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Rodabaugh, Gary Lee, Ph.D.

Michigan State University, 1987

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AN INVESTIGATION INTO PROCESSES CONTRIBUTING TO VOLUNTARY EXPOSURE OF MICHIGAN ANGLERS TO CONTAMINATED WATERWAYS AND CONTAMINATED FISH

By

Gary Lee Rodabaugh

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Fisheries and Wildlife

1987

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ABSTRACT

AN INVESTIGATION INTO PROCESSES CONTRIBUTING TO VOLUNTARY EXPOSURE OF MICHIGAN ANGLERS TO CONTAMINATED WATERWAYS AND CONTAMINATED FISH

By

Gary Lee Rodabaugh

Water pollution has become a topic of critical concern in Michigan since the late 1960's. This concern has resulted in an advisory against the consumption of contaminated fish species from specific Michigan waterways.

This research involved the development of a questionnaire that measured a wide variety of beliefs, attitudes, risk perceptions, and behaviors relating the the consumption of those fish.

The study population consisted of a random sample of 400 households that were located within one mile of the North and South Branches of the Shiawassee River, in Shiawassee County, Michigan. The South Branch is highly contaminated with polychlorinated biphenyls (PCB) and consumption of fish from this branch has been advised against since 1978. The North Branch, while visually identical, does not contain measurable levels of industrial contaminants.

This study has shown that the information regarding water quality and the risks associated with environmental contamination has reached specific groups of anglers. While it has reached those anglers residing near contaminated waters, it would appear that the Michigan Department of Natural Resources (MDNR) has had little to do with the spread of that knowledge.

Anglers residing near contaminated waters, although having lower educational levels and lower SES, are securing the information on their own. The information they do receive from MDNR is perceived as of low credibility by this group who exhibits a high degree of specific knowledge about local and statewide water quality.

Anglers who reside near waters that are not contaminated have greater knowledge of general water quality, perceive the MDNR as credible, have higher levels of education and SES, yet continue to fish on contaminated waters and eat the fish they catch. These individuals may best be reached with increased educational programs, due to the high credibility placed on information from MDNR.

An anglers willingness to fish on contaminated waters and consume the catch was found to increase with increasing education and SES. Additionally, anglers who perceive the MDNR as a credible source of information were less likely to eat the contaminated fish they caught. Those anglers that lived near contaminated waters were more aware of local water quality and less likely to fish on contaminated waters than their counterparts residing near non-contaminated waters.

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INTRODUCTION

THE PROBLEM AND ITS SETTING

During the years from 1979-1981 I spent a great deal of time on the waters of the Shiawassee River between Howell and Corunna, Michigan. This section of the river has had a fish consumption ban in effect since 1977 because of severe PCB (Polychlorinated biphenyl) contamination.

Rarely did I complete a trip down the river without encountering fishermen actively pursuing their favorite species. When I informed them of the consumption ban, their responses ranged from "I didn't know that" to "that may have been a problem a long time ago, but they (DNR) took all of the signs down years ago, so it's OK to eat the fish now." Most of those anglers indicated that they intended to consume their catch.

This apparent lack of awareness among local fishermen increased my interest in the problem of educating sport fishermen to problems associated with contaminated waterways.

In Michigan we have the unique situation of having one of the largest populations of anglers in the country. This is in direct relation to the abundance of aquatic resources in the state. We are also a primary industrial state with its associated environmental pollution problems.

This situation presents a prime opportunity to sample the attitude of a large population of anglers to determine the effectiveness of the government efforts to protect the health of sportsmen. It also offers a prime opportunity to establish "target" groups of individuals who may not be exposed to the fish consumption warnings as they are now presented.

Anglers are an important economic factor throughout Michigan. Many major tourist areas depend on dollars produced by the sport fishing industry. Much of Michigan's attraction is based on the general quantity as well as the quality of that fishery.

The growing concern about the edibility of Michigan fish species has resulted in a warning on the back of the Michigan fishing regulation booklet, designating those waterways where chemical contaminants have resulted in an advisory against fish consumption. Even though this warning has been on the license booklet for years, many anglers are apparently unaware of the fish consumption advisory. Media exposure on specific preparation methods to reduce contamination has been similarly ineffective.

As a way of discovering fishermen awareness on this subject, Great Lakes anglers were questioned. Casual interviews were conducted with pier fishermen, the vast majority of whom were attempting to catch as many fish as possible to extend their family food budget. Some stated that removing the belly fat of salmon would eliminate any contamination, indicating some knowledge of the problem, but not enough knowledge to realize that this practice reduces but does not eliminate contamination levels. Virtually none of the fishermen were aware of the consumption warning on the back of the fishing license booklet.

Casual discussion with these anglers seemed to indicate a lack of awareness of the problem itself, as well as the reasons for the ban. Many of the local anglers interviewed on the Shiawassee River and Great Lakes either had not read the license booklet for many years because of their familiarity with the regulations for the species they pursue, or had not purchased a license and therefore have had no exposure to the warning.

A review of the general problem led to a more specific concern: "Are some groups bearing the brunt of this lack of awareness?". Lower socioeconomic (SES) groups, women, and anglers under 16 years of age might be most susceptible.

The consumption warning on the booklet states that "children, women who are pregnant, nursing, or expect to bear children" should not eat specific species of fish from most of the Great Lakes (salmonids, whitefish, lake trout, etc.). This notice is published on a booklet that is not distributed to the very groups to which the warning is directed. Children are not required to purchase a fishing license, women who are allowed to fish on their husbands' license may never see the booklet, and the booklet is not consistently distributed to all anglers purchasing licenses. Also the ever-growing population of poor Americans who fish for sustenance - but cannot afford the price of a fishing license - are not exposed to the warning.

This may result in lower SES groups being at risk from increased consumption of contaminated fish caused by lack of awareness of the consumption advisory.

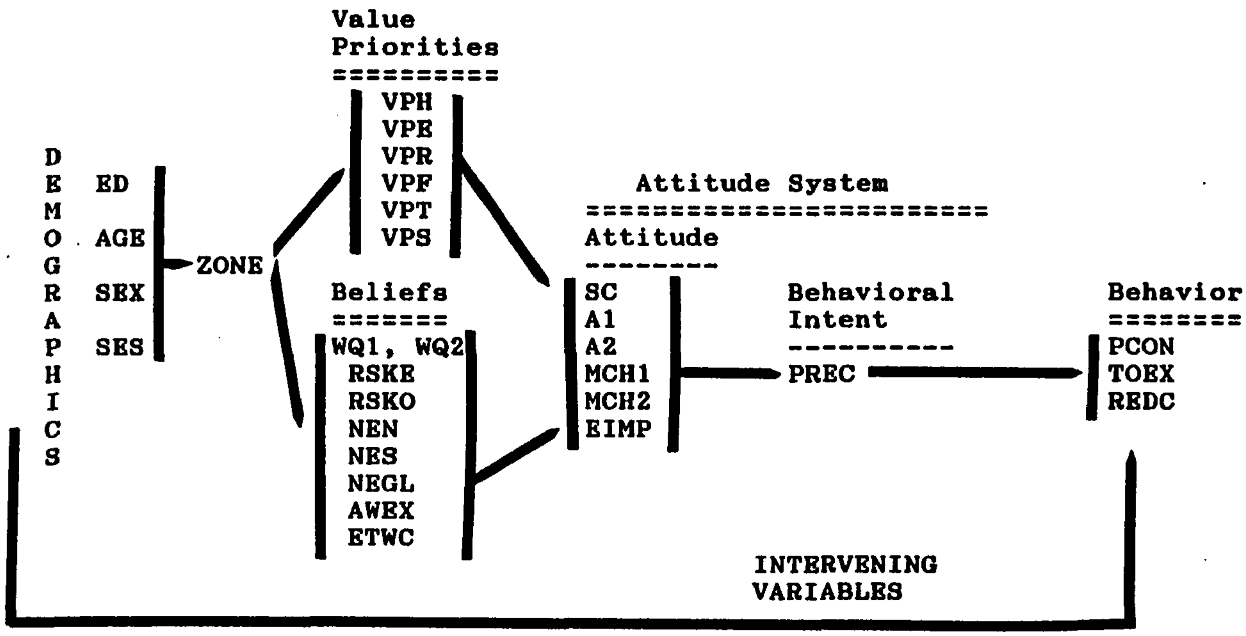
In addition to analyzing specific group exposures, this study will highlight factors contributing to anglers' behavior patterns in relation to consumption of contaminated fish, as well as the extent of the problem in this population. We will also attempt to find explanations for situations where awareness and non-compliance exist simultaneously. Other areas to be clarified by this study are the extent to which non-compliance is due to lack of awareness, inadequate belief systems concerning contaminants and impacts on human health, and value priorities (health vs. economic). These are measured by use of a questionnaire containing various attitude and belief scales as well as questions specific to the Shiawassee River area.

The goal of this research is an increased knowledge of anglers' behavior in relation to consumption of contaminated fish. From this increased knowledge specific recommendations can be made for increasing the compliance of Michigan anglers with the consumption advisory statements.

From these concerns, the following research propositions were developed and studied.

For clarity, the hypothetical decision stage model is presented on the following page, and is periodically repeated throughout the document in a non-numbered format to assist the reader in locating the various indices and acronyms being discussed.

Perception of contamination problem



ACRONYM	INDEX	DESCRIPTION
DEMOGRAPHICS:	ED	Education
	AGE	Age in years
	SEX	Gender
	SES	Socio-economic status
VALUE PRIORITIES :	VPH	Value Priority - Health
	VPE	Value Priority -Economics
	VPR	Value Priority -Recreation
	VPF	Value Priority -Freedom of will
	VPT	Value Priority -Traditionalism
	VPS	Value Priority -Socialization
BELIEFS :	WQ1	Water Quality - Literature scale
	WQ2	Water Quality - Situational scale
	RSKE	Risk of eating contaminated fish
	RSKO	Overall risk of contaminated waters
	NEN	Nature and Extent of N. Shiawassee contamination
	NES	Nature and Extent of S. Shiawassee contamination
	NEGL	Nature and Extent of Great Lakes contamination
	AWEX	Awareness of the extent of contamination
	ETWC	Exposure to consumption advisory
ATTITUDE :	SC	Source Credibility
	A1	Alienation - Literature scale
	A2	Alienation - Situational scale
	MCH1	Macho attitude - Literature scale
	MCH2	Macho attitude - Situational scale
	EIMP	Environmental Importance
BEHAVIORAL INTENT :	PREC	Precautionary attitude
BEHAVIOR :	PCON	Participation on contaminated waters
	TOEX	Total exposure via consumption of contam. fish
	REDC	Attempts to reduce contamination

Hypothetical Decision Stage Model

RESEARCH PROPOSITIONS

PROPOSITION 1 - ANGLERS AREA OF RESIDENCE WILL BE PREDICTED BY DEMOGRAPHICS.

P1.1 Anglers area of residence will be positively predicted by educational levels and socioeconomic status.

P1.2 Anglers area of residence will not be predicted by age or gender.

PROPOSITION 2 - ANGLER VALUE PRIORITIES WILL BE PREDICTED BY AREA OF RESIDENCE AND DEMOGRAPHICS.

P2.1 Value priorities will not be correlated with area of residence.

P2.2 Value priorities will be predicted by angler demographic factors.

P2.21 Health related value priorities will be positively predicted by education, gender and socioeconomic status, and negatively correlated with age.

P2.22 Economic related value priorities will be negatively predicted by education and socioeconomic status, while being negatively predicted by age and gender.

P2.23 Recreation related value priorities will be positively correlated with education, age, gender, and socioeconomic status.

P2.24 Freedom of will and traditionalism related value priorities will be positively predicted by age but negatively predicted by education socioeconomic status, and gender.

P2.25 Socialization related value priorities will be positively predicted by education, age, socioeconomic status, and negatively predicted by gender.

P2.3 Value priorities are not predicted exclusively by area of residence.

PROPOSITION 3 - BELIEFS WILL BE PREDICTED BY DEMOGRAPHICS BUT NOT BY AREA OF RESIDENCE.

P3.1 Beliefs will not be predicted by area of residence.

P3.2 All belief factors will be positively predicted by education and socioeconomic status.

P3.3 All belief factors will be negatively predicted by age.

P3.4 Risk perception will be positively predicted by gender.

P3.5 All belief factors (other than risk perception) will be predicted by gender.

P3.6 Belief factors are not predicted exclusively by area of residence.

PROPOSITION 4 - ATTITUDES WILL BE PREDICTED BY VALUE PRIORITIES, BELIEFS, DEMOGRAPHICS, BUT NOT BY AREA OF RESIDENCE.

P4.1 Attitude factors will not be predicted by area of residence.

P4.2 Attitude factors will be predicted by value priorities.

P4.21 Source credibility and environmental importance factors will be positively predicted by health related value priorities.

P4.22 Alienation and macho factors will be negatively predicted by health related value priorities.

P4.23 Attitude factors will be positively predicted by economic and recreationalism value priorities.

P4.24 Source credibility and environmental importance factors will be negatively predicted by freedom of will and socialization value priorities.

P4.25 Alienation and macho factors will be negatively predicted by freedom of will and socialization value priorities.

P4.26 Source credibility will be negatively predicted by traditionalism value priorities.

P4.27 Alienation, environmental importance, and macho factors will be positively predicted by traditionalism value priorities.

P4.3 Attitude factors will be predicted by belief factors.

P4.31 Source credibility and environmental importance factors will be positively predicted by belief factors.

P4.32 Alienation and macho factors will be negatively predicted by belief factors.

P4.4 Attitude factors will be predicted by demographics.

P4.41 Source credibility and environmental importance factors will be positively predicted by education, socioeconomic status and age, but not predicted by gender.

P4.42 Alienation and macho factors will be negatively predicted by education and socioeconomic status, while being positively predicted by age and gender.

P4.5 Attitude factors are not exclusively predicted by value priorities and beliefs.

PROPOSITION 5 - BEHAVIORAL INTENT WILL BE PREDICTED BY ATTITUDE, VALUE PRIORITIES, BELIEFS, AREA OF RESIDENCE, AND DEMOGRAPHICS.

P5.1 Behavioral intent will be predicted by attitudes.

P5.11 Precautionary behavioral intent will be positively predicted by source credibility and environmental importance factors.

P5.12 Precautionary behavioral intent will be negatively predicted by macho and alienation factors.

P5.2 Precautionary behavioral intent will be positively predicted by belief factors.

P5.3 Precautionary behavioral intent will be predicted by value priorities.

P5.31 Precautionary behavioral intent will be positively predicted by health related value priorities and negatively predicted by economic related value priorities factors.

P5.32 Precautionary behavioral intent will be not be predicted by recreationalism, freedom of will, traditionalism, or socialization value priorities.

P5.4 Precautionary behavioral intent will be predicted by area of residence.

P5.5 Precautionary behavioral intent will be positively predicted by demographics.

P5.51 Precautionary behavioral intent will be positively predicted by education, gender, and socioeconomic status.

P5.52 Precautionary behavioral intent will be negatively predicted by age.

P5.6 Precautionary behavioral intent is not exclusively predicted by attitude factors.

PROPOSITION 6 - BEHAVIORS WILL BE PREDICTED BY BEHAVIORAL INTENT, ATTITUDES, VALUE PRIORITIES, BELIEFS, AREA OF RESIDENCE, AND DEMOGRAPHICS.

P6.1 The number of fish caught per year will not be predicted by any of the factors measured.

P6.2 Behaviors will be predicted by behavioral intent.

P6.21 Participation on contaminated waters, exposure via consumption, and number of hours spent fishing each year will be negatively predicted by behavioral intent.

P6.22 Efforts to reduce contamination via special preparation methods will be positively predicted by behavioral intent.

P6.3 Behaviors will be predicted by attitudes.

P6.31 Participation on contaminated waters and exposure via consumption will be negatively predicted by source credibility and environmental importance factors.

P6.32 Participation on contaminated waters and exposure via consumption will be positively predicted by alienation and macho factors.

P6.33 Efforts to reduce contamination via preparation methods will be positively predicted by source credibility and environmental importance factors.

P6.34 Efforts to reduce contamination via preparation methods will be negatively predicted by alienation and macho factors.

P6.35 Fishing hours per year will be negatively predicted by source credibility.

P6.36 Fishing hours per year will be positively predicted by environmental importance factors.

P6.37 Fishing hours per year will not be predicted by alienation or macho factors.

P6.4 Behavior will be predicted by value priorities.

P6.41 Participation on contaminated waters and exposure via consumption of contaminated fish will be negatively predicted by health related value priorities.

P6.42 Participation on contaminated waters and exposure via consumption will be positively predicted by economic, recreationalism, freedom of will, traditionalism, and socialization value priorities.

P6.43 Efforts to reduce contaminants via special preparation methods will be positively predicted by health, economic, recreationalism, and freedom of will related value priorities.

P6.44 Efforts to reduce contaminants via special preparation methods will be negatively predicted by traditionalism and socialization related value priorities.

P6.45 Fishing hours per year will be positively predicted by health, economic, recreationalism, socialization, traditionalism, and freedom of will related value priorities.

P6.5 Behaviors will be predicted by belief factors.

P6.51 Participation on contaminated waters, exposure via consumption, and fishing hours per year will be negatively predicted by beliefs.

P6.52 Efforts to reduce contaminants by use of special preparation methods will be positively predicted by belief factors.

P6.6 Behaviors will be predicted by area of residence.

P6.61 Participation on contaminated waters, exposure via consumption, and fishing hours per year will be reduced in contaminated zone anglers.

P6.62 Efforts to reduce contaminants via special preparation methods will be increased in contaminated zone anglers.

P6.7 Behaviors will be predicted by demographic factors.

P6.71 Participation on contaminated waters and exposure via consumption will be negatively predicted by education, gender, and socioeconomic status.

P6.72 Participation on contaminated waters and exposure via consumption will be positively predicted by angler age.

P6.73 Efforts to reduce contaminants via special preparation methods will be positively predicted by education and socioeconomic status.

P6.74 Efforts to reduce contaminants via special preparation methods will be negatively predicted by age and gender with females using fewer reduction methods.

P6.75 Fishing hours per year will be positively predicted by education, age, and socioeconomic status.

P6.76 Fishing hours per year will be negatively predicted by gender with females spending less time angling.

P6.8 Behaviors are not predicted exclusively by behavioral intent.

LITERATURE REVIEW

Pollution of our fragile environment has been a continual problem throughout *Homo sapiens*' recent history. However, it has only been since the Industrial Revolution that we have begun to appreciate that our environment has only a limited capacity to detoxify our wastes.

Michigan is a primary example of this situation. Although the extent of toxic substance loads cannot be determined with a high degree of accuracy, University of Minnesota (Botts, 1983) researchers have estimated total deposition of some trace organic chemicals for the Great Lakes (Table 1). The fate of these chemicals has yet to be accurately predicted. However, it is no longer believed that they necessarily remain bound to the sediments after they have settled out of the water column (First Annual Progress Report, 1980). With as many as 470 potentially toxic chemicals found in Great Lakes fish (Eisenreich, 1981), angler exposure through consumption is of great concern.

Polychlorinated biphenyls (PCB's) were first prepared by Schmidt and Schultz in 1881, but were of little economic value until 1930. At that time, commercial production of polychlorinated biphenyls began to yield a wide range of

Table 1 - Great Lakes Airborne Organic Deposition

Total Depositon of Airborne Trace Organics To The Great Lakes*

Compound	Superior	Michigan	Huron	Erie	Ontario
Total PCB	9.80	6.90	7.20	3.10	2.30
Total DDT	0.58	0.40	0.43	0.19	0.14
Dieldrin	0.54	0.38	0.55	0.17	0.13
HCB	1.70	1.20	1.20	0.53	0.39
Methoxychlor	8.30	5.90	6.10	2.60	1.90
Edosulfan	8.00	5.60	5.80	2.50	1.90
Total PAH	163.00	114.00	118.00	51.00	38.00
Anthracene	4.80	3.40	3.50	1.50	1.10
DBP	16.00	11.00	12.00	5.00	3.70
Pyrene	8.30	5.90	6.10	2.60	1.90

*Deposition expressed in metric tons per year.

products including dielectric fluids, heat transfer agents, and waterproofing agents.

In general, the many uses of polychlorinated biphenyls are a direct result of the unique chemical and physical properties of this highly-chlorinated chemical. These properties include insolubility in water, relative nonvolatility, solubility in organic compounds (particularly hydrocarbons), and possession of a high dielectric constant. PCB's are relatively inert toward acids, alkalies, and other corrosive chemicals, are stable toward oxidation, and resist combustion at temperatures above their boiling point. Temperatures for complete combustion must be in excess of 1000 degrees Centigrade. Unfortunately the combination of these useful characteristics has led to the bioaccumulation and system-wide retention of PCB's in the world's environment (Rodabaugh, 1981).

Chemicals which are soluble in hydrocarbons are typically also soluble in lipids. As such, these environmentally-stable lipophylic compounds will tend to concentrate in the lipid-rich populations of living organisms. This is particularly important in aquatic organisms in which the bioaccumulation factors can be on the order of 10,000 to 1,000,000 times the ambient water concentrations (Rodabaugh, 1981).

Humans are not as removed from the problem as much as once thought. Small, chronic environmental doses can cause reduced reproduction in many aquatic organisms, resulting in depressed population levels for many species. This represents an indirect economic effect by reducing populations of game fish. Those fish that do survive are often so highly contaminated as to cause a potential danger to public health. This may be of critical concern in a state such as Michigan, where a significant portion of recreational spending is directly related to recreational fishing activities (Rodabaugh, 1981).

Polychlorinated biphenyls have been found to cause mammalian health effects. Observed effects include microsomal enzyme induction, porphysogenic action, estrogenic activity, and immunosupression (Casarette & Doul, 1982, p.647).

PCB's appear to be stored in fat by simple physical dissolution into the tissue. Neutral fats, the primary storage site, can account for up to 50% of body weight on an obese individual and 20% on relatively lean individuals. This process of lipid storage acts as a buffer, minimizing target organs damage by removing PCB from the system. However, there is ample evidence to suggest massive doses of PCB can be released to the circulatory system if fat is mobilized for energy production, as is the case with dieting individuals (Casarette & Doul, 1982).

The precise degree of risk associated with consumption of contaminated fish is unknown, and chronic human health effects caused by consumption of contaminated Great Lakes fish has yet to be proven (Bro et al., 1978).

However, some authors have used risk assessment projections to predict the number of additional cancers that may be expected due to contaminated fish consumption (Maxim and Harrington, 1984). Unfortunately, risk projections are just that, predictions of harm rather than actual number of people harmed. These can vary by a factor of up to 180 depending on the model chosen for the prediction.

Bro indicates that Great Lakes anglers consume more fish than the national average. His study calculated that the average Great Lakes angler who consumes 1 meal/week (approximately 11 kg of fish per year) may be exposing themselves to increased risk of developing cancer. This projected risk ranged from one additional cancer in 1,000 Great Lakes anglers who consume 1 meal/week/lifetime from Lake Superior, to three cancers per 100 anglers who consume 1 meal/week/lifetime from Southern Lake Michigan.

Star (1969) rates risks as voluntary or involuntary and notes that the public is generally willing to accept voluntary risks approximately 1000 times greater than involuntary risks, and that the perceived risk of death resulting from an activity appears to be the yardstick by which risk is measured. However, Slovic et al. (1980) notes that individuals rarely perceive the actual risk associated with an activity (Table 2).

Star also comments that a risk of death from an

Table 2 - Risk Estimation, Lay People vs Experts

Experts and lay people were asked to rank the risk of dying in any year from various activities and technologies. The experts' ranking closely matches known fatality statistics. (Slovic et al., 1980)

PUBLIC		EXPERTS
1	Nuclear Power	20
2	Motor Vehicles	1
3	Handguns	4
4	Smoking	2
5	Motorcycles	6
6	Alcoholic beverages	3
7	General (public) aviation	12
8	Police work	17
9	Pesticides	8
10	Surgery	5
11	Fire fighting	18
12	Large construction	13
13	Hunting	23
14	Spray cans	26
15	Mountain climbing	29
16	Bicycles	15
17	Commercial aviation	16
18	Electric power (nonnuclear)	9
19	Swimming	10
20	Contraceptives	11
21	Skiing	30
22	X-rays	7
23	High school and college football	27
24	Railroads	19
25	Food preservatives	14
26	Food coloring	21
27	Power mowers	28
28	Prescription antibiotics	24
29	Home appliances	22
30	Vaccinations	25

activity in the 1 death per 1000 range are not normally acceptable to the general population and concerted public action is often undertaken immediately when the risk is publicized. Risks of 1/10,000 deaths/person/year do not command immediate attention, but will illicit an approval to spend money to reduce the hazard. Risks of 1/100,000 deaths/person/year are actively recognized, but placed low on the list of priorities, and risks of 1/1,000,000 or less are generally accepted and are not of great concern to the public at large.

Much of the risk associated with the consumption of Great Lakes fish is a result of the carcinogenic potential of PCB and DDT levels (Bro et al., 1987). Table 3 reflects the relative carcinogenic potency of chemical compounds typically found in Great Lakes fish based on New York Department of Public Health and U.S. Environmental Protection Agency estimates.

It is important to note that consumption risk is a relative activity. Table 4 reports the projected additional cancer risk associated with consuming Great Lakes sportfish. The risks range from 96 additional cancers/ million people/lifetime to 3,300 additional cancers/million people/lifetime. When considering the cancer risk from all sources to be 25,000 per 100,000, the consumption of contaminated fish represents 3.8 - 13.0 percent of the lifetime cancer risk. Since risk estimates are generally additive, ie. participating in several risky activities

Table 3 - Carcinogenic Potency of Compounds in Great Lakes Fish

Contaminant **	NY-SDH*	EPA*
Hexachlorobenzene	13	1.7
Dieldrin	12	30
Heptachlor	3.5	3.4
Toxaphene	1.5	1.1
Chlorodane	1.1	1.6
DDT	0.88	8.4
p,p'-DDE	0.39	
Mirex	0.38	
gamma-Hexachlorocyclohexane(Lindane)	0.32	1.3
beta-Hexachlorocyclohexane	0.29	1.5
PCBs	0.22	4.3
Chloroform	0.12	0.18
alpha-hexachlorocyclohexane	0.11	2.7
Hexachlorobutadiene	0.083	0.078
Vinyl Chloride	0.032	0.017
Tetrachloroethylene	0.016	0.040
Trichloroethylene	0.008	0.013
Carbon Tetrachloride	0.008	0.083
Bis-(2-chloroethyl)-ether		1.1
1,2-Dichloroethane		0.037
Benzene		0.051

* Potencies are expressed as the inverse of milligrams of contaminant per kilogram of body weight per day dosed: $(mg/kg/day)^{-1}$. Assumes that a 70 kg individual is exposed over a 70 year lifetime. Values are 95% upper confidence limits of estimated potency.

Source: NY-SDH = New York State Department of Health (Kim and Stone 1981).

EPA = U.S. Environmental Protection Agency (1980).

** Table taken with permission from Bro et al, (1987).

Table 4 - Comparison of Carcinogenic Hazards*

Source	Cancer Risk (10^{-5} lifetime risk)
Average U.S. lifetime risk of cancer of all types	25,000
Typical Foods:	
Four tablespoons peanut butter per day (aflatoxin)	60
One pint milk per day (aflatoxin)	14
8 oz. broiled steak per week (cancer only)	3
One diet soda per day (saccharin)	70
Average U.S. fish consumption	33
Great Lakes:	
Lake Michigan sport fish consumption (EPA 1980 potency values)	480 to 3,300
Lake Michigan sport fish consumption (New York State Health Dept. values)	96 to 340
Niagara River Water: 2 liters per day (EPA 1980 potency values)	0.3
Drinking Water:	
Average U.S. groundwater, communities greater than 10,000 population, 2 liters per day.	1
Urban water supplies, 1976-77 contaminant levels, 2 liters per day.	120 to 5,300
Air:	
Average U.S. urban air, normal breathing	63 to 560

* Table used with permission from Bro *et al*, 1987.

will add more to your likelihood of injury or death than will be experienced by a person taking very few risks, elimination of one percent of the risk of cancer (or death) could be considered a significant improvement in an individuals survival.

Risks associated with consuming contaminated fish can be reduced if the individual prepares or cooks the fish in specific ways (Michigan DNR License Booklet, 1983). Removal of the skin, filleting, and trimming off fatty portions reduce contamination levels. Cooking on a rack, barbecuing, or poaching allow excess contaminated fatty fluids to fall away from the fish or dilute the fluids in the surrounding cooking media.

The research area selected for this study encompasses approximately 70 river miles along the North and South Branches of the Shiawassee River in Michigan's central lower peninsula. Sediments from this river area were first found to be highly contaminated with polychlorinated biphenyls (PCB) in 1974. Follow-up studies performed in 1977 provided verification of extremely high levels of PCB in various species of fish (Shaver, 1978).

Investigations conducted by the Michigan Department of Natural Resources found the source of contamination to be the Cast Forge Company in Howell (Livingston County), Michigan. Cast Forge manufactures aluminum castings for the automotive industry. During the manufacturing process, lubricants contaminated with PCB were routinely discharged to the South Branch of the Shiawassee River until 1973. From 1973-1977 PCB laden wastes were discharged to an on-site lagoon and surrounding land surface. Rainwater runoff and periodic flooding continued to transport high-level PCB waste materials a short distance to the Shiawassee River. As a result of this continued discharge, some species of fish found in the South Branch of the Shiawassee River contained as much as 345 mg/kg PCB in 1977.

As a precaution against hazards like the situation above, Michigan public health agencies warn against consumption of certain fish from contaminated waterways. This warning is in the form of an advisory published on the last page of Michigan's fishing regulation booklet (Figure 1). The South Branch of the Shiawassee River is one such waterway targeted by the consumption advisory.

Yet public awareness is often stifled by the attempts of various governmental agencies to avoid responsibility. While this may simply be a function of lack of direction from higher officials, the public is left confused and suffers from a lack of any source of information - much less a credible source. An example of this problem is highlighted in an article by Schmidt (1981);

> The advisory (against consumption) is, by all accounts, inaccurate, out-of-date, and grossly incomplete. Why isn't it updated? A spokesman for the Department of Natural Resources (DNR)

Some sport fish contain chemical contaminants. Although levels of some contaminants have markedly declined, uncertainties about the impact of prolonged exposure dictates the following advice,

Do not eat any fish-Deer Lake, Carp R., (Marquette Co.), Titabawassee river (downstream from Dow Dam), Saginaw River, Pine River (downstream from St. Louis), Chippewa River (downstream from mouth of Pine), Raisin River (downstream from Monroe Dam), Portage Creek (downstream from Milham Park), Shiawassee River (M-59 to Owosso), and Cass River (downstream from Bridgeport).

Do not eat certain fish-Grand River (Clinton Co.) avoid carp, Lake Matatawa avoid carp, Hersey River (Reed City area) avoid bullheads and trout, St. Joseph River (downstream from Berrien Springs Dam) avoid carp, Kalamazoo River (downstream from Kalamazoo) avoid carp and suckers.

Certain Great Lakes fish should not be eaten-by children, women who are pregnant, nursing or expect to bear children. Limit consumption by all others to no more than 1 meal per week, Lake Michigan - carp, catfish, salmon(3), trout(3), and whitefish(1); Lake Superior - lake trout; Lake Huron-carp(2), catfish(2), muskellunge(1), salmon(1,3), trout (1,3); Lake St. Clair and the Detroit and St. Clair rivers-muskellunge; and Lake Erie (western edge) - carp, catfish and muskellunge.

1. Southern half of lake only.
2. Saginaw Bay area only.
3. Advisory also applies to tributaries into which these species migrate.

NOTE: Fatty fish continue to show higher contaminant levels than lean fish. Cleaning fish by skinning, filleting, and trimming off fatty portions, reduces contaminant levels, baking on a rack, barbecueing, poaching, or frying in vegetable oil also reduce contaminant levels.

Figure 1 - Public health advisory concerning consumption of contaminated Michigan fish (1984).

> explains "That's the DPH's (Department of Public Health) responsibility." A spokesman for the DPH explains, "We don't have the responsibility for monitoring fish; we have to rely on the DNR. It's kind of complicated" (Schmidt, 1981).

One uncertainty revolves around the lack of data on the human health consequences of exposure to low levels of these chemicals for long periods of time. Botts (1983) argues that "The Food and Drug Administration action on PCB's damaged commercial fishing (in the Great Lakes), but the public health warnings against consumption do not seem to scare off sports fishermen." Botts continues: "Fishermen ignore posted signs warning against any consumption of fish caught there because of high concentrations of PCB's from previous direct discharge of industrial wastes (First Annual Progress Report, 1980).

Edelstein (1985) noted that the discovery of contaminating materials in one's environment can have a profound effect on many aspects of everyday life. Persons affected suddenly realize that family members must be taught that the water in the stream or from the faucet may be poison. Simple pleasures such as fishing, swimming, bathing, or even cooking dinner suddenly require creative measures to protect loved ones.

When this realization occurs to anglers, they may find it difficult to decide what constitutes protection of themselves and family members if they have very little understanding of the technical nature of the problem. The problem may also be compounded by persons who have had a lifetime of local exposures, yet exhibit no deleterious effects from that exposure. The average angler must rely for understanding on information supplied by governmental agencies (Janoff-Bulman and Freize - 1983). Edelstein argues that the greatest bitterness is reserved for the government which is expected to offer effective and substantial solutions to the problem.

Unfortunately, the one factor that rivals the stress generated by a contaminating episode is the regulatory process itself. Governments often exacerbate the problem by offering assistance on a rather arbitrary and capricious basis, with little apparent consideration of the affected individual. When this aid is delayed through normal bureaucratic process, further distrust of the agency is virtually guaranteed (Edelstein, (1985).

Anglers and residents must also re-evaluate the environment itself. What may have once given solace and comfort to the individual now produces fear and uncertainty and becomes a physical as well as a financial trap. Thus the environment may become a more significant and ominous portion of one's world. Commonly accepted requisites of life, air, water, wildlife, and soil, normally thought to be freely available in the desired purity, now are not trusted to be safe (Edelstein, 1985).

Interest in public attitudes in the area of the environment has increased greatly in the last decade (Dunlap 1978). These studies, to a great extent, have dealt with the social bases of concern for the quality of the environment. Survey techniques have produced data on social and demographic variables. These include age, sex, income, education, occupational prestige, residence, political party, and political ideology (Van Liere and Dunlap 1980).

Van Liere *et al*. (1980) suggest five general hypotheses concerning an individual's decision processes in relation to environmental interactions with certain value priorities:

> THE AGE HYPOTHESIS: Younger people tend to be more concerned about environmental quality than older people. Negative correlations between age and environmental concern seem to predominate. It has been argued (Malkis and Grasmick, 1977) that young people are not as fully integrated into American economic system (i.e., the dominant social order). Traditional values and behavior of the dominant economic class are often the first to be affected by changes in environmental attitudes (Hornback 1974). From this it is perhaps easy to see why the

young can more easily afford to become involved with environmental causes.

THE SOCIAL CLASS HYPOTHESIS: Environmental concern is positively associated with social class as indicated by education, income and occupational prestige. This hypothesis is based on Maslow's (1970) hierarchy of needs theory, which infers that environmental concern is a luxury to be indulged in only if more basic material needs (food, shelter, economic security) have been fully met. Thus only higher socioeconomic classes may be prone to environmental causes. Morrison *et al.* (1972) suggest that environmental attitudes are based on "relative" deprivation conditioning as opposed to "absolute" deprivation. This is to say that lower socio-economic groups may be continuously exposed to poor living, working, and recreational conditions and therefore are not aware of environmental problems. On the other hand, middle class individuals have had exposure to better conditions and are more concerned over degradation of environmental conditions.

THE RESIDENCE HYPOTHESIS: Urban residents are more likely to be environmentally concerned than rural residents. Discussions in this area (Tremblay 1978) argue that rural areas that depend heavily on activities that exploit the environment are likely to be less concerned about the environment than urban populations. It has also been noted that small towns (Murdock 1977) need to sustain continued economic growth which takes place over environmental concerns.

THE SEX HYPOTHESIS: Relatively few studies have dealt with this hypothesis, and those few that have are split on their conclusions. McEvoy (1972) argues that males are more active in politics and local affairs, and have higher levels of education, therefore higher levels of environmental awareness. Conversely, others (Passino and Lounsbury 1976) have argued that males are more likely to be concerned with job security and economic stability than females, with a resultant decrease in environmental concern.

Van Liere et al. (1980) conclude from the above that researchers have limited success in explaining the social bases of environmental concern because of the tendencies to lump too many parameters into each study. He further indicates that attention should be focused on specific environmental issues instead of lumping many diverse issues and attempting to set policy based on excessively diverse studies. "In order to achieve better understanding of the social bases of environmental concern," they conclude, "researchers should conceptualize such concern more precisely than has generally been done in the past, and also pay at least as much attention to the cognitive as to the demographic determinants of support for environmental protection."

Cutter (1981) researched environmental attitudes in poor communities surrounding polluted areas and developed several conclusions relating to environmental attitudes. Key points in her studies included correlations between area of residence and an individual's concern about the pollutant levels in the immediate environment. Persons who lived within one mile of contaminated water were found to be more concerned about pollution than others living farther away.

In addition, persons in areas of high pollution exhibited higher levels of concern about the environment. Those residents who were poor also showed more concern for the environment. This study produced many interrelated items such as 1) blacks were more concerned than whites, 2) increased numbers of whites in a neighborhood were associated with lower levels of concern, and 3) poor housing correlated with elevated environmental concern (Cutter, 1981).

Cutter concludes that the obvious correlation is that blacks generally live in poor housing, have a low SES (socioeconomic status), and are forced to live in areas that whites are able to escape. Most often this type of area develops because the local environment is so polluted that properties are the most affordable to lower SES individuals (Cutter, 1981).

How then can the individual on the street make decisions that may have long-term deleterious effects on his or her family's health? He/she must seek the counsel of others and have the ability to understand what is presented to him/her. An individual's educational level will play an important role in this information process.

One key cognitive aspect of decision making concerning problems associated with use of contaminated waters/fish is the degree of risk perceived by those individuals involved.

A question that must be considered in relation to risk decisions is, "just exactly how safe is safe?" This is a question that concerns regulators and citizens alike. Each law is written independently of the others and as a result our legal statutes are quite strict against levels of carcinogens in foods, yet more tolerant of those same chemicals in the air and water that are no less essential to life (Howard et al., 1978).

An example of the divergent concern for risk is the amount of money spent to save one life. Americans are willing to spend, through taxes and budget allotments, about $140,000 in highway construction money to save a life, but will spend $5 million to save a person from death due to radiation exposure (Howard et al., 1978).

If we as a society are willing to spend this amount of money to protect an individual from direct harm, how much are we willing to pay to protect the individual from indirect or long term harm? Of necessity, this must be based on the societal concern for the problem as well as our ability to understand the consequences.

In a literature review concerning public information about natural resource issues, Peyton ( ) makes the following observations:

1. The public tends to know only the information that is given to them by planning agencies or interest groups. This information tends to be quite polar, depending on the outlook of the interest group.
2. The public tends to have little or no input until a proposal is made.
3. The public's main sources of information in traditional planning are newspapers and conversations with friends. They tend to know little more than what others supply to them.
4. The public's perceptions and attitudes about an environmental issue often are dependent upon their own self-interest, and upon the short-term consequences of the issue.
5. Many persons, even when well informed about a

particular environmental issue, feel that their actions would not have an influence on planners or on the final decision.

From these observations it seems logical that most persons (or anglers) know very little about the risks associated with contaminated waters/fish. We all know someone who has been injured in an auto accident and we are also very familiar with the implications and causes associated with automobile accidents. But how many of us have known someone who has been injured in a chemical accident that had a direct and obvious effect, much less know someone who has suffered obvious or apparent injury from exposure to chemically contaminated food? Indeed, very few of us.

Risk can be measured on the basis of several categories such as injuries, deaths, psychological damage, social damages, economic damage of property loss (White, 1975). It can be defined (Mileti, 1980) as "the chance that a physical system exceeds some 'normal' level and cause damage to people, social and economic systems."

Hohenemser _et al._ (1983) developed a diagrammatic representation of causal sequencing that may enlighten some aspects of risk decisionmaking. Stages of hazard causation were characterized by 12 physical, biological, and social descriptors that could be measured quantitatively. These were correlated with various energy and material hazards.

As with many decisions in daily life, the perception of risk is rarely equivalent to the actual risk involved (Mileti, 1980). Defined as "cognition or belief in the seriousness of the threat of an environmental extreme (problem), as well as the subjective probability of experiencing a damaging environmental extreme" (Kunreuther 1978, Slovic et al., 1974), perceptions of risk have contributing factors. Among the factors of risk perception are the ability of a group to estimate the risk (Slovic et al., 1974; Burton et al., 1978; Hewitt and Burton, 1971; White, 1974), perceived causes of the environmental problem (Burton et al., 1978), experience (White et al., 1975; Mileti, 1975; Burton et al., 1978; Hutton et al., 1979; Kates, 1970), and the propensity of people to deny risk (White and Haas, 1975; Kunreuther, 1978; Mileti et al., 1980).

An important value/risk judgment is that each individual will be the best possible judge of his/her own interests. These are affected by other variables in the decision process, but in order to make a valid hazard/risk judgment, an individual should know the levels of pollution and how that level could be expected to affect his/her health.

It has been noted (Hutton et al., 1979) that the more potential damage encountered in an environmental situation, the more likely groups will adjust to the situation. That is to say that minor problems require only minor efforts to compensate and can be selectively ignored, but major problems require major efforts to reduce dissonance, either by a change in attitude or a change in behavior. Since the individual may not be able to change the environmental situation, an attitude change may reduce dissonance.

Kates (1978) conducted studies to illustrate how individuals perceive the effects and consequences of various environmental problems. He notes that technology is listed as a primary causative factor having permanent effects on a continuing basis for populations ranging from local to international.

Kates also presents definitions of response mechanisms that individuals may use to deal with the problems associated with a polluted environment.

> **Adaptations** can be thought of as long-term responses to hazard that are deeply embedded in human biology or culture. Typical of these are the human adaptabilities to high altitudes or extreme cold.
>
> **Adjustments** are short-term responses to hazard purposefully or incidentally adopted. Adjustments take three major forms: measures that accept consequences by bearing, sharing or distributing the effects; measures that modify events or reduce the vulnerability of society to loss; and, on rare occasion, changes in basic location, livelihood or productive systems.

In spite of increased potential damage, there is still a propensity to deny risk. Shippee (1980) cites Gans (1962) concerning residents of environmentally-undesirable locations. In this study, residents of high-risk areas (with respect to property and physical health) not only exhibited strong positive feelings toward these areas, but many also actively denied the existence of threats in the area. Others tended to underestimate markedly the probability of future risks. This denial and other cognitive dissonance activities tend to cloud reasoned decision making. The nature of the dissonance and methods of dissonance reduction should vary as a function of distance from the hazard. Residents located closest to the hazard should also exhibit the greatest amount of denial.

Dabelko (1981) postulates that the populace is inherently open to manipulation of its attitudes by authority figures. These authority figures may be individuals such as Ralph Nader or organizations like the Environmental Protection Agency (EPA). In essence, the figure with the most credibility has the ability to manipulate the public attitude in the direction required by the situation. This can often be done indirectly by changing a standard to fit the situation, suddenly the standard may no longer be exceeded and is thus safe - even though it is only the standard, not the measurement, that has changed.

Although residents of hazardous areas typically deny the risk involved (White and Haas, 1975; Kunreuther, 1978) to themselves or their possessions, studies have shown that risk perception has become more realistic and accurate "AS THE ACCESS OF THE (group) TO SCIENTIFIC INFORMATION ABOUT THE CHARACTER OF THE RISK INCREASES" (Emphasis added) (Kunreuther, 1978; Mileti, 1980).

Mileti (1980) also notes that local groups do not necessarily adapt to environmental problems on their own, but in fact must be guided by the regulations imposed by the larger social entities (government).

Mileti concludes:

> Generally, social units adjust to mitigate the risk imposed by environmental extremes: (1) if they think there is reason to adjust, (2) if the costs and bother to adjust are seen as worth the benefits that could be gained, (3) on the basis of available information which is often biased and incomplete, (4) on the basis of risk perceptions which are typically inaccurate, (5) if the work required to maintain an adjustment does not require much change from the pre-adjustment <u>status quo</u> of life, (6) if opposition to adjustment which typically arises on the basis of alternative goals is not too great, and (7) if larger level units of human aggregation provide adjustment incentives (1980, p. 342).

Moore and Golledge (   ) discuss several basic assumptions underlying environmental knowledge. They believe that it is a dynamic process in which information extracted from the environment is constantly received, sorted, selected, organized, and used in daily decision making processes.

However, it is also noted that there is little predictability in this process. Each individual has a highly selective view of the information presented and various degrees of past experiences that assist in the decision process. Much of this past experience also hinges on a need-to-know basis, i.e., the needs and value systems of the individual are important in determining awareness or knowledge about the environment.

Included in these considerations is the often made assumption that individuals must know about their external environments so that they can exist in them. We assume that all persons have this cognitive awareness. Quite simply, these assumptions cannot be made in an across-the-board manner. Individuals often exhibit many psychological defense mechanisms, such as denial, that allow them to function in a potentially threatening situation with reduced stress levels.

Sims and Baumann (1983) postulate ". . . nor does it follow that even if a public IS informed of a risk and DOES know what to do, it therefore WILL do what it knows it could or should do." The authors make it clear that

KNOWING what to do does not necessarily lead to AWARENESS of a problem which does not necessarily lead to BEHAVIOR, but instead that "information may lead to behavior change . . . under highly specified conditions . . . if properly executed . . . with specified targets."

These authors also refer to a literature review done by Slovic et al. (1980) in which three characteristics of cognition of risk were presented as follows: First, people want intellectual closure; that is, once opinions are formed (regardless of the representativeness of the evidence on which they are based), they tend to become fixed, and new evidence is made to conform even if it requires considerable distortion. Second, estimating risk is discomforting; people are ill at ease when forced to base decisions on insufficient information or face the insecurity of probabilities or strive to solve the intellectual puzzle of calculating risk. They become anxious, and to avoid such intellectual and emotional situations, they oversimplify and settle for erroneous solutions - anything to do away with ambiguity and uncertainty. Finally, people manifest what Slovic calls the "availability bias" - that is, hazards that come to mind easily, that have dramatic and drastic consequences, are overestimated, while common, everyday hazards, although of equal or far greater danger, are underestimated.

Drabek and Stephenson (1971) reported on a group of flood victims who had considered the officially broadcast warnings as simply "informational." The victims felt that a message that was truly important would have been communicated to them by means other than television or radio.

Systems designed to warn a group of individuals, consisting of printed messages or informational campaigns, may lack the information necessary to be effective in risk reduction (Mileti, 1975).

Sims and Baumann (1983) also points out six key areas that affect the effectiveness of warnings:

1. A warning must be clear.
2. A warning should not warn; it should spell out what the desired response is.
3. A warning (eg. appeal, educational program) must be perceived as emanating from a credible source.
4. A warning's effectiveness is greatly increased if reinforced socially or locally.
5. A warning's effectiveness depends on the medium of communication used.
6. The type of appeal made by the warning must be assessed. There is now mounting evidence that the use of threat (or fear), so common to hazard messages (both educational and warning) is often misguided.

