
To:	Chesapeake Bay Trust, Diversity Workgroup, Toxic Contaminants Workgroup
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Subject:	Technical Memorandum on Literature Review Findings on the Effectiveness of Fish Consumption Advisory Communication

1. Introduction

The 2014 Chesapeake Bay Watershed Agreement, which sets forth a plan for collaboration across the Bay’s political boundaries by establishing goals and outcomes for Bay restoration, includes outcomes that recognize the need to improve the effectiveness of fish consumption advisories, particularly as they pertain to minority watershed stakeholders and subsistence fishers. The management strategies for three outcomes—Diversity Outcome, Toxic Contaminants Policy and Prevention Outcome, and Toxic Contaminants Research Outcome—each include discussions of this need. The Diversity Management Strategy and Action Plan specifically identifies the need to conduct advisory outreach to subsistence fishermen and communities of color through culturally appropriate signage and other materials using multiple distribution mechanisms. The Toxic Contaminants Policy and Prevention Management Strategy, which focuses mostly on polychlorinated biphenyls (PCBs), includes improvements in fish consumption advisory communication as a strategic element because it will be effective in building public awareness on the severity and extent of PCBs in the environment, which will translate to supporting legal and political action to reduce PCB inputs.

To support these management strategies, Tetra Tech was contracted by the Chesapeake Bay Trust to conduct a literature review on fish consumption advisory effectiveness and, on the basis of on those findings, develop recommendations and tools to help Bay localities more effectively reach minorities, subsistence fishermen, and the families they support with the fish they catch.

2. Methodology for Literature Review

Tetra Tech performed a literature review to collect and assess available literature on the existing approaches to communicating fish consumption advisories, the effectiveness of the communication methods used, and any recommendations for increasing awareness of and compliance with consumption advisories.

The first step involved gathering a list of specific known articles and documents that were recommended for review by members of the Diversity Workgroup and the Toxics Contaminants Workgroup, such as *Addressing the Risk: Understanding and Changing Anglers’ Attitudes about the Dangers of Consuming Anacostia River Fish* (referred to as the Anacostia anglers’ study) (OpinionWorks 2012) and *Consumption Advisories in Tributaries to the Chesapeake Bay* (Gibson 2005). Tetra Tech then created a list of key words to use when conducting online searches for relevant studies and reports. These included, but were not limited to, the following (individually and in combination):

- Fish consumption
- Fish consumption advisory
- Fish advisory
- Subsistence fishing
- Risk communication
- Outreach methods
- Angler's study

After collecting articles through an online search and reading each article's abstract, the articles were sorted into five groupings according to their relevance and availability. Priority 1 articles were flagged as the top six most relevant articles which were easily obtainable online. Priority 2 articles were also relevant and easily obtainable online. Priority 3 articles were relevant, but not easily available and required additional effort to obtain. Priority 4 articles were not relevant but were easily available. Priority 5 articles were not relevant and were not easily obtainable. Tetra Tech then reviewed the six articles coded as Priority 1 in depth to serve as a starting point for determining what information to retrieve and analyze from each article. Tetra Tech created a spreadsheet to organize and store the details from each article and populated the spreadsheet with information from the six Priority 1 articles.

The following key information was documented in the spreadsheet for each article:

- Priority level (how relevant and accessible the article is)
- Citation
- Abstract
- Method used to assess fish consumption or awareness of advisories
- Sample size
- Location of study
- Urban, rural, or suburban area
- Demographic information (e.g., race, income, education, etc.)
- Communication method used for advisories (i.e., newspaper, TV, signs)
- Whether advisories were found to be effective
- Conformance (or why advisories were ineffective)
- Recommendations for improving communication methods

A preliminary version of the spreadsheet was provided to leading members of both the Toxic Contaminants Workgroup and the Diversity Workgroup to gather feedback. After review and comment, minor adjustments were made to the spreadsheet. Tetra Tech then continued reviewing the remaining Priority 2 articles as well as the Priority 3 articles we could obtain. We then reviewed secondary sources and selected several of those to review in detail as well. We identified 31 documents in total; we reviewed 23 of those in detail. The remaining eight documents were either unobtainable or not relevant. Of those 23 reviewed, 21 were direct studies on fish consumption advisory awareness and/or effectiveness, while two were literature review summaries. Table 1 lists the 23 articles that were reviewed. The literature review was limited based on the project budget, and therefore this was not an exhaustive search of all the literature available.

