The Application of Social Judgment Analysis to Urban Fisheries Management

by

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(ABSTRACT)

Social judgment analysis was used to define design criteria for urban fisheries in small ponds and natural waterfronts. The analysis involved (1) compiling a team of expert judges, (2) creating a series of hypothetical cases for ponds and waterfronts, (3) having the experts judge the quality of the cases, and (4) creating multiple regression equations that described their individual and combined judgments.

Fifty-nine urban fisheries managers were identified from a survey of public fisheries agencies and private organizations. Twenty-eight experts were selected based on amount and types of experience and geographic distribution. Content analysis of the urban fisheries literature was used to identify potentially important design elements. Sixteen experts each judged the quality of 40 small pond and 40 waterfront fisheries based on (1) percentage of the management program devoted to education, (2) percentage of the program planned locally, (3) percentage of the program funded locally, (4) accessibility of the fishery, (5) percentage of the shoreline available for fishing, (6) stocking rate, (7) overall water quality, and (8) shoreline distance between fish attraction structures.

Urban pond fisheries experts identified two general management approaches to urban pond fisheries. Group 1 managers indicated a focused policy based primarily on stocking, shoreline available for fishing, and accessibility of the fishery. Group 2 managers indicated a broader policy less directed at any particular element, but with emphasis on stocking, water quality, education, and available shoreline. Both groups indicated that local planning, local funding, and attraction structures were relatively unimportant in their decisions concerning fishery quality. Waterfront

experts favored an even broader management policy with a greater distribution of relative importance across all the elements. However, the relatively small number of waterfront experts included in the policy development and the broad approach indicates the variability of waterfronts. This variability made the development of management generalizations for urban waterfront fisheries difficult.

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Introduction

Sport fishing continues to increase in popularity in the United States. According to a 1985 Gallup Poll of leisure activities, fishing is the second most popular outdoor recreation activity among adults (SFI 1987). Preliminary results of the 1985 Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Fish and Wildlife Service 1987) indicate a 15 percent increase in fishing effort and a nine percent increase in number of anglers from 1980 to 1985. More than one-fourth of all adults aged 16 and older fished in 1985 (U.S. Fish and Wildlife Service 1987).

Recreational fishing has long been considered a rural activity (Duttweiler 1975; Radonski 1984). In 1980, 55 percent of U.S. anglers lived in rural areas (U.S. Fish and Wildlife Service 1982) and participation rates continue to be highest among rural residents (U.S. Fish and Wildlife Service 1987). By 1985, however, a demographic shift in angler residence had occurred. In 1985, 60 percent of anglers lived in urban areas (U.S. Fish and Wildlife Service 1987).

There are many reasons to expect fishing activity to be increasing in urban settings. Most urban residents live in the nearly 1000 cities with populations greater than 25,000 that are also located on large waterfronts (i.e. rivers, lakes, bays, or ocean; Heritage Conservation Service undated). More than one-half of the contiguous United States population lives within 50 miles of the ocean coast

(Wren 1980). In addition, there are over 3,700 urban lakes in the United States offering fishing sites (Leedy et al. 1981). With so many people, waters, and increasing popularity, the potential demand for urban fishing is unquestionably great (Martin 1986).

Many of the early efforts to introduce urban residents to fishing were done away from urban areas. The U.S. Bureau of Sport Fisheries (U.S. Fish and Wildlife Service) initiated fishing programs as day camps in Oklahoma City, Oklahoma; Newark, New Jersey; Boston, Massachusetts; Portland, Oregon; and Atlanta, Georgia (Duttweiler 1975). These programs transported children to fishing sites outside the cities. In another example, Los Angeles, California, offered ocean fishing excursions to children on fishing barges off the coast (Duttweiler 1975).

More recently, urban fishing has concentrated on city-based activities. In 1970 the Bureau of Sport Fisheries began a city park fishing program in St. Louis, Missouri, and a similar effort in Washington, DC (Duttweiler 1975). The Pennsylvania Fish Commission operated its "Center City Cane Pole Fishing Program" across the state (Stroud 1973). In 1976 the state of New York developed a comprehensive statewide urban fisheries plan (McBride 1978). Four target urban areas were identified in which to implement the plan by 1978 (New York Bureau of Fisheries undated). The plan called for the development of prototype programs that could be carried on through cooperative efforts of local governments and private organizations, while the state contributed technical expertise (Bureau of Sport Fisheries undated). This kind of cooperative venture has been encouraged for state and local governments (Duttweiler 1975; Breen 1984; Leonard 1984).

A wide range of fishing experiences can be found within urban areas. Arcata, California offers wild trout and salmon fishing (Allen 1984). Put-and-take carp and catfish fishing are available in Tuscon, Arizona, and St. Louis, Missouri (Edwards 1984; Haas 1984). The Potomac River in Washington, DC, provides opportunities for bass anglers (James Cummins, DC Environmental Control Division/Fisheries, pers. comm.). Shoreline and pier fishing in marine waters are also proving popular in Seattle, Washington (Buckley 1982); Tampa, Florida (Seaman et al. 1984); and

New York City (Heatwole and West 1985). Many of these special programs are developed within the overall urban recreation programming (Duttweiler 1975; Leonard 1984). New York City and Detroit, Michigan, established children's fishing derbies as part of their recreation activities. New Jersey developed youth fishing derbies and San Diego, California, and Oklahoma City, Oklahoma, began annual fishing events (Duttweiler 1975).

Urban Fisheries Management

As urban populations increase, the necessity for managing urban waters also increases. City planners know the value of water-related recreation, waterfront development, and renovation. Fishing is an accepted and welcome recreation activity in rural areas and cities (Duttweiler 1975; Leonard 1984; Martin 1986). Providing fishing activities and opportunities not only supply social benefits as recreation but may also stimulate local economic growth (Breen 1984; Martin 1986). Planners realize that water quality must be good if water-related projects are to succeed (Kendig, 1984). Improving water quality offers opportunities to implement fisheries management programs. Because of the recreational and economic benefits of fishing, planners and city officials are likely to include urban fisheries in their plans (Leedy et al. 1981).

Several cities employ fisheries managers. Washington, DC; Cleveland, Ohio; Oklahoma City, Oklahoma; and Arcata, California, are examples of cities managing their aquatic resources. Some states provide technical assistance in the form of urban fisheries coordinators or extension specialists. Twenty states reported that they had distinct urban fisheries programs (Underhill 1984). Most states, however, provide expertise through district and regional managers.

Though potential angling demand may be high in urban areas, sport fishing is poorly developed as an urban recreational resource (Duttweiler 1975; Radonski 1984). Water pollution, limited mobility of residents, limited access, and lack of information presumably restrict angling participation in cities (Scott 1973; Leedy et al. 1981; Radonski 1984). Urban fisheries management is substantially different from traditional fisheries management (Jeffries 1984). Although the principles are the same, the relative importance of various elements changes. The needs to stock fish, protect water quality, provide access, teach fishing skills, and assure angler safety are more critical in densely populated urban areas (Radonski 1984). Factors other than catch are often cited by urban and non-urban anglers when describing overall angling quality (Carl 1982; Ditton and Fedler 1984). These may include site facilities, natural beauty, and water quality (Carl 1982).

Species preference was an important difference among Missouri anglers (Alcorn 1981). Urban anglers in St. Louis had definite preferences for certain species. The majority (41%) preferred channel catfish (*Ictalurus punctatus*) and/or bullheads (*Ictalurus* spp.). Twenty-six percent preferred common carp (*Cyprinus carpio*), ten percent preferred largemouth bass (*Micropterus salmoides*) and five percent preferred bluegill (*Lepomis macrochirus*) (Alcorn 1981). A statewide survey of Missouri anglers, in contrast, reported that the five most popular species, in order of preference, were largemouth bass, rainbow trout (*Salmo gairdneri*), walleye (*Stizostedian vitreum*), smallmouth bass (*Micropterus dolomieui*), and channel catfish (Weithman and Anderson 1978). It was also indicated that the St. Louis urban fishery is primarily a food fishery (Alcorn 1981).

These differences and the relative newness of urban fisheries management compound the problem of obtaining analytic information about them. Much of traditional fisheries management is applicable to urban fisheries, but management strategies should take into account these differences. Many urban fisheries have developed on a trial and error basis, without the aid of observational or experimental research. For practical reasons, the time, money, and control over the fisheries will probably never exist for developing an objective scientific basis for urban fisheries management.

The knowledge base for urban fisheries management, therefore, is the accumulated wisdom of experienced urban fisheries managers. In order to help assure future success and to improve the exchange of information, this implicit, site-specific experience must be converted into an explicit form that can be used at new locations by novice urban fisheries managers. Descriptive information is shared among professionals at workshops and symposia, but it is usually not in the form of concise statements that can guide management. Before urban fisheries management can progress, an effective means of capturing the experience of veteran managers is essential.

Social Judgment Analysis

Understanding the human judgment process is difficult (Hammond et al. 1975). Individuals make decisions implicitly. This unexpressed portion of decision-making is a source of ambiguity because it is difficult to communicate to others. If this difficulty occurs among those responsible for program operation and policy formulation, disputes may hamper the processes, resulting in less efficient and effective decision-making (Hammond et al. 1975; Rohrbaugh 1979).

A variety of techniques have been employed to eliminate ambiguity in policy formulation. These have been particularly useful in studying decision-making and policy disputes (Adelman and Brown 1979). The Delphi technique has been used extensively in policy formulation (Zuboy 1981; Crance 1987a; Crance 1987b), but has been criticized for lack of validation and questionable accuracy (Rohrbaugh 1979). Several social judgment analysis methods have been employed in a variety of problem areas (Anderson et al. 1981; Hyman et al. 1984). Social judgment analysis was chosen for this project based on previous performances, critical reviews (Hammond et al. 1975; Rohrbaugh and Wehr 1978; Adelman and Brown 1979), and availability of computer software.

Social judgment analysis is a quantitative method for describing group judgments. It has its basis in social judgment theory, which suggests that the integration of information to form a judgment includes: (1) placing a degree of importance (weight) on each piece of information (element); (2) developing a specific functional relation between each element and judgment; and (3) using a particular method to integrate the information (in this case, multiple regression) (Rohrbaugh 1979). The theory also holds that disputes result from differences in the weights assigned to elements by each person and in the functional relation by which each person relates the elements to the judgments (Rohrbaugh 1979). Social judgment analysis permits the study and analysis of human judgment using a quantitative and explicit method. This is accomplished through multiple regression statistics and graphic displays of the functional relation between elements and judgments (Hammond et al. 1975; Rohrbaugh 1979).

Social judgment analysis has been applied to a variety of problems including: assessing cancer risk (Hammond and Marvin 1981); judging regional air quality (Mumpower et al. 1979); improving public participation (Rohrbaugh and Wehr 1978; Mumpower and Dennis 1979); and selecting police ammunition (Hammond et al. 1975). The analysis is particularly useful for groups making controversial policy decisions because generalizations can be derived from the results. It appears to be applicable to fisheries management in that the analysis is designed for semi-analytic matters. Because fisheries management decisions often involve objective rules and data, along with a certain amount of subjective interpretation, social judgment analysis is well-suited for this study.

Social judgment analysis is particularly appropriate to the problem of urban fisheries because growing interest and program expansion (Alcorn 1981) make generalizations necessary. Few general guidelines exist for novice or experienced urban fisheries managers. Limited research opportunities make science insufficient to provide all the information. Though there are experienced managers, little has been done to utilize their collective wisdom. Social judgment analysis provides the means to capture this implicit information and express it in explicit forms for future use.

The purpose of this study was to evaluate expert judgment and provide generalizations that would facilitate the design of urban fisheries in small impoundments and along large waterfronts. The course of this study had four objectives:

1. Identify experienced urban fisheries managers;
2. Identify the characteristics that contribute to the quality of urban fisheries;
3. Generate explicit formulae as guides for development of urban fisheries in small impoundments and along large waterfronts; and
4. Verify the applicability of formulae with existing data from actual urban fisheries.

Methods

Social judgment analysis was used to reveal the implicit wisdom of veteran urban fisheries managers. A separate analysis was performed for each type of urban fishery: small impoundments and large waterfronts. The overall process developed multiple linear regression equations for each of the fishery types. The products of the analysis are equations describing management policies for small impoundments and large waterfronts. Each equation describes the relationship between a series of facts (elements) about the fisheries and a quality score (1-20) assigned by veteran managers.

Identification and selection of experts

The initial portion of the study was the identification of urban fisheries experts who served as judges of hypothetical fisheries (cases). The experts were chosen to represent a broad spectrum of knowledge, experience, and geographic coverage. Urban fisheries managers were identified through a short mail survey sent to state fisheries agencies and to other organizations and individuals involved in urban fisheries management (Appendix A.1). A stamped, addressed post card was included for their response (Appendix A.2). The survey asked chiefs of the 63 state fisheries agencies to identify their most experienced urban fisheries managers and others known to them. A review of the technical literature revealed four consultants, four municipal governments, and three Tennessee Valley Authority (TVA) employees actively involved in urban fisheries management. Individuals from these sources were asked to participate in the study and to identify other urban fisheries specialists (Appendix A.3).

A second survey (Appendix A.4) and a letter (Appendix A.3) explaining the study were sent to the individuals identified in the initial survey. This step was designed to define the experience and activities that guided the selection of judges for the judgment process. This survey included a stamped, addressed post card requesting information about the individual's experience with urban fisheries. The managers were asked which of ten broad activities they performed on small impoundments and large waterfronts. Managers were assigned an experience score based on their responses. Experience (E) was calculated as

$$E = A \times T$$

where

A = number of management activities, and

T = number of years experience.

The experts were stratified by waterbody type and geographic area. The small impoundment and waterfront groups were divided into the four American Fisheries Society (AFS) Divisions.

Twenty judges were required for each waterbody type, including 16 for the judgment process and 4 for a pre-test. The experts were chosen based on experience scores. Within each AFS division, the five most experienced individuals for ponds and for waterfronts (as indicated by E) were selected. A total of 20 judges was selected for each waterbody type. Because some individuals were among the most experienced for both waterbody types, they were selected to participate as judges for both ponds and waterfronts. One individual was randomly selected from each division to participate in a pre-test. Four experts representing ponds and 4 representing waterfronts served as judges in a pre-test of the judgment analysis. A total of 16 judges, representing each waterbody type, remained in the sample for further analysis.

Element selection

The task for the experts was to judge the quality of a series of hypothetical urban fisheries (cases). The cases were described in terms of several facts (elements) deemed important in designing urban fisheries. The selection involved three steps: (1) identifying the elements; (2) establishing a range of values for each element; and (3) establishing steps by which element values change.

Elements were identified and refined in a two-step process using content analysis of urban fisheries literature and open-ended telephone interviews with selected experts. Content analysis is used to identify specified characteristics by systematically assessing documents (Krippendorff 1980; Knuth 1986). It was employed to note frequencies of occurrence of items within the urban fisheries literature. The major references were the Proceedings of the Urban Fishing Symposium (Allen 1984) and a review of urban fishing by Duttweiler (1975). Fisheries journals, papers presented at recent professional meetings, recreation journals, and geographic journals also were researched for relevant articles. All articles were reviewed initially to select subject categories which were used to classify information (Stankey 1972; Knuth 1986). Each article was reviewed again, and the first time one new category of information was mentioned in the context of design and planning, it was scored as "present". The frequency of occurrence and range of possible values were noted.

Categories of information that were determined following the above procedure served as the elements for the social judgment analysis. Because the judgment analysis could only accommodate eight elements, the eight categories with the highest frequency of occurrence (percent of articles "present") in the literature were selected. Open-ended telephone interviews with the eight pre-test judges were part of the element and value validation. A cover letter and list of the eight elements, their descriptions, and range of values was mailed to each pre-test judge (Appendices A.5, A.6, A.7). They were given a one-week period to review the elements and suggest improvements. After one week, open-ended telephone interviews, approximately 20 minutes in length, were held with each pre-test judge. They were asked to review each element and indicate if these were sufficient descriptors of urban fisheries. Suggested changes were noted for each judge.

Case generation

Once the elements were selected, fishery cases were developed through the PC software package, POLICY PC. It was obtained from a user-supported network, Executive Decision Services of Albany, New York. POLICY PC is an interactive computer program that was developed for analyzing human judgment. It allows for the input of necessary information for case creation and judgment analysis. The desired number of cases, elements, value ranges, and number of judges are required. Element values for each case were generated randomly. The package permits the selection of up to eight elements and 50 cases.

This study incorporated eight elements that made up each case. An element was described by a range of values with discrete steps. The program randomly generated values for each of the elements for every case. When nonlinear functional relations are considered the general rule

$$C = 15 + 5(e-3)$$

applies to case generation, where

C = number of cases, and

e = number of elements.

For this study, therefore, 40 cases were used.

A pre-test was conducted to discover if the judges understood the process and to indicate the soundness of the choice of elements. Each case was printed on a 6x16 mm card and the group of 40 cases mailed to each pre-test judge. Included were a letter of introduction (Appendices A.8 and A.9) and a brief description of the fishery and elements (Appendices A.10 and A.11).

After the pre-test, cases were mailed to 16 waterfront judges and 16 pond judges. There was overlap of judges because of their expertise in both waterfront and pond fisheries. A total of 28 judges were mailed fishery cases (Appendix A.12), letters of introduction (Appendices A.13 and A.14), brief descriptions of the fisheries and elements, and instructions for judging the cases (Appendix A.15). Judges were instructed to indicate the quality of each fishery as element values changed. The judgment scale was from one (lowest quality) to twenty (highest quality). Judges returned their decisions in stamped, addressed envelopes for analysis.

Analysis

Returns were entered into the POLICY PC program as scores from one to twenty for each case for each judge. To be included in the subsequent analyses,judges had to have utilized at least one-half of the range of possible scores (1-20) and have an overall mean judgment near the mean of the expected normal distribution (in this case, 10). The judgment data were analyzed in terms of multiple regression statistics. Elements represented the independent variables and judgment scores were dependent variables. POLICY PC provided regression statistics and graphic displays for each judge. Judgment means, standard deviations, residuals, and multiple correlation coefficients were calculated.

The relative weight and function form were also reported for each element. Relative weight indicates the importance of an element. It is based on the relative magnitude of the beta weight associated with it (Adelman and Mumpower 1979). Beta weights are standardized by dividing each beta weight by the sum of the beta weights for all elements and then multiplying by 100. Relative weights then sum to 100 so that the relative weight for one element is the percentage of the variability in the judgments explained by that element (Executive Decisions Services 1986). The relative variability of judges' assignment of relative weights was compared for each element using the coefficient of variation (CV). CV was calculated with the equation

$$CV = \frac{s}{\bar{x}}$$

where s is the standard deviation and $\bar{x}$ is the mean relative weight for each element.

Additionally, function forms were generated by POLICY PC. Function forms are graphic displays relating element values to judgments. These relationships could be linear or nonlinear in form. The decision to describe a judgment rule linearly or nonlinearly was based on whether the addition of a quadratic term (representing a nonlinear function) significantly improved an individual's judgment model. The T-ratio (Executive Decision Services 1986) was used to assess the significance (a = 0.05) of an additional variable to a judgment model.

The quantitative models developed by POLICY PC are constructed using multiple linear regression analysis. In judging the hypothetical urban fishery cases, individuals made a numeric judgment (1-20) regarding quality for 40 cases in which the values of the elements varied. This process led to explicit formulae that described the quality of urban small impoundment and waterfront fisheries in the form

$$\hat{Y} = b_0 + \sum_{i=1}^{n} b_i x_i + \sum_{i=1}^{n} (b_i (x_i - \bar{x}_i)^2)$$

where

$\hat{Y}$ is the predicted judgment,

b_0 is the slope,

b_i, $i = 1,n$ are the regression coefficients associated with each element,

x_i, $i = 1,n$ are the n elements upon which judgment is based, and

$\bar{x}_i$, $i = 1,n$ are the mean values for the n elements.