There are four key variables involved in attempting to persuade an audience about the risks associated with an activity (Simms and Baumann, 1983): (1) source variables, (2) message variables, (3) audience variables, and (4) temporal variables. Some important aspects of these variables are discussed below.

SOURCE VARIABLES - Source credibility must be conferred by an audience or it does not exist. This conferral is often accomplished in the first minute of a presentation and will carry more weight in an attitude change early in the program than later on. This credibility of the source is enhanced if the source is perceived as trustworthy and as having some expertise in the area being discussed. Power can also be seen as a source variable. Although it has little to to with credibility, if the source effectively uses the five main categories of power (reward, coercive, referent, expert, and legitimate) the attitude change may still be accomplished.

MESSAGE VARIABLES - Fear appeals are often used to attempt to change attitudes. This is the case in trying to inform anglers of potential hazards associated with consumption of contaminated fish. If the fear arousal is intense and if the recommendations or actions are explicit and possible, fear can be an effective communication device. Additionally, highly-credible sources can use more intense fear appeals, fear appeal is more likely to be effective if it threatens a valued other, an intense fear appeal with evidence is more effective than an appeal without supporting evidence, and that fear appeals point out immediate consequences of non-compliance are more effective than those that point out long-term effects.

AUDIENCE VARIABLES - The people most wanted in the audience are often least likely to be there. Even if they are there and are easily persuaded, they are likely to be just as easily persuaded toward opposite conclusions at a later date.

Ego involvement with the subject matter can also work against the presenter of information. This is often seen as biased information and is not assimilated by the group. Additionally, it seems that in North American society, women are more persuadable than men (Simms and Baumann, 1983).

TEMPORAL VARIABLES - In time the effects of the persuasive effort may wear off, although a negative source of information will wear off less quickly than a positive one. The duration of effect can also be increased by repeating the communication on a regular basis or by attempting to accomplish a "sleeper effect" where the message becomes stronger as the audience thinks about it.

From this review it is apparent that additional survey work is needed in the area of specific attitudes of specific groups toward specific environmental problems. Generalities prevail in the literature, while many researchers have called for analysis of narrower situations.

METHODS AND MATERIALS

INVESTIGATIVE METHOD

SURVEY AREA: The survey area consists of the Shiawassee River, which has two branches that are completely separated by dams. The North Branch is not contaminated by chemical wastes, whereas the South Branch is the river most heavily contaminated with PCB in Michigan. The city of Byron sits at the confluence of the two branches and separates their flow with two 10-foot dams.

The South Branch originates in Howell and is contaminated for 54 river miles until it reaches the Shiawasseetown Impoundment. This section of river has been closed to fish consumption since approximately 1977, but has been posted with consumption advisories only once since that time. The fish consumption warning signs have been removed by vandals and none have been present since 1980.

Boundaries were drawn on U.S. Geological Survey maps one mile to each side of both branches of the river to select a readily accessible and proximal population (Figure 2).

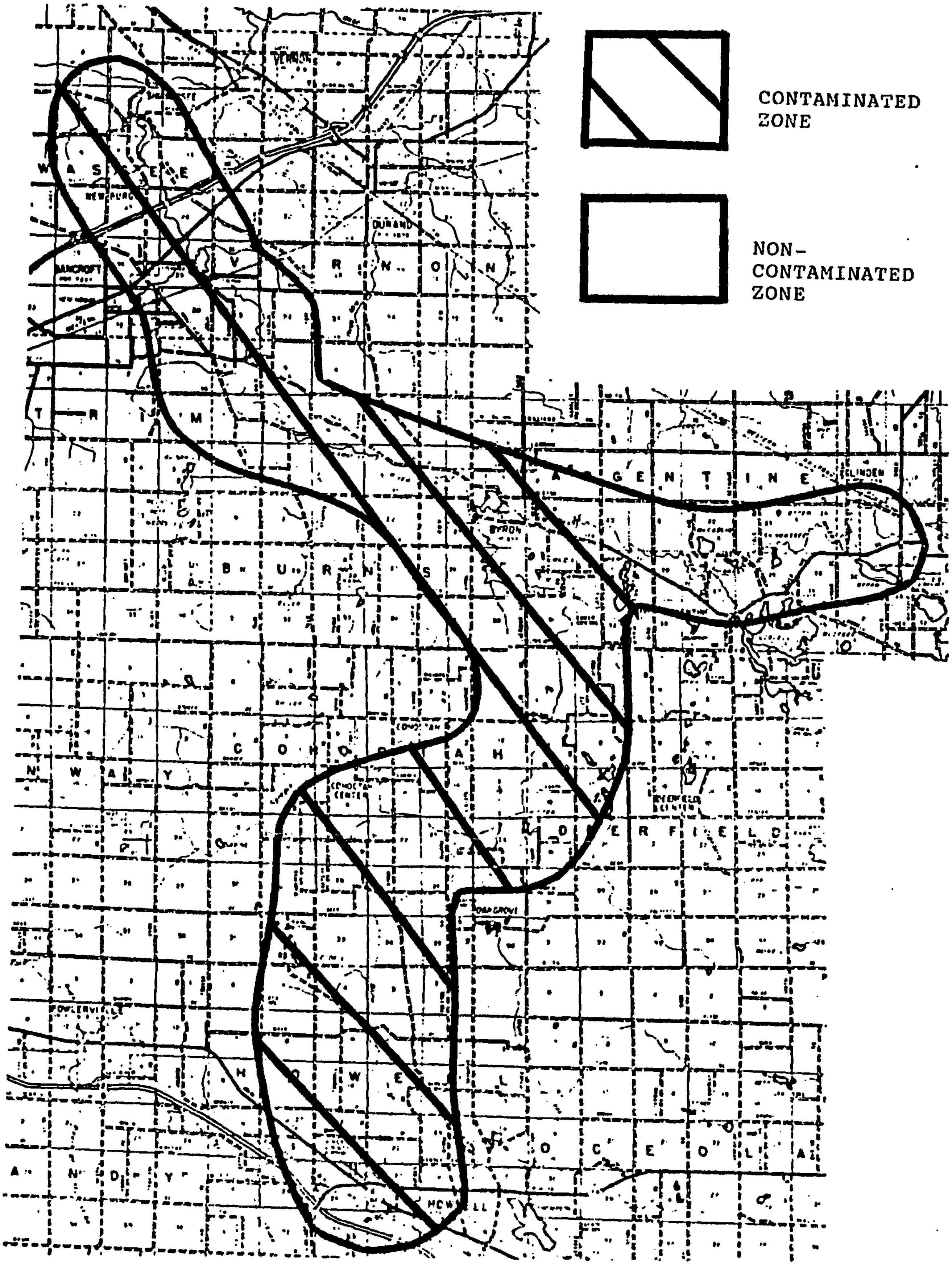


Figure 2 - Study area.

POPULATION AND SUB-POPULATIONS - The two mile wide boundaries contain a population of approximately 1000 households on the contaminated South Branch, and approximately 1200 households on the non-contaminated North Branch. These approximations were obtained by counting the buildings on the map and verified by using approximations from county plat maps. For comparative purposes these two groups of households in contaminated and non-contaminated areas of the watershed were designated as sub-populations to determine the influence of proximity to contaminated water on perception of risk, environmental knowledge, problem awareness, recreational use of contaminated waters, and consumption of fish from those waters.

The major reasons for selecting this proximity population are as follows;

1. Every household is located within one mile of the Shiawassee River. This served as a partial control to limit the effect of distance from the river on behaviors, attitudes, and other characteristics of the subjects.
2. Approximately 80% of the population is within 2 miles of a non-contaminated body of water which also served as partial control. In addition, approximately 97% of the population is within 4 miles of a non-contaminated body of water.
3. Though the South Branch is contaminated,it has received national attention as one of the best

smallmouth bass rivers in Michigan (Outdoor Life, 1977) and therefore needed to be studied to determine the effectiveness of the consumption advisory which was not mentioned in the article.

4. Because of the proximity of all households to bodies of water, a high percentage of anglers were expected in the population.

QUESTIONNAIRE DEVELOPMENT

Figures 3 and 4 represent a hypothetical decision making process involved in consumption of fish. At each decision point a set of values and/or beliefs must come into play. These decision points are the critical areas described by this investigation. In essence, these decision processes are an exercise in risk assessment that must be made by each angler based on his own knowledge, attitudes, beliefs, background and values.

A survey was designed to question respondents on the processes involved in this risk assessment, and to measure the effectiveness of current fish consumption warnings. The survey also assessed the beliefs, attitudes and knowledge scores of any angler in the household.

It is not the purpose of this study to design an instrument to measure environmental awareness. It is, in fact, a study designed to utilize available instruments already published in an attempt to better clarify a problem

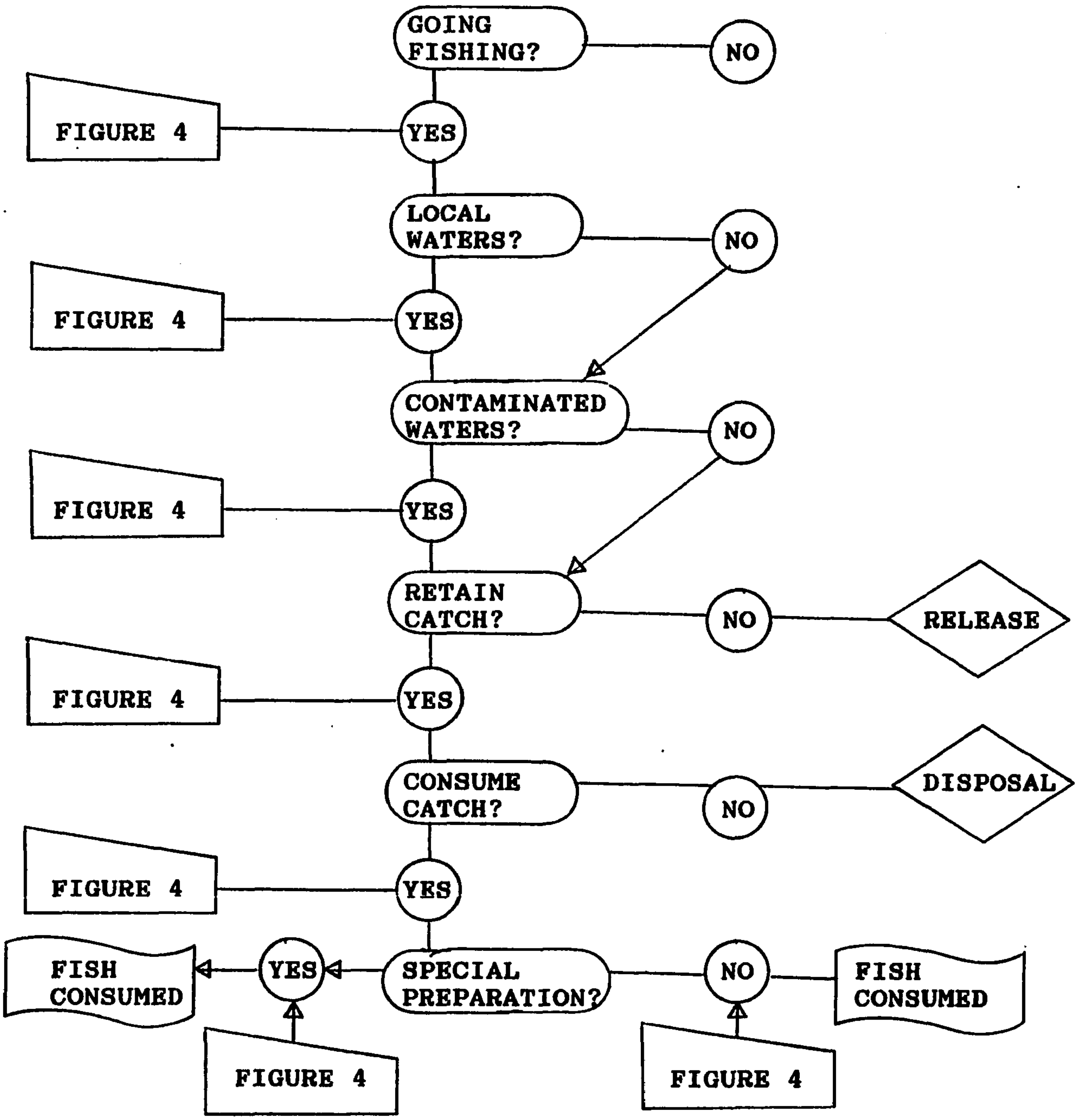
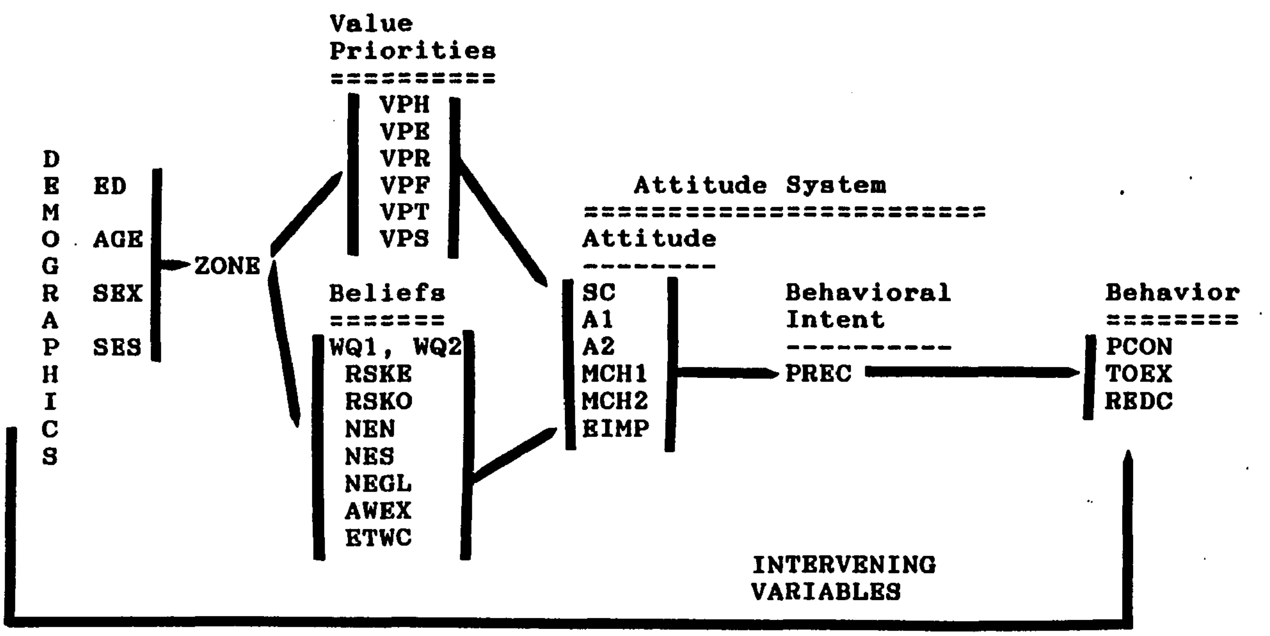


FIGURE 3 - Hypothetical anglers decision path when considering the consumption of fish caught.

Perception of contamination problem



ACRONYM	INDEX	DESCRIPTION
DEMOGRAPHICS:	ED	Education
	AGE	Age in years
	SEX	Gender
	SES	Socio-economic status
VALUE :	VPH	Value Priority - Health
PRIORITIES	VPE	Value Priority -Economics
	VPR	Value Priority -Recreation
	VPF	Value Priority -Freedom of will
	VPT	Value Priority -Traditionalism
	VPS	Value Priority -Socialization
BELIEFS :	WQ1	Water Quality - Literature scale
	WQ2	Water Quality - Situational scale
	RSKE	Risk of eating contaminated fish
	RSKO	Overall risk of contaminated waters
	NEN	Nature and Extent of N. Shiawassee contamination
	NES	Nature and Extent of S. Shiawassee contamination
	NEGL	Nature and Extent of Great Lakes contamination
	AWEX	Awareness of the extent of contamination
	ETWC	Exposure to consumption advisory
ATTITUDE :	SC	Source Credibility
	A1	Alienation - Literature scale
	A2	Alienation - Situational scale
	MCH1	Macho attitude - Literature scale
	MCH2	Macho attitude - Situational scale
	EIMP	Environmental Importance
BEHAVIORAL INTENT :	PREC	Precautionary attitude
BEHAVIOR :	PCON	Participation on contaminated waters
	TOEX	Total exposure via consumption of contam. fish
	REDC	Attempts to reduce contamination

Figure 4 - Hypothetical angler decision process, the model.

area. The questionnaire involves not only specific scales developed by the other authors, but also involves questions specific to the area under study.

Questions include types that test the recognition of quotes from the warning published on the back of the fishing license booklet (Figure 1). Also administered were questions that relate to specific contaminated waterways such as the Shiawassee River and the Great Lakes. These attempt to differentiate the opinions of anglers to see if they are more willing to eat Great Lakes fish (which are under much the same warning) than those fish caught in local waters.

We will also examine the credibility attributed to the governmental agencies involved in the distribution of the information by the respondents.

QUESTION DESIGN - The questions have been designed to measure various attributes of the above mentioned variables. Data were collected through the design of questions based on the following areas of investigation:

DEMOGRAPHIC CHARACTERISTICS

The questions on the following page (Figure 5) were developed by Spaulding (1968) in a report issued by the Rhode Island Water Resources Center. Spaulding used this information as a method of classification of respondents into three socioeconomic groups in a "Social Status Index."

It was recognized that requesting specific SES information can often result in negative attitudes toward the questionnaire (Young, 1966). For this reason, SES and demographic questions were placed on the last page of the questionnaire to minimize negative attitude toward the survey.

Use of this series of questions not only gave a usable Socioeconomic Status value, but also, with the addition of questions to reflect age and gender, gave the values needed for the demographic section of the attitude diagram.

Many studies have reported education to be a strong indicator of support for environmental issues and perceptions about environmental quality (Spaulding, 1968). Most of the authors argue that well educated groups have little concern with the problems of economic survival and have more free time to devote to issues that are not fundamental aspects of human existence.

Morrison _et al_. (1972) also point out that "the rise of the mass environmental movement of the past decade was largely based on some emerging consensus that pollution --

THIS PAGE REQUESTS INFORMATION THAT WILL AID US IN OUR RESEARCH. AGAIN, ALL INFORMATION OBTAINED FROM THIS QUESTIONNAIRE IS TOTALLY CONFIDENTIAL.

135. Your Formal School Training. Please circle the highest grade completed.

a. Grade School	: 1 2 3 4 5 6 7 8
b. High School	: 1 2 3 4
c. College	: 1 2 3 4
d. Graduate Study	: 1 2 3 4
e. Other	: 1 2 3 4 5 6 7 8

136. House Value: How much would the house in which you are living sell for at the present time?

___ a. Under $20,000
___ b. $20,000 - 29,999
___ c. $30,000 - 39,999
___ d. $40,000 - 49,999
___ e. $50,000 - 59,999
___ f. $60,000 or more

137. Income: Please check the income range which indicates the total income for all your family members during 1983.

___ a. $0 - 9,999	___ g. $40,000 - 44,999
___ b. $10,000 - 14,999	___ h. $45,000 - 49,999
___ c. $15,000 - 19,999	___ i. $50,000 - 54,999
___ d. $20,000 - 24,999	___ j. $55,000 - 59,999
___ e. $25,000 - 29,999	___ k. $60,000 - 64,999
___ f. $30,000 - 34,999	___ l. $65,000 or more

138. Occupation of Household Head: Please write in the type of work done by the head of the household to earn a living. Be as specific as possible. ______________________________

____

____

If the person filling out this questionaire is not the head of the household, please indicate your occupation here: ____

____

139. YOUR AGE? ________

140. MALE OR FEMALE (CIRCLE ONE)

Figure 5 - Demographic questions.

a utilitarian issue -- was an important national problem."

One change was made in the final version of questionnaire. In order to reflect the changes in "average" SES values due to inflation since 1972, the ranges described in the original index were doubled in the cases of income and house value.

Gender was measured as male=1 and female=0 to create a dummy variable situation for statistical analysis.

SOCIO-ECONOMIC STATUS (SES) - Socio-economic status (SES) was calculated with information obtained in the Frame of Reference questions (Figure 5).

The index was described by Spaulding (1968) in a report issued by the Rhode Island Water Resources Center. Spaulding used education, income, profession, and house value as a basis for classification of respondents into three socio-economic groups.

There were some modifications made to the original index that make it more appropriate to the 1980's. First, all monetary ranges were doubled to allow for the effects of almost 20 years of inflated incomes and property values. Secondly, the education measurement was removed and analyzed separately. Finally, each of the three remaining categories was multiplied by a correction factor so that each would account for 12 points in the final 36 point scale. The resulting total was then divided by 36 points to ease data management.

Educational level was assigned a score of 1 (1 - 8 years), 2 (9 - 14 years) or 3 (15 or more years). Income was assigned a score of 1 (Less than $20,000), 2 ($20,000 - $40,000), or 3 (Greater than $40,000).

Profession or occupation was assigned values of 1 (retired, service personnel, labor, operations, students, unemployed, and farmers), 2 (craftsmen, sales, clerical, teachers, and blue collar), or 3 (professionals, managers, or white collar), and multiplied by 4 to produce a possible score of 12.

House value was assigned a score of 1 to 6 with increasing value receiving higher scores. This number was then multiplied by 2 to produce a possible score of 12.

Income was assigned a progressively increasing score of 1 to 12 with increasing income.

An individual respondents SES was based on the summation of the score in the 3 categories divided by the number of possible points (36).

Although this treatment of SES is not identical to Spauldings' work, the weighting of each portion so that it contributes an equal portion to the total is felt to be in line with the original concept of the measure.

AREA OF RESIDENCE

An anglers' area of residence was categorized as either living in within 1 mile of a contaminated body of water, or not residing with 1 mile of contaminated waters.

Values of "0" were assigned to contaminated zone anglers and values of "1" were assigned to non-contaminated zone anglers, thus creating a dummy variable for analysis.

VALUE PRIORITIES - VPH, VPE, VPR, VPF, VPT, VPS

Six key value priorities were selected, based on their potential effect on individual participation on contaminated waters (PCON) and the individual's total level of exposure to contaminants based on the consumption of contaminated fish (TOEX).

Respondents were asked to divide 100 points among the six value priorities described in Figure 6. The value assigned by the angler to each variable was used for statistical analysis.

BELIEF SYSTEM

TECHNICAL KNOWLEDGE (WQ1, WQ2) - Spaulding (1968) developed an instrument for the Rhode Island Water Resources Center in which an 8-item surface water quality scale was

MOST PEOPLE FEEL THAT SOME REASONS FOR ENJOYING OUT-OF-DOORS ACTIVITIES ARE MORE IMPORTANT THAN OTHERS. TO HELP US FIND OUT WHAT YOU FEEL IS MOST IMPORTANT, IMAGINE THAT YOU HAVE 100 POINTS TO DIVIDE AMONG THE 6 CATEGORIES LISTED BELOW. FOR EXAMPLE, IF "FREEDOM OF WILL" IS VERY IMPORTANT TO YOUR ENJOYMENT OF THE OUT-OF-DOORS, YOU MAY WANT TO GIVE MOST OF THE 100 POINTS TO THAT CATEGORY AND DIVIDE THE REMAINING POINTS AMONG THE OTHER 5 CATEGORIES. PLEASE PLACE THE POINTS IN THE BLANK PROVIDED AT THE LEFT OF EACH CATEGORY.

92. ____ HEALTH - OUTDOOR ACTIVITIES IMPROVE OR MAINTAIN MY HEALTH AND/OR MY FAMILIES HEALTH.

93. ____ ECONOMICS - OUTDOOR ACTIVITIES OFFER A RELATIVELY INEXPENSIVE FORM OF RECREATION.

94. ____ RECREATIONAL EXPERIENCE - OUTDOOR ACTIVITIES PROVIDE MUCH SATISFACTION AND ENJOYMENT.

95. ____ FREEDOM OF WILL - I GET A SATISFYING SENSE OF FREEDOM FROM OUTDOOR ACTIVITIES WHICH ALLOW ME TO DO WHAT I WANT TO, WHEN I WANT TO.

96. ____ TRADITIONALISM - I HAVE ALWAYS ENJOYED OUTDOOR ACTIVITIES.

97. ____ SOCIALIZATION - I PARTICIPATE IN OUTDOOR ACTIVITIES BECAUSE MY FRIENDS DO.

TOTAL 100 POINTS

Figure 6 - Value priorities questions.

included. Items 16-23 are the total scale as presented by Spaulding. Items 24, and 27-32 were designed and included to reflect the level of knowledge about water quality in the immediate area of residence, knowledge of pathways of contaminants into fish, and knowledge of health effects.

The index value is constructed by judging the responses for a respondent to be "right" if they show agreement with a "true" statement, disagreement with a "false" statement, or uncertainty with respect to a "questionable" statement about surface waters. Other responses were regarded as "wrong." "Right" answers were regarded as reflecting accuracy of conceptualization about surface water quality, while "wrong" answers were regarded as reflecting inaccurate conceptualization.

The index was calculated by assigning a score of 1 to each correct response and a score of 0 for each incorrect response (Appendix E). The scores for individual items were added and then divided by 8 for the WQ1 scale (Water Quality 1 - literature scale, Figure 7) and divided by 7 for the WQ2 scale (Water Quality 2 - Situation Specific scale, Figure 8).

PERCEIVED RISK (RSKE, RSKO) - This scale was developed to determine anglers' attitudes and beliefs concerning the risk of eating (RSKE, Figure 9) contaminated fish, and their concerns about overall risk (RSKO, Figure 10) of pollution and environmental contamination. The items in

FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.

1 STRONGLY AGREE	2 AGREE	3 UNCERTAIN	4 DISAGREE	5 STRONGLY DISAGREE	
1	2	3	4	5	16. Surface water usually falls on the earth a long distance from the place it is eventually used.
1	2	3	4	5	17. As it is found in streams, ponds, and reservoirs, surface water is suitable for human use.
1	2	3	4	5	18. The supply of surface water will probably never be exhausted.
1	2	3	4	5	19. Human beings cannot pollute surface water.
1	2	3	4	5	20. The capacity of nature, in any given situation, to purify polluted surface water is unlimited.
1	2	3	4	5	21. Most surface water falls on very high places and runs down to low ones.
1	2	3	4	5	22. Human beings have no influence or control over surface water in streams, ponds, and reservoirs.
1	2	3	4	5	23. Human beings have influence and control over surface water from the time it falls until the time it is used.

Figure 7 - Water quality literature scale questions (WQ1).

1 STRONGLY AGREE	2 AGREE	3 UNCERTAIN	4 DISAGREE	5 STRONGLY DISAGREE	FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.
1	2	3	4	5	24. Chemicals that get into the surface water can get into the fish in those waters.
		*			* * * *
1	2	3	4	5	27. Eating fish from water that contains chemicals will not affect my health.
1	2	3	4	5	28. It is safe to eat fish from all the streams, ponds, and reservoirs within one mile of my home.
1	2	3	4	5	29. There are no chemicals in any of the waterways within one mile of my home.
1	2	3	4	5	30. Some chemicals stay in the water for a long time.
1	2	3	4	5	31. A chemically contaminated waterway will look dirty.
1	2	3	4	5	32. Most water pollution comes from industry.

Figure 8 - Water quality situation specific scale (WQ2).

SECTION IV.

FOR QUESTIONS 55 - 64 BELOW, PLEASE CIRCLE THE NUMBER ON THE SCALE THAT BEST REPRESENTS YOUR FEELINGS ABOUT THE RISKS OF EATING FISH THAT CONTAIN POSSIBLY DANGEROUS LEVELS OF CHEMICALS.

55. Do people take the risk of eating contaminated fish voluntarily? If some of the risks are voluntarily taken and some are not, mark an appropriate spot towards the center of the scale.

RISK TAKEN VOLUNTARILY 1 2 3 4 5 6 7 RISK TAKEN INVOLUNTARILY

56. To what extent is the risk of death immediate - or is death likely to occur at some later time?

EFFECT IMMEDIATE 1 2 3 4 5 6 7 EFFECT DELAYED

57. To what extent are the risks known precisely by the persons who eat fish with possibly dangerous levels of chemicals?

RISK LEVEL KNOWN 1 2 3 4 5 6 7 RISK LEVEL NOT PRECISELY KNOWN

58. To what extent are the risks of eating these contaminated fish known to science?

RISK LEVEL KNOWN 1 2 3 4 5 6 7 RISK LEVEL NOT PRECISELY KNOWN

59. If you were to eat contaminated fish, to what extent can you, by personal skill or diligence, avoid health problems?

PERSONAL RISK CAN NOT BE CONTROLLED 1 2 3 4 5 6 7 PERSONAL RISK CAN BE CONTROLLED

60. Is the risk of eating contaminated fish new and novel or old and familiar?

NEW AND NOVEL 1 2 3 4 5 6 7 OLD AND FAMILIAR

61. Is this a risk that kills people one at a time (chronic risk) or a risk that kills large numbers of people all at once (catastrophic risk)?

CHRONIC RISK 1 2 3 4 5 6 7 CATASTROPHIC RISK

62. Is this a risk that people have learned to live with and can think about reasonably calmly, or is it one that people have a great dread for - on the level of a gut reaction?

COMMON RISK 1 2 3 4 5 6 7 DREADED RISK

63. When eating contaminated fish results in a mishap or illness, how likely is it that the consequence will be fatal?

CERTAIN NOT TO BE FATAL 1 2 3 4 5 6 7 CERTAIN TO BE FATAL

64. What are the chances that occasionally eating fish (2-4 times each month) from waters known to contain industrial chemical contamination will cause a noticeable health problem?

NO NOTICEABLE HEALTH PROBLEM 1 2 3 4 5 6 7 DEFINITE NOTICEABLE HEALTH PROBLEM

Figure 9 - Risk of eating contaminated fish questions (RSKE).

FOR QUESTIONS 65 - 74 BELOW, PLEASE CIRCLE THE NUMBER ON THE SCALE THAT BEST REPRESENTS YOUR FEELINGS ABOUT THE HEALTH RISKS OF THE POLLUTION OF MICHIGAN WATERWAYS.

65. Do people face the risk of water pollution voluntarily? If some of the risks are voluntarily taken and some are not, mark the appropriate spot towards the center of the scale.

RISK TAKEN VOLUNTARILY 1 2 3 4 5 6 7 RISK TAKEN INVOLUNTARILY

66. To what extent is the risk of death immediate - or is death likely to occur at some later time?

EFFECT IMMEDIATE 1 2 3 4 5 6 7 EFFECT DELAYED

67. To what extent are the risks known precisely by the persons who are exposed to water pollution?

RISK LEVEL KNOWN 1 2 3 4 5 6 7 RISK LEVEL NOT PRECISELY KNOWN

68. To what extent are the risks of water pollution known to science?

RISK LEVEL KNOWN 1 2 3 4 5 6 7 RISK LEVEL NOT PRECISELY KNOWN

69. If you are exposed to the risk of water pollution, to what extent can you, by personal skill or diligence, avoid health problems?

PERSONAL RISK CAN NOT BE CONTROLLED 1 2 3 4 5 6 7 PERSONAL RISK CAN BE CONTROLLED

70. Is the risk of water pollution new and novel or old and familiar?

NEW AND NOVEL 1 2 3 4 5 6 7 OLD AND FAMILIAR

71. Is this a risk that kills people one at a time (chronic risk) or a risk that kills large numbers of people all at once (catastrophic risk)?

CHRONIC RISK 1 2 3 4 5 6 7 CATASTROPHIC RISK

72. Is this a risk that people have learned to live with and can think about reasonably calmly, or is it one that people have great dread for - on the level of a gut reaction?

COMMON RISK 1 2 3 4 5 6 7 DREAD RISK

73. When exposure to water pollution results in a mishap or illness, how likely is it that the consequence will be fatal?

CERTAIN NOT TO BE FATAL 1 2 3 4 5 6 7 CERTAIN TO BE FATAL

74. What are the chances that your exposure to water pollution in Michigan will cause noticeable health problems for you or your family?

NO NOTICEABLE HEALTH PROBLEMS 1 2 3 4 5 6 7 DEFINITE NOTICEABLE HEALTH PROBLEMS

Figure 10 - Risk of exposure to overall pollution (RSKO).

this section were developed by Slovic et al.(1980) to establish the risk profiles of 30 different technologies and activities as perceived by several groups of lay persons and professionals. Appendix C shows examples of how these risk profiles were drawn for two energy related items.

In this study, the perceived risk profiles were compared between those persons residing within one mile of contaminated waters, and those within one mile of non-contaminated waters. From this, we should be able to detect any differences in the perceived risk based on proximity of residence to contaminated waterways.

Slovic et al.(1980) note that "across all 30 items, rating of dread and of the severity of consequences were found to be closely related to the lay person's perception of risk." Although the instrument is not designed to produce a single score for risk perception (rather a risk profile), Slovic's statement may justify the use of the sum of rating of dread and severity of consequences to produce a single value. An alternative method, used here, was to reverse the scoring values for the word pairs "Not Controllable - Controllable" and "New - Old" (Appendix C) to produce a scale that would show nuclear energy to have a consistently high value when nine parameters were added.

Slovic et al., (1980), also remark that "examination of risk profiles based on mean ratings for the nine characteristics proved helpful in understanding the risk judgements of lay people. Nuclear power, for example, had the dubious distinction of scoring at or near the extreme on all of the characteristics associated with high risk. Its risks were seen as involuntary, delayed, unknown, uncontrollable, unfamiliar, potentially catastrophic, dreaded, and severe (certainly fatal)." Slovic also referred to the profile of nuclear energy as "spectacular and unique." Thus, by holding nuclear energy as a high item on the scale, it was possible to form an additive index based on the method in the preceding paragraph.

This additive score was then divided by the additive score (58.39) of Slovics' Nuclear Energy Profile (also with reverse scoring) thus creating a single ratio score for risk. This 0.0-1.0 score offered ease of graphing and statistical manipulation without altering the data. The accuracy of this scale may have been improved if each respondent had also completed the original Slovic instrument and the resultant score used as a divisor. However, it was felt that the instrument was already painfully long and an additional 10 items would be burdensome.

AWARENESS OF NATURE AND EXTENT OF PROBLEM (AWEX, NEN, NES, NEGL) - York (1970) developed a 24 item semantic differential scale for determination of three factors of water quality. Factor 1 contained 13 word pairs relating to the Aesthetic-Healthy nature of a river near Atlanta, Georgia. Through factor analysis, York determined that the five pairs listed on the scale used here exhibited the highest correlations between perceived and actual water quality. The author's estimated reliability for the selected items were FRAGRANT:FOUL=.84, DIRTY:CLEAN=.72, FRESH:STALE=.76, HEALTHY:UNHEALTHY=.83, MUDDY:CLEAR=.69.

This short scale, presented for three bodies of water, is designed to reflect the awareness of water quality problems in the area of residence as well as the larger aspect of Great Lakes water quality. The three scales are designated as NEN (Nature & Extent North branch), NES (Nature & Extent South branch), and NEGL (Nature and Extent Great Lakes, Figure 11). Respondents' scores on all three water bodies were used to indicate whether proximity to the contaminated waterways was correlated with levels of awareness, perceived risk, and other variables under study.

Each item in Figure 11 is scored 1 - 7, with pristine water qualities scoring high and pollution qualities scoring lower.

An additional scale was developed to determine the respondents' AWareness of the EXtent (AWEX, Figure 12) of contaminated waterways in Michigan. This scale consisted of a list of all Michigan waters that were included in the consumption advisory as contaminated. Respondents were asked to identify waters that they believed might contain possibly hazardous levels of industrial chemicals. Twenty-three contaminated waters were listed along with one non-

BELOW ARE THREE SUBJECTS WITH FIVE PAIRS OF WORDS LISTED BELOW EACH. PLEASE CIRCLE THE NUMBER THAT BEST DESCRIBES YOUR FEELINGS ABOUT THE SUBJECT. FOR EXAMPLE, IF YOU WERE ASKED YOUR FEELINGS ABOUT SALMON SNAGGING, AND YOU THOUGHT THAT SNAGGING WAS NEITHER GOOD NOR BAD, YOU WOULD MARK THE MIDDLE OF THE SCALE (SEE BELOW).

EXAMPLE:	GOOD	1	2	3	<u>4</u>	5	6	7	BAD

SUBJECT 1. North branch of the Shiawassee River (Fenton to Byron).

75.	FRAGRANT	1	2	3	4	5	6	7	FOUL
76.	DIRTY	1	2	3	4	5	6	7	CLEAN
77.	FRESH	1	2	3	4	5	6	7	STALE
78.	HEALTHY	1	2	3	4	5	6	7	UNHEALTHY
79.	MUDDY	1	2	3	4	5	6	7	CLEAR

SUBJECT 2. South Branch of the Shiawassee River (Howell to Corunna).

80.	FRAGRANT	1	2	3	4	5	6	7	FOUL
81.	DIRTY	1	2	3	4	5	6	7	CLEAN
82.	FRESH	1	2	3	4	5	6	7	STALE
83.	HEALTHY	1	2	3	4	5	6	7	UNHEALTHY
84.	MUDDY	1	2	3	4	5	6	7	CLEAR

SUBJECT 3. The Great Lakes (Huron, Michigan, Superior, Erie).

85.	FRAGRANT	1	2	3	4	5	6	7	FOUL
86.	DIRTY	1	2	3	4	5	6	7	CLEAN
87.	FRESH	1	2	3	4	5	6	7	STALE
88.	HEALTHY	1	2	3	4	5	6	7	UNHEALTHY
89.	MUDDY	1	2	3	4	5	6	7	CLEAR

Figure 11 - Nature and extent of specific waterway contamination (NEN, NES, NEGL).

100. Please place a check mark next to any of the waters listed below that you think may contain potentially dangerous levels of industrial chemicals.

Shiawassee River (N. Branch, Fenton to Holly)
Shiawassee River (S. Branch, Howell to Corunna)
Deer Lake
Carp River
Carp Creek (Marquette County)
Tittabawassee River (Downstream from Dow Dam)
Saginaw River
Pine River (Downstream from St. Louis)
Chippewa River (Downstream from mouth of Pine River)
Raisin River (Downstream from Monroe Dam)
Portage Creek (Downstream from Milham Park)
Cass River (Downstream from Bridgeport)
Grand River (Clinton County)
Lake Macatawa
Hersey River (Near Reed City)
St. Joseph River (Downstream from Berrien Springs Dam)
Kalamazoo River (Downstream from Kalamazoo)
Lake Michigan
Lake Superior
Lake Huron
Lake St. Clair
Detroit River
St. Clair River
Lake Erie

Figure 12 - Awareness of extent of contamination in Michigan (AWEX).

contaminated water, the North Branch of the Shiawassee River.

Scoring of this scale was done by summation of the number of check marks (not including the North Branch) and dividing by the total number of contaminated waters (23). This resulted in a ratio score ranging from 0 to 1.0 that was used for correlational analysis in this project. The population's knowledge, or lack of knowledge, was identified by calculating the percentage of the population that recognized contaminated waters.

EXPOSURE TO WARNING AGAINST CONSUMPTION (ETWC) - This scale presented two specific questions about whether the angler had seen the warnings on any Michigan waters or in any book, paper, pamphlet, etc. The scale was scored as NO=0, UNCERTAIN=1, and YES=2. These scores were added and divided by 18, which was the total possible for questions 133 and 134 (Figure 13).

ATTITUDE MEASURES

SOURCE CREDIBILITY (SC) - York (1971) developed a three part instrument to rate several aspects of credibility. In the full instrument Section I rates "authoritativeness", Section II rates "character", and Section III functions as an overall rating of credibility. This semantic

BELOW ARE THREE SIGNS THAT YOU MIGHT SEE ON THE SHORE OF A RIVER, LAKE, OR POND. PLEASE ANSWER THE QUESTION ON THE LEFT BY CIRCLING THE ANSWER THAT IS CLOSEST TO HOW YOU FEEL ABOUT EACH SIGN. ANSWER EACH QUESTION FOR EACH OF THE SIGNS. YOU WILL HAVE THREE CIRCLES FOR EACH QUESTION.

	Do not eat any fish from these waters.	*Do not eat carp, trout, catfish, suckers or muskellunge from these waters.*	*Children, and women who are pregnant, nursing, or expect to bear children, should not eat fish from these waters. All others should not eat more than one meal per week.*
130. If this sign were placed on your favorite fishing area, would you still fish there?	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN
131. If you decided to keep fishing there, would you eat the fish from this water?	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN
132. Would you allow your family to eat fish from this area?	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN
133. Have you seen this warning, or a similar warning, before on any Michigan water?	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN
134. Have you seen this type of warning in print before? (newspaper, booklet, book, etc.)	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN

Figure 13 - Exposure to consumption advisory questions (ETWC).
(Questions 133 and 134 only)

Figure 20 - Precautionary behavioral intent questions (PREC).
(Questions 130 thru 132)

differential scale was found to have high item discriminability (r=.66-.86) and a "high" level of reliability. Scoring is accomplished by summing the individual item ratings to yield a total scale score.

For this study, only sections I & II were used. This allows for a shorter scale by eliminating the "character" rating which tends to apply more to individuals than to the institutions we are investigating (Figure 14), thus creating a single number value used in correlation studies.

ALIENATION (A1, A2) - As described by Nettler (1964), alienation is characteristic of an individual "who has been estranged from, made unfriendly toward, his society and the culture it carries".

The 8-item scale used here is a combination of 2 scales developed by Nettler. In his instrument, four separate alienation scales were developed and validated both individually and as a combined scale of alienation. The author states that "questions representing shorthand expressions of these alienated sentiments (disdain for mass culture, politics, religion, and "familism") yield reliable, valid, and unidimensional scales when scored on a two category basis."

Nettler's Scale 1 (Mass Culture Alienation, items 1-4) and Nettler's Scale 2 (Alienation Toward Familism, items 5-8) were selected and combined to form the additive scale (numbers 8-15) used here.

FOR THE WORD PAIRS BELOW, CIRCLE THE NUMBER WHICH BEST REPRESENTS HOW YOU FEEL ABOUT THE INFORMATION YOU GET FROM THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES. FOR EXAMPLE, IF YOU THINK THAT THE DNR IS NEITHER QUALIFIED OR UNQUALIFIED, YOU WOULD CIRCLE NUMBER 4 AT THE MIDDLE OF THE SCALE.

1. RELIABLE	1	2	3	4	5	6	7	UNRELIABLE
2. INFORMED	1	2	3	4	5	6	7	UNINFORMED
3. UNQUALIFIED	1	2	3	4	5	6	7	QUALIFIED
4. INTELLIGENT	1	2	3	4	5	6	7	UNINTELLEGENT
5. VALUABLE	1	2	3	4	5	6	7	WORTHLESS
6. INEXPERT	1	2	3	4	5	6	7	EXPERT
7. BELIEVABLE	1	2	3	4	5	6	7	NOT BELIEVABLE

Figure 14 - Source credibility questions (SC).

Items were scored as follows;

disagree = 0	agree = 1
yes = 1	no = 0
married = 0	single = 1

Higher scores on this scale indicate respectively higher levels of alienation. Reported reproducibility coefficients ranged from .87 to .94 (Figure 15).

Again a situational scale (A2, Figure 16), dealing with alienation attitudes, was constructed using specific questions, concerning contaminated waters/fish and based on the concepts described in the literature scale (A1, Figure 15). Both indices were used for correlational analysis.

MACHO (MCH1, MCH2) - The Power and "Toughness" scale was developed by Adorno et al.(1950) as part of the California F Scale of Authoritarianism. The F Scale consists of subscales that tap nine central "personality trends." The Power and "Toughness" subscale attempts to reflect "preoccupation with dominance-submission, strong-weak, leader-follower dimensions; identification with power figures; overemphasis upon conventional attributes of the ego; and exaggerated assertion of strength and toughness."

The original 7-item scale has been shortened to a 5-item version. The two items that were omitted referred to

PLEASE CIRCLE THE WORD AT THE LEFT OF EACH QUESTION THAT, IN YOUR OPINION, BEST ANSWERS THE QUESTION.

YES/NO	8.	Do you read Reader's Digest?
YES/NO	9.	Do national spectator sports (football, baseball, etc.) interest you?
DISAGREE/AGREE	10.	"Our public education is in pretty sorry shape." Do you agree or disagree?
YES/NO	11.	Do you enjoy TV?
YES/NO	12.	Are you interested in having children? (Or would you be at the right age?)
MARRIED/SINGLE	13.	For yourself, assuming you could carry out your decision to do things over again, do you think a single life or married life would be more satisfactory?
DISAGREE/AGREE	14.	"If people really admitted the truth, they would agree that children are more often a nuisance than a pleasure to their parents." Do you agree or disagree?
YES/NO	15.	Do you think most married people lead trapped (frustrated or miserable) lives?

Figure 15 - Alienation literature scale questions (A1).

FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.

1 STRONGLY AGREE	2 AGREE	3 UNCERTAIN	4 DISAGREE	5 STRONGLY DISAGREE	
1	2	3	4	5	51. I would like it better if I was the only person who fished in my favorite spot.
1	2	3	4	5	52. If there was a river running through my property, I would not let other people fish there.
1	2	3	4	5	53. I would rather NOT take my family fishing with me.
1	2	3	4	5	54. Fishing in an area with lots of people is more enjoyable than fishing by myself.

Figure 16 - Alienation situation specific questions (A2).

"pre-war Germany" and "plots in secret places." Although it is likely that these were important items at the time the scale was developed, with World War II immediately past and the Cold War in progress they are considered no more than a source of "noise" in the scale today. Since the authors report reliabilities ranging from .81 to .97, with an average reliability of .90 for the scale, removal of the two items should not significantly affect the scale. Unfortunately, time constraints did not allow pilot studies of the modified scale.

One additional modification has been made to the original scale. The scale, as developed by Adorno, did not offer a neutral response of "neither agree or disagree." This forced either a positive or negative response, which may have biased the instrument by underestimation of respondents who are actually of neutral opinion. By adding the neutral response, the scale is now on the more commonly accepted 5-point format used elsewhere. The MACHO scales are referred to as MCH1 (literature scale, Figure 17 and MCH2 (situation specific scale, Figure 18).

Items 35, 36, and 38 were reverse scored. In the situational macho scale, the items were added and divided by 5 to produce the number analyzed in this research.

ENVIRONMENTAL IMPORTANCE (EIMP) - Lounsbury (1979) developed a current outlook survey containing 6 scales. Items 39-41,44-45 represent the scale for Outdoor

FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.

1 STRONGLY AGREE	2 AGREE	3 UNCERTAIN	4 DISAGREE	5 STRONGLY DISAGREE	
1	2	3	4	5	25. No weakness or difficulty can hold us back if we have enough will power.
1	2	3	4	5	26. What the youth needs most is strict dicipline, rugged determination, and the will to work and fight for family and country.
1	2	3	4	5	33. People can be divided into two distinct classes; the weak and the strong.
1	2	3	4	5	42. An insult to our honor should always be punished.
1	2	3	4	5	43. What this country needs most, more than laws and political programs, is a few courageous, tireless, devoted leaders in whom the people can put their faith.

Figure 17 - Macho literature scale (MCH1).

FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.