Table 1. Articles included in the literature review

Author	Date	Article title
Beehler et al.	2001	Polluted Fish, Sources of Knowledge, and the Perception of Risk: Contextualizing African American Anglers' Sport Fishing Practices
Beehler et al.	2003	Characterizing Latino Anglers' Environmental Risk Perceptions, Sport Fish Consumption, and Advisory Awareness
Burger	2004	Fish Consumption Advisories: Knowledge, Compliance and Why People Fish in an Urban Estuary
Burger	2005	Fishing, Fish Consumption, and Knowledge about Advisories in College Students and Others in Central New Jersey
Burger et al.	2001	Science, Policy, Stakeholders, and Fish Consumption Advisories: Developing a Fish Fact Sheet for the Savannah River
Chess et al.	2005	Speaking Like a State: Environmental Justice and Fish Consumption Advisories
Connelly and Knuth	1998	Evaluating Risk Communication: Examining Target Audience Perceptions About Four Presentation Formats for Fish Consumption Health Advisory Information
Furgal et al.	2005	Digesting the Message about Contaminants and Country Foods in the Canadian North: A Review and Recommendations for Future Research and Action
George et al.	2010	Subsistence Consumption of Locally Caught Fish in Rochester, New York: 2009 Rapid Assessment Report
Gibson	2005	Fish Consumption Advisories in Tributaries to the Chesapeake Bay
Habron et al.	2008	Local Understanding of Fish Consumption Advisory Risks in Michigan's Upper Peninsula: The Role of Structure, Culture, and Agency
Kalkirtz et al.	2008	Environmental Justice and Fish Consumption Advisories on the Detroit River Area of Concern
Katner et al.	2011	Fishing, Fish Consumption and Advisory Awareness among Louisiana's Recreational Fishers
Knobeloch et al.	2005	Fish Consumption, Advisory Awareness, and Hair Mercury Levels Among Women of Childbearing Age
Lauber et al.	2011	Assessment of the Great Lakes States' Fish Consumption Advisory Programs
LePrevost et al.	2013	Need for Improved Risk Communication of Fish Consumption Advisories to Protect Maternal and Child Health: Influence of Primary Informants
May and Burger	1996	Fishing in a Polluted Estuary: Fishing Behavior, Fish Consumption and Potential Risk.
McDermott	2003	Communicating a Complex Message to the Population Most at Risk: An Outreach Strategy for Fish Consumption Advisories
OpinionWorks	2012	Addressing the Risk: Understanding and Changing Anglers' Attitudes about the Dangers of Consuming Anacostia River Fish
Pflugh et al.	1999	Urban Anglers' Perception of Risk From Contaminated Fish
Shubat et al.	1996	Fish Consumption Advisories and Outreach Programs for Southeast Asian Immigrants
Tilden et al.	1997	Health Advisories for Consumers of Great Lakes Sport Fish: Is the Message Being Received?
Westphal et al.	2008	Anglers' Appraisals of the Risks of Eating Sport-Caught Fish from Industrial Areas: Lessons from Chicago's Calumet Region

3. Summary of Findings

This section includes a summary of the overall findings across the 23 articles reviewed. Most of the studies covered in the articles included primary research (e.g., surveys, focus groups, interviews) to determine the target audience’s awareness and understanding of existing advisory messaging, as well as how that awareness and understanding has affected their fish consumption behaviors.

Location and Demographic Focus of Studies

Only two of the studies reviewed focused on populations within the Chesapeake Bay Watershed (OpinionWorks 2012 and Gibson 2005) (Table 2). OpinionWorks (2012) used a large set of field interviews of anglers conducted at 10 sites along the riverbank to measure the characteristics, practices, and attitudes of the fishing population. They also performed focus groups and one-on-one interviews and a household survey of the neighborhoods surrounding the lower Anacostia River. The majority of participants were minorities and had no more than a high school education. The study showed that advisory information is not reaching most anglers in this area. The anglers believe contamination is on the outside of the fish; therefore, they rely on visual or tactile inspection. They also believe an illness would occur immediately after consumption of the fish. Many of these anglers share fish, even if they know it’s contaminated, with those who are hungry and need it for food. Recommendations for improving advisory outreach methods include using strong and direct language and striking and meaningful visual images, and reaching out to anglers during social events. More details on recommendations are provided later on in this document.

