WATER KNOWLEDGE AND ATTITUDE ASSESSMENT OF THE CITIZENS OF CLALLAM COUNTY, WASHINGTON STATE

By

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*if there is magic on this planet, it is contained in water... its substances reach everywhere; it touches the past and prepares the future; it moves under the poles and wanders thinly in the heights of the air. It can assume forms of exquisite perfection in snowflake, or strip the living to a single shining bone cast up by the sea. -- Loren Eisley**

*source unknown

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CHAPTER I

INTRODUCTION

Background

Clallam County in Washington State is located in the far Northwestern tip of the contiguous U.S. and is relatively undeveloped (see map, page 2). Forest industries, agriculture, fishing, and tourism are all important parts of its economic base and are linked to the abundant rainfall in this region. Unfortunately, the people of Clallam County have begun to experience deterioration of their natural resources as recent rapid population increases, agricultural and industrial growth, and controversial forest management practices have worked together to exacerbate existing problems. These activities have resulted in especially serious threats to water resources within the county. This loss of environmental quality is important to county residents because the actual and perceived purity of the environment in this area affect both its current prosperity and its future development.

The coastal-maritime ecosystem, with its unique micro climatic zones, offers a wide-diversity of landscapes. The attractive character of the area has brought many new inhabitants over the last several years. The population for Clallam County is 56,464. The populations of the cities of Sequim, at 3,616; and Port Angeles, at 17,710; do not account for outlying county areas (Bohman, 1992).

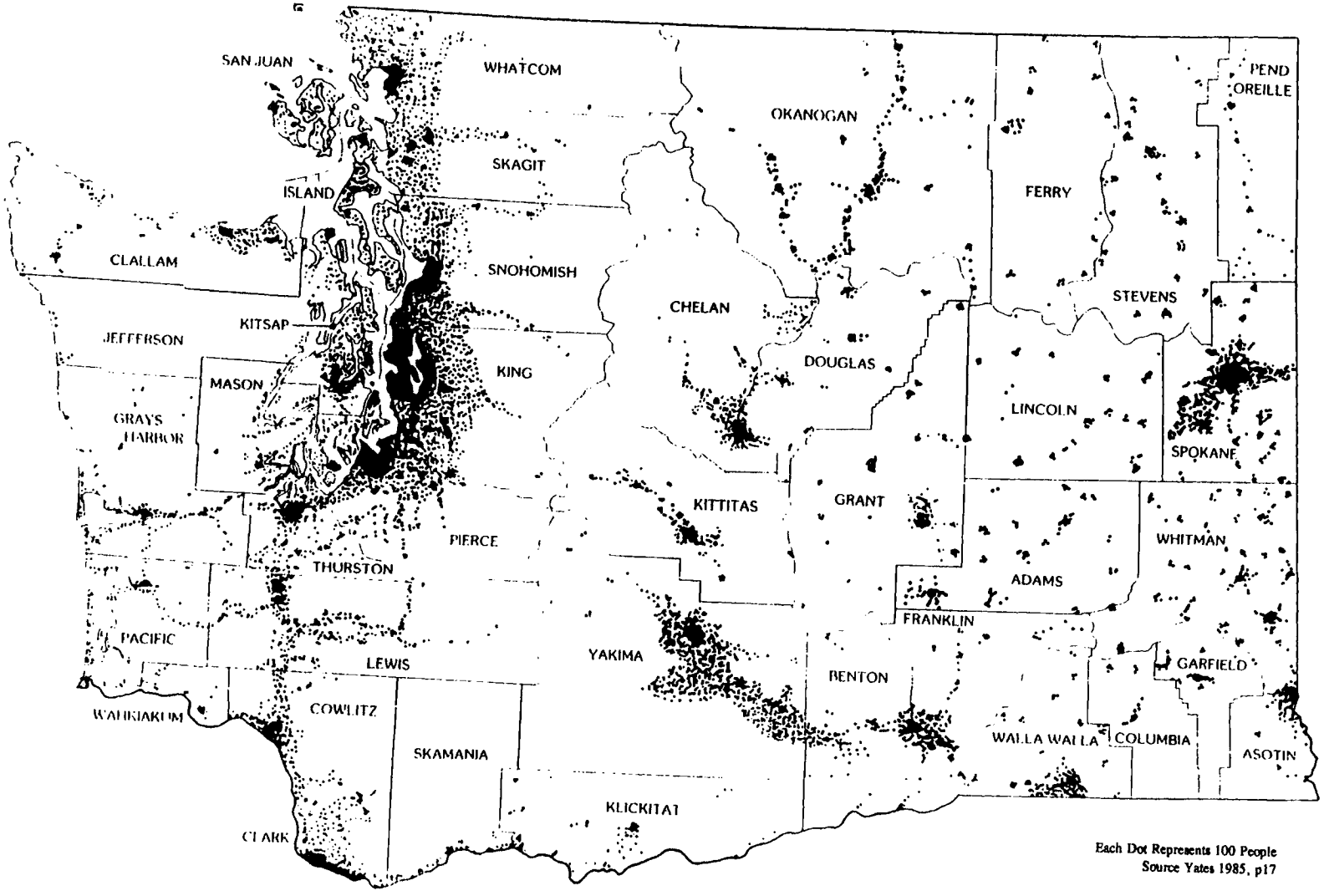

Figure 1. Distribution of Population 1980, Washington State

The increased growth has created greater demand for land, housing, and other developments. Such plans have faced divided public support. The objections stemmed, in part, from the perception that underground water supplies were already overtaxed. Neighbors in the area of one proposed subdivision reported "we already have low water pressure, stoppages without being notified, and have been put on meters" (Frybarger, 1990, p. A6).

New conditions in the forest products industry also promise to create controversial situations. Until recently, the community received revenues from timber removal surcharges (Manders, 1990a, p. A10). Because these revenues were reduced, demand for the further development of other industries increased, with the hope that revenues from such development would supplant the former losses. The local Chamber of Commerce was supportive of one such proposition for a major destination resort in the area and related attempts to change the boundaries of a large nearby State Park to accommodate the development (Holter, 1990, p. A5). Finally, popular pressure against the resort forced its cancellation. Local administrators face important policy questions from these kinds of projects and the increases in associated water demand and wastewater treatment facilities that they create (Ogden, 1970).

Housing developments present other challenges as well, some of which have natural causes. Recent catastrophic flooding of existing developments was attributed to poor planning and bureaucratic inadequacies, and the associated reconstruction that was required faced similar institutional impediments (Frybarger, 1990, p. A6). Resource managers and environmentalists in the county believe that the lack of environmental awareness, which created the negative impacts associated with those

past developments, as well as rapid population growth, agricultural and industrial growth, and unsound forest management practices, must change; that without such change, the region cannot continue to prosper.

Statement Of The Problem

There is a growing awareness that it is not necessarily industrial pollution and development interests that are primarily creating water quality problems in this region. As found elsewhere, the increasing recognition of the role that local citizens have in maintaining quality water resources means that a greater emphasis must also be placed on improving stewardship at the household and farmstead level.

The recent flood situation in Clallam County and on the national scene, of the Mississippi River system, has focused attention on human inability to 'manage' nature with high levels of confidence. These occurrences have also shown how such unexpected events, and a myriad of human activities, can affect other water related issues such as non-point pollution (non-point pollution is water pollution that has no distinctly trackable point of origin; roadway oil, eroded silt, and lawn herbicides running into streams are all examples). Although man may have contributed to the problem, Clallam County's flood was the result of the unpredictable location of natural changes in the course of the Dungeness River. However, other water-related problems are caused by the predictable repercussions of current management practices (such as construction in flood plains) or are the result of continued growth trends and generally greater use. Some of these practices have already resulted in the

deterioration of local water resources and are expected to continue to cause further problems.

As a result of concern about the seriousness of these issues, and the cooperative efforts of several governmental agencies, the Clallam County Water Quality Division (CCWQD--part of the County's Department of Community Development) was charged with developing a watershed management plan for the Dungeness River area. Money had been provided to Clallam County by a Centennial Clean Water Grant from the Washington State Department of Ecology. These grants are available to help communities which create impacts on water quality in Puget Sound, with a variety of water-related activities. Some of these activities are: the construction of wastewater treatment plants, the development of non-point pollution mitigation programs, and the performance of water-quality related planning activities.

The grant required the CCWQD to carry out recommendations made by the Puget Sound Water Quality Authority. The recommendations included the establishment of a watershed ranking committee. It was made up of representatives from several stakeholder groups including: Native American Tribal Nations, government agencies, The League of Women Voters, and real estate and sports & recreation interest groups (Jenkins, 1993).

The committee's job was to prioritize the county's river basins for the development of an action plan. The Dungeness River Basin, a geographically determined area running out from the Olympic Mountain Range and out into the coastal plain near the City of Sequim, received the highest rating of those ranked and was therefore selected for watershed management plan development.

Another geographical area also running from the Olympic Mountains, further west and generally surrounding the City of Port Angeles, was officially named the Port Angeles Regional Watershed. This area received the second highest rating and a separate grant was provided for its planning activities. It is referred to herein as the *Port Angeles Area.*

The ratings indicate serious impairment, threat, or concern for the following factors:

- commercial or recreational shellfish decertified/threatened
- fish kills or impaired habitat or productivity
- impairment of drinking water
- urban development patterns (Clallam County Watershed, 1988, p. 24).

The action plans are envisioned as ways to mitigate negative impacts from planning and development decisions of the past and to enhance future water quality protection (Op. cit., 1988, p. ES-1). An earlier plan for the nearby Sequim Bay watershed (also an Olympic Mountain watershed, east of the Dungeness River Basin watershed) recommended a long-term, adaptive, management approach (Sequim Bay Watershed, 1989, pg. v). This is described as: "using the best information available at the time, with the assumption that rules and field methods can be changed in response to research and monitoring results" (The Timber Fish Wildlife Agreement). Allowing the incorporation of new information into the decision making process, this approach would feature continued citizen oversight, participation, and annual review. The Sequim Bay watershed had already been targeted for early action by the Puget

Sound Water Quality Authority and so was not included in the ranking process that included the Port Angeles Area and Dungeness River Basin watersheds.

The action plans were required to include both regulatory and educational components. The educational elements were part of the emphasis on community involvement and were to be part of both the development and implementation of management strategies. The responsibilities for developing the required educational elements belonged to the CCWQD and were to be conducted by a community education coordinator in conjunction with a watershed management committee assembled from a cross-section of the community (Bohman, 1990). As part of this comprehensive management plan and existing agreements, efforts to begin educational programs in the Sequim Bay and Dungeness River watersheds (subsequently referred to herein as the *Sequim Area*) were beginning as the study got underway. These efforts were scheduled to last a total of 30 months.

Educational programs are included as part of approaches to improve water quality, as described above, because of increasing recognition that the public's actions have enormous impacts on water quality. Research in areas of science and environmental education has shown relationships between what individuals know and the attitudes that they hold; these attitudes then affect behaviors. The challenge for environmental educational programs is to affect behavioral changes which result in better citizen stewardship of natural resources. So that educational programs about water resources will be most useful, it is desirable for program planners to understand the current status of public attitudes and levels of knowledge regarding water-related

issues. By doing so, public misconceptions may be identified and specifically addressed by programs developed to meet those needs.

Additionally, to determine the effectiveness of these programs, comparisons can be made using the results of similar tests administered before and after educational outreach efforts. Such a pre-post methodology can then help to determine how effective past programs have been.

Research Goals

The general purpose of this study is to gain an understanding of water-related public attitudes, opinions, and knowledge (Water AOK factors) and their interrelationship. The study searches for patterns of responses to questions relating to these and other associated factors which could provide direction for educators dealing with local water issues. This information could also be used to create plans for natural resource protection and to elevate values for water among the citizens of our states and nation.

The specific goal of this study was to provide information on the Water AOK factors of the residents living in the two highest priority watersheds in Clallam County in Washington State. Because one of the watershed areas had received educational outreach while the other had not, the Clallam County Water Resource Survey (known herein as the Water AOK Survey) was developed to gain comparable data on these factors. Using the instrument designed by the researcher, the CCWQD conducted the survey to obtain this information.

The educational goals of Clallam County's watershed planning efforts are to "support, improve, and encourage a stewardship ethic in the watershed, ... (and) there will be specific activity to inform, educate and involve individuals, businesses, groups, industry and governmental entities in the cleanup and protection of the watershed resources" (Department of Ecology Grant Agreement, 1989). These educational goals are mutually reinforcing. An understanding by educational program planners of the AOK factors among the public will aid in the evaluation of approaches to meet the County's educational goals. The success of meeting those goals will further the goals of resource protection. The information will also provide baseline data for comparisons with the results of any future surveys of similar design.

Preferences for what the future environment should be vary considerably among local citizens. Interests for future scenarios range from attempting to remain a relatively quiet retirement village, through hopes for a vibrant tourist center, to continued industrial growth as local saw mills are developed to conform with new timber industry mandates. These new requirements promised sweeping changes in the local economy as restrictions on the export of logs from the area and state were implemented beginning in 1991 (Manders, 1990, p. A18). With such varying perspectives in the community, it is important that the various elements ultimately be harmonized.

Mutual cooperation and support will be required for any successful efforts to improve water quality. For this to occur, the water-related educational needs of each group must be met. This will require that a wide variety of programs and outreach strategies be formulated and that the educational goals and objectives for those

programs be well defined. In addition, the Watershed Management Committee may find that the knowledge gained about the public's views and understanding will have general relevance to the formulation of the entire management plan.

Objectives of Study

The following questions were identified as being relevant to the problems in Clallam County. These questions were used to develop the specific hypotheses statements that would, in turn, drive the development of the questions asked on the Water AOK Survey. Obtaining answers to these questions was the primary specific objective of this study. The numbers in parentheses refer to question numbers in the 'Water AOK Survey'--see Appendix A (Appendix B = survey questionnaire key).

I. What are the community's general attitudes in relation to water? Identify current prevailing citizen attitudes about the use of water or activities and events that affect its future quality or quantity.

   A. Use Watkins' Water Concerns Scale. (#21-25)

   B. Use Weigel & Weigel's Environmental Concern Scale. (#26-41)

II. What is the community's general level of knowledge about water? Identify what citizens know about non-point pollution, groundwater, and other water quality and quantity issues. (#3-17)

   A. Does the community have a good general understanding of water quality and quantity issues?

   B. Does the community understand "non-point pollution"? (#3, 10, 17)

C. Does the community understand "groundwater"? (#4, 6, 8, 9, 16)

III. Do relationships between AOK factors and demographic variables exist?

A. Is there a relationship between differences in length of residence in area and knowledge about water? (#51)

B. Is there a relationship between differences in length of residence in area and attitudes about water? (#51)

C. Is there a relationship between differences in use of land and knowledge about water? (#52)

D. Is there a relationship between differences in use of land and attitudes about water? (#52)

E. Is there a relationship between differences in duration of annual local residence and knowledge about water? (#53)

F. Is there a relationship between differences in duration of annual local residence and attitudes about water? (#53)

G. Is there a relationship between differences in occupation and knowledge about water? (#54)

H. Is there a relationship between differences in occupation and attitudes about water? (#54)

I. Is there a relationship between differences in level of education and knowledge about water? (#55)

J. Is there a relationship between differences in level of education and attitudes about water? (#55)

K. Is there a relationship between differences in income and knowledge about water? (#56)

L. Is there a relationship between differences in income and attitudes about water? (#56)

M. Is there a relationship between differences in age and knowledge about water? (#57)

N. Is there a relationship between differences in age and attitudes about water? (#57)

O. Is there a relationship between differences in rural/urban residency and knowledge about water? (#42)

P. Is there a relationship between differences in rural/urban residency and attitudes about water? (#42)

IV. Do people in this area feel that they know enough about water issues in the community to participate in evaluating and planning water-related projects? (#19)

V. What do residents consider to be the most important water-related concern/greatest water pollution problem? (#1, 50) What government measure is favored for local water quality problems? (#2)

VI. How do citizens view the importance and relationship of water related activities and water availability for future growth of the region? (general purpose of #s 18, 44, 45, 46, 47, 48, 58, 64A, 65)

VII. Do citizens believe that future planning policy formulation and regulation would be better facilitated by an increased reliance on watershed boundaries rather than political boundaries? (#s 20 & 43)

The issue of the appropriate locus of responsibility for water management and policy planning was an addition to the primary objectives of the study. The Snohomish County aquatic resources protection program quoted in the Clallam County Watershed Ranking Project For The Management Of Nonpoint Source Pollution (Tetra Tech, Inc. 1988, p. 50) described encouragement for development that is compatible with existing aquatic systems and hydrological patterns and appeared to represent a new paradigm for community development.

From the previously stated questions, specific testable hypotheses were developed. The list of 131 null hypotheses can be found listed in Appendix B and in Chapter IV's Data Analysis Section. Wherever statistically significant responses were found, tables and figures (pie charts and bar graphs) were developed to help describe the data. The remainder of the stated questions were answered by descriptive data analysis.

Assumptions Of Study

1. All knowledge questions are of equal difficulty.
2. The demographic characteristic mix of variables were equally distributed within all geographic areas studied.

3. Respondents were representative of the survey population.

Limitations Of The Study

Data is relevant only to the inhabitants of the geographical regions included in the two watersheds. Sample size was restricted.

Definition Of Terms

Agriculture--includes farming/livestock/crop production, pond aquaculture, nurseries, Christmas Tree farms.

Attitude--in relation to the Clallam County Water Resource Survey questionnaire, the responses for the combined Watkins Water Concern Scale and Weigel & Weigel Environmental Concern Scale; generally, a state of mind or feeling (Webster, 1988).

CCWQD--Clallam County Water Quality Division.

Clallam County Water Resource Survey--formal title of the Water AOK Survey.

Commercial/service--business, government, real estate, tourism/hospitality industry, campgrounds, RV parks, marinas.

Construction/trades/manufacturing--building trades, contractors, industrial processes & manufacturing.

Dungeness watershed (see also, Sequim Area)--the name of one of two watersheds composing one of the two major areas under study.

Duplicates--owner of more than 1 property of selected addresses for Clallam County Water Resource Survey questionnaire mailing.

ECS--Weigel & Weigel Environmental Concerns Scale.

Fisheries--includes wildlife and habitat.

Forestry--forest products industry, includes logging, tree farms, lumber mills.

Likert Scale--a commonly used method of taking a range of responses such as follow: Strongly Agree, Agree, No Opinion, Disagree, Strongly Disagree.

Major study areas--the two greater study areas (Port Angeles Area and Sequim Area--see map, page 41) composed of geographically determined sub-areas known as minor study areas. Watersheds boundaries were primarily used to define both major and minor study areas.

Minor study areas--the geographically determined subdivisions of each of the two major study areas. There were nine minor study areas in the Sequim (major) study area, and eight minor study areas in the Port Angeles (major) study area.

Non-point pollution-water pollution which has no distinctly trackable point of origin, examples are: roadway oil and lawn pesticides running into streams, malfunctioning septic tank/drainfield systems.

Opinion--a belief or idea held with confidence but not substantiated by direct proof or knowledge.

Port Angeles Area (PA Area)--one of the two primarily-geographical major study areas (see map & description in "Description Of Sample," Chapter III, p. 38-41).

Questionnaire--a written form/type of survey instrument.

Recreation--includes campgrounds, RV parks, marinas.

Residential/domestic--includes homes and gardens.

Rural--outside the cities of Port Angeles and Sequim as defined by Clallam County zones of identification.

Sample size--term for the number of respondents.

Sequim Bay Watershed--the name of one of two watersheds within one of two major study areas.

Sequim Area (SQ Area)--one of the two primarily-geographical major study areas (see map & description in "Description Of Sample," Chapter III, p. 38-41).

Survey--an inspection, investigation, or comprehensive view.

Town--inside the cities of Port Angeles and Sequim as defined by Clallam County zones of identification.

WCS--Watkins Water Concern Scale.

Watkins--Watkins Water Concern Scale.

Weigel & Weigel--Weigel & Weigel Environmental Concerns Scale.

Water AOK Survey--name used in study for Clallam County Water Resource Survey.

Water clean-up--efforts to bring polluted waters to higher quality standards.

Water pollution--contaminates in water.

Water resources--seas, rainfall, groundwater, springs, lakes, rivers, creeks, and smaller streams; can include household and process waste water.

Water source--location or availability of useable water.

Watershed--a geographic area defined by geologic features, which acts as a catchment basin for rainfall and surface water which flow through it.

CHAPTER II

REVIEW OF SELECTED LITERATURE

Background

The Clallam County Water Quality Division's (CCWQD) management plans for the Port Angeles and Sequim Areas are concerned with non-point water pollution and the key role citizens have in solving water-related problems. This concern made it necessary to assess citizen attitudes, opinions, and knowledge (the AOK factors), about water resource issues and education. This study is an attempt to assist the CCWQD in carrying out the management plans.

A literature search was conducted in the Library and Center for Environmental Education at Oklahoma State University (OSU). Relevant information was also found at the OSU Center for Water Research. The OSU Library search for sources included an *ERIC* (Education Resource Information Center) and card catalog search for studies similar to the one being planned. Information on methodology was sought. Descriptors such as natural environment, water, natural resource, natural resource management, education, survey, questionnaire, assessment, attitude, attitude behavior relationship, attitude change, attitude measures, attitude of concept, and educational research were used in various combinations.

The library sections with the most useful information were as follows:

1. civil engineering, water management, and water resources planning
2. ecological and social issues (environmental studies)
3. education, and environmental and science education research

Discussion

At the beginning of the 1960's the Outdoor Recreation Resources Review Commission became "the first Federal agency to make serious use of opinion survey techniques to assess public desires regarding the use of natural resources" (White, 1969, p. 80). An earlier 29 question, 'Test of Reasoning in Conservation', developed by the Conservation Foundation, was designed to measure "knowledge of essential facts, concepts, or principles of conservation, understanding of the implications of various aspects of conservation" and to sense respondents' preferences for various solutions (Doran, 1974, p. 56). These early works led the way for using survey methods for learning what the public knows and values with regard to natural resources.

Several reviewed works have clarified the desirability of including public opinion and concern as part of the process of public policy formulation. White's chapter IV (1969) entitled "Resolving Ambiguity: What the Public Wants in Water Quality" is highly relevant. His rather academic and political/philosophical treatise deals with identifying and establishing clear aims for water policy and is based on a wealth of historical background and legislative insight. In addition to an early and prophetic conceptualization of a citizen advisory council, he supports genuine citizen

opinion assessment via interviews and written surveys. Of particular relevance to the task of measuring public attitudes and knowledge are his remarks with regard to the survey process:

> Assessment must take place before definite plans have been drawn. In making it, there should be candid recognition that the methods employed may shape the results ... A reliable sounding of preferences requires the citizen feel himself in a situation where conditions of choice are similar to those he will encounter in dealing with a real stream, that he be exposed to the full range of information and opinion as to the alternatives open to him, and that he have a realistic sense of man's capacity to deal with water and the life it sustain's. To do this will call for a close and unprecedented collaboration of natural scientists and engineers with social scientists in designing a new kind of assessment that will inevitably change attitudes as it tests them. This is one of the exciting challenges lying ahead in water management.

Clusen (1973), with the broad perspective of (then) Vice-president and Chair for the Committee on Environmental Program and Projects for the League of Women Voters of the U.S., discusses the socio-political perspective that "the public('s) role is that of choice-maker, people deciding what kind of community they want to live in, making judgements about which values they wish to create or protect." She describes the need for the kind of research involved in the Clallam County study, to determine "attitudes and public preferences with respect to competing demands."

Since these earlier beginnings, involving the public has become a much more widely recognized value and is a required element in Clallam County's planning.

A recent (1980's) paper by the former chief of the Bonneville Power Administration (BPA), Peter Johnson, written late in the era of BPA's turbulent involvement in the Washington Public Power Supply System nuclear power reactor construction "boom and bust," is a most helpful and concise rationale for such public involvement:

> While others are mired in political controversy and litigation, the astute practitioner of public involvement will have hammered out an agreement, and gotten on with the project. Public involvement will lead to better decisions. Instead of getting the thinking of just one, two, or three people, you get the best thinking of many, who will feel inspired by the opportunity to make a contribution. Old assumptions will be questioned. New possibilities will be considered.

Manty, et. al. (1975), writing in the Proceedings of the International Seminar on Water Resources Education, discuss the issue of public involvement as it specifically applies to water resource planning and education. In addition to the recommendation to establish a citizen advisory body to participate in public policy development, they provide us with a five step process useful for the consideration of anyone developing a water resources education program. The process: Define the Problem, Identify Alternative Solutions, Design a Plan of Action, Implement the

Action Plan, Evaluate the Action Plan; is described with rich detail and practical insight. Both the paper and the Proceedings volume should not be overlooked.

Johnson (1974), in her discussion of sociological contributions to water resources management and development provides an excellent overview of several topics, including public participation and community decision making. Her insight into societal values and sociological impediments to change are clearly related to the role of environmental education as she discusses possible solutions to water pollution problems and especially to the lack of information about them. She cites the public's ability to organize and respond to a defined problem and describes, "the need (is) to change the public's posture to a motivated awareness that results in action." She provides an excellent bibliography.

Doran (1974) recognized the need for establishing objectives for environmental educational efforts and evaluating their accomplishment. In an excellent discussion of the important role of attitudes, values, and beliefs, he endorsed the need for both affective and cognitive elements in such educational programs. He reviews several noteworthy studies that have made valuable contributions and also recommends other studies with relevant evaluative information. Hendee (1973), Maloney and Ward (1973), Erickson (1971), and Watkins (1974), among others, were all mentioned and were referenced as part of the Clallam County Water Resource Survey (Water AOK Survey) development literature review. Doran, although cognizant of the difficulties in developing such evaluation tools, encourages the research, development, and greater use of these types of surveys.

Hendee stressed the need to clearly define objectives so that educational programs could be effectively evaluated. Hounshell and Liggett (1973), also endorsing the need for evaluation, perceived a need for essential baseline data. Maloney, et. al. (1975) sum up the thinking this way: "we must determine what the population knows, thinks, feels, and actually does regarding ecology and pollution...before an attempt can be made to modify critically relevant behaviors."

Roth (1970) obtained data from educational professionals to determine their priorities for establishing key concepts that were felt to be critical for use in planning instructional programs. Although his work was designed to help academic planners come to agreement on what constituted important educational concepts, several statements in his instrument regarding water/natural resources could be useful in assessing public understanding. Two key concepts specific to water are:

- Water supplies, both in quantity and quality are important to all levels of living.
- Water is a reusable and transient resource, but the available quantity may be reduced or quality impaired.

Professional educator respondents across many disciplines were asked whether these concepts were: Essential, Highly Desirable, Desirable, Satisfactory, or Unacceptable. Both concepts received among the highest ratings from respondents.

Erickson (1971) developed a survey instrument of 80 statements about wildlife which were administered to 49 people. These were evaluated using a Q-sort technique which requires prioritizing answers in a personal interview. While this method of attitude assessment was not applicable for the Clallam County survey, one question in

particular was noted as having the "strong consensual standing among respondents" that suggested consideration be given to its use in the study. Respondents were asked their reaction to the following: "many rivers and streams contain sewage and materials that are harmful to fish and other life, and these materials are causing their decline. In order to increase fish life, pollution must be controlled no matter what the cost to society." Although the statement could have been modified for use in the AOK Survey, it was felt that other questions adequately covered the essential concepts.

Using only 19 statements on a larger sample of people (313), Watkins (1974) found five statements for measuring concern for and about water resources and concluded that, "... by knowing a respondent's score one is able to make reasonable generalizations about his attitudes (p. 58)." These statements make up his Water Concerns Scale and were eventually selected as key parts of Clallam County's survey. Watkins suggests:

> Perhaps environmentalists may be able, through the assessment of the attitudes of a particular population, to help bridge the gulf between the administrative solutions needed and the hesitations on the part of the water consumers to accept them (p. 54)

The five statements of the Water Concerns Scale were included as one part of a two-part series of validated survey instruments (sub-scales) measuring public attitude about water/natural resources. Both instruments were used in their entirety with questions in their original order.

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The second sub-scale was a survey produced by Weigel and Weigel (1978). Spring-boarding from earlier work, they used 31 original items administered to 141 randomly selected persons to develop their Environmental Concern Scale. Sixteen statements were dependable enough to make up a more recent version which asks respondents to rate items along a five-point Likert dimension ranging from "strongly agree" to "strongly disagree." (The Likert scale was also used by Watkins and is probably the most commonly used format for responses.)

Most of the statements in the Environmental Concern Scale were general enough to be considered for water resource issues and were also selected for the Clallam County survey. One distinct feature of this scale is its relationship to future behavior. It was found that respondents scoring in certain ranges will tend to respond to opportunities for environmentally-related action with a predictable frequency.

Hart (1978) stated that "the strongest predictor of environmental attitude has been previous knowledge of environmental information." By focusing on ecological comprehension as a possible determinant for attitude he expanded on earlier conclusions and set about to design a study to test this hypothesis. He confirmed statistically significant relationships between environmental information and environmental attitude and also found significance related to ecological comprehension. He suggested that his instrument may be useful for evaluation in a pre/post fashion such as in the Clallam County study.

Doran (1974), in addition to describing the several surveys mentioned earlier, also refers to instrument size. He describes questionnaires ranging in number of questions as follows: 29, 17, 56, 24, 36, 69, 130, 32, 20, and 16. Additionally, two

works using statements instead of questions, had 80 and 19 each. Many of the above dealt with student evaluation methods and these are noted only to indicate the general size being discussed. Two other surveys reviewed had 15 and 88 items (Padgitt, 1987; Moore, 1988).

Doran also gives examples of response rates (number of respondents) of over 300, and 450. Erickson's work (above) discussed a study of 49 people. Other studies looked at, had response rates or participant numbers ranging as follows: 25, 126, 162, 250, and 128 individuals.

Helweg (1985) in discussing the appropriate size of a survey, concluded after some elaborate calculations that "the size is independent of the total population--the sample size needed is rarely over 1200, whether the population is that of a small city or of a whole country." He determined that, regardless of population size, to experience 95 percent confidence (0.05 level of confidence) normally requires only 384 persons. The Clallam County survey was conducted by mail. Considering the possibility of a low response of only 10 percent, and the need for at least 384 responses, the total number of questionnaires sent ideally needed to be around 4000 (also, see Dunlap and Van Liere [1978 and 1984]).

Additionally, Helweg states that the procedure for sampling "can be random or systematic--every seventh household, for example. It can also be stratified random--as when the population is divided into groups (e.g. by income) and random samples chosen within these groups. Or cluster sampling can be used. An example of cluster sampling is when a geographic unit such as a city block is chosen from an identified neighborhood.

A study by Andrews, Madsen, and Hardin (1979), broached an important area not generally associated with water resource issues, that is the growth and associated societal change resulting from water development projects. Such growth generally requires providing increased educational and law enforcement services and is related to problems with urbanization in general. Burdge (1973), in the same volume, contributed one of the most exhaustive bibliographies found in fields of water resource-related social science research.

Another smaller but interesting bibliography worthy of review was found in Fitzsimmons' and Salama's (1973) paper. They mentioned several types of data gathering methods used in surveys, such as: mail questionnaires, focused interviews, observations of group meetings, telephone surveys, and case histories of project areas. Further light on types of surveys was found in Helweg's work (1985):

> You can use home interviews--the most expensive option but one that normally gets a 60 to 70 percent response. Questionnaires dropped off and picked up later can also garner a 60 to 70 percent response. A telephone survey is much cheaper than a questionnaire survey; a mail survey is more convenient, but the response may be as low as 10%.

Work by Moore (1988) was a sort of summation of all of the earlier research. His focus was on the testing and examination of a set of attitudinal scales dealing specifically with water quality issues and emphasizing non-point pollution. He goes into depth in his rationale for using the five surveys (including Weigel and Weigel)

that he has drawn from, citing their "internal consistency." This report had much relevant information for the development of the Clallam County questionnaire.

In addition to a strong endorsement for the Weigel's work, Moore credits Padgitt and Hoyer (1987) with finding (in contrast to frequent findings), "little difference between farmers and non-farmers with respect to water quality beliefs and concerns." Moore suggests the possibility that attitudes may be changing. Both Padgitt and Moore dealt primarily with the contrasts between farmer and non-farmer attitudes but were useful orientations to the problem of attitude assessment.

Finally, an interesting work, Consumer Behavior by John Mowen (1987), included a chapter on consumer beliefs, attitudes, and behaviors. In it, he discusses what values shape our decisions and how those values are formed (and modified). Regarding consumer behavior, he expresses some of the same goals environmental educators often try to include in their programs:

> The direct influence of behavior tends to occur when strong situational or environmental forces propel the consumer to engage in a behavior. The ecological design of the physical environment is an excellent example of how behaviors can be directly induced. (p. 208)

Designed to instruct the reader in consumer behavior, his discussion of the formulation and distribution of messages is especially relevant to educational program planners, and although very theoretical, this work could have interesting implications for agency personnel involved in the Clallam County efforts or anyone involved in the processes and mechanisms of behavior change.

Summary

The literature review revealed several studies that had indirect relevance to the work in Clallam County and a few with a direct relationship. Researchers had become increasingly aware of the desirability of determining what natural resource decisions were preferred by the public and knowing whether those preferences were based on real understanding of the circumstances or misconception. Attempts were made to identify what variables played the biggest roles in shaping preferences and understanding.

The recognition of the importance of the public's involvement in resource management decisions was clarified; such recognition has resulted in formal requirements for such participation, as is the case in Clallam County. The inclusion of questions in the Water AOK Survey designed to measure both knowledge and attitude was confirmed and specific questions were identified to contribute directly to the questionnaire's development.

Distribution schemes and statistical evaluation methods were researched and determined by discussion and review. It was found that there was a need for assessing the starting point or baseline to improve the effectiveness of educational efforts. Methods for such assessments were reviewed and helped to formulate the questionnaire developed for Clallam County.

CHAPTER III

DESIGN AND METHODOLOGY

Introduction

Faculty in Oklahoma State University's (OSU) Department of Curriculum and Instruction and the Center for Environmental Education made initial contact with the Clallam County Water Quality Division (CCWQD) during the summer of 1990. Discussions proceeded to outline a role for OSU, working in cooperation with CCWQD staff, to assess water-related attitudes, opinions, and knowledge (Water AOK factors) among the county's residents. The gathering of data from the public using such a survey instrument was consistent with the goals of the Center for Environmental Education and the CCWQD and it was agreed that a survey instrument to assess these factors should be developed for Clallam County.

In the fall of 1990, to facilitate the evaluation of Clallam County's educational efforts, all parties agreed upon a pre-test/post-test research design in which the survey information from the people living in the Sequim Area would be compared with the results from a later survey of the same area. There was also agreement on the value of comparing these early results with a later survey from the adjacent Port Angeles Area. This was considered desirable as the people in the Sequim Area were to receive education prior to educational efforts for the Port Angeles Area population. In subsequent discussions between faculty, CCWQD, and the researcher, a determination

was made to develop a survey instrument consisting of a comprehensive written questionnaire using primarily multiple-choice and Likert scalable questions.

Because the study was being done to assist the CCWQD of the Department of Community Development, the Clallam County Water Resource Survey (Water AOK Survey) instrument and sampling methodology procedure development required their participation. Using the mail, fax, and conference telephone calls, drafts of the survey instrument were created and reviewed. Later, on-site interaction with the CCWQD staff yielded final confirmation of questions and preferred methodology. By this time, the Sequim Area had received educational outreach efforts for almost two years while the Port Angeles Area had not, and this difference effectively provided the pre-test/post-test conditions originally conceived for the Sequim Area. It was concluded that surveys would be sent out to both the Sequim and Port Angeles Areas, as opposed to the Sequim Area only.

Comparing the responses from the Port Angeles Area (pre-test), with those responses coming from the Sequim Area (post-test), would give insight to outreach effectiveness. This research design and evaluation of survey data would help determine if people in the region felt differently and knew more about water resources after educational programs were implemented than at the outset. This information would, of course, be useful for educational planners in designing future programs.

Development of Instrument

Prior to the involvement of OSU's Center for Environmental Education, the CCWQD had begun preparations for a survey. Early in discussions, in response to

their request, several appropriate questions were gathered from the literature and prior studies conducted by the OSU Center for Environmental Education (Mills, 1983), and sent to Clallam County. Using a few of the draft questions that were sent, and several other questions emphasizing detailed demographic information, the CCWQD produced a "Water Quality Questionnaire," administered as an insert in the local newspaper, The Sequim Gazette. Although limited in scope, it did provide some useful initial information, however, there was no follow-up or statistical analysis of the responses.

Our agreement was to develop a survey questionnaire that would statistically measure respondent's attitudes and knowledge of water quality and quantity issues among citizens in the region. The survey's development made it necessary to conduct an extensive search for references in the literature (discussed in Chapter Two). The opinions of residents were also of interest to researchers and program planners and several opinion questions were included for the use of Clallam County.

Our goal for questionnaire development was to select questions that would:

- identify the knowledge base of the respondents
- indicate respondent's environmental attitude
- indicate a reliable presence of values concerning water resources
- obtain a sufficient number of responses
- pose questions relevant to the sample population's environment
- determine proclivity toward positive environmental actions
- obtain demographic data

In the early stages of developing the watershed action plan for Clallam County, a public meeting was held. The following questions were developed in association with that meeting and were included in the Water AOK Survey:

Questions From The Public Hearings In Clallam County:

1. What is your most important concern? (e.g., protection/prevention, correction/cleanup, fish and wildlife habitat, risks due to potential growth/increased use, urban household wastes, public health and drinking water concerns, groundwater issues)
2. What is the most important source of nonpoint pollution? (e.g., agriculture, logging, marinas, urban use, household, septic systems)
3. What actions should be implemented? (e.g., education/public awareness, cleanup, enhancement projects, county ordinances, local [programs], increased fees/taxes).

The challenge in the creation of the Water AOK Survey was to design questions which would provide data to answer the research questions stated in the General Procedures section in Chapter One of Water Knowledge and Attitude Assessment of the Citizens of Clallam County, Washington State. The approach taken was to create an equal number of water quality and water quantity questions to ascertain citizens' knowledge of these topics (Water Knowledge Scale) and to balance these with questions that would help describe respondent attitudes.

In addition to the questions from the public hearings, questions were drawn from existing tests and questionnaires (Watkins, 1974; Weigel & Weigel, 1978; Mills,

Southwest Water Resource Knowledge Survey, 1983; Padgitt, 1987 [modified]). Others were original questions designed by the researcher and approved by the CCWQD (some of these were inspired by Tetra Tech's [1988] report on the Clallam County watershed ranking project). For example, because the officials in Clallam County were particularly interested in non-point pollution, specific questions were developed (numbers 3, 10, and 17). Additionally, five groundwater-specific questions (numbers 4, 6, 8, 9, and 16) were included in the Water Knowledge Scale.

Including a balance between various areas of water knowledge was a concern. A Conceptual Framework For Water Education: An Educator's Guide To Goals, Concepts And General Objectives For Curriculum Development (1981) [see Appendix C] was used as a guide to ensure that questions covered a breadth of concepts. The knowledge questions were of mixed difficulty.

The survey by Andrews and Madsen (1973, p. 72), provided a question in an area of particular merit. The authors asked respondents "how would it affect your enjoyment of life if you were no longer able to participate in any water related recreational activities in which you now participate?" Almost 80% in the Andrews and Madsen study felt it would lessen their quality of life. Although this was an excellent question, it was not used because two complete attitude scales were used in this study to give a more reliable response. The Watkins Water Concerns Scale and Weigel and Weigel Environmental Concerns Scale, were selected and used in their entirety with items remaining in sequence. Using these two valid and reliable scales, which respectively measured concerns about water in particular and environmental issues in

general, would provide program planners with useful information and meaningful reference points.

Watkins' interests were with "the respondent's willingness to do something about the water resource problem, their awareness of it, and their knowledge of certain socioeconomic relationships and availability of water." (Watkins, 1974, p. 55) The Weigel's Environmental Concern Scale is, "a research tool capable of examining the correlates and determinates of attitudinal concern about environmental quality, longitudinal change in public attitudes, and the attitudinal impact of environmentally oriented policies, legislation, and educational efforts." (Weigel & Weigel, 1978, p.12)

Watkins ran four trial scales to obtain "an acceptable co-efficient of reproducibility (reliability) of .895." and validated his scale by factor analysis (Watkins, p. 55). Weigel & Weigel determined that their scale "exhibited satisfactory internal consistency" by a test/re-test methodology (correlation .83) and obtained validity by "the known-groups comparison" (Sierra Club), and by demonstration of "prediction of environmentally relevant behavior." (Weigel & Weigel, p. 12)

Other researcher-developed questions were also included. These questions have not been thoroughly tested for reliability or validity. Some were created to determine knowledge and these were checked for content and accurate answers were obtained from literature or CCWQD officials. Others were created with the idea that they would be part of the attitude block of questions. The latter were, upon reconsideration, determined to be more appropriately viewed as opinion questions. Rather than drop these, they were retained as having merit primarily for the discrete information they would provide to county planners.

Communication with the CCWQD office, which coordinated the project, was by telephone, fax, and mail service. Throughout the study, phone conversations and an in-person visit with Mrs. Jeffrey Bohman and Tim McNulty, and later, Ms. Leanne Jenkins, were most informative. However, work on a study so physically removed presents inherent communication problems and creates difficult information needs. To help solve this problem a subscription to the local newspaper "The Sequim Gazette," was taken to aid familiarity with local issues. It was a moderate expense and provided valuable information.

Throughout the development of the instrument, each question was critiqued and much discussion occurred at every turn. Determination of the questionnaire's size (number of questions) remained a difficult decision. The questionnaire must not be so long as to become (or appear) arduous to complete, yet it must maximize the information obtained. Professional environmental educators at Oklahoma State University filled out the questionnaire as a test for length and gave review and comments. Comments on the Water AOK Survey were positive and the time required and number of questions were not out of line with other surveys, requiring approximately 15 minutes to complete. This length was deemed acceptable. The questionnaire (see Appendix A) was eventually created in a 8.5" by 7" booklet form. Using a booklet allowed both sides of each page to be used and provided a relatively user-friendly format which diminished the threat posed by a larger single page format.

A letter from the CCWQD (May of 1991) provided comments and identified the need for further discussion on the draft questionnaire sent to them in early 1991. However, ensuing telephone discussions were unable to finalize the questionnaire, the

procedure, or the level of commitment for funding the mailings and other related costs. In addition, it was necessary to get their approval for each question on the final questionnaire and difficulties arose in ascertaining correct answers for some of the factual questions relevant to the study areas. These matters were not clarified until on-site work with CCWQD took place in the late summer and fall of 1992.

At that time the Clallam County Planning Division staff, including the director, environmental education specialist, and secretary, all gave the questionnaire further review. The CCWQD was able to resolve many, but not all, of the difficulties and it was still necessary to drop some of the researcher-designed knowledge questions for which no acceptable answers could be found. In view of this, it appears as though some of these questions would have been too difficult. Additionally, the rationale and wording for the remaining questions underwent close review by the Board of Clallam County Commissioners.

Prior to distribution, The Baywatchers, a non-profit environmental group, also examined the questionnaire. Finally, the approval of the Washington State Department of Ecology--who had issued the original grant--was required and obtained, and the survey questions and design were accepted. The CCWQD staff had input throughout the process and agreed upon each and every question prior to finalization. The process required last minute adjustments in both the content and format of both the questionnaire and the survey. The end result was a comprehensive assessment tool composed of questions to measure citizen's attitude, opinion, and knowledge and to solicit demographic data.

After the survey was developed and approved, it was distributed. Some telephone follow-up was conducted by Clallam County personnel. The responses were then mailed to OSU, tabulated and given statistical analyses.

Description Of The Sample

It was important to ensure representation distributed from across the two Major study areas, the Sequim and Port Angeles. To accomplish this, the director of the CCWQD designated eight geographic areas (minor study areas) from within the Port Angeles Regional Watershed (Port Angeles Area--population approximately 20,000) and the already designated nine geographic areas (minor study areas) from the combined Sequim and Dungeness watersheds (Sequim Area--population approximately 8,000) were used. These minor areas were unequally populated, roughly equally-sized geographic subdivisions of the two larger watershed, or major areas, used in the study (see map-- page 41).

The eastern boundary of the Sequim Area is located east of Sequim Bay and south into the Olympic National Forest. From there, the boundary encompasses the high country in Jefferson County within the Olympic National Park and continues through the Dungeness Valley. The western edge of the area, which includes Bagley Creek, is positioned approximately 4 miles east of Port Angeles.

The part of the Port Angeles Area identified for the study was west of Morse Creek to just west of the Elwha River. It drains from the high ridges of the Olympic Range to Port Angeles Harbor and the Strait of Juan de Fuca. Also included in this

watershed are Lee's Creek, Ennis Creek, Peabody Creek, Valley Creek, Tumwater Creek, Dry Creek, and the Elwha River drainages.