1 STRONGLY AGREE	2 AGREE	3 UNCERTAIN	4 DISAGREE	5 STRONGLY DISAGREE	
1	2	3	4	5	34. I would obey all signs or regulations on a waterway whether they made sense to me or not.
1	2	3	4	5	35. People who worry about chemicals in fish are inferior.
1	2	3	4	5	36. If I were to go fishing with friends or family, I would decide when and where we would go.
1	2	3	4	5	37. If a conservation officer or other official told me that fish were not safe to eat, then I wouldn't eat them.
1	2	3	4	5	38. A person who knowingly fishes in water that contains industrial chemicals is more macho than others.

Figure 18 - Macho situation specific scale questions (MCH2).

Recreation and is taken directly from his survey. Item 47 is taken from the Environmental Action scale and items 46,48,49, and 50 were taken from the Environmental Concern scale. The original Environmental Concern scale consists of 15 items which are scored and used against a reference scale to determine where the respondent would rate in relation to the "standardization" group.

Lounsbury originally used a 6 point scale, which has been modified to a 5 point scale to allow for a neutral opinion to be expressed. Items are scored from 1-5 points, with higher values assigned to environmentally favorable responses. Items 39-41,44,46,47,49,50 are scored 1 (strongly disagree) to 5 (strongly agree) and items 45 and 48 are scored 5 (strongly disagree) to 1 (strongly agree).

A simple summation of the item scores divided by the total number of points possible (50) produces an index where higher scores indicate a greater degree of importance of the environment (Figure 19).

BEHAVIORAL INTENT

PRECAUTIONARY ATTITUDE (PREC) - An additional scale was constructed by the researcher (Figure 20). The PRECAUTIONARY ATTITUDE (PREC) scale was designed to determine if anglers would indicate a willingness to participate on contaminated waters or consume fish from

FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.

1 STRONGLY AGREE	2 AGREE	3 UNCERTAIN	4 DISAGREE	5 STRONGLY DISAGREE	
1	2	3	4	5	39. I enjoy taking long walks.
1	2	3	4	5	40. I could spend hours near a forest stream watching and listening to wildlife.
1	2	3	4	5	41. I wish I could spend more time out-of-doors.
1	2	3	4	5	44. Fishing is fun.
1	2	3	4	5	45. I have more fun doing things indoors than out-of-doors.
1	2	3	4	5	46. I am worried about future children's chances of living in a clean environment.
1	2	3	4	5	47. We need intensive educational programs to inform the public of environmental problems and solutions.
1	2	3	4	5	48. I find it easy to live with pollution.
1	2	3	4	5	49. I would be willing to pay more taxes if it meant that pollution problems could be significantly reduced in our society.
1	2	3	4	5	50. If mankind is going to survive at all, environmental pollution must be stopped.

Figure 19 - Environmental importance scale questions (EIMP).

BELOW ARE THREE SIGNS THAT YOU MIGHT SEE ON THE SHORE OF A RIVER, LAKE, OR POND. PLEASE ANSWER THE QUESTION ON THE LEFT BY CIRCLING THE ANSWER THAT IS CLOSEST TO HOW YOU FEEL ABOUT EACH SIGN. ANSWER EACH QUESTION FOR EACH OF THE SIGNS. YOU WILL HAVE THREE CIRCLES FOR EACH QUESTION.

	Do not eat any fish from these waters.	*Do not eat carp, trout, catfish, suckers or muskellunge from these waters.*	*Children, and women who are pregnant, nursing, or expect to bear children, should not eat fish from these waters. All others should not eat more than one meal per week.*
130. If this sign were placed on your favorite fishing area, would you still fish there?	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN
131. If you decided to keep fishing there, would you eat the fish from this water?	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN
132. Would you allow your family to eat fish from this area?	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN
133. Have you seen this warning, or a similar warning, before on any Michigan water?	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN
134. Have you seen this type of warning in print before? (newspaper, booklet, book, etc.)	YES NO UNCERTAIN	YES NO UNCERTAIN	YES NO UNCERTAIN

Figure 13 - Exposure to consumption advisory questions (ETWC). (Questions 133 and 134 only)

Figure 20 - Precautionary behavioral intent questions (PREC). (Questions 130 thru 132)

contaminated waters if they had observed consumption advisory signs on the waterway. Each angler was asked to answer YES, NO, or UNCERTAIN to questions relating to quotes from the consumption advisory (Questions 130-132, Figure 20). The questions were scored YES=0, UNCERTAIN=1, and NO=2.

The scores were summed and divided by the total possible score (18) to produce a ratio score.

BEHAVIORS

PARTICIPATION ON CONTAMINATED WATERS (PCON) - PCON (participation on contaminated waters) is an index based on anglers reports on their actual participation on contaminated waters in the past 12 months (Figure 21). Each angler was asked to report whether they had fished in any of the 23 contaminated waters listed on the license booklet (question 99) and how many times they had fished each waterway.

PCON in itself does not present a hazard to the angler, it simply reflects the anglers' willingness to participate on select contaminated waters. Nor does it reflect the anglers' knowledge of whether or not the water is contaminated. These quantities were measured with indices described earlier.

The reported angling activity on each contaminated

99. Have you fished in any of the waters listed below in the last 12 months? If your answer is "NO", please mark the box on the left. If your answer is "YES", mark the "YES" box AND please indicate the number of times you fished there in the last 12 months.

NO	YES	NUMBER OF TIMES?	
			Shiawassee River (N. Branch, Fenton to Holly)
			Deer Lake
			Carp River
			Carp Creek (Marquette County)
			Tittabawassee River (Downstream from Dow Dam)
			Saginaw River
			Pine River (Downstream from St. Louis)
			Chippewa River (Downstream from mouth of Pine River)
			Raisin River (Downstream from Monroe Dam)
			Portage Creek (Downstream from Milham Park)
			Cass River (Downstream from Bridgeport)
			Grand River (Clinton County)
			Lake Macatawa
			Hersey River (Near Reed City)
			St. Joseph River (Downstream from Berrien Springs Dam)
			Kalamazoo River (Downstream from Kalamazoo)
			Lake Michigan
			Lake Superior
			Lake Huron
			Lake St. Clair
			Detroit River
			St. Clair River
			Lake Erie

Figure 21 - Participation on contaminated waters questions (PCON).

waterway was summed to establish an overall level of participation on contaminated water in terms of fishing events. The accuracy of this measure would likely have been improved if the angler had reported the number of hours spent on each fishing trip to contaminated waters. It was felt that the anglers were unlikely to be able to accurately determine hours on contaminated versus non-contaminated waters over a 12 month period.

TOTAL EXPOSURE (TOEX) - Anglers in the research area were asked to report the number of meals of fish consumed from contaminated waters (Figure 22). In each question, target species designated in the consumption advisory were listed to narrow the response to specific species in specific waterways with known elevated levels of contaminants. The reported meals of fish consumed were added and used as an index reflective of TOtal EXposure to contamination from consumption of contaminated fish.

ATTEMPTS TO REDUCE CONTAMINATION (REDC) - One key aspect of exposure to contamination from fish consumption is various methods used to REDuce Contamination through special cleaning and preparation activities (Figure 23). Six preparation methods were listed, each of which is known to reduce levels of contaminants in fish. Anglers were asked to check the different methods that they use. Their

101. Have you eaten ANY fish from the following waters in the past 12 months?

____ NO ---- GO TO 102.

____ YES

ABOUT HOW MANY MEALS OF FISH HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? ________

Shiawassee River (S. Branch, Howell to Corunna)

Deer Lake
Carp River
Carp Creek (Marquette County)
Tittabawassee River (Downstream from Dow Dam)
Saginaw River
Pine River (Downstream from St. Louis)
Chippewa River (Downstream from mouth of Pine)
Raisin River (Downstream from Monroe Dam)
Portage Creek (Downstream from Milham Park)
Cass River (Downstream from Bridgeport)

102. Have you eaten CARP from any of the following waters in the past 12 months?

____ NO ---- GO TO 103.

____ YES

ABOUT HOW MANY MEALS OF CARP HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? ________

Grand River (Clinton County)
Lake Macatawa
St. Joseph River (Near Berrien Springs)
Kalamazoo River (Downstream from Kalamazoo)
Lake Michigan
Lake Erie
Saginaw Bay

103. Have you eaten BULLHEADS OR CATFISH from any of the following waters in the past 12 months?

____ NO ---- GO TO 104.

____ YES

ABOUT HOW MANY MEALS OF CATFISH HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS?________

Hersey River (Near Reed City)
Lake Michigan
Lake Erie
Saginaw Bay

104. Have you eaten SUCKERS from the Kalamazoo River (Downstream from Kalamazoo) in the past 12 months?

____ NO ---- GO TO 105.

____ YES

ABOUT HOW MANY MEALS OF SUCKERS HAVE YOU AND YOUR FAMILY EATEN FROM THE KALAMAZOO RIVER IN THE PAST 12 MONTHS? ______

Figure 22 - Total exposure to contamination via consumption of contaminated fish questions (TOEX).

105. Have you eaten any TROUT from any of the following waters in the past 12 months?

Hersey River (Near Reed City)
Lake Michigan
Lake Huron
Lake Superior (Lake trout only)

____ NO ---- GO TO 106.

____ YES

ABOUT HOW MANY MEALS OF TROUT HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? ______

106. Have you eaten any MUSKELLUNGE (MUSKY) from any of the following waters in the past 12 months?

Lake Huron
Lake St. Clair
Lake Erie
St. Clair River
Detroit River

____ NO ---- GO TO 107.

____ YES

ABOUT HOW MANY MEALS OF MUSKY HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? _____

107. Have you eaten SALMON from Lake Michigan or Lake Huron (or salmon migration streams running into Lake Michigan or Lake Huron) in the past 12 months?

____ NO ---- GO TO 108.

____ YES --- ABOUT HOW MANY MEALS OF SALMON HAVE YOU AND YOUR FAMILY EATEN FROM LAKE MICHIGAN OR LAKE HURON IN THE PAST 12 MONTHS? ______

108. Have you eaten WHITEFISH from Lake Michigan waters in the past 12 months?

____ NO ---- GO TO 109.

____ YES --- ABOUT HOW MANY MEALS OF WHITEFISH HAVE YOU AND YOUR FAMILY EATEN FROM LAKE MICHIGAN IN THE PAST 12 MONTHS? _____

Figure 22 - Continued.

LISTED BELOW ARE SEVERAL METHODS USED WHEN GETTING FISH READY TO COOK. PLEASE PUT A CHECK IN THE SPACE NEXT TO THE METHODS YOU USUALLY USE. MARK AS MANY AS APPLY.

109. I DON'T EAT FISH.
110. SKIN THE FISH BEFORE COOKING.
111. SCALE THE FISH BUT LEAVE THE SKIN ON.
112. REMOVE BELLY FLAP.
113. FILLET FISH.
114. OTHER (please explain)

LISTED BELOW ARE SEVERAL COOKING METHODS FOR FISH. PLEASE PUT A CHECK IN THE SPACE NEXT TO THE METHODS YOU USUALLY USE WHEN COOKING YOUR CATCH. MARK AS MANY AS APPLY.

115. I DON'T EAT FISH.
116. BROIL ON RACK.
117. COOK THE FISH WHOLE (HEAD, TAIL, AND ALL).
118. DEEP FRY.
119. POACHED.
120. EAT RAW.
121. OTHER (please explain).

Figure 23 - Attempts to reduce contaminants via special preparation methods questions (REDC).

responses were summed and divided by six to produce a 0 - 1.0 scale, with 0 indicating no attempts to reduce contaminants, and 1.0 indicating maximum efforts to reduce contaminants. Three additional preparation methods not known to reduce contaminants were included as controls (#111, 117, 120).

ADMINISTRATION OF QUESTIONNAIRE

A survey was designed to question respondents on the processes involved in risk assessment, and to measure the effectiveness of current fish consumption warnings (Appendix B). The survey also assessed the beliefs, attitudes and knowledge scores of any angler in the household.

A computer program was used to generate a 400 unit random sample of residences from the population of approximately 2500 households. The questionnaire was then distributed by driving the roads within the population boundaries previously stated and stopping at houses in the order designated in the generated random number table.

This survey was hand delivered to 348 households in the population. The use of hand delivery has been found to increase the rate of return of a self-administered questionnaire (Finifter, 1983).

A brief introductory screening interview was conducted when the questionnaire was delivered. Any angler over 16 years of age was allowed to complete the questionnaire. An angler was considered to be any person who fishes more than twice in a 12 month period and is over 16 years of age. If there were no anglers in the household, the contact person (if over 16 years of age) was asked to fill out the questionnaire and return it. Because of the implications associated with use of minor subjects, 16 was selected as the minimum participation age.

Every fifth household was given two questionnaires and asked to have both adults fill out the questionnaire separately and return it. It was hoped that this would insure a larger percentage of women participants. However, most households refused two questionnaires because it was perceived as an excessive burden on their time.

The initial contact was also used to inform subjects that if they decided not to participate in the study, they should leave the questionnaire blank and mail it back to the researcher. The questionnaire code number was then removed from the follow-up list and the respondent was classified as "refused to participate."

The moment the questionnaires were received by the researcher, those who completed the questionnaires were classified "participant" or "non-participant," the code numbers were taken off the follow-up list, and the cover removed and destroyed. Each questionnaire received a sequential number as received that identified the origin of the questionnaire, thus allowing segregation of responses.

The rear cover of each questionnaire was coded with a 1, 2, or 3 to indicate whether it came from the contaminated subpopulation (1), the confluence subpopulation (2), or the non-contaminated subpopulation (3).

The questionnaire was designed in such a way that, upon completion, it could be sealed and sent pre-addressed and pre-paid to the researcher's post office box in Byron. A concentrated follow-up was undertaken to secure a maximum return of the completed questionnaires. Two efforts were made beyond the initial contact to ask participants to complete the questionnaire and return it. Replacement questionnaires were supplied with each contact.

The first follow-up was again by hand delivery of a second questionnaire two weeks after the initial contact. This was supplemented by a mailing (by certified mail with return receipt card) two weeks later as a final contact. After this last follow-up, no other efforts were made to increase response levels by further contact.

STATISTICAL ANALYSIS

One hundred eighty-nine (189) usable questionnaires were returned during the course of the study. Of the 189 respondents, 125 (66.1%) were anglers. Of the 189 respondents, 91 were from the non-contaminated zone, 69 (75.8%) of whom were anglers. The contaminated zone accounted for 98 respondents with 56 (57.1%) anglers.

Each questionnaire was then transcribed to a score sheet which reduced the questionnaire to a single card and recoded each response to the appropriate numerical score.

The individual score cards were entered in the Lotus 1-2-3 spreadsheet program on an IBM-XT PC that calculated the group means by residence area. These group means were used to replace any missing data for individual respondents.

The spreadsheet was used to calculate the 31 indices and values used in this study. These indices were entered on a DEC (Digital Electronics Corporation) mainframe computer for analysis with the SPSS (Statistical Package for the Social Sciences) program.

MISSING DATA - Anderson et al. (1983) [See Rossi 1983, pg. 415], in a review of missing data literature, describes two broad strategies for handling missing data: (a) deletion, and (b) estimation. Ideally, all questionnaires should have been completed with no missing data. However, 36% of the questionnaires contained at least one blank. Of 1430 missing responses (4.85% of all responses), 594 (41.54%) came from question numbers 75-89 (Table 5). This may have been due to the respondents hesitance to voice an opinion concerning waters they had inadequate information about. In fact, respondents often indicated that they were unaware of or unfamiliar with those bodies of water mentioned in questions that they did not respond to.

Since it would have resulted in a loss of 36% of the questionnaires, deletion was not considered a viable method of handling the problem of missing data.

Estimation of missing data followed by substitution of that estimate for the missing data was selected as the most

TABLE 5 - Missing data.

POPULATION	BLANKS	# OF ENTRIES	% BLANK	#75-89 BLANKS	% OF TOTAL BLANKS
Non-Contam. Zone	757	14,105	5.37	347	46
Contaminated Zone	673	15,345	4.39	247	36.7
TOTAL	1430	29,450	4.86	594	41.5

In general, missing data (responses to individual items on the questionnaire) was not a problem. Only 4.86% of the total number of items were left blank. Many of these were the result of respondents skipping several pages while completing the questionnaire. Also, the majority of the missing data were due to the respondents unwillingness to complete items # 75 - 89. This group of questions accounted for 41.5% of the missing data.

viable alternative.

Next, the method of substitution was selected. Many methods of estimation and substitution required a prior knowledge of the relationships before calculating estimated values. That is to say, the exact relationship of non-missing data cases are calculated by R-square, ANOVA, or similar regression technique. The result is then used to estimate the value to be substituted for the missing data. Such an _a priori_ predictive criterion was not available with this data set.

This calculated data point would, of course, fall exactly on the calculated regression line, creating an increased bias in subsequent analysis for linearity. To avoid this bias, the "method of unweighted means" (Yates, 1933) as modified by Ford (1976) was selected.

The logic behind this method is that in a normally-distributed population, the sample mean provides an optimal estimate of the most probable value - that is, the value we could expect to occur on the average before an observation is made. Thus each of the two subpopulations produced a different mean value for each question.

It is important to note that only very rarely were all items in a scale left blank. More commonly, a single item in the multi-item scale was inadvertently missed and required substitution of the group mean. Therefore, very little effect should be attributed to the substitution of the group mean.

For those items with score values of 0, 1, and 2, the median value was substituted.

In general, missing values were not a problem in the study. As can be seen in Table 5, the percent of missing values was quite low throughout the study.

STATISTICAL SELECTION - Two methods of statistical analysis were selected for examination of the data -Pearson's r and regression R-square. A significance level of 0.05 was selected for this analysis.

Pearson's r was selected as a correlation statistic to measure the strength of relationships between interval data. Since most of the measurements were established as interval data, Pearsons r is an appropriate statistic.

In order to justify the use of Pearson's r, several assumptions must be made in advance. These assumptions include: 1) Linearity - although the data will have variability, it should not exhibit an obvious curvilinearity, 2) Symmetrical distributions - data should be distributed symmetrically, but may not be linear, 3) Unimodal distribution - data should not have multiple peaks in the distribution, 4) Comparable distributions - the data distribution of x and y must be comparable, i.e. have the same general shape of distribution, and 5) Continuous measurement - data should reflect a continuous scale of measurement rather than a categorical scale such as gender or, political party.

Pearson's r does not imply a causal relationship. Quite simply, it reflects that there is some type of reliable, predictable relationship between the variables.

In an attempt to clarify relationships further, partial correlations were run. In partial correlation analysis, the linear effect of the control variables are removed from the analysis. Thus the new correlation values may allow inference as to whether the initial correlation was an actual reflection of the relationship or was an artifact (spurious correlation) contingent on the control variable. This same technique allows determination of masking variables by holding them constant and observing whether or not the correlation increases.

An additional statistic, R SQUARE, was calculated to determine the amount of variance in the dependent variable that is explained by the variance in the independent variable. Multiple regression is a general statistical tool that allows analysis of a dependent variable in relation to a set of independent variables. When used as a descriptive tool, it allows us to find the best linear prediction, evaluate its accuracy, control for confounding factors, and attempt to find structural relationships.

Although r square can be calculated from Pearson's r, it is a correlational relationship based on the magnitude of one variable changing as the magnitude of the second variable changes without a clearly dependent/independent variable being established (Zar 1974, pg. 198-199). Since definite dependent and independent variables are being studied, the standardized regression coefficient BETA is used to determine the amount of variance in the dependent variable accounted for by the variance in the independent variable. (Zar 1974, pg. 199)

The model was analyzed in a stepwise fashion, first utilizing area of residence (ZONE) as a dependant variable and demographics as independent variables. Next, value priorities and beliefs are used as dependant variables, regressed against area of residence and demographics as separate zero order calculations. At this point, significant zero order regressions between ZONE and value priorities or beliefs are run, forcing demographics into the equation after ZONE has accounted for all of the variance possible.

This process of calculating zero order correlations for all variables preceding the dependant variable, then performing a stepwise multivariate regression with significant variables immediately preceding the dependent variables and forcing all other prior variables, is used throughout the model.

STATISTICAL VALIDITY

Finifter (1983) discussed a set method of controlling variance in a research situation. The method, called the Maxi-Mini-Con principle, presented three ways to deal with variance. These were; 1) Maximization of experimental (systematic) variance, 2) Minimization of error variance, and 3) Control of extraneous variance.

MAXIMIZATION OF SYSTEMATIC VARIANCE - The object of maximization is to make sure that the research is set up with as wide a difference between the variables as possible: in this case, two populations that reside near very opposite water quality situations.

The systematic variance in this investigation is maximized by using a random sample that makes up approximately 20% of the two sub-populations. There exists a clear experimental variance between the sub-populations on the basis of proximity to contaminated water supplies.

MINIMIZING ERROR VARIANCE - Error variance is minimized by the following;

1. Selecting population segments with minimal differences in individuals. Each of the sub-populations consist of a semi-rural group of residents within commuting distance of large employment centers (Flint, Lansing, Howell,

Owosso).

2. By selecting a population that includes all residents that live within one mile of the river, the possible effects of distance from a fishable waterway are minimized. Many anglers may tend to fish close to home to minimize expense and time spent traveling. While some anglers obviously invest travel time in an effort to "get away from it all", it seems unlikely that more than a minority can afford to do this every time the decision is made to go fishing.

CONTROL OF EXTRANEOUS VARIANCE - Extraneous variance is that variance that originates internally or externally in a research situation that is not designed into the experiment and interferes with the determination of causal relationships. It can be minimized by 1) elimination of the variable (not a good choice), 2) randomization of treatments, groups, populations, or respondent selections, or 3) rank ordering individuals based on a selected criteria and alternately placing sequential individuals into different groups.

In this project, extraneous variance was minimized by randomly selecting participants for the study and by including key variables in the investigational design. All variables in the study may be held constant for partial correlational studies thus minimizing extraneous variance. Questions were designed to reflect the following variables in each household;

1. sex
2. age
3. annual income
4. education
5. awareness of contamination
6. waterways being fished
7. waterways being avoided
8. species and amounts of fish consumed
9. awareness of chemicals involved and their effects

INTERNAL VALIDITY - Internal validity seeks to answer the question, "Does, in fact, the experimental treatment/design make a difference in this specific experimental instance?"

Internal validity can be compromised by 13 errors associated with experimental design: history, maturation, testing, instrumentation, regression selection, mortality interaction of selection and maturation, casual time order, diffusion or imitation of treatment compensation, compensatory rivalry, and demoralization.

Response bias from non-respondents and the survey instrument itself may play a part in compromising internal validity. This is the first time the instrument has been used and although the face validity is acceptable, total internal validity has not been verified.

By selection of a proximal population, theoretically comprising a homogeneous representation of the population, and use of a single sampling event, it is hoped that internal validity problems have been minimized.

EXTERNAL VALIDITY - External validity refers to the generalizability of the research in question.

The research area described for this study is a limited one. As such, relationships found here may not be generalizable to the state level. Anglers in this study appear to represent a wide variety of socioeconomic groups and social attitudes.

It is expected that this study will give insight into factors important in human behavior in other areas related to voluntary exposure to contaminating materials.

RESULTS

Three hundred forty eight (348) questionnaires were distributed to the study population. One hundred eighty-nine (189) individuals responded with usable questionnaires. Of the respondents, ninety-one (91) reside in the non-contaminated zone of the study. Sixty nine (69=75.8%) of the respondents in the non-contaminated zone were anglers. Forty one (41) of the anglers in this zone had fished an average of 6.68 times (Range = 1 - 40 times) on contaminated waters in the preceding year and had consumed an average of 10.1 meals of contaminated fish (Range = 1 -42 meals) in the same time period (Table 6).

Ninety eight residents of the contaminated zone responded with usable questionnaires, with fifty six (56 = 57.1%) of the respondents reporting that they had fished at least twice in the previous 12 months. Forty one (41) of the contaminated zone anglers had fished contaminated waters an average of 9.02 times per year (Range = 1 - 30 times) and had consumed an average of 7.92 meals of contaminated fish in the same time period (Range = 1 - 42 meals).

Although the original target group for this research was the individual who resided near contaminated water, fished that water and consumed his/her catch, only four (4)

Table 6 - Characterization of respondents.

Number of respondents (Total)	189
Number residing in contaminated zone	91
Number of anglers in contaminated zone	69
Number of respondents in non-contaminated zone	98
Number of anglers in non-contaminated zone	56
Number of anglers residing in contaminated zone that fished on contaminated waters	41
Number of anglers rsdiding in the non-contaminated zone that fished on contaminated waters	41

individuals were found to meet that criteria. However, a significant number of the anglers did participate on contaminated waters found in other areas of Michigan and consumed the contaminated fish they caught. What began as a local study developed into a study of the state-wide fishing activities of a local population in relation to contaminated waters. Table 7 presents the mean values for the indices studied.

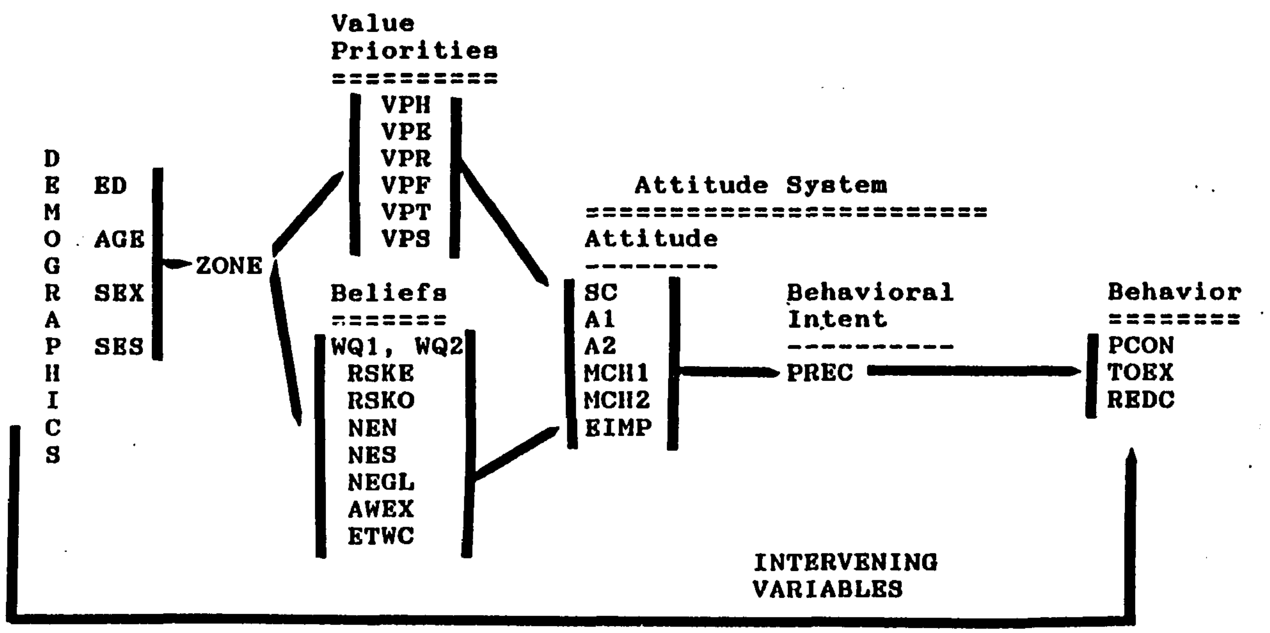
FORMAT STATEMENT

The balance of this study will be presented as a sequential presentation of the propositions stated earlier in the research paper, with a stepwise investigation of the model.

Table 7 - Mean values for variables in the study (n=125).

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SEX	1.14	.34	Gender
SES	.75	.13	Socioeconomic status
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence
VALUE PRIORITIES			
VPH	20.92	14.44	Health related value priority
VPE	12.56	9.53	Economic related value priority
VPR	27.48	15.34	Recreation related value priority
VPF	19.98	14.75	Freedom of will value priority
VPT	13.59	11.13	Traditionalism value priority
VPS	5.26	7.30	Socialization value priority
BELIEFS			
WQ1	.68	.17	General water quality knowledge
WQ2	.72	.18	Situation specific WQ knowledge
RSKE	.69	.10	Risk of eating contam. fish
RSKO	.68	.10	Risk of overall pollution
NEN	.49	.14	Knowledge of N. Shiawassee WQ
NES	.69	.13	Knowledge of S. Shiawassee WQ
NEGL	.47	.13	Knowledge of Great Lakes WQ
AWEX	.28	.22	Knowledge of Michigan water quality
ETWC	.66	.18	Exposure to consumption advisory
ATTITUDES			
SC	.72	.14	Source credibility of MDNR
A1	.34	.14	General alienation
A2	.56	.12	Situation specific alienation
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho
EIMP	.78	.07	Environmental importance
BEHAVIORAL INTENT			
PREC	.86	.15	Precautionary behavioral intent
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

Perception of contamination problem



ACRONYM	INDEX	DESCRIPTION
DEMOGRAPHICS:	ED	Education
	AGE	Age in years
	SEX	Gender
	SES	Socio-economic status
VALUE PRIORITIES :	VPH	Value Priority - Health
	VPE	Value Priority -Economics
	VPR	Value Priority -Recreation
	VPF	Value Priority -Freedom of will
	VPT	Value Priority -Traditionalism
	VPS	Value Priority -Socialization
BELIEFS :	WQ1	Water Quality - Literature scale
	WQ2	Water Quality - Situational scale
	RSKE	Risk of eating contaminated fish
	RSKO	Overall risk of contaminated waters
	NEN	Nature and Extent of N. Shiawassee contamination
	NES	Nature and Extent of S. Shiawassee contamination
	NEGL	Nature and Extent of Great Lakes contamination
	AWEX	Awareness of the extent of contamination
	ETWC	Exposure to consumption advisory
ATTITUDE :	SC	Source Credibility
	A1	Alienation - Literature scale
	A2	Alienation - Situational scale
	MCH1	Macho attitude - Literature scale
	MCH2	Macho attitude - Situational scale
	EIMP	Environmental Importance
BEHAVIORAL INTENT :	PREC	Precautionary attitude
BEHAVIOR :	PCON	Participation on contaminated waters
	TOEX	Total exposure via consumption of contam. fish
	REDC	Attempts to reduce contamination

Hypothetical Decision Stage Model

PROPOSITION 1 - ANGLERS' AREA OF RESIDENCE WILL BE PREDICTED BY DEMOGRAPHICS.

The zero order correlation matrix for anglers' area of residence (Zone) vs demographic variables is presented in Table 8.

HYPOTHESIS 1.1 Anglers' area of residence will be predicted by educational levels and socioeconomic status, with persons living farther from contaminated waters likely to have higher education and socioeconomic status.

The study population can be divided into two groups based on area of residence in relation to contaminated waters. Anglers living within one mile of contaminated waters were scored as "0" and anglers not within one mile of contaminated waters were scored "1" in a dummy variable format.

Zero order correlations indicate that anglers with higher levels of education (ED, $r=.195$, $P=.015$) and higher socioeconomic status (SES, $r=.200$, $P=.013$) are more likely to reside in areas not considered to be contaminated.

The standardized multivariate regression coefficients (Beta) were calculated (Table 9) for all demographic variables with a stepwise regression that allows the variable accounting for the most variance to be entered into the

Table 8 - Zero order correlations of demographics vs area of residence (n=125).

	ED	AGE	SEX	SES
ZONE	.195 P=.015	-.097 P=.141	-.028 P=.374	.200 P=.013

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SEX	1.14	.34	Gender
SES	.75	.13	Socioeconomic status
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence

Table 9 - Significant multivariate regression correlations between demographics and area of residence.

Dependent variable = ZONE

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SES	.200	5.13	.025	.032

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
SES	.75	.13	Socioeconomic status
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence

equation first. Subsequent variables entered must compete for the remaining variance.

Socioeconomic status (SES) was found to be positively predictive (Beta = .2002) of area of residence (ZONE) indicating that higher SES anglers have a propensity to live in proximity to non-contaminated waters. This non-contaminated area does consist of higher SES individuals and represents a more middle class suburban setting as opposed to the contaminated zone area which is more rural in nature.

Education was unable to account for sufficient variance (Beta = .130) to enter the regression equation at the $P<.05$ significance level subsequent to the entry of socioeconomic status.

H1.2 Anglers' area of residence will not be predicted by age or gender.

There was no prior evidence that this study population should vary significantly in age or gender in any way that would be dependent upon area of residence.

Area of residence was not found to be predicted by angler age or gender.

PROPOSITION 2 - ANGLER VALUE PRIORITIES WILL BE PREDICTED BY AREA OF RESIDENCE AND DEMOGRAPHICS.

The zero order correlation matrix for angler value priorities vs area of residence is presented in Table 10. Zero order correlations for value priorities vs demographics is presented in Table 12.

HYPOTHESIS 2.1 Value priorities will not be correlated with area of residence.

Zero order correlations indicate that anglers residing nearer non-contaminated waters placed lower value on health related value priority (VPH, r=-.218, P=.007) and higher value on the recreational (VPR, r=.032, P=.032) aspect of outdoor activities. Earlier results (H1.1) suggest that non-contaminated zone anglers are of higher education and socioeconomic status. These anglers may be expected to place increased value the recreational aspect of the environment, and less value on the economic aspect of the environment (VPE, r=-.1366, P=.064). However, H2.21 suggests that there is no correlation between VPH and demographic factors. This is indicative that there are other unmeasured variables accounting for the relationship.

As can be seen in Table 11, only health related value priority (VPH) was found to be predicted (Beta = -.2175) by

Table 10 - Zero order correlations of value priorities vs area of residence (n=125).

	VPH	VPE	VPR	VPF	VPT	VPS
ZONE	-.218 P=.007	-.137 P=.064	.166 P=.032	.036 P=.344	.060 P=.254	.056 P=.267

Variable	Mean	Std.dev.	Description
<u>AREA OF RESIDENCE</u>			
ZONE	.52	.66	Area of residence
<u>VALUE PRIORITIES</u>			
VPH	20.92	14.44	Health related value priority
VPE	12.56	9.53	Economic related value priority
VPR	27.48	15.34	Recreation related value priority
VPF	19.98	14.75	Freedom of will value priority
VPT	13.59	11.13	Traditionalism value priority
VPS	5.26	7.30	Socialization value priority

Table 11 - Significant multivariate regression correlations between area of residence and value priorities.

Dependent variable = VPH

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ZONE	-.218	6.11	.015	.040

Variable	Mean	Std.dev.	Description
<u>AREA OF RESIDENCE</u>			
ZONE	.52	.66	Area of residence
<u>VALUE PRIORITIES</u>			
VPH	20.92	14.44	Health related value priority

area of residence (ZONE) when analyzed with multivariate regression. The economic value priority (VPE) was unable to enter the regression equation at the $P<.05$ level.

This suggests that anglers residing in the contaminated zone held health related value priority higher than did non-contaminated zone anglers.

HYPOTHESIS 2.2 Value priorities will be predicted by angler demographic factors.

H2.21 Health related value priority will be positively predicted by education, gender and socioeconomic status, and negatively correlated with age.

Zero order correlations (Table 12) produced no significant relationships between health related value priority and any of the demographic factors. The direction of the zero order correlations for education and SES, while not significant, was in the negative direction.

Female anglers and anglers with higher levels of education and socioeconomic status were expected to place a higher value on health. The results did not show this relationship in the study population.

Older anglers were expected to be less concerned with health related factors in relation to outdoor activities. No

Table 12 - Zero order correlations of value priorities vs demographics (n=125).

	VPH	VPE	VPR	VPF	VPT	VPS
ED	-.024 P=.395	.051 P=.283	.184 P=.020	.036 P=.345	-.195 P=.015	-.158 P=.039
AGE	.023 P=.400	.079 P=.192	-.048 P=.297	-.029 P=.374	.086 P=.171	-.122 P=.087
SEX	.092 P=.154	-.168 P=.030	.104 P=.124	-.039 P=.335	-.015 P=.436	-.034 P=.353
SES	-.023 P=.398	-.082 P=.182	.128 P=.077	-.049 P=.295	-.059 P=.257	.076 P=.199

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SEX	1.14	.34	Gender
SES	.75	.13	Socioeconomic status
VALUE PRIORITIES			
VPH	20.92	14.44	Health related value priority
VPE	12.56	9.53	Economic related value priority
VPR	27.48	15.34	Recreation related value priority
VPF	19.98	14.75	Freedom of will value priority
VPT	13.59	11.13	Traditionalism value priority
VPS	5.26	7.30	Socialization value priority

significant relationships were shown to exist between age of anglers and the value placed on health in relation to outdoor activities.

H2.22 Economic related value priority will be negatively predicted by education, socioeconomic status, age, and gender.

Anglers in this population were expected to place less importance on the economic cost involved in outdoor activities with increasing education and SES. Lower educated and lower SES anglers were expected to have a greater need to use the environment as a source of low cost recreation. As angler age increased, it was anticipated that they would be more economically stable and less dependent upon the environment as a source of low cost recreation. Female anglers were expected to place less significant value on the economic value of the environment.

Zero order correlations (Table 12) produced only one significant correlation. That correlation was with gender (SEX, r=-.168, P=.030) and indicates that females are less concerned with the economic aspect of outdoor activities.

H2.23 Recreation related value priority will be positively correlated with education, age, gender, and socioeconomic status.

The zero order correlations were only significant for education (r=.184, P=.020).

A high value was placed on the recreational satisfaction and enjoyment of outdoor activities. Recreational value priority (VPR) was found to be positively predicted (Table 13) by anglers' educational level (Beta = .1839) indicating that anglers with higher educational levels are more likely to enjoy the satisfaction of outdoor activities.

Angler age, gender, and socioeconomic status were not found to be predictive of priorities placed on recreational value priority factors in the zero order matrix and had insufficient Beta's to enter the regression equation after education had accounted for its' portion of the variance.

H2.24 Freedom of will and traditionalism related value priorities will be positively predicted by age but negatively predicted by education, socioeconomic status, and gender.

The zero order correlation matrix (Table 12) exhibits only one significant correlation, traditionalism value priority (VPT) was negatively correlated (Table 13) with

Table 13 - Significant multivariate regression correlations between value priorities and demographics.

Dependent variable = VPR

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ED	.184	4.30	.040	.026

Dependent variable = VPT

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ED	-.195	4.84	.030	.030

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
VALUE PRIORITIES			
VPR	27.48	15.34	Recreation related value priority
VPT	13.59	11.13	Traditionalism value priority

education (ED, r=-.194, P=.015).

The educational level of anglers in the study population was found to be negatively predictive (Beta = -.1945) of value priorities relating to traditionalism (VPT). This correlation supports the proposition that better educated anglers will be less tradition oriented in their use of the environment.

Angler age, gender and SES were not found to be predictive of freedom of will (VPF) or traditionalism (VPT) value priorities, and did not have sufficient Beta's to enter the equation after education.

H2.25 Socialization related value priority will be positively predicted by education, age, socioeconomic status, and by gender.

Higher educated, higher SES, and older anglers were expected to value the socialization aspect of environmental use. Female anglers were expected to value the socialization phase of environmental use less than males.

Zero order correlations (Table 12) found a negative correlation between education and VPS (r=-.1508, P=.039), with higher educated anglers placing less value on the socialization aspect of the outdoors.

No demographic Beta's were strong enough to enter the stepwise multivariate regression equation used in this study.

HYPOTHESIS 2.3 If value priorities are predicted by area of residence, value priorities will not be predicted exclusively by area of residence.

The significant relationships between value priorities and area of residence were subjected to stepwise regression analysis with demographic factors forced into the equation after area of residence (ZONE) had initially accounted for as much variance as possible (Table 14).

Since health related value priority (VPH) was the only variable to exhibit a relationship with zone, it was the only variable for which the stepwise regression was performed.

Forcing demographic factors into the equation after area of residence (ZONE) produced no further correlation.

When considering the model to this point (Figure 24), we find that socioeconomic status (SES) is positively predictive of area of residence (ZONE) which is subsequently negatively predictive of health related value priority (VPH).

Education, while not predictive of zone, was found to be negatively predictive of an anglers' traditionalism (VPT) in relation to the environment, and positively predictive of an anglers' recreational (VPR) value priority for the environment.

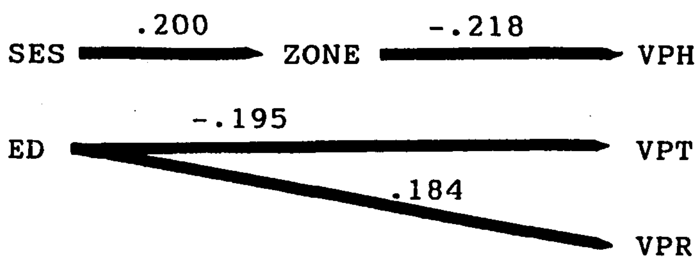


Figure 24 - Singificant correlations between demographics, area of residence, and value priorities.

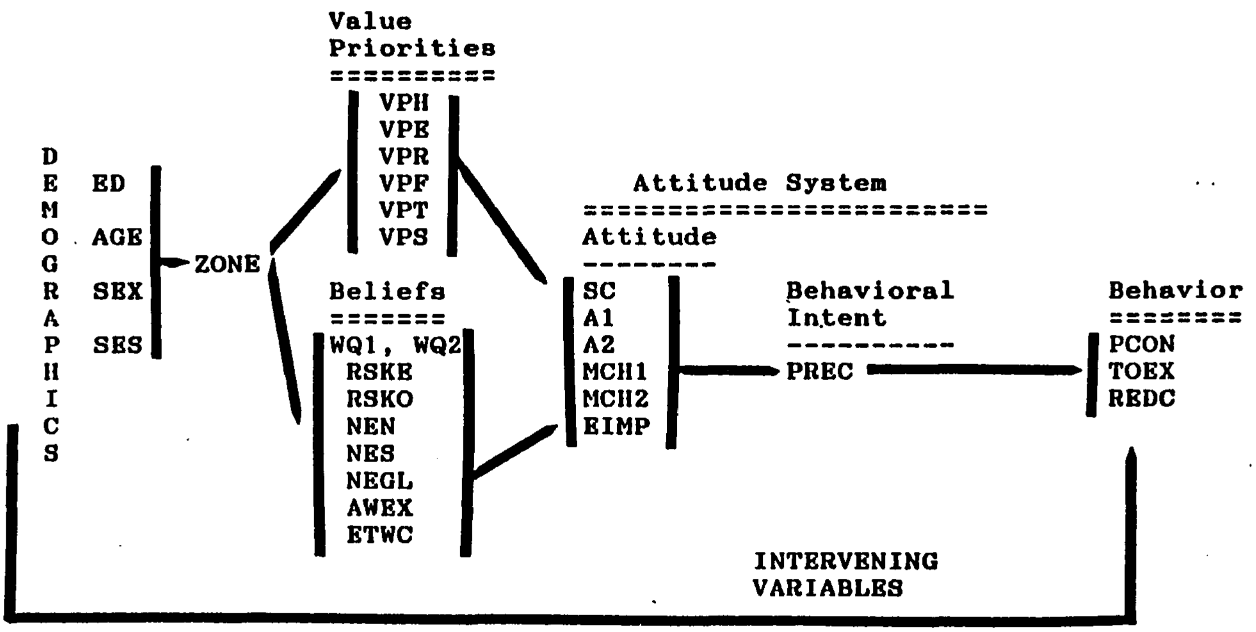
Table 14 - Multivariate regression correlations forcing demographics on significant "value priority vs area of residence" relationships.

Dependent variable = VPH

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ZONE	-.218	6.11	.015	.040

Variable	Mean	Std.dev.	Description
<u>AREA OF RESIDENCE</u>			
ZONE	.52	.66	Area of residence
<u>VALUE PRIORITIES</u>			
VPH	20.92	14.44	Health related value priority

Perception of contamination problem



ACRONYM	INDEX	DESCRIPTION
DEMOGRAPHICS:	ED	Education
	AGE	Age in years
	SEX	Gender
	SES	Socio-economic status
VALUE PRIORITIES :	VPH	Value Priority - Health
	VPE	Value Priority -Economics
	VPR	Value Priority -Recreation
	VPF	Value Priority -Freedom of will
	VPT	Value Priority -Traditionalism
	VPS	Value Priority -Socialization
BELIEFS :	WQ1	Water Quality - Literature scale
	WQ2	Water Quality - Situational scale
	RSKE	Risk of eating contaminated fish
	RSKO	Overall risk of contaminated waters
	NEN	Nature and Extent of N. Shiawassee contamination
	NES	Nature and Extent of S. Shiawassee contamination
	NEGL	Nature and Extent of Great Lakes contamination
	AWEX	Awareness of the extent of contamination
	ETWC	Exposure to consumption advisory
ATTITUDE :	SC	Source Credibility
	A1	Alienation - Literature scale
	A2	Alienation - Situational scale
	MCH1	Macho attitude - Literature scale
	MCH2	Macho attitude - Situational scale
	EIMP	Environmental Importance
BEHAVIORAL INTENT :	PREC	Precautionary attitude
BEHAVIOR :	PCON	Participation on contaminated waters
	TOEX	Total exposure via consumption of contam. fish
	REDC	Attempts to reduce contamination

Hypothetical Decision Stage Model

PROPOSITION 3 - BELIEFS WILL BE PREDICTED BY DEMOGRAPHICS BUT NOT BY AREA OF RESIDENCE.

Zero order correlation matrix of beliefs vs demographic is presented in Table 17. Beliefs vs area of residence are presented in Table 15.

HYPOTHESIS 3.1 Beliefs will not be predicted by area of residence.

Zero order correlations indicate that situational water quality knowledge (WQ2, r=-.463, P=.000) and angler knowledge of Great Lakes water quality (NEGL, r=-.1613, P=.036) are negatively predicted (Table 15) by area of residence (ZONE). Since anglers residing in the contaminated zone were scored as "0" in a dummy variable situation, it is apparent that this group of anglers is more knowledgeable about situation specific water quality and has a greater knowledge of the water quality associated with the Great Lakes.

Area of angler residence (ZONE) was found to predict strongly (Table 16) the situational water quality knowledge scale (WQ2) in this population (Beta = -.463), when subjected to a stepwise multivariate regression analysis.

Knowledge of Great Lakes water quality did not produce a significant Beta when analyzed with multivariate stepwise regression. No other belief factors were found to be predicted by area of residence.

Table 15 - Zero order correlations of beliefs vs area of residence (n=125).

	WQ1	WQ2	RSKE	RSKO	NEN	NES
ZONE	.077 P=.196	-.463 P=.000	.142 P=.057	.010 P=.454	.068 P=.224	-.111 P=.110

	NEGL	AWEX	ETWC
ZONE	-.161 P=.036	.041 P=.326	-.109 P=.114

Variable	Mean	Std.dev.	Description
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence
BELIEFS			
WQ1	.68	.17	General water quality knowledge
WQ2	.72	.18	Situation specific WQ knowledge
RSKE	.69	.10	Risk of eating contam. fish
RSKO	.68	.10	Risk of overall pollution
NEN	.49	.14	Knowledge of N. Shiawassee WQ
NES	.69	.13	Knowledge of S. Shiawassee WQ
NEGL	.47	.13	Knowledge of Great Lakes WQ
AWEX	.28	.22	Knowledge of Michigan water quality
ETWC	.66	.18	Exposure to consumption advisory

Table 16 - Significant multivariate regression correlations between beliefs and area of residence.

