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Capacity building in stakeholders around Detroit River fish consumption advisory issues

Donna R. Kashian[1,6], Ann E. Krause[2,7], Larissa Sano[3,8], Branda Nowell[4,9], and Ken G. Drouillard[5,10]

[1]Department of Biological Sciences, Wayne State University, Detroit, Michigan 48202 USA
[2]University of Toledo, Toledo, Ohio 43606 USA
[3]Water Center and Cooperative Institute for Limnology and Ecosystems Research, University of Michigan, Ann Arbor, Michigan 48109 USA
[4]School of Public and International Affairs, North Carolina State University, Raleigh, North Carolina 27607 USA
[5]Great Lakes Institute for Environmental Research (GLIER), University of Windsor, Windsor, Ontario, Canada N9B 3P4

Abstract: The Detroit River is an international water body that has several fish consumption advisories for contaminants that affect human health and economic revenue for the USA and Canada. Despite the importance of these advisories, little progress has been made in developing effective management strategies or coordinating monitoring, research, and policy efforts between the 2 nations. We engaged 44 stakeholder organizations to increase community capacity on these issues for the Detroit River. We assessed capacity with key informant interviews and a network survey. Our analysis identified weak ties in information sharing and collaboration between countries. We used this information to improve stakeholder capacity, which included forming working groups that focused on system analysis, identification of priority issues, and definitions of organizational roles. Outcomes included outreach materials addressing environmental-justice issues and risk-analysis models of polychlorinated biphenyl (PCB) body burdens in fish. Our assessment of workshop participants with a longitudinal survey indicated that we increased network capacity and issue awareness in our stakeholders by providing new ways for them to work together. The engagement of stakeholders also improved research outcomes. By identifying stakeholder concerns related to scientific questions about consumption advisories early in the process, researchers were able to direct their efforts to generating translational research that better addressed stakeholder needs.
Key words: capacity, fish consumption advisory, stakeholders, PCBs, management, contaminants

The conventional model for transferring scientific knowledge gained through research to stakeholders (translation) often leads to limited environmental action (transfer). van Kerkhoff and Lebel (2006) critiqued this traditional model by presenting scenarios to increase engagement and power sharing by stakeholders to improve science translation and transfer. One scenario was a model described as *integration funders* in which funders require specified interaction with practitioners to achieve certain goals (van Kerkhoff and Lebel 2006). We implemented this model in an attempt to address complex issues related to fish consumption advisories (FCAs) in the Detroit River when the US Environmental Protection Agency (EPA) requested that Michigan Sea Grant fund a team to work with organizations involved in developing FCAs. Our goals, as the selected team, were to mitigate this environmental health problem by increasing community engagement and to put knowledge gained through scientific research into practice (Wondolleck and Yaffee 2000).

Consumption of fish often is touted for its health benefits because fish can be a quality source of protein and omega-3 fatty acids, which support cardiovascular health and brain development (Mozaffarian and Rimm 2006). Fish consumption carries risks because persistent environmental contaminants, including Hg, dioxin, and polychlorinated biphenyls (PCBs) are often found in fish at levels that pose human health risks, such as cancer, neurotoxicity, and immune dysfunction (Turyk et al. 2012). Fish con-

E-mail addresses: [6]dkashian@wayne.edu; [7]aekmcb@gmail.com; [8]llubomud@umich.edu; [9]branda_nowell@ncsu.edu; [10]kgd@uwindsor.ca

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sumption advisories are guidelines developed by governmental agencies to provide recommendations to minimize the risk associated with contaminants. The Michigan Department of Community Health issues FCAs for the USA side of the river and the Ontario Ministry of Environment issues them for the Canadian side.

These advisories are important for fisheries management and protection of public health, but little progress has been made in reducing FCAs in the Detroit River. Uncertainties remain regarding the primary drivers of FCAs, including the relative contribution of sediment hot spots, the role of point vs nonpoint contaminant sources, and the appropriateness of using tissue concentrations to identify thresholds for action. To date, binational coordination and communication related to FCAs has been limited.

These challenges led Michigan Sea Grant to identify FCAs in the Detroit River as a promising case study for an *integrated assessment*. The integrated assessment process brings together scientists and decision-makers from diverse backgrounds to address challenging problems, build partnerships, and provide a framework for sharing knowledge (Hisschemöller et al. 2001). Thus, it can be considered an approach to *participatory action research* (Hisschemöller et al. 2001, van Kerkhoff and Lebel 2006) in which stakeholders are engaged at the level of the organization to set shared agendas and goals and to create support for specific projects. Because decision makers (the intended audience) are an integral part of the project, the research becomes more effective (McIntyre 2008). Thus, integrated assessments have the potential to build capacity among stakeholders, such as resource managers, industry, conservation clubs, and fishing clubs (Wenger 1998).