The demographic questions sought information as follows (indicates questionnaire number):

1. town or rural residence
2. location within county and designated Major/minor study areas
3. length of time in area -- question #51
4. use of land -- question #52
5. percentage of annual local residence -- question #53
6. occupation -- question #54
7. education -- question #55
8. income -- question #56
9. age -- question #57

Collection Of The Data

The county tax assessor's list of properties was finally determined to be the best source of addresses from which the mailings would be selected. The list included all of the addresses within the two Major study areas categorized by map section. A process to locate those assessor's list properties within the geographically determined Major and minor study areas was created.

The minor study areas had been created as geographic sub-divisions of the Major study areas. Placement of the one-mile square sections into each minor study area was achieved by determining which minor study area contained 50 percent or

more of the section. All of the addresses for that entire section were then assigned to the minor study area.

Within each minor study area, a proportional selection of addresses was made by computer (every 8th address in the Sequim Area, every 20th address in the Port Angeles Area). This systematic methodology provided a useable approach to selecting an approximately equal number of addresses for each Major study area from the assessor's list. The approach also provided a sample that was more evenly distributed across the study areas than would have been obtained by other selection methods.

With a similar number of addresses from dissimilar-sized populations in each of the two major study areas, the efficiency of the comparisons to be made between the major study areas was maximized, although this lessened the dependability of the combined data for the entire sample .

Following the identification of subject mailing addresses, duplicates (identified owner of more than one selected property) or addresses identified as outside the study areas were removed. The number of mailings actually sent was based on a desired total sample of approximately 2000 mailings (the actual number of questionnaires mailed totaled 1958). The primary limitations on the number of mailings planned were the funds available for postage. It was expected that the 1/8th and 1/20th proportion would increase the probability that an equal distribution of mailings would be sent between the major study areas. Within each major study area, the process was designed to obtain the desired total of responses proportionally from the several minor study areas.

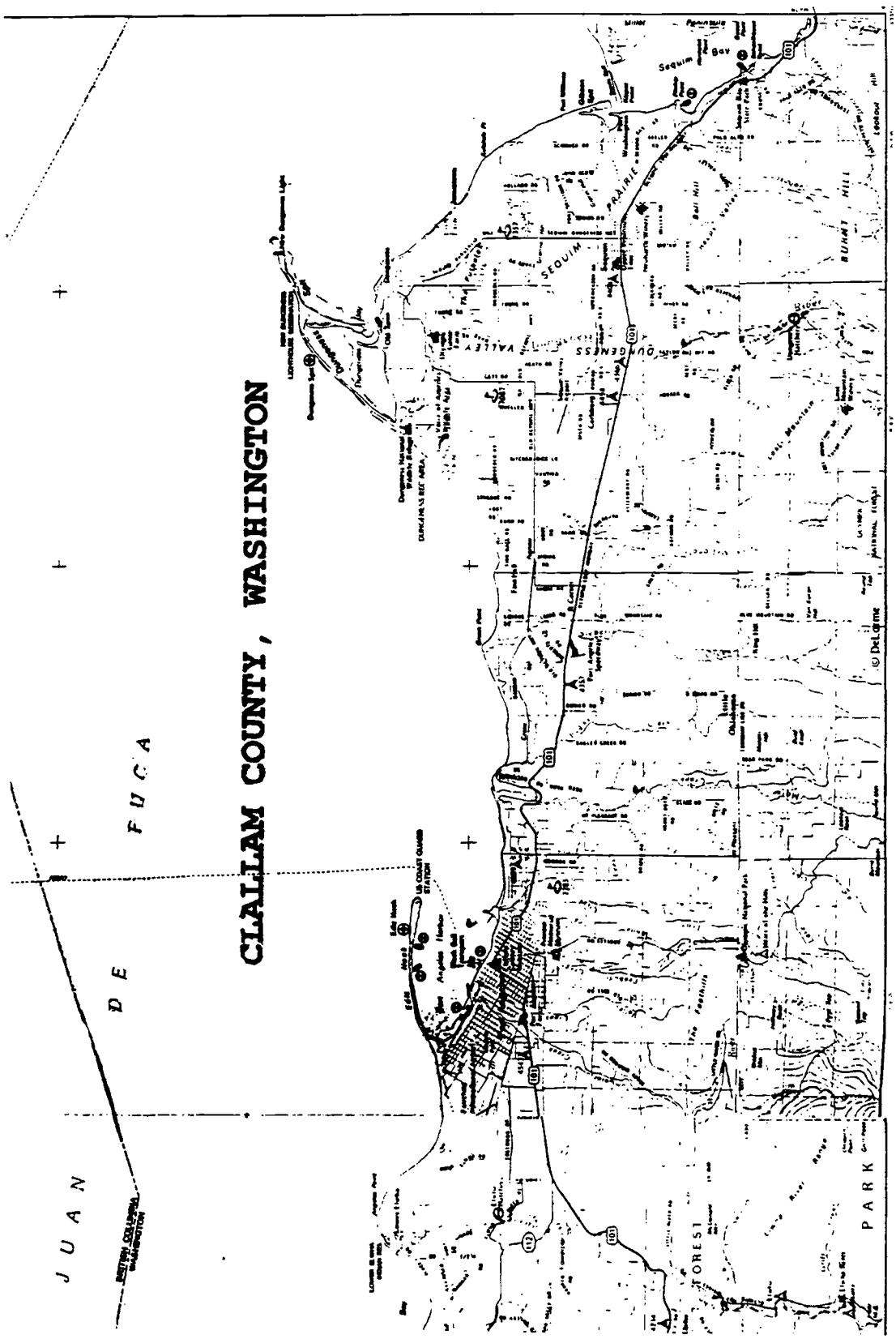

Figure 2. Clallam County, Washington

The mailing of the questionnaires took place in early December, 1992. Approximately five working days later, the CCWQD sent a post card encouraging the participation of the recipients. If no response was received with the next seven working days, phone calls were initiated to further encourage responses. These steps were taken in an attempt to eliminate the nonresponse and early-return bias found in voluntarily returned mailed questionnaires.

The questionnaire was mailed with an excellent accompanying cover letter written by the serving Clallam County Office of Water Quality Manager, Jeff Bohman (see Appendix A). The letter was on the inside cover of the questionnaire booklet, and described the survey's purpose while assuring anonymity for those responding. The booklets were returned to the CCWQD by respondents, collected, and mailed to Oklahoma State University where the responses were transferred to computer answer sheets for statistical analysis. The transfer took place during the spring and early-summer of 1993. The data was run on the University's mainframe computer during the summer.

In addition to the descriptive statistics (percentage and frequency of response), three types of data analysis were selected: simple one-way analysis of variance (ANOVA)--null hypotheses 5-67; Pearson Correlation--null hypotheses 1-4 & 83, 84, 87, 88, 91, 92, 94, 95, 97, 98 120-129; and Chi-Square--null hypotheses 68-82 & 85, 86, 89, 90, 93, 96, 99-119. The ANOVA compared several demographic characteristics with the mean scores for the Water Knowledge Scale, Watkins Water Concern Scale, and Weigel & Weigel Environmental Concern Scale. The groundwater and non-point water pollution knowledge questions were also compared

between the Port Angeles and Sequim Areas (major study areas) and between the minor study areas within each major study area.

Throughout the analysis, a .05 level of confidence was used as the standard for rejecting hypotheses. Because public policy implementation must go forward on the best available data, visible numerical trends identified in the data are also described in the analyses (Results and Discussion, Chapter IV; and Summary, Conclusions, and Recommendations, Chapter V) even though they do not meet the .05 level of confidence criteria for statistical significance. The possibility that some of these may be due strictly to chance is recognized.

In the ANOVA test we are looking for evidence that the differences between the variable factors are statistically significant. Upon finding such difference, the Tukey Studentized Range Test (after Student, see Tukey, 1957) was run to confirm findings and pinpoint where the significant difference was. In the event that a previously identified statistically significant difference failed to be confirmed or located by this conservative statistical test, the Duncan Multiple Range Test, a less-conservative method was run to obtain this information. Duncan's Test is an acceptable method for determining which variables are scoring significantly differently.

The Pearson Correlation was used to locate identified statistical relationships between factors. This can be thought of as a test for strength and direction of relationships existing between factors; as one factor increases, is there a corresponding linear increase in the other factor? ... or, a linear decrease? Pearson Correlations

were properly used only where variables were ordinal ("variable can be compared in magnitude, with different values representing different quantities" [Agresti, 1986]).

The Chi-Square test identifies where data-links or dependence occurs between variables but, for validity, must be based on 80% or more of the cells in the table having at least five responses. The Chi-Square test was used when variables were nominal ("categories that vary in some quality but not in magnitude" [op cit]), or ordinal.

Number And Percent Of Surveys Returned (based on usable responses):

1. from the entire survey area, 537 responses were returned (of 1958 sent), this was a 27% response rate.
2. from the Port Angeles Area, 263 responses were returned, this was 49% of total.
3. from the Sequim Area, 274 responses were returned, this was 51% of total.

Method For Scoring Each Question:

1. Water Knowledge Scale questions (#3-17) were given 4 points for correct answers, there was a possible point total of 60.
2. attitude items were given 4 points for positive responses, there was a possible point total of 84.
    a. Watkins Water Concern Scale (#21-25), 20 possible points.
    b. Weigel & Weigel Environmental Concern Scale, (#26-41), 64 possible points.

3. opinion questions/items (1, 2, 18, 19, 20 & 43, 42, 44, 45, 46, 47, 48, 49, 50, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67), responses were not scored for correctness but were subjected to chi-square or Pearson Correlation analyses.
4. demographic questions (#51-57) were not scored for correctness but were used as variables for selected comparisons.

Data Was Analyzed To Provide:

1. the frequency distribution of responses to each question.
2. the response rate (% of response to each option).
3. a demographic summary.
    a. by mean/median for each personal characteristic (age, income, etc.), except: length of residence, occupation, and area of residence
4. mean/median analysis for entire sample and for each of two major study areas by:
    a. knowledge score
    b. Watkins Water Concern Scale
    c. Weigel & Weigel Environmental Concern Scale
5. for selected opinion question:
    a. a correlation by demographic characteristic, except for three variables for which Pearson Correlation was inappropriate (use of land, occupation, and area of residence)

Summary

The AOK Survey instrument used in this study was in development for two years. It is the product of government, university, and individual expert input. There were few compromises considering the survey was required to meet the standards set by an extremely diverse range of professionals and public officials.

CHAPTER IV

RESULTS AND DISCUSSION OF THE STUDY

Participant Information

Total useable responses received numbered 537. Although this number was satisfactory, not all of the questionnaires returned had the complete data required to do a particular analytical test (a question necessary for a given test may have been unanswered). In such cases the number of responses processed did not total 537.

The recent growth experienced by the Port Angeles and Sequim areas is well documented by the responses received. Almost 20% of the respondents lived in the area only 5 years or less, and almost a third of the respondents lived in the area only 10 years or less. The trend towards a newer group of citizens is further reinforced as we note that 56% of the respondents had been in the area 20 years or less. This left only 44% of the respondents in the length of residence category of "21 years and over."

These facts have even greater meaning when we observe that 90% of the respondents were 40 years of age or older and 70% were age 50 or older, dispelling an explanation of youthful respondents weighting the "length of residence" tally toward shorter times. Clearly, our respondents were among the more mature segments of the population (52% listed occupation as retired).

Besides "retired," other occupations were listed and responded as follow: commercial/service (13.4%); construction/trades/manufacturing and "other," both at 8.7%; and government [non-military] (5.5%); full-time homemaker (4.2%); forestry (3.4%); and agriculture (2.5%). Incomes were spread fairly evenly in the middle-brackets with 30% in the $25-40,000, and 23% in both the $13-25,000 and $40-60,000 ranges. 16% were over $60,000, leaving only 8% with incomes under $13,000.

We learned that more than 95% of the respondents were residents at least 76% of the year, with most of the others residing locally 51-75% of the time. Their use of land was primarily as year-round residences (91%) with 5% listing uses as farm or ranch. Recreational properties (not home or business) were listed as use by 2.5% of respondents, business by 1%.

Over 60% of the respondents had attended college for over two years. 19% had 4 year degrees and 15.5% had graduate degrees. This left 33.5% finishing high-school with 5% at less than 12 years of formal education. The population appears to be well educated.

Data Analysis

Research Hypotheses (data may show only zeroes when rounding very small fractions)

1. There is no significant relationship between mean Water Knowledge Scale scores and mean scores on the Watkins Water Concerns Scale (WCS) within the Port Angeles Area.

Mean scores for the Water Knowledge and Water Concerns Scales were 35.24 and 13.23 respectively (of 60 and 20 possible scores respectively). Analysis of Pearson Correlation coefficients showed a positive correlation at the .0001 level of confidence. The hypothesis is rejected.

Table 1 below shows the level of confidence (LOC) for rejecting hypotheses one (1), two (2), and three (3) based on Pearson Correlation analyses of Port Angeles Area data for the three discrete scales within the Clallam County Water Resource Survey (Water AOK Survey).

Table 1
Pearson Correlation Coefficients for Hypotheses Numbers 1-3
In Bold (with LOC in parentheses)

REGION=PORT ANGELES

	KNOWLEDGE	WATERCS	ENVIROCS
Knowledge Scale	**1.0000**	**0.2692**	**0.2298**
Water Concern Scale	(0.0001)	**1.0000**	**0.3118**
Environmental Concern Scale	(0.0003)	(0.0001)	**1.0000**

2. There is no significant relationship between mean Water Knowledge Scale scores and mean scores on the Weigel and Weigel Environmental Concerns Scale (ECS) within the Port Angeles Area.

Mean scores for the Water Knowledge and Environmental Concerns Scales were 35.24 and 41.18 respectively (of 60 and 64 possible scores respectively). Analysis of Pearson Correlation coefficients showed a positive correlation at the .0003 level of confidence. The hypothesis is rejected.

3. There is no significant relationship between mean WCS scores and mean ECS scores within the Port Angeles Area.

Mean scores for the WCS and ECS were 13.23 and 41.18 respectively (of 20 and 64 possible scores respectively). Analysis of Pearson Correlation coefficients showed a positive correlation at the .0001 level of confidence. The hypothesis is rejected.

We see that there exists a positive correlation between each of the three scales in relation to one another among the Port Angeles Area respondents. That is interpreted to mean that as the scores for one scale increase, a parallel increase in scores in the other scales is found.

4. There is no significant relationship between mean Water Knowledge Scale scores and mean scores on the WCS in the Sequim Area.

Mean scores for the Water Knowledge and Water Concerns Scales were 36.25 and 13.22 respectively (of 60 and 20 possible scores respectively). Analysis of Pearson Correlation coefficients showed a positive correlation at the .0001 level of confidence. The hypothesis is rejected.

Table 2 below shows the level of confidence for rejecting hypotheses four (4), five (5), and six (6) based on Pearson Correlation analyses of Sequim Area data for the three discrete scales within the Water AOK Survey.

Table 2
Pearson Correlation Analyses for Hypotheses Numbers 4-6
In Bold (with LOC in parentheses)

	REGION=SEQUIM		
	KNOWLEDGE	WATERCS	ENVIROCS
Knowledge Scale	**1.0000**	**0.3789**	**0.2592**
Water Concern Scale	(0.0001)	**(1.0000)**	**0.2976**
Environmental Concern Scale	(0.0001)	(0.0001)	**1.0000**

5. There is no significant relationship between mean Water Knowledge Scale scores and mean scores on the ECS within the Sequim Area.

   Mean scores for the Water Knowledge and Environmental Concerns Scales were 36.25 and 41.75 respectively (of 60 and 64 possible scores respectively). Analysis of Pearson Correlation coefficients showed a positive correlation at the .0001 level of confidence. The hypothesis is rejected.

6. There is no significant relationship between mean WCS scores and mean ECS scores within the Sequim Area.

Mean scores for the Water Concerns and Environmental Concerns Scales were 13.22 and 41.75 respectively (of 20 and 64 possible scores respectively). Analysis of Pearson Correlation coefficients showed a positive correlation at the .0001 level of confidence. The hypothesis is rejected.

We see that there also exists a positive correlation between each of the three scales in relation to one another among the Sequim Area respondents. Again, the interpretation is that as the scores for one scale increase, a parallel rise in scores in the other scales is identified.

7. There is no significant difference between the mean Water Knowledge Scale scores for the Port Angeles and Sequim Areas.

   Mean scores for the PA and Sequim Areas was 35.24 and 36.25 respectively (of 60 possible). An analysis of variance did not indicate a significant difference.

Table 3
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 7

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
Major Study Areas	129.04	1	129.04	1.24	0.267
Knowledge Scores	52496.57	504	104.16		
TOTAL	52625.61	505			

8. There is no significant difference between mean Water Knowledge Scale scores within the seven minor study areas of the Port Angeles Area.

Of 60 possible, mean scores for the seven minor study areas were 30.40, 33.83, 35.00, 36.22, 36.65, 37.29, and 38.18. An analysis of variance indicated no significant difference.

Table 4
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 8

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Min Study Areas	855.15	6	142.52	1.46	0.194
Knowledge Scores	23369.18	239	97.78		
TOTAL	24224.33	245			

9. There is no significant difference between mean Water Knowledge Scale scores within the nine minor study areas of the Sequim Area.

Of 60 possible, mean scores for the nine minor study areas were 32.18, 35.59, 36.25, 36.27, 36.78, 37.85, 39.00, 39.43, and 41.82. An analysis of variance indicated no significant difference.

Table 5
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 9

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Min Study Areas	957.97	8	119.78	1.1	0.363
Knowledge Scores	27314.28	251	108.82		
TOTAL	28272.25	259			

10. There is no significant difference between mean scores for non-point pollution questions within the Port Angeles and Sequim Areas.

The mean scores for non-point pollution questions within the PA and Sequim Areas were 6.75 and 7.00 respectively (12 possible total). An analysis of variance indicated no significant difference.

Table 6
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 10

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
Major Study Areas	7.92	1	7.92	0.83	0.361
Knowledge Scores	4751.69	501	9.48		
TOTAL	4759.6	502			

11. There is no significant difference between mean scores for non-point pollution questions within the seven minor study areas of the Port Angeles Area.

Of 12 possible, mean scores for the non-point pollution questions were 4.40, 6.41, 6.81, 7.16, 7.20, 7.45, and 7.56. An analysis of variance indicated no significant difference.

Table 7
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 11

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Min Study Areas	101.38	6	16.9	1.64	0.137
Non-Point Know	2430.31	236	10.3		
TOTAL	2531.69	242			

12. There is no significant difference between mean scores for non-point pollution questions within the nine minor study areas of the Sequim Area.

Of 12 possible, mean scores for the non-point pollution questions were 6.00, 6.46, 6.50, 6.74, 7.06, 7.43, 7.71, 8. 33 and 8.36. An analysis of variance indicated no significant difference.

Table 8
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 12

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Min Study Areas	100.75	8	12.59	1.49	0.16
Non-Point Know	2119.25	251	8.44		
TOTAL	2220	259			

13. There is no significant difference between mean scores for groundwater questions within the Port Angeles and Sequim Areas.

Mean scores for groundwater questions within the PA and Sequim Areas were 12.15 and 12.34 respectively (20 possible total). An analysis of variance indicated no significant difference.

Table 9
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 13

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
Major Study Areas	4.72	1	4.72	.24	.628
Groundwtr Know	10092.83	503	20.07		
TOTAL	10097.55	504			

14. There is no significant difference between mean scores for groundwater questions within the seven minor study areas of the Port Angeles Area.

Of 20 possible, mean scores were 10.80, 11.54, 12.00, 12.22, 12.65, 13.43, and 13.64. An analysis of variance indicated no significant difference.

Table 10
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 14

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Min Study Areas	180.65	6	30.1	1.71	0.12
Groundwtr Know	4214.08	239	17.63		
TOTAL	4394.73	245			

15. There is no significant difference between mean scores for groundwater questions within the nine minor study areas of the Sequim Area.

Of 20 possible, mean scores were 11.00, 11.62, 11.81, 12.13, 12.25, 12.57, 12.63, 13.23, and 13.82. An analysis of variance indicated no significant difference.

Table 11
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 15

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Min Study Areas	89.4	8	11.17	0.5	0.857
Groundwtr Know	5608.7	250	22.43		
TOTAL	5698.1	258			

16. There is no significant difference between mean scores on the WCS for the Port Angeles and Sequim Areas.

Mean WCS scores for the PA and Sequim Areas were 13.23 and 13.22 respectively (20 total possible). An analysis of variance indicated no significant difference.

Table 12
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 16

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
Major Study Areas	0.00+	1	0.00+	0.00+	.981
Water Concern S.	3667.61	501	7.32		
TOTAL	3667.61	502			

17. There is no significant difference between mean scores on the WCS within the seven minor study areas of the Port Angeles Area.

Of 20 possible, mean scores were 12.74, 12.79, 13.15, 13.50, 13.72, 14.16, and 14.20. An analysis of variance indicated no significant difference.

Table 13
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 17

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Min Study Areas	83.36	6	13.89	1.9	0.081
Water Concern S.	1743.89	239	7.3		
TOTAL	1827.25	245			

18. There is no significant difference between mean scores on the WCS within the nine minor study areas of the Sequim Area.

Of 20 possible, mean scores were 12.69, 12.87, 13.00, 13.38, 13.47, 13.97, 14.00, 14.00, and 14.18. An analysis of variance indicated no significant difference.

Table 14
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 18

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Min Study Areas	58.12	8	7.26	1.01	0.428
Water Concern S.	1782.24	248	7.19		
TOTAL	1840.36	256			

19. There is no significant difference between mean scores on the ECS for the Port Angeles and Sequim Areas.

Mean scores for the ECS within the PA and Sequim Areas were 41.18 and 41.75 respectively (64 possible total). An analysis of variance indicated no significant difference.

Table 15
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 19

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
Major Study Areas	41.18	1	41.18	0.48	0.488
Enviro Concerns S.	42615.48	498	85.57		
TOTAL	42656.66	499			

20. There is no significant difference between mean scores on the ECS within the seven minor study areas of the Port Angeles Area.

Of 64 possible, mean scores were 37.50, 40.14, 40.42, 41.65, 42.60, 44.09, and 45.05. An analysis of variance indicated no significant difference.

Table 16
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 20

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Min Study Areas	833.63	6	138.94	1.61	0.144
Enviro Concern S.	20231.73	235	86.09		
TOTAL	21065.36	241			

21. There is no significant difference between mean scores on the ECS within the nine minor study areas of the Sequim Area.

Of 64 possible, mean scores were 39.43, 40.46, 41.20, 41.36, 41.53, 41.74, 42.58, 43.62, and 44.62. An analysis of variance indicated no significant difference.

Table 17
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 21

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Min Study Areas	343.45	8	42.93	0.5	0.853
Enviro Concern S.	21206.67	249	85.17		
TOTAL	21550.12	257			

22. There is no significant difference between town and rural residence in the Port Angeles Area and mean Water Knowledge Scale scores.

Of 60 possible, mean scores for town and rural residents were 31.17 and 35.68 respectively. The difference amounted to about 4.5 points. An analysis of variance indicated that this was a significant difference at the .035 level of confidence (LOC). The hypothesis is rejected.

Table 18
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 22

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Town/Rural Res	440.34	1	440.34	4.52	0.035
Knowledge Scores	23783.98	244	97.48		
TOTAL	24224.32	245			

23. There is no significant difference between town and rural residence in the Port Angeles Area and mean scores on the WCS.

Of 20 possible, mean scores for town and rural residents were 13.00 and 13.25 respectively. An analysis of variance indicated no significant difference.

Table 19
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 23

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Town/Rural Res	1.38	1	1.38	0.18	0.668
Water Concern S.	1825.87	244			
TOTAL	1827.25	245			

24. There is no significant difference between town and rural residence in the Port Angeles Area and mean scores on the ECS.

Of 64 possible, mean scores for town and rural residents were 40.73 and 41.22 respectively. An analysis of variance indicated no significant difference.

Table 20
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 24

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Town/Rural Res	7.91	1	4.91	0.06	0.813
Enviro Concern S.	21060.45	240	87.75		
TOTAL	21065.36	241			

25. There is no significant difference between town and rural residence in the Sequim Area and mean Water Knowledge Scale scores.

Of 60 possible, mean scores for town and rural residents were 39.50 and 36.14 respectively. An analysis of variance indicated no significant difference.

Table 21
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 25

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Town/Rural Res	87.39	1	87.39	0.8	0.372
Knowledge Scores	28184.86	258	109.24		
TOTAL	28272.25	259			

26. There is no significant difference between town and rural residence in the Sequim Area and mean scores on the WCS.

Of 20 possible, mean scores for town and rural residents were 12.40 and 13.24 respectively. An analysis of variance indicated no significant difference.

Table 22
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 26

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Town/Rural Res	4.3	1	4.3	0.6	0.44
Water Concern S.	1836.06	255	7.2		
TOTAL	1840.36	256			

27. There is no significant difference between town and rural residence in the Sequim Area and mean scores on the ECS.

Of 64 possible, mean scores for town and rural residents were 39.75 and 41.82 respectively. An analysis of variance indicated no significant difference.

Table 23
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 27

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Town/Rural Res	33.09	1	33.09	0.39	0.53
Enviro Concern S.	21517.04	256	84.05		
TOTAL	21550.12	257			

28. There is no significant difference between lengths of residence in the Port Angeles Area and mean Water Knowledge Scale scores.

An analysis of variance indicated no significant difference. The bar graph following Table 24 below shows the range of mean scores.

Table 24
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 28

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Residence Time	344.84	4	86.21	0.87	0.484
Knowledge Scores	23856.69	240	99.4		
TOTAL	24201.53	244			

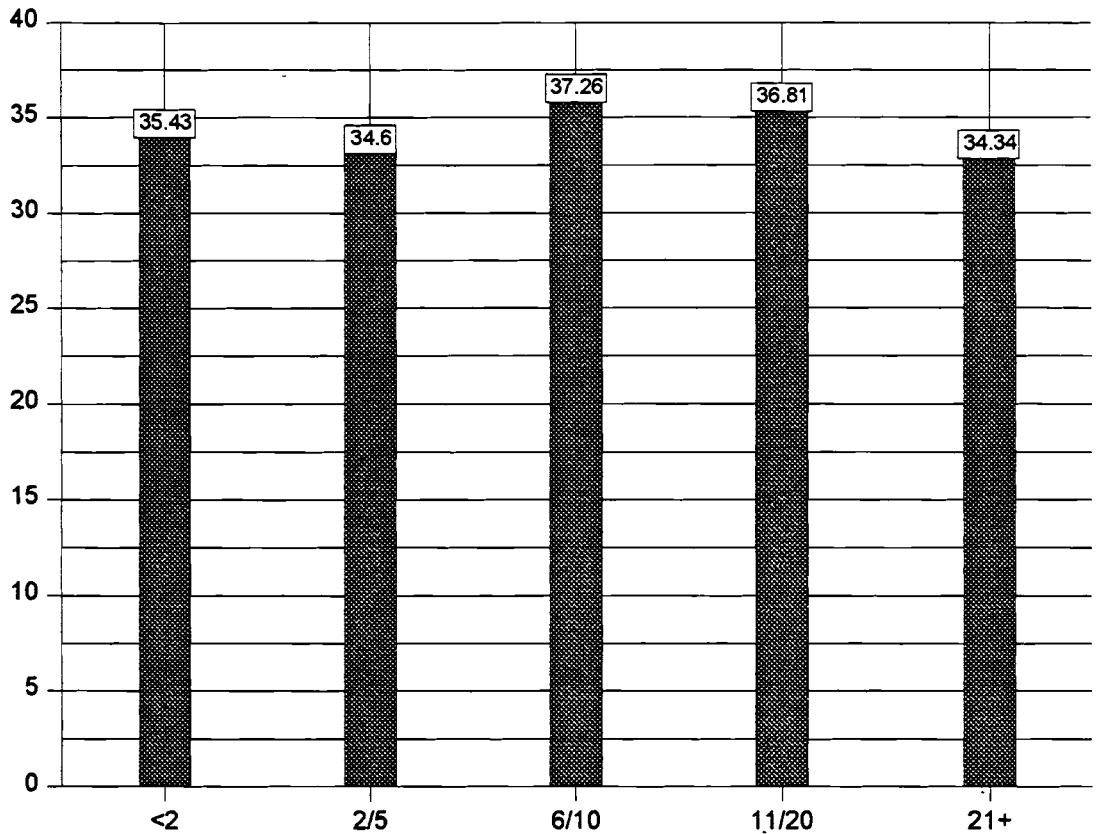

Figure 3. Mean Water Knowledge Scores By Length of Residence for PA Area

29. There is no significant difference between lengths of residence in the Port Angeles Area and the mean scores on the WCS.

An analysis of variance indicated a significant difference at the .050 LOC. The hypothesis is rejected.

Table 25
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 29

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Residence Time	69.54	4	17.38	2.41	0.05
Water Concern S.	1730.27	240	7.21		
TOTAL	1799.81	244			

The bar graph below shows the mean WCS scores for the PA Area. The Duncan Test was able to identify that the significantly different scores were the 2-5 year residents' score and the 6-10 year residents' score.

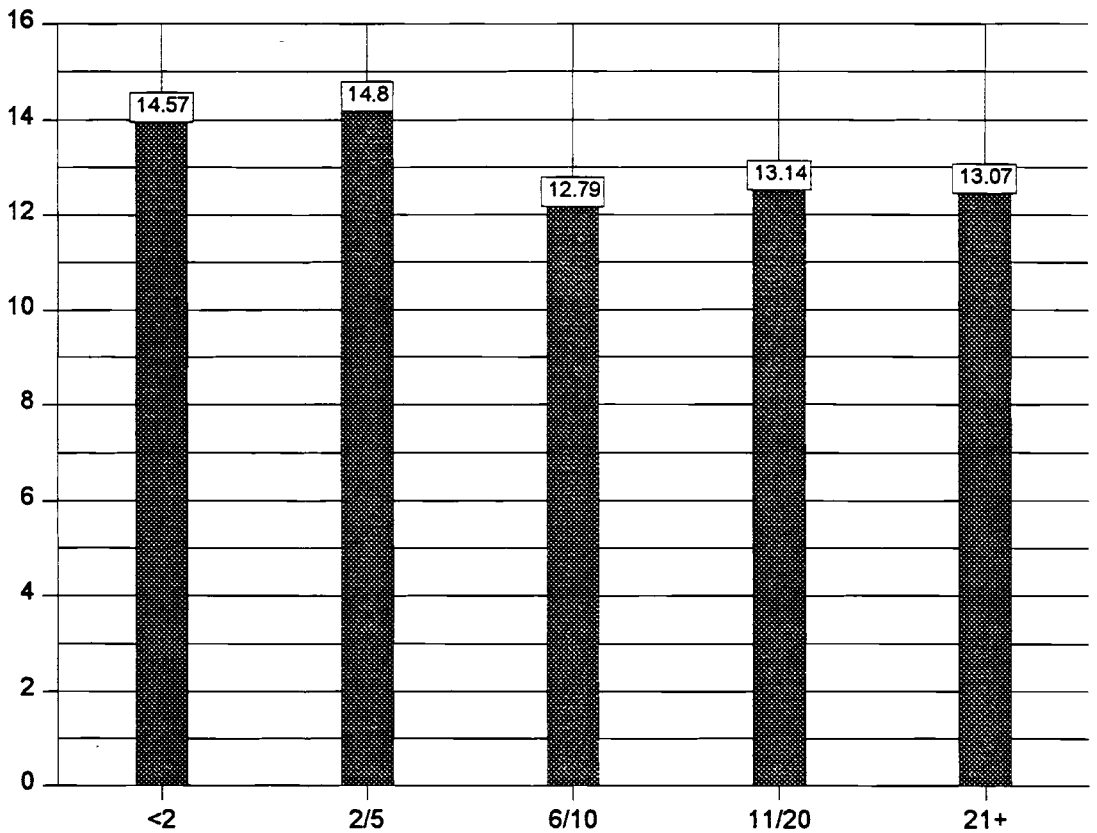

Figure 4. Mean Water Concern Scale Scores By Length of Residence For PA Area

30. There is no significant difference between lengths of residence in the Port Angeles Area and the mean scores on the ECS.

An analysis of variance indicated no significant difference.

Table 26
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 30

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Residence Time	705.05	4	176.26	2.05	0.088
Enviro Concern S.	20360.31	237	85.91		
TOTAL	21065.36	241			

The following chart shows the mean ECS scores for the PA Area. Although there was insufficient statistical evidence to reject the hypothesis because the observed .088 LOC did not meet the .05 LOC required for statistical significance, we can note a clear numerical trend in the PA Area for the newer arrivals to score considerably higher on the Environmental Concerns Scale. In contrast to the scores on the WCS scale the 6-10 year group scored quite high, actually leading the 2-5 year group in mean score (45 compared to 44.3).

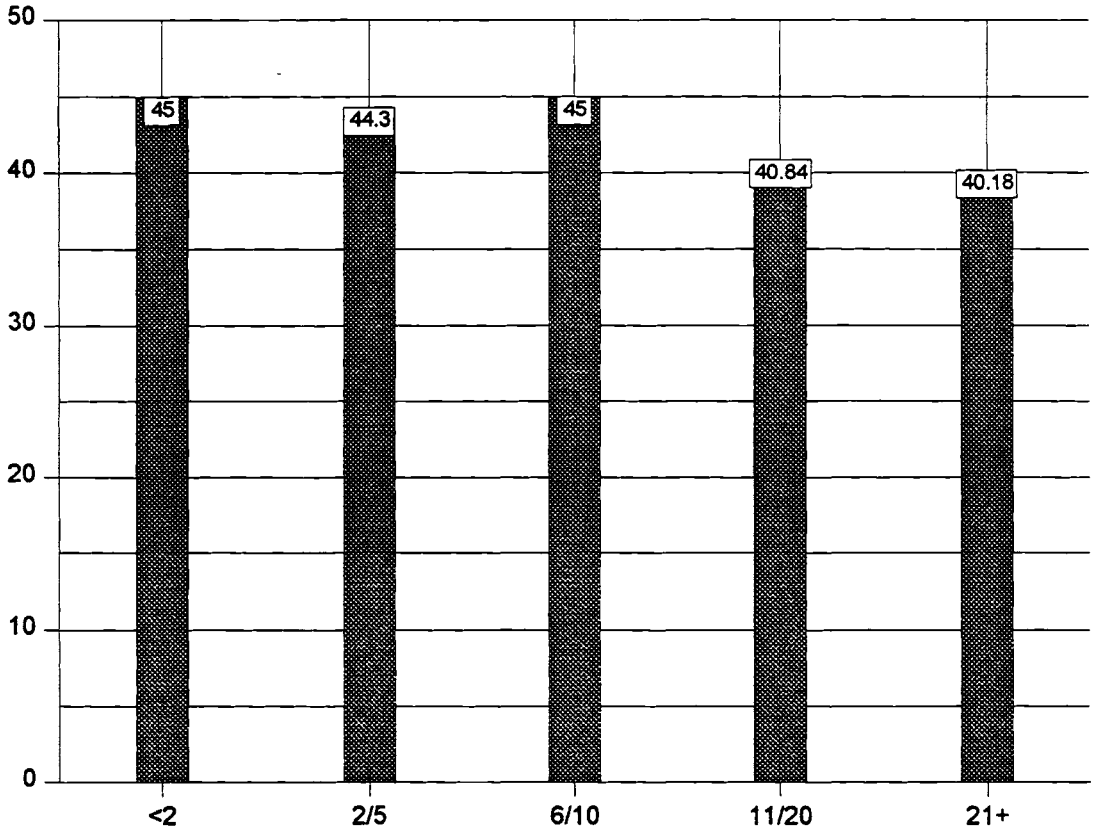

Figure 5. Mean Environmental Concern Scale Scores By Length of Residence For PA Area

31. There is no significant difference between lengths of residence in the Sequim Area and mean Water Knowledge Scale scores.

An analysis of variance indicated no significant difference. The bar graph following Table 27 below shows the range of mean scores.

Table 27
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 31

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Residence Time	665.04	4	166.26	1.53	0.193
Knowledge Scores	27304.83	252	108.35		
TOTAL	27969.87	256			

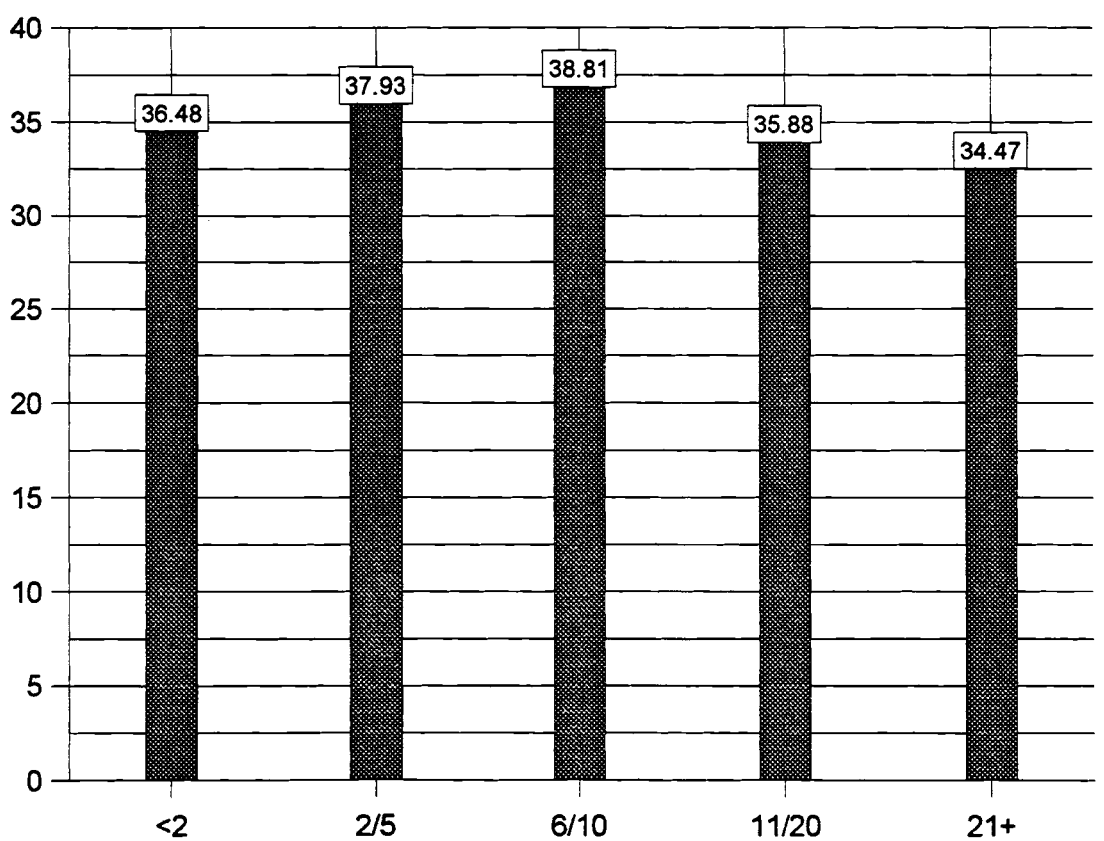

Figure 6. Mean Water Knowledge Scores By Length Of Residence For Sequim Area

32. There is no significant difference between lengths of residence in the Sequim Area and the mean scores on the WCS.

An analysis of variance indicated no significant difference. The chart following Table 28 shows the range of mean scores.

Table 28
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 32

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Residence Time	20.21	4	5.05	0.7	0.595
Water Concern S.	1804.14	249	7.25		
TOTAL	1824.35	253			

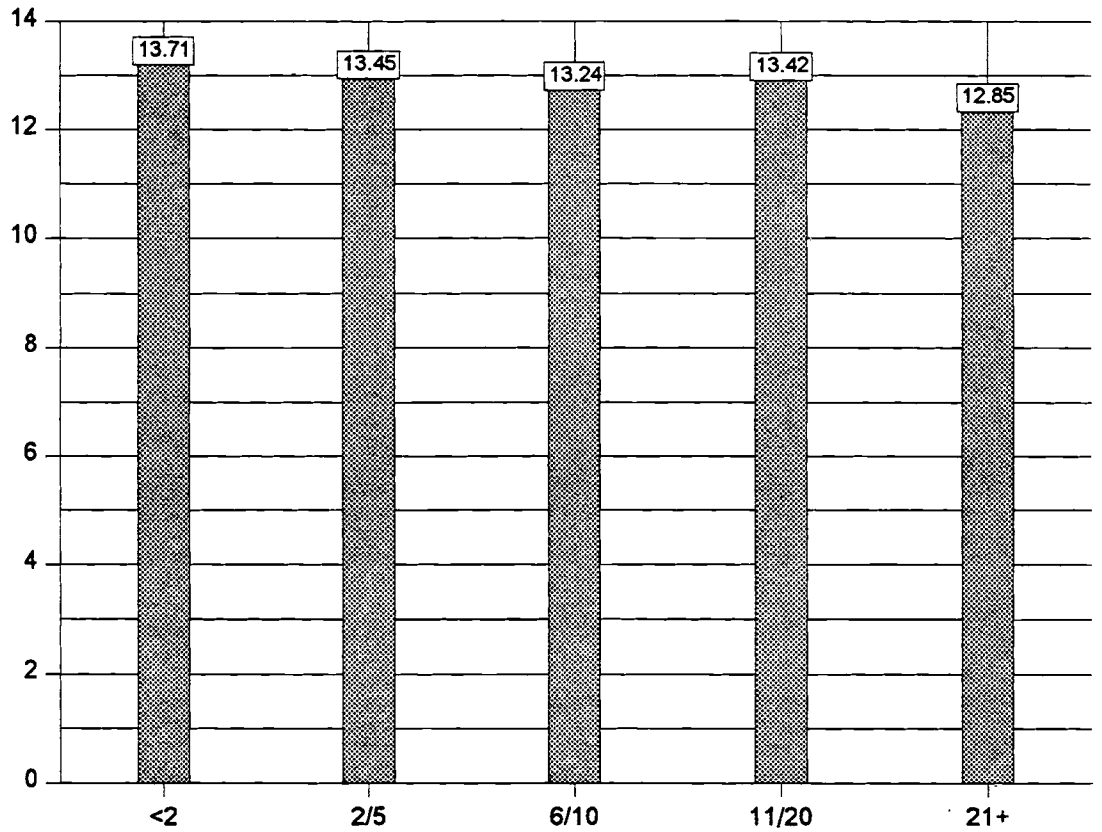

Figure 7. Mean Water Concerns Scale Scores By Length of Residence (In Years) For Sequim Area

33. There is no significant difference between lengths of residence in the Sequim Area and the mean scores on the ECS.

An analysis of variance indicated a significant difference at the .009 LOC. The hypothesis is rejected.

Table 29
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 33

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Residence Time	1118.06	4	279.51	3.46	0.009
Enviro Concern S.	20215.88	250	80.86		
TOTAL	21333.94	254			

Referencing the Tukey Test we find that the significance is between the "less than 2 year" group (46.65 mean score) and the longest residing "21 plus" (39.11 mean) group. Although the other scores did not meet the test for significant difference, we note a general numerical trend toward decreasing scores as length of residence increases. The following chart shows the range of mean scores.

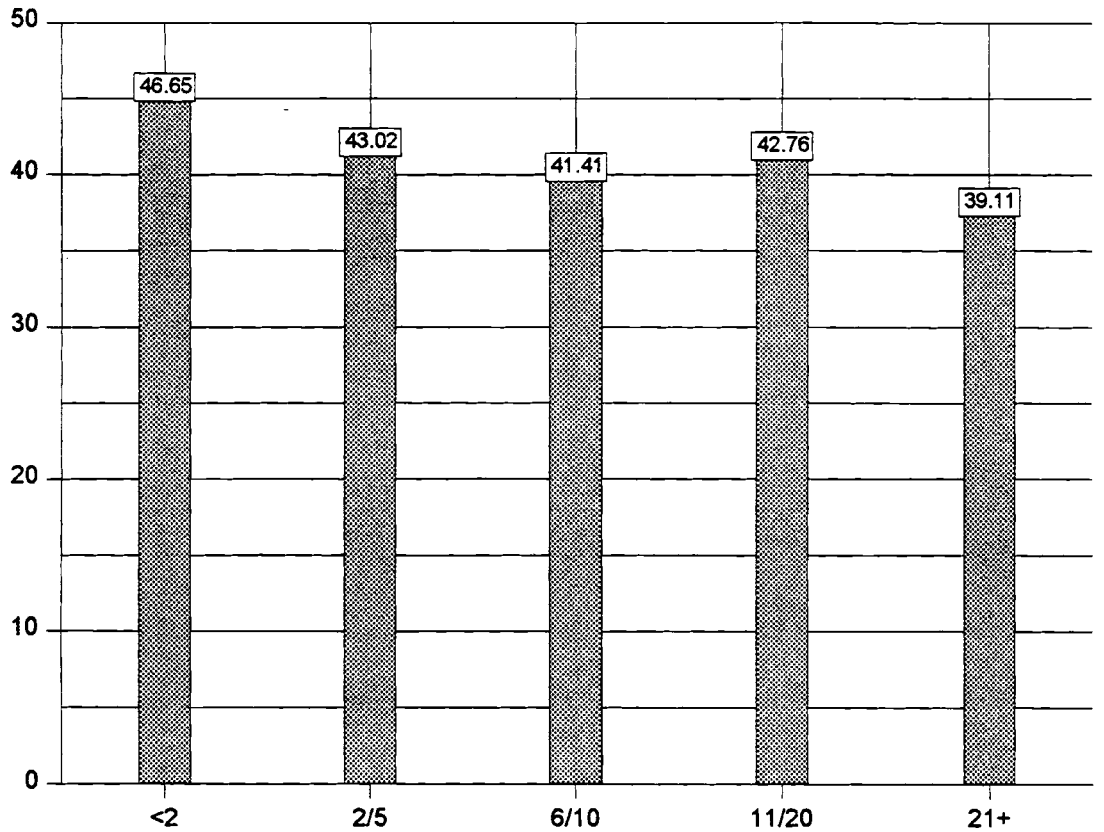

Figure 8. Mean Environmental Concerns Scale Scores By Length Of Residence (In Years) For Sequim Area

34. There is no significant difference between the uses of land in the Port Angeles Area and mean Water Knowledge Scale scores.

