

**How Some Southeast Asian Americans in Providence, RI
Perceive the Risk of Mercury Exposure from Eating Fish**

An Environmental Health Literacy Approach

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Thesis

submitted in partial fulfillment of the requirements for the Degree of Bachelor of
Arts from the Center for Environmental Studies at Brown University

May 2003

Acknowledgements

I would like to thank my thesis advisor, Chris Zarcadoolas, first and foremost, who was with me throughout the thesis process and provided me with invaluable guidance and support. Thank you to Sherri Curria, Bob Vanderslice and Dhitinut Ratnapradipa in the Office of Environmental Health Risk Assessment at the Rhode Island Department of Health, who provided me with the opportunity to examine mercury risk communication at the state level and have been a strong source of faith and support. Special thanks to Sam, Eddie, Mae and Toua at the Socioeconomic Development Center for Southeast Asians (SEDC) for connecting me with members of the local Southeast Asian community. Thank you to Lia at Hmong United and Thomas at the Laotian Community Center for taking an interest in my research and connecting me with people to interview. Thanks to Lia and Jennet for assisting with interpretation. Thank you Pat Dickson for helping me approach and manage the thesis process. Special thanks to Patti and Betsy at the Center for Environmental Studies (CES), Vanessa Li, the CES students, my friends and family. Your words, support and assistance helped me reach this point and continue to encourage me.

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Executive Summary

The purpose of this study is to identify environmental health literacy (EHL) of Southeast Asian fishers in the context of mercury exposure from eating fish. This study is relevant because environmental health officials in Rhode Island (RI) suspect that Southeast Asian fishers in the state and their families are being exposed to hazardous levels of mercury due to high fish consumption and are concerned that this group is not aware of the risks of eating certain types of fish. The conclusions of this study are presented as recommendations to the Rhode Island Department of Health (HEALTH) and the Department of Environmental Management (DEM) on areas to focus further research and implications for current risk communication.

Small amounts of mercury are known to cause severe brain and nervous system defects. The vast majority of mercury humans are exposed comes from eating fish. Developing babies and young children are most sensitive to mercury and women of childbearing age are advised to limit their consumption of certain fish for risk to this sensitive group. A national biomonitoring study published by the CDC in January 2003 reports that while average exposures of Americans to mercury are below hazardous levels, certain subpopulations that consume higher-than-average amounts of fish such as subsistence fishers and certain ethnic populations may be exposed to unsafe levels of mercury.

Risk communication and education is one way to reduce public risk of mercury exposure by educating people to avoid eating fish that are high in mercury. Most states in the country issue fish consumption advisories. RI issued a fish consumption advisory for mercury in April of 2002. In order to effectively convey an environmental health message to a target population, risk

communicators must understand the population's EHL. EHL is defined as the ability to use reading, writing, science, numeracy and civic skills to understand and act on environmental and health information in order to reduce personal risk and make informed decisions. This thesis identifies important fishing behaviors and assesses a discrete number of environmental and environmental health literacy levels among the target population.

Southeast Asian fishers are chosen as the study population for a number of reasons. National studies have found that Asian and Pacific Islanders (APIs) consume much more fish than the general population. Asian Americans are the fastest growing population in RI; about half are Southeast Asian. It is very probable that Southeast Asians are a low literacy group in the state. They are about four times as likely to be poor as the general RI population, many adults do not speak English and the group has a relatively short history in the United States and RI.

I interviewed 15 male fishers in the Providence area who belong to the three largest Southeast Asian groups in RI - Cambodians, Laotians and Hmong. I asked them questions about fishing practices and attitudes, family fish consumption and their EHL. All of the fishers and their families consume enough contaminated fish to be at risk of mercury exposure.

While most fishers were conversant about DEM-enforced fishing regulations, none were familiar with the fish consumption advisory. Most fishers did not fully understand the nature of mercury contamination, but trusted the information given by HEALTH and DEM. Most fishers showed high civic literacy and numeracy skills.

I have demonstrated that assessing aspects of environmental and environmental health literacy are critical. Recommendations for further research within EHL include focusing on high-risk populations such as women and subsistence fishers, measuring the reading ability of the study population and expanding the science literacy assessment. Outside of further research in EHL, RI should collect fish consumption data for Southeast Asians as well as the general state population. The state has an opportunity to integrate this data collection into the developing biomonitoring program.

Further risk communication and education to this and other populations should be a collaborative process with the population. This research indicates that the Southeast Asian fishing population will be receptive to such collaboration and that the product of this effort can be the advancement of people's environmental health literacy and thus their abilities to mitigate risk.

Introduction

The increased focus on toxicants such as lead in the last 30 years among urban ethnic minority children living in the United States has raised the consciousness of the public and environmental health advocates about how exposure to various pollutants is distributed across the U.S. population. The story of disproportionate exposures to toxic substances among ethnic minorities is not new. In fact, the burgeoning environmental justice movement focuses on exploring why certain minority groups bear the brunt of exposure to a long list of substances and discovering ways to reduce exposure disparities. (Bullard 1993; 16)

This thesis focuses on mercury exposure from fish consumption among Southeast Asian fishers and their families in Providence, RI. There are several reasons that make this issue ripe for study. One is that mercury pollution has become a significant concern worldwide. The United Nations Environment Program has recently made a commitment to addressing mercury pollution at the international level (U.S. Department of State 2003). Another reason is that mercury risk is disproportionate across the United States. Certain groups such as Asian Americans and Pacific Islanders have elevated risks (Burger et al 1999; 428; Hutchison 1994; 475).

Aside from reducing the amount of mercury in the environment, the best way to reduce personal risk of mercury exposure is to know which fish have high mercury levels and which fish are safe to eat. Making sure the public has this knowledge and makes the right choices is the primary goal of risk communication and public education. The interesting caveat is that along with increased exposures to certain environmental risks, the group most exposed to mercury also bears the burden of other disparities, such as low literacy. (Doak et al 1995; 3) Environmental health literacy is an important factor to understand in a risk population because it describes what type of environmental health information a group would be most able to comprehend and use.

For this study, I studied aspects of environmental health literacy in Southeast Asian fishers in the context of mercury exposure from eating fish. Southeast Asians are my population of interest because many in the state have shown fishing and fish consumption characteristics that indicate possible increased risk of mercury exposure and it is likely that they have unique literacy characteristics that should be considered when designing communication strategies.

In Chapter 1, I discuss the risks posed by mercury in the United States today and who is most sensitive to its effects as well as who may be most exposed. In Chapter 2, I discuss risk communication as a means of reducing risk of mercury exposure and summarize the status of mercury-in-fish risk communication in the United States today. In Chapter 3, I discuss literacy, its development as a concept, its status in the United States today, its many applications and its importance to environmental health risk communication. In Chapter 4, I introduce my target population – SE Asian fishers who consume the fish they catch, why they deserve attention in mercury risk assessment and why they deserve attention in literacy assessment. In Chapter 5, I present my methodology and lay out my approach for identifying ways to identify environmental health literacy in Southeast Asian fishers in the context of mercury exposure from eating fish. In Chapter 6, I present the results of my research. In Chapter 7, I conclude with recommendations to the Rhode Island Department of Health on better ways to communicate with the Southeast Asian community of Rhode Island and ways to integrate environmental health literacy assessment into the risk communication process.

Chapter 1. Mercury Risk

Mercury and its Sources

In the U.S., mercury exposure is gaining more and more attention as a serious environmental threat to human health. Mercury occurs naturally (chemical abbreviation “Hg”) but is also released into the environment in excessive amounts via human-based processes – predominantly emissions from coal-fired power plants, medical waste incinerators and municipal waste combustors. (Baumann et al 2001; 7) “The US Environmental Protection Agency (EPA) estimates that these anthropogenic releases have increased to a level two to five times those of pre-industrial times.” (Mahaffey 1999; 397) Mercury exists in metallic, inorganic and organic forms and can be a solid (salt), silvery-white liquid or permeable gas. Greater than 95% of mercury derived from ingested methylmercury (meHg), the organic form, is absorbed. (Mahaffey 1999; 398) Most humans are exposed to mercury in this form. Mercury is a chemical element that cannot be destroyed, can permeate almost all types of environments in one form or another, and can remain volatile in the atmosphere for a long time.

Effects of Hg Exposure and Most Sensitive Individuals

Current mercury risk assessment in the United States is motivated by the finding that mercury impairs the brain and nervous system. (Stern 2002a) Following this finding, very young children, especially developing fetuses, are most sensitive to mercury exposure since they represent developmental stages where nervous system development is most critical. (EPA 1997; 3-22) Mercury is not only extremely permeable across the blood-brain barrier but also the placenta, and when a pregnant mother is exposed, it tends to accumulate in the fetus. The severe

outcomes that may arise in the child include brain damage, lack of coordination, mental retardation, seizures, blindness and an inability to speak. (ATSDR 1999)

In addition to brain and nervous system effects, evidence is mounting that Hg damages the cardiovascular and immune systems. (Salonen et al 1995; Stern 2002a) The evidence supporting cardiovascular effects of mercury is particularly interesting since fish consumption is often touted for its positive heart and cardiovascular effects.” (Guallar et al 2002; 1752) This evidence supports the claim that the high mercury content of certain fish may actually counteract the very health benefits that motivate some people to eat that fish in the first place. This evidence is also significant because it suggests that young children and women of childbearing age may not bear the burden of risk and that older individuals and men are also highly sensitive to mercury. This evidence is therefore very relevant to how risk is assessed and communicated.

Dose - Response

Much is known about the effects of mercury at high doses, but evidence of the effects of mercury at low doses is much less clear. “Lower level exposures from maternal consumption of fish have not been consistently associated with adverse neurodevelopmental outcomes in children.” (Abelsohn 2002; 1549) However, the idea that human exposure to levels of mercury contained in commonly eaten fish can cause appreciable and significant effects is not far-fetched. A study published in the same month of submission of this thesis reports that 89% of high-end fish consumers studied had mercury levels above the limit determined to be safe by the EPA and many fishers showed visible signs of mercury poisoning. (Hightower & Moore 2002; 606)

Exposure

The CDC conducted a national biomonitoring study in 1999 to measure the levels of certain chemicals and substances of interest, including mercury, in the U.S. population. The study included a dietary intake inventory as well as measurement of both blood and hair mercury levels (blood and hair mercury concentrations are the most common biomarkers of mercury exposure). The study concluded that *average* exposure of the *average* American to mercury, even among women of childbearing age and young children, was below the levels deemed to be unsafe. While the study managed to estimate average exposure levels, the authors concede an inability to focus on specific highly-exposed populations. The 1999 National Health and Nutrition Examination Survey (NHANES), the instrument that provided the data for the CDC biomonitoring study, “cannot provide estimates of Hg exposure in certain highly exposed groups (e.g., subsistence fisherman and others who eat large amounts of fish).” (CDC 2001; 142)

Indeed, on *average*, women of childbearing age and young children in the U.S. do not eat enough fish to put them at risk of mercury poisoning. However, specific groups who consume exceptional amounts of fish or are especially sensitive to its mercury burden, face substantial individual risks. While experts have certain qualitative leads on specific groups such as subsistence fishers (CDC 2001; 143) and certain ethnic populations, more quantitative data is necessary to determine who bears the brunt of exposure and to what extent.