Dependent variable = WQ2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ZONE	-.463	33.58	.000	.208

Variable	Mean	Std.dev.	Description
<u>AREA OF RESIDENCE</u>			
ZONE	.52	.66	Area of residence
<u>BELIEFS</u>			
WQ2	.72	.18	Situation specific WQ knowledge

HYPOTHESIS 3.2 All belief factors will be positively predicted by education and socioeconomic status.

It was anticipated that anglers with higher education and socioeconomic status would produce higher scores on knowledge based belief measures.

Zero order correlations (Table 17) for educational level were positive for the literature based water quality scale (WQ1, r=.165, P=.033). However, education was found to negatively predict situational water quality scores (WQ2, r=-.181, P=.022) and knowledge of South Shiawassee water quality (NES, r=-.171, P=.028). This would indicate that anglers with higher levels of education scored higher on general knowledge of water quality, whereas, anglers with lower levels of education were more likely to be aware of local (situation specific water quality knowledge) and more likely to be knowledgeable of the water quality of the contaminated South Shiawassee. Based on the results in H3.1, the anglers with lower levels of education were more likely to reside along the contaminated South Shiawassee. It is understandable that these anglers would be more aware of the waters they reside near.

In this study population, educational level was found to be negatively predictive of angler's situational water quality knowledge (WQ2, Beta = -.197) when analyzed with a multivariate stepwise regression equation (Table 18). It is

Table 17 - Zero order correlations of beliefs vs demographics (n=125).

	WQ1	WQ2	RSKE	RSKO	NEN
ED	.165 P=.033	-.181 P=.022	.042 P=.321	-.045 P=.308	.035 P=.350
AGE	.211 P=.009	.155 P=.042	.017 P=.426	.460 P=.305	.112 P=.107
SEX	.100 P=.134	.205 P=.011	-.274 P=.381	.296 P=.372	.041 P=.327
SES	.152 P=.045	-.073 P=.211	-.050 P=.291	-.046 P=.306	.097 P=.141

	NES	NEGL	AWEX	ETWC
ED	-.171 P=.028	-.093 P=.152	.056 P=.267	.104 P=.125
AGE	-.079 P=.191	-.050 P=.290	-.086 P=.172	.061 P=.248
SEX	-.045 P=.311	-.051 P=.285	.152 P=.045	-.087 P=.166
SES	-.209 P=.010	-.194 P=.015	-.029 P=.375	-.044 P=.315

Variable	Mean	Std.dev.	Description
<u>DEMOGRAPHICS</u>			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SEX	1.14	.34	Gender
SES	.75	.13	Socioeconomic status
<u>BELIEFS</u>			
WQ1	.68	.17	General water quality knowledge
WQ2	.72	.18	Situation specific WQ knowledge
RSKE	.69	.10	Risk of eating contam. fish
RSKO	.68	.10	Risk of overall pollution
NEN	.49	.14	Knowledge of N. Shiawassee WQ
NES	.69	.13	Knowledge of S. Shiawassee WQ
NEGL	.47	.13	Knowledge of Great Lakes WQ
AWEX	.28	.22	Knowledge of Michigan water quality
ETWC	.66	.18	Exposure to consumption advisory

Table 18 - Significant multivariate regression correlations between beliefs and demographics ED and SES.

Dependent variable = NEGL

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SES	-.194	4.83	.030	.030

Dependent variable = NES

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SES	-.209	5.62	.019	.036

Dependent variable = WQ2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ED	-.198	5.37	.006	.066

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
SES	.75	.13	Socioeconomic status
BELIEFS			
NES	.69	.13	Knowledge of S. Shiawassee WQ
NEGL	.47	.13	Knowledge of Great Lakes WQ

difficult to understand or explain why more educated anglers produce lower scores on situational water quality. It would be expected that anglers with higher education would be aware of water quality both situationally and generally. This was not the case in the population studied here.

This increased knowledge level associated with lower levels of education, yet affected by proximity to contaminated waters, is supported by the negative correlation of socioeconomic status with angler knowledge of Great Lakes water quality (NEGL, Beta = -.194) and South Shiawassee water quality (NES, Beta = -.209). Both the Great Lakes and the South Shiawassee River are considered contaminated and appear to be consistently identified by anglers residing near contaminated waters.

Zero order correlations for socioeconomic status vs beliefs (Table 17) were positive for general water quality knowledge (WQ1, r=.152, P=.045) and negative for both knowledge of South Shiawassee water quality (NES, r=-.209, P=.010) and knowledge of Great Lakes water quality (NEGL, r=-.194, P=.015). Anglers with higher SES scored higher on general water quality knowledge, but were less knowledgeable about South Shiawassee and Great Lakes water quality. Higher SES anglers did not live near the contaminated South Shiawassee (H1.1), and may not have a particular reason to be aware of South Shiawassee water quality. However, it was expected that the higher SES angler should have known more about Great Lakes water quality rather than less.

HYPOTHESIS 3.3 All belief factors will be negatively predicted by age.

Older anglers were expected to be less knowledgeable about water quality in general and in Michigan.

Zero order correlations (Table 17) were positive for both the general water quality knowledge scale (WQ1, $r=.212$, $P=.009$) and the situation specific water quality scale (WQ2, $r=.155$, $P=.042$) indicating that older anglers were in fact more knowledgeable of water quality as measured by the scales used here.

When analyzed with stepwise multivariate regression (Table 19), it was found that age was positively predictive of the literature based water quality knowledge scale (Beta = .212). This scale was designed to represent an angler's general knowledge about the function of water and water quality in the environment.

After the general scale had accounted for its portion of the variance, the situational scale (WQ2) did not produce a beta significant enough to enter the regression equation.

Table 19 - Significant multivariate regression correlations between beliefs and AGE.

Dependent variable = WQ1

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
AGE	.212	5.78	.018	.037

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
AGE	40.40	14.38	Age in years
BELIEFS			
WQ1	.68	.17	General water quality knowledge

HYPOTHESIS 3.4 Risk perception will be negatively predicted by gender.

Females were scored "0" and males were scored "1" in a dummy variable situation.

Zero order correlations for belief factors as predicted by gender were not significant in this study (Table 17).

It was anticipated that females would perceive increased risk associated with water quality problems, partially because of the traditional role of females as family nurturers and in charge of food quality.

No significant relationships between gender and risk measures (RSKO, RSKE) were found.

HYPOTHESIS 3.5 All belief factors (other than risk perception) will be positively predicted by gender.

Zero order correlations (Table 17) were positive for situational water quality knowledge (WQ2, r=.205, P=.011) and awareness of the extent of contamination in Michigan waterways (AWEX, r=.152, P=.045), indicating that male anglers had greater situational knowledge and knew more about the extent of contamination in Michigan waterways.

Situational water quality measures (WQ2) were found to be positively predicted (Table 20) by gender (SEX) in the

Table 20 - Significant multivariate regression correlations between beliefs and gender.

Dependent variable = WQ2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SEX	.205	5.40	.022	.034

Variable	Mean	Std.dev.	Description
<u>DEMOGRAPHICS</u>			
SEX	1.14	.34	Gender
<u>BELIEFS</u>			
WQ2	.72	.18	Situation specific WQ knowledge

study population (Beta = .2051) when analyzed with stepwise multivariate regression. Since males were designated "1" and females designated "0" in a dummy variable situation, it is apparent that males were more knowledgeable about water quality when measured on a situational specific scale.

The awareness of Michigan water quality (AWEX) was unable to produce a Beta sufficient enough to enter the equation after WQ2 had accounted for its portion of the variance.

HYPOTHESIS 3.6 Belief factors are not predicted exclusively by area of residence.

When belief factors were analyzed with multivariate stepwise regression against area of residence (ZONE), only situational water quality (WQ2) produced a significant beta. Therefore, only WQ2 was used in the final regression equation, with demographic variables forced into the equation after ZONE had accounted for all of the variance possible.

While area of residence was found to be a very strong predictor of angler's situational water quality knowledge (WQ2, Beta = -.4631), socioeconomic status (SES, Beta = .0435) and gender (SEX, Beta = .1919) were also found to be predictive of situational water quality knowledge, with higher SES anglers and males producing higher scores on situational water quality knowledge (WQ2) factors.

It is important to note that the negative relationship between education and situational water quality (WQ2) found in H3.2 has now disappeared once area of residence has been controlled. Thus the interpretation for the finding, proposed above, is supported.

In examining the model to this point in the analysis (Figure 25), we begin to see that education and SES are correlating past area of residence to the value priorities and belief systems. Thus far SES is the only variable to function through area of residence to the value priority and belief system.

Forced entry of variables in a stepwise multivariate regression equation (Figure 21) begins to limit the visible pathways in the model. In this forced regression (Table 21), male anglers with higher SES are more knowledgeable about situational water quality, with anglers residing in contaminated water areas being more knowledgeable about water quality and having a higher health related value priority concerning the environment.

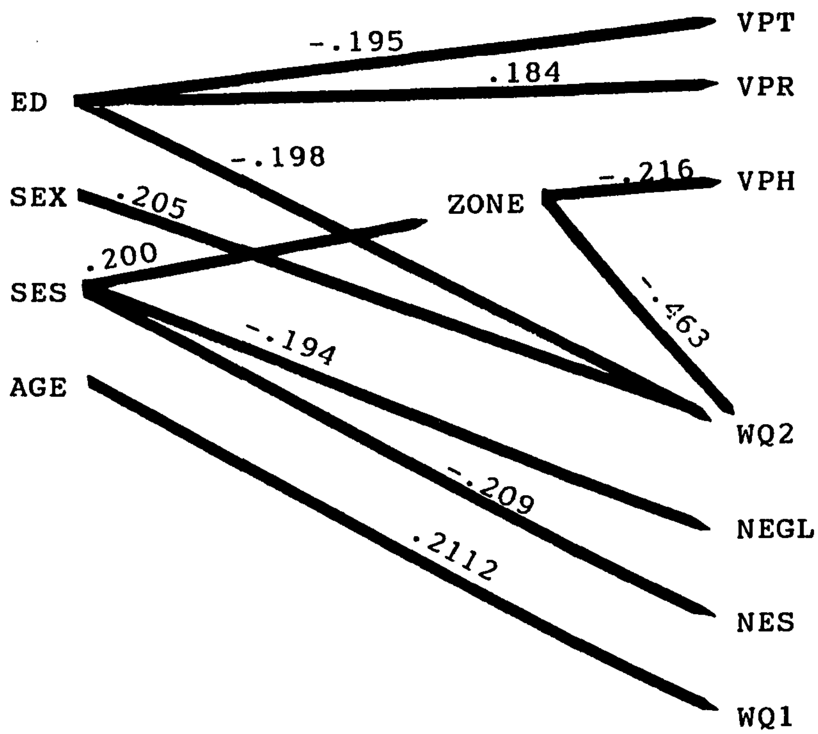


Figure 25 - Zero order correlations between demographics, area of residence, value priorities, and beliefs.

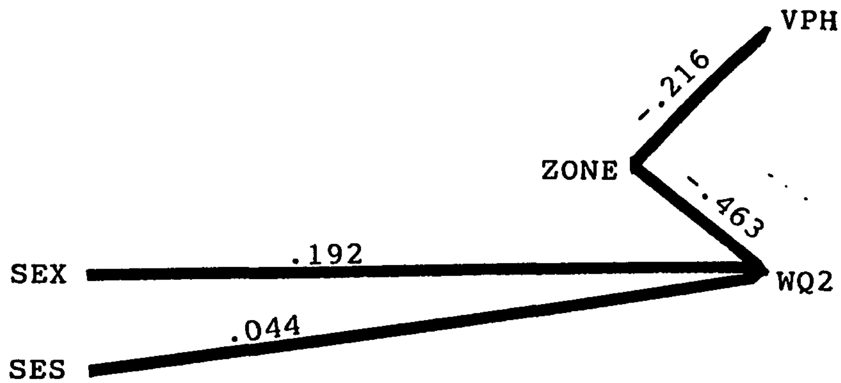


Figure 26 - Significant regressions for value priorities and beliefs vs area of residence, forcing demographics.

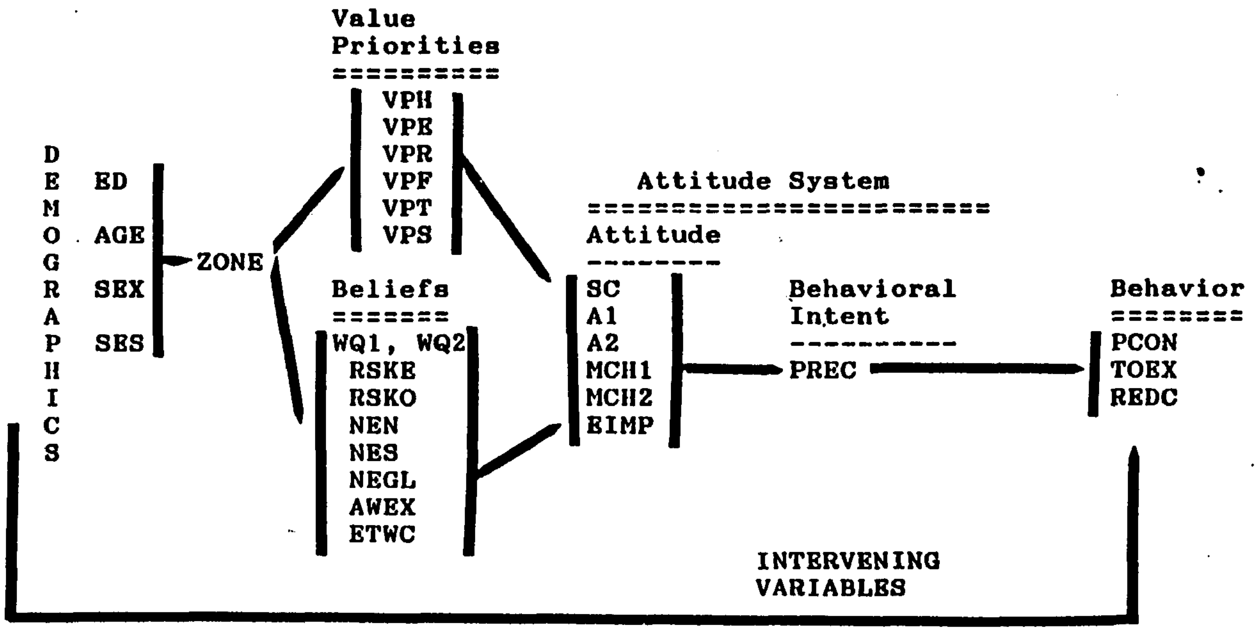
Table 21 - Multivariate regression correlations forcing demographics on significant "beliefs vs area of residence" relationships.

Dependent variable = WQ2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ZONE	-.463	33.58	.000	.208
SEX	.192	20.47	.000	.239
SES	.044	8.90	.000	.242

Variable	Mean	Std.dev.	Description
<u>DEMOGRAPHICS</u>			
SEX	1.14	.34	Gender
SES	.75	.13	Socioeconomic status
<u>AREA OF RESIDENCE</u>			
ZONE	.52	.66	Area of residence
<u>BELIEFS</u>			
WQ2	.72	.18	Situation specific WQ knowledge

Perception of contamination problem



ACRONYM	INDEX	DESCRIPTION
DEMOGRAPHICS:	ED	Education
	AGE	Age in years
	SEX	Gender
	SES	Socio-economic status
VALUE PRIORITIES :	VPH	Value Priority - Health
	VPE	Value Priority -Economics
	VPR	Value Priority -Recreation
	VPF	Value Priority -Freedom of will
	VPT	Value Priority -Traditionalism
	VPS	Value Priority -Socialization
BELIEFS :	WQ1	Water Quality - Literature scale
	WQ2	Water Quality - Situational scale
	RSKE	Risk of eating contaminated fish
	RSKO	Overall risk of contaminated waters
	NEN	Nature and Extent of N. Shiawassee contamination
	NES	Nature and Extent of S. Shiawassee contamination
	NEGL	Nature and Extent of Great Lakes contamination
	AWEX	Awareness of the extent of contamination
	ETWC	Exposure to consumption advisory
ATTITUDE :	SC	Source Credibility
	A1	Alienation - Literature scale
	A2	Alienation - Situational scale
	MCH1	Macho attitude - Literature scale
	MCH2	Macho attitude - Situational scale
	EIMP	Environmental Importance
BEHAVIORAL INTENT :	PREC	Precautionary attitude
BEHAVIOR :	PCON	Participation on contaminated waters
	TOEX	Total exposure via consumption of contam. fish
	REDC	Attempts to reduce contamination

Hypothetical Decision Stage Model

PROPOSITION 4 - ATTITUDES WILL BE PREDICTED BY VALUE PRIORITIES, BELIEFS, DEMOGRAPHICS, BUT NOT BY AREA OF RESIDENCE.

Zero order correlation matrices are presented as follows; attitudes vs value priorities (Table 22), attitudes vs beliefs (Table 25), attitudes vs area of residence (Table 28), and attitudes vs demographics (Table 30).

The relationship of each value priority in relation to the individual attitude measures will be addressed separately in the following hypotheses. With a final analysis being performed on significant value priorities and beliefs with a multivariate stepwise regression equation forcing area of residence and demographics into the equation.

HYPOTHESIS 4.1 Attitude factors will be predicted by value priorities.

H4.11 Source credibility and environmental importance factors will be positively predicted by health related value priority.

Zero order correlation (Table 22) for health related value priority vs source credibility was negative ($r=-.217$, $P=.008$).

Source credibility (SC) was negatively predicted by

Table 22 - Zero order correlations of attitudes vs value priorities (n=125).

	SC	A1	A2	MCH1	MCH2	EIMP
VPH	-.217	.047	.051	.192	.1200	-.024
	P=.008	P=.301	P=.285	P=.016	P=.091	P=.397
VPE	-.039	-.083	.047	-.178	.004	-.018
	P=.335	P=.180	P=.303	P=.024	P=.484	P=421
VPR	.148	-.034	-.014	-.203	-.176	-.122
	P=.050	P=.352	P=.439	P=.012	P=.025	P=.088
VPF	.096	-.044	-.030	.035	.028	.148
	P=.144	P=.313	P=.368	P=.351	P=380	P=.050
VPT	.015	.108	-.047	.100	.037	.016
	P=.436	P=.116	P=.303	P=.133	P=.341	P=.429
VPS	-.045	.017	.007	.050	-.027	.047
	P=.307	P=.428	P=.471	P=.290	P=.384	P=.302

Variable	Mean	Std.dev.	Description
VALUE PRIORITIES			
VPH	20.92	14.44	Health related value priority
VPE	12.56	9.53	Economic related value priority
VPR	27.48	15.34	Recreation related value priority
VPF	19.98	14.75	Freedom of will value priority
VPT	13.59	11.13	Traditionalism value priority
VPS	5.26	7.30	Socialization value priority
ATTITUDES			
SC	.72	.14	Source credibility of MDNR
A1	.34	.14	General alienation
A2	.56	.12	Situation specific alienation
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho
EIMP	.78	.07	Environmental importance

health related value priority (Beta = -.2169) in the multivariate regression equation (Table 23), with anglers reporting higher levels of health value priority perceiving the Michigan Department of Natural Resources as having reduced credibility.

Environmental importance factors were not predicted by health related value priority.

H4.12 Alienation and macho factors will be negatively predicted by health related value priority.

Zero order correlations (Table 22) indicate that the literature general macho scale was positively predicted by health related value priority (VPH, r=.192, P=.016) indicating that more macho anglers place a higher priority on the health related aspects of outdoor use.

When subjected to stepwise multivariate regression analysis, alienation and macho factors were not predicted by health related value priority (VPH).

Table 23 - Significant multivariate regression correlations for source credibility and envirionmental importance attitudes vs health value priority.

Dependent variable = SC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
VPH	-.217	6.07	.015	.039

Variable	Mean	Std.dev.	Description
<u>VALUE PRIORITIES</u>			
VPH	20.92	14.44	Health related value priority
<u>ATTITUDES</u>			
SC	.72	.14	Source credibility of MDNR

H4.13 Attitude factors will be positively predicted by economic and recreationalism value priorities.

Zero order correlations (Table 22) indicate that recreationalism value priority is positively predictive of source credibility (SC, r=.148, P=.050). Recreationalism was negatively predictive of both the general macho scale (MCH1, r=-.203, P=.012) and the situation specific macho scale (MCH2, r=-.176, P=.025) indicating that the more macho angler did not consider the use of the environment as a recreational entity.

Economic value priority is negatively predictive of general macho attitude (MCH1, r=-.178, P=.024) indicating that more macho individuals are less concerned with the economic value of the environment.

When analyzed with stepwise multivariate regression analysis (Table 24), the literature based macho scale (MCH1) was negatively predicted by both economic (Beta = -.2243) and recreationalism (Beta = -.2029) value priority factors. As in the zero order correlations, this would indicate that more macho individuals were less likely to value both the economic and recreational aspects of use of the environment.

Table 24 - Significant multivariate regression correlations for attitudes vs economic and recreationalism value priorities.

Dependent variable = MCH1

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
VPR	-.203	5.28	.023	.033
VPE	-.224	6.01	.003	.075

Variable	Mean	Std.dev.	Description
VALUE PRIORITIES			
VPE	12.56	9.53	Economic related value priority
VPR	27.48	15.34	Recreation related value priority
ATTITUDES			
MCH1	.66	.12	General Macho

H4.14 Source credibility and environmental importance factors will be negatively predicted by freedom of will and socialization value priorities.

Zero order correlations (Table 22) indicate that only environmental importance attitude (EIMP) is predicted by freedom of will value priority (VPF, r=.148, P=.050). This would seem to reflect an angler's increased level of environmental importance attitude with increasing freedom of will value priority associated with environmental use.

When analyzed in a stepwise multivariate regression equation, neither source credibility nor environmental importance factors were predicted by freedom of will (VPF) or socialization (VPS) value priorities.

H4.15 Alienation and macho factors will be negatively predicted by freedom of will and socialization value priority.

Zero order correlations (Table 22) did not produce any significant relationships. However, alienation measures and general macho factors were correlated in the positive (although non-significant) direction. Situation specific macho factors were in the negative (although non-significant) direction.

Alienation (A1 and A2) and macho (MCH1 and MCH2) were not predicted by freedom of will (VPF) or socialization (VPS) value priorities when analyzed with multivariate stepwise regression.

H4.16 Source credibility will be negatively predicted by traditionalism value priority.

Traditionalism (VPT) value priority was not predictive of anglers perception of Michigan Department of Natural Resources credibility (SC) in either zero order (Table 22) correlations or multivariate stepwise regression analysis.

H4.17 Alienation, environmental importance, and macho factors will be positively predicted by traditionalism value priority.

Traditionalism value priority measures were not found to be predictive of alienation (A1, A2), environmental importance (EIMP), or macho (MCH1, MCH2) attitude factors in either zero order correlations (Table 22) or multivariate stepwise regression analysis.

HYPOTHESIS 4.2 Attitude factors will be predicted by belief factors.

H4.21 Source credibility and environmental importance factors will be positively predicted by belief factors.

Zero order correlations (Table 25) indicate that source credibility is negatively predicted by knowledge of Great Lakes water quality (NEGL, r=-.241, P=.003). Anglers in the study population who know more about Great Lakes water quality appear to consider the Michigan Department of Natural Resources of lower credibility.

When analyzed with stepwise multivariate regression (Table 26), source credibility (SC) was found to be negatively predicted by belief factors related to knowledge of Great Lakes water quality (NEGL, Beta = -.2410). It is consistent to perceive increased knowledge of Great Lakes water quality would result in decreased MDNR (Michigan Department of Natural Resources) credibility. Conversely, anglers who perceive MDNR to be highly credible may perceive the lack of highly visible consumption advisories to be an indication of increased water quality in the Great Lakes and thus have lower knowledge scores.

There were a great many significant zero order correlations between beliefs and the environmental importance measure (EIMP). EIMP was significantly predicted, in a

Table 25 - Zero order correlations of attitudes vs beliefs (n=125).

	SC	A1	A2	MCH1	MCH2	EIMP
WQ1	-.141 P=.058	-.011 P=.452	-.079 P=.191	-.069 P=.227	-.218 P=.007	.115 P=.101
WQ2	-.009 P=.459	.108 P=.116	.027 P=.383	.106 P=.121	-.070 P=.220	.150 P=.047
RSKE	.085 P=.173	.128 P=.077	.056 P=.266	-.164 P=.034	-.180 P=.022	.160 P=.037
RSKO	-.104 P=.124	.107 P=.118	-.091 P=.157	-.010 P=.457	-.087 P=.168	.149 P=.049
NEN	.014 P=.437	.065 P=.238	-.065 P=.237	-.126 P=.081	.011 P=.452	-.176 P=.025
NES	-.056 P=.266	.008 P=.046	-.047 P=.300	.092 P=.153	.130 P=.075	.180 P=.023
NEGL	-.249 P=.003	.048 P=.299	.151 P=.046	.265 P=.001	.033 P=.358	.229 P=.005
AWEX	.035 P=.348	.099 P=.135	.046 P=.306	.111 P=.108	.082 P=.182	.259 P=.002
ETWC	.047 P=.300	-.061 P=.251	.020 P=.414	-.063 P=.241	-.080 P=.187	-.045 P=.309

Variable	Mean	Std.dev.	Description
<u>BELIEFS</u>			
WQ1	.68	.17	General water quality knowledge
WQ2	.72	.18	Situation specific WQ knowledge
RSKE	.69	.10	Risk of eating contam. fish
RSKO	.68	.10	Risk of overall pollution
NEN	.49	.14	Knowledge of N. Shiawassee WQ
NES	.69	.13	Knowledge of S. Shiawassee WQ
NEGL	.47	.13	Knowledge of Great Lakes WQ
AWEX	.28	.22	Knowledge of Michigan water quality
ETWC	.66	.18	Exposure to consumption advisory
<u>ATTITUDES</u>			
SC	.72	.14	Source credibility of MDNR
A1	.34	.14	General alienation
A2	.56	.12	Situation specific alienation
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho
EIMP	.78	.07	Environmental importance

Table 26 - Significant multivariate regression correlations for beliefs vs source credibility and environmental importance attitudes.

Dependent variable = SC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
NEGL	-.241	7.59	.007	.050

Dependent variable = EIMP

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
AWEX	.259	8.81	.004	.059
NEGL	.210	7.58	.001	.096

Variable	Mean	Std.dev.	Description
<u>BELIEFS</u>			
NEGL	.47	.13	Knowledge of Great Lakes WQ
AWEX	.28	.22	Knowledge of Michigan water quality
<u>ATTITUDES</u>			
SC	.72	.14	Source credibility of MDNR
EIMP	.78	.07	Environmental importance

positive direction, by situational water quality knowledge (WQ2, r=.150, P=.047), risk of eating contaminated fish (RSKE, r=.160, P=.037), risk of overall water pollution (RSKO, r=.149, P=.049), knowledge of South Shiawassee water quality (NES, r=.180, P=.023), knowledge of Great Lakes water quality (NEGL, r=.229, P=.005), and awareness of the extent of contaminated waters in Michigan (AWEX, r=.259, P=.002).

This large block of correlations for beliefs vs environmental importance would seem to indicate that the angler with a strong knowledge about the quality of the environment develops a strong appreciation for the importance of the environment.

Only knowledge of North Shiawassee water quality (NEN, r=-.176, P=.025) was found to be negatively predictive of EIMP. It was apparent early in the study that almost fifty percent of the anglers residing along the non-contaminated North Shiawassee believed that it was in fact contaminated. This incorrect perception may explain the negative relationship shown here.

In a stepwise multivariate regression analysis, environmental importance (EIMP) proved to be positively predicted by measures of anglers knowledge of the extent of contaminated waters in Michigan (AWEX, Beta = .2585) and with knowledge of Great Lakes water quality (NEGL, Beta = .2096). This indicates that anglers with increased knowledge and awareness may develop an increased importance for the environment (EIMP).

With AWEX and NEGL being the strongest of the zero order correlations, they were able to account for the majority of the variance. Situational water quality knowledge (WQ2), risk of eating (RSKE), risk of overall pollution (RSKO), knowledge of North Shiawassee (NEN), and knowledge of Great Lakes water quality (NEGL) were unable to develop sufficient beta's to enter the multivariate equation.

H4.22 Alienation and macho factors will be negatively predicted by belief factors.

Zero order correlations (Table 25) for alienation vs belief factors, indicates that the situational alienation measure (A2) was positively predicted by Great Lakes water quality knowledge (NEGL, r=.151, P=.046). At least in this group of anglers, knowledge of Great Lakes water quality would appear to be indicative of increased alienation, a correlation that cannot be explained at this time.

Alienation factors were not predicted by knowledge based belief factors when analyzed by stepwise multivariate regression.

Zero order correlations for macho factors (Table 25) were negative between the situational macho measurement (MCH2) and the general water quality knowledge factor (WQ1, r=-.218, P=.007). Negative correlations were found for both the general macho factor (MCH1:RSKE, r=-.164, P=.034) and the situational macho factor (MCH2:RSKE, r=-.180, P=.022) in relation to eating contaminated fish (RSKE). This result would support the generalization that macho anglers are less concerned with the risk associated with eating contaminated fish. Although not significant, these macho anglers also produced negative correlations with the risk associated with overall pollution of the environment (RSKO).

The situational macho scale (MCH2) was found to be positively predicted by angler knowledge of Great Lakes water quality (NEGL, r=.265, P=.001).

In a stepwise multivariate regression analysis (Table 27), the literature based macho scale (MCH1) was positively predicted by anglers knowledge of Great Lakes water quality (NEGL, Beta = .2645) and negatively predicted by anglers perception of the risk of eating contaminated fish (RSKE, Beta = -.1913).

The situational based macho scale (MCH2) was negatively predicted by the literature general water quality scale (WQ1, Beta = -.2175). The risk of eating factor (RSKE) did not develop sufficient beta to enter the regression equation.

From this it is apparent that more macho anglers knew less about water quality in general, were more aware of Great Lakes water quality, and perceive a reduced risk of consuming the contaminated fish they catch.

Table 27 - Significant multivariate regression correlations for beliefs vs alienation and macho attitudes.

Dependent variable = MCH1

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
NEGL	.265	9.26	.003	.062
RSKE	-.191	7.25	.001	.092

Dependent variable = MCH2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
NEGL	-.218	6.11	.015	.040

Variable	Mean	Std.dev.	Description
<u>BELIEFS</u>			
RSKE	.69	.10	Risk of eating contam. fish
NEGL	.47	.13	Knowledge of Great Lakes WQ
<u>ATTITUDES</u>			
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho

HYPOTHESIS 4.3 Attitude factors will not be predicted by area of residence.

Zero order correlations (Table 28) show that source credibility was positively predicted by area of residence (ZONE, r=.176, P=.025) indicating that non-contaminated zone anglers (scored "1" in a dummy variable set) perceived the Michigan DNR as being more credible.

Those anglers residing in the contaminated zone (scored "0" in the dummy variable set) were also found to be more macho (MCH2, r=-.187, P=.019) than their counterparts.

The same two attitude factors were found to be predicted by area of residence when analyzed with stepwise multivariate regression (Table 29). Source credibility (SC) was found to be positively predicted by area of residence (ZONE, Beta = .1761) indicating that anglers residing near non-contaminated waters perceived the Michigan DNR as more credible than those anglers residing near contaminated waters.

The situational scale measuring macho attitudes (MCH2) was found to be negatively predicted by area of residence (Beta = -.1866), with contaminated zone anglers exhibiting more macho attitudes than other anglers in the study.

Table 28 - Zero order correlations of attitudes vs area of residence (n=125).

	SC	A1	A2	MCH1	MCH2	EIMP
ZONE	.176 P=.025	.006 P=.473	-.046 P=.305	-.120 P=.092	-.187 P=.019	-.108 P=.115

Variable	Mean	Std.dev.	Description
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence
ATTITUDES			
SC	.72	.14	Source credibility of MDNR
A1	.34	.14	General alienation
A2	.56	.12	Situation specific alienation
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho
EIMP	.78	.07	Environmental importance

Table 29 - Significant multivariate regression correlations for area of residence vs attitudes.

Dependent variable = SC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ZONE	.176	3.93	.050	.023

Dependent variable = MCH2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ZONE	-.187	4.44	.037	.027

Variable	Mean	Std.dev.	Description
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence
ATTITUDES			
SC	.72	.14	Source credibility of MDNR
MCH2	.46	.09	Situation specific Macho

HYPOTHESIS 4.4 Attitude factors will be predicted by demographics.

H4.41 Source credibility and environmental importance factors will be positively predicted by education, socioeconomic status and age, but not predicted by gender.

Zero order correlations (Table 30) found that source credibility was not predicted by any of the demographic measures.

Environmental importance, however, exhibited negative correlations with demographic variables AGE (r=-.200, P=.013) and socioeconomic status (SES, r=-.267, P=.001), indicating that younger, lower SES anglers placed a greater importance on the environment.

Source credibility (SC) was not predicted by demographic factors when analyzed with stepwise multivariate regression (Table 31).

Environmental importance (EIMP) was negatively predicted by age (Beta = -.201) and socioeconomic status (SES, Beta = -.266). This is in opposition to the projected positive direction of the relationship. It is unclear why higher SES individuals would place decreasing value on the environment. However, older individuals often assess a lower importance on the environment based on past generation perceptions of an environment that can withstand unlimited human intervention.

Table 30 - Zero order correlations of attitudes vs demographics (n=125).

	SC	A1	A2	MCH1	MCH2	EIMP
ED	-.011 P=.451	-.055 P=.271	.164 P=.034	-.390 P=.000	-.224 P=.006	-.026 P=.387
AGE	.012 P=.446	.017 P=.425	-.292 P=.000	-.030 P=.371	.059 P=.256	-.200 P=.031
SEX	-.009 P=.462	-.016 P=.428	-.039 P=.335	.041 P=.324	.057 P=.264	-.091 P=.156
SES	-.051 P=.264	-.022 P=.406	.035 P=.351	-.115 P=.101	-.231 P=.005	-.267 P=.001

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SEX	1.14	.34	Gender
SES	.75	.13	Socioeconomic status
ATTITUDES			
SC	.72	.14	Source credibility of MDNR
A1	.34	.14	General alienation
A2	.56	.12	Situation specific alienation
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho
EIMP	.78	.07	Environmental importance

Table 31 - Significant multivariate regression correlations for demographics vs attitudes.

Dependent variable = EIMP

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SES	-.267	9.40	.003	.064
AGE	-.202	7.68	.001	.097

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
AGE	40.40	14.38	Age in years
SES	.75	.13	Socioeconomic status
ATTITUDES			
EIMP	.78	.07	Environmental importance

H4.42 Alienation and macho factors will be negatively predicted by education and socioeconomic status, while being positively predicted by age and gender.

Zero order correlations (Table 30) show that the situational alienation scale (A2) was positively predicted by educational levels (ED, r=.164, P=.034) and negatively predicted by AGE (r=-.291, P=.000). Anglers exhibiting higher levels of alienation tend to be younger with higher levels of education, in this study population.

This same correlation with age is found when the variables were analyzed with a stepwise multivariate regression equation. After age had accounted for its share of the variance, education was unable to generate sufficient beta to enter the regression equation (Table 32).

Gender and SES did not produce significant zero order correlations or beta values associated with alienation.

Zero order correlations associated with macho factors in relation to demographics (Table 30) show that education is negatively correlated with both the general macho attitude scale (MCH1, r=-.390, P=.000) and the situation specific macho scale (MCH2, r=-.224, P=.006). This indicates that increasing levels of education will produce lower levels of macho attitude in the study population.

Since education and SES are highly correlated, the negative relationship between the situation specific macho

Table 32 - Significant multivariate regression correlations for demographics vs alienation and macho attitudes.

Dependent variable = A2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
AGE	-.292	11.42	.001	.078

Dependent variable = MCH1

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ED	-.390	22.09	.000	.145

Dependent variable = MCH2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SES	-.231	6.92	.010	.046

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SES	.75	.13	Socioeconomic status
ATTITUDES			
A2	.56	.12	Situation specific alienation
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho

factor (MCH2) and SES (r=-.231, P=.005) is not unexpected.

Macho attitudes were negatively predicted by education (ED:MCH1, Beta = -.3902) and socioeconomic status (SES:MCH2, Beta = -.2308) when analyzed with a stepwise multivariate regression equation. These results support the proposition that less educated and lower SES anglers will exhibit higher levels of macho attitudes.

H4.5 Attitude factors are not exclusively predicted by value priorities and beliefs.

Figure 27 presents the initial, separate variable, group regression correlations for attitude variables.

The literature based macho attitude measure (MCH1) was the most widely predicted measure in the study. When ZONE and demographic factors were forced into the regression equation (Figure 28 and Table 33) subsequent to significant value priorities and belief factors, education showed a strong negative correlation with macho attitude (Beta = -.3902). Macho was slightly positively correlated with SES (Beta = .0911) in the forced regression equation even though it was not significant in zero order correlations.

The situation specific macho measure (MCH2) was also slightly negatively correlated with education (Beta = -.1202), and moderately with SES (Beta = -2308) and risk of eating (RSKE, Beta = -.192). Beta's for both education and

RSKE were increased to significance when forced into the equation, however, area of residence (ZONE) and general water quality knowledge (WQ1) lost significance in the analysis.

Environmental importance measure was also predicted by demographic factors. Increasing age (Beta = -.1817) and SES (Beta = -.2665) were indicative of decreased reported environmental importance, while increasing education (Beta = .1079) and awareness of the extent of Michigan contamination (AWEX) was indicative of increased assessment of environmental importance. In this forced regression, the beta of knowledge of North Shiawassee water quality was reduced to non-significance, while education's beta was increased to significance.

SES was also negatively predictive of source credibility (Beta = -.1345) along with the two significant zero order correlations for VPH and NEGL. The zero order correlation for area of residence (ZONE) was lost in the forced equation, while SES beta increased to significant levels.

Alienation measures were not found to be significant in the zero order correlations or multivariate regressions performed.

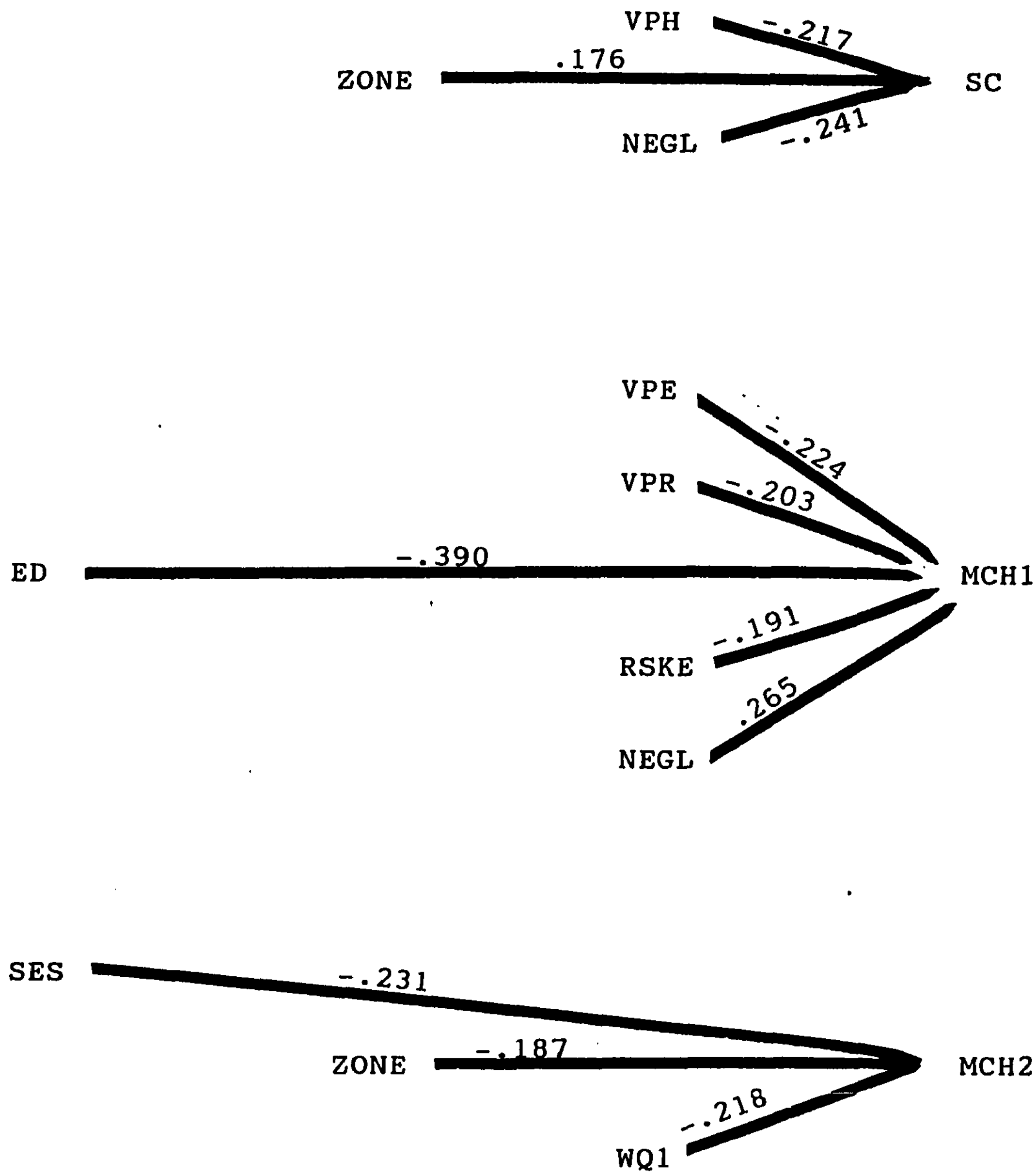


Figure 27 - Zero order correlations for attitudes vs value priorities, beliefs, area of residence, and demographics.

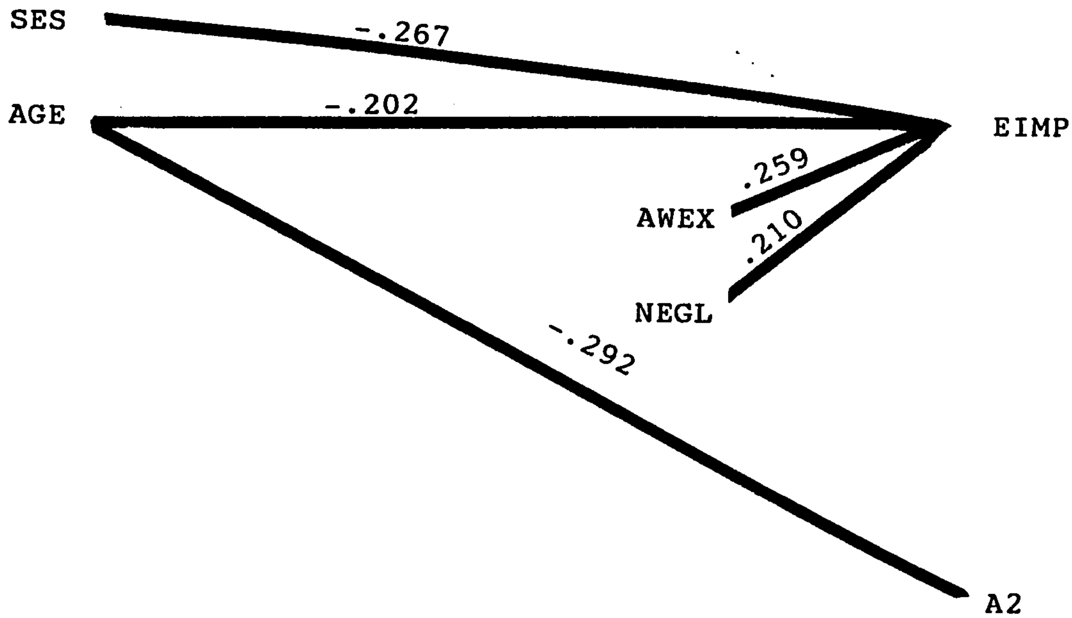


Figure 27 - Continued.

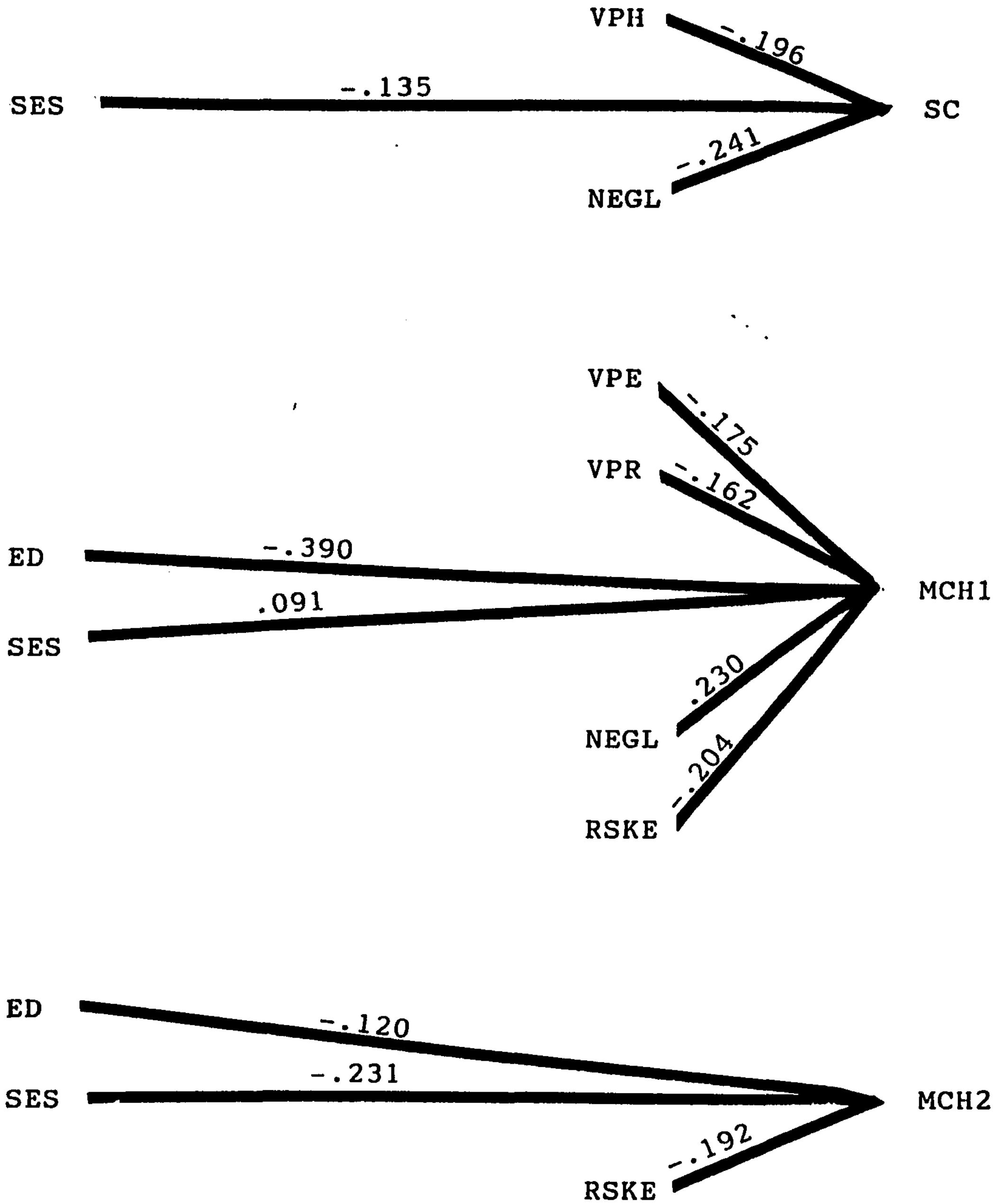


Figure 28 - Multivariate regression correlations of attitudes vs value priorities and beliefs, forcing area of residence and demographics.

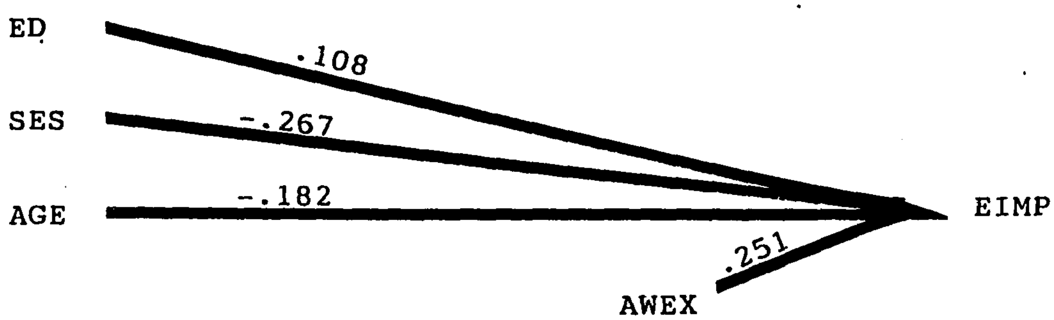


Figure 28 - Continued.

Table 33 - Significant multivariate regression correlations for attitudes vs value priorities and beliefs, subsequently forcing area of residence and demographics.

Dependent variable = SC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
VPH	-.196	6.50	.002	.082
NEGL	-.241	7.59	.007	.050
SES	-.135	2.34	.028	.071

Dependent variable = MCH1

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
VPE	-.175	12.40	.000	.216
VPR	-.164	10.19	.000	.270
NEGL	.230	15.72	.000	.192
RSKE	.204	11.40	.000	.251
ED	-.390	22.09	.000	.145
SES	.091	5.71	.000	.254

Dependent variable = MCH2

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
RSKE	-.192	6.04	.003	.075
ED	-.120	2.77	.015	.078
SES	-.231	6.92	.010	.046

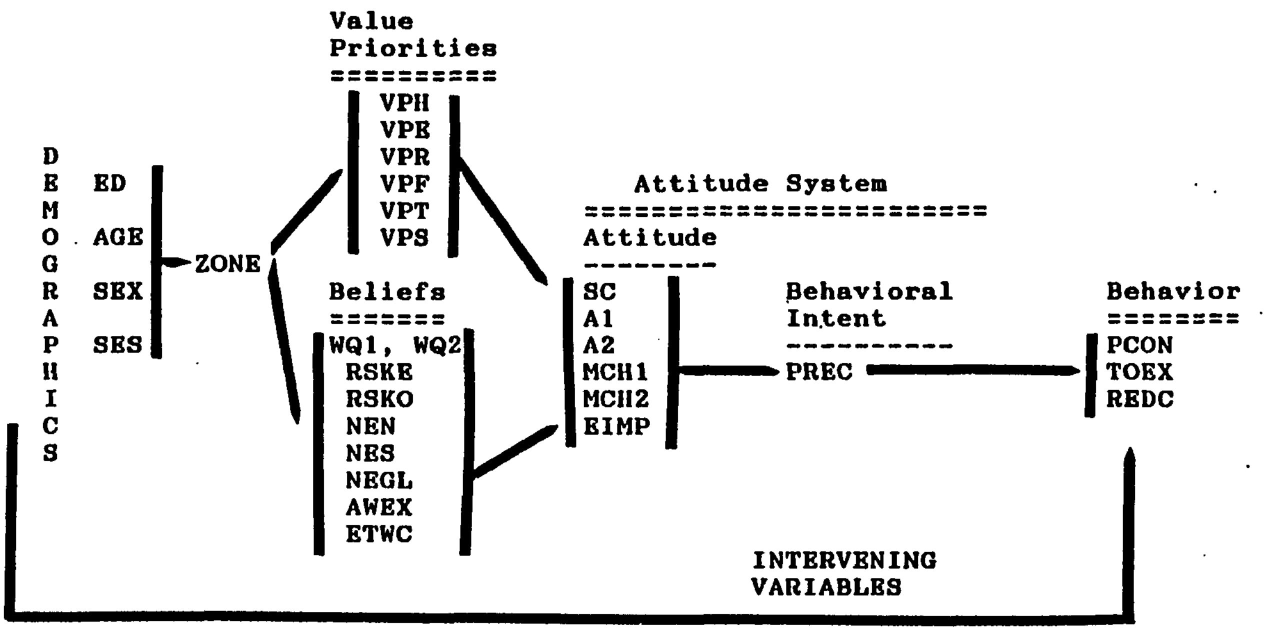
Dependent variable = EIMP

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
AWEX	.251	9.44	.000	.120
ED	.108	4.56	.000	.147
AGE	-.182	8.07	.000	.146
SES	-.267	9.40	.003	.064

Table 33 - Continued

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SES	.75	.13	Socioeconomic status
VALUE PRIORITIES			
VPH	20.92	14.44	Health related value priority
VPE	12.56	9.53	Economic related value priority
VPR	27.48	15.34	Recreation related value priority
BELIEFS			
RSKE	.69	.10	Risk of eating contam. fish
NEGL	.47	.13	Knowledge of Great Lakes WQ
AWEX	.28	.22	Knowledge of Michigan water quality
ATTITUDES			
SC	.72	.14	Source credibility of MDNR
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho
EIMP	.78	.07	Environmental importance

Perception of contamination problem



ACRONYM	INDEX	DESCRIPTION
DEMOGRAPHICS:	ED	Education
	AGE	Age in years
	SEX	Gender
	SES	Socio-economic status
VALUE PRIORITIES :	VPH	Value Priority - Health
	VPE	Value Priority -Economics
	VPR	Value Priority -Recreation
	VPF	Value Priority -Freedom of will
	VPT	Value Priority -Traditionalism
	VPS	Value Priority -Socialization
BELIEFS :	WQ1	Water Quality - Literature scale
	WQ2	Water Quality - Situational scale
	RSKE	Risk of eating contaminated fish
	RSKO	Overall risk of contaminated waters
	NEN	Nature and Extent of N. Shiawassee contamination
	NES	Nature and Extent of S. Shiawassee contamination
	NEGL	Nature and Extent of Great Lakes contamination
	AWEX	Awareness of the extent of contamination
	ETWC	Exposure to consumption advisory
ATTITUDE :	SC	Source Credibility
	A1	Alienation - Literature scale
	A2	Alienation - Situational scale
	MCH1	Macho attitude - Literature scale
	MCH2	Macho attitude - Situational scale
	EIMP	Environmental Importance
BEHAVIORAL INTENT :	PREC	Precautionary attitude
BEHAVIOR :	PCON	Participation on contaminated waters
	TOEX	Total exposure via consumption of contam. fish
	REDC	Attempts to reduce contamination

<u>Hypothetical Decision Stage Model</u>

PROPOSITION 5 - BEHAVIORAL INTENT WILL BE PREDICTED BY ATTITUDE, VALUE PRIORITIES, BELIEFS, AREA OF RESIDENCE, AND DEMOGRAPHICS.

HYPOTHESIS 5.1 Behavioral intent will be predicted by attitudes.

H5.11 Precautionary behavioral intent will be positively predicted by source credibility and environmental importance factors.

H5.12 Precautionary behavioral intent will be negatively predicted by macho and alienation factors.

The behavioral intent measure PREC was not found to be predicted by any of the attitude factors measured in this study when subjected to stepwise multivariate regression analysis.

A negative zero order correlation (Table 34) was found for PREC:A2 ($r=-.163$, $P=.035$) indicating a slight tendency for more alienated anglers to exhibit a lower level of precautionary behavioral intent.

Table 34 - Zero order correlations of behavioral intent vs attitudes (n=125).

	SC	A1	A2	MCH1	MCH2	EIMP
PREC	-.059	.008	-.163	-.025	-.135	.039
	P=.258	P=.464	P=.035	P=.390	P=.066	P=.333

Variable	Mean	Std.dev.	Description
<u>ATTITUDES</u>			
SC	.72	.14	Source credibility of MDNR
A1	.34	.14	General alienation
A2	.56	.12	Situation specific alienation
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho
EIMP	.78	.07	Environmental importance
<u>BEHAVIORAL INTENT</u>			
PREC	.86	.15	Precautionary behavioral intent

HYPOTHESIS 5.2 Precautionary behavioral intent will be positively predicted by belief factors.

The situational water quality scale (WQ2) was found to be positively predictive (Table 35) of precautionary behavioral intent (multivariate Beta = .186, zero order r=.186, P=.019) indicating that anglers that were more aware of water quality in their immediate area were likely to have a more precautionary behavioral intent (Table 36).

No other belief factors produced significant zero order or beta values when analyzed against PREC.

HYPOTHESIS 5.3 Precautionary behavioral intent will be predicted by value priorities.

H5.31 Precautionary behavioral intent will be positively predicted by health related value priority and negatively predicted by economic related value priority factors.

H5.32 Precautionary behavioral intent will be not be predicted by recreationalism, freedom of will, traditionalism, or socialization value priorities.

Table 35 - Zero order correlations of behavioral intent vs beliefs (n=125).

	WQ1	WQ2	RSKE	RSKO	NEN
PREC	.028 P=.337	.186 P=.019	-.119 P=.095	-.044 P=.314	.006 P=.472

	NES	NEGL	AWEX	ETWC
PREC	-.007 P=.470	-.067 P=.231	-.052 P=.283	.110 P=.112

Variable	Mean	Std.dev.	Description
BELIEFS			
WQ1	.68	.17	General water quality knowledge
WQ2	.72	.18	Situation specific WQ knowledge
RSKE	.69	.10	Risk of eating contam. fish
RSKO	.68	.10	Risk of overall pollution
NEN	.49	.14	Knowledge of N. Shiawassee WQ
NES	.69	.13	Knowledge of S. Shiawassee WQ
NEGL	.47	.13	Knowledge of Great Lakes WQ
AWEX	.28	.22	Knowledge of Michigan water quality
ETWC	.66	.18	Exposure to consumption advisory
BEHAVIORAL INTENT			
PREC	.86	.15	Precautionary behavioral intent

Table 36 - Significant multivariate regression correlations for behavioral intent vs beliefs.

Dependent variable = PREC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
WQ2	.186	4.41	.038	.027

Variable	Mean	Std.dev.	Description
BELIEFS			
WQ2	.72	.18	Situation specific WQ knowledge
BEHAVIORAL INTENT			
PREC	.86	.15	Precautionary behavioral intent

Precautionary behavioral intent was not predicted by value priorities in the population studied when examining both zero order correlations and stepwise multivariate regression matrices (Table 37).

HYPOTHESIS 5.4 Precautionary behavioral intent will be predicted by area of residence.

Anglers residing in the contaminated zone were found to be more precautionary in relation to the behaviors they intended to perform as evidenced by the negative correlation (Beta = -.204) between area of residence (ZONE) and precautionary behavioral intent factors (PREC) in both zero order (Table 38) and multivariate regression (Table 39).

Table 37 - Zero order correlations of behavioral intent vs value priorities (n=125).

	VPH	VPE	VPR	VPF	VPT	VPT
PREC	.102 P=.128	.077 P=.198	-.023 P=.400	-.046 P=.305	-.040 P=.330	.014 P=.438

Variable	Mean	Std.dev.	Description
VALUE PRIORITIES			
VPH	20.92	14.44	Health related value priority
VPE	12.56	9.53	Economic related value priority
VPR	27.48	15.34	Recreation related value priority
VPF	19.98	14.75	Freedom of will value priority
VPT	13.59	11.13	Traditionalism value priority
VPS	5.26	7.30	Socialization value priority
BEHAVIORAL INTENT			
PREC	.86	.15	Precautionary behavioral intent

Table 38 - Zero order correlation of behavioral intent vs area of residence (n=125).

	ZONE
PREC	-.205 P=.011

Variable	Mean	Std.dev.	Description
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence
BEHAVIORAL INTENT			
PREC	.86	.15	Precautionary behavioral intent

Table 39 - Significant multivariate regression correlations for behavioral intent vs area of residence.

Dependent variable = PREC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ZONE	-.205	5.37	.022	.034

Variable	Mean	Std.dev.	Description
<u>AREA OF RESIDENCE</u>			
ZONE	.52	.66	Area of residence
<u>BEHAVIORAL INTENT</u>			
PREC	.86	.15	Precautionary behavioral intent

HYPOTHESIS 5.5 Precautionary behavioral intent will be predicted by demographics.

H5.51 Precautionary behavioral intent will be positively predicted by education, gender, and socioeconomic status.

H5.52 Precautionary behavioral intent will be negatively predicted by age.

Precautionary behavioral intent was not found to significantly correlate with demographic factors (Table 40). Only education came close to significance (ED, $r = -.125$, $P = .081$). Note that the zero order correlations for education, gender, and SES were in the negative direction rather than the predicted positive direction. Age did not produce significant correlations, but the zero order correlation was also in the opposite direction of that predicted.

Table 40 - Zero order correlations of behavioral intent vs demographics (n=125).

	ED	AGE	SEX	SES
PREC	-.126	.068	-.017	-.113
	P=.081	P=.224	P=.427	P=.104

Variable	Mean	Std.dev.	Description
<u>DEMOGRAPHICS</u>			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SEX	1.14	.34	Gender
SES	.75	.13	Socioeconomic status
<u>BEHAVIORAL INTENT</u>			
PREC	.86	.15	Precautionary behavioral intent

HYPOTHESIS 5.6 Precautionary behavioral intent is not exclusively predicted by attitude factors.

Between variable correlations (Figure 29) show that angler situational water quality knowledge (WQ2) is positively predictive of precautionary behavioral intent (PREC).

When attitudes, value priorities, beliefs, area of residence, and demographic factors are forced into the regression equation, the situational macho scale (MCH2, Beta = -.180) developed a significant correlation while the situational water quality correlation (WQ2), significant in zero order correlations, was reduced to less than significant (Figure 30). Area of residence remained as a moderate negative correlation (Beta = -.205) indicating contaminated zone anglers were more cautious than non-contaminated zone anglers (Table 41).

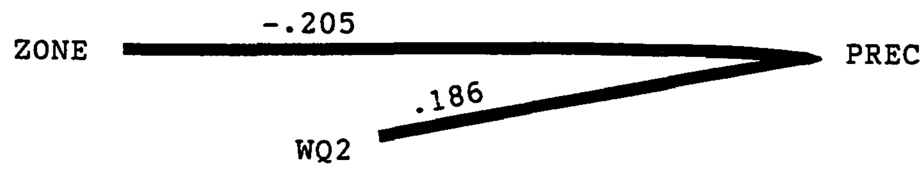


Figure 29 - Significant multivariate regression correlations for
behavioral intent vs attitudes, beliefs, value priorities,
area of residence, and demographics.

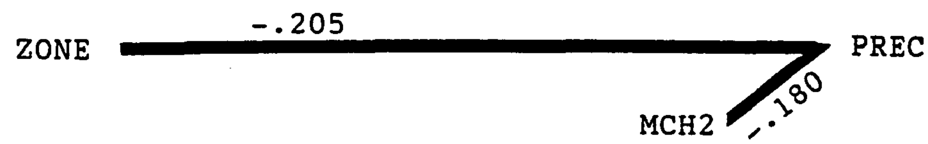


Figure 30 - Significant multivariate regression correlations between behavioral intent and attitudes, forcing value priorities, beliefs, area of residence, and demographics

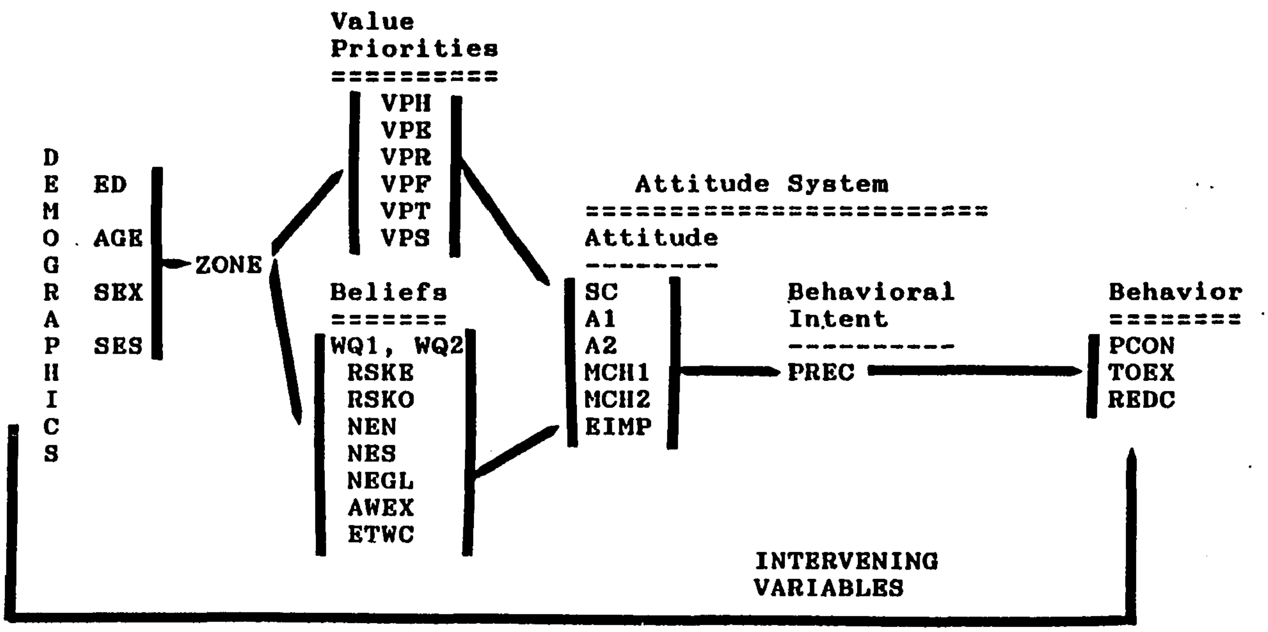
Table 41 - Significant multivariate regression correlations for behavioral intent vs attitudes, forcing value priorities, beliefs, area of residence and demographics.

Dependent variable = PREC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
MCH2	-.180	4.80	.010	.058
ZONE	-.205	5.37	.022	.034

Variable	Mean	Std.dev.	Description
<u>AREA OF RESIDENCE</u>			
ZONE	.52	.66	Area of residence
<u>ATTITUDES</u>			
MCH2	.46	.09	Situation specific Macho
<u>BEHAVIORAL INTENT</u>			
PREC	.86	.15	Precautionary behavioral intent

Perception of contamination problem



ACRONYM	INDEX	DESCRIPTION
DEMOGRAPHICS:	ED	Education
	AGE	Age in years
	SEX	Gender
	SES	Socio-economic status
VALUE PRIORITIES :	VPH	Value Priority - Health
	VPE	Value Priority -Economics
	VPR	Value Priority -Recreation
	VPF	Value Priority -Freedom of will
	VPT	Value Priority -Traditionalism
	VPS	Value Priority -Socialization
BELIEFS :	WQ1	Water Quality - Literature scale
	WQ2	Water Quality - Situational scale
	RSKE	Risk of eating contaminated fish
	RSKO	Overall risk of contaminated waters
	NEN	Nature and Extent of N. Shiawassee contamination
	NES	Nature and Extent of S. Shiawassee contamination
	NEGL	Nature and Extent of Great Lakes contamination
	AWEX	Awareness of the extent of contamination
	ETWC	Exposure to consumption advisory
ATTITUDE :	SC	Source Credibility
	A1	Alienation - Literature scale
	A2	Alienation - Situational scale
	MCH1	Macho attitude - Literature scale
	MCH2	Macho attitude - Situational scale
	EIMP	Environmental Importance
BEHAVIORAL INTENT :	PREC	Precautionary attitude
BEHAVIOR :	PCON	Participation on contaminated waters
	TOEX	Total exposure via consumption of contam. fish
	REDC	Attempts to reduce contamination

<u>Hypothetical Decision Stage Model</u>

PROPOSITION 6 - BEHAVIORS WILL BE PREDICTED BY BEHAVIORAL INTENT, ATTITUDES, VALUE PRIORITIES, BELIEFS, AREA OF RESIDENCE, AND DEMOGRAPHICS.

HYPOTHESIS 6.1 Behaviors will be predicted by behavioral intent.

H6.11 Participation on contaminated waters and exposure via consumption will be negatively predicted by behavioral intent.

H6.12 Efforts to reduce contamination via special preparation methods will be positively predicted by behavioral intent.

Behaviors were not predicted by behavioral intent in the group of anglers studied. The highest zero order correlation (Table 42) was PCON:PREC at $r=-.117$, $P=.098$, indicating that anglers with higher precautionary attitude behavioral intent are less likely participate on contaminated waters (PCON).

Table 42 - Zero order correlations of behaviors vs attitudes (n=125).

	PREC
PCON	-.117 P=.098
TOEX	-.094 P=.148
REDC	-.028 P=.380

Variable	Mean	Std.dev.	Description
BEHAVIORAL INTENT			
PREC	.86	.15	Precautionary behavioral intent
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

HYPOTHESIS 6.2 Behaviors will be predicted by attitudes.

H6.21 Participation on contaminated waters and exposure via consumption will be negatively predicted by source credibility and environmental importance factors.

Source credibility was found to negatively predict an anglers exposure via consumption of contaminated fish (TOEX, Beta = -.277, zero order r=-.277, P=.001) indicating that as anglers perceive the MDNR as being a more credible source of information, the angler will reduce consumption of contaminated species (Table 43).

Environmental importance was not found to be predictive of participation on contaminated waters (PCON) or TOEX in this population of anglers.

H6.22 Participation on contaminated waters and exposure via consumption will be positively predicted by alienation and macho factors.

Although alienation and macho factors did not produce significant correlations (Table 43), both the general (A1, r=.123, P=.085) and situational (A2, r=.123, P=.086) alienation scales did produce zero order correlations in the predicted positive direction.

Table 43 - Zero order correlations of behaviors vs attitudes (n=125).

	PCON	TOEX	REDC
SC	-.035 P=.349	-.278 P=.001	-.051 P=.285
A1	.123 P=.085	-.003 P=.486	-.036 P=.345
A2	.123 P=.086	-.012 P=.449	-.071 P=.214
MCH1	.016 P=.429	-.076 P=.201	.108 P=.115
MCH2	-.020 P=.413	.036 P=.345	-.020 P=.413
EIMP	.069 P=.223	-.004 P=.482	.198 P=.014

Variable	Mean	Std.dev.	Description
ATTITUDES			
SC	.72	.14	Source credibility of MDNR
A1	.34	.14	General alienation
A2	.56	.12	Situation specific alienation
MCH1	.66	.12	General Macho
MCH2	.46	.09	Situation specific Macho
EIMP	.78	.07	Environmental importance
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

Alienation and macho factors were not predictive of participation on contaminated waters or exposure to contamination via consumption of contaminated fish when analyzed with stepwise multivariate regression (Table 44).

H6.23 Efforts to reduce contamination via preparation methods will be positively predicted by source credibility and environmental importance factors.

Anglers who place a higher value on environmental importance factors (EIMP, Beta = .197, zero order r=.197, P=.014) were more likely to invest the additional time involved to utilize special preparation methods to reduce the contaminant levels in their catch (REDC, Table 45).

Source credibility was not found to be predictive of REDC in zero order or stepwise multivariate regression analysis.

H6.24 Efforts to reduce contamination via preparation methods will be negatively predicted by alienation and macho factors.

Although no significant zero order correlations developed (Table 43), general (A1, r=-.036, P=.345) and

Table 44 - Significant multivariate regression correlations for participation on contaminated waters and exposure via consumption vs alienation and macho attitudes.

Dependent variable = TOEX

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SC	-.278	10.27	.002	.077

Variable	Mean	Std.dev.	Description
<u>ATTITUDES</u>			
SC	.72	.14	Source credibility of MDNR
<u>BEHAVIORS</u>			
TOEX	5.92	8.54	Total consumption of contam. fish

Table 45 - Significant multivariate regression correlations for efforts to reduce contamination vs source credibility and environmental importance attitudes.

Dependent variable = REDC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
EIMP	.198	5.00	.027	.031

Variable	Mean	Std.dev.	Description
<u>ATTITUDES</u>			
EIMP	.78	.07	Environmental importance
<u>BEHAVIORS</u>			
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

situational (A2, r=-.071, P=.345) alienation factors were in the predicted negative direction. Macho values were directionally split, with the general measure (MCH1) being positive and the situational macho measure (MCH2) exhibiting a negative correlation with efforts to reduce contamination.

HYPOTHESIS 6.3 Behavior will be predicted by value priorities.

H6.31 Participation on contaminated waters and exposure via consumption of contaminated fish will be negatively predicted by health related value priority.

No significant zero order or multivariate correlations developed between these variables (Table 46), although PCON did correlate in the predicted negative direction.

H6.32 Participation on contaminated waters and exposure via consumption will be positively predicted by economic, recreationalism, freedom of will, traditionalism, and socialization value priorities.

No zero order correlations developed between PCON and TOEX and the value priorities. No zero order or stepwise multivariate regression correlations approached significance in this study population (Table 46).

Table 46 - Zero order correlations of behaviors vs value priorities (n=125).

	PCON	TOEX	REDC
VPH	-.027 P=.384	.063 P=.242	-.067 P=.228
VPE	.003 P=.485	.049 P=.292	-.153 P=.044
VPR	.084 P=.177	-.040 P=.330	.008 P=.466
VPF	.020 P=.414	.016 P=.431	.126 P=.080
VPT	-.018 P=.419	-.075 P=.203	.052 P=.283
VPS	-.108 P=.115	-.051 P=.286	-.009 P=.459

Variable	Mean	Std.dev.	Description
VALUE PRIORITIES			
VPH	20.92	14.44	Health related value priority
VPE	12.56	9.53	Economic related value priority
VPR	27.48	15.34	Recreation related value priority
VPF	19.98	14.75	Freedom of will value priority
VPT	13.59	11.13	Traditionalism value priority
VPS	5.26	7.30	Socialization value priority
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

H6.33 Efforts to reduce contaminants via special preparation methods will be positively predicted by health, economic, recreationalism, and freedom of will related value priorities.

Zero order correlations (Table 46) indicate that only the economic based value priority (VPE, r=-.153, P=.044) correlates significantly with REDC in this group. The direction is opposite of that predicted with anglers who place a higher economic value on the environment making fewer efforts to reduce contamination via special preparation methods.

Health, recreationalism, and freedom of will value priorities failed to produce significant zero order correlations with REDC.

H6.34 Efforts to reduce contaminants via special preparation methods will be negatively predicted by traditionalism and socialization related value priorities.

Traditionalism and socialization related value priorities failed to develop significant zero order or stepwise multivariate regression correlations (Table 46).

HYPOTHESIS 6.4 Behaviors will be predicted by belief factors.

H6.41 Participation on contaminated waters and exposure via consumption, will be negatively predicted by beliefs.

Significant zero order correlations (Table 47) for beliefs vs participation on contaminated waters (PCON) were not in the predicted direction. Anglers with higher levels of general water quality knowledge (WQ1, r=.191, P=.016), greater knowledge of North Shiawassee water quality (NEN, r=.166, P=.032), greater awareness of the extent of contaminated waters in Michigan (AWEX, r=.223, P=.006), and more exposure to the consumption advisory (ETWC, r=.189, P=.017) were found to participate more on contaminated waters. Possible explanations for increased knowledge, yet increased participation is offered in H6.42 below.

When analyzed with stepwise multivariate regression (Table 48), participation on contaminated waters was positively predicted by the belief measures NEN (water quality on the N. Shiawassee, Beta = .184) and AWEX (awareness of Michigan contaminated waters, Beta = .223). The reasons for anglers who are aware of the contaminated waters (AWEX) and are aware that the N. Shiawassee is not contaminated, continuing to participate on contaminated waters is unclear. Section H6.42 below indicates that anglers

Table 47 - Zero order correlations of behaviors vs beliefs (n=125).

	PCON	TOEX	REDC
WQ1	.191	.113	.131
	P=.016	P=.104	P=.073
WQ2	.070	-.125	-.190
	P=.220	P=.083	P=.017
RSKE	.039	-.095	-.110
	P=334	P=.147	P=.111
RSKO	.004	-.053	-.049
	P=.483	P=.278	P=.293
NEN	.166	.024	-.070
	P=.032	P=.396	P=.220
NES	-.075	.032	-.020
	P=.203	P=.361	P=.414
NEGL	.004	-.028	-.083
	P=.483	P=.377	P=.180
AWEX	.223	.042	.195
	P=.006	P=.320	P=.015
ETWC	.189	.002	.121
	P=.017	P=.492	P=.090

Variable	Mean	Std.dev.	Description
BELIEFS			
WQ1	.68	.17	General water quality knowledge
WQ2	.72	.18	Situation specific WQ knowledge
RSKE	.69	.10	Risk of eating contam. fish
RSKO	.68	.10	Risk of overall pollution
NEN	.49	.14	Knowledge of N. Shiawassee WQ
NES	.69	.13	Knowledge of S. Shiawassee WQ
NEGL	.47	.13	Knowledge of Great Lakes WQ
AWEX	.28	.22	Knowledge of Michigan water quality
ETWC	.66	.18	Exposure to consumption advisory
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

Table 48 - Significant multivariate regression correlations for participation on contaminated waters and exposure via consumption vs beliefs.

Dependent variable = PCON

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
AWEX	.223	6.42	.013	.042
NEN	.184	5.54	.005	.068

Variable	Mean	Std.dev.	Description
BELIEFS			
NEN	.49	.14	Knowledge of N. Shiawassee WQ
AWEX	.28	.22	Knowledge of Michigan water quality
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters

who fish on contaminated waters may make an increased effort to reduce contamination via special preparation methods, or by not consuming the fish they catch.

The zero order correlation for exposure to the consumption advisory (ETWC) failed to develop significance in the multivariate analysis.

Levels of consumption of contaminated fish (TOEX) was not significantly predicted by belief factors, although situational water quality (WQ2, r=-.124, P=.083) does appear to indicate that anglers with increased situational water quality knowledge are consuming fewer meals of contaminated fish.

H6.42 Efforts to reduce contaminants by use of special preparation methods will be positively predicted by belief factors.

Although the zero order correlation of situational water quality knowledge is in the negative direction (WQ2, r=-.190, P=.017), other knowledge based belief measures are in the positive direction predicted (Table 47).

General knowledge of water quality (WQ1, r=.131, P=.073) and exposure to the consumption advisory (ETWC, r=.121, P=.090), while not significant at the P<.05 level, are indicative of increasing knowledge resulting in increased efforts to reduce the amount of contaminants in the fish consumed (REDC). The awareness of the extent of contamination in Michigan waters (AWEX, r=.195, P=.015) also supports the concept that increased knowledge will result in increased efforts to reduce contamination.

This increased effort to reduce contaminants with increasing knowledge, in light of the results in H6.41, indicates that more knowledgeable anglers are indeed participating more on contaminated waters, but are mitigating that participation by increasing efforts to reduce the contaminants with special preparation methods.

Stepwise multivariate regression analysis (Table 49) also indicates that anglers who reported use of special preparation methods to reduce contaminants in their catch were found to be more aware of the extent of contaminated waters in Michigan (AWEX, Beta = .1954), yet were less knowledgeable about situational specific water quality (WQ2, Beta = -.1917).

Table 49 - Significant multivariate regression correlations for efforts to reduce contamination vs beliefs.

Dependent variable = REDC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
AWEX	.195	4.88	.029	.030
WQ2	-.192	4.94	.009	.060

Variable	Mean	Std.dev.	Description
BELIEFS			
WQ2	.72	.18	Situation specific WQ knowledge
AWEX	.28	.22	Knowledge of Michigan water quality
BEHAVIORS			
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

HYPOTHESIS 6.5 Behaviors will be predicted by area of residence.

H6.51 Participation on contaminated waters and exposure via consumption will be reduced in contaminated zone anglers.

Although PCON did not develop a significant zero order correlation with area of residence (ZONE, $r=-.141$, $P=.058$) at the $P<.05$ level (Table 50), the negative correlation indicates that contaminated zone anglers are participating less on contaminated waters. This information is supportive of the fact that contaminated zone anglers were found to have greater levels of water quality knowledge.

Total consumption of contaminated fish (TOEX) was not found to be predicted by ZONE.

H6.52 Efforts to reduce contaminants via special preparation methods will be increased in contaminated zone anglers.

An anglers area of residence was not found to predict behaviors in either zero order or multivariate regression equations (Table 50).

Table 50 - Zero order correlations of behaviors vs area of residence (n=125).

	PCON	TOEX	REDC
ZONE	-.141 P=.058	.012 P=.446	.085 P=.172

Variable	Mean	Std.dev.	Description
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

HYPOTHESIS 6.6 Behaviors will be predicted by demographic factors.

H6.61 Participation on contaminated waters and exposure via consumption will be negatively predicted by education, gender, and socioeconomic status.

Zero order correlations (Table 51) show that although predicted relationships develop, they develop in the positive direction. Both participation on contaminated waters (PCON, r=.218, P=.007) and consumption of contaminated fish (TOEX, r=.216, P=.008) were positively predicted by education (ED).

Zero order correlations were not significant for gender, but male anglers appeared to be more likely to participate on contaminated waters (PCON, r=.120, P=.092).

Gender zero order correlations were also in the positive direction, but did not develop significance for either PCON or TOEX.

SES zero order correlations (Table 51) also developed in the positive direction in relation to PCON (r=.117, P=.098) and TOEX (r=.240, P=.004), with higher SES anglers being more likely to consume contaminated fish. Since education and SES are highly correlated, it is expected that SES relationships will be in the same direction as education.

Table 51 - Zero order correlations of behaviors vs demographics (n=125).

	PCON	TOEX	REDC
ED	.218 P=.007	.216 P=.008	.091 P=.155
AGE	-.069 P=.223	.016 P=.428	-.081 P=.183
SEX	.120 P=.092	.018 P=.420	-.011 P=.451
SES	.117 P=.098	.240 P=.004	.008 P=.464

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
AGE	40.40	14.38	Age in years
SEX	1.14	.34	Gender
SES	.75	.13	Socioeconomic status
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

When analyzed with stepwise multivariate regression, (Table 52) PCON was found to positively correlate with education (Beta = .218) and socioeconomic status (SES; Beta = .2400) was found to positively predict an anglers willingness to consume the contaminated catch. As we have shown, education is not necessarily indicative of water quality knowledge. It is also possible that higher SES anglers may consume their catch to partially justify the cost of pursuit of exotic species in the Great Lakes.

The zero order correlation for education in relation to TOEX is reduced to non-significance in the multivariate regression equation, while the correlation for SES in relation to PCON is also reduced to non-significance in the multivariate regression equation.

Gender was not predictive of behaviors in this population of anglers.

H6.62 Participation on contaminated waters and exposure via consumption will be positively predicted by angler age.

Neither zero order correlations nor stepwise multivariate regression were able to produce significant correlations between an anglers age and PCON or TOEX (Table 51).

Table 52 - Significant multivariate regression correlations for participation on contaminated waters and exposure via consumption vs education, gender and socioeconomic status.

Dependent variable = PCON

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
ED	.218	6.13	.015	.040

Dependent variable = TOEX

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SES	.240	7.52	.007	.050

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
SES	.75	.13	Socioeconomic status
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish

H6.63 Efforts to reduce contaminants via special preparation methods will be positively predicted by education and socioeconomic status.

Neither zero order nor multivariate regression analysis (Table 51) were found to produce significant relationships between REDC and the demographic variables ED and SES.

H6.64 Efforts to reduce contaminants via special preparation methods will be negatively predicted by age and positively predicted by gender with females using fewer reduction efforts.

Efforts to reduce contamination were not predicted by demographic factors when examining zero order correlations (Table 51) or multivariate regression equations.

HYPOTHESIS 6.7 Behaviors are not predicted exclusively by behavioral intent.

Each behavior in the model was subjected to stepwise regression analysis forcing all non-behavior measures into the equation. Zero order correlation discussed to this point are diagramed in Figure 31.

Participation on contaminated waters (PCON) was found to be positively predicted by an anglers educational level (ED, Beta = .206), the anglers knowledge of N. Shiawassee (NEN, Beta = .190) water quality and awareness of the extent of contaminated waters in Michigan (AWEX, Beta = .223).

This forced entry of all variables in the model now allows area of residence (ZONE, Beta = -.198) to enter the equation at the $P<.05$ level. Here again we see that more educated anglers are more willing to participate on contaminated waters, with contaminated zone anglers being less willing to participate on contaminated bodies of water.

Consumption of contaminated fish (TOEX) was reduced with an increased perception of MDNR credibility (SC, Beta = .225), yet increased with increased socioeconomic status (SES, Beta = -.278). No variables that had previously proven significant in regression analysis were lost, nor any gained.

Efforts to reduce contamination (REDC) was also predicted by measures other than behavioral intent. When forced into the stepwise multivariate regression equation (Table 53) the previously significant beta for AWEX is lost,

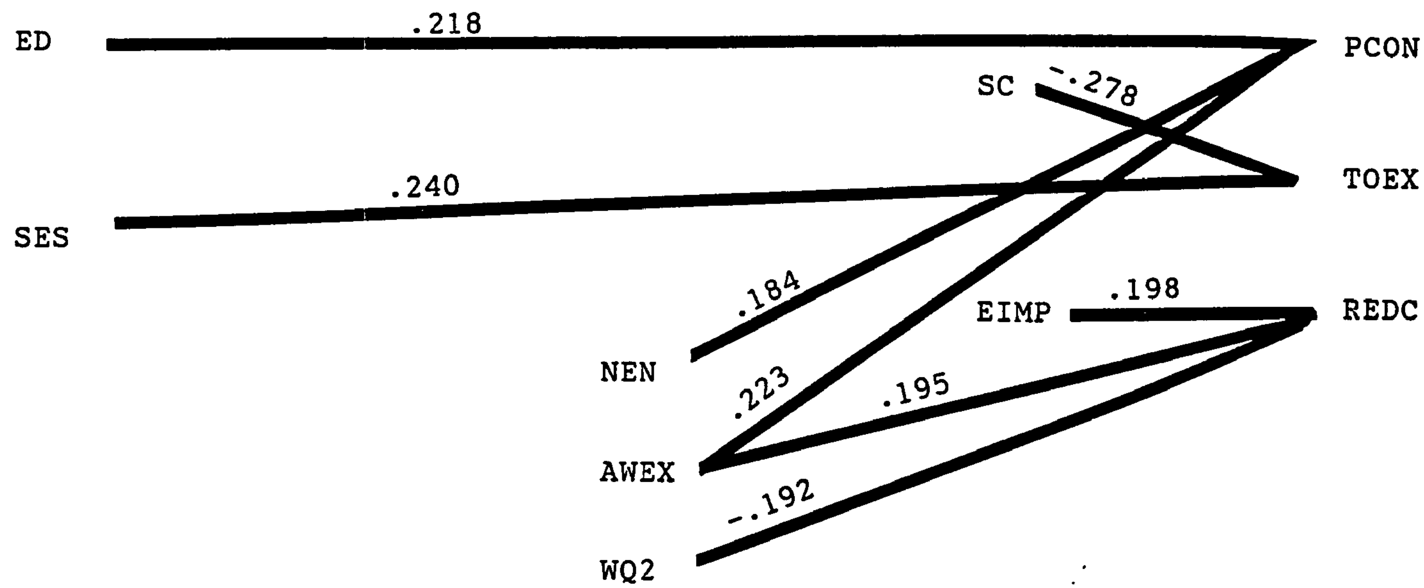


Figure 31 - Significant multivariate regression correlations for behaviors vs behavioral intent, attitudes, value priorities, beliefs, area of residence, and demographics.

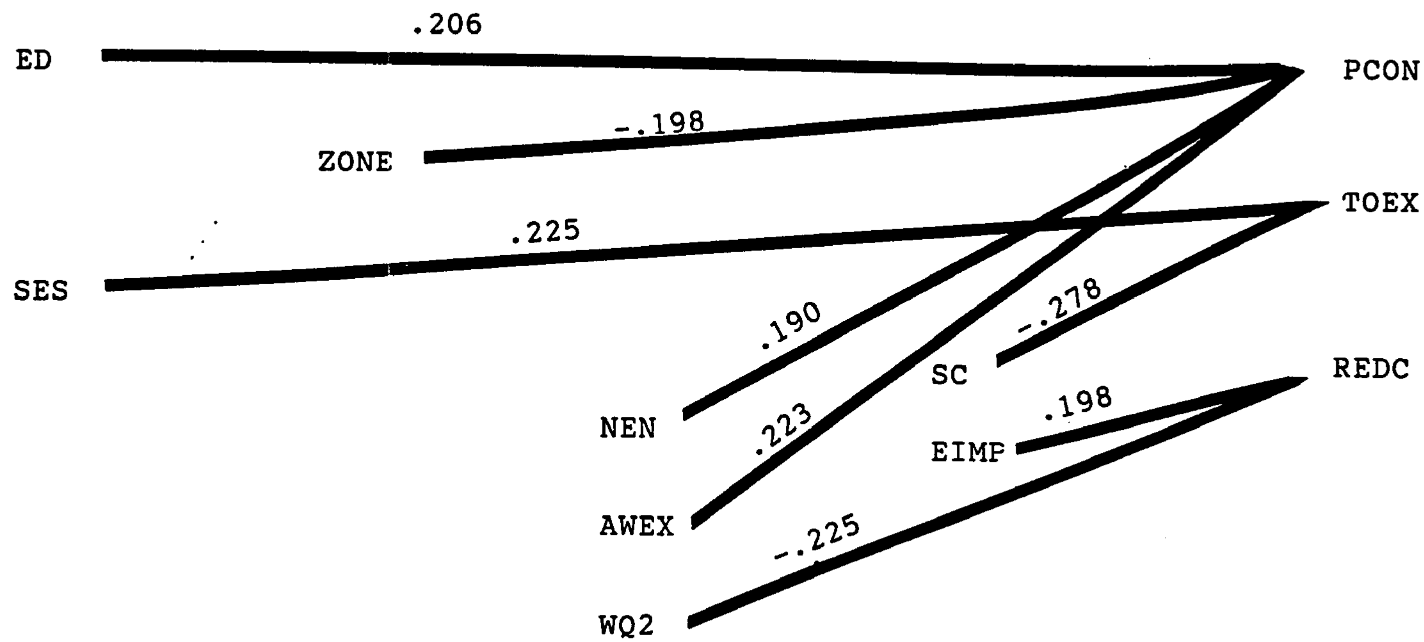


Figure 32 - Significant multivariate regression correlations for behaviors vs behavioral intent, forcing attitudes, value priorities, beliefs, area of residence, and demographics.

Table 53 - Significant multivariate regression correlations for behaviors vs behavioral intent, forcing attitudes, value priorities, beliefs, area of residence and demographics.

Dependent variable = PCON

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
NEN	.190	5.93	.000	.137
AWEX	.223	6.42	.013	.042
ZONE	-.198	6.00	.001	.108
ED	.206	6.17	.003	.077

Dependent variable = TOEX

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
SC	-.278	10.27	.002	.070
SES	.225	8.91	.000	.113

Dependent variable = REDC

Indep. Variable	BETA	F	Sig. F	Adj.Rsq.
EIMP	.198	5.00	.027	.031
WQ2	-.225	5.92	.004	.074

Table 53 - Continued

Variable	Mean	Std.dev.	Description
DEMOGRAPHICS			
ED	13.54	2.60	Educational level
SES	.75	.13	Socioeconomic status
AREA OF RESIDENCE			
ZONE	.52	.66	Area of residence
BELIEFS			
WQ2	.72	.18	Situation specific WQ knowledge
NEN	.49	.14	Knowledge of N. Shiawassee WQ
AWEX	.28	.22	Knowledge of Michigan water quality
ATTITUDES			
SC	.72	.14	Source credibility of MDNR
EIMP	.78	.07	Environmental importance
BEHAVIORS			
PCON	5.15	9.32	Participation on contaminated waters
TOEX	5.92	8.54	Total consumption of contam. fish
REDC	.42	.18	Efforts to reduce contam. via special preparation methods

while the beta for the situational water quality knowledge (WQ2, Beta = -.225) factor is increased. The correlation with EIMP (Beta = .198) remains the same. These correlations are indicative of an angler who makes greater effort to reduce contaminants in his catch as he/she is more aware of the extent of contamination in the state, and as he/she places a higher importance on the environment.

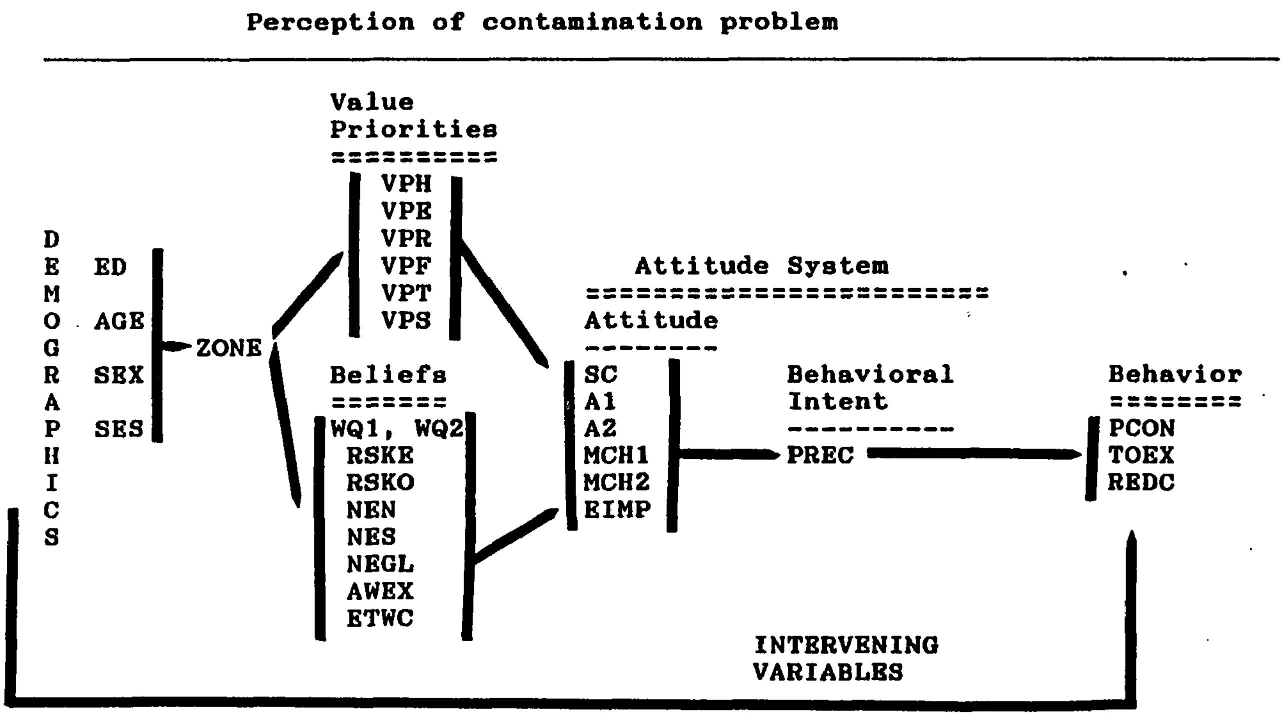
Anglers with decreasing knowledge of situational water quality (WQ2) may make increased effort to reduce contamination as a compensatory mechanism for that lack of knowledge.

