City fish: an analysis of demand for and value of urban sport fishing in Tucson and Scottsdale, Arizona

CITY FISH:
AN ANALYSIS OF DEMAND FOR AND VALUE OF URBAN SPORT FISHING IN TUCSON AND SCOTTSDALE, ARIZONA

by

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ABSTRACT

This study evaluated the demand for and value of urban sport fishing in the Phoenix and Tucson Metropolitan Areas during the 1977-78 fiscal year. This form of outdoor recreation is analyzed by both consumers' surplus and non-discriminating monopolist methods using demand curves estimated by ordinary least squares regression. Both Clawson-Hotelling travel--cost and willingness-to-pay approaches were used. The primary objective of this research was to obtain a new economic value of the experimental one-year urban fishing program using primary data from personal interviews with anglers and cost figures supplied by the Arizona Department of Game and Fish. The secondary objective of the study was to evaluate certain non-economic aspects of the program that might influence plans for future urban fishing projects.

The end results of the analysis are net economic values for urban fishing in Arizona and implications for future programs. Analysis points out some facets of the program and its participants lending credence to the hypothesis that this form of recreation may be an inferior good. While the value of consumers' surplus would likely exceed the costs of a continuing program, collectable revenues would likely be less than costs.

CHAPTER 1

THE PROBLEM

Introduction

A number of small manmade lakes have been and are being developed in Phoenix and Tucson, Arizona by state and local agencies. Although some of these lakes contain fish and have been fished by residents under the state fishing license, the fishing is of poor quality. In July, 1977, the Arizona Department of Game and Fish began an experimental one year program of stocking two of these urban lakes--Chaparral in Scottsdale in the Phoenix Metropolitan area and Lakeside in southeastern Tucson. Since Game and Fish felt that the program should be at least partially self-supporting, a special urban fishing permit in addition to the general state license was to be purchased by those wishing to participate. For adults the permit cost three dollars for six months in addition to the regular yearly license; for children under the age of fourteen who are not required to buy the state license the special permit cost one dollar for six months. If the adults had only a state fishing license instead of a state combination hunting and fishing license they also needed to purchase a trout stamp if they wished to fish for trout.

Warm-water and cold-water seasons were established. Channel catfish, carp, and tilapia were stocked from July until mid-November,

1977 and then again from April through June, 1978. Trout were stocked from mid-November of 1977 to the end of March, 1978.

Objectives

The study that follows focuses on monetary and non-monetary benefits that the urban sport fishing program did and can provide and compares these benefits to the costs of sustaining the program. Both modified Clawson-Hotelling travel-cost and willingness-to-pay approaches are attempted in estimating the demand for urban fishing. Demand is estimated, the Marshallian consumers' surplus is determined. Also, non-discriminating monopolist values are calculated to ascertain the producer's (Arizona Department of Game and Fish) revenue-maximizing price.

Once total benefits are computed, a cost-benefit analysis can be done. Arizona Game and Fish supplied actual costs of the experimental program as it was implemented during fiscal year 1977-78 as well as estimated costs of a continuing program. By comparing benefits to costs, a net economic value of the program is calculated.

In addition, non-economic results are examined. Summarized, the non-economic results are:

1. to estimate intensity of minority usage;
2. to evaluate angler comments and complaints;
3. to observe angler participation by lake and season; and
4. to give implications for future programs.

Description of the Areas Studied

Chaparral Lake is located in Scottsdale, Arizona on Hayden Road between McDonald and Chaparral Roads. It is a part of the Indian Bend Wash Greenbelt System and covers about ten and one half acres. The median income of the ninety-nine percent Anglo area is $19,000 per year and forty-one percent of all households have children under the age of eighteen. The park itself has excellent facilities: a stadium, a municipal pool, picnic benches, playing fields, and grass.

Lakeside Lake, about twelve acres in size, is located in southeastern Tucson near the intersection of Pantano and Stella Roads and about three miles from the main gate of Davis-Monthan Air Force Base. The median income of the area is about $17,500 per year. Forty-six percent of all households have children under the age of eighteen; over ninety-five percent of the population are Anglo. Facilities are adequate but not as good as at Chaparral. Picnic tables and ramadas, a playing field for sports, a basketball court, and a playground for small children are on the west bank of the park. However, the remaining three shores of the lake have neither facilities nor grassy banks.

CHAPTER 2

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

The two basic building blocks of any research are accepted theory and previous experience. In this chapter the general economic theory used in the analysis of the demand for urban fishing is first outlined.

Demand, Consumer's Surplus, and Elasticity

The demand curve for a specific commodity relates the alternative quantities of the good that would be purchased at various market prices of the commodity at a given point in time, all other things being equal. With the exception of the truly insignificant Giffen's Paradox, the demand curve is negatively sloped. That is, as the price of a good falls, the quantity demanded of that good rises. Changes in price result in a movement along the demand curve. In Figure 2.1, when price drops from P to P', quantity demand increases from Q to Q'.

Other determinants of demand--income of the population, consumer tastes and preferences, population size, and prices of compliment of substitute goods--influence the actual level of the demand schedule. If, for example, it becomes more fashionable to purchase a particular commodity, the entire demand curve shifts up and to the right for each price/quantity combination. At any given price, the corresponding quantity demanded is greater for D'D' than for the original DD (see Figure 2.2).

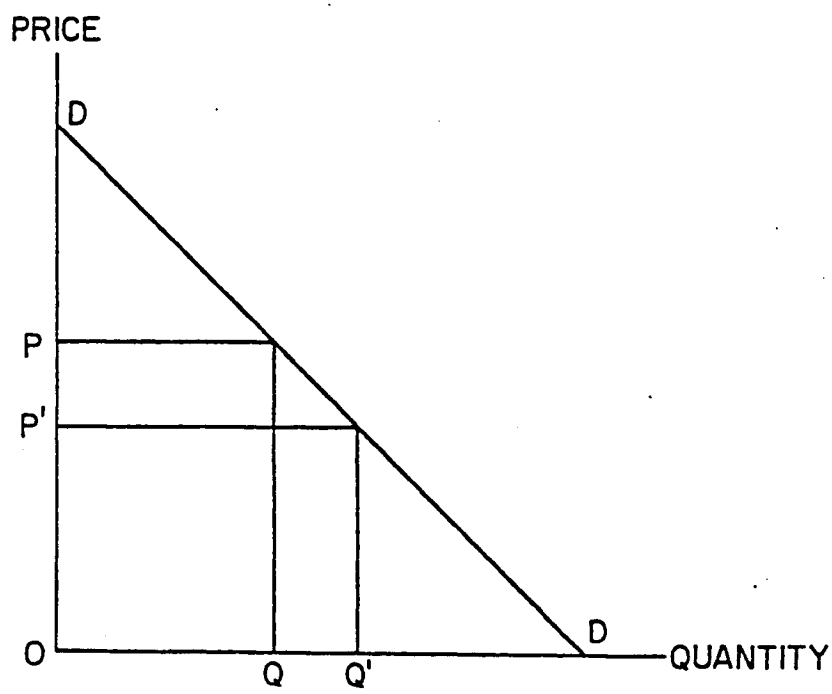

Figure 2.1 A Demand Curve (Hypothetical)

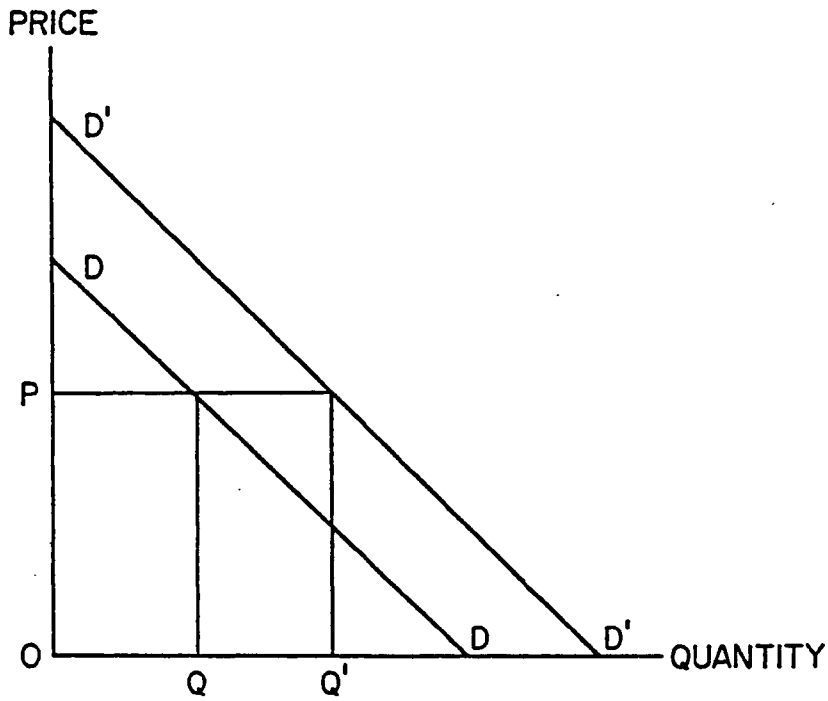

Figure 2.2 Shifts in Demand (Hypothetical)

Consumer's surplus, roughly defined, is a measure of the additional satisfaction the consumer receives from a commodity above the price he paid for it. The consumer has some idea of what he is willing to pay rather than to without; this price must be at least as much as he does pay. The difference between the price he would pay and the price he actually does pay is called the consumer's surplus. In Figure 2.3, the shaded area is the consumer's surplus.

The price elasticity of demand is a measure of the relative responsiveness of quantity demanded to changes in price. It is calculated by dividing the percentage change in quantity demanded by the corresponding percentage change in price. If price drops by one percent and the quantity demanded increases by two percent, then the price elasticity of demand is negative two. If price elasticity, abbreviated E, is greater than negative one, demand is said to be elastic; if E is between zero and minus one, demand is inelastic; if E equals negative one, demand is unitary elastic. Price elasticity of demand has strong implications for total revenue. In response to a price increase and a quantity decrease, if E is:

less than negative one	then:	total revenue decreased
between zero and negative one		total revenue increases
equal to negative one		total revenue is unchanged

Demand and Outdoor Recreation

An important difference between outdoor recreation and an ordinary market commodity is that recreation normally lacks a formally defined price. Although some recreation areas have a general admission

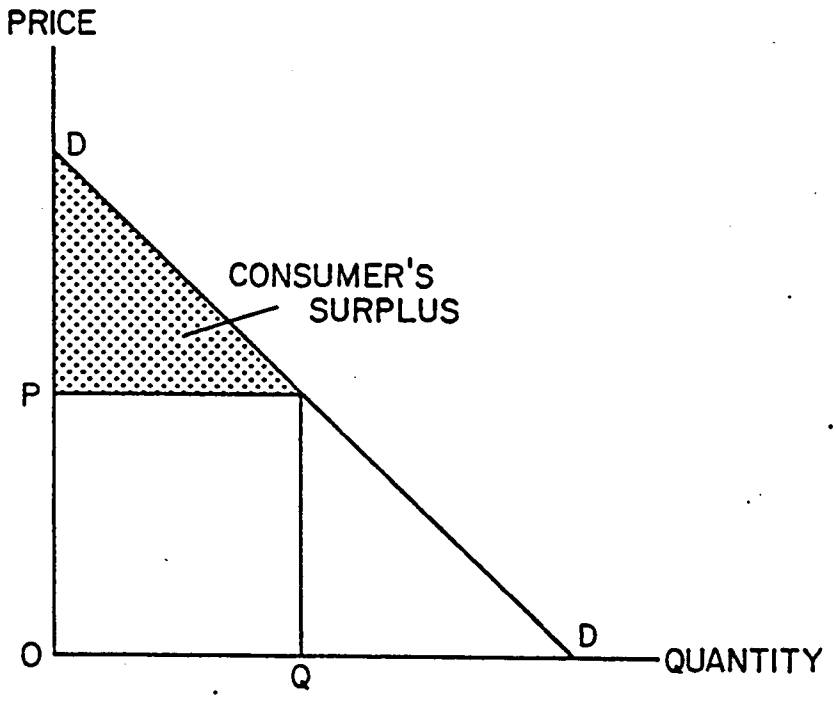

Figure 2.3 Consumer's Surplus

fee, many have no real money price, and since price/quantity variation is never observed, statistical estimation of a demand curve is impossible. However, recreation does have value and a method of deriving a surrogate price must be used.

The Clawson-Hotelling Approach

Elements of the substitute price are the time and money costs of participation. Money costs are used to find the demand curve itself, while time costs can act as shifters of the demand schedule. An example of money costs is the cost of gasoline to make a trip. Time cost is the opportunity cost of the time required for the recreation trip; time could also shift demand in than an individual's demand for recreation may be greater at each price level if he has a two-week vacation than if he has no vacation time at all.

Estimating the demand curve for a recreation activity is accomplished in two steps. In the basic Clawson-Hotelling approach, a demand schedule for the recreation experience first is derived by relating the variable cost of the recreation to the number of visits to the area per population unit (such as per 1,000 population) from the area of residence. Then, the demand curve for the site itself is obtained from the demand curve for the recreation experience by assuming that recreators would react to alternative added costs of recreating in the area in the same way they react to their travel costs. The added cost per visits values are summed horizontally across distance zones to derive the aggregate demand curve for the site. An in-depth example of this method can be found in Sublette and Martin (1975, pp. 5-7).

The Willingness-to-Pay Approach

Another way of deriving demand is the willingness-to-pay approach. Individuals are asked how much they would be willing to pay to participate at a site rather than forego the opportunity to recreate there. The responses are paired to the number or percent of people who would be willing to pay at least that amount, thereby estimating the demand curve for that recreation site.

Value

After the demand curve for the site has been estimated, consumers' surplus can be found. Since there is little or no entry fee for most outdoor activities, the entire area under the demand curve is the consumers' surplus. The value may be interpreted as the total net value of the site to the consumers.