Burger et al. found that among 258 fishers surveyed along the Savannah River on the borders of Georgia and South Carolina, differences in ethnicity and education were significantly correlated with differences in fishing habits. Specifically, the authors found that, “Blacks fished more often, ate more fish meals of slightly larger serving sizes, and consumed more fish per year than did Whites.” (Burger et al 1999; 427) These ethnic differences in fishing habits and

consumption were not attributable to income. This observed contrast between ethnic and educational groups within a study population of active recreational and subsistence fisherman warrants further research focus on subgroups of the U.S. population that are at increased risk of mercury exposure, namely the fishing population and communities of color. Thus, other communities of color such as the SE Asian community in Providence, R.I. have raised concerns about their suspected high exposure to mercury and other contaminants due to active fishing.

Conclusion

Scientific knowledge regarding mercury is incomplete. There is still reasonable doubt in the scientific community about the precise nature of effect of mercury at low doses and who within the U.S. population may be most exposed or vulnerable to mercury. However, the scientific community is relatively certain that at relatively low doses, mercury does cause adverse effects in humans and that mercury in fish is pervasive, long-lasting and difficult to detect by the common person in fish. This knowledge qualifies mercury as a considerable threat to human health and demands immediate action. As I will discuss in the following chapter, risk communication is a viable and common approach to abating public and personal risk of exposure to mercury from eating fish.

Chapter 2. Mercury Risk Communication in the U.S.

Experts agree that there are two primary and complementary approaches to reducing human exposure to mercury: mercury source reduction and mercury risk communication. Mercury source reduction refers to reducing the amount of mercury in the environment by reducing emissions and collecting mercury products. Mercury risk communication entails educating the public about ways to reduce its exposure to mercury that presently exists in the environment, such as choosing to eat fish low in mercury and participating in mercury clearinghouses. Though mercury source reduction is much more of a primary prevention approach and has more of a lasting impact on reducing mercury risk, it will not happen soon. Mercury's long life in the environment and lobbying by the mercury industry both work to postpone results from mercury source reduction to the long-term. (Baumann, et al. 2001; 14)

With mercury risk accumulating in the environment today, something needs to be done in the meantime to reduce public risk of mercury exposure. Mercury risk communication is something that can happen right now. Through advisories and targeted risk communication and education, the public can become more informed and make decisions to mitigate this risk.

Fish Consumption Advisories in United States

Currently 39 states issue fish consumption advisories about the risks of mercury exposure. Almost 75% of all fish consumption advisories have been issued at least in part because of mercury contamination. Since 1993, the number of state mercury advisories has increased 115%, representing a growth from 23 states issuing to 44 in 2001. Though the number of mercury-in-fish advisories decreased between 2001 and 2002, the number of lake acres and river miles covered by the advisories increased significantly, 7% and 48% respectively, largely due to a few states who have adopted statewide advisories for concern that all water bodies in

their jurisdiction may be affected by some amount of mercury contamination. (EPA 2002a) All state advisories are similar in that they provide recommendations to the public about specific types of fish to avoid eating or specific types of water bodies or locations from which to avoid getting fish. However, they can vary greatly from state to state in the types of fish, locations and populations they target as well as the amount of exposure for which they aim to protect.

Most mercury advisories across the United States (including those of the US EPA and the FDA) are *two-tiered*, which means that the advisory lists different recommendations for two different populations: a sensitive population and the general population. In the case of mercury, the *sensitive population* includes all women of childbearing age (15-44 years old) and young children (12 years old and younger). The general population includes all other members of the U.S. population. The two-tiered structure of mercury advisories rests on the assumption that the sensitive population is indeed more “sensitive” to mercury than the general population.¹ That is to say that any given amount of mercury causes more significant or a greater intensity of adverse health effects in exposed members of the sensitive population than in exposed members of the general population.

Based on the levels of contamination in their waterbodies, states issue no-consumption advisories or just restricted consumption advisories for certain types of fish that bioaccumulate mercury easily. These advisories may be targeted to the general population or specific sensitive populations. Massachusetts has issued what is considered the most protective advisory, because it advises all pregnant women to avoid all fish from state waters. (Baumann et. al. 2001; 34)

Alaska has issued a statewide “No Restriction” advisory, which signifies that results from state

¹ This assumption is believed to be correct because environmental health officials are in most consensus on the neurotoxic effects of mercury. However, as discussed in Chapter 1, there is mounting evidence that mercury has cardiovascular and immunotoxic effects which suggest that the general population may be closer to the sensitive population in risk. This may mean that the two-tiered advisory structure is not necessary.

water quality testing indicate that fish in water bodies in the state contain very low levels of contaminants and are therefore safe to eat. (EPA 2002a) A statewide advisory warns the public of potential harmful contamination in all water bodies in the state of a specific type (i.e., lakes, rivers, and/or coastal waters).

RI Mercury-in-Fish Advisory

In April 2002, the RI Department of Health (HEALTH), through the Office of Environmental Health Risk Assessment (OEHRA), issued an advisory about the risk of mercury exposure from eating fish. HEALTH recognizes the same sensitive population as the EPA (i.e., pregnant women, nursing mothers, women of childbearing age and children under age 12) and uses a two-tiered structure for its advisory. The advisory appeared in 4 places: a brochure (provided in Appendix B), a brochure-insert, the HEALTH website and the “Contaminants-in-Fish” hotline.

The brochure and brochure-insert are currently available in English and Spanish. OEHRA designed the brochure in collaboration with the Office of Family Health at HEALTH. It presents information on the general benefits of eating fish, the risks of eating fish with high levels of mercury and types of fish that should be avoided. OEHRA designed the brochure-insert in collaboration with the RI Department of Environmental Management (DEM). It discusses more specifically the types of fish that should be avoided and locations to be avoided for fishing. The Contaminants-in-Fish hotline telephone number and HEALTH website URL are included in the brochure. HEALTH pre-tested fishers of Providence WIC centers for knowledge of mercury and post-tested the brochure with the target advisory population as well as state fishers. The brochure is the main leg of the RI Mercury-in-Fish Advisory.

HEALTH focused distribution of the brochure and the brochure-insert on state Centers for Women, Infants, and Children (WIC centers) and state-certified fishing license vendors. Therefore, the *primary target advisory population* includes fishers at WIC centers and visitors to fishing license vendor sites across the state. WIC fishers are included because WIC services cater precisely to members of the *sensitive population*, yet only those of low socioeconomic status. The rationale behind including fishing license vendors in the target advisory population is that some of their customers may seek licenses in order to engage in dietary or subsistence fishing. If these customers are not directly part of the sensitive population (e.g. men), they may have family members or friends in the risk population to whom they bring their fish catch to eat.

Need for Targeted Advisories

As the CDC reported based on its biomonitoring study of 1999, mercury risk is not a problem for the majority of Americans who eat average amounts of fish but for certain subpopulations that eat exceptional amounts of fish. In Chapter 4, I will make the case for why Asians and Pacific Islanders (API), including the large presence of Southeast Asians in Rhode Island, are an example of such a subpopulation and deserve focused attention in the state's risk communication strategy.

So far, HEALTH has taken steps to pre-test and post-test the advisory information with members of the sensitive population but not yet among specific communities at risk. HEALTH is currently translating the brochure and brochure-insert to Thai and Lao. However, HEALTH must take steps to account for other factors that contribute to cultural difference other than language difference.

Health promotion experts acknowledge that effective risk communication must not only address the language preferences but also reflect the *values* and *concerns* of the target population, that is, reflect the cultural framework within which the population interprets the risk. (Frazer & Smith 1997) The SE Asian community and other communities that consume large amounts of fish may have different conceptions of mercury risk information based on different cultural realities. Among elements to be considered is the target population's fundamental literacy and environmental health literacy. Literacy is a measure that describes not just people's abilities to read and write but their abilities to understand and use environmental and science information. I will discuss this aspect in the next chapter.

Chapter 3: The Importance of Literacy in Characterizing a Target Population

Risk communication and literacy

A risk communicator has four main goals:

- 1) Getting people's attention.
- 2) Being relevant.
- 3) Being clear and understandable.
- 4) Ultimately influencing knowledge and behavior.

The first goal involves using the right medium (print, media, public outreach, etc.) to attract the target audience to the risk message. The second goal means talking about issues that actually pertain to the target audience. The third goal involves presenting a risk message with a language and vocabulary that is understandable to the target audience. The fourth goal is the main goal – to encourage people to adopt behaviors that reduce their risk.

Understanding the literacy of the target audience will inform and improve achievement of all of these goals. Understanding literacy is useful for analyzing existing risk information and designing new risk communication.

Key Aspects of Literacy

In this chapter, I will discuss key aspects of literacy as they relate to understanding and communicating risk of mercury exposure.

1) Fundamental Literacy

The National Institute for Literacy (NIFL) refers to a definition of literacy from the federal Workforce Investment Act of 1998: “literacy is an individual’s ability to read, write, speak [in English]², compute and solve problems at levels of proficiency necessary to function on the job, in the family of the individual and in society.” (NIFL 2003) Literacy, by this definition, is also referred to as general, functional and fundamental literacy. The common understanding of literacy is that it is a measure of the abilities to read and write. NIFL has recently recognized that especially due to advancements in technology and information exchange in the world today, the abilities to speak (and understand spoken word) and to compute and solve problems (known in other contexts as *numeracy*) have become as germane to literacy attainment as reading and writing.

Beyond expansion of the definition of fundamental literacy, the literacy models are addressing other components of literacy. The following are specific components which bear strong connection to the context of environmental health risk information. They include: science literacy, civic literacy, health literacy, environmental literacy and environmental health literacy. Environmental health literacy represents the newest component of literacy model and a synergy of the other components.