Gibson (2005) interviewed anglers in Washington, DC, on the Potomac and Anacostia rivers to determine the efficacy of urban advisories. They asked anglers questions pertaining to their fishing and consumption habits, advisory knowledge, and risk perceptions. The author suggests that minority anglers, particularly African-Americans, receive the message in advisories but do not comply with advisory recommendations because of cultural influences and inadequate dissemination of information. The author suggests ways to better understand angler risk perception and better educate anglers about the risks of ignoring advisory recommendations.

Although most of the studies focused on locations outside the Bay watershed, the findings are still relevant to the goals of the Bay Agreement because many of them specifically studied advisory communication targeting at-risk populations and minorities, which is the focus of the Diversity Workgroup.

Table 2. Literature sources by location

# of studies	Location
10	Great Lakes
5	Northeast
3	Southeast
2	Chesapeake Bay
2	Nationwide
1	Canada

More than half (13) of the studies focused on fishing in urban or suburban areas. Only two studies focused on rural areas (Table 3). The remaining eight studies did not specify the area or did not focus on only one particular area.

Fourteen (61 percent) of the studies focused primarily on the general population, although some of those studies also covered some minority populations (Table 4). Five studies specifically covered at-risk populations, including women of childbearing age, and 10 studies focused specifically on minorities.

Table 3. Literature sources by community type

# of studies	Area type
8	Urban (Buffalo, NY; Baltimore, MD and Washington, DC; Great Lakes; Chicago, IL; Northwest IN; Newark Bay [NY, NJ])
8	Not specified (Savannah River [SC, GA]; Great Lakes; Canada; LA, nationwide; Elizabeth, NJ)
5	Suburban (MN; NC; Detroit River [MI, Canada]; Rochester, NY; NJ)
2	Rural (MI Upper Peninsula; NY/NJ Estuary)

Table 4. Literature sources by target population type

# of studies	Population type
15	General population
10	Minority (total)
10	Minority (African American)
9	Minority (Latino/Hispanic)
6	Minority (Asian)
3	Minority (Native American)
5	At-risk (women of childbearing age or children)

Communication Methods

A number of different communication methods are typically used by state environmental, fish and game, or health departments to communicate fish advisories to the fishing public. In the literature reviewed, the most commonly cited method used for distributing advisory information was the regulation booklet provided at the point of purchase of fishing licenses. This is in contrast with the method cited as most recalled by study participants, which was word of mouth. Table 5 shows the number of sources that noted use of the method by an agency or noted the method as being recalled by the study respondents in focus groups or interviews. Some of the studies did not specify the communication methods used by the agency or what method the interviewee recalled seeing.

Table 5. Communication method for advisories

Number of studies in which this method was reported being used	Number of studies in which this method was reported being recalled by respondents	Communication method used for fish consumption advisories
11	5	Fishing license materials/regulations booklets
8	5	Signs/posters
8	4	Brochures or printed materials
6	1	Press releases
5	4	Websites or online
2	8	Television or audiovisual source
2	10	Word of mouth
1	7	Newspaper
1	2	Magazines
1	3	Radio
-	2	Lessons taught (schools or community)
-	2	Doctor
-	2	Materials from public health offices
-	1	Media sources (unspecified)

Out of the 23 sources reviewed, the methods reported being used the most to communicate fish consumption advisories include information provided with a fishing license or in fishing regulation booklets, signs or posters, brochures or printed materials, press releases, and websites. However, the communication methods that were the most often cited as being recalled by study respondents were word of mouth, television, and newspapers, with fewer studies noting respondent recalling information from signs, brochures, or fishing regulations guide booklets. Because some of this information is self-reported, there is no way to verify its accuracy. For example, in one study, participants said they recalled seeing advisory information on television, when in fact the jurisdiction didn't use television as an outreach method at all. It is possible that those respondents heard a news story that mentioned the advisory in passing or that they heard about the advisory elsewhere and mistakenly thought they heard about it from television. Additionally, some studies reported a method being used or recalled, but the method might not have been *frequently* used or *frequently* recalled. Therefore, this table can only provide a general idea regarding the discrepancy between what is used and what is recalled. As noted earlier, because some studies did not provide information on what actual methods an agency used to get the word out about an advisory, it is difficult to determine which methods were effective and which were not.