An analysis of variance indicated a significant difference at the .037 LOC. The hypothesis is rejected.

Table 30
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 34

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Land Use	832.9	3	277.63	2.86	0.037
Knowledge Scores	23368.63	241	96.97		
TOTAL	24201.53	244			

The Tukey Test identified the statistically significant difference to be between the year-round residence group (35.43 mean score), and the business establishment group (18.67 mean). The recreational group scores (35.56), and farm/ranch group scores (35.11) were consistent with the Water Knowledge Scale scores demonstrated by the year-round residence land use group. There were only three business establishment group respondents, compared to 224 in the year-round residence group (the other two groups each having nine respondents), therefore the data is suspect. The following chart shows the range of mean scores.

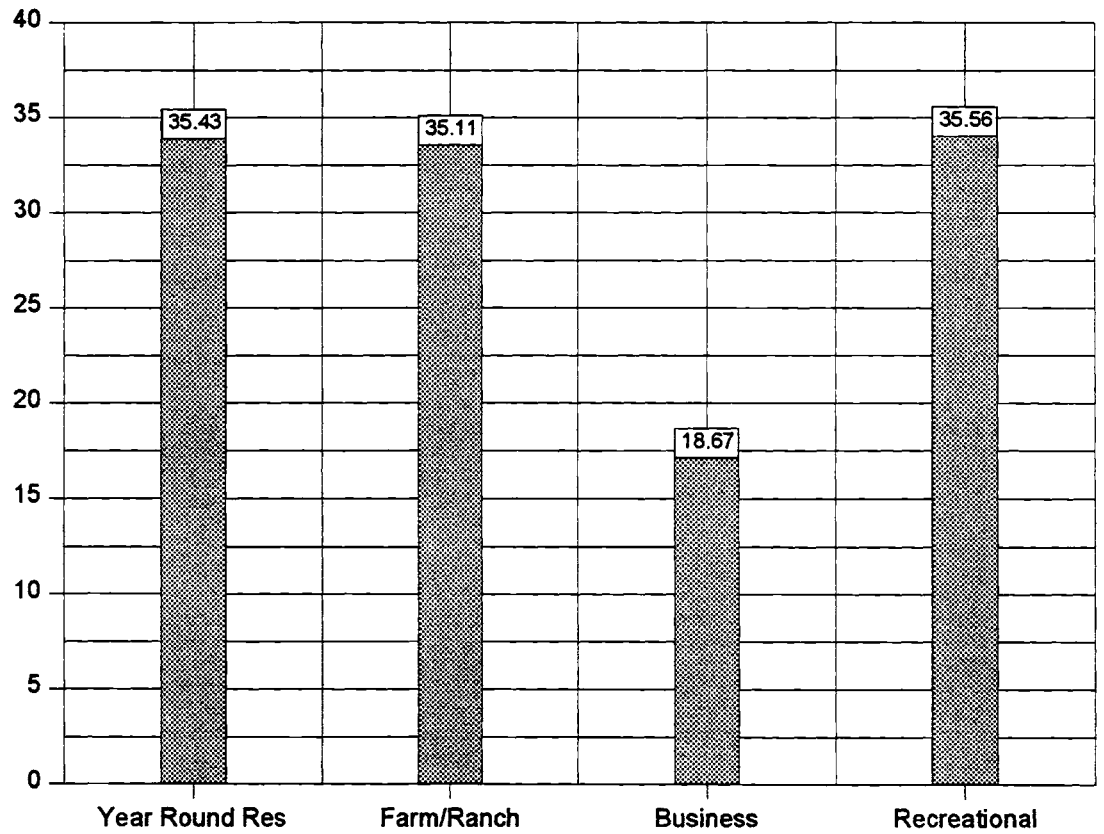

Figure 9. Mean Water Knowledge Scores By Use Of Land For Port Angeles Area

35. There is no significant difference between the uses of land in the Port Angeles Area and the mean scores on the WCS.

An analysis of variance indicated no significant difference. The chart following Table 31 depicts the mean scores for the groups listed.

Table 31
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 35

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Land Use	34.53	3	11.51	1.57	0.197
Water Concern S.	1765.28	241	7.32		
TOTAL	1799.81	244			

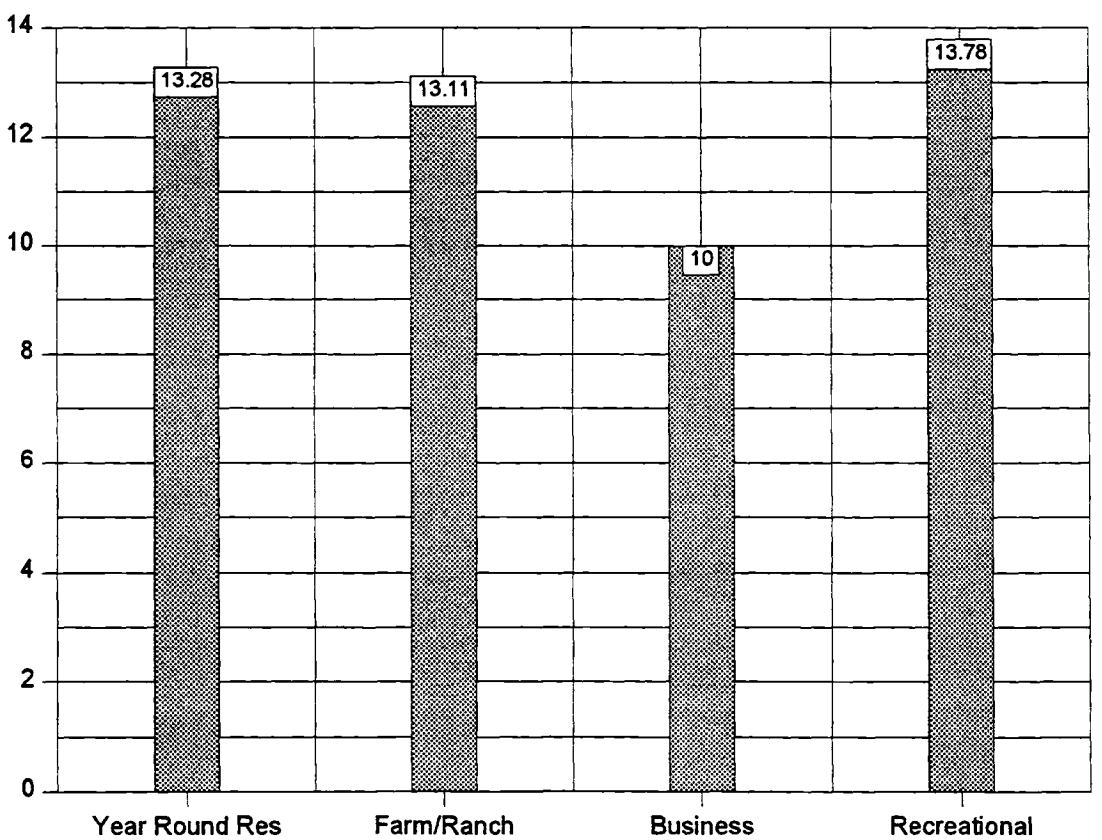

Figure 10. Mean Water Concern Scale Scores By Use Of Land For Port Angeles Area

36. There is no significant difference between the uses of land in the Port Angeles Area and the mean scores on the ECS.

An analysis of variance indicated a significant difference at the .020 LOC. The hypothesis is rejected.

Table 32
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 36

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
Land Use	848.09	3	282.7	3.33	0.02
Enviro Concern S.	20217.27	238	84.95		
TOTAL	21065.36	241			

Duncan's Test showed the significance to be between the business establishment and year-round residence land use groups with 30.33 and 41.72 mean scores respectively. The recreational and farm/ranch groups had scores of 35.67 and 37 respectively. Again the low respondent numbers in the business category make the data suspect, especially when we note that the standard deviation in this group was a rather high 14.58. The following chart shows the mean scores for these groups.

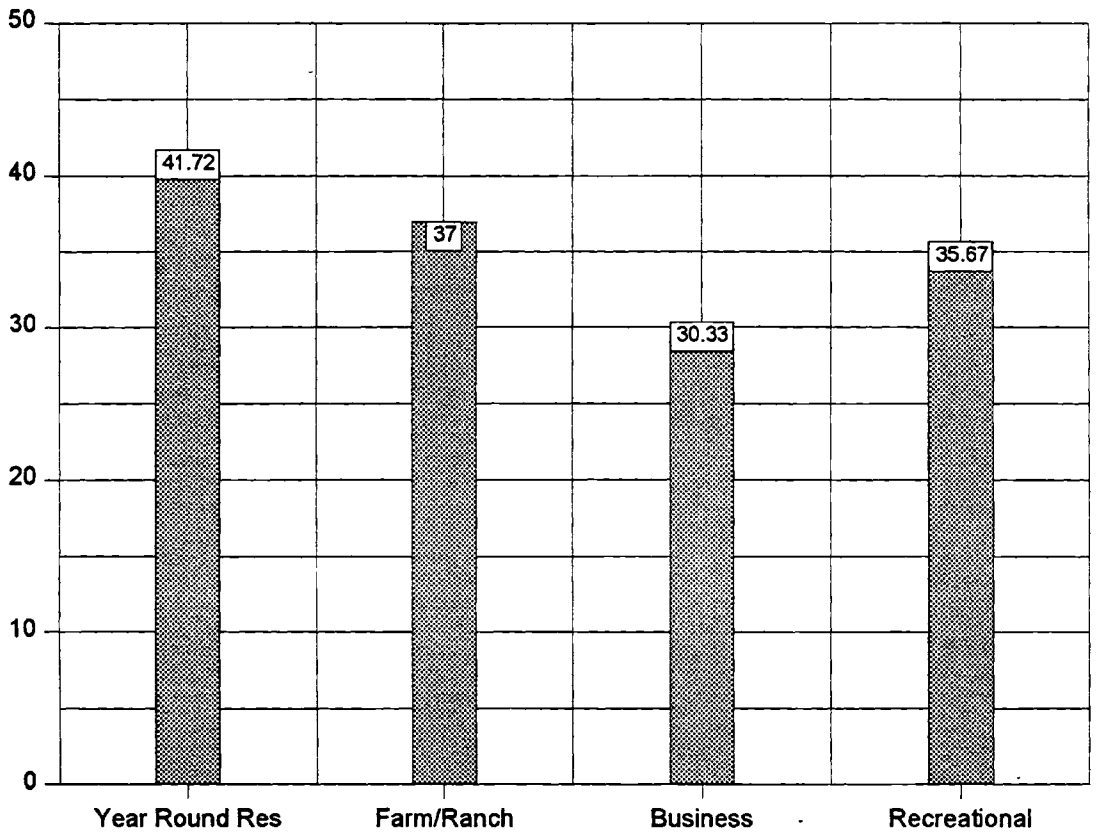

Figure 11. Mean Environmental Concern Scale Scores By Use Of Land For Port Angeles Area

37. There is no significant difference between the uses of land in the Sequim Area and mean Water Knowledge Scale scores.

An analysis of variance indicated no significant difference. The chart following Table 33 shows the mean scores.

Table 33
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 37

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Land Use	421.11	4	105.28	0.96	0.428
Knowledge Scores	27420.64	251	109.25		
TOTAL	27841.75	255			

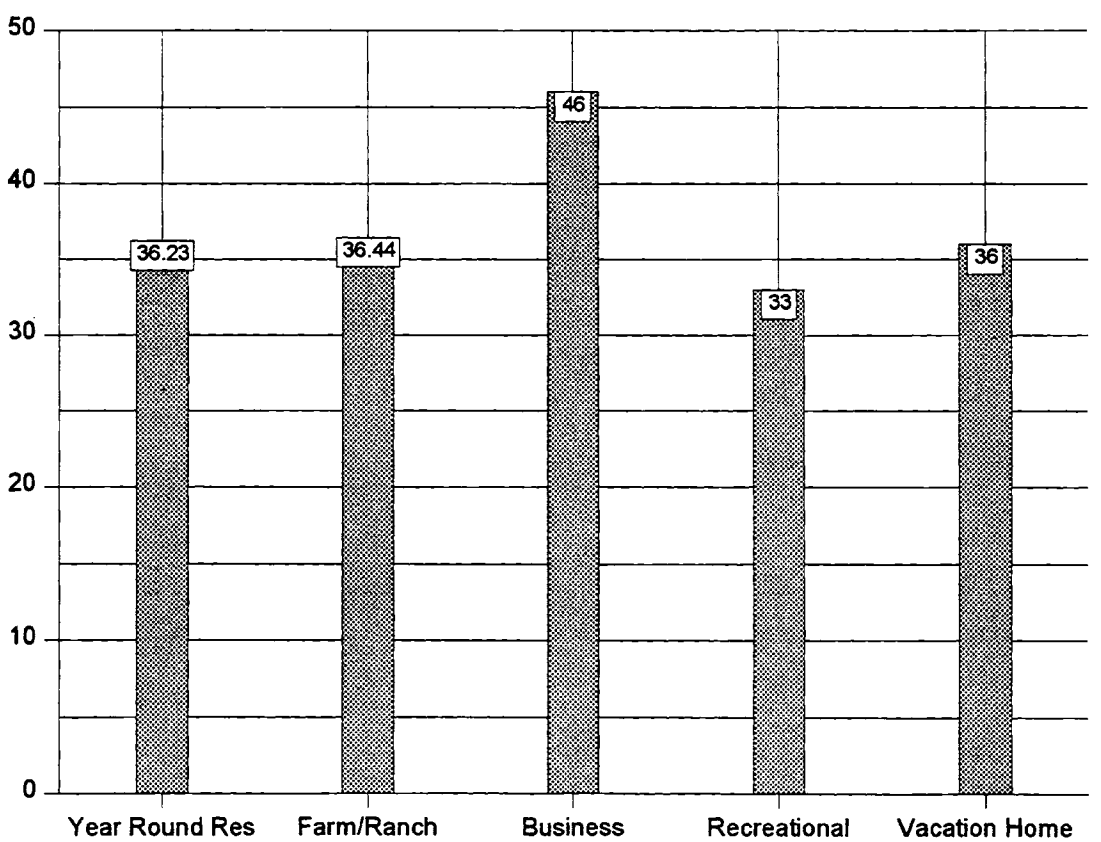

Figure 12. Mean Water Knowledge Scores By Use Of Land For Sequim Area

38. There is no significant difference between the uses of land in the Sequim Area and the mean scores on the WCS.

An analysis of variance indicated no significant difference.

Table 34
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 38

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Land Use	25.59	4	6.4	0.89	0.471
Water Concern S.	1785.65	248	7.2		
TOTAL	1811.24	252			

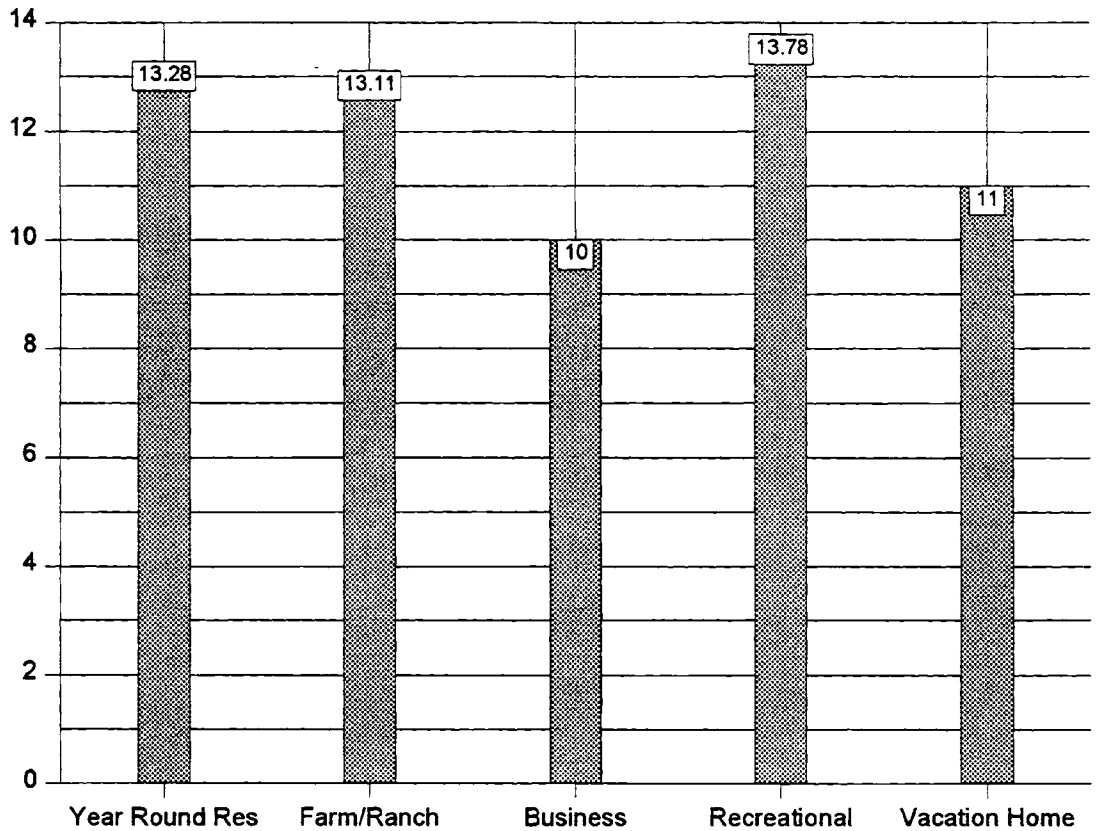

Figure 13. Mean Water Concern Scale Scores By Use Of Land For Sequim Area

39. There is no significant difference between the uses of land in the Sequim Area and the mean scores on the ECS.

An analysis of variance indicated a significant difference at the .044 LOC. The hypothesis is rejected.

Table 35
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 39

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Land Use	815.13	4	203.78	2.49	0.044
Enviro Concern S.	20385.96	249	81.87		
TOTAL	21201.09	253			

The Tukey Test identified the significance to be between the year-round residence and farm/ranch land use groups, with scores of 42.36 and 37.75 respectively. The business establishment and recreational use groups (each with 4 respondents) scored 37.75 and 37 respectively. Figure 14 shows these mean scores.

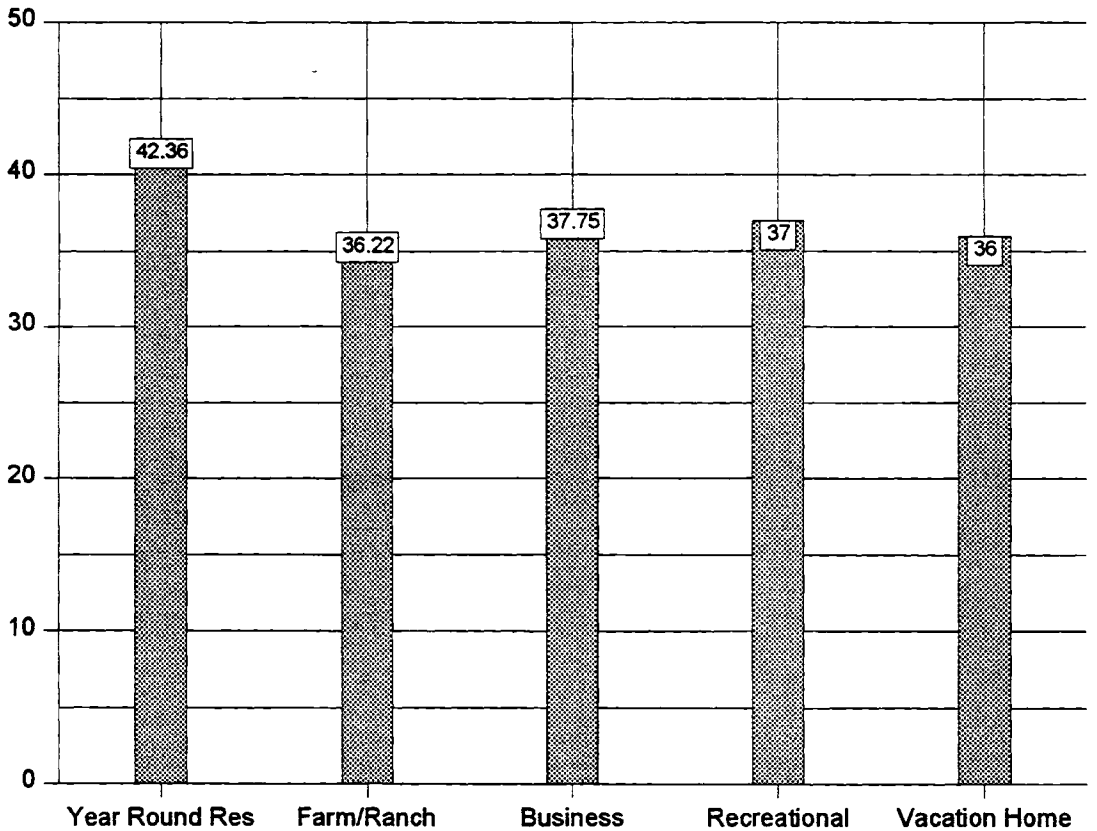

Figure 14. Mean Environmental Concern Scale Scores By Use Of Land For Sequim Area

40. There is no significant difference between the durations of annual local residence in the Port Angeles Area and mean Water Knowledge Scale scores. An analysis of variance indicated no significant difference.

Table 36
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 40

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA % Annual Res	542.8	3	180.93	1.84	0.14
Knowledge Scores	23658.74	241	98.17		
TOTAL	24201.53	244			

Only two of the categories, 51%--75% (9), and 76%+ (234) had more than one response. The data is suspect. The following chart shows the mean scores.

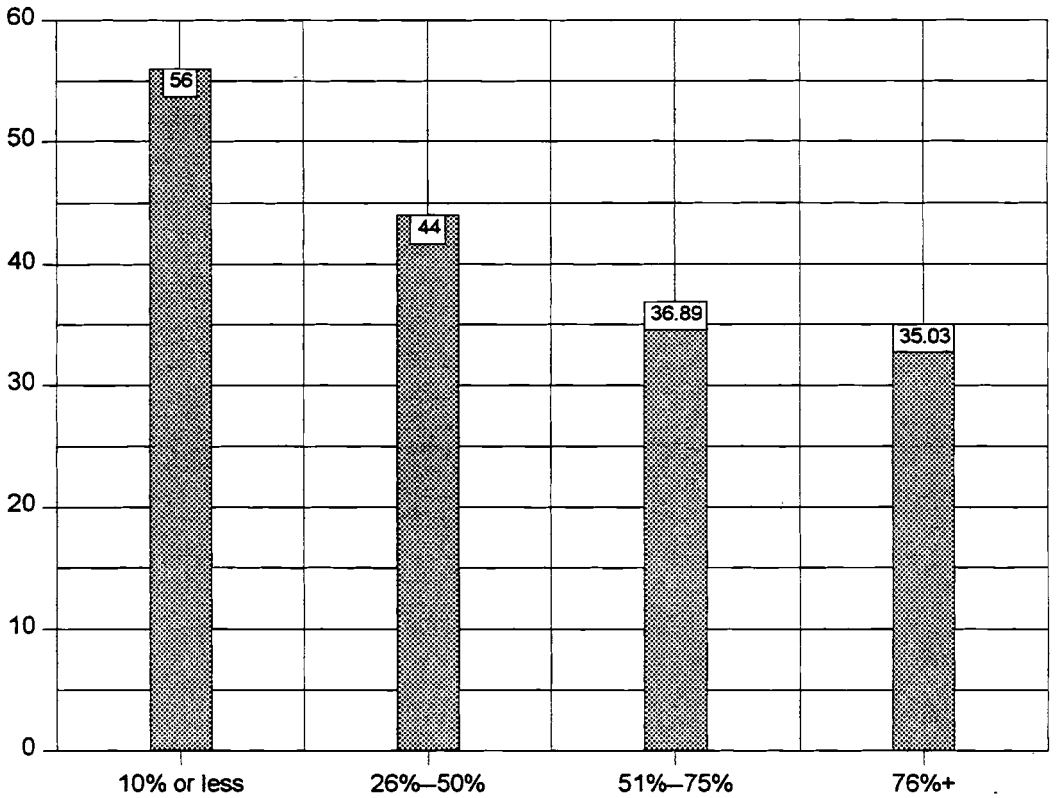

Figure 15. Mean Water Knowledge Scores By Duration Of Annual Residence For Port Angeles Area

41. There is no significant difference between the durations of annual local residence in the Port Angeles Area and the mean scores on the WCS.

An analysis of variance indicated no significant difference.

Table 37
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 41

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA % Annual Res	3.47	3	1.16	0.16	0.926
Water Concern S.	1796.35	241	7.45		
TOTAL	1799.81	244			

Only one respondent in each of the first two groups make the data suspect. The following chart shows the mean scores.

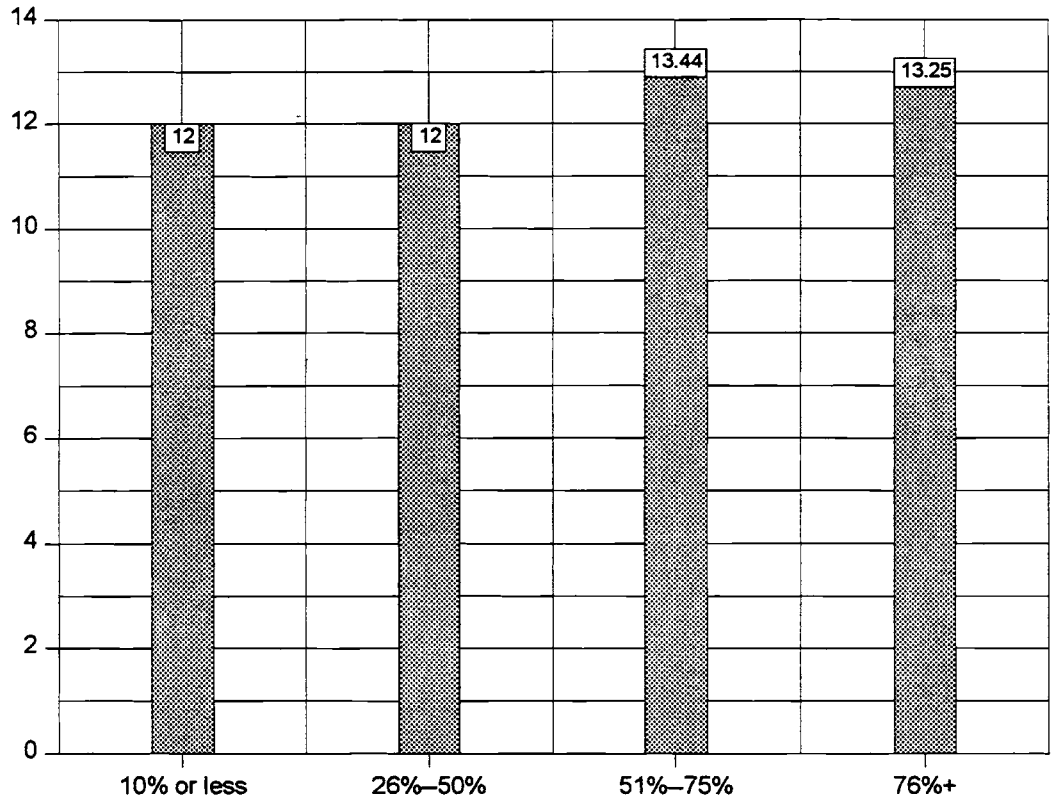

Figure 16. Mean Water Concern Scale Scores By Duration Of Annual Residence For Port Angeles Area (20-25% group had no respondents)

42. There is no significant difference between the durations of annual local residence in the Port Angeles Area and the mean scores on the ECS.

An analysis of variance indicated no significant difference.

Table 38
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 42

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA % Annual Res	320.54	3	106.85	1.23	0.301
Enviro Concern S.	20744.82	238	87.16		
TOTAL	21065.36	241			

Again, only one respondent in each of the first two groups makes the data suspect. The mean scores follow.

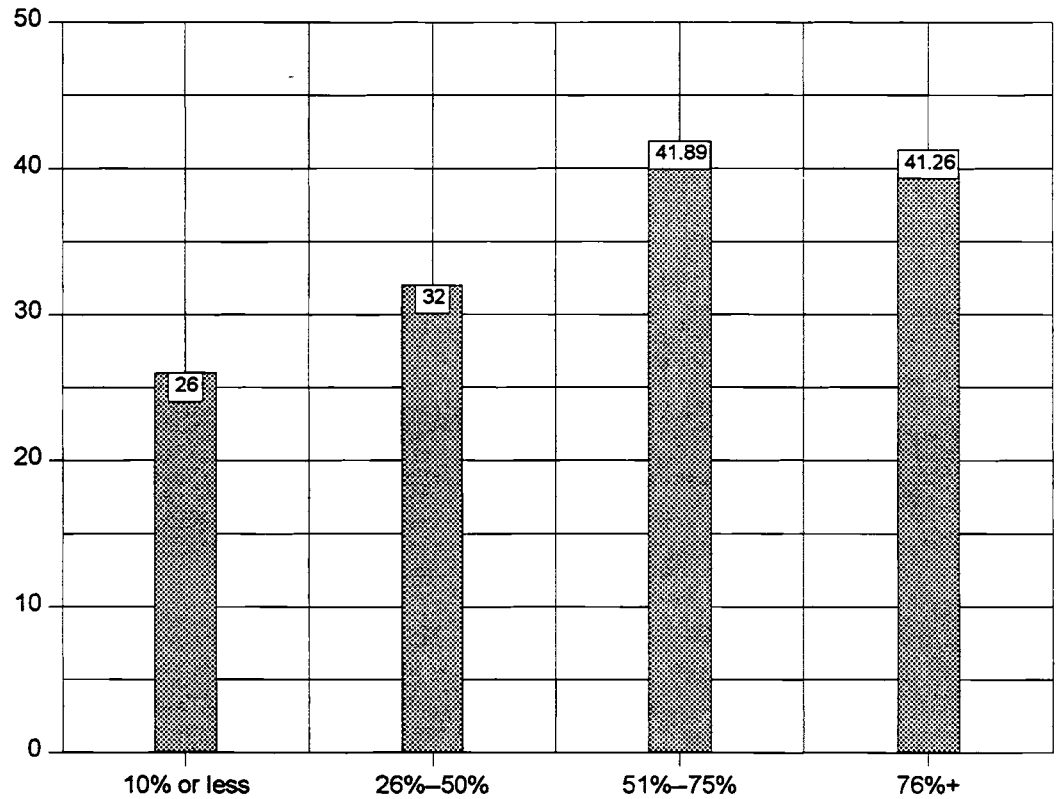

Figure 17. Mean Environmental Concern Scale Scores By Duration Of Annual Residence For Port Angeles Area

43. There is no significant difference between the durations of annual local residence in the Sequim Area and mean Water Knowledge Scale scores.

An analysis of variance indicated a significant difference at the .022 LOC. The hypothesis is rejected.

Table 39
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 43

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ % Annual Res	1039	3	346.33	3.26	0.022
Knowledge Scores	27082.7	255	106.21		
TOTAL	28121.7	258			

Duncan's Test identified significant differences between the 26-50% residents (18 mean score) and both the 51-75% and 76% plus residents (37.33 and 36.59 respectively). The 10% and less group also had considerably lower scores (28 mean) than the residents of longer annual duration. Here again, only two respondents in the 26-50% and three in the 51-75% categories leave the data suspect. The mean scores follow.

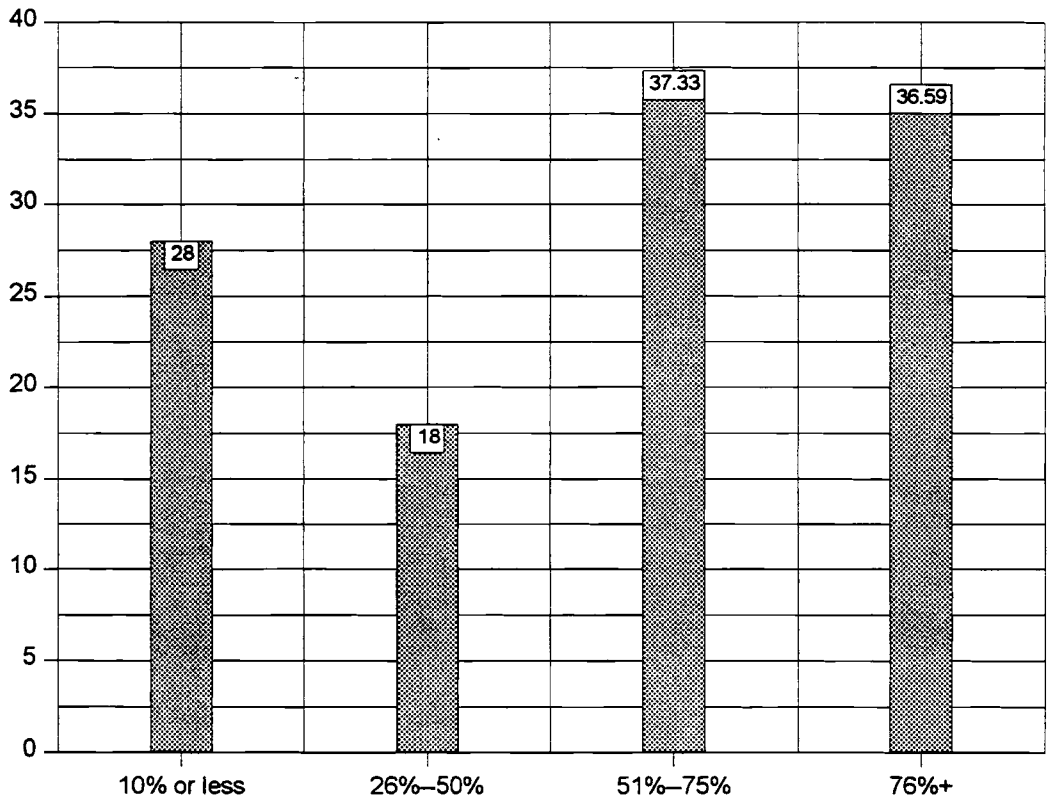

Figure 18. Mean Water Knowledge Scores By Duration Of Annual Residence For Sequim Area (20-25% group had no respondents)

44. There is no significant difference between the durations of annual local residence in the Sequim Area and the mean scores on the WCS.

An analysis of variance indicated a significant difference at the .044 LOC. The hypothesis is rejected.

Table 40
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 44

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ % Annual Res	57.92	3	19.30	2.75	0.044
Water Concern S.	1772.02	252	7.03		
TOTAL	1829.94	255			

Duncan's Test identified significant differences between the 51-75% group (16.67 mean) and both the 26-50% and 10% and less groups at 12 and 10.5 mean scores respectively. Again, however, low numbers (3,2, and 5 by order of mention) make the data suspect. The mean scores follow.

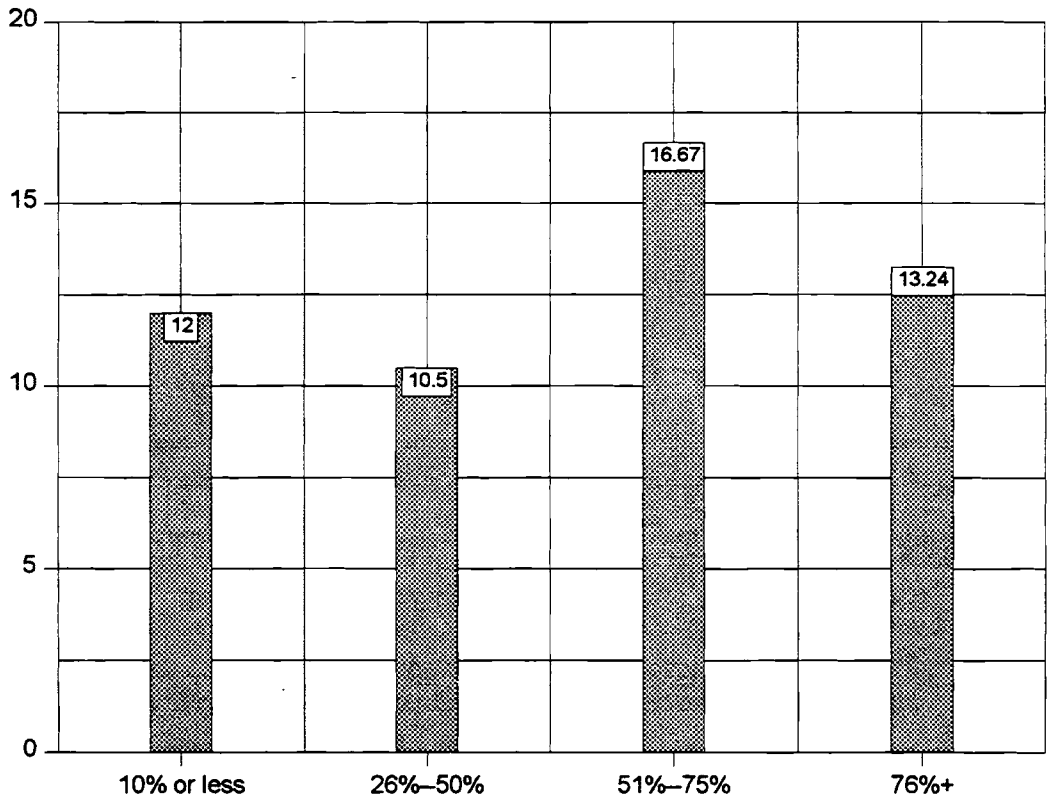

Figure 19. Mean Water Concern Scale Scores By Duration Of Annual Residence For Sequim Area (20-25% group had no respondents)

45. There is no significant difference between the durations of annual local residence in the Sequim Area and the mean scores on the ECS.

An analysis of variance indicated a significant difference at the .01 LOC. The hypothesis is rejected.

Table 41
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 45

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ % Annual Res	935.57	3	311.86	3.83	0.01
Enviro Concern S.	20575.36	253	81.33		
TOTAL	21510.93	256			

Tukey's Test identified a significant difference between the 76%+ group (42.00 mean) and the 26-50% group at 21.50 mean score (for 2 respondents). Again, the low numbers of response in some groups make the data suspect.

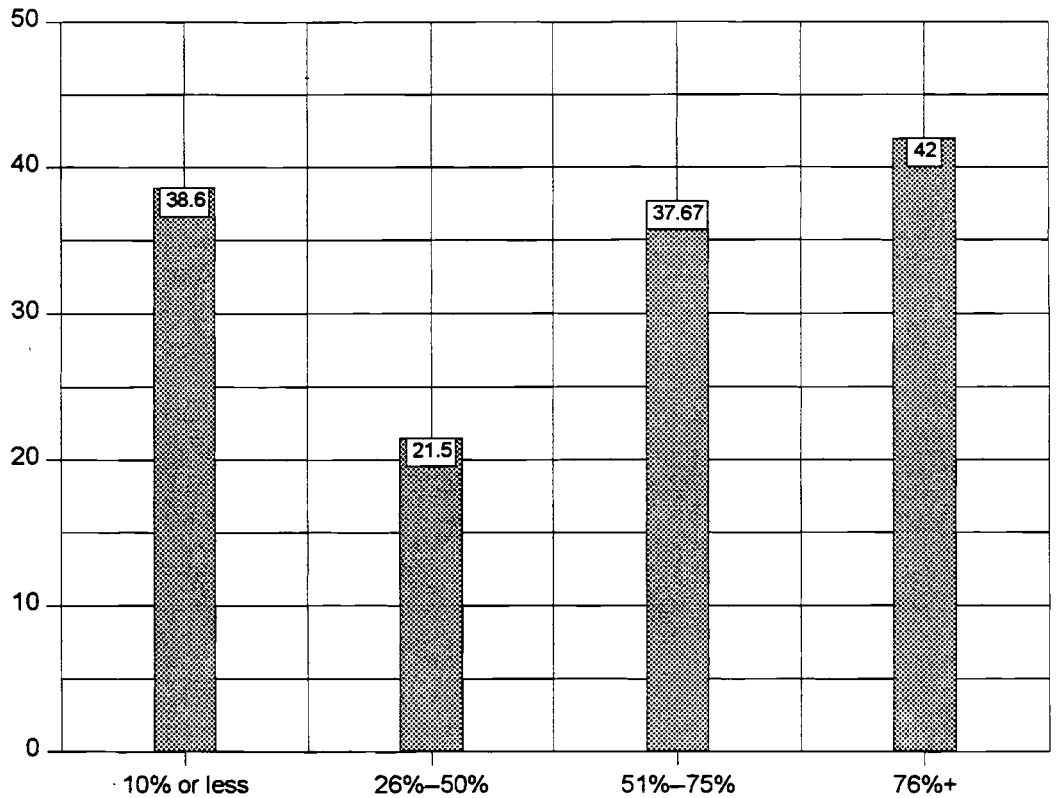

Figure 20. Mean Environmental Concern Scale Scores By Duration of Annual Residence For Sequim Area (20-25% group had no respondents)

46. There is no significant difference between occupations in the Port Angeles Area and mean Water Knowledge Scale scores.

An analysis of variance indicated no significant difference. The mean scores follow the table.

Table 42
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 46

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Occupations	1293.43	9	143.71	1.48	0.156
Knowledge Scores	22624.53	233	97.1		
TOTAL	23917.96	242			

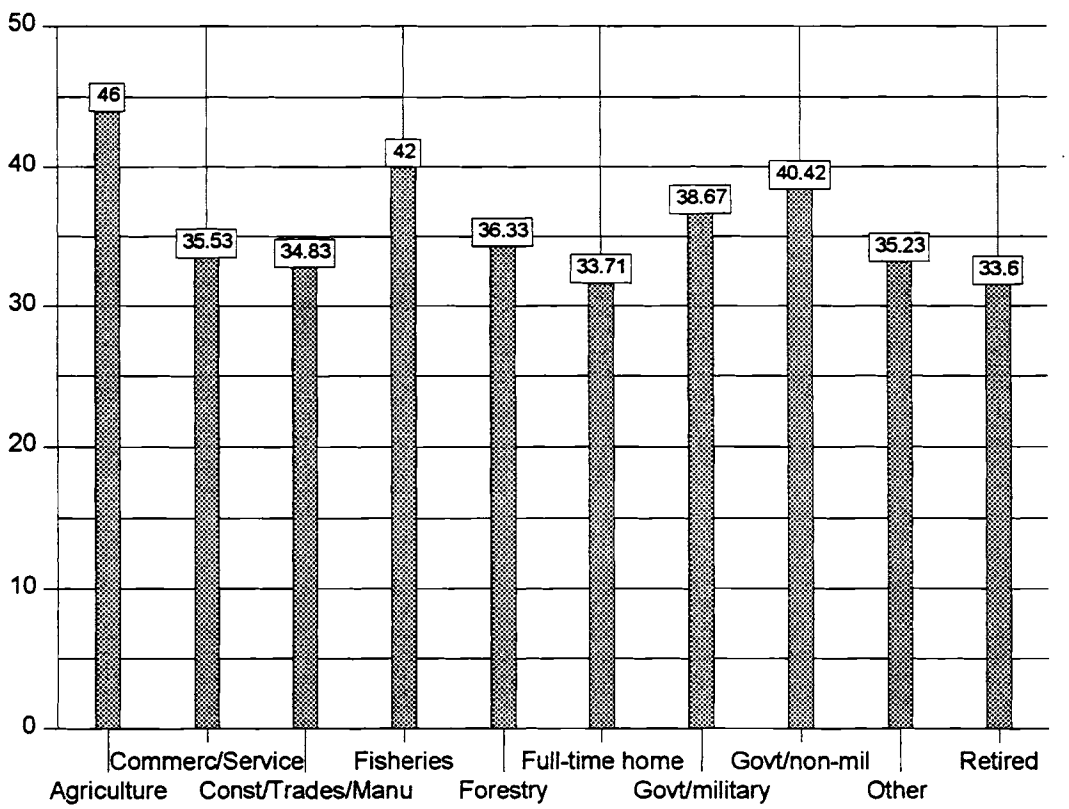

Figure 21. Mean Water Knowledge Scores By Occupation For Port Angeles Area

47. There is no significant difference between occupations in the Port Angeles Area and the mean scores on the WCS.

An analysis of variance indicated no significant difference. A chart of mean scores follows Table 43.