2) Science Literacy

The concept of science literacy has received much attention in the last century. There are many definitions of science literacy. The most comprehensive and most useful definition is that of Miller. According to Miller (1983), science literacy has 3 dimensions (Laugsch 78):

- (a) an understanding of the norms and methods of science (i.e., the nature of science)

² Brackets are my own. Of course, literacy does not just apply to understanding and using the English language. It occurs in all languages and societies.

- (b) an understanding of key scientific terms and concepts (i.e., scientific content knowledge), and
- (c) an awareness and understanding of the impact of science and technology on society

Most other definitions focus solely on dimension b, scientific content knowledge, which characterizes science literacy as knowledge of an absolute list of scientific facts, which can easily be tested. Miller's definition adds to this characterization dimensions (a) and (c), which highlight the arguably more important skills of understanding the "nature of science" and the impact of science and technology on society [and one's own daily life], respectively.

Some uses of science literacy include fostering technological advancement, increasing the competitiveness of national research and development and increasing participation of citizens in public discourse on scientific or science-based issues. This last use is what many see as the key reason why science literacy is important. "Understanding how ideas are investigated and analyzed can be valuable for staying abreast of important issues, participating in the political process, and assessing the validity of other types of information." (National Science Board 2002; 7-10)

3) Civic Literacy

Civic literacy refers to the "knowledge and skills that we [citizens] need for effective participation in community, government and politics." (LibertyNet 1996) The uses of civic literacy are directly stated in the definition: "effective participation in community, government and politics." This has become a very relevant literacy in recent times in the United States due to low participation of the general population in the voting process and surveys that report low public awareness of and knowledge about public issues.

4) Health Literacy

Another important aspect of literacy is health literacy. People are faced with a large array of information, decisions and services regarding their personal health. This occurs in the health care setting in situations such as reading and understanding prescriptions and informed consent documents and assessing personal risk from undergoing a risky operation or procedure. But this also occurs in the day-to-day such as in choosing what meals to eat and allotting time for exercise. Each person must evaluate health information – assess risk, effectiveness, practicality, etc. Certainly, one person can be better at doing this than another, that is to say that one person can have higher health literacy than another. **Health literacy** is defined as “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health” (Nutbeam 1998; 10)

5) Environmental Literacy

Environmental literacy is defined as “the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore, or improve the health of those systems.” (Roth 1992; 3) This application of literacy also takes from other literacies. There is a civic component – “taking appropriate action to maintain, restore or improve the health of those systems”. There is also a science literacy component, because an understanding of science and the scientific process is vital to understanding the health of environmental systems. And in order to understand the health of the environment and the possible harms it may endure, one needs quantitative skills (numeracy) as well.

Both environmental literacy and health literacy are composed of common abilities, and those common abilities form the basis for observing environmental health literacy. These common abilities are science literacy, numeracy and civic literacy. Whether the topic is health of the environment or health of the individual, a key component of environmental health literacy is *science literacy*. Indeed a central tenet of many environmental belief systems is that environmental health and personal health are not separate entities but connected, and understanding both draws on similar scientific concepts. *Numeracy* is almost inextricably linked to science literacy and especially in the realm of risk communication, numeracy is key to assessing risk, measuring risk and comparing risk. *Civic literacy* is important because issues of environmental, health and environmental health importance appear in public discourse everyday and public participation in the debate is essential.

6) *Environmental Health Literacy*

A literacy framework can assist in more fully understanding mercury risk. This context is environmental health. The OEHRA at HEALTH and other similar offices across the United States are communicating mercury risk information in order to protect the health of the public. Understanding the root cause of the health risk – pollution – typically belongs to another realm of literacy, environmental literacy. Understanding how pollution of mercury and air particulates can affect the health of the environment can thus be seen as environmental literacy and how this pollution can affect human health is environmental health literacy. As intuition would say, environmental health literacy draws largely from health literacy and environmental literacy. Based on these concepts, I define **environmental health literacy** as the ability to use reading,

writing, science and numeracy skills to understand and act on environmental and health information in order to reduce personal risk and make informed decisions.

Observing Environmental Literacy

In order to design an approach for assessing environmental health literacy in target populations, it is necessary to explore the nature of the concepts that are central to understanding risk of mercury exposure from fish consumption.

To understand the path of mercury from source to risk, for example, people make use of their environmental literacy. People must be able to conceptualize how most mercury is transferred from smoke stacks into the air and then settles into water where it *bioaccumulates* in organisms going up the *food chain* to fish and aquatic animals. A grasp of these ecological concepts is useful towards understanding how a human-based process such as mercury pollution from an incinerator can have an impact on the state of the environment and therefore signifies environmental literacy.

To conceptualize the path of mercury from fish to effect in humans, people must use health literacy. One essential concept is that mercury gets into people mainly from eating fish and that once in the body, mercury can cause harmful effects to the brain and nervous system. Other essential concepts are that mercury is most harmful to fetuses, infants and young children, their brains and nervous systems are most vulnerable and they can be exposed via transfer through the placenta and through breast milk.

The conservative stance of environmental health risk communicators is that the health literacy concepts described in the last paragraph are much more germane to the objective of influencing people to reduce their personal environmental health risk than the environmental

concepts described in the paragraph before last. The barebones essential skill needed to reduce personal risk is being able to distinguish between mercury-safe and mercury-unsafe fish. Indeed, understanding the sources of mercury to the environment and its path to fish may not be necessary towards developing that skill.

However, it is important to note that reducing personal risk is not the only impact of risk communication and education. Informing citizens so that they can fully participate in public discourse regarding the risk issue, that is, raising the civic literacy of the target population, is another important impact. Understanding the environmental components of mercury risk is important for members of the public to adequately participate in mercury source reduction, mercury risk assessment and mercury risk management.

Status of Literacy in the U.S.

Fundamental literacy in the United States is extremely low. About 50% of the adult population in the U.S. reads at or below the eighth grade level. (Kirsch, et al. 1993) This means that at least 50% of the adult population cannot read typical newspapers, which are written between the 9th- and 12th-grade levels. (Doak et al 1995; 3) This population also cannot read most printed health information, which is typically written between the 10th- and 12th-grade levels. (Kirsch, et al. 1993) The problem of low literacy is more pronounced among the elderly population (age 65 and over) and inner-city minorities. (Doak et al 1995; 3; NALS 1993)

The effects of low literacy in specific settings are visible. A person with low health literacy, for example, suffers both higher chances of chronic physical or mental health problems (Davis et al 1996; 96) and annual average health care costs four times greater than for the general population (Weiss et al 1994; 95).

Conclusion

In this chapter, I introduced the concept and measure of literacy and discussed its importance and relevance to communicating environmental health risk information. I have presented several components of literacy that are especially relevant to environmental health information such as science literacy, civic literacy, health literacy and environmental literacy. I have drawn on these components in forming the frame of a new application of literacy – environmental health. I have compared these concepts and identified common abilities that could possibly form the basis of environmental health literacy assessment: science literacy, numeracy and civic literacy.

In the chapter after next (Chapter 5: Methodology), I will discuss how I planned my approach to observing these abilities in my target population. But first, I must introduce you to my target population – the Southeast Asian community of Providence, RI.

Chapter 4. Southeast Asian Fishers

High fish consumers

Why have I chosen to focus on Asian fishers? Asian and Pacific Islanders (APIs) represent a number of ethnic groups in the United States that are suspected of being at higher risk of toxic exposure because of high fish consumption levels. (EPA 2001; 14) Though data on actual body levels of mercury and other toxics is not yet available for specific populations such as APIs, thorough studies have been conducted that measure high fish consumption levels in this population, which are very suggestive that APIs in the United States are highly exposed to toxics that bioaccumulate in fish.

The most comprehensive study so far is the *Asian and Pacific Islander Seafood Consumption Study*, conducted by the EPA Region 10 Office (Northwest U.S.) in conjunction with the National Institute for Environmental Health Science. This study measured an average consumption level of 89g of fish per day per person (average body weight = 62 kg) for a sample of 202 fishers, which represent ten API ethnic groups (including the groups of focus in this study). (EPA 1999; 2) Compared to an average level of fish consumption among the general U.S. population and sport fishers of 17.8 g/day and even the average level among “subsistence” fishers of 86.3 g/day (Jacobs, et. al. 1998), API communities consume a large amount of fish. Furthermore, this study concludes that “seafood consumption is almost universal within the API community,” but levels vary between ethnic groups. (EPA 1999; 51)

As for the ethnic groups of focus in this study, the EPA Region 10 study also found that Laotians and Hmong were among the groups who harvested (a.k.a. “fished”) the most seafood. A study of differences in fish practices and fish consumption between ethnic groups in Wisconsin

found that Hmong households consumed almost twice as much fish as the average Wisconsin fisher. (Hutchison 1994; 475)

Large presence in RI

Why have I chosen to focus on SE Asians fishers in RI? SE Asians are increasingly becoming a larger presence in RI. According to the 1980 and 1990 census, “Rhode Island led the nation in percentages increase[d] (245.6%) of the Asian [American] population...and [t]he Asian [American] population in Rhode Island, believed to be predominantly Southeast Asian [American], was the state's fastest growing minority group.” (UW-SENE 1991) The SE Asian groups most represented in RI are [in order of population size]: Cambodians, Laotians and Hmong. Along with the Vietnamese, they represent about 50% of the RI Asian American population. (RI DOH 2001) In 2000, RI had the seventh largest Cambodian population (Pfeifer 2003a), the 17th largest Laotian population (Pfeifer 2003c) and the 12th largest Hmong population in the U.S. (Pfeifer 2003b)

Many people have observed SE Asians fishing in the state. Though there have been no published studies on this topic, a 1995 Brown graduate in Environmental Studies conducted a risk assessment for Southeast Asian American fishers of the Turner Reservoir in East Providence. Environmental officials reported to Lee that many in state risk management had observed a large presence of SE Asian fishers in the state. (Lee 1995)

Low literacy is likely

The SE Asian population in Providence, RI is very likely to be low literate. Dehn and Schneider observed that the level of functional illiteracy, that is, literacy below the 5th-grade

level (Doak et al 1995; 189), among a Hmong patient population was above 50 percent (Dehn & Schneider 1989), which is more than double the functional illiteracy level of the whole U.S. population. Many of the Southeast Asians who live in Providence are themselves refugees or are in families of refugees, having left Laos, Cambodia and Thailand following the Vietnam War and civil wars in Cambodia and Laos. Following the Vietnam War, the Northern Vietnamese who controlled Laos waged a genocidal war against the Hmong. The Hmong were forced to flee from Laos and many took refuge in the United States. Unprepared for such a move, many of the refugees arrived in the United States unskilled, little-educated and unprepared for a life in the United States.

