Environmental Justice and Fish Consumption Advisories on the Detroit River Area of Concern

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LIST OF ACRONYMS

ACCESS: Arab Community Center for Economic and Social Services
AOCs: Great Lakes' Area of Concerns
CILER: The Cooperative Institute for Limnology and Ecosystems Research
CSOs: combined sewer overflows
DWEJ: Detroiters Working for Environmental Justice
EPA: Environmental Protection Agency
PCBs: Polychlorinated biphenyls
MDCH: Michigan Department of Community Health
MDEQ: Michigan Department of Environmental Quality
MDNR: Michigan Department of Natural Resources
RAP: Remedial Action Plan
SDEV: Southwest Detroit Environmental Vision
SSOs: sanitary sewer overflows
USDA: United States Department of Agriculture
USFWS: United States Fish and Wildlife Service
WIC: Women, Infant and Children program

ABSTRACT

The Detroit River serves as a source of recreation, food, transportation and is an international demarcation. Decades of industrial and municipal pollution have threatened this valuable resource, particularly for those that are dependent on it for a food source. As Detroit, MI and Windsor, Ontario jointly govern this waterway, both communities were examined as a part of this study. The demographics of these communities are varied, with those living in Detroit predominantly African American. We sought to determine if fish consumption advisories are indeed an environmental justice issue; whether the most vulnerable populations receive and utilize this information; if contaminated fish consumption contributes to food insecurity; and how public information provided by institutions influences anglers. To accomplish this, we conducted creel surveys of anglers on the Canadian and US sides of the Detroit River to look at comparative aspects of jurisdictional boundaries affecting the attitudes, knowledge and beliefs of risks of fish consumption and contamination. Our results and conclusions reflect and highlight the environmental injustice surrounding fish consumption and the status of fish advisories.

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CHAPTER 1: INTRODUCTION

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Fish consumption advisories are created by governments to inform anglers and fish consumers about potential health concerns regarding contaminants in fish. They are not regulations but rather guidelines with the objective of helping those who intend to consume fish make informed decisions regarding the consumption of fish. State issued consumption advisories are problematic for those that do not receive the information or distrust its source. Those that are most affected by fish contaminants, sensitive populations of fish consumers such as women of child-bearing age and children, often do not or cannot receive this information. Issues of environmental justice further exacerbate information flows and in respect to sources of contamination, particularly in urban waters. Many subsistence anglers fish in contaminated urban waters such as the Detroit River.

The Detroit River is a connecting channel between Lake St. Clair and Lake Erie that spans 32-miles, 11 municipalities, two counties, one state, one province, and two countries. It is home to numerous industries and a variety of ethnic neighborhoods and multiple social groups which aid in its conservation as a recreation point and a historical site. As a part of the Great Lakes ecosystem, it is under the jurisdiction of several agencies at the local, state, federal, and international levels, and under the control of multiple policy initiatives. In 1986, Canada and the United States signed the Great Lakes Water Quality Agreement, designating the Detroit River an Area of Concern. This created yet another layer of policy in which international cooperation is a necessary component to delist the Detroit River from the Areas of Concern. Beyond this complex web of governmental institutions and policy, there is a vibrant community of anglers. Anglers arrive to fish at the waters of the Detroit River because of its proximity to their homes, the pleasure it brings them, and the fish which inhabit it. In many cases fish in the river are used as a food resource. Subsistence anglers on

the Detroit River represent a subset of the Great Lakes angler population who are at risk of contamination due to the presence of potentially harmful contaminants.

Fish contamination in the Detroit River is a result of a long history of heavy industrial development, non-point source pollution, and storm-water runoff. While aquatic ecosystems in an industrialized Michigan have seen a peak of contaminants, the problems associated with polluted sediment still persist. Contamination problems in the Detroit River are further exacerbated by emerging chemical inputs like pharmaceutical bi-products, everyday household detergents from stormwater runoff, and combined sewer overflows. As our waterways are being inundated by toxins, further degradation may entail potentially serious health risks to Canadian and American fish consumers. There is a particular threat to those anglers that rely on fish for a healthy and well-balanced diet.

The purpose of this study was to identify angler groups on the Detroit River and assess which among them rely on the Detroit River as a food extractive resource. We sought to engage in a dialogue with anglers on their perception, knowledge, and attitudes towards fishing and fish consumption on the Detroit River Area of Concern. Based on these issues, we developed the hypothesis that there is an environmental justice issue regarding fish consumption on the Detroit River Area of Concern. We believe that fish consumption is an environmental justice issue that stems from inadequate risk communication through fish consumption advisories which compound issues of food security. We feel that people of color and those with low-incomes are differentially impacted by the risks of contaminated fish because fish consumption advisories fail to take into consideration cultural, social and economic needs. Because of cultural, economic, and food security reasons, they are forced out of habit to fish the Detroit River, contaminated by point and non-point source pollution. This becomes an environmental injustice issue when the State fails to protect its citizens by relying on ineffective fish advisories rather than reclaim the river to a more

acceptable and healthy resource for multiple use.

Three questions guided our research:

1. Is there an environmental justice issue regarding fish consumption on the Detroit River exist?
2. Is the current fish consumption advisory information effective for all populations?
3. How do public information resources report or frame Detroit River governmental institutions?
4. How does food insecurity compound these issues of environmental justice and fish consumption advisories on the Detroit River?

Using this framework and our research questions to guide our practicum, we interviewed anglers on the Detroit River and investigated the media's reporting of institutional stakeholders.

We interviewed anglers from June through September of 2008 on the Michigan and Canadian sides of the Detroit River Area of Concern to assess the knowledge, attitudes, and beliefs about contamination and fish consumption. Closed and open-ended questions were utilized to investigate the behavior of anglers, perception of water quality and fish quality, and anglers' knowledge associated with state-issued fish consumption advisories. The second part of our study included an external survey of public media sources. We searched websites, newspapers, and online sources to gauge the strength of association between those organizations that govern the Detroit River and terms associated with contamination, fishing, and environmental justice. This two-pronged approach allowed us not only to understand anglers' perspectives, but also the messages they are receiving outside of the advisory itself.

In partnership with The Cooperative Institute for Limnology and Ecosystems

Research (CILER) and the University of Michigan's Environmental Justice Initiative, this practicum contributed to the integrated assessment, "What are the Causes, Consequences and Correctives of Fish Consumption Advisories on the Detroit River Area of Concern?" This assessment includes major governmental, private, and non-governmental institutions on both the Canadian and U.S. side of the river working to understand fish consumption advisories. The surveys conducted with anglers aided in assessing the effectiveness of fish consumption advisories as a mechanism to address risk for those most affected by the risk of contamination. Through speaking with anglers directly, we hope to offer correctives that incorporate environmental justice principles of equity, increased food security, and appropriate policy suggestions to make fishing a safe and healthy endeavor for all who catch and consume fish from the Detroit River.

Why Environmental Justice Now?

Certain aspects of Michigan's environmental situation as pertains to class and race are known. Low-income communities and people of color suffer a disproportionate burden of toxic waste in their neighborhoods.[1] Low-income African-Americans have less access to healthy food resources than other ethnicities.[2] This is particularly true in Detroit where there is a severe lack of access to grocery stores that carry fresh foods. Throughout Michigan, African-American and Latino populations have been disproportionately burdened by a lack of health care coverage, obesity, and diabetes.[3] Mohai and Bryant find that race as a category of environmental quality assessment is especially valid in Detroit, not because

[1]Bryant, B. & Hockman, E. (1994). *Hazardous Waste and Spatial Relations According to Race and Income in the State of Michigan*. (R) in progress.
[2] Zenk, S., Schultz, A., Israel, B., James, S., Bao, S., & Mark Wilson. (2006). Fruit and vegetable access differs by community racial composition and socioeconomic position in Detroit, Michigan. *Ethnicity and Disease, 16*, 275-280.
[3] Center for Disease Control's National Center for Chronic Disease Prevention and Health Promotion (2005). Behavioral risk factor surveillance system. Retrieved February 28, 2008 from http://apps.nccd.cdc.gov/brfss/

different people of color do not value the environment, but rather that the nature of that valuation relies on more immediate concerns of the pollution of air, water, and land derived from cultural differences and environmental deprivation.[4] This is separate and qualitatively different than conservation efforts in the predominantly white environmental movement. For this reason, it is crucial to explore how urban inhabitants understand and interact with their physical and natural resources.

Despite recent findings that little has changed as far as environmental conditions for people of color over the past 20 years, significant political momentum has gained in Detroit.[5] Over the last 20 years, Detroit has seen different non-profit social justice groups focus their attention on environmental issues. Detroiters Working for Environmental Justice (DWEJ) has been organizing communities in Detroit since 1994 on issues that range from lead in homes to youth education and metropolitan air quality.[6] The Arab Community Center for Economic and Social Services (ACCESS) has provided research and advocacy in community public health since 1988.[7] Southwest Detroit Environmental Vision (SDEV) has worked to build a business and community health connection through environmental programs since 1991.[8] In turn, larger national and state level non-profit environmental groups have turned towards urban environmentalism, rather than solely focusing on conservation.[9] For example, The Sierra Club's Environmental Justice national chapter is

[4] Mohai, Paul & Bunyan Bryant (1998). "Is There a 'Race' Effect on Concern for Environmental Quality?" *Public Opinion Quarterly.* Vol. 62.
[5] Bullard, R., Mohai, P., Saha, R., & Wright, B. (2007). "Toxic wastes and race at twenty 1987-2007: Grassroots Struggles to Dismantle Environmental Racism in the United States." *United Church of Christ Justice and Witness Ministries.* Cleveland, OH.
[6] Detroiters Working for Environmental Justice. Retrieved March 1, 2008 from http://www.dwej.org/.
[7] ACCESS. Retrieved March 4, 2008 from http://www.accesscommunity.org/site/PageServer?pagename=Community_Health_and_Research
[8] Southwest Environemental Vi
sion. Retrieved March 4, 2008 from http://www.sdevonline.org/
[9] See Sierra Club, http://www.sierraclub.org/environmental_justice/ National Wildlife Federation internship opportunities explicitly list environmental justice, and have created partnerships with DWEJ towards this goal. Also East Michigan Environmental Action Council has worked with Michigan Welfare Rights of water shut-offs in Highland Park, http://www.emeac.org/

located in Detroit, and has partnered with DWEJ and others. Other organizations like Michigan Environmental Council or East Michigan Environmental Action Council have also begun to initiate projects and dialogues in Detroit. The very meaning of environmentalism has begun to change, and is doing so at a rapid rate in Detroit.

Environmental Justice, the idea that environmental externalities are disproportionately distributed onto communities of color and those living in poverty, is the frame for discussing fish consumption and fish consumption advisories. The study focuses on aspects of race and income on the Detroit River because of the historical role race has played in the way resources have been distributed around the river. The study's aim is to determine exactly who the subsistence anglers are on the Detroit River, elucidate their attitudes, knowledge, and beliefs regarding contamination, and investigate how or why subsistence anglers continue to fish regardless of governmental risk communication efforts.

We also sought to examine the role of community food security, or access to healthy foods at the neighborhood level that are safe, culturally acceptable, nutritious, of high quality, and affordable. In trying to contextualize the traditions of fishing, we also looked at the cultural value of fishing for anglers. For these reasons, the Detroit River is understood as a neighborhood where information is exchanged, a food resource is yielded, and cultural activities are practiced. On the Detroit River and the Great Lakes, fish consumption advisories are distributed, assessed and incorporated into knowledge, attitudes and beliefs. What role does fishing play in anglers' lives, and how do fish consumption advisories limit or change those attitudes, knowledge, or beliefs?

From anglers' vantage point, we also investigate how those institutions that govern the Detroit River in Michigan approach the disproportionate burden of toxins on people of color and low-income communities. Specifically, we look at how successes and failures of fish consumption advisories as a tool to protect marginalized populations are shaped by

those institutions. The question posed to these institutions is: How has race and/or income been utilized as metrics in assessing at-risk populations and understanding the way in which risk communication is effective for Detroit River anglers? We ask this question with the ultimate goal of understanding at-risk, fish consuming populations on the Detroit River, and the ways in which we can approach fish consumption advisories.

Detroit organically became the focus of this study because of the body of literature associated with the historical frame of race and urban Detroit. However, our study also examines the Canadian side of the Detroit River to compare and contrast a separate set of political tools used for risk communication, and public policies that vastly differ from Michigan and U.S. federal policies. This is no way infers that there are no environmental justice issues on the Canadian side of the Detroit River, but redirects the focus of institutional approaches to environmental justice issues to Michigan.

CHAPTER 2: STUDY AREA

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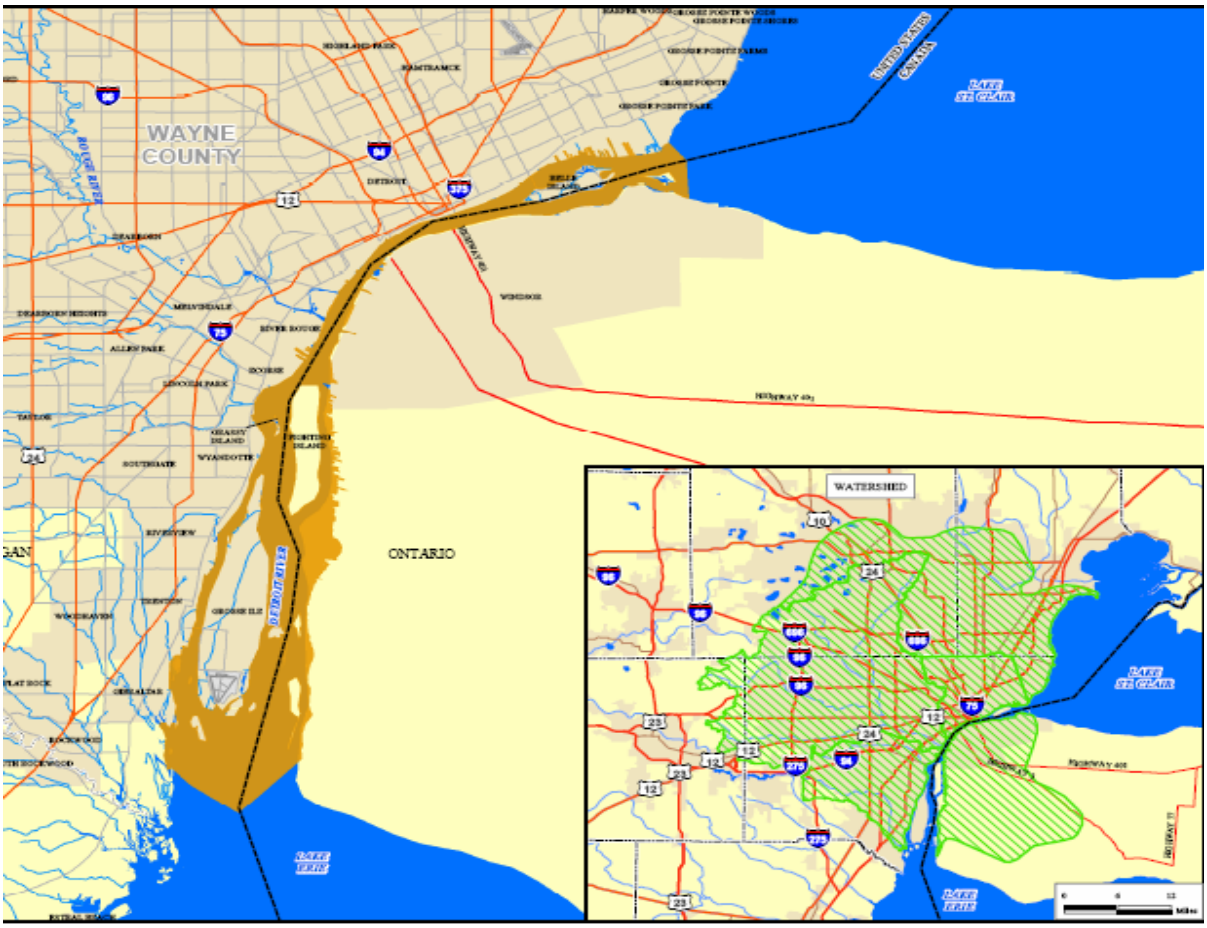


Figure 2.1 Detroit River Area of Concern
Source: EPA: Detroit River Area of Concern http://www.epa.gov/glnpo/aoc/detroit.html

The Detroit River Area of Concern

In 1987 the United States and Canada's Great Lakes Water Quality Agreement spearheaded efforts to recover the Great Lakes region, creating the Great Lakes' Remedial Action Plans for all 43 Area of Concerns (AOCs). AOCs are defined as "geographic areas that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life." [10] The U.S. and Canadian governments have identified 43 such areas; 26 in U.S. waters, 17 in Canadian waters, with 5 shared between the United States and Canada on

[10] EPA (2007). *Great Lakes Areas of Concern.* http://epa.gov/greatlakes/aoc/detroit.html

connecting river systems.[11] Of the 14 beneficial use impairments, those that most greatly affect the Detroit River include: restrictions on fish and wildlife consumption; tainting of fish and wildlife flavor; restrictions on drinking water consumption, or taste and odor; degradation of fish and wildlife populations; fish tumors or other deformities; degradation of aesthetics; and loss of fish and wildlife habitat.[12] According to the agreement, both countries must make efforts to improve the impaired waters so they may once again be suitably clean for beneficial use.

The Great Lakes Water Quality Agreement led to the creation of the Remedial Action Plan (RAP) with the goal to jointly assign responsibilities to recover and delist the Detroit River as an AOC. The Detroit River RAP priorities include control of combined sewer overflows (CSOs), control of sanitary sewer overflows (SSOs), point/nonpoint source pollution controls, remediation of contaminated sediments, habitat restoration, and pollution prevention. A gamut of activities, involving private and public actors, has taken place since the creation of RAPs that include, but are not limited to, efforts addressing SSOs and CSO's, biodiversity surveys, stakeholder workshops, and comprehensive remediation.[13] In May of 2004, President Bush signed Executive Order 13340 calling for a Regional Collaboration of National Significance to facilitate the Great Lakes communities—local, state, federal, Tribal, and Canadian—to convene on the protection and restoration of the Great Lakes.[14]

These efforts inspired the creation of the Detroit River International Refuge that spans from the lower Detroit Metro Area to near Toledo, Ohio. The U.S. Fish and Wildlife Services have provisioned a 15-year plan that includes multi-sector and bi-national efforts

[11] For more information on Great Lakes Area of Concerns see GLIN Website: http://www.greatlakes.net/envt/pollution/aoc.html
[12] EPA (2007). *Great Lakes Areas of Concern.* http://epa.gov/greatlakes/aoc/detroit.html
[13] Great Lakes Commission (2002). *An overview of the U.S. Great Lakes AOCs*. U.S. EPA Great Lakes National Program Office and the Great Lakes Commission Report, March 2002.
[14] EPA Great Lakes National Program Office (2004). *Framework for the Great Lakes Regional Collaboration*. Retrieved March 5, 2008 from http://www.epa.gov/glnpo/

for management.[15] The City of Detroit was not included in the refuge due to concerns over the city's ability to meet the stringent clean-up requirements. However, international cooperation regarding the Detroit River AOC indicates the magnitude and concern of both the ecological and human health. The study area includes two large metropolitan areas with unique characteristics on each bank of the Detroit River.

Detroit and Wayne County, Michigan

The largest metropolitan area in both the Detroit River AOC and the southeast Michigan region is Detroit/Wayne County. The most recent census figures report that Wayne County has been losing population at a rapid rate, second only to Louisiana's Orleans Parish in the wake of Hurricane Katrina. By 2006, a city of almost 2 million people in 1950 had fallen to 871,121 residents (see table 2.1).[16] There are many reasons for the decrease in population, several of which stem from the decline of southeast Michigan's main economic force, the automotive industry. The decrease in population was accelerated by "white flight" and urban sprawl. The State of Michigan's population also suffers from slow economic growth and high unemployment rates. The result has been blight and abandoned property, which have plagued the city for years as the population dwindled. The number of vacant lots in the city is double the number of lots with structures. The vacant lot numbers are estimated at 80,000 with taxable parcels with structures reaching only 40,000.[17] Currently, in the City of Detroit, 31.4 % of all people, and 27% of families, are below the poverty level, while 20.5% of Detroit's population is unemployed. With few job prospects, lack of a solid tax

[15] Hartig, John (2007). Detroit River International Wildlife Refuge. U.S. Fish and Wildlife Refuge. Retrieved March 06, 2008 from http://www.fws.gov/Midwest/DetroitRiver/
[16]United States Census Bureau. Retrieved March 07, 2008 from www.census.gov
[17] The Kirwan Institute for the Study of Race and Ethnicity (2007). Land banking in Detroit. Retrieved March 05, 2008, from http://kirwaninstitute.org/news/news_landbankdetroit.html

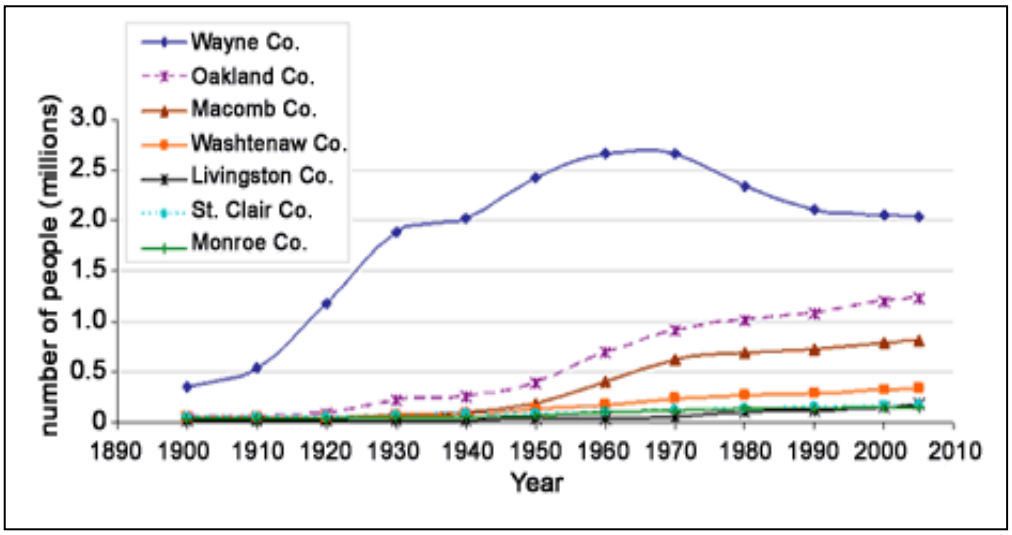
base, and poor public transportation, many find it difficult to thrive in their daily life. These figures demonstrate the dire situation with which many Detroit residents must contend.

Table 2.1 Detroit and Wayne County MI, Select Demographics

	Detroit 2000	Wayne County 2000	US Avg 2000	Detroit 2006	Wayne County 2006	US Avg 2006
Population						
Total Population	951,270	2,061,162		834,116	1,266,432	
Caucasian	12.3%	51.7%	75.1%	10.0%	51.6%	73.9%
African American	81.6%	42.2%	12.3%	83.1%	41.5%	12.4%
Housing						
Vacant Housing	10.3%	7.0%	9.0%	23%	14.8	11.6%
Med. Value of home	$63,600	$99,400	$119,600	$91,700	$139,500	$185,200
Income						
Median HH Income	$29,526	$40,776	$41,994	$28,364	$41,784	$48,451
Families Below Poverty	21.7%	12.7%	9.2%	27%	14.8%	9.8%
Individuals Below Poverty	26.1%	16.4%	12.4%	32.5%	19.6%	13.3%
Families Below Poverty – Female Householder	21.7%		26.5%	38.1%		28.6%
Unemployment – Families with children	28.6%	18..5%		36.4%	21.7%	
Unemployment Families with female householder	39.5%	35.8%		45.4%	39.2%	
Unemployment – Individuals	26.1%	16.4%	3.7%	32.5%	19.6%	6.4%

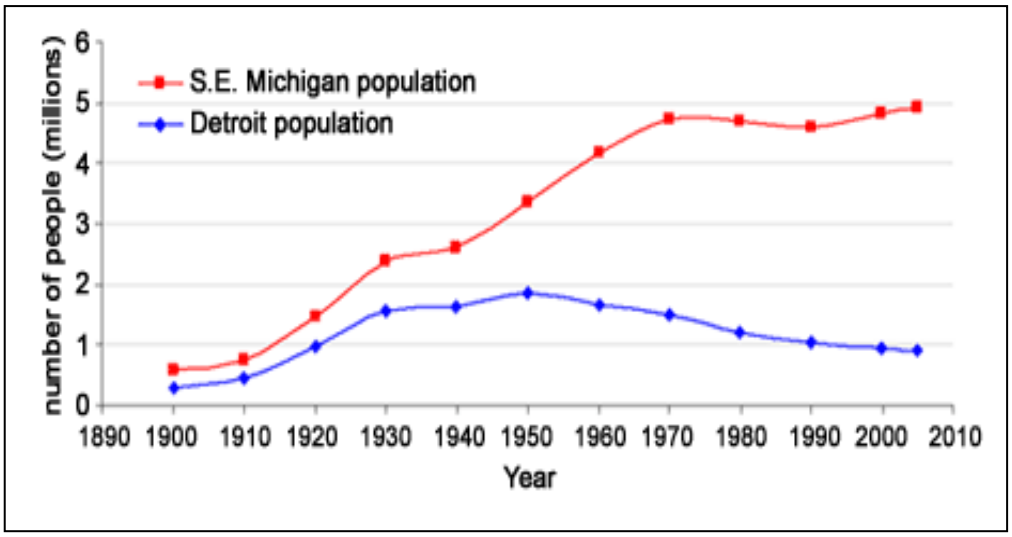
Source: U.S. Census, 2007

Figure 2.2 Wayne and Surrounding Counties Population Trends from 1890-2010



Source: EPA, http://www.epa.gov/med/grosseile_site/indicators/population.html

Figure 2.3 Detroit and SE Michigan Population Trends from 1890-2010

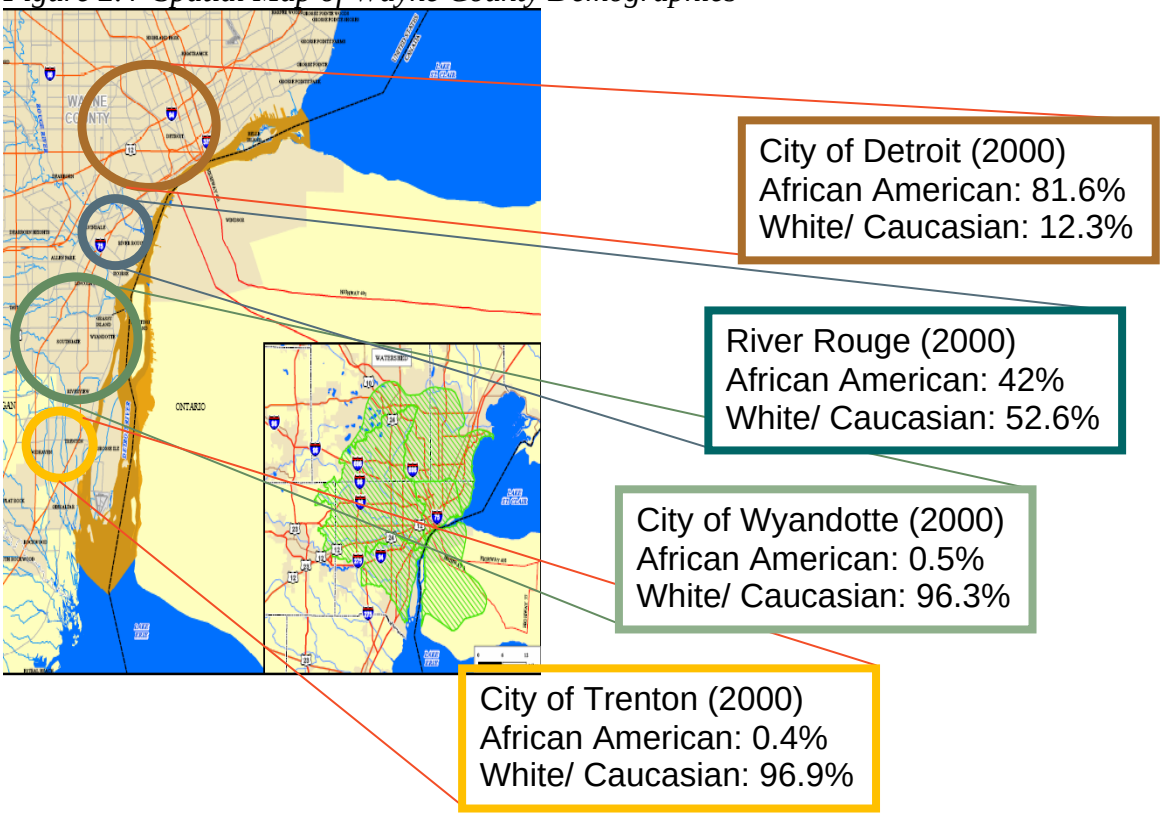


Source: EPA, http://www.epa.gov/med/grosseile_site/indicators/population.html

It is well-known that the extreme decrease in population in the second half of the twentieth century was highly racialized. Segregation indicators for the Detroit Metropolitan Area report that African Americans in the Detroit Metro area experience very high levels of segregation and isolation (see figure 2.4).[18] The extreme population segregation stems from historical and socio-structural discrimination that was found in hiring practices, housing segregation, police violence, income disparity, and access to social services and physical resources.[19]

[18] Lewis Mumford Center (2000). *Metropolitan racial and ethnic change—Census 2000.* Retrieved March 09, 2008 from http://www.albany.edu/mumford/census.
[19] Sugrue, T. (1996). *The origins of urban crisis: Race and inequality in postwar Detroit.* Princeton, NJ: Princeton University Press.