Another interpretation of the value of outdoor recreation is the non-discriminating monopolist approach. It is assumed that a single owner possesses the site and introduces a price. Rational monopolist as he is, he chooses that price which will maximize his total revenue. For the monopolist, this price will correspond to the quantity at which E is equal to minus one. Alternatively, the price will be where the marginal revenue intersects the Q-axis (the slope of the marginal revenue curve for a monopolist is exactly double that of the demand curve). In Figure 2.4 this revenue-maximizing price is P at Q with total revenue equal to PQ given demand curve DD. At this point, marginal revenue is zero and the price elasticity of demand is minus one.

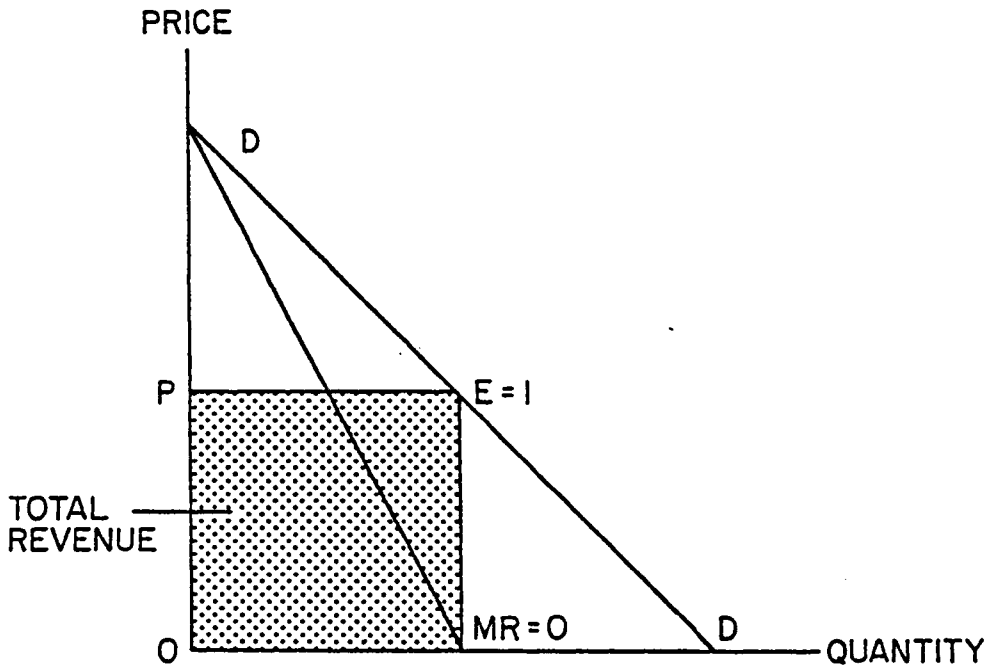

Figure 2.4 Non-Discriminating Monopolist Value (Hypothetical)

Literature Review

Prior to 1949, although all experts agreed that recreation was not a free good and must have some value, no conceptual models were avaliable to determine exactly what this value was or what the demand for recreation might be. Some were against evaluating recreation's value and argued that (a) it simply could not be done, or (b) it was undesirable to try. Illogical attempts at deriving the value of outdoor recreation ranged from the "cost approach" which claimed benefits of recreation were equal to the costs of developing and maintaining the site, the "gross expenditures approach" which stated that benefits were equivalent to the total expenditures for recreation, and finally a mathematical formula--economic value of recreation was equal to GNP divided by the total population multiplied by the number of days in the year.

In 1949, Harold Hotelling suggested a new measure for approximating the value of national parks to the public. Concentric zones around the parks were drawn such that the cost from one zone to the park would be cnstant within that zone. The fact that people from a zone visit the park at all implied that the service of the park is at lease worth the cost of travelling to it. By 1958, Trice and Wood had applied Hotelling's idea to three areas of the Sierras and derived a "free value received" by the consumer. This value corresponded to the consumers' surplus. However, later that same year, Hines (1958) claimed that this analysis had made the unrealistic assumption that individual

utility functions were identical. Further studies accepted the Trice and Wood idea in spite of its limitations.

Also in 1959, Clawson, employing Hotelling's basic idea, showed that participation in outdoor recreation at major national parks was a function of the cost per visit. In effect, he derived a demand curve for the recreational experience with visits on the Q-axis and cost per visit on the P-axis. He also calculated the value of consumers' surplus of recreation, and, using elasticities, determined how the visits would change given an increase in the entrance fee.

In 1964, Brown, Singh, and Castle published their landmark study of Oregon's salmon and steelhead sport fishing. This study, which followed the general Clawson technique, took into account the various intricacies of recreation and recreators. Since fishing was not confined to one area of the state, different fishing zones were established. Then each zone was subdivided into various income groups. An index of fishing success was derived and used. Other variables associated with time, cost, and distance travelled were included in the extensive study. Finally, the model was estimated by both single and simultaneous equations. The success of that research encouraged and serves as a pattern for subsequent research on recreation.

Knetsch (1963) expanded the basic recreation demand approach to include variables other than costs and distance: income, the availability of close substitutes, congestion, and park size and quality. In addition, he posited the negative effect of time constraints on recreation.

Prior to 1973, recreation studies used zone averages of time and travel costs in demand models. Unfortunately, the models had problems with multicollinearity. Brown and Nawas (1978), in their study of Oregon big game hunting solved the problem. They used two methods of evaluating recreation: the traditional approach which used grouped data to describe cost and distance, and a new idea of substituting individual observations for the area averages. They discovered that although R^2 values dropped, t-statistics of the variable coefficients rose. Ergo, they concluded that use of individual rather than grouped data increased model efficiency.

In Arizona, Sublette and Martin (1975), Martin, Gum and Smith (1974), and Gum et al. (1973) did a series of studies on hunting, fishing, and general outdoor recreation in the state. Further refinements of the Brown-Nawas individual observation method allowed value estimates to be produced from the sums of individual demand curves. Data were taken from questionnaires of random samples of households and stepwise ordinary least squares multiple regression analysis was used to derive the statistical demand estimates. In specific cases, however, where travel and other variable costs were very low, the Clawson-Hotelling approach did not produce significant demand equations. In these cases, the willingness-to-pay approach was successfully adapted (Sublette and Martin 1975).

Martin and Gum (1977) used cluster analysis in recreation demand for the first time to examine the structure of recreation demand. Socio-economic characteristics of different groups within a given sample were utilized to define consumer tastes and preferences as a factor of demand.

They concluded that for many types of outdoor recreation, most people would change their responses to recreation participation only after changing their attitudes as opposed to response to changes in measurable variables such as income. In order to estimate future demand, they claimed that some measure of the direction of change in attitudes must be estimated.

Smith and Munley (1978) recently examined the relative performance of four different estimation procedures for recreation demand: ordinary least squares (OLS), generalized least squares, logit and probit. Methodologically speaking, OLS was considered less useful than the other three, yet it was used more frequently. When they applied all methods to identical data, they found that OLS performed at least as well as the other techniques and suggested (p. 175) "less attention should be directed to the problems of OLS and to apologies for failing to use a more sophisticated method . . . "

In the area of urban sport fishing as a form of recreation, Schupp (1972) outlines the need for urban fishing programs, especially in large metropolitan areas. His report reviewed several experimental programs and compared the implementation procedures of the various programs. In addition, he explained the operation of the highly successful St. Louis, Missouri program and discussed some of the problems of urban fisheries such as the choice of fishing sites, stocking rates, and funding. Finally, he listed and described planning procedures and operational techniques for an effective urban fishing program.

Duttweiler (1975a, 1975b, 1975c) presented a three-part series on urban fishing involving the methodology for evaluation of urban sport fishing. He explained that traditional approaches to recreation demand, especially the Clawson-Hotelling analysis, were ineffective in terms of this new form of recreation since the small amounts of and distance involved did not provide adequate differentiation for demand analysis. He also stated advantages and disadvantages of several data collection techniques--direct observation, personal interviews, telephone and mail questionnaires, and self-registration--and concluded that a combination of techniques would have to be used to provide adequate information for program evaluation. He did not, however, analyze the demand for urban sport fishing.

This analysis of urban fishing in Arizona is the first economic study of an urban fishery. It incorporates the methods of Gum and Martin (1975) and Sublette and Martin (1975) to estimate the demand for and value of urban sport fishing for the Phoenix and Tucson areas in separate analyses. The willingness-to-pay approach and the Clawson-Hotelling approach in its basic form are the fundamental methods of the following study, with the bulk of the analysis utilizing individual rather than grouped data. Both consumers' surplus and non-discriminating monopolist values of outdoor recreation are estimated, and personal interviews as well as direct observation are used to derive data.

CHAPTER 3

THE DATA

The Questionnaire and Tally Sheet

The data were obtained from two personal interview questionnaires, each consisting of 29 questions. One of the two questionnaires was used on alternate weeks. Both questionnaires are in the Appendix. One is designated the yellow questionnaire, the other the green.

Questions one and two are identification questions--they specify the lake, date of the interview, and day and time of the interview. Questions three and four are demographic in nature and are used to show race, age, occupation (income), and address of the angler. The address was later used to determine distance travelled to the lake. Questions five through 22 are general angler information relative to participation, success, attitudes and alternatives. Questions 23 through 26 are economic questions; that is, the willingness-to-pay series of questions. Finally, questions 27 through 29 ask preference on stocking and comments about the urban fishing program.

Both questionnaires were designed to determine whether or not an angler would be willing to pay a specific amount for fishing at the urban lake under three different conditions: (a) if the fishing were identical to the fishing as it was during the program in 1977-78, (b) if the catch limits on the angler's favorite fish were doubled, and

(c) if the lake was not stocked. On the green questionnaire the dollar amounts were increased in increments of five dollars to a maximum of twenty dollars. In addition, values were increased by five dollars for question (b) if the response to (a) was yes and remained the same for (b) if the answer to (a) was no.

The yellow questionnaire was identical with one exception--an angler was asked simply how much he would be willing to pay for the urban fishing permit under the three conditions outlined above. Both questionnaires asked for how much the angler would be willing to sell his permit if he could not buy another for six months.

A tally sheet also was used each interview day to summarize general fishing statistics: how many people were fishing, what fish were caught, how many hours an angler had been fishing, and the breakdown of the population at the lake by race, sex, and age group. A copy of the tally sheet is in the Appendix.

Selection of Day and Time of Interviews

Interviews were made at both lakes throughout the entire year of the stocking program. At each lake, two days of each week and one day of each weekend were selected at random for purposes of interviewing. Drawing was made without replacement.

Once the day was determined, a corresponding time period was randomly drawn with replacement. Each day had been divided into four time periods. Morning was from 6 a.m. until 10 a.m.; noon included hours from 10 a.m. to 2 p.m.; afternoon was from 2 p.m. until 6 p.m.; night extended from 6 p.m. until 10 p.m. or closing of the park, whichever came first.

Selection of Interviewees

Upon arrival at the lake, the interviewer began to determine her/his interviewing sample. An instantaneous count (I) of all people at the lake was made and every nth person was to be interviewed where

$$n = \frac{I}{10}, \quad n \text{ rounded to the nearest integer.}$$

If 27 people were counted, then n - 27 / 10 = 2.7, or 3 and every third person was interviewed. If n was less than ten, then each angler was interviewed. No more than ten interviews were taken in any day.

Since interviews were taken throughout the whole year, reinterviews were possible and rules had to be established governing the reinterview procedure. An angler was not interviewed more than once each month. If a non-qualifying angler fell into the sample, he was to be omitted from the interviewing schedule and replaced with the next qualifying individual. If a previously-interviewed angler was acceptable (i.e., interviewed over a month ago), he was asked only the circled questions on the questionnaire.

All anglers at the lake during the specified period were tallied regardless of their reinterview status. The interviewer made one complete circle about the lake per visit.

A listing of total interviews and reinterviews is in Table 3.1. Table 3.2 lists the total of all who purchased permits during the experimental urban fishing program. A total of 12,515 urban fishing permits were sold to adults and juveniles in the state.

Table 3.1 Total Interviews and Reinterviews

Lake	Year	Age Group	Interviewed[a]	Reinterviews[b]
Chaparral	1977	Adults	262	46
Chaparral	1977	Juveniles	49	1
Chaparral	1978	Adults	209	43
Chaparral	1978	Juveniles	35	0
Lakeside	1977	Adults	213	39
Lakeside	1977	Juveniles	42	2
Lakeside	1978	Adults	193	37
Lakeside	1978	Juveniles	13	18
TOTAL ADULTS			877	165
TOTAL JUVENILES			139	21
TOTAL			1,016	186

[a] First time interviews only.

[b] Total number of reinterviews includes more than one reinterview per person if applicable and also includes reinterviews of anglers who purchased permits in both 1977 and 1978.

Table 3.2. Total Urban Fishing Permits Sold, 1977-78

Lake	Year	Age Group	Total Sold[b]
Chaparral	1977	Adults	1,621
Chaparral	1977	Juveniles	1,427
Chaparral	1978	Adults	2,180
Chaparral	1978	Juveniles	1,383
Lakeside	1977	Adults	1,526
Lakeside	1977	Juveniles	1,099
Lakeside	1978	Adults	2,162
Lakeside	1978	Juveniles	1,117
TOTAL ADULTS			7,489
TOTAL JUVENILES			5,026
TOTAL SOLD			12,515

[a] Permits were statewide. However, only a few Tucson residents fished in Phoenix and vice versa.

[b] Total is exclusive of duplicate permits.

CHAPTER 4

EMPIRICAL RESULTS

The Travel-Cost Approach

The Clawson-Hotelling travel-cost approach requires an estimate of total visits per person, by lake and season, in order to compare visits to distance travelled (distance is a proxy for variable cost since for short distances the two are highly correlated). Total visits were estimated by evaluating the number of times a person had visited the lake since purchasing his permit (question six of the questionnaire) and then forcasting his participation to the end of the permit period at the same rate. Reinterviews were useful to increase accuracy since they gave a running record of an individual's visits. Estimates of total visits are in Table 4.1.

The derived total visits variable for each individual was regressed in a stepwise ordinary least squares multiple regression with the Statistical Package for the Social Sciences (SPSS) against distance and other independent variables such as income, age, race, and sex.