Some studies showed that anglers, women in particular, preferred television or magazines. Many anglers, particularly lower income and minority anglers, reported that they got their information mostly by word of mouth, which often included other anglers. Sometimes older anglers and esteemed members of the community were cited as the most valued sources of information.

Only two of the studies reviewed (Gibson 2005 and Katner et al. 2011) compared the method by which the advisory information was *received* by the audience with their *preferred* method of receiving advisory information. For the most part, the method that was used lined up with what respondents stated were their preferred methods. Gibson (2005) noted that anglers in Washington, DC, reported becoming aware of fish consumption advisories primarily through television, newspapers, fishing regulation guide books, and signs/posters at fishing site. When those same anglers were asked about their preferred mode of receipt of advisory information, they ranked signs, television, newspaper, and personal contact with anglers as their most preferred methods. What is interesting about Gibson's study is what he found when he looked at the effectiveness of advisory dissemination modes by determining how often a particular mode caused a change in anglers' fish consumption behavior. He found that conversations with a game warden, radio announcements, fishing regulations booklets, and signs at fishing sites were most effective in terms of behavior change. Reading regulations books convinced 31 percent of anglers to change their consumption behavior, while 29 percent of anglers changed their consumption behavior after seeing signs (Gibson 2005).

Effectiveness of Advisory Communication

Thirteen of the articles quantitatively assessed knowledge of local fish consumption advisories. The average rate of awareness was 53 percent. Only three of the 13 studies found that less than 50 percent of the population assessed were aware of such advisories. Although more than half of the target audiences on average seem to be aware of advisories, whether they change their behavior as a result is what really matters in terms of effectiveness. Furthermore, the determination of whether advisories were effective or ineffective is subjective and based on self-reporting through surveys, focus groups, and interviews. In reviewing the literature, the general impression is that most of the studies reviewed found the advisories to be ineffective overall. Six studies reported advisories to be ineffective. In 12 (more than half) of the studies, researchers did not specifically say whether the advisories were effective (or they were not looking at specific advisory effectiveness); instead, they summarized literature reviews or discussed using audience research to prepare outreach materials. Most of the studies reviewed used interviews, surveys, and/or focus groups to collect information on fish consumption behavior and advisory awareness; some studies, but not all, quantified their results.

In only three studies (Gibson 2005, Katner et al. 2011, and McDermott 2003) did researchers feel that advisory communication was effective; two other studies (Beehler et al. 2001 and Burger 2005) noted advisory communication was only *somewhat* effective.

Details on the findings of the studies that noted effective advisories are as follows:

- Gibson (2005) found that nearly all anglers who saw advisories in the Washington, DC area felt the information was easy to understand, and 26% of the overall population changed their eating habits as a result. Many anglers did not eat caught fish before they saw the advisory. African-Americans most commonly changed their consumption habits after seeing advisories (27%). Additionally, African-Americans placed the most importance in following fish advisories, with 89% believing that following consumption advisories was very important. Signs were relatively effective among each race in communicating advisories and were the most desired means of communication (94%), but newspaper and television advertisements were far more prevalent.

When anglers in DC were asked which formats they would prefer to receive advisory information in, signs, newspaper, and word of mouth were the top three rated methods. Perhaps the rate of behavior change would have been even higher had advisory information been provided more frequently in those formats rather than in only the modes that were used by the DC Department of Health. According to Gibson, the health department does not have a formal protocol for outreach, but typically uses the following methods: posting signs, occasional and infrequent press releases to media sources, internet press releases, information in regulations booklets, printed pamphlets and fact sheets, and providing information on the backs of fishing licenses.