Figure 2.4 Spatial Map of Wayne County Demographics



Source: U.S. Census, 2000

This sort of extreme segregation and historical racism has had a direct effect on the distribution of resources, and indirectly, on various effects of human health.[20] Schultz et al. eloquently mapped the direct and indirect consequences of racial bias in the distribution of resources as present in Detroit throughout the twentieth century.[21] We used this model to focus on how industrial pollutants (e.g., PCBs, mercury and dioxin) have compounded environmental stressors on subsistence anglers and their food resources. Because Detroit River fish provide access to a healthy dietary supplement, contamination modifies and limits consistent access to healthy resources. Industrial pollutants, and those who control and monitor them, are therefore charged with the responsibility of communicating the risks associated with contaminated fish consumption. The inability to access the riverfront for

[20] Schultz, A. J., Williams, D., Israel, B., Lempert, L. B. (2002). "Racial and spatial relations as fundamental determinants of health in Detroit. *The Milbank Quarterly*, (*80*)4, 677-707.
[21] Ibid.

food extraction because of development or private property can also act as an environmental stressor that affect residents' diet, much like pollution. An inability to access the riverfront also carries long-lasting social consequences as there is also a social value of fishing on the riverfront. Therefore, stressors such as contamination, the state, and riverfront development, in the context of a highly segregated environment can compound risk for urban consumers of fish, threatening one form of livelihood for an already vulnerable population.

The City of Detroit has experienced a re-growth of sorts as the Downtown district has become an entertainment and sports hub with the addition of Ford Field, Comerica Park, and several casinos. For the first time in 20 years hotels are coming back to the area along with a surge of restaurants, night clubs, and upscale housing. While Detroit appears to be a livelier and interesting place to be, its residents continue to suffer an increase in poverty levels, unemployment, and vacant properties, as well as a dwindling population. Southeastern Michigan population continues to increase, while Wayne County and the City of Detroit are rapidly losing residents to the outlying areas (see table 2.3). This demographics shift further increased racial and economic segregation. The loss of population also has negative repercussions for county and city funding as the tax base shrinks. This combined with the economic situation and budgetary issues facing the State of Michigan creates a difficult political situation for Detroit and the allocation of scarce resources.

Yet these grim statistics in Detroit have not hampered efforts to clean up and increase riverfront development in Detroit. A primary component of this redevelopment capitalizes on the Detroit River and its real estate potential. In this vein, Mayor Coleman Young worked throughout the 1980s to establish public access through Chene and other parks under the leadership of Dan Krichbaum.[22] Since 2000, millions of investment dollars have poured

[22] Staff writer. (2007, Dec. 15-21). Granholm names Dan Krichbaum chief operating officer. *Arab American News.*

into the revitalization of the Detroit Riverfront. Coined the Detroit RiverWalk, these efforts have brought together old and new partnerships to transform the formerly industrial space to one used primarily for leisure, tourism, and high-end real estate.

The Detroit Riverfront Conservancy, established in 2002 by Mayor Kwame Kilpatrick, continues to renovate and create access points along the river. The Detroit Riverfront Conservancy represents comprehensive efforts from the private and public sector to raise money to make the Detroit Riverfront a viable market for real estate investment and entertainment. The Conservancy, headed by several major businesses, is charged with collaborating investments towards developing the RiverWalk. It has raised roughly $93 million to achieve its goals of long-term development of parks and green spaces, facilitating community understanding of the Conservancy's vision, and implementation of improvements and programming activities, among other things.[23] The redevelopment of the riverfront has paved the way for reinvestment and revitalization of downtown Detroit while much of the city continues to suffer from declining populations and subsequent economic issues.

Windsor and Ontario, Canada

With only the Detroit River separating the two cities, Windsor Ontario has a much different cultural, economic, and environmental outlook than Detroit. As noted in table 2.2, the average income of Canadians in the Windsor area is much higher than those of Detroit residents. Another marked difference lies in the demographics, where only 2-3% of the population identifies as "black" while in Detroit, this number is 85%. While these numbers are from 2001, they are likely not much different today. The different cultural groups and

[23] The Riverfront Conservancy. (2003-2005). Mission statement. Retrieved February 3, 2008 from http://detroitriverfront.org/index.asp?item=321&name=Mission+Statement&site=5

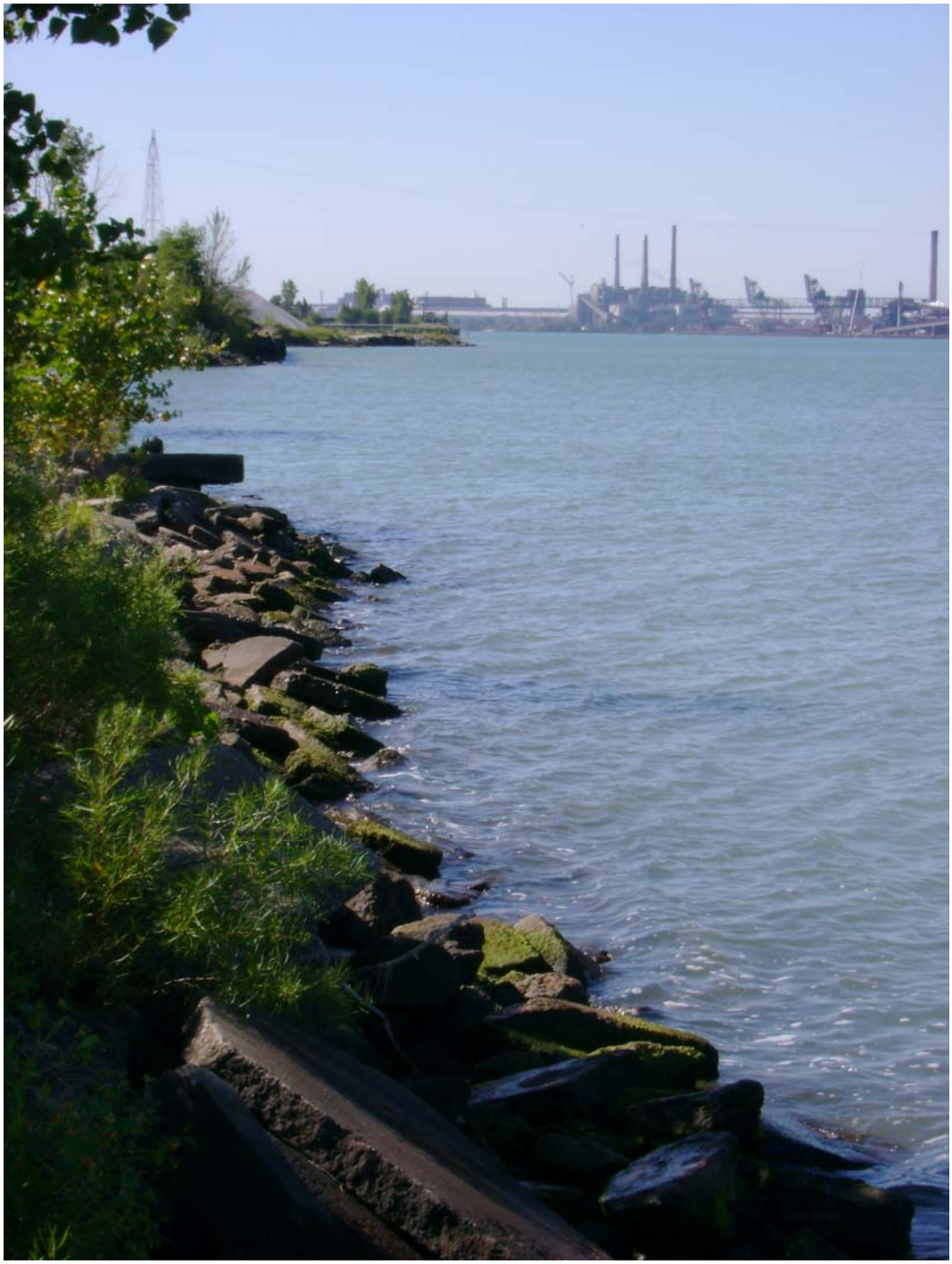
income levels and the smaller population on the Canadian side of the Detroit River indicate a different approach to issuing and distributing fish consumption advisories.

Table 2.2 2001 Canadian Census Data (Canadian Dollars)[21]

	Total Population	Chinese	S. Asian	Black	Filipino	Avg Family Income	Avg Individual Income	Low Income Families	Low Income Ind.
Amherstburg	20,339	0%	0%	1%	0%	$ 85,790.00	$ 29,987.00	6.1%	26.5%
Lasalle	25,285	1%	1%	2%	1%	$ 96,946.00	$ 38,486.00	2.9%	20%
Windsor	209,218	2%	3%	3%	1%	$ 66,490.00	$ 29,915.00	13.2%	34.9%

[21] Statistics Canada, (2001). 2001 Census. Retrieved March 30, 2008. http://www12.statcan.ca/english/census01/home/index.cfm

CHAPTER 3: BACKGROUND



CHAPTER 3: BACKGROUND

Environmental Justice

Environmental Justice refers to a social movement based on environmental, and economic equity for people of color and low-income individuals. It is an extension of the civil rights movement that focuses on health and environmental impacts that disproportionately affect people based on their income and color. Its roots began in Warren County, North Carolina when residents protested the dumping of Polychlorinated biphenyl (PCBs) in a landfill in a predominantly black township. This sparked the seminal 1987 report *Toxic Waste and Race in the United States* by the United Church of Christ. This research demonstrated that people of color and low-income individuals were more likely to live near toxic waste sites.[24] With this report, the environmental justice movement gained a certain amount of legitimacy and sparked a proliferation of research in academia. In 2007, an updated version of this report, *Toxic Waste and Race at Twenty 1987-2007*, discussed that while attention had been brought to this issue in 1987, little had changed in the present day lives of those living in the shadows of environmental disparities.[25] In the 1990s, fish consumption studies on the Detroit River have brought to light the issue of environmental injustice, however, we contend that little has changed.[26]

In January of 1990, Bunyan Bryant and Paul Mohai of the University of Michigan organized a working conference to bring scholars and activists together to work on the issue

[24] United Church of Christ. (1987). *Toxic wastes and race in the United States: A national report on the racial and socio-economic characteristics of communities with hazardous waste sites.* Commission for Racial Justice United Church of Christ. Cleveland, OH.
[25] Bullard, R., Mohai, P., Saha, R., & Wright, B. (2007). "Toxic wastes and race at twenty 1987-2007: Grassroots Struggles to Dismantle Environmental Racism in the United States." *United Church of Christ Justice and Witness Ministries.* Cleveland, OH.
[26] West, P., Fly, M., Larkin, F., & Marans, R. W. (1994). Minority anglers and toxic fish consumption: Evidence from a statewide survey of Michigan. In B. Bryant & P. Mohai (Eds.), *Race and the incidence of environmental hazards: A time for discourse.* Boulder, CO: Westview Press.

of environmental justice.[27] The majority of presenters at this conference were people of color. One of the conference's outcomes was a series of meetings with high-level government officials and legislators, during which they were urged to take the necessary actions to protect communities against environmental harm.[28] These officials and legislators brought the issue to President Bill Clinton and on February 11, 1994, President Clinton signed Executive Order 12898 creating "federal actions to address environmental justice in minority populations and low-income populations," further legitimizing the movement and bringing additional attention to the many research agendas that required attention.[29] One of the highlighted areas of concern was contaminated fish consumption and sensitive populations of color and low income. Michigan's Governor Jennifer Granholm signed a similar initiative on November 21, 2007. Executive Directive 2007-23 mandates that "the Department of Environmental Quality shall develop and implement a state environmental justice plan to promote environmental justice in Michigan." [30] It includes several components to measure the impact on environmental justice communities as well as suggested solutions.

Fish Advisories and Environmental Justice

Many scholars have pursued important research in the field of fish advisories, risk communication, and environmental justice. Researchers in other locations have found that fishing behavior,[31] i.e., the type and amount of fish,[32] cooking styles of local fish,[33] the

[27] Bryant, B., & Mohai, P. (1992). The Michigan conference: A turning point. *EPA Journal*, *18*(1).
[28] Ibid.
[29] Environmental Protection Agency (2008). Environmental justice. Retrieved February 20, 2008 from http://www.epa.gov/compliance/basics/ejbackground.html.
[30] Office of the Governor. 2007. Executive Directive 2007-23. Retrieved March 5, 2008. http://www.michigan.gov/gov/0,1607,7-168-36898-180696--,00.html
[31] Floyd, M., & Johnson, C. (2002). Coming to terms with environmental justice in outdoor recreation: A conceptual discussion with research implications. *Leisure Sciences, 29*, 57-77.
[32] Burger, J. (2002). Consumption patterns and why people fish. *Environmental Research*. 90, pp. 125-135.

frequency of fishing,[34] have varied by race, income, age, education, and gender. The vast heterogeneity of fishing behavior further depends on geographic location, racial identity,[35] the awareness of contamination advisories,[36,37] and the knowledge of health effects caused by consuming contaminated fish.[38] In this section we provide a synthesized analysis of several empirical studies that focus specifically on fish consumption advisories and fish consumption. We find that although authors do not refer to the disproportionate burden of health risks from consumption of contaminated fish as environmental justice, race and income are major indicators in addressing fish consumption rates, and fish consumption advisory knowledge.

Authors looking at race and income as predictive factors for exposure to contaminated fish through consumption patterns and/or fish consumption advisory awareness found that there are substantial differences between racial and ethnic groups in different regions. Joanna Burger et al. reported on the Savannah River in 1999, where they found that low-income, black anglers consume more fish, more often than white anglers, thus putting them in a higher risk category. This lead the researchers to conclude that, "the use of general demographics (white, middle-class angler, between the ages of 30-40) to determine potential risk of fish consumption patterns for specific waters may seriously miss

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[33] Burger, J., Stephens, W., Boring, C., Kuklinski, M., Gibbons, W. J., & Gochfield, M. (1999). Factors in exposure assessment: Ethnic and socioeconomic differences in fishing and consumption of fish caught along the Savannah River. *Risk Analysis, 19*(3).

[34] Hunt, K., & Ditton, R. (2002). Freshwater fishing participation patterns of racial and ethnic groups in Texas. *North American Journal of Fisheries Management, 22*, pp. 52-65.

[35] Beehler, G., McGuiness, B., & Vena, J. (2001). Polluted fish, sources of knowledge, and the perception of risk: Contextualizing African American anglers' sport fishing practices. *Human Organization, 60*(3).

[36] Imm, P., Knobeloch, L., Anderson, H., & the Great Lakes Sport Fish Consortium (2005). Fish consumption advisory awareness in the Great Lakes Basin. *Environmental Health Perspectives, 111*(10).

[37] Silver, E., Kaslow, J., Lee, D., Sun, L., Lynn, T. M., Weis, E. et al. (2007). Fish consumption and advisory awareness among low-income women in California's Sacramento–San Joaquin Delta. *Environmental Research, 104*.

[38] Corburn, J. (2002). Combining community-based research and local knowledge to confront asthma and subsistence-fishing hazards in Greenpoint/Williamsburg, Brooklyn, New York. *Environmental Health Perspectives, 110*(2).

the mark."[39] Since then, Burger has published over 35 articles on the topic, highlighting the need for targeted risk communication.

A series of studies have followed Burger's work, pointing to the different approaches to risk management, one that explicitly highlights race and ethnicity within the fish consumption issue. Beehler et al. found that African American anglers in Buffalo, New York were either unaware or tended to utilize local knowledge rather than state-based knowledge to direct fishing practices.[40] Corburn found that, not only are anglers in Brooklyn unaware of the risks of consuming contaminated fish, but also that risk management institutions were unaware of the high-risk population on the East River. [41] Hunt and Ditton found that different ethnic groups in Texas exhibited significant behavioral differences in outdoor recreation preferences including species of fish preferred and frequency of fishing.[42] Dellinger worked with Native Americans of the upper Great Lakes region finding that tribes consume a considerably larger amount of fish than the average fish consumer, and this varies with specie even amongst tribes.[43] Steenport et al. found that although a majority of anglers on the Fox River in Wisconsin practiced catch and release, many anglers were unaware of the fish consumption advisory or the risks of eating contaminated fish. Many fish consumers on the Fox River were also non-English speaking.

Other researchers have looked into the intersections of race, gender and income when considering exposure to risk of contaminated fish consumption. Bienenfeld et al. surveyed

[39] Burger, J., Warren, S., Boring, C., Kuklinski, M., Gibbons, W. J., & Michael Gochfield (1999). Factors in exposure assessment: Ethnic and socioeconomic differences in fishing and consumption of fish caught along the Savannah River. *Risk Analysis, 19*(3).
[40] Beehler, Gregory, McGuiness, Bridget, and John Vena (2001). Polluted fish, sources of knowledge, and the perception of risk: Contextualizing African American anglers' sport fishing practices." *Human Organization, 60(3).*
[41] Corburn, Jason (2002). Combining Community-based Research and Local Knowledge to Confront Asthma and Subsistence-Fishing Hazards in Greenpoint/Williamsburg, Brooklyn, New York. *Environmental Health Perspectives.* 10 (Supplement 2).
[42] Hunt, Kevin and Robert, Ditton (2002). Freshwater fishing participation patterns of racial and ethnic groups in Texas. *North American Journal of Fisheries Management,* 22(1).
[43] Dellinger, John (2004). Exposure Assessment and initial intervention regarding fish consumption of tribal members of the Upper Great Lakes Region in the United States. *Environmental Research,* 95, pp 325-340.

Women, Infant and Children (WIC) participants in East Harlem finding that 10% of women were eating non-commercial fish from contaminated waters. Those who were aware of the advisory were statistically significantly associated with consumption of such fish.[44] Similarly, researchers associated with the California Department of Health Services in the Sacramento-San Joaquin Delta, found that Hmong and Cambodian women consumed a higher proportion of sports fish on average than other ethnic groups who also varied in overall consumption rates. Generally, African-American women were found to consume the most fish overall. This study was particularly alarming given that the sample population was taken from the Women, Infant and Children (WIC) program. This study explicitly shows low-income, women of color are in an elevated risk category during child-bearing years.[45]

[44] Bienenfeld, LA, Golden, Anne, and Elizabeth Garland (2003). Consumption of fish from polluted waters by WIC participants in East Harlem." *Journal of Urban Health,* 80(2).
[45] Silver, Elana, Kaslow, Jessica, Lee, Diana, Lee, Sun, Tan, Lynn May, Weis, Erica, and Alyce Ujihara (2007). Fish Consumption and advisory awareness among low-income women in California's Sacramento-SanJoaquin Delta. *Environmental Research,* 103(3), pp 410-419.

Table 3.1 Studies of Fish Consumption as an Environmental Justice Issue

Studies of fish consumption as an environmental justice issue

Author	Region	Is fish consumption an environmental justice issue?		
		Race/ethnicity	Socioeconomic status	Secondary factors
Beehler, Gregory (2001)	Great Lakes, New York	yes	n/a	Motivation for fishing, knowledge, tradition
Burger, Joanna (1999)	Georgia	yes	yes	Age, education
Burger, Joanna (2001)	New Jersey	yes	yes	Age, education, frequency of consumption, and reasons for fishing
Corburn, Jason (2004)	Brooklyn, New York	yes	yes	Age, language
Dellinger, John (2004)	Upper Great Lakes	yes	n/a	Tribe
Hornbarger, Katherine et al (1994)	Detroit River	yes	yes	Cultural practices
Hunt, Kevin (2002)	Texas	yes	n/a	Gender, language
Imm et al (2005)	Great Lakes	yes	yes	Age, gender, education, state of residence
Silver, Elana (2007)	Sacramento, California	yes	yes	Age, education, pregnancy
Steenport, Dyan M. (2000)	Fox River, Wisconsin	yes	n/a	Knowledge of health risks, language
Tilden, John (1997)	Great Lakes	yes	n/a	Age, gender, education, state of residence
West et al (1992)	Michigan	yes	yes	Age, size of location, education, years of residence in MI

These studies show remarkable evidence that race and income are significant factors in analyzing the risk of consuming fish and the compounded nature of that risk. Yet several studies show that Michigan is no different in its risk communication abilities, nor different in its disproportionate burden of environmental risks to people of color. In 1992, Patrick West found that low-income Native Americans and middle-income black anglers consumed more

fish, and more types of fish, than white anglers.[46] In 1997, an overall study in the Great Lakes area assessed fish consumption advisory awareness.[47] A telephone survey of over 8,000 people found that women and "non-whites" were less likely to know about fish consumption advisories than their white male counterparts.[48] Imm et al. found similar results in 2001 and 2002. Michigan's population, the greatest consumer of Great Lakes sport fish of all Great Lakes states, is uneven in fish consumption advisory awareness. According to the study, only half of all Great Lakes sport fish consumers were aware of the advisory, and only 15% of black sport fish consumers were aware of the advisory. The situation surrounding race and ethnicity is especially pertinent in the Saginaw River Basin where a 2007 study reported that minority anglers were less aware of current advisories and were consuming high-risk species of fish at a higher rate than whites.[49] While no studies before 1993 reported on fish consumption or advisory awareness, we know fish consumption in Michigan has been an Environmental Justice issue since 1992.

We also examined other factors beyond race and income in many of these articles. While we do not want to discount the importance of such factors as education, age, language, and culture, we do want to highlight the importance of considering race and income as factors. Each of these factors varies greatly by location and study. For example, while education may be a predictive factor in Burger et al.'s 1999 study, results are not determinative for education in Imm et al.'s 2005 study. Language is also another area that is highly variable dependent on the demographics on the locus studied. The California study of

[46] West, P., Fly, M., Larkin, F., & Marans, R. W. (1994). Minority anglers and toxic fish consumption: Evidence from a statewide survey of Michigan. In B. Bryant & P. Mohai (Eds.), *Race and the incidence of environmental hazards: A time for discourse.* Boulder, CO: Westview Press.
[47] Tilden, J., Hanrahan, L P., Anderson, H., Palit, C., Olson, J., Kenzie, W.M. (1997). Health advisories for consumers of Great Lakes sport fish: Is the message being received? *Environmental Health Perspectives, 105*(12).
[48] Ibid.
[49] Michigan Department of Community Health (June, 2007). Fish consumption survey of people fishing and harvesting fish from the Saginaw Bay Watershed. Saginaw Bay Watershed Initiative Network. Retrieved March 20, 2008, from www.twwatch.org.

risk exposure relied heavily on language differences because of the high variety of ethnicities in the area, while Beehler's study looked primarily at English-speaking African Americans.[50] Similarly, the issue of age is also less of a direct determinant in risk exposure because of the high variability of age grouping among studies, and also regional differences. Lastly, cultural variation is very important in the assessment of risk exposure because of the qualitative relationship anglers have with the environment, fishing, and other anglers. Yet not all studies qualitatively examine angler behavior, and therefore, are more difficult to compare across studies. These variations are still important in the study, and push researchers to understand the dynamic relationship of various factors within their specific region.