The quadratic term $(b_i(x_i - \bar{x}_i)^2)$ was included to account for nonlinearity of three elements. Multiple linear regression equations were obtained for each judge. The results from each judge, therefore, had produced an individual policy describing the design of an urban pond fishery or waterfront fishery based on the eight elements used.

The next step was to combine these individual policies in a way that would produce overall policies for urban pond fisheries and urban waterfront fisheries. First, judges' scores for 40 cases were correlated. This was done for both pond and waterfront fisheries. Pearson correlation coefficients were obtained and used to group judges who judged cases similarly (≥ 0.50). Second, mean scores for each case were calculated for each group of similarly-thinking judges. These mean scores were then entered into the POLICY PC program. The resulting analysis provided a single urban fisheries design policy for each group of judges.

Results

Characteristics of managers

Of the 74 agencies and organizations contacted in the initial survey, 58 responded (78.4%). A total of 73 individuals were identified as potential participants in the project (Table 1). Each individual identified was sent the second survey, and 59 (80.8%) responded. The second survey verified the individuals' willingness to participate and provided information about their urban fisheries management experiences.

Twenty persons reported experience only with urban ponds, and 15 individuals reported experience only with urban waterfront fisheries (Table 2). Twenty-four individuals reported experience with both pond and waterfront fisheries, making a total of 44 individuals with urban pond experience and 39 individuals with urban waterfront experience. On the average, waterfront fisheries managers reported more experience ($\bar{x}$ = 6.3 years) than urban pond managers ($\bar{x}$ = 5.6 years).

Table 1. Agencies, organizations, and individuals contacted and those who responded to the first and second survey.

	Agencies	Municipal Governments	Consultants	TVA	Total
Initial Survey					
Contacted	63	4	4	3	74
Responded	48	3	4	3	58
Names Received	61	4	5	3	73
Second Survey					
Individuals Contacted	61	4	5	3	73
Responded	47	4	5	3	59

Table 2. Total number of individuals reporting experience with urban fisheries (actual number of experts participating in analysis in parentheses).

AFS Division	Ponds Only	Waterfronts Only	Both	Total Ponds	Total Waterfronts
Northeastern	4 (1)	4 (1)	7 (4)	11 (5)	11 (5)
Southern	5 (1)	4 (1)	7 (4)	12 (5)	11 (5)
North Central	8 (2)	2 (2)	7 (3)	15 (5)	9 (5)
Western	4 (4)	5 (4)	3 (1)	6 (5)	8 (5)
Total	20 (8)	15 (8)	24 (12)	44 (20)	39 (30)

Managers also reported their activities in urban fisheries management (Table 3). Urban pond fisheries managers participated in an average of 5.5 of the 10 activities mentioned in the survey. Waterfront fisheries managers participated in an average of 5.1 of the 10 activities. The number of activities for an individual ranged from one to ten.

Activities were grouped under three general categories: (1) administrative; (2) management; and (3) monitoring. The highest percentage of managers (59%) participated in administrative activities (statewide planning, local planning, analysis/report writing). Fifty-four percent of the managers participated in management activities (stocking, habitat improvement, access improvement, public education). The lowest percentage of managers (43%) participated in monitoring activities (biological sampling, habitat sampling, angler/creel surveys). Among individual activities, those related to habitat were the least common (24% and 41%). Local planning (71%), public education (61%), stocking (56%), access improvement (56%), and angler/creel surveys (54%) were the most common activities reported.

Experience scores, reflecting the product of the length and kinds of experience of managers, ranged from 2 to 200 for the 59 potential participants. Urban pond fisheries managers averaged 47.5 versus 57.0 for waterfront fisheries managers. This difference can be attributed principally to more years of experience reported by waterfront managers. These scores indicated a wide variety of urban fisheries management experiences and the need to identify a smaller group of experts for judgment analysis.

Identification of experts

A subset of the most experienced urban fisheries managers was identified for participation in the judgment analysis. In order to obtain a broad spectrum of urban fisheries experiences, individuals

Table 3. Urban fisheries management activities of managers (total sample, n = 59; expert sample, n = 28).

Activity	Percentage of managers participating	
	Total sample (n = 59)	Expert sample (n = 28)
Administrative	59%	72%
Local planning	71% (42)	79% (23)
Analysis/report writing	59% (35)	72% (21)
Statewide planning	47% (28)	66% (19)
Management	54%	66%
Education	61% (36)	79% (23)
Access improvement	56% (33)	76% (22)
Stocking	56% (33)	62% (18)
Habitat improvement	41% (24)	45% (13)
Monitoring	43%	59%
Angler/creel surveys	54% (32)	69% (20)
Biological sampling	49% (29)	69% (20)
Habitat sampling	24% (14)	38% (11)

identified from the second survey were grouped according to their AFS division affiliation (Table 2). Of the pond managers, six resided in the Western Division, twelve in the Southern Division, fifteen in the North Central Division, and eleven in the Northeastern Division. Of the waterfront managers, eight resided in the Western Division, eleven in the Southern Division, nine in the North Central Division, and eleven in the Northeastern Division. The five most experienced managers, based on experience scores, from each division, were selected to participate in the study. As in the larger sample of managers, overlap existed for pond and waterfront experiences. Overall, eight managers were selected as urban pond experts, eight were selected as urban waterfront experts, and twelve were selected as both pond and waterfront experts.

There were substantial differences in the average number of years of experience reported by these subsets of urban pond and waterfront experts. Urban waterfront experts reported twice as many years of experience ($\overline{X}$ = 15.6 years) as urban pond experts ($\overline{X}$ = 7.8 years). Waterfront experts also reported more than twice the years of experience reported by all (39) waterfront managers in the total sample ($\overline{X}$ = 6.3 years). Urban pond experts, in contrast, reported only 28% more experience ($\overline{X}$ = 7.8 years) than all (44) pond managers identified in the total sample ($\overline{X}$ = 5.6 years).

Urban pond fisheries experts reported participation in more management activities ($\overline{X}$ = 7.1) than waterfront fisheries experts ($\overline{X}$ = 6.3), twice the difference noted for the entire sample. For each fishery type, slight differences were observed in the average number of reported activities between the total sample and the expert sample. The average number of activities reported by the total sample of pond managers was 5.5 versus 7.1 for the expert sample. Waterfront managers in the expert sample reported an average of 6.3 activities versus 5.1 for the total sample. As in the total sample, experts participated most frequently (72%) in administrative activities (statewide planning, local planning, data analysis/ report writing). Sixty-six percent of the experts participated in management activities (stocking, habitat improvement, access improvement, public education).

The lowest percentage of experts (59%) participated in monitoring activities (biological sampling, habitat sampling, angler/creel surveys).

Managers in the expert sample reported higher percentages of participation in each of the 10 activities than did all managers, but the relative order was similar (Table 3). As in the total sample, local planning (79%), public education (79%), access improvement (76%), angler creel surveys (69%), and stocking (62%) were participated in by the most experts. The fewest experts participated in habitat sampling (38%) and habitat improvement (45%).

Experience scores ranged from 8 to 180 and 8 to 200 for pond and waterfront experts, respectively. As for the total, urban waterfront fisheries experts had higher experience scores ($\overline{X} = 94.1$) than urban pond fisheries experts ($\overline{X} = 75.8$). Experience scores for the experts were considerably higher than scores for all pond and waterfront managers, increasing by 60% and 65%, respectively.

This analysis of the characteristics of urban fisheries managers indicates that a group of expert urban fisheries managers does exist. The criteria for indexing expertise (length and type of experience) were combined to provide a more complete measurement of overall experience. These experience scores, as well as every other measure of management experience, increased substantially from the total sample to the expert subset. The subset of managers based on these criteria provided the expertise necessary for social judgment analysis.

Content analysis

Nine general categories of information about urban fisheries (Table 4) were identified in the initial review of the Proceedings of the Urban Fishing Symposium (Allen 1984) and of Duttweiler's

Table 4. General information categories and frequency of occurrence of information items from review of 47 articles.

Category	Frequency (%) of occurrence	Information items
Education	47% (22)	Fishing clinics, derbies, classroom instruction
Planning	43% (20)	Local, state, cooperative efforts
Stocking	36% (17)	Rate, size, species
Funding	34% (16)	Local, state, private, cooperative efforts
Water quality	30% (14)	Suitability for available species, health safety, water quality criteria
Habitat management	30% (14)	Attraction structures
Mobility	26% (12)	Proximity to anglers, transportation facilities
Fishing access	26% (12)	Shoreline access
Site quality	19% (9)	Physical facilities, commercial facilities

(1975) urban fisheries review. Twenty-two separate information items were identified within the nine general categories. These 22 information items were used to classify the content of the 47 articles about urban fisheries design reviewed (Appendix B) to determine the elements for the judgment analysis.

The education category contained the most frequently reported information items. Education in the form of fishing clinics, derbies, and classroom instruction was reported in 22 of the 47 articles (47%). Local, state, and cooperative planning efforts were reported in 43% of the articles. Stocking, in terms of rates, sizes, and species, was reported in 36% of the reviewed articles. Funding for urban fisheries management, including local, state, and cooperative funding, was described in 16 of the 47 articles (34%). Suitability of the water for sustaining fish species, protecting human health, and surpassing standard water quality criteria were mentioned in 30% of the articles. Habitat management in terms of the presence of fish attraction structures, was reported in 30% of the articles. Resident mobility was described as the proximity of the fishing site to anglers or as availability of transportation to anglers in 26% of the articles. Fishing access was reported in terms of shoreline availability in 26% of the articles. Site quality was reported in terms of physical and commercial facilities in 19% of the articles.

The frequency of occurrence of items within the categories indicated a steady decline in frequency from category to category. It was expected that frequency of occurrence would be rather high for a small number of categories, with frequency decreasing rapidly until a few items were mentioned infrequently. No such changes in frequency were found.

Content analysis results exhibited some similarities with the experience of urban fisheries managers. In both the total sample and expert subset, a large percentage of managers participated in planning, education, and stocking activities. These three activities appeared with the greatest frequencies in the reviewed literature. One substantial difference is the relatively low frequency of access-related items in the literature (26%), while more than half of the managers (56% of all managers and 76% of experts) participated in access improvement activities.

Element definition

The original intent was to use the content analysis to separate information categories into frequently and infrequently mentioned topics, and to include only the frequently mentioned topics as elements in the judgment analysis. Because the content analysis revealed no obvious separation, the maximum number of elements (8) compatible with the judgment analysis software was used.

Eight of the nine general information categories were selected as elements for judgment analysis. These eight elements, including education, planning, stocking, funding, water quality, habitat management, mobility, and fishing access, were the most frequently mentioned categories in the reviewed literature. The least frequently mentioned topic, site quality, was not included. Because no differences were found between pond and waterfront fisheries design in the literature, the same eight elements were used for both urban pond and waterfront analyses.

Each element required a quantitative descriptor, a range in quantitative values, and an increment of change within the range of values. Possible descriptors for each information item were noted if they occurred in the literature. Each of the 22 specific information items was considered a possible descriptor. Table 5 displays the initial list of descriptors for the elements selected for the judgment analysis. These particular descriptors were chosen because they represented broadly the important design criteria related to each element. For example, the education element, described as the percentage of the local fisheries management program devoted to education, was broad enough to include the idea of fishing clinics, derbies, and classroom instruction but also explicitly described the role of education in an hypothetical urban fisheries program.

Table 5. Elements selected to describe hypothetical urban fisheries prior to pre-testing.

Element	Descriptor	Range
Education	Percentage of local fisheries management program devoted to education. Includes programming, materials, classes, and presentations.	0-100%
Local planning	Percentage of local involvement in planning fisheries management strategies. Includes municipal or county involvement.	0-100%
Local funding	Percentage of local financial support for fisheries management program.	0-100%
Accessibility of the fishery	Percentage of local households without cars.	0-100%
Water quality	Water quality suitable to support available species.	(1)rough fish-all year (2)warmwater fish-part of year (3)warmwater fish-all year (4)coldwater fish-part of year (5)coldwater fish-all year
Shoreline available for fishing	Percentage of shoreline accessible to anglers	0-100%
Stocking rate	Annual density of catchable-size fish stocked	0-1000 lbs./acre
Habitat management	Shoreline distance between fish attraction structures	(1) 25 yards (2) 50 yards (3) 100 yards (4) 200 yards (5) 400 yards

The value ranges for the elements were developed subjectively through literature review and discussion with committee members. Education, planning, funding, residential mobility, and shoreline access were described in terms of percentages (0 - 100%). Each of these elements varied at 10% increments. For example, shoreline access could be described as 0, 10, 20, 30, ... 100% of shoreline available to shore anglers. The stocking element was described as total annual stocking rate ranging from 0 to 1000 lbs/acre with increments of 100 lbs/acre. The fish attraction structure element was described as shoreline distance, in yards, between attraction structures. This element had a range of five distances, each one doubling from 25 yards to 400 yards. The eighth element, water quality, was expressed as five equal steps of increasing quality in terms of fish that could survive at a particular water quality level (rough fish species, warmwater species, and coldwater species) and length of season during which a species could survive (part of the year or all of the year).

The list of elements, including their descriptions, ranges, and increments, was evaluated by eight pre-test judges. The pre-test judges responded favorably to most of the initial elements. Suggested changes in the elements are listed in Table 6. The judges unanimously rejected the mobility element, which expressed residential mobility in terms of the percentage of households without cars. Judges felt that it was not easily integrated with the rest of the information. It was changed to the percentage of the local population that is within walking distance of the fishery or can reach it by public transportation, which the judges accepted. Other recommended changes included value-range changes for shoreline availability (from 0-100% to 10-100%) and education (from 0-100% of program funds to 0-50%). Each of these recommendations was made so that hypothetical fishery cases were not described with impossible conditions. Specifically, a fishery with 0% shoreline access was not a fishery at all. Also, a program with 100% of the budget devoted to education could engage in no other activities. The range, 0-50%, permitted variation in education allocations without eliminating other aspects of the hypothetical fishery cases.

Table 6. Changes in elements suggested by pre-test judges.

Element	Suggested Changes	Final Form
Education	Reduce range from 0-100% to 0-50%	Percentage of local fisheries management program devoted to education; includes programming, materials, classes, and presentations. Range 0-50%
Local Planning	No changes suggested.	
Local Funding	No changes suggested.	
Accessibility of the fishery	Requires more explicit description, such as methods used to reach fishery	Percentage of population that is within walking distance of the fishery or can reach it by public transportation. Range 0-100%
Shoreline available for fishing	Reduce range from 0-100% to 10-100%	Percentage of shoreline accessible to anglers; refers to land where fishing is possible and is permitted without restriction by landowner. Range 10-100%
Water quality	Include marine environments.	Water quality suitable to support available species represents range of conditions (1-5) in terms of the fish community present; for marine environments, this range represents increasing water quality from 1-5.
Stocking rate	No changes suggested.	
Habitat management	Change title to more aptly describe element.	Fish attraction structures.

The pre-test judges also expressed concern about the lack of additional general information about the hypothetical fishery. Each judge felt that more description about the fisheries was necessary in order to make informed decisions about their quality. Therefore, brief, general descriptions, which remained the same for all hypothetical fisheries, were added to the list of elements for each waterbody type. These included waterbody size, resident population, and toxic contamination information. The revised element descriptions and ranges for the two fishery types are displayed in Appendices A.10 and A.11.

Forty hypothetical fishery cases were developed with POLICY PC. Values within the range of possible values for each element were randomly assigned to each case (Appendix C.1). The range of values generated assured judges a variety of possible cases to judge.

Pre-test analysis

Eight judges (four for ponds and four for waterfronts) were selected to perform the judgment analysis as a pre-test of the fisheries managers' ability to understand and complete the judgment process. All eight judges returned judgments (100% response; Appendix C.2). Ranges of judgment scores, average judgements, and multiple correlation coefficients are shown in Table 7 for pond and waterfront judges.

Both groups of judges utilized most of the 20-point range of possible judgment scores. Pond judges utilized slightly more of the range than waterfront judges. This wide range of scores indicated that judges critically reviewed the cases and could make distinctions among low and high quality fisheries. Mean judgment scores for the four pond judges ranged from 10.3 to 12.2. Mean judgment scores for the four waterfront judges ranged from 7.8 to 15.0. The narrow range of means for pond fisheries indicated scoring consistency among judges and that scores were centered

Table 7. Ranges of scores, mean scores ($\overline{X}$), and multiple correlation coefficients (R) for each pre-test judge of urban pond and waterfront fisheries.

Fishery	Judge	Score Ranges	$\overline{X}$	R
Pond	1	6-18	11.0	0.90
	2	3-20	12.2	0.89
	3	5-16	10.4	0.77
	4	1-20	10.3	0.73
Waterfront	1	12-20	15.0	0.80
	2	1-20	7.8	0.96
	3	3-17	9.4	0.93
	4	6-18	11.7	0.77

on the mid-point of the range, as desired. The broader range in mean scores for waterfront judges indicated somewhat lower consistency in judgment among these judges than pond judges. Consistency for each judge, however, measured by R was high for both groups (0.73 - 0.90 for pond judges and 0.77 - 0.96 for waterfront judges). These high R values showed that the predictive capability of the regression model for each judge was good. This means that each judge was consistent in the way she/he integrated information, and that most of the variance in judgment scores was accounted for by the eight independent elements.

The pre-test results indicated that the elements were suitably structured and that the experts were capable of using the process to judge fishery quality. The somewhat lower consistency for waterfronts was expected, given the broader range of fisheries included in the waterfront category. No additional changes were made, therefore, in the descriptions of the cases, the structure of the elements, or the instructions to the judges.

Judgment analysis

Sixteen experts each were asked to judge pond and waterfront cases. Eleven experts were asked to judge pond fisheries, eleven to judge waterfront fisheries, and five to judge both fishery types.

Pond judgment

Twelve experts completed the analysis for hypothetical urban pond fisheries (75% response). Judgment scores are presented in Appendix D.1. Eleven of the 12 judges utilized at least one-half of the 20-point range of possible scores (Table 8). Mean judgments by these experts were distributed around 10, the mid-point of the range. One judge utilized less than one-third of the

Table 8. Ranges of scores, mean scores ($\overline{X}$), and multiple correlation coefficients (R) for twelve urban pond fisheries managers in the judgment analysis.

Judge	Score Range	$\overline{X}$	R
1[a]	3-8	5.2	0.85
2	1-20	9.7	0.90
3	2-15	9.0	0.87
4	1-18	12.0	0.96
5	5-17	11.5	0.87
6	5-17	11.8	0.94
7	2-17	11.4	0.92
8	2-12	6.1	0.96
9	2-20	10.5	0.98
10	5-19	11.1	0.86
11	1-19	9.9	0.94
12	1-20	10.8	0.89

[a] Judge 1 was eliminated from further analysis.

range (3-8), providing a mean judgment score of 5.2. Because this judge did not integrate information in a manner similar to the other 11 judges, his judgments were eliminated from the analysis.

Preliminary analyses determined whether the functional forms for each element should be modeled as linear or nonlinear (i.e., without or with a quadratic term in the regression model). Models were developed with and without quadratic terms for each judge. Tests for significance (Appendix D.2) of the addition of variables estimated with quadratic terms indicated that treating accessibility of the fishery, water quality, stocking rate, available shoreline, and fish attraction structure as nonlinear variables improved the model for four, three, four, three, and four judges, respectively (Table 9). Although available shoreline, as a nonlinear variable, improved the model for three judges, the function form for the majority of judges indicated that the judges viewed the relationship between available shoreline and fishery quality as a more linear function. Also, fish attraction structure, despite its improvement to the model as a nonlinear variable, was relatively unimportant to judges (mean relative weight = 4.64). Unimportant elements (relative weight $\leq$ 5) should be estimated linearly (Executive Decision Services 1986).