For clarity, the original model is presented in Figure 33.

ADDITIONAL RESULTS

Anglers were also asked to report the amounts of fish consumed by their spouses and children (Figure 34). As can be seen in Figures 35 & 36, the vast majority of anglers' spouses consume the same amount of fish that the anglers. This was found to be the case with both the contaminated zone and the non-contaminated zone anglers. Children of anglers also tend to eat the same amount of fish as their parents (Figures 37 & 38).

Anglers were asked to report the number of times they had purchased a fishing license (Figure 34) in the past 5



ACRONYM	INDEX	DESCRIPTION
DEMOGRAPHICS:	ED	Education
	AGE	Age in years
	SEX	Gender
	SES	Socio-economic status
VALUE PRIORITIES :	VPH	Value Priority - Health
	VPE	Value Priority -Economics
	VPR	Value Priority -Recreation
	VPF	Value Priority -Freedom of will
	VPT	Value Priority -Traditionalism
	VPS	Value Priority -Socialization
BELIEFS :	WQ1	Water Quality - Literature scale
	WQ2	Water Quality - Situational scale
	RSKE	Risk of eating contaminated fish
	RSKO	Overall risk of contaminated waters
	NEN	Nature and Extent of N. Shiawassee contamination
	NES	Nature and Extent of S. Shiawassee contamination
	NEGL	Nature and Extent of Great Lakes contamination
	AWEX	Awareness of the extent of contamination
	ETWC	Exposure to consumption advisory
ATTITUDE :	SC	Source Credibility
	A1	Alienation - Literature scale
	A2	Alienation - Situational scale
	MCH1	Macho attitude - Literature scale
	MCH2	Macho attitude - Situational scale
	EIMP	Environmental Importance
BEHAVIORAL INTENT :	PREC	Precautionary attitude
BEHAVIOR :	PCON	Participation on contaminated waters
	TOEX	Total exposure via consumption of contam. fish
	REDC	Attempts to reduce contamination

Figure 33 - Hypothetical decision process mechanism.

124. When I keep fish, my spouse usually eats; (CHECK ONE)

THE SAME NUMBER OF MEALS OF FISH THAT I DO.
MORE MEALS OF FISH THAN I DO.
FEWER MEALS OF FISH THAN I DO.

125. When I keep fish, my children usually eat; (CHECK ONE)

THE SAME NUMBER OF MEALS OF FISH THAT I DO.
MORE MEALS OF FISH THAN I DO.
FEWER MEALS OF FISH THAN I DO.

126. In the last 5 years, how many times have you;

A. PURCHASED A FISHING LICENSE?
B. HAD YOUR SPOUSE PURCHASE A SEPARATE FISHING LICENSE?
C. PUT YOUR SPOUSE ON YOUR FISHING LICENSE?
D. READ THE BOOKLET THAT COMES WITH THE FISHING LICENSE?

Figure 34 - License and consumption activities questions.

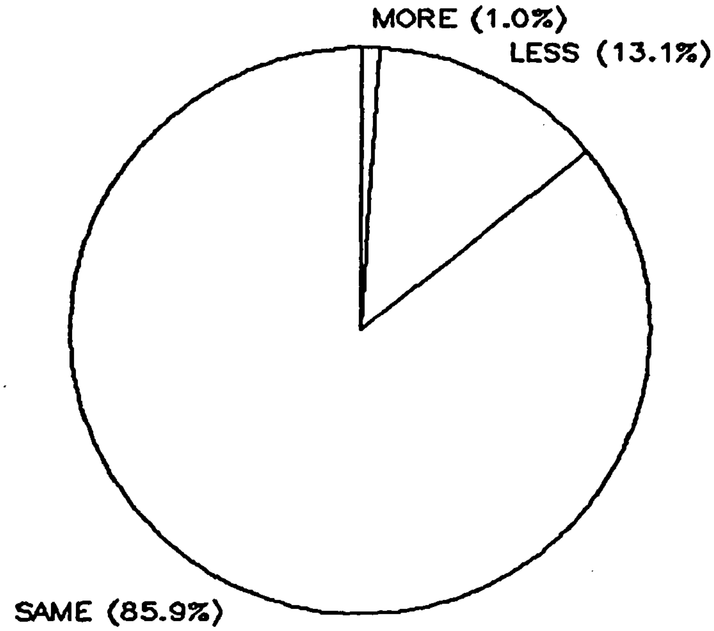


Figure 35 - Spouse consumption of fish for anglers residing in the contaminated zone.

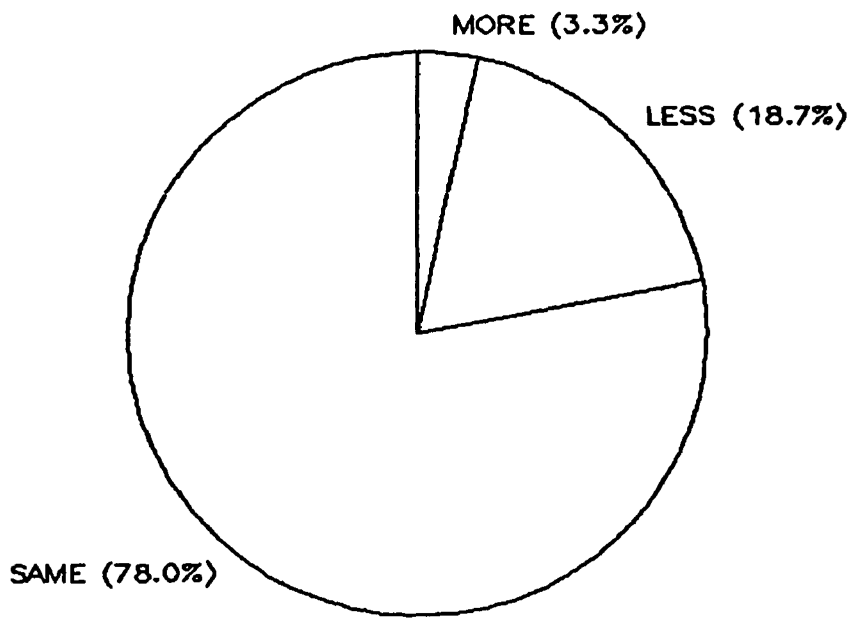


Figure 36 - Spouse consumption of fish for anglers residing in the non-contaminated zone.

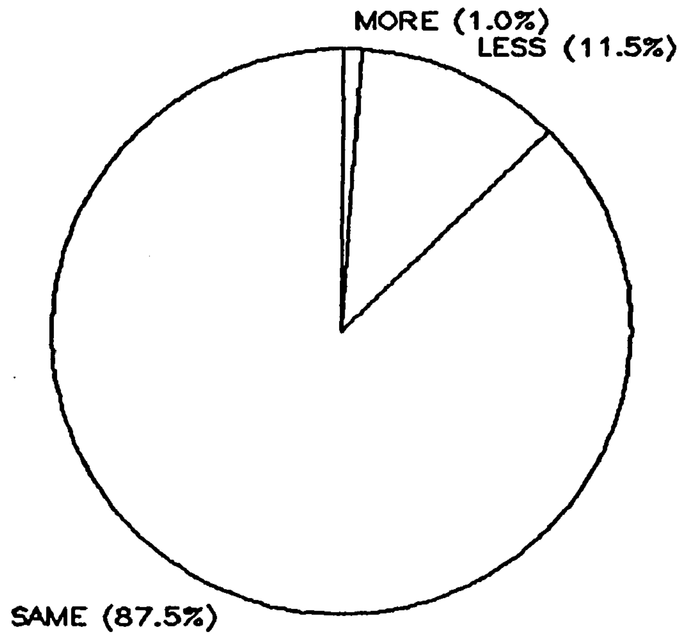


Figure 37 - Childrens' consumption of fish for anglers residing in the contaminated zone.

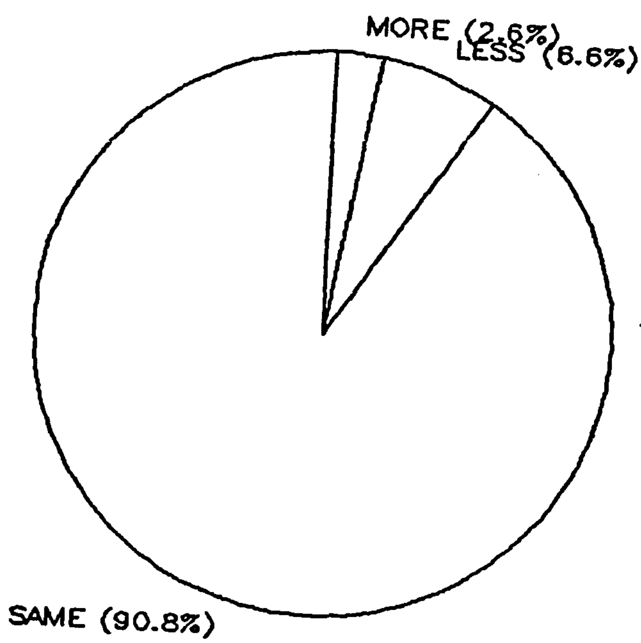


Figure 38 - Childrens' consumption of fish for anglers residing in the non-contaminated zone.

years. Contaminated zone anglers reported that a majority of them (66.1%) had purchased a license each year for the past 5 years, while 12.5% of them had purchased no fishing license in the past 5 years (Figure 39). It must be remembered that all of these individuals reported that they had been fishing at least twice in the past 12 months, and were quite likely to have the same level of angling activity during the past 5 years.

Non-contaminated zone anglers exhibited essentially the same level of non-compliance, with 14.5% of them not having purchased a license in the past 5 years. Also, fewer of them (52.2%) that had purchased a license for 5 consecutive years (Figure 40).

Both groups of anglers indicated that their spouses had purchased a separate license approximately 5 percent of the time (Figure 41 & 42).

A reverse order of spouse participation on the anglers license was found between groups (Figure 43 & 44). Fifty-two percent (51.8%) of the contaminated zone anglers put their spouse on their license for 5 years while 26.8% did not put their spouse on any fishing license. On the other hand, 33.3% of the non-contaminated zone anglers put spouses on their license for 5 years and 43.5% did not put their spouse on any fishing license over the same time period. It is unclear whether there are true differences here or whether the non-contaminated zone anglers simply have fewer fishing spouses. The latter may in fact be the case, since family/spouse

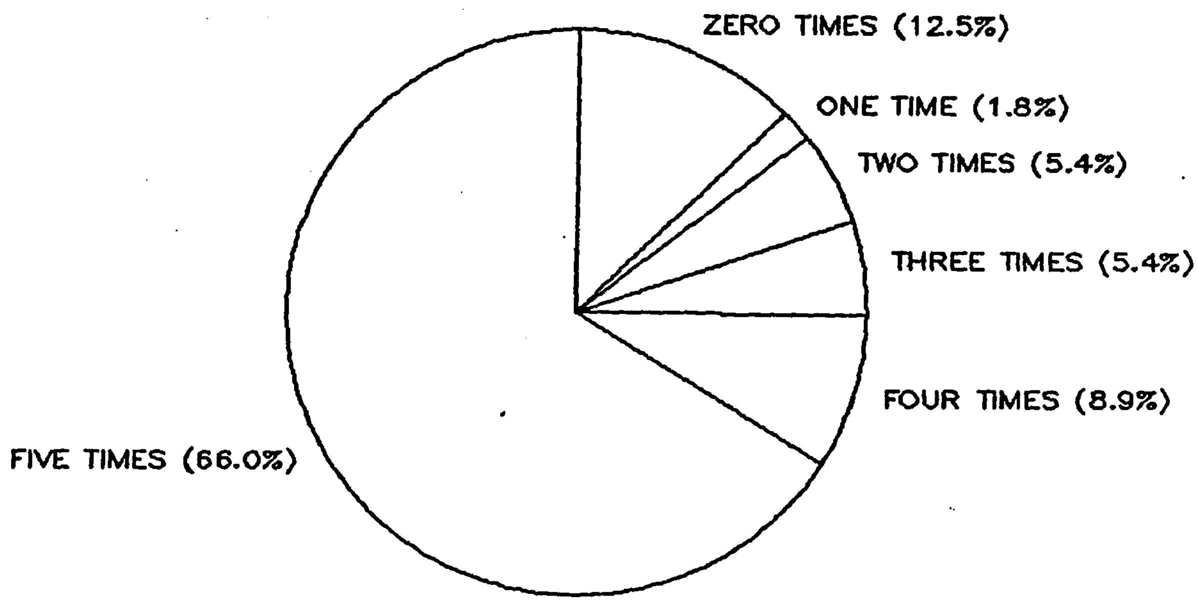


Figure 39 - Number of license purchases in past 5 years for anglers residing in the contaminated zone.

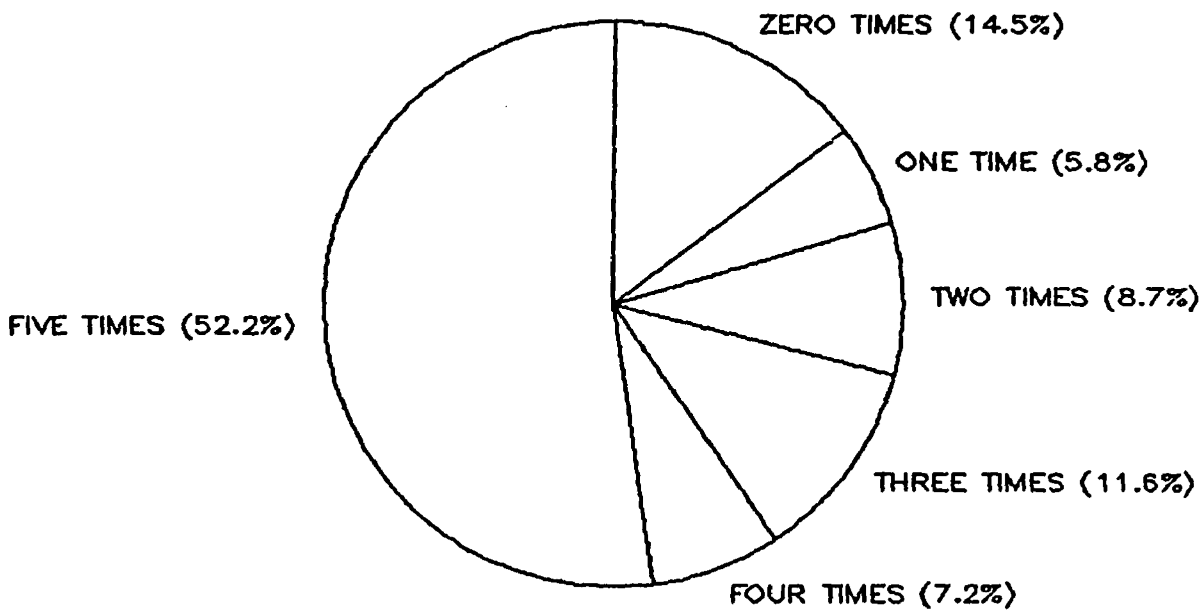


Figure 40 - Number of license purchases in past 5 years for anglers residing in the non-contaminated zone.

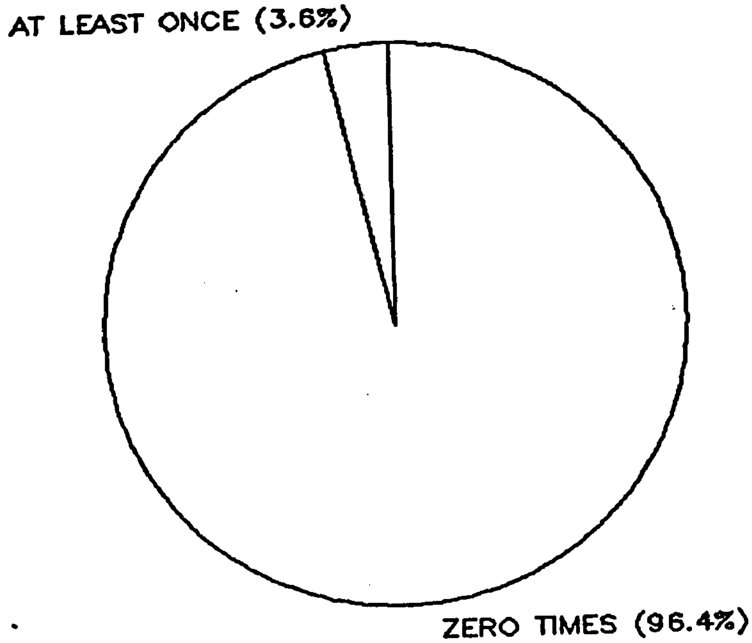


Figure 41 - Number of spouses purchasing a separate license in past 5 years for anglers residing in the contaminated zone.

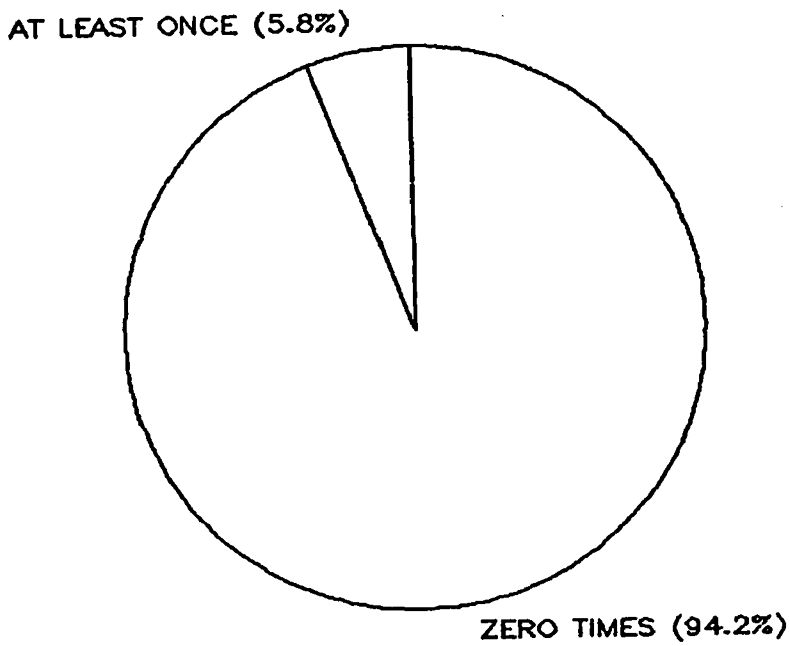


Figure 42 - Number of spouses purchasing a separate license in past 5 years for anglers residing in the non-contaminated zone.

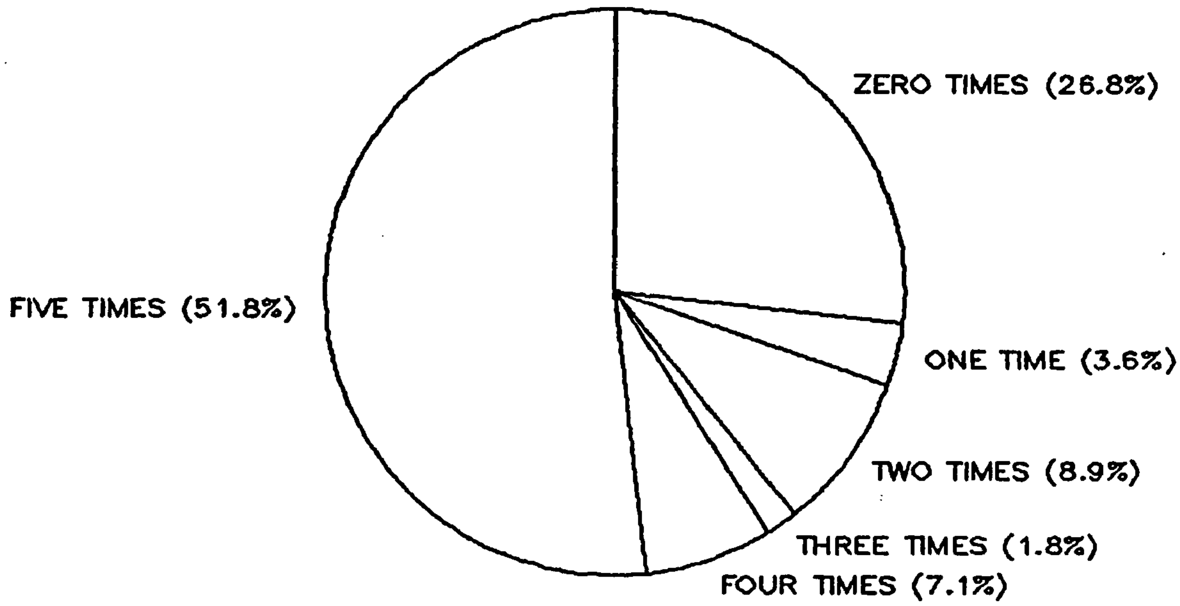


Figure 43 - Number of times the spouse was placed on the anglers' license for anglers residing in the contaminated zone.

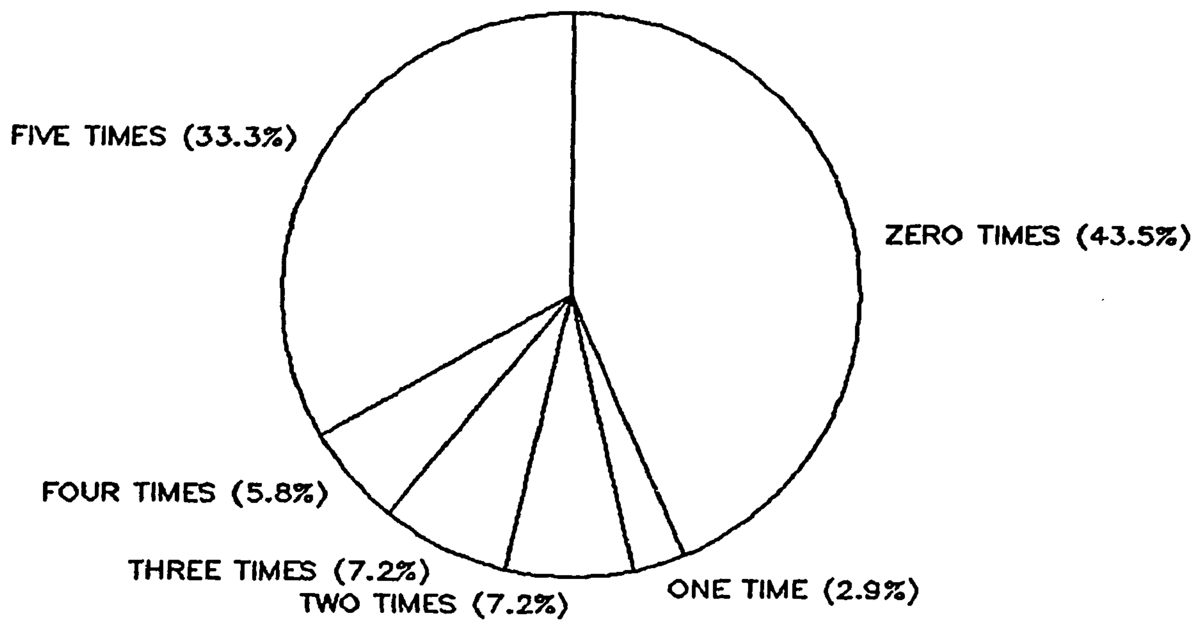


Figure 44 - Number of times the spouse was placed on the anglers' license for anglers residing in the non-contaminated zone.

participation in angling is often associated with lower SES groups because it is an inherently inexpensive family activity.

At this point it is interesting to examine how many times anglers have read the license booklet over the past 5 years. Figure 45 places the charts for license purchases next to the number of times anglers read the booklet. Note that in both contaminated and non-contaminated zones license purchase does not mean that the booklet was read. The non-contaminated zone had 14.5% of its anglers that had not purchased a license, yet 26.1% had not read the license book. At the other end of the scale 52.2% had purchased 5 licenses but only 39.1% had read the booklets every year.

Contaminated zone anglers not only purchased more licenses (66.1%), but also had a higher percentage of anglers who read the booklet each year (48.2%).

One key aspect of exposure is the amount of fish consumed by the individual anglers and his family (Figure 46). Although anglers reported the amount of contaminated fish consumed (TOEX), they were also asked to report the percentage of caught fish that were kept (Figure 47 & 48) and the percentage of kept fish that were eaten (Figure 49 & 50).

Figure 39 indicates that contaminated zone anglers have a greater tendency to release fish, with 46.5% reporting that they keep none of the fish they catch. This may be a direct response to increased awareness levels among contaminated zone anglers. Non-contaminated zone anglers reported that

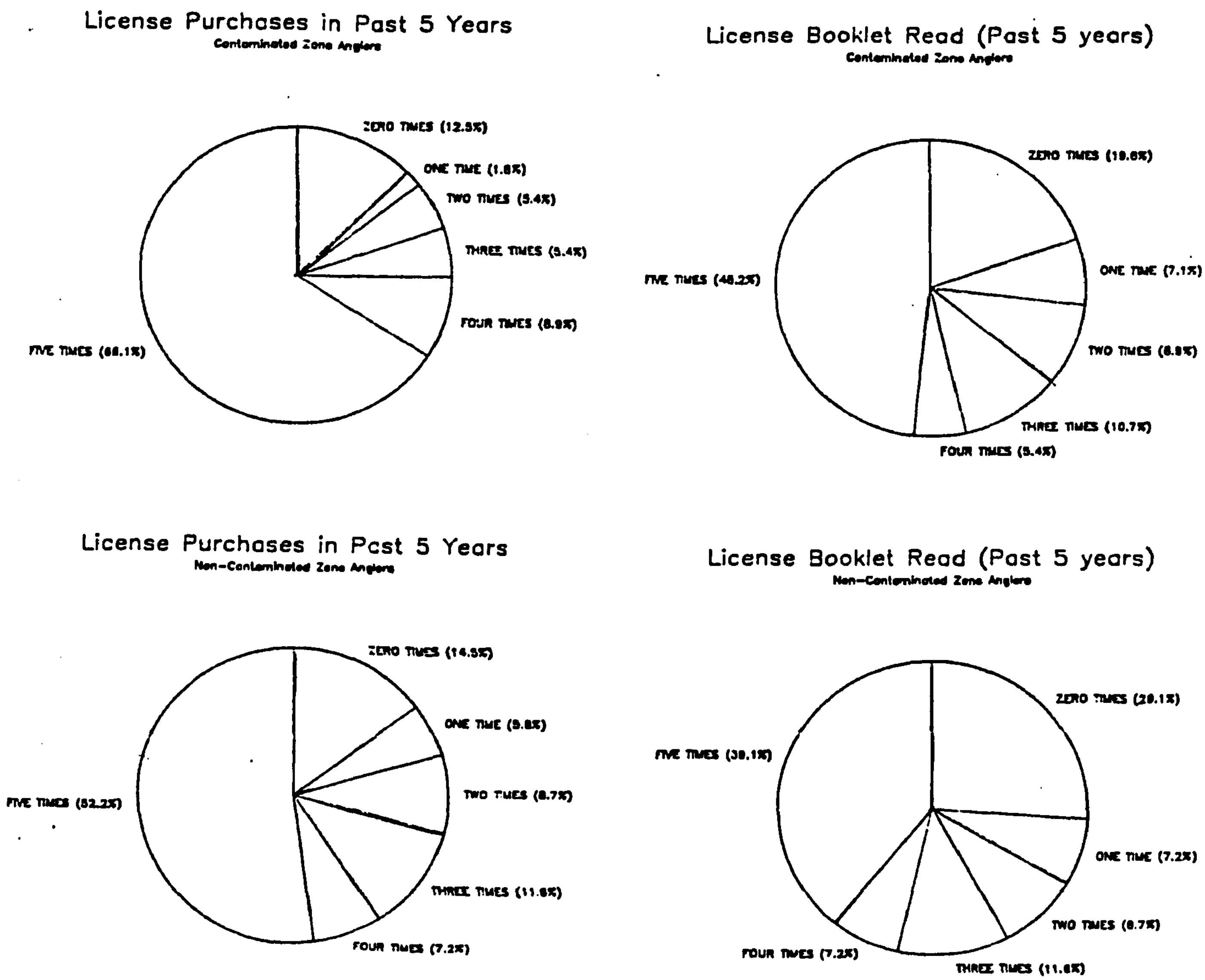


Figure 45 - Angler use of license booklet.

122. On the average, when I fish I keep; (CIRCLE ONE).

0% OF THE FISH
1% TO 20% OF THE FISH
20% TO 40% OF THE FISH
40% TO 60% OF THE FISH
60% TO 80% OF THE FISH
80% TO 100% OF THE FISH

123. Of the fish I keep, I personally eat: (CIRCLE ONE).

0% TO 20% OF THE FISH
1% TO 20% OF THE FISH
20% TO 40% OF THE FISH
40% TO 60% OF THE FISH
60% TO 80% OF THE FISH
80% TO 100% OF THE FISH

Figure 46 - Percentage of fish kept/eaten questions.

only 28.6% released all fish caught (Figure 48).

Very closely related to the percentage of fish kept is the percentage of kept fish eaten (Figure 49 & 50). For example, 48.5% of the anglers in the contaminated zone reported that they ate 0% of the fish they kept and 11.1% reported that they ate 80-100% of the fish kept. Non-contaminated zone anglers reported that only 28.6% of them ate none of the fish they kept, with 16.5% of the anglers eating 80 to 100% of the fish they keep. Anglers were not asked about what they did with the fish that were kept but not eaten (Figures 47 & 48).

Note that in both the percentage of fish kept and the percentage of fish eaten, the contaminated zone anglers kept fewer fish and ate fewer of the ones that they did keep. On the other hand, non-contaminated zone anglers both kept more and ate more of the fish that they kept. This may well reflect a more knowledgeable and precautionary group of anglers in areas where water and fish contamination are a problem.

All respondents were also asked to choose between higher pay vs more company spending on environmental protection (Figure 51). Area of residence (contaminated vs non-contaminated) seemed to have very little effect on this group of questions. A surprising 94.7% of contaminated zone respondents and 91.8% of non-contaminated zone respondents chose increased company spending on environmental protection programs rather than accepting a 10% pay increase (Fig. 52 &

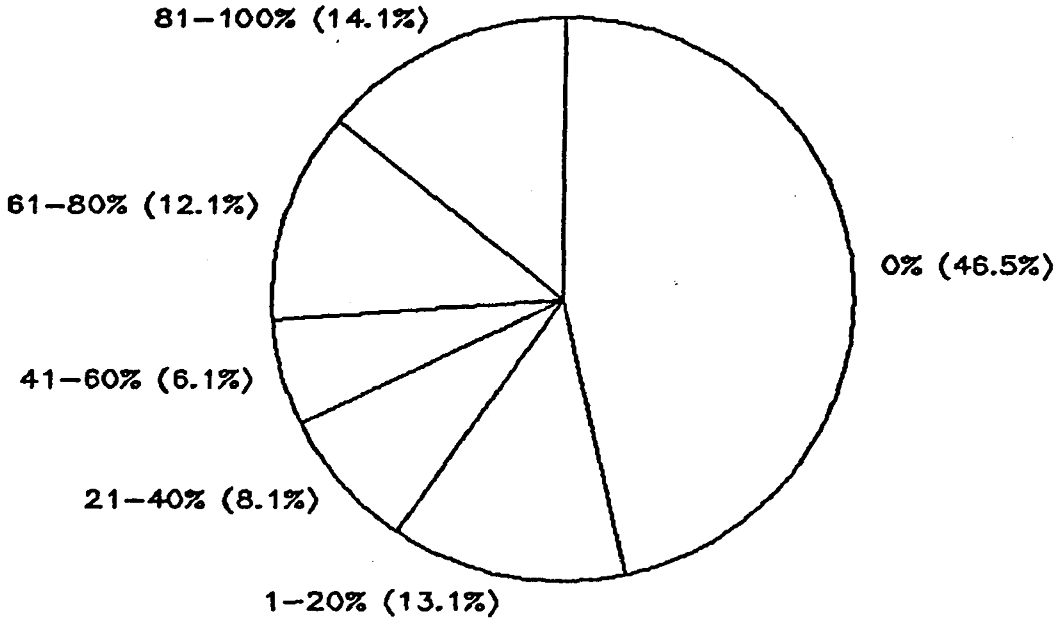


Figure 47 - Percentage of caught fish that were kept by anglers residing in the contaminated zone.

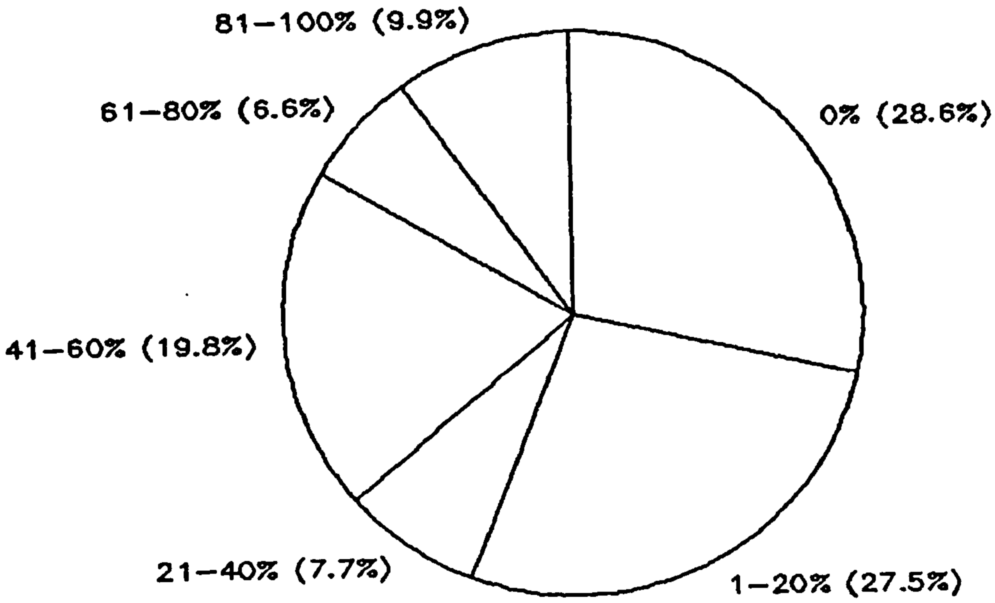


Figure 48 - Percentage of caught fish that were kept by anglers residing in the non-contaminated zone.

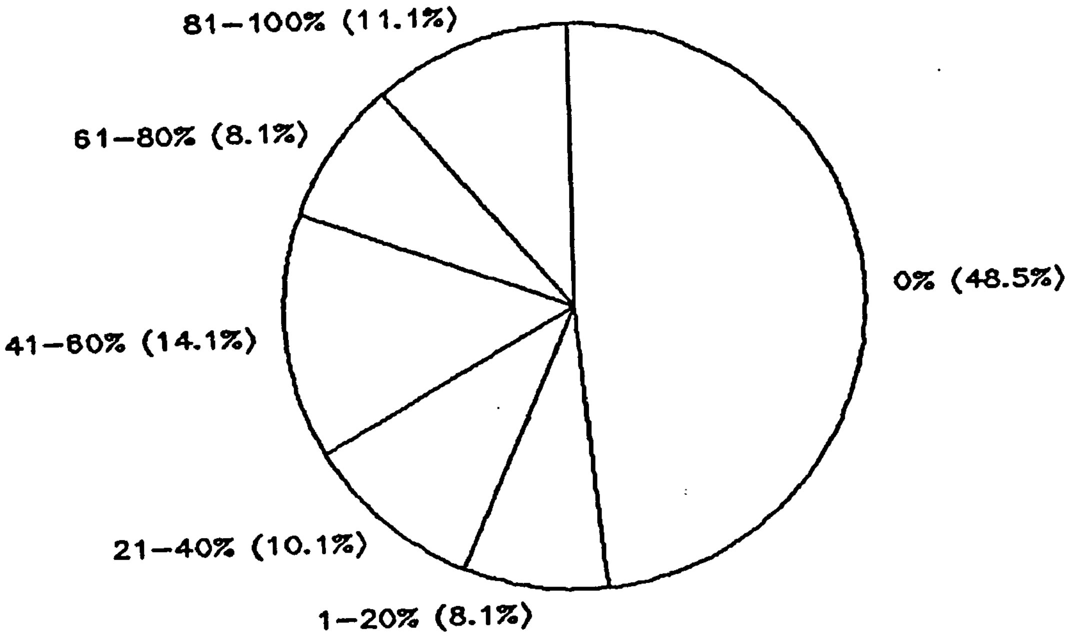


Figure 49 - Percentage of kept fish that were consumed by anglers residing in the contaminated zone.

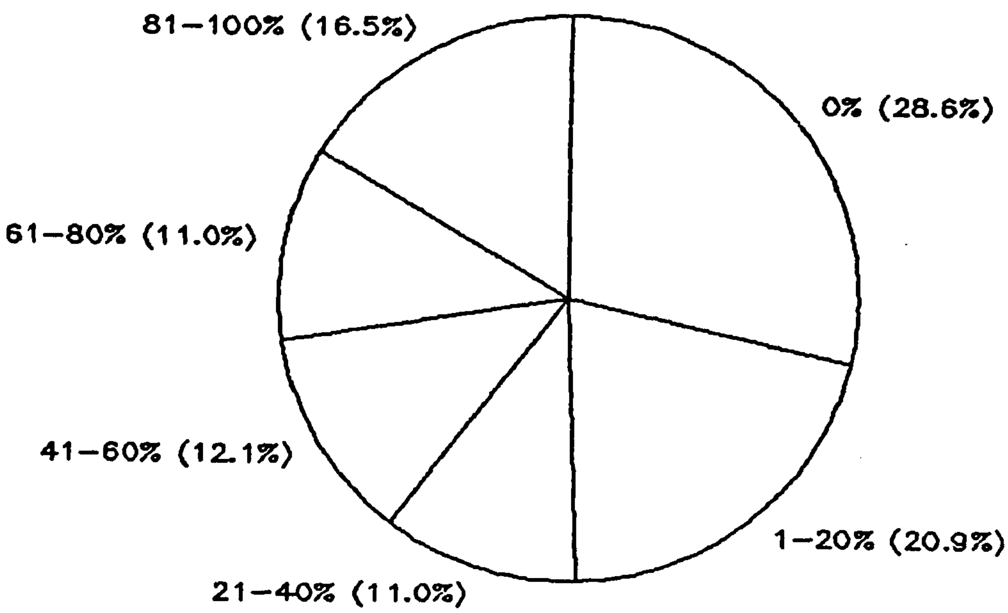


Figure 50 - Percentage of kept fish that were consumed by anglers residing in the non-contaminated zone.

BELOW ARE TWO PAIRS OF STATEMENTS. FOR EACH PAIR YOU ARE ASKED TO CIRCLE THE ONE STATEMENT THAT YOU MOST AGREE WITH. CIRCLE THE LETTER A OR B IN FRONT OF THE STATEMENT YOU CHOOSE.

90. If I had to choose, I would rather;

A. ACCEPT A 10% PAY INCREASE FROM MY COMPANY BECAUSE THE COMPANY HAD REDUCED ITS SPENDING FOR POLLUTION CONTROL AND FOR ENVIRONMENTAL PROTECTION.

B. KEEP MY PRESENT WAGES AND HAVE THE COMPANY SPEND 10% MORE FOR POLLUTION CONTROL AND ENVIRONMENTAL PROTECTION.

91. If I had to choose, I would rather;

A. ACCEPT A 10% PAY INCREASE FROM MY COMPANY BECAUSE THE COMPANY HAD DROPPED SOME OF MY HEALTH AND MEDICAL BENEFITS.

B. KEEP MY PRESENT WAGES AND HAVE THE COMPANY IMPROVE MY HEALTH AND MEDICAL BENEFITS.

Figure 51 - Questions used to determine an anglers' willingness to exchange the environment or health benefits for increased pay.

Figure 52 - Environmental protection priority vs pay increases for anglers residing in the contaminated zone.

Figure 53 - Environmental protection priority vs pay increases for anglers residing in the non-contaminated zone.

53). Respondents appear to place a high value on environmental protection compared to the value of a 10% pay increase.

When given the same choice of a 10% pay increase or increased health benefits, respondents again chose by an overwhelming margin to forgo the 10% pay raise to obtain increased health benefits (Figure 54 & 55).

It is apparent from these results that members of the study population exhibit a major concern for the environment and their health. This is supported by the fact that consistently more than 90% of the respondents **DID NOT** choose a significant 10% pay raise in exchange for relatively intangible increased company spending on environmental protection and medical benefits.

Figure 54 - Health benefits priority vs pay increases for anglers residing in the contaminated zone.

Figure 55 - Health benefits priority vs pay increases for anglers residing in the non-contaminated zone.

DISCUSSION

The discussion section will be organized as a direct discussion of the model formulated earlier, originating at the demographic variables and ending with angler behaviors.

This study population was not as homogenous as originally believed. Early results indicated that higher educated and higher SES individuals were residing in areas that are considered as non-contaminated.

The non-contaminated zone anglers placed lower value on health, economic, traditionalism, and socialization related value priorities than on satisfaction benefits of recreation. This may be due to the fact that the anglers residing in the non-contaminated zone had higher SES and increased SES was associated with increased importance placed on satisfaction and enjoyment benefits of outdoor recreation. This increased recreational importance placed on the environment may be a logical characteristic of anglers with higher education, SES, and the resultant increased amount of recreational leisure time associated with having "made it" in modern society.

Female anglers were also found to place a lower value on the economic aspect of the environment. It may be the historical aspect of males occupying the position of provider that decreases the female economic priority for the environment.

Interestingly, educational level did not mean that the angler was more knowledgeable about water quality. Knowledge based beliefs produced numerous correlations.

Consistently throughout the study, higher education and SES anglers scored higher on general water quality knowledge scales than their counterparts. Those counterparts residing along the contaminated waterway had lower educational levels and SES, yet a significantly higher knowledge of local water quality, Great Lakes water quality, and Michigan water quality. It is reasonable to assume that anglers residing near contaminated waters would know more about that water, yet these anglers were also much more aware of specific water quality throughout the state.

It is perhaps important here to relate the comment offered by an older angler with whom the results of this study were discussed. When told of this apparent conflict his explanation was indicative of years of living and understanding of human behavior. "Those fishermen with all the book learnin' think they know it all, so they ain't worried about the polluted fish. But us folks that have to live next to this crap had better know about it or we don't survive long."

This gentleman perhaps captured a significant survival mechanism for those of us without "book learnin'". The anglers who are most affected by the contamination are actually making significant efforts to understand and deal with the contamination. It is the "smart folks" who are exposing themselves to the most danger.

Angler attitudes also produced a large number of significant correlations. Increases in health related value priority was found to be negatively related to an anglers' perception of MDNR credibility. Those anglers placing a high value on health appear to find that the MDNR lacks credibility.

Those anglers who knew about Great Lakes water quality also reported that they perceived the MDNR as being a low credibility organization.

Non-contaminated zone anglers found the MDNR to be a very credible source of information, however, this group knew less about local water quality and may be more socially detached from local conditions.

Alienated anglers in this population tended to be younger and higher educated individuals.

Macho anglers were found to place an increased value on health in relation to the benefits of outdoor activities, while having decreased values associated with recreation and economics. Therefore, the macho anglers, while concerned with health, are not using the environment as an economic or recreational experience. Tough guys aren't in it for the fun or the money. Predictably, more macho anglers also believe that there is little risk from eating contaminated fish.

Increased education in this group of anglers was also indicative of a less macho individual. Perhaps the concept of having an increased understanding of the world via education is the cause of a less macho individual who does not have to prove his superiority.

Those anglers who value the freedom of will that the environment offers also place a higher level of importance in the environment in general.

Beliefs were found to be very strongly predictive of an anglers' attitude toward the importance of the environment. Anglers with high levels of environmental importance attitude knew about local water quality, believed that eating contaminated fish and pollution in general were very risky, knew about the water quality in the South Shiawassee, the Great Lakes, and Michigan in general.

Only those anglers who did not have a strong concept of local water quality (higher educated, higher SES, non-contaminated zone anglers) showed a decreased environmental importance when correlated with their knowledge of North Shiawassee water quality. This relationship may well be an artifact due to anglers residing along the North Shiawassee being less aware of local water quality.

Young, lower SES anglers were also found to place a high level of importance on the environment. This may be based on older anglers prior conception of an environment that that can withstand unlimited human intervention.

In considering an anglers' intent to perform a behavior, more alienated individuals reported a lower precautionary intent. Those anglers living near contaminated waters, who were also more knowledgeable of local water quality, reported a higher level of precautionary intent. This would seem to be indicative of the concept that those who know about contamination are going to be much more cautious.

Finally we examined the effects of all variables in the study on the behavior of anglers in the study.

Only source credibility and environmental importance variables were found to correlate with behaviors. Anglers who perceived the MDNR as being more credible tended to participate less on contaminated waters. However, we have seen that anglers who have a significant knowledge concerning local and state wide water quality, perceive the MDNR as a low credibility source of information. Quite simply, those anglers who believe the MDNR fish contaminated waters less often, but the anglers who actually know about Michigan water quality do not believe the MDNR.

It was also found that increased education and SES was indicative of an angler who not only participated more, but also consumed a significant portion of his/her catch. Anglers in this category reported that 28.6 percent of them released all of the fish they caught. They also reported that 28.6 percent of them ate none of the fish they kept. Here we have persons who would be expected to understand the health risks, and do not have an economic basis for requiring fish as a food supplement, keeping and eating a large portion of the fish they catch.

It must be noted, however, that individuals with a higher level of environmental importance made increased efforts to reduce contaminants via special preparation methods.

Conversely, 46.5 percent of anglers residing near contaminated waters released all of the fish they caught, and 48.5 percent did not consume any of the fish they did keep. These anglers also made increased efforts to reduce contaminants via preparation methods, but perhaps the most significant minimization occurs from the fact that almost half of these anglers release all of their fish and only eat half of what they keep.

While this may appear wasteful, the natural tendency to take home a trophy seems to give way to the knowledge that the trophy is too contaminated to eat.

At this final point it is perhaps important to note that anglers' families eat the same numbers and amounts of fish that they do. It may also be important for the MDNR to note that 12-14 percent of the anglers in this study (depending on area of residence) did not purchase a fishing license in the past 5 years, even though they each indicated that they went fishing at least twice in the last 12 months. This may be due to lack of enforcement, but is certainly the source of considerable lost income to the MDNR fisheries program.

SUMMARY

This study has shown that the information regarding water quality and the risks associated with environmental contamination has indeed reached specific groups of anglers. While it has reached those anglers residing near contaminated waters, it would seem that the MDNR information dissemination efforts were unlikely to be the source of that knowledge.

Anglers residing near contaminated waters, although having lower educational levels and lower SES, secured the information on their own. The information they received from MDNR was perceived as having low credibility by this group who exhibits a high degree of specific knowledge about local and statewide water quality.

Anglers who reside near waters that are not contaminated had greater knowledge of general water quality, perceive the MDNR as credible, have higher levels of education and SES, yet continue to fish on contaminated waters and eat the fish they catch.

These individuals may best be reached with increased educational programs targeted at those anglers who are most likely to believe the MDNR and who already have a general knowledge of water quality.

This investigation has produced additional information that will aid researchers in the understanding of some of the many dimensions associated with voluntary exposure to contaminated waterways/fish in Michigan anglers.

Throughout the study several key factors and indices correlate with an anglers' activities on contaminated waters and the anglers' willingness to consume contaminated fish. Among these key factors are the anglers' educational level and socioeconomic status.

It must be noted that the two groups studied were not as homogenous as was first perceived. Both groups tended to produce very different patterns of correlations throughout the study. Those anglers residing in the non-contaminated zone were higher in education and SES and produced significant positive correlations between these variables and their participation on contaminated waters (PCON) as well as their willingness to consume those contaminated fish (TOEX).

Even though the anglers residing in the non-contaminated zone produced these stronger correlations, they reported less actual number of trips to fish on contaminated waters.

On the other hand, anglers residing in the contaminated zone were more likely to go fishing on contaminated waters, but consumed fewer of the contaminated fish.

The two groups of anglers also appeared to have much different processes involved in the decision process hypothesized here. The better educated and higher SES non-contaminated zone anglers appear to have a significant relationship between their belief system and their attitude system. Since belief is characterized as what an individual knows about something, it would appear logical that the better educated individual may more accurately "know" about a situation and thus produce a better correlation between beliefs and attitudes.

Conversely, those anglers with lower SES and educational levels typically found in the contaminated zone, may rely on pre-formed value systems that are not necessarily subject to knowledge about the problem.

An area of special concern is the credibility of the Michigan Department of Natural Resources. Anglers who perceive the MDNR as a credible source of information exhibit reductions in exposure.

The model researched here did not produce consistent pathways through the model. However, education and socioeconomic status were consistently correlated with many of the other variables in the study. At one point or another, education and SES were able to correlate with area of residence, value priorities, beliefs, attitudes, and behaviors. It is clear that an anglers' educational level and socioeconomic status allow the angler to relate differently in response to the outdoors.

In an effort to increase angler response to the consumption warning, an advisory should be developed that is not dependant on age, knowledge, or socioeconomic status. An advisory that will address both the individuals value priorities and their belief systems.

This may best be approached by making an effort to report the actual risk of consumption of contaminated fish when compared to other risks in life. Unfortunately, our risk projections simply add one more risk to the life of an individual. Possibly the only effective way to do it would be to produce a multi-level warning that would be meaningful to all educational and socioeconomic groups.

Such a warning must be explanatory, not simply a directive to people that they should not do something.

They must be informed that scientists have projected that a certain degree of harm is anticipated based on the level of consumption and the anglers' efforts to reduce the contamination levels.

An effort must be made to report the range of hazards associated with daily life and the additive nature of risk. Persons that lead a high risk life may make the decision that the added risk level of 1.6-24 deaths per million per year is not significant enough to worry about (Appendix F).

On the other hand, people who lead a very conservative life, watch their diets, pursue low risk activities, may consider 1.6-24 deaths per million per year to be a totally unacceptable additional risk in life.

People must be given enough information to make their own decision, even if that decision is simply to take the word of the MDNR and not investigate the additional risks.

A multi-level warning may best be accomplished with the addition of a warning designed along the following lines.

"Scientists have determined that there is a health risk associated with eating fish from the contaminated waters listed above. These risks are thought to be highest for women of child bearing age, pregnant women, and young children.

Michigan Department of Public Health and Michigan Department of Natural Resources believe that there is sufficient evidence to recommend that women of child bearing age, pregnant women, and young children, not consume fish from the waters listed above.

Scientist have estimated an additional risk of 1.6-24 additional deaths per million anglers per year as a result of consuming these fish. The risks associated with consuming potentially contaminated fish can be reduced by specific methods of fish preparation such as removing the belly flap, filleting, broiling on a rack, or deep frying.

Additional information on chemical contaminants in each waterway, fish contamination levels, risk levels and health risks are available in the pamphlet titled "CONTAMINANTS IN MICHIGAN WATERWAYS AND ASSOCIATED HEALTH RISKS" that can be obtained from the Michigan Department of Public Health at (address for booklet here)."

This hypothetical advisory and booklet indicates that scientists believe that there is a risk, and that the MDNR and MDPH believe those scientists. This will allow individuals to simply accept the scientists, the authority of the government, or depend on the credibility of the agencies in question.

Additionally, the advisory would give real numbers to the risk comparison and allow individuals that function on a "knowledge" basis to have a sound basis for their risk judgement.

Lastly, the advisory targets high risk groups such as pregnant women and plays on their value priorities (significant others) in an effort to help reduce the exposure of Michigan anglers to contamination from consumption of chemically contaminated fish.

APPENDICES

APPENDIX A

Comments from participants in the study.

RESPONDENTS COMMENTS

(Statements in parenthesis were added by the researcher)

1001 If a person does not fish "alot", he or she would be guessing!

1004 Would like to see all our waters in Michigan cleaned up from all types of pollution.

1008 I feel one reason pollution is so bad is in the winter everyone throws garbage on the ice, and when summer comes & ice melts all garbage goes into lake. A lot of people just don't care. Something should be done.

1015 If this is a "scientific" survey you should have stayed with the subject of pollution. The "attitude" questions are not going to produce valid data for categorizing the various individuals answering the questions. Obviously, no one likes pollution, but we all contribute to it to some degree, and industry bears a share of the problem, in an effort to make the products we all want to have.

1016 If I fish a river for trout that I've heard is polluted I will catch and release. The lakes around here that are connected to the rivers around here I will usually not fish for pan fish -Ponema - Jack hat (local lakes).

1017 We owned a hunting property in the upper (U.P.) for many years. The High-Roll-aways just north of Manistique, U.P. off Rte. 94. I noted a lot of unnecessary work done during that time. Trees planted that deer do not feed on. A good grouse area moved to another area - with negative results. Allowing bear hunters to hunt with dogs - thus driving away all the game.

1020 The reason that I do not do more fishing, is because of the polluted waters and am uncertain of the quality of the fish in the state.

1021 I do not fish myself as I have had very little time to do so, unless on vacation, but that was several years ago. My 4 sons are all avid fishermen and hunters and love the outdoors so the only fish I get now are from them, which isn't to often as they are married and enjoy their won catch. Sorry I couldn't have been more helpful.

1022 I feel the DNR is doing a great job and feel there should be more officers. Keep up the good work.

1023 I have lived on Lake Ponemah, Genesee county, for 28 years and think this lake should be stocked with some smallmouth and largemouth bass as they are getting fewer and fewer.

1024 We question the inclusion of many biased "value" entries. We omitted them. They were offensive.

1029 Would like to be informed of anything learned when all the questionnaires have been evaluated.

1031 I would like to see stiffer regulations on industrial pollution with enforcement possibly the responsibility of MIOSHA. Also more license fees used to stock inland lakes for all people instead of spending so much stocking the Great Lakes for commercial Indian fisherman and other people rich enough to afford $25,000.00 boats.

1034 Interesting to note that the waters in questions 99 and 100 most all have levels of industrial chemicals in them of some degree (it was the intent of those questions to test awareness of contamination). People are eating the fish, without knowing the levels of contamination and the after effects.

1041 This is an excellent questionnaire. I enjoyed the in depth questions. I live on one of the lakes in Linden area and care deeply about water quality. In 12 years of living here I have seen a fantastic change in the water clarity from pea soup to clean water now. Shiawassee flows through the lake (the uncontaminated N. Branch of the Shiawassee) and that was the biggest polluting source. Thanks for DNR help. My property value is greatly improved!! Keep up the good work.

1045 I believe any person who is retired and with a disability should be able to buy a fishing and hunting license at a senior resident (senior citizen discount) as most disabled persons live on a fixed income and their most precious outlet is the outdoors but cannot afford its cost. Thank you.

1049 Salt that is put on the roads is going into our drinking water.

1051 1) The credibility of the DNR is basically very poor.
2) The DNR should only be involved with fish and game management. We need a separate department to handle water resources. The DNR is involved in too much, and as a result isn't doing any one responsibility too well.
3) How about turning over your final results to the MUCC?
4) You need one more question in your survey. Question 141 should be: Which is a bigger threat to the quality of fishing in Michigan;
a) water pollution
b) Indian fishing rights

1057 I enjoyed participating in this survey, I only hope it helps! Congratulations and best of luck to the DNR for the great work their doing.

1059 Questions # 59 should be completely rewritten along with the answer in the question, personal skill in avoiding health problems is the issue. The answer deals with the risk involved - unanswerable. In question # 65, are you talking about eating contaminated fish or water pollution in general? Answer # 74 depends on the level of contamination. Section V: Not familiar with Shiawassee River. Most of the fishing I do is on small or private lakes in Northern Lower or Lower Michigan for bluegill, rockbass, bass, etc. Pollution in these lakes is very low to the best of my knowledge.

1062 The DNR might know a lot about fish, but I don't feel they have any right to regulate or tell a landowner what he can do on his own property. I believe they interfere with a persons rights.

1068 I would never object to taxes going where they are supposed to go. It's safer not to fish anywhere that take chances. I would not fish or hunt for sport. Only for food. My experience with chemical contamination creates a total fear of anything relating to chemicals. But try to get away from all of it. That's a joke.

1072 Good Luck - A Good Study.

1078 Many of your questions are too vague. NO warning sign that did not include a phone number and address to contact would influence me. In most cases I fish for sport and the escape from the overstructured high paced lives that we live.

1080 Referring to question # 128 (average number of fish caught on each fishing trip) - We, as fishermen can not or should not be able to answer this question. There are many reasons why, like weather conditions or what kind of fish we are after. I could go out today and catch 10 bass with a plastic worm, but tomorrow it could be 1 or 2, or nothing at all, no matter what I throw at them, and if the wind is blowing directly form the east, I stay home and tie flies. We, anglers cannot have an average, we can not predict the outcome any more than the weather man can predict the weather. If someone tells you their average, and you believe it, then you must believe that frogs fly.

1088 1) We are both head of household.
2) I don't like to fish - it hurts the fish.
3) You have some weird items.

2003 I answered for my husband on some questions because the questions weren't specific enough. I don't eat fish, he does.

2005 Michigan has one of the best fish and wildlife programs. People from other states comment on the wild game they are able to see just by driving around. People that aren't even hunters or fishermen are thrilled just to be able to look at game. Especially deer.

It's only through a well controlled program and real sportsmen that make it possible.

I cannot fish or hunt comfortably around crowds - so miss some of the big fish runs we have. But anyone can catch fish at that time - so it's more challenging after the crowds leave, but everyone should have the opportunity to feel the thrill of catching a fish if they wish to. I think the most fun is bank fishing and certainly more comfortable for a family with kids. Campfire and maybe bake a fish - or hot dogs, but it's quite hard to find such places for most families.

I'd like to see more places built like the breakwater at the mouth of the Augres River and also at Caseville. They give opportunity for good bank fishing and also good bay fishing when the water is too rough for small crafts.

We may have to go to more controlled places such as goose hunting. Anything beats elbow to elbow or someone throwing a hook over your head. You have a line from the water to go to the restroom, and somebody else has your place when you return.

I don't believe any child sitting on a bank with a pole in his hand waiting for the "big one", is thinking about what kind of trouble he can get into. Lets make a fishing spot and an opportunity for what CAN BE one of of the most inexpensive sports for our people.

Rather it's catching the "big one" or when the wife sets the anchor in the water and turns to tell you "it just came untied", they are memories and stories you have forever. - Signed A Happy Sportsman.

2010 Dear sirs, I feel many of these questions are not needed. And this Department with all its so called smart college boys could have spent time and or money better than this questionnaire. This will be a insult to the intelligents (respondents spelling) of alot of people spending their time reading this worthless piece of paper the people doing this for a living are the inferior ones, and far from being macho as they put it. They should be giving different areas in Mich. information about findings in all area of this matter of pollution. Please let us know what the outcome of this great Dept. findings are! Michigan needs help with people like you.

2028 I don't think that your questionnaire was worth sending me another copy, costing the college money that could have been used elsewhere in your program. I do although feel that your study is necessary and should be put to the best possible use. - Mr. Concerned Citizen.

3005 In section III question 26, youth should be taught self discipline.

3011 I would like to be able to fish and eat the fish out of the Shiawassee River from Byron to Corunna, but can't seem to fins out if the fish are really safe to eat or if there is a restriction on the consumption.

Also concerning snagging of salmon this is a good source of income for Mich. and the DNR. There should be places through out the state to snag. Not only are the fish going to die anyway but it gives the person who can't afford $10,000 for a boat or a large amount of money for a charter to catch a salmon after all he did spend the money for a trout stamp.

I've seen young and old & grandmothers & grandpa's in the river trying to snag - that otherwise wouldn't have bought a trout stamp, and it does take a little more than luck when snagging.

Note - How many people at the top, running the DNR - actually got out to some of these streams and watched people enjoying themselves - thanks.

3014 You get very personal on the back page.

3015 The questions concerning the DNR, water pollution, etc, were pertinent questions. However the questions about how much income this family has, how much the home is worth, etc., and other questions are not relevant to my feelings about the DNR to be prying and offensive. So you have no way of knowing how truthfully these questions have been answered. I was as truthful as you dept. was.

3016 You had questions 12-13-14-22-46 which I felt had or have no place in this questionnaire. Best of luck!!

3017 I feel this questionnaire is excellent except for personal information. I cannot relate why it is important that I provide this information.

3019 Dear Sirs or Dear Persons, This completes a most wonderful fish story, Never heard one like IT before.

3025 It only took about 20 minutes - very good questions. The DNR should be made STRONGER. If people change, pollution, or damage freshwater, surface or underground reserves they should be made to pay - heavy - enough of the slap on the wrist stuff.

I believe oil dumping on roads and waste oil from autos is very harmful to ground water - recycle should be mandatory. Stop the salt on roads - the run off is going into the water WE ALL need. If the South needs our water supplies - tough - when was the last time a southern state helped Mich. with its industry or tax problems etc. People need to be informed about water, it is a renewable resource - but it has a limit, and it can't always be cleaned. But too many say who cares it is always there when I need it - I will clean it up later, let someone else do it.

3026 I thought some questions were irrelevant to the survey. But I do feel a concern for keeping our environment safe & clean for recreation & food source. But what can we do to solve the problem. Stop the industry from polluting the waters. What are the laws protecting these waters. I think you should use the tax money already there more wisely. We the people are taxed enough.

There are far more important problems to worry about than just water pollution. Did you know that the average person takes in more and more pollution from the air that we will ever get from eating fish. I live in the ocean so I don't care about fresh water fish, I am packed in salt water.

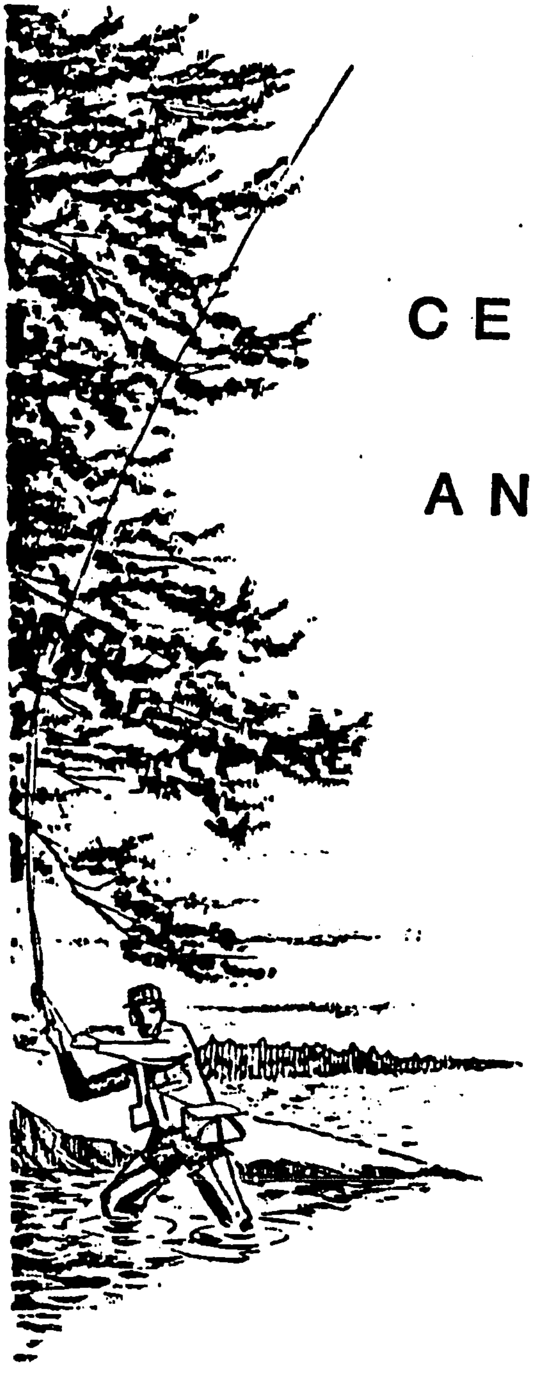
Signed - Charlie Tuna

3028 The back of my property is on a back wash of Lobdell Lake. It is a stinking, mosquito breeding mess. Is there anything you can do about it? When I first moved here 8 years ago, I contacted the DNR & Health Dept with no results - It does need attention.

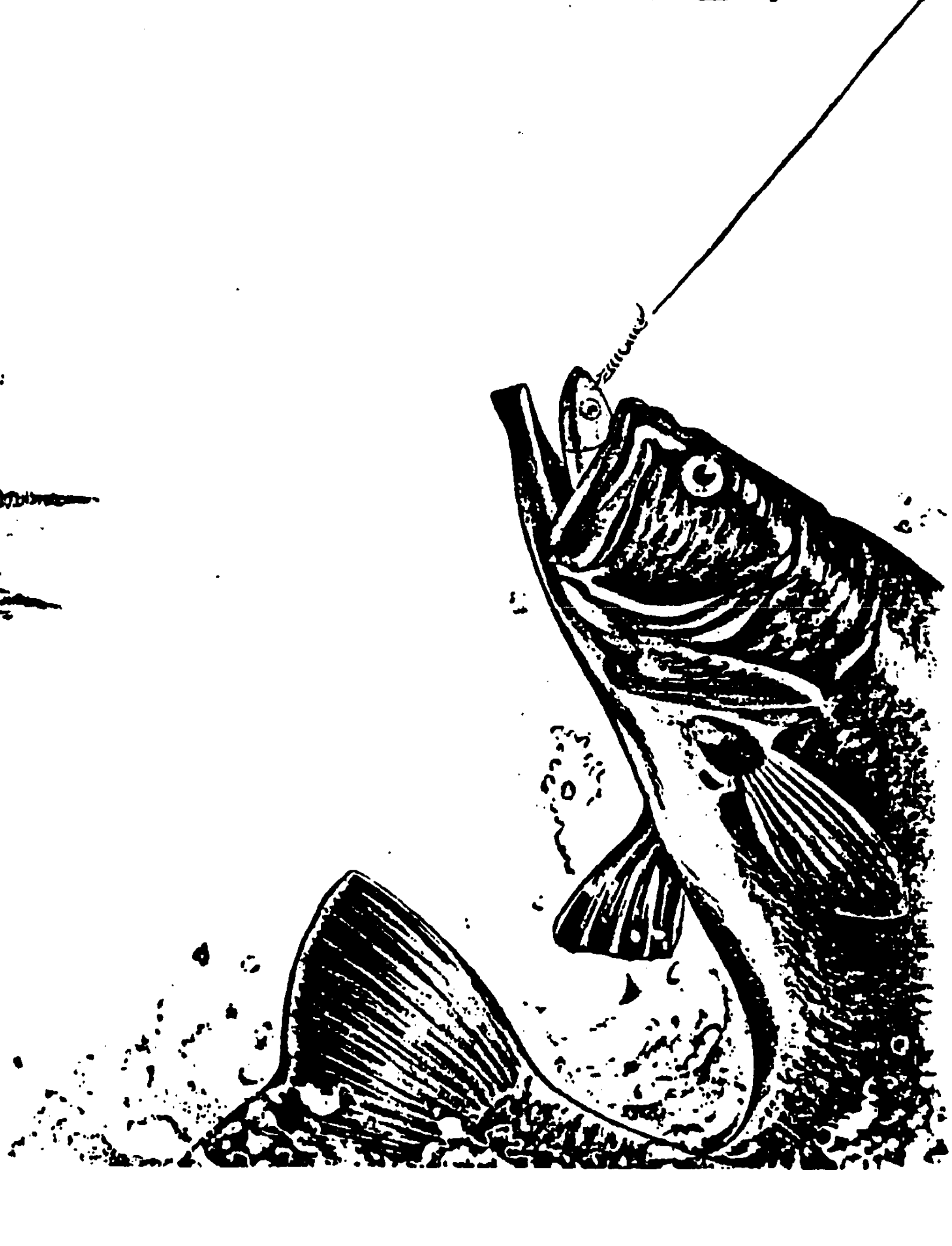
3029 I would like to explain my reason for answer to Sec. I, In 1982 my mother was at home by herself and was looking out her back window of her house which is on 33 acres in Livingston county. 13 acres of which is wooded. On this day in October she spotted two people hold up a hawk in which they shot. She called me at work and I told her to call the DNR and they told her it was a trespasse problem and to call the sheriff and they said it was a poaching problem and to call the DNR. To finish I would like to say DNR is fine for information on where to hunt & fish, but for protection on everyones' hunting and fishing privileges they are absolutely worthless.

APPENDIX B

The Questionnaire.



CENTRAL MICHIGAN ANGLER SURVEY



EAGLE CLAW
GOOD LUCK HOOK

THANK YOU FOR ACCEPTING THIS QUESTIONAIRE.

THE ATTACHED "GOOD LUCK HOOK" IS A TOKEN OF OUR APPRECIATION FOR YOUR ASSISTANCE IN THIS RESEARCH EFFORT.

THE HOOK IS YOURS TO KEEP WHETHER YOU COMPLETE THE QUESTIONAIRE OR NOT, BUT WE HOPE YOU WILL BE "HOOKED" ON HELPING US.

THANK YOU AGAIN!

Dear Angler / Non-angler,

Did you know that 20% of the worlds available fresh water is found in Michigans' Great Lakes and inland waters? Each of us depends on fresh water for our day to day existance, and each of us has a stake in Michigans' natural resources.

You have been chosen to participate in this study because of the large number of recreational opportunities in your area. Please help us to better understand your opinions on Michigan natural resources by completing this questionaire.

We realize that each of us is often more busy than we care to be, but if you could spare 30 - 45 minutes you can let others know just exactly how you feel about many aspects of Michigans' environment. You are under no obligation to participate in this project, but we would sincerely appreciate your help.

Your responses are totally confidential and anonymous, so please DO NOT SIGN OR PRINT YOUR NAME ON THIS QUESTIONAIRE.

To return the questionaire, simply peel the protective tape off the rear cover flap, fold the flap over the front cover, and place it in any mail box. The questionaire is pre-addressed and postage paid.

Your help in this research is deeply appreciated.

Very Sincerely Yours,

Gary L. Rodabaugh

Gary L. Rodabaugh, Researcher
Michigan State University
Fisheries and Wildlife Department

My completion and return of this questionaire constitutes my consent to participate in this study.

SECTION I.

FOR THE WORD PAIRS BELOW, CIRCLE THE NUMBER WHICH BEST REPRESENTS HOW YOU FEEL ABOUT THE INFORMATION YOU GET FROM THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES. FOR EXAMPLE, IF YOU THINK THAT THE DNR IS NEITHER QUALIFIED OR UNQUALIFIED, YOU WOULD CIRCLE NUMBER 4 AT THE MIDDLE OF THE SCALE.

1. RELIABLE	1	2	3	4	5	6	7	UNRELIABLE
2. INFORMED	1	2	3	4	5	6	7	UNINFORMED
3. UNQUALIFIED	1	2	2	4	5	6	7	QUALIFIED
4. INTELLIGENT	1	2	3	4	5	6	7	UNINTELLIGENT
5. VALUABLE	1	2	3	4	5	6	7	WORTHLESS
6. INEXPERT	1	2	3	4	5	6	7	EXPERT
7. BELIEVABLE	1	2	3	4	5	6	7	NOT BELIEVABLE

SECTION II.

PLEASE CIRCLE THE WORD AT THE LEFT OF EACH QUESTION THAT, IN YOUR OPINION, BEST ANSWERS THE QUESTION.

YES/NO	8. Do you read Reader's Digest?
YES/NO	9. Do national spectator sports (football, baseball, etc.) interest you?
DISAGREE/AGREE	10. "Our public education is in pretty sorry shape." Do you agree or disagree?
YES/NO	11. Do you enjoy TV?
YES/NO	12. Are you interested in having children? (Or would you be at the right age?)
MARRIED/SINGLE	13. For yourself, assuming you could carry out your decision to do things over again, do you think a single life or a married life would be more satisfactory?
DISAGREE/AGREE	14. "If people really admitted the truth, they would agree that children are more often a nuisance than a pleasure to their parents." Do you agree or disagree?
YES/NO	15. Do you think most married people lead trapped (frustrated or miserable) lives?

SECTION III.

FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.

STRONGLY AGREE	AGREE	UNCERTAIN	DISAGREE	STRONGLY DISAGREE	
1	2	3	4	5	16. Surface water usually falls on the earth a long distance from the place it is eventually used.
1	2	3	4	5	17. As it is found in streams, ponds, and reservoirs, surface water is suitable for human use.
1	2	3	4	5	18. The supply of surface water will probably never be exhausted.
1	2	3	4	5	19. Human beings cannot pollute surface water.
1	2	3	4	5	20. The capacity of nature, in any given situation, to purify polluted surface water is unlimited.
1	2	3	4	5	21. Most surface water falls on very high places and runs down to low ones.
1	2	3	4	5	22. Human beings have no influence or control over surface water in streams, ponds, and reservoirs.
1	2	3	4	5	23. Human beings have influence and control over surface water from the time it falls until the time it is used.
1	2	3	4	5	24. Chemicals that get into the surface water can get into the fish in those waters.
1	2	3	4	5	25. No weakness or difficulty can hold us back if we have enough will power.
1	2	3	4	5	26. What the youth needs most is strict dicipline, rugged determination, and the will to work and fight for family and country.
1	2	3	4	5	27. Eating fish from water that contains chemicals will not affect my health.
1	2	3	4	5	28. It is safe to eat fish from all the streams, ponds, and reservoirs within one mile of my home.
1	2	3	4	5	29. There are no chemicals in any of the waterways within one mile of my home.
1	2	3	4	5	30. Some chemicals stay in the water for a long time.
1	2	3	4	5	31. A chemically contaminated waterway will look dirty.
1	2	3	4	5	32. Most water pollution comes from industry.
1	2	3	4	5	33. People can be divided into two distinct classes: the weak and the strong.
1	2	3	4	5	34. I would obey all signs or regulations on a waterway whether they made sense to me or not.

Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree	
1	2	3	4	5	35. People who worry about chemicals in fish are inferior.
1	2	3	4	5	36. If I were to go fishing with friends or family, I would decide when and where we would go.
1	2	3	4	5	37. If a conservation officer or other official told me that fish were not safe to eat, then I wouldn't eat them.
1	2	3	4	5	38. A person who knowingly fishes in water that contains industrial chemicals is more macho than others.
1	2	3	4	5	39. I enjoy taking long walks.
1	2	3	4	5	40. I could spend hours near a forest stream watching and listening to wildlife.
1	2	3	4	5	41. I wish I could spend more time out-of-doors.
1	2	3	4	5	42. An insult to our honor should always be punished.
1	2	3	4	5	43. What this country needs most, more than laws and political programs, is a few courageous, tireless, devoted leaders in whom the people can put their faith.
1	2	3	4	5	44. Fishing is fun.
1	2	3	4	5	45. I have more fun doing things indoors than out-of-doors.
1	2	3	4	5	46. I am worried about future children's chances of living in a clean environment.
1	2	3	4	5	47. We need intensive educational programs to inform the public of environmental problems and solutions.
1	2	3	4	5	48. I find it easy to live with pollution.
1	2	3	4	5	49. I would be willing to pay more taxes if it meant that pollution problems could be significantly reduced in our society.
1	2	3	4	5	50. If mankind is going to survive at all, environmental pollution must be stopped.
1	2	3	4	5	51 I would like it better if I was the only person who fished in my favorite spot.
1	2	3	4	5	52. If there was a river running through my property, I would not let other people fish there.
1	2	3	4	5	53. I would rather NOT take my family fishing with me.
1	2	3	4	5	54. Fishing in an area with lots of people is more enjoyable than fishing by myself.

SECTION IV.

FOR QUESTIONS 55 - 64 BELOW, PLEASE CIRCLE THE NUMBER ON THE SCALE THAT BEST REPRESENTS YOUR FEELINGS ABOUT THE RISKS OF EATING FISH THAT CONTAIN POSSIBLY DANGEROUS LEVELS OF CHEMICALS.

55. Do people take the risk of eating contaminated fish voluntarily? If some of the risks are voluntarily taken and some are not, mark an appropriate spot towards the center of the scale.

RISK TAKEN VOLUNTARILY 1 2 3 4 5 6 7 RISK TAKEN INVOLUNTARILY

56. To what extent is the risk of death immediate - or is death likely to occur at some later time?

EFFECT IMMEDIATE 1 2 3 4 5 6 7 EFFECT DELAYED

57. To what extent are the risks known precisely by the persons who eat fish with possibly dangerous levels of chemicals?

RISK LEVEL KNOWN 1 2 3 4 5 6 7 RISK LEVEL NOT PRECISELY KNOWN

58. To what extent are the risks of eating these contaminated fish known to science?

RISK LEVEL KNOWN 1 2 3 4 5 6 7 RISK LEVEL NOT PRECISELY KNOWN

59. If you were to eat contaminated fish, to what extent can you, by personal skill or diligence, avoid health problems?

PERSONAL RISK CAN NOT BE CONTROLLED 1 2 3 4 5 6 7 PERSONAL RISK CAN BE CONTROLLED

60. Is the risk of eating contaminated fish new and novel or old and familiar?

NEW AND NOVEL 1 2 3 4 5 6 7 OLD AND FAMILIAR

61. Is this a risk that kills people one at a time (chronic risk) or a risk that kills large numbers of people all at once (catastrophic risk)?

CHRONIC RISK 1 2 3 4 5 6 7 CATASTROPHIC RISK

62. Is this a risk that people have learned to live with and can think about reasonably calmly, or is it one that people have a great dread for - on the level of a gut reaction?

COMMON RISK 1 2 3 4 5 6 7 DREADED RISK

63. When eating contaminated fish results in a mishap or illness, how likely is it that the consequence will be fatal?

CERTAIN NOT TO BE FATAL 1 2 3 4 5 6 7 CERTAIN TO BE FATAL

64. What are the chances that occasionally eating fish (2-4 times each month) from waters known to contain industrial chemical contamination will cause a noticeable health problem?

NO NOTICEABLE HEALTH PROBLEM 1 2 3 4 5 6 7 DEFINITE NOTICEABLE HEALTH PROBLEM

FOR QUESTIONS 65 - 74 BELOW, PLEASE CIRCLE THE NUMBER ON THE SCALE THAT BEST REPRESENTS YOUR FEELINGS ABOUT THE HEALTH RISKS OF THE POLLUTION OF MICHIGAN WATERWAYS.

65. Do people face the risk of water pollution voluntarily? If some of the risks are voluntarily taken and some are not, mark the appropriate spot towards the center of the scale.

RISK TAKEN VOLUNTARILY 1 2 3 4 5 6 7 RISK TAKEN INVOLUNTARILY

66. To what extent is the risk of death immediate - or is death likely to occur at some later time?

EFFECT IMMEDIATE 1 2 3 4 5 6 7 EFFECT DELAYED

67. To what extent are the risks known precisely by the persons who are exposed to water pollution?

RISK LEVEL KNOWN 1 2 3 4 5 6 7 RISK LEVEL NOT PRECISELY KNOWN

68. To what extent are the risks of water pollution known to science?

RISK LEVEL KNOWN 1 2 3 4 5 6 7 RISK LEVEL NOT PRECISELY KNOWN

69. If you are exposed to the risk of water pollution, to what extent can you, by personal skill or diligence, avoid health problems?

PERSONAL RISK CAN NOT BE CONTROLLED 1 2 3 4 5 6 7 PERSONAL RISK CAN BE CONTROLLED

70. Is the risk of water pollution new and novel or old and familiar?

NEW AND NOVEL 1 2 3 4 5 6 7 OLD AND FAMILIAR

71. Is this a risk that kills people one at a time (chronic risk) or a risk that kills large numbers of people all at once (catastrophic risk)?

CHRONIC RISK 1 2 3 4 5 6 7 CATASTROPHIC RISK

72. Is this a risk that people have learned to live with and can think about reasonably calmly, or is it one that people have great dread for - on the level of a gut reaction?

COMMON RISK 1 2 3 4 5 6 7 DREAD RISK

73. When exposure to water pollution results in a mishap or illness, how likely is it that the consequence will be fatal?

CERTAIN NOT TO BE FATAL 1 2 3 4 5 6 7 CERTAIN TO BE FATAL

74. What are the chances that your exposure to water pollution in Michigan will cause noticeable health problems for you or your family?

NO NOTICEABLE HEALTH PROBLEMS 1 2 3 4 5 6 7 DEFINITE NOTICEABLE HEALTH PROBLEMS

SECTION V.

BELOW ARE THREE SUBJECTS WITH FIVE PAIRS OF WORDS LISTED BELOW EACH. PLEASE CIRCLE THE NUMBER THAT BEST DESCRIBES YOUR FEELINGS ABOUT THE SUBJECT. FOR EXAMPLE, IF YOU WERE ASKED YOUR FEELINGS ABOUT SALMON SNAGGING, AND YOU THOUGHT THAT SNAGGING WAS NEITHER GOOD NOR BAD, YOU WOULD MARK THE MIDDLE OF THE SCALE (SEE BELOW).

EXAMPLE:	GOOD	1	2	3	4	5	6	7	BAD

SUBJECT 1. North branch of the Shiawassee River (Fenton to Byron).

75.	FRAGRANT	1	2	3	4	5	6	7	FOUL
76.	DIRTY	1	2	3	4	5	6	7	CLEAN
77.	FRESH	1	2	3	4	5	6	7	STALE
78.	HEALTHY	1	2	3	4	5	6	7	UNHEALTHY
79.	MUDDY	1	2	3	4	5	6	7	CLEAR

SUBJECT 2. South branch of the Shiawassee River (Howell to Corunna).

80.	FRAGRANT	1	2	3	4	5	6	7	FOUL
81.	DIRTY	1	2	3	4	5	6	7	CLEAN
82.	FRESH	1	2	3	4	5	6	7	STALE
83.	HEALTHY	1	2	3	4	5	6	7	UNHEALTHY
84.	MUDDY	1	2	3	4	5	6	7	CLEAR

SUBJECT 3. The Great Lakes (Huron, Michigan, Superior, Erie).

85.	FRAGRANT	1	2	3	4	5	6	7	FOUL
86.	DIRTY	1	2	3	4	5	6	7	CLEAN
87.	FRESH	1	2	3	4	5	6	7	STALE
88.	HEALTHY	1	2	3	4	5	6	7	UNHEALTHY
89.	MUDDY	1	2	3	4	5	6	7	CLEAR

SECTION VI.

BELOW ARE TWO PAIRS OF STATEMENTS. FOR EACH PAIR YOU ARE ASKED TO CIRCLE THE ONE STATEMENT THAT YOU MOST AGREE WITH. CIRCLE THE LETTER A OR B IN FRONT OF THE STATEMENT YOU CHOOSE.

90. If I had to choose, I would rather:

A. ACCEPT A 10% PAY INCREASE FROM MY COMPANY BECAUSE THE COMPANY HAD REDUCED ITS SPENDING FOR POLLUTION CONTROL AND FOR ENVIRONMENTAL PROTECTION.

B. KEEP MY PRESENT WAGES AND HAVE THE COMPANY SPEND 10% MORE FOR POLLUTION CONTROL AND ENVIRONMENTAL PROTECTION.

91. If I had to choose, I would rather:

A. ACCEPT A 10% PAY INCREASE FROM MY COMPANY BECAUSE THE COMPANY HAD DROPPED SOME OF MY HEALTH AND MEDICAL BENEFITS.

B. KEEP MY PRESENT WAGES AND HAVE THE COMPANY IMPROVE MY HEALTH AND MEDICAL BENEFITS.

MOST PEOPLE FEEL THAT SOME REASONS FOR ENJOYING OUT-OF-DOORS ACTIVITIES ARE MORE IMPORTANT THAN OTHERS. TO HELP US FIND OUT WHAT YOU FEEL IS MOST IMPORTANT, IMAGINE THAT YOU HAVE 100 POINTS TO DIVIDE AMONG THE 6 CATEGORIES LISTED BELOW. FOR EXAMPLE, IF "FREEDOM OF WILL" IS VERY IMPORTANT TO YOUR ENJOYMENT OF THE OUT-OF-DOORS, YOU MAY WANT TO GIVE MOST OF THE 100 POINTS TO THAT CATEGORY AND DIVIDE THE REMAINING POINTS AMONG THE OTHER 5 CATEGORIES. PLEASE PLACE THE POINTS IN THE BLANK PROVIDED AT THE LEFT OF EACH CATEGORY.

92. ____ HEALTH - OUTDOOR ACTIVITIES IMPROVE OR MAINTAIN MY HEALTH AND/OR MY FAMILIES HEALTH.

93. ____ ECONOMICS - OUTDOOR ACTIVITIES OFFER A RELATIVELY INEXPENSIVE FORM OF RECREATION.

94. ____ RECREATIONAL EXPERIENCE - OUTDOOR ACTIVITIES PROVIDE MUCH SATISFACTION AND ENJOYMENT.

95. ____ FREEDOM OF WILL - I GET A SATISFYING SENSE OF FREEDOM FROM OUTDOOR ACTIVITIES WHICH ALLOW ME TO DO WHAT I WANT TO, WHEN I WANT TO.

96. ____ TRADITIONALISM - I HAVE ALWAYS ENJOYED OUTDOOR ACTIVITIES.

97. ____ SOCIALIZATION - I PARTICIPATE IN OUTDOOR ACTIVITIES BECAUSE MY FRIENDS DO.

TOTAL 100 POINTS

98. DID YOU GO FISHING TWO TIMES OR MORE IN THE LAST 12 MONTHS?

______ YES ----- *PLEASE CONTINUE WITH QUESTION 99.*

______ NO ------ *PLEASE SKIP TO QUESTION 130 AND COMPLETE THE QUESTIONNAIRE.*

99. Have you fished in any of the waters listed below in the last 12 months? If your answer is "NO", please mark the box on the left. If your answer is "YES", mark the "YES" box AND please indicate the number of times you fished there in the last 12 months.

NO	YES	NUMBER OF TIMES?	
			Shiawassee River (N. Branch, Fenton to Byron)
			Shiawassee River (S. Branch, Howell to Corunna)
			Deer Lake
			Carp River
			Carp Creek (Marquette County)
			Tittabawassee River (Downstream from Dow Dam)
			Saginaw River
			Pine River (Downstream from St. Louis)
			Chippewa River (Downstream from mouth of Pine River)
			Raisin River (Downstream from Monroe Dam)
			Portage Creek (Downstream from Milham Park)
			Cass River (Downstream from Bridgeport)
			Grand River (Clinton County)
			Lake Macatawa
			Hersey River (Near Reed City)
			St. Joseph River (Downstream from Berrien Springs Dam)
			Kalamazoo River (Downstream from Kalamazoo)
			Lake Michigan
			Lake Superior
			Lake Huron
			Lake St. Clair
			Detroit River
			St. Clair River
			Lake Erie

100. Please place a check mark next to any of the waters listed below that you think may contain potentially dangerous levels of industrial chemicals.

- ______ Shiawassee River (N. Branch, Fenton to Byron)
- ______ Shiawassee River (S. Branch, Howell to Corunna)
- ______ Deer Lake
- ______ Carp River
- ______ Carp Creek (Marquette County)
- ______ Tittabawassee River (Downstream from Dow Dam)
- ______ Saginaw River
- ______ Pine River (Downstream from St. Louis)
- ______ Chippewa River (Downstream from mouth of Pine River)
- ______ Raisin River (Downstream from Monroe Dam)
- ______ Portage Creek (Downstream from Milham Park)
- ______ Cass River (Downstream from Bridgeport)
- ______ Grand River (Clinton County)
- ______ Lake Macatawa
- ______ Hersey River (Near Reed City)
- ______ St. Joseph River (Downstream from Berrien Springs Dam)
- ______ Kalamazoo River (Downstream from Kalamazoo)
- ______ Lake Michigan
- ______ Lake Superior
- ______ Lake Huron
- ______ Lake St. Clair
- ______ Detroit River
- ______ St. Clair River
- ______ Lake Erie

101. Have you eaten ANY fish from the following waters in the past 12 months?

____ NO ---- GO TO 102.

____ YES

ABOUT HOW MANY MEALS OF FISH HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? ________

Shiawassee River (S. Branch. Howell to Corunna)

Deer Lake
Carp River
Carp Creek (Marquette County)
Tittabawassee River (Downstream from Dow Dam)
Saginaw River
Pine River (Downstream from St. Louis)
Chippewa River (Downstream from mouth of Pine)
Raisin River (Downstream from Monroe Dam)
Portage Creek (Downstream from Milham Park)
Cass River (Downstream from Bridgeport)

102. Have you eaten CARP from any of the following waters in the past 12 months?

____ NO ---- GO TO 103.

____ YES

ABOUT HOW MANY MEALS OF CARP HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? ________

Grand River (Clinton County)
Lake Macatawa
St. Joseph River (Near Berrien Springs)
Kalamazoo River (Downstream from Kalamazoo)
Lake Michigan
Lake Erie
Saginaw Bay

103. Have you eaten BULLHEADS OR CATFISH from any of the following waters in the past 12 months?

____ NO ---- GO TO 104.

____ YES

ABOUT HOW MANY MEALS OF CATFISH HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? ________

Hersey River (Near Reed City)
Lake Michigan
Lake Erie
Saginaw Bay

104. Have you eaten SUCKERS from the Kalamazoo River (Downstream from Kalamazoo) in the past 12 months?

____ NO ---- GO TO 105.

____ YES

ABOUT HOW MANY MEALS OF SUCKERS HAVE YOU AND YOUR FAMILY EATEN FROM THE KALAMAZOO RIVER IN THE PAST 12 MONTHS? ______

105. Have you eaten any TROUT from any of the following waters in the past 12 months?

____ NO ---- GO TO 106.

____ YES

ABOUT HOW MANY MEALS OF TROUT HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? ______

Hersey River (Near Reed City)
Lake Michigan
Lake Huron
Lake Superior (Lake trout only)

106. Have you eaten any MUSKELLUNGE (MUSKY) from any of the following waters in the past 12 months?

____ NO ---- GO TO 107.

____ YES

ABOUT HOW MANY MEALS OF MUSKY HAVE YOU AND YOUR FAMILY EATEN FROM THESE WATERS IN THE PAST 12 MONTHS? _____

Lake Huron
Lake St. Clair
Lake Erie
St. Clair River
Detroit River

107. Have you eaten SALMON from Lake Michigan or Lake Huron (or salmon migration streams running into Lake Michigan or Lake Huron) in the past 12 months?

____ NO ---- GO TO 108.

____ YES --- ABOUT HOW MANY MEALS OF SALMON HAVE YOU AND YOUR FAMILY EATEN FROM LAKE MICHIGAN OR LAKE-HURON IN THE PAST 12 MONTHS? ______

108. Have you eaten WHITEFISH from Lake Michigan waters in the past 12 months?

____ NO ---- GO TO 109.

____ YES --- ABOUT HOW MANY MEALS OF WHITEFISH HAVE YOU AND YOUR FAMILY EATEN FROM LAKE MICHIGAN IN THE PAST 12 MONTHS? _____

LISTED BELOW ARE SEVERAL METHODS USED WHEN GETTING FISH READY TO COOK. PLEASE PUT A CHECK IN THE SPACE NEXT TO THE METHODS YOU USUALLY USE. MARK AS MANY AS APPLY.

109. ____ I DON'T EAT FISH

110. ____ SKIN THE FISH BEFORE COOKING.

111. ____ SCALE THE FISH BUT LEAVE THE SKIN ON

112. ____ REMOVE BELLY FLAP

113. ____ FILLET FISH

114. ____ OTHER (please explain) ______________________________

LISTED BELOW ARE SEVERAL COOKING METHODS FOR FISH. PLEASE PUT A CHECK IN THE SPACE NEXT TO THE METHODS YOU USUALLY USE WHEN COOKING YOUR CATCH. MARK AS MANY AS APPLY.

115. ____ I DON'T EAT FISH

116. ____ BROIL ON RACK

117. ____ COOK THE FISH WHOLE (HEAD, TAIL, AND ALL)

118. ____ DEEP FRY

119. ____ POACHED

120. ____ EAT RAW

121. ____ OTHER (please explain)______________________________

122. On the average, when I fish I keep: (CHECK ONE)

____ 0% OF THE FISH
____ 1% TO 20% OF THE FISH
____ 20% TO 40% OF THE FISH
____ 40% TO 60% OF THE FISH
____ 60% TO 80% OF THE FISH
____ 80% TO 100% OF THE FISH

123. Of the fish I keep, I personally eat: (CHECK ONE)

____ 0% OF THE FISH
____ 1% TO 20% OF THE FISH
____ 20% TO 40% OF THE FISH
____ 40% TO 60% OF THE FISH
____ 60% TO 80% OF THE FISH
____ 80% TO 100% OF THE FISH

124. When I keep fish, my spouse usually eats: (CHECK ONE)

____ THE SAME NUMBER OF MEALS OF FISH THAT I DO.
____ MORE MEALS OF FISH THAN I DO.
____ FEWER MEALS OF FISH THAN I DO.

125. When I keep fish, my children usually eat: (CHECK ONE)

____ THE SAME NUMBER OF MEALS OF FISH THAT I DO.
____ MORE MEALS OF FISH THAN I DO.
____ FEWER MEALS OF FISH THAN I DO.

126. In the last 5 years, how many times have you:

____ A. PURCHASED A FISHING LICENSE?

____ B. HAD YOUR SPOUSE PURCHASE A SEPARATE FISHING LICENSE?

____ C. PUT YOUR SPOUSE ON YOUR FISHING LICENSE?

____ D. READ THE BOOKLET THAT COMES WITH THE FISHING LICENSE?

127. ____ ABOUT HOW MANY TIMES HAVE YOU GONE FISHING IN THE PAST 12 MONTHS?

128. ____ ON THE AVERAGE, HOW MANY FISH DO YOU CATCH EACH TIME YOU GO FISHING?

129. ____ ON THE AVERAGE, HOW MANY HOURS DO YOU SPEND ON THE WATER EACH TIME YOU GO FISHING?

BELOW ARE THREE SIGNS THAT YOU MIGHT SEE ON THE SHORE OF A RIVER, LAKE, OR POND. PLEASE ANSWER THE QUESTION ON THE LEFT BY CIRCLING THE ANSWER THAT IS CLOSEST TO HOW YOU FEEL ABOUT EACH SIGN. ANSWER EACH QUESTION FOR EACH OF THE SIGNS. YOU WILL HAVE THREE CIRCLES FOR EACH QUESTION.