Our goal was to increase the capacity of stakeholders around the Detroit River to work on issues related to FCAs. Suarez-Balcazar et al. (2009) identified 4 elements for building optimal capacity: 1) leadership, 2) a learning climate that "fosters open communication, critical self-evaluation, and new ideas," 3) resources, and 4) support. We made an initial assessment of capacity, evaluated the process, and evaluated the outcome based on these elements.

METHODS FOR ASSESSING AND BUILDING CAPACITY

Initial capacity assessment

We identified agency stakeholders concerned with fish contamination in the Detroit River and assessed the capacity of the stakeholder network to take collective action. We defined stakeholders as any public, private, or community organization concerned or involved, directly or indirectly, with the release of PCBs or developing advisories or affected by PCBs in the Detroit River system. We engaged stakeholders by identifying key organizations and inviting them to participate in a series of workshops and surveys.

We began with a series of *key informant* interviews with stakeholders from the USA and Canada. Key informants were identified by the EPA advisor assigned to our project. Priority was given to soliciting diverse viewpoints. Key informants represented organizations that could be categorized into 1 of 5 roles: 1) industry and economic development, 2) regulatory compliance, 3) monitoring and research, 4) FCA policy makers, or 5) community end users (see appendix 2.1 by Kashian et al. 2010 for a full list of stakeholder organizations). Interview responses were used to identify key issues and to specify concerns, vision, priorities, and capacities to work on priority issues. Key informants were asked to nominate other stakeholders working on FCAs as identified by their recent campaigns, mission, research, or population served, or interaction with the Detroit River.

We used the interviews to develop a survey to help us understand the communication network among stakeholders and to inform workshop participants about the resources and capacities that existed (see appendix 2.1 by Kashian et al. 2010 for the full survey). The survey included: 1) questions about the contact person and their organization, 2) network questions, and 3) issues related to FCAs. We administered the survey electronically to 44 organizations.

Workshop series

We held 3 workshops in 3 y and used outcomes from one workshop to inform the structure of the next. A primary goal of the workshops was to engage stakeholders, so we developed small-group (breakout) activities involving scripted questions for stakeholders. We recorded and posted participant responses on a website. We used breakout groups so that we could cover more topics/issues in the same amount of time and so that more participants could contribute to the conversation. Breakout groups reported back to the larger group for a broad discussion of the topic. Each participant voted on the top 5 issues identified by the breakout groups. This technique allowed us to generate a group consensus to which every participant had equal contribution.

The 1st workshop was held in Detroit, Michigan, and was based on a framework for promoting system change (Foster-Fishman et al. 2007). The specific objectives were to: 1) learn from each other about organizational roles and how each organization fit within a broader system of stakeholders in the Detroit River network (measuring knowledge), 2) develop new contacts and identify opportunities for collaboration, 3) increase awareness of the system surrounding contaminants and human-health effects and share the perspectives of participants regarding the role of their organization in this system, 4) identify opportunities to reduce uncertainties regarding FCAs and to maximize the effectiveness of future management efforts,

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and 5) identify through stakeholder consensus the top 5 issues related to FCAs in the Detroit River.

We measured knowledge on issues and networks by asking participants to rate how knowledgeable they felt about a series of questions related to each area. We used the scale: 1) not at all, 2) a little, 3) somewhat, 4) quite, and 5) highly. We measured participants' perceived knowledge of issues with 7 statements identified as important in the on-going management of the Detroit River (see survey question B2 in appendix 2.2 by Kashian et al. 2010). We measured participants' perceived knowledge of networks with 5 statements focused on the broad network of organizations and agencies involved/invested in the issue of contamination and its associated effect on human health via consumption of contaminated fish in the Detroit River (see survey question B3 in appendix 2.2 by Kashian et al. 2010). We used Cronbach's α (Cronbach 1951) to estimate reliability of the scales for measuring knowledge of issues and networks (SAS version 9.1; SAS Institute, Cary, North Carolina).

The 2nd workshop was held in Windsor, Ontario. The goal of this workshop was to develop working groups to address the top issues identified in the 1st workshop. A secondary goal was to revise stakeholder roles. Based on a survey of stakeholder organizations, we found that only 47% of stakeholder organizations agreed with our assignment of their role in the network. A clear definition of roles and how organizations fit into those roles is an essential part of assessing stakeholder capacity, so we discussed role names and definitions. Participants defined 4 working groups: 1) outreach, 2) food web, 3) environmental justice, and 4) beneficial-use impairment.