Based on this analysis and on independent reasoning about the shape of the function forms, the best overall model was determined to include five linearly estimated elements (education, local planning, local funding, available shoreline, and fish attraction structures) and three elements estimated with quadratic functions (accessibility of the fishery, water quality, and stocking). Four of the five linear estimates were positive linear functions. As education, local planning, local funding, and available shoreline increased, experts perceived increasing quality. The relationship between fish attraction structures and quality was negatively linear; as distances between structures increased, perceived quality decreased. Relationships described with quadratic functions were curvilinear in form. Represented by inverted parabolas, these relationships indicated that quality increased as element values increased to a certain point, then leveled off or began to decrease.

Table 9. Pond judges whose judgment models were significantly improved by the addition of the quadratic term ($b_i(x_i - \bar{x}_i)^2$).

Judge	Element							
	Education	Local Planning	Local Funding	Accessibility of the fishery	Available Shoreline	Water Quality	Stocking	Fish Attraction Structures
2	X			X	X			
3								
4				X	X		X	X
5								
6						X	X	X
7		X				X		
8								
9					X			
10				X				X
11								
12				X		X	X	X
Total	1	1	0	4	3	3	3	4

Multiple correlation coefficients (R) for each judge's analysis are given in Table 8. R values ranged from 0.86 to 0.98. These high correlations indicated that the regression models were accurate representations of the judges' decisions. High R values also demonstrated internal consistency by each judge. In other words, high correlation coefficients indicated that urban pond judges were consistent in their use of the information presented and that a multiple regression equation could replicate the experts' decision- making process.

Relative weights, attributed to each element by each judge (Table 10), indicated the relative importance of each element to the perceived quality of an urban pond fishery. Ranges of the weights for all 11 judges were: education, 1-28; local planning, 2-17; local funding, 0-15; accessibility of the fishery, 3-47; available shoreline, 0-26; water quality, 2-39; stocking, 10-49; and fish attraction structures, 2-9. Stocking had the highest average relative weight (29.2), followed by accessibility of the fishery (18.4), water quality (14.9), available shoreline (13.2), education (8.0), local planning (6.7), local funding (4.9), and fish attraction structures (4.6).

Six of the eleven judges placed greatest importance on stocking when judging the quality of urban pond fisheries. Two judges felt that accessibility of the fishery was most important, while the other three experts judged available shoreline, education, and local planning as most important.

Variability among judges in their assessment of relative weights was indicated by coefficients of variation (CV; Table 10). The two elements that were the most and least important to judges were also the least variable. Stocking (CV = .505) and fish attraction structures (CV = .569) were the least variable in terms of relative weight assignment. Available shoreline (CV = .631), local planning (CV = .688), water quality (CV = .700), and accessibility of the fishery (CV = .749) exhibited intermediate variation, and education (CV = .986) and local funding (CV = 1.100) were most variable. Lower CVs presumably reflect substantial agreement among judges about the relative importance of an element. Apparently, judges were most in agreement regarding the high importance of stocking and the low importance of fish attraction structures on fisheries quality.

Table 10. Relative weights* assigned by 11 urban pond fisheries managers to eight elements, mean relative weight ($\overline{X}$), standard deviation (S), and coefficient of variation (CV) for each element.

Element	Judge 2	3	4	5	6	7	8	9	10	11	12	$\overline{X}$	S	CV
Education	9	1	6	1	7	13	1	28	10	2	10	8.00	7.89	.986
Local Planning	2	2	7	2	5	17	11	6	9	6	7	6.73	4.47	.688
Local Funding	2	4	3	14	0	9	1	15	1	5	0	4.91	5.41	1.100
Accessibility of the fishery	47	25	23	3	15	11	8	7	23	5	35	18.36	13.79	.749
Shoreline available	20	11	4	15	21	8	21	14	26	0	5	13.18	8.33	.631
Water quality	9	12	2	9	23	16	11	11	7	39	25	14.91	10.43	.700
Stocking rate	10	40	49	45	27	16	44	15	23	40	12	29.18	14.76	.505
Fish attraction structures	2	6	6	9	2	9	3	4	2	3	5	4.64	2.62	.569

* Based on a 100-point scale.

Increasing CVs presumably reflect increasing disagreement among experts about the relative importance of an element to urban pond fisheries design. Education and local funding are, therefore, the design elements about which urban pond managers would most likely disagree. The variability in judgment of the importance of education, for example, was also reflected in the difference among the survey of managers, content analysis, and relative weight assignment. Managers reported a 79% participation rate in education, and 47% of the reviewed articles contained education items. However, when faced with making decisions about urban fisheries, managers tended to give low relative weights to education (mean relative weight = 8.0).

Waterfront judgment

Thirteen experts returned judgments on the hypothetical fisheries (81% response). Judgment scores are given in Appendix D.3. All judges utilized over one-half of the 20-point range of possible scores (Table 11). Mean judgments for all judges were near the mid-point of the range, from 8.3 to 13.2 . All 13 judges, therefore, were included in further analysis.

Preliminary analyses were done to determine best estimates for elements in the model. Models were developed with and without quadratic terms for each judge. Tests for significance (Appendix D.4) of the addition of variables estimated with quadratic terms indicated that accessibility of the fishery, available shoreline, water quality, and planning as nonlinear variables improved the model for four, three, four, and four judges, respectively (Table 12). Although planning estimated as a nonlinear variable improved the model, the function form of judges' decisions about planning indicated that the relationship between planning and fishery quality was primarily linear and the mean relative weight was lowest among judges (6.69).

Based on this analysis and on independent reasoning about the shape of the function forms, the best overall model was determined to include five linearly estimated elements (education, local

Table 11. Ranges of scores, mean scores ($\overline{X}$), and multiple correlation coefficients (R) for thirteen urban pond fisheries managers in the judgment analysis.

Judge	Score Range	$\overline{X}$	R
1	1-20	11.2	0.95
2	1-19	8.3	0.97
3	5-18	9.8	0.93
4	2-19	11.1	0.91
5	1-20	10.5	0.83
6	6-15	10.7	0.95
7	1-15	9.8	0.91
8	5-18	12.7	0.91
9	5-19	13.2	0.84
10	3-17	9.4	0.81
11	4-15	9.4	0.84
12	3-20	12.1	0.87
13	1-19	9.9	0.94

Table 12. Urban waterfront judges whose models were significantly improved by the addition of the quadratic term ($b_i(x_i - \bar{x}_i)^2$).

Judge	Element							
	Education	Local Planning	Local Funding	Accessibility of the fishery	Available Shoreline	Water Quality	Stocking	Fish Attraction Structures
1						X		
2								
3								
4				X				
5	X	X	X	X	X			
6					X	X		
7		X				X		X
8		X	X	X	X			
9				X			X	
10								
11	X							X
12		X				X		
13								
Total	2	4	2	4	3	4	1	2

planning, local funding, stocking, and fish attraction structures) and three elements estimated with quadratic functions (accessibility of the fishery, available shoreline, and water quality). Four of the five linear estimators were positive linear functions. As education, local planning, local funding, and stocking increased, experts perceived increasing quality. The relationship between fish attraction structures and quality was negatively linear; as distances between structures increased, perceived quality decreased. Relationships described with quadratic functions were curvilinear in form. Represented by inverted parabolas, these relationships indicated that quality increased as element values increased to a certain point, then leveled off or began to decrease.

Multiple correlation coefficients (R) for each judge's analysis are given in Table 11. R values ranged from 0.81 to 0.97. These high correlations indicated that the regression models were accurate representations of the judges' decisions. High R values also demonstrated internal consistency by each judge. In other words, high correlation coefficients indicated that urban waterfront judges were consistent in their use of the information presented and that a multiple regression equation could replicate the experts' decision- making process.

Relative weights, attributed to each element by each judge (Table 13), indicate the relative importance of each element to the perceived quality of an urban waterfront fishery. Ranges of the weights for all 13 judges were: education, 0-16; local planning, 0-17; local funding, 1-51; accessibility of the fishery, 3-31; available shoreline, 3-35; water quality, 6-59; stocking, 3-39; and fish attraction structures, 1-15. Water quality had the highest average relative weight (20.8), followed by accessibility of the fishery (16.7), stocking (15.8), available shoreline (14.5), local funding (10.0), education (8.0), fish attraction structures (7.6), and local planning (6.7).

Five of the thirteen judges placed greatest importance on accessibility of the fishery when judging the quality of urban waterfront fisheries. Three judges felt that available shoreline was most important; two assigned the greatest weight to water quality; two felt stocking was most important; and one judge placed greatest importance on local funding.

Table 13. Relative weights* assigned by 13 urban waterfront fisheries managers to eight elements, mean relative weight ($\overline{X}$), standard deviation (S), and coefficient of variation (CV) for each element.

	Judge															
Element	1	2	3	4	5	6	7	8	9	10	11	12	13	$\overline{X}$	S	CV
Education	3	3	0	10	4	13	10	5	16	8	14	16	2	8.00	5.57	.696
Local Planning	0	3	3	1	11	10	17	14	8	9	4	4	1	6.69	5.33	.795
Local Funding	9	3	5	1	5	13	7	15	9	51	5	2	5	10.00	12.97	1.297
Accessibility of the fishery	5	3	40	31	27	10	9	19	21	3	14	30	5	16.69	12.30	.736
Shoreline available	35	10	17	6	21	12	11	8	26	8	26	6	3	14.54	9.72	.670
Water quality	19	59	15	21	6	8	19	18	16	7	22	24	37	20.85	14.08	.677
Stocking rate	21	18	16	18	13	18	15	17	3	6	4	17	39	15.77	9.08	.575
Fish attraction structures	9	1	4	11	13	15	12	5	2	9	12	3	3	7.62	4.79	.630

* Based on a 100-point scale.

Variability among judges in their assessment of relative weights was indicated by coefficients of variation (CV; Table 13). Stocking (CV = .575) and fish attraction structures (CV = .630) were the least variable in terms of relative weight assignment. Available shoreline (CV = .670), water quality (CV = .677), education (CV = .696), accessibility of the fishery (CV = .736), and local planning (CV = .795) were intermediate in variation. Local funding (CV = 1.297) was most variable. Lower CVs presumably reflect substantial agreement among judges about the relative importance of an element. As in the urban pond fisheries, stocking and fish attraction structures were least variable. Judges were most in agreement regarding these two elements' role in waterfront fisheries quality. Increasing CV's presumably reflect increasing disagreement among experts about the relative importance of an element to urban waterfront fisheries design. Local funding is, therefore, the design element about which waterfront fisheries managers would most likely disagree.

Summary of individual pond and waterfront judgments

Relative importance of the eight elements was similar for urban pond and waterfront fisheries, with only minor differences in the ranking of elements by relative weights. According to the experts, stocking, water quality, accessibility of the fishery, and available shoreline were the four most important factors affecting the fishery quality for both waterbody types. Stocking was the most important element to managers judging urban pond fisheries, but was third in importance to waterfront judges. Education, local planning, and fish attraction structures were least important. Fish attraction structures was the least important element to pond judges and next to least important to waterfront judges.

Variability in assigning relative weights was also similar for both groups. The least variable elements for both groups were stocking and fish attraction structures. The low variability indicated that judges were most similar in their assessment of stocking as an important factor in urban fisheries and of fish attraction structures as an unimportant factor. Generally, elements that were important to managers had relatively low variability in assigned quality scores; these included stocking, water quality, and available shoreline. Accessibility of the fishery, however, also an important element, had relatively high variability in quality scores. One reason that may account for this is that although accessibility of the fishery was important to managers, some may have been confused about the presentation of the element or they may have been unsure about how to measure the role of mobility in urban fisheries management.

Policy formation

The objective of the study was to develop a combined policy for each fishery type representing the collected wisdom of the experts. The individual policies about urban fisheries developed alone were combined based on the correlation of judgment scores among pairs of judges.

Pond fisheries policies

Eleven urban pond fisheries policies were developed with POLICY PC. Judgment scores of all fishery cases were correlated to determine if each pair of judges assigned similar scores to cases. Appendix E.1 shows the correlation matrix of judgment scores for pond fisheries. Two judges were considered to have the same judgment policy if R exceeded 0.50. The combination of these separate policies resulted in the formation of two groups, representing six and five judges each. Group 1 included judges 3, 4, 5, 6, 8, and 10. One pair of judges (5,10) did not meet the criterion of $R > 0.50$ ($R = 0.40$), but both judges met the criterion with the other four judges. Therefore, judges 5 and 10 were included in the group. Group 2 included judges 6, 7, 8, 9, and 11. One pair of judges (9,11) did not meet the criterion of $R > 0.50$ ($R = 0.43$), but both judges met the criterion with the other three judges. Therefore, judges 9 and 11 were included in the group.

Judgment scores for each group were calculated by averaging individual scores for all judges in the group for each hypothetical case. The average scores served as the group judgments (as though for a single judge) and were analyzed with POLICY PC. The ranges of judgment scores for Group 1 and Group 2 were similar, ranging from 3 to 16 and 3 to 17, respectively. The mean score for Group 1 was slightly higher (10.3) compared to the mean score for Group 2 (10.0). The multiple correlation coefficients ($R = 0.96$ and 0.98) for Group 1 and Group 2 indicate that the regression models were accurate representations of group policies.

Relative weights (Table 14; Figure 1) indicated that stocking was most important (41%) to Group 1. This was followed by available shoreline (20%), accessibility of the fishery (17%), water quality (9%), local funding (6%), education (4%), local planning (3%), and fish attraction structures (0%). Functional relationships of Group 1's decisions are shown graphically in Figure 2. These descriptions indicated that for accessibility of the fishery, water quality, and stocking rate, the highest quality occurred at an intermediate point in the range available. Education, planning, and attraction structures were not important in judges' decisions. The Group 1 policy was expressed by the regression equation:

$$\hat{Y} = 2.6582615 + 0.0156175x_1 + 0.0055594x_2 + 0.0103243x_3 + 0.0286396x_4 + 0.0388362x_5 + 0.4313952x_6 + 0.0080957x_7 - 0.0001366x_8 - 0.0004143(x_4 - \bar{x}_4)^2 - 0.1884163(x_6 - \bar{x}_6)^2 - 0.0000084(x_7 - \bar{x}_7)^2$$

where,

x_1 is the percentage of the fisheries management program devoted to education and programming,

x_2 is the percentage of local involvement in planning fisheries management strategies,

Table 14. Relative weights* assigned by Group 1 and Group 2 urban pond fisheries judges to the eight elements describing urban pond fisheries.

Element	Group 1	Group 2
Education	4	13
Local planning	3	9
Local funding	6	6
Accessibility of fishery	17	8
Shoreline available for fishing	20	13
Water quality	9	20
Stocking rate	41	27
Fish attraction structures	0	5

* Based on 100-point scale

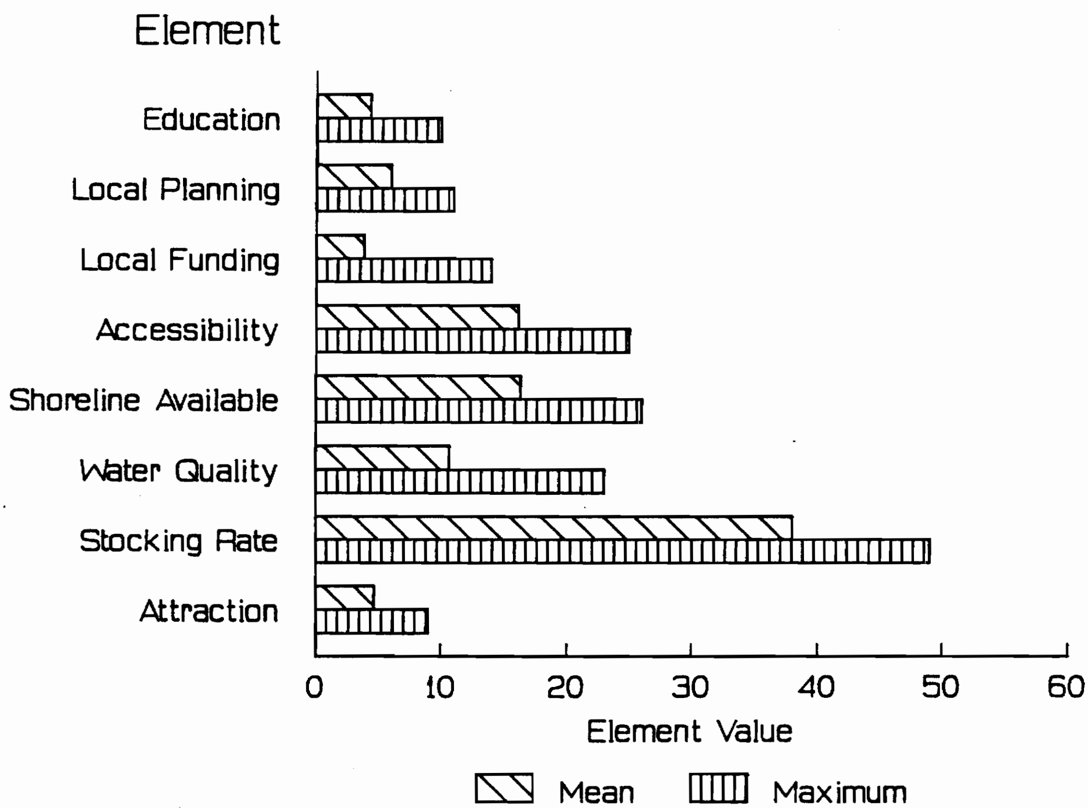

Figure 1. Mean relative weights and maximum relative weights assigned to each element by Group 1 judges.