- Katner et al (2011) noted that 30% of 1,040 respondents reported changing their consumption behavior because of an advisory. Of that 30%, one third stopped eating all fish from water bodies where health warnings have been issued, 27% ate fewer fish from water bodies with health warnings, 25% ate more fish bought from a store or vendor, 24% stopped eating certain types of fish from water bodies under advisory, 14% switched to another location, and 11% practiced catch-and-release. Awareness of advisories was attributed to six main avenues of communication: (1) newspapers or magazines (53%); (2) television (48%); (3) family or friends (30%); (4) brochures or fishing regulation booklets (30%); (5) signs at bait shop, landing, boat launch and fishing sites (20%); and (6) radio (16%).
- McDermott (2003) developed a brochure and a face-to-face lesson plan to communicate fish consumption advisories to low-income women of childbearing age. They tested the brochure with a focus group, made revisions, and tested again with another focus group. The text, read at the fifth grade level, was as short as possible and much of the story was told in pictures. Two languages were available (English and Spanish); the Spanish version avoided words that had different meanings for Puerto Ricans and Mexicans. Of those who read the brochure, 72% thought that “it is not a good idea” to eat fish from the port. Some stated that all fish in Newark Bay should not be eaten because of contamination, rather than just the six species listed in the advisory. When asked to interpret a figure, 100% gave a response that was fundamentally correct (when the woman eats fish that is contaminated, the chemicals will “go to the baby”). The study found 70% of respondents indicated an intention to change how they choose or prepare the fish they eat, which rose to 90% when applied only to women who reported that a family member goes fishing. This study also found that using multiple outreach methods (brochure and face-to-face communication) was more effective than printed material alone for communicating a health-related message.

Only two studies interviewed or surveyed anglers before and after implementation of a new outreach method for fish consumption advisories. The first study is McDermott (2003), mentioned above. The second study, LePrevost et al. (2013), looked at Badin Lake in North Carolina and found that after installing a detailed sign at 25 access points around the lake, knowledge of the fish consumption advisory increased from 32% of people being aware of the sign to 51%. However, despite becoming more aware, many commented that the signs were not eye-catching and were difficult to read. The authors felt that future signs should be larger and more colorful and be designed to reach sensitive subpopulations.

Reasons for Ineffectiveness

Most of the articles reviewed provided quite a bit of insight on why advisories in various states might not have been effective or how they should be improved. The reasons for ineffectiveness can be grouped into two broad categories:

- Ineffectiveness in terms of awareness and understanding of the advisory information
- Ineffectiveness in terms of perception and behavior habits

Table 6 lists the reasons that researchers provided to explain why advisories might not have been effective in terms of (1) making sure target audiences are aware that an advisory exists or (2) making sure the language used in the outreach materials is understandable by the audience. The reason that most frequently appeared across studies is the lack of understanding among target audiences about the heightened risks that children or women of childbearing age face when eating contaminated fish. Little understanding about pollution and bioaccumulation, as well as lengthy, confusing language, also ranked high in terms of frequently reported reasons for ineffectiveness.

Table 7 lists the reasons that researchers provided to explain why advisories might not have been effective in terms of perceptions about health risks and consumption habits/behaviors. Distrust of government information sources was most frequently listed as a reason why anglers continue to eat fish despite advisories. Of the 11 studies that specifically mentioned this reason, three specifically targeted minority populations (Latino, African-American, and Asian). Also frequently mentioned is the lack of visual cues that would indicate a diseased or contaminated fish. When anglers see what appears to be a normal, healthy fish, they assume it is safe to eat, despite knowing about the advisory. This barrier needs to be overcome.