As predicted by Duttweiler (1975c) and substantiated by Sublette and Martin (1975), the results of the travel-cost approach are too poor to be reported in detail. R^2 values were very low; t-statistics rarely rose above 1.0. These results may be because people are simply unaware of time and travel costs of urban sport fishing in Phoenix and

Table 4.1. Estimates of Total Visits, 1977-78.

Lake	Year	Age Group	Total Visits
Chaparral	1977	Adults	10,767.34
Chaparral	1977	Juveniles	11,207.85
Chaparral	1978	Adults	5,495.11
Chaparral	1978	Juveniles	2,566.22
Lakeside	1977	Adults	8,820.12
Lakeside	1977	Juveniles	8,308.40
Lakeside	1978	Adults	2,811.99
Lakeside	1978	Juveniles	2,952.95
TOTAL			52,929.98

Tucson. Both lakes are situated in residential areas and, in most cases, the urban lakes are closer to the anglers' homes than are their places of employment. In addition, the radius of the participation area generally did not exceed 20 miles, which in terms of the Southwest, is no farther than driving to the grocery store.

Willingness-to-Pay Functions

Direct Questions

The most successful willingness-to-pay demand functions were estimated from the direct questions asked from the yellow questionnaire. The functions were estimated from the relationship between three willingness-to-pay dollar values and the corresponding cumulative frequencies in percent of responses willing to pay at least that dollar amount. The willingness-to-pay levels were (1) if the 1977-78 season conditions at the lake held, (2) if the limits on the angler's favorite fish were doubled, and (3) if the lake was no longer stocked. The associated questions (questions 23 through 25 on the yellow questionnaire) were:

(23) What is the most amount of money you would pay for your six month Urban Waters Fishing Permit rather than not fish here at all? (In addition to the regular fishing license if angler is 14 or over.)

(24) If the limit on your favorite fish were twice as high, what is the maximum amount you would pay for your six month Urban Waters Fishing Permit rather than not fish here at all?

(25) If the lake wasn't stocked, like last year, what is the maximum amount you would pay for your six month Urban Waters Fishing Permit?

The data by lake, year, and age group showing the dollar amounts an angler would be willing to pay and the cumulative frequency in percent of anglers who would be willing to pay at least that amount are in Tables 4.2 through 4.9.

Equations were estimated by the PLANETS ordinary least squares regression program.

Unless a function was a straight-line equation, linear transformations were made before estimating the function by regression. First, the functional form--usually an exponential--was estimated. Generally, these were of the form

$$P = a + bX,\ X = Q^{-n},\ 0 < n < 1.$$

If autocorrelation resulted, residuals of the equation (P actual - P estimated) were observed and n was adjusted higher or lower, depending upon the pattern of the residuals. Iterative regressions were run until the following criteria were met:

(1) t-statistics of the constant terms and the variable coefficient were at least at the 99 percent confidence level;

(2) R^2 values were not less than .7 and preferably above .85; and

(3) the Durbin-Watson statistic for autocorrelation (except for Chaparral Juveniles in 1978) did not fall in the autocorrelation range.

Table 4.2. Willingness-to-Pay for an Urban Fishing Permit and Cumulative Frequencies in Percent of Paying at Least That Amount: Chaparral Lake, 1977, Adults (Direct Question Approach).

1977-78 Conditions		Limit Doubled		Lake Not Stocked	
Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency
(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)
1	98.9	1	99.5	1	76.9
2	97.8	2	98.4	2	74.7
				2.5	65.9
3	60.4	3	97.8	3	64.8
		3.25	73.1		
3.5	59.9	3.5	72.5	3.5	22.0
4	59.3				
5	30.2	5	41.2	5	8.8
6	24.7	6	29.6	6	6.6
7	22.0	7	24.7		
8	21.4	8	24.2	8	5.5
8.5	20.3	8.5	22.0		
		9	21.4		
10	7.1	10	7.1	10	1.1
12	4.9	12	5.5		
15	3.8	15	3.8		
20	2.2	20	2.2		
		25	2.6		
40	1.6	40	1.1		
50	1.1				

Table 4.3. Willingness-to-Pay for an Urban Fishing Permit and Cumulative Frequencies in Percent of Paying at Least That Amount: Chaparral Lake, 1977, Juveniles (Direct Question Approach).

1977-78 Conditions		Limit Doubled		Lake Not Stocked	
Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency
(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)
1	77.1	1	88.6	1	83.3
				1.5	25.0
2	65.7	2	65.7	2	20.8
2.5	51.4			2.5	12.5
3	25.7	3	60.1	3	4.2
		3.5	54.3		
4	22.9	4	51.4		
		4.5	45.7		
5	2.9	5	22.9	5	0.1
		6	14.3		
		8	8.6		
10	0.1	10	5.7		
		12	0.1		

Table 4.4. Willingness-to-Pay for an Urban Fishing Permit and Cumulative Frequencies in Percent of Paying at Least That Amount: Chaparral Lake, 1978, Adults (Direct Question Approach).

1977-78 Conditions		Limit Doubled		Lake Not Stocked	
Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency
(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)
				1	98.2
2	99.1	2	99.1	2	92.9
				2.5	73.2
3	56.5	3	75.7	3	23.2
3.5	55.7	3.5	74.8		
4	54.8	4	67.0	4	19.8
4.5	46.1				
5	21.7	5	41.7	5	7.1
6	16.5	6	30.4		
7	13.0	7	29.6	7	3.4
		7.5	24.3		
		8	19.1		
10	3.5	10	6.1	10	0.1
12	2.6	12	4.3		
		15	2.6		
20	0.9	20	1.7		
		25	0.1		
50	0.1				

Table 4.5. Willingness-to-Pay for an Urban Fishing Permit and Cumulative Frequencies in Percent of Paying at Least That Amount: Chaparral Lake, 1978, Juveniles (Direct Question Approach).

1977-78 Conditions		Limit Doubled		Lake Not Stocked	
Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency
(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)
1	83.3			1	86.7
				1.25	80.0
				1.5	53.3
2	77.8	2	83.3	2	40.0
2.5	66.7				
3	33.3	3	72.2	3	33.3
		3.5	55.6	3.5	6.7
4	27.8	4	44.4	4	0.1
5	5.6	5	33.3		
		6	22.2		
		7	16.7		
		8	11.1		
10	0.1	10	0.1		

Table 4.6. Willingness-to-Pay for an Urban Fishing Permit and Cumulative Frequencies in Percent of Paying at Least That Amount: Lakeside Lake, 1977, Adults (Direct Question Approach).

1977-78 Conditions		Limit Doubled		Lake Not Stocked	
Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency
(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)
1	99.2			1	85.1
2	98.4	2	99.2	2	83.0
				2.5	72.3
3	48.8	3	66.4	3	27.7
4	43.2	4	63.2	4	25.5
5	10.4	5	25.6	5	6.4
6	8.8	6	18.4		
7	4.8	7	16.0		
		8	15.2		
10	3.2	10	6.4	10	4.3
12	1.6			12	2.1
15	0.8	15	4.0		
		20	1.6		
		25	0.8		

Table 4.7. Willingness-to-Pay for an Urban Fishing Permit and Cumulative Frequencies in Percent of Paying at Least That Amount: Lakeside Lake, 1977, Juveniles (Direct Question Approach).

1977-78 Conditions		Limit Doubled		Lake Not Stocked	
Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency
(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)
1	70.8	1	91.7	1	71.4
				1.5	21.4
2	66.7	2	75.0	2	14.3
2.25	62.5				
2.5	58.3			2.5	7.1
3	37.5	3	50.0	3	0.1
4	20.8	4	37.5		
5	4.1	5	33.3		
		6	20.8		
7	0.1	7	16.7		
		8	12.5		
		10	8.3		
		12	4.2		

Table 4.8. Willingness-to-Pay for an Urban Fishing Permit and Cumulative Frequencies in Percent of Paying at Least That Amount: Lakeside Lake, 1978, Adults (Direct Question Approach).

1977-78 Conditions		Limit Doubled		Lake Not Stocked	
Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency
(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)
				1	53.6
				2	39.3
3	35.4	3	68.3	3	7.1
4	34.1	4	62.2		
5	7.2	5	34.1	5	0.1
		6	29.2		
7	6.1	7	18.3		
10	4.9	10	6.1		
15	0.1	15	4.9		
		20	0.1		

Table 4.9. Willingness-to-Pay for an Urban Fishing Permit and Cumulative Frequencies in Percent of Paying at Least That Amount: Lakeside Lake, 1978, Juveniles (Direct Question Approach)[a]

1977-78 Conditions		Limit Doubled		Lake Not Stocked	
Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency	Willingness to Pay	Cumulative Frequency
(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)
				0	50.0
1	33.3			1	0.1
2	0.1	2	33.3		
		4	0.1		

[a] Sample size reduced by computer to only 2 due to irrational responses.

Derived willingness-to-pay equations for all three willingness-to-pay levels--conditions for the 1977-78 season, if the limits on the angler's favorite fish were doubled, and if the lake were not stocked--are analyzed for each lake, year, and age group and are shown in Table 4.10. Graphs of the equations are in Figures 4.1 through 4.8. The results for Lakeside Juveniles in the 1978 season were virtually binomial and, therefore, were derived without the aid of regression. For example, the willingness-to-pay equations for conditions in the 1977-78 season are $P = 2 - .03Q$ for values of Q between zero and 33.3 percent and $P = 1.5 - .01Q$ for Q between 33.3 and 100 percent.

Consumers' Surplus Values

The mean consumer's surplus per angler associated with each demand functions is computed by evaluating the integral of the equation from zero to 100 percent or where the curve intercepts the Q-axis (in the case of a logarithmic function, such as that for Lakeside Juveniles in 1977, willingness-to-pay if the lake were no longer stocked, the limits are from 0.1 to 100 percent since the integral of ln (0) is undefined). The mean value of an angler's consumer surplus is found in Table 4.11.

After the average value of the consumer's surplus is derived, the consumers' surplus for all those who purchased permits is calculated. The procedure is simply to multiply the mean consumer's surplus by the number of anglers who purchased permits. Values for each case are summed; the resultant amount is the total consumers' surplus for both lakes for the duration of the experimental urban fishing program. For

Table 4.10. Willingness-to-Pay Demand Functions

Lake	Year	Age Group	Conditions	Equation[a]	R^2[b]	DW[c]
Chaparral	1977	Adults	1977-78	$P = -66.03 + 85.65\ Q^{-.05}$ (-8.00) (9.41)	,829	2.068
			Limits Doubled	$P = 2.44 + 36.37\ Q^{-.75}$ (4.03) (19.95)	.959	1.049
			Not Stocked	$P = -2.96 + 14.19\ Q^{-.25}$ (-3.71) (9.48)	.899	1.574
Chaparral	1977	Juveniles	1977-78	$P = -6.69 + 13.29\ Q^{-.10}$ (-7.06) (11.57)	.957	1.667
			Limits Doubled	$P = 23.30 + 32.98\ Q^{-.05}$ (-4.93) (6.10)	.783	1.256
			Not Stocked	$P = -2.74 + 6.28\ Q^{-.10}$ (-4.72) (9.29)	.945	1.035
Chaparral	1978	Adults	1977-78	$P = 1.89 + 15.43\ Q^{-.50}$ (5.95) (48.64)	.995	1.344
			Limits Doubled	$P = -2.17 + 24.47\ Q^{-.33}$ (-5.62) (45.61)	.944	1.346
			Not Stocked	$P = 2.47 + 3.22\ Q^{-.40}$ (3.45) (4.22)	.704	1.139

Table 4.10; continued

Lake	Year	Age Group	Conditions	Equation[a]	R^2[b]	DW[c]
Chaparral	1978	Juveniles	1977-78	$P = 5.06 - 0.04\ Q$ (13.60) (-6.67)	.897	2.469
			Limits Doubled	$P = 8.03 - 0.08\ Q$ (20.27) (-9.39)	.926	.757
			Not Stocked	$P = 3.78 - 0.03\ Q$ (16.37) (-7.78)	.908	2.001
Lakeside	1977	Adults	1977-78	$P = -4.02 + 17.80\ Q^{-.25}$ (-6.56) (18.52)	.974	2.239
			Limits Doubled	$P = -8.25 + 31.38\ Q^{-.25}$ (11.86) (27.49)	.987	2.371
			Not Stocked	$P = -5.15 + 19.98\ Q^{-.25}$ (-3.90) (8.10)	.902	2.682
Lakeside	1977	Juveniles	1977-78	$P = 5.89 - 0.60\ Q$ (13.53) (-7.18)	.878	1.577
			Limits Doubled	$P = -13.53 + 33.79\ Q^{-.18}$ (-19.53) (28.31)	.989	1.977
			Not Stocked	$P = 2.54 - 0.28\ \ln Q$ (10.71) (-3.52)	.740	1.566

Table 4.10, continued

Lake	Year	Age Group	Conditions	Equation[a]	R^2[b]	DW[c]
Lakeside	1978	Adults	1977-78	$P = -10.40 + 20.58\ Q^{-.1}$ (-3.18) (5.55)	.856	2.062
			Limits Doubled	$P = -40.42 + 55.17\ Q^{-.05}$ (-6.02) (7.36)	.884	2.285
			Not Stocked	$P = 4.30 - 0.06\ Q$ (7.18) (-3.45)	.785	2.744
Lakeside	1978	Juveniles	1977-78	$P = 2.00 - 0.03\ Q,\ 0.0 \leq Q \leq 33.3$		
				$P = 1.50 - 0.015\ Q,\ 33.3 \leq Q \leq 100.0$		
			Limits	$P = 4.00 - 0.06\ Q,\ 0.0 \leq Q \leq 33.3$		
			Doubled	$P = 3.00 - 0.03\ Q,\ 33.3 \leq Q \leq 100.0$		
			Not Stocked	$P = 1.00 - 0.02\ \ 0.0 \leq Q \leq 50.0$		
				$P = 0.00\ \ 50.0 \leq Q \leq 100.0$		

[a] P is willingness-to-pay in dollars
Q is cumulative frequency in percent of people willing to pay at least P
t-statistics are in parenthesis below the corresponding coefficient