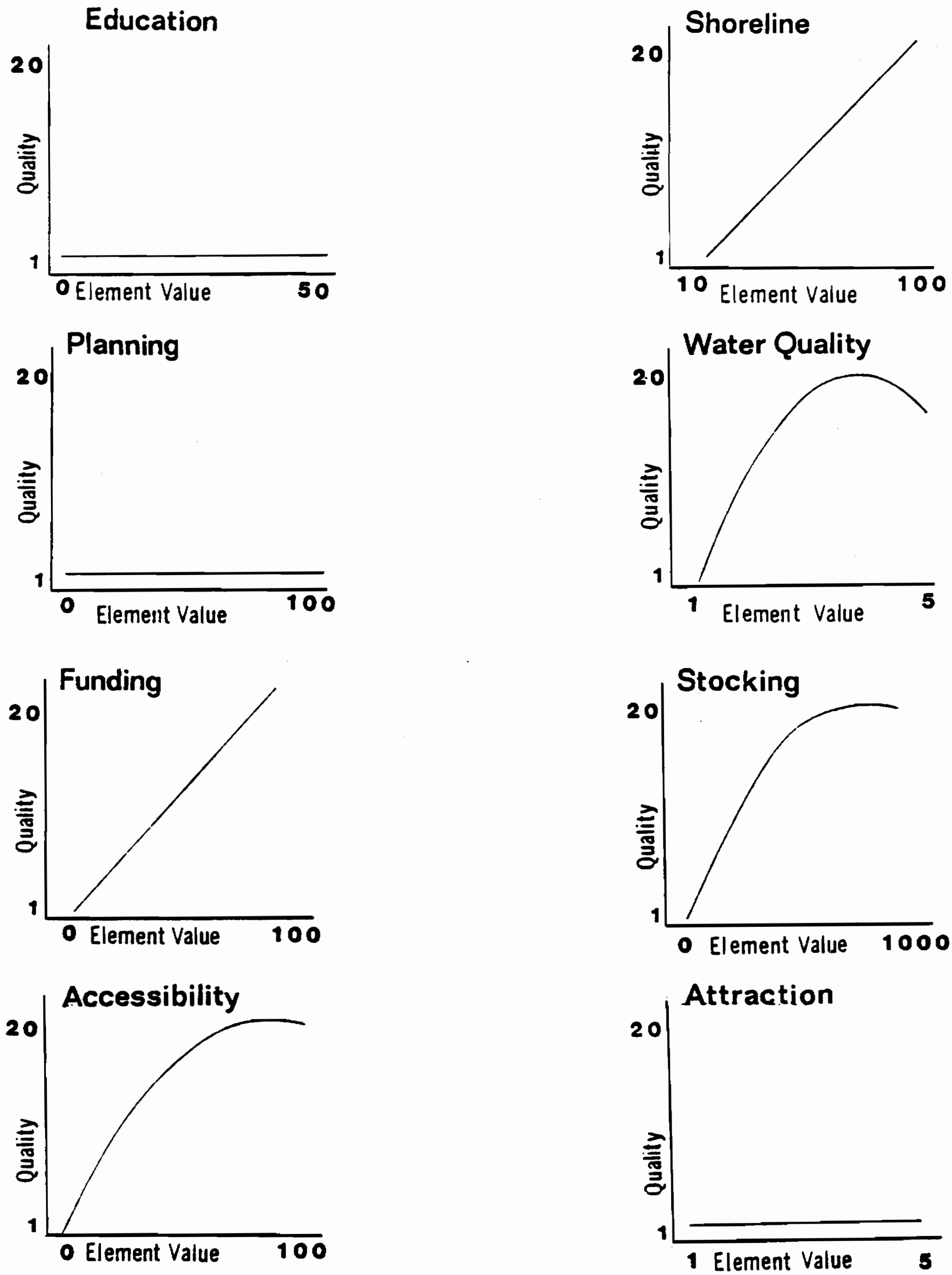

Figure 2. Graphical representations of Group 1 pond judges' decisions.

x_3 is the percentage of local financial support for fisheries management strategies,

x_4 is the percentage of local population that is within walking distance of the fishery or can reach it by public transportation,

x_5 is the percentage of shoreline available to anglers,

x_6 is the water quality suitable to support available species,

x_7 is the annual density of catchable-size fish stocked,

x_8 is the shoreline distance between fish attraction structures,

$(x_4 - \bar{x}_4)^2$ is the quadratic term describing the variable x_4,

$(x_6 - \bar{x}_6)^2$ is the quadratic term describing the variable x_6, and

$(x_7 - \bar{x}_7)^2$ is the quadratic term describing the variable x_7.

Relative weights (Table 14; Figure 3) indicated that stocking was most important (27%) to Group 2. Stocking was followed by water quality (20%), available shoreline (13%), education (13%), local planning (9%), accessibility of the fishery (8%), local funding (6%) and fish attraction structures (5%). Functional relationships of Group 2's decisions (Figure 4) indicated that for accessibility of the fishery and water quality, the highest quality occurred at an intermediate point in the range available. The Group 2 policy was expressed by the regression equation:

$$\hat{Y} = 0.3235875 + 0.0598247x_1 + 0.0217634x_2 + 0.0131688x_3 + 0.0187437x_4$$
$$+ 0.0327079x_5 + 1.2917874x_6 + 0.0065420x_7 - 0.3006875x_8$$
$$- 0.0000686(x_4 - \bar{x}_4)^2 - 0.3474713(x_6 - \bar{x}_6)^2 - 0.0000016(x_7 - \bar{x}_7)^2$$

where all variables are the same as in the previous equation.

Group 1 and Group 2's policies are similar in that stocking, water quality, and available shoreline are the three most important elements for each. There were differences, however, in the relative importance of elements within the two policies. The Group 1 policy had the greatest weight (87%) concentrated on stocking, available shoreline, accessibility of the fishery, and water quality. The Group 2 policy had a slightly more even distribution of relative weights, with 73% of the weight placed on stocking, water quality, available shoreline, and education. Only three elements

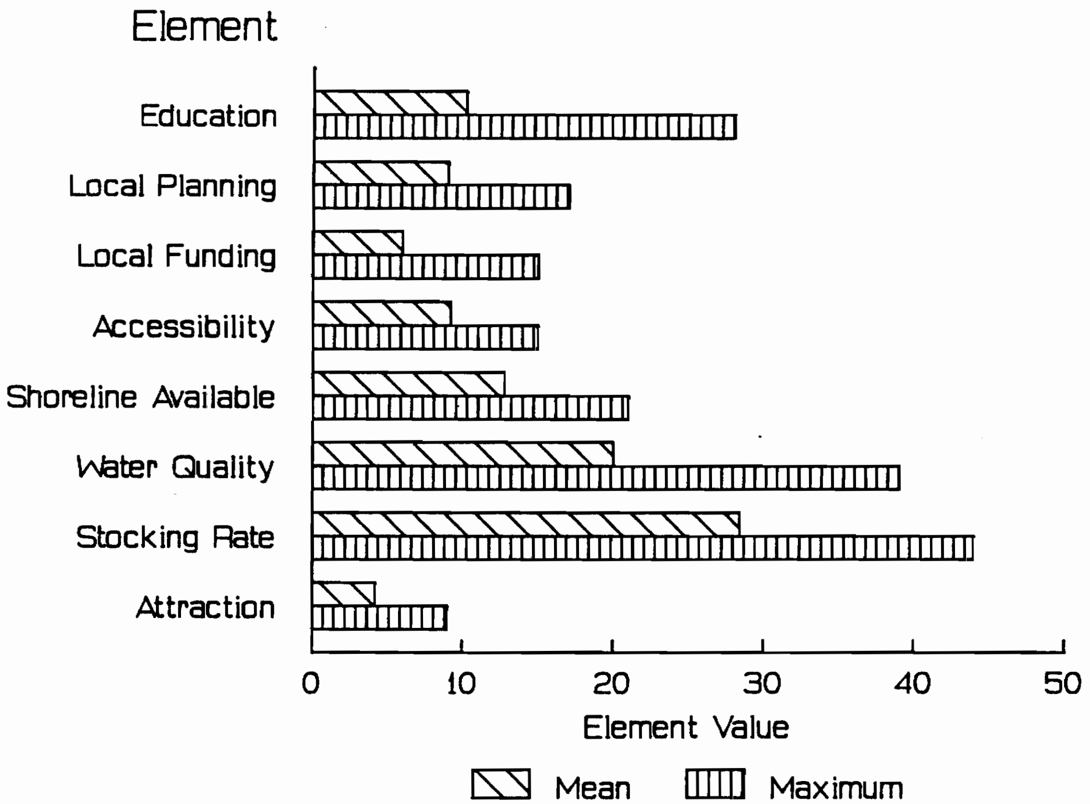

Figure 3. Mean relative weights and maximum relative weights assigned to each element by Group 2 judges.

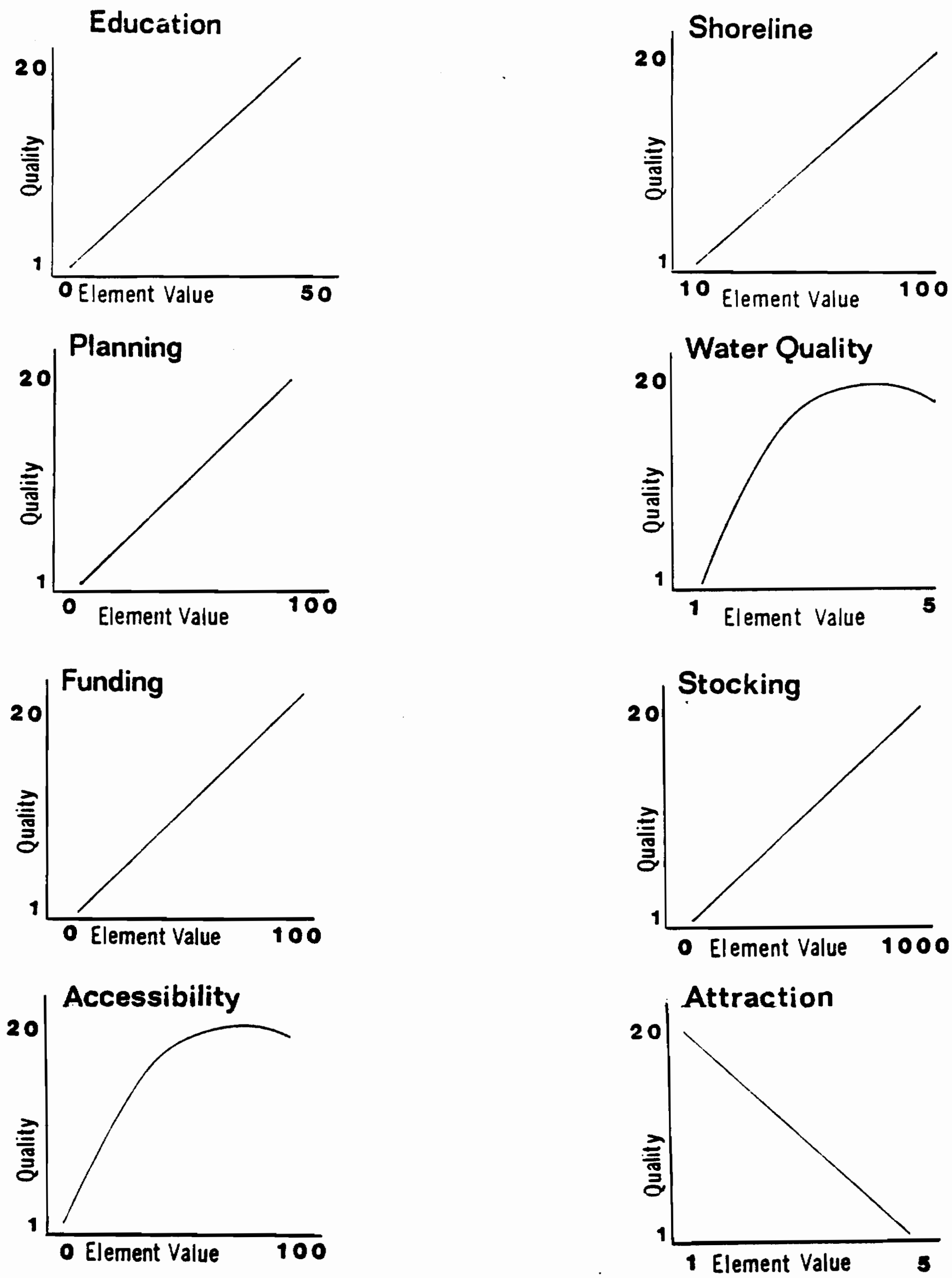

Figure 4. Graphical representations of Group 2 pond judges' decisions.

received 78% of the weighting in the Group 1 policy (stocking, available shoreline, and accessibility of the fishery). The Group 2 policy, however, placed 60% of the weighting on three elements (stocking, water quality, and education or available shoreline). The most substantial differences between Groups 1 and 2 are the differences in the relative importance of stocking, water quality, accessibility of the fishery, and education. The importance of the roles of stocking, accessibility of the fishery, and available shoreline are clearly emphasized in the Group 1 urban pond fisheries policy. The Group 2 policy also includes stocking and available shoreline as important, but with much less emphasis. According to Group 2, water quality became more important, while accessibility of the fishery became less important in the design of urban pond fisheries. Education's role in urban pond fisheries management also increased in Group 2's policy as did local planning. The differences in the range of relative weights indicated a more focused approach to pond fisheries management by Group 1 compared to a broader policy of Group 2.

Waterfront fisheries policy

Twelve urban waterfront fisheries policies were developed with POLICY PC. Judgment scores of all fishery cases were correlated to determine if each pair of judges assigned similar scores to cases. Appendix E.2 is the correlation matrix of judgment scores for waterfront fisheries. Two judges were considered to have the same judgment policy if R exceeded 0.50. The combination of these separate policies resulted in the formation of one group representing six judges. The waterfront group included judges 1, 6, 7, 8, 9, and 12. Two pairs of judges (8,9 and 9,12) did not meet the criterion of $R \geq 0.50$ ($R = 0.48$ and 0.49), but both judges were met the criterion with the other four judges. Therefore, judges 8, 9, and 12 were included in the group.

Judgment scores for the group were calculated by averaging individual scores for all judges in the group for each hypothetical case. The average scores served as the group judgments (as though for a single judge) and were analyzed with POLICY PC. Judgment scores for the waterfront group ranged from 5 to 17 with a mean score of 11.8.

The multiple correlation coefficient ($R = 0.96$) for the six-judge waterfront group indicated that the regression model was an accurate representation of the group policy. Relative weights (Table 15; Figure 5) indicated that available shoreline was most important (18%) to the waterfront group. This was followed by water quality (17%), stocking (14%), accessibility of the fishery (13%), education (11), local funding (9%), fish attraction structures (9%), and local planning (8%). The functional relationships of the waterfront judges' decisions (Figure 6) indicated that for accessibility of the fishery, available shoreline, and water quality, highest quality occurred at the highest point in the range available. The waterfront group policy was expressed by the regression equation

$$\hat{Y} = 3.4669871 + 0.0511918x_1 + 0.0173540x_2 + 0.0194767x_3 + 0.299950x_4 + 0.0457998x_5 + 1.0958662x_6 + 0.00030812x_7 - 0.5335040x_8 - 0.0003515(x_4 - \bar{x}_4)^2 - 0.0000052(x_5 - \bar{x}_5)^2 - 0.37117726(x_6 - \bar{x}_6)^2$$

where,

x_1 is the percentage of the fisheries management program devoted to education and programming,

x_2 is the percentage of local involvement in planning fisheries management strategies,

x_3 is the percentage of local financial support for fisheries management strategies,

x_4 is the percentage of local population that is within walking distance of the fishery or can reach it by public transportation,

x_5 is the percentage of shoreline available to anglers,

x_6 is the water quality suitable to support available species (in marine environments, this represents increasing water quality from 1 to 5),

x_7 is the annual density of catchable-size fish stocked,

x_8 is the shoreline distance between fish attraction structures,

$(x_4 - \bar{x}_4)^2$ is the quadratic term describing the variable x_4,

Table 15. Relative weights* assigned by waterfront judges to the eight elements describing urban waterfront fisheries.

Element	Waterfront Group
Education	11
Local planning	8
Local funding	9
Accessibility of fishery	13
Shoreline available for fishing	18
Water quality	17
Stocking rate	14
Fish attraction structures	9

* Based on 100-point scale

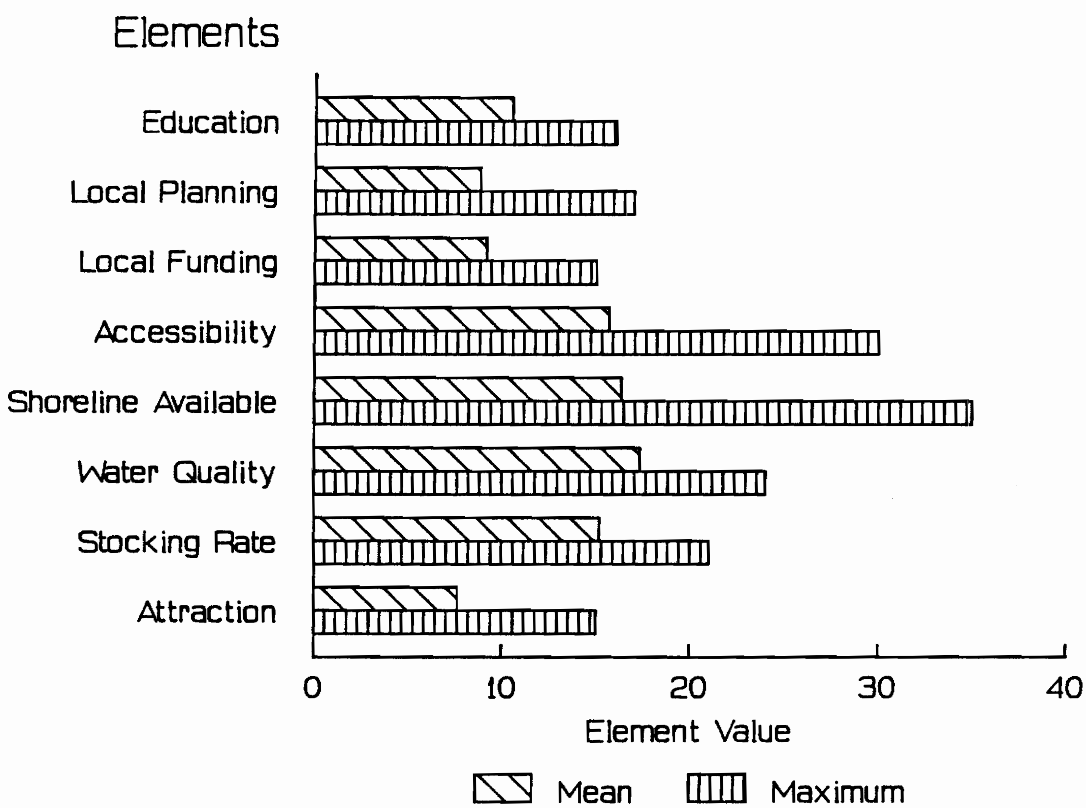

Figure 5. Mean relative weights and maximum relative weights assigned to each element by Group 2 judges.

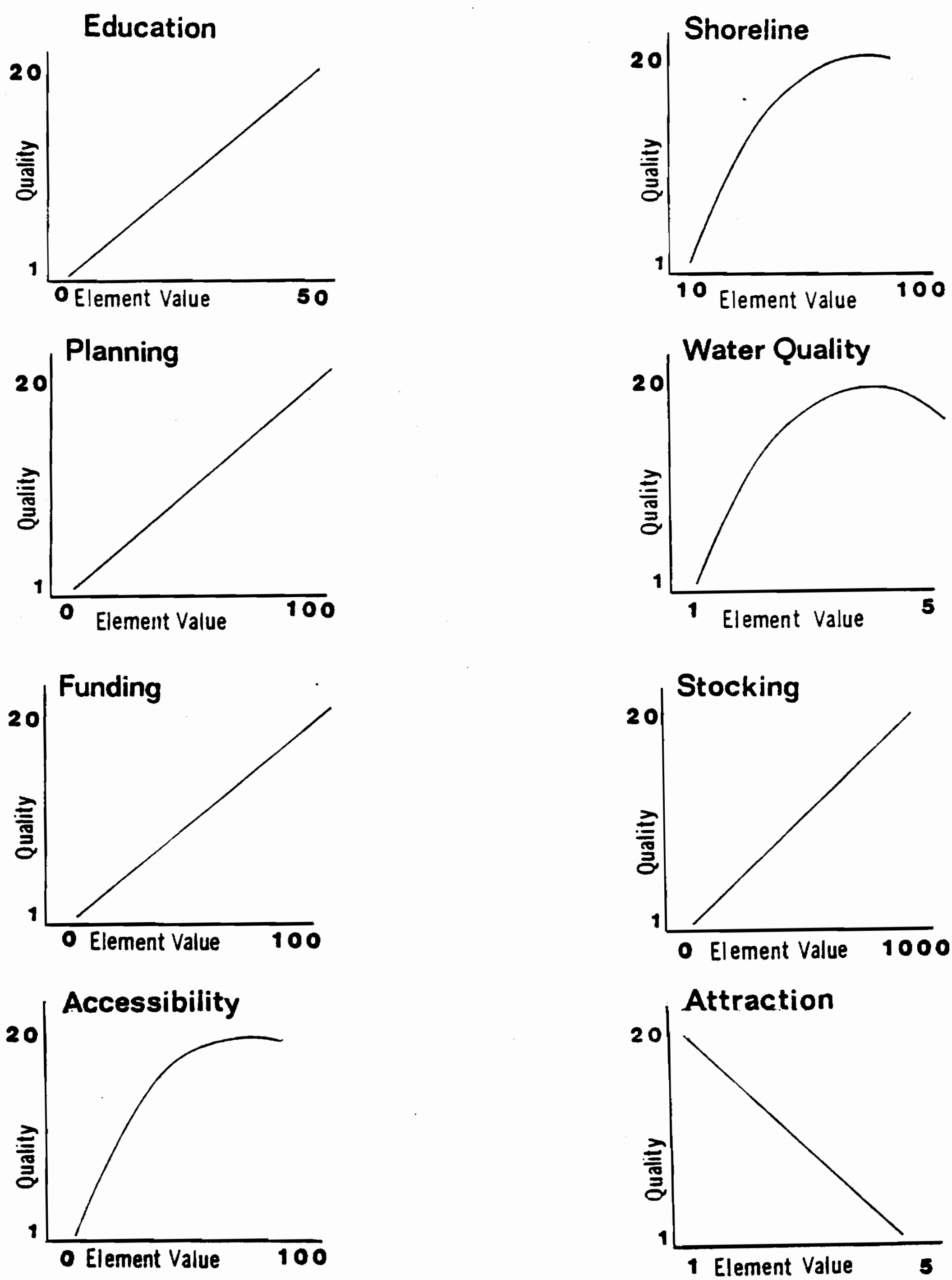

Figure 6. Graphical representations of waterfront judges' decisions.