These settlement circumstances have led to a host of social problems and challenges for Southeast Asian communities in the United States. “Many Southeast Asian Americans who came as refugees lack a proficiency in English, have little education, and remain unemployed.” (Uba 1992; 547) In Providence, RI, the legacy of that settlement situation is apparent. Though 11.6% of the students in Providence public schools in 1992 were Asian American (PSEFS 1992-93), only 60% of Asians 25 and older in the state have received a high school diploma, compared to 72% of the general population. (RI DOH 2001) As explained in the chapter on literacy, low income, foreign origin and low English proficiency are all linked with low literacy. Though a general or comprehensive literacy assessment of the Southeast Asian population that is representative of the Providence population or U.S. population has not been conducted, there is strong reason to believe this population has low literacy.

Conclusion

In the preceding chapters, I have described the nature of mercury risk in the United States today and have presented risk communication and education as an important tool for abating mercury risk. I have also established the importance of assessing the literacy of any population targeted for specific risk communication and recognizing the different values, language and concerns of each population. In this chapter, I bring these concepts into one context by introducing my study population – Southeast Asian American fishers living in Providence, RI and vicinity. This population is believed to be at elevated risk of mercury exposure, is a growing presence in RI and is very likely to be low-literate.

It is in this context that I pose my study question: **“How can we begin to identify environmental health literacy of Southeast Asian fishers in the context of mercury exposure from eating fish?”** Health information that is tailored to the specific health literacy and sensitivity of groups such as the SE Asian population of Rhode Island is an important focus in the overall efforts to improve public understanding of environmental health risks.

In the next chapter, I present the methods I used to investigate this question.

Chapter 5. Methodology

In order to identify risk perception and some specific but limited aspects of environmental health literacy among SE Asian fishers, I conducted semi-structured, in-depth interviews with fifteen members of the Cambodian, Laotian and Hmong communities of the Providence area who actively fish and eat the fish they catch. Because the vast majority of Asians in RI live in the Providence area (RI DOH 2001), I recruited in Providence and vicinity.

The Interview Protocol

I designed an interview protocol of 45-50 questions, which took one to one and a half hours to administer. I began each interview with a statement of informed consent, for which I explained my research interests, the agenda of the interview, the steps I would take to maintain confidentiality and the fisher's right to end the interview and/or ask questions at any time. After I secured informed consent, I asked the fisher whether it would be alright if I tape-recorded the interview. If the fisher consented, I recorded the interview and used the tape for transcription. At the end of each interview, I left the fisher with my contact information. The protocol explored the following topics: fish consumption, fishing practices, aspects of science literacy, civic literacy and numeracy (the interview protocol is provided in Appendix A). I did not assess reading ability by means of the REALM (Davis, et al. 1993) or TOFHLA. (Parker, et al. 1995) I piloted the protocol each with a Cambodian, Hmong and Laotian fisher.

Interview Props

In order to assist the informant in identifying fish species during the interview, I referred to two posters published by the DEM Office of Fish and Wildlife: one showing illustrations and

common names of most commonly caught freshwater fish in RI and the other showing the same of the most commonly caught saltwater fish in RI. I also displayed maps of Rhode Island and Narragansett Bay for fishers to identify locations where they fish and see other fishers. After the interview, I gave the fishers their own copies of the DEM fish posters as a token of appreciation as well as an illustrated booklet published by DEM Law Enforcement which lists 2002 state fish catch limits, a brochure from the RI Department of Health (HEALTH) which explains the state Mercury in Fish advisory and the RI Freshwater Fishing Abstract, a booklet which describes laws, recommendations and resources relevant to RI freshwater fishers.³

Regarding fish consumption, the final protocol explored:

- reasons for eating fish
- types of fish eaten
- types of fish avoided
- sources of fish eaten
- amount of fish eaten per week
- frequency of eating fish throughout the year

Regarding fishing practices, the final protocol explored:

- reasons for fishing
- fishing locations
- awareness of posted fishing regulations / advisories

³ The DEM fish posters and Freshwater Fishing Abstract are only published in English. The HEALTH mercury-in-fish brochure is published in both English and Spanish, but I only provided fishers with the English version. The DEM Law Enforcement booklet is published in seven languages, including Hmong, Cambodian and Laotian.

In terms of assessing aspects of literacy, I focused on:

Science Literacy

- Understanding that fish is generally a healthy food.
- Some fish can be contaminated, and some fish are safer than others.
- Contamination can be hidden to the senses

Numeracy

- Follow frequency-related advisories, i.e. (for general population); examples:
 - Limit freshwater fish to **1 meal per week**
 - Limit eel and black crappie from all ponds to **1 meal per month**
- Catch smaller fish, in accordance with DEM size limits⁴

Civic Literacy

- Understand and fish according to the bans, size limits and laws associated with fishing
- Participate in public discourse about mercury-in-fish risk and even contribute to management of the risk
- Degree of trust in information sources

In the protocol, I was assessing fishers' abilities in these critical aspects of literacy. Some of the design was informed by the *Science and Engineering Indicators* study, which has been conducted by the National Science Foundation (NSF) since 1979. This study surveys the general

⁴ This skill/task is titled exactly as it is written in the RI advisory. It requires slightly more thought to follow than it seems. The DEM fish size limits are restrictions on the minimum length allowable for a fish caught by anyone fishing in RI waters. This is done to protect the fish populations by allowing them to mature for an adequate amount of time. Interestingly, the RI Mercury -in-Fish Advisory advises the public not to eat larger fish because they contain more mercury than smaller fish, by virtue of bioaccumulation. Therefore, this skill asks for a balancing act – catch fish large enough to satisfy DEM fish size regulation and catch fish small enough to reduce mercury exposure – so ideally catching fish *at* the DEM size limit or slightly larger.

public to assess perception, knowledge and awareness of science and scientific issues. For scientific knowledge, the NSF tests the participant in true/false, fill-in and open-ended format on concepts that it has identified as key for having scientific literacy today. (The questions on scientific knowledge are shown in Appendix B.) Though my study is modeled after this concept-based literacy assessment, I do not use a test format. I ask questions about the fisher through which I can look for understanding of specific literacy concepts.

Recruiting and S.E.D.C.

I connected with my fishers primarily as friends, relatives and contacts of community leaders and activists I had been working with. I made initial contact with staff members of the Socioeconomic Development Corporation for Southeast Asians (SEDC), located on Elmwood Ave in Providence, in November. I presented my research interests and asked staff for their opinions on the utility and feasibility of this study. They responded with keen interest and support. The staff represented Cambodian, Laotian, Hmong and Vietnamese heritage. Most ate fish with their families and a few of the men were active fishers. My first two pilots were with a Laotian staff member and a Cambodian staff member at SEDC. Some had heard about the risks of exposure to mercury and other toxins from eating fish, but most did not.

Though I had the support of the SEDC, Hmong United (a community organization for Hmong in RI) and other community leaders, it was extremely difficult and challenging to recruit fishers. Most of my community contacts agreed that this “snowball” method (i.e., grow the sample size with the contacts of the fishers you have already met) – would be the most effective. Most described the local Southeast Asian as extremely busy, being in families w/ two income-bearers, so it would be extremely difficult to assemble a meeting from which to recruit.

Using an Interpreter

I conducted four of the interviews with Hmong fishers through an interpreter. This interpreter is both a Hmong community advocate as well as a relative of one of the fishers. A senior at Brown who speaks Cambodian also interpreted for another interview with a Cambodian fisher.

Findings

General Findings⁵

The Fishers

Thirteen of the fifteen fishers live in Providence. One of the fishers lives in Woonsocket and the other lives in Cranston. All of the fishers are men. I aimed to recruit women because they are part of the sensitive population, but because I wanted to find out information about fishing practices, the fishers' families believed it was more fit that I interview the men, because they are the ones who go fishing. Every household had at least one member of the sensitive population. Each fisher told me that his entire family, including women and sometimes young children, eat the fish they catch.

All of the fishers are first-generation; they were either born in Cambodia or Laos (the Hmong are a nomadic group which live primarily in the highlands of Laos and China). The fishers have lived in RI for an average of 16 years (Median = 18) and have been fishing in RI for an average of 11 years (Median = 10). So, the fishers have generally spent much of their time in RI fishing.

Nine fishers were willing to report their household income levels (before taxes) to me. Five of those nine are within 130% of the 2002 Federal Poverty Level. The fishers represented a variety of careers. Two of the fishers are on staff at the SEDC. Only three of the five fishers who reported household income levels within 130% of the federal poverty level are currently working. Their employment positions are machine operation, computer repair and kitchen work at a fast-food restaurant. The other two fishers are retired and unemployed.

⁵ My sample size is 15 and therefore not representative of the Cambodian, Hmong, Laotian or general Southeast Asian populations of Providence. The quantitative data I report should only be interpreted as representing my fishers and **not** these larger populations.

Fish consumption

Fish is a **consistent part of the diet** of the fishers. **All but one** said they almost always eat fish in meals generally with the whole family, though a few fishers indicated that their very young children do not eat fish (generally under age 3). Six fishers said their families eat between **1 and 2 meals of fish per week**. Three fishers claimed they eat **2 meals of fish per week** with their families, and two fishers claimed their families eat between two and three meals of fish per week. The amount of fish each fisher's family eats per week is seasonal. During the fishing season (April through September), the fishers and their families eat more fish, because much of the fish they eat is personally caught. Outside of the fishing season, fish consumption drops. One fisher reported consumption levels for both times of year: during the winter, he and his family eat one meal per month and during the summer (or fishing season), they eat between two meals per month and one meal per week.

A healthy alternative

Though fish is consistently eaten, it is **not the main source of protein in the diets of most of the fishers**. The fishers turn to beef, pork and chicken as the main sources of protein in their diets. Four fishers freely mentioned that a common reason they choose to eat fish in a particular meal is that they want an alternative to meat, which they consume in most meals.⁶ Even when fish is served, it may not be the main protein source on the plate; some fishers claimed that they often eat fish alongside various types of meat in single meals. However, most fishers agreed that fish has a distinct taste that provides variety to their family diet.

⁶ I did not probe for the response of meat as an alternative, so it is very possible that other fishers think of fish similarly, especially since the majority of fishers referred to fish as a secondary protein source.