The last workshop was held in Detroit, Michigan, with the goals to: 1) give an overview of outcomes from the working groups in addressing key issues in the FCA community, 2) discuss the next priorities for FCAs in the Detroit River, and 3) identify future funding opportunities.

Workshop process and outcome assessment

We used surveys at the beginning and end of the workshop process as assessment tools for evaluating the participatory research process. First, we surveyed the stakeholder organizations to help investigators and workshop participants understand the stakeholder network. These results guided the process for understanding the capacity of the stakeholder network. We included information generated from a social network analysis (SNA) to evaluate strong and weak relationship ties among our stakeholders based on method developed by Frank (1995). Surveyed organizations reported the nature of their relationships with other organizations in the stakeholder community. These relationships were characterized as: 1) received data or information from the other organization at least once over the past 12 mo, 2) collaborated with the other organization at least once during the past 12 mo, or 3) had at least one professional relationship that linked the surveyed organization to members of the other organization such that the surveyed organization would feel comfortable requesting assistance or support on a project (see Kashian et al. 2010 for details). The density of ties in a network is defined as the proportion of the sum of the weights of the actual/realized ties to the maximum weights of potential ties (maximum weight = 3), where every organization has the potential to have a tie with every other organization in the network.

Second, we administered a survey at the beginning of the 1st workshop that provided information on specific metrics related to participants' critical issues, perceptions, and knowledge of the issues, network of organizations, and resource availability in the network. Last, we administered a postworkshop survey to assess changes in participants' critical issues, perceptions, and knowledge. We also asked participants whether they had made new connections since the 1st workshop, and if so, how many. This survey also measured how much participants valued the integrated assessment products. We evaluated findings from the pre- and postworkshop surveys with an analysis of variance (ANOVA) (SAS 9.1) with time as the independent variable and mean knowledge as the dependent variable, calculated as the sum of the responses of an individual divided by the number of statements that measure dimensions of knowledge, to assess the capacity of the stakeholder community and the impact of our workshops.

COMMUNITY CAPACITY-BUILDING FOR FCAs

Leadership

Response rates to our key informant and initial assessment surveys by organization role were: industrial and economic development (71%), regulatory compliance (90%), monitoring and research (100%), policy on FCA advisories (86%), and community end user (87%). In our initial assessment of capacity, we could not identify individuals in stakeholder organizations who would lead efforts to address the issues identified by the stakeholder network. Moreover, key informant interviews and SNA of the stakeholder community indicated that a key state governmental agency (Agency X) had no strong relationships with stakeholder organizations in the FCA community and lacked contextual awareness of the stakeholder network.

During the 2nd workshop, stakeholders identified 4 working groups (outreach, food web, environmental justice, and beneficial-use impairments). A strong leader from within Agency X emerged in the outreach working group. This individual contributed high capacity to the network in the form of motivation, knowledge about FCA, and outreach skills. Through this leader, Agency X secured a small grant

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to work on FCA outreach materials for the Detroit River. Thus, the outreach working group made progress on a critical FCA issue—awareness of FCAs.

During workshop 3, a leader was identified for a subgroup of the foodweb working group (fish monitoring coordination), who helped to facilitate communication between organizations in the USA and Canada. By the end of the 3rd workshop, this group had set improved international coordination of fish collection for FCAs as a goal. Leaders also were identified for the environmental justice and beneficial-use impairment working group, but these groups did not follow through on proposed efforts.

Learning climate

We reviewed the results from our surveys for evidence of open communication, critical self-evaluation, and new ideas. Our SNA revealed weak ties between Canadian and USA organizations at the beginning of the workshop process. We used a clustering method (Frank 1995, 1996, Krause et al. 2003) to explore the likelihood of connections between organizations in the USA and Canada. Relationships between organizations in the same country (within the USA or within Canada) were 5.3× more likely than relationships between organizations in different countries ($p < 0.05$). At the end of the process, we asked participants whether they had made new connections, and if so, how many, since the 1st workshop. Ninety-five percent of participants responded that they had made new connections (average of 3.3 new connections).