[b] R^2 is adjusted for degrees of freedom

[c] DW is the Durbin-Watson statistic for autocorrelation

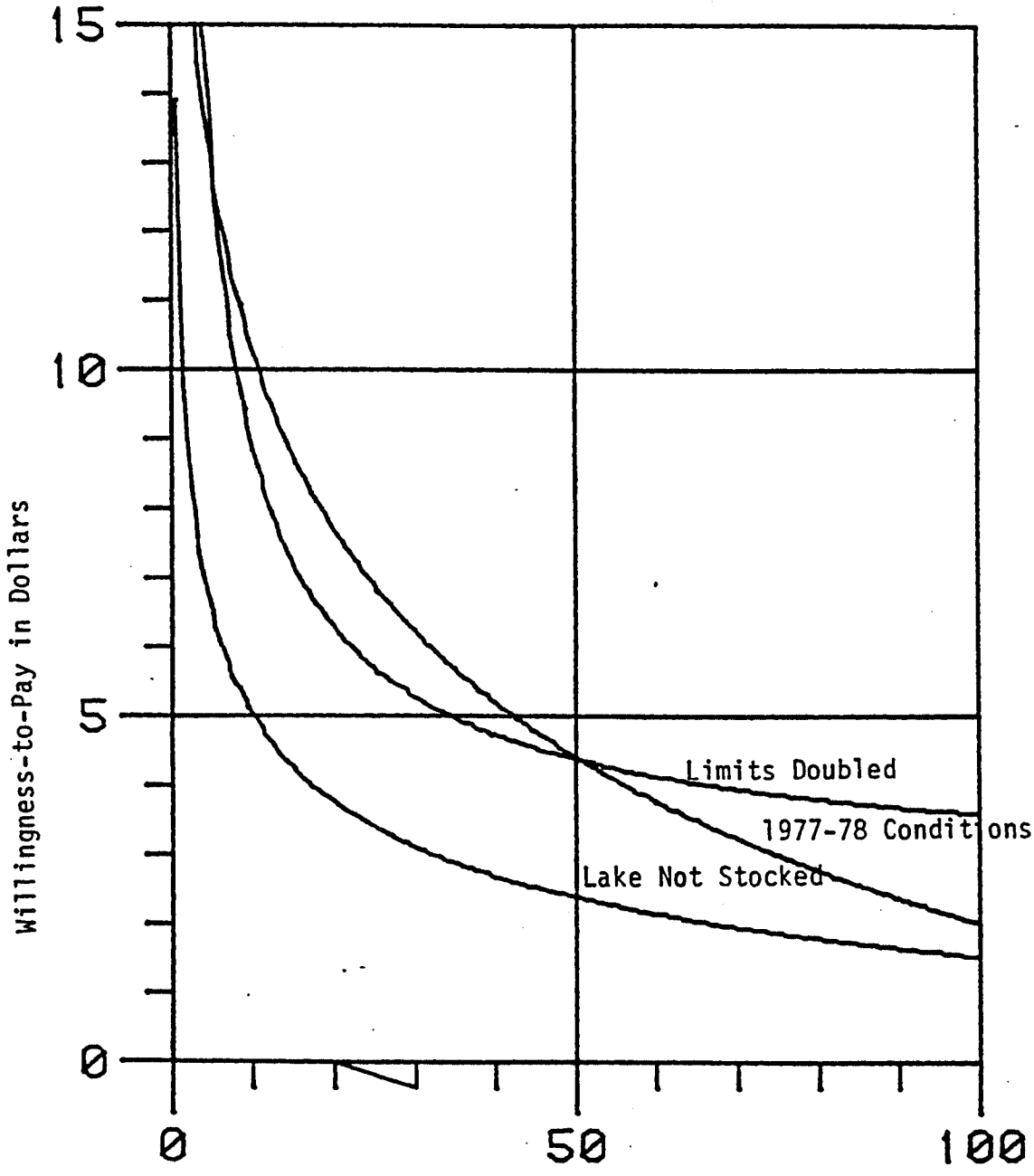

Figure 4.1. Willingness-to-Pay for a Six-Month Urban Fishing Permit, Chaparral, 1977, Adults as a Function of Cumulative Frequency in Percent of Anglers Willing to Pay at Least That Amount.

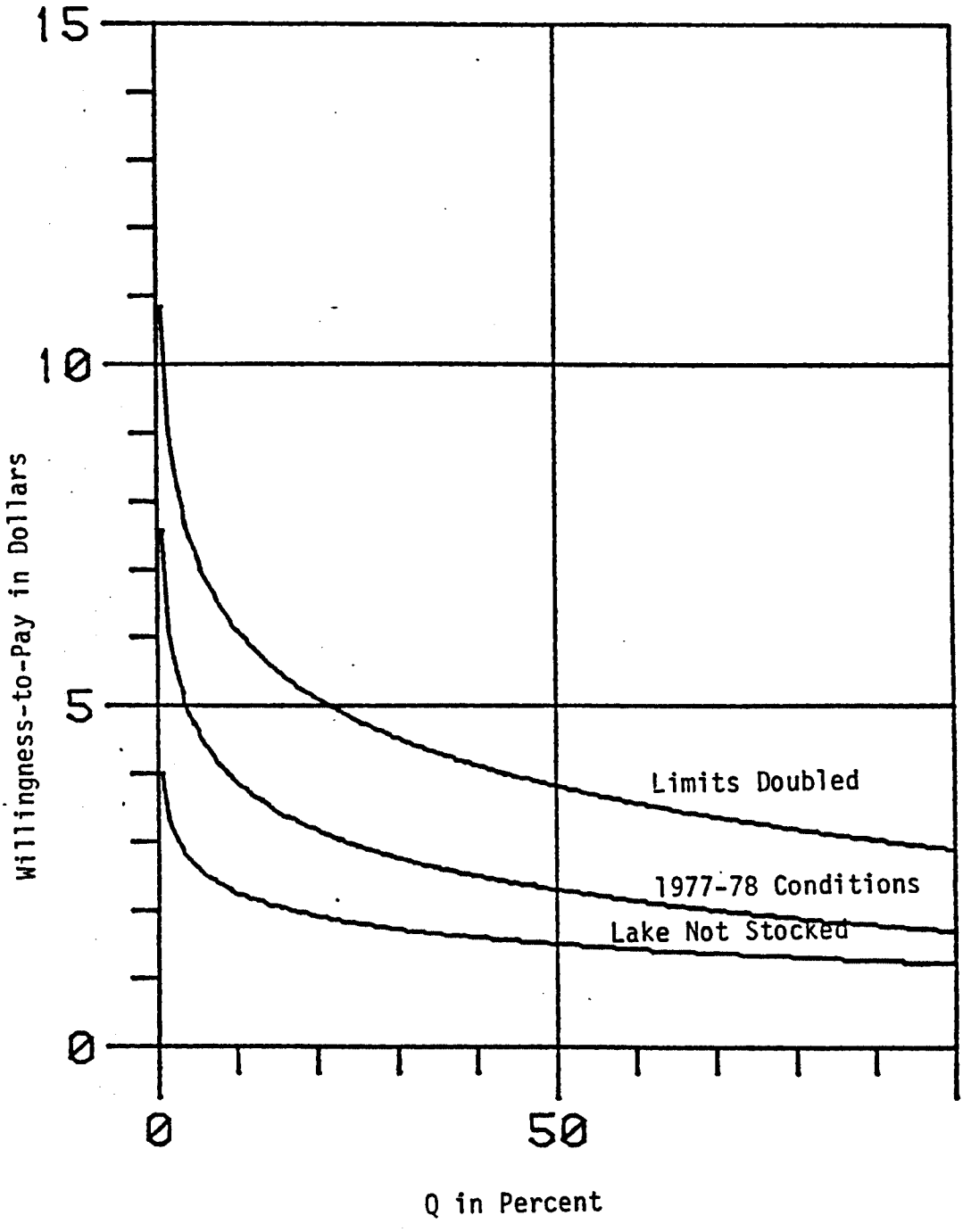

Figure 4.2. Willingness-to-Pay for a Six-Month Urban Fishing Permit, Chaparral, 1977, Juveniles as a Function of Cumulative Frequency in Percent of Anglers Willing to Pay at Least That Amount.

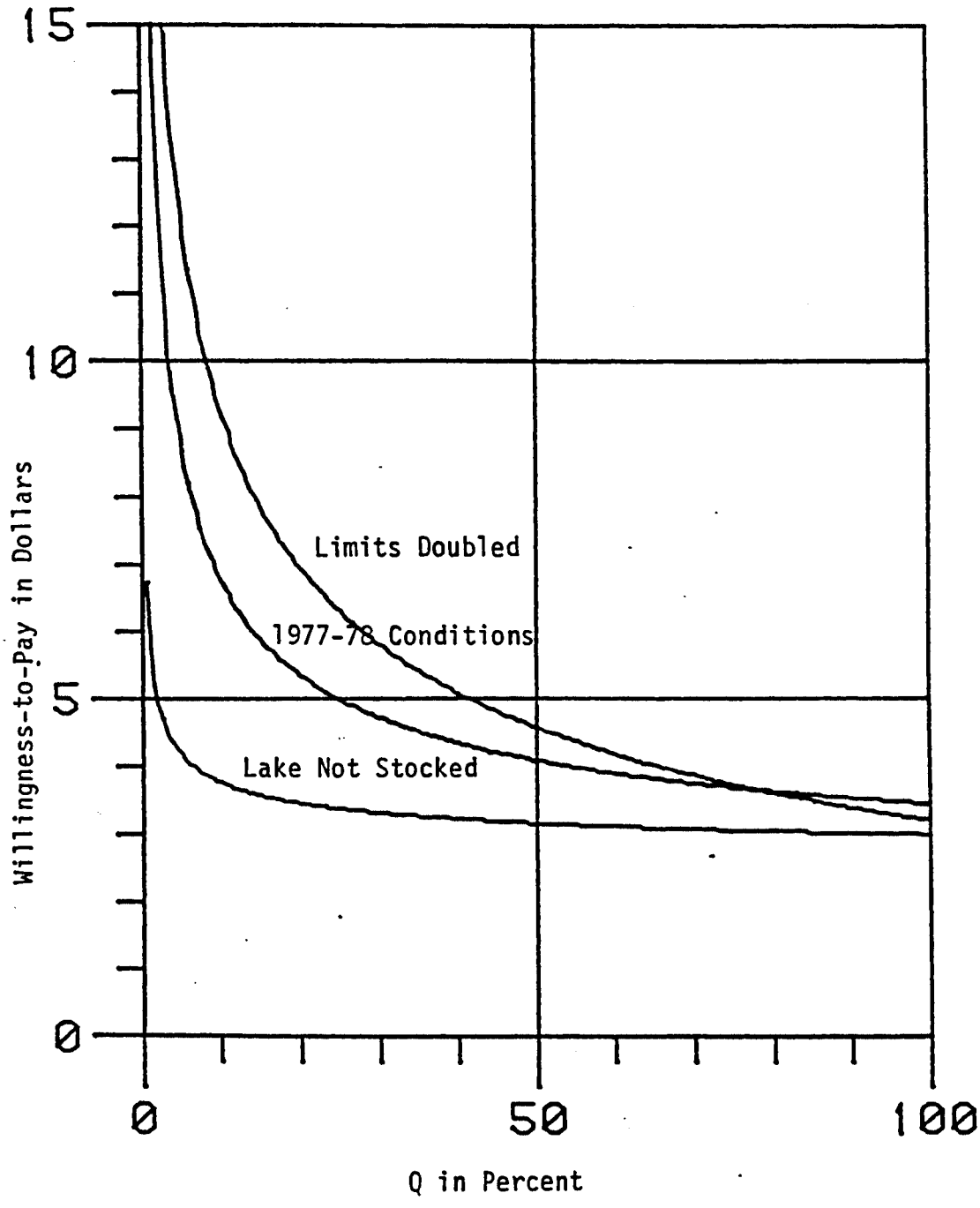

Figure 4.3. Willingness-to-Pay for a Six-Month Fishing Permit, Chaparrral, 1978, Adults as a Function of Cumulative Frequency in Percent of Anglers Willing to Pay at Least That Amount.

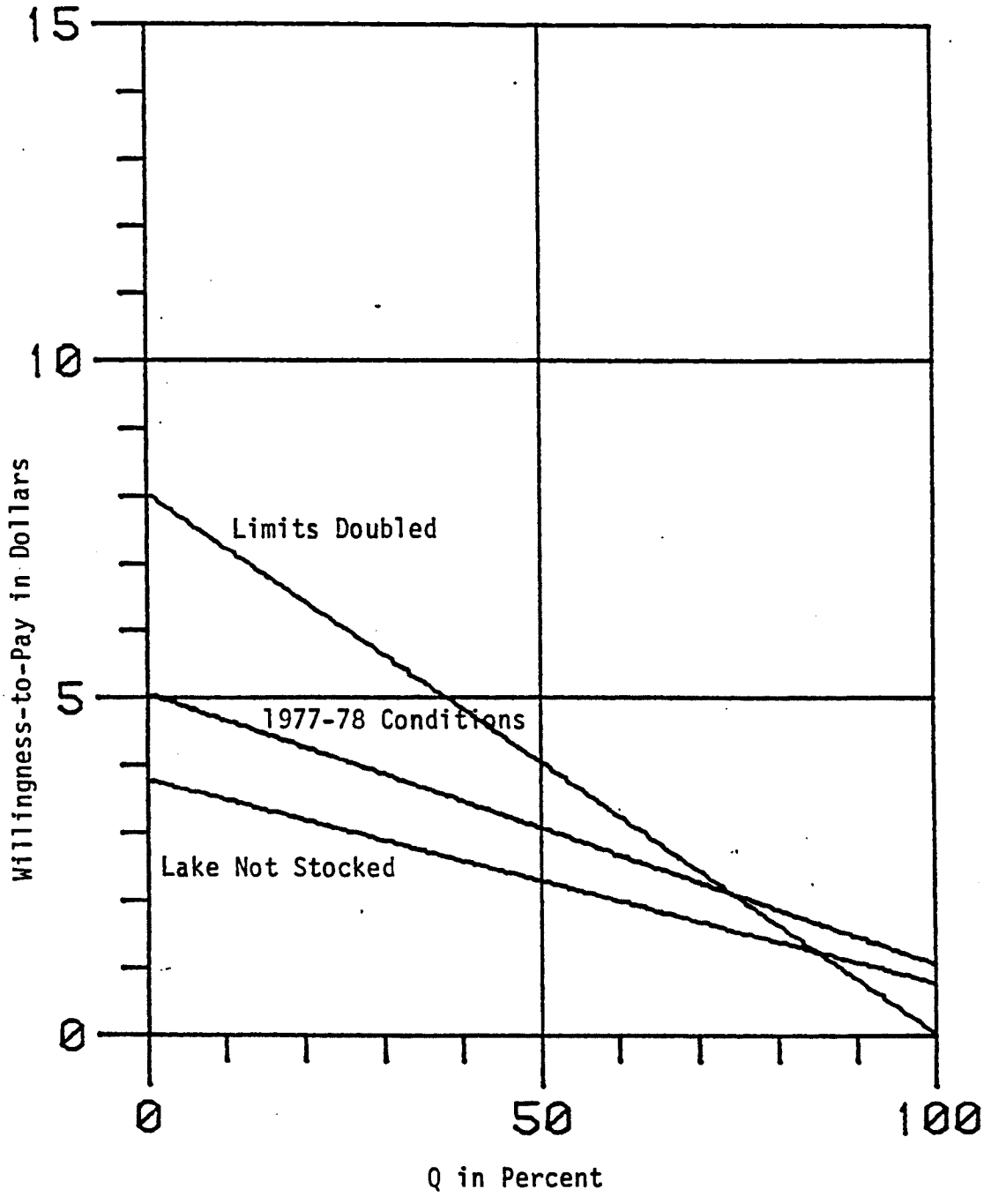

Figure 4.4. Willingness-to-Pay for a Six-Month Fishing Permit, Chaparral, 1978, Juveniles as a Function of Cumulative Frequency in Percent of Anglers Willing to Pay at Least That Amount.