	Do not eat any fish from these waters.	*Do not eat carp, trout, catfish, suckers or muskellunge from these waters.*	*Children, and women who are pregnant, nursing, or expect to bear children, should not eat fish from these waters. All others should not eat more than one meal per week.*
130. If this sign were placed on your favorite fishing area, would you still fish there?	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**
131. If you decided to keep fishing there, would you eat the fish from this water?	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**
132. Would you allow your family to eat fish from this area?	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**
133. Have you seen this warning, or a similar warning, before on any Michigan water?	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**
134. Have you seen this type of warning in print before? (newspaper, booklet, book, etc.)	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**	**YES** **NO** **UNCERTAIN**

THIS PAGE REQUESTS INFORMATION THAT WILL AID US IN OUR RESEARCH. AGAIN, ALL INFORMATION OBTAINED FROM THIS QUESTIONNAIRE IS TOTALLY CONFIDENTIAL.

THIS PAGE REQUESTS INFORMATION THAT WILL AID US IN OUR RESEARCH. AGAIN, ALL INFORMATION OBTAINED FROM THIS QUESTIONNAIRE IS TOTALLY CONFIDENTIAL

135. Your Formal School Training. Please circle the highest grade completed.

a. Grade School	: 1 2 3 4 5 6 7 8
b. High School	: 1 2 3 4
c. College	: 1 2 3 4
d. Graduate Study	: 1 2 3 4
e. Other	: 1 2 3 4 5 6 7 8

136. House Value: How much would the house in which you are living sell for at the present time?

___ a. Under $20,000
___ b. $20,000 - 29,999
___ c. $30,000 - 39,999
___ d. $40,000 - 49,999
___ e. $50,000 - 59,999
___ f. $60,000 or more

137. Income: Please check the income range which indicates the total income for all your family members during 1983.

___ a. $0 - 9,999	___ g. $40,000 - 44,999
___ b. $10,000 - 14,999	___ h. $45,000 - 49,999
___ c. $15,000 - 19,999	___ i. $50,000 - 54,999
___ d. $20,000 - 24,999	___ j. $55,000 - 59,999
___ e. $25,000 - 29,999	___ k. $60,000 - 64,999
___ f. $30,000 - 34,999	___ l. $65,000 or more

138. Occupation of Household Head: Please write in the type of work done by the head of the household to earn a living. Be as specific as possible. ______________________

____

____

If the person filling out this questionnaire is not the head of the household, please indicate your occupation here: ______________________

____

139. YOUR AGE? ________

140. MALE OR FEMALE (CIRCLE ONE)

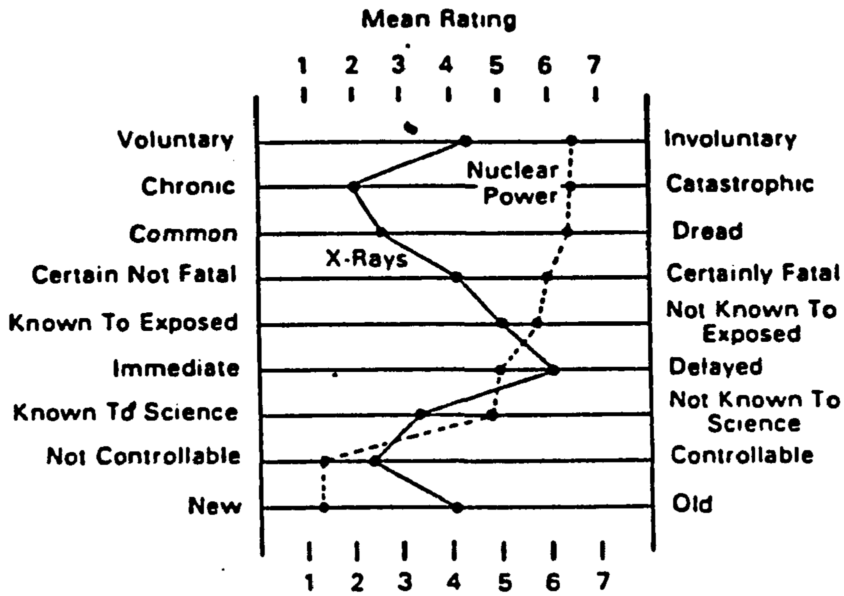
Please feel free to write any comments you may have on this back cover. We are interested in your opinions.

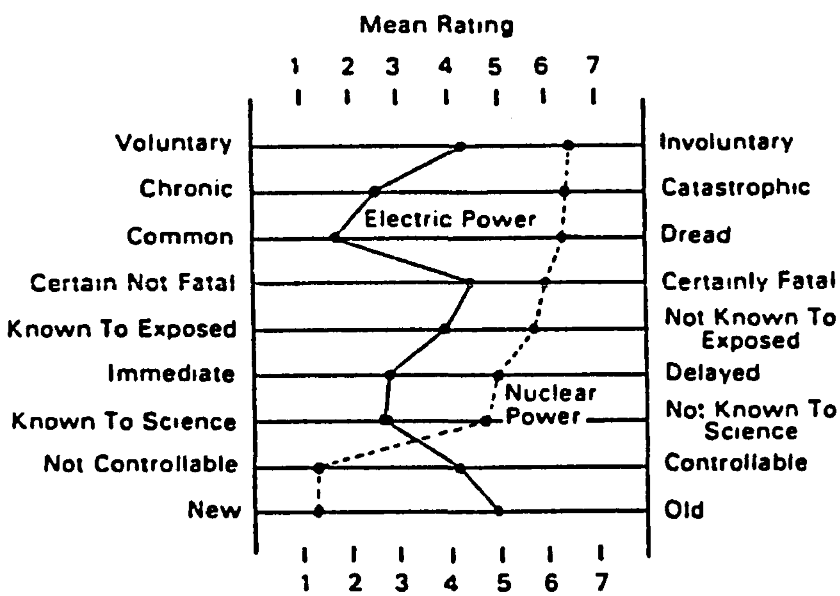
TO RETURN QUESTIONAIRE, PEEL OFF BACKING ON REAR FLAP, FOLD FLAP OVER FRONT COVER, STICK, AND MAIL.

APPENDIX C

Risk Ratings.

APPENDIX C





From Slovic et al (1980). Rated characteristics of risk for nuclear power and related technologies. (NOTE. Items "Not Controllable - Controllable" and "New - Old" were reverse scored for this research.)

APPENDIX D

University Committee on Research Involving Human Subjects
Approval Form.

August 27, 1984

Dr. H. Bredeck
238 Administration Building
Michigan State University
East Lansing, Mi 48824-1046

Dr. Bredeck:

Per our conversation on 8-24-84:

1. The code number on the questionaire is used for followup contact on the household.

2. First followup contact will be two weeks after initial contact.

3. Second followup contact will be one week after first followup. No further contacts will be attempted.

4. Households will be identified by random selection of residence locations, i.e. 1st, 3rd, 7th, etc. household on block. Family names will not be known at any point in the research.

5. If subject does not want to participate, he will be advised to simply send it back blank. This subject will then be listed as having responded with a "refusal to participate."

6. Only the head anglers first name will be written on the questionaire. The last name will never be known by the researcher. The cover of the questionaire, containing the first name and code number will be destroyed upon receipt of the questionaire by the researcher.

7. The followup contact list will be destroyed immediately after the second followup.

8. Individual respondents are not identifiable by name, address, code number, or location once the questionaire has been returned. After second followup and the destruction of the followup list, no member of the sample population is identifiable in any manner.

I hope that this response contains the information needed to exempt this research project.

Please feel free to contact me at any time.

Gary L Rodabaugh

Gary Rodabaugh
Sr. Environmental Specialist
Chev. Flint Mfg.
Flint, Mi 48555
(313) 766-4914

Home: PO Box 112
Byron, Mi 48418
(313) 266-5584

MICHIGAN STATE UNIVERSITY

UNIVERSITY COMMITTEE ON RESEARCH INVOLVING
HUMAN SUBJECTS (UCRIHS)
238 ADMINISTRATION BUILDING
(517) 355-2186

EAST LANSING • MICHIGAN • 48824

August 31, 1984

Mr. Gary Rodabaugh
P.O. Box 112
Byron, Michigan 48418

Dear Mr. Rodabaugh:

Subject: Proposal Entitled, "A Study to Evaluate the Effectiveness of Fish Consumption Warnings on the Behavior of Anglers on Contaminated Waterways"

I am pleased to advise that I concur with your evaluation that this project is exempt from full UCRIHS review, and approval is herewith granted for conduct of the project.

You are reminded that UCRIHS approval is valid for one calendar year. If you plan to continue this project beyond one year, please make provisions for obtaining appropriate UCRIHS approval prior to August 31, 1985.

Any changes in procedures involving human subjects must be reviewed by the UCRIHS prior to initiation of the change. UCRIHS must also be notified promptly of any problems (unexpected side effects, complaints, etc.) involving human subjects during the course of the work.

Thank you for bringing this project to my attention. If I can be of any future help, please do not hesitate to let me know.

Sincerely,

H E Bredeck

Henry E. Bredeck
Chairman, UCRIHS

HEB/jms

cc: Peyton

MSU is an Affirmative Action/Equal Opportunity Institution

APPENDIX E

Correct answers for Water Quality questions.

FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.

1 STRONGLY AGREE	2 AGREE	3 UNCERTAIN	4 DISAGREE	5 STRONGLY DISAGREE	
$\boxed{1}$	$\boxed{2}$	3	4	5	16. Surface water usually falls on the earth a long distance from the place it is eventually used.
1	2	$\boxed{3}$	$\boxed{4}$	$\boxed{5}$	17. As it is found in streams, ponds, and reservoirs, surface water is suitable for human use.
1	2	3	$\boxed{4}$	$\boxed{5}$	18. The supply of surface water will probably never be exhausted.
1	2	3	$\boxed{4}$	$\boxed{5}$	19. Human beings cannot pollute surface water.
1	2	3	$\boxed{4}$	$\boxed{5}$	20. The capacity of nature, in any given situation, to purify polluted surface water is unlimited.
1	2	3	$\boxed{4}$	$\boxed{5}$	21. Most surface water falls on very high places and runs down to low ones.
1	2	3	$\boxed{4}$	$\boxed{5}$	22. Human beings have no influence or control over surface water in streams, ponds, and reservoirs.
$\boxed{1}$	$\boxed{2}$	3	4	5	23. Human beings have influence and control over surface water from the time it falls until the time it is used.

<u>FIGURE 9 - WATER QUALITY LITERATURE SCALE QUESTIONS</u> (WQ1)

$\boxed{}$ - Answers scored as correct.

1 STRONGLY AGREE	2 AGREE	3 UNCERTAIN	4 DISAGREE	5 STRONGLY DISAGREE	FOR EACH OF THE FOLLOWING STATEMENTS, CIRCLE THE ONE NUMBER ON THE LEFT SIDE OF THE PAGE TO INDICATE WHICH ANSWER IS MOST NEARLY ACCURATE FOR YOU.
1	2	3	4	5	24. Chemicals that get into the surface water can get into the fish in those waters.
		*			* * * *
1	2	3	4	5	27. Eating fish from water that contains chemicals will not affect my health.
1	2	3	4	5	28. It is safe to eat fish from all the streams, ponds, and reservoirs within one mile of my home.
1	2	3	4	5	29. There are no chemicals in any of the waterways within one mile of my home.
1	2	3	4	5	30. Some chemicals stay in the water for a long time.
1	2	3	4	5	31. A chemically contaminated waterway will look dirty.
1	2	3	4	5	32. Most water pollution comes from industry.

FIGURE 10 - WATER QUALITY SITUATIONAL QUESTIONS (WQ2)

□ - Answers scored as correct in all zones.

▽ - Answers scored as correct in the contaminated zone only.

○ - Answers scored as correct in the non-contaminated zone only.

APPENDIX F

Risk of death from eating contaminated fish from Lakes Superior and Michigan.

RISK OF DEATH FROM EATING CONTAMINATED FISH FROM LAKES SUPERIOR AND MICHIGAN

Lake Superior
1 cancer/1000 anglers/lifetime
= .001 cancers/lifetime
assume 75 year lifetime
=.001 / 75 = .000013 cancers/yr
assume 50% fatality from cancer
= .0000066 death/year
X 12% calculated exposure for study population
= 1.6×10^{-6} death risk/year

Lake Michigan
3 cancers/100 anglers/lifetime
=.03 cancers/lifetime
assume 75 year lifetime
= .03 / 75 = .0004
assume 50% mortality
= .0002 death/year
X 12% calculated exposure for study population
= 2.4×10^{-5} death risk/year

Bro et al (1987) estimates the number of additional cancers expected in Great Lakes anglers who consume one meal of Great Lakes fish per week for their entire lifetime.

From that we have assumed a 75 year lifespan and that one half of the cancers developed will be fatal.

Additionally, our subjects were found to consume aproximately 12% of the amount of fish per year projected by Bro, therefore the calculations are corrected accordingly.

APPENDIX G

Zero order correlations block.

- - - - - - - - - - - - - - - P E A R S O N   C O R R E L A T I O N   C O E F F I C I E N T S - - - - - - - - - - - - - - -

	SC	A1	A2	WQ1	WQ2	MCH1	MCH2	EIMP	RSKE	RSKC	NEN
SC	1.0000 (0) P= .	.0928 (125) P= .152	-.0743 (125) P= .205	-.1411 (125) P= .058	-.0093 (125) P= .459	-.1299 (125) P= .074	-.0040 (125) P= .482	.0377 (125) P= .338	.0849 (125) P= .173	-.1039 (125) P= .124	.0144 (125) P= .437
A1	.0928 (125) P= .152	1.0000 (0) P= .	.0587 (125) P= .258	-.0109 (125) P= .452	.1077 (125) P= .116	.0214 (125) P= .406	.0519 (125) P= .283	.0159 (125) P= .430	.1282 (125) P= .077	.1068 (125) P= .118	.0645 (125) P= .238
A2	-.0743 (125) P= .205	.0587 (125) P= .258	1.0000 (0) P= .	-.0788 (125) P= .191	.0270 (125) P= .383	-.0123 (125) P= .446	.1146 (125) P= .102	.0633 (125) P= .242	.0563 (125) P= .266	-.0908 (125) P= .157	-.0647 (125) P= .237
WQ1	-.1411 (125) P= .058	-.0109 (125) P= .452	-.0788 (125) P= .191	1.0000 (0) P= .	-.0053 (125) P= .477	-.0693 (125) P= .221	-.2175 (125) P= .007	.1147 (125) P= .101	.0858 (125) P= .171	.0968 (125) P= .141	-.0298 (125) P= .371
WQ2	-.0093 (125) P= .459	.1077 (125) P= .116	.0270 (125) P= .383	-.0053 (125) P= .477	1.0000 (0) P= .	.1056 (125) P= .121	-.0696 (125) P= .220	.1502 (125) P= .047	.0172 (125) P= .425	.0578 (125) P= .261	.0288 (125) P= .375
MCH1	-.1299 (125) P= .074	.0214 (125) P= .406	-.0123 (125) P= .446	-.0693 (125) P= .221	.1056 (125) P= .121	1.0000 (0) P= .	.2890 (125) P= .001	.1490 (125) P= .049	-.1642 (125) P= .034	-.0097 (125) P= .457	-.1257 (125) P= .081
MCH2	-.0040 (125) P= .482	.0519 (125) P= .283	.1146 (125) P= .102	-.2175 (125) P= .007	-.0696 (125) P= .220	.2890 (125) P= .001	1.0000 (0) P= .	-.1403 (125) P= .059	-.1802 (125) P= .022	-.0868 (125) P= .168	.0109 (125) P= .452
EIMP	.0377 (125) P= .338	.0159 (125) P= .430	.0633 (125) P= .242	.1147 (125) P= .101	.1502 (125) P= .047	.1490 (125) P= .049	-.1403 (125) P= .059	1.0000 (0) P= .	.1603 (125) P= .037	.1490 (125) P= .049	-.1760 (125) P= .025
RSKE	.0849 (125) P= .173	.1282 (125) P= .077	.0563 (125) P= .266	.0858 (125) P= .171	.0172 (125) P= .425	-.1642 (125) P= .034	-.1802 (125) P= .022	.1603 (125) P= .037	1.0000 (0) P= .	.5247 (125) P= .000	-.0721 (125) P= .212
RSKC	-.1039 (125) P= .124	.1068 (125) P= .118	-.0908 (125) P= .157	.0968 (125) P= .141	.0578 (125) P= .261	-.0097 (125) P= .457	-.0868 (125) P= .168	.1490 (125) P= .049	.5247 (125) P= .000	1.0000 (0) P= .	-.1586 (125) P= .039
NEN	.0144 (125) P= .437	.0645 (125) P= .238	-.0647 (125) P= .237	-.0298 (125) P= .371	.0288 (125) P= .375	-.1257 (125) P= .081	.0109 (125) P= .452	-.1760 (125) P= .025	-.0721 (125) P= .212	-.1586 (125) P= .039	1.0000 (0) P= .
NES	-.0563 (125) P= .266	.0083 (125) P= .463	-.0473 (125) P= .300	-.0793 (125) P= .190	-.0074 (125) P= .467	.0923 (125) P= .153	.1295 (125) P= .075	.1795 (125) P= .023	.0678 (125) P= .226	.2162 (125) P= .008	-.4514 (125) P= .000
NEGL	-.2410 (125) P= .003	.0476 (125) P= .299	.1513 (125) P= .046	.0225 (125) P= .402	.1057 (125) P= .120	.2645 (125) P= .001	.0328 (125) P= .358	.2291 (125) P= .005	.0957 (125) P= .144	.1539 (125) P= .043	-.3835 (125) P= .000
VPH	-.2169 (125) P= .008	.0471 (125) P= .301	.0513 (125) P= .285	-.0072 (125) P= .468	.0795 (125) P= .189	.1913 (125) P= .016	.1200 (125) P= .091	-.0236 (125) P= .397	-.1522 (125) P= .045	-.0095 (125) P= .458	-.1700 (125) P= .029
VPE	-.0386 (125) P= .335	-.0827 (125) P= .180	.0466 (125) P= .303	-.0107 (125) P= .453	.1656 (125) P= .033	-.1776 (125) P= .024	.0036 (125) P= .484	-.0179 (125) P= .421	-.1421 (125) P= .057	-.1012 (125) P= .131	-.0316 (125) P= .363

(COEFFICIENT / (CASES) / 1-TAILED SIG)   " . " IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED

- - - - - - - - - - - - - - P E A R S O N C O R R E L A T I O N C O E F F I C I E N T S - - - - - - - - - - - - - -

	SC	A1	A2	WQ1	WQ2	MCH1	MCH2	EIMP	RSKE	RSKO	NEN
VPR	.1475	-.0344	-.0139	.0293	-.0222	-.2029	-.1756	-.1215	.0301	.0357	.1640
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .050	P= .352	P= .439	P= .373	P= .403	P= .012	P= .025	P= .088	P= .369	P= .346	P= .034
VPF	.0957	-.0441	-.0305	-.0026	-.0766	.0347	.0276	.1481	.1546	.0923	-.0199
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .144	P= .313	P= .368	P= .489	P= .198	P= .351	P= .380	P= .050	P= .043	P= .153	P= .413
VPT	.0145	.1078	-.0465	-.0414	-.0966	.1002	.0371	.0161	.0813	-.1209	.0549
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .436	P= .116	P= .303	P= .324	P= .142	P= .133	P= .341	P= .429	P= .184	P= .090	P= .272
VPS	-.0454	.0165	.0065	.0635	.0443	.0499	-.0266	.0467	-.0035	.0739	-.0040
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .307	P= .428	P= .471	P= .241	P= .312	P= .290	P= .384	P= .302	P= .484	P= .206	P= .482
PCCN	-.0351	.1234	.1229	.1914	.0698	.0163	-.0198	.0688	.0387	.0040	.1659
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .349	P= .085	P= .086	P= .016	P= .220	P= .429	P= .413	P= .223	P= .334	P= .483	P= .032
AWEX	.0353	.0995	.0459	.1703	.0082	.1113	.0818	.2585	.1299	.0436	-.0758
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .348	P= .135	P= .306	P= .029	P= .464	P= .108	P= .182	P= .002	P= .074	P= .315	P= .200
TOEX	-.2776	-.0031	-.0115	.1132	-.1248	-.0756	.0359	-.0040	-.0948	-.0532	.0239
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .001	P= .486	P= .449	P= .104	P= .083	P= .201	P= .345	P= .482	P= .147	P= .278	P= .396
RECC	-.0512	-.0360	-.0714	.1307	-.1901	.1081	-.0199	.1976	-.1101	-.0491	-.0696
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .285	P= .345	P= .214	P= .073	P= .017	P= .115	P= .413	P= .014	P= .111	P= .293	P= .220
FCPY	.0661	-.0801	.1647	-.0073	-.0015	.1790	.0337	.1983	.0185	.0276	.0717
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .232	P= .187	P= .033	P= .468	P= .494	P= .023	P= .355	P= .013	P= .419	P= .380	P= .213
FHPY	-.1225	.0379	.2039	.0756	.0148	.0883	.0591	.1468	.1504	.0738	.1845
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .087	P= .337	P= .010	P= .201	P= .435	P= .164	P= .256	P= .051	P= .047	P= .207	P= .020
ED	-.0112	-.0549	.1635	.1645	-.1812	-.3902	-.2236	-.0260	.0419	-.0453	.0349
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .451	P= .271	P= .034	P= .033	P= .022	P= .000	P= .006	P= .387	P= .321	P= .308	P= .350
AGE	.0123	.0170	-.2915	.2118	.1551	-.0296	.0593	-.2001	.0169	.0460	.1120
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .446	P= .425	P= .000	P= .009	P= .042	P= .371	P= .256	P= .013	P= .426	P= .305	P= .107
SEX	-.0086	-.0164	-.0386	.0998	.2051	.0413	.0570	-.0911	-.0274	.0296	.0405
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .462	P= .428	P= .335	P= .134	P= .011	P= .324	P= .264	P= .156	P= .381	P= .372	P= .327
SES	-.0571	-.0215	.0345	.1520	-.0725	-.1147	-.2308	-.2665	-.0497	-.0457	.0971
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .264	P= .406	P= .351	P= .045	P= .211	P= .101	P= .005	P= .001	P= .291	P= .306	P= .141
PREC	-.0585	.0081	-.1631	.0284	.1860	-.0252	-.1354	.0389	-.1187	-.0439	.0063
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .258	P= .464	P= .035	P= .377	P= .019	P= .390	P= .066	P= .333	P= .094	P= .314	P= .472

~~(COEFFICIENT / (CASES) / 1-TAILED SIG)~~ " . " IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED

- - - - - - - - - - - - - - P E A R S O N   C O R R E L A T I O N   C O E F F I C I E N T S - - - - - - - - - - - - - -

	SC	A1	A2	WQ1	WQ2	MCH1	MCH2	EIMP	RSKE	RSKO	NEN
ETWC	.0474	-.0607	.0196	.0398	.0668	-.0634	-.0801	-.0450	-.0740	-.1086	-.0295
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .300	P= .251	P= .414	P= .330	P= .229	P= .241	P= .187	P= .309	P= .206	P= .114	P= .372
GM	-.0507	-.0347	.1760	.0730	-.0706	-.0234	-.0543	.0643	.1765	.0744	-.0138
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .287	P= .350	P= .025	P= .209	P= .217	P= .398	P= .274	P= .238	P= .024	P= .205	P= .439
ZONE	.1761	.0062	-.0460	.0772	-.4631	-.1198	-.1866	-.1082	.1422	.0104	.0686
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .025	P= .473	P= .305	P= .196	P= .000	P= .092	P= .019	P= .115	P= .057	P= .454	P= .224

(COEFFICIENT / (CASES) / 1-TAILED SIG)   " . " IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED

- - - - - - - - - - - - - - - P E A R S O N   C O R R E L A T I O N   C O E F F I C I E N T S - - - - - - - - - - - - - - -

	NES	NEGL	VPH	VPE	VPR	VPF	VPT	VPS	PCCN	AWEX	TOEX
SC	-.0563 (125) P= .266	-.2410 (125) P= .003	-.2169 (125) P= .008	-.0386 (125) P= .335	.1475 (125) P= .050	.0957 (125) P= .144	-.0145 (125) P= .436	-.0454 (125) P= .307	-.0351 (125) P= .349	.0353 (125) P= .348	-.2776 (125) P= .001
A1	.0083 (125) P= .463	.0476 (125) P= .299	.0471 (125) P= .301	-.0827 (125) P= .180	-.0344 (125) P= .352	-.0441 (125) P= .313	.1078 (125) P= .116	.0165 (125) P= .428	.1234 (125) P= .085	.0995 (125) P= .135	-.0031 (125) P= .486
A2	-.0473 (125) P= .300	.1513 (125) P= .046	.0513 (125) P= .285	.0466 (125) P= .303	-.0139 (125) P= .439	-.0305 (125) P= .368	-.0465 (125) P= .303	.0065 (125) P= .471	.1229 (125) P= .086	.0459 (125) P= .306	-.0115 (125) P= .449
WQ1	-.0793 (125) P= .190	.0225 (125) P= .402	-.0072 (125) P= .468	-.0107 (125) P= .453	.0293 (125) P= .373	-.0026 (125) P= .489	-.0414 (125) P= .324	.0635 (125) P= .241	.1914 (125) P= .016	.1703 (125) P= .029	.1132 (125) P= .104
WQ2	-.0074 (125) P= .467	.1057 (125) P= .120	.0795 (125) P= .189	.1656 (125) P= .033	-.0222 (125) P= .403	-.0766 (125) P= .198	-.0966 (125) P= .142	.0443 (125) P= .312	.0698 (125) P= .220	.0082 (125) P= .464	-.1248 (125) P= .083
MCH1	.0923 (125) P= .153	.2645 (125) P= .001	.1918 (125) P= .016	-.1776 (125) P= .024	-.2029 (125) P= .012	.0347 (125) P= .351	.1002 (125) P= .133	.0499 (125) P= .290	.0163 (125) P= .429	.1113 (125) P= .108	-.0756 (125) P= .201
MCH2	.1295 (125) P= .075	.0328 (125) P= .358	.1200 (125) P= .091	.0036 (125) P= .484	-.1756 (125) P= .025	.0276 (125) P= .380	.0371 (125) P= .341	-.0266 (125) P= .384	-.0198 (125) P= .413	.0818 (125) P= .182	.0359 (125) P= .345
EIMP	.1795 (125) P= .023	.2291 (125) P= .005	-.0236 (125) P= .397	-.0179 (125) P= .421	-.1215 (125) P= .088	.1481 (125) P= .050	.0161 (125) P= .429	.0467 (125) P= .302	.0688 (125) P= .223	.2585 (125) P= .002	-.0040 (125) P= .482
RSKE	.0678 (125) P= .226	.0957 (125) P= .144	.1522 (125) P= .045	-.1421 (125) P= .057	.0301 (125) P= .369	.1546 (125) P= .043	.0813 (125) P= .184	-.0035 (125) P= .484	.0387 (125) P= .334	.1299 (125) P= .074	-.0948 (125) P= .147
RSKO	.2162 (125) P= .008	.1539 (125) P= .043	-.0095 (125) P= .458	-.1012 (125) P= .131	.0357 (125) P= .346	.0923 (125) P= .153	-.1209 (125) P= .090	.0739 (125) P= .206	.0040 (125) P= .483	.0436 (125) P= .315	-.0532 (125) P= .278
NEN	-.4514 (125) P= .000	-.3835 (125) P= .000	-.1700 (125) P= .029	.0316 (125) P= .363	.1640 (125) P= .034	-.0199 (125) P= .413	.0549 (125) P= .272	-.0040 (125) P= .482	.1659 (125) P= .032	-.0758 (125) P= .200	.0239 (125) P= .396
NES	1.0000 (0) P= .	.3253 (125) P= .000	.1648 (125) P= .033	-.0005 (125) P= .498	-.0740 (125) P= .206	-.0111 (125) P= .451	-.0710 (125) P= .216	-.0159 (125) P= .430	-.0748 (125) P= .203	.1786 (125) P= .023	.0322 (125) P= .361
NEGL	.3253 (125) P= .000	1.0000 (0) P= .	.0922 (125) P= .153	.0643 (125) P= .238	-.0843 (125) P= .175	-.0379 (125) P= .337	.0077 (125) P= .466	-.0525 (125) P= .281	.0039 (125) P= .483	.0806 (125) P= .136	-.0283 (125) P= .377
VPH	.1648 (125) P= .033	.0922 (125) P= .153	1.0000 (0) P= .	-.0952 (125) P= .145	-.3442 (125) P= .000	-.3027 (125) P= .000	-.2164 (125) P= .008	-.1397 (125) P= .061	-.0266 (125) P= .384	-.0989 (125) P= .136	.0633 (125) P= .242
VPE	-.0005 (125) P= .498	.0643 (125) P= .238	-.0952 (125) P= .145	1.0000 (0) P= .	-.1902 (125) P= .017	-.2206 (125) P= .007	-.1365 (125) P= .065	-.0880 (125) P= .165	.0033 (125) P= .485	-.0786 (125) P= .192	.0494 (125) P= .292

(COEFFICIENT / (CASES) / 1-TAILED SIG)   " . " IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED

- - - - - - - - - - - - - - P E A R S O N   C O R R E L A T I O N   C O E F F I C I E N T S - - - - - - - - - - - - - -

	NES	NEGL	VPH	VPE	VPR	VPF	VPT	VPS	PCCN	AWEX	TOEX
VPR	-.0740 (125) P= .206	-.0843 (125) P= .175	-.3442 (125) P= .000	-.1902 (125) P= .017	1.0000 (0) P= .	-.3391 (125) P= .000	-.1955 (125) P= .014	-.1632 (125) P= .035	.0336 (125) P= .177	.0255 (125) P= .389	-.0396 (125) P= .330
VPF	-.0111 (125) P= .451	-.0379 (125) P= .337	-.3027 (125) P= .000	-.2206 (125) P= .007	-.3391 (125) P= .000	1.0000 (0) P= .	-.2261 (125) P= .006	-.0831 (125) P= .178	.0195 (125) P= .414	.0551 (125) P= .146	.0158 (125) P= .431
VPT	-.0710 (125) P= .216	.0077 (125) P= .466	-.2164 (125) P= .008	-.1365 (125) P= .065	-.1955 (125) P= .014	-.2261 (125) P= .006	1.0000 (0) P= .	-.0413 (125) P= .324	-.0184 (125) P= .419	.0162 (125) P= .429	-.0751 (125) P= .203
VPS	-.0159 (125) P= .430	-.0525 (125) P= .281	-.1387 (125) P= .061	-.0880 (125) P= .165	-.1632 (125) P= .035	-.0531 (125) P= .178	-.0413 (125) P= .324	1.0000 (0) P= .	-.1081 (125) P= .115	.0613 (125) P= .248	-.0511 (125) P= .286
PCCN	-.0748 (125) P= .203	.0039 (125) P= .483	-.0266 (125) P= .384	.0033 (125) P= .485	.0836 (125) P= .177	.0195 (125) P= .414	-.0184 (125) P= .419	-.1081 (125) P= .115	1.0000 (0) P= .	.2228 (125) P= .006	.3504 (125) P= .000
AWEX	.1786 (125) P= .023	.0806 (125) P= .186	-.0989 (125) P= .136	-.0786 (125) P= .192	.0255 (125) P= .389	.0951 (125) P= .146	.0162 (125) P= .429	.0613 (125) P= .248	.2228 (125) P= .006	1.0000 (0) P= .	.0422 (125) P= .320
TOEX	.0322 (125) P= .361	-.0283 (125) P= .377	.0633 (125) P= .242	.0494 (125) P= .292	-.0396 (125) P= .330	.0158 (125) P= .431	-.0751 (125) P= .203	-.0511 (125) P= .286	.3504 (125) P= .000	.0422 (125) P= .320	1.0000 (0) P= .
REDC	-.0196 (125) P= .414	-.0825 (125) P= .180	-.0674 (125) P= .228	-.1534 (125) P= .044	.0078 (125) P= .466	.1264 (125) P= .080	.0518 (125) P= .283	-.0094 (125) P= .459	.1724 (125) P= .027	.1954 (125) P= .015	.1876 (125) P= .018
FCPY	.0844 (125) P= .175	.0809 (125) P= .185	.0430 (125) P= .317	-.0595 (125) P= .255	-.0402 (125) P= .328	.0063 (125) P= .472	.0422 (125) P= .320	-.0285 (125) P= .376	.2165 (125) P= .008	.1031 (125) P= .126	.0381 (125) P= .337
FHPY	-.0007 (125) P= .497	.0324 (125) P= .360	-.0405 (125) P= .327	-.1138 (125) P= .103	.0715 (125) P= .214	.0253 (125) P= .390	.0764 (125) P= .199	-.0501 (125) P= .290	.4540 (125) P= .000	.2776 (125) P= .001	.3064 (125) P= .000
ED	-.1709 (125) P= .028	-.0926 (125) P= .152	-.0241 (125) P= .395	.0519 (125) P= .283	.1839 (125) P= .020	.0359 (125) P= .345	-.1945 (125) P= .015	-.1583 (125) P= .039	.2178 (125) P= .007	.0562 (125) P= .267	.2166 (125) P= .008
AGE	-.0789 (125) P= .191	-.0501 (125) P= .290	.0229 (125) P= .400	.0786 (125) P= .192	-.0482 (125) P= .297	-.0291 (125) P= .374	.0858 (125) P= .171	-.1222 (125) P= .087	-.0688 (125) P= .223	-.0855 (125) P= .172	.0164 (125) P= .428
SEX	-.0445 (125) P= .311	-.0514 (125) P= .285	.0919 (125) P= .154	-.1683 (125) P= .030	.1041 (125) P= .124	-.0385 (125) P= .335	-.0146 (125) P= .436	-.0342 (125) P= .353	.1196 (125) P= .092	.1521 (125) P= .045	.0182 (125) P= .420
SES	-.2090 (125) P= .010	-.1944 (125) P= .015	-.0234 (125) P= .398	-.0819 (125) P= .182	.1282 (125) P= .077	-.0486 (125) P= .295	-.0588 (125) P= .257	.0763 (125) P= .199	.1165 (125) P= .098	-.0287 (125) P= .375	.2400 (125) P= .004
PREC	-.0068 (125) P= .470	-.0665 (125) P= .231	.1022 (125) P= .128	.0766 (125) P= .198	-.0229 (125) P= .400	-.0461 (125) P= .305	-.0398 (125) P= .330	.0140 (125) P= .438	-.1166 (125) P= .098	-.0519 (125) P= .283	-.0943 (125) P= .148

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- - - - - - - - - - - - - - P E A R S O N   C O R R E L A T I O N   C O E F F I C I E N T S - - - - - - - - - - - - - -

	NES	NEGL	VPH	VPE	VPR	VPF	VPT	VPS	PCON	AWEX	TOEX
ETWC	.1196	-.0443	-.0959	.1956	.0762	-.1843	.1998	-.1278	.1393	.1456	.0017
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .092	P= .312	P= .144	P= .014	P= .199	P= .020	P= .017	P= .078	P= .017	P= .053	P= .492
GM	-.0141	-.0634	.1850	-.1653	-.0375	-.0797	.1051	.0446	-.1222	.0971	.0229
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .438	P= .241	P= .018	P= .033	P= .165	P= .188	P= .122	P= .311	P= .087	P= .141	P= .400
ZONE	-.1107	-.1613	-.2175	-.1366	.1662	.0362	.0597	.0560	-.1412	.0408	.0123
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)
	P= .110	P= .036	P= .007	P= .064	P= .032	P= .344	P= .254	P= .267	P= .058	P= .326	P= .446

(COEFFICIENT / (CASES) / 1-TAILED SIG) " . " IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED

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	RECC	FCPY	FHPY	ED	AGE	SEX	SES	PREC	ETWC	GM	ZONE
SC	-.0512 (125) P= .285	.0661 (125) P= .232	-.1225 (125) P= .087	-.0112 (125) P= .451	.0123 (125) P= .446	-.0086 (125) P= .462	-.0571 (125) P= .264	-.0585 (125) P= .258	.0474 (125) P= .300	-.0507 (125) P= .287	.1761 (125) P= .025
A1	-.0360 (125) P= .345	-.0801 (125) P= .187	.0379 (125) P= .337	-.0549 (125) P= .271	.0170 (125) P= .425	-.0164 (125) P= .428	-.0215 (125) P= .406	.0081 (125) P= .464	-.0607 (125) P= .251	-.0347 (125) P= .350	.0062 (125) P= .473
A2	-.0714 (125) P= .214	.1647 (125) P= .033	.2089 (125) P= .010	.1635 (125) P= .034	-.2915 (125) P= .000	-.0386 (125) P= .335	.0345 (125) P= .351	-.1631 (125) P= .035	.0196 (125) P= .414	.1760 (125) P= .025	-.0460 (125) P= .305
WC1	.1307 (125) P= .073	-.0073 (125) P= .468	.0756 (125) P= .201	.1645 (125) P= .033	.2118 (125) P= .009	.0998 (125) P= .134	.1520 (125) P= .045	.0284 (125) P= .377	.0398 (125) P= .330	.0730 (125) P= .209	.0772 (125) P= .196
WC2	-.1901 (125) P= .017	-.0015 (125) P= .494	.0148 (125) P= .435	-.1812 (125) P= .022	.1551 (125) P= .042	.2051 (125) P= .011	-.0725 (125) P= .211	.1860 (125) P= .019	.0668 (125) P= .229	-.0706 (125) P= .217	-.4631 (125) P= .000
MCH1	.1081 (125) P= .115	.1790 (125) P= .023	.0893 (125) P= .164	-.3902 (125) P= .000	-.0296 (125) P= .371	.0413 (125) P= .324	-.1147 (125) P= .101	-.0252 (125) P= .390	-.0634 (125) P= .241	-.0234 (125) P= .398	-.1158 (125) P= .092
MCH2	-.0199 (125) P= .413	.0337 (125) P= .355	.0591 (125) P= .256	-.2236 (125) P= .006	.0593 (125) P= .256	.0570 (125) P= .264	-.2308 (125) P= .005	-.1354 (125) P= .066	-.0801 (125) P= .187	-.0543 (125) P= .274	-.1866 (125) P= .019
EIMP	.1976 (125) P= .014	.1983 (125) P= .013	.1468 (125) P= .051	-.0260 (125) P= .387	-.2001 (125) P= .013	-.0911 (125) P= .156	-.2665 (125) P= .001	.0385 (125) P= .333	-.0450 (125) P= .309	.0643 (125) P= .238	-.1082 (125) P= .115
RSKE	-.1101 (125) P= .111	.0185 (125) P= .419	.1504 (125) P= .047	.0419 (125) P= .321	.0169 (125) P= .426	-.0274 (125) P= .381	-.0497 (125) P= .291	-.1187 (125) P= .094	-.0740 (125) P= .206	.1765 (125) P= .024	.1422 (125) P= .057
RSKO	-.0491 (125) P= .293	.0276 (125) P= .380	.0738 (125) P= .207	-.0453 (125) P= .308	.0460 (125) P= .305	.0296 (125) P= .372	-.0457 (125) P= .306	-.0439 (125) P= .314	-.1086 (125) P= .114	.0744 (125) P= .205	.0106 (125) P= .454
NEN	-.0696 (125) P= .220	.0717 (125) P= .213	.1845 (125) P= .020	.0349 (125) P= .350	.1120 (125) P= .107	.0405 (125) P= .327	.0971 (125) P= .141	.0063 (125) P= .472	-.0295 (125) P= .372	-.0138 (125) P= .439	.0686 (125) P= .224
NES	-.0196 (125) P= .414	.0844 (125) P= .175	-.0007 (125) P= .497	-.1709 (125) P= .028	-.0789 (125) P= .191	-.0445 (125) P= .311	-.2090 (125) P= .010	-.0068 (125) P= .470	.1196 (125) P= .092	-.0141 (125) P= .438	-.1107 (125) P= .110
NEGL	-.0825 (125) P= .180	.0809 (125) P= .185	.0324 (125) P= .360	-.0926 (125) P= .152	-.0501 (125) P= .290	-.0514 (125) P= .285	-.1944 (125) P= .015	-.0665 (125) P= .231	-.0443 (125) P= .312	-.0634 (125) P= .241	-.1613 (125) P= .036
VPH	-.0674 (125) P= .228	.0430 (125) P= .317	-.0405 (125) P= .327	-.0241 (125) P= .395	.0229 (125) P= .400	.0919 (125) P= .154	-.0234 (125) P= .398	.1022 (125) P= .128	-.0959 (125) P= .144	.1880 (125) P= .018	-.2175 (125) P= .007
VPE	-.1534 (125) P= .044	-.0595 (125) P= .255	-.1138 (125) P= .103	.0519 (125) P= .283	.0786 (125) P= .192	-.1683 (125) P= .030	-.0819 (125) P= .182	.0766 (125) P= .198	.1956 (125) P= .014	-.1653 (125) P= .033	-.1366 (125) P= .064

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	REDC	FCPY	FHPY	ED	AGE	SEX	SES	PREC	ETWC	GM	ZONE
VPR	.0078 (125) P= .466	-.0402 (125) P= .328	.0715 (125) P= .214	.1839 (125) P= .020	-.0492 (125) P= .297	.1041 (125) P= .124	.1262 (125) P= .077	-.0229 (125) P= .400	.0762 (125) P= .199	-.0875 (125) P= .166	.1662 (125) P= .032
VPF	.1264 (125) P= .080	.0063 (125) P= .472	.0253 (125) P= .390	.0359 (125) P= .345	-.0281 (125) P= .374	-.0385 (125) P= .335	-.0486 (125) P= .295	-.0461 (125) P= .305	-.1943 (125) P= .020	-.0797 (125) P= .188	.0362 (125) P= .344
VPT	.0518 (125) P= .283	.0422 (125) P= .320	.0764 (125) P= .199	-.1945 (125) P= .015	.0858 (125) P= .171	-.0146 (125) P= .436	-.0588 (125) P= .257	-.0398 (125) P= .330	.1898 (125) P= .017	.1051 (125) P= .122	.0597 (125) P= .254
VPS	-.0094 (125) P= .459	-.0285 (125) P= .376	-.0501 (125) P= .290	-.1583 (125) P= .039	-.1222 (125) P= .087	-.0342 (125) P= .353	.0763 (125) P= .199	.0140 (125) P= .438	-.1279 (125) P= .078	.0446 (125) P= .311	.0560 (125) P= .267
PCON	.1724 (125) P= .027	.2165 (125) P= .008	.4640 (125) P= .000	.2178 (125) P= .007	-.0688 (125) P= .223	.1196 (125) P= .092	.1165 (125) P= .098	-.1166 (125) P= .098	.1893 (125) P= .017	-.1222 (125) P= .087	-.1612 (125) P= .058
AWEX	.1954 (125) P= .015	.1031 (125) P= .126	.2776 (125) P= .001	.0562 (125) P= .267	-.0855 (125) P= .172	.1521 (125) P= .045	-.0287 (125) P= .375	-.0519 (125) P= .283	.1456 (125) P= .053	.0971 (125) P= .141	.0408 (125) P= .326
TCEX	.1876 (125) P= .018	.0381 (125) P= .337	.3064 (125) P= .000	.2164 (125) P= .008	.0164 (125) P= .428	.0182 (125) P= .420	.2400 (125) P= .004	-.0943 (125) P= .148	.0017 (125) P= .492	.0229 (125) P= .400	.0123 (125) P= .446
REDC	1.0000 (0) P= .	.1080 (125) P= .115	.1045 (125) P= .123	.0914 (125) P= .155	-.0814 (125) P= .183	-.0111 (125) P= .451	.0082 (125) P= .464	-.0277 (125) P= .380	.1209 (125) P= .090	-.0519 (125) P= .283	.0854 (125) P= .172
FCPY	.1080 (125) P= .115	1.0000 (0) P= .	.6361 (125) P= .000	-.0177 (125) P= .423	-.1795 (125) P= .023	.0253 (125) P= .390	.0511 (125) P= .286	-.2100 (125) P= .009	.0235 (125) P= .397	-.0796 (125) P= .189	.1311 (125) P= .072
FHPY	.1045 (125) P= .123	.6361 (125) P= .000	1.0000 (0) P= .	.0105 (125) P= .454	-.1313 (125) P= .072	-.0043 (125) P= .481	.0374 (125) P= .339	-.1502 (125) P= .047	.0703 (125) P= .218	-.0991 (125) P= .136	.0720 (125) P= .213
ED	.0914 (125) P= .155	-.0177 (125) P= .423	.0105 (125) P= .454	1.0000 (0) P= .	-.0366 (125) P= .343	.0742 (125) P= .205	.4628 (125) P= .000	-.1258 (125) P= .081	.1035 (125) P= .125	.0196 (125) P= .415	.1951 (125) P= .015
AGE	-.0814 (125) P= .183	-.1795 (125) P= .023	-.1313 (125) P= .072	-.0366 (125) P= .343	1.0000 (0) P= .	.1123 (125) P= .106	-.0066 (125) P= .471	.0684 (125) P= .224	.0614 (125) P= .248	-.0160 (125) P= .430	-.0968 (125) P= .141
SEX	-.0111 (125) P= .451	.0253 (125) P= .390	-.0043 (125) P= .481	.0742 (125) P= .205	.1123 (125) P= .106	1.0000 (0) P= .	.1630 (125) P= .035	-.0166 (125) P= .427	-.0873 (125) P= .166	.1683 (125) P= .030	-.0289 (125) P= .374
SES	.0082 (125) P= .464	.0511 (125) P= .286	.0374 (125) P= .339	.4628 (125) P= .000	-.0066 (125) P= .471	.1630 (125) P= .035	1.0000 (0) P= .	-.1132 (125) P= .104	-.0436 (125) P= .315	.0324 (125) P= .360	.2062 (125) P= .013
PREC	-.0277 (125) P= .380	-.2100 (125) P= .009	-.1502 (125) P= .047	-.1258 (125) P= .081	.0684 (125) P= .224	-.0166 (125) P= .427	-.1132 (125) P= .104	1.0000 (0) P= .	.1096 (125) P= .112	-.0922 (125) P= .153	-.2045 (125) P= .011

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	REDC	FCPY	FHPY	ED	AGE	SEX	SES	PREC	ETWC	GM	ZONE
ETWC	.1209	.0235	.0703	.1035	.0614	-.0873	-.0436	.1096	1.0000	.0120	-.1086
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(0)	(125)	(125)
	P= .090	P= .397	P= .219	P= .125	P= .248	P= .166	P= .315	P= .112	P= .	P= .447	P= .114
GM	-.0519	-.0796	-.0991	.0194	-.0160	.1683	.0324	-.0522	.0120	1.0000	.0919
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(0)	(125)
	P= .283	P= .189	P= .136	P= .415	P= .430	P= .030	P= .360	P= .153	P= .447	P= .	P= .154
ZONE	.0854	.1311	.0720	.1951	-.0968	-.0299	.2002	-.2045	-.1086	.0919	1.0000
	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(125)	(0)
	P= .172	P= .072	P= .213	P= .015	P= .141	P= .374	P= .013	P= .011	P= .114	P= .154	P= .

(COEFFICIENT / (CASES) / 1-TAILED SIG) " . " IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED

LIST OF REFERENCES

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