More than just taste, another reason why the fishers believe that fish is a good dietary alternative is that it is healthy. One of the more educated fishers explained, “Research shows that there are benefits to eating fish. A combination of meat and fish is always good.” In fact, the most popular reason why the fishers eat fish is health. Fourteen of fifteen fishers acknowledged that fish is healthy and a “good source of protein” and many of those thirteen cited the health benefits of fish freely without any probe. One fisher argued that fish is good for the diet because it is healthier than meat. “The more fish you eat, the better for your health. Eating fish reduces the amount of beef and pork you eat. Gotta eat more fish.” The majority of fishers believe that eating fish is good for their health.

Custom or choice

Six of fourteen fishers said they eat fish partly out of tradition, which I conveyed to them as “eating fish because it is something they did with their families as children”. Two of the remaining eight fishers made a point to claim fishing exclusively as a personal choice and personal interest and absolutely not influenced by tradition. One fisher began an explanation for why fish consumption may have been more of a tradition for Cambodians now in the United States when they were in Cambodia than when in the United States.

Back then, we don’t have a whole lot of meat. Fish becomes a tradition, because that’s the only thing around. It becomes part of the culture. For our family, it’s not something we have to eat – it’s something we enjoy. The diet changed once Cambodians came to the U.S.

As this and other fishers mention, there are a lot more options for protein in the diet in the United States than in their homelands. With less pressure on choosing fish as a sole source of protein, fish has transformed from an object of cultural tradition to a matter of personal choice - fish has turned from staple to alternative. We will see in the “Attitudes towards fishing” section

that the amount of fish in the diet of the fishers is also influenced by the individual's sense of recreation and his ability to spend time and money.

Fish Species

The three most popular species of fish consumed by the fishers are scup, striped bass and tautog – all saltwater fish. All fifteen fishers consume both scup and striped bass and ten of fifteen fishers consume tautog. The number-one reason why the fishers catch these particular types of fish is that they are easy to catch and reasonably tasty. These fish are relatively abundant at the fishing sites the fishers visit (almost always saltwater, except for one fisher who prefers to fish almost exclusively in the Merrimack River in Connecticut). Scup and tautog are relatively low in mercury, but striped bass is listed in the RI Advisory as a fish to be completely avoided by the sensitive population. This means that if the women and young children in the families of the fishers are consuming fish at the rates indicated, there is reason to believe that they are at risk of high mercury exposure.

A third of fishers said their families eat bluefish, which is also listed as a saltwater fish to be completely avoided by the sensitive population. However, two fishers specifically mentioned that they avoid eating bluefish because of its oily taste. This attitude concurs with intercept survey work I have done with fishers in Newport during the summer of 2002 to test understanding of the Mercury-in-Fish Advisory. Most of the fishers I intercepted for that survey also admitted an aversion to bluefish because of its taste.

Almost all fishers said they do eat some types of freshwater fish. The most commonly reported freshwater fish is brown bullhead.

Sources of fish

During the fishing season, the primary source of dietary fish for these fishers and their families is **personally-caught fish** – mostly fish they have caught themselves or fish caught by family or friends. For most fishers, a significant portion of the fish diet immediately after the close of the fishing season in October is still personally-caught fish, because they freeze excess fish from the fishing season. One fisher indicated that this storage usually lasts him and his family until December.

Another main source of fish to fishers, especially outside of the fishing season, is **Asian markets**. Examples of some of these stores include Sunny Market and the New Asian Market in Providence. Fourteen of fifteen fishers said they buy some of their fish from Asian markets and five of the fourteen indicated that it was their main source of fish. However, during the fishing season for many in this group, personally-caught fish superseded market fish as a primary source.

Three fishers indicated the **supermarket** as their largest or second-largest source of fish. However, the majority of fishers said they avoid the supermarket altogether for their fish purchases. One fisher offered an explanation why: “Usually our people like to cook something...whole and then cook separate the tail for another dish. There [the supermarket] they clean the meat and separate the fish.” Many of the fishers opt to buy fish from the Asian market where the fish is sold whole rather than the supermarket where much of the fish is pre-cut, because they can prepare the fish in any way they choose. Five fishers indicated that they eat some fish at restaurants, but this may happen only a few times per year.

Attitudes towards fishing

Fishing is Fun

For the majority of the fishers, the decision to fish was not driven by a strong desire to have fish in the diet, but more so because of the social and recreational aspects of fishing as an activity. I took a rather standard approach to identifying the reasons why the fishers fish – I plainly asked them “Why do you fish?” - of course, prepared with a number of probes to assist their response.

One fisher (#12) summarized fishing with three simple descriptors: **“fun, friends and beer”**. To this fisher, fishing is a pastime, an opportunity to spend time with friends and escape the pressures of everyday life. Interestingly, this fisher seems to perceive fishing much like he does other hobbies of his, such as car repair. “I started fishing because I like it, and I don’t wanna be home. I don’t go too often. Sometimes I’m busy and I just work on the car.” Another fisher explained that he only started to fish recently. Before that, he played basketball. Not surprisingly, many fishers used the words “hobby” and “sport” to describe their attachments to the activity of fishing.

But more than an ordinary activity to pass the time, Fisher #12 and his friends organize excursions around fishing. Every now and then, they drive all the way to Connecticut to fish in the Merrimack River, leaving their homes in RI at about 5 pm and returning at 7am the next day. They choose a site along the river, set up camp and stay the night, giving them prime opportunity to catch the big fish when they are biting: late night, around midnight, and in the early morning around 6am. In this case, they are putting a little more concerted effort into planning a trip and choosing a site.

The decision to fish: How much fun? How much money? How much time?

Despite the fact that fishing is fun to many of the fishers, the situation remains that many of those who fish bring their catch home for their families to eat. Depending on which types and sizes of fish are biting on the days they fish, fishers report that they do keep a good portion of their catch for consumption – either for themselves or their families or for friends and extended family members. The prevailing attitude is that if they catch the fish, and it is within legal limits, they will keep the fish and eat it. In addition to recreation / fun, I observed two other factors that affect the decision of the fishers to fish: time and money.

As I described, fishing for the fishers is not a low maintenance activity. It requires an investment of time and money. These fishers may spend their whole Saturday fishing at Newport or Jamestown or Point Judith Pond. Or if they are like Fisher #12, who only likes river fishing and complains that RI does not have any “real” rivers, they will spend the night across state lines. Typically, they need that time to catch a sizeable amount of fish. According to several fishers, fishing isn’t cheap these days either. Fisher #3 emphasizes, “Fishing is expensive – that’s a key note – it’s expensive.” He estimated the cost of fishing at \$23, which includes gas (Providence to southern RI), fishing gear such as sinkers, hooks, bait and line (which all need to be changed every 2-3 weeks) and food for the trip. Another fisher quoted these costs at \$15.

However, these men do not have a whole lot of time and money to spend. Most of the fishers are working class and have large families to support. The fishers are balancing many concerns. Fishing is seen as a way to meet multiple goals – have fun and catch fish. Every time they go fishing, they assess the potential costs and benefits. What are the chances of catching fish? How much money can I save by going fishing rather than going to the store? How much time will I spend? How much fun will I have?

For some, fishing is a win-win situation. Fisher #2 casts it very much in this way: “If you catch fish, you have fish. If you don’t catch fish, you have fun.” The majority of the fishers, however, would not evaluate the decision to fish so simply. They mention the additional issue of **expense**. They modify Fisher #2’s cost-benefit statement to be: “If you catch fish, you save money. If you don’t catch fish, you lose money.” While some fishers loosely agreed that they fished to save money, others like Fisher #3 adamantly refuted the claim that fishing costed less, especially with the recent increase in fishing costs. All agreed that if your intention is to bring fish home, there is a certain financial risk you take, and all fishers have to make an assessment of that risk. What tips many of the fishers towards opting to fish when that risk is hard to gauge is fishing’s high recreational value.

Literacy Findings

Science Literacy

Three of the science literacy concepts I sought to assess were 1) Fish is generally a healthy food; 2) Some fish can be contaminated, and some fish are safer than others; and 3) Contamination can be hidden to the senses.

Fish is generally a healthy food

I looked for understanding of this concept in Question 3 - “Why do you and your family eat fish?” I asked this question open-ended but was prepared with the following probes: a) “because it is healthy”, b) “because it is inexpensive”, and c) “because it something I ate with my family as a child [heritage/tradition]”. As I have discussed above, all but one of the fishers referred to the health benefits of fish as their reason for eating it, and often as their primary

reason. Their characterizations of these health benefits, which I have also presented above, indicate that their awareness and appreciation of the general healthiness of fish is high.

Some fish can be contaminated, and some fish are safer than others

I looked for understanding of this concept in two questions: Question 5: “Are there any kinds of fish that you try to avoid? If so, which kinds? Why do you avoid them?” and Question 16: “Are you ever concerned about how safe it is to eat the fish that you buy or catch?”

QUESTION 5: AVOID FISH?

Most fishers said that they do avoid some type of fish. The majority of the reasons they had for **avoiding fish are based on taste**. For example, a few people mentioned that they avoid bluefish because of its oily taste. This is encouraging news in the eyes of the RI Advisory because bluefish is one of the saltwater fish listed to be completely avoided by the sensitive population due to its high content of polychlorinated biphenyls (PCBs), a chemical commonly dumped into RI waterways throughout the state’s industrial history. When I post-tested the brochure with fishers in Newport in the summer of 2002, I also observed that many people avoided bluefish as well for the same reason. However, this is not a mark of high science literacy on this concept because their rationale for avoiding bluefish is based on taste not health.

Only two fishers mentioned health reasons for avoiding fish. Fisher #13 remarked:

“For us, we’re very picky about what we catch and what we eat. In freshwater, you really have to know where to go. These [trout] – they stock these, so we perceive that it’s safe, and they only really stock it in clean waters. We only fish in certain saltwater spots, too.”

In this statement, Fisher #13 conveys that he assesses saltwater fish to be safer than freshwater fish, which is generally an accurate assessment. The RI Advisory is much more restrictive about consuming fish from freshwater sources than consuming fish from saltwater

sources. Fisher #13 also conveys that he trusts DEM, the fish it stocks and ponds it stocks fish in – this question of trust will be discussed more in the Civic Literacy Findings section.

CONCERNED ABOUT FISH?