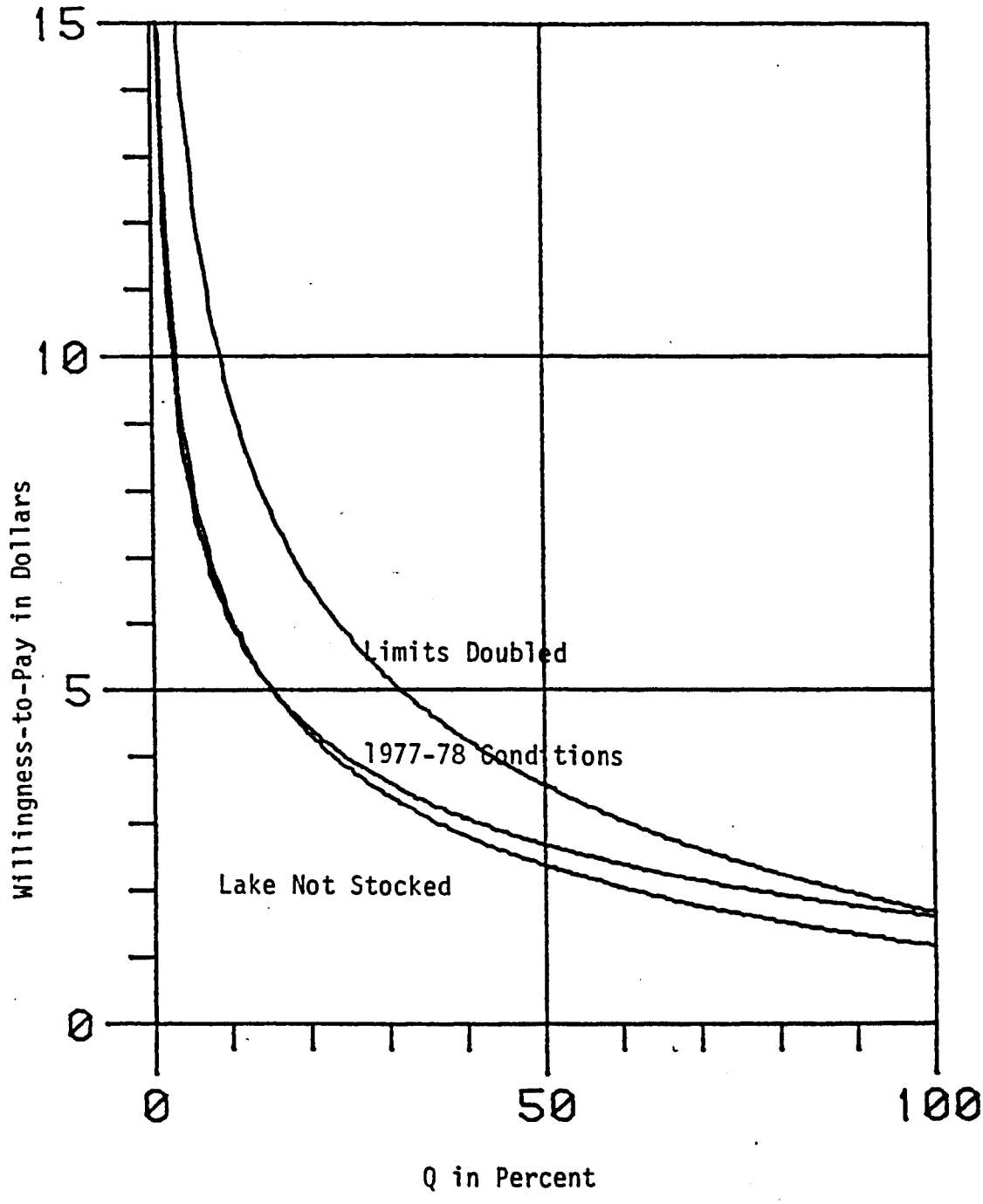

Figure 4.5. Willingness-to-Pay for a Six-Month Urban Fishing Permit, Lakeside, 1977, Adults as a Function of Cumulative Frequency in Percent of Anglers Willing to Pay at Least That Amount.

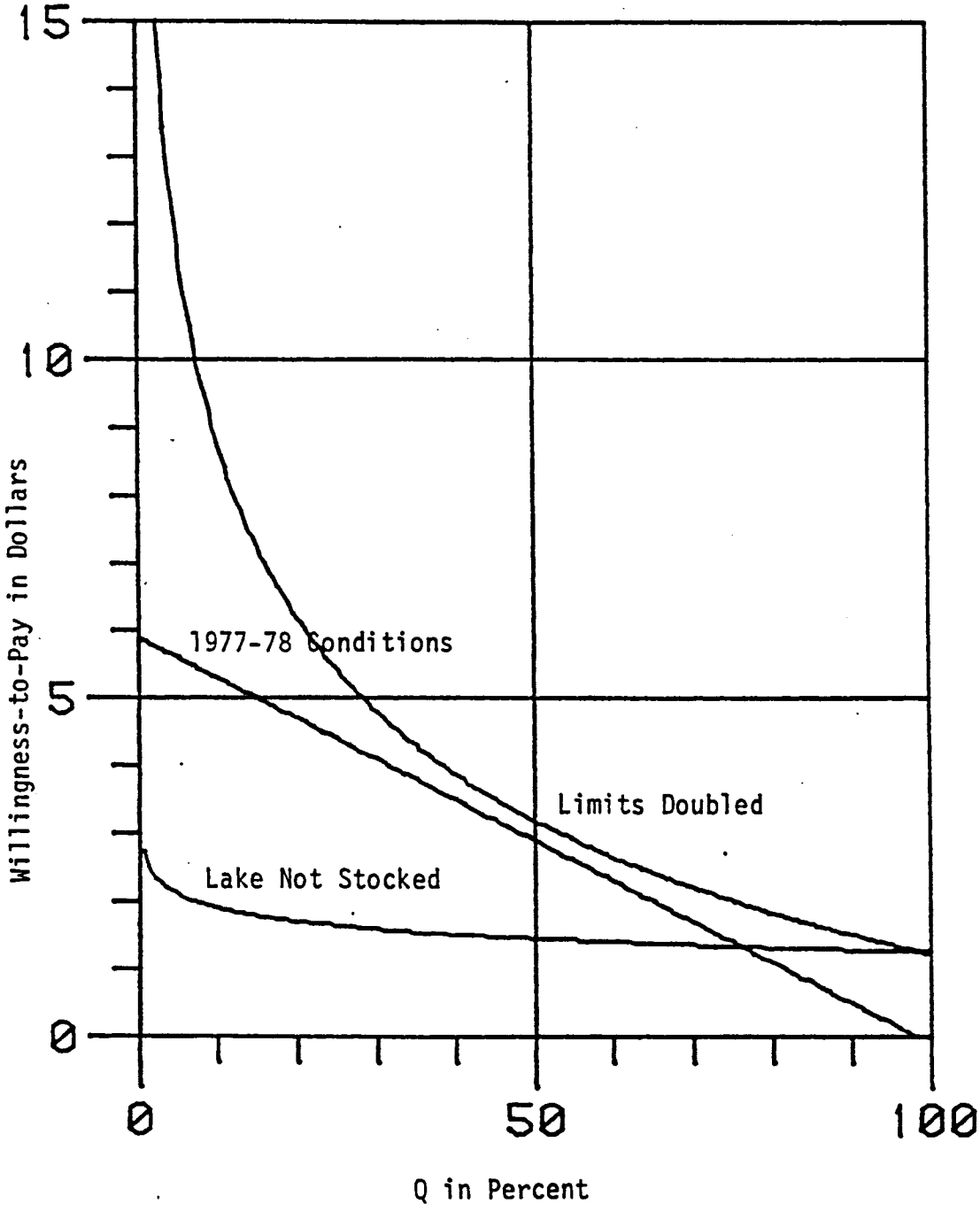

Figure 4.6. Willingness-to-Pay for a Six-Month Urban Fishing Permit, Lakeside, 1977, Juveniles as a Function of Cumulative Frequency in Percent of Anglers Willing to Pay at Least That Amount.

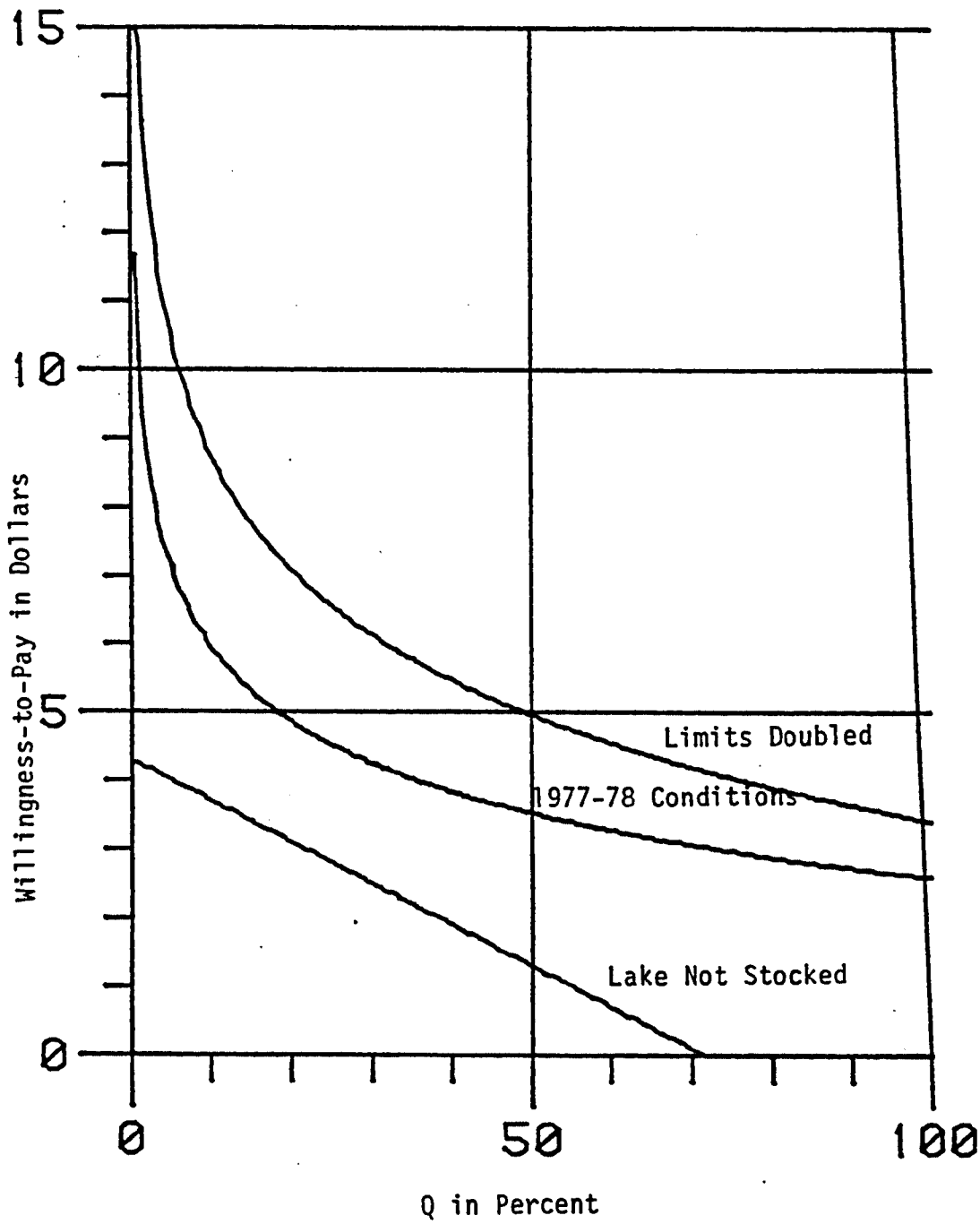

Figure 4.7. Willingness-to-Pay for a Six-Month Urban Fishing Permit Lakeside, 1978, Adults as a Function of Cumulative Frequency in Percent of Anglers Willing to Pay at Least That Amount.