In 1994, a group of graduate students from the School of Natural Resources and Environment at the University of Michigan conducted a study on the Detroit River concerning risk exposure, fish consumption, and its implications of environmental injustice. The students specifically interviewed African-Americans concerning fishing behavior: how often and what types of fish they caught; how black anglers prepared fish; gift culture versus catch and release; and their willingness to change their behavior. Anglers were also asked to assess the state's efforts in warning them of risks, their general awareness of risks, and what the state could improve its risk communications. The report was an interesting springboard for our study as the results gave us some direction in approaching our analysis. Their findings suggested that African American anglers in the 1990s selected high-risk benthic fish (such as drum and catfish) for consumption as well as more popular sport fish. The study also indicated that most of the anglers held fishing licenses and were aware of risks but did not change their behavior according to the fish consumption guidelines. Three quarters of

[50] Beehler, G., McGuiness, B., & Vena, J. (2001). Polluted fish, sources of knowledge, and the perception of risk: Contextualizing African American anglers' sport fishing practices. *Human Organization, 60*(3).

our interviewees criticized the State of Michigan for not doing enough; there was a general feeling of distrust of the state, the Michigan Department of Natural Resources (MDNR), and Governor Engler. They were also skeptical of the state's efforts to control anglers' behavior rather than pollution.[51]

With this study in mind, we positioned ourselves to understand fish consumption on the Detroit River within a larger socio-historical context. Our study, in contrast to the 1994 perspective, is more balanced by interviews from Canada and the United States, specifically Detroit and other cities along the Detroit River. The demographics are markedly different within each of the areas along the Detroit River, and as the literature review suggests, understanding heterogeneity of angler populations on a particular body of water is necessary in addressing risk exposure. Furthermore, the literature is clear that not all populations use nor perceive natural resources in the same way. For this reason we aim to assess the Detroit River fishing communities by using the variables of race, income, education, age, and gender. This involves a holistic view of the area, its history, resource distribution, and demographics. We have included an explanation of food security, and its importance in the area where people live and fish. As stated previously, fishing is an activity that yields food for some anglers. In the absence of fresh food alternatives, the nutrients that fish provides become ever more important.

Compounding Factors

1. Food Security

Food security, as defined by the United States Department of Agriculture (USDA), refers to the "access by all people at all times to enough nutritious food for an active, healthy

[51] Hornbarger, K., MacFarlene, C., & Pompa, C. R. (1994). Target audience analysis: Recommendations for effectively communicating toxic fish consumption advisories to anglers on the Detroit River. In *Natural Resources Sociology Lab Technical Report #11*. Ann Arbor, MI: Natural Resource Sociology Research Lab, University of Michigan.

life."[52] Yet, there are 13 million children and 23 million adults living in food-insecure households within the United States. In addition, the stress that this places on families has multiple psychological, physiological, and social implications.[53] Simple measures of economic provisioning for food cannot adequately predict the extent to which a family, or individual, has food-security.[54] More recent scholars of food security have focused on the diverse and complex nature of food insecurity, looking towards ways to disaggregate and holistically analyze the issue.[55] In addition to relative cost and access to healthy food sources, it is essential that food sources must be socially and culturally acceptable for those who are suffering from food insecurity. For example, those dealing with hunger must also deal with additional stressors like familial isolation and social stigma when going to food banks or shelters.[56] It is understood that cultural and societal pressures, networks, and knowledge play a role in food security. When social organizations fails to provide secure food sources, hunger ensues, and hunger in turn affects social networks and the functioning of institutional resources.[57]

In Detroit, much attention has been paid to the issue of food security, particularly to the role of grocery stores and fresh food access and quality, as well as the role of urban agriculture. A 2006 study of fresh fruit and vegetable access in the Detroit area reported that the quality and quantity of fresh produce at food stores was significantly less in low-income, African-American communities as compared to middle-income, racially heterogeneous

[52] U.S. Department of Agriculture. (2008). Food and nutrition service. Retrieved March 04, 2008 from http://www.fns.usda.gov/fsec/.
[53] Alaimo, K. (2005). Food insecurity in the United States: An overview. *Top Clinical Nutrician*, *20*(4), 281-298.
[54] Rose, D. (1999). Economic determinants and dietary consequences of food insecurity in the United States. *American Society for Nutritional Sciences.* 129:517-520.
[55] Maxwell, S. (1996). Food security: A post-modern perspective. *Food Policy*, *21*(2), 155-170.
[56] Hamelin, A., Habicht, J., & Beaudry, M. (1999). Food insecurity: Consequences for the household and broader social implications. *American Society for Nutritional Sciences.* 129:525-528.
[57] Molnar, J. (1999). Sound policies for food security: The role of culture and social organization. *Review of Agricultural Economics*, *21*(2) 489-498..

neighborhoods in Detroit.[58] Another report in 2006 rearticulated the food-security debate, stating that of 1,073 total grocery stores in Detroit, most were fringe locations (convenience stores) that specialized in alcohol, money orders, cigarettes, lottery tickets, and other non-food products. Furthermore, the study states that over half of Detroit residents live in areas defined as a food desert, areas that require residents to travel twice as far or farther, to reach main stream grocery stores than a fringe location.[59] This is staggering considering that neither African-American, nor racially heterogeneous low-income neighborhoods contain at least one chain grocery store.[60]

Food security research has neglected to incorporate angling as an aspect of food access and security for those members who use it as a food resource. Perhaps the most significant statistic is that 34% of Great Lakes angling in Michigan occur in Lake St. Clair and the Detroit River. Also, the total amount of fishing activity on the Detroit River has actually increased by 30% from 1984 to 2003.[61] For this reason we have incorporated what we know about food security into our questions on subsistence fishing on the Detroit River and ask what elements make fishing in the Detroit River a secure food resource? Access and availability are two factors that determine whether or not a person has the physical resources or means to fish. However, there are limitations on the quantity of fish permissible to a consumer because of the listed persistent contaminants. Those limitations are contingent on the quality of water that flows down the straight. Anglers, both men and women, depend on the state of Michigan and the Province of Ontario to communicate which fish are acceptable and which are not.

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[58] Zenk, S., Schultz, A., Israel, B., James, S., Bao, S., & Mark Wilson. (2006). Fruit and vegetable access differs by community racial composition and socioeconomic position in Detroit, Michigan. *Ethnicity and Disease, 16*, 275-280.
[59] Gallagher, M. (2006). Examining the impact of food deserts on public health in Detroit. *La Salle Bank Midwest Report.*.
[60] Ibid.
[61] Sharp, E. (April 10, 2003). Fewer anglers find fish at the end of the lines. *Detroit Free Press*.

2. Health Benefits of Fish Consumption

In the late 1970s it was found that Native Alaskans' diets, high in fresh fish consumption, had possibly resulted in longer life expectancies and healthier hearts, sparking much interest and research in the medical and public health fields about the benefits of consuming fish.[62] Through many years of research, it has been discovered that Omega-3 fatty acids are essential for a healthy circulatory system, specifically assisting in lowering blood pressure and the risk of coronary heart disease. Omega-3 fatty acids have also been shown to provide other benefits such as relief from arthritis and maintaining a healthy neurological system.[63]

Fish are high in Omega-3 nutrients and lean proteins, making them a particularly healthy choice in that they provide both nutrients and a low fat protein source.[64] The American Heart Association has since recommended the daily intake of Omega-3 fatty acids for heart and circulatory health, but limits intakes for women and children, indicating the importance of fish consumption while considering the risks.[65]

The many health benefits of consuming fish create a dilemma for those concerned with potential contaminants. Toxicants often enter the human body through the ingestion of fish and other food sources, so that attempts to eat a healthy diet complete with the lean proteins found in fish can be harmful to human health. The contaminants can be especially detrimental to women of childbearing age, developing fetuses and children, as some

[62] Harris, W. (2004). Fish oil supplementation: Evidence for health benefits. *Cleveland Clinic Journal of Medicine*, 71(3).
[63] Ibid.
[64] Sidhu, K. S. (2003). Health benefits and potential risks related to consumption of fish or fish oil. *Regulatory Toxicology and Pharmacology*, *38*, 336-344.
[65] Kris-Etherton, P. M., Harris, W. S., & Appel, L. J. (2003). Omega-3 fatty acids and cardiovascular disease: New recommendations from the American Heart Association. *Arteriosclerosis, Thrombosis and Vascular Biology*, *23*(151).

contaminants can be transferred through breast milk.[66] Balancing a healthy diet with concerns of toxicants in food sources creates confusion and sometimes fear, particularly for those with the least access to clear information.

3. Contaminants in Fish

While there are many potential contaminants in fish, the focus of this study are those contaminants included in fish consumption advisories: mercury, PCBs, and dioxins. Concerns over these contaminants stem from years of scientific and medical research on their human health effects, often most problematic for women of childbearing age, developing fetuses and children. Mercury, PCBs, and dioxin are the three chemicals listed in the Fish Consumption Advisory issued by the Michigan Department of Community Health (MDCH) that are found in the Detroit River. The advisory suggests restricted consumption of several types of fish. Each contaminant is discussed in depth below.

A. Mercury

One of the most commonly cited contaminants in fish is mercury which is typically found in the form methylmercury in the environment. While naturally occurring in small doses, anthropomorphic sources of mercury are typically released into the atmosphere through the burning of fossil fuels and into terrestrial and aquatic environments through mining and other industrial practices.[67,68] Mercury is also found in thermometers, dental amalgam, batteries, and fluorescent light bulbs. In the environment, mercury finds it way into sediments in aquatic ecosystems where it bioaccumulates in fish through the food chain

[66] Ponce, R. A, Bartell, S. M., Wong, E. Y., LaFlamme, D., Carrington, C., Lee, R. C. et al. (2000). Use of quality-adjusted life year weights with dose-response models for public health decisions: A case study of the risks and benefits of fish consumption. *Risk Analysis, 20*(4).
[67] Environmental Protection Agency Fact Sheet: "Mercury Update: Impact of Fish Advisories" June 2001.
[68] Egeland, G. M., & Middaugh, J. P. (1997). Balancing fish consumption benefits with mercury exposure. *Science, New Series, 278*(5345).

and direct exposure to the contaminants.[69] Exposure to mercury has been widely studied and shown to cause neurological problems, vision and hearing loss in adults. High doses of methylmercury have been known to be fatal, such as in Minamata, Japan in the 1950s.[70] The most severe effects are seen on developing fetuses with health issues ranging from mild developmental delays to more severe issues such as cerebral palsy.[71] Great Lakes fish consumers have been found to have a larger amount of mercury in blood samples than normal, but not to any great clinical concern.[72] Fish consumption was first restricted in the Detroit River because of high levels of mercury in 1970.[73]

B. PCBs

Polychlorinated biphenyls, commonly referred to as PCBs are a mix of 209 possible organic and synthetic compounds previously used in a wide range of industrial products because of their diverse properties.[74] These include oil, waxy, non-flammable, chemically stable, high boiling point, and electrical insulating properties.[75] PCBs have been introduced into the environment through industrial processes and waste disposal. These chemicals have been associated with several toxic health effects including cancer, skin rashes and negative effects on the immune, reproductive, nervous, and endocrine systems skin rashes.[76] Human exposure to PCBs typically occurs through the ingestion of contaminated food sources.

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[69] Environmental Protection Agency Fact Sheet: "Mercury Update: Impact of Fish Advisories" June 2001.
[70] Ratcliffe, H. E., & Swanson, G. M. (1996). Human exposure to mercury: A critical assessment of the evidence of adverse health effect. *Journal of Toxicology and Environmental Health, 49,* 221-270.
[71] Clarkson, T. W. (1992). Mercury: Major issues in environmental health. *Environmental Health Perspectives, 100,* 31-38.
[72] Anderson, F., Hanrahan, C., Olson, L., Burse, J., Needham, V. W., Paschal, L. et al. (1998). Profiles of Great Lakes critical pollutants: A sentinel analysis of human blood and urine. *Environmental Health Perspectives, 106*(5) 279-289..
[73] Peakall, D., & Lovett, R. (1972). Mercury: Its occurrence and effects in the ecosystem. *BioScience. 22*(1).
[74] Environmental Protection Agency (1999). Polychlorinated biphenyls (PCBs) update: Impact on fish advisories.
[75] Environmental Protection Agency. (1999). Health effects of PCBs. Retrieved May 6, 2007 from http://www.epa.gov/pcb/pubs/effects.html
[76] Environmental Protection Agency (1999). Polychlorinated biphenyls (PCBs) update: Impact on fish advisories.

Domestic production of PCBs was banned in 1977 when concerns over the compounds' toxicity and persistence were raised. More than 1.5 million pounds were manufactured before production ceased.

PCBs are persistent in the environment and have been shown to accumulate in the tissues of animals because of their fat solubility. Due to the persistence of PCBs in the environment, it is often found in aquatic sediments and throughout the food chain, long after the ban on the creation of new PCBs. Although the EPA reports that there have been long-term declines in PCB concentrations in the Great Lakes since the 1970s, the Detroit River continues to be a significant source of PCBs for Lake Erie.[77] Furthermore, a recent survey of fish consumption advisories demonstrates that although contaminant levels of mercury and PCBs have been declining, restrictions on the consumption of Great Lakes sport fish has become more stringent.[78] According to the EPA, those that rely on seafood and fish for subsistence purposes are at higher risk of being effected by PCBs. This is supported by He et al.'s 2001 longitudinal study on Michigan's Great Lakes sport fish consumers' blood serum levels. Although there has been a slight decline or stabilization in some people, researchers found that there has been no significant change in the amount of PCBs found in Great Lakes sport fish consumers' blood serum from 1973 to 1993.[79] This was attributed to the continued exposure to and the long half-life ofPCBs.

C. Dioxins

Polychlorinated Dibenzo-p-dioxins, commonly known as dioxins, are a group of synthetic organic chemicals. They are produced unintentionally as a byproduct of industrial

[77] Environmental Pretection Agency. (2003). *Evaluating ecosystem results of PCB control measures within the Detroit River-Western Lake Erie Basin*. Chicago, IL: Great Lakes National Program Office.
[78] Ibid
[79] He, J., Stein, A., Humphrey, H., Paneth, N., & Courval, J. (2001). Time trends in sport-caught Great Lakes fish consumption and serum polychlorinated biphenyl levels among Michigan anglers, 1973-1993. *Environmental Science and Technology, 35*(3).

processes such as incineration, combustion, and the bleaching process of pulp wood.[80] Additional sources include diesel trucks and the burning of treated wood. Dioxins are typically released into the atmosphere or introduced into the environment through waste disposal processes.

Humans are most prominently exposed to dioxins through the consumption of food such as fish, meat, and dairy as it accumulates in the fat of animals and is passed through the food chain. The contaminants tend to settle out of the air and into soils and water, building up in the fat of fish. Dioxins are persistent in the environment and they tend to bio-accumulate in fish through the food chain. The accumulation of dioxins in fish creates a risk for anglers, particularly those urban anglers that fish near the source of such contaminants.[81]

Dioxins include a broad array of chemical compounds that share the ability to act as a hormone, a subtle attack on the human and animal body that is not entirely understood.[82] Chemicals that act as hormones are known as endocrine disruptors that have been linked to cancer, particularly in women. Research on animals exposed to dioxins has also shown toxic effects on the liver, gastrointestinal system, blood, skin, endocrine, immune, nervous, and reproductive systems.[83] Long-term human exposure to toxins is typically difficult to study. A massive dioxin release in Sevaso, Italy in 1976 provided such an opportunity for Italian researchers. Bertazzi et al. found that while it remained difficult to prove conclusively that those exposed to the highest levels of dioxins had increased health effects, they did find that in a 15 year period, cancer deaths for men in the exposed areas were greater than the rest of

[80] Environmental Protection Agency (1999). Polychlorinated biphenyls (PCBs) update: Impact on fish advisories.
[81] Ibid.
[82] Birnbaum, L. S. (1994). The mechanism of dioxin toxicity: Relationship to risk assessment. *Environmental Health Perspectives*, *102* (Supplement 9: Toxicological Evaluation of Chemical Interactions).
[83] Environmental Protection Agency (1999). Polychlorinated biphenyls (PCBs) update: Impact on fish advisories.

the population. They suffered other health effects such as respiratory and circulatory system diseases.[84]

4. Communicating the Risks: The Role of the State

In the late 1980s, many U.S. states began looking at ways to protect their constituents from toxicants and created fish consumption advisories. In Canada, this process began earlier in the mid 1970s. The advisories incorporate specific guidelines for people to safely eat fish that include size, specie, and number of meals for a given time period for each population, with more vulnerable populations typically receiving more stringent restrictions. These advisories are created as guidelines for consumers of sport caught fish, with the ultimate choice of which fish and in what quantities they should be eaten being left to the angler to decide. Those who do not receive this information are unable to balance the risks and benefits of fish consumption through an informed decision. For others, factors such as food insecurity and poverty outweigh the risks of eating fish. Thus, the role of the state is to not only to attempt to protect their constituents by providing accurate, timely, and accessible information, but also to assist those who must make these difficult decisions.

A brief description of the fish advisory process illustrates the administrative differences in communication between the United States and Canada. In the United States, state governments individually create and issue fish consumption advisories in a wide variety of ways. Only mercury levels are suggested on the federal level by the U.S. EPA and Food and Drug Administration. Some governments prefer statewide advisories, and others, a smaller scale advisory on a county or watershed level, often depending on how their local governments function and which agency is responsible for issuing the advisory. Further

[84] Bertazzi, P. A., Consonni, D., Bachetti, S., Rubagotti, M., Baccarelli, A., Zocchetti, C. et al. (2001). Health effects of dioxin exposure: A 20-year mortality study. *American Journal of Epidemiology, 153*(11).

variation occurs with regards to the type of advisories, if they are specific to a body of water or region, or for commercially caught fish. The lack of a universal mandate or guidelines for creating state specific advisories leads to confusion and extreme variations in the quality of the advisories and outreach methods.

The process in Canada is more streamlined with fewer agencies and perhaps more resources. The acceptable level of contamination ingested through fish consumption is administered federally by Health Canada which provides that information to Environment Canada. Environment Canada is then responsible for communicating that information on the provincial level as well as for sampling and testing fish for contamination. In Windsor, the largest Canadian city on the Detroit River, fish consumption advisories are distributed by the Ontario Ministry of Environment when a fishing license is purchased. In the U.S., mercury advisories are suggested by the U.S. EPA and Food and Drug Administration, but these governmental departments depend on the states to provide contamination advisories. Dioxin and PCB advisories are created by individual states with varied processes and there is no uniform guide for fish consumption advisories; however, the Great Lakes states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin wrote the Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory.[85] Though most have utilized parts of the protocol for regional advisories, each state adapted it for their own needs.[86] The MDNR tests fish at various locations throughout Michigan and relays the results to the MDCH. The MDCH subsequently establishes the fish advisory based upon the results from the analysis of toxins in the fish samples. These fish advisories are then made available online at specified websites. Detroit and Windsor anglers receive two different

[85] Anderson, H., Amrhein, J. F., Shubat, P., & Hesse, J. (1993). Protocol for a uniform Great Lakes sport fish consumption advisory. Great Lakes Fish Advisory Task Force Protocol Drafting Committee.
[86] Fischer, L. J., Bolger, P. M., Carlson, G. P., Jacobson, J. L., Knuth, B. A., Radike, M. J. et al. (1995). *Critical Review of a Proposed Uniform Great Lakes Fish Advisory Protocol.* Lansing: Michigan Environmental Science Board, Lansing.

advisories for the Detroit River. Many U.S. residents visit Canada to fish, and are thereby required to purchase Canadian fishing licenses where they are provided Canadian advisories, resulting in these anglers coming away with a different message, which adds to their confusion.

Table 3.2 Species Listed in the Michigan and Ontario Advisories[87] [88]

Michigan Advisory		Ontario	
Species	**Contaminants**	**Species**	**Contaminants**
Carp	PCBs, Dioxin	Carp	Mercury, PCBs, Dioxin, Furans, Chlorinated phenols, Chlorinated benzenes, Polycyclic aromatic hydrocarbons
Freshwater Drum	Mercury, PCBs	Freshwater Drum	Mercury, PCBs
Northern Pike	PCBs	Northern Pike	Mercury, PCBs
Walleye	PCBs	Walleye	Mercury, PCBs, Dioxins, Furans
Yellow Perch	PCBs	Yellow Perch	Mercury, PCBs
Suckers	PCBs		
		White Perch	Mercury, PCBs
		White Bass	Mercury, PCBs, Dioxin, Furans, Dioxin-like PCBs
		Rock Bass	Mercury, PCBs
		Catfish	Mercury, PCBs, Dioxin, Furans, Dioxin-like PCBs

United States and Michigan Fish Consumption Advisories

The Michigan Fish Consumption Advisory is a 25 page pamphlet organized by watershed. As seen in figure 3.1 below, it consists of a table with many shapes and boxes. The introduction to the advisory includes a brief discussion of the risks and benefits of eating

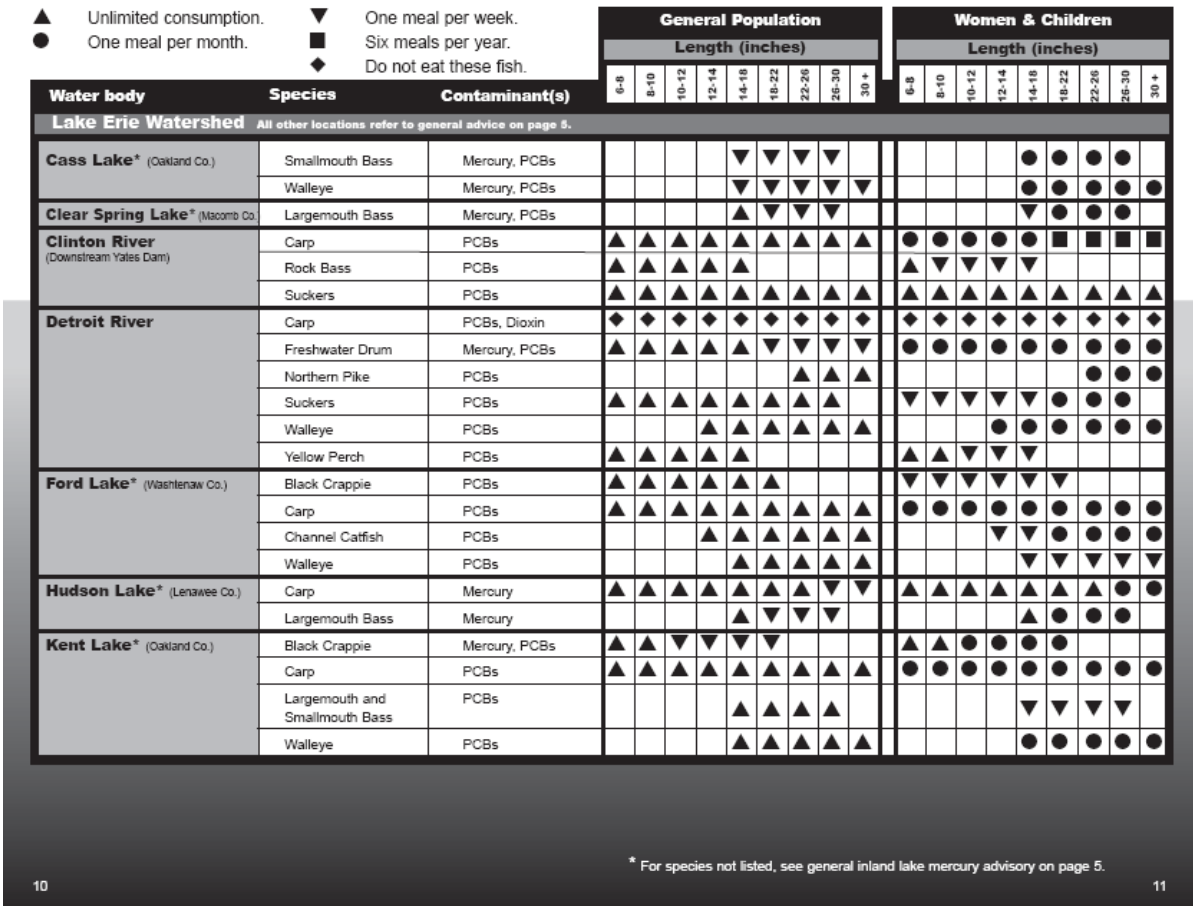
[87] Michigan Department of Community Health. (2007). *Michigan family fish consumption guide*. Retrieved March 4, 2008, from http://www.michigan.gov/dnr/0,1607,7-153-10364---,00.html
[88] Ontario Ministry of the Environment. (2007). *Guide to eating Ontario sport fish, 24th edition*. Retrieved March 4, 2008, from http://www.ene.gov.on.ca/envision/guide/

fish, the safest ways to prepare fish, and a description of how to use the information contained in the tables.[89] The advisory specifies how many fish of a particular specie and size in a specific body of water are acceptable to eat per month. These recommendations aid in making the decision to avoid potentially adverse effects of PCBs, mercury, and in some cases dioxins. The advisory considers the average meal to be half a pound of fish and recommends that women and children, considered sensitive sub-populations, eat less fish per month than the average male angler weighing 155 pounds. In Michigan, six species from the Detroit River are listed with consumption limits.

The fish consumption advisory process in Michigan includes several institutional players. Fish are collected for sampling by the MDNR and tested for contamination by the Michigan Department of Environmental Quality (MDEQ). The monitoring results are sent to the MDCH which determines what amounts of contaminants are safe to eat and issues the advisory.

[89] Michigan Department of Community Health. (2007). *Michigan family fish consumption guide*. Retrieved March 4, 2008, from http://www.michigan.gov/dnr/0,1607,7-153-10364---,00.htm

Figure 3.1 2007 Michigan Family Fish Consumption Guide, Pages 10 and 11[90]



▲ Unlimited consumption. ● One meal per month. ▼ One meal per week. ■ Six meals per year. ◆ Do not eat these fish.

Water body	Species	Contaminant(s)	General Population Length (inches) 6-8	8-10	10-12	12-14	14-18	18-22	22-26	26-30	30 +	Women & Children Length (inches) 6-8	8-10	10-12	12-14	14-18	18-22	22-26	26-30	30 +
Lake Erie Watershed All other locations refer to general advice on page 5.																				
Cass Lake* (Oakland Co.)	Smallmouth Bass	Mercury, PCBs					▼	▼	▼	▼						●	●	●	●	
	Walleye	Mercury, PCBs					▼	▼	▼	▼	▼					●	●	●	●	●
Clear Spring Lake* (Macomb Co.)	Largemouth Bass	Mercury, PCBs					▲	▼	▼	▼						▼	●	●	●	
Clinton River (Downstream Yates Dam)	Carp	PCBs	▲	▲	▲	▲	▲	▲	▲	▲	▲	●	●	●	●	●	■	■	■	■
	Rock Bass	PCBs	▲	▲	▲	▲	▲					▲	▼	▼	▼	▼				
	Suckers	PCBs	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Detroit River	Carp	PCBs, Dioxin	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
	Freshwater Drum	Mercury, PCBs	▲	▲	▲	▲	▲	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●
	Northern Pike	PCBs							▲	▲	▲							●	●	●
	Suckers	PCBs	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	▼	●	●	●	
	Walleye	PCBs				▲	▲	▲	▲	▲	▲				●	●	●	●	●	●
	Yellow Perch	PCBs	▲	▲	▲	▲	▲					▲	▲	▼	▼	▼				
Ford Lake* (Washtenaw Co.)	Black Crappie	PCBs	▲	▲	▲	▲	▲	▲				▼	▼	▼	▼	▼	▼			
	Carp	PCBs	▲	▲	▲	▲	▲	▲	▲	▲	▲	●	●	●	●	●	●	●	●	●
	Channel Catfish	PCBs				▲	▲	▲	▲	▲	▲				▼	▼	●	●	●	●
	Walleye	PCBs					▲	▲	▲	▲	▲					▼	▼	▼	▼	▼
Hudson Lake* (Lenawee Co.)	Carp	Mercury	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲	▲	▲	▲	▲	▲	▲	●	●
	Largemouth Bass	Mercury					▲	▼	▼	▼						▲	●	●	●	
Kent Lake* (Oakland Co.)	Black Crappie	Mercury, PCBs	▲	▲	▼	▼	▼	▼				▲	▲	●	●	●	●			
	Carp	PCBs	▲	▲	▲	▲	▲	▲	▲	▲	▲	●	●	●	●	●	●	●	●	●
	Largemouth and Smallmouth Bass	PCBs					▲	▲	▲	▲						▼	▼	▼	▼	
	Walleye	PCBs					▲	▲	▲	▲	▲					●	●	●	●	●

* For species not listed, see general inland lake mercury advisory on page 5.