Table 6. Reasons for ineffectiveness in terms of awareness and understanding

# of studies cited in	Reason for ineffectiveness
6	Lack of understanding regarding chronic health effects or about populations who face different risk levels (e.g., children, unborn)
5	Lack of understanding regarding pollutants and bioaccumulation
4	Too much detail provided/need more graphics
4	Confusing language/information; government jargon; reading level is too high
4	Information not provided in other languages
4	Lack of targeting to women who are more likely to be responsible for making meal/cooking decisions
3	Multiple agencies distribute message differently
3	Mismatch between dissemination method <i>used</i> and dissemination <i>preferred</i>
3	Not all anglers obtain fishing licenses
2	Lack of information permanence (temporary signage/fleeting press release)
1	Political/technical disagreement on what should be covered in advisory or outreach materials
1	Confusion on which agency is responsible for outreach

Table 7. Reasons for ineffectiveness in terms of perception/behavior

# of studies cited In	Reason for ineffectiveness
11	Distrust of government information; trust knowledge of community, friends, or themselves more
8	Lack of visual cues indicating contaminated fish (e.g., sores/deformities, polluted water); think they can remove contaminated parts
6	Significant emphasis on cultural or health importance of eating local fish
6	Lack of immediate human sickness among family/peers
5	Need the fish as a food source
2	Think it is safer because it is local

Recommendations Provided in Literature for Improving Communication Methods

The majority of the reviewed studies indicated that fish advisories are ineffective; as a result, many of the studies included suggestions for improving future communication efforts. For example, many authors noted that there was an overall lack of understanding about chronic health effects or the risk to different populations. Some of the recommendations provided that address this issue are to better educate anglers, include more details in the advisory about health risks, and integrate health care and social service workers into advisory education. One of the other most common reasons for advisory ineffectiveness is a distrust of government information and the preference to trust their own knowledge or that of friends or community members. Some of the recommendations provided in the reviewed documents that address this include improving the government’s relationships with anglers, building of trust, partnering with nonprofit groups, and educating trusted community leaders about advisory information and asking them to help share the information with others. Table 8 provides a brief overview of the key suggestions that were prevalent in many of the studies.

Table 8. Key recommendations to improve advisory communication

Category - # of studies cited in	Recommendation
Language	
3	Use fifth grade or below reading level
3	Make it multilingual
1	Use plain language; don’t use government-speak
1	Use a cajoling rather than commanding tone
1	Use words such as “danger,” “warning,” “caution,” or “stop.”
1	Make the message stark and serious
Level of detail	
7	Keep it simple; use concise and direct text
3	Include details: <ul style="list-style-type: none"> • Specific information on fish type, size, number, frequency • Adequately explain bioaccumulation

	<ul style="list-style-type: none"> Adequately explain the risk of frequently eating contaminated fish
1	Address common misconceptions
1	Use a single integrated advisory recommending eating the safest fish and seafood
Appearance and visual impact	
7	Use graphics and diagrams
1	Make sign bigger; add more color
Communication method	
10	Target advisory messages to specific populations
5	Focus on reaching women of childbearing age, such as through doctors and clinics, since they are most at risk and often do most of the cooking at home
4	Use multiple methods of outreach
4	Engage community leaders, including those in the fishing community (elders in particular) as well as prominent church members, to learn about and share information.
3	Share information at social events
3	Use signs, especially permanent
2	Have on-site demonstrations, workshops, and lessons
1	Use signs at fishing access points
Other recommendations	
8	Better educate anglers
6	Work with other agencies to use a consistent message
3	Improve the government's relationships with anglers and build trust
2	Learn what causes inherent perceptions
2	Integrate health care and social service workers into advisory education (especially through personal interactions)
2	Discuss risks and benefits together
1	Deliver advisory messages frequently
1	Partner with nonprofit groups
1	Involve independent parties in sampling, testing, and reporting
1	Encourage licensing
1	Consider definitive no-consumption guidelines

4. Next Steps

The Chesapeake Bay Trust could consider several options that can assist Bay localities in developing effective fish consumption advisory communication tactics:

Option 1—Develop a Short “How-To” Guide to Show Jurisdictions Best Practices for Wording, Graphics, and Dissemination

Many of the studies recommended similar improvements to advisory messaging that were either suggested by study participants themselves or were realized by study authors when comparing outreach modes and types. Those recommendations could be compiled and organized into a how-to guide for localities to refer to when developing their own fish consumption advisory outreach materials and activities. The how-to guide would cover best practices for language, tone, level of detail, graphics,

delivery methods, frequency, and messengers. The guide could be distributed online and through direct email to health agencies, fish and wildlife departments, and other agencies responsible for communicating fish advisories to protect public health. This approach would allow localities maximum ability to tailor their outreach materials to their locations, audiences, and advisory details, which would be ideal. The draft guide could be vetted by key informants at health departments, social services agencies, natural resource professions, state agencies, and others prior to finalization to ensure that it has the information they need.