$(x_5 - \bar{x}_5)^2$ is the quadratic term describing the variable x_5, and

$(x_6 - \bar{x}_6)^2$ is the quadratic term describing the variable x_6.

The waterfront group policy had the greatest weight (62%) concentrated on available shoreline, water quality, stocking, and accessibility of the fishery. Like both pond policy groups, available shoreline, stocking, water quality, and accessibility of the fishery were most important to waterfront managers. However, there was decreased emphasis on any single element. In fact, there was a greater distribution of relative weights among the elements. The five most heavily weighted elements ranged from 11% to 18% of total weight. The Group 2 pond fisheries policy and the waterfront fisheries policy exhibited several similarities. The broader distribution of weights indicated a less intensively focused approach to urban fisheries management. Waterfront managers indicated that all elements are considered more equally in the evaluation of a fishery. The most substantial similarities existed in the importance of education and local planning to both Group 2 and the waterfront group. Education received 13% and 11% of the total weight from Group 2 and the waterfront group, respectively. Local planning received 9% and 8% of the total weight from Group 2 and the waterfront group, respectively.

Application of model to urban ponds

In order to evaluate the utility of the urban pond model, both Group 1 and Group 2 policy models were applied to actual fisheries. Part of the difficulty of evaluating actual fisheries is that quality can be measured in several ways. Whereas, social judgment analysis provides a single, quantitative value reflecting the quality of a hypothetical urban fishery, no such value exists for real situations. Catch rate, which is often part of the measure of success for fisheries and was available for nine small urban impoundments, was used as a surrogate for "quality" in this application. Element values were obtained for these nine fisheries and used to calculate a quality score based on the regression equations. These scores were then compared with the catch rates of actual fisheries. Because the calculated quality scores were based on the values of actual fisheries, a positive relationship should exist between the surrogate measure of fishery quality (catch rate) and the calculated quality scores.

Three state agencies (Missouri, Illinois, and Arizona) and one municipal government (Oklahoma City, OK) supplied values for the eight elements used in this study for nine small urban impoundments (Appendix F). Missouri, Illinois, and Arizona contributed information on two ponds each, while Oklahoma City supplied data on three small impoundments. The impoundments ranged from inner-city park ponds stocked with bullheads to small water supply reservoirs stocked with walleye. Catch rates ranged from 0.28 to 1.8 fish/angler/ hour (Table 16). Because element values were the same for the three Oklahoma City and two Illinois impoundments, average catch rates were calculated. Predicted quality scores ranged from 13 to 15 and 12 to 15 for Group 1 and Group 2, respectively (Table 16).

The narrow ranges of predicted quality scores made the detection of any general trend in the relationship difficult. Generally, though, higher predicted scores were associated with higher catch rates. The Group 2 model predicted a broader range of scores than did the Group 1 model. The Group 2 policy presumably represented a broader approach to urban pond fisheries management. Therefore, the possible range of predicted scores would be expected to reflect this broader perspective of management. These results, although intuitive, indicated that with additional data, the policy models would be useful predictors of the fisheries quality of small urban impoundments.

Table 16. Catch rates (fish/angler/hour), mean catch rates ($\bar{X}$), and predicted quality scores ($\hat{Y}$) for nine small impoundments.

	Catch rate (fish/angler/hour)		$\hat{Y}$	
	Actual	$\bar{X}$	Group 1	Group 2
Illinois				
Pond 1	1.60 \	1.70	15	15
Pond 2	1.80 /			
Oklahoma				
Pond 1	0.80 >			
Pond 2	0.32 >	0.47	13	14
Pond 3	0.28 >			
Missouri				
Pond 1	0.48		15	13
Pond 2	1.20		13	15
Arizona				
Pond 1	0.33		13	12
Pond 2	0.49		14	13

Discussion

Urban fisheries management is a relatively new and unfamiliar area to many managers. Much of what is already known about fisheries management may be applied to urban fisheries, but programs must take into account the ecological and societal differences that exist in urban settings (Jeffries 1984). Water quality, species availability and preferences, and access difficulties are a few of the potential differences that face urban fisheries managers (Duttweiler 1975; Leedy et al. 1981). Though more information is available to managers than ever before, it is rarely in the form of concise statements applicable to new and varied situations. Moreover, knowledge is often implicit. The accumulated experience and wisdom of fisheries managers are not easily accessible. Obtaining part of that knowledge is the primary goal of a group of techniques known as "policy capturing."

Social judgment analysis

Policy capturing, or the analysis of group judgment, was accomplished in this study through social judgment analysis. Urban fisheries managers related their experience and implicit knowledge to hypothetical urban fisheries. These experts made numerical judgments about these fisheries, and the results were used to assess the importance of the elements of the fisheries and to develop generalizations about urban fisheries. The results of this study show that the implicit knowledge of experienced managers can be converted into explicit statements describing the quality of hypothetical urban fisheries. The concept is based fundamentally on sound psychological theory (Hammond et al. 1975; Anderson et al. 1981) and should appeal to fisheries policy-makers.

The advantages of social judgment analysis over other decision analyses include: (1) the imitation of the actual decision process; (2) judge independence; (3) the use of a single method (in this study, multiple regression analysis) to integrate all dimensions of the problem; and (4) the graphic representation of decision rules (Hammond et al. 1975; Rohrbaugh 1979). Decision-making requires the weighting of and integration of several factors. The presentation of the decision problem in the form of hypothetical fishery cases ensured an approximation of an individual's actual judgment process. Individuals performed the judgment task singly, without the constraints of group effort. This permitted decision-making to occur in a less pressured environment (i.e. without confrontation in a group setting). The linear regression model has been applied to a variety of judgment problems (Hammond et al. 1975). Its simplicity and descriptive power have made it an important tool in the study of decision-making (Dawes and Corrigan 1974). Social judgment analysis also provides pictorial representations of decisions. These graphic displays are helpful in analysis and as feedback for judges. In this way, implicit knowledge becomes explicit and available (Hammond et al. 1975).

Many other methods exist to capture group judgment for policy formulation. Some of the most commonly used techniques include conferences, brainstorming, nominal group technique, surveys, and the Delphi method (Adelman and Brown 1979; Hwang and Lin 1987). Conferences and brainstorming are widely used to generate ideas and information at the group level. Reaching decisions, however, requires much group discussion and the decision-making process can be difficult to control (Hwang and Lin 1987). Also, group discussion can prevent full participation by individuals through confrontation and social pressure (Hwang and Lin 1987). Nominal group techniques have been extensively used by organizations for planning purposes (Hwang and Lin 1987). This method permits members of a group to generate ideas independently by writing them down for discussion and voting on the ideas at a later time. Although it allows for independent idea generation, nominal group techniques may exert control over group members (Hwang and Lin 1987). Surveys are one of the most familiar methods of collecting information from groups. Although surveys permit independent decision-making, they often do not present information in a way that is easily integrated to produce value judgments (Adelman and Brown 1987).

Social judgment applications have two very important advantages over these methods of group judgment analysis. First, performing a judgment task alone without the constraints of group interaction permits the judge to weigh and integrate information critically and carefully (Hammond et al. 1975). The presentation of decision problems as hypothetical cases permits a closer approximation of the actual decision process. Also, the resulting judgment is a single value that permits quantitative analysis. Second, pictorial representations of the rules used in decision-making are generated. These diagrams are useful in the analysis of the importance of various elements to the process.

The Delphi method is one of the most widely used decision capturing techniques. It has been employed in policy formation (Rohrbaugh 1979) and has been used in fisheries policy development (Zuboy 1978; Crance 1987). Delphi is designed to obtain the most reliable consensus from a group of experts by a series of questionnaires with controlled feedback (Hwang and Lin 1987). It has been observed that Delphi has been accepted without critical reviews of its principles and methods (Hwang and Lin 1987). Although judges are independent, Gustafson (1973) found no significant differences in the judgments obtained with the nominal group technique and the Delphi method. The advantages of social judgment analysis over the Delphi method are similar to those already described. Particularly important is the way in which the decision problems are presented. The Delphi method requires the formulation of specific questions for three separate questionnaires and analyses. There are two specific advantages to social judgment analysis. First,the questions in

Delphi, as in surveys, may not present the information in a format that permits the access of implicit knowledge. Social judgment analysis presents a decision problem to be weighed and integrated with several pieces of independent information. The hypothetical decision presents the problem in a familiar fashion to judges. This presentation closely approximates actual decision-making. Second, the Delphi method with its iteration of three separate questionnaires and analyses is time consuming (Hwang and Lin 1987). Results from social judgment analysis may be obtained more quickly from a small group. Rohrbaugh (1979), in a comparison of Delphi and social judgment analysis, did not find significant differences in the quality of judgments of the two methods, but did report that the social judgment group reached final consensus more easily than the Delphi group. The use of positive feedback (graphical representations) permitted judges to reduce disagreement in a more efficient manner.

The design of urban fisheries

The results of the content analysis of urban fisheries literature and of the social judgment analysis showed some disparities between the content of the literature and the information obtained from managers. Within the technical literature, education and planning were most frequently mentioned as important aspects of urban fisheries management. Stocking and accessibility of the fishery were cited less often. Managers, through the judgment process, indicated that stocking and accessibility were very important to the success of a fishery. Thus, there appears to be a gap in the design criteria recommended by the technical literature and managers.

Two reasons may exist for this disparity. First, most field managers may perceive urban fisheries programs as providing experiences for the angler once at the fishery rather than as programs seeking also to attract anglers to the fishery. At the local level, managers are apt to feel that it is more important to provide fish (stocking) and fishing opportunities (accessible fisheries) than to plan and implement a broad range of fishing experiences. The limited time and financial resources of managers, particularly those whose responsibilities include more than urban areas, prohibit substantial fisheries programs in urban areas. The authors of the literature, perhaps somewhat removed from day-to-day management activities, may perceive urban fisheries management programs in a broader sense. The program should be organized and implemented with as much local involvement as possible (local planning) and should provide proper instruction and guidance (local education) to users of a developing resource.

The second reason the gap may exist is that the literature reflects new thoughts and ideas about urban fisheries. Because much of "traditional" fisheries management is applicable to urban settings, the literature is reporting the next step for management to follow. Authors are focusing on other elements in the design of urban fisheries programs. Fisheries managers know that stocking and angler access are important and they know how to implement these strategies. The relatively low variability in judges' assessment of the importance of stocking, available shoreline, and accessibility of the fishery indicated general agreement on these elements. The relatively high variability in the importance of education, local planning, and local funding indicated disagreement among managers over the weighting of these elements.

Nevertheless, the differences in the relative importance of fisheries design elements between the technical literature and experienced managers point out that management information needs are not being met by the literature. Therefore, inexperienced urban fisheries managers may not have access to much of the information necessary to plan and implement successful urban fisheries programs. By utilizing the wisdom of experienced managers, useful information becomes available to supplement existing sources. These differences highlight areas where further research and analysis ought to occur in order to bridge this gap.

The implicit knowledge "captured" with social judgment analysis permitted the development of generalizations about urban pond and waterfront fisheries design. Although the literature did not reveal substantial differences in the design elements of urban pond and and waterfront fisheries, managers' judgments did reflect differences in the relative importance of specific elements. Group 1 and Group 2 urban pond managers both emphasized stocking, available shoreline, and accessibility of the fisheries in their judgment policies. The Group 1 policy towards urban pond fisheries is directed at three specific strategies. This was indicated by the particularly heavy weighting attributed to stocking, available shoreline, and accessibility of the fishery. Group 2, while including these elements among the most important factors to consider in urban pond management, placed substantially less importance on any particular element. The Group 2 judgments indicated a policy that was broader in scope than Group 1. More factors were important to Group 2 in its appraisal of fisheries quality. Specifically, water quality, education, and local planning were considered much more important in the Group 2 policy.

Waterfront fisheries managers highlighted water quality and available shoreline but also included education, stocking, local planning, and local funding as important in their judgments. This balanced approach to management is similar to Group 2's policy but with an even broader perspective. The broader distribution of weights in the waterfront fisheries policy could be attributed to the broader perspectives fisheries managers require to effectively manage waterfront fisheries. Urban waterfront fisheries, because of their nature and location, are more variable than urban pond fisheries for several reasons. First, waterfront fisheries are parts of large systems such as rivers, large lakes, or marine environments. Large aquatic ecosystems are difficult to manage because of their size and dynamic nature. Second, urban waterfronts are typically located in the oldest and most heavily developed areas of cities. This greatly restricts angler access and is prohibitive to the planning and development of public access fisheries. Third, again because of their location in industrial centers, water quality along large waterfronts is typically poor. Threats to aquatic life and human health are additional constraints in the development of public access. Because of the variability and restrictions of urban waterfront fisheries, managers need to enhance the overall angling experience when opportunities become available. This is reflected in the relative importance of each element in the urban waterfront fisheries policy.

The differences in the three groups of judgments for ponds and waterfronts are substantial enough to indicate that three levels of management policies for urban fisheries exist. First, a narrowly focused policy for urban ponds is directed at a small number of elements. Specifically, stocking, available shoreline, and accessibility of the fishery are the management criteria considered most important to the design of quality urban pond fisheries. Second, a slightly broader management approach to urban pond fisheries requires attention to those same factors, but with less emphasis to each. Additional elements such as education and water quality require similar consideration. Third, an even broader approach is favored for urban waterfront fisheries management. This policy requires consideration for all elements, with available shoreline and water quality only slightly more important than the remaining elements.

It should be recognized that the waterfront fisheries management policy was developed from one group of six of the thirteen waterfront fisheries experts. Seven judges' scores were not significantly correlated among themselves or with any of the six remaining judges. The fact that more than one-half of the waterfront experts was not included in the waterfront fisheries policy or in separate policies indicates that establishment of a generalized waterfront fisheries policy may not be possible. The lack of agreement among the majority of judges concerning fisheries quality points to the variability of waterfront fisheries. Some of the reasons for this variability were discussed above. Because of the variability, the generalized waterfront fisheries policy described here, should be viewed with caution.

These generalizations can provide useful insight and general general guidelines to an inexperienced urban fisheries manager for the planning and implementation of urban fisheries programs. The purpose of these generalizations is to help bridge the gap between the literature and managers. The generalizations are not meant to replace the technical literature, but to enhance the information already available. Because urban fisheries, and all other fisheries, are variable, these preliminary generalizations should be used by managers as a starting point in the planning process. More information about urban fisheries programs is necessary to improve the general models developed in this study. The results of this study indicated that those areas of low importance and high variability (i.e. disagreement among judges) should be studied closely. Specifically, local funding, planning, and education in urban fisheries programs should be evaluated. These are of importance in the technical literature, but were considered relatively unimportant to expert judges. The roles of these elements in the design of urban fisheries will become more important to managers as demands on urban fisheries resources increase.

The first step in this research could be the refinement of the elements used in this study. Each of the eight urban fisheries elements could be studied individually and described in terms of specific criteria. For example, the results of this study indicated that high stocking rates improved the perceived quality of urban fisheries by managers. Hypothetical urban fisheries cases could be constructed to evaluate the importance of other aspects of stocking, such as size, species, and frequency of stocking. Similarly, education could be presented as classroom instruction or fishing instruction. Each of these refinements in the elements could result in more and detailed information about them and how they are considered in urban fisheries design by experts.

Despite the improvements to the models through element refinement, two problems can be expected in model verification and application. First, developing quality indicators for urban fisheries that are comparable to the quality score system of social judgment analysis is difficult. Several indicators of success are probably employed by managers when evaluating fisheries. Among these could be catch rates, total harvest, angler density, and other measures of angler use or satisfaction. Adjusting these measures for compatibility with the scoring system of social judgment analysis may provide a method to verify results of the models.

Second, the number of actual urban fisheries for which data were available was small. The limited availability of information relating to the elements used in this study made model application difficult. A larger sample of urban fisheries would have increased the probability of obtaining a wider range of element values. Therefore, a wider range of predicted quality scores could be used to compare with measures of fisheries success. The collection of more data on urban fisheries and the refinement of elements will improve the verification process.

Further application of social judgment analysis

Social judgment analysis could be applied to particular management problems in conjunction with other methods of problem evaluation. There are two general areas of fisheries policy matters where social judgment analysis may be applied. First, social judgment analysis could be used to enhance results of problem evaluations by field managers. These are often problems that involve the assessment of the knowledge of individuals. The Delphi technique has been used to assess expert opinion regarding harvest regulations for spiny lobster in Florida (Zuboy 1981) and to develop habitat suitability curves for paddlefish (Crance 1987b). Social judgment analysis may be used to enhance the results of Delphi inquiries. The information gained from Delphi could be used to develop hypothetical cases in which individuals would be asked to make judgments about the quality of a particular situation. The process provides, then, an indication of quality and develops functional relationships between perceived quality and the elements of the problem. Social judgment analysis would supply additional information about the decision-making process, especially about the relative importance of each element in decision-making.

Second, social judgment analysis could be used to assess angler preferences. Anglers asked to judge hypothetical fisheries could offer insightful and useful views on fisheries management practices that otherwise would be difficult to measure with angler questionnaire surveys alone. The results of these judgment analyses would provide managers with a focus for resolving misunderstandings by the public of management practices. Also, managers could implement strategies in those areas of importance to anglers, thus improving the angling experience.

Social judgment analysis may not be suitable for problems that do not require judgments about quality or lack the complexity of many management decisions. It is best suited for those problems where most of the knowledge is implicit. If guidelines and criteria have been established for a decision-making process, then the approach to problem solving is facilitated. Social judgment analysis provides a mechanism to capture the important elements of a problem where explicit guidelines for solution are not readily available.

Suggestions for further research

The process of selecting important factors to be used in judgment analysis is the most difficult and subjective step in the study of group judgment. This study utilized the available technical literature on urban fisheries management. However, this relatively new area of management practices made it difficult to determine specific elements in the problem of urban fisheries design. More research of existing urban fisheries and the programs that guide their management are required to fill gaps in the existing literature. Angler, creel, and biological surveys of existing and developing urban fisheries will be useful in assessing the preferences, satisfaction, and success of urban anglers as well as determine the biological implications of fishing pressure and regulations. Additional, specific information concerning urban fisheries will provide a broader knowledge base for these fisheries and facilitate element selection.