10 11

The number of fish advisories that are in effect in the United States has grown substantially since their inception. According to the EPA, the total number of advisories nationwide had grown to 3,852 by 2006. This amounts to a total of 38% of the nation's lakes, or 15,368,068 lake acres, and 26% of total river miles, or 930,938 miles total. All of the Great Lakes states, namely: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin include 100% of their lakes under fish consumption advisories, and all but Minnesota and Michigan have included 100% of their rivers. However, Michigan and Minnesota have 3.5% of their rivers under a fish advisory, which is significantly higher than all but 3 other states that do not include all of their rivers under advisory.[91]

[90] Michigan Department of Community Health. (2007). *Michigan family fish consumption guide*. Retrieved March 4, 2008, from http://www.michigan.gov/dnr/0,1607,7-153-10364---,00.html

[91] Environmental Protection Agency. (2007). EPA fact sheet. In *2005/2006 National listing of fish advisories*.

Although the State of Michigan has established an extensive reporting strategy for fish contaminant monitoring,[92] communicating those results to a non-technical audience is challenging. A study completed in 1997 reported that among the estimated 376,000 Great Lakes anglers, only half were aware of Great Lakes fish consumption advisories. Of those who were aware of the advisory, more men were aware than women, and more white anglers were aware than minority anglers.[93] This was attributed to the fact that advisories were received with the purchase of a fishing license, though this is no longer the case. Also, in response to these findings many Great Lakes states produced targeted fish consumption advisories directed to either people of color and/or women of reproductive age to fill the gap for at-risk consumers.[94]

Michigan's health risks communications were targeted to women and children through the Michigan Family Fish Consumption Guide until budget cuts undermined the states ability to do so. In 2004, the MDCH cut its $350,000 appropriations to update and distribute the Michigan Family Fish Consumption Guide. In 2002 and 2003, 50,000 copies were distributed to local health departments, WIC offices, all in addition to the normal distribution that took place when fishing licenses were purchased.[95] Michigan is currently under unprecedented budget constraints and anglers report a lack of access to a physical advisory, though the updated version is available on the MDNR and MDCH websites. The current online addition is targeted to the sport angler that has internet access. The lack of a

[92]Michigan Department of Environmental Quality.. Michigan fish contaminant monitoring online database. Retrieved February, 2008, from http://www.deq.state.mi.us/fcmp/Sites.asp

[93] Tilden, J., Hanrahan, L P., Anderson, H., Palit, C., Olson, J., Kenzie, W.M. (1997). Health advisories for consumers of Great Lakes sport fish: Is the message being received? *Environmental Health Perspectives, 105*(12).

[94] Ashizawa, A., Hicks, H. E., & De Rosa, C. T. (2005). Human health research and policy development: Experience in the Great Lakes region. *International Journal for Hygiene and Environmental Health, 208*.

[95] Chambers, J. (2004, June 18) State guide to eating fish is victim to cuts – Pregnant women, anglers will have to use old information. *Detroit News*

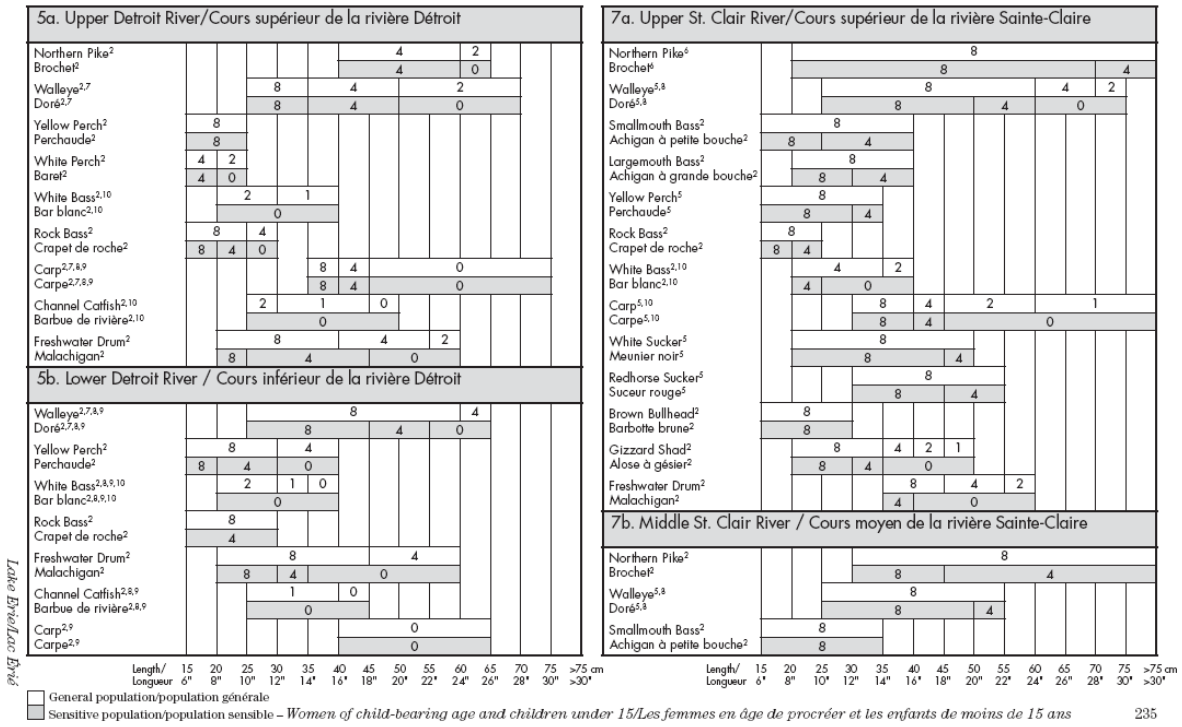
physical advisory pamphlet adds additional confusion and often leaves out vulnerable populations.

Canada and Ontario Fish Consumption Advisories

Canadian fish consumption advisories are presented in the form of a detailed, 279 page document. The physical document is available when a fishing license is purchased, online, and in several other locations such as bait shops, Canadian Tire stores, and liquor stores. The introduction to the guide contains detailed descriptions of the fish testing process, advice for cooking and cleaning fish, descriptions of how to use the guide, historical context of the advisory and monitoring process, and detailed information about each contaminant. The guide is available in 19 languages.[96] Canada began an extensive fish monitoring program in 1976, with the first guide being published in 1977. The current guide recommends restricted consumption of nine species and fish consumption is suggested to be no more than eight servings per month for all populations.

[96] Ontario Ministry of the Environment. (2007). *Guide to eating Ontario sport fish, 24th edition*. Retrieved March 4, 2008, from http://www.ene.gov.on.ca/envision/guide/

Figure 3.2 Guide to Eating Ontario Sport Fish 2007-2008 Edition, Page 235



Fish Consumption on the Detroit River

Residents of Detroit and the surrounding area utilize the Detroit River Area of Concern as a food source.[97] According to the MDNR, fishing on the Detroit River has increased by nearly 30% from 1983 to 2002. Yet, the Detroit River subsistence angler population is quite different from the angler population of greater Michigan and Canada. It is urban, and the resource is located in proximity to several industrial areas and potential sources of contaminants that may compound the risk of exposure. In addition to external pressures, minority and low-income subsistence anglers of the Detroit River are less likely to be aware of the advisory, risks of eating sports fish, and are less likely to practice mitigating measures of catch and preparation.[98] Therefore, urban subsistence anglers are at a high risk

[97] West, P., Fly, M., Larkin, F., & Marans, R. W. (1994). Minority anglers and toxic fish consumption: Evidence from a statewide survey of Michigan. In B. Bryant & P. Mohai (Eds.), *Race and the incidence of environmental hazards: A time for discourse.* Boulder, CO: Westview Press.

[98] Silverman, W. (1990). P. West & W. Redman (eds.). *Michigan sport fish consumption advisory: A study in risk communication.* Ann Arbor, MI: School of Natural Resources and Environment, University of Michigan.

of exposure to PCBs, mercury, and dioxins, and their adverse effects—and yet this group has not been recognized as an at-risk group.

Yet as we have demonstrated here, there is a large body of literature that investigates at-risk anglers based on categories beyond that of just gender. Scholars from coast to coast have investigated how populations' risks may increase based on a series of factors including, but not limited to, gender, age, education, income, and race or ethnicity. They have not only investigated these categories as independent variables, but have also investigated reasons why fishing continues despite risks.

CHAPTER 4: METHODS

CHAPTER 4: METHODS

Methods for Analyzing Characteristics of Detroit River Anglers

This practicum utilized a two pronged approach to analyze the objectives and questions regarding environmental justice issues surrounding fish consumption advisories in the Detroit River Area of Concern: directly interviewing anglers and analyzing the public actions of institutional stakeholders. The methods section is therefore divided into two subsections that outline these separate methodologies.

The first phase of this project included creating and conducting creel surveys with urban anglers on the Detroit River in both Michigan and Ontario. Creel surveys are a method of interviewing anglers during or after fishing activities to determines the number and species of fish they catch as well as other pertinent information regarding the human dimension, fishing experience, and natural environment.[99]

The second phase of this project examined the institutional stakeholders with the ability to make decisions regarding fish consumption advisories on the Michigan shores of the Detroit River. This was conducted to determine what types of actions are being taken by those charged with providing information to those that need it most. This analysis included only Michigan agencies due to the existence of greater environmental justice concerns and risk communication issues in the Detroit area rather than in Ontario.

Angler Survey

Design

The angler survey was designed to reflect our research questions using a matrix of each objective and corresponding question. This method ensured that each research question was addressed, each survey question was valid, and that the overall survey was brief. It

[99] Ditton, R.B. and K.M. Hunt. 2001. Combining Creel Intercept and Mail Survey Methods to Understand the Human Dimensions of Local Freshwater Fisheries. *Fisheries Management and Ecology*. Vol 8, No 4-5, pp 295-301.

included a mixture of structured and open-ended questions. The first few questions were designed to create a relationship with anglers as well as learn about their fishing habits and attitudes. The rest of the survey directly related to our research questions and hypothesis. The combination of structured and open ended questions allowed us to give a brief, ten minute survey and still conduct in-depth analysis of the respondents.

The angler survey is an adaptation of the mental models approach as developed by Morgan et al.[100] This approach uses a systematic method to capture "free responses" from interviewees. Instead of pre-constructing responses that we believed the sample population would give, the mental models approach allowed us to capture their unique responses, the open-ended questions allowing the sample population to express beliefs about hazards and risk in their own terms.[101] Using open-ended questions allowed the interviewer to elicit more complete information from the anglers' thought processes. During the interview process, patterns and/or similar responses emerged, at which point the open-ended questions were transformed into categorical answers.

Due to the nature and time constraints of our practicum we did not use the full mental models approach. Instead, an adaptation of this approach which allowed the use of some structured and open-ended questions was utilized. This provided an opportunity for the researchers to establish a rapport with the anglers, while not taking up too much of their time. It also allowed for greater depth of analysis of many of the questions in the survey. Structured questions can be administered and analyzed much more efficiently than open ended questions.[102] In addition, the use of structured questions allows one to obtain a frequency of a response, hazard or concern much more quickly and efficiently than an open-ended question. Understanding the frequency and breadth of responses targets the concepts

[100] Morgan, G. M., et al. (2002) *Risk communication*. UK: Cambridge University Press.
[101] Ibid., 20.
[102] Ibid., 84.

and misconceptions that are commonly shared throughout the target population.[103] This is the simplest form of analysis to see how prevalent a particular topic or concern is in the community.[104]

Pilot Survey

We began the survey process by drafting a pilot survey with questions targeting our hypothesis. The pilot survey largely consisted of open-ended questions so that we could record a wide range of the anglers' responses. The pilot survey was conducted in early May of 2007 at fishing spots along the Huron River in Ypsilanti and Ann Arbor, Michigan. The Ypsilanti area was selected for the pilot survey to minimize any potential for contaminating our survey population as well as its demographic and economic situation, which were similar to those of Detroit. The responses from the pilot study and conversations with anglers were used to modify and refine the final angler survey.

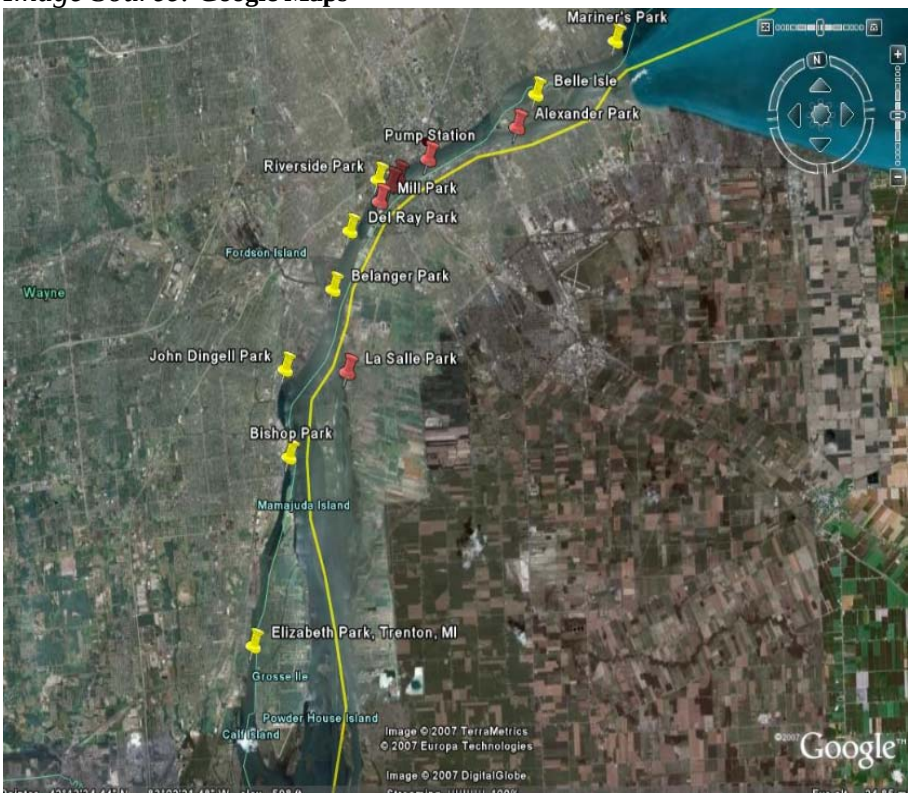
Detroit River Site Selection

The interview sites were selected through a "windshield" site tour of public fishing locations and by word of mouth from anglers throughout the interview process. The windshield survey was conducted by driving along the length of all 32 miles of the Detroit River in Michigan and Ontario and visiting public fishing access points and boat launches. These site tours were conducted in early May on a fair weather, Saturday afternoon when many fishing spots were busy. The parks where anglers were present and fishing were noted on maps and numbered. Many of the popular or best fishing locations are known only to the fishing community, so we visited other locations that were not included in our original assessment throughout the survey process. Only legal, public access fishing locations were

[103] Ibid., 84.
[104] Ibid., 79.

considered for this study for the safety of both the researchers and anglers, though anglers were observed fishing on private property.

Figure 4.1 : Fishing locations, Yellow tacks in Michigan, Red in Ontario
Image Source: **Google Maps**



Survey Day Selection

Interviews were conducted three days a week over an eight week period. Researchers were assigned in pairs to each survey day. Two researchers were required to attend each survey day for safety and time management purposes. Every Saturday and Sunday was designated as two of our three interviewing days and the third day was a randomly selected weekday. The following process was used to equally balance the five possible selections: Monday, Tuesday, Thursday, and Friday were each written on one slip of paper, while Wednesday was written on two slips of paper. A coin toss determined if Monday and Tuesday or Thursday and Friday would be written on a second slip of paper so that eight total slips of paper would be produced. The eight slips were placed randomly in

eight envelopes. Each envelope was then opened and the day of the week written on the slip of paper determined the order of weekday survey days. The survey schedule left some flexibility to account for inclement weather and new information regarding fishing locations. A few days of inclement weather were encountered and rescheduled while keeping the number of week and weekend days within the preplanned ratio. We conducted surveys during the period of August 8, 2007 to September 22, 2007.

Statistical Analysis Methodology for Characteristics of Detroit River Anglers

Data Collection

The collected close-ended survey data were entered into a Microsoft Excel spreadsheet and coded. For example, our classification for country was 1 for the United States and 2 for Canada. The open-ended questions were entered verbatim into the database program Filemaker Pro. Each interviewer entered the responses for the interviews she conducted to maintain accurate transcription. To obtain a deeper analysis of the frequency, content, and interest of each respondent,[105] the open-ended responses were coded into distinct variables to allow us to treat them as categorical variables in SPSS.

The demographic variables that characterized our sample population included: race, income, gender, country (United States versus Canada), site, the range of number of fish taken home, catch and release, and non-catch and release. These demographic variables allowed us to analyze our data through the lens of environmental justice. The remaining response variables were analyzed against the sample population environmental justice indicators. Since our data were categorical in nature the chi-square test with an alpha level of .05 was used to determine significance.

[105] Ibid., 79.

Statistical Analysis Methodology for Stakeholders

The external analysis was conducted by searching eleven web-based sites for six selected stakeholders and key words related to fish consumption advisories and environmental justice on the Detroit River. The time frame searched varied by the specific internet-based source. For two searches, The Detroit News and Lansing State Journal, sources dated back to 1999, limited by the search archives capacity; The Detroit Free Press used sources dating back to 1994; and the other search engines used current dates available online. For analysis purposes, each stakeholder was assigned numeric coding: MDCH (1), EPA (2), MDCH (3), USFWS (4), MDEQ (5), and Wayne County (6). The 10 key workd search variables used in this analysis included: the Detroit River, chemicals (mercury, PCB and dioxin), river cleanup, environment, fish (included fishing), justice, license (included permit and permit violation), Wayne County (parks), pollution, and racism. The Detroit River was used as a constant in all searches. The frequency of occurrence of our search terms was recorded. We used the cluster analysis module within SPSS to determine each stakeholder's association with the search variables. Each cluster analysis set a limit of three clusters because the six stakeholders represented three areas. For example, one would expect the U.S. Fish and Wildlife Service and the EPA to have a natural grouping because they are both federal environmental agencies. The resulting clusters differed from each other based on the significant of the variables from an ANOVA with an alpha level of .05.

A factor analysis was conducted to consolidate the topic variables and stakeholder data into meaningful variables. In a factor analysis, a variable's appearance on a given factor signifies its hypothetical correlation with that factor. Variables that load strongly on on a factor are assumed to represent a common construct. Within SPSS we used the

principal components factor analysis followed by varimax rotation to obtain what is known as “simple structure” resulting in factors with variables that load strongly on one factor.

CHAPTER 5: RESULTS

CHAPTER 5: RESULTS

Results from Detroit River angler analysis

One hundred and forty-eight anglers were approached and 115 surveys were conducted. Response rates were highest during the middle of the interview period, and began to decline near completion due to repeat candidates and the end of the summer fishing season. Interviewees included those actively engaged in fishing and recreation on the Detroit River front.

Angler demographics

Angler demographics are presented in Table 5.1. Percentages for the characteristics were computed for valid responses. A total of 78 anglers (67.8%) were interviewed in the United States and 37 anglers (32.2%) were interviewed in Canada. The majority of Michigan anglers were interviewed "Downriver" in areas that included Trenton, Ecorse, Wyandotte, and River Rouge for a total at 41.7% of the sample population (*n* 48), while 26.1% of the sample population (*n* 30) were interviewed in the Detroit area. Approximately 83% (*n* 94) of the anglers surveyed were male and 16.8% of the anglers surveyed were female. The median and mode age group was 41 to 65 years of age (*n* 72) with 64.9% of the population. The median age was 45 years old.

Table 5.1 Selected Angler Demographics

Characteristic	n	(%)
Race, N = 111 (unknown for 4 or 3.5%)		
Caucasian	45	40.5
People of Color	66	59.5
Country, N = 115		
Canada	37	32.2
USA	78	67.8
Income, N = 97 (unknown 18 or 15.7%)		
$0-24,999	13	13.4
$25,000-49,999	35	36.1
$50,000-74,999	29	29.9
$75,000-100,000+	20	20.6
Gender, N = 113 (unknown 2 or 1.7%)		
Male	94	83.2
Female	19	16.8
Education, N = 104 (known 11 or 9.6%)		
High school & less	56	53.8
Higher education	48	46.2
Location, N = 115		
Detroit	30	26.1
Downriver	48	41.7
Canada	37	32.2
Age, N = 111 (unknown 4 or 3.5 %)		
18 to 40	33	29.7
41 to 65	72	64.9
Greater than 66	6	5.4

The largest ethnic group was Caucasian, 40.5% (*n* 45), followed by African-American 38% (*n* 44), Asian/Pacific Islander 3% (*n* 4), Latino 3% (*n* 3), Arab/Middle Eastern 4% (*n* 5), Native American 1% (*n* 1), multiracial 4% (*n* 5), and other 4% (*n* 3). Combined, people of color composed 59.5% of the population (*n* 66). The most frequently reported household income level was $25,000 – 49,999, 36.1% of the sample population (*n* 35). The second most frequently reported income was $50,000 – 74,000, 29.9% of the sample population (*n* 29). Approximately 13% of the population earned $24,999 annually or below (*n* 13). For education attainment, 53.8% of the population had a high school education or less

(*n* 56) and 46.2% (*n* 48) of the population had obtained higher education (trade school, some college, associate's, bachelor's, and master's degree or above).

Food Security: Importance to Diet, Number and Specie of Fish Taken Home

Respondents were asked how important fish was to their diet. The demographic breakdown of anglers that reported fish important to their diet is presented in Table 5.2. The responses were statistically significant based on race, location, and age. More than three quarters of people of color stated that fish was important to their diet (*n* 57) and more than 80% of Detroit anglers reported fish to be important to their diet. Downriver anglers also reported fish to be more important to their diet (67.4%, *n 43)* than anglers in Canada, yet our analysis between the United States and Canada was not significant. Anglers within ages 40 to 65 (80%, *n* 70) and ages greater than 66 (80%, *n* 5) reported fish consumption to be very important to their diet. This variable was not significant based income, gender, and education yet within the entire angler population having fish in their diet proved favorable.

Table 5.2 Percent of Anglers Who Stated that Fish Was Important to Their Diet

Characteristic	%	X^2	p
Race			
Caucasian	59.5	3.832	.050
People of Color	78.9		
Country			
Canada	61.1	1.767	.184
USA	73.6		
Income			
$0-24,999	66.7	.665	.881
$25,000-49,999	63.6		
$50,000-74,999	78.6		
$75,000-100,000+	66.7		
Gender			
Male	68.5	.426	.514
Female	76.5		
Education			
High school & less	64.2	2.169	.141
Higher education	77.8		
Location			
Detroit	82.8	3.682	.159
Downriver	67.4		
Canada	61.1		
Age			
18 to 40	48.3	10.255	.006
41 to 65	80		
Greater than 6 5	80		

To better understand how important caught fish was to the anglers' diet, we asked them how many fish they took home per week. This question was first divided into three categories: takes home more than 10 fish per week, takes home less than 10 fish per week, and catch and release (takes home no fish). The responses were also divided into two other categories: catch and release, and take home fish (more than 10 fish a week and less than 10 fish a week combined). Table 5.3 displays the results and demographics of fishing habits. More than half of Caucasians interviewed practiced catch and release fishing (*n* 45), whereas 34.4% of people of color interviewed practiced catch and release. The practice of catch and

release was statistically significant by country; Canadian anglers practiced catch and release 55.6% (*n* 36*)* of the time while U.S. anglers practiced catch and release only 35.6% (*n* 73) of the time.