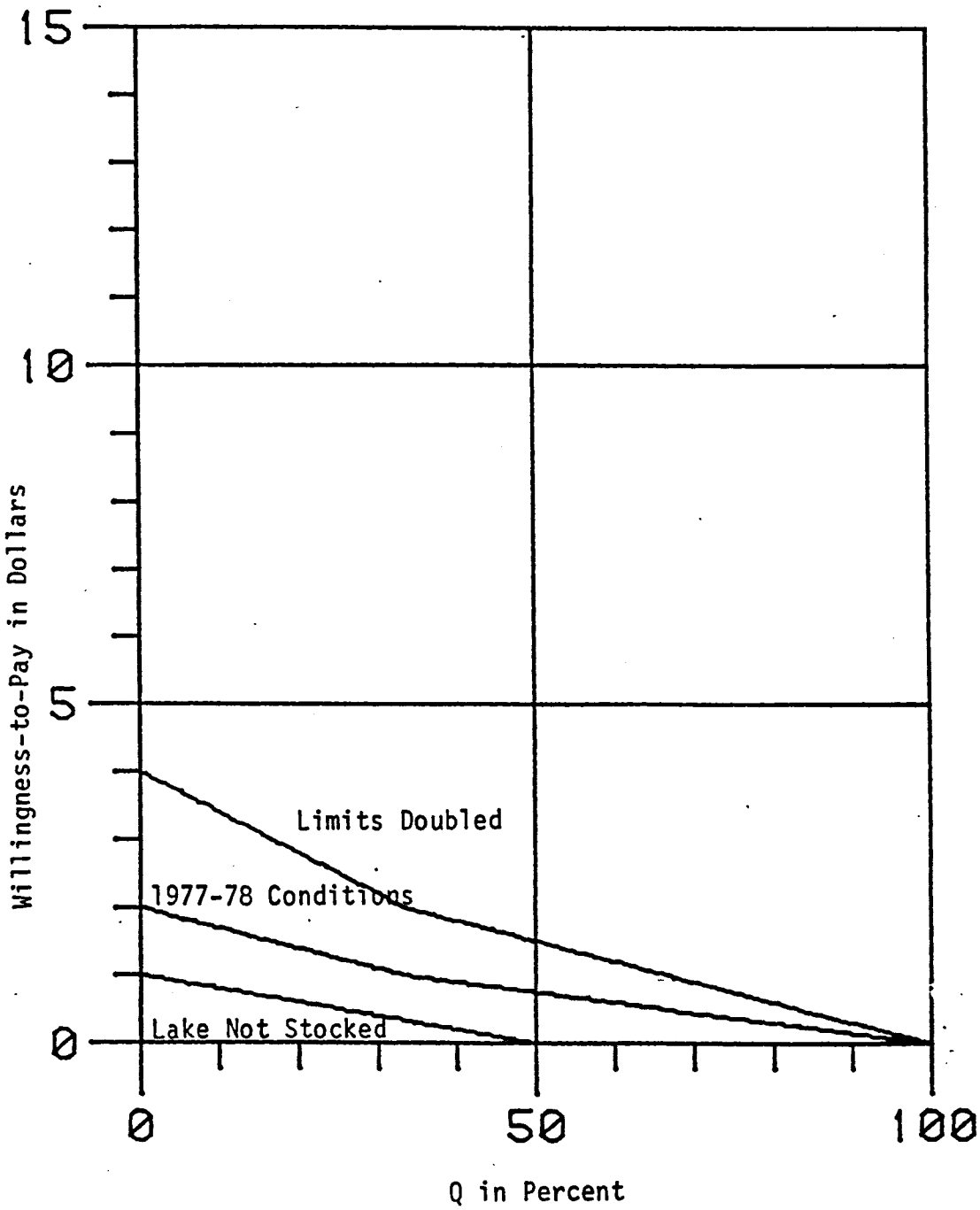

Figure 4.8. Willingness-to-Pay for a Six-Month Urban Fishing Permit, Lakeside, 1978 Juveniles as a Function of Cumulative Frequency in Percent of Anglers Willing to Pay at Least That Amount.

Table 4.11 Mean Consumers' Surplus per Angler for the Sample (Direct Question/Yellow Form Approach)

Lake	Year	Age Group	1977-78 Conditions	Limits Doubled	Lake Not Stocked	Sample Size
			. . . . . dollars			
Chaparral	1977	Adults	5.94	7.04	3.02	182
Chaparral	1977	Juveniles	2.63	4.28	1.66	35
Chaparral	1978	Adults	4.98	5.82	2.81	115
Chaparral	1978	Juveniles	3.06	4.03	2.28	18
Lakeside	1977	Adults	3.48	4.98	3.27	125
Lakeside	1977	Juveniles	2.89	4.46	2.57	24
Lakeside	1978	Adults	4.03	5.71	1.54	82
Lakeside	1978	Adults	.83	1.67	.25	3

the 1977-78 conditions, consumers' surplus was $46,596. If the limits on an angler's favorite fish were doubled, the value jumps to $62,492--an increase of about 34 percent. The consumers' surplus value derived for the condition where the lakes are not stocked is $27,965, a decrease of nearly forty percent from the consumers' surplus value under the 1977-78 conditions. Details of the consumers' surplus values for the population are in Table 4.12.

Five Dollar Auction Method

An alternative method of evaluating willingness-to-pay is the five dollar auction (green questionnaire) discussed in Chapter 3. Since only four points are available, no function could be estimated by regression but a demand curve can be drawn with the data points for comparison with the derived curves from the direct question (yellow form) data.

In the first two columns of Table 4.13, the willingness-to-pay values and the corresponding cumulative frequencies in percent of anglers willing to pay at least that amount are listed for the five dollar auction. The third column is the comparative value of the cumulative frequency derived from the direct question willingness-to-pay level equations of Table 4.10. The last column shows the residual value, where the residual is the cumulative frequency of a willingness-to-pay level from the auction less the cumulative frequency of that same willingness-to-pay derived from the direct question equation. A graphic representation of this comparison is in Figure 4.9 in which willingness-to-pay functions for Lakeside Adults in 1977 given 1977-78 conditions are plotted for both direct questions and five dollar auction data.

Table 4.12. Total Consumers' Surplus for the Population of Anglers with Permits.

Lake	Year	Age Group	1977-78 Conditions	Limits Doubled	Lake Not Stocked	Population Size
			. . . . . dollars			
Chaparral	1977	Adults	9,629	11,412	4,895	1,621
Chaparral	1977	Juveniles	3,753	6,108	2,369	1,427
Chaparral	1978	Adults	10,856	12,688	6,126	2,180
Chaparral	1978	Juveniles	4,232	5,573	3,153	1,383
Lakeside	1977	Adults	5,310	7,599	4,990	1,526
Lakeside	1977	Juveniles	3,176	4,902	2,824	1,099
Lakeside	1978	Adults	8,713	12,345	3,329	2,162
Lakeside	1978	Juveniles	927	1,865	279	1,117
TOTAL			46,596	62,492	27,965	12,515

Table 4.13. Willingness-to-Pay Values, Five Dollar Auction (Green Forms) Compared with Direct Question Approach (Yellow Forms) from Derived Equations, Adults Only.

Lake	Year	Fishing Condition	Willingness to Pay (dollars)	Green Cumulative Frequency (percent)	Yellow Cumulative[a] Frequency (percent)	Residual[b]
Chaparral	1977	1977-78 Conditions	5	50.0	42.2	7.8
			10	24.0	10.8	13.2
			15	11.5	3.0	8.5
			20	2.1	0.9	1.2
		Limits Doubled	5	43.8	34.4	9.4
			10	38.4	8.1	30.3
			15	24.7	4.1	20.6
			20	11.0	2.6	8.4
		Lake Not Stocked	5	20.3	10.1	10.2
			10	8.5	1.4	7.1
			15	1.7	0.4	1.3
			20	0.0	0.0	0.0

Table 4.13, continued. Auction Compared with Direct Question Approach

Lake	Year	Fishing Condition	Willingness to Pay (dollars)	Green Cumulative Frequency (percent)	Yellow Cumulative[a] Frequency (percent)	Residual[b]
Chaparral	1978	1977-78 Conditions	5	60.2	24.6	35.6
			10	35.5	3.6	31.9
			15	16.1	1.4	14.7
			20	7.5	0.7	6.8
		Limits Doubled	5	39.5	41.3	- 1.8
			10	36.0	8.3	27.7
			20	7.0	1.3	5.7
		Lake Not Stocked	5	20.8	1.8	19.0
			10	9.1	0.1	9.0
			15	3.9	0.0	3.9
			20	0.0	0.0	0.0

Table 4.13, continued. Auction Compared with Direct Question Approach.

Lake	Year	Fishing Condition	Willingness to Pay (dollars)	Green Cumulative Frequency (percent)	Yellow Cumulative[a] Frequency (percent)	Residual[b]
Lakeside	1977	1977-78 Conditions	5	49.4	15.2	34.2
			10	27.6	2.6	25.0
			15	14.9	0.8	14.1
			20	8.0	0.3	7.7
		Limits Doubled	5	48.1	31.5	16.6
			10	40.5	8.7	31.8
			15	20.2	3.3	16.9
			20	3.8	1.5	2.3
		Lake Not Stocked	5	29.3	15.0	14.3
			10	14.7	3.0	11.7
			15	5.3	1.0	4.3
			20	1.3	0.4	0.9

Table 4.13, continued. Auction Compared with Direct Question Approach.

Lake	Year	Fishing Condition	Willingness to Pay (dollars)	Green Cumulative Frequency (percent)	Yellow Cumulative[a] Frequency (percent)	Residual[b]
Lakeside	1978	1977-78 Conditions	5	52.5	18.2	34.3
			10	28.7	1.1	27.6
			15	10.9	0.4	10.5
			20	5.9	0.0	5.9
		Limits Doubled	5	57.1	48.9	8.2
			10	55.2	6.1	49.1
			15	30.4	0.9	29.5
			20	7.6	0.2	7.4
		Lake Not Stocked	5	12.9	0.0	12.9
			10	8.6	0.0	8.6
			15	4.3	0.0	4.3
			20	0.0	0.0	0.0

[a] Cumulative Frequency is derived from equations in Table 4.10.
[b] Residual is Green Cumulative Frequency less Yellow Cumulative Frequency.

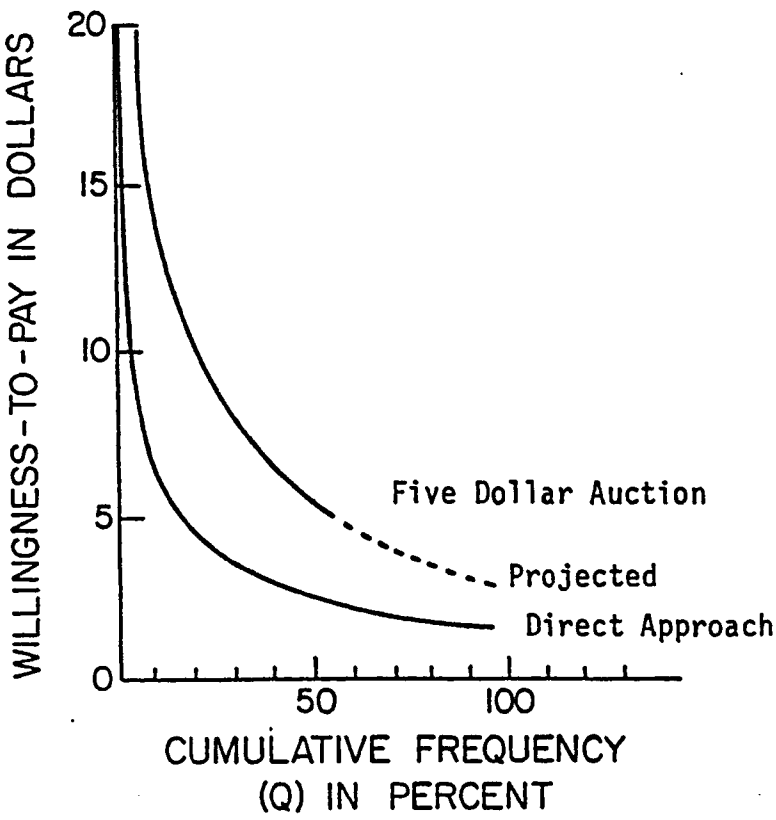

Figure 4.9 Willingness-to-Pay, 1977-78 Conditions, Lakeside Adults, Direct Approach (Yellow Forms) versus Five Dollar Auction Approach (Green Forms)

Values from the auction are consistently higher than equivalent values derived from the direct question equations. This difference may have occured for a number of reasons. First, responses to the direct questions of the yellow questionnaire may be biased downward toward three dollars as this was the price paid for the urban permit and serves as a benchmark figure. Second, values asked on the green questionnaire begin at five dollars and increase in increments of five dollars, hence, values for the auction may be biased upward. Third, when anglers are asked to set their own price as they are under the yellow questionnaire, the values may be lower than if they are asked simply to respond yes or no to a stated price--it is easier to agree with the interviewer than to think of a value on one's own. Lastly, the interviewer error may cause upward bias in the answers to the willingness-to-pay questions on the green forms. Salesmanship or a change in vocal tone may coerce the interviewee to increase his value to a level higher than what he really would be willing to pay.

The Non-Discriminating Monopolist Values

Non-discriminating monopolist values are estimated for both questionnaires. For the direct question approach (yellow questionnaire), calculus was used to solve for the point on the derived demand curves where total revenues were maximized and elasticity was equal to minus one. In the case of the auction (green forms), willingness-to-pay was multiplied by the cumulative frequency willing to pay that amount and the non-discriminating monopolist price was the price at which the product was largest. In both cases, cumulative frequency was replaced

by an associated number of anglers, and revenue was computed by multiplying the non-discriminating price by the number of people who would be willing to pay that price.

To find the associated value for the population, it is necessary to solve the ratio:

$$\frac{\text{Total Revenue from Sample}}{\text{Sample Size}} = \frac{\text{Total Revenue from Population}}{\text{Population Size}}$$

where the total revenue of the population is unknown. Results for the population are listed in Table 4.14 for the direct approach under 1977-78 and limit doubled conditions and in Table 4.15 for the five dollar auction.