Social judgment analysis may also provide important information concerning the urban angler's perceptions of fisheries management practices. It would be extremely useful for managers to gauge the public's views regarding a fishery, especially a fishery where management strategies are applied for the first time. The analysis of urban anglers' judgments would help managers design an urban fisheries management program that includes the users' perceptions of a quality fishery.

In addition, standard methods or guidelines for the selection of elements in social judgment studies are suggested. These procedures would improve the applicability of social judgment analysis over a wide range of management policy problems. Future research into acquiring important information from the technical literature will be important to continued social judgment research.

It will be important to future fisheries managers to compare predicted quality scores with measures of fisheries quality. More information about the assessment of quality for fisheries programs is suggested and the development of standard measures for fisheries program quality such as quality indices, is encouraged. More research is required to better understand the predictive ability of models developed with social judgment analysis. Further applications of social judgment models should provide better indications of predictive capabilities. Social judgment analysis should play a role in the development of expert systems for fisheries management. The ability of these models to predict changes in quality as variables change will be useful to fisheries managers as a planning tool.

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Appendices

Appendix A.1. Cover letter to agency chiefs.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

SCHOOL OF FORESTRY AND WILDLIFE RESOURCES—DEPARTMENT OF FISHERIES AND WILDLIFE SCIENCES

October 15, 1986

Robert Hanten
South Dakota Game
Fish & Parks Dept.
445 East Capitol
Pierre, SD 57501-3185

Dear Mr. Hanten:

We are beginning a new development project entitled "Designing Successful Urban Fishing Programs." The project, funded by the Sport Fishery Research Foundation, will involve generating useable generalizations to guide the planning and implementation of urban fishing programs. These generalizations will be based on the existing knowledge and experience of experts in order to optimize benefits from the two major types of urban fisheries—small impoundments and long waterfronts on large waters.

We will produce these generalizations using a technique called social judgment analysis, which converts the experience of urban fishery managers into explicit quantified statements that can be applied nationwide. The technique requires about two hours of work by 20-30 individual managers, each judging the "quality" of a series of hypothetical urban fisheries.

To start the project, we are contacting the fisheries management administrator in each state to identify, if appropriate, the urban fisheries "expert(s)" in his agency who might be willing to participate. If you would like to contribute your agency's expertise, please identify the urban fisheries specialist(s) or the fisheries manager(s) on your staff most familiar with urban fishing on the self-addressed, stamped post card and return it to me. If you know of other people whom we should contact outside the agency, please include their names also.

Bret Preston, graduate student on the project, and I are very excited about social judgment analysis as a way to capture the wisdom of experienced professionals and transfer it to novice managers. We hope you also see the great potential of this approach and are willing to participate.

Thanks again for your help and cooperation. If you would like more information, please call me at 703-961-6959.

Sincerely,

Larry A. Nielsen
Associate Professor and Acting Head

Appendix A.2. Return post card from agency chiefs.

The urban fisheries experts in

________________ are:

Name____________________________

Address__________________________

____

____

Name____________________________

Address__________________________

____

____

Name____________________________

Address__________________________

____

____

____ No urban fisheries program

Appendix A.3. Cover letter sent to managers identified from agency chiefs and literature.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

SCHOOL OF FORESTRY AND WILDLIFE RESOURCES—DEPARTMENT OF FISHERIES AND WILDLIFE SCIENCES

We are beginning a new development project entitled "Designing Successful Urban Fishery Programs." The project, funded by the Sport Fishery Research Foundation, will involve generating useable generalizations to guide the planning and implementation of urban fishing programs. These generalizations will be based on the existing knowledge and experience of experts in order to optimize benefits from two major types of urban fisheries--small impoundments and long waterfronts.

We will produce these generalizations using a technique called social judgment analysis, which converts the experience of urban fishery managers into explicit quantified statements that can be applied nationwide. The technique requires about two hours of work by 20-30 individuals, each judging the "quality" of a series of hypothetical urban fisheries.

To start the project, we are contacting those persons who have had experience in urban fisheries development and management. If you would like to contribute your expertise or know those who may be experienced in urban fisheries, please complete the self-addressed, stamped post card and return it to me.

Bret Preston, graduate student on the project, and I are very excited about social judgment analysis as a way to capture the wisdom of experienced professionals and transfer it to novice managers. We hope you also see the great potential of this approach and are willing to participate.

Thanks again for your help and cooperation. If you would like more information, please call me at 703-961-6959.

Sincerely,

Larry A. Nielsen
Associate Professor and Acting Head

/cwl

enclosure

Appendix A.4. Return post card from managers.

Name________________________________

Address_____________________________

____

____

Phone_______________________________

Number of years working with urban fisheries on:

small impoundments_______

natural waterfronts_______

Please check the urban fisheries activities in which you spend a substantial portion of your time:

____ Statewide planning
____ Local (district) planning
____ Data analysis/Report writing
____ Biological sampling
____ Habitat sampling
____ Angler/Creel surveys
____ Stocking
____ Habitat improvement
____ Access improvement
____ Public education

Thank you!

Appendix A.5. Cover letter sent to managers participating in pre-test element evaluation for urban pond fisheries.

VIRGINIA TECH
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Department of Fisheries and Wildlife Sciences
Blacksburg, Virginia 24061

May 15, 1987

Mark Ambler
Oklahoma Dept. of Wildlife Conservation
Rt. #1, Box 75-B
Porter, OK 74454

Dear Mr. Ambler:

Congratulations! (Nervous already, aren't you?) We hope you remember our study of urban fisheries design and that you are pleased with the the directory we sent recently. As an urban fisheries specialist identified through our survey, you have been selected as one of the 28 most experienced urban fisheries specialists. This group of 28 people will be the "experts" who will judge various hypothetical fisheries in the social judgment process. We hope that you are willing to be a participant (if not, you can tell us when we call next week).

To begin this part of the study, we have randomly chosen eight individuals, two from each AFS division, to participate in the "pre-test" of the judgment process. You are also one of those lucky eight. The pre-test has two parts -- first, to evaluate our selection of "elements" to describe hypothetical fisheries and, second, to run through the judgment process.

We would like you to review our selected elements for ponds and their ranges of values as described on the attached page. These were selected based on reviews of the literature. Each of these could be used in the description of hypothetical urban fishery situations.

For example, an hypothetical fishery could be described as follows:

40% of local program devoted to education
70% of program planned locally
30% of program funded locally
10% of local households without cars
80% of shoreline accessible by anglers
water quality suitable for warmwater species all year
stocking rate of 300 lbs/acre of catchable-size fish
50 yards of shoreline between fish attraction structures

Based on this description, you (as a judge) would assign a score reflecting the quality of this fishery.

We would like you, the expert, to tell us if these elements and their ranges adequately describe important components of urban fisheries. We are interested in your reactions to the elements and/or ranges and in their definitions. Within a week after you receive this information we will contact you by telephone to receive your comments and recommendations.

Please feel free to contact us if you have any questions.

Larry A. Nielsen (703) 961-6959
Bret Preston (703) 961-5320

Thank you for your time and consideration.

Sincerely,

Larry A. Nielsen
Associate Professor

Bret Preston
Graduate Research Assistant

Appendix A.6. Cover letter sent to managers participating in pre-test element evaluation for urban waterfront fisheries.

VIRGINIA TECH
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Department of Fisheries and Wildlife Sciences
Blacksburg, Virginia 24061

May 15, 1987

Clement J. Walton
State of Maine Marine Resources Laboratory
West Boothbay Harbor
Maine 04575

Dear Mr. Walton:

Congratulations! (Nervous already, aren't you?) We hope you remember our study of urban fisheries design and that you are pleased with the the directory we sent recently. As an urban fisheries specialist identified through our survey, you have been selected as one of the 28 most experienced urban fisheries specialists. This group of 28 people will be the "experts" who will judge various hypothetical fisheries in the social judgment process. We hope that you are willing to be a participant (if not, you can tell us when we call next week).

To begin this part of the study, we have randomly chosen eight individuals, two from each AFS division, to participate in the "pre-test" of the judgment process. You are also one of those lucky eight. The pre-test has two parts -- first, to evaluate our selection of "elements" to describe hypothetical fisheries and, second, to run through the judgment process.

We would like you to review our selected elements for waterfronts and their ranges of values as described on the attached page. These were selected based on reviews of the literature. Each of these could be used in the description of hypothetical urban fishery situations.

For example, an hypothetical fishery could be described as follows:

40% of local program devoted to education
70% of program planned locally
30% of program funded locally
10% of local households without cars
80% of shoreline accessible by anglers
water quality suitable for warmwater species all year
stocking rate of 300 lbs/acre of catchable-size fish
50 yards of shoreline between fish attraction structures

Based on this description, you (as a judge) would assign a score reflecting the quality of this fishery.

We would like you, the expert, to tell us if these elements and their ranges adequately describe important components of urban fisheries. We are interested in your reactions to the elements and/or ranges and in their definitions. Within a week after you receive this information we will contact you by telephone to receive your comments and recommendations.

Please feel free to contact us if you have any questions.

Larry A. Nielsen (703) 961-6959
Bret Preston (703) 961-5320

Thank you for your time and consideration.

Sincerely,

Larry A. Nielsen
Associate Professor

Bret Preston
Graduate Research Assistant

Appendix A.7. List of elements for pre-test evaluation.

Element	Descriptor	Range
Education	Percentage of local fisheries management program devoted to education. Includes programming, materials, classes, and presentations.	0-100%
Local planning	Percentage of local involvement in planning fisheries management strategies. Includes municipal or county involvement.	0-100%
Local funding	Percentage of local financial support for fisheries management program.	0-100%
Accessibility of the fishery	Percentage of local households without cars.	0-100%
Water quality	Water quality suitable to support available species.	(1)rough fish-all year (2)warmwater fish-part of year (3)warmwater fish-all year (4)coldwater fish-part of year (5)coldwater fish-all year
Shoreline available for fishing	Percentage of shoreline accessible to anglers	0-100%
Stocking rate	Annual density of catchable-size fish stocked	0-1000 lbs./acre
Habitat management	Shoreline distance between fish attraction structures	(1) 25 yards (2) 50 yards (3) 100 yards (4) 200 yards (5) 400 yards

Appendix A.8. Cover letter to urban pond pre-test judges.

VIRGINIA TECH

Department of Fisheries and Wildlife Sciences
Blacksburg, Virginia 24061

June 9, 1987

Ronald D. Mayo
The Mayo Associates
204-108 S. Washington
Seattle, WA 98104

Dear Mr. Mayo:

Thank you for your help and participation thus far in our urban fisheries project. Based on our conversations, we have made some changes in our urban fisheries elements. Your suggestions have proved to be very helpful. We hope these changes will also assist you in this next step. Yes, now you may exercise your judgment in the social judgment process.

We would like you, as a judge, to review a series of 40 hypothetical urban ponds and assign a quality score to each fishery. The scores may range from one, lowest quality, to twenty, highest quality. In order to make a judgment about the quality of these fisheries, we are asking you to use your knowledge and experience as well as the information provided. Thus, it is very important to use the knowledge accumulated from the urban fisheries you know best when assigning a quality score.

General characteristics of the fishery and a list of the elements used to describe each hypothetical fishery are described on the accompanying page. This information combined with your experience should allow you to make a judgment about the quality of each hypothetical fishery case. Specific instructions for performing the judgments are also enclosed. There are 40 fishery cases to examine. We anticipate the task will require about one hour to complete. After you complete the exercise, please return the cards in the self-addressed, stamped envelope. We would appreciate your return of the completed judgments by June 25.

Thank you very much for your time and participation in our project. We will let you know the results as soon as possible. If you have any questions, please feel free to contact us.

Larry A. Nielsen (703) 961-6959
Bret A. Preston (703) 961-5320

Sincerely,

Larry A. Nielsen
Associate Professor

Bret A. Preston
Graduate Research Assistant

Virginia Polytechnic Institute and State University

Appendix A.9. Cover letter to urban waterfront pre-test judges.

VIRGINIA TECH

Department of Fisheries and Wildlife Sciences
Blacksburg, Virginia 24061

June 9, 1987

Stephen J. Crooke
California Dept. of Fish and Wildlife
245 W. Broadway, Suite 350
Long Beach, CA 90802

Dear Mr. Crooke:

Thank you for your help and participation thus far in our urban fisheries project. Based on our conversations, we have made some changes in our urban fisheries elements. Your suggestions have proved to be very helpful. We hope these changes will also assist you in this next step. Yes, now you may exercise your judgment in the social judgment process.

We would like you, as a judge, to review a series of 40 hypothetical urban waterfronts and assign a quality score to each fishery. The scores may range from one, lowest quality, to twenty, highest quality. In order to make a judgment about the quality of these fisheries, we are asking you to use your knowledge and experience as well as the information provided. Thus, it is very important to use the knowledge accumulated from the urban fisheries you know best when assigning a quality score.

General characteristics of the fishery and a list of the elements used to describe each hypothetical fishery are described on the accompanying page. This information combined with your experience should allow you to make a judgment about the quality of each hypothetical fishery case. Specific instructions for performing the judgments are also enclosed. There are 40 fishery cases to examine. We anticipate the task will require about one hour to complete. After you complete the exercise, please return the cards in the self-addressed, stamped envelope. We would appreciate your return of the completed judgments by June 25.

Thank you very much for your time and participation in our project. We will let you know the results as soon as possible. If you have any questions, please feel free to contact us.

Larry A. Nielsen (703) 961-6959
Bret A. Preston (703) 961-5320

Sincerely,

Larry A. Nielsen
Associate Professor

Bret A. Preston
Graduate Research Assistant

Appendix A.10. Description and elements of pond fishery.

Common Characteristics of Small Impoundment Fishery

The fishery you are to judge has the following characteristics: a small lake or impoundment, less than 50 acres in surface area, located within an urban area with a population greater than 50,000 persons; all fish caught meet minimum federal standards for safe human consumption; angler use is approximately 5 anglers/acre/day (2000 trips/acre/year).

Elements Used to Describe Urban Fisheries

Education

Percentage of the local fisheries management program devoted to education and programming. Education includes developing programs, creating materials, and conducting classes or presentations. Range 0 - 50%

Local Planning

Percentage of local involvement in planning fisheries management strategies. Local planning includes municipal or county involvement, as different from state agency involvement. Range 0 - 100%

Local Funding

Percentage of local financial support for fisheries management program. Local funding includes municipal, county, or private funding as different from state agency funding. Range 0 - 100%

Accessibility of the Fishery

Percentage of population that is within walking distance of the fishery or can reach it by public transportation. Range 0 - 100%

Shoreline Available For Fishing

Percentage of shoreline accessible to anglers. This refers to land where fishing is possible and is permitted without restriction by the landowner. Range 10 - 100%

Overall Water Quality

Water quality suitable to support available species. Rather than isolate individual water quality criteria, this represents conditions in terms of the fish community present.

Range: *
- (1) suitable for rough fish - all year
- (2) suitable for warmwater species - part of year
- (3) suitable for warmwater species - all year
- (4) suitable for coldwater species - part of year
- (5) suitable for coldwater species - all year

* For marine environments this range represents increasing water quality from 1 - 5.

Stocking Rate

Annual density of catchable-size fish stocked. This refers to the cumulative total, regardless of stocking frequency. Range 0 - 1000 lbs/acre

Fish Attraction Structures

Shoreline distance between fish attraction structures. Assume that these are within casting distance of a shoreline angler.

Range:
- (1) 25 yards
- (2) 50 yards
- (3) 100 yards
- (4) 200 yards
- (5) 400 yards

Appendix A.11. Description and elements of waterfront fishery.

Common Characteristics of Waterfront Fishery

The fishery you are to judge has the following characteristics: an extensive natural waterfront along a large river, large lake, or marine coast, located within an urban area with a population greater than 50,000 persons; all fish caught meet minimum federal standards for safe human consumption.

Elements Used to Describe Urban Fisheries

Education

Percentage of the local fisheries management program devoted to education and programming. Education includes developing programs, creating materials, and conducting classes or presentations. Range 0 - 50%

Local Planning

Percentage of local involvement in planning fisheries management strategies. Local planning includes municipal or county involvement, as different from state agency involvement. Range 0 - 100%

Local Funding

Percentage of local financial support for fisheries management program. Local funding includes municipal, county, or private funding as different from state agency funding. Range 0 - 100%

Accessibility of the Fishery

Percentage of population that is within walking distance of the fishery or can reach it by public transportation. Range 0 - 100%

Shoreline Available For Fishing

Percentage of shoreline accessible to anglers. This refers to land where fishing is possible and is permitted without restriction by the landowner. Range 10 - 100%

Overall Water Quality

Water quality suitable to support available species. Rather than isolate individual water quality criteria, this represents conditions in terms of the fish community present.

Range: *
- (1) suitable for rough fish - all year
- (2) suitable for warmwater species - part of year
- (3) suitable for warmwater species - all year
- (4) suitable for coldwater species - part of year
- (5) suitable for coldwater species - all year

* For marine environments this range represents increasing water quality from 1 - 5.

Stocking Rate

Annual density of catchable-size fish stocked. This refers to the cumulative total, regardless of stocking frequency. Range 0 - 1000 lbs/acre

Fish Attraction Structures

Shoreline distance between fish attraction structures. Assume that these are within casting distance of a shoreline angler.

Range:
- (1) 25 yards
- (2) 50 yards
- (3) 100 yards
- (4) 200 yards
- (5) 400 yards

Appendix A.12. Hypothetical fishery case.

CASE 4

Education	0%
Local Planning	60%
Local Funding	10%
Accessibility of the Fishery	60%
Shoreline Available for Fishing	30%
Overall Water Quality	Warmwater species-part of year
Stocking Rate	900 lbs/acre
Fish Attraction Structures	25 yards

SCORE:_____

Appendix A.13. Cover letter to urban pond experts.

VIRGINIA TECH
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Department of Fisheries and Wildlife Sciences
Blacksburg, Virginia 24061

July 9, 1987

Ben D. Jaco
TVA
130 Summer Place Building
Knoxville, TN 37902

Dear Mr. Jaco:

Congratulations! As an urban fisheries specialist identified through our survey, you have been selected as one of the 28 most experienced urban fisheries specialists. We hope that you have found the Directory of Urban Fisheries Specialists, the first output of the project, useful and that you are still willing to participate in the study. This group of 28 persons will serve as judges for the social judgment process, the major part of the study.

Social judgment analysis is a technique that helps make wisdom and experience explicit. This kind of information could be very useful to inexperienced managers. That is why you, the expert, are invaluable. We would like to capture your experience and make it available to those who may be able to use it. By expanding the knowledge base, you will be helping to improve urban fisheries management decisions nationwide.

We would like you, as a judge, to review a series of 40 hypothetical urban ponds and assign a quality score to each fishery. The scores may range from one, lowest quality, to twenty, highest quality. In order to make a judgment about the quality of these fisheries, we are asking you to use your knowledge and experience as well as the information provided. Thus, it is very important to use the knowledge accumulated from the urban fisheries you know best when assigning a quality score.

General characteristics of the fishery and a list of the elements used to describe each hypothetical fishery are described on the accompanying page. This information combined with your experience should allow you to make a judgment about the quality of each hypothetical fishery case. Specific instructions for performing the judgments are also enclosed. There are 40 fishery cases to examine. We anticipate the task will require about one hour to complete. After you complete the exercise, please return the cards in the self-addressed, stamped envelope. We would appreciate your return of the completed judgments by July 23.

Thank you very much for your time and participation in our project. We will let you know the results as soon as possible. If you have any questions, please feel free to contact us.