Option 2—Develop an Infographic that Can Easily Be Used in Multiple Ways

As described earlier, out of the 23 sources reviewed, the most recalled outreach formats noted by study respondents were word of mouth, newspapers, television, signs, and fishing regulations guide booklets. When anglers in Washington, DC were asked which formats they would prefer to receive advisory information in, signs, newspaper, and word of mouth were the top three rated methods. Based on the results of the studies reviewed, one of the most cost-effective outreach materials for communicating fish consumption advisories could be a simple infographic that can be used in multiple formats—as an ad in the newspaper, sign, poster, shareable social media graphic, graphic insert in fishing regulations booklets, etc. If designed with the right languages, tone, graphics, and reading level, such an infographic could tackle many of the reasons the researchers laid out as to why current advisory information is not as effective as it should be, especially when it comes to minority or at-risk populations. The infographic could be designed in both color and black and white (for newspaper or 1-color sign printing) and could be distributed online to Bay jurisdictions to download and add language specific to the advisories and health agencies in their areas. The artwork would be provided online for download, customization, and production by individual localities to make them specific to their agency and advisory.

Option 3—Develop a Presentation Kit That Can Be Delivered at Community Meetings, Fishing Tournaments, or Popular Fishing Locations to Help Create a Buzz about Advisories that Can Spread on Its Own Via Word of Mouth

Because one of the most preferred ways that study respondents said they receive health advisory information is from other anglers, family, or friends, developing a mechanism to reach anglers in informal, friendly settings would be a good way to increase anglers' awareness of, understanding of, and belief in fish consumption advisories. According to the Anacostia anglers' study, OpinionWorks (2012) found that many DC-area anglers see fishing as a social activity and enjoy talking about fishing with their peers. The report recommends that health officials use fishing tournaments or other fishing activities as ways to get anglers together and educate them about advisories. One way this could be done is by developing 1 or 2 retractable banner displays (see example at right) with simple messaging that can be set up and taken down easily most anywhere. A set of brief talking points could also be included with the banner to ensure that the presenter provides consistent, tailored messaging for the audience. The talking points could also be turned into a takeaway handout or sticker prompt that attendees can stick on their tackle boxes. The sticker prompt would serve as a reminder about the advisory every time the angler picks up their tackle box to go fishing. Behavior prompts are social marketing tactics that reinforce the adoption of desired behaviors. The materials and talking points would make it easy for a variety of people with different skill levels to learn and present the information in different settings. If localities can train well-respected fishermen in key fishing communities to deliver the presentation themselves, it would be even more effective. The banner/presentation could also be posted and delivered at local WIC (Women, Infant, and Children) nutrition program offices to target pregnant women and women with young children still at home who seek supplemental food through the program. Materials would be provided online for download, customization, and production by individual localities to make them specific to their agency and advisory.



5. References

- Beehler, G.P., B.M. McGuinness, and J.E. Vena. 2001. Polluted Fish, Sources of Knowledge, and the Perception of Risk: Contextualizing African American Anglers' Sport Fishing Practices. *Human Organization* 60(3):288–297.
- Beehler, G.P., B.M. McGuinness, and J.E. Vena. 2003. Characterizing Latino Anglers' Environmental Risk Perceptions, Sport Fish Consumption, and Advisory Awareness. *Medical Anthropology Quarterly* 17(1):99–116.
- 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. 2005. Fishing, Fish Consumption, and Knowledge about Advisories in College Students and Others in Central New Jersey. *Environmental Research* 98(2):268–275.