Table 43
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 47

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Occupations	64.27	9	7.14	396	0.47
Water Concern S.	1726.41	233	7.41		
TOTAL	1790.67	242			

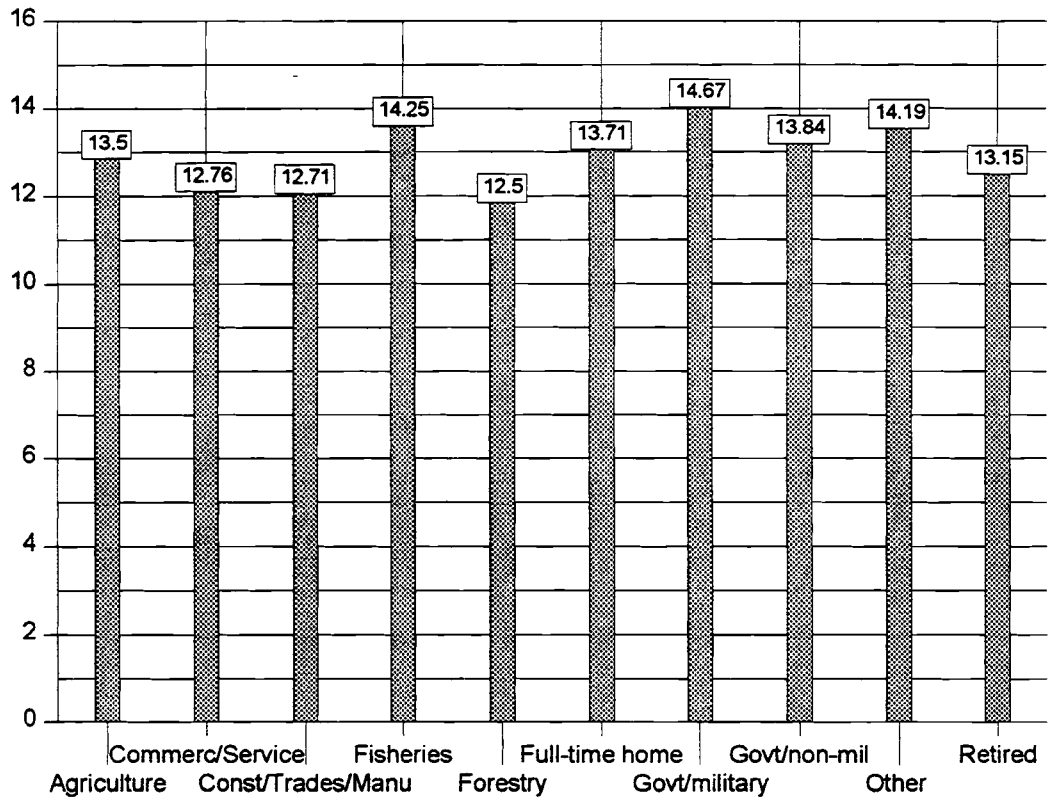

Figure 22. Mean Water Concern Scale Scores By Occupation For Port Angeles Area

48. There is no significant difference between occupations in the Port Angeles Area and the mean scores on the ECS.

An analysis of variance indicated a significant difference at the .012 LOC. The hypothesis is rejected.

Table 44
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 48

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Occupations	1813.91	9	201.55	2.42	0.012
Enviro Concern S.	19153.38	230	83.28		
TOTAL	20967.3	239			

Tukey's Test identified significant differences between those involved in the occupation of forestry (32.92 mean score) and those involved in both the occupations of government/non-military (45.11) and other (44.28). No other occupation approached the low scores of those in forestry. The closest was construction/trades/manufacturing at 37.46. Except full-time homemaker at 39.29, all of the remaining scores were in the low to mid 40s.

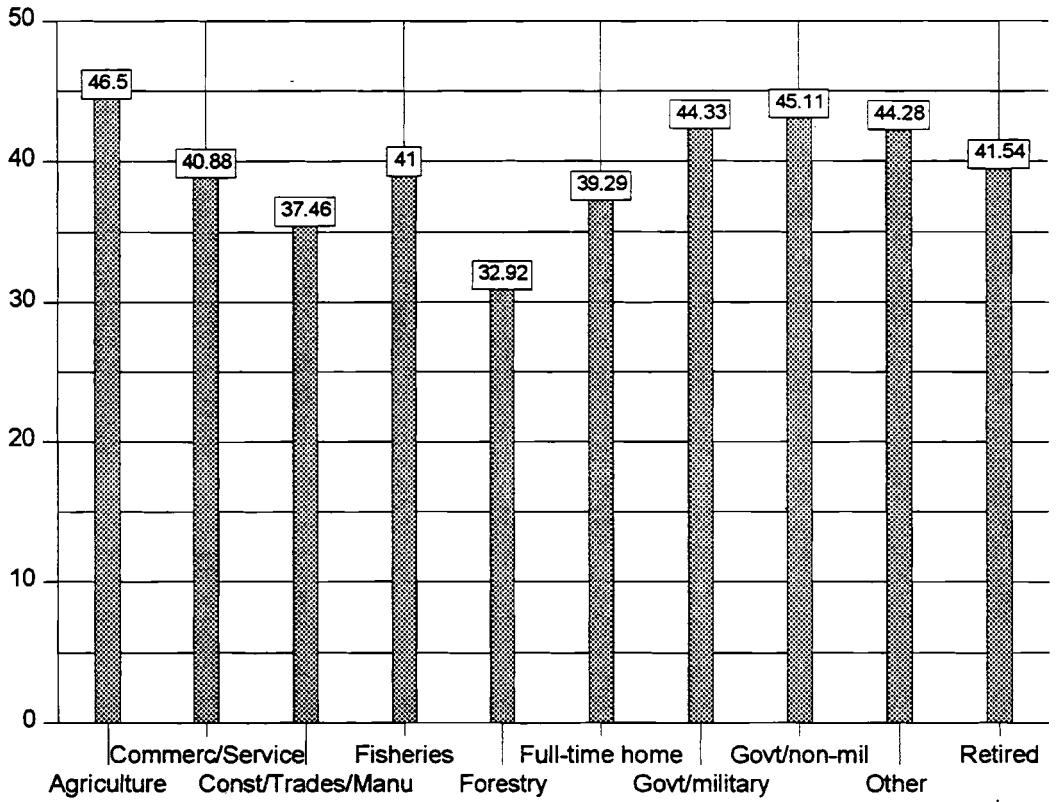

Figure 23. Mean Environmental Concern Scale Scores By Occupation For Port Angeles Area

49. There is no significant difference between occupations in the Sequim Area and mean Water Knowledge Scale scores.

An analysis of variance indicated a significant difference at the .003 LOC. The hypothesis is rejected.

Table 45
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 49

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Occupations	2643.5	9	293.72	2.86	0.003
Knowledge Scores	25294.25	246	102.82		
TOTAL	27937.75	255			

Tukey's Test identified the full-time homemaker occupation (28.86 mean score) as being significantly different from three other occupations. They are: commercial/service (39.75), other (43.2), and government/non-military (44). Agriculture (34.54), retired (35.18), forestry (36.80), and construction/ trades/manufacturing (37.88) were the other occupations having more than one respondent. The following chart shows the mean scores.

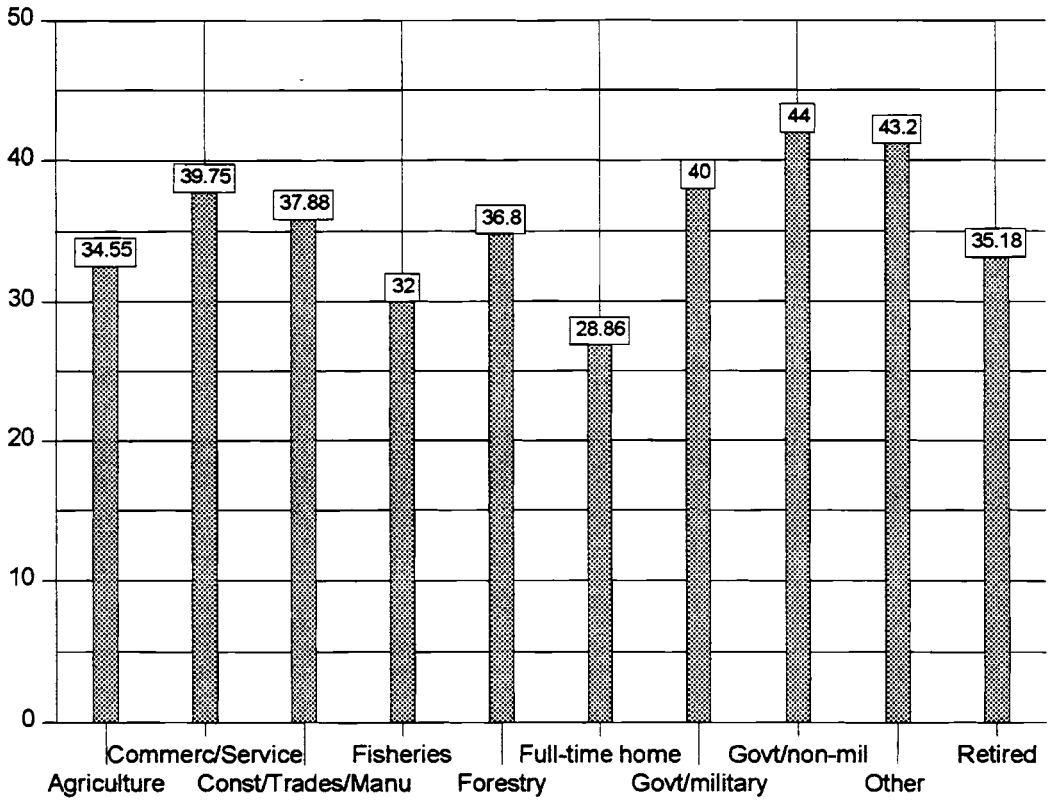

Figure 24. Mean Water Knowledge Scores By Occupation For Sequim Area

50. There is no significant difference between occupations in the Sequim Area and the mean scores on the WCS.

An analysis of variance indicated no significant difference. The mean scores are shown on the chart following Table 46.

Table 46
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 50

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Occupations	68.24	9	7.58	1.05	0.401
Water Concern S.	1755.07	243	7.22		
TOTAL	1827.31	252			

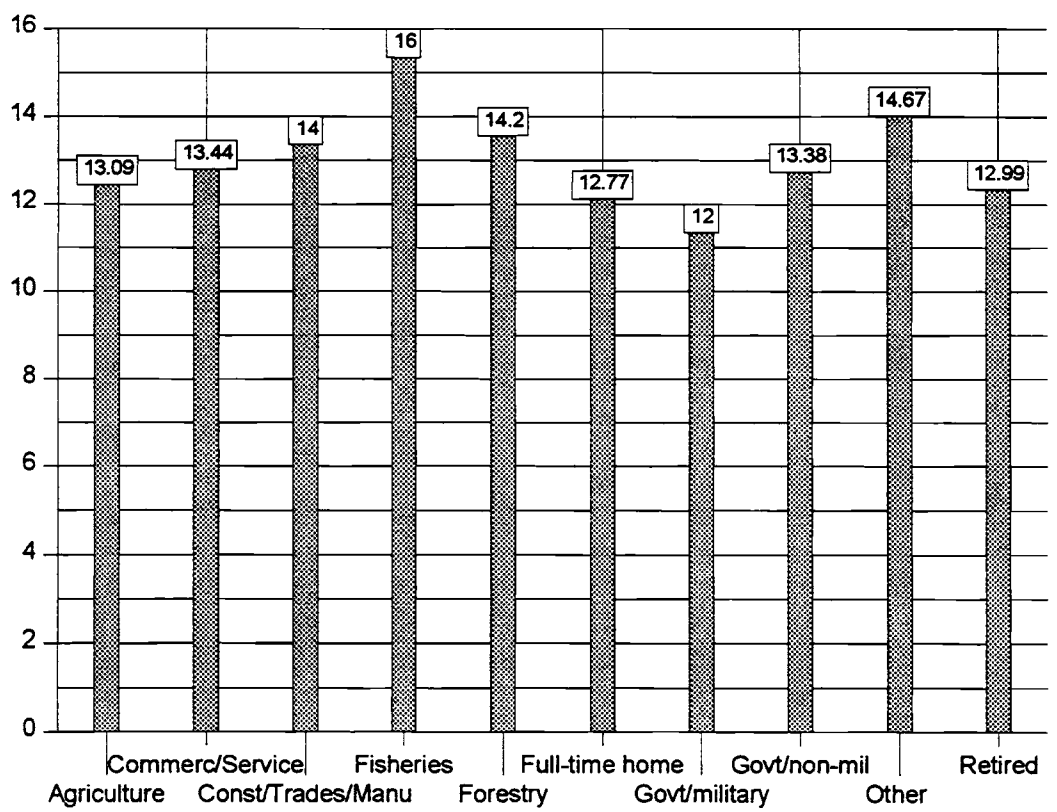

Figure 25. Mean Water Concern Scale Scores By Occupation For Sequim Area

51. There is no significant difference between occupations in the Sequim Area and the mean scores on the ECS.

An analysis of variance indicated a significant difference at the .012 LOC. The hypothesis is rejected.

Table 47
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 51

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Occupation	1751.38	9	194.6	2.43	0.012
Enviro Concern S.	19551.95	244	80.13		
TOTAL	21303.33	253			

The Tukey Test identified agriculture (32.91 mean score) as being significantly different than other (46.4), construction/trades/manufacturing (44.71), and retired (42.06) occupations. Next lowest to agriculture was forestry occupations at 38, then commercial/service at 39.16, and full-time homemaker at 41.46. Fisheries and military government only had one respondent each. The following chart shows the mean scores.

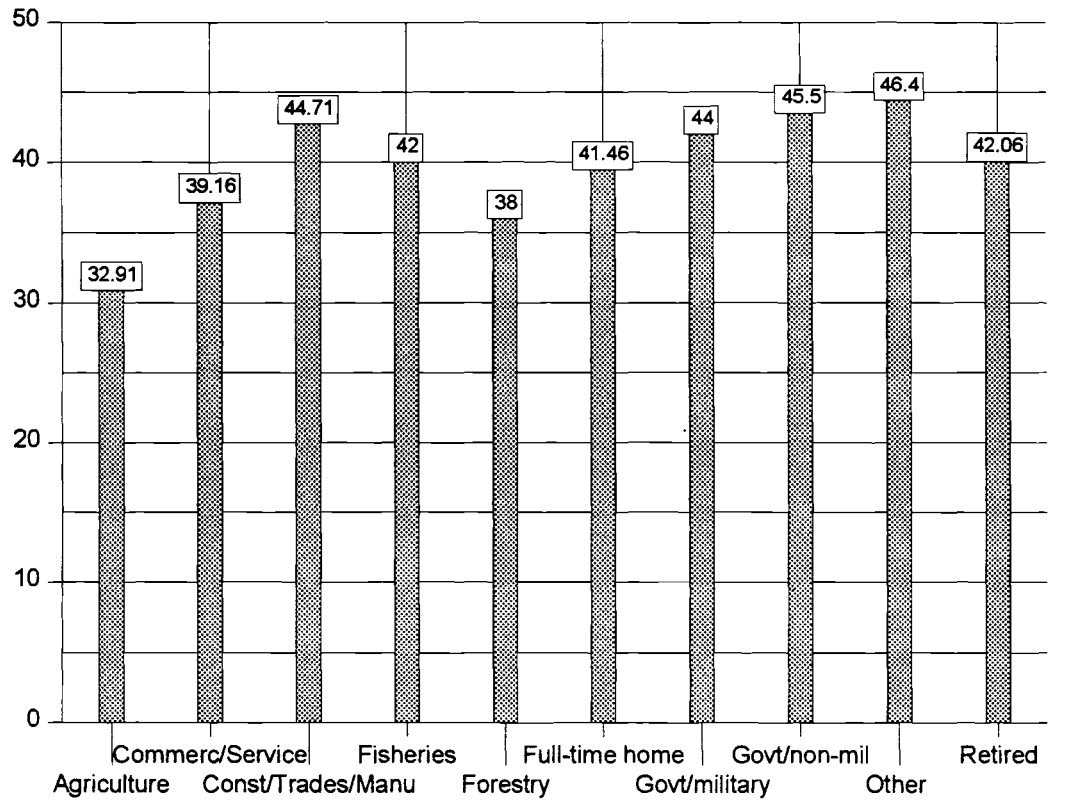

Figure 26. Mean Environmental Concern Scale Scores By Occupation For Sequim Area

52. There is no significant difference between the levels of education in the Port Angeles Area and mean Water Knowledge Scale scores.

An analysis of variance indicated a significant difference at the .000+ LOC (.000+ indicates very small fractions). The hypothesis is rejected.

Table 48
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 52

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Education	2934.34	4	733.59	8.33	0.00+
Knowledge Scores	20863.14	237	88.03		
TOTAL	23797.49	241			

The Tukey Test showed significant relationships between both graduate and four-year degreed respondents with each of the two least educated groups, high-school and "less than 12" years of school. The more educated respondents scored considerably higher on the Water Knowledge Scale questions. The increase in mean scores directly corresponded with the level of education completed. The following chart shows the mean scores.

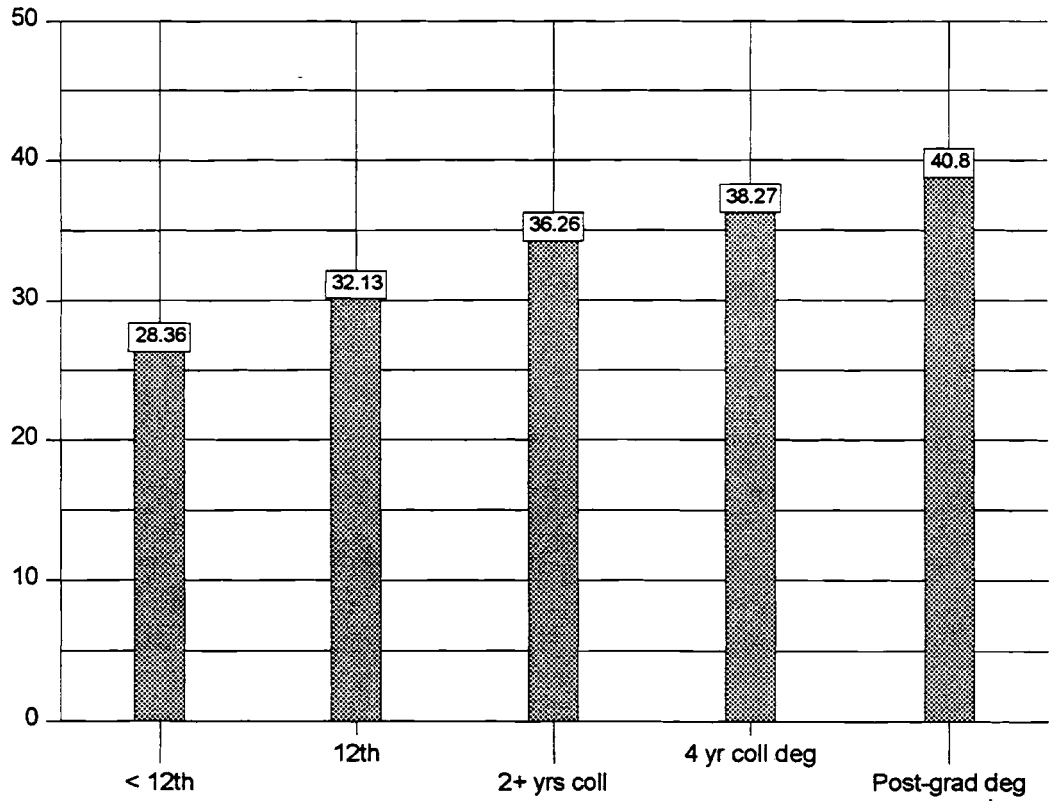

Figure 27. Mean Water Knowledge Scores By Education For Port Angeles Area

53. There is no significant difference between the levels of education in the Port Angeles Area and the mean scores on the WCS.

An analysis of variance indicated a significant difference at the .045 LOC. The hypothesis is rejected.

Table 49
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 53

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Education	71.34	4	17.84	2.48	0.045
Water Concern S.	1704.2	237	7.19		
TOTAL	1775.54	241			

The Duncan Test showed the significance to be between the "less than 12" years of education completed group and both the "2+ years of college" and "post-graduate degree" groups. The trend of higher scores with increased education continued with a slight anomaly occurring with elevated scores in the "2+ years of college" group. The following chart shows the mean scores.

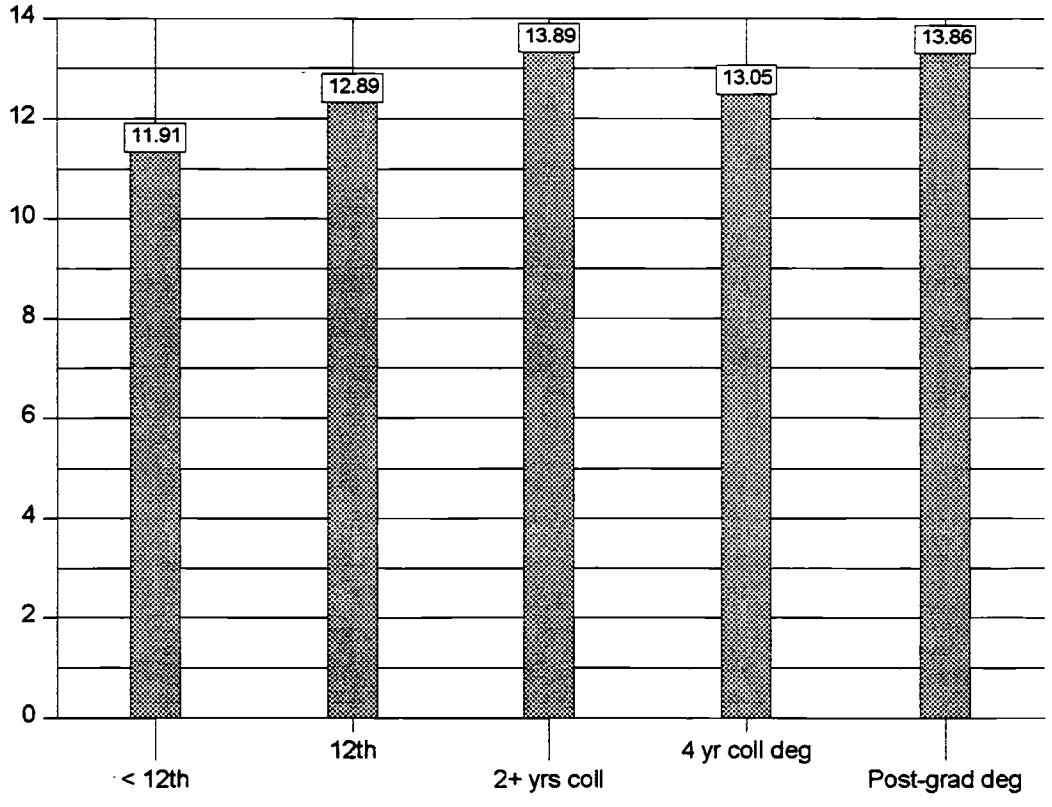

Figure 28. Mean Water Concern Scale Scores By Education For Port Angeles Area

54. There is no significant difference between the levels of education in the Port Angeles Area and the mean scores on the ECS.

An analysis of variance indicated a significant difference at the .006 LOC. The hypothesis is rejected.

Table 50
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 54

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Education	1244.61	4	311.15	3.79	0.006
Enviro Concern S.	19364.27	234	82.75		
TOTAL	20608.88	238			

The Tukey Test showed the significance to be between the post-graduate degreed group and both the high-school and less than 12 years of education completed group. Once again, the correspondence between increased education and increasing scores on this Environmental Concerns Scale is a direct relationship.

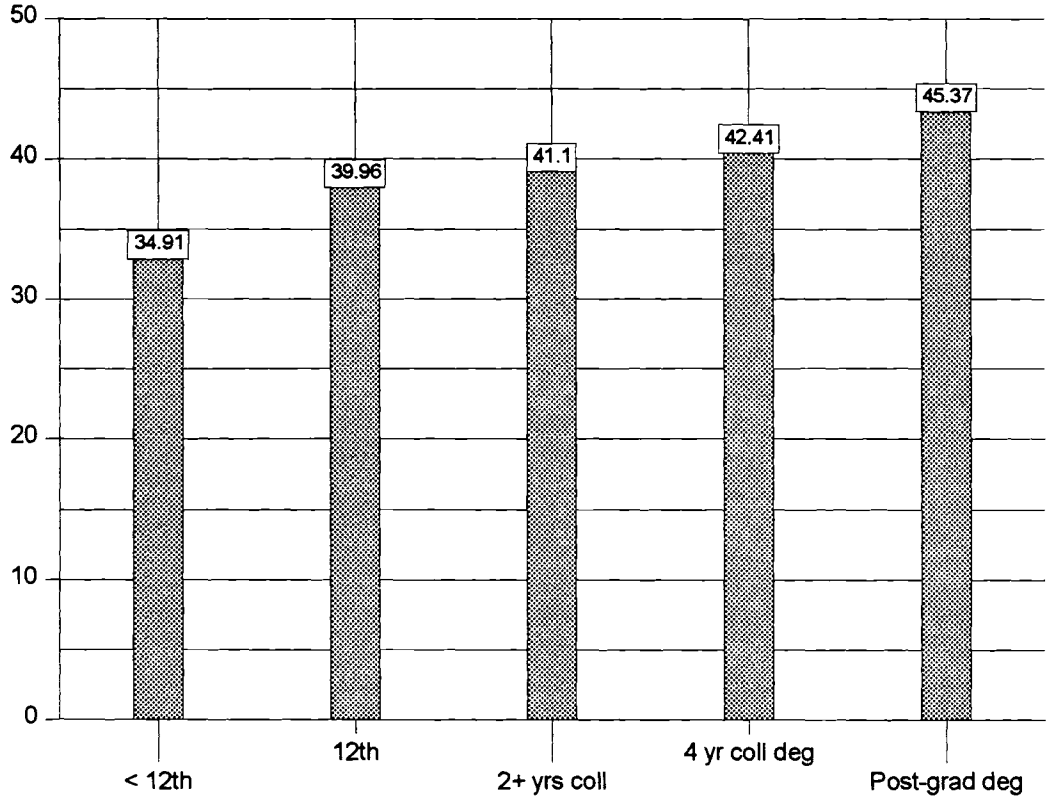

Figure 29. Mean Environmental Concern Scale Scores By Education For Port Angeles Area

55. There is no significant difference between the levels of education in the Sequim Area and mean Water Knowledge Scale scores.

An analysis of variance indicated a significant difference at the .000+ LOC (.000+ indicates very small fractions). The hypothesis is rejected.

Table 51
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 55

SOURCE	SUM OF SQUARE	DF	MEAN SQUARE	F	PROB > F
SQ Education	4772.85	4	1193.21	12.99	0.00+
Knowledge Scores	22593.78	246	91.84		
TOTAL	27366.63	250			

The Tukey Test showed significant differences between most relationships. The exceptions were between "post-graduate" and "4 year college" degreed groups, "2 years of college" and "less than 12 years" groups, and high-school and "less than 12" groups. All others showed statistically significant differences and had increases in scores directly corresponding with increases in educational level. The following chart shows the mean scores.

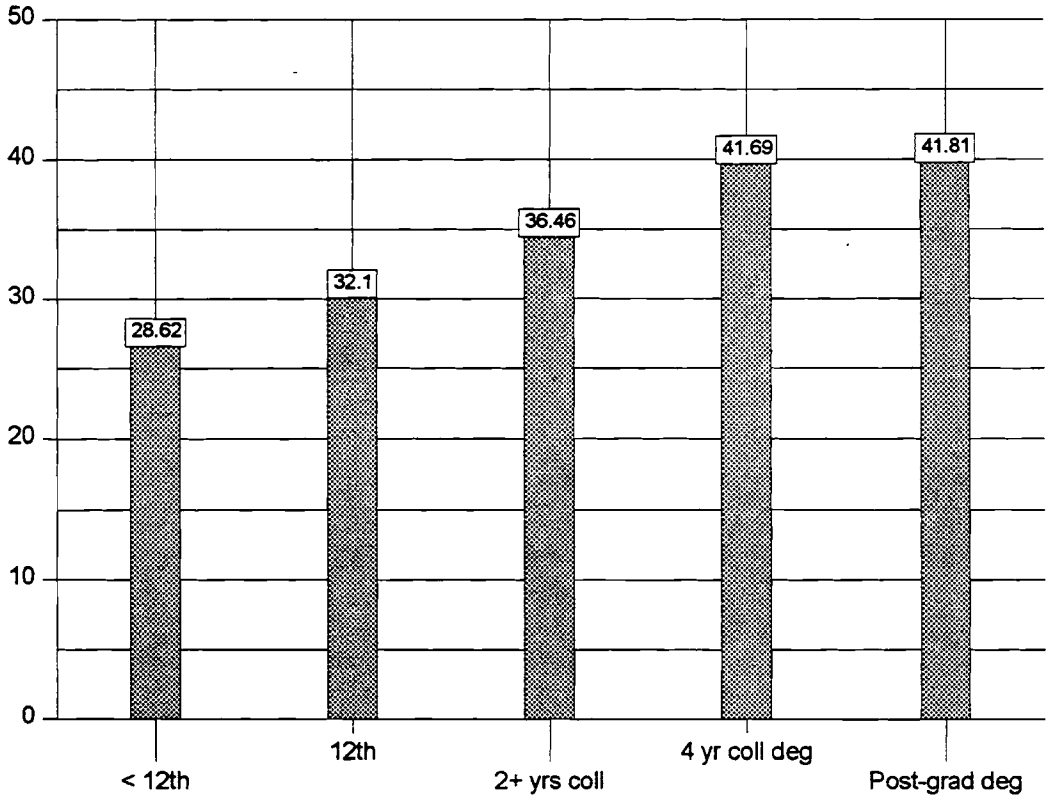

Figure 30. Mean Water Knowledge Scores By Education For Sequim Area

56. There is no significant difference between the levels of education in the Sequim Area and the mean scores on the WCS.

An analysis of variance indicated a significant difference at the .001 LOC. The hypothesis is rejected.

Table 52
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 56

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Education	128.86	4	32.21	4.65	0.001
Water Concern S.	1692.16	244	6.94		
TOTAL	1821.02	248			

Tukey's Test showed the significance to be between the "4 year college degree" group and the three following groups: "2+ years of college," high-school, and "less than 12." The correspondence between the increase of scores and increase of education is direct with the exception of the "4 year college degree" group who's scores surpassed those of the post-graduate group. The following chart shows the mean scores.

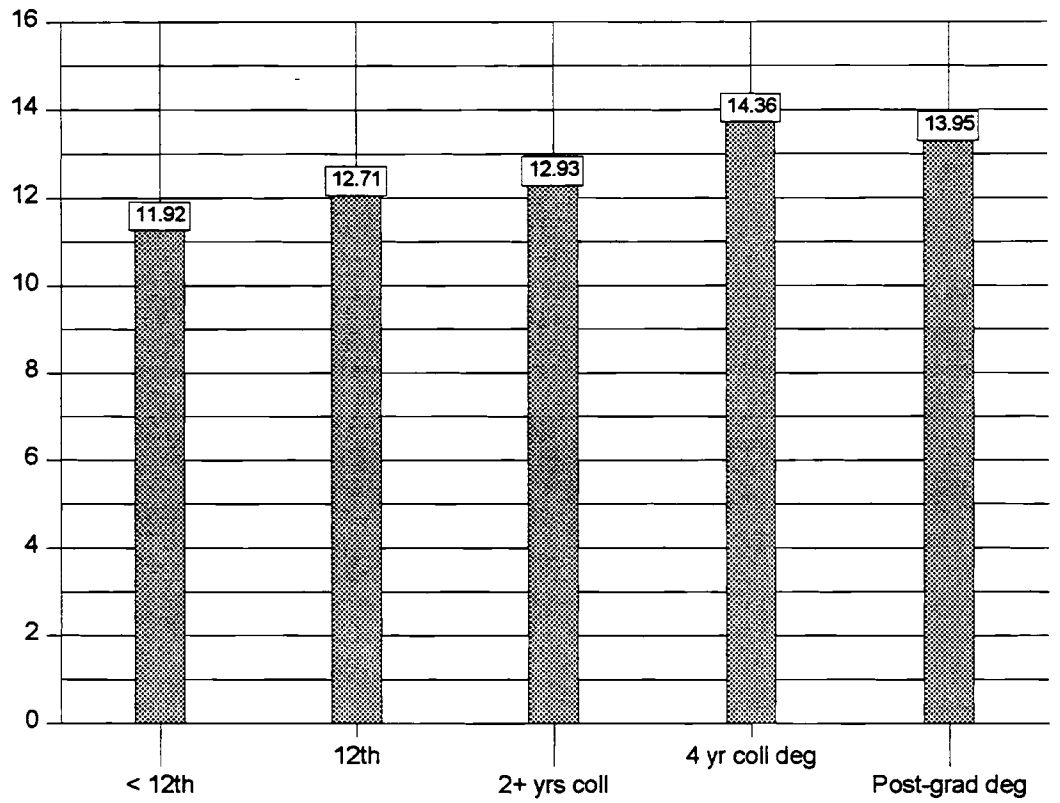

Figure 31. Mean Water Concern Scale Scores By Education For Sequim Area

57. There is no significant difference between the levels of education in the Sequim Area and the mean scores on the ECS.

An analysis of variance indicated no significant difference. Although we did not find a statistically significant difference within the mean scores for the various groups, a general numerical trend of increasing scores on the Environmental Concerns Scale as the level of education

increases holds true with one anomaly. The post-graduate degree group scored lower than the 2 year and 4 year degreed groups. A chart showing the mean scores follows Table 53.

Table 53
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 57

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Education	645.52	4	161.38	2	0.095
Enviro Concern S.	19726.54	245	80.52		
TOTAL	20372.06	249			

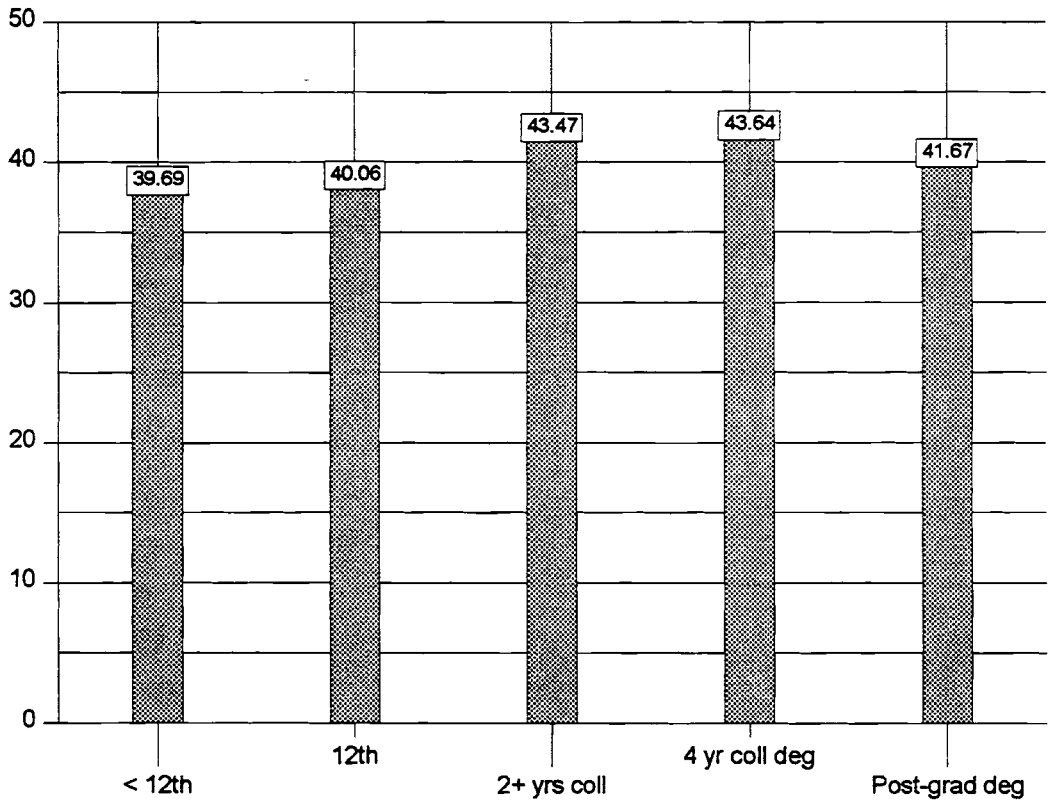

Figure 32. Mean Environmental Concern Scale Scores By Education For Sequim Area

58. There is no significant difference between incomes in the Port Angeles Area and mean Water Knowledge Scale scores.

An analysis of variance indicated no significant difference. A chart showing the mean scores follows Table 54.

Table 54
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 58

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Incomes	495.79	4	123.95	1.22	0.301
Knowledge Scores	21963.66	217	101.22		
TOTAL	22459.46	221			

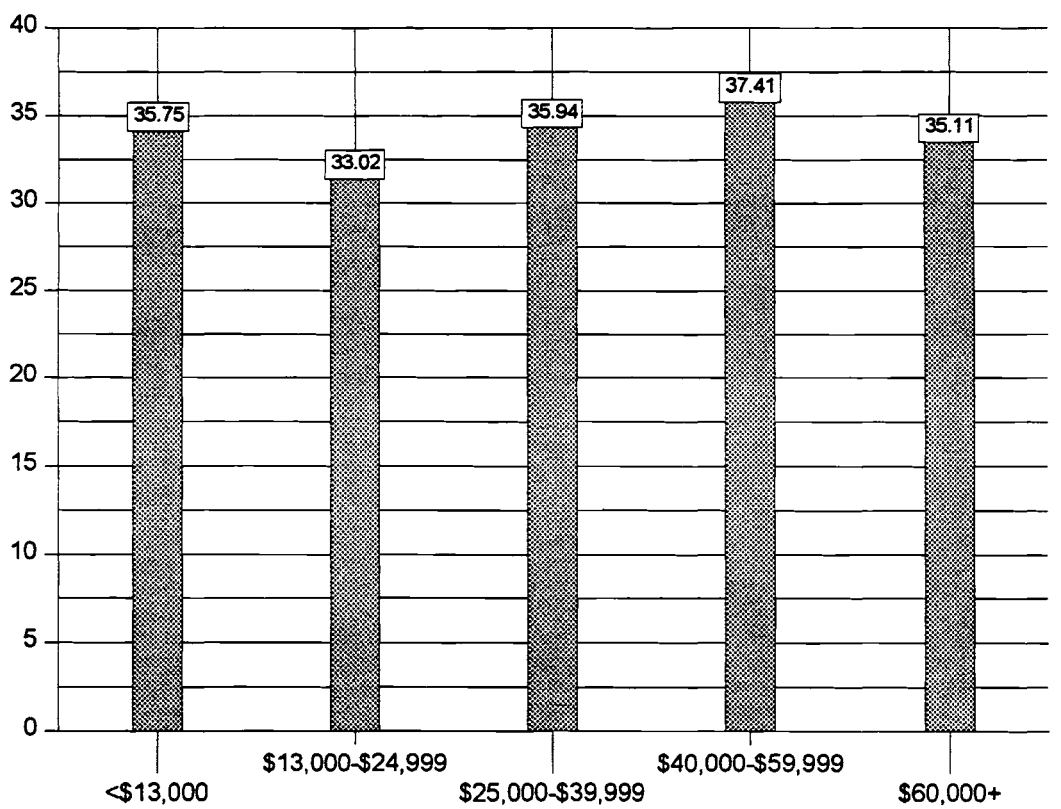

Figure 33. Mean Water Knowledge Scores By Income For Port Angeles Area

59. There is no significant difference between incomes in the Port Angeles Area and the mean scores on the WCS.

An analysis of variance indicated no significant difference. A chart showing the mean scores follows Table 55.

Table 55
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 59

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Incomes	40.8	4	10.2	1.37	0.244
Water Concern S.	1612.41	217	7.43		
TOTAL	1653.21	221			

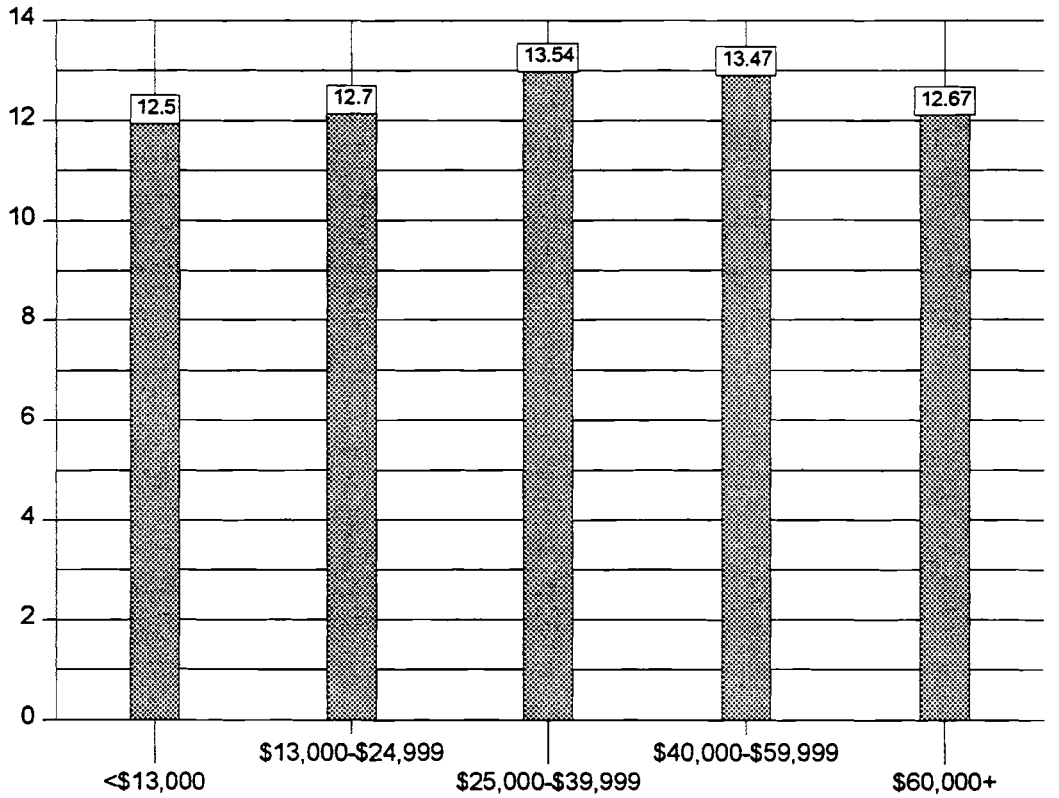

Figure 34. Mean Water Concern Scale Scores By Income For Port Angeles Area

60. There is no significant difference between incomes in the Port Angeles Area and the mean scores on the ECS.

An analysis of variance indicated no significant difference. A chart showing the mean scores follows Table 56.