The non-discriminating monopolist values were estimated assuming no congestion costs. Hence, values which are less than the actual price paid--three dollars for adults and one dollar for juveniles--may not be the maximizing price in practice. At least at Lakeside, it appeared that on many weekends no more anglers could be accomodated. Assuming that the price of the permit during the 1977-78 season resulted in maximum capacity at the lake, an alternative revenue-maximizing price would be derived by finding that point of the demand function where willingness-to-pay multiplied by the number of people willing to pay that amount is largest from zero to one hundred percent only, regardless of the elasticity. These values, when computed, are:

(1) for Chaparral Juveniles in 1977, this price is one dollar yielding a total revenue of $3392;

Table 4.14. Non-Discriminating Monopolist Values, Direct Approach (Yellow Forms)

Lake	Year	Age Group	Sample Size	Population Size 1977-78[a]	Population Size At Price[b]	Price[c] 1977-78	Total Revenues Sample	Total Revenues Population
						. . . . . dollars		
Chaparral	1977	Adults	182	1,621	1,018	3.35	382.91	3,410.42
Chaparral	1977	Juveniles	35	1,427	4,819	.75	88.65	3,614.39
Chaparral	1978	Adults	115	2,180	363	5.59	107.05	2,029.30
Chaparral	1978	Juveniles	18	1,383	874	2.53	28.79	2,212.04
Lakeside	1977	Adults	125	1,526	1,854	1.32	200.46	2,447.22
Lakeside	1977	Juveniles	24	1,099	539	2.95	34.75	1,591.26
Lakeside	1978	Adults	83	2,162	6,903	1.12	293.25	7,731.79
Lakeside	1978	Juveniles	3	1,117	420	1.00	1.13	420.74
TOTALS				12,515	16,790			23,457.16

Table 4.14; continued

Lake	Year	Age Group	Sample Size	Population Size 1977-78[a]	Population Size At Price[b]	Price[d] Doubled	Total Revenues Sample	Total Revenues Population
						. . . . . dollars		
Chaparral	1977	Adults	182	1,621	105	11.40	134.29	1,196.07
Chaparral	1977	Juveniles	35	1,427	6,550	1.23	197.59	8,056.00
Chaparral	1978	Adults	115	2,180	9,990	1.07	563.89	10,689.39
Chaparral	1978	Juveniles	18	1,383	694	4.01	36.21	2,782.14
Lakeside	1977	Adults	125	1,526	1,011	2.75	227.64	2,779.03
Lakeside	1977	Juveniles	24	1,099	589	2.97	38.22	1,750.16
Lakeside	1978	Adults	82	2,162	3,904	2.13	315.35	8,314.47
Lakeside	1978	Juveniles	3	1,117	559	1.50	2.25	837.75
TOTALS				12,515	23,402			26,784.01

a Actual size of the population that bought permits during the 1977-78 season.
b Size of the population that would buy permits at the Non-Discriminating Monopolist Price.
c Non-Discriminating Price under 1977-78 conditions.
d Non-Discriminating Monopolist Price if limits on anglers' favorite fish are doubled.

Table 4.15. Non-Discriminating Monopolist Values, Five Dollar Auction Approach (Green Forms)

Lake	Year	Age Group	Sample Size	Population Size 1977-78[a]	Population Size At Price[b]	Price[c]	Total Revenues Sample	Total Revenues Population
						. . . . dollars		. . . . .
Chaparral	1977	Adults	76	1,621	810	5.00	190.00	4,052.50
Chaparral	1977	Juveniles	12	1,427	475	5.00	19.98	2,375.96
Chaparral	1978	Adults	93	2,180	774	10.00	330.15	7.739.00
Chaparral	1978	Juveniles	17	1,383	488	5.00	30.01	2,441.00
Lakeside	1977	Adults	87	1,526	420	10.00	240.12	4,211.76
Lakeside	1977	Juveniles	18	1,099	366	5.00	29.97	1,829.84
Lakeside	1978	Adults	111	2,162	620	10.00	318.57	6,204.94
Lakeside	1978	Juveniles	10	1,117	447	5.00	20.00	2,234.00
TOTALS				12,515	4,200			30,789.00

[a] Actual size of the population that bought permits during the 1977-78 season

[b] Size of the population that would buy permits at the Non-Discriminating Monopolist Price

[c] Non-Discriminating Monopolist Price under 1977-78 Conditions

(2) for Lakeside Adults in 1977, this price is three dollars with revenues of $1891;

(3) for Lakeside Adults in 1978, the value is also three dollars with total revenues equal to $4735; and

(4) values above one dollar for juveniles and three dollars for adults remain as before.

Ergo, the non-discriminating monopolist value for the 1977-78 season for both lakes is $19,681 if congestion costs are assumed.

Revenues and Costs

Total revenues generated in 1977-78 from selling the urban fishing permit are listed on Table 4.16. Sellers of the permits other than the Department of Game and Fish were the city parks departments and Yellow Front Stores near the lakes. Sellers other than the Department were allowed to keep five percent of all sales, and therefore, the revenues are adjusted downward by this amount. The revenues do not include costs for replacement permits as less than ten individuals paid for the replacement permit which cost one dollar.

Two sets of cost estimates supplied by the Arizona Department of Game and Fish are on Table 4.17. The first set is a list of costs of the program as it was implemented during the 1977-78 season; the second is the estimated cost of a continuing program in which the supply of fish is contracted. In 1977-78, for the experimental program, the Department of Game and Fish purchased and transported and, in some cases, caught, the fish with their own manpower. As can be seen in the

Table 4.16. Total Revenues to the Arizona Department of Game and Fish Exclusive of Duplicate Permits, with Five Percent of Sales to Yellow Front Stores and City Parks Departments.

Lake	Year	Age Group	Game and Fish Sales	Yellow Front City Parks Sales	Total Revenue to Arizona Game and Fish
			dollars		
Chaparral	1977	Adults	180.00	4,457.40	4,637.40
Chaparral	1977	Juveniles	29.00	1.328.10	1.357.10
Chaparral	1978	Adults	312.00	5,916.60	6.228.60
Chaparral	1978	Juveniles	33.00	1,282.50	1,315.50
Lakeside	1977	Adults	78.00	4,275.00	4,353.00
Lakeside	1977	Juveniles	11.00	1,033.60	1,044.60
Lakeside	1978	Adults	132.00	6,039.15	6.171.15
Lakeside	1978	Juveniles	6.00	1,055.45	1,061.45
TOTALS			781.00	25,387.80	26,168.80

Table 4.17. Costs for the 1977-78 Urban Fishing Program: Actual and Contracted Estimates[a]

Fish	Number Stocked	Actual Cost		Estimated Cost if Contracted		
		Total Cost	Cost Per Fish	Number Stocked	Total Cost	Cost Per Fish
		. . . . dollars			. . . . dollars	
Carp	5,996	28,588	4.77	5,996	7,195	1.20
Trout	18,000	10,440	.58	18,000	8,100	.45
Tilapia	6,228	4,439	.71	6,228	1,718	.28
Catfish	13,987	19,141	1.37	13,987	21,855	1.50
TOTALS	44,211	62,608	1.42	44,211	38,878	.88

[a] Data supplied author by Arizona Department of Game and Fish, Urban Lakes Program (Gary Edwards, Fisheries Biologist), 1977-78.

Table, the costs of continuing the program are about 38 percent less than the costs of the program during the 1977-78 season.

Costs and Benefits

Costs and benefits can be compared to derive a net economic value of urban sport fishing. All combinations of costs and benefits are used in order to find the net value for all cases. Results are in Table 4.18.

As can be seen, the losses of the program could be cut drastically if the Arizona Department of Game and Fish would opt for a contracting arrangement as opposed to methods chosen for the 1977-78 fiscal year. Revenues generated by the sale of permits may never balance costs of the program. However, the consumers will always realize a gain and, if the fish are contracted, society as a whole would have a net economic benefit of nearly eight thousand dollars.

Net economic costs of the program are given for fourteen different cases. The greatest net cost given the 1977-78 costs and that the lakes were stocked is derived from the non-discriminating monopolist method for the direct question approach. This value is only three thousand dollars less than the actual net social costs of the program as derived from actual revenues less actual costs of the program. The least cost to society as a whole for the 1977-78 cost figures is the consumers' surplus value if the limits of the anglers' favorite fish were doubled less the costs of the program. The value is very close to the break-even point.

Table 4.18. A Comparison of Costs and Benefits in Dollars of the Urban Sport Fishing Program, 1977-78.

				Non-Discriminating Monopolist Values, Direct and Five Dollar			
	1977-78 Conditions	Limit Doubled	Lake Not Stocked	Total Revenues from the Direct Approach[b] 1977-78 Conditions	Limit Doubled	Five Dollar Auction[c]	Actual 1977-78 Revenues[d]
Benefits --	(46,596)	(62,492)	(27,965)	(23,457)	(26,784)	(30,789)	(26,168.80)
Benefits Minus Acutal Costs[e] (62,608)	-16,012	-116	27,965[f]	-39,151	-35,824	-31,819	-36,439.20
Benefits Minus Estimated Costs if Contracted[e] (38,868)	7,728	23,624	27,965[f]	-15,411	-12,084	-8,079	-12,699.20

[a] Taken from Table 4.12.
[b] Taken from Table 4.14.
[c] Taken from Table 4.15.
[d] Taken from Table 4.16.
[e] Taken from Table 4.17.
[f] No stocking implies no costs or revenues.

If the fish were to be contracted, society as a whole benefits. Consumers' surplus values for both the 1977-78 limits doubled conditions less the estimated costs of stocking if the fish are contracted yields a net benefit.

However, the non-discriminating monopolist values and actual 1977-78 revenues less estimated costs still show net costs.

CHAPTER 5

NON-ECONOMIC RESULTS

In this chapter the typical urban angler and his participation as well as his feelings about the program are described. The section on minority usage may have implications for equitable policy in future programs. Also, the sections on angler comments, complaints, and suggestions may help administrators learn what the average angler expects for an urban fishing program.

Minority Usage

Chaparral Lake

More than 98 percent of all households in the City of Scottsdale are Anglo with only one percent Mexican-American and less than half of a percent Black or American Indian. For the Phoenix Metropolitan Area as a whole, there are 90 percent Anglos, eight percent Mexican-Americans and three percent Blacks and less than one percent Orientals. However, as Figure 5.1 and Table 5.1 indicate, usage by these minorities, especially by Blacks, is considerably higher than the demographic statistics would suggest. In fact, for a two month period during the 1977 catfish season, the percentage of Blacks at Chaparral Lake was over ten times that of Blacks in the Phoenix Metropolitan Area and was also higher than the proportion of Blacks in the Black communities near the airport.

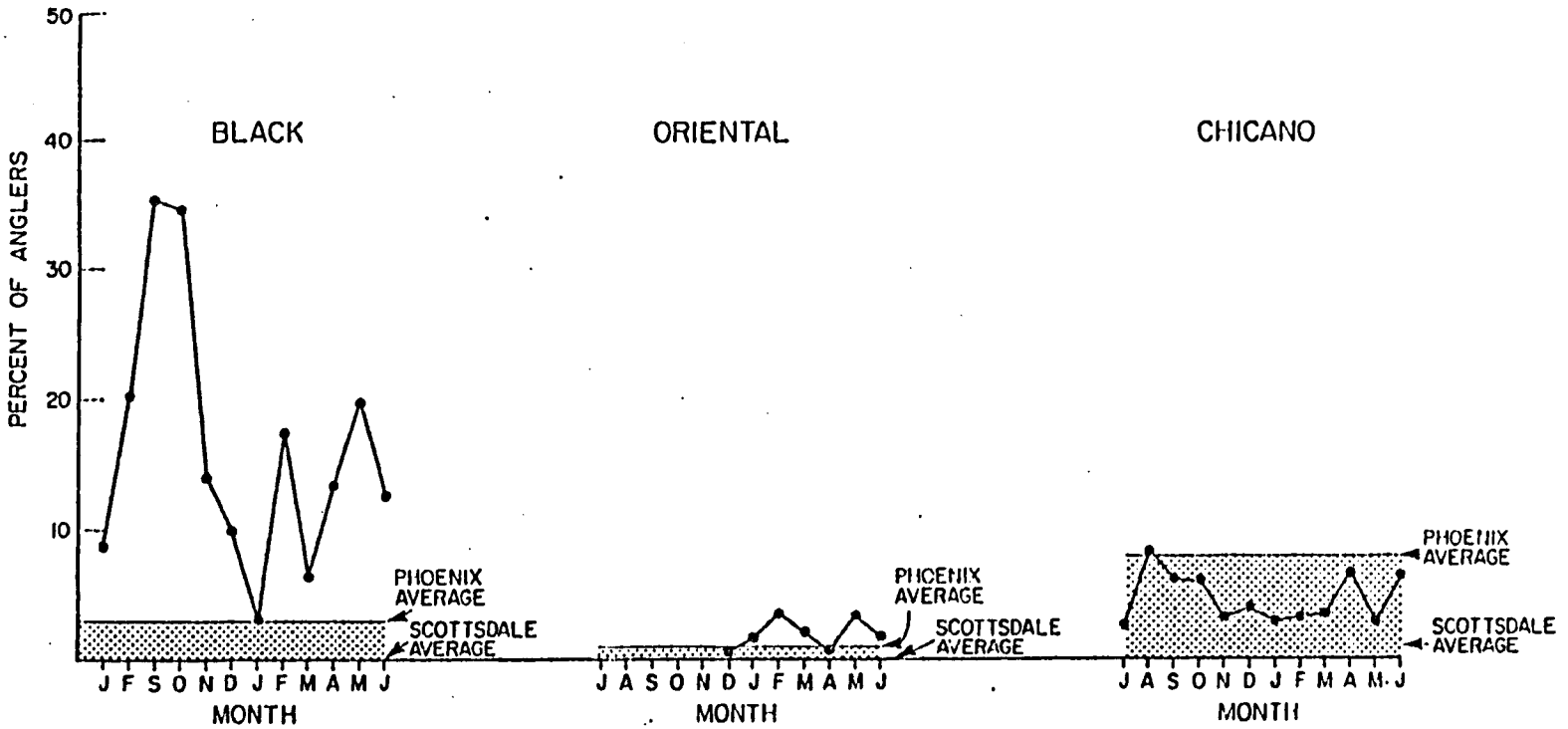

Figure 5.1. Percentages of Minorities at Chaparral Lake by Month, Compared to Phoenix and Scottsdale Area Minority Percentages.