Larry A. Nielsen (703) 961-6959
Bret A. Preston (703) 961-5320

Sincerely,

Larry A. Nielsen
Associate Professor

Bret Preston
Graduate Research Assistant

Appendix A.14. Cover letter to urban waterfront experts.

VIRGINIA TECH
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Department of Fisheries and Wildlife Sciences
Blacksburg, Virginia 24061

July 9, 1987

C. Blake Weirich
Pennsylvania Fish Commission
Rt. 2, Box 39
Somerset, PA 15501

Dear Mr. Weirich:

Congratulations! As an urban fisheries specialist identified through our survey, you have been selected as one of the 28 most experienced urban fisheries specialists. We hope that you have found the Directory of Urban Fisheries Specialists, the first output of the project, useful and that you are still willing to participate in the study. This group of 28 persons will serve as judges for the social judgment process, the major part of the study.

Social judgment analysis is a technique that helps make wisdom and experience explicit. This kind of information could be very useful to inexperienced managers. That is why you, the expert, are invaluable. We would like to capture your experience and make it available to those who may be able to use it. By expanding the knowledge base, you will be helping to improve urban fisheries management decisions nationwide.

We would like you, as a judge, to review a series of 40 hypothetical urban waterfronts and assign a quality score to each fishery. The scores may range from one, lowest quality, to twenty, highest quality. In order to make a judgment about the quality of these fisheries, we are asking you to use your knowledge and experience as well as the information provided. Thus, it is very important to use the knowledge accumulated from the urban fisheries you know best when assigning a quality score.

General characteristics of the fishery and a list of the elements used to describe each hypothetical fishery are described on the accompanying page. This information combined with your experience should allow you to make a judgment about the quality of each hypothetical fishery case. Specific instructions for performing the judgments are also enclosed. There are 40 fishery cases to examine. We anticipate the task will require about one hour to complete. After you complete the exercise, please return the cards in the self-addressed, stamped envelope. We would appreciate your return of the completed judgments by July 23.

Thank you very much for your time and participation in our project. We will let you know the results as soon as possible. If you have any questions, please feel free to contact us.

Larry A. Nielsen (703) 961-6959
Bret A. Preston (703) 961-5320

Sincerely,

Larry A. Nielsen
Associate Professor

Bret Preston
Graduate Research Assistant

Appendix A.15. Instructions for judgment.

INSTRUCTIONS FOR JUDGMENT PROCESS

1. Select a one-hour time block within the next two weeks (if possible) to complete the process. (If you are doing both ponds and waterfronts, select two one-hour time blocks rather than a continuous two-hour period.)
2. Review the attached sheet, Characteristics and Elements, which describes the general characteristics of the fishery and the elements which will vary for each fishery.
3. Examine fishery case 1. Then assign a score from one, lowest quality, to twenty, highest quality. Then, review fishery case 2 and assign a score. Continue reviewing and assigning scores until you have finished all 40 cases. Remember to use your professional experience as well as the information provided when making your judgments.
4. After assigning scores to all 40 cases you may review your judgments and make any changes in scores. Again, start with case 1 and continue sequentially through to the end.
5. If you have any questions, please call (collect, if you wish) Larry Nielsen or Bret Preston at (703) 961-6959.
6. Return judgments in the self-addressed, stamped envelopes.
7. Thank you for your participation.

Appendix B. Literature reviewed for content analysis.

Alcorn, S.R. 1981. Fishing quality in two urban fishing lakes, St. Louis, Missouri. N. Am. J. Fish. Manage. 1:80-84.

Allen, G.H. 1984. Arcata urban sports fisheries: a case history. Pages 208-243 *in* L.J. Allen, ed. Proc. Urban Fishing Symposium. American Fisheries Society, Bethesda, Maryland.

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Breen, A.E. 1984. Urban fishing and waterfront development. Pages 98-102 *in* L.J. Allen, ed. Proc. Urban Fishing Symposium. American Fisheries Society, Bethesda, Maryland.

Brown, T.L. 1984. Special problems in evaluating urban fishing programs. Pages 151-155 *in* L.J. Allen, ed. Proc. Urban Fishing Symposium. American Fishieries Society, Bethesda, Maryland.

Buckley, R.M. 1982. Marine habitat enhancement and urban recreational fishing in Washington. Mar. Fish. Rev. 44(6-7):28-37.

Buckley, R.M. 1984. Urban fisheries in marine waters. Pages 132- 140 *in* L.J. Allen, ed. Proc. Urban Fishing Symposium. American Fisheries Society, Bethesda, Maryland.

Carl, L.M. 1982. Social impacts of a stream reclamation project on urban anglers. N. Am. J. Fish. Manage. 2:164-170.

Deans, D.L. 1984. It's our turn. Pages 244-249 *in* L.J. Allen, ed. Proc. Urban Fishing Symposium. American Fisheries Society, Bethesda, Maryland.

DesJardine, R.L. 1984. Fish stocking, an aspect of urban fisheries management. Pages 118-131 *in* L.J. Allen, ed. Proc. Urban Fishing Symposium. American Fisheries Society, Bethesda, Maryland.

Ditton, R.B. and A.J. Fedler. 1984. Towards an understanding of experience preferences of urban anglers. Pages 55-63 *in* L.J. Allen, ed. Proc. Urban Fishing Symposium. American Fisheries Society, Bethesda, Maryland.

Duttweiler, M.W. 1984. Training needs of urban fishing planning and management personnel. Pages 67-70 *in* L.J. Allen, ed. Proc. Urban Fishing Symposium. American Fisheries Society, Bethesda, Maryland.

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Appendix C.1. Values of 40 hypothetical fishery cases judged by experts.

	Element							
Case	Education (%)	Local Planning (%)	Local Funding (%)	Accessibility of the fishery (%)	Available Shoreline (%)	Water Quality*	Stocking Rate (lbs/acre)	Fish Attraction Structures**
1	20	10	10	20	10	1	600	4
2	50	30	0	100	100	2	600	5
3	50	80	10	20	70	5	1000	5
4	0	60	10	60	30	2	900	1
5	50	20	90	10	40	5	600	1
6	20	50	40	60	90	3	700	2
7	30	80	40	0	60	4	600	2
8	50	40	80	20	20	2	900	2
9	300	80	50	30	20	3	200	2
10	30	100	30	0	40	2	300	5
11	30	0	90	70	30	1	100	1
12	50	0	40	80	40	3	400	5
13	30	60	50	90	10	5	100	3
14	20	70	90	60	100	1	400	4
15	40	70	70	20	30	5	400	1
16	0	20	50	50	50	3	200	5
17	50	70	0	100	70	4	200	4
18	50	40	50	20	30	1	800	5
19	20	40	20	90	30	1	200	3
20	20	100	20	50	100	2	200	5
21	30	90	40	80	40	2	200	2
22	10	10	40	30	70	1	0	3
23	30	30	80	90	70	3	400	2
24	10	10	90	100	40	4	0	3
25	40	10	100	40	80	1	1000	5
26	20	80	90	100	80	1	100	5
27	30	100	30	0	40	2	300	5
28	10	70	80	0	30	5	500	2
29	10	30	90	0	40	3	100	3
30	10	10	20	20	10	4	700	1
31	30	50	60	90	10	5	100	3
32	30	50	10	90	20	3	400	1
33	10	40	50	90	80	5	600	3
34	0	20	70	30	20	1	700	2
35	10	50	20	90	60	1	500	3
36	10	40	30	50	60	4	600	2
37	40	10	10	0	50	3	100	4
38	40	100	60	40	50	1	800	4
39	0	80	50	50	100	2	600	1
40	10	40	50	30	10	5	800	5

*Numbers 1-5 indicate that water quality suitable to support:
(1) rough fish - all year
(2) warmwater species - part of year
(3) warmwater species - all year
(4) coldwater species - part of year
(5) coldwater species - all year

**Numbers 1-5 indicate the shoreline distance between structures is:
(1) 25 yards
(2) 50 yards
(3) 100 yards
(4) 200 yards
(5) 400 yards

Appendix C.2. Judgment scores of pre-test judges.

	Pond judges				Waterfront judges			
Case	1	2	3	4	1	2	3	4
1	6	3	5	7	12	4	3	6
2	12	19	9	3	15	5	17	9
3	12	18	11	5	20	1	14	12
4	11	13	12	12	18	1	11	9
5	15	12	15	8	12	3	10	16
6	17	17	15	20	16	2	17	14
7	12	14	10	12	14	3	10	13
8	11	11	12	6	16	1	5	11
9	10	8	8	15	15	10	6	8
10	7	10	7	2	11	9	4	7
11	8	8	5	14	12	14	10	6
12	11	15	10	10	16	8	10	10
13	11	5	8	17	16	16	6	13
14	13	16	10	11	14	8	12	11
15	13	13	12	13	16	6	9	15
16	10	12	9	8	17	13	8	8
17	12	16	8	3	19	13	17	14
18	10	13	7	11	14	1	4	10
19	9	10	5	10	14	11	10	10
20	9	13	12	1	16	14	11	12
21	12	11	13	16	15	12	12	18
22	6	4	3	5	13	19	8	8
23	15	17	16	19	17	7	14	15
24	10	9	10	7	14	20	10	13
25	11	20	12	9	16	1	9	10
26	11	11	11	13	13	18	14	8
27	8	8	10	2	12	9	5	11
28	13	10	14	9	14	5	7	13
29	9	8	12	4	13	15	4	12
30	8	7	13	4	15	1	7	14
31	12	6	10	17	14	16	5	14
32	11	8	12	20	16	7	5	13
33	18	20	12	19	19	5	16	18
34	8	15	11	10	14	1	5	10
35	11	14	9	18	15	6	13	11
36	16	18	11	15	17	3	14	18
37	6	10	8	1	12	17	4	10
38	10	15	12	16	16	1	7	12
39	13	19	13	6	15	3	17	12
40	13	10	12	14	16	1	5	12

Appendix D.1. Judgment scores of 11 pond experts.

CASE	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12
1	3	3	11	8	7	3	4	2	10	4	10
2	10	12	18	12	16	13	8	15	18	15	6
3	5	10	15	15	17	15	12	20	12	19	16
4	15	12	18	13	12	13	9	6	12	16	7
5	5	8	13	16	13	16	7	20	14	16	18
6	20	15	16	17	16	17	12	13	19	15	15
7	1	5	12	13	13	14	7	15	8	14	1
8	5	8	15	13	12	16	8	16	8	16	4
9	5	6	8	11	10	14	4	9	9	10	14
10	1	5	10	8	9	9	5	9	5	11	1
11	10	5	9	9	8	8	2	9	7	2	8
12	1	12	15	10	14	12	5	13	15	11	16
13	5	6	6	6	10	12	4	11	12	13	19
14	17	10	14	11	12	10	7	12	16	4	13
15	5	8	13	12	12	15	7	15	15	15	20
16	20	8	12	6	11	10	5	5	12	8	14
17	10	12	13	8	15	12	6	16	14	10	17
18	5	10	16	12	11	9	6	12	10	5	11
19	17	7	12	9	10	8	4	4	12	3	9
20	17	10	12	8	13	13	6	7	15	8	6
21	17	8	12	9	13	15	4	12	10	8	6
22	10	2	1	5	5	2	2	3	5	1	7
23	17	12	14	13	15	16	7	17	14	9	17
24	10	4	1	9	12	3	3	9	8	6	7
25	12	14	18	15	11	11	9	17	15	8	12
26	15	7	10	10	8	11	4	12	12	2	8
27	1	8	8	10	11	9	5	8	5	6	1
28	1	8	9	13	11	13	6	10	7	15	1
29	1	6	3	11	10	9	4	6	5	5	1
30	5	10	9	11	11	9	5	4	8	16	14
31	5	8	8	9	9	12	4	11	5	11	19
32	20	12	11	11	13	15	6	9	9	10	15
33	20	15	17	17	16	16	10	13	16	18	20
34	5	10	15	14	9	6	5	3	14	6	11
35	15	12	16	11	12	9	7	7	12	6	13
36	20	12	16	17	15	13	8	10	13	16	17
37	1	6	3	11	10	8	2	9	10	5	1
38	15	12	17	17	12	12	9	15	12	7	12
39	15	10	16	16	16	16	10	8	13	8	6
40	5	10	16	15	12	11	7	7	8	18	18

Appendix D.2. Regression coefficients (b), standard error (SE), and T ratios (b/SE) for elements estimated with a quadratic function for pond judgments ($t=2.069$, $df=23$, $p=0.05$).

Judge 2		b	SE	T-ratio
Education	quadratic	-0.0014990	+0.0006993	-2.1476727
Planning	quadratic	-0.0001646	+0.0002136	-0.7709687
Funding	quadratic	-0.0004285	+0.0002401	-1.7849136
Mobility	quadratic	+0.0000053	+0.0002186	+0.0237534
Shoreline	quadratic	-0.0000882	+0.0002063	-0.4296446
Waterquality	quadratic	-0.3031547	+0.0875517	-3.4625745
Stocking	quadratic	+0.0000004	+0.0000021	+0.1772267
Attraction	quadratic	-0.0424500	+0.0995710	-0.4263294
Judge 3				
Education	quadratic	-0.0051037	+0.0021965	-2.3235571
Planning	quadratic	-0.0010961	+0.0006710	-1.6334713
Funding	quadratic	+0.0003756	+0.0007541	+0.4980945
Mobility	quadratic	-0.0036910	+0.0006866	-5.3756537
Shoreline	quadratic	-0.0029467	+0.0006480	-4.5471377
Waterquality	quadratic	-0.4686958	+0.2750080	-1.7042991
Stocking	quadratic	-0.0000129	+0.0000064	-2.0099733
Attraction	quadratic	+0.3570799	+0.3127629	+1.1416951
Judge 4				
Education	quadratic	-0.0007131	+0.0016904	-0.4218725
Planning	quadratic	-0.0003369	+0.0005164	-0.6524494
Funding	quadratic	+0.0002965	+0.0005803	+0.5108337
Mobility	quadratic	-0.0007742	+0.0005284	-1.4652101
Shoreline	quadratic	-0.0006798	+0.0004987	-1.3631502
Waterquality	quadratic	-0.3383233	+0.2116432	-1.5985536
Stocking	quadratic	-0.0000102	+0.0000050	-2.0588918
Attraction	quadratic	+0.0461851	+0.2406990	+0.1918792
Judge 5				
Education	quadratic	+0.0013904	+0.0012007	+1.1580020
Planning	quadratic	-0.0006219	+0.0003668	-1.6954163
Funding	quadratic	+0.0001450	+0.0004122	+0.3516530
Mobility	quadratic	-0.0012852	+0.0003753	-3.4241242
Shoreline	quadratic	-0.0008667	+0.0003542	-2.4467244
Waterquality	quadratic	+0.0804513	+0.1503291	+0.5351678
Stocking	quadratic	-0.0000209	+0.0000035	-5.9235624
Attraction	quadratic	+0.2464941	+0.1709673	+1.4417617
Judge 6				
Education	quadratic	-0.0012198	+0.0016500	-0.7392329
Planning	quadratic	+0.0000181	+0.0005041	+0.0358824
Funding	quadratic	-0.0002463	+0.0005665	-0.4348818
Mobility	quadratic	+0.0001441	+0.0005158	+0.2794329
Shoreline	quadratic	-0.0005161	+0.0004868	-1.0600750
Waterquality	quadratic	-0.0745810	+0.2065868	-0.3610151
Stocking	quadratic	-0.0000039	+0.0000048	-0.8084776
Attraction	quadratic	-0.1262499	+0.2349484	-0.5373315

Judge 7

		b	SE	T-ratio
Education	quadratic	+0.0012420	+0.0008921	+1.3921847
Planning	quadratic	+0.0001204	+0.0002725	+0.4418178
Funding	quadratic	+0.0000640	+0.0003063	+0.2089248
Mobility	quadratic	-0.0001986	+0.0002789	-0.7121453
Shoreline	quadratic	-0.0002936	+0.0002632	-1.1156670
Waterquality	quadratic	-0.4712565	+0.1116918	-4.2192574
Stocking	quadratic	-0.0000063	+0.0000026	-2.4122822
Attraction	quadratic	-0.0963481	+0.1270256	-0.7584934

Judge 8

		b	SE	T-ratio
Education	quadratic	-0.0011346	+0.0014246	-0.7964071
Planning	quadratic	-0.0010568	+0.0004352	-2.4251764
Funding	quadratic	-0.0005896	+0.0004891	-1.2055814
Mobility	quadratic	-0.0005006	+0.0004453	-1.1240399
Shoreline	quadratic	-0.0001341	+0.0004203	-0.3189402
Waterquality	quadratic	-0.5957851	+0.1783642	-3.3402734
Stocking	quadratic	-0.0000041	+0.0000042	-0.9807317
Attraction	quadratic	+0.3925935	+0.2028512	+1.9353770

Judge 9

		b	SE	T-ratio
Education	quadratic	-0.0002317	+0.0006788	-0.3413832
Planning	quadratic	-0.0002874	+0.0002074	-1.3856722
Funding	quadratic	-0.0000881	+0.0002330	-0.3781121
Mobility	quadratic	-0.0002492	+0.0002122	-1.1742240
Shoreline	quadratic	-0.0002145	+0.0002003	-1.0709772
Waterquality	quadratic	-0.0980803	+0.0849883	-1.1540445
Stocking	quadratic	-0.0000000	+0.0000020	-0.0015850
Attraction	quadratic	-0.0116552	+0.0966561	-0.1205847

Judge 10

		b	SE	T-ratio
Education	quadratic	-0.0005904	+0.0006446	-0.9160299
Planning	quadratic	-0.0000801	+0.0001969	-0.4069251
Funding	quadratic	+0.0000924	+0.0002213	+0.4174607
Mobility	quadratic	+0.0000898	+0.0002015	+0.4458053
Shoreline	quadratic	-0.0009845	+0.0001902	-5.1769824
Waterquality	quadratic	-0.0625967	+0.0806990	-0.7756810
Stocking	quadratic	+0.0000011	+0.0000019	+0.6012687
Attraction	quadratic	-0.0352734	+0.0917779	-0.3843343

Judge 11

		b	SE	T-ratio
Education	quadratic	+0.0015499	+0.0020328	+0.7624639
Planning	quadratic	-0.0002718	+0.0006210	-0.4376467
Funding	quadratic	+0.0008898	+0.0006979	+1.2749428
Mobility	quadratic	-0.0016972	+0.0006354	-2.6709089
Shoreline	quadratic	-0.0000925	+0.0005997	-0.1541518
Waterquality	quadratic	+0.0786813	+0.2545112	+0.3091465
Stocking	quadratic	-0.0000188	+0.0000060	-3.1590884
Attraction	quadratic	-0.1851933	+0.2894522	-0.6398062

Judge 12

		b	SE	T-ratio
Education	quadratic	+0.0000372	+0.0018490	+0.0200955
Planning	quadratic	-0.0000108	+0.0005648	-0.0190403
Funding	quadratic	-0.0003794	+0.0006348	-0.5976717
Mobility	quadratic	+0.0001559	+0.0005780	+0.2697574
Shoreline	quadratic	+0.0004076	+0.0005455	+0.7471653
Waterquality	quadratic	-0.3843005	+0.2314920	-1.6601026
Stocking	quadratic	+0.0000006	+0.0000054	+0.1154373
Attraction	quadratic	+0.1703001	+0.2632728	+0.6468579

Appendix D.3. Judgment scores of 13 waterfront experts.