Most fishers said they were **not concerned about the safety of the fish they eat**. Some in the group were confident that they are fishing in safe locations. In answering this question, both Fishers #1 and #3 indicated #13's perception that **saltwater fish is safer than freshwater**. Fisher #1 took comfort in that fact, because he avoids freshwater locations when he fishes, and therefore was not concerned about the safety of the fish he catches. To him, freshwater seemed like the sole risk, and as long as he fishes in saltwater he is safe. The reality is that mercury permeates all types of water bodies, and though freshwater locations tend to accumulate more mercury since they are typically closer to emissions and can be closed sinks for mercury uptake, saltwater risk is not negligible. The RI Advisory identifies shark and swordfish as two types of fish that accumulate mercury to such an extent that they should be completely avoided by the sensitive population. Both Fishers #3 and #13 demonstrated understanding that certain saltwater fish pose risks as well.

Contamination can be hidden to the senses

I specifically looked for understanding of this concept in two questions: Question 21 – “How do you know if a fish that you catch or buy is healthy or safe to eat?” and Question 31 – “If I were to tell you that some fish are *contaminated*, would you understand what I mean when I say the word ‘contaminated’?”

HOW DO YOU KNOW THAT A FISH IS SAFE?

Almost all fishers named something about the fish that can be noticed with the five senses. The most common response was checking the skin of the fish. “Mostly, we look at the

fish. Is it clean and healthy and not any spots there?” Another popular feature is the eyes. The eyes must be black and clear, not red and milky, as one fisher informed me. The fishers also agreed, after I asked, that the fish “should smell like fish”. The fishers named very basic features to check out, which they fully acknowledged as basic, intuitive things to do. “If we see spots, we know that it’s not a good fish. Not only the people who have education know how the fish can be not healthy, but the old people know too, because if it does not look like a regular fish, they’re not going to take it.”

However, contamination is not always intuitive and observable. Only two fishers freely mentioned the location where they fish without being asked a probe as a consideration in determining the safeness of fish. “One thing, not the fish, but the area. Is there clean water? A factory? There should not be junk in the water?” The cleanliness and health of the site does seem like a factor in the judgment of many fishers, though not a priority factor.

UNDERSTAND “CONTAMINATED”?

The fishers again showed that their understanding of **contamination seemed primarily based on noticeable features of the fish** – features that can be seen, smelled, touched and tasted. Most said they believe contamination is bad.

In addition to observable features, they characterized “contamination” with action-based descriptions. The three most common words given in a response to this question are “Don’t take it!” The fishers seemed to know that if they see or hear this word associated with a food or fish, they should stay away from it. Another fisher described contamination in terms of what you feel after you consume something contaminated. “You eat something and right away, you feel like it’s not like the last time, like you’re not feeling good, or it doesn’t taste good.” The interesting thing about mercury in the context of this response is that in addition to having an “invisible”

existence in the fish, it will only manifest its effects in the consumer after continual consumption, not after a single meal as described in the response.

Only **two people demonstrated knowledge of the fact that contamination can sometimes be hidden**. Though he was not speaking of contamination, Fisher #12 told me an anecdote he was reminded of when he saw a picture of an oyster toadfish on the poster I used of the “Most Commonly Caught Freshwater Fish in RI”.

We don’t eat it, it could have poison – Who knows? In my country [Laos] there are two different kinds of catfish. One is like this [the oyster toadfish], another looks exactly the same, but it’s different. If you don’t cook it too good – it’s poisonous. In my country, some people get poisoned from that fish.

It turns out the oyster toadfish can be poisonous if it is not cooked correctly. The fish produces a venom under its scales. Fisher #12 understands that two fish can look exactly the same, but one can be unsafe to eat.

Civic Literacy

None of the questions in the protocol were specifically geared towards assessing civic literacy, but there were many opportunities in the interview for the fisher to demonstrate his civic literacy. I observed a number of things in the fisher responses.

Knowledge of relevant regulations, bans, limits and advisories

None of the fishers were knowledgeable about the RI Mercury-in-Fish advisory.

This may speak to shortcomings in publicity of the advisory rather than low civic literacy of the fishers. The fishers were very knowledgeable about RI fish size limits and DEM-enforced state fishing regulations. Many fishers freely quoted state size limits for certain fish (i.e., scups can be no less than 10 inches in length). I think a key factor in their widespread awareness is that the

information is written law that is supposedly enforced. A few fishers talked about DEM Law Enforcement boats which patrol the waters to check the fish catches of recreational and commercial fishers. Each of the fishers makes sure to bring a ruler along with him when fishing to make sure the fish he catches are within regulation. “You always have to catch the right size. If you catch the small one, you have to let it go.”

Participation in public discourse and management of risk

Two of the fishers are staff members of the SEDC and are in good position to collaborate with HEALTH, DEM and other health promoters to foster effective risk communication to the local SE Asian community. The other fishers are in a variety of employment positions and represent a variety of socioeconomic positions (SEPs). Two other fishers also work in the social services and may be able to help bridge communication between social services and the SE Asian population. Drawing from my experience recruiting fishers in this population, a potential roadblock for some members of this population to exercising their civic literacy is their dearth of free time. Many in the community are working class or of lower SEP. In building a partnership with this population for the sake of risk communication and risk, environmental health officials will need to develop incentives to attract and structure discourse to accommodate a busy, working population.

Trust

Most fishers said they are **very trustful of existing health protection structures**. For example, the one concession that the fishers who refuse to fish in freshwater make is DEM-stocked ponds. “They [DEM] stock these fish, so we perceive its safe, and they only really stock

it in clean waters.” Fishers also indicated that they trust HEALTH. I asked many if they would change the way they fish or the types of fish they eat if the Department of Health told them that some of the fish they eat is unsafe to eat. All said yes. I was not able to explore the basis of their trust of these institutions, but one fisher commented on another health protection structure that implied an almost blind trust of the government institutions who protect health. He remarked about inspections of commercial fish: “It’s just food, that’s all. We trust the food we buy at the store – healthy stuff.” The issue of trust in this population of social and health service programs is an interesting topic of study and warrants further exploration.

Numeracy

I looked for understanding of numeracy concepts in any question in which I asked the fisher to quantify something. Examples include: Question 9 - asking how much fish the fisher and his family consumes per week; Question 10 - asking at what times during the year does the fisher fish and eat fish and how often he goes fishing; and Question 8 – asking the fisher to rank the sources of fish for his family. In general, the fishers were very capable of performing these quantitative tasks. Three fishers appeared to have difficulty in ranking their families’ sources of fish, but I believe that is more attributable to my difficulty in asking the question clearly rather than the fishers’ difficulties in rank.

Follow frequency-related advisories

Along with awareness of size and catch limits, the fishers were very knowledgeable about the duration of the legal fishing season and moreover seemed to know when certain types of fish

start biting. Because of this ability, it seems that this group of fishers would be able to understand and follow the frequency-related information given in the RI Advisory.

Catch smaller fish, in accordance with DEM size limits

I was not able to explore whether the fishers would be able to understand this concept, but I do have indication that the fishers are wary of fish length, as most measure the fish they catch with rulers to abide by state size regulations. This suggests that as long as the recommendation to “Catch smaller fish, in accordance with DEM size limits” is explained clearly (as I have done in the footnote on page 30) SE Asian fishers similar to the fishers of this study should not have difficulty following it.

Chapter 7. Discussion

Summary of Findings

I interviewed fifteen male fishers who live in the Providence area and are predominantly first-generation Southeast Asian Americans. Although fish is secondary to meat as a main protein source for these fishers, all reported that during the fishing season, their families eat at least one meal of fish per week. According to the RI Mercury-in-Fish Advisory (see Appendix B), this consumption level potentially places sensitive individuals in the study population at risk. The most common reason the fishers claimed for eating fish was that it is healthy. The three most popular species of fish consumed by the fishers and their families are scup, striped bass and tautog. This population obtains most of their fish from their own fishing, mostly at saltwater sites in the southern coastal region of the state, and from local Asian markets. Fishing is widely seen as a fun and social way to supplement the diet, but also time-consuming and not cheap.

As described, the fishers showed understanding of the science literacy concept that fish is generally a healthy food. This concurs with the opening message of the RI Mercury-in-Fish Advisory (see Appendix B). However, only a few recognized that some fish can be unhealthy and that though a fish may appear to be healthy, it can be unhealthy (i.e., due to mercury contamination). The fishers demonstrated high civic literacy in their intimate knowledge of DEM-enforced fish size limits, fishing seasonality and other relevant state fishing regulations. They place a lot of trust in DEM, HEALTH and other health protection structures, but the basis of this trust is uncertain. The fisher's strong understanding of relevant fishing regulations also implies functional numeracy as observation of fish size limits requires fishers to know the lengths of the fish they catch. However, this finding is not conclusive.

Future Research

This study raises a number of questions worthy of further investigation, both in regards to gaining a better understanding of environmental health literacy and also in regards to learning more about who is at risk in the state, i.e., mapping the “riskscape.”

Studying environmental health literacy

This study aimed to assess small components of people’s environmental health literacy as an important factor in effective risk communication. While I explored the concept in a number of ways in looking at the problem of risk of mercury exposure to Southeast Asian fishers who eat their catch, there were a number of limitations. First and foremost, the study population was small and not representative of the larger Southeast Asian population in the state. That said, the conclusions and recommendations I present in this chapter are intended as points to be field-tested in further research with this population.

Important Populations to Study

WOMEN

A priority in designing future studies of environmental health literacy in the context of mercury should be a focused sampling of groups who face the largest risk of mercury exposure and poisoning. Two important populations are women and subsistence fishers. The perceptions and environmental health literacy of women are important because they are the gateway of exposure to the sensitive population – fetuses, infants and young children.

SUBSISTENCE FISHERS

Though the term subsistence may be interpreted in a number of ways, in the context of fish consumption, it typically refers to people who rely on the fish they catch to supplement their diet because they cannot afford to obtain their food in other ways. (RI DOH 2003; EPA 2003)

My study population was diverse by ethnicity (representing the three largest Southeast Asian communities of the state) and as well as socioeconomic position. Though all the fishers of this study indicated that their families consume fish at levels that place them at high risk of mercury exposure according to the RI Advisory, only a few said they fish because they rely on their catch to supplement their diet. Interestingly, those fishers had the lowest socioeconomic position of the group.

Furthermore, many fishers indicated that often, fishing is an expense, not a cost-saver, and they do it largely for recreational reasons. This suggests that if there are people in the local Southeast Asian community who fish for subsistence, as I have defined it, they are fishing in a manner that is different from that of my fishers. Two fishers mentioned that they have seen Southeast Asian people at freshwater sites who appear to be fishing for subsistence. This adds to the anecdotal evidence that these fishers exist. Future investigation must focus on identifying them.

