. *Fisheries*, 16(6), 5-12.
- Renn, O. (1992). Concepts of Risk: A Classification. In S. G. Krimsky, D. (Ed.), *Social Theories of Risk* (pp. 53-79). Westport, Ct.: Praeger Publishers.
- Roe, A. (2003). Fishing for Identity: Mercury Contamination and Fish Consumption Among Indigenous Groups in the United States. *Bulletin of Science, Technology, & Society*, 23(5), 368-375.
- Sandman, P. (1987). Risk Communication: Facing Public Outrage. *EPA Journal*, 21-22.
- Scherer, C. W. (1991). *Strategies for communicating risks to the public*. Paper presented at the Institute for Food Technologists Annual Meeting, Dallas, Texas.
- Shaw, J., & Johnson, B. (1990). *A Look Inside: Risk Communication and Public Participation within the New Jersey Department of Environmental Protection*. Trenton, New Jersey: New Jersey Department of Environmental Protection and Energy.
- Sheeshka, J., & Murkin, E. (2002). Nutritional Aspects of Fish Compared with Other Protein Sources. *Comments on Toxicology*, 8(4-6), 375-397.
- Shimshack, J. P., Ward, M. B., & Beatty, T. K. M. (2005). *Are Mercury Advisories Effective? Information, Education, and Fish Consumption*. Tufts University Working Paper.
- Shubat, P. J., Raatz, K. A., & Olson, R. A. (1996). Fish consumption advisories and outreach programs for Southeast Asian immigrants. *Toxicology Industry Health*, 3-4, 427-434.
- Skerfving, S. (1974). Methylmercury Exposure, Mercury Levels In Blood And Hair, And Health Status In Swedes Consuming Contaminated Fish. *Ecotoxicology*, 2, 3-23.
- Slovic, P. (1986). Informing and educating the public about risk. *Risk Analysis*, 4, 403-415.
- Slovic, P. (1992). Perception of Risk: Reflections on the Psychometric Paradigm. In S. G. Krimsky, D. (Ed.), *Social Theories of Risk* (pp. 117-152). Westport: Kraeger Publishers.

- Smith, K. M., & Sahyoun, N. R. (2005). Fish Consumption: Recommendations Versus Advisories, Can They Be Reconciled? *Nutrition Reviews*, 63(2), 39-47.
- Springer, C. M. (1990). *Risk Management And Risk Communication Perspectives Regarding Lake Ontario's Chemically Contaminated Sport Fishery*. Unpublished Masters Thesis, Cornell University, Ithaca, NY.
- Tinker, T. L. (1996). Recommendations to Improve Health Risk Communication: Lessons Learned from the U.S. Public Health Service. *Journal of Health Communication*, 1, 197-217.
- Tinker, T. L., Collins, C. M., King, H. S., & Hoover, M. D. (2000). Assessing risk communication effectiveness: perspectives of agency practitioners. *Journal of Hazardous Materials*, B73, 117-127.
- Tyler, S. K. (1996). *Writing Sample Analyzer*, from <http://obsidian.skytyler.com/tools/writer/sample.php>
- USDHHS. (1993). *Recommendations to Improve Health Risk Communication. A Report on Case Studies in Health Risk Communication*. Washington, D.C.: Public Health Service Committee to Coordinate Environmental Health and Related Programs, U.S. Department of Health and Human Services.
- USEPA. (1992). *Seven Cardinal Rules of Risk Communication* (No. EPA-230-K-92-001). Washington, D.C.: U.S. Environmental Protection Agency.
- USEPA. (1995). *Guidance For Assessing Chemical Contaminant Data For Use in Fish Advisories: Risk Communication (Vol. 4)* (No. EPA 823-R-95-001). Washington, D.C.
- USEPA. (1999). *Conference Proceedings: American Fisheries Society Forum on Contaminants in Fish*. Alexandria, VA: American Fisheries Society, U.S. Environmental Protection Agency.
- USEPA. (2001a). *Conference Proceedings: National Forum on Contaminants in Fish*. Chicago, Illinois: U.S. Environmental Protection Agency, Minnesota Department of Health, Society for Risk Analysis.
- USEPA. (2001b). *Mercury Update: Impact on Fish Advisories* (No. EPA-823-F-01-011). Washington, D.C.: U.S. Environmental Protection Agency.
- USEPA. (2002). *Conference Proceedings: National Forum on Contaminants in Fish*. Burlington, VT: American Fisheries Society, U.S. Environmental Protection Agency.

- USEPA. (2004). *Conference Proceedings: National Forum on Contaminants in Fish*. San Diego, CA: U.S. Environmental Protection Agency, California Office of Environmental Health Hazard Assessment, Agency for Toxic Substances and Disease Registry.
- USEPA. (2005a). *Fact Sheet: 2004 National Listing of Fish Advisories* (No. EPA-823-F-05-004). Washington, D.C.: EPA.
- USEPA. (2005b). *Conference Proceedings: National Forum on Contaminants in Fish*. Baltimore, MD: U.S. Environmental Protection Agency, Maryland Department of the Environment.
- Vaughan, E. (1995). The Significance of Socioeconomic and Economic Diversity for the Risk Communication Process. *Risk Analysis*, 15(2), 169-180.
- Velicer, C. M., & Knuth, B. A. (1994). Communicating contaminant risks from sport-caught fish: The importance of target audience assessment. *Risk Analysis*, 14(5), 833-841.