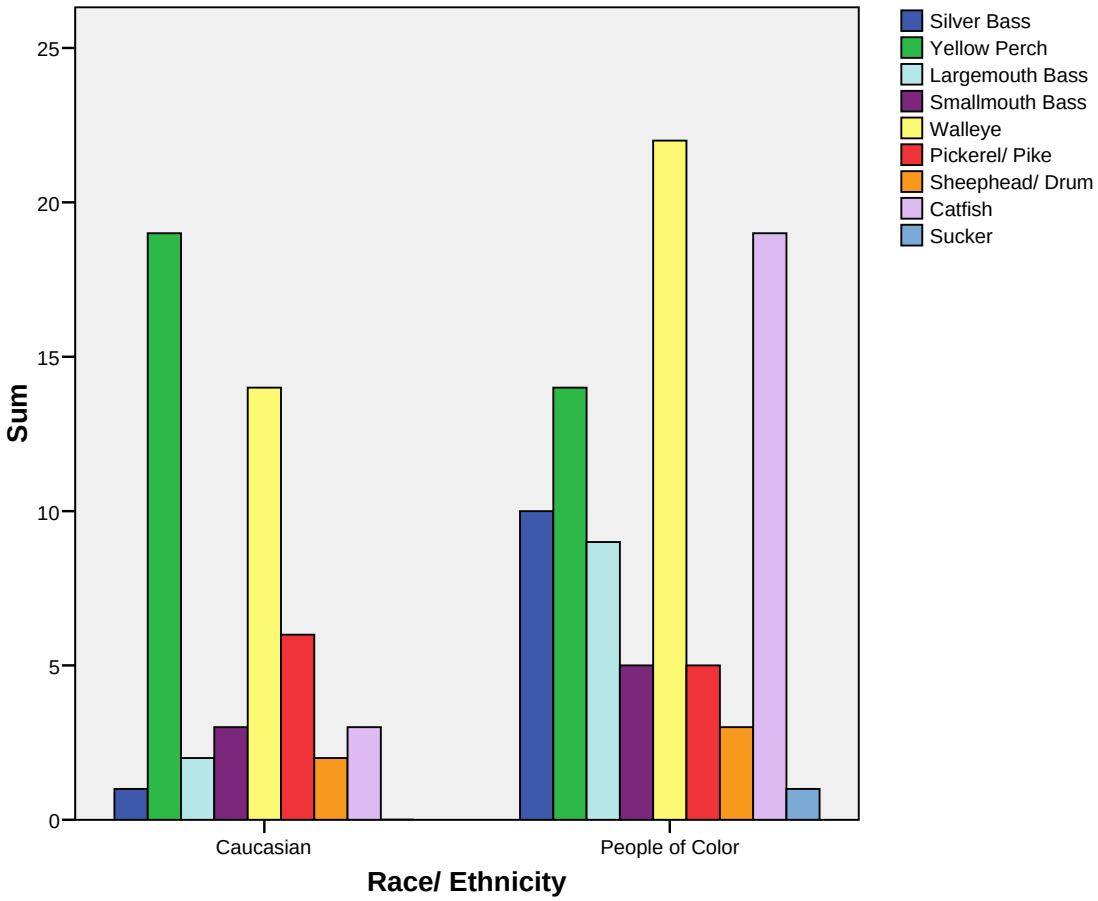
Table 5.3 Demographics and Take Home Fish versus Catch and Release

Characteristic	Catch & Release (%)	Take home (%)	X^2	p
Race				
Caucasian	53.3	46.7	3.789	.052
People of color	34.4	65.6		
Country				
Canada	55.6	44.4	3.930	.047
USA	35.6	64.4		
Income				
$0-24,999	46.2	53.8	1.724	.881
$25,000-49,999	42.4	57.6		
$50,000-74,999	38.5	61.5		
$75,000-100,000+	50	50		
Gender				
Male	44.6	55.4	.988	.320
Female	31.3	68.8		
Education				
High school & less	45.5	54.5	.300	.584
Higher education	40	60		
Location				
Detroit	28.6	71.4	4.854	.088
Downriver	40	60		
Canada	55.6	44.4		
Age				
18 to 40	39.4	60.6	1.775	.412
41 to 65	44.1	55.9		
Greater than 66	16.7	83.3		

The most common species of fish taken home by anglers were walleye and catfish. Figure 5.1 depicts the breakdown of species taken home and angler race/ethnicity. Thirty percent of people of color interviewed took home catfish (*n* 61), while approximately 7% of Caucasians took home caught catfish (*n* 45). The amount of catfish taken home was also

significant for location and age. Thirty-one percent of Downriver anglers interviewed took home catfish versus anglers in Detroit and Canada, who took home 10% (*n* 30) and 14% (*n* 37), respectively, of the catfish they caught. Twenty-one percent of anglers interviewed between 18 and 40 years of age, 21.1% (*n* 33), and 67% of those older than 66 (*n* 6) years of age, kept most of their catfish. Walleye was significant by location and country. U.S. anglers took home 42.3% (*n* 78) of their caught walleye. Accordingly, Detroit and Downriver anglers kept 40% (*n* 30) of their caught walleye versus the 48.3% (*n* 48) of Canadian anglers interviewed who kept 13.5% (*n* 37) of their caught walleye.

Figure 5.1 People of Color, Caucasians, and Types of Caught Fish Species



Food Security: Fishing frequency

Two groups were determined through fishing frequency: those that fished more than once per week and those that fish less than once a week, as displayed in Table 5.4. People of

color generally fished more than once a week (81.3%, *n* 60), and more often, than Caucasians (60.50%, *n* 43). Men reportedly fished more than once a week (77.4%, *n* 93), and more often, than women (44.4%, *n* 18). The other indicator variables failed to be statistically significant, yet our results demonstrate that the Detroit River angler population generally fished more often than once a week.

Table 5.4 Fishing Frequency

Fishing Frequency	Less than once per week (%)	More than once per week (%)	X^2	p
Race				
Caucasian	30.5	60.5	5.6	.018
People of color	18.8	81.3		
Country				
Canada	34.3	65.7	1.027	.311
USA	25	75		
Income				
$0-24,999	15.4	84.6	1.886	.596
$25,000-49,999	27.3	72.7		
$50,000-74,999	25	75		
$75,000-100,000+	36.8	63.2		
Gender				
Male	22.6	77.4	6.6	.01
Female	52.9	47.1		
Education				
High school & less	25.9	74.1	.039	.844
Higher education	27.7	72.3		
Location				
Detroit	16.7	83.3	2.737	.255
Downriver	30.4	69.6		
Canada	34.3	65.7		
Age				
18 to 40	32.3	67.7	.816	.665
41 to 65	24.3	75.7		
Greater than 66	66.7	66.7		

Food Security: Environmental Justice

To investigate fish consumption and fishing rates as an environmental justice issue, we combined the race and income variables. The intersection of race, income, and fishing frequency is presented in Table 5.5. Income was bifurcated at $50,000 annually into high and low income categories. Here high and low-income people of color fished more than once per week at a rate of 81.5%. Yet not all anglers of the same racial and ethnic category take home fish at the same rate. Seventy-three percent of low-income people of color took fish home versus 56% of high-income people of color. More strikingly, low-income Caucasian anglers only took home fish at a rate of 35%. Not only are people of color fishing more often, but they took home fish more often overall even when controlling for income. These rates are not statistically significant, but do reveal racial and income trends.

Table 5.5 Race, Income, and Fishing Frequency

Race and Income Intersection	Fish more than once per week (%)	Take Home (%)
Low Income Caucasian/ White	68.4	35
High Income Caucasian/ White	57.9	55
Low Income People of Color	81.5	73.1
High Income People of Color	81.5	56
X^2	4.4	6.666
p	.219	.083

Food Security: Change in Access Due to Riverfront Modification

Significant changes have occurred on both the Canadian and U.S. banks of the Detroit River in recent years, including the development of real estate, industrial site clean up, and new park locations. The anglers were asked whether the riverfront modifications significantly changed their fishing behaviors or activities. Table 5.6 highlights angler's responses to riverfront modifications. If the anglers responded yes, they were asked the open-

ended question: “how.” Anglers reported a host of changes with positive and negative effects ranging from improved access and cleaner sites to increased crowding and the destruction of fish habitat. Reports of the effects of riverfront development were statistically significant between incomes. The highest ($50,000-74,999, 76.9%, *n* 13) and lowest ($0-24,000, 75%, *n* 8) income ranges most often reported positive riverfront changes. Reports of a negative effect due to riverfront changes were reported by the middle income ($25,000-49,999, 75%, *n* 16) group. Positive and negative changes in riverfront development were evenly split between the highest income groups. Changes in riverfront modification failed to be statistically significant for race, gender, education, country, location, and age.

Table 5.6 Riverfront Modification Results

Changes in riverfront modification	Positive Changes (%)	Negative Changes (%)	X^2	p
Race				
Caucasian	42.9	57.1	.881	.348
People of color	55.9	44.1		
Country				
Canada	46.7	53.3	.049	.825
USA	50	50		
Income				
$0-24,999	75	25	9.617	.022
$25,000-49,999	25	75		
$50,000-74,999	76.9	23.1		
$75,000-100,000+	50	50		
Gender				
Male	47.9	52.1	.012	.913
Female	50	50		
Education				
High school & less	46.9	53.1	.325	.569
Higher education	55	45		
Location				
Detroit	40	60	1.577	.455
Downriver	59.1	40.9		
Canada	46.7	53.3		
Age				
18 to 40	43.8	56.3	2.287	.319
41 to 65	52.6	47.4		
Greater than 66	0	100		

Food security: Perception of water quality

Anglers were asked to rate the Detroit River's water quality on a scale from 1 to 5, 1 being the worst and 5 the best, based on their perception. This variable was significant for race, education, country of residence, and age as illustrated in Table 5.7. People of color gave the Detroit River a higher rating in water quality than Caucasians. Fifty-two percent of people of color said the Detroit River was of moderate quality and 32.2% said it was of high quality; whereas 51.3% of Caucasians (*n* 39) perceived the Detroit River to have poor water

quality and 35.9% reported the river to have moderate water quality. Canadian anglers (*n* 32) were more likely to give the Detroit River a lower quality rating, with 46.9% rating it as poor and 43.8% rating it as moderate. U.S. anglers (*n* 74) were more likely to give the river a moderate or higher rating, 45.9% and 29.7% respectively. Of all participants, younger anglers were more likely to give the river a lower quality rating than older anglers. The 18 to 40 year old age group rated the river as having poor water quality 47% (*n* 32) of the time, while 50% of the 40 to 65 (*n* 65) age group said the river had moderate water quality, and 60% of the greater than 66 age group (*n* 5) said the river had high water quality. Of those in the oldest age group, none reported the Detroit River to be of poor water quality.

Table 5.7 Perception of Water Quality

Water Quality	Poor (%)	Moderate (%)	High (%)	X^2	p
Race					
Caucasian	51.3	35.9	12.8	13.564	.001
People of color	17.5	52.4	30.2		
Country					
Canada	46.9	43.8	9.4	7.597	.022
USA	24.3	45.9	29.7		
Income					
$0-24,999	8.3	75	16.7	5.665	.462
$25,000-49,999	36.4	45.5	18.2		
$50,000-74,999	32.1	46.4	21.4		
$75,000-100,000+	35.3	35.3	29.4		
Gender					
Male	27.6	46	26.4	3.099	.212
Female	47.1	41.2	11.8		
Education					
High school & less	31.4	43.1	25.5	.449	.799
Higher education	27.3	50	22.7		
Location					
Detroit	16.7	50	33.3	9.009	.061
Downriver	29.5	43.2	27.3		
Canada	46.9	43.8	9.4		
Age					
18 to 40	46.9	37.5	15.6	9.664	.046
41 to 65	24.6	50.8	24.6		
Greater than 66	0	40	60		

Food Security: Perception of Water Quality and Fish Consumption

To discern whether or not anglers utilized their own perception to judge the appropriateness of fish consumption, we cross tabulated anglers' perception of water quality and tendency to take fish home. Table 5.8 depicts that those who take home more fish perceived the Detroit River to be of higher water quality. Those that practiced catch and release more often gave the Detroit River a lower water quality rating. Indeed those who took fish home at any rate gave the Detroit River water quality a moderate to high rating.

Table 5.8 Perception of Water Quality versus Number of Fish Taken Home

Water quality	Poor (%)	Moderate (%)	High (%)	X^2	p
Take home fish	22	45.8	32.2	9.785	.008
Catch & release	46.3	43.9	9.8		

Anglers that fished more than once a week reported a higher water quality rating than those who fished less than once a week as depicted in Table 5.9. The significance is just beyond a 0.5 alpha. Yet those anglers who fish less than once a week and give the Detroit River a poor rating have an adjusted residual of 2.5.

Table 5.9 Perception of Water Quality versus Fishing Frequency

Water quality	Poor (%)	Moderate (%)	High (%)	X^2	p
Fish more than once/week	24.7	49.4	26	5.879	.053
Fish less than once/week	50	30.8	19.2		

Social Interaction: Fishing habits

The questions regarding anglers' fishing habits highlighted from whom they learned to fish, with whom they shared their caught fish, how caught fish were prepared for personal consumption, and how well they were acquainted with other anglers on the shores of the Detroit River.

Social Interaction: Sharing of Fish with Family, Friends, and Neighbors

We asked the anglers who took home fish, if they shared fish, and if so, with whom. The response was divided into three categories of analysis: fish given to family, fish given to friends, and fish given to the community as depicted in Table 5.10. Age was the best indicator of with whom anglers share their fish. Eighty-four percent (*n* 19) of the 18 to 40 age group shared their fish with family. The amount of sharing their catch with family

decreased as age increased. Likewise, the 40 to 65 age group most often shared their catch with the community (32.7%, *n* 55). In addition to age, the option to share their catch with friends was statistically significant for race/ethnicity and country of residence. Twenty-three percent (*n* 52) of people of color chose to share their catch with friends, whereas Caucasians shared their fish with friends only 4% (*n* 26) of the time. Similarly, U.S. anglers chose to share their catch 20.3% of the time while Canadian anglers reported that they did not share their catch. The analysis between income level and the giving of their catch to friends was significant. Approximately 42% of the low-income group ($0-24,999) reported giving their catch to friends, whereas 7.4% (*n* 27) of the middle-income ($25,000-49,999), 10.5% of high-income ($50,000-74,999), and 27.3% of the highest-income bracket ($75,000-100,000+) reported giving their catch to friends. We were not able to determine which income groups gave more often to family and to community as the outcomes were fairly evenly distributed.

Table 5.10 Sharing Fish with Family, Friends, and Community

Sharing of Fish	Family (%)	X^2	p	Friends (%)	X^2	p	Community (%)	X^2	p
Race									
Caucasian	53.8	.021	.886	3.8	4.355	.037	26.9	.214	.644
People of color	55.6			96.2			22.2		
Country									
Canada	55.6	.004	.948	0	.334	.563	33.3	1.338	.247
USA	54.7			20.3			20.3		
Income									
$0-24,999	58.3	4.677	.322	41.7	9.200	.056	8.3	7.569	.109
$25,000-49,999	59.3			7.4			33.3		
$50,000-74,999	47.4			10.5			10.5		
$75,000-100,000+	72.7			27.3			45.5		
Gender									
Male	56.1	.810	.368	15.2	.334	.563	22.7	.218	.641
Female	42.9			21.4			28.6		
Education									
High school & less	50	1.395	.238	21.4	1.117	.291	26.2	.676	.411
Higher education	63.6			12.1			18.2		
Location									
Detroit	53.8	.017	.992	19.2	4.384	.112	30	1.526	.466
Downriver	55.3			21.1			16.7		
Canada	55.6			0			26.7		
Age									
18 to 40	84.2	9.620	.008	5.3	2.254	.324	5.3	7.902	.019
41 to 65	45.5			20			32.7		
Greater than 66	33.3			16.7			0		

Social Interaction: Learning to Fish

As part of the survey, we asked the anglers who taught them how to fish and then divided their answers into 3 categories: someone of their generation, someone of their parents' generation, or someone of their grandparents' generation. Table 5.11 depicts with whom anglers learned to fish from. We wanted to discern if fishing was a cultural and social interaction. However, significance was inconclusive as generational fishing was evenly distributed between the three categories.

Table 5.11 Learning to Fish

Learn to Fish	Same Generation (%)	Parental Generation (%)	Grandparental Generation (%)	X^2	p
Race					
Caucasian	31.1	64.4	4.4	1.813	.404
People of color	34.8	54.5	10.6		
Country					
Canada	43.2	54.1	2.7	3.058	.217
USA	30.8	59	10.3		
Income					
$0-24,999	46.2	38.5	15.4	7.568	.271
$25,000-49,999	22.9	62.9	14.3		
$50,000-74,999	37.9	58.6	3.4		
$75,000-100,000+	50	45	5		
Gender					
Male	37.2	54.3	8.5	1.302	.522
Female	26.3	68.6	5.3		
Education					
High school & less	35.7	58.9	5.4	.935	.627
Higher education	33.3	56.3	10.4		
Location					
Detroit	33.3	50	16.7	6.394	.172
Downriver	29.2	64.6	6.3		
Canada	43.2	54.1	2.7		
Age					
18 to 40	27.3	57.6	15.2	5.3	.25
41 to 65	37.5	58.3	4.2		
Greater than 66	50	50			

Social Interaction: Fish Preparation

Anglers were asked how they prefer to prepare their fish. The possible options included frying, or baking and grilling as illustrated in Table 5.12. Overwhelmingly anglers chose to fry their fish. The option to prepare fish via frying was significant for income and education. All of the income groups except the $50,000-74,999 income bracket prepared their fishing by frying it 90% or more of the time. The $50,000-74,999 income bracket chose to fry their fish 58.8% (*n* 17) of the time.

Table 5.12 Fish Preparation

Preparation of Fish	Fry (%)	Bake or grill (%)	X^2	p
Race				
Caucasian	87	13	.631	.427
People of color	79	20		
Country				
Canada	87.5	12.5	.429	.512
USA	80.4	19.6		
Income				
$0-24,999	90	10.0	8.84	.031
$25,000-49,999	92	8		
$50,000-74,999	58.8	41.2		
$75,000-100,000+	90	10		
Gender				
Male	84.5	15.5	2.087	.149
Female	66.7	33.3		
Education				
High school & less	91.9	8.1	5.744	.017
Higher education	69.0	31.0		
Location				
Detroit	80.8	19.2	.435	.805
Downriver	80	20		
Canada	87	12.5		
Age				
18 to 40	80	20	1.228	.541
41 to 65	80	20		
Greater than 66	100	0		

Social Interaction: Acquaintance with other Anglers on the Detroit River

We asked Detroit River anglers how well they knew other anglers on the shores of the Detroit River. This was a closed-ended question that coded into categories: “know others well” and “don’t know others.” The results were statistically significant by education and location, as illustrated in Table 5.13. Sixty percent of those who had no higher education reported knowing other riverfront anglers well. Approximately 67% of Detroit-based anglers

reported knowing other anglers well compared with Downriver or Canadian anglers. Acquaintance with other anglers was not significant by country, race, gender, income, or age.

Table 5.13 Acquaintance with other Anglers

Acquaintance with other Anglers	Know others well (%)	Don't know others (%)	X^2	p
Race				
Caucasian	43.2	56.8	.734	.391
People of color	51.5	48.5		
Country				
Canada	43.2	56.8	.232	.630
USA	48.1	51.9		
Income				
$0-24,999	53.8	46.2	.416	.937
$25,000-49,999	44.1	55.9		
$50,000-74,999	48.3	51.7		
$75,000-100,000+	50	50		
Gender				
Male	47.9	52.1	.071	.79
Female	44.4	55.6		
Education				
High school & less	60	40	5.191	.023
Higher education	37.5	62.5		
Location				
Detroit	66.7	33.3	7.078	.029
Downriver	36.7	63.8		
Canada	43.2	56.8		
Age				
18 to 40	40.6	59.4	1.524	.467
41 to 65	48.6	51.4		
Greater than 66	66.7	33.3		

Communication: Awareness of and Access to the Fishing Advisory

We posed a series of questions to determine the anglers' awareness and familiarity of the fish consumption advisory, illustrated in Table 5.14. First, anglers were asked whether they were aware of the current fish consumption advisory. There was no marked difference between interviewed people of color and Caucasians regarding fish consumption advisory

awareness. Awareness of the advisory was, however, statistically significant with age. Sixty-four percent of the age group 41 to 65 (*n* 72) reported being aware of the advisory, and only 40.6% of the age group 18 to 40 (*n* 32) and 33.3% of the age group greater than 66 reported being aware of the advisory. Within income, the highest reported awareness, 72.4%, was in the $50,000 – 74,999 income bracket, while the lowest income bracket demonstrated the lowest awareness of fish advisories (38.5%).

Table 5.14 Awareness of Fish Advisory

Characteristic	Yes (%)	No (%)	X^2	p
Race				
Caucasian	50	50	.611	.434
People of Color	57.6	42.4		
Country				
Canada	45.9	54.1	1.573	.210
USA	58.4	41.6		
Income				
$0-24,999	38.5	61.5	4.900	.179
$25,000-49,999	52.9	47.1		
$50,000-74,999	72.4	27.6		
$75,000-100,000+	55	45		
Gender				
Male	55.3	44.7	.000	.985
Female	55.6	44.4		
Education				
High school & less	52.7	46.3	.326	.568
Higher education	58.3	41.7		
Location				
Detroit	63.3	36.7	2.047	.359
Downriver	55.3	44.7		
Canada	45.9	45.6		
Age				
18 to 40	40.6	59.4	6.111	.047
41 to 65	63.9	36.1		
Greater than 66	33.3	66.7		

Communication: Extent of Fish Advisory Knowledge

The next step in our assessment of advisory awareness was to ask anglers if they could describe the advisory's contents to determine the extent of their knowledge of the advisory. Table 5.15 depicts anglers' knowledge of material within the fish advisory. Nearly all of the Detroit River angler population gave responses with incorrect information, and many were unable to give any response. We were not able to discern statistical significance between those that said nothing, said an incorrect answer, or those that gave a partially correct answer. Yet, there was a marked difference between country of residence and the extent of the angler's knowledge of the advisory's contents. Of the Canadian anglers interviewed, 75% said they were aware of the advisory and could recite correct information pertaining to its content, while only 25% said they were aware and had incorrect or no information regarding its content. Of the American anglers interviewed, only 53.3% said that they were aware and had correct information of the advisory's content, while 48.7% reported awareness but had incorrect or no information about the advisory.

Table 5.15 Knowledge of the Fish Advisory Material

Characteristic	Don't know or wrong (%)	Correct or right idea (%)	X^2	p
Race				
Caucasian	59.1	40.9	2.230	.135
People of Color	72.7	27.3		
Country				
Canada	63.9	36.1	.183	.669
USA	67.9	32.1		
Income				
$0-24,999	76.9	23.1	4.668	.323
$25,000-49,999	68.6	31.4		
$50,000-74,999	51.7	48.3		
$75,000-100,000+	73.7	26.3		
Gender				
Male	67.7	32.3	.682	.409
Female	57.9	42.1		
Education				
High school & less	66.1	33.9	.047	.829
Higher education	68.1	31.9		
Location				
Detroit	60	40	1.569	.456
Downriver	72.9	27.1		
Canada	63.9	36.1		
Age				
18 to 40	84.8	15.2	13.127	.001
41 to 65	53.5	46.5		
Greater than 66	100	0		

Communication: Change in behavior due to advisory knowledge

Next we asked anglers how the advisory's information was helpful to them, if at all. We wanted to determine whether information from the advisory had provided the anglers with more knowledge, or had influenced the anglers to change or modify their fishing habits and behavior. Table 5.16 depicts anglers' knowledge of the fish advisory and its effect on their behavior. Of the entire angler population, approximately 60% believed that the advisory was helpful. Interestingly, 71% of women reported a change in behavior or knowledge, but due to a small sample size of women anglers this is inconclusive.

Table 5.16 Knowledge of Advisory and the Affect on Angler Behavior

Knowledge of advisory	Don't know or wrong (%)	Correct or right idea (%)	X^2	p
Admits no change in behavior	51.4	39.1	.844	.358
Admits change in behavior	48.6	60.9		

Communication: Fish Advisory Awareness and Fish Consumption

To ascertain whether or not anglers' awareness of the fish advisory affected their consumption of fish, we cross tabulated the amount of knowledge with the tendency to take fish home, as illustrated in Table 5.17. These variables were not statistically significant, yet, those who had some idea of the advisory's content were more likely to practice catch and release, but only by a small margin.

Table 5.17 Knowledge of the Advisory versus Number of Fish Taken Home

Knowledge of advisory	Don't know or wrong (%)	Correct or right idea (%)	X^2	p
Take home fish	60.3	54.3	.349	.555
Catch & release	39.7	45.7		

Lastly, anglers were asked whether they knew where they could access a fish advisory. The majority of anglers stated that they could access the advisory on the internet. However, many anglers believed that fish advisories were given with their license or could be obtained at a physical location such as a K-Mart, a Bait Shop or Canadian Tire.

Communication: Environmental Justice and Fish Consumption Advisory Knowledge

As previously noted we combined race and income variables to access knowledge of fish advisories as an environmental justice issue. Table 5.18 illustrates the intersection of race, income, and anglers' knowledge of advisory contents. Again, the results are not statistically significant but interesting. Low-income Caucasian/white anglers correctly

reported the contents of the advisory 40% of the time, versus 21.4% of low-income people of color. There was very little difference in the rate of advisory knowledge between different incomes within the Caucasian/white demographic. Overall, individuals of all races and incomes were unaware of the fish consumption advisory contents.

Table 5.18 Race, Income, and Knowledge of the Advisory's Contents

Race and Income Intersection	Knowledge of advisory contents (%)	X^2	p
Low Income Caucasian/white	40	2.8	.408
High Income Caucasian/ White	42		
Low Income People of Color	21.4		
High Income People of Color	35.7		

Results from Stakeholder Angler Analysis

Factor Analysis Results

A factor analysis was conducted to ascertain the similarity of the 11 search engines used in the cluster analysis. Four factors emerged. Table 5.19 illustrates the results of the search engine factor analysis. The Detroit Free Press, Google, Detroit News, and MEC loaded on factor one. The NWF, EMEAC, and the website search loaded on factor two. The Lansing State Journal and Crain's Business Detroit loaded on factor three. The Metro Times and the Sierra Club loaded on factor four, but with opposite sign, indicating an inverse relationship between these two sources.

A second factor analysis was conducted using 10 search variables and two factors emerged. Table 5.20 illustrates the results of the search terms factor analysis. The search variables justice, license, pollution, fish, chemicals [dioxin, mercury, PCB], cleanup, and environment appeared in component one. The variables parks, Detroit River, and racism appeared in component two.

Table 5.19 Factor Analysis of the Search Engines

Search Engine	Factor 1	Factor 2	Factor 3	Factor 4
Detroit Free Press	.889	-.003	-.085	.102
Google	.881	.316	.005	-.041
Detroit News	.880	.119	.334	.057
Michigan Environmental Council	.680	.394	-.057	.071
National Wildlife Federation	.173	.886	-.093	-.208
East Michigan Environmental Action Council	.179	.886	-.096	.139
Website	.239	.885	.159	.237
Lansing	.172	-.025	.909	-.020
Crain's Business Detroit	-.088	-.039	.869	.207
Sierra Club	-.197	.094	.002	-.864
Detroit Metro Times	-.091	.304	.246	.594

Table 5.20 Factor Analysis of Search Terms

Search Term	Factor 1	Factor 2
Justice	.943	.153
License	.940	.036
Pollution	.903	.388
Fish	.881	.447
Chemical	.887	.387
Cleanup	.784	.443
Environment	.782	.520
Parks	.296	.950
River	.235	.943
Racism	.240	.897

Cluster Analysis Results

In the Detroit News searches, the MDNR and EPA appeared together in a cluster, the MDCH, United States Fish and Wildlife Service (USFWS), and MDEQ appeared in another cluster, and Wayne County appeared in a final cluster. The clusters were significantly different from each other with respect to the "Detroit River" and "parks" variables. In the Detroit Free Press searches, the MDEQ appeared in cluster one, Wayne County in cluster two, the MDNR, EPA, MDCH, and the USFWS appeared in cluster three. The variables that significantly distinguish the clusters are environment, fish, justice, license, and parks. The

cluster analysis from MEC produced three clusters. The MDNR and USFWS appeared in cluster one, the EPA and Wayne County in cluster two, and the MDCH and MDEQ in cluster three. The clusters are significantly different by the variables chemicals, fish, justice, parks, and pollution. The information from each website was combined according to search variable. The MDNR appeared in cluster one, the EPA in cluster two, and the MDCH through Wayne County in cluster three. The clusters are distinguishable by the following variables: the Detroit River, chemicals, cleanup, environment, fish, justice, license, parks, and pollution. Google was utilized as a broad search engine, highly visible to the public sphere. Wayne County appeared in cluster one, the EPA cluster two, and the MDNR, MDCH, USFWS, and MDEQ appeared in cluster three. The clusters are significantly different by all of the variables except racism. The clusters from Crain's Business Detroit, the Lansing State Journal, the Detroit Metro Times, East Michigan Environmental Action Council, the National Wildlife Federation, and the Sierra Club failed to be significant.

Stakeholder Commonality

The most common variables in this study included fish, pollution, chemicals, river cleanup, and environment. Figures 5.2, 5.3, 5.4, 5.5, and 5.6 depict each stakeholder breakdown by news source. There were few references of the terms justice and license. A total frequency for the topics that hung together as an important environmental factor (fish, pollution, chemicals, and environment) were tallied and plotted against "river" frequencies for the six stakeholders to illustrate how they clustered within search sites. The graphs for the sources that resulted in significant cluster difference are presented subsequently.

Figure 5.2 Stakeholder Clusters from the Detroit News

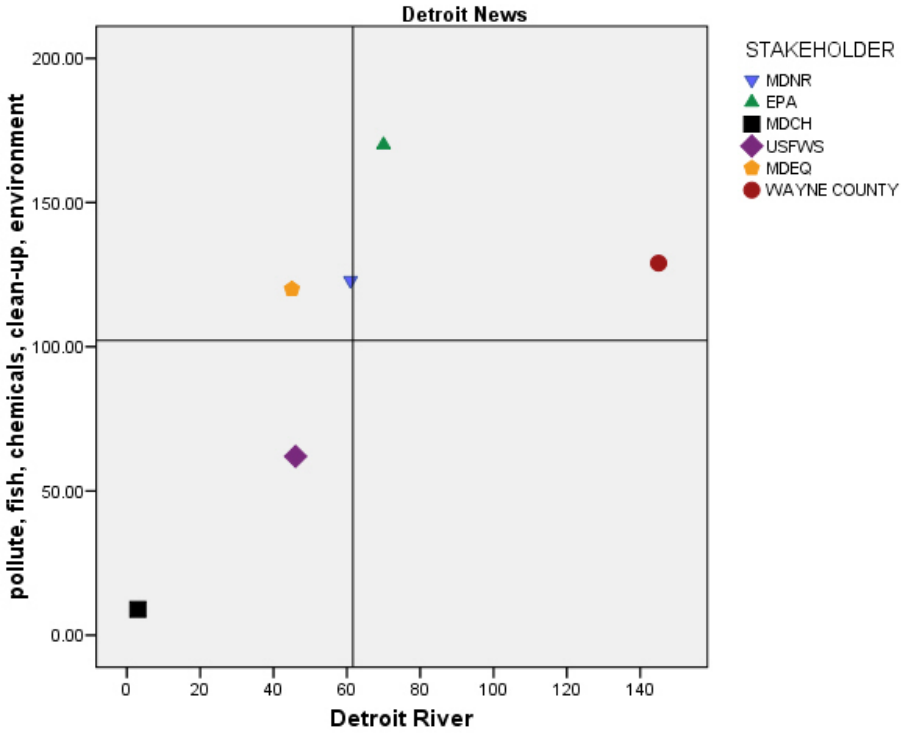


Figure 5.3 Stakeholder Clusters from the Detroit Free Press

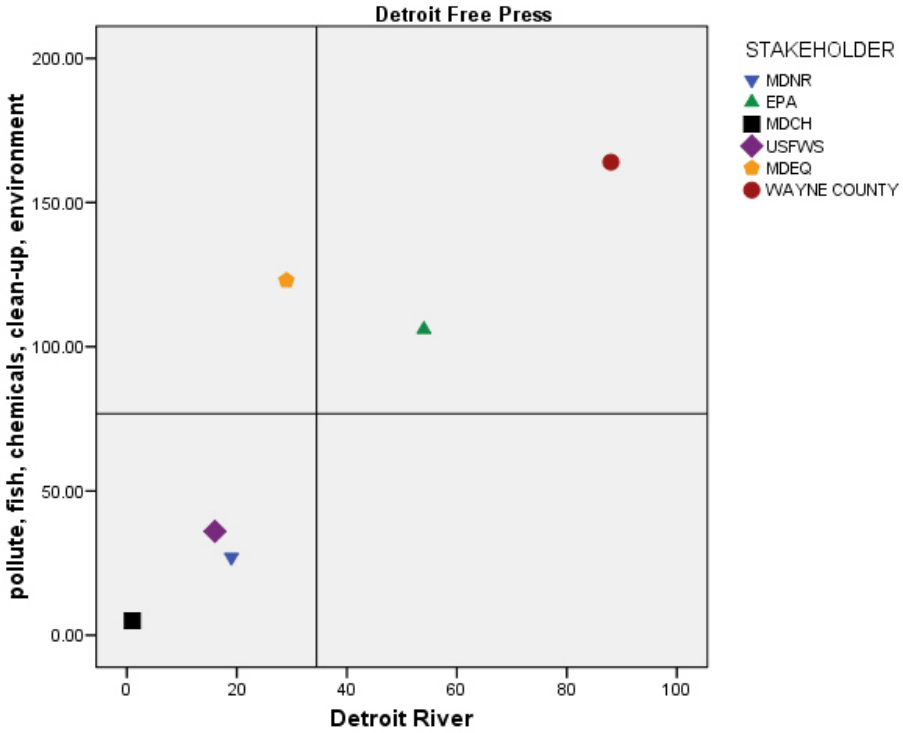


Figure 5.4 Stakeholder Clusters from the Michigan Environmental Council Website

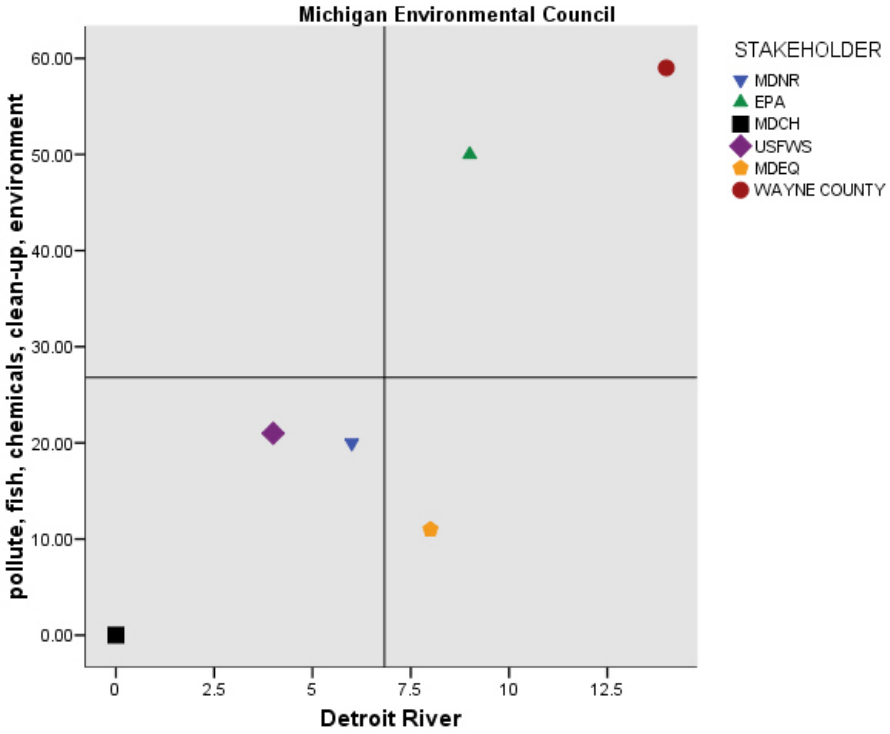


Figure 5.5 Stakeholder Clusters from Various Stakeholder Websites

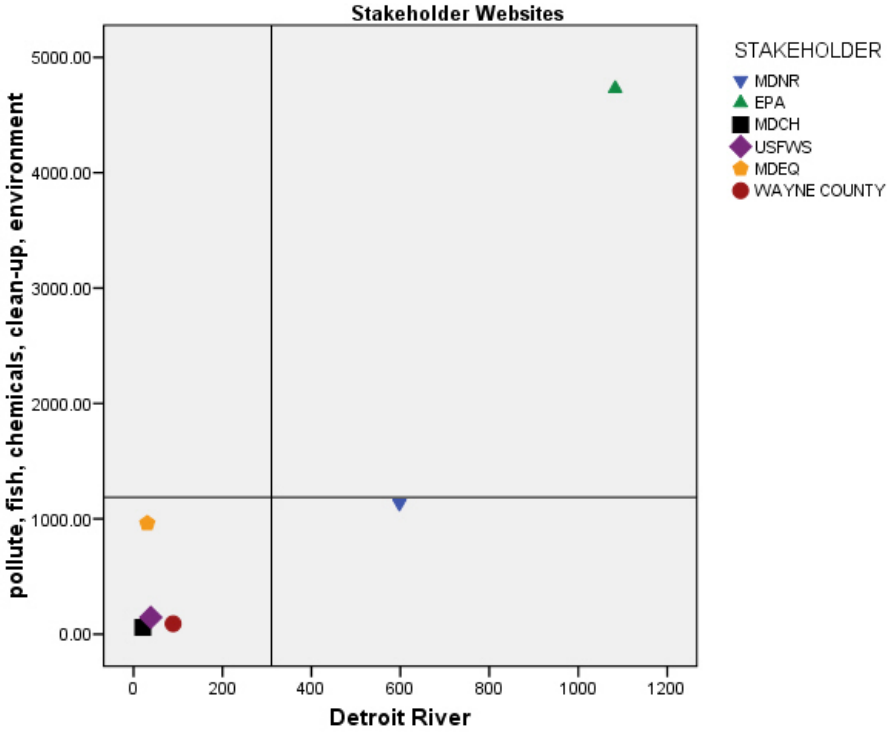
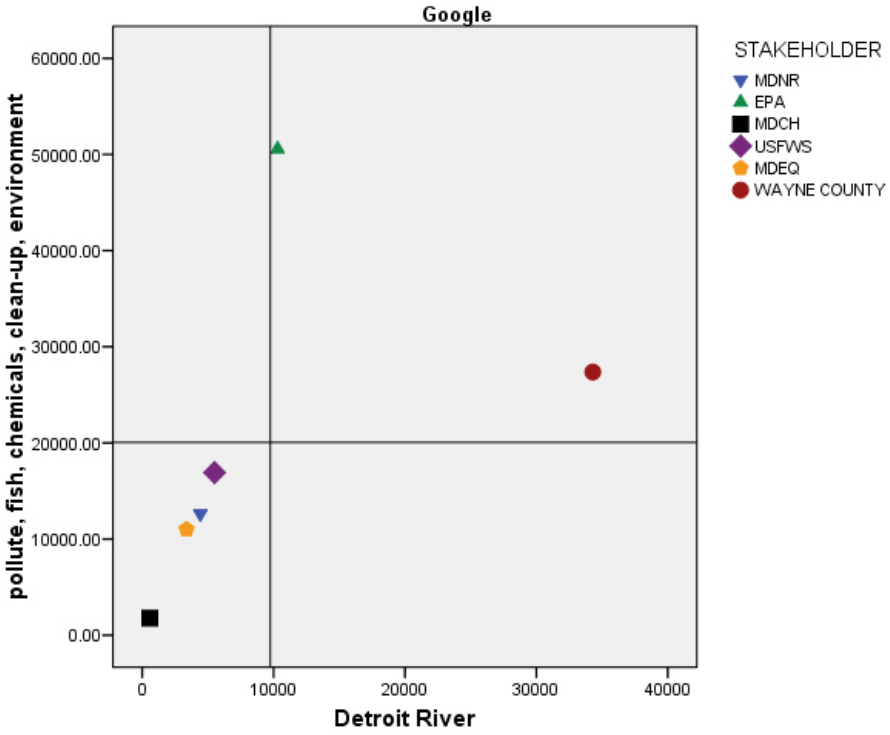


Figure 5.6 Stakeholder Clusters from Google Search Engine



CHAPTER 6: DISCUSSION

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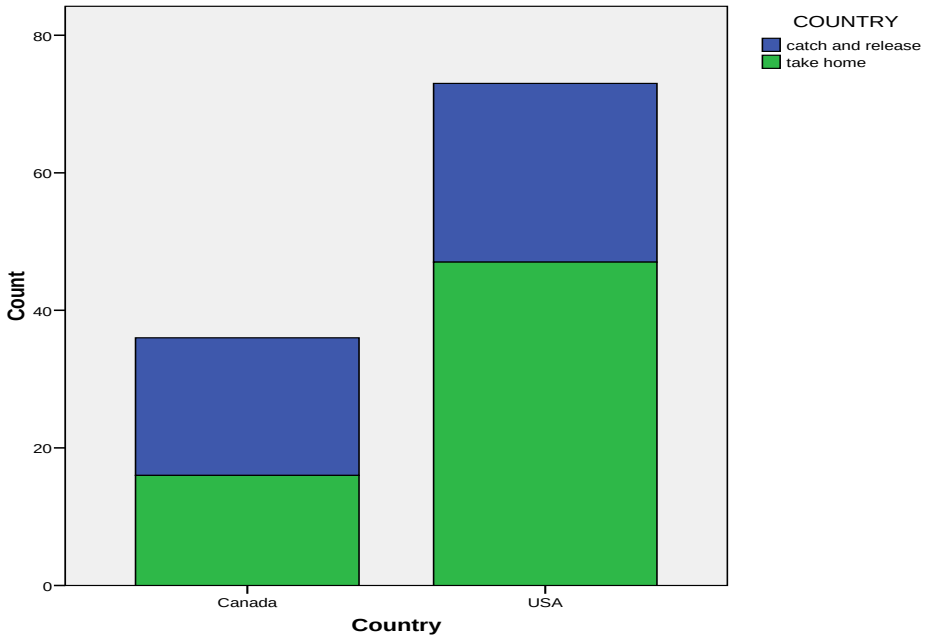
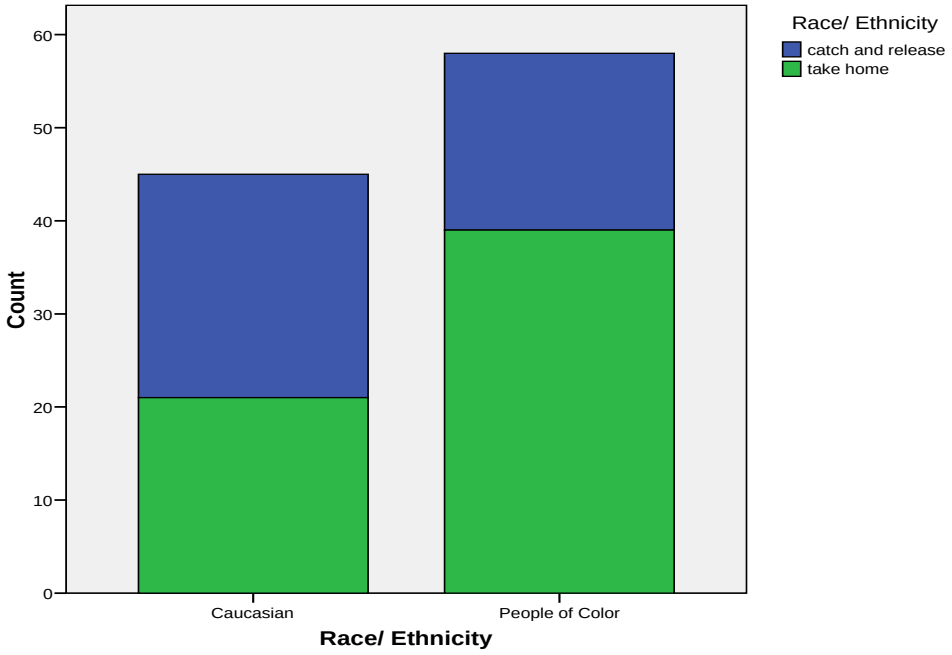
Fish Consumption as an Environmental Justice Issue

Fish consumption advisories and fish consumption on the Detroit River is indeed an environmental justice issue. Fishing for sport versus fishing for food on the Detroit River is significantly marked by race and fishing location, but not by gender, income, education, or age (Figure 6.1 and 6.2 below). We might attribute this disparity to external factors such as the river's flow, proximity to the River Rouge—a major contributor to contaminant loads—or other external factors, however, this disparity cannot be divorced from the racial composition of downriver inhabitants and the City of Detroit. While the City of Detroit is vastly African-American, downriver cities such as Wyandotte and Trenton are over 95% Caucasian. The geographic disparity of those who catch and release also implicitly indicates a racial disparity. When combined with frequency, our results demonstrate that Detroiters are taking more fish home in greater numbers and frequency than their downriver counterparts, putting Detroiters and people of color in a distinctly higher risk category. They are least likely to be aware of risks because of the State's failure to successfully warn them of these potential risks of consuming contaminated fish.

Figures 6.1 Number of People by County Who Practice Catch and Release versus Take Home



Figures 6.2 Number of People by Race/Ethnicity Who Practice Catch and Release versus Take Home



The portrait of subsistence anglers falls in line with other researchers' reports of consumers in other urban areas. Unlike Burger et al., income was not a significant indicator of catch and release versus take home practices, suggesting a more complex interaction with the resource than one based solely on income.[106] West also found in 1992 that low-income anglers of color were not the highest consumption group. He was surprised at the time that low- and middle-income anglers of color were consuming fish at the same rates; we found there was no significant difference, and therefore no change in behavior by income. Yet people of color in the United States, and specifically within the City of Detroit, tend to take home fish more often than their white or Canadian counterparts.

A 47-year old Caucasian woman fishing at Mill Park in Windsor, Ontario stated, "We fish in Windsor purely for pleasure, further north is where the good eating fish are." The woman's comment was indicative of Canadians' preference for pleasure fishing near home and fishing for a food source in other areas. This is consistent with Dawson's findings that Canadian anglers believe that the fish caught "up north" are cleaner, less contaminated, and better tasting.[107] Fishing for sport in contaminated areas like the Detroit River and traveling to other bodies of water to practice fishing for food points towards a luxury of disposable income for travel. This disposable income was contrasted by the comments of one angler of color who candidly stated that, "White people fish for sport, I fish for child support." Yet fishing in and consuming fish from the Detroit River is not purely an economic indicator as reflected in consumption by income. Rather we must look beyond simple economics to understand what motivates people to consume fish from the Detroit River. When we asked anglers if they fished in other locations, some anglers mentioned

[106] Burger, J., Stephens, W., Boring, C., Kuklinski, M., Gibbons, W. J., & Gochfield, M. (1999). Factors in exposure assessment: Ethnic and socioeconomic differences in fishing and consumption of fish caught along the Savannah River. *Risk Analysis*, *19*(3).
[107] Dawson, J. (1997). Hook, line and sinker: A profile of shoreline fishing and fish consumption in the Detroit River area. *Health Canada Fish and Wildlife Nutrition Project.*

other local areas and other anglers referenced going up north or down south to fish. More research is definitely needed regarding geographical preferences for recreational activities and its relationship to social structures like race and income.

Women are also more likely to take fish home, but due to the small sample size of women on the riverfront, our result is inconclusive. The interesting aspects regarding race, location, and gender are reflected in the simple demographics of Detroit. In 2006, 40% of Detroit's households headed by a female lived below the poverty level. The added pressure to provide resources for their families compounds the weight of costs and benefits when deciding whether or not to take fish home. Formerly, advisories were distributed to WIC offices, but since Michigan's Department of Natural Resources budget was cut, women and children at high risk have not received information through local resources. More research is needed on women anglers in Detroit and on the exposure pathways drawn from Detroit River fish.

There are several possible reasons why some people practice catch and release fishing and others take fish home for consumption. Many of those that consume fish also reported a higher perception of water quality. This indicates that those who feel the water is clean also feel that the fish are safe to take home and consume. Anglers with a low perception of water quality tended to use fishing as a social activity rather than as a food resource. Those anglers who preferred to take fish home, especially anglers of color, reported sharing their catch with others. Hornbarger et al. found in 1994 that the gift culture of fish was important to African-Americans on the Detroit River, indicating that there was social capital attached to catching and sharing fish. This proved to be true for many in our sample population within Detroit. People often said that they offered the fish they caught to family and some anglers said that they gave it to their friends, neighbors, churches, or held community barbeques. Given the insecure food situation that many people in Detroit face,

fish have become a social currency as well as a health and nutrition asset. For some anglers, catch and release fishing refutes the very simple need for food. Subsequently, we explore some of the explanations for prioritizing the benefits of fish consumption over the risks of potential exposure to contaminants.

Types of Fish

It is important to discuss not only what population is taking fish home but also what species of fish are consumed and how often they are consumed. Figure 6.3 illustrates the sum of specie preference by race/ethnicity. Some species, such as catfish and carp, are more highly contaminated than others. Fish species is also an indicator of cultural or racial preference. While only 6% of Caucasian anglers reported taking catfish home to consume, 31% of people of color reported engaging in this activity. People of color reported taking home silver bass eight times more often than that of white anglers, and largemouth bass over three times more often, while Caucasian anglers reported taking yellow perch home nearly twice as often as people of color. This suggests that racial and ethnic groups on the Detroit River have established different preferences in regards to consumable fish species. This concurs with Hornbarger et al.,[108] Burger,[109] and Hunt's[110] conclusion that ethnic and racial groups have different behaviors and preferences with regard to type of species consumed.

The reasons that the different racial and ethnic groups surveyed take home different fish species are likely based on cultural differences. Some anglers candidly commented that many people of color migrated to the Detroit area from the South during the industrial

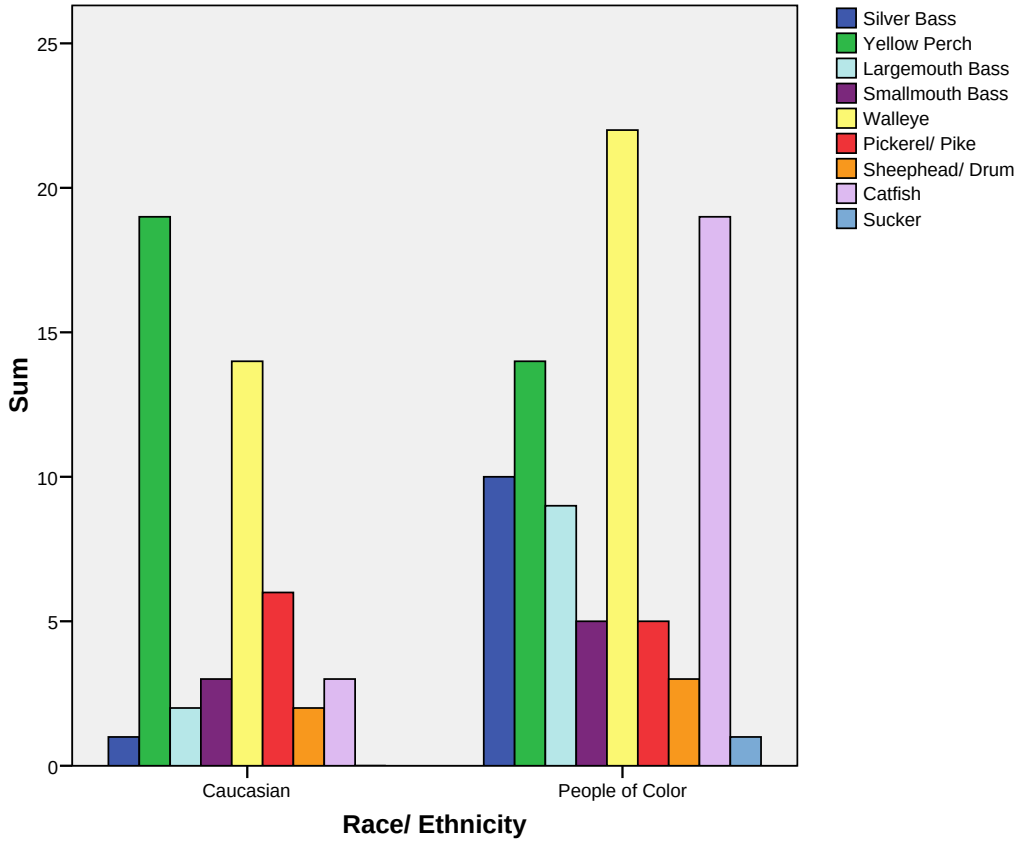
[108] Hornbarger, K., MacFarlene, C., & Pompa, C. R. (1994). Target audience analysis: Recommendations for effectively communicating toxic fish consumption advisories to anglers on the Detroit River. In *Natural Resources Sociology Lab Technical Report #11*. Ann Arbor, MI: Natural Resource Sociology Research Lab, University of Michigan.
[109] Burger, J. (2002). Consumption patterns and why people fish. *Environmental Research.* Section A 90, 125-135.
[110] Hunt, K., & Ditton R. (2002). Freshwater fishing participation patterns of racial and ethnic groups in Texas. *North American Journal of Fisheries Management, 22*(1).

revolution in search of jobs and to escape racial inequalities that beleaguered southern states. With them, they brought the cultural activities of fishing as well as cooking southern style food that includes catfish as a favored dish. This is supported by our statistics that fishing as an activity is intergenerational. We infer that those who learned such a skill also learn which fish are acceptable for consumption. Walleye is a species that is often caught for sport and and is generally favored by all anglers for consumption. There is an international walleye and bass fishing tournament on the Detroit River that actively promote pelagic sport fish, typically more available to those that have access to boats. This type of sport fishing is then often attributed to more affluent anglers.

Yet there is a social stigmatization of those people who eat certain types of fish species, a stigmatization that is racialized in Detroit. Some people believe that anglers who consume fish from the Detroit River—especially benthic, or bottom feeding, fish—are poor, or inferior in some way. Bottom-feeders like catfish and carp are more likely to have higher levels of contaminants than pelagic fish of the same water body because of their trophic feeding level. Therefore, benthic fish are often referred to, or suggested to be, "dirty" or "bad" fish. One Caucasian angler admitted not knowing many details in the advisory, but said he knows, "Don't eat too many bottom feeders, especially not catfish." Another angler in Elizabeth Park stated, "I don't mean to be racist, but black people eat carp." Another Downriver angler said, "Black people will eat anything." These statements were misinformed representations which directly associated the perceived unacceptable habit of consuming benthic fish with a single racial group. The acceptability of consumption of benthic fish is tempered by contamination. Thus, the interface of pelagic specie preference and fish contamination not only puts those with preferences for benthic fish in a higher risk category for contamination, but also associates them with inappropriate social behavior, i.e., eating bad fish. With their lack of protection from contamination, benthic fish, and their

consumers will continue to be stigmatized socially and racially. More qualitative information is needed to assess fish consumption as an acceptable practice.

Figure 6.3 Sum of Specie Preference by Race/Ethnicity



Frequency of Fishing

Of the anglers surveyed, there is a sharp distinction between those who fish infrequently and those who fish consistently throughout the summer months. In comparing those anglers who fish greater than once a week and those who fish less than once a week, the majority of those who fish more than once a week were men of color on the U.S. side of the Detroit River and within the City of Detroit. This may be explained by the large population of people of color in Detroit, but it also points to our many conversations with anglers who felt more comfortable fishing in certain areas and parks. For example, Mariner's Park on the east side of Detroit was a favored location for people of color. At

Mariner's Park, they had developed a real sense of community in which they were able to be themselves and share culturally significant experiences. The anglers noted the many activities they share together including fish fries, equipment sharing, and knowledge exchanges.

Some of the anglers that we interviewed in Detroit had been fishing for up to 40 or 50 years, and shared much knowledge with us about fishing, preferred fishing spots and changes in access over long periods of time. Anglers in Detroit utilized many different parks on the river to fish. We often went from Belle Isle, Riverview Park on the Southwest side and Mariner's Park on the East side, at times meeting anglers we had previously interviewed throughout our study period. Through these regular visits to fishing spots, social capital is built and knowledge is shared. For example, many anglers in Detroit spoke openly and at length about invasive species and the arrival of the round goby. Without reading a newspaper, or finding information on the internet, its presence was known by anglers, and behaviors shared. Anglers also skinned and gutted fish to share knowledge with our research team and demonstrate the fish's anatomy. An entire lexicon of fish health assessments, independent from the state advisory, had been established to discuss fish edibility. This confers with Beehler's study in Buffalo, New York, that showed African-American men preferring localized knowledge over state-based information. Local knowledge not only shows expertise and experience on the river, but brings commonality to the space. In Beehler's article, he mentions that African-American New York anglers have at times interacted with Detroit anglers, and that their language and preferences for fishing differed. Detroit is a unique fishing community that values time on the river, and relies on it for food, but also for a social community.

From these insights we can infer that subsistence anglers of color are not only taking fish home at a greater proportion and eating more types of fish, but are fishing with more

frequency than Caucasian anglers. Simply put, eating fish from the Detroit River is acceptable to some, depending on what types of fish are consumed and what part of the river they come from. In 1992, West found that black anglers consumed more fish, and more types of fish than Caucasian anglers.[111] This not only indicates that fish consumption is an environmental justice issue on the Detroit River, but one that has been sustained for at least the past 15 years.

Are Fish Consumption Advisories an Environmental Justice Issue?

Our research has shown that fish consumption advisories on the Detroit River are indeed an environmental justice issue. Anglers fishing on the Detroit River do so in contaminated waters. While it may seem that they have the choice to consume or not consume the fish they catch, there are several compounding factors including cultural values, communication of risk, access to information, food insecurity and institutional trust. The following discussion demonstrates in detail that this is indeed the case.

Awareness of the Fish Consumption Advisory

Knowledge of fish consumption advisories on the Detroit River is an environmental justice issue. The contents of the fish consumption advisory also represent an environmental justice issue due to the difference in angler specie preferences and behaviors on the Detroit River. These issues indicate the complicated relationship anglers have with information held within the fish consumption advisory and the State of Michigan that develops it.

We asked Detroit River anglers if they were aware of the local fish consumption advisory, and then asked a follow up question regarding what they could tell us about the

[111] West, P., Fly, M., Larkin, F., & Marans, R. W. (1994). Minority anglers and toxic fish consumption: Evidence from a statewide survey of Michigan. In B. Bryant & P. Mohai (Eds.), *Race and the incidence of environmental hazards: A time for discourse.* Boulder, CO: Westview Press.

local fish consumption advisory. Roughly half of all respondents reported awareness of the advisory, which is consistent with Tilden's findings in 1997 on the Great Lakes.[112] There was no significant difference between any particular group by income, education, race/ethnicity, or nation. When prompted to state *what* they knew about the consumption advisory, very few participants could clearly describe the advisory's contents. Few anglers could correctly report the advisory's details, such as naming a specific contaminant or the recommended reduced fish consumption by species. There was no significant difference between any of the racial or ethnic groups regarding the amount of knowledge they could recite regarding the fish consumption advisory. However, low income anglers of color were least knowledgeable of the advisory's contents. Taken as a whole, our findings support concerns highlighted in our literature review that awareness of the fish consumption advisory in the Great Lakes area is low among all populations.[113] [114]

The only significant category in awareness of the fish consumption advisory was age. The least awareness age group was individuals less than forty years of age. This is consistent with Tilden et al.,[115] Anderson et al.,[116] and Imm.[117] Imm compared the results of advisory awareness between 1997 and 2001 in the Great Lakes area and found that the youngest age group, 18-34 years of age, had actually decreased in awareness from 49% to 38%, while the older age groups either reported similar or increased awareness. Imm's

[112] Tilden, J., Hanrahan, L P., Anderson, H., Palit, C., Olson, J., Kenzie, W.M. (1997). Health advisories for consumers of Great Lakes sport fish: Is the message being received? *Environmental Health Perspectives*, *105*(12).
[113] Ibid.
[114] Imm, P., Knobeloch, L., Anderson, H., & and the Great Lakes Sport Fish Consortium. (2005). Fish consumption advisory awareness in the Great Lakes Basin. *Environmental Health Perspectives*, *111*(10).
[115] Tilden, J., Hanrahan, L P., Anderson, H., Palit, C., Olson, J., Kenzie, W.M. (1997). Health advisories for consumers of Great Lakes sport fish: Is the message being received? *Environmental Health Perspectives*, *105*(12).
[116] Anderson, Hanrahan, Smith, Draheim, Kanarek, & Olsen, J. (2004). The role of sport-fish consumption advisories in mercury risk communication: A 1988-1999 12 state survey of women age 18-45. *Environmental Research*, *95*.
[117] Imm, P., Knobeloch, L., Anderson, H., & and the Great Lakes Sport Fish Consortium. (2005). Fish consumption advisory awareness in the Great Lakes Basin. *Environmental Health Perspectives*, *111*(10).

findings, along with our research, might suggest that as anglers grow older they become interested in the substance and information of fishing advisories. Yet the younger age group, while practicing anglings, does not seek out that information. With the absence of access to a Michigan fish advisory, younger anglers do not receive the information when they purchase a license, and therefore, must voluntarily seek out the fish consumption advisory on the internet.

In the United States, the Michigan fish consumption advisory is only available on the internet, whereas in Canada the advisory is available online and in print at multiple locations, including businesses that sell fish licenses. Anglers were asked if they were aware of the location in which they could access a fish consumption advisory, if indeed they wished to read it. Although not statistically significant, 50% of people of color knew where they could access the fish consumption advisory compared to roughly 74% of their Caucasian counterparts. One hundred percent of anglers over 65 were aware that it was available on the internet, indicating an overall awareness of the advisory and where to find it.

An angler may be aware of that fish consumption advisory has been issued, but if it is not readily available at a local shop, he or she may not be able to access it at all. Even still anglers are not able to access the advisory online or are unaware of its existence. Some suggested that a sign on the riverfront or publishing the information in a newspaper would be adequate. In the past, WIC offices distributed advisories directly to at risk populations such as women and children, which provided information access to the most vulnerable populations. It would be beneficial to once again target those that are at most risk. Additionally, further research must be conducted concerning internet access. Many people knew that the advisory could be found online, but did not indicate whether they had access to a computer, or the skills and knowledge to go online and find it.

Awareness of fish consumption advisories, and anglers' relationship to its information, are two qualitatively separate categories of analysis. If knowledge is not incorporated, it could be for a variety of reasons, such as distrust of the state as suggested by Hornbarger et al. or food security issues as previously discussed. When asked about the fish consumption advisory, one 71-year-old, African American male stated, "White people don't want us to eat anything, they want us to starve." This particular angler was very distrustful of any information provided, and continued to state his displeasure with the system and disregard for information from institutional sources. An angler in River Rouge demonstrated a similar sentiment, stating, "The people in Lansing, they don't know what's going on down here—and they don't care." This confirms the continued distrust within the angling community that Hornbarger et al. found in 1994.[118] Therefore fish consumption advisories are an environmental justice issue as the state fails to provide adequate information and protect the anglers from the polluted waters.

Locally generated knowledge becomes an important aspect of risk communication on every level. But how local is local enough? Beehler suggests that sources of knowledge must be generated by the community itself as a form of agency.[119] The anglers we spoke with had their own vocabulary to assess the health of fish. Many anglers commented that a bad fish is one that smells like oil, has tumors or sores, or is soft to the touch. They explained that fish such as these should not be eaten. Others claimed that a bad fish will taste bad or that a good fish will curl in the pan. More investigation on local forms of

[118] Hornbarger, K., MacFarlene, C., & Pompa, C. R. (1994). Target audience analysis: Recommendations for effectively communicating toxic fish consumption advisories to anglers on the Detroit River. In *Natural Resources Sociology Lab Technical Report #11*. Ann Arbor, MI: Natural Resource Sociology Research Lab, University of Michigan.

[119] Beehler, G., McGuiness, B., & Vena, J. (2001). Polluted fish, sources of knowledge, and the perception of risk: Contextualizing African American anglers' sport fishing practices. *Human Organization*, *60*(3) 288-287.

knowledge and assessment should be done to highlight the connections between local forms of knowledge, language, and their links to contamination risk and exposure.

The State's Role

Inevitably, anglers depend on the state to communicate which fish are acceptable to eat and which fish are unsafe to eat, as the state is the sole source of contaminant testing and consumption advisories. Neither Michigan nor Ontario mandate that anglers limit their consumption and neither imposes a fine or fee associated with simple consumption. The fish consumption advisory is a suggestion to reduce risk. The state has the monopoly on the information, knowledge, and resources associated with not only monitoring the fish within the Detroit River but also existing and emerging pollution. This monopoly of information is extremely important to note, because this information, pertinent for some anglers to change their behavior, is still not readily accessible. Other interactions between U.S. anglers and the state exacerbate the distrustful relationship, which further conflates the fish consumption issue with the food security issue.

Fish consumption advisories and other testing methods in the Detroit River are inherently skewed as only certain types of fish are listed or tested. For example, the Michigan fish consumption advisory for the Detroit River does not list catfish. Catfish are also not listed as a fish tested through the MDEQ's Fish Contaminant Monitoring Program on the Detroit River.[120] In Canada however, catfish are listed and limited consumption is recommended both the Upper and Lower Detroit River. Therefore,unless U.S. anglers obtain the Ontario Fish Consumption Guide, they will not be exposed to this information. If an angler from the United States does receive the Canadian advisory, they are receiving

[120] Michigan Department of Environmental Quality. Fish contaminant monitoring program. Retrieved March 8, 2008, from http://www.deq.state.mi.us/fcmp/.

information that is inconsistent with the Michigan advisory, which may confuse the angler. This scenario is a potentially hazardous one for the U.S. catfish consumer. In one study conducted through the Great Lakes Institute for Environmental Research, shockingly higher levels of total PCBs were found in channel catfish than in other benthic feeding fish.[121]

The testing of fish for contaminants, and fish consumption advisories, are therefore an environmental justice issue on the U.S. side of the Detroit River. Subsistence anglers on the U.S. bank of the Detroit River have access to a limited amount of information concerning their specific eating habits. This limited information places U.S. anglers in a food insecure environment due to contaminants and the lack of information catered to their specific behavior and culture. This problem is linked to the lack of information present in Michigan-based fish consumption advisories, state testing, and the advisory's limited distribution channels. Because of variation in behavior, historical disenfranchisement, and spatial segregation, this problem is racialized, largely affecting the family and community structure of subsistence anglers.

Moreover, in assessing subsistence anglers' understanding of the fish consumption advisory we must also look at the other forms of river governance. The state's other representative on the Detroit River is the DNR. Some anglers of color reported that plain clothed DNR officers came and took away their catch and equipment without revealing their status as an officer until after the angler showed their fish. Anglers' interactions with the river are moderated by the state, which assumes the dual role of enforcement and regulation of the anglers. Since 1994 some anglers have continued to ask: instead of regulating anglers, why doesn't the state stop harmful pollution?[122] From this perspective, which further

[121] Li, H., Drouillard, K. G., Bennett, E., Haffner, D., & Letcher, R. (2003). Plasma associated halogenated phenolic contaminants in benthic and pelagic fish species from the Detroit River. *Environmental Science and Technology*, 37, 832-839.

[122] Hornbarger, K., MacFarlene, C., & Pompa, C. R. (1994). Target audience analysis: Recommendations for effectively communicating toxic fish consumption advisories to anglers on the Detroit River. In *Natural*

illustrates that fish consumption advisories are indeed an environmental justice issue, one can understand how anglers who depend on the Detroit River for food resources, could reject the presence of the advisory as a defiant act of self-preservation. Food security then becomes an issue of power relative to the role of the state and the urban angler.

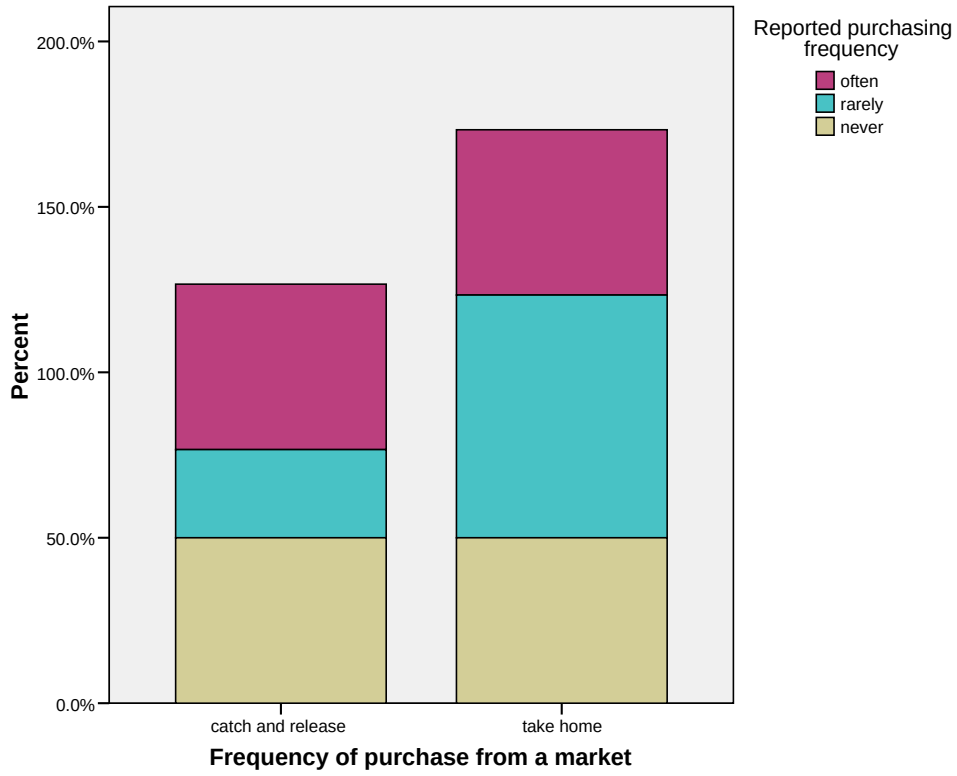
How Does Fish Consumption Affect Food Security Issues?

At the onset our research, Detroit was already considered a "food desert"—a place where a majority of food distribution centers sold non-food products. News of one of the last chain grocery stores closing piqued our interest and sense of urgency about the food security situation in Detroit. We therefore sought to determine what elements make fishing in the Detroit River a secure food resource. It is important to note that fish are a viable food resource not simply because they are present, but also because fish are considered safe, socially and physically acceptable. Fish consumption as a secure food resource is tempered by contamination, species, social preference, access to alternatives, and a personal risk assessment contingent on a variety of factors, primarily perception.

Importance of Fish to the Diet

People of color assigned significantly greater importance to the role of fish within their diet overall. Figure 6.4 illustrates the frequency of fish purchased by anglers from a market. Yet in Canada, 55% of all anglers reported that fish was an important aspect of a well-balanced diet, compared to 35% of U.S. anglers, although Canadian anglers generally don't take their catch home. This discrepancy could be explained by the multiple sources of fish purchasing and consumption within Canada. By nation, a larger proportion of U.S. anglers reported that they rarely buy fish from a market or grocery store.

Figure 6.4 Frequency of Fish Purchase from a Market



Social and Cultural Activities

Our results overwhelmingly indicated that fishing is a social activity, yet fish consumption is not socially acceptable for all. According to the state, unlimited consumption of certain fish is not acceptable or safe. Likewise, according to many people, any amount of consumption of certain species, like carp or catfish, is taboo. And according to some fish consumers, catfish and other species are favored over others. Again, people of color do not fish for sport at the rate that white anglers do—and the different groups, even when controlling for income, have different behaviors with regards to their interactions with fishing and fish consumption. Sharing fish caught from the Detroit River plays an important social role for anglers of color. This demographic shares their fishing knowledge and catch to build social capital that may accrue more benefits than the perceived cost of contamination exposure. The risk of food insecurity is a factor in that some anglers reported

a lack of accessible fishing areas and limitations of consumption through contamination risks.

Sharing fish as a social activity

Fishing can be understood as an important intergenerational, social and cultural activity, from which knowledge is generated and passed on to others. Fishing is a learned skill, often taught by someone of a parental or grand parental generation. Of all anglers surveyed, approximately 60% of them learned how to fish from their parental generation and 35% learned from someone of their own age. Seventy-seven percent of the anglers surveyed, reported having taught someone else to fish. Many anglers reported that they found fishing to be an important aspect of their lives that allowed them to relax and enjoy nature. It was also often reported that fishing was a welcomed change, an opportunity to enjoy time with family and friends, particularly children. This information is consistent across all incomes, races, ages, and education levels. The idea of shared knowledge creates the foundation for our understanding of social acceptability of fishing as an activity. Yet there is a marked difference in those who fish for recreation or sport versus those who take their catch home for consumption.

Eighty-three percent of those who consume their catch report sharing it with others. Significantly, U.S. people of color with an annual household income of less than $25,000 reported “friends” as the primary recipients of their Detroit River catch. The highest income bracket, and those aged 40-65 over any other age group proved to be the significant characteristic in giving food to the community. In addition to the fact that fishing is an intergeneration activity, the act of giving fish away to family and friends suggests a larger network of fish consumers beyond that of Detroit River anglers. This is especially dependant upon the angler’s age, race or ethnicity, income level, and nation of residence.

Hornbarger et al. and Dawson also highlight the importance of gift culture on the Detroit River, indicating that sharing fish has long been a tradition.[123]

Access

Over the past several years, both the United States and Canada have been developing their riverfronts as an effort to both meet the Remedial Action Plan's goals to eliminate the beneficial use impairments, and to rehabilitate the riverfront for multiple uses such as parks, entertainment, and housing. The developments have been met with both criticism and praise. We asked anglers if their fishing habits were affected by the riverfront changes, and their responses were roughly divided into positive and negative comments. Other forms of access to the resource are related to boating, and as stated before, access to other bodies of water.

Park Access

Many anglers referred to the improved environment along the river, including increased safety, cleaner areas in new parks, railings, grass, and decreased rabble-rousing from individuals perceived to be a threat. In Canada, recently renovated downtown parks offer clean walkways and sculpture parks. In Detroit, the Downtown Riverwalk has expanded shore access and the Detroit International Wildlife Refuge has begun to invest heavily in the shoreline improvements southwest of the city. In response, some anglers reported improved access to the river, more fishing options, cleaner sites, and improved parking and road access. One 60–year-old, African-American male fishing at Belanger Park in the United States noted that the "parks are much nicer, no 'crazy acting' people." An

[123] Dawson, J. (1997). Hook, line and sinker: A profile of shoreline fishing and fish consumption in the Detroit River area. *Health Canada Fish and Wildlife Nutrition Project.*

Arab/Middle East angler at Dingell Park reported that the changes discouraged "messy anglers" who are "unwelcome" at the recently renovated parks.

Many anglers also complained of reduced access to favored fishing spots and explained that former fishing sites had been replaced with new parks in which they felt unwelcome. The transference of public property to housing, or private property, also presented a challenge. One angler fishing at Dingell Park in Wyandotte, Michigan, noted that the new developments created "less area to fish, more pubic areas for kids and sitting." Other anglers indicated the new parks, attracting more people to downtown areas, making them more crowded and unwelcoming to anglers. A 47-year-old, female angler from Mill Park in Windsor, Canada, noted that she "didn't like to fish downtown, too many people, it is not quiet enough." Some anglers argued that the new parks were degrading the environment, destroying fish habitat, and contributing to the pollution. To support this criticism, they highlighted the rip rap rocks on shore, construction, and increased litter and trash from park visitors. A 49-year-old, African male fishing on Belle Isle noted that "They cut the fisherman out from fishing. They are cut off from the bank fishing. It affects them in that they can not afford a boat. The majority of people cannot afford a boat in Detroit. Many people buy property [along the shore] and they don't want you fishing there."

Our research team also noticed the incredible amount of private property that spanned the Canadian areas south of La Salle, and a lack of industrial areas adjacent to fishing areas. Canadian anglers have a direct view of the industrial activities on the Michigan side of the River. Although there remains some areas of industrialization on the Canadian shore, they are buffered by private property and green areas that make the river inaccessible. Canadian fishing spots do, however, have direct views of industrial areas on the Michigan side. Smoke stacks, factories, and other industrial sites are visible from the Canadian parks as well as the American ones. In the City of River Rouge, the park is located

entirely within the property of an industrial site. The upkeep and investment in parks may also influence the perception of water quality.

Anglers that fish from the banks of Trenton's Elizabeth Park have recently received a lot of press about the Detroit River, and the country's first International Wildlife Refuge, in which the park is placed. The park is beautiful and clean, with new boardwalks, weekend music, and other community activities. To enter Riverside Park from the City of Detroit, anglers must cross one of the heaviest truck traffic areas from the Ambassador Bridge. In Riverside Park, as well as Mariner's Park on the east side of Detroit, there is trash, litter, iron parts, and broken glass. There are no bathrooms and anglers and others are left without decent necessities. Although some men feel this is not required for outdoor activities, many indicated that women and children did not feel comfortable recreating here without bathroom facilities. The City of Detroit has recently invested millions of dollars into the new Riverwalk and Belle Isle, but some anglers no longer feel welcome to fish on those shores. This disparity on the U.S. side has not gone unnoticed. One angler commented that, "Downriver they take care of their anglers. And the Grand Prix is the only reason they cleaned up Belle Isle." More research should be conducted regarding the disparate resources along the Detroit River and how it affects anglers' relationship to the River.

Access to Open Waters

We asked anglers if they had fished by boat and many indicated that they do on occasion, but without physical evidence of boating activity and frequency it was difficult to verify these statements. One African-American angler summed up the disparity in water access by stating that, "People in boats are generally white . . . there is definite segregation of people in boats and fishing on the shore—it is very crowded when the fish are running and boaters call police on the shore anglers." Interactions such as these demonstrate the

strain between boaters and on-shore fisherpeople, with those with more access using their position to intimidate and remove any competition from other anglers. Another angler explained that people in Detroit simply cannot afford boats, and therefore cannot compete or utilize the more lucrative fishing spots away from shore.

Perception of Water Quality and Fish Consumption

The limitations on fish consumption are related to the quality of the water that flows down the Detroit River. The perception of water quality is highly variable, but significantly determined by race, age, and locality. Anglers of color generally rate the water quality to be of moderate to high quality and white anglers tended to rate the water quality as moderate to low. Those who perceive the Detroit River to be of moderate or of high quality were found in the United States, and remarkably in the City of Detroit, rather than their Downriver counterparts. This same demographic not only tends to fish more frequently, but are more likely to take fish home rather than practice catch and release.

We understand these findings to reflect the highly segregated geography in Wayne County. Anglers in Detroit take great pride in fishing on the Great Lakes. It offers an escape from the city's stress, heat, and traffic. Mariner's Park in Detroit, specifically, is located at the intersection of the Detroit River and Lake St. Clair, which we found to be quite beautiful, with no views of industrial activities. Rather, Mariner's Park was an area where the water was filled with boaters and revelers from the wealthier northern suburbs of the Gross Pointes and St. Clair Shores. While the park itself was in disrepair, the surrounding views across the river and on Lake St. Clair are of trees and naturally landscaped areas. The lack of visual contact with polluting activities may influence anglers' perception of the Detroit River as clean.

Older anglers also believed that the water quality had improved, often explaining that fish kills or oil spills were common in the past compared with the present. Many older anglers noted that the water is "much cleaner than it used to be." A feeling of pride in Detroit is also incredibly important to maintaining the integrity of the community and its resources. Believing that the Detroit River's water quality is high is integral to accessing fish as a food resource in a generally food insecure area like Detroit. We might assume that for an angler to believe the river is polluted is to devalue his or her source of a healthy food resource.

Perception of water quality is also related to the relationship that anglers have to the resource. Those anglers who fish on the Detroit River more than once a week also have a more positive association, and therefore perception, of the resource. People in Detroit also commented that along with the improved water quality, the fish were getting bigger and increasing in quantity. Some anglers were concerned about how the fish's behavior has changed. For example, they preferred fatty food baits rather than worms. Anglers were also concerned about water levels, indicating that they have been steadily dropping. But those who visited the river with greater frequency did have very positive attitudes about the resource and its contents.

Canadian anglers performed catch and release fishing more often than Michigan anglers, fished less frequently, and generally reported a lower water quality in the Detroit River. This may indicate increased awareness of contamination in fish or more concern for the amount of contamination they visualize in the Detroit River. A 42-year-old, Caucasian male fishing at La Salle Park in Ontario noted that the water "Has gotten cleaner, still not up to par. As long as we have big industry in Sarnia, it will never be clean." Although many Canadian anglers recognized clean-up efforts and political movement toward remediation, consumption levels were still significantly less than in the United States. Wide-spread

distribution of the fish consumption advisory may be the cause for fish consumption concerns, but other forms of health knowledge may be accessible with conflating factors such as universal health care available in Canada.

We visually observed the presence of several industrial areas clearly visible to Canadian anglers directly across the river from where most public fishing areas are located. Many of the locations where Canadian anglers fished were also not polished parks, but rather empty dirt lots that were difficult to access. These lots were often littered with trash and the only access to the waterfront was through a precarious hike down large rip rap boulders. Canadian anglers also pointed out the many industrial activities, including Zug Island, they were able to see from their favorite fishing spots both in Ontario and Michigan. This may contribute to the Canadian anglers' perception of lower water quality than their American counterparts.

Balancing the Risks and Benefits

Knuth et al. offer interesting insights into the process of the evaluation of risk in their 2003 report on weighing health benefits compared to health risks.[124] Of the nearly 5,000 anglers interviewed, they found that when risks of contamination were high most respondents would eat less fish regardless of the benefits, yet when risks were low anglers changed their behavior in accordance with the magnitude of the perceived benefits. With regards to water quality, if an individual believes that the water quality is good, he or she is more likely to take fish home. Knuth et al.'s research points to an interesting relationship of self-evaluation necessary for food security and fish consumption.

[124] Knuth, Connelly, Sheeshka, &Patterson, J. (2003). Weighing health benefit and health risk information when consuming sport-caught fish. *Risk Analysis*, 23(6) 1185-1197.

Those who caught and ate fish in the Detroit River felt they could trust the Detroit River as a resource because they could look at the water or fish and directly assess them. One African American angler fishing at Elizabeth Park in Trenton, Michigan, noted that he was aware of the fish consumption advisory, but "paid no attention [to the advisory], the same stuff [can be bought] in the grocery store." This angler elaborated, "Why would I buy something I can catch myself," but also indicated that he felt there was no need to pay attention to the information provided because the store bought alternatives were associated with the same risks. There was also a sense of safety in locally caught fish. The fear of buying fish from a grocery store was also expressed by some anglers who did not trust the source of store purchased fish. One angler stated that there was a higher risk involved in eating fish brought from China than those caught in the Detroit River. This viewpoint may have some validity as Hites found that farmed salmon had significantly larger amounts of total contaminants than wild salmon[125]. For those who did not consume Detroit River fish, the sentiment was the opposite. Many believed that sushi or store bought fish were more reliable, safer, or cleaner. Without a similar advisory relating the contaminant levels compared to Detroit River fish, many will remain in the dark about their contaminant exposure.

There is also an interesting cultural component to the process of risk evaluation. If we add the cultural value of fishing as a benefit to the process of risk evaluation in the way Knuth et al. did with health benefits, we can understand the negative trade off involved with giving up fish.[126] Gift culture, as a practice, infers social capital built in exchange for non-monetary goods. In Detroit, sharing fish with family, friends, or the community plays an important role in social cohesion. To accept fish consumption as a health risk, thus sacrifice

[125] Hites, R. A., Foran, J. A., Carpenter, D. O., Hamilton, M. C., Knuth, B. A., & Schwager, S. J. (2004). Global assessment of organic contaminants in farmed salmon. *Science*, *3*, 226–229.
[126] Knuth, Connelly, Sheeshka, &Patterson, J. (2003). Weighing health benefit and health risk information when consuming sport-caught fish. *Risk Analysis*, 23(6) 1185-1197.

the gifting process would have great social consequences. Health officials in Native American communities have reported similar trends.[127] If one community is threatened by elevated risks and abandons the cultural practice, aspects of the tribe's culture are also threatened.

Health risks must also be weighed against other relative community risks in Detroit. One angler stated that "Fishing is the perfect drug prevention program." This angler keenly highlighted that other personal safety issues are present so that fish contamination seems like less of a risk. Many in Detroit have already been told that the air and soil are contaminated, meaning the threat of contaminated fish is minor or yet another layer of risk.[128][129] One Detroit angler offered fish to his elderly neighbors, saying that if he didn't bring food, who knows what they would eat. Anglers must balance other personal and environmental risks compared to their assessment of the risk of fish contamination.

With this we would like to offer fish consumption advisories and environmental justice on the Detroit River to the body of literature dealing with food security in the City of Detroit. Fishing is a culturally acceptable way of accessing a healthy source of Omega-3 fatty acids and offers a seasonally consistent resource. People share knowledge and resources, be it bait, fishing spots, or fish. In an area where access to fresh fruit and vegetables are scarce, fish is a healthy component for creating a well-balanced diet. Some subsistence anglers on the Detroit River are simply not willing to allow the state to moderate their behavior, gift culture, knowledge, or access to relaxation and food. The question is

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[127] Corey, F. (2007). Aroostook Band of Micmacs: Fish consumption advisory issues. In *EPA Forum on Contaminants in Fish*, Retrieved June 26, 2007, from http://www.epa.gov/waterscience/fish/forum/2007/pdf/section2g.pdf

[128] Keehler, Dvonch, Yip, Parker, Israel, Marsik, Morishita, Barres, Robins, Brakefield-Caldwell, & Sam, M. (2002). Assessment of personal and community level exposures to particulate matter among children with asthma in Detroit, Michigan as a part of community action against asthma. *Environmental Health Perspectives*. *110*(2).

[129] Bryant, B. & Hockman, E. (1994). *Hazardous Waste and Spatial Relations According to Race and Income in the State of Michigan*. (R) in progress.

then, how can we protect those most vulnerable from contamination without removing the value of such a practice?

Cluster Analysis Discussion

Many anglers use sources other than the state issued fish consumption advisory to derive conclusions about the Detroit River, Michigan sport fish, current pollution news, and efforts towards river cleanup. Local newspapers are quite often the source of this information and the most prominent sources of information in our study included the Detroit News and Google. It appears that these information sources are not only highly visible in the public sphere but also provide significant information about fish and pollution on the Detroit River.

The Detroit News, the MDCH, USFWS, and MDEQ were the four most visible stakeholder agencies. These three stakeholders are the most active in providing information on the Detroit River when searching for the phrases: pollution control, fish testing, and water quality (MDEQ), park improvement through the International Wildlife Refuge (USFWS), and fish consumption advisory development and distribution (MDCH). The MDEQ and MDCH are responsible for developing the Michigan fish consumption advisory. Overall these institutions are responsible for the monitoring, recuperation, and overall ecological health of the Detroit River, and furthermore, responsible for providing local residents with that information. It is advantageous that this local news source actively engages in the dialogue between anglers and the environmental governance institutions. And since the Detroit River is a very popular and heavily used fishing location, it is of the utmost importance the connection between anglers and institutions. Based on the high level of reporting it is possible to state that fish, the Detroit River, and pollution, are very visible and important concerns of residents along the river.

Our search in Google yielded the EPA and Wayne County as the two most visible stakeholders on the Detroit River. Their cluster was defined by parks, fish, pollution, and river cleanup, which allows us to assume that concerning the Detroit River, these two agencies are highly correlated with pollution, parks, and cleanup on the Detroit River. Both of these agencies are active in monitoring polluting industries. Therefore, we can also assume that these agencies have the most impact on holding industries accountable for pollution and demanding cleanup.

Cluster Analysis Conclusion

The visibility of several government institutions' actions concerning fish, pollution, and communication on the Detroit River offers the general public some idea of what the institutions' responsibilities are within the region. This also offers the general public, and citizen organizations, a point of reference from which river governance can be assessed, critiqued, or potentially accessed. Of the six government institutions that were active in some capacity on the Detroit River, the MDCH, USFWS, and MDEQ, defined by the terms Detroit River, environment, fish, parks, and pollution, are the most prevalent category from the Detroit News. The Detroit Free Press defined the clusters similarly to the Detroit News. It appears as though the Detroit News and Free Press were the strongest determinants in regards to what concepts each stakeholder was related to in the public sphere.

Anglers can rely on the Detroit newspapers to report on the Detroit River environment and name the appropriate institutions responsible for their governance. Yet these sources generally do not connect racial, social, or environmental justice issues. Whether or not anglers choose to either blame, or praise institutions mentioned above is also a separate but necessary component of future analysis. Furthermore, considering that these institutions are not democratic electorates, this may also confer with issues of trust related to

the Detroit River's governance and anglers. Institutional accessibility or accountability was not explored in this study, but is a necessary component for future research.

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Limitations

As with all studies, we dealt with some limitations and challenges that may affect our data and results. These limitations include the small overall sample size of anglers, the comparatively small number of Canadians, and the short time span during which the surveys were conducted. By the end of the survey period, we began to encounter many of the same anglers we had already interviewed. Some anglers mentioned that the hot August weather was a lull in the fishing season due to the "dog days of summer," which may have lowered the number of anglers fishing on the shores of the Detroit River during our survey period. We traveled to Canada several times and did not encounter anglers at any of the locations, indicating a generally lower number of Canadian anglers on the Detroit River. Fishing locations on both sides of the river often proved to be a research challenge as well. One way that we found locations for interviewing anglers was by asking about their favorite fishing spots during the survey process. Many anglers reported fishing at locations that are not official parks. These areas were very often fenced in or industrial private property, into which we did not feel comfortable venturing. This limited us from encountering some favored fishing spots and possibly the most vulnerable fishing population.

Another barrier to the interviewer-angler trust relationship was their past experiences with the DNR and trust. Trust between the interviewees and anglers may also have been a factor. While only a few anglers declined to participate in the survey, many of those who did participate indicated a lack of time or interest in speaking with us. Additionally, those who may have been afraid of our keeping track of their catch numbers may not have been entirely truthful when self-reporting. Some anglers responded with answers such as

"enough" or "the limit" when asked how many fish they take home. This likely affected our data on the self-reported numbers of fish consumed by anglers. One way we dealt with these trust issues was to provide refreshments to the anglers

Regardless of these limitations and challenges, we had an overall pleasant and positive experience interviewing anglers on the Detroit River. Most anglers were open and happy to provide their input for our study, as well as curious to find out the results. The survey and anecdotal information we gathered will be invaluable to our understanding of the environmental justice issues surrounding fish consumption on the Detroit River.

Playground area at Belanger Park, River Rouge, MI

Elizabeth Park, Trenton, MI – Boardwalk

Elizabeth Park, Trenton, MI – Boardwalk

Fishing Dock at Belanger Park, River Rouge, MI

Riverside Park, Detroit MI

Mill Park, Ontario, Canada

Mill Park, Ontario, Canada

Summary

Our study's purpose was to identify angler groups on the Detroit River and assess which among them rely on the Detroit River as a food extractive resource. We sought to engage in a dialogue with the anglers on their perception, knowledge, and attitudes towards fishing and fish consumption on the Detroit River Area of Concern. Specifically, we asked anglers about their fishing habits, their fish consumption patterns, and the extent to which they were concerned about water quality and its effects on the fish. This information was then used to understand how fish consumption relates to Detroit River AOC fish consumption, water quality and contamination perception, and the intersection within a food secure network. Simply put, to whom is eating fish from the Detroit River acceptable, and why or why not.

1. In the subsequent discussion we seek to understand if fish consumption is an environmental justice issue. For those individuals living around the Detroit River, they flock to the Detroit River for leisure and to fish. However, we also found that anglers of color and U.S. anglers were taking fish home with them at a higher rate, fishing more frequently, and sharing their fish with friends and family. The network of river to table may be wider than we once formerly thought.

2. Fish consumption advisories can also been seen as an environmental justice issue, however, further explanation is required. Anglers of color report awareness of the fish consumption advisory at a greater proportion than their white counterparts. Yet when asked to recall information from the advisory, over 70% of anglers of color and 60% of Caucasian anglers reported that they could not recall any of the advisory's information or were wrong when recounting facts. The message relaying the dangers of elevated fish consumption is

not reaching everyone across the board—and it is especially not reaching people of color. In addition, there are several external considerations that should be taken into account when discussing the advisory's creation. For example, certain species of fish and explanations of chemicals are not represented in the U.S. advisory that are available in Canadian advisory. This creates an additional consideration for environmental justice, in that agencies are currently not responding to the cultural differences and preferences of anglers by race and ethnicity. This is highlights the idea that an effective advisory would not deal solely with angler awareness, but also agency awareness.

3. On the agency side of this equation, we sought to understand the way in which institutions were working to protect angler populations and the corresponding ecosystem. To accomplish this, we looked at how governing bodies within the United States interact with the Detroit River, and how that is reflected in the news and on the internet. Pollution, fish, clean-up, and environment are the terms most often associated with the Detroit River. Racism and justice did not closely associate with the Detroit River. The Detroit News, Detroit Free Press, and Google were the best in providing information about the terms: pollution, fish, Detroit River clean-up, and the environment. Overall, it depends on which resource you are looking at to see how river agencies relate to those concepts.

4. Lastly, we wanted to incorporate what we knew about food insecurity and our findings on subsistence fishing on the Detroit River. We asked what elements make fishing in the Detroit River a secure food resource. Our results demonstrated that fishing is a social activity, yet fish consumption is not socially acceptable for all anglers. Again, people of color do not fish for sport at the rate that white anglers do—and the different groups, even when controlling for income, have different behaviors in regards to their interactions with

fishing and fish consumption. Sharing fish caught from the Detroit River plays an important social role for anglers of color. These anglers share knowledge about fishing and contamination as well as their catch, building social capital and potentially accruing more benefits than the perceived cost of contamination exposure. The risk of food insecurity is a factor for some anglers reporting a lack of fishing areas and consumption limitations.

CHAPTER 7: CONCLUSION AND RECOMMENDATIONS

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In 2005 and 2006, 22 states and Washington D.C. reported that 100% of their lake acres and river miles were under advisory for one or more contaminants. The total number of active advisories in the United States in 2005 totaled 3,373.[130] In 1992, the state of Michigan eliminated appropriations necessary to communicate those risks through a physical advisory. Ashizawa states that, "As our scientific knowledge base increases, policy evolves resulting in changes to improve the activities used to promote and protect the public health. The more targeted approach by Great Lakes states [Wisconsin and Pennsylvania] for fish advisory communication programs is an example of that change."[131] However, our data show that this decision is not affecting all populations in the same ways. If scientific knowledge is increasing on fish consumption risks, who is this scientific information or policy serving, or protecting?

More efforts for targeted fish consumption advisories must respond to the actual behaviors of high risk groups. In the case of environmental research, the connection between contaminants and human activities is paramount. With regards to the specific case of Detroit, Michigan, and beyond, the continued contextualization of race and income must take place. We have found that Michigan fish consumption advisories do not adequately communicate the risks according to fish consumer habits and behaviors in the Detroit River. In 1992, West wrote that, "A broader confirmation of these pilot study findings would also have implications for more intensive, focused 'targeting' of fish consumption advisory communications to sub-groups such as urban minorities that are at a greater risk due to disproportionate consumption of fish from polluted rivers, but who may be less apt to read

[130] Environmental Protection Agency. (2007). 2005/2006 National listing of fish advisories. In *USEPA Office of Water*. Retrieved March, 4 2008, from http://www.epa.gov/fishadvisories

[131] Ashizawa, A., Hicks, H., & de Rosa, C. (2005). Human heatlh research and policy development: Experience in the Great Lakes region. *International Journal Hygiene and Environmental Health, 208*.

and abide by standard fish consumption advisory brochures." These findings were available as early as 1990,[132] and they remain true in 2008.

The state of Michigan may not have the ability to address fish consumption advisory issues because of current budget constraints, but other efforts are taking place to protect anglers. Those efforts must take into consideration anglers' knowledge, attitudes, and beliefs regarding fish and contamination. They must not provide anglers with information regarding contamination but allow anglers to be a part of the process of defining risk. Otherwise, government institutions will continue to run the risk of speaking "in the undifferentiated bureaucratic monotone… which perpetuates environmental injustice by failing to consider the cultures, attitudes, and behaviors of a segment of the population that does not look like bureaucrats of the state."[133] Decentralization of natural resource management and the contextualization of costs and benefits within the community that is exposed to those risks are both at the crux of the environmental justice movement.[134] We again define environmental justice in this context as people of color and those with low-incomes are differentially impacted by the risks of contaminated fish because fish consumption advisories fail to take into consideration cultural, social and economic needs. Because of cultural, economic, and food security reasons, they are forced out of habit to fish the Detroit River, contaminated by point and non-point source pollution. This becomes an environmental injustice issue when the State fails to protect its citizens by relying on ineffective fish advisories or fails to reclaim the river to a more acceptable and healthy resource for multiple use.

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[132]. West, P., Fly, M., Larkin, F., & Marans, R. W. (1992). Minority anglers and toxic fish consumption: Evidence from a statewide survey of Michigan. In B. Bryant & P. Mohai (Eds.), *Race and the incidence of environmental hazards: A time for discourse.* Boulder, CO: Westview Press

[133] Chess, C., Burger, J., & McDermott, M. H. (2005). Speaking like a State: Environmental justice and Fish consumption advisories. *Society and Natural Resources*, 18.

[134] Floyd, M., & Johnson, C. (2002). Coming to terms with environmental justice in outdoor recreation: A conceptual discussion with research implications. *Leisure Sciences*, *29*, 50-77.

With this we offer several recommendations that have come from the anglers and our research experience.

1. Create and Distribute a Creative and Easy to Understand Advisory

As one of the main issues surrounding fish consumption advisories on the Detroit River remains access to information, we recommend that the state or an NGO issue an easy to read advisory that is actually printed and provided to anglers when they purchase their licenses. Cuts in the advisory program's state funding have created the need for seeking creative funding options such as small grants or highlighting the issue's importance to those in the legislature. Reinstatement of the WIC distribution of fish consumption advisory to target at risk mothers in an easy to read and understand format is also recommended.

Another potential solution could be to build signs on the river front that inform anglers of the advisory. We have observed this technique employed in other states where general information was provided on shore-side signs that incorporate pictures and guides. This could also be a distribution point for pamphlets and additional information regarding the advisory and high-risk groups. A visible and stationary sign in major fishing parks could potentially be produced through grant funding.

2. Incorporate Cultural Values into the Risk Model.

Fish consumption advisories have been utilized for the past several decades across the country in many types of communities. Some of these advisories are targeted to specific cultural communities and appear to be more effective as they are able to take specific needs into account. One such example is in Alaska where the administering agency has a program promoting fish consumption at appropriate rates among native Alaskans for whom fish is an

integral staple in their diet. Many other states issue paper advisories in creative ways that attract the anglers' attention and engage them in participation. These include laminated rulers that indicate the lengths that are safe to eat and in what quantities as well as easy to read pocket-sized pamphlets.

3. Issue the Fish Consumption Advisory in the Detroit News and Detroit Free Press

Fish consumers do not understand what PCBs are and the potential impacts they can have on human development. Although many people are aware of the presence of mercury in the Detroit River as popularized by Marvin Gaye's "The Ecology," (1971) they are not necessarily aware of sources of mercury and the deleterious effects on human health. MDCH currently has this information and could easily distribute an informational packet to the media much like a public service announcement. As public service announcements are a requirement for local TV and radio stations, this information could be created by interns through small grants and provided to local stations for broadcasting. This information must cater to the watershed, much like the advisory, since the AOC is becoming a more critical issue.

4. Assess the Disproportionate Distribution of Resources on the Detroit River for Parks

There is an awareness that funds and resources allocated to the International Wildlife Refuge are not reaching the City of Detroit. This creates a disproportionately burdensome aesthetic for anglers in Detroit. This process must incorporate community input in the modification of parks that offer fishing access. One angler stated that there was not one park in the City of Detroit with handicap access. Many anglers feel unwelcome in newly developed parks within the city. Other anglers believe that downtown Detroit and Downriver parks are spotless while the eastside and southwest side parks are in need of

repair and cleanup. Canadians also indicated that new developments were destroying the natural habitat and breeding areas of fish, altering their fishing behavior. Many of these anglers chose to fish in undeveloped parks that are unofficially marked, putting them in danger of sanction.

5. A Joint Fish Consumption Advisory between Ontario and Michigan

Michigan and Ontario currently develop fish consumption advisories separately. The information varies from province to state, although they share the same body of water. The sharing of information of information between these governments will reduce the gap in knowledge on potential contaminant sources and the consequences of those contaminants. It will also increase access to the advisories and reduce confusion on behalf of the anglers. The Integrated Assessment led by CILER aims to do just this.[135]

6. Youth Education and Intergenerational Programs

One of the anglers interviewed for this study suggested that the Detroit River and Parks along the Detroit River could be used as an educational tool. Although Michigan State University Extension—Wayne County provides this service, their resources are limited. This angler rather suggested that people bring their children to the river on the weekend to expose them to the benefits and splendors of the natural resources in their own backyard.

7. Incorporate Information about Water Quality into the Information Network

We were often asked: what exactly is the water quality like in the Detroit River? Anglers understand that water quality in the Detroit River is linked to the Great Lakes and they are concerned with the ecosystem's health. Anglers know that water levels have been

[135] www.ciler.umich.edu/fca

going down and are concerned. They also believe that the water quality has improved over the past several decades, but are unsure as to how much it has improved. There should be a simple mechanism to incorporate emerging and historical contaminants in the news regularly. There should also be reports indicating temporal trends of those contaminants over time. This will generally incorporate anglers' knowledge of water quality on the Detroit River without directly threatening their resource or frightening them individually.

8. Give Anglers of Color a Space to Promote Recreation in Culturally Appropriate Ways

Anglers in Detroit and the surrounding areas are very proud of their heritage and hobbies. Many anglers feel as though they have been forgotten by the City of Detroit, which in their opinion, wants to sell their parks, forget them, or exclude them from new parks. Anglers of color in Detroit have a long history on the Great Lakes and on the Detroit River. Positive portraits of anglers of color will counterbalance negative stigma around fish consumption and around the activity of fishing as an old man sport for teens. There must be a positive identity for anglers of color in the popular media to attract and maintain a healthy relationship to the environment in the city.

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Appendix I

Detroit River Fish Consumption Advisory Angler Survey

Date: _____ Location: _____ Angler # _____

INTRODUCTION

1. How many years have you been fishing on the Detroit River?
_____

2. Why do you fish?
☐ Leisure ☐ Escape or quite ☐ Close to nature ☐ Family ☐ Community Building
☐ Food source ☐ Social gatherings (Family, friends, fish fry)
☐ Other _____
_____

3. Where are the best fishing spots along the Detroit River?
_____

4. When are the best times to fish? _____

5. Do you fish at any other location? ☐ Yes ☐ No
5a. If so, where? _____

6. How often do you fish in the Detroit River?
☐ Everyday ☐ Very often (1-3 times weekly) ☐ Somewhat often (1-3 times monthly) ☐ Infrequently (1-2 per summer) ☐ Almost never (once a year)

BOATER QUESTIONS (If no, skip to question 10)

7. Do you ever fish by boat? ☐ Yes ☐ No
7a. If yes: What type of boat do you typically fish in? _____
_____

8. When you are fishing on the Detroit River by boat, how far do you typically go out from shore? _____

9. Are the fish a different quality further away from the shore? ☐ Yes ☐ No
9a. If yes, please explain: _____

BEHAVIOR

10. In fishing season, about how many fish do you catch a week? _____
10a. Of these, how many do you take home and consume?_____

11. About how many fish per week (in fishing season) is that? _____

12. What type of fish do you typically take home? What sizes (in inches)?
Species _____ Size _____
Species _____ Size _____
Species _____ Size _____
Species _____ Size _____
Species _____ Size _____

13. Have you ever exchange fish for another good? ☐ Yes ☐ No
13a. If yes, can you tell me a little bit about that? _____
_____

14. Who taught you how to fish/how did you learn to fish? _____
_____

15. Have you taught anyone how to fish? ☐ Yes ☐ No
15a. If so, who? _____

16. How do you like to prepare and cook the fish? _____

17. Generally, do you cook it yourself or does someone else? ☐ Self ☐ Other
17a. If someone else, who does that most of the time? _____

18. Do you remove the head, tail, skin, fat, and bone from the fish before you eat it?
☐ Yes ☐ No
18a. If yes, why? _____

19. Do other members of your household or community eat the fish you catch?
☐ Yes ☐ No
19a. If yes, who? _____

20. How important is fish as part of your diet?
☐Very important ☐ somewhat important ☐ Important ☐ Somewhat not important ☐ Not at all important

21. How often do you buy fish from the market? ☐Very often ☐ somewhat often ☐ often ☐ not often ☐ rarely
21a. If yes, what types? _____
_____

22. How well do you know the other fisherpeople along the river?
☐ Extremely well ☐ Very well ☐ Well ☐ Not very Well ☐ Not at all

23. Where are the most popular or crowded areas to fish? _____

24. Are new parks and developments changing where you fish? ☐ Yes ☐ No
24a. If yes, how?_____

CURRENT FISH ADVISORY

25. Are you aware of the current fish consumption advisory? ☐ Yes ☐ No

26. What can you tell me about the current fish consumption advisory distributed by the state? _____
_____
_____

27. Do you know where you can access a fish advisory pamphlet or information?
☐ Yes ☐ No
27a. If yes, where?_____

28. How are the fish consumption advisories helpful to you? _____
_____
_____

29. Has this pamphlet influenced how or where you fish, if at all?
☐ Yes ☐ No ☐ Don't Know ☐ N/A ☐ Other _____
29a. If Yes, How? _____
_____

30. How would you prefer to receive fish advisory information?
☐ Internet ☐ Church ☐ Health Clinic ☐ River signs ☐ Community Center ☐ TV
☐ Radio ☐ Barber ☐ Corner Store ☐ Bait Shop ☐Other _____

CONTAMINATION AWARENESS

31. How would you rate the water quality of the Detroit River (1 being the lowest, 5 the highest)?
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

32. Tell me a little bit about how water quality affects fish:
_____
_____

33. How do you determine if the fish is good to eat?
_____
_____

34. If you think a fish is not good to eat, what do you do with it?
_____
_____

35. Where did you learn how to gauge if fish is not good to eat?
_____
_____

36. Do you share that information with other fishermen? ☐ Yes ☐ No
    36a. If yes, how often? ☐ Always ☐ Sometimes ☐ Never

37. In the time since you have been fishing on the Detroit River, what changes, if any, have you noticed in fish or water quality? _____
_____
_____

38. What information, if any, would you like to know about fishing and water quality?
_____
_____

OPTIONAL

39. Age: _____

40. Gender: ☐ Male ☐ Female

41. Zip Code: _____

42. Number of members in household: _____

43. Race/Ethnicity:
☐ Caucasian
☐ African American/Black
☐ Latino
☐ Asian/Pacific Islander
☐ Native American
☐ Arab/ Middle Eastern
☐ Other: _____

44. Highest Education Level:
☐ Middle School
☐ Less than High School Diploma
☐ High School Diplopma/GED
☐ Trade School
☐ Some college
☐ Associates Degree
☐ Bachelor's Degree
☐ Masters Degree or above

45. Yearly Household Income:

☐ 0 – 24,999
☐ 25,000 - 49,999
☐ 50,000 - 74,999
☐ 75,000 - 99,999
☐ 100,00

46. ADDITIONAL COMMENTS AND NOTES