Table 5.1. Ethnicity of Anglers at Chaparral Lake by Month, 1977-78

Month	Black	Oriental	Chicano	Anglo
	percent			
July	8.9	0.0	2.5	87.6
August	20.3	0.0	8.1	71.6
September	35.5	0.0	6.0	58.5
October	34.7	0.0	6.0	59.3
November	14.1	0.0	3.1	82.8
December	10.9	0.4	3.9	84.8
January	3.2	1.7	2.9	92.2
February	17.4	3.5	3.1	76.0
March	6.4	2.0	3.4	88.0
April	13.3	0.6	6.5	79.6
May	19.9	3.3	2.8	74.0
June	12.6	2.7	6.3	78.4
Phoenix Metropolitan Average[a]	3.0	1.0	8.0	90.0

[a] Total greater than 100 percent due to households with more than one ethnic group represented. Estimate for Phoenix Metropolitan Average taken from Inside Phoenix, 1978.

Oriental participation was not observed until December but afterward was higher than the Scottsdale and Phoenix area average for the minority.

The basic pattern of Black and Chicano usage is that percentages are higher during catfish season. This pattern may have occured for a variety of reasons: weather is warmer and trout stamps may cost more than their budgets allow as these minorities are typically much poorer than the whites of the area. Most often these minorities claimed that their favorite fish was catfish, but this reason may be more income-related than is commonly believed.

Lakeside Lake

Minority usage at Lakeside Lake followed essentially the same pattern as that at Chaparral. Blacks appear to be overrepresented when the metropolitan area averages are considered. The pattern of minority participation being low in the winter and high in the summer is more exaggerated than at Chaparral. Orientals are more numerous, perhaps as a result of Lakeside's proximity to Davis-Monthan Air Force Base. Chicano usage, unlike that at Chaparral, is low given the demographics of Tucson, but about the same as Phoenix and may be because of cultural bias against sport fishing.

Graphic descriptions of minority usage are found in Figure 5.2. Summaries of ethnicity are in Table 5.2.

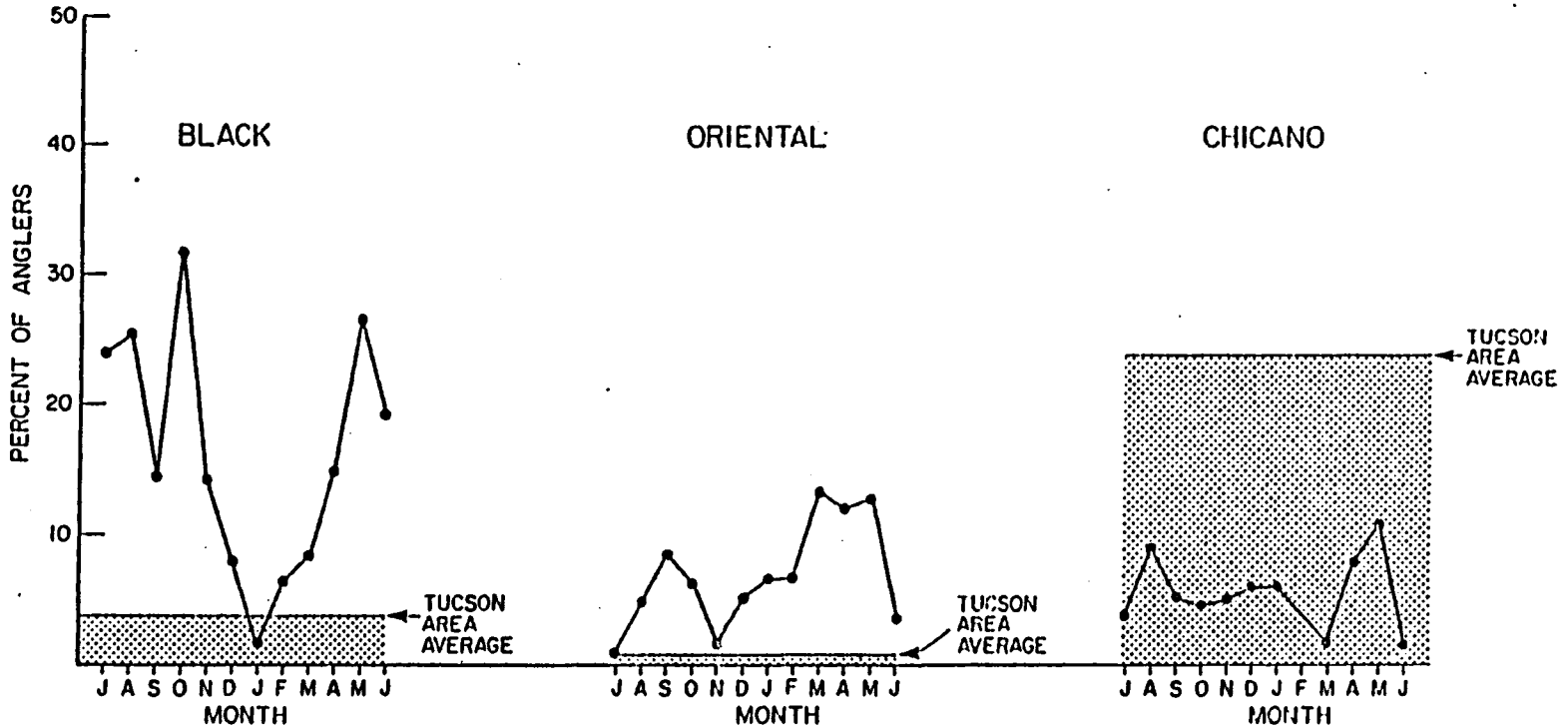

Figure 5.2. Percentages of Minorities at Lakeside Lake by Month, Compared to Tucson Area Minority Percentages.

Table 5.2. Ethnicity of Anglers at Lakeside Lake by Month, 1977-78.

Month	Black	Oriental	Chicano	Anglo
		percent		
July	24.0	0.8	3.9	71.3
August	25.2	4.7	9.0	61.1
September	14.4	8.3	5.1	72.2
October	31.7	6.1	4.4	57.8
November	14.1	1.9	5.0	79.0
December	8.0	5.0	6.0	81.0
January	1.7	6.5	6.0	85.8
February	6.6	6.6	3.8	83.0
March	8.3	13.3	1.7	76.7
April	14.9	12.0	8.2	64.9
May	26.4	12.9	11.0	49.7
June	19.2	3.3	1.7	75.8
Tucson Area Average[a]	3.7	0.8	24.0	71.5

[a] Estimate is from Tucson Trends, 1978.

Qualifications

The above statements must be qualified. Since the data used came from the tally sheets rather than from interviews, repeating anglers were not identified and doubled counting of any race may have occurred. Ergo, the percentage of Blacks or Chicanos may be either lower or higher than indicated compared to area demographics. However, the estimates accurately portray the ethnicity of the anglers at the lakes in any given month.

Intensity of minority usage may be the result of cultural preference or income. To discover which effect is larger, a cross-tabulation of race and distance travelled was made. If results showed that a higher percentage of minorities--especially Blacks--fishing at the lakes came from a relatively high income area near the lake, minority usage could be attributed more to cultural preferences than to income level and vice versa.

Results overwhelmingly showed that the minorities came primarily from the lowest income areas of both cities, which corresponded to one of the farthest distances travelled. Even in the case of Lakeside which is near Davis-Monthan Air Force Base with a relatively high Black population, the Blacks originated from the more distant neighborhoods. Ergo, urban fishing may be an inferior good--as income increases, demand for the good decreases. This aspect of the program will be pursued later in this chapter.

Miscellaneous Angler Responses

Question 13: Would You Have Come to the Park Today if You Weren't Going to Fish?

Only 16.9 percent of all respondents claimed that they would have come to the park if they weren't going to fish. Although it cannot be concluded that the lakes were the major park attraction, it can be assumed that stocking the lakes significantly increased park attendance during the 1977-78 season, especially at Lakeside, which lacks a municipal pool and has no park facilities on three of its four shores.

When asked why they were at the lake if not for fishing, interviewees gave remarkably similar responses. The most common response at 43 percent was for exercise, including sporting events, using a playground, and jogging or walking. Another large group, 31.5 percent, claimed they could give no specific reason for coming to the park other than to sit or get out of the house. Of this group, over half were housewives, retired, unemployed, disabled or students. Responses are summarized in Table 5.3.

Question 14: If You Weren't Fishing Here Today, What Would You Probably Be Doing?

Over half of all those interviewed--54.7 percent--said they would have been at home if they were not fishing at the urban lake. Within this category, various responses were television viewing, housework, sleeping and simply "at home." A total of 4.9 percent confessed that they would or should be at work or in class if they weren't fishing; only 2.2 percent said they would be fishing elsewhere regardless

Table 5.3. Response to Question 13 by Percent: Would You Have Come to the Park Today if You Weren't Going to Fish?

Responses	Percent	Percent
Would not be at the park		83.1
Would be at the park		16.9
For exercise	43.0	
No specific reason	31.5	
Picnic/family outing	28.4	
Any water-related activity other than fishing	7.1	
TOTAL	100.0	100.0

of work or class. However, it would be rash to conclude that the introduction of fishing into an arid area contributes to worker or student absenteeism.

Activities with less than 25 responses (2.2 percent) were grouped under the heading Miscellaneous. Examples of this type of response are "something sinful" and "at Church." Fourteen percent of all those questioned gave no answer.

A complete listing of answers to question 14 are in Table 5.4.

Question 29: Do You Have Any Comments about the Urban Fishing Program?

Comments were grouped into five categories: highly favorable, slightly favorable, highly unfavorable, and no comment. Favorable comments outnumbered the unfavorable by nearly three and one half to one, and the highly favorable category was the largest of all five groups. The breakdown by category, examples of each, and the percentage or respondents in each category can be found in Table 5.5.

The single most popular feature of the urban lakes fishing program was the convenience of having a stocked lake nearby. Anglers overwhelmingly approved of the program as a gas and time saver, and some hope for expansion of the program to other areas of Tucson and Phoenix was expressed.

Although 21.4 percent of all those who commented had a complaint, nearly 90 percent of the complaints were accompanied by some praise or the comment lodged was unrelated to the urban fishing program itself. Examples of these complaints are: "very good, but not stocked enough," "needs more garbage cans and trees," and "not for adults but terrific

Table 5.4. Responses to Question 14 by Percent: If You Weren't Here Fishing Today, What Would You Be Doing?

Category	Percent of Total	Response	Percent of Category
At Home	54.7	Watching Television	35.3
		"At Home"	30.3
		Sleeping	11.8
		Doing Homework	11.0
		Gardening	5.2
		Reading/Studying	3.4
		Eating/Cooking	2.2
		Other	0.8
Sports & Exercise	10.1	Playing	21.4
		Swimming	17.8
		Golf	9.8
		Walking	8.9
		Bicycling	7.1
		Motorcycling	5.4
		Football	4.5
		Baseball	3.6
		Tennis	3.6
		Basketball	2.7
		Soccer	2.7
		Jogging	2.7
		Bowling	1.8
		Pool	1.8
		Softball	1.8
		Skating	1.8
Working or In Class	4.9		
Fishing Elsewhere	2.2		

Table 5.4, continued

Category	Percent of Total	Response	Percent of Category
Miscellaneous	10.1	Nothing	13.3
		Drinking	12.0
		Hobbies	8.2
		Picnic	7.0
		Hunting/Shooting	6.3
		At This Park	5.7
		Visiting Friends	4.4
		Sightseeing	3.8
		Don't Know	3.2
		Relaxing	3.2
		Working on Cars	3.2
		Shopping	3.2
		Looking for a Job	3.2
		At Mountains	2.5
		At Movies	2.5
		Out	2.5
		Vacationing	1.9
		Recreating	1.3
		Partying	1.3
		Messing with Girls	1.3
		Looking at People	.6
		Camping	.6
		Flying Kites	.6
		Fighting with Sister	.6
		At the Fair	.6
		Walking the Dog	.6
		At Elks' Club	.6
		Taking Pills	.6
		At Rec. Center	.6

Table 5.4, continued

Category	Percent of Total	Response	Percent of Category
Miscellaneous (continued)		Sabino Canyon	.6
		In the Desert	.6
		Wishing was Fishing	.6
		At Church	.6
		Something Sinful	.6
		Playing Cards	.6
		Playing Dominoes	.6
No Answer	14.3		

Note: Some percentages may not total to exactly 100 percent due to rounding.

Table 5.5. Responses to Question 29 by Percent: Do You Have Any Comments about the Urban Fishing Program?

Category	Example	Percent
Highly Favorable	Love it, terrific	37.9
Slightly Favorable	Program is OK	10.9
Slightly Unfavorable	Needs more fish	13.5
Highly Unfavorable	Lousy fishing, a dud, will not return	0.8
No Comment		36.9
TOTAL		100.0

for kids." Complaints about stocking were most common. Most anglers said that the lakes were not stocked enough or that small fish were stocked too often and should not be stocked at all (there were plants of channel catfish fingerlings in November at both lakes). Complaints are summarized in Table 5.6.

Participation by Age and Sex

Table 5.7 shows the montly breakdown by lake of percentage of male and femal anglers. From the data, it appears women of both Phoenix and Tucson prefer fishing in the milder fall and spring months.

Table 5.8 has monthly breakdowns by lake of percentages of anglers classified as adults and juveniles. As would be expected, the highest percentages of juveniles participating occurs in months when school is not in session-summer and holiday months.

Determination of Variables Affecting Adult Angler Participation

Throughout the data-gathering period, it was noticed that certain factors had definite effects on the number of anglers at the lakes on any given day. However, no single variable truly dominated another. For example, rain generally precluded a high turnout, but at times more people were fishing during a Saturday rain shower than on a warm sunny Tuesday afