

Cornell University Fish Consumption Research 2011-2016 Key Findings and Recommendations for Outreach and Education

Cornell University has worked since 2011 with the Great Lakes Consortium for Fish Consumption Advisories, with funding from the U.S. Environmental Protection Agency, to study fish consumption and health advisories in the Great Lakes region. We have conducted a number of inquiries focused on women of childbearing age (WCBA) and anglers, particularly urban anglers. We have used a variety of methods to study these groups including mail surveys, focus groups, and fish consumption diaries. We have also surveyed Consortium members to gain insights from their practical experience and conducted a literature review.

Below we summarize key findings and recommendations from our research that relate to outreach and education efforts by Consortium members. We organize the findings into four sections – fish consumption, effective messaging, effective delivery, and impacts of communication. Within each section we report findings for anglers first, then WCBA. We use endnotes to briefly describe the studies from which we derived the reported findings, and provide a link to the full report for more details.

FISH CONSUMPTION

Anglers

- **Anglers eat mostly purchased fish.** From our mail survey of anglers living near the Great Lakes^a, we found that anglers reported eating about 20 meals of fish per year, with three-quarters being purchased fish and the remainder locally-caught. Very few anglers (<1%) reported consuming locally-caught fish above the 52 meals per year statewide recommendation of some states.
- **Most of the fish that urban anglers eat is low (mercury) risk fish.** From the fish consumption diaries^b, we found that purchased fish accounted for more than 80% of the meals of fish that urban anglers reported eating, and most of these meals were low-mercury fish. On average, urban anglers reported eating about 1 meal of fish each week, with a range of 0.1 to 4.6 meals per week.
- **Anglers eat 5 to 7 ounces of cooked fish per meal.** From the fish consumption diaries^b, we found that purchased fish meals averaged 5.4 to 5.7 ounces of cooked fish. Locally-caught fish meals average 6.3 to 7.0 ounces. (Participants indicated portion size in reference to a picture of a portion of salmon and were told it was 6 oz. cooked [8 oz. pre-cooked]; we asked participants if the meal they ate was larger, smaller, or the same size as the picture. For meals reported as being the same size, we assumed 6 oz. For meals reported as smaller than the picture, we assumed 4 oz. For meals reported as being larger than the picture, we used a sensitivity analysis to compare two options for calculating portion size. For one option, we estimated the larger portion size to be 8 oz. and for the other we assumed the size to be 10 oz.)
- **Older, female, and nonwhite anglers are more likely than other anglers to eat too much contaminated fish.** Advisory exceedance ranged from 7-10% to 27-40% in our three urban angler diary study sites (with the range reflecting different assumptions)^b. Women were more likely to exceed guidelines, in part, because they are subject to stricter fish consumption guidelines than men. Older and nonwhite anglers tended to eat more

fish, which made them more likely to exceed the guidelines. Higher income and better educated anglers also ate more fish, but because they ate a higher proportion of low-mercury, purchased fish than other anglers, they were not more likely to exceed the guidelines.

WCBA

- **Women of childbearing age could obtain more health benefits if they ate more fish.** We found this in both our study of new mothers^c and WCBA anglers^b. Over 80% of new mothers reported eating less than one fish meal per week during pregnancy. Among WCBA anglers, who are more likely than other women to eat fish, two-thirds of the women reported eating less than 1 meal of fish each week. Only 10-12% reported eating within the federally-recommended range of 8 to 12 oz. of fish per week, with 84-87% eating less than the recommended amount.
- **WCBA eat less than 6 ounces of cooked fish per meal.** From the fish consumption diaries^b, we found that purchased fish meals averaged 4.7 to 5.2 ounces of cooked fish. Locally-caught fish meals average 5.5 to 5.8 ounces. (Participants indicated portion size in reference to a picture of a portion of salmon and were told it was 6 oz. cooked [8 oz. pre-cooked]; we asked participants if the meal they ate was larger, smaller, or the same size as the picture. For meals reported as being the same size, we assumed 6 oz. For meals reported as larger than the picture, we assumed 8 oz. For meals reported as being smaller than the picture, we used a sensitivity analysis to compare two options for calculating portion size. For one option, we estimated the smaller portion size to be 3 oz. and for the other we assumed the size to be 4 oz.)
- **Most of the fish that women eat is low in mercury.** Purchased fish accounted for more than 80% of the meals of fish that women reported eating in our diary study^b, and two-thirds of these purchased fish consumed are classified as low-mercury fish by the EPA/FDA. Only 3-5% of women of childbearing age exceeded federal consumption guidelines for purchased fish. Few women in the new mothers study^c (<10%) reported eating any of the four species of highly contaminated purchased fish before pregnancy, and almost none (< 3%) reported eating them during or after pregnancy.
- **Nevertheless, one-quarter of women exceed state and federal guidelines that include both purchased and locally-caught fish^b.** The number of women exceeding these guidelines varied considerably from state to state. In Ohio, Illinois, and Wisconsin, 12-19% of women exceeded these guidelines. In New York and Indiana, 25-29% of women exceeded these guidelines. In Pennsylvania, Minnesota, and Michigan, 35-42% of women exceeded these guidelines.

EFFECTIVE MESSAGING

Anglers

- **Most anglers are aware of locally-caught fish consumption guidelines, but not the details.** Over 90% of licensed anglers living near the Great Lakes^a indicated that they were aware of the locally-caught fish advisories. Less than half (45%), however, reported being aware of specific advice.
- **Consortium members think aiming for consistent messages is an important goal^d.** For example, some Consortium members suggested during interviews that advisory

messages that are consistent across states and shared water bodies may be less confusing to anglers, especially those who cross state borders to fish.

- **Messages should be clear, concise, and simple.** Consortium members^d recommended using straightforward, succinct messages, a recommendation consistent with both other literature^d and participants in our WCBA and urban angler focus groups^{e,f}. An example of such a message from the urban angler focus groups was “eating one meal or even several meals of contaminated fish may not make you sick right away but contaminants can build up in your body over time eventually causing health problems.”
- **Guidelines should provide information on both benefits and risks.** Consortium members and the literature supported providing information on both the benefits and risks of fish consumption in advisory materials^d. Focus group results suggested that messages that encourage people to eat particular species may make it more likely that they will get the health benefits of fish consumption^e.
- **Knowledge gaps and misperceptions exist among anglers.** Our survey of anglers living near the Great Lakes^a revealed that one-quarter of the anglers did not know if health problems from eating contaminated fish were mainly short term, whether fish contaminated with chemicals would taste odd, or if smaller fish generally have more contaminants than larger fish. Non-white anglers were more likely than white anglers to think that fish contaminated with chemicals will taste odd. Overall, fewer than half of the anglers knew that contamination cannot be detected by taste.
- **Several messages are associated with increased desire to follow the recommendations.** Analysis from the survey of anglers living near the Great Lakes^a found messages emphasizing that chemical contaminants in fish can accumulate in the body over time and cause long-term impacts hold considerable promise in promoting use of advisory recommendations.
- **The term “sport-caught fish” may be misunderstood by many anglers.** Focus group participants^e generally interpreted the term to apply only to those fish that were valued game or trophy fish. Consortium members often refer to “locally-caught fish” or “fish caught by you or someone you know,” but we did not ask about these terms in our focus groups.
- **Urban anglers could benefit from messages that emphasize risk-reducing fish preparation strategies.** From focus groups^e, we found that because some urban anglers may not have any choice but to eat fish, focusing advisories on communicating risk-reduction strategies may be worthwhile.

WCBA

- **Consortium members^d think aiming for consistent messages is an important goal.** Based on focus groups with WCBA^e, we recommended that working toward consistency in advisory messages targeting women may help to reduce confusion about which types of women should be reducing their exposure to contaminants in fish, and why they should be reducing their exposure.
- **Messages should be clear, concise, and simple.** Consortium members^d recommended using straightforward, succinct messages, a recommendation consistent with both other literature^d and participants in our WCBA and urban angler focus groups^{e,f}. Some examples of such messages from the WCBA focus groups were “fish are high in protein” and “omega-3 fats may be beneficial during fetal brain and eye development.”

- **Guidelines should provide information on both benefits and risks.** Consortium members and the literature supported providing information on both the benefits and risks of fish consumption in advisory materials^d. Focus group results suggested that positive advisory messages that encourage women to eat particular species may make it more likely that they will get the health benefits of fish consumption^e.
- **Several messages are associated with increased desire to follow the recommendations.** From our survey of new mothers^c, we found several messages that could be particularly influential: (1) eating fish is good for you and for your baby, (2) there are health benefits of fish consumption for children, (3) it is important to eat fish, and (4) it is important to follow health advisory recommendations.
- **Women who are or could someday become pregnant is the preferred wording to reference WCBA.** From our survey of new mothers^c, we found the preferred wording for WCBA was “women who are or could someday become pregnant.” Focus groups suggested wording that included an age range^e.
- **The term “sport-caught fish” may be misunderstood by many WCBA.** Focus group participants^e generally interpreted the term to apply only to those fish that were valued game or trophy fish. Consortium members often refer to “locally-caught fish” or “fish caught by you or someone you know,” but we did not ask about these terms in our focus groups.

EFFECTIVE DELIVERY

Anglers

- **Messages should be communicated in multiple ways from trusted and credible sources.** Consortium members and the literature^d have concluded that ways in which messages are communicated may vary for different audiences, but methods should be chosen through which target audiences will encounter the messages frequently.
- **Anglers favor receiving information in the fishing regulations guide.** From our studies^a, the regulations guide is the most used source, and the most often preferred. Some anglers suggested using websites as a source of more complete information than can be covered in the regulations guide.
- **Less educated anglers are more likely to want to do what their family and friends think is best.** Less educated anglers living near the Great Lakes^a were more likely to report wanting to do what their family and friends think is best with regard to limiting the amount anglers themselves eat, suggesting communication methods that involve social networks might be effective.
- **Several sources suggest using community-based programs to reach urban anglers.** We found in our survey of anglers living near the Great Lakes^a that urban anglers in general may not require a special approach for communicating fish consumption advice, but subpopulations within urban anglers, such as immigrant populations, may be best targeted by using community-based programs to communicate fish consumption advice. This finding was supported by other literature and the beliefs of Consortium members^d. From our focus groups^e, we similarly concluded that some at-risk urban audiences, such as immigrant groups and low income anglers, may be easiest to reach through community-based communication programs conducted in partnership with local organizations.

WCBA

- **Messages should be communicated in multiple ways from trusted and credible sources.** Consortium members and the literature^d have concluded that communication methods should be chosen through which target audiences will encounter the messages frequently.
- **Many women do not receive information about fish consumption prior to getting pregnant.** In our survey of new mothers^c, we found that half to two-thirds of women have not received information about fish consumption prior to getting pregnant. Focus group results suggested that many women do not seek out advisory information^e. Therefore, if a goal of agencies is to make women aware of recommendations before pregnancy, then communication methods in addition to the OB/GYN offices (a primary source during pregnancy) likely will be needed.

IMPACTS OF COMMUNICATION

Anglers

- **Communication about the benefits and risks of specific types of fish consumption decreased fish consumption in anglers who ate a lot of fish.** (*We studied urban anglers, but we believe these findings would apply to non-urban anglers as well.*) Using the results from our diary study^b, we found that receiving a fish consumption guideline brochure led to a reduction in fish consumption for anglers who ate the most fish. These anglers reduced their consumption of purchased fish, sport-caught fish, high-contaminant purchased fish and both high- and low-contaminant sport-caught fish. (We defined “high-contaminant fish” as those for which guidelines recommend less than one meal/week.) The brochure also led to a reduction in sport-caught fish consumption by those anglers who exceeded advisory recommendations in 2014. These anglers reduced their consumption of sport-caught fish compared to the control group by nearly 2 fish over the course of the summer.
- **The experimental brochure, describing the benefits and risks of fish consumption and providing guidelines for consumption, led to small increases in fish consumption in urban anglers who ate very little fish^b.** These anglers increased their consumption of sport-caught fish and high-contaminant purchased and sport-caught fish. These increases in fish consumption came without increasing the number of anglers who were exceeding advisory recommendations.
- **For every 10,000 brochures distributed, we estimate that 1,948-2,452 anglers eating the most fish would reduce their consumption of high-contaminant fish by 6,457-8,127 meals each year^b.** Similarly, the 2,504-3,048 anglers eating the most purchased fish would reduce their consumption of high-contaminant purchased fish by 4,780-5,818 meals each year, and the 1,120-1,532 anglers eating the most sport-caught fish would reduce their consumption of high-contaminant sport-caught fish by 3,381-4,625 meals each year. At the same time, high-consuming anglers would also reduce their consumption of low-contaminant sport-caught fish. The 2,133-2,651 anglers eating the most sport-caught fish would reduce their consumption of low-contaminant sport-caught

fish by 5,629-6,996 meals each year. These estimates are based on the fish consumption messages and methods of distributing the brochures used in our study. The distribution methods (and possibly messages) used in advisory programs would differ.

Although high-consuming anglers would reduce their consumption of fish, anglers who ate very little fish would increase their consumption of high-contaminant fish. For every 10,000 brochures distributed, the 668-1,004 anglers who ate the least purchased fish would increase their consumption of high-contaminant purchased fish by 786-1,181 meals each year. The 3,661-4,255 anglers who ate the least sport-caught fish would increase their consumption of high-contaminant sport-caught fish by 4,023-4,675 meals each year. Because these anglers ate almost no fish initially, increasing their consumption of high-contaminant fish by these small amounts would pose very little risk to them. Thus, communication of fish consumption guidelines would allow anglers who were at low risk to take additional advantage of their opportunities to eat fish.

WCBA

- **Communicating fish consumption guidelines in a narrative format, which included a story about how a hypothetical woman learned about which fish she could eat safely, increased consumption among women who were eating the least amount of fish.** We found in our diary study^b that using a narrative format (messages communicated as part of a story about a hypothetical woman of childbearing age) as part of a fish consumption guidelines brochure can lead women to eat more low-mercury fish, which could be beneficial to their health. Women who ate the least fish (< 0.7 meals/week at baseline) stood to benefit the most from increasing their fish consumption. In our study, women who ate < 0.7 meals/week of fish and received fish consumption messages in a “narrative” format increased their fish consumption largely by eating more low-mercury, purchased fish. These women did not increase their consumption of more contaminated fish.
- **Communicating fish consumption guidelines in a narrative format, which included a story about how a hypothetical woman learned about which fish she could eat safely, also decreased consumption among women who were eating too much fish^b.** Women who ate too much fish (>2.8 meals/week at baseline) were also influenced by the narrative form of the brochure. They ate fewer meals after receiving the brochure, but did not decrease their consumption sufficiently to be within advisory recommendations.
- **We estimate for every 10,000 narrative brochures distributed, 2,797-3,330 women of childbearing age would eat more fish, totaling 14,544-17,316 more fish meals each year^b.** This increase in fish consumption would not result in any more women exceeding fish consumption guidelines. Furthermore, we estimate for every 10,000 narrative brochures distributed, 76-90 women of childbearing age who were currently exceeding fish consumption guidelines would eat fewer fish, totaling 1,011-1,197 fewer fish meals each year.

^a A mail survey was sent to 8,000 licensed anglers living in states bordering the Great Lakes in 2011 to: 1) quantify current fish consumption of anglers (and their household members); 2) identify the most important factors influencing fish consumption; 3) assess awareness of fish consumption advisories and general knowledge about those advisories; and 4) assess current and preferred sources of information about advisories. Responses were obtained from 1,712 anglers, with a telephone follow-up survey to 399

non-respondents to estimate the degree to which non-respondents differed from respondents. Detailed results from the survey can be found at

<https://ecommons.cornell.edu/bitstream/handle/1813/40457/HDRUReport12-3.pdf?sequence=1&isAllowed=y>

^b A two-year diary study was implemented in 2014 and 2015 with WCBA anglers and urban anglers living in the Great Lakes region. Information about all fish meals eaten during a 16-week period between mid-May and early September each year was recorded by participants in a web-based diary. In 2014, 1,395 WCBA anglers and 1,363 urban anglers participated throughout the entire 16-week period. Four versions of an experimental brochure were designed and sent to random subsamples of participants between 2014 and 2015. There was also a control group that did not receive a brochure. During the summer of 2015 diary participants recorded their fish consumption, which allowed us to assess changes in consumption due to the brochure. A total of 1,135 WCBA anglers and 1,041 urban anglers provided information about fish consumption during both years of the study. Detailed results from the study can be found at <https://ecommons.cornell.edu/bitstream/handle/1813/51499/HDRU%20Report%2016-3%20Version%202.pdf?sequence=2&isAllowed=y>

^c A mail survey was sent to 3,000 women who recently gave birth in Minnesota, Wisconsin and Pennsylvania (1,000 per state) in 2012 to: 1) quantify fish consumption (before, during, and after pregnancy); 2) identify the most important factors influencing fish consumption; 3) assess awareness and general knowledge of fish consumption recommendations for women of childbearing age; and 4) identify information sources for fish consumption recommendations. Responses were obtained from 857 women, with a telephone follow-up survey to 130 non-respondents to estimate the degree to which non-respondents differed from respondents. Detailed results from the survey can be found at <https://ecommons.cornell.edu/bitstream/handle/1813/40459/HDRUReport13-1.pdf?sequence=1&isAllowed=y>

^d We synthesized existing knowledge about effective fish consumption advisory practices as of 2013 from two sources of information: 1) insights from practitioners with expertise in fish consumption advisory communication (members of the Consortium), which were assessed using a Delphi survey technique; and 2) findings reported in the literature. Detailed results from this synthesis can be found at <https://ecommons.cornell.edu/bitstream/handle/1813/40463/HDRUReport13-6.pdf?sequence=1&isAllowed=y>

^e Three focus groups were conducted with WCBA and three with urban anglers living in the Great Lakes region in 2011. The purpose of the focus groups was to assess factors influencing fish consumption, and how these audiences responded to information about the health risks and benefits of fish consumption. A total of 25 WCBA and 41 urban anglers participated in the focus groups. Detailed results from the research can be found at <https://ecommons.cornell.edu/bitstream/handle/1813/40453/HDRUReport11-8.pdf?sequence=1&isAllowed=y>

^f Three focus groups were conducted with WCBA and four with urban anglers living in the Great Lakes region in 2013. The purpose of the focus groups was to assess: 1) how much and what types of information are most likely to encourage desired fish consumption behaviors; 2) which formats for presenting fish consumption guidelines are most clear and likely to be interpreted as intended; and 3) what general guidelines (not species-specific) for choosing fish to consume are most clear and likely to be interpreted as intended. A total of 39 WCBA and 58 urban anglers participated in the focus groups. Detailed results from the research can be found at <https://ecommons.cornell.edu/bitstream/handle/1813/43937/HDRUReport13-20.pdf?sequence=2&isAllowed=y>