Expanding the Concept

In addition to defining study populations, future environmental health literacy studies should expand. I was not able to measure the reading ability of my participants. Reading ability is important to assess, especially if the majority of risk communication in the state will be in printed form. On that note, part of a civic literacy assessment is determining not only what information sources a group trusts but also what communication media a group prefers, be it a printed brochure, a community meeting, a TV or radio announcement or hearsay. Some environmental health researchers argue that the printed brochure, which is the main leg of the RI Mercury-in-Fish Advisory, is not the most effective medium for achieving the ultimate goal of risk communication – behavioral change. “While brochures can be efficacious in promoting

knowledge gain and attitude change, there is little evidence that they have a strong role in behavior change.” (Harvey & Fleming 2003; 23) Nevertheless, brochures are the most popular medium of risk communication (Harvey & Fleming 2003; 22); an assessment of readability is important.

Though I was able to make inferences about the numeracy of the fishers based on their knowledge of size limits, seasonal restrictions and other number-based regulations, I did not assess their literacy by giving them a sample of numeric environmental health information and asking them test questions, as a fundamental literacy assessment would. Adapting a numeracy assessment to the environmental health setting is important for a proper environmental health literacy assessment.

There are also several science literacy concepts that must be explored. What may be critical information is how much the public understands about where the mercury in the fish they eat comes from. That is to say, do they understand how mercury gets from the smokestack into fish? Do people have a framework for understanding bioaccumulation? It may be enough to know that some fish are bad and some fish are good in order to reduce your personal risk. How essential is it to understand science concepts in order to make judgments about personal health and to be able to participate in debate and discussion of the issue (i.e., scientific civic literacy).

Mapping the riskscape – fish consumption in RI

As of now, strategies to communicate about mercury risk from eating fish are solely based on national exposure studies and anecdotal information on fishing in the state about who is being exposed to toxins from eating fish in RI. The evidence is sufficient so that groups who generally consume a high amount of fish like Asians deserve focused attention in risk

management strategies. However, the state needs to collect its own fish consumption data in order to determine precisely how risk is distributed across the state.

In collaboration with other states in New England, RI is currently designing a biomonitoring program for the state. This initiative entails analyzing blood and hair samples from the RI population to measure the amounts of certain chemicals. It is good news that in the first phase of the program, RI has decided to monitor mercury levels and to focus on the Southeast Asian population of the state. The biomonitoring program, especially with its focus on mercury, would be a prime opportunity to measure fish consumption levels. This is exactly what the CDC does in its biomonitoring assessment – it links sample analysis with the National Health and Nutrition Examination Survey (NHANES), which collects data on fish consumption. Collecting this information together will help answer how the fishing and fish consumption behavior of Southeast Asians and other groups in the state affect their mercury risk.

Current risk communication

While this study identifies a number of opportunities for further research, it can also speak to current communication about mercury risk from eating fish and perceptions about the study population.

Communicating to a population that may not be fishing for subsistence

Risk assessors have been concerned for years about the levels of toxic exposure to Southeast Asian fishers in the state. It has been common for this group to be associated with subsistence fishing. Indeed, the local media has reported on the potentially high risks borne by the “Southeast Asian subsistence fisher” (Mockenhaupt 1999; Laslandra 2001).

However, my results indicate that Southeast Asians fishing in the state do not completely fit that characterization. The responses of my fishers suggest that while they often supplement their diet with the fish they catch, Southeast Asians may be fishing more for recreational reasons than for subsistence. This is relevant because in order to communicate risk effectively to a particular target population, it is important to know who the target population is and what the nature of their relationship with the risk is. A subsistence fisher will interpret a health message differently from a recreational fisher.

It is possible that my sample may exclude a larger subsistence population in the state. However, some of my fishers have commented that conditions have changed since Southeast Asians first arrived in Providence and a larger subsistence fishing population from years ago may have dwindled.

A population that may be aware of the health benefits of fish

My results also show that the fishers are very aware of the health benefits of fish and for many, those benefits are a strong motivator to eat the fish. This is encouraging to risk assessors who fear that fish consumption advisories can have the ill effect of scaring people from eating *all* types of fish, which is an effect arguably as bad as eating mercury-contaminated fish, because most fish are such a healthy part of the diet (see Appendix B for list of health benefits). This may imply that as the fishers show an already high appreciation for the health benefits of fish, risk communication can focus on communicating how to distinguish the “bad” fish from the “good” fish.

The nature of contamination

Understanding how mercury contamination occurs and manifests is important for understanding how to distinguish the bad fish from the good fish. Responses from many of the fishers indicate that they currently do not have that understanding. Their understanding of fish contamination seems to be centered on defects in fish that are noticeable with the senses. Further education about the nature of contamination may be warranted.

Conclusion

An implied recommendation of this chapter is that risk communication must occur in full collaboration with the target population. I have demonstrated that assessing aspects of environmental and environmental health literacy are critical. The pursuit of the research objectives presented above should be done with the community's consent and input. The responses of my fishers indicate that increased collaboration with the local Southeast Asian community in the future is entirely possible and welcomed. As I have discussed, the fishers place a lot of trust in HEALTH, DEM and existing health protection structures, and have showed an interest in discussing and approaching the issue of mercury risk.

Appendix A. Interview Protocol

MATERIALS

- tape recorder
- interview protocol
- pen and pad
- DEM Freshwater and Saltwater Fish Posters
- Maps
 - o RI State
 - o Naragansett Bay

INTRODUCTION AND INFORMED CONSENT:

Hi, my name is Mike. I'm a senior at Brown University. Right now, I am trying to learn what Southeast Asian people in Providence think and feel about eating fish and how healthy the fish are to eat. I have been working with *MY CONNECTION TO RESPONDENT; IE, "SAM @ SEDC"*, and he/she gave me your name. I have learned so far that fishing and eating fish are important to many Southeast Asians.

I am going to ask you questions about the fish you eat and the fish you catch. With information from these interviews, I plan to recommend to the Rhode Island Department of Health better ways to communicate with the Southeast Asian population about safe fish to eat. I thank you again for spending your time with me today. The interview should last no more than thirty minutes. If you have any questions or are uncomfortable with anything during the interview, please feel free to let me know. I will keep your answers confidential and not reveal your name to anyone else outside this interview.

Do you have any questions so far?

- a. y / n
- b. If 'y': What questions do you have?

Do you mind if I tape-record this interview? It will let me pay more attention to you, since I will not have to write down so much.

- a. y / n

Okay, let's begin...

FISH CONSUMPTION

- 1) My first few questions are about fish. When I say fish, I am talking about all fresh or saltwater finfish, shellfish, and some other underwater animals in ponds, lakes, rivers, streams and oceans (FDA CFSAN 1995). Do you eat fish?
 - a. Y / n

- 2) Does your family eat fish?
a. Y / n
- 3) Why do you eat fish?
a. checklist
- ? healthy
 - ? inexpensive
 - ? heritage/tradition
 - ? Other: _____
 - ? Other: _____
- b. **Probes**
- i. *Health*: Would you say you eat fish because you think it is a healthy food?
1. yes = “healthy” in checklist
 - ii. *Price*: Would you say you eat fish because it is inexpensive?
1. yes = “inexpensive” in checklist
 - iii. *Tradition*: Would you say you eat fish because it is a food that you ate with your family when you were growing up?
1. yes = “heritage/tradition” in checklist
- 4) Which kinds of fish do you and your family eat?
a. open-ended
b. RATIONALE: See if respondent and his/her family eats any of the Hg-unsafe species
c. **Probe**: Can you identify which of these fish (*USE CARD SET #1.*) you eat?
i. Y / n
ii. **If ‘y’**: Which ones?

FISH not EATEN

- 5) Are there any kinds of fish that you try to avoid?
a. y / n
b. **If ‘n’**: *GO TO QUESTION 8.*
- 6) If yes, which kinds? (*If necessary, USE CARD SET #1.*)
a. open-ended
b. SEE HOW respondent differentiates between different types of fish

7) Why do you avoid them?

a. open-ended

8) Where do you get most of the fish that you and your family eat?

a. checklist

? Local fish market

? Supermarket

? Restaurant

? Personal fish catch (informant, friends, family)

? Other: _____

? Other: _____

b. *If informant mentions more than one source: WRITE LIST OF ANSWERS ON AN INDEX CARD, SHOW TO INFORMANT, REPEAT ANSWERS AND ASK WHICH ONE OF THE SOURCES IS THE MOST COMMON, SECOND-MOST COMMON, THIRD-MOST COMMON, AND SO ON.*

c. **Probes**

- i. Do you buy it at the local fish market? the supermarket?
- ii. Do you eat fish at restaurants?
- iii. Do you or your friends or your family catch the fish?

9) How much fish would you say that you and your family eat per week?

a. **Probes**

- i. Do you usually eat fish when you are with your family, or do you eat it without them as well?
 1. y / n
- ii. When you are with your family, how many fish would you eat in one meal?
 1. # of fish _____ fish
- iii. Do you know around how much each fish weighs?

10) Do you and your family eat fish regularly throughout the year or at certain times of the year more than others?

- a. regularly / certain times
 - b. **If “certain times”, ASK:** During which months do you eat more fish?
-

FISHING

11) For how long have you been fishing in Rhode Island?

- a. open-ended
-

12) For how long have you been living in RI?

- a. open-ended
-

13) Why do you fish?

- a. checklist

- ? for food
- ? to save money
- ? to be social
- ? for sport
- ? to relax
- ? heritage/tradition
- ? Other: _____
- ? Other: _____

- b. **Probes**

- i Do you fish for food that you and your family will eat?
 - 1. yes = “for food” in checklist
- ii Do you fish because it is less expensive to catch fish than to buy food?
 - 1. yes = “saves money” in checklist
- iii Do you fish to be social (to meet and chat with other people)?
 - 1. yes = “to be social” in checklist
- iv Do you fish for sport (for the enjoyable challenge of catching fish)?
 - 1. yes = “for sport” in checklist
- v Do you fish for relaxation?
 - 1. yes = “to relax” in checklist
- vi Do you fish because it is a tradition in your family?
 - 1. yes = heritage/tradition

14) Do you go fishing with other people?

- a. y / n

15) f ‘y’ to Question 14, *ASK*: How do you know them?

- a. open-ended

16) *Perception of Issue*: Are you ever concerned about how safe it is to eat the fish that you buy or catch?

- a. open-ended
i. **Probe**: Why / Why not?

17) Where do you go fishing? *USE MAP*.

- a. open-ended
b. Would you be able to show me on this map where you fish? *SHOW MAP*.
i. y / n
ii. **RATIONALE**: See if respondent fishes in any Hg-contaminated locations that are advised to be avoided
iii. **If ‘n’**: **NOTE WHICH WAYS INFORMANT USES TO IDENTIFY THE PLACE (I.E., BY A LANDMARK)**.

18) Have you ever heard of any fishing bans or seen any posted notices or advisories that say “Do not eat the fish”?

- a. Y / n
b. **If no**: **GO TO QUESTION 18**

19) **If yes to Question 14**: Where and when did you see this? **If informant can navigate map**: *USE MAP*.

- a. open-ended (location and time)

20) Why did the ban / notice / advisory / sign say “Do not eat the fish”?

- a. open-ended

ENVIRONMENTAL HEALTH LITERACY

SCIENCE LITERACY

21) How do you know if a fish that you catch or buy is healthy or safe to eat?

- a. open-ended
- b. **Probes**
- i. Is it something about the color?
 - ii. ...the smell?
 - iii. ...who you buy from?
 - iv. ...where you fish?

- v. What makes a fish unhealthy to eat?

22) Have you ever seen anything strange or abnormal on the outside or inside of a fish that you caught?

- a. Y / n

23) **If 'y' to Question 22:** What did you do with it?

- i. Did you eat it?
- ii. Did you throw it out?
- iii. Did you give it away?

24) Have you heard of some fish in RI that are NOT safe to eat?

- a. y / n

b. ***If 'n' and the informant speaks English: SKIP TO QUESTION 28.***

- c. *If 'n' and the informant does NOT speak English: SKIP TO QUESTION 35.*
- 25) If yes: What did you hear?
a. open-ended

- 26) If yes: Do you believe that?
a. open-ended

- 27) Have you or has someone in your family ever gotten sick from eating fish?
a. Y / n

- 28) What was wrong with the fish that you / your family member ate?
a. open-ended

- 29) If I were to tell you that being exposed to too much of some things can be *toxic*, would you understand what I mean when I say the word "toxic"?
a. y / n
b. *If 'n', SKIP TO QUESTION 26.*

- 30) If yes, What are the first things you think of when you hear the word "toxic"?
a. open-ended

- 31) If I were to tell you that some fish are *contaminated*, would you understand what I mean when I say the word "contaminated"?
a. y / n
b. *If 'n', SKIP TO QUESTION 28.*

- 32) What are the first things you think of when you hear the word "contaminated"?
a. open-ended

33) Mercury is something that can get into fish. Have you ever heard of mercury?

- a. y / n
- b. **If 'n', GO TO QUESTION 31.**

34) If yes, please tell me what you know about mercury?

- a. open-ended

b. **Probe:** Do you think mercury is good or bad?

- i. good / bad
- ii. Why do you think so?
 1. open-ended

35) How did you learn about mercury? From which sources did you get your information?

- a. open-ended

b. **Probes**

- i. Did somebody tell you?
- ii. Did you read it somewhere?
- iii. Did you see something on TV or hear something on the radio?

DEMOGRAPHICS

Now, I will ask questions about you...

36) Which is your ethnic group?

- a. ___ Thai

- b. ___ Cambodian
- c. ___ Lao
- d. ___ Hmong
- e. ___ Vietnamese
- f. ___ Other: _____

37) Have you gone to school in the United States?

- a. Y / n

38) **If 'y' to Question 37, ASK:** What is your highest level of education in the United States?

- a. Open-ended

39) What is your highest level of education in *<country of origin>*?

- a. open-ended
- b. **Probe:** What topics did you learn?
 - i. open-ended

40) What is the name of the language or language(s) you speak with your family and friends?

- a. open-ended

41) In which language do you prefer to read?

- a. open-ended

42) What do you do for a living?

- a. open-ended

43) What is your yearly household income before taxes?

- a. Open-ended

44) How many people live in your home?

- a. # of people _____ people

45) Who are they?

- a. Open-ended
- b. **Probes**
 - i. How are they connected to you?
 - ii. Is one of them your spouse? Some of them your children?

46) How old are the people in your household?

- a. Ages of household members

b. _____

47) How old are you?

- a. _____ years

48) Do you know of any other Southeast Asians who fish and eat their catch?

- a. Y / n

49) **If 'y' to Question 41, ASK:** Would you be able to give us their phone numbers so that we can contact them and ask them if they would also like to be interviewed?

- a. Y / n

****END****

If you have any questions after this interview, don't hesitate to contact me. My phone number is (401) 453-9739 and my email address is mj@brown.edu. **GIVE CONTACT CARD TO INFORMANT.**

Appendix B. RI Mercury in Fish Brochure and Insert

Figure 1. Brochure (unfolded) – Outside

Choose the Right Fish To Eat

You and your growing baby need protein. Fish is a good source of protein. However, some fish is not safe to eat. You need to know how to choose the **right fish** to eat. Read this brochure to find out how.



Call 222-4770 for more information about safe fish, or visit our website at www.healthri.org

Contaminants in Fish Hotline
222-4770
www.healthri.org

MAKE HEALTH PART OF YOUR FAMILY
RHODE ISLAND DEPARTMENT OF HEALTH

Fish is Good



Mercury is Bad!
Advice for mothers on choosing safe fish to eat.

Figure 2. Brochure (unfolded) - Inside

Fish Is Good

- Fish is a good source of protein.
- Fish has many vitamins and minerals.
- Fish is low in fat.
- Fish can be part of a healthy diet.
- A healthy diet helps prevent heart disease.

Mercury Is Bad!

Mercury is a metal found in nature and used for many things. Sometimes mercury gets into ponds, lakes, rivers and the ocean through pollution. This can be dangerous because when mercury pollutes the water, it can get into the fish that live there. If you eat fish with mercury, the mercury can act as a poison and harm you and your baby.

Like lead poisoning, too much mercury can affect your baby's brain and how your baby learns, moves and behaves. It can cause serious health problems for your baby.

If you are pregnant, nursing or planning to have a baby in the next year, you can avoid mercury by choosing the **right fish** to eat. You can't see or smell mercury in fish. Mercury can't be cut away, cleaned or cooked out of fish. The best way to avoid mercury is to know which fish to choose for a healthy diet.

Choose Fish Wisely For You and Your Family

Some fish can have high levels of mercury and other contaminants that aren't safe for your baby. Avoid eating:

- Swordfish
- Shark
- Bluefish
- Striped bass
- Freshwater fish caught in RI other than trout caught in stocked waters

If you eat tuna, make sure you choose **light tuna**, not other types of tuna.

For more information, call 222-4770 or visit our website at www.healthri.org.

Figure 3. Insert – Page 1

**Advice on Mercury
in Fish**

If your family likes to catch fish in Rhode Island, and you eat the fish you catch, you need to know which fish are safe to eat. The information on the front and back of this card should help you make the best decisions.

When Fishing in Saltwater

Flounder, haddock and most other saltwater fish you can catch in the Bay and Ocean are low in mercury and safe to eat.

Young children and women who are pregnant, nursing or planning to have a baby in the coming year should not eat shark, swordfish, bluefish and striped bass.

Clams, crabs and other shellfish are low in mercury. Collect shellfish from approved areas. Approved areas are shown on the weather page of the Providence Journal or you can call the Department of Environmental Management at 222-3961 for information. Remember to cook shellfish thoroughly before eating them.

Before you eat the fish you catch

Check the Department of Health Website:
www.healthri.org/environment/risk/fish.htm
Or call the Contaminants in Fish Hotline
at 222-4770

Figure 4. Insert – Page 2

When Fishing in Freshwater

Young children and women who are pregnant, nursing or planning to have a baby in the coming year should not eat freshwater fish from Rhode Island ponds, lakes, or rivers. Choose trout from stocked waters or saltwater fish instead.

For everyone else:
Others can safely eat **one meal of most freshwater fish per week** if they know where to fish and what kinds of fish are safe to catch and eat:

- Avoid fish with the most mercury (bass, pike, pickerel).
- Fish for stocked trout.
- With the exception of trout, **do not eat any fish** from the lower Woonasquatucket River; Yawgoog, Wincheck, and Meadowbrook Ponds; and Quidnick Reservoir.
- Vary where you fish and what kind of fish you eat.
- Choose smaller fish to eat (according to the Department of Environmental Management's allowable size limit regulations).
- Limit eel and black crappie taken from all ponds, and all fish from Tucker, Yawgoo and Watchaug Ponds, to **one meal per month.**

Before you eat the fish you catch

Check the Department of Health Website:
www.healthri.org/environment/risk/fish.htm
Or call the Contaminants in Fish Hotline
at 222-4770

February, 2002

Appendix C. NSF Measure of Scientific Literacy

- This next set of statements relates to different subjects you may have learned about in school or heard on the news. For each statement that I read, please tell me if it is true or false. If you don't know or aren't sure, just, just indicate this and move to the next question.

	True	False	Don't Know
a) The earliest humans lived at the same time as the dinosaurs.	T	F	DK
b) The continents on which we live have been moving their location for millions of years and will continue to move in the future.	T	F	DK
c) The center of the Earth is hot.	T	F	DK
d) All radioactivity is man-made.	T	F	DK
e) Electrons are smaller than atoms.	T	F	DK
f) The oxygen we breathe comes from plants.	T	F	DK
g) It is the father's gene that decides whether the baby is a boy or a girl.	T	F	DK
h) Lasers work by focusing sound waves.	T	F	DK
i) Antibiotics kill viruses as well as bacteria.	T	F	DK
j) The universe began with a huge explosion.	T	F	DK
k) Human beings, as we know them today, developed from earlier species of animals.	T	F	DK
l) Cigarette smoking causes lung cancer.	T	F	DK
m) Radioactive milk can be made safe by boiling it.	T	F	DK
n) All bacteria are harmful to humans	T	F	DK
o) Senility is inevitable as the brain ages and loses tissue	T	F	DK
p) Ordinary tomatoes do not contain genes while genetically modified tomatoes do	T	F	DK
q) Human beings can survive on almost any combination of foods, provided the total diet has enough calories.	T	F	DK

- **When you read or hear news stories, you come across certain sets of words and terms. Some news articles refer to the results of a scientific study. When you read or hear the term scientific study do you have a clear understanding of what it means, a general sense of what it means, little understanding, or no understanding of what it means?**

a) No understanding..... θ

b) Little understanding..... θ

c) General sense..... θ

d) Clear understanding..... θ

- 13a) If answer above is 3 is c or d - In your own words, could you explain what it means to study something scientifically? ENTER EXACT RESPONSE. (If answer above is a. or b. go to the next question.)**

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