CASE	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
1	1	2	5	11	4	7	1	5	8	3	8	6	4
2	17	7	18	15	2	13	12	12	18	6	9	18	15
3	16	19	12	8	6	12	13	15	16	6	9	18	19
4	9	6	8	19	15	12	12	12	12	5	7	14	16
5	15	18	6	8	10	15	15	14	17	15	10	17	16
6	20	8	15	16	19	14	15	17	19	12	15	18	15
7	16	15	6	4	13	12	12	14	10	9	11	10	14
8	13	4	6	19	9	13	13	14	10	13	6	14	16
9	12	6	8	11	13	11	11	13	13	10	8	15	10
10	8	4	5	4	1	9	9	10	10	9	6	10	11
11	7	1	10	15	14	11	7	10	15	9	7	9	2
12	11	8	12	16	7	10	10	12	16	10	7	14	11
13	6	13	14	6	16	11	12	14	13	10	11	14	13
14	13	5	12	13	7	11	9	14	17	11	11	12	4
15	10	14	8	8	14	12	14	17	15	12	9	14	15
16	10	10	10	12	9	8	8	12	15	8	7	14	8
17	13	14	14	9	4	12	11	14	18	7	10	16	10
18	9	4	5	10	11	9	7	14	11	9	4	10	5
19	7	3	8	17	18	7	5	10	8	5	11	9	3
20	11	3	8	14	1	10	11	11	17	5	11	11	8
21	10	3	10	14	16	12	12	14	19	8	10	11	8
22	6	2	5	11	3	6	1	8	5	15	10	3	1
23	15	9	15	19	19	14	15	18	18	13	12	17	9
24	10	12	14	2	8	9	2	13	10	17	13	13	6
25	13	5	12	19	8	12	8	13	15	12	8	10	8
26	10	3	12	13	12	11	8	11	15	11	10	12	2
27	8	5	6	3	2	9	9	9	12	5	6	5	6
28	12	14	6	3	11	12	11	14	10	12	11	7	15
29	13	6	5	3	5	8	9	10	12	12	8	7	5
30	10	14	8	7	5	10	9	9	12	9	11	9	16
31	6	12	10	9	17	11	12	15	8	10	11	17	11
32	10	10	12	15	20	12	13	15	10	8	10	19	10
33	19	16	15	11	18	12	15	17	17	8	15	20	18
34	8	3	8	10	10	10	5	10	5	11	7	8	6
35	10	3	12	18	20	9	8	14	12	8	11	12	6
36	17	15	14	9	17	10	12	15	17	6	14	12	16
37	11	6	6	4	3	8	5	7	11	8	8	10	5
38	10	5	10	14	15	12	8	13	15	12	7	8	7
39	18	7	12	19	6	14	15	14	17	9	9	9	8
40	8	17	10	6	12	9	9	15	10	9	9	11	18

Appendix D.4. Regression coefficients (b), standard error (SE), and T ratios (b/SE) for elements estimated by a quadratic function for waterfront judgments ($t = 2.069$, $df = 23$, $p = 0.05$).

		b	SE	T-ratio
Judge 1				
Education	quadratic	+0.0004275	+0.0012018	+0.3557018
Planning	quadratic	-0.0005857	+0.0003672	-1.5952265
Funding	quadratic	-0.0005422	+0.0004126	-1.3142041
Mobility	quadratic	+0.0004206	+0.0003757	+1.1196604
Shoreline	quadratic	-0.0003105	+0.0003546	-0.8756762
Waterquality	quadratic	-0.7390101	+0.1504726	-4.9112606
Stocking	quadratic	-0.0000020	+0.0000035	-0.5657926
Attraction	quadratic	-0.1286356	+0.1711305	-0.7516813
Judge 2				
Education	quadratic	+0.0002355	+0.0013365	+0.1762006
Planning	quadratic	-0.0000650	+0.0004083	-0.1592095
Funding	quadratic	+0.0004635	+0.0004588	+1.0100901
Mobility	quadratic	-0.0001503	+0.0004178	-0.3596344
Shoreline	quadratic	-0.0007817	+0.0003943	-1.9825171
Waterquality	quadratic	+0.2935255	+0.1673336	+1.7541315
Stocking	quadratic	-0.0000043	+0.0000039	-1.0899056
Attraction	quadratic	+0.1609470	+0.1903065	+0.8457254
Judge 3				
Education	quadratic	-0.0013372	+0.0013636	-0.9806265
Planning	quadratic	+0.0002271	+0.0004166	+0.5451269
Funding	quadratic	+0.0001768	+0.0004681	+0.3776217
Mobility	quadratic	-0.0002507	+0.0004263	-0.5882459
Shoreline	quadratic	+0.0000972	+0.0004023	+0.2416936
Waterquality	quadratic	-0.2806378	+0.1707244	-1.6438062
Stocking	quadratic	-0.0000023	+0.0000040	-0.5796378
Attraction	quadratic	-0.0848406	+0.1941625	-0.4369565
Judge 4				
Education	quadratic	-0.0004098	+0.0022861	-0.1792449
Planning	quadratic	-0.0008929	+0.0006984	-1.2785482
Funding	quadratic	-0.0004041	+0.0007848	-0.5148711
Mobility	quadratic	-0.0017343	+0.0007146	-2.4269657
Shoreline	quadratic	-0.0001004	+0.0006745	-0.1488145
Waterquality	quadratic	-0.3529103	+0.2862181	-1.2330121
Stocking	quadratic	+0.0000000	+0.0000067	+0.0014036
Attraction	quadratic	+0.3006764	+0.3255120	+0.9237030
Judge 5				
Education	quadratic	-0.0109735	+0.0015351	-7.1483245
Planning	quadratic	-0.0029051	+0.0004690	-6.1945963
Funding	quadratic	-0.0017696	+0.0005270	-3.3577924
Mobility	quadratic	-0.0010154	+0.0004799	-2.1159968
Shoreline	quadratic	-0.0033798	+0.0004529	-7.4625630
Waterquality	quadratic	+0.2314111	+0.1921987	+1.2040201
Stocking	quadratic	-0.0000041	+0.0000045	-0.9088150
Attraction	quadratic	+0.2438449	+0.2185850	+1.1155610
Judge 6				
Education	quadratic	+0.0007392	+0.0006266	+1.1797061
Planning	quadratic	+0.0002497	+0.0001914	+1.3043754
Funding	quadratic	+0.0000548	+0.0002151	+0.2546391
Mobility	quadratic	+0.0002144	+0.0001959	+1.0944343
Shoreline	quadratic	+0.0004109	+0.0001849	+2.2228148
Waterquality	quadratic	-0.1789372	+0.0784532	-2.2808132
Stocking	quadratic	-0.0000013	+0.0000018	-0.7188582
Attraction	quadratic	+0.0876951	+0.0892238	+0.9828666

Judge 7		b	SE	T-ratio
Education	quadratic	-0.0004075	+0.0013798	-0.2953033
Planning	quadratic	-0.0009671	+0.0004215	-2.2942519
Funding	quadratic	-0.0006439	+0.0004737	-1.3593372
Mobility	quadratic	-0.0001255	+0.0004313	-0.2910636
Shoreline	quadratic	+0.0001969	+0.0004071	+0.4836015
Waterquality	quadratic	-0.5179516	+0.1727530	-2.9982209
Stocking	quadratic	-0.0000051	+0.0000040	-1.2591136
Attraction	quadratic	+0.4806013	+0.1964696	+2.4461961
Judge 8				
Education	quadratic	-0.0013978	+0.0007579	-1.8442956
Planning	quadratic	-0.0012568	+0.0002315	-5.4283342
Funding	quadratic	-0.0007098	+0.0002602	-2.7280748
Mobility	quadratic	-0.0005432	+0.0002369	-2.2929342
Shoreline	quadratic	-0.0007495	+0.0002236	-3.3518057
Waterquality	quadratic	-0.1767950	+0.0948902	-1.8631533
Stocking	quadratic	-0.0000025	+0.0000022	-1.1234018
Attraction	quadratic	+0.1122147	+0.1079174	+1.0398207
Judge 9				
Education	quadratic	-0.0005137	+0.0018910	-0.2716704
Planning	quadratic	+0.0003363	+0.0005777	+0.5822207
Funding	quadratic	+0.0011173	+0.0006492	+1.7211670
Mobility	quadratic	-0.0018525	+0.0005911	-3.1339223
Shoreline	quadratic	-0.0008205	+0.0005579	-1.4707694
Waterquality	quadratic	-0.4519864	+0.2367494	-1.9091345
Stocking	quadratic	-0.0000140	+0.0000055	-2.5282440
Attraction	quadratic	+0.2105209	+0.2692519	+0.7818734
Judge 10				
Education	quadratic	+0.0015051	+0.0017339	+0.8680457
Planning	quadratic	+0.0002871	+0.0005297	+0.5420140
Funding	quadratic	-0.0010098	+0.0005953	-1.6964198
Mobility	quadratic	+0.0006591	+0.0005420	+1.2160311
Shoreline	quadratic	+0.0001843	+0.0005116	+0.3603072
Waterquality	quadratic	-0.1112762	+0.2170911	-0.5125782
Stocking	quadratic	+0.0000081	+0.0000051	+1.5977961
Attraction	quadratic	-0.2460459	+0.2468948	-0.9965616
Judge 11				
Education	quadratic	-0.0043514	+0.0007613	-5.7153940
Planning	quadratic	+0.0000638	+0.0002326	+0.2742086
Funding	quadratic	+0.0000419	+0.0002614	+0.1604270
Mobility	quadratic	-0.0000006	+0.0002380	-0.0026412
Shoreline	quadratic	-0.0000596	+0.0002246	-0.2651254
Waterquality	quadratic	+0.1194997	+0.0953215	+1.2536497
Stocking	quadratic	-0.0000016	+0.0000022	-0.7298971
Attraction	quadratic	-0.3669742	+0.1084078	-3.3851268
Judge 12				
Education	quadratic	-0.0007187	+0.0020021	-0.3589550
Planning	quadratic	-0.0014266	+0.0006116	-2.3324485
Funding	quadratic	+0.0002259	+0.0006873	+0.3286845
Mobility	quadratic	-0.0006388	+0.0006258	-1.0207185
Shoreline	quadratic	-0.0002048	+0.0005907	-0.3466826
Waterquality	quadratic	-0.5349814	+0.2506647	-2.1342214
Stocking	quadratic	-0.0000019	+0.0000059	-0.3152995
Attraction	quadratic	+0.2961266	+0.2850776	+1.0387579
Judge 13				
Education	quadratic	+0.0000372	+0.0018490	+0.0200955
Planning	quadratic	-0.0000108	+0.0005648	-0.0190403
Funding	quadratic	-0.0003794	+0.0006348	-0.5976717
Mobility	quadratic	+0.0001559	+0.0005780	+0.2697574
Shoreline	quadratic	+0.0004076	+0.0005455	+0.7471653
Waterquality	quadratic	-0.3843005	+0.2314920	-1.6601026
Stocking	quadratic	+0.0000006	+0.0000054	+0.1154373
Attraction	quadratic	+0.1703001	+0.2632728	+0.6468579

Appendix E.1. Pearson correlation coefficients for urban pond fisheries judges.

PEARSON CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 40

	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12
J2	1.00000 0.0000	0.49987 0.0010	0.37926 0.0158	0.15907 0.3269	0.34801 0.0278	0.26118 0.1036	0.33481 0.0347	-0.00809 0.9605	0.50747 0.0008	-0.09146 0.5746	0.29782 0.0620
J3	0.49987 0.0010	1.00000 0.0000	0.77455 0.0001	0.61969 0.0001	0.71358 0.0001	0.56983 0.0001	0.73704 0.0001	0.37319 0.0177	0.67266 0.0001	0.42391 0.0064	0.45214 0.0034
J4	0.37926 0.0158	0.77455 0.0001	1.00000 0.0000	0.62544 0.0001	0.58930 0.0001	0.53259 0.0004	0.77740 0.0001	0.37858 0.0160	0.65011 0.0001	0.41688 0.0075	0.34337 0.0301
J5	0.15907 0.3269	0.61969 0.0001	0.62544 0.0001	1.00000 0.0000	0.58687 0.0001	0.54734 0.0003	0.77395 0.0001	0.44130 0.0044	0.39542 0.0116	0.51593 0.0007	0.20890 0.1958
J6	0.34801 0.0278	0.71358 0.0001	0.58930 0.0001	0.58687 0.0001	1.00000 0.0000	0.72357 0.0001	0.76132 0.0001	0.57517 0.0001	0.59963 0.0001	0.60537 0.0001	0.29585 0.0638
J7	0.26118 0.1036	0.56983 0.0001	0.53259 0.0004	0.54734 0.0003	0.72357 0.0001	1.00000 0.0000	0.66081 0.0001	0.65420 0.0001	0.42207 0.0067	0.65533 0.0001	0.30022 0.0598
J8	0.33481 0.0347	0.73704 0.0001	0.77740 0.0001	0.77395 0.0001	0.76132 0.0001	0.66081 0.0001	1.00000 0.0000	0.51185 0.0007	0.56723 0.0001	0.61724 0.0001	0.28580 0.0738
J9	-0.00809 0.9605	0.37319 0.0177	0.37858 0.0160	0.44130 0.0044	0.57517 0.0001	0.65420 0.0001	0.51185 0.0007	1.00000 0.0000	0.38692 0.0136	0.43240 0.0053	0.28223 0.0777
J10	0.50747 0.0008	0.67266 0.0001	0.65011 0.0001	0.39542 0.0116	0.59963 0.0001	0.42207 0.0067	0.56723 0.0001	0.38692 0.0136	1.00000 0.0000	0.22045 0.1717	0.45708 0.0030
J11	-0.09146 0.5746	0.42391 0.0064	0.41688 0.0075	0.51593 0.0007	0.60537 0.0001	0.65533 0.0001	0.61724 0.0001	0.43240 0.0053	0.22045 0.1717	1.00000 0.0000	0.35818 0.0232
J12	0.29782 0.0620	0.45214 0.0034	0.34337 0.0301	0.20890 0.1958	0.29585 0.0638	0.30022 0.0598	0.28580 0.0738	0.28223 0.0777	0.45708 0.0030	0.35818 0.0232	1.00000 0.0000

Appendix E.2. Pearson correlation coefficients for urban waterfront fisheries judges.

PEARSON CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 40

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
J1	1.00000 0.0000	0.40595 0.0093	0.47695 0.0019	0.15911 0.3268	0.10282 0.5278	0.64854 0.0001	0.67299 0.0001	0.58584 0.0001	0.64829 0.0001	0.13854 0.3939	0.43358 0.0052	0.50026 0.0010	0.48794 0.0014
J2	0.40595 0.0093	1.00000 0.0000	0.26379 0.1000	-0.44191 0.0043	0.15997 0.3241	0.35171 0.0260	0.49363 0.0012	0.54162 0.0003	0.20333 0.2083	0.10542 0.5174	0.43620 0.0049	0.49081 0.0013	0.76052 0.0001
J3	0.47695 0.0019	0.26379 0.1000	1.00000 0.0000	0.35399 0.0250	0.33458 0.0348	0.43329 0.0052	0.36433 0.0208	0.54077 0.0003	0.60207 0.0001	-0.00855 0.9583	0.54152 0.0003	0.63369 0.0001	0.22745 0.1581
J4	0.15911 0.3268	-0.44191 0.0043	0.35399 0.0250	1.00000 0.0000	0.33348 0.0355	0.33194 0.0364	0.20717 0.1996	0.19903 0.2182	0.31803 0.0455	-0.11134 0.4940	-0.02523 0.8772	0.24304 0.1308	-0.11785 0.4689
J5	0.10282 0.5278	0.15997 0.3241	0.33458 0.0348	0.33348 0.0355	1.00000 0.0000	0.30841 0.0528	0.35100 0.0264	0.61239 0.0001	0.08556 0.5996	0.09365 0.5654	0.41700 0.0074	0.39978 0.0106	0.17295 0.2859
J6	0.64854 0.0001	0.35171 0.0260	0.43329 0.0052	0.33194 0.0364	0.30841 0.0528	1.00000 0.0000	0.82430 0.0001	0.68250 0.0001	0.60515 0.0001	0.22536 0.1621	0.22587 0.1611	0.59640 0.0001	0.53335 0.0004
J7	0.67299 0.0001	0.49363 0.0012	0.36433 0.0208	0.20717 0.1996	0.35100 0.0264	0.82430 0.0001	1.00000 0.0000	0.75434 0.0001	0.61554 0.0001	-0.01571 0.9234	0.28360 0.0762	0.66555 0.0001	0.69610 0.0001
J8	0.58584 0.0001	0.54162 0.0003	0.54077 0.0003	0.19903 0.2182	0.61239 0.0001	0.68250 0.0001	0.75434 0.0001	1.00000 0.0000	0.48133 0.0017	0.27379 0.0874	0.43926 0.0046	0.68407 0.0001	0.55356 0.0002
J9	0.64829 0.0001	0.20333 0.2083	0.60207 0.0001	0.31803 0.0455	0.08556 0.5996	0.60515 0.0001	0.61554 0.0001	0.48133 0.0017	1.00000 0.0000	-0.07784 0.6331	0.28057 0.0795	0.49414 0.0012	0.26172 0.1028
J10	0.13854 0.3939	0.10542 0.5174	-0.00855 0.9583	-0.11134 0.4940	0.09365 0.5654	0.22536 0.1621	-0.01571 0.9234	0.27379 0.0874	-0.07784 0.6331	1.00000 0.0000	0.12774 0.4322	0.00964 0.9529	-0.05776 0.7233
J11	0.43358 0.0052	0.43620 0.0049	0.54152 0.0003	-0.02523 0.8772	0.41700 0.0074	0.22587 0.1611	0.28360 0.0762	0.43926 0.0046	0.28057 0.0795	0.12774 0.4322	1.00000 0.0000	0.37243 0.0180	0.26800 0.0945
J12	0.50026 0.0010	0.49081 0.0013	0.63369 0.0001	0.24304 0.1308	0.39978 0.0106	0.59640 0.0001	0.66555 0.0001	0.68407 0.0001	0.49414 0.0012	0.00964 0.9529	0.37243 0.0180	1.00000 0.0000	0.56287 0.0002
J13	0.48794 0.0014	0.76052 0.0001	0.22745 0.1581	-0.11785 0.4689	0.17295 0.2859	0.53335 0.0004	0.69610 0.0001	0.55356 0.0002	0.26172 0.1028	-0.05776 0.7233	0.26800 0.0945	0.56287 0.0002	1.00000 0.0000

Appendix F. Element values for Arizona, Missouri, Illinois, and Oklahoma urban ponds.

Element	Arizona		Missouri		Illinois	Oklahoma
	Pond 1	Pond 2	Pond 1	Pond 2	Pond*	Pond*
	Value	Value	Value	Value	Value	Value
Education	10%	50%	0%	50%	40%	20%
Local planning	0%	0%	20%	30%	0%	70%
Local funding	20%	20%	0%	0%	0%	100%
Accessibility of the fishery	10%	10%	50%	0%	80%	10%
Shoreline available for fishing	100%	100%	100%	80%	80%	90%
Water quality	coldwater species-part year	coldwater species-part year	warmwater species-all year	warmwater species-all year	warmwater species-all year	warmwater species-all year
Stocking rate (lbs/acre)	1000	1000	1000	1000	1000	1000
Fish attraction structures	400 yds	400 yds	400 yds	100 yds	400 yds	50 yds

* More than one pond reported, but element values were identical.

Vita

Bret Allen Preston was born March 11, 1959, in Newark, Ohio. He graduated from Barnesville High School in June, 1977. He earned a B.A. in Geography from Eastern Kentucky University, Richmond, Kentucky, in May, 1981. He entered the Virginia Polytechnic Institute and State University graduate program in September, 1985, and is currently a candidate for Master of Science in Fisheries and Wildlife Sciences (Fisheries Option). In October, 1987, he married Leanna B. Miles in Trumansburg, New York.

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