Table 56
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 60

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Incomes	353.07	4	88.27	0.97	0.422
Enviro Concern S.	19377.81	214	90.55		
TOTAL	19730.88	218			

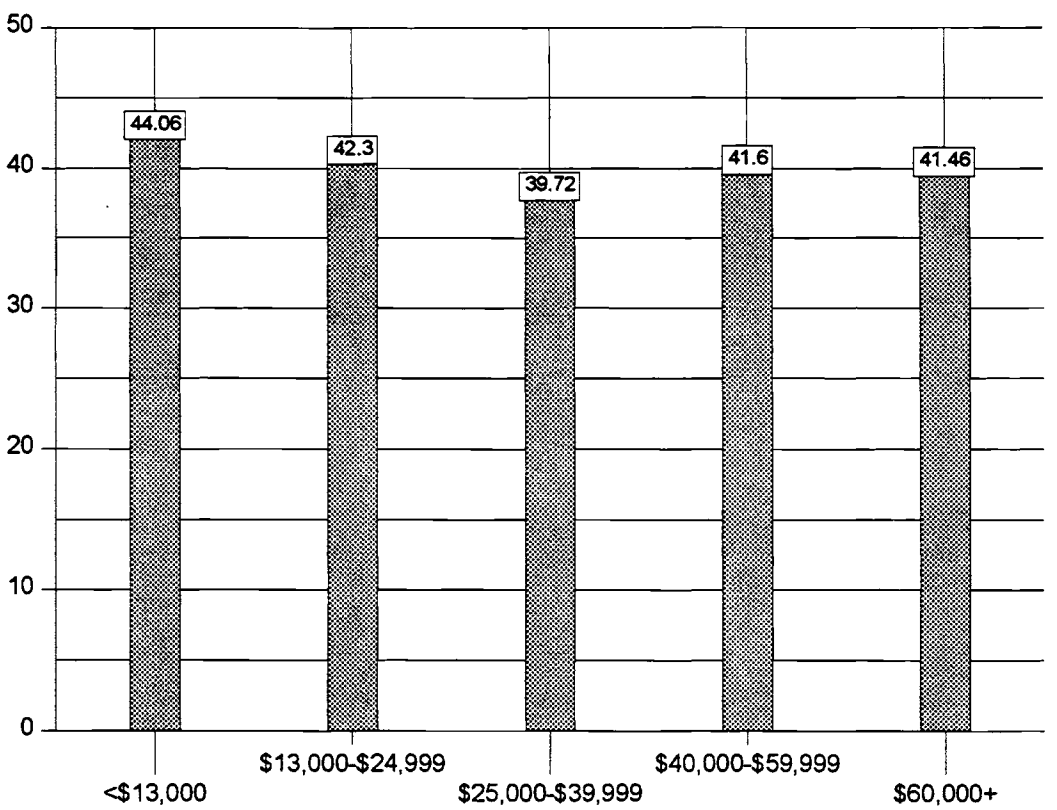

Figure 35. Mean Environmental Concern Scale Scores By Income For Port Angeles Area

61. There is no significant difference between incomes in the Sequim Area and mean Water Knowledge Scale scores.

An analysis of variance indicated a significant difference at the .012 LOC. The hypothesis is rejected. Neither Tukey's nor Duncan's tests were able to identify the significantly different groups. What is clear is the direct correspondence of increased mean scores directly paralleling increased income. A chart showing the mean scores follows Table 57.

Table 57
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 61

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Incomes	1373.73	4	343.43	3.29	0.012
Knowledge Scores	21744.88	208	104.54		
TOTAL	23118.57	212			

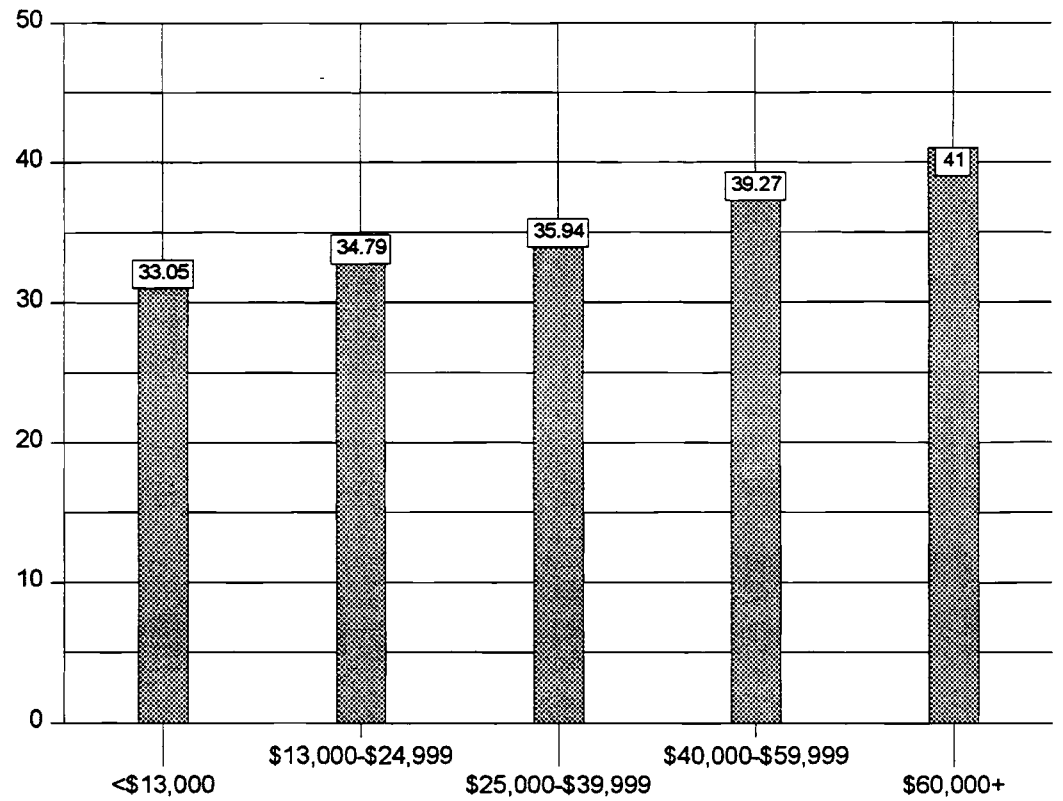

Figure 36. Mean Water Knowledge Scores By Income For Sequim Area

62. There is no significant difference between incomes in the Sequim Area and the mean scores on the WCS.

An analysis of variance indicated a significant difference at the .016 LOC. The hypothesis is rejected.

Table 58
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 62

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Incomes	93.11	4	23.28	3.12	0.016
Water Concern S.	1546.64	207	7.47		
TOTAL	1639.75	211			

Tukey's test showed the significance to be between the "less than $13,000" and $40,000-59,999" income groups. For the most part a numerical trend exists with increasing scores paralleling increasing income; although, the highest income group of $60,000 and above was in the middle of the range of mean scores. A chart showing the mean scores follows.

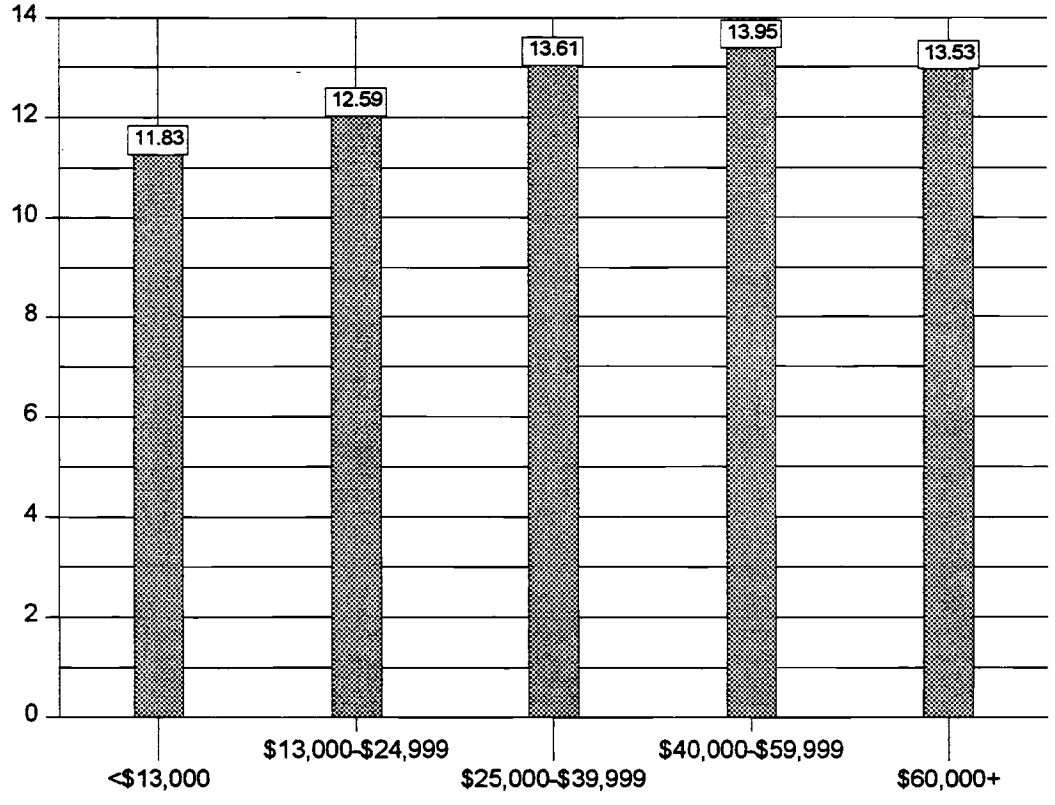

Figure 37. Mean Water Concern Scale Scores By Income For Sequim Area

63. There is no significant difference between incomes in the Sequim Area and the mean scores on the ECS.

An analysis of variance indicated no significant difference.

Table 59
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 63

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Incomes	220.02	4	55	0.64	0.636
Enviro Concern S.	17847.81	207	86.22		
TOTAL	18067.83	211			

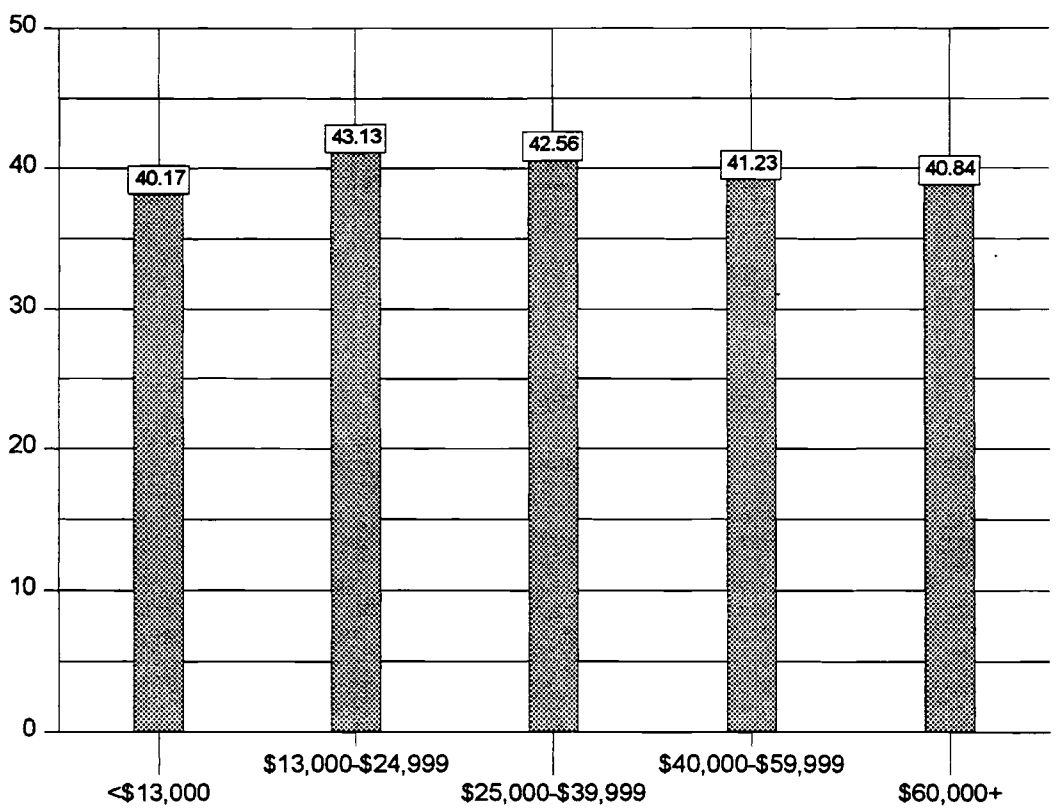

Figure 38. Mean Environmental Concern Scale Scores By Income For Sequim Area

64. There is no significant difference between ages in the Port Angeles Area and mean Water Knowledge Scale scores.

An analysis of variance indicated a significant difference at the .008 LOC. The hypothesis is rejected.

Table 60
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 64

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Ages	1706.42	6	284.4	3.01	0.008
Knowledge Scores	22209.05	235	94.51		
TOTAL	23915.44	241			

Tukey's test showed a significant difference between the 30-39 and over 70 age groups. We find a numerical trend within the mean scores here, also, with mean scores trending downward with increased respondent age (with the exception of the 60-69 aged group scoring slightly better than the 50-59 group). The following chart shows the mean scores (only three respondents were under 30 years of age, including one under 20).

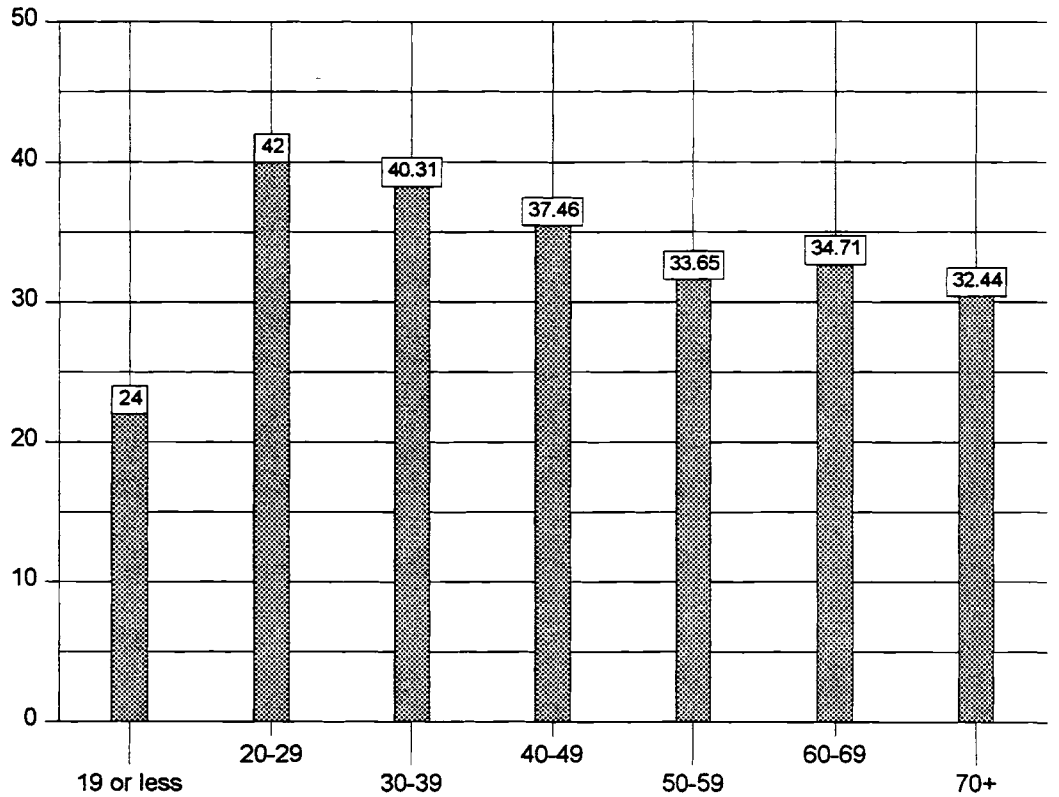

Figure 39. Mean Water Knowledge Scores By Age For Port Angeles Area

65. There is no significant difference between ages in the Port Angeles Area and the mean scores on the WCS.

An analysis of variance indicated a significant difference at the .010 LOC. The hypothesis is rejected.

Table 61
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 65

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Ages	121.47	6	20.24	2.88	0.01
Water Concern S.	1654.08	235	7.04		
TOTAL	1775.54	241			

Tukey's test showed the significant difference to be the lower mean scores for the 50-59 group compared with both the 60-69 and 40-49 age groups. The following chart shows the mean scores (only three respondents were under 30 years of age, including one under 20).

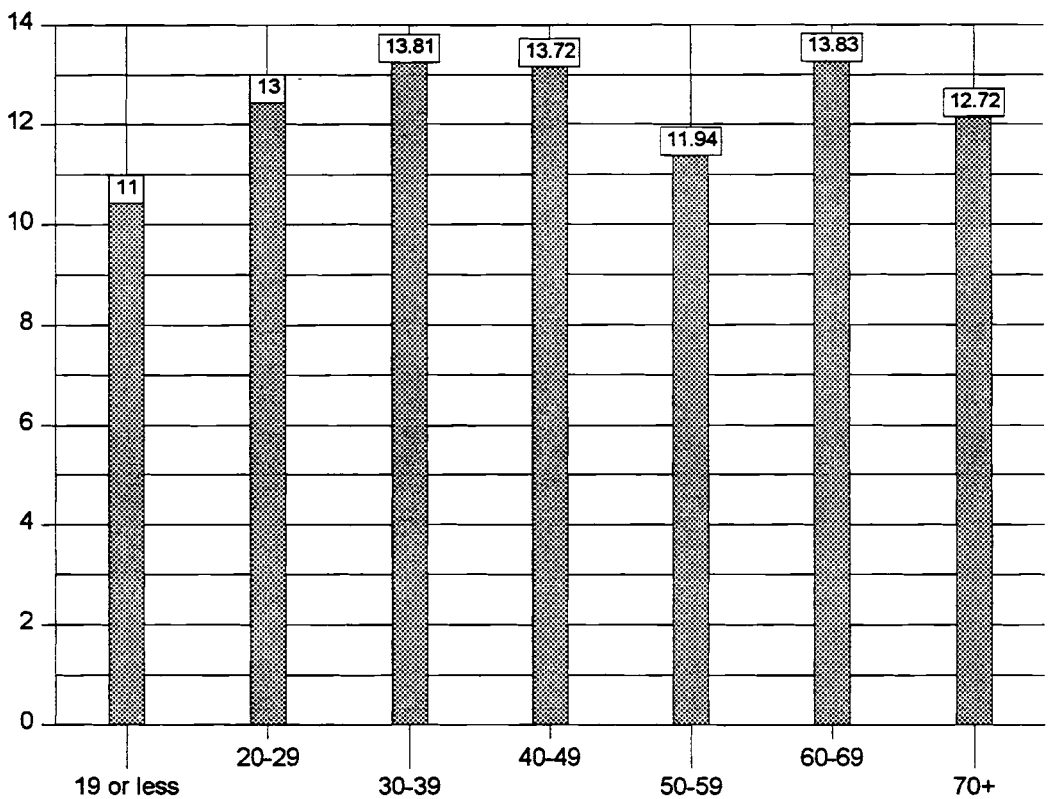

Figure 40. Mean Water Concern Scale Scores By Age For Port Angeles Area

66. There is no significant difference between ages in the Port Angeles Area and the mean scores on the ECS.

An analysis of variance indicated no significant difference. The chart following Table 62 shows the mean scores (only three respondents were under 30 years of age, including one under 20).

Table 62
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 66

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
PA Ages	741.54	6	123.6	1.44	0.199
Enviro Concern S.	19876.26	232	85.67		
TOTAL	20617.8	238			

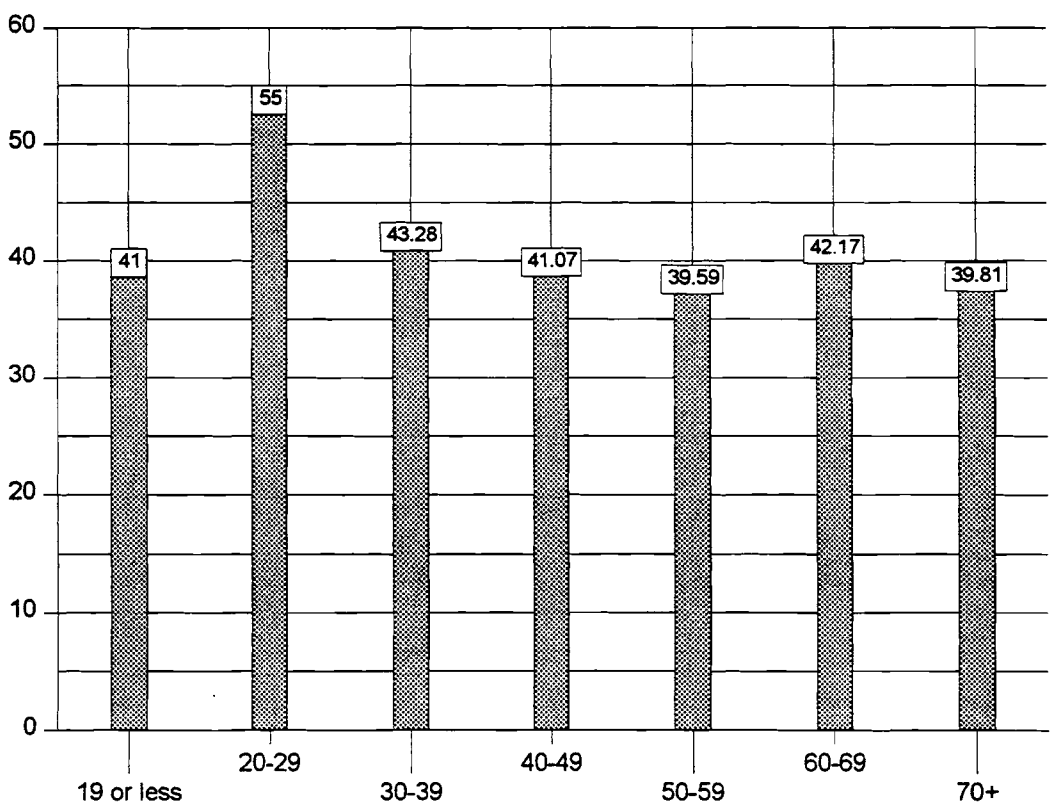

Figure 41. Mean Environmental Concern Scale Scores By Age For Port Angeles Area

67. There is no significant difference between ages in the Sequim Area and mean Water Knowledge Scale scores.

An analysis of variance indicated a significant difference at the .000+ LOC (.000+ indicates very small fractions). The hypothesis is rejected.

Table 63
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 67

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Ages	3233.71	5	646.74	6.55	0.00+
Knowledge Scores	24287.55	246	98.73		
TOTAL	27521.27	251			

Tukey's test showed significant differences between the 70 plus age group and each of the other groups (20-29 did not qualify with only 1 respondent). There was a perfect numerical correspondence between increasing age and decreasing mean scores. The following chart shows the mean scores.

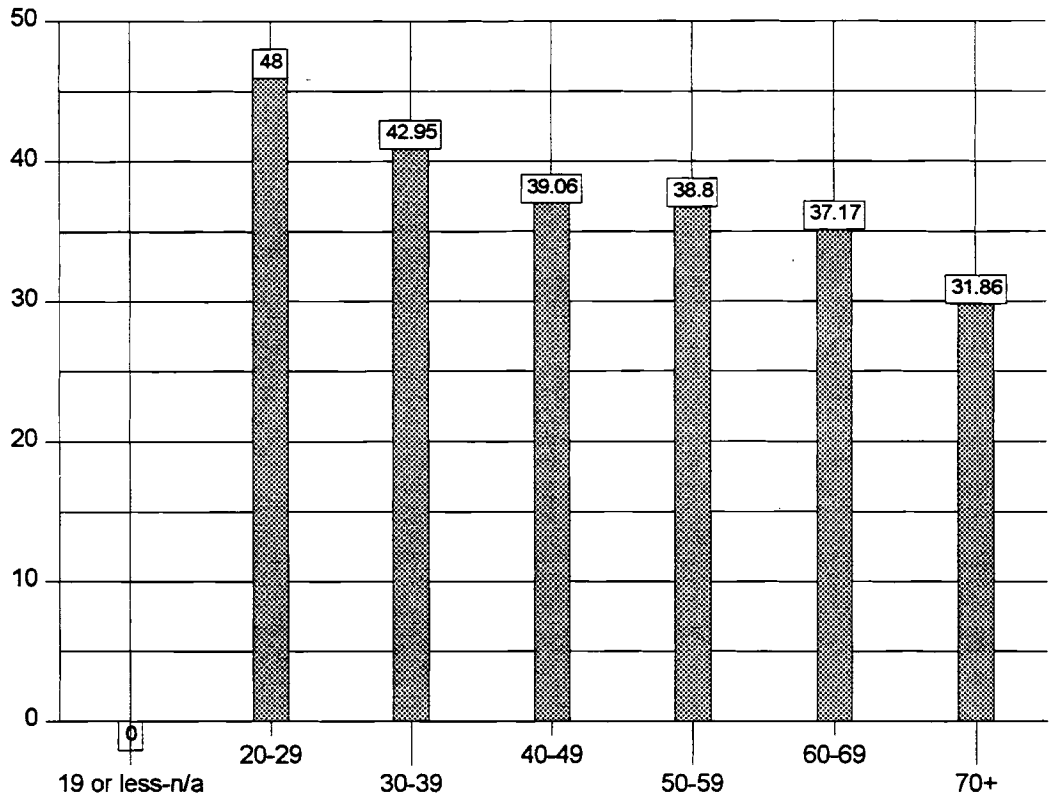

Figure 42. Mean Water Knowledge Scores By Age For Sequim Area

68. There is no significant difference between ages in the Sequim Area and the mean scores on the WCS.

An analysis of variance indicated a significant difference at the .001 LOC. The hypothesis is rejected.

Table 64
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 68

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Ages	156.31	5	31.29	4.6	0.001
Water Concern S.	1650.54	243	6.8		
TOTAL	1806.85				

Tukey's test showed significant differences between the lower scores of the 70 plus age group and compared with both the 40-49 and 50-59 groups. Additionally, with the exception of a 40-49 group scoring slightly higher than the 30-39 group, we again see the trend of reduced scores with increasing age. The following chart shows the mean scores (there was only one respondent under 30 years of age, none under 20).

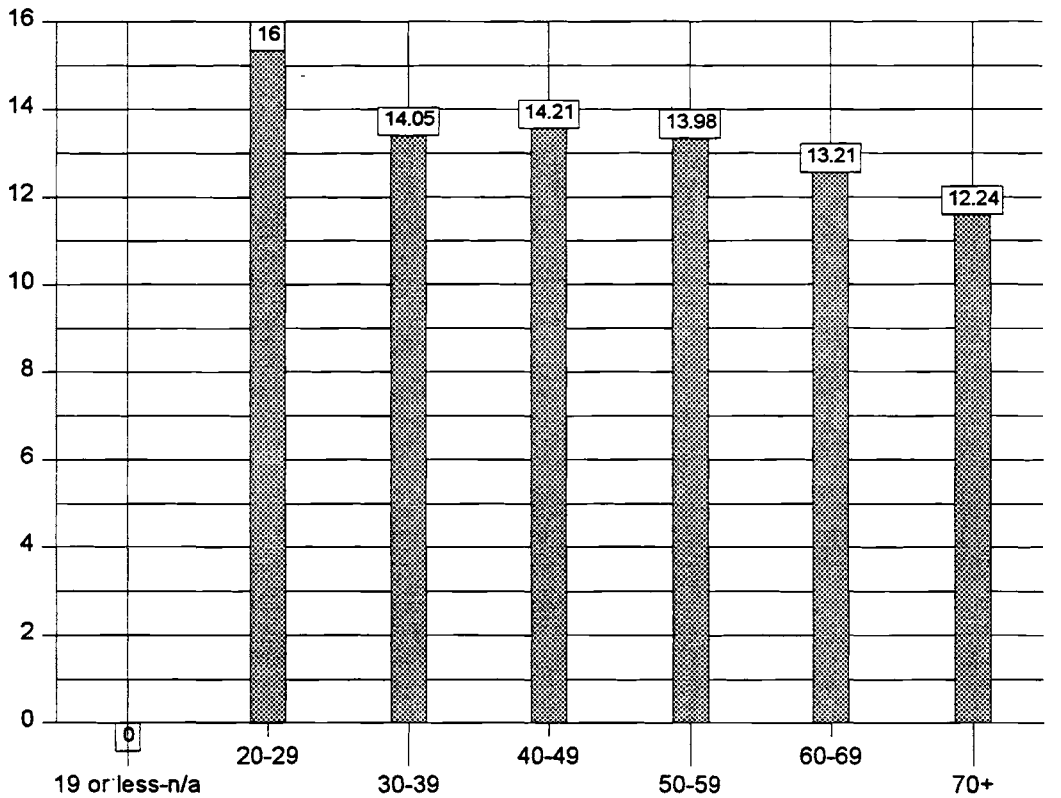

Figure 43. Mean Water Concern Scale Scores By Age For Sequim Area

69. There is no significant difference between ages in the Sequim Area and the mean scores on the ECS.

An analysis of variance indicated no significant difference. The chart following Table 65 shows the mean scores (there was only one respondent under 30 years of age, none under 20).

Table 65
Analysis of Variance Showing LOC (prob > f) for Rejecting Hypothesis 69

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROB > F
SQ Ages	508.78	5	101.75	1.22	0.302
Enviro Concern S.	20420.67	244	83.69		
TOTAL	20929.44	249			

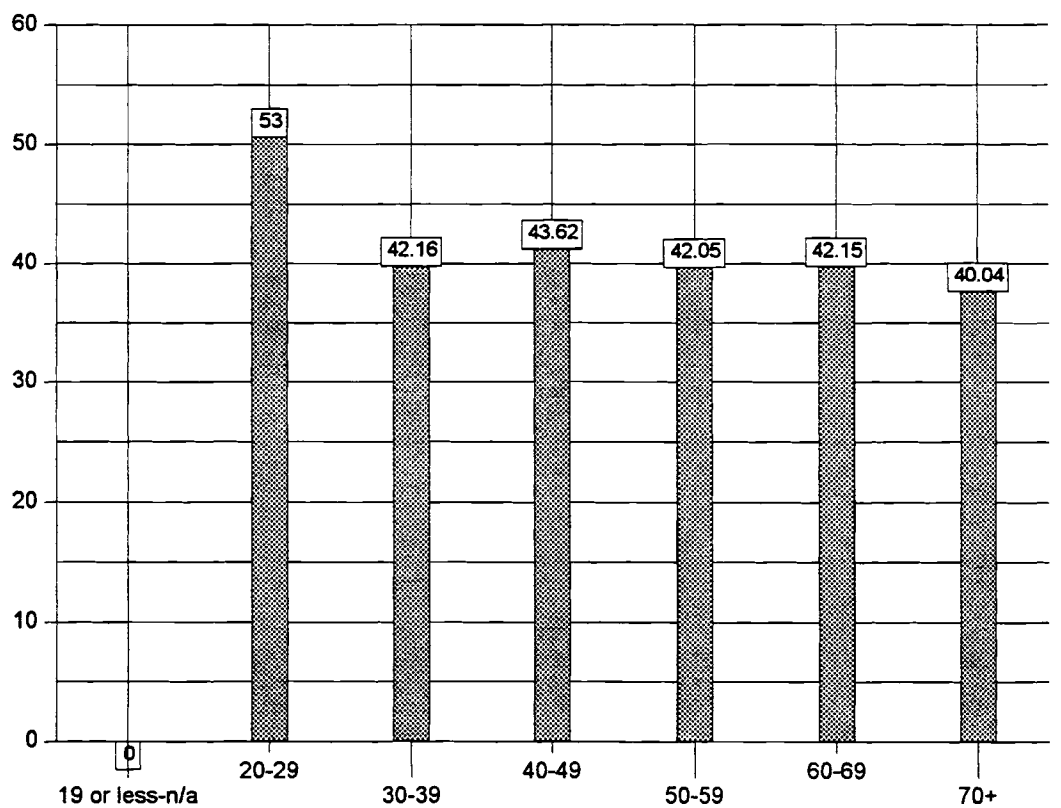

Figure 44. Mean Environmental Concern Scale Scores By Age For Sequim Area

The first opinion question to appear on the Water AOK Survey asked respondents for their greatest water-related concern (survey question #1). The responses for the entire sample are illustrated in the following chart:

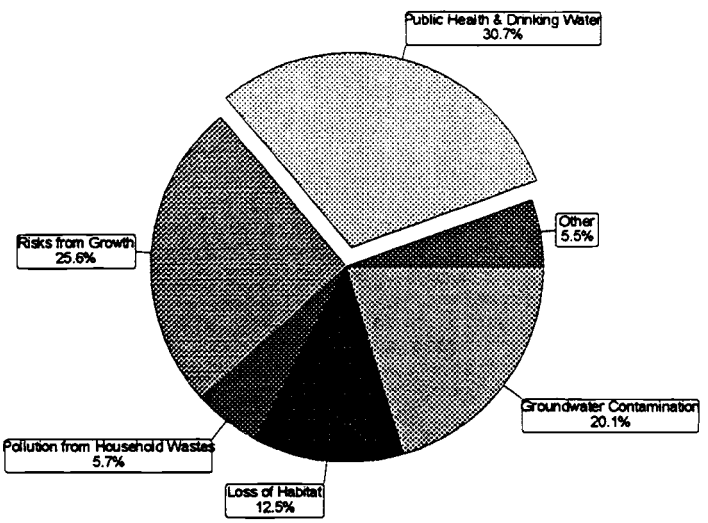

Figure 45. Survey Question #1--Most Important Water-Related Concern (Percentage Of Response For Entire Sample)

We see public health and drinking water concerns, risks due to potential growth/increased use, and groundwater contamination issues emphasized in that order.

The following graph depicts a comparison of survey question #1 responses from the Port Angeles Area and Sequim Area by percentage of responses for each category:

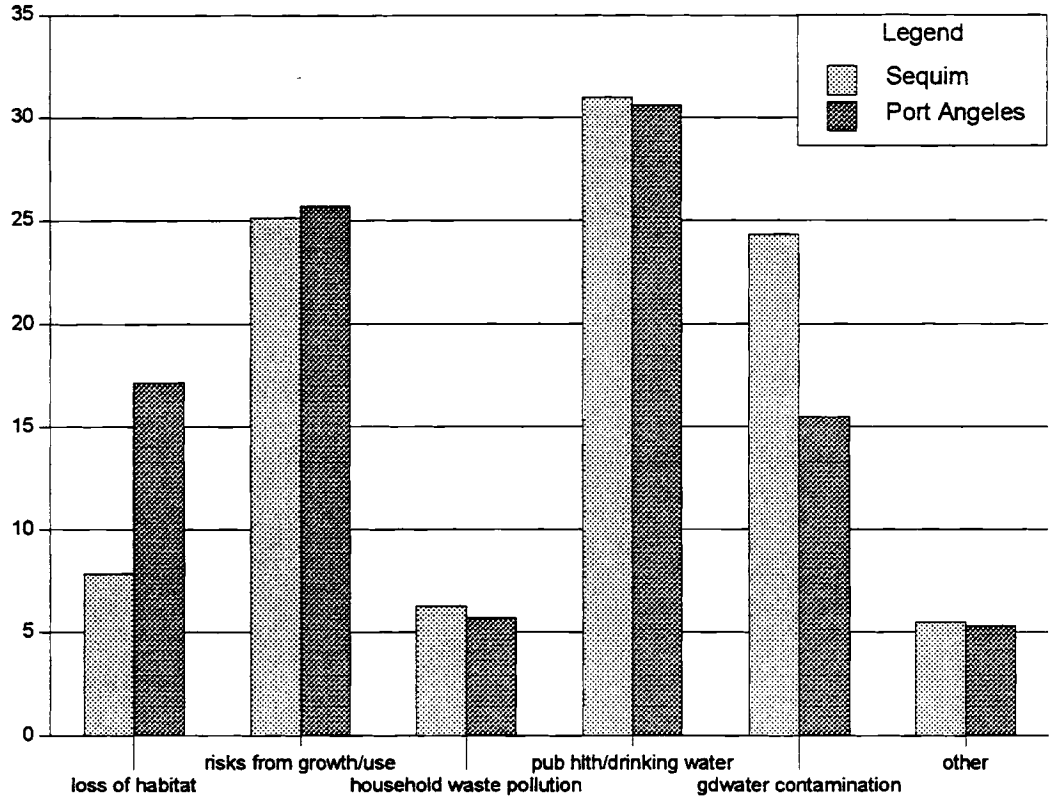

Figure 46. Survey Question #1--Most Important Water-Related Concern (Percentage Of Total Response By Major Study Areas)

There are two major items of interest here. One observable difference between the responses for the PA and SQ study areas is in the concern for loss of habitat, with the Port Angeles Area having about twice as many people concerned. The second item we note is that the Sequim Area sample showed about one third more responses for concern about groundwater contamination.

All of the next seven hypotheses (70-76) deal with the relationship between different sets of demographic data for the entire sample within the category of greatest water related concern. A Chi-Square analysis was run for each, based on the demographic variable in question.

70. There is no significant relationship between length of residence in the region and greatest water-related concern.

    The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 27% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

71. There is no significant relationship between use of land and greatest water-related concern.

    The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 70% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

72. There is no significant relationship between duration of annual local residence and greatest water-related concern.

    The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 75% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

73. There is no significant relationship between occupation and greatest water-related concern.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 60% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

74. There is no significant relationship between education and greatest water-related concern.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected.

75. There is no significant relationship between income and greatest water-related concern.

The Chi-Square analysis did not indicate a significant probability permitting the hypothesis to be rejected. It should be noted that 15% of the respondents did not answer this question about income.

76. There is no significant relationship between age and greatest water-related concern.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 38% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

The second opinion question to appear on the Water AOK Survey asked respondents for their most favored action by government in relation to water quality

problems (survey question #2). The responses for the entire sample are illustrated in the following chart:

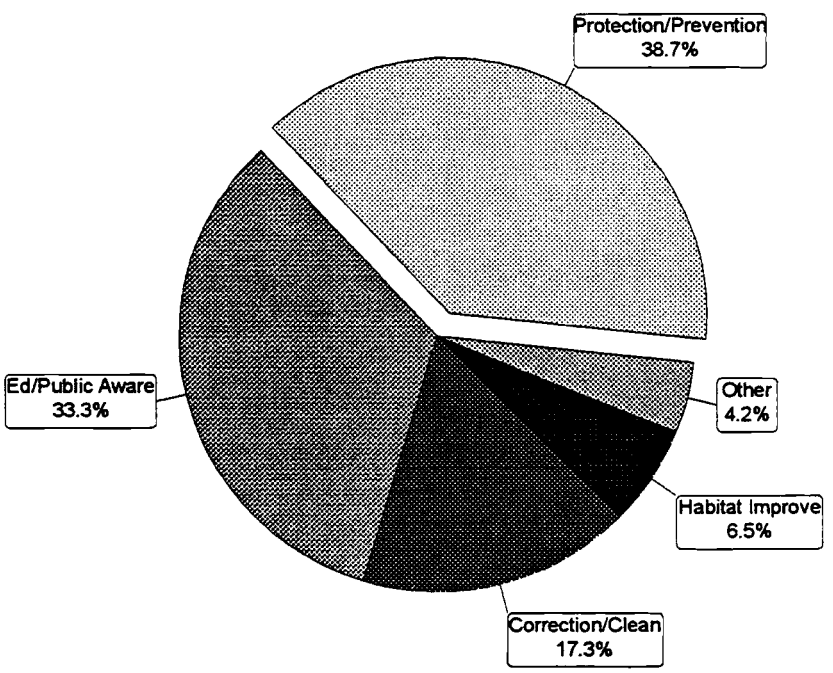

Figure 47. Survey Question #2--Preferred Action By Government Regarding Water Quality (Percentage Of Response for Entire Sample)

We find that both protection/prevention and education/public awareness are favored by about one-third of the respondents. Correction/cleanup has about half as many in favor.

The following graph depicts a comparison of survey question #2 responses for the Port Angeles and Sequim Areas by percentage of responses for each category:

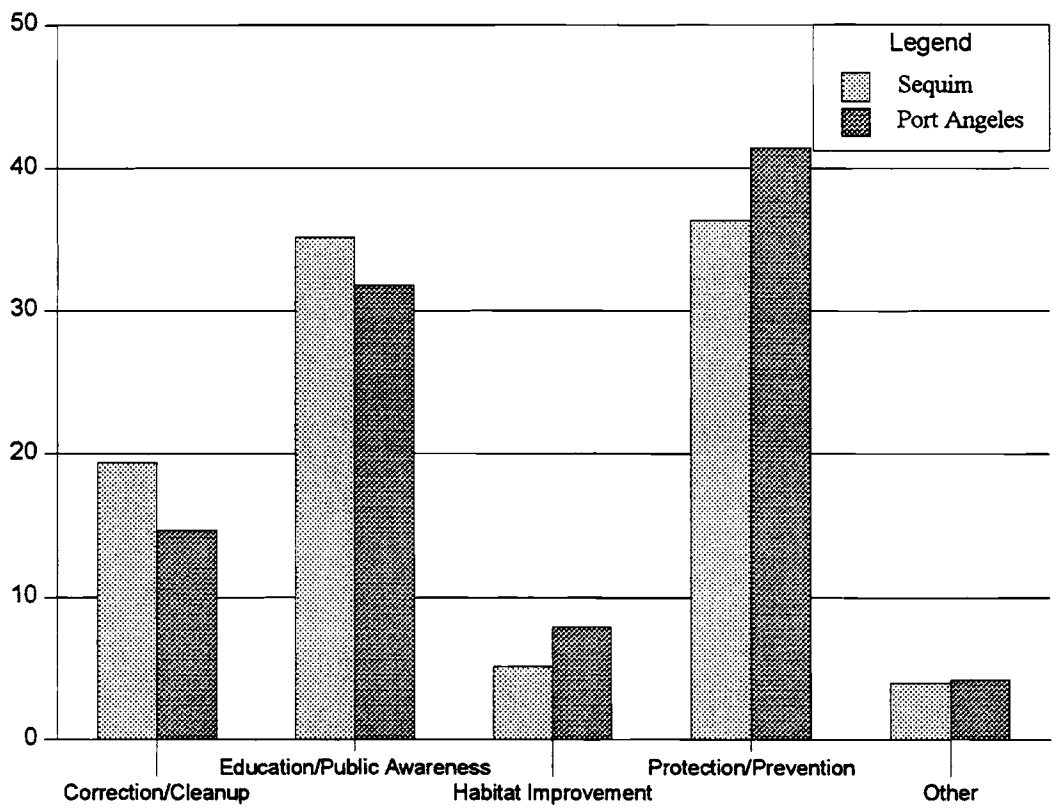

Figure 48. Survey Question #2--Preferred Action By Government Regarding Water Quality (Percentage Of Total Response By Major Study Areas)

The differences found on this question for the entire sample are explained as we observe that both protection/prevention and education/public awareness each once

again have the favor of about a third of the respondents in the Sequim Area. We find these two options being selected by about three fourths of the Port Angeles respondents, however, with protection/prevention more favored. Correction/cleanup still has about half as many (about a sixth) in favor in Sequim but fewer in the PA Area.

All of the next seven hypotheses (77-83) deal with the relationship between different sets of demographic data for the entire sample within the category of most favored action by government in relation to water quality problems. A Chi-Square analysis was run for each, based on the demographic variable in question.

77. There is no significant relationship between length of residence in the region and favored actions to mitigate problems.

The Chi-Square analysis indicated statistical significance of .046. The probability is that the hypothesis could be rejected. It should be noted that 28% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. However, the responses include an "other" option which may have skewed the results. Three of the seven cells with expected counts of less than five were in this option. Considering the disproportionate representation of the population by length of residence, and that the low counts were for the small population groups, the data may actually be useful. Although, without further tests, the locations of the significance could not be identified, Table 66 shows the relationship of responses to Water AOK Survey

question #2 by length of residency (all numbers are percentages of responses):

Table 66
Survey Question #2--Favored Actions To Mitigate Problems
Percentage of Response For Entire Sample By Length of Residency In Region

Years of Res in Region	Correction/ Cleanup	Education/ Pub Aware	Habitat Improvement	Protection/ Prevention	Other	Total
Less Than 2	1.36	0.39	0.19	2.72	0	4.66
2 - 5	2.33	4.27	0.78	7.18	0.39	14.95
6 - 10	2.33	3.11	0.97	4.47	0.58	11.46
11 -20	4.85	7.18	1.17	10.68	0.97	24.85
21 +	6.21	18.28	3.3	13.98	2.33	44.08
Total	17.09	33.2	6.41	39.03	4.27	100%

The numerical differences show an emphasis on protection/prevention, although, in sharp contrast to the other population segments, the largest segment--residents of over 21 years--favored education/public awareness. That category was rated second for each of the other groups, except for the less than two year" residents who placed it a distant third.