The reliability of participants' perceptions of his/her level of knowledge of the issues of FCA on the Detroit River was very good (Cronbach's $\alpha = 0.88$) before and reasonable (Cronbach's $\alpha = 0.75$) after the workshops. The reliability of participants' perceptions of their knowledge of the network of organizations and agencies involved in the issue of FCAs was very good before and after the workshops (Cronbach's $\alpha = 0.89$ and 0.82, respectively). Participants' perceived knowledge of FCAs in the Detroit River ($n = 39$, $F_{1,38} = 9.05$, $p = 0.0046$) and of network organizations ($n = 39$, $F_{1,38} = 10.65$, $p = 0.0023$) increased significantly from before to after the workshops. Thus, our analysis revealed greater knowledge of issues and the network of organizations at the end than at the beginning of the workshop process, a result indicating greater capacity to work toward goals.

Thus, the workshop activities fostered a strong learning climate. In Workshop 1, stakeholders learned about other organizations in the Detroit River FCA community, reflected on the current status of the FCA stakeholder community as assessed by our research team, developed a map of the organizations in the system, and identified top key questions/issues. In Workshop 2, stakeholders developed role titles and definitions. In Workshop 3, stakeholders revisited key issues, revised them based on the accomplishments of working groups, and developed new working groups in which they identified their leaders, their available resources, and their immediate next steps.

Resources and support

The SNA provided insights into the availability of resources and support. Before the workshops, a key organization, Agency X, had few relational ties with other stakeholder organizations in the community. Moreover, ⅔ of the members associated with organizations also were identified as having weak relationship ties according to the SNA. These members teamed up with members from 3 organizations that had very strong relationship ties in the community and were key facilitators of information flow in the community. Thus, weakly connected members gained access to resources and support available to the more central organizations. These members also had the potential to bring new resources and support from outside the community that the more-central members may have been missing, thereby maximizing the resources and support available to this group.

A leader did not emerge for the working group on environmental justice. However, the outreach working group incorporated this issue into their mission and products when a group of graduate students addressed the issues of environmental justice on the Detroit River as part of a master's thesis research project (Kalkirtz et al. 2008). At the time, anglers had little access to information about FCAs because the advisories were complex and available primarily on the internet. Based on Kalkirtz et al. (2008) findings and working with our stakeholders new informational material was developed that made it easier for anglers to understand which fish to eat, how to prepare those fish, and why eating fish is important. Working with our stakeholders, we also made information accessible by posting it on signs at key fishing places. Thus, the outreach working group greatly expanded the capacity of the stakeholder network.

INTEGRATED ASSESSMENT OUTCOMES

The most valuable outcomes of this integrated assessment were improved public awareness of Detroit River FCAs (80% of participants agreed or strongly agreed) and provision of valuable scientific information on Detroit River FCAs (86% agreed or strongly agreed). Participants agreed that the integrated assessment project helped address top-priority issues for Detroit River FCAs. Another positive outcome of this project was its ability to improve science-based outcomes by building stakeholder capacity. Stakeholder input was integral in defining outcomes from

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the research component of this project. Stakeholder input helped identify key needs and helped direct the ways in which scientific information was conveyed and published (Kashian et al. 2010). For example, before our study, catfish caught in the Detroit River were not clearly identified in the Michigan Fish Advisory as having a "Do not eat these fish" advisory. The information generated by our study led to a request by stakeholders to include this fish in the "Do not eat these fish" advisory, which is more protective of human health.

We used the stakeholder database from the integrated assessment to recruit members to the outreach working group. Members of this group represented diverse stakeholder roles, including FCA policy-makers, fish consumers, stewards, economic developers, individuals engaged in monitoring and research, and funders. This diversity ensured resources and support. One positive outcome of our integrated assessment was that additional funds were secured for outreach efforts and matched by the integrated assessment grant. Information from the environmental justice study (Kalkirtz et al. 2008) was used to develop outreach materials and to determine how the information would be disseminated. One example was the development and posting of informational signs at popular fishing locations along the Detroit River, so anglers would have better access to the advisory information.

CONCLUSIONS

We sought to unite stakeholder interests and expertise with a scientific assessment of causes and consequences of FCAs. We built capacity by increasing engagement of stakeholders in the issue. Stakeholder capacity was greatly enhanced when available and willing leaders emerged to spearhead initiatives. Engagement of stakeholders early in the process improved research outcomes by enhancing information transfer and focusing outcomes on stakeholder needs. This model of stakeholder engagement is a promising way to improve translation and transfer of scientific research done in complex socioecological contexts and that has direct implications for environmental and human health. In many cases, stakeholders have specific needs that are unknown to researchers because of the absence of direct communication between the 2 parties. We engaged stakeholder groups early in the process to help identify key questions and information needs related to FCAs in the Detroit River, and in so doing, we were able to use this information to strengthen connections between science and management/policy outcomes.

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