- Burger, J., M. Gochfeld, C.W. Powers, L. Waishwell, C. Warren, and B.D. Goldstein. 2001. Science, Policy, Stakeholders, and Fish Consumption Advisories: Developing a Fish Fact Sheet for the Savannah River. *Environmental Management* 27(4):501–514.
- Chess, C., J. Burger, and M. Hughes McDermott. 2005. Speaking Like a State: Environmental Justice and Fish Consumption Advisories. *Society and Natural Resources* 18(3):267–278.
- Connelly, N.A., and B.A. Knuth. 1998. Evaluating Risk Communication: Examining Target Audience Perceptions About Four Presentation Formats for Fish Consumption Health Advisory Information. *Risk Analysis* 18(5):649–659.
- Furgal, C. M., S. Powell, and H. Myers. 2005. Digesting the Message about Contaminants and Country foods in the Canadian North: A Review and Recommendations for Future Research and Action. *Arctic* 58(2):103–114.
- George, V., A. Kjolhede, and K. Korfmacher. 2010. *Subsistence Consumption of Locally Caught Fish in Rochester, New York: 2009 Rapid Assessment Report*. University of Rochester Medical Center, Environmental Health Sciences Center, Community Outreach and Education Core, Rochester, NY.
- Gibson, J.C. 2005. *Fish Consumption Advisories in Tributaries to the Chesapeake Bay*. PhD dissertation, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- Habron, G., M. Barbier, and R. Kinnunen. 2008. Local Understanding of Fish Consumption Advisory Risks in Michigan's Upper Peninsula: The Role of Structure, Culture, and Agency. *Rural Sociology* 73(2):275–299.
- Kalkirtz, V., M. Martinez, and A. Teague. 2008. *Environmental Justice and Fish Consumption Advisories on the Detroit River Area of Concern*. Master's Thesis, University of Michigan, School of Natural Resources and Environment, Ann Arbor, MI.
- Katner, A., E. Ogunyinka, M.H. Sun, S. Soileau, D. Lavergne, D. Dugas, and M. Suffet. 2011. Fishing, Fish Consumption and Advisory Awareness among Louisiana's Recreational Fishers. *Environmental Research* 111(8):1037–1045.
- Knobeloch, L., H.A. Anderson, P. Imm, D. Peters, and A. Smith. 2005. Fish Consumption, Advisory Awareness, and Hair Mercury Levels among Women of Childbearing Age. *Environmental Research* 97(2):220–227.
- Lauber, T.B., N.A. Connelly, B.A. Knuth, and J. Niederdeppe. 2011. *Assessment of the Great Lakes States' Fish Consumption Advisory Programs*. HDRU Publication No. 11-7. Cornell University, College of Agriculture and Life Sciences, Department of Natural Resources, Human Dimensions Research Unit, Ithaca, NY.
- LePrevost, C.E., K.M. Gray, M. Hernández-Pelletier, B.D. Bouma, C. Arellano, and W.G. Cope. 2013. Need for Improved Risk Communication of Fish Consumption Advisories to Protect Maternal and Child Health: Influence of Primary Informants. *International Journal of Environmental Research and Public Health* 10:1720–1734.

- May, H., and J. Burger. 1996. Fishing in a Polluted Estuary: Fishing Behavior, Fish Consumption and Potential Risk. *Risk Analysis* 1(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):23–37.
- OpinionWorks. 2012. *Addressing the Risk: Understanding and Changing Anglers' Attitudes about the Dangers of Consuming Anacostia River Fish*. OpinionWorks, Annapolis, MD.
- Pflugh, K.K., L. Lurig, L. Von Hagen, S. Von Hagen, and J. Burger. 1999. Urban Anglers' Perception of Risk from Contaminated Fish. *Science of the Total Environment* 228(2):203–218.
- Shubat, P.J., K.A. Raatz, and R.A. Olson. 1996. Fish Consumption Advisories and Outreach Programs for Southeast Asian Immigrants. *Toxicology and Industrial Health* 12(3-4):427–434.
- Tilden, J., L.P. Hanrahan, H. Anderson, C. Palit, J. Olson, and W. Mac Kenzie. 1997. Health Advisories for Consumers of Great Lakes Sport Fish: Is the Message Being Received? *Environmental Health Perspectives* 105(12):1360.
- Westphal, L.M., M. Longoni, C.L. LeBlanc, and A. Wali. 2008. Anglers' Appraisals of the Risks of Eating Sport-Caught Fish from Industrial Areas: Lessons from Chicago's Calumet Region. *Research in Human Ecology* 51(1):46–62.