78. There is no significant relationship between use of land and favored actions to mitigate problems.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 68% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

79. There is no significant relationship between duration of annual local residence and favored actions to mitigate problems.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 70% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

80. There is no significant relationship between occupation and favored actions to mitigate problems.

The Chi-Square analysis indicated statistical significance with a LOC of .003. The hypothesis could be rejected. It should be noted that 58% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. However, the responses include an "other" option which may have skewed the results. In addition, the respondents to our survey indicate a population heavily weighted in the retired segment. The data is somewhat suspect. It is possible, however, that the data does reflect the reality of the population. Although, without further tests, the location of significant differences can not be identified, the following table is presented for the reader's perusal (all numbers are percentages of responses):

Table 67
Survey Question #2--Favored Actions To Mitigate Problems
Percentage Of Response For Entire Sample By Occupation

Occupation	Correction/ Cleanup	Education/ Pub Aware	Habitat Improvement	Protection/ Prevention	Other	Total %
Agriculture	0	1.36	0.39	0.78	0	2.53
Fisheries	0.19	0.19	0.39	0	0.19	0.97
Forestry	0	1.56	0.19	1.36	0	3.12
Const./ Trade/Manu-facturing	1.17	3.12	1.17	2.53	0.58	8.58
Commercial/ Service	2.53	4.68	0.58	5.46	0.58	13.84
Government/ Military	0.19	0.19	0	0.39	0	0.78
Government/ Non-Military	0.78	0.58	0.39	3.7	0	5.46
Retired	10.14	18.32	2.14	19.88	1.95	52.44
Full-Time Homemaker	1.36	0.97	0	1.36	0	3.70
Other	0.97	1.95	0.97	3.7	0.97	8.58
Total %	17.35	32.94	6.24	39.18	4.29	100%

Again, we find numerical differences showing the majority of respondents agreeing that protection/ prevention, education/public awareness, and correction/ cleanup are, in order, the most important steps to take; with the first two categories generally fairly close and reversed in the natural resource and construction/ manufacturing occupations.

81. There is no significant relationship between education and favored actions to mitigate problems.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that expected counts within the cells for this test were sufficient for a valid test.

82. There is no significant relationship between income and favored actions to mitigate problems.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 24% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

83. There is no significant relationship between age and favored actions to mitigate problems.

The Chi-Square analysis indicated statistical significance of .046. The probability is that the hypothesis could be rejected. It should be noted that 40% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. However, the responses include an "other" option which may have skewed the results. In addition, the respondents to our survey indicate a population heavily weighted in the retirement aged segment (only 4 of 506 respondents were under the age of 30). The data is somewhat suspect. It is possible, however, that the data does approximately reflect the reality of the population, and although--without further tests--the location of significant differences

can not be identified, the following table is presented for the reader's perusal (all numbers are percentages of responses):

Table 68
Survey Question #2--Favored Actions To Mitigate Problems
Percentage Of Response For Entire Sample By Age

Age	Correction/ Cleanup	Education/ Pub Aware	Habitat Improvement	Protection/ Prevention	Other	Total %
19 or Less	0	0	0	0.2	0	0.20
20 - 29	0.2	0	0	0.4	0	0.59
30 - 39	2.17	2.17	0.99	3.75	0.59	9.68
40 - 49	2.57	6.13	1.58	8.70	0.59	19.57
50 - 59	1.58	5.14	0.79	5.93	1.58	15.02
60 - 69	3.16	10.08	1.98	11.46	1.19	27.87
70 +	7.31	9.88	1.38	8.10	0.40	27.08
Total %	17.00	33.4	6.72	38.54	4.35	100%

We find herein the same numerical differences seen earlier, the majority of respondents agreeing that protection/prevention, education/public awareness, and correction/ cleanup are, in order, the most important steps to take; with the first two categories generally fairly close and reversed in the 70-plus age group.

The fourth opinion question to appear on the Water AOK Survey asked respondents to indicate their agreement along a five-point Likert dimension with the

statement that follows: "I know enough about water issues to participate in the evaluation and planning of proposed projects" (survey question #19). The responses for the entire sample are illustrated in the following chart:

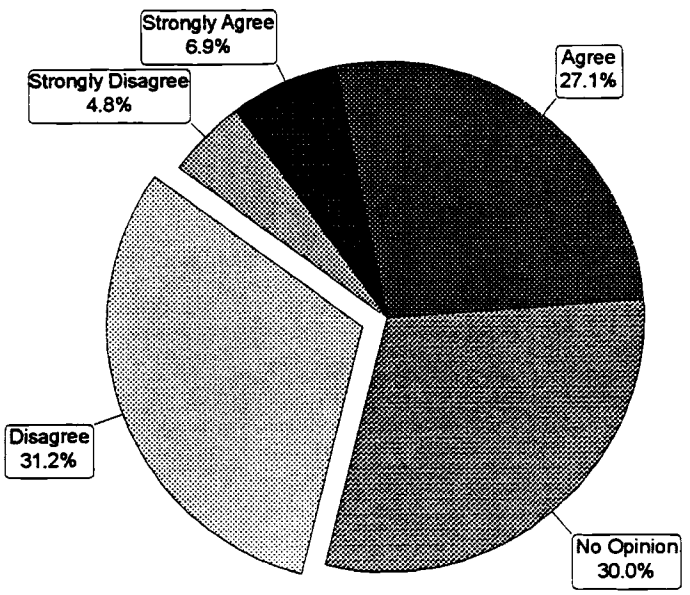

Figure 49. Survey Question #19--I Know Enough About Issues To Participate (Percentage Of Response For Entire Sample)

The most outstanding feature of this data is that the respondents are tightly clumped in the middle with very little strong opinion. More respondents felt unprepared than prepared, however.

The following graph depicts a comparison of survey question #19 responses for the Port Angeles Area and Sequim Area by percentage of responses for each category:

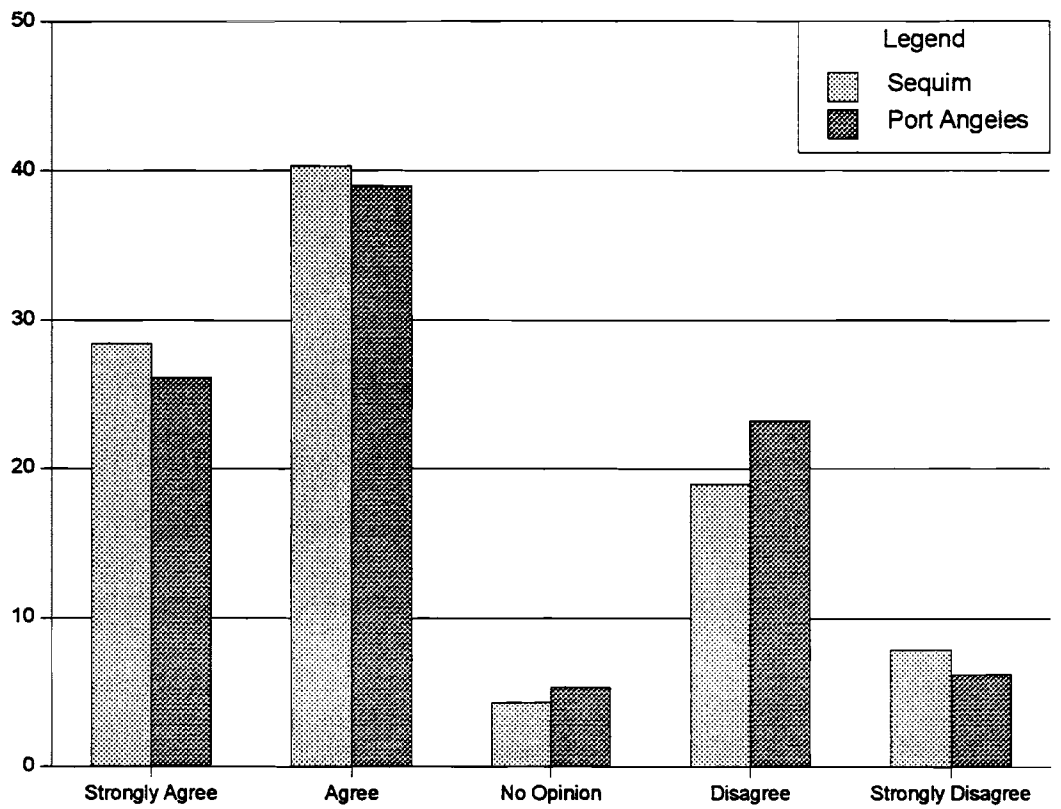

Figure 50. Survey Question #19--I Know Enough About Issues To Participate (Percentage Of Response By Major Study Areas)

Much the same results as in the entire sample is found for the PA Area. A slight change spreading away from the middle is found in the SQ Area.

All of the next seventeen hypotheses (84-100) deal with the relationship between different sets of demographic data for the entire sample within the category of perception of adequate preparation to participate in evaluating and planning water-related projects (survey question #19). A Chi-Square analysis was run for each, based on the demographic variable in question. Additionally, for each of the two major study areas, Pearson Correlations were run to test the five hypotheses which had ordinal data in intervals.

84. Within the entire sample, there is no significant relationship between length of residence in the region and perception of adequate preparation to participate in evaluating and planning water-related projects.

    The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected.

85. Within the PA Area, there is no significant relationship between length of residence in the region and perception of adequate preparation to participate in evaluating and planning water-related projects.

    The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

86. Within the SQ Area, there is no significant relationship between length of residence in the region and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

87. Within the entire sample, there is no significant relationship between use of land and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 68% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

88. Within the entire sample, there is no significant relationship between duration of annual local residence and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 75% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

89. Within the PA Area, there is no significant relationship between duration of annual local residence and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

90. Within the SQ Area, there is no significant relationship between duration of annual local residence and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

91. Within the entire sample, there is no significant relationship between occupation and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 56% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

92. Within the entire sample, there is no significant relationship between education and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Chi-Square analysis indicated a significant probability at the .031 level of confidence that the hypothesis could be rejected. Although further tests are required to identify the location of significant differences, the following table provides a detailed look at the results (all numbers are percentages of responses):

Table 69
Survey Question #19--Perception Of Adequate Preparation To Participate In Evaluating And Planning Water-Related Projects
Percentage Of Response For Entire Sample By Education

Education Completed	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree	Total
Less Than 12th	0.20	1.18	1.57	1.57	0.39	4.91
12th	1.38	7.86	11.00	11.20	1.57	33.01
2 + Years College	1.96	8.25	8.06	7.86	0.79	26.92
4 Year College Degree	0.79	4.72	6.09	6.68	1.38	19.65
Post-Graduate Degree	2.75	5.3	2.95	3.73	0.79	15.52
Total	7.07	27.31	29.67	31.04	4.91	100.00

We find numerical differences showing some movement toward greater confidence to participate as education level increases. There is an anomaly with a reversion toward uncertainty and not feeling prepared at the four-year college level.

93. Within the PA Area, there is no significant relationship between education and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

94. Within the SQ Area, there is no significant relationship between education and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation indicated a significant probability at the .002 level of confidence that the hypothesis could be rejected. The responses in Table 69 (previous page) help us to see the numerical differences in the entire sample generally indicating greater confidence to participate as education level increases (again, with an anomaly toward uncertainty and not feeling prepared at the four-year college level). We can infer that the significant correlation for the Sequim Area data is consistent with the directions reflected in the table for the entire sample.

95. Within the entire sample, there is no significant relationship between income and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 16% of the data was missing for this question.

96. Within the PA Area, there is no significant relationship between income and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

97. Within the SQ Area, there is no significant relationship between income and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation indicated a significant probability at the .007 level of confidence that the hypothesis could be rejected. The response table (for the entire sample) shows a numerical trend toward increasing level of confidence to participate as income increases.

98. Within the entire sample, there is no significant relationship between age and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 40% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

99. Within the PA Area, there is no significant relationship between age and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

100. Within the SQ Area, there is no significant relationship between age and perception of adequate preparation to participate in evaluating and planning water-related projects.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

All of the next seven hypotheses (101-107) deal with the relationship between different sets of demographic data for the entire sample within the category of greatest water pollution problem in respondent's area (survey question #50). A Chi-Square analysis was run for each, based on the demographic variable in question.

101. There is no significant relationship between length of residence in the region and what is considered the greatest water pollution problem in respondent's area.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 34% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

102. There is no significant relationship between use of land and what is considered the greatest water pollution problem in respondent's area.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 74% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

103. There is no significant relationship between duration of annual local residence and what is considered the greatest water pollution problem in respondent's area.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 71% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

104. There is no significant relationship between occupation and what is considered the greatest water pollution problem in respondent's area.

The Chi-Square analysis indicated a significant probability at the .031 level of confidence that the hypothesis could be rejected. It should be noted, however, that 71% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. Nonetheless, in reviewing the response table for this data, one fact jumps out above all the rest. For most occupations the "not sure" answer has the highest responses and no occupation has any other answer more frequently. People generally do not feel that they know what the greatest water pollution problems are in the areas where they live!

105. There is no significant relationship between education and what is considered the greatest water pollution problem in respondent's area.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 26% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

106. There is no significant relationship between income and what is considered the greatest water pollution problem in respondent's area.

The Chi-Square analysis did not permit the hypothesis to be rejected. It should be noted that 34% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. Additionally, 19% of the data were missing.

107. There is no significant relationship between age and what is considered the greatest water pollution problem in respondent's area.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 49% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

All of the next seven hypotheses (108-114) deal with the relationship between different sets of demographic data for the entire sample within the category of community priorities when facing shortages (survey question #58). A Chi-Square analysis was run for each, based on the demographic variable in question. The following chart depicts a summary of responses for the entire sample:

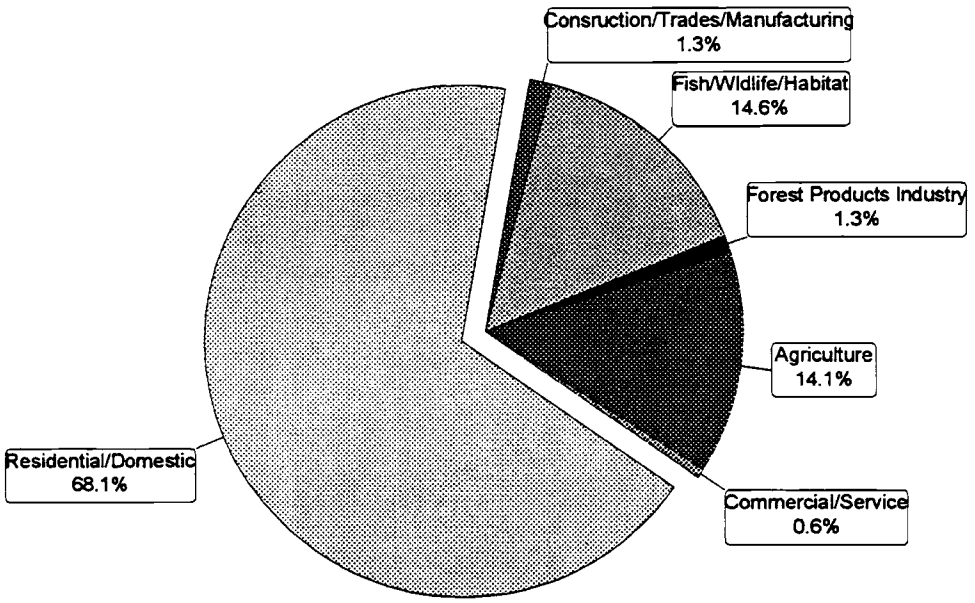

Figure 51. Survey Question #58--1st Priority For Use When Amounts Are Limited (Percentage Of Response For Entire Sample)

We see that the residential/domestic sector was selected by over 68% of the respondents, with two other sectors (agriculture and fisheries, wildlife, habitat) each being selected by about 14% each. The other three sectors combined were selected by less than 4% of the respondents.

108. There is no significant relationship between length of residence in the region and in how the communities prioritize water use when facing shortages.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 57% of the

cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

109. There is no significant relationship between use of land and in how the communities prioritize water use when facing shortages.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 77% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

110. There is no significant relationship between duration of annual residence and in how the communities prioritize water use when facing shortages.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 75% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

111. There is no significant relationship between occupation and in how the communities prioritize water use when facing shortages.

The Chi-Square analysis indicated a significant probability at a .000+ level of confidence that the hypothesis could be rejected. It should be noted that 73% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. As discussed earlier, because of the very high number of retired respondents, the data is suspect. Nonetheless, because the possibility exists that these responses actually represent the demographic characteristics of the region, and especially

in light of the obvious popularity of selected options, the data is worth considering. The following graph depicts a breakdown of all of the responses by occupation:

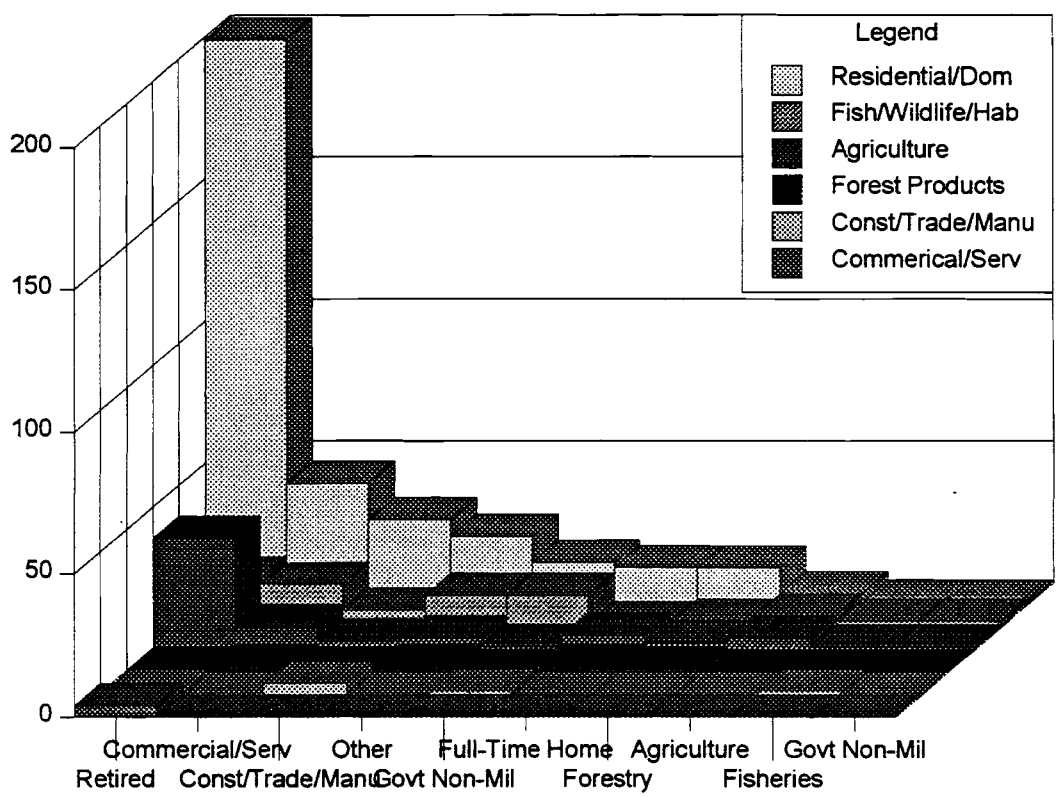

Figure 52. Survey Question #58--1st Priority For Use When Amounts Are Limited (Responses For Entire Sample By Occupation)

112. There is no significant relationship between education and in how the communities prioritize water use when facing shortages.

The Chi-Square analysis indicated a significant probability at a .000+ level of confidence that the hypothesis could be rejected. It should be noted that 57% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. As discussed earlier, in light of the obvious popularity of selected options, the data is worth considering. The following chart depicts the summary of responses for the entire sample:

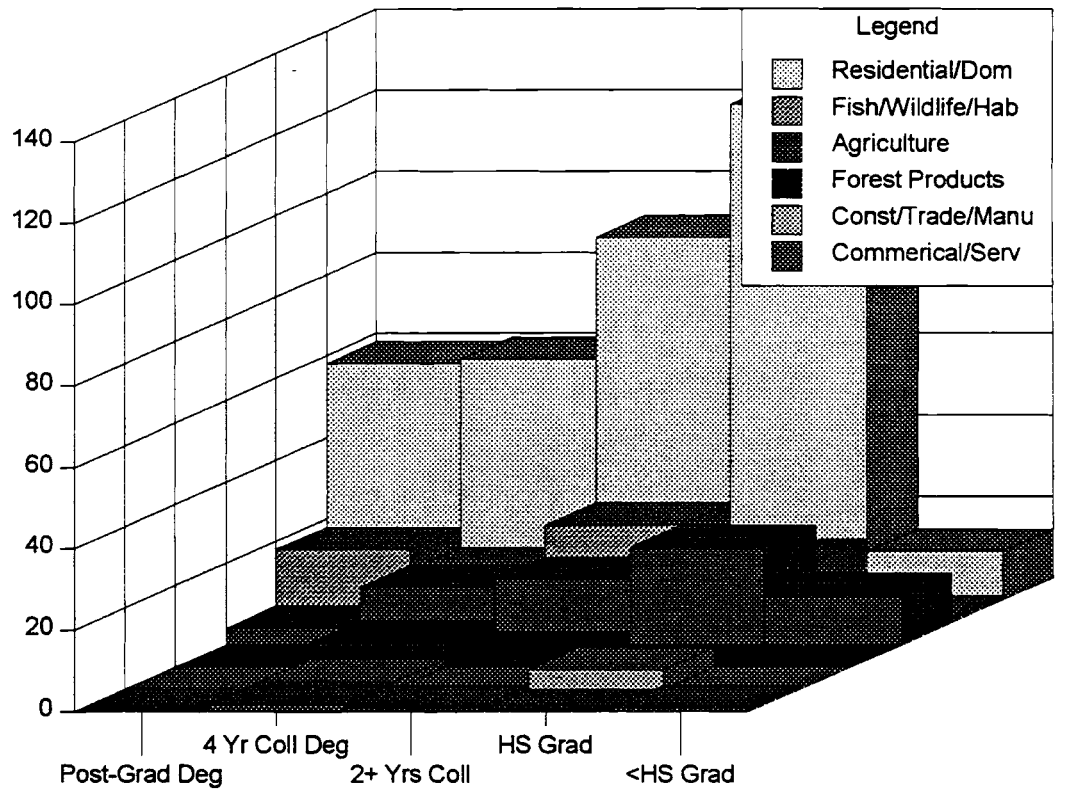

Figure 53. Survey Question #58--1st Priority For Use When Amounts Are Limited (Responses For Entire Sample By Education)

113. There is no significant relationship between income and in how the communities prioritize water use when facing shortages.

The Chi-Square analysis indicated a significant probability at a .019 level of confidence that the hypothesis could be rejected. It should be noted that 53% of the cells for this test had expected counts of less than

five. Chi-Square may not be a valid test. As discussed earlier, in light of the obvious popularity of selected options, the data is worth considering. The following chart depicts the summary of responses:

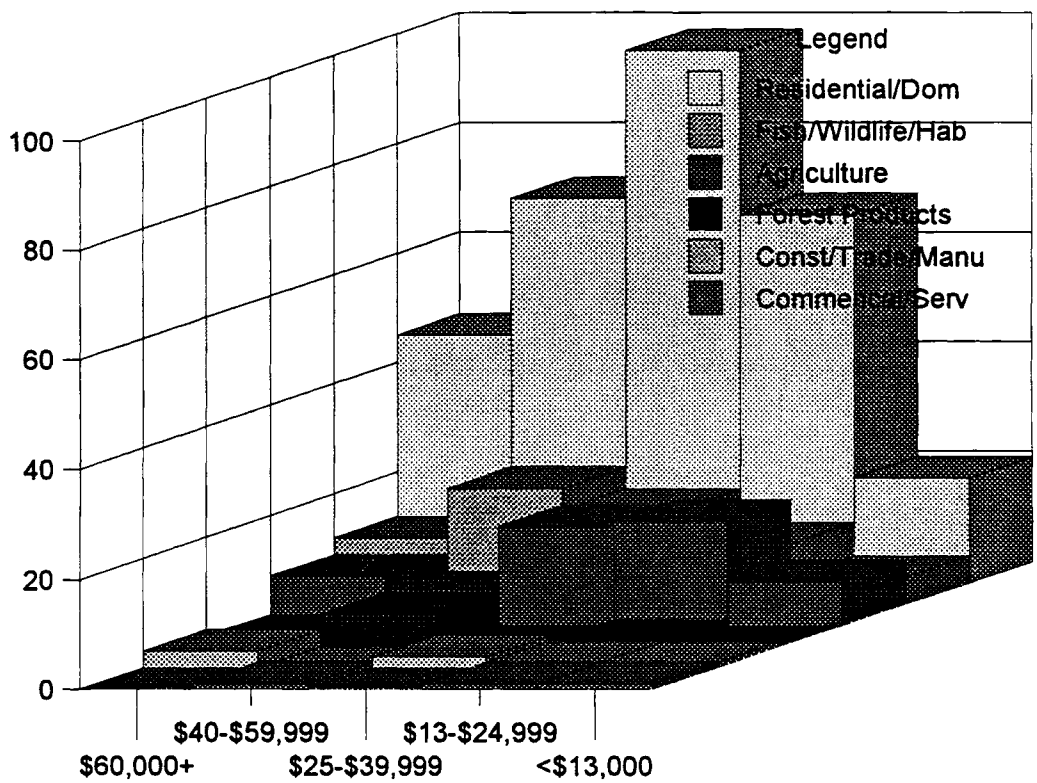

Figure 54. Survey Question #58--1st Priority For Use When Amounts Are Limited (Responses For Entire Sample By Income)

five. Chi-Square may not be a valid test. As discussed earlier, in light of the obvious popularity of selected options, the data is worth considering. The following chart depicts the summary of responses:

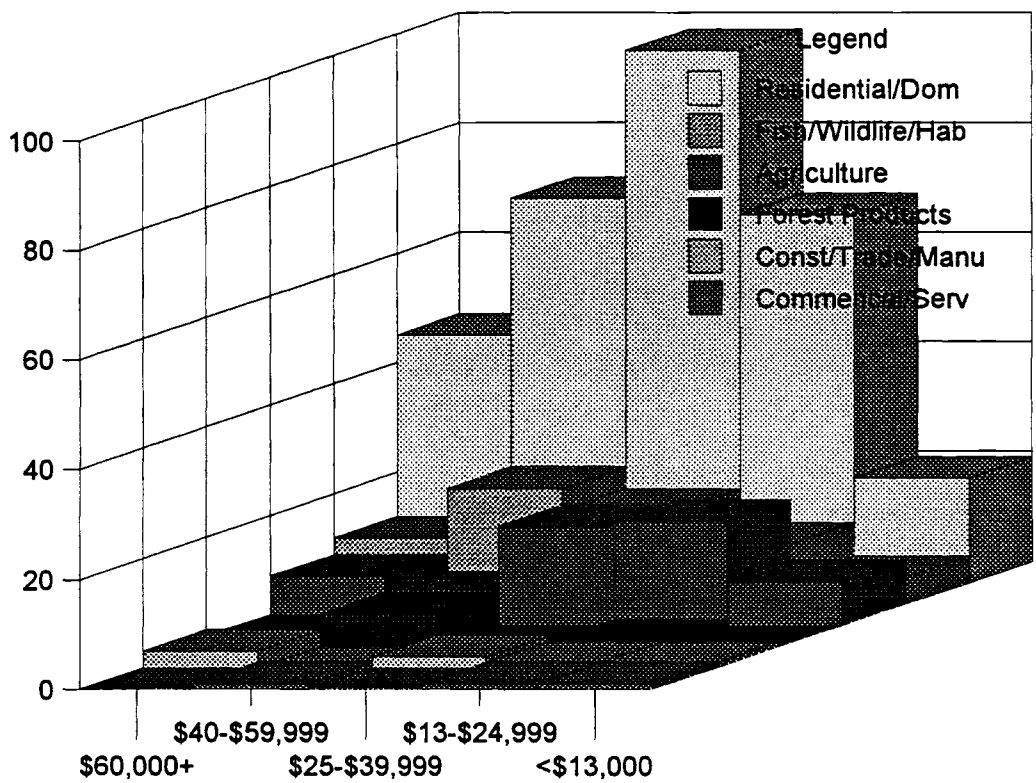

Figure 54. Survey Question #58--1st Priority For Use When Amounts Are Limited (Responses For Entire Sample By Income)

114. There is no significant relationship between age and in how the communities prioritize water use when facing shortages.

The Chi-Square analysis indicated a significant probability at a .000+ level of confidence that the hypothesis could be rejected. It should be noted that 58% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. As discussed earlier, in light of the obvious popularity of selected options, the data is worth considering. The following chart depicts the summary of responses:

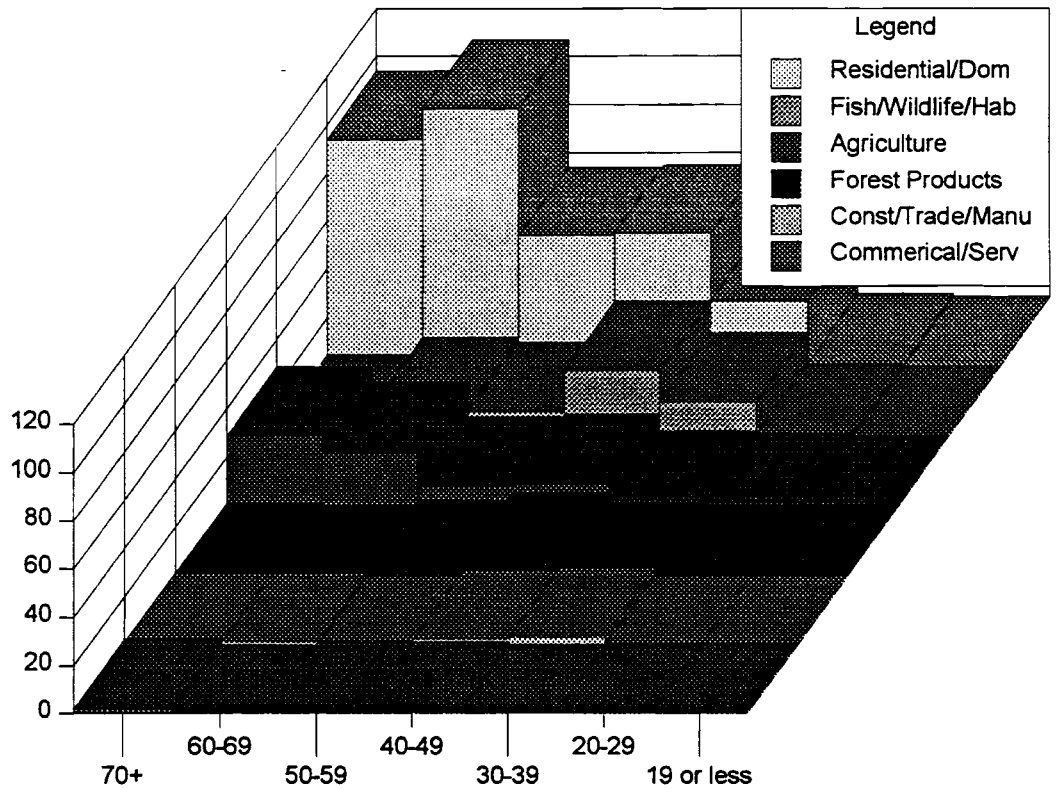

Figure 55. Survey Question #58--1st Priority For Use When Amounts Are Limited (Responses For Entire Sample By Age)

All of the next seven hypotheses (115-121) deal with the relationship between different sets of demographic data for the entire sample within the category of priority for economic sector growth when enough water exists (survey question #65). This question was preceded by a yes/no question asking: "Given enough water, do you feel that the community would benefit from increased growth in any of the... (six

land-use categories)". Only 296 respondents felt that growth would be beneficial; therefore, fewer responses are described. A Chi-Square analysis was run for each, based on the demographic variable in question. The following chart depicts a summary of the combined responses for the entire sample:

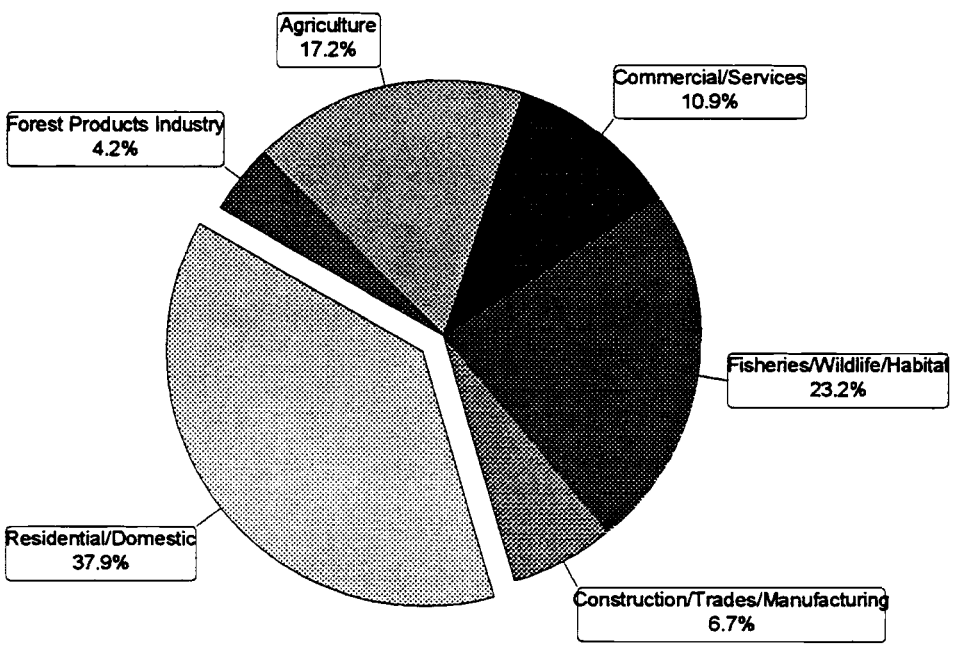

Figure 56. Survey Question #65--1st Priority For Growth When Water Is Available (Percentage Of Response For Entire Sample)

115. There is no significant relationship between length of residence in the region and opinion of priority for economic sector growth when enough water exists.

The Chi-Square analysis indicated a significant probability at a .041 level of confidence that the hypothesis could be rejected. It should be noted that 43% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. (Additionally, 44% of the data were missing. This latter problem is the result of this question being optional; to be answered only if the respondent felt growth would be beneficial if enough water was available.) One observation from the data is that residential/domestic growth was clearly favored by the 6-10, 11-20, and 21+ groups. Only the 2-5, and less than 2 year groups displaced it for first place. These shorter period residents chose fish/wildlife/ habitat as first. The following chart depicts the summary of responses:

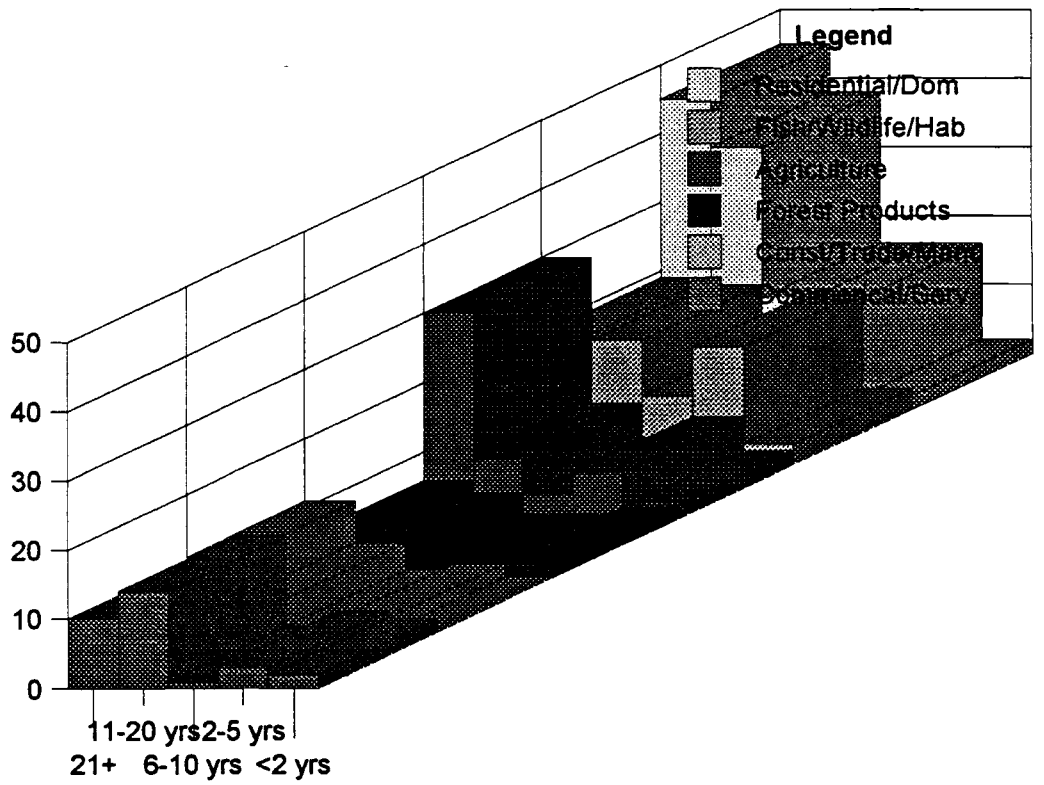

Figure 57. Survey Question #65--1st Priority For Growth When Water Is Available (Responses For Entire Sample By Length Of Residence In Region)

116. There is no significant relationship between use of land and opinion of priority for economic sector growth when enough water exists.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 75% of the cells for this test had expected counts of less than five. Chi-Square

may not be a valid test. While not statistically significant, the data once again indicate a preference for residential/domestic growth among those favoring further growth. The single exception was the respondent category listing their use of land as recreational.

117. There is no significant relationship between duration of annual residence and opinion of priority for economic sector growth when enough water exists.

The Chi-Square analysis did not permit the hypothesis to be rejected. It should be noted that 75% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

118. There is no significant relationship between occupation and opinion of priority for economic sector growth when enough water exists.

The Chi-Square analysis indicated a significant probability at a .001 level of confidence that the hypothesis could be rejected. It should be noted that 75% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test. The responses were interesting, however. Although most occupations gave overwhelming support for residential/domestic growth as the priority, ten responding forestry workers gave equal support to fish/wild/hab. Of nineteen non-military government workers responding, almost half gave fish/wild/hab first place. Agriculture (only 7 responses total) said agriculture was best growth area and fisheries industry workers (only 3 total) gave fish/wild/hab first place (2).

119. There is no significant relationship between education and opinion of priority for economic sector growth when enough water exists.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 40% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

120. There is no significant relationship between income and opinion of priority for economic sector growth when enough water exists.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 43% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

121. There is no significant relationship between age and opinion of priority for economic sector growth when enough water exists.

The Chi-Square analysis did not indicate a significant probability that the hypothesis could be rejected. It should be noted that 47% of the cells for this test had expected counts of less than five. Chi-Square may not be a valid test.

The third opinion question on the Water AOK Survey (question #18) asked respondents to indicate their agreement with a statement designed to gauge their perception of the importance of water on the future development of the area. Because it was deemed representative of several opinion questions generally dealing with water use and future availability, it was selected for analysis as part of this study. Those

remaining questions, numbers 42, and 44-48, will be summarized later in this chapter following the analysis of survey question #18.

This question asked respondents to indicate their agreement with the statement: "Individual use of water will influence the development of this area for generations into the future." A five-point Likert dimension was used. Pearson correlations were then run to determine whether a statistically significant relationship existed. The responses for the entire sample are illustrated in the following chart:

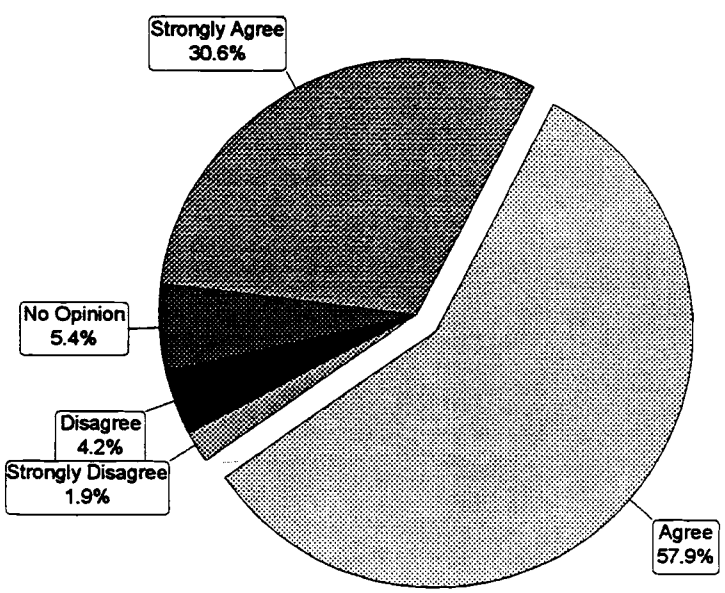

Figure 58. Survey Question #18--Individual Water Use Influences Future Development of Area (Percentage Of Response For Entire Sample)

We find general agreement with the statement.

The following graph depicts a comparison of survey question #18 responses for the Port Angeles Area and Sequim Area by percentage of responses for each category:

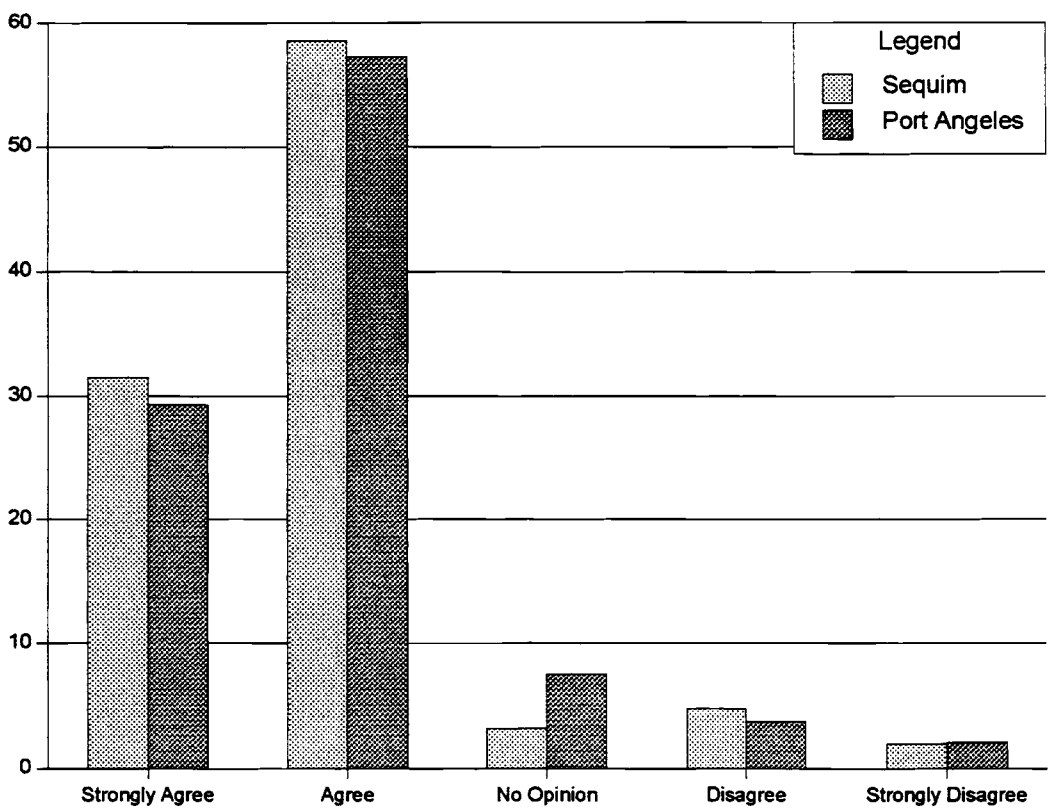

Figure 59. Survey Question #18--Individual Water Use Influences Future Development Of Area (Percentage Of Total Response By Major Study Area)

We find general agreement among the majority of respondents in both Major Study Areas. In the Sequim Area there is a slight shift away from the "no opinion" response toward agreement with the statement.

A Pearson Correlation was run to determine any associations with five different sets of demographic data in each of the two major study areas. Demographic questions for which respondents provided ordinal data in intervals were eligible for this test and were selected. The following ten hypotheses were tested:

122. In the PA Area, there is no significant relationship between length of residence and perception of influence of individual use of water on development in future.

    The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

123. In the SQ Area, there is no significant relationship between length of residence and perception of influence of individual use of water on development in future.

    The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

124. In the PA Area, there is no significant relationship between duration of annual local residence and perception of influence of individual use of water on development in future.

    The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

125. In the SQ Area, there is no significant relationship between duration of annual local residence and perception of influence of individual use of water on development in future.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

126. In the PA Area, there is no significant relationship between education and perception of influence of individual use of water on development in future.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

127. In the SQ Area, there is no significant relationship between education and perception of influence of individual use of water on development in future.

The Pearson Correlation indicated a significant probability at the .028 level of confidence that the hypothesis could be rejected. The correlation was in the direction of agreement with survey question #18 for respondents with greater education.

128. In the PA Area, there is no significant relationship between income and perception of influence of individual use of water on development in future.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

129. In the SQ Area, there is no significant relationship between income and perception of influence of individual use of water on development in future.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

130. In the PA Area, there is no significant relationship between age and perception of influence of individual use of water on development in future.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

131. In the SQ Area, there is no significant relationship between age and perception of influence of individual use of water on development in future.

The Pearson Correlation did not indicate a significant probability that the hypothesis could be rejected.

As described earlier, several other Water AOK Survey opinion questions generally sought information related to water use and future water availability (Chapter One, Research Question #V). Respondents were asked to indicate their agreement along the Likert dimension with the statements listed below (AOK Survey numbers 42 and 44-48). A brief account of related descriptive statistics follow each statement.

42. People in rural areas need to be concerned about the water resources, not city/town dwellers.

Approximately 83% of all respondents expressed disagreement with the statement and only 3.68% had no opinion. Differences between Major Study Areas included: almost 86% of PA residents expressed disagreement compared with slightly less than 81% of SQ residents (no opinions were about the same in each area). Mean scores were 4.05 and 3.93 respectively.

44. The amount of fresh water available is a major factor in determining how much business, how many homes, and what kind of agriculture an area can support.

    95.6% of all respondents expressed agreement with the statement and only 2.20% had no opinion. Differences between Major Study Areas included: 95.51% of PA residents expressed agreement compared with 95.67% of SQ residents (no opinions were also about the same in each area). Primary difference was in strength of agreement=stronger in SQ Area. Mean scores were 1.72 and 1.67 respectively.

45. Community decisions about water will influence the development of this area for generations into the future.

    95.98% of all respondents expressed agreement with the statement and only 2.21% had no opinion. Differences between Major Study Areas included: 94.69% of PA residents expressed agreement compared with 97.23% of SQ residents. No opinions were 3.27 and 1.19 respectively. Primary differences were much stronger agreement in SQ Area (SAgree=28.98/36.76 respectively) with less no opinion in SQ. Mean scores were 1.68 in both areas.

46. Few chemicals (fertilizers, fungicides, herbicides, pesticides) can enter groundwater, so they do not pose a health risk for humans.

    Approximately 93.5% of all respondents expressed disagreement with the statement and only 2.61% had no opinion. Differences between Major Study Areas included: 95.1% of PA residents expressed

disagreement compared with 92.12% of SQ residents. No opinions were 3.27 and 1.97 respectively Mean scores were 4.38 and 4.33 respectively.

47. Forests are very important contributors to the availability of clean water in the creeks and rivers.

93.57% of all respondents expressed agreement with the statement and 4.02% had no opinion. Differences between Major Study Areas included: 92.25% of PA residents expressed agreement compared with 94.86% of SQ residents. No opinions were 4.49 and 3.56 respectively. Primary differences were stronger agreement in SQ Area (SAgree=40.82/43.87 respectively) with less no opinion and disagreement in SQ. Mean scores were 1.71 and 1.63 in PA and SQ respectively.

48. Household water conservation measures don't have much effect on the availability of water.

88.33% of all respondents expressed disagreement with the statement and 2.82% had no opinion. Differences between Major Study Areas included: 86.83% of PA residents expressed disagreement compared with 89.76% of SQ residents. No opinions were 4.53 and 1.18 respectively. Primary differences were stronger disagreement in SQ Area (SDisagree=18.93/ 23.62 respectively) with much less no opinion (4.53 and 1.18 respectively) in SQ. Mean scores were 3.97 and 4.03 in PA and SQ respectively.

One other question--not yet addressed, attempted to learn how people understood access to Clallam County's riverine resources. It was included with the opinion questions because it sought information unrelated to the goals of the knowledge questions. This question asked respondents to indicate their agreement with the statement:

49. The rivers in Clallam County are open to the public and can be walked without trespassing.

> 50.20% of all respondents expressed disagreement with the statement while 24.29% expressed no opinion. Differences between Major Study Areas included: 47.72% of PA residents expressed disagreement compared with 52.61% of SQ residents. No opinions were 25.73 and 22.89 respectively. Primary differences were stronger disagreement in SQ Area (SDisagree=6.64/9.64 respectively) with less no opinion (25.73/22.89 respectively) and agreement (26.56/24.49 respectively) in SQ. Mean scores were 3.24 and 3.34 in PA and SQ respectively.

Finally, Research Question #6 (in Chapter One) was to be answered by a pair of survey questions which were developed with the goal of determining citizen opinion about the appropriate locus of responsibility for water management and policy planning. The research question was expressed as follows:

> Do citizens believe that future planning policy formulation and regulation would be better facilitated by an increased reliance on watershed boundaries rather than political boundaries?

The two specific survey questions were developed to attempt to answer this research question and appeared as Water AOK Survey questions numbers 20 & 43. To assess validity, they were split apart and written with one soliciting a positive answer and one a negative answer. Once again, responses were along a five-point Likert dimension. The questions and survey results follow:

20. Decisions about water resources would be better made by people living within the affected areas than by people from all over the county.

    Approximately 67% of all respondents expressed agreement with the statement and 4.86% had no opinion. Differences between Major Study Areas included: 65.14% of PA residents expressed agreement compared with 68.78% of SQ residents. No opinions were 5.39 and 4.35 respectively. Primary differences were stronger agreement in SQ Area (SAgree=26.14/28.46 respectively) with less no opinion and disagreement in SQ. Mean scores were 2.44 and 2.38 in PA and SQ respectively.

43. County government boundaries, not ecological boundaries (like river basins) are best for dealing with water issues.

    Approximately 72.19% of all respondents expressed disagreement with the statement and 17.79% had no opinion. Differences between Major Study Areas included: 71.43% of PA residents expressed disagreement compared with 72.91% of SQ residents. No opinions were 18.07 and 17.53 respectively. Mean scores were 3.82 in both PA and SQ.

CHAPTER V

SUMMARY AND CONCLUSIONS, RECOMMENDATIONS

Introduction

This research sought background information about methods, instruments, and questions useful for the development of the Clallam County Water Resources Survey (Water AOK Survey). As described in Chapter Four, the Water AOK Survey yielded a wealth of interesting information. The findings are expected to be useful for those responsible for the educational components of the watershed management plan and could be used to determine what educational program and public policy development actions might be expected to have positive impact on the behaviors of Clallam County citizens with regard to water resources. Based on computer-assisted analysis of the survey data, an attempt has been made to translate that data into a useful form; specifically, to identify who should be targeted for what kind of educational outreach programs.

The complex processing of so much inter-related data remained a challenge as statistically significant relationships valid at the .05 level of confidence (LOC) were sought. However, the nature of the project--because we are not involved in pure scientific research, but in a quasi-scientific approach to actual problems--requires us to observe other numerical relationships existing in the data between various categories

of respondents; to piece together all available information; to make inferences; and finally, to recommend the best possible solutions to those actual problems.

With regard to this quasi-scientific approach, it is recognized that such numerical differences which have not been validated through generally accepted statistical procedures could possibly be due to random chance. The author, therefore, approaches the use of such data with apprehension, but with good faith. The reader is similarly encouraged to give pause at the inferences drawn from the non-statistically validated data relationships; such discussions are so identified.

Summary And Conclusions

The data analyses began by exploring the relationship of the 15 question Water Knowledge Scale with the two attitude scales, the five question Watkins Water Concern Scale (WCS) and the 16 question Weigel & Weigel Environmental Concern Scale (ECS) within each major study area. This yielded the most outstanding statistically significant conclusions from the survey analysis:

> Across both major study areas, we find overwhelming, consistent, positive correlations between both the WCS and ECS and the Water Knowledge Scale. Knowledge and attitude are linked, and increased knowledge corresponds with higher scores on attitude tests. The probabilities that the null hypotheses for these tests were not false were never more than .0003. Those null hypotheses were rejected and alternative hypotheses, that significant relationships exist between mean

Water Knowledge Scale scores and mean scores for both the WCS and the ECS, were accepted.

Another very important factor in the research was a comparison of Water Knowledge Scale scores between the two major study areas, the Sequim area having received the benefit of some environmental education efforts in the earlier pre-survey stages of this study. Throughout the following description of findings, comparative differences between Water Knowledge Scale scores for each of the two major study areas will be highlighted in *italics*.

Although the difference between mean Water Knowledge Scale scores for all respondents in the Port Angeles and Sequim areas was not found to be statistically significant, *there was a numerical difference in the mean scores* (35.24--PA, 36.25--SQ). Additionally, as discrete groups, the *Sequim area respondents vastly outscored Port Angeles respondents on the number of Water Knowledge Scale questions answered correctly*. Furthermore, *for most demographic categories, Sequim respondents scored higher on knowledge questions*. Because levels of education between the two major study areas were very close (3.0082 with 1.1598 standard deviation for PA, 3.0877 with 1.1732 standard deviation for SQ), the data suggest that the educational outreach efforts in the Sequim area may have been successful.

At this point, let us return to the objectives of the study (from Chapter I, page 10). The questions which follow (roman numerals I-VII) had been identified as being relevant to the problems in Clallam County and provided the research basis. From these questions specific testable hypotheses statements were developed (the list of 131

null hypotheses can be found listed in Appendix C and in Chapter IV's Data Analysis section). These hypotheses drove the development of the questions asked on the Water AOK Survey questionnaire (see Appendix A [Appendix B--key]). Obtaining answers to the research questions was the primary specific objective of this study. The descriptive data which follows each research question will explain what was learned.

I. What are the community's general attitudes in relation to water? Identify current prevailing citizen attitudes about the use of water or activities and events that affect its future quality or quantity.

A. Use Watkins' Water Concerns Scale (AOK Survey questions #s 21-25--each answer indicating strong concern was scored 4 points, [non-strong] concern was scored 3 points, no opinion--2, 1 point was given if answer not indicating concern was not "strong." Possible 20 total).

Mean scores for the WCS were 13.23 for PA and 13.22 for SQ. This scale's strengths are its reproducibility (or reliability), and its utility to assist in making "reasonable generalizations" about comparative attitudes of concern for water resources. Watkins found that income and education (similar to other studies) were the greatest factors determining concern. Similar findings appeared in our study. Significant differences in mean score were found in both major study areas based on educational differences (hypotheses #s 53 & 56) and in the Sequim Area based on income (hypothesis # 62). The numerical

trends for these three tests also showed generally increasing scores with increasing education.

B. Use Weigel & Weigel's Environmental Concern Scale (AOK Survey questions #s 26-41--each answer indicating strong concern was scored 4 points, [non-strong] concern was scored 3 points, no opinion--2, 1 point was given if answer not indicating concern was not "strong." Possible 64 total).

Mean scores for ECS were 41.18 for PA and 41.75 for SQ. This scale's strengths are its reliability, validity and utility to "predict variation in overt behavior over an extended period of time" (Weigel & Weigel, p. 11). Even though SQ Area respondents scored higher than PA Area respondents, scores for both major study areas were lower than for randomly sampled New Englanders surveyed in the Weigels' study in the mid-1970s (44.2 mean score) and much lower than their control group consisting of Sierra Club members (54.5 mean score). Although the ECS can be used to predict likelihood of respondents engaging in environmentally beneficial activities, we did not find a statistically significant difference in scores and have insufficient data to make such a prediction.

II. What is the community's general level of knowledge about water? Identify what citizens know about non-point pollution, groundwater, and other water quality and quantity issues (AOK Survey questions #s 3-17--each correct answer was worth 4 points, 60 total).

As the following numerical data will show, *respondents in the Sequim Area had higher mean scores than those in the Port Angeles area on 11 of the 15 knowledge questions (73%). This is 270% better than the 4 questions PA residents scored higher on.* No significance was found within the non-point pollution (hypotheses #s 10, 11 & 12) or groundwater question responses (hypotheses #s 13, 14 & 15) that were part of the larger knowledge block.

A. Does the community have a good general understanding of water quality and quantity issues? (AOK Survey questions #s 3-17)

Mean scores for the Water Knowledge Scale were 35.24 for PA and 36.25 for SQ (60 possible); this was not a statistically significant difference. In addition to the non-point and groundwater series questions, the percentage of correct scores for the remaining questions in the Knowledge Scale were as follow:

5= *60.18 for PA and 69.29 for SQ.*

7= 30.40 for PA and 27.67 for SQ.

11= *86.42 for PA and 89.64 for SQ.*

12= *72.31 for PA and 73.62 for SQ.*

13= *93.44 for PA and 97.65 for SQ.*

14= *39.33 for PA and 40.89 for SQ.*

15= *39.57 for PA and 42.39 for SQ.*

B. (How well) Does the community understand "non-point pollution"? (AOK Survey questions #s 3, 10, & 17)

Mean scores for the non-point question series were 6.75 for PA and 7.00 for SQ (12 possible). Of particular concern was the answer to question # 10 on the difference between point and non-point pollution sources. Over 70% of all respondents did not answer correctly. Individual question percentage of correct scores were as follow:

3= *57.33 for PA and 60.32 for SQ.*

10= 27.85 for PA and 27.02 for SQ.

17= *89.96 for PA and 94.84 for SQ.*

C. (How well) Does the community understand "groundwater"? (AOK Survey questions #s 4, 6, 8, 9, & 16)

Mean scores for the groundwater question series were 12.15 for PA and 12.34 for SQ (20 possible). Of particular concern for the Clallam County study was the answer to question # 16 on groundwater's definition. Almost 40% of all respondents did not answer correctly (the author is also quite interested in question # 6 about North American groundwater removal rates which only slightly more than a quarter of the respondents answered correctly). Individual question percentage of correct scores were as follow:

4= 97.12 for PA and 92.37 for SQ.

6= *26.67 for PA and 27.71 for SQ.*

8= *52.48 for PA and 59.29 for SQ.*

9= *71.90 for PA and 79.05 for SQ.*

16= 60.83 for PA and 60.00 for SQ.

III. Do relationships between AOK factors and demographic variables exist? (Numbers in parentheses are AOK Survey question numbers, unless otherwise identified)

Several hypotheses were developed to see if statistically significant differences existed between Water Knowledge Scale, Water Concerns Scale, and Environmental Concerns Scale scores and demographic groups. With regard to the Weigel and Weigel Environmental Concerns Scale, as in the Water Knowledge Scale scores, we find that the Sequim Area scores higher in most comparisons across major study areas.

The Watkins Water Concern Scale scores did not show consistency through individual demographic group comparisons across major study areas, the final result contributed little or no insight. Also, no significant difference was found between minor study area Water Knowledge Scale scores within the two major study areas (hypotheses #s 8 & 9).

A. Is there a relationship between differences in length of residence in area and knowledge about water? (# 51)

When viewed by lengths of residence (hypotheses #s 28 & 31), we find that *the SQ Area scored numerically higher on the Water Knowledge Scale in all of the categories except the 11-20 year group, where the scores were very close.* It is noteworthy that the mean scores for the next (and longest residing) group--21 plus years, were also extremely close between major study areas. This means that it is in the mean scores for the newest arrivals, composing the other three groups

(less than 2, 2-5, and 6-10), where the greatest difference in mean scores among this demographic group is found between study areas (the 6-10 year group had the highest scores in both areas). *New arrivals in the Sequim Area scored consistently higher than new arrivals in the Port Angeles Area.* It is noteworthy that Port Angeles scores for new arrivals were particularly low, more closely matching the scores of the longest residents of both areas than the scores of the higher-scoring 6-10 year groups.

Because the data for these hypotheses did not meet the .05 LOC test for validity (denoting statistical significance), we cannot be certain that such coincidences are not due to chance. However, as mentioned earlier, the necessity of taking action based on the best available information requires an attempt to identify evidence of data patterns that can lead to inferences.

B. Is there a relationship between differences in length of residence in area and attitudes about water? (AOK Survey question # 51)

There was a general numerical trend showing scores on both the ECS and WCS to be higher in those more recently arrived in the region; ECS scores are considerably higher. A significant difference was found between the WCS scores of the 2 thru 5 and the 6 thru 10 year residents in the PA Area; significance was also found between the ECS scores of the <2 and 21+ year groups in the SQ Area (where the

6-10 year group scored next to lowest--41.41, above the longest residing group).

C. Is there a relationship between differences in use of land and knowledge about water? (AOK Survey question # 52)

When comparing Water Knowledge Scale scores between PA and SQ study areas by land use categories (hypotheses #s 34 & 37, respectively), we see numerical differences showing higher scores in the Sequim area. Business (18.67 PA/46.00 SQ), farm/ranch (35.11 PA/36.44 SQ), and year-round residence (35.43 PA/36.22 SQ) all scored higher in Sequim, the only land-use exception being recreational respondents (35.56 PA/33.00 SQ). High standard deviations and low numbers of respondents were found in both the categories of business (3 PA/4 SQ respondents), and recreation (9 PA/4 SQ respondents). Significance was found between the mean scores for business and year-round residents in PA.

D. Is there a relationship between differences in use of land and attitudes about water? (AOK Survey question # 52)

Again, low response was found for most categories in use of land comparisons (hypotheses #s 35, 36, 38 & 39). Both PA and Sequim Area respondents using land primarily as year-round residence were found to have considerably better ECS scores than those using land for farm/ranch purposes; the difference was significant in the SQ Area where business and recreational users also had mean scores which

were very close to those of farm/ranch respondents. The difference between mean ECS scores for year-round and business users was significant in the PA Area (where high standard deviations of business category respondents [14.58] indicate that some respondents had extremely low ECS scores); and farm/ranch, and recreational also scored well below year-round residents. WCS scores in both major study areas were lowest for business and farm/ranch respondents (business lowest in PA area, reversed in SQ Area).

The findings on attitude with relation to use of land for agricultural purposes are consistent with most research (Moore, 1988) and in contrast with both his suggestion of the possibility that attitudes may be changing, and those of Padgitt and Hoyer (1987) showing "little difference between farmers and non-farmers with respect to water quality beliefs and concerns."

E. Is there a relationship between differences in duration of annual local residence and knowledge about water? (AOK Survey question # 53)

Low response was found for most categories in durations of annual local residence comparisons (hypotheses #s 40 & 43), where--as in the land use group--the year-round residents/residences vastly outnumber other groups. *Significantly higher Water Knowledge Scale scores for the SQ Area were found compared with the two groups able to compare more than one response--20 thru 50% and 51 thru 75% of year in residence.*

F. Is there a relationship between differences in duration of annual local residence and attitudes about water? (AOK Survey question # 53)

A general trend was found for those respondents spending greater parts of the year in the region to score higher on the WCS than those there for shorter parts of the year. More of year in residence generally corresponds with higher scores on both the ECS and WCS. Significance was found in the SQ Area WCS mean scores between the 51 thru 75% of year residents and both the 10% and less and 20 thru 50% groups. Also in the SQ Area, ECS mean scores between the 76%+ and 26 thru 50% groups were significantly different.

G. Is there a relationship between differences in occupation and knowledge about water? (AOK Survey question # 54)

In looking at occupations (hypotheses #s 46 & 49), three groups--agriculture, fisheries, and government/military had very low respondent levels to compare (2 or less in one of the major areas). *A comparison of the other seven groups: commercial/service, construction/trades/ manufacturing, forestry, full-time homemaker, non-military government, retired, and "other"; shows that all but one had higher Water Knowledge Scale scores in the Sequim area.* The numerical differences ranged from slight to moderate as follows: the full-time homemaker group scored much lower in SQ (significantly lower than 3 other SQ Area occupations--commercial/service, other, and non-military government), with considerably different Water

Knowledge Scale scores between the two major study areas (33.71 PA/28.86 SQ). This spread was second in magnitude only to the "other" category (35.23 PA/43.2 SQ). The commercial/ service, construction/ trades/manufacturing, and non-military government, groups in the Port Angeles Area all had mean Water Knowledge Scale scores that were three or more points lower than their Sequim Area counterparts. Noteworthy findings in relation to needs for education among occupations (based on 2 or more responses) are further summarized below:

1. SQ Area agriculture--scored low on the Water Knowledge Scale (34.55 mean) with extremely high standard deviations (14.23). The only occupational group in SQ with lower knowledge scores was full-time homemakers.
2. SQ Area forestry--had the fourth lowest SQ Water Knowledge Scale scores (36.80 mean).
3. SQ Area full-time homemaker--had the most seriously low SQ Water Knowledge Scale scores (28.86 mean). Full-time homemaker knowledge scores were statistically significant compared with the following SQ occupations: commercial/service (39.79), other (43.20), and government non-military (44.00).
4. SQ Area retired--had the third lowest SQ Water Knowledge Scale scores (35.18 mean) with high standard deviation (10.39).

5. PA Area commercial/service--had low Water Knowledge Scale scores (35.53 mean), much lower than SQ (39.75 mean score) for this occupation.

6. PA Area construction/trades/manufacturing--had the third lowest PA Water Knowledge Scale scores (34.83 mean--also much lower than the SQ 37.88 mean score).

7. PA Area Forestry--had low Water Knowledge Scale scores (36.33 mean, with very high standard deviation of 12.92).

8. PA Area full-time homemaker--had second lowest PA Water Knowledge Scale scores (33.71 mean).

9. PA Area "other"--had low Water Knowledge Scale scores (35.23 mean).

10. PA Area retired--had the lowest PA Water Knowledge Scale scores (33.60 mean).

H. Is there a relationship between differences in occupation and attitudes about water? (AOK Survey question # 54)

Significant differences in PA Area mean ECS scores were found between forestry occupation respondents and the respondents in both non-military government and other categories. Next lowest PA Area numbers were found for const./trades/manu. and full-time homemaker groups.

In the SQ Area, significant differences were found between the agricultural occupations (lowest) and retired, const./trades/manu., and

"other" groups. Next lowest were the forestry occupations, then commercial/service and full-time homemaker respondents.

Noteworthy findings in relation to the attitude scales among occupations (based on 2 or more responses) are further summarized below:

1. SQ Area agriculture--SQ area agriculture occupation respondents scored very significantly lower on the ECS (32.91 mean) than all other occupations, their scores were significantly different in comparison with the following SQ occupations: retired (42.06), construction/trades/ manufacturing (44.71), and other (46.40).
2. SQ Area forestry--had the second lowest SQ Area ECS scores (38.00 mean).
3. SQ Area full-time homemaker--had the lowest SQ Area WCS scores (12.77 mean).
4. SQ Area retired--had the second lowest SQ Area WCS scores (12.99 mean).
5. PA Area commercial/service--had the third lowest PA Area WCS scores (12.76 mean).
6. PA Area construction/trades/manufacturing--had the second lowest PA Area scores for the WCS (12.71 mean); also, had the second lowest PA Area ECS scores (37.46 mean).

7. PA Area Forestry--had the lowest PA Area WCS scores (12.50 mean). Also, had extremely low(est) ECS scores (32.92 mean). These were statistically significant compared with PA Area occupational categories "other" (44.28 mean) and government non-military (45.11 mean).

8. PA Area full-time homemaker--had the third lowest ECS (39.29 mean).

9. PA Area "other"--n/a

10. PA Area retired--n/a

I. Is there a relationship between differences in level of education and knowledge about water? (AOK Survey question # 55)

As we looked at the correspondence between Water Knowledge Scale scores and levels of education in each of the major study areas (hypotheses #s 52 & 55), a direct, positive numerical relationship was found in every category within both study areas (more education=higher scores). Additionally, **the differences were statistically significant in most categories.** This established, we gain deeper insight from the discovery that a comparison of the Water Knowledge Scale scores between study areas indicates that, with only one exception, *every category measured higher in the Sequim Area* (the one exception was at the level of "high-school completed," with the PA mean score of 34.13 exceeding the SQ mean of 34.10 by a margin smaller than that separating any other category within these groupings).

J. Is there a relationship between differences in level of education and attitudes about water? (AOK Survey question # 55)

Generally, numerical patterns showed that as respondent's educational level increases, ECS and WCS scores increase. Additionally, for both scales, 3 PA Area categories showed significant differences; as did 4 SQ Area WCS categories. Also, Sequim area ECS scores were generally higher than PA Area scores.

K. Is there a relationship between differences in income and knowledge about water? (AOK Survey question # 56)

An examination of the data relating to income (hypotheses #s 58 & 61) generally shows relationships similar to those for education, as income goes up--Water Knowledge Scale scores go up. *Again, Sequim scored higher with one exception, incomes below $13,000 (also, one score was the same in both major areas).* In addition to finding significant relationships among some of the categories of respondents in the Sequim Area (.0123 LOC), a positive numerical relationship between increases in both income and Water Knowledge Scale scores through all categories in the Sequim Area was found and general evidence toward the same situation in the PA Area, although, in PA both the <$13,000 and $60,000+ category were out of sequence.

L. Is there a relationship between differences in income and attitudes about water? (AOK Survey question # 56)

Generally, as income increases, WCS scores increase (this was consistent with Watkins [1974] findings); this trend showed to be significant in the SQ Area; also, ECS scores tended to slightly decrease in both areas, PA Area ECS scores were slightly higher.

M. Is there a relationship between differences in age and knowledge about water? (AOK Survey question # 57)

Comparing age groups between the study areas (hypotheses #s 64 & 67), *we again find generally higher Water Knowledge Scale scores in the Sequim Area.* However, an interesting twist is found in the data. The correspondence between age and increasing scores is a negative relationship. In addition to finding significant relationships among some of the categories of respondents in both areas (.0001 SQ/.0075 PA LOC), there was also a consistent negative numerical relationship between increases in age and Water Knowledge Scale scores through all categories in the Sequim Area and all but the 60-69 age category in PA. Generally, as ages go up, the Water Knowledge Scale scores go down. Among categories with more than one respondent, the younger respondents have higher mean Water Knowledge Scale scores. The exception in PA had the smallest margin separating any of the other categories.

N. Is there a relationship between differences in age and attitudes about water? (AOK Survey question # 57)

While significant differences were found between the 50 thru 59 age group (low) and the 40 thru 49 and 60 thru 69 categories for PA Area WCS respondents, no clear trend emerges. In the SQ Area, we see a strong, statistically reinforced trend generally showing that as respondent ages increased, WCS scores decreased. ECS scores for both areas reveal only hints of similar trends.

O. Is there a relationship between differences in rural/urban residency and knowledge about water? (AOK Survey question # 42

Hypotheses #s 22 and 25 sought statistically significant differences in the Water Knowledge Scale scores for town and rural residents. The Port Angeles (PA) Area's responses (hypothesis # 22) indicated a significant difference at the .035 LOC with a difference of about 4.5 points in the mean score (35.68 rural/31.17 town), a substantial spread. Looking at the Water Knowledge Scale scores for the entire sample showed that PA Area rural respondents scored right near the mean for the whole group, while the town residents were a solid 2 points lower than the mean for the whole. Port Angeles rural residents know significantly more about water than town residents.

Sequim Area (SQ) Water Knowledge Scale scores (hypothesis # 25), while not showing a statistically significant difference in rural/town scores, nonetheless showed that numerical differences existed. Town residents in Sequim scored higher than their rural counterparts, with a mean of 39.5, compared to 36.14 for rural residents. Sequim rural

residents know less about water than town residents. *Both town and rural mean scores for SQ are higher than PA's highest mean score.* The difference is most prominent in town scores, with PA @ 31.17 and SQ @ 39.5. Sequim rural residents scored lower than town residents with the converse true in Port Angeles.

P. Is there a relationship between differences in rural/urban residency and attitudes about water? (AOK Survey question # 42)

The numerical differences in mean WCS scores for both major study areas show slightly higher water concerns for rural residents than for town residents, no other discernable trends were found.

IV. Do people in this area feel that they know enough about water issues in the community to participate in evaluating and planning water-related projects? (AOK Survey question # 19)

Mean scores for this opinion question on the five point Likert Scale were 3.00 for PA and 2.99 for SQ (3=no opinion). Only 34%of the people agree that they know enough about water issues to participate in evaluating and planning water-related projects (30% had no opinion). Pearson Correlations in the SQ Area, showed significant positive relationships between agreement and both higher educational levels and larger annual household income. No significant relationships were shown for the PA Area. Also, see V. Question #2 below.

V. What do residents consider to be the most important water-related concern/greatest water pollution problem? (AOK Survey questions #s 1 & 50)

What government measure is favored for local water quality problems? (AOK Survey question # 2)

These opinion questions were answered as follow:

1= public health & drinking water for both major study areas.

50= not sure, then septic systems were top two answers for both major study areas.

2= protection of water quality/pollution prevention for both major study areas.

An indicator of whether people felt that they know enough about water issues (see IV. above) was discovered in the responses to Water AOK Survey question number 2. The oldest population, in contrast with all other age groups, stressed education/public awareness mitigation measures for water quality problems over protection and prevention measures; they also have significantly lower knowledge scores than all other age groups. This awareness of lack of knowledge could account for the emphasis on education as the preferred measure.

VI. How do citizens view the importance and relationship of water-related activities and water availability for future growth of the region? (general purpose of AOK Survey questions #s 18, 44, 45, 46, 47, 48, 58, 64A, & 65)

These opinion questions were answered as follow:

18= 88.4% of respondents agreed that individual use of water will influence the development of this area for generations into the future (5.4% had no opinion). Additionally, Pearson Correlations for the SQ

Area showed a significant positive relationship between agreement and higher educational levels.

44= 96% of respondents agreed that the amount of fresh water available is a major factor in determining how much business, how many homes, and what kind of agriculture an area can support (2.1% had no opinion). Additionally, Pearson Correlations showed significant positive relationships as follow: for the SQ Area--between agreement and greater percentage of year in residence; for the PA Area--between agreement and both higher level of education and *smaller* annual household income.

45= 96% of respondents agreed that community decisions about water will influence the development of this area for generations into the future (2.1% had no opinion). and greater percentage of year in residence. Additionally, Pearson Correlations for the SQ Area showed a significant positive relationship between agreement and greater percentage of year in residence.

46= 94.5% of respondents didn't agree that few chemicals (fertilizers, fungicides, herbicides, pesticides) can enter groundwater, so they do not pose a health risk for humans (2.7% had no opinion). Additionally, Pearson Correlations for the SQ Area showed a significant positive relationship between disagreement and higher level of education.

47= 93% of respondents agreed that forests are very important contributors to the availability of clean water in the creeks and rivers (4.2% had no opinion). Additionally, Pearson Correlations for the PA Area showed a significant positive relationship between agreement and higher level of education.

48= 88% of respondents didn't agree that household water conservation measures don't have much effect on the availability of water (2.7% had no opinion).

58= About 68% of respondents in both areas indicated that, in the future, if faced with limited amounts of water, first priority for water is residential/ domestic use.

64A=Almost 70% of all respondents answered YES, that given enough water, the community would benefit from increased growth in one or more of six categories mentioned (74.88-PA/65.37-SQ).

65= 39% of respondents who thought that the community would benefit from increased growth identified residential/domestic as the highest benefit category. 22% favored fish/wildlife/habitat.

VII. Do citizens believe that future planning policy formulation and regulation would be better facilitated by an increased reliance on watershed boundaries rather than political boundaries? (AOK Survey question #s 20 & 43)

The issue of the appropriate locus of responsibility for water management and policy planning was an addition to the primary objectives of the study. The Snohomish County aquatic resources protection program quoted

in the Clallam County Watershed Ranking Project For The Management Of Nonpoint Source Pollution (Tetra Tech, Inc. 1988, p. 50) described encouragement for development that is compatible with existing aquatic systems and hydrological patterns. This appeared to represent a new paradigm for community development and the two questions on the Water AOK Survey were designed to ascertain public opinion about this idea.

67% of all respondents agreed that decisions about water resources would be better made by people living within the affected areas than by people from all over the county (# 20); 5% had no opinion. Additionally, Pearson Correlations showed significant positive relationships as follow: for the SQ Area--between agreement and higher level of education; for the PA Area--between disagreement and both higher level of education and larger annual household income.

72% of all respondents disagreed that county boundaries, not ecological boundaries (like river basins) are best for dealing with water issues (# 43); 18% had no opinion. Additionally, Pearson Correlations showed significant positive relationships as follow: for the SQ Area--between disagreement and both higher level of education and larger annual household income; for the PA Area--between disagreement and higher level of education.

The above findings will be useful for those making educational outreach strategy decisions in Clallam County. The complexity and importance of such decisions will require utilizing the information that has been gained.

Recommendations

As a means to link findings from the preceding Summary and Conclusions section (pg. 186) with recommendations, the outline provided by the study's objectives will again be used.

I. What are the community's general attitudes in relation to water? Identify current prevailing citizen attitudes about the use of water or activities and events that affect its future quality or quantity.

A. Use Watkins' Water Concerns Scale (AOK Survey #s 21-25).

To refresh the reader's memory, Watkins findings that education was the greatest factor determining concern also appeared in our study. Significant differences in mean score were found in both major study areas based on educational differences with numerical trends for these tests also showed generally increasing scores with increasing education. The WCS statements that follow are listed by AOK Survey statement number.

21. "We really haven't thought about cutting down our use of water." 42.2% of all respondents agreed (5.3% had no opinion). Clallam County public education programs need to stress the environmental, social, and economic benefits to be gained from water conservation.

22. "Water reclaimed from wastewater is as good as any other water." 45.9% of all respondents disagreed (17.7% had no

opinion). It appears as though the public has a bias toward water which has been through "nature's filters." Although this point is hard to argue, Clallam County education programs should include both cognitive and affective information about reclaimed water.

23. "Humans have a right to free and unlimited use of water." 9.7% of all respondents agreed (3.2% had no opinion). Considering the impacts of this viewpoint on ecosystem health, it is fortunate that this view is not more widely held. Nonetheless, the idea that one out of every seven and a half people do not reject this idea is somewhat troubling; especially if those individuals are in resource-intensive occupations. County education programs should clarify what the outcomes of this idea's popularization would be.

24. "Nature has a way to solve water supply problems before they get serious." Although only 4.4% of all respondents agreed, 3.4% had no opinion. This results in about one in thirteen people relatively unconcerned (or negatively concerned) with societal responses to scientific information to the contrary. Cognitive and affective education programs must address this situation.

25. "It's the people who should do something about the water problem." 4.5% of all respondents disagreed (3.7% had no

opinion). Optimally, the one in twelve who do not agree that they have responsibility in this matter, would become part of the team. Cognitive education outlining what can be done may be useful here.

B. Use Weigel & Weigel's Environmental Concern Scale (AOK Survey #s 26-41).

The ECS statements that follow had, in the author's opinion, special relevance for the Clallam County Water Quality Division. They are listed by AOK Survey statement number.

26. "The government will have to introduce harsh measures to halt pollution since few people will regulate themselves." 30.7% of all respondents disagreed (7.8% had no opinion). These results indicate a general willingness by respondents to accept harsh governmental measures to discourage and prevent pollution. Clallam County officials could use this information to clarify the public's position for those uncertain about directions for public policy development.

28. "I'd be willing to make personal sacrifices for the sake of slowing down pollution even though the immediate results may not seem significant." 5.5% of all respondents disagreed (10.5% had no opinion). These results indicate very strong willingness to personally support steps to decrease pollution. Clallam County officials may want to highlight these findings

in information campaigns and consider instituting ways for the public to put such attitudes into practice.

29. "Pollution is not personally affecting my life." 19.7% of all respondents agreed (6.3% had no opinion). Vastly more respondents feel that pollution is affecting their lives than not. Again, public policy developers should be cognizant of these realities.

30. "The benefits of modern consumer products are more important than the pollution that results from their production and use." An extremely small number of respondents agreed (4.3%; 7%--no opinion). With such strongly expressed views one might ask: could Clallam County become a world leader in finally settling the question of whether such products should be allowed to contaminate the extraordinary natural environment in the area? At the least, it would appear that Clallam County officials should have no uncertainty about dealing with the pollution resulting from the management or disposition of such products.

32. "Courses focusing on the conservation of natural resources should be taught in the public schools." 5.5% of all respondents disagreed (4.6% had no opinion). Again, any uncertainty by Clallam County school officials about what the will of the people is with regard to modifications to curricula

should be eliminated. Similarly, the idea of resource agency-developed programs tailored for public school students would appear to find strong endorsement. And, because of the established link between knowledge and attitude, partnerships should be explored between programs for public schools which capitalize on the human resources and expertise found in the region's natural resource agencies.

33. "Although there is continual contamination of our lakes, streams, and air, nature's purifying processes soon return them to normal." 4.8% of all respondents agreed (4.4% had no opinion). Respondents seem to have a basic understanding that the speed at which natural processes are able to deal with pollution isn't "soon." Educational programs among adults do not generally need to develop this concept, but can instead follow on from this point to provide more specific information about natural water cleansing rates and mechanisms. One troubling possibility looms, however: some occupational groups have greater impact on natural resources and it was found that it is often within such key groups that some of the lowest attitude/concern and knowledge scores are found. This may mean that well-targeted specific outreach efforts need to be carried out to provide both cognitive and affective information to such identified groups.

35. "The government should provide each citizen with a list of agencies and organizations to which citizens could report grievances concerning pollution." 15.1% of all respondents disagreed (16% had no opinion). Such an information list should be developed and distributed via both paper and electronic data distribution systems. If not already available, this list is a good candidate for an easy first product by county staff. If such information is already available, greater publicity and distribution are in order. The distribution and continual updating of this kind of information may be the basic mechanism to keep these issues of concern in the forefront of local citizens' attention and provide the vehicle to deepen their understanding of the natural systems which support the communities of the region.

39. "Industry is trying its best to develop effective anti-pollution technology." 29.9 % of all respondents agreed (16% had no opinion). Well over two-thirds of the people are not persuaded that industry's best effort is being put forth. Industries which feel themselves an exception to such perceptions may be good partners for information outreach programs and, if verified as good environmental citizens, could be held up as examples to those slower to understand the full impacts of environmentally-related behaviors.

41. "I would be willing to accept a one hundred dollar ($100.00) increase in my expenses next year to promote the wise use of natural resources." 33.3% of all respondents disagreed (22.1% had no opinion). This statement helps us to see that a greater willingness to accept real costs for such "promotion" exists than does a rejection of the principle of paying for environmental protection.

II. What is the community's general level of knowledge about water? Identify what citizens know about general water quality and quantity issues, non-point pollution, and groundwater. (AOK Survey #s 3-17)

A. Does the community have a good general understanding of water quality and quantity issues?

The two main findings, general numerically higher Water Knowledge Scale scores in the Sequim Area in contrast with the Port Angeles Area (with many such relationships showing statistical significance), and the statistically significant direct positive correlation of knowledge with attitude, clarify the need for more educational outreach in the Port Angeles Area; where the greatest number of county residents live. Specifically, water-related cognitive and affective educational programs are recommended to improve general understanding and attitude. Issues determined to be of particular importance to Clallam County should be identified. **Basic concepts**

which provide a foundation for particular information should then be formulated and promulgated along with such particulars.

B. Does the community understand "non-point pollution"? (AOK Survey #s 3, 10, & 17) See "C" below...

C. Does the community understand "groundwater"? (AOK Survey #s 4, 6, 8, 9, & 16)

Non-point pollution and groundwater scores in the Sequim Area indicate improvement. The fact that Sequim Area residents received water education programs appears to have been responsible for the positive responses. Using work conducted in the Sequim Area as a model, with modifications suggested from the data presented in this study, similar outreach in the PA Area should be implemented with an emphasis on infusing knowledge.

III. Do relationships between AOK factors and demographic variables exist?

A. Is there a relationship between differences in length of residence in area and knowledge about water? (AOK Survey # 51)

Higher scores among new arrivals indicate a need to specially emphasize cognitive programs with longer residents, however, this audience may be difficult to target in practice. Additionally, generally lower scores in the PA Area should focus extra effort there.

B. Is there a relationship between differences in length of residence in area and attitudes about water? (AOK Survey # 51)

Trends showing higher scores in newer arrivals (backed by some statistically significant relationships) indicate that citizens of longer residence seem to lag behind new arrivals in the region with regard to positive environmental attitudes. This creates the challenge of finding ways to bring affective educational outreach programs to those longer residents. We have found that increased knowledge of water correlates to better attitude scores (WCS/ECS) and therefore conclude that cognitive programs must be part of the remedy.

C. Is there a relationship between differences in use of land and knowledge about water? (AOK Survey # 52)

Even though Water Knowledge Scale scores for both major areas were not decidedly low (36.25 SQ/35.24 PA), the standard deviations indicate that some respondents would be very appropriate targets for cognitive educational outreach efforts. All categories, with the exception of recreational users, scored lower in the PA Area where outreach should be emphasized with special emphasis placed on business users who, despite few respondents, scored so consistently low as to seem deserving.

D. Is there a relationship between differences in use of land and attitudes about water? (AOK Survey # 52)

Low WCS and ECS scores for Sequim Area residents using land for farm/ranch indicates an obvious specific target group for affective educational outreach. Sequim Area recreational and business

users would also be appropriate audiences for such programs based on their similarly low scores. This is especially interesting with regard to business because this group scored high in the knowledge area. In the PA Area, all groups except year-round residents are candidates for affective information, especially business.

E. Is there a relationship between differences in duration of annual local residence and knowledge about water? (AOK Survey # 53)

Significantly lower Water Knowledge Scale scores for the SQ Area indicate that educational outreach should be focused on those spending less than 75% of the year in residence; due to the low number of responses in some respondent categories, conclusions are tenuous. Additionally, because of the nature of the question (are respondents not in the county for parts of the year?), those scoring lower have less potential negative impacts on the local environment resulting from their uninformed actions (they are not in Clallam County creating problems). Lower priority for action is recommended.

F. Is there a relationship between differences in duration of annual local residence and attitudes about water? (AOK Survey # 53)

Although respondents spending lesser percentages of the year in residence have correspondingly lower scores on the ECS and WCS than those with greater percentages of annual residence, clear conclusions cannot be drawn due to the low number of responses in

some respondent categories. Lower priority for action is recommended.

G. Is there a relationship between differences in occupation and knowledge about water? (AOK Survey # 54)

Because they are relatively easily identified groups, the occupations listed below should all receive specially targeted educational outreach. It is important to note that both agriculture and forestry occupations, although not large reporting population segments, have disproportionately large impacts on natural resources and the environment. Because of the high standard deviations found in these scores, which indicate very low scores among some in these groups, these groups are especially important. Recommendations for outreach to occupations with relation to both knowledge and attitude are combined in "H" below.

H. Is there a relationship between differences in occupation and attitudes about water? (AOK Survey # 54)

1. SQ area agriculture--scored lowest on the ECS and low on the Water Knowledge Scale. Both cognitive and affective educational outreach should occur.
2. SQ forestry--scored low on the Water Knowledge Scale and second lowest on the ECS. Both cognitive and affective educational outreach should occur.

3. SQ full-time homemaker--scored lowest on the WCS and on the Water Knowledge Scale. Both cognitive and affective educational outreach should occur.
4. SQ retired--scored low on the Water Knowledge Scale and on the WCS. Both cognitive and affective educational outreach should occur.
5. PA commercial/service--scored low on the Water Knowledge Scale and the WCS. Both cognitive and affective educational outreach should occur.
6. PA construction/trades/manufacturing--scored low on the Water Knowledge Scale, WCS, and ECS. Both cognitive and affective educational outreach should occur.
7. PA Forestry--scored lowest on the WCS and ECS and low on the Water Knowledge Scale. Both cognitive and affective educational outreach should occur.
8. PA full-time homemaker--scored low on the Water Knowledge Scale and on the ECS. Both cognitive and affective educational outreach should occur.
9. PA "other"--scored low on the Water Knowledge Scale scores, could possibly be targeted for cognitive educational outreach using the available write-in data.
10. PA retired--scored lowest on the Water Knowledge Scale; cognitive educational outreach should occur.

I. Is there a relationship between differences in level of education and knowledge about water? (AOK Survey # 55)

See "J" below.

J. Is there a relationship between differences in level of education and attitudes about water? (AOK Survey # 55)

Greater education was clearly the most significant factor related to higher Water Knowledge Scale scores *and* corresponding higher environmental attitude scores. Fewest years in school generally corresponds with lower Water Knowledge Scale scores, Water Concern Scale scores, and Environmental Concern Scale scores. The recommendation is for more water-related environmental education throughout all strata and categories of the community, particularly in Port Angeles; and especially, early in the formal schooling experience, at least by middle-school.

The work by Weigel and Weigel indicated that increased knowledge was linked with a greater propensity toward action. Such action in the case of Clallam County residents could begin with personal behavior changes in relation to their use of--and impacts on--water resources, and continue into greater involvement in community decision-making processes. Ascertaining how much difference in behavior was found between groups with significantly different scores would be a very desirable piece of follow-up research.

Promising new materials from National Project WET (Water Education for Teachers--see Project Wild Aquatics, 1987) may be a useful tool for those working in an outreach capacity with county residents and in schools. This new curriculum is a compliment to the Project Wild Aquatics Guide, published by the Western Regional Environmental Education Council. The popularity and efficacy of such materials help us to see that learning about environmental processes and ecosystem interactions is an excellent candidate for a central theme for life-long learning in a community context. Water's essential role in those processes and interactions, and appropriate human conservational behaviors, are possibly the KEY elements in such learning.

Because we have reasons to infer that the educational outreach efforts conducted in the Sequim Area may be the cause of the generally higher Water Knowledge Scale scores among those respondents, a secondary recommendation is to determine if levels of education between the major study areas are significantly different. If they are not, the inference of past educational outreach program efficacy are is further supported.

K. Is there a relationship between differences in income and knowledge about water? (AOK Survey # 56)

Because numerical patterns in both study areas generally show that as respondent's income levels increase mean Water Knowledge

Scale scores increase, cognitive programs for lower income residents are recommended; especially in the PA Area where mean scores were generally lower.

L. Is there a relationship between differences in income and attitudes about water? (AOK Survey # 56)

Observed relationships between increasing income and decreasing ECS scores indicate that affective educational programs and messages may be beneficial for wealthier segments of the population. Because WCS scores are lower among lower income people, cognitive and affective education about water topics should be provided for these audiences.

M. Is there a relationship between differences in age and knowledge about water? (AOK Survey # 57)

A clear pattern of lower Water Knowledge Scale scores among the older respondents indicate a need for cognitive programs. Again, lower scores (except in the large 70+ bracket) in the PA Area increase the need there.

N. Is there a relationship between differences in age and attitudes about water? (AOK Survey # 57)

Because ECS and WCS scores generally go down in both major study areas as age category goes up, both cognitive and affective educational programs should be especially designed and developed for

older adults. Such programs should be emphasized in Port Angeles where mean scores among older residents are generally lower.

O. Is there a relationship between differences in rural/urban residency and knowledge about water? (AOK Survey # 42)

Educational outreach efforts should be concentrated in the PA Area and especially on the vastly outscored urban residents (well below the mean). This may be the most easily identified demographic area to find the greatest improvement.

P. Is there a relationship between differences in rural/urban residency and attitudes about water? (AOK Survey # 42)

Slightly lower scores for town residents would support some affective programs there.

IV. Do people in this area feel that they know enough about water issues in the community to participate in evaluating and planning water-related projects? (AOK Survey # 19)

Although, this is a question of opinion, only a third of all respondents agreed that they do know enough. Clearly, everyone affects the availability and quality of water. The central role of water in our lives makes a lack of understanding in this area a matter for serious concern. For so few to understand this extremely important element seems to make a statement about the emphasis of education and information in our society. A change by schools and government toward clarification of water issues is recommended.

V. What do residents consider to be the most important water-related concern/greatest water pollution problem? (AOK Survey #s 1, & 50) What government measure is favored for local water quality problems? (AOK Survey # 2)

The responses to these opinion questions should be analyzed by county officials for agreement with the latest available data. Should discrepancies be found in the public's opinions when compared with known risks, educational efforts to correct the misconceptions should be implemented. The questions were most commonly answered as follow:

1= public health & drinking water for both major study areas

50= not sure, then septic systems were top two answers for both major study areas

2= protection of water quality/pollution prevention for both major study areas

Again, a contrasting emphasis, showing the oldest respondents favoring education programs, could be a kind of self-assessment; they also scored lowest on the Water Knowledge Scale. This is a very large group of respondents and, if corresponding with actual county demographic profiles, a very sizeable component of the community. Special cognitive programs could be designed and carried out to this easily-identified audience.

VI. How do citizens view the importance and relationship of water related activities and water availability for future growth of the region? (general purpose of AOK Survey #s 18, 44, 45, 46, 47, 48, 58, 64A, & 65)

A review of these opinion questions can be summarized as showing that most respondents show a general understanding of the importance of water to the future and awareness that good management will be required to protect its quality and availability. Nonetheless, in view of the other findings as part of this analysis, it appears that many respondents may need additional information to fully and accurately understand what those requirements are.

VII. Do citizens believe that future planning policy formulation and regulation would be better facilitated by an increased reliance on watershed boundaries rather than political boundaries? (AOK Survey #s 20 & 43)

Less than an average of 20% of respondents expressed an opinion tending to support the political boundary basis for decision making. It is recognized that these questions have not been through an experimental process to establish either validity or reliability. Nonetheless, on the basis of the numerical data it appears that previous efforts such as the establishment of watershed-based committees are widely supported by county residents. Further administrative restructuring within the county to accommodate the preferences identified by Water AOK Survey question numbers 20 and 43 may be explored along with additional opportunities for watershed-based decision-making.

Having identified measurable differences within major study areas between sub-groups such as: specific occupations, income groups, age groups, land use groups, etc.; further work could be done to test for significance between major study areas. This may be desirable to further clarify relationships which cannot now be determined to be statistically significant because of low response numbers (see analyses in Chapter Four).

To eliminate bias it is important to design surveys so that all categories of respondents are equally likely to respond. It would be good to know if the high preponderance of Water AOK Survey respondents over the age of 60 (>55%) is because this actually reflects the makeup of the population or whether this is because this group is more inclined to respond because of their interests (or their time availability). Also, almost all of the information resulting from this survey was obtained from mature adults; a far-sighted program with a vision for the future would necessarily need to concentrate appropriate efforts on youth and young adults.

Further research in the region would be desirable to follow-up on statistically significant differences in Environmental Concerns Scale responses with relation to propensity toward expected behavior.

Information about the results of this survey should be easily accessible to county residents. It is time for genuine public involvement in governmental policy and this information could have the positive effect of encouraging public participation in policy development and decision- making processes. Because of the large number of

older citizens in the area, governmental officials should present written materials in larger, easily-read type faces.

Community educational programs incorporate elements of public relations and formal and non-formal education. The selection of public information dissemination strategies and of curriculums for both formal and informal settings should take into account the educational needs of the target audiences and the wide variety of people in the river basin. Although it appears that the key to the public's attitudes and knowledge about water and other natural resources is the environmental knowledge possessed, this knowledge is not to be confused with formal education. While it may be true that fewer opportunities exist today in our society in the realms of non-formal and experiential learning, such learning can be even more informative than formal education because of the amount of data that all of the combined senses are able to bring to the learning process.

Finally, along with the development of printed materials, an excellent way to disseminate the information found in the study would be to produce a television program and/or provide videotaped information. Such a program could be produced at local community access stations where cable service is provided. Additionally, Washington State and other governments have produced general information videotapes.

Video has already been demonstrated to be very effective in conveying water-related educational concepts and information (Gustav, 1993; also, see Grigg, 1975 for an excellent discussion of both water specific and educational uses of videotaped instruction). Such a program could be run on community television and videotaped by

individuals and organizations for auxiliary distribution. Because of the association that this project has with the Puget Sound Water Quality Authority and the Washington State Department of Ecology, there is some possibility that officials in these agencies could be called on for help with such a project. The Department of Ecology is exploring greater utilization of cable-access broadcasting of public education and information programs, and arrangements have been made with production facilities that could be used to create such programs at very low costs.

For those who are concerned with the quality of the environment in this beautiful area of the United States, and elsewhere throughout the globe, hope remains that by increasing our knowledge of public understanding through obtaining and analyzing reliable public survey data, educational programs can be developed which will create greater awareness and knowledge about water and other natural resources. Helweg (1985) underscores the importance of this kind of information when he states, **"the only way planners can discover community perceptions that confirm or counter the claims of special interest groups is to obtain statistical data from a public survey."**

Burdge (1973--2nd entry) further supports this idea. He states, "The role of the academic sociologist is not well fitted to 'purposeful research.' This community, along with the resource agencies, must seek a more in-house role for the social scientist. We advocate a quasi-consultant research and extension role for in-house sociologists. Graduate training must be geared to such an employment alternative." He further states, "If attitude research is to continue, it must focus in the area of 'trade-offs,' such as answers to the question, Would you take less pollution if it

yielded less disposal income?" *(This excellent and pragmatic question should be pursued; it leads to yet another, more elusive question, of continuing interest to the author which could also be the focus of considerable investigation--is the psychological satisfaction gained by the use of disposable income [that beyond what is essentially necessary] a replacement for the frustrated satisfaction of purity not found in the natural world? ie--one goes to "nature" for renewal [campground, park, water body] and finds or senses [or fears!] pollution residues or ugly remnants of so-called "civilization," so one gives up on a relationship with this elusive "natural world" and instead spends disposable income on unessential consumer goods. ... But, that is another question for future research.)*

I believe that public knowledge about environmental matters shapes citizen attitudes and modifies their opinions about the care and use of natural resources--their behaviors change. When this change occurs, attitudes of concern are demonstrated through more appropriate decisions made in relation to the environment -- decisions about almost everything! Ultimately, as a result of this concern and knowledge among citizens and governing agencies, destructive behaviors will diminish and corrective actions will be taken.

The purpose of this study has been to provide information which will help policy makers do better planning and educators do better educating. I am certain that appropriately selected, well-focused, and competently conducted educational campaigns to increase the public's knowledge of water can be effective in modifying attitudes and opinions which work against the sustainable use of quality water resources. It is to this end that the assessment of Water AOK factors is aimed.

A SELECTED BIBLIOGRAPHY

Agresti, A., and Finlay, B. (1986). Statistical Methods for the Social Sciences. San Francisco: Dellen Publishing Co.

Andrews, W. H., and Madsen, G. E. (1973). Social Impacts and Methodological Perspectives from Post Audit Analysis of Water Resource Development. In, Andrews, et. al. (Eds.), The Social Well-Being And Quality Of Life Dimension In Water Resources Planning And Development. Logan: Utah State University.

Andrews, W. H., Madsen, G. E., & Hardin, C. W. (1979). Testing Social Indicators In The Techcom Model For Water Development. (1979) Logan: Utah State University.

Archbald, D. and Gundlach, P. (1970). Environmental Education: An Integrated Approach, Environmental Education, 1(3), 77-78.

Bohman, J. (1990). Telephone conversation.

Bohman, J. (1992). In-person interview.

Burdge, R. V. (1973). A Summary of Sociological Studies of Water Resources Dealing with Social Goals and the Quality of Life: "The Strawman" and Other Studies. In, Andrews, et. al. (Eds.), The Social Well-Being And Quality Of Life Dimension In Water Resources Planning And Development. Logan: Utah State University.

Burdge, R. V. (1973). Sociological Methodology and Preliminary Findings on the Relationship Between the Quality of Life Including Social Goals and Water Resource Management. In, Andrews, et. al. (Eds.), The Social Well-Being And Quality Of Life Dimension In Water Resources Planning And Development. Logan: Utah State University.

Clallam County Watershed Ranking Project For The Management Of Nonpoint Source Pollution (1988). Bellevue, WA: Tetra Tech, Inc.

Clusen, R. C. (1973). The Role of Social Scientists in the Determination of the Social Well-Being and Quality of Life Dimension in Water Resources. In, Andrews, et. al. (Eds.), The Social Well-Being And Quality Of Life Dimension In Water Resources Planning And Development. Logan: Utah State University.

(A) Conceptual Framework For Water Education: An Educator's Guide To Goals, Concepts And General Objectives For Curriculum Development (1981). Salt Lake City, UT: Water and Man, Inc.

Department of Ecology Grant Agreement (1989). Olympia, WA: Washington State Department of Ecology.

Doran, R. L. (1974). "State Of The Art" For Measurement And Evaluation Of Environmental Objectives, The Journal Of Environmental Education, *(*), 50-63.

Dunlap, R. E., and Van Liere, K. D. (1978). The 'New Environmental Paradigm'. Journal Of Environmental Education, 9, 10-19.

_____, (1984). Commitment to the Dominant Social Paradigm and Concern for Environmental Quality. Social Science Quarterly, 65, 1013-28.

Environmental Quality and Social Behavior (1973). Washington, D. C.: National Academy Of Sciences.

Erickson, D. L. (1971). Attitudes And Communications About Wildlife, The Journal Of Environmental Education, 2(4), 17-20.

Fitzsimmons, S. J. and Salama, O. (1973). The Relationship Between Social Psychological Systems and Water Resources Development: A Summary. In, Andrews, et. al. (Eds.), The Social Well-Being And Quality Of Life Dimension In Water Resources Planning And Development. Logan: Utah State University.

Frybarger, J. (1990). Decent Planning Should Be Goal. In, J. Manders (Ed.), The Sequim (WA) Gazette, 18(49), A6.

Grigg, N. S., Yevjevich, V., Indelicato, S., and Rossi, G. (1975). Advanced Water Resources Education Using Videotape Media. In, Water Resources Education. Champaign, IL: International Water Resources Association.

Gustav, R. S. (1993). Water Environment Education: How Do You Reach the MTV Generation? In, Operations Forum.

Hart, E. P. (1978). Examination Of BSCS Biology And Nonbiology Students' Ecology Comprehension, Environmental Information Level, And Environmental Attitude, Journal Of Research In Science Teaching, 15(1), 73-78.

Helweg, O. J. (1985). Water Resources: Planning and Management. (1985) New York, NY: John Wiley & Sons.

Hendee, J. C. (1972). Challenging The Folklore Of Environmental Education, The Journal Of Environmental Education, 3(3), 19-23.

Holter, J. (1990). Chamber Favors Park Proposal. In, J. Manders (Ed.), The Sequim (WA) Gazette, 18(49), A5.

Hounshell, P. B. and Liggett, L. (1973). Assessing The Effectiveness Of Environmental Education, The Journal Of Environmental Education, 5(2), 28-30.

Jenkins, L. J. (1993). Telephone conversation.

Johnson, P. T. (unknown). How I Learned To Harness Public Controversy To Make Better Decisions. Unpublished paper.

Johnson, S. (1974). Recent Sociological Contributions to Water Resources Management and Development. In, James, L. D. (Ed.), Man & Water. Lexington: The University Press of Kentucky.

Manty, D., Glasser, R., and Nehman, G. (1975). Public Water Resources Education and Participation In The United States of America. In, Water Resources Education. Champaign, IL: International Water Resources Association.

Maloney, M. P., Ward, M. P., and Braucht, G. N. (1975). Psychology in Action-A Revised Scale for the Measurement of Ecological Attitudes and Knowledge, American Psychologist, 30, 787-790.

Manders, J. (Ed.) (1990). SARC Budget Allows For Loss Of Levy And Timber Funding. The Sequim (WA) Gazette, 18(49), A10.

_____, (1990). DNR Starting Education Program On Changes In Log Exports. The Sequim (WA) Gazette, 18(49), A18.

Mills, T. J. (1990). Personal conversation.

Mills, T. J. (1983). Water Resource Knowledge Assessment Of College Bound High-School Students. In, Proceedings of the Oklahoma Academy of Science (1983). Stillwater, OK: Oklahoma Academy of Science.

Moore, K. M. (1988). Farmer And Non-Farmer Attitudes Toward Environmental Policy Issues: An Exploratory Survey. (1988) Stillwater: University Center for Water Research.

Mowen, J. C. (1987). Consumer Behavior (1987). New York: MacMillan Publishing Company.

Mowen, J. C. (1988). Consumer Evaluations of Decision Makers When Process Conflicts with Outcome for Decisions Made Under Uncertainty. (1988) Stillwater, OK: University Center for Water Research.

Ogden, D. M. (1970). Politics Of Water Resources Development. In, Social & Ecological Aspects Of Irrigation & Drainage. New York, NY: American Society Of Civil Engineers.

Padgitt, S., and Hoyer, B. (1987). Agriculture and Groundwater Quality: Farmers Versus Non-farmers in a New Environmental Battleground. Paper presented at the Annual Meeting of the Rural Sociological Society. Madison, Wisconsin. August 1987.

Perkins, L. M. (1990). Personal conversation.

Project Wild--Aquatic (1987). Boulder, CO: Western Regional Environmental Education Council.

Roth, R. E. (1970). Fundamental Concept For Environmental Management Education (K-16), Environmental Education, 1(3), 55-74.

Sequim Bay Watershed Management Plan (1989). Port Angeles, WA: Clallam County Department of Community Development.

The Timber Fish Wildlife Agreement (undated pamphlet). author/publisher unknown

Tukey, J. W. (1957). Quick And Dirty Methods In Statistics--Simple Analyses For Standard Designs, Proceedings 5th Annual Conference of the American Society of Quality Control, 189-?.

Webster's II New Riverside University Dictionary (1988). Boston, MA: Houghton Mifflin Company.

Watkins, G. A. (1974). Developing A "Water Concern" Scale, The Journal Of Environmental Education, 5(4), 54-58.

Weigel, R. and Weigel, J. (1978). Environmental Concern-The Development of a Measure, Environment and Behavior, 10(1), 3-15.

White, G. F. (1969). Strategies of American Water Management. (1969) Ann Arbor: The University of Michigan Press.

APPENDIXES

Appendix A

CLALLAM COUNTY WATER RESOURCE SURVEY

For each of the following questions please circle only one best answer for any question. (circle the number in front of the answer)

1. What is your most important water-related concern? (circle one answer)

   1 loss of fish & wildlife habitat
   2 risks due to potential growth/increased use
   3 urban household wastes creating pollution
   4 public health & drinking water concerns
   5 groundwater contamination issues

2. What action would you most like to see implemented by your government agencies regarding water quality problems in this zone of the county? (circle one answer)

   1 correction/cleanup
   2 education/public awareness
   3 enhancement projects
   4 increased fees/taxes
   5 protection/prevention
   6 other: (write in)_____

3. Non-point water pollution: (circle one answer)

   1 is a big problem
   2 results from many human activities
   3 doesn't come from identifiable sources
   4 could be substantially decreased with proper actions
   5 all of the above

4. The upper surface of underground water is called: (circle one answer)

   1 sea level
   2 ozone layer
   3 stratified zone
   4 water table
   5 none of the above

5. For water resources, the term "best management practice" usually refers to...

1 a consultant in management
2 managing against non-point pollution with least cost
3 managing to meet minimum sanitation code requirements
4 the cheapest management approach
5 none of the above

6. North Americans are removing fresh water from underground sources: (circle one answer)

1 half as fast as it is being replaced
2 at about the same rate as it is being replaced
3 twice as fast as it is being replaced
4 four times as fast as it is being replaced
5 not sure

7. Approximately what percentage of the U.S. population is adjacent to estuaries and coastal waters? (circle one answer)

1 10%
2 30%
3 60%
4 90%
5 not sure

8. Natural chemical and biological recycling processes can renew water resources; the type that generally take the longest to be renewed is: (circle one answer)

1 ground water
2 lake
3 river
4 ocean
5 not sure

9. The process by which soluble materials in the soil are washed into a lower layer of soil or are dissolved and carried away is called: (circle one answer)

1 absorption
2 dispersion
3 inversion
4 leaching
5 not sure

10. Which are usually considered point source pollution? (circle one answer)

1 agricultural chemical runoff from fields
2 wastes from a sewage plant
3 sediments from stream banks
4 wildlife wastes from forest
5 all of above

11. A watershed is best described as . . . (circle one answer)

1 a small building used for housing pumping equipment
2 an agricultural area used to drain off excess water
3 the place where aquatic recreational/fishing gear is kept
4 divisions or parcels of standing timber or forest
5 an area where all the falling precipitation drains to a common outlet

12. In addition to timber, forests produce: (circle one answer)

1 clean water
2 wildlife
3 clean air
4 fish
5 all of the above

13. When household wastewater in homes outside the city goes down the drain, it usually... (circle one answer)

1 goes to the waste treatment plant through sewer lines
2 goes to on-site septic systems (such as: septic tank and drainfield, evapotranspiration tank)
3 returns directly to source either by stream or pipe
4 goes directly to the Strait of Juan de Fuca
5 goes into a lagoon for purification

14. When fertilizers or manures 'enrich' the water of a stream, lake, or other resource: (circle one answer)

1 we call this, "pollution"
2 it provides nutrients for water plants
3 there is less oxygen for fish
4 microscopic aerobes help clean the water
5 all of the above

15. Generally, the best single indicator of water quality is its: (circle one answer)

    1 color
    2 depth
    3 clarity
    4 dissolved oxygen content
    5 odor

16. Groundwater is best described as: (circle one answer)

    1 water found in small ponds or natural pools
    2 water in underground streams
    3 any water found on the surface of the ground
    4 water flowing from natural springs
    5 water found underground in porous rock/gravel & soils

17. Non-point water pollution can result from poor management of: (circle one answer)

    1 cars and machines
    2 land clearing operations
    3 farming or landscaping with chemicals
    4 human or animal wastes
    5 all of the above

Questions 18 through 49 are general questions related to water and other natural resources and ask your opinion by requesting a strongly agree to strongly disagree answer. (circle one answer)

1-STRONG A (strongly agree)
2-AGREE
3-NO OPINION
4-DISAGREE
5-STRONG D (strongly disagree)

18. Individual use of water will influence the development of this area for generations into the future.
    1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

19. I know enough about water issues to participate in the evaluation and planning of proposed projects.
    1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

20. Decisions about water resources would be better made by people living within the affected areas than by people from all over the county.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

21. We really haven't thought about cutting down our use of water.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

22. Water reclaimed from wastewater is as good as any other water.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

23. Humans have a right to free and unlimited use of water.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

24. Nature has a way to solve water supply problems before they get serious.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

25. It's the people who should do something about the water problem.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

26. The government will have to introduce harsh measures to halt pollution since few people will regulate themselves.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

27. We should not worry about killing too many game animals because in the long run things will balance out.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

28. I'd be willing to make personal sacrifices for the sake of slowing down pollution even though the immediate results may not seem significant.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

29. Pollution is <u>not</u> personally affecting my life.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

30. The benefits of modern consumer products are more important than the pollution that results from their production and use.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

31. We must prevent any type of animal from becoming extinct, even if it means sacrificing some things for ourselves.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

32. Courses focusing on the conservation of natural resources should be taught in the public schools.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

33. Although there is continual contamination of our lakes, streams, and air nature's purifying processes soon return them to normal.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

34. Because the government has such good inspection and control agencies, its very unlikely that pollution due to energy production will become excessive.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

35. The government should provide each citizen with a list of agencies and organizations to which citizens could report grievances concerning pollution.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

36. Predators such as hawks, crows, skunks, and coyotes which prey on farmer's grain crops and poultry should be eliminated.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

37. The currently active anti-pollution organizations are really more interested in disrupting society, than they are in fighting pollution.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

38. Even if public transportation was more efficient than it is, I would prefer to drive my car to work.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

39. Industry is trying its best to develop effective anti-pollution technology.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

40. If asked, I would contribute time, money, or both to an organization like the Sierra Club that works to improve the quality of the environment.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

41. I would be willing to accept a one hundred dollar ($100.00) increase in my expenses next year to promote the wise use of natural resources.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

42. People in rural areas need to be concerned about the water resources, not city/town dwellers.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

43. County government boundaries, not ecological boundaries (like river basins) are best for dealing with water issues.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

44. The amount of fresh water available is a major factor in determining how much business, how many homes, and what kind of agriculture an area can support.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

45. Community decisions about water will influence the development of this area for generations into the future.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

46. Few chemicals (fertilizers, fungicides, herbicides, pesticides) can enter groundwater, so they do not pose a health risk for humans.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

47. Forests are very important contributors to the availability of clean water in the creeks and rivers.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

48. Household water conservation measures don't have much effect on the availability of water.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

49. The rivers in Clallam County are open to the public and can be walked without trespassing.
1-STRONG A 2-AGREE 3-NO OPINION 4-DISAGREE 5-STRONG D

50. The single greatest water pollution problem in the area where you live is...

1 sediment
2 animal wastes
3 sewage
4 road runoff
5 chemicals
6 septic systems
7 not sure

51. How many years have you continuously lived in the Port Angeles, Dungeness Sequim region? (circle one answer)

1 less than 2
2 2 through 5
3 6 through 10
4 11 through 20
5 21 or more

52. Which one of the following answers best describes your primary use of land at the address questionnaire was received? (circle one answer)

1 personal year-round residence
2 personal vacation home
3 farm or ranch
4 business establishment
5 recreational (no home or business)
6 investment (no home or business)
7 other: (write in)_____

53. On average what percentage of your year is spent in local residence? (circle one answer)

1 10% or less
2 11% through 25%
3 26% through 50%
4 51% through 75%
5 76% or more

54. Occupation? (circle one answer)

1 agriculture
2 fisheries
3 forestry
4 construction/trades/manufacturing
5 commercial/service
6 government, military
7 government, non-military
8 retired
9 full-time homemaker
10 other: write in)_____

55. Grade completed in school? (circle one answer)

1 less than 12th
2 12th
3 2 or more years of college
4 4 year college degree
5 post-graduate degree

56. Approximate annual household income? (circle one answer)

1 less than $13,000
2 $13,000 through $24,999
3 $25,000 through $39,999
4 $40,000 through $59,999
5 $60,000 or more

57. Age? (circle one answer)

1 younger than 30
2 30-39
3 40-49
4 50-59
5 60-69
6 70 plus

Please select one of the following numbered categories to answer each of the next six questions (58-63). Use a category only one time.

1- agriculture--includes farming/livestock/crop production, pond aquaculture, nurseries, Christmas Tree farms

2- commercial/service--business, government, real estate, tourism/hospitality industry, campgrounds, RV parks, marinas

3- construction/trades/manufacturing

4- fisheries, wildlife, habitat

5- forest products industry--includes logging, tree farms, mills

6- residential/domestic-homes (not construction) and gardens

In the future, if we are faced with limited amounts of water, who should get it?

For each question circle a different number.

58. First priority for water is... 1 2 3 4 5 6

59. Second priority for water is... 1 2 3 4 5 6

60. Third Priority for water is... 1 2 3 4 5 6

61. Fourth priority for water is... 1 2 3 4 5 6

62. Fifth priority for water is... 1 2 3 4 5 6

63. Sixth priority for water is... 1 2 3 4 5 6

64. Given enough water, do you think the community would benefit from increased growth in any of the six above categories?
(circle yes or no) YES NO

65. If you circled YES in question 64, please identify the number (1-6) for no more than you three highest benefit categories and briefly explain why growth may be best in these categories.

A. Category #_____ why? . . . . . .
. . . . . .

B. Category #_____ Why? . . . . . .
. . . . . .

C. Category #_____ Why? . . . . . .
. . . . . .

Appendix B

SURVEY QUESTIONNAIRE KEY

QUESTION NUMBER -- QUESTION TYPE/CORRECT OR POSITIVE RESPONSE

1 -- OPINION
2 -- OPINION
3 -- K/5
4 -- K/4
5 -- K/2
6 -- K/3
7 -- K/3
8 -- K/1
9 -- K/4
10 -- K/2
11 -- K/5
12 -- K/5
13 -- K/2
14 -- K/5
15 -- K/4
16 -- K/5
17 -- K/5
18 -- OPINION
19 -- OPINION
20 -- OPINION

QUESTIONS #21-25, WATER CONCERN SCALE -- The most positive response to each question, either Strongly Agree (SA) or Strongly Disagree (SD), is listed below next to its number. These questions should be given a rating of 0-4 each, depending on the Likert scale answer, which may either be stated as agreement or disagreement with the statement. The maximum available score is 20. The strongly positive answer (either strongly agree or strongly disagree) gets 4, the positive (either agree or disagree) gets 3. The no opinion response gets 2; and the negative response (again, either agree or disagree) gets 1. Zero (0) is given for a strong negative response.

21 -- A/5 (SD)
22 -- A/1 (SA)
23 -- A/5 (SD)
24 -- A/5 (SD)
25 -- A/1 (SA)

QUESTIONS #26-41, ENVIRONMENTAL CONCERNS SCALE -- These questions should also be given a rating of 0-4 each, depending on the Likert scale answer. The total available is 64 for all most-positive responses to the scale. The most positive response to each question, either Strongly Agree (SA) or Strongly Disagree (SD), is listed below next to its number.

26 -- A/1 (SA)
27 -- A/5 (SD)
28 -- A/1
29 -- A/5
30 -- A/5
31 -- A/1
32 -- A/1
33 -- A/5
34 -- A/5
35 -- A/1
36 -- A/5
37 -- A/5
38 -- A/5
39 -- A/5
40 -- A/1
41 -- A/1

42 -- OPINION
43 -- OPINION
44 -- OPINION
45 -- OPINION
46 -- OPINION
47 -- OPINION
48 -- OPINION
49 -- OPINION
50 -- OPINION
51 -- 57, DEMOGRAPHIC
58 -- 65, OPINION

Appendix C

NULL HYPOTHESES

1. There is no significant relationship between mean water knowledge scores and mean scores on the Watkins Water Concern Scale (WCS) within the Port Angeles Area.
2. There is no significant relationship between mean water knowledge scores and mean scores on the Weigel and Weigel Environmental Concerns Scale (ECS) within the Port Angeles Area.
3. There is no significant relationship between mean WCS scores and mean ECS scores within the Port Angeles Area.
4. There is no significant relationship between mean water knowledge scores and mean scores on the WCS within the Sequim Area.
5. There is no significant relationship between mean water knowledge scores and mean scores on the ECS within the Sequim Area.
6. There is no significant relationship between mean WCS scores and mean ECS scores within the Sequim Area.
7. There is no significant difference between mean water knowledge scores for the Port Angeles and Sequim Areas.
8. There is no significant difference between mean water knowledge scores within the seven minor study areas of the Port Angeles Area.
9. There is no significant difference between mean water knowledge scores within the nine minor study areas of the Sequim Area.
10. There is no significant difference between mean scores for non-point pollution questions within the Port Angeles and Sequim Areas.
11. There is no significant difference between mean scores for non-point pollution questions within the seven minor study areas of the Port Angeles Area.
12. There is no significant difference between mean scores for non-point pollution questions within the nine minor study areas of the Sequim Area.
13. There is no significant difference between mean scores for groundwater questions within the Port Angeles and Sequim Areas.
14. There is no significant difference between mean scores for groundwater questions within the seven minor study areas of the Port Angeles Area.
15. There is no significant difference between mean scores for groundwater questions within the nine minor study areas of the Sequim Area.
16. There is no significant difference between mean scores on the WCS for the Port Angeles and Sequim Areas.
17. There is no significant difference between mean scores on the WCS within the seven minor study areas of the Port Angeles Area.

18. There is no significant difference between mean scores on the WCS within the nine minor study areas of the Sequim Area.
19. There is no significant difference between mean scores on the ECS for the Port Angeles and Sequim Areas.
20. There is no significant difference between mean scores on the ECS within the seven minor study areas of the Port Angeles Area.
21. There is no significant difference between mean scores on the ECS within the nine minor study areas of the Sequim Area.
22. There is no significant difference between town and rural residence in the Port Angeles Area and mean water knowledge scores.
23. There is no significant difference between town and rural residence in the Port Angeles Area and mean scores on the WCS.
24. There is no significant difference between town and rural residence in the Port Angeles Area and mean scores on the ECS.
25. There is no significant difference between town and rural residence in the Sequim Area and mean water knowledge scores.
26. There is no significant difference between town and rural residence in the Sequim Area and mean scores on the WCS.
27. There is no significant difference between town and rural residence in the Sequim Area and mean scores on the ECS.
28. There is no significant difference between lengths of residence in the Port Angeles Area and mean water knowledge scores.
29. There is no significant difference between lengths of residence in the Port Angeles Area and the mean scores on the WCS.
30. There is no significant difference between lengths of residence in the Port Angeles Area and the mean scores on the ECS.
31. There is no significant difference between lengths of residence in the Sequim Area and mean water knowledge scores.
32. There is no significant difference between lengths of residence in the Sequim Area and the mean scores on the WCS.
33. There is no significant difference between lengths of residence in the Sequim Area and the mean scores on the ECS.
34. There is no significant difference between the uses of land in the Port Angeles Area and mean water knowledge scores.
35. There is no significant difference between the uses of land in the Port Angeles Area and the mean scores on the WCS.
36. There is no significant difference between the uses of land in the Port Angeles Area and the mean scores on the ECS.
37. There is no significant difference between the uses of land in the Sequim Area and mean water knowledge scores.
38. There is no significant difference between the uses of land in the Sequim Area and the mean scores on the WCS.
39. There is no significant difference between the uses of land in the Sequim Area and the mean scores on the ECS.

40. There is no significant difference between the durations of annual local residence in the Port Angeles Area and mean water knowledge scores.
41. There is no significant difference between the durations of annual local residence in the Port Angeles Area and the mean scores on the WCS.
42. There is no significant difference between the durations of annual local residence in the Port Angeles Area and the mean scores on the ECS.
43. There is no significant difference between the durations of annual local residence in the Sequim Area and mean water knowledge scores.
44. There is no significant difference between the durations of annual local residence in the Sequim Area and the mean scores on the WCS.
45. There is no significant difference between the durations of annual local residence in the Sequim Area and the mean scores on the ECS.
46. There is no significant difference between occupations in the Port Angeles Area and mean water knowledge scores.
47. There is no significant difference between occupations in the Port Angeles Area and the mean scores on the WCS.
48. There is no significant difference between occupations in the Port Angeles Area and the mean scores on the ECS.
49. There is no significant difference between occupations in the Sequim Area and mean water knowledge scores.
50. There is no significant difference between occupations in the Sequim Area and the mean scores on the WCS.
51. There is no significant difference between occupations in the Sequim Area and the mean scores on the ECS.
52. There is no significant difference between the levels of education in the Port Angeles Area and mean water knowledge scores.
53. There is no significant difference between the levels of education in the Port Angeles Area and the mean scores on the WCS.
54. There is no significant difference between the levels of education in the Port Angeles Area and the mean scores on the ECS.
55. There is no significant difference between the levels of education in the Sequim Area and mean water knowledge scores.
56. There is no significant difference between the levels of education in the Sequim Area and the mean scores on the WCS.
57. There is no significant difference between the levels of education in the Sequim Area and the mean scores on the ECS.
58. There is no significant difference between incomes in the Port Angeles Area and mean water knowledge scores.
59. There is no significant difference between incomes in the Port Angeles Area and the mean scores on the WCS.
60. There is no significant difference between incomes in the Port Angeles Area and the mean scores on the ECS.
61. There is no significant difference between incomes in the Sequim Area and mean water knowledge scores.

62. There is no significant difference between incomes in the Sequim Area and the mean scores on the WCS.
63. There is no significant difference between incomes in the Sequim Area and the mean scores on the ECS.
64. There is no significant difference between ages in the Port Angeles Area and mean water knowledge scores.
65. There is no significant difference between ages in the Port Angeles Area and the mean scores on the WCS.
66. There is no significant difference between ages in the Port Angeles Area and the mean scores on the ECS.
67. There is no significant difference between ages in the Sequim Area and mean water knowledge scores.
68. There is no significant difference between ages in the Sequim Area and the mean scores on the WCS.
69. There is no significant difference between ages in the Sequim Area and the mean scores on the ECS.
70. There is no significant relationship between length of residence in the region and greatest water-related concern (question #1).
71. There is no significant relationship between use of land and greatest water-related concern (question #1).
72. There is no significant relationship between duration of annual local residence and greatest water-related concern (question #1).
73. There is no significant relationship between occupation and greatest water-related concern (question #1).
74. There is no significant relationship between education and greatest water-related concern (question #1).
75. There is no significant relationship between income and greatest water-related concern (question #1).
76. There is no significant relationship between age and greatest water-related concern (question #1).
77. There is no significant relationship between length of residence in the region and favored actions to mitigate problems (question #2).
78. There is no significant relationship between use of land and favored actions to mitigate problems (question #2).
79. There is no significant relationship between duration of annual local residence and favored actions to mitigate problems (question #2).
80. There is no significant relationship between occupation and favored actions to mitigate problems (question #2).
81. There is no significant relationship between education and favored actions to mitigate problems (question #2).
82. There is no significant relationship between income and favored actions to mitigate problems (question #2).
83. There is no significant relationship between age and favored actions to mitigate problems (question #2).

84. Within the entire sample, there is no significant relationship between length of residence in the region and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
85. Within the Port Angeles Area (PA Area), there is no significant relationship between length of residence in the region and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
86. Within the Sequim Area (SQ Area), there is no significant relationship between length of residence in the region and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
87. Within the entire sample, there is no significant relationship between use of land and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
88. Within the entire sample, there is no significant relationship between duration of annual local residence and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
89. Within the PA Area, there is no significant relationship between duration of annual local residence and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
90. Within the SQ Area sample, there is no significant relationship between duration of annual local residence and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
91. Within the entire sample, there is no significant relationship between occupation and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
92. Within the entire area, there is no significant relationship between education and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
93. Within the PA Area, there is no significant relationship between education and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
94. Within the SQ Area, there is no significant relationship between education and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
95. Within the entire area, there is no significant relationship between income and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19)
96. Within the PA Area, there is no significant relationship between income and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
97. Within the SQ Area, there is no significant relationship between income and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).

98. Within the entire area, there is no significant relationship between age and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
99. Within the PA Area, there is no significant relationship between age and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
100. Within the SQ Area, there is no significant relationship between age and perception of adequate preparation to participate in evaluating and planning water-related projects (question #19).
101. There is no significant relationship between length of residence in the region and what is considered the greatest water pollution problem in respondent's area (question # 50).
102. There is no significant relationship between use of land and what is considered the greatest water pollution problem in respondent's area (question # 50).
103. There is no significant relationship between duration of annual local residence and what is considered the greatest water pollution problem in respondent's area (question # 50).
104. There is no significant relationship between occupation and what is considered the greatest water pollution problem in respondent's area (question # 50).
105. There is no significant relationship between education and what is considered the greatest water pollution problem in respondent's area (question # 50).
106. There is no significant relationship between income and what is considered the greatest water pollution problem in respondent's area (question # 50).
107. There is no significant relationship between age and what is considered the greatest water pollution problem in respondent's area (question # 50).
108. There is no significant relationship between length of residence in the region and in how the communities prioritize water use when facing shortages (question #58).
109. There is no significant relationship between use of land and in how the communities prioritize water use when facing shortages (question #58).
110. There is no significant relationship between duration of annual residence and in how the communities prioritize water use when facing shortages (question #58).
111. There is no significant relationship between occupation and in how the communities prioritize water use when facing shortages (question #58).
112. There is no significant relationship between education and in how the communities prioritize water use when facing shortages (question #58).
113. There is no significant relationship between income and in how the communities prioritize water use when facing shortages (question #58).
114. There is no significant relationship between age and in how the communities prioritize water use when facing shortages (question #58).
115. There is no significant relationship between length of residence in the region and opinion of priority for economic sector growth when enough water exists (question #65).

116. There is no significant relationship between use of land and opinion of priority for economic sector growth when enough water exists (question #65).
117. There is no significant relationship between duration of annual residence and opinion of priority for economic sector growth when enough water exists (question #65).
118. There is no significant relationship between occupation and opinion of priority for economic sector growth when enough water exists (question #65).
119. There is no significant relationship between education and opinion of priority for economic sector growth when enough water exists (question #65).
120. There is no significant relationship between income and opinion of priority for economic sector growth when enough water exists (question #65).
121. There is no significant relationship between age and opinion of priority for economic sector growth when enough water exists (question #65).
122. In the PA Area, there is no significant relationship between length of residence and perception of influence of individual use of water on development in future (question #18).
123. In the SQ Area, there is no significant relationship between length of residence and perception of influence of individual use of water on development in future (question #18).
124. In the PA Area, there is no significant relationship between duration of annual local residence and perception of influence of individual use of water on development in future (question #18).
125. In the SQ Area, there is no significant relationship between duration of annual local residence and perception of influence of individual use of water on development in future (question #18).
126. In the PA Area, there is no significant relationship between education and perception of influence of individual use of water on development in future (question #18).
127. In the SQ Area, there is no significant relationship between education and perception of influence of individual use of water on development in future (question #18).
128. In the PA Area, there is no significant relationship between income and perception of influence of individual use of water on development in future (question #18).
129. In the SQ Area, there is no significant relationship between income and perception of influence of individual use of water on development in future (question #18).
130. In the PA Area, there is no significant relationship between age and perception of influence of individual use of water on development in future (question #18).
131. In the SQ Area, there is no significant relationship between age and perception of influence of individual use of water on development in future (question #18).

Appendix D

A CONCEPTUAL FRAMEWORK FOR WATER EDUCATION: AN EDUCATOR'S GUIDE TO GOALS, CONCEPTS AND GENERAL OBJECTIVES FOR CURRICULUM DEVELOPMENT

I. IT IS ESSENTIAL THAT STUDENTS UNDERSTAND HOW WATER INFLUENCES THE PHYSICAL ENVIRONMENT

1. It is important to understand the fundamental physical and chemical properties of water.
2. It is important to understand the nature and functions of the hydrologic cycle.
3. It is important to understand how water influences the physical characteristics of the earth.
4. It is important to understand the sources of water.
5. It is important to understand how water is distributed.

II. IT IS ESSENTIAL THAT STUDENTS UNDERSTAND HOW WATER IS NECESSARY TO LIVING THINGS

1. Water is necessary for the life processes of all living things.
2. It is important to understand how water influences living things.

III. IT IS ESSENTIAL THAT STUDENTS UNDERSTAND HOW WATER IS NECESSARY TO HUMAN ACTIVITY

1. It is important to understand the historical influence of water on civilizations.
2. It is important to understand the uses of water in contemporary societies, industrial and non-industrial.
3. It is important to understand the nature and practice of water management.
4. It is important to understand that there are many water-related issues and choices.
5. It is important to understand the relationship of water and the American economy.
6. There are many consequences, both positive and negative, of any water management activity.
7. There are values and practices that will maintain or extend the quality and quantity of the earth's water resources.

Appendix E

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 03-24-94 **IRB#:** ED-94-076

Proposal Title: INVESTIGATION OF PUBLIC ATTITUDES, OPINION, AND KNOWLEDGE ABOUT WATER RESOURCES

Principal Investigator(s): Ted Mills, Douglas Palenshus

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): NONE

APPROVAL STATUS SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

IF THIS APPLICATION HAD BEEN SUBMITTED IN A TIMELY FASHION, IT WOULD HAVE BEEN APPROVED AS EXEMPT.

Signature: _____ Date: March 24, 1994

Chair of Institutional Review Board

VITA

Douglas Palenshus

Candidate for the Degree of

Master of Science

Thesis: WATER KNOWLEDGE AND ATTITUDE ASSESSMENT OF THE CITIZENS OF CLALLAM COUNTY, WASHINGTON STATE

Major Field: Environmental Science

Biographical:

Personal Data: Born in Detroit, Michigan on September 22, 1944, the son of Herbert Walter and Melva Ida (Stacey) Palenshus.

Education: Clarenceville High School, Livonia, Michigan, 1961; Riverside Military Academy, Gainesville, Georgia, 1962 (P.G. Certificate); El Camino College, Redondo Beach, California, 1969 (A.A.); Heritage College, Toppenish, Washington, 1984 (coursework); The Evergreen State College, Olympia, Washington, 1986 (B.A.); completed the requirements for the Master of Science degree in Environmental Science in July 1995.

Environmental and Science Experience:

Education/Outreach Specialist for WASHINGTON STATE DEPARTMENT OF ECOLOGY, Nuclear Waste Program-Hanford Project. Analyze technical information; develop, implement community outreach plan; coordinate/facilitate public and tribal involvement; develop informational materials; serve/d on four agency-wide teams: Diversity, Environmental Equity, Education, and Values.

OSU Instructor for upper-division elementary science methods courses and multi-cultural high-school environmental science academy; presented computerized interactive Water Resource Management Simulations at workshops, conferences, fairs, and hydrogeology training programs.

PROJECT WILD/AQUATICS and PROJECT LEARNING TREE trainer for educator workshops.

Camp Conservation/Outdoor Educator. Organized back-country excursions and field programs for all ages at a year-round residential camp in the maritime-northwest Cascade Mountains.

Field Trip Supervisor/Counselor for community YMCA.

Administrative/Organizational Experience:

Board of Directors, Environmental Education Association of Washington (Diversity Committee Chair, Outreach/Marketing Committee Co-Chair); Environmental Information Network (Tri-Cities).

Coordinator of OSU CENTER FOR ENVIRONMENTAL EDUCATION. Coordinated application and acceptance as the first center in the National Network for E.E. Served on Attorney General's Oklahoma Environmental Network. Created outreach programs for events such as: national environmental video-teleconference, and as State Coordinator for Earth Day 1990's 20th Anniversary.

Washington State Governor's Intern and Procedures Development Coordinator for Productivity Improvement Project; guided program efforts to implement computerized manuals, led technical writing.

Coordinator of TESC's ENVIRONMENTAL RESOURCE CENTER. Organized, publicized, and produced events, coordinated volunteers, initiated fundraising program, and managed increased budgets. Projects included: greenline planning conference, campus recycling, nuclear waste symposium, film series, annual Earth Fair.

Grantwriter and Community Development Projects Manager. Designed, developed funding proposals, supervised construction of alternative energy, water conservation and sanitation projects at a large residential camp in the foothills of the Cascade Mountains.

Small Businessman. THE ENERGY COMPANY; manufactured wood-fired, water-heating energy equipment.

Communications/Technology Skills:

Market Research Asst - NATIONAL UNIVERSITY TELECONFERENCE NETWORK (satellite video-teleconferencing).

Production Assistant at OSU's nationally recognized educational television station.

Presenter - "E.E. on T.V." and Water Resource Management Simulator at national conferences and workshops.

Computer desktop publishing, multi-media development, and audio/video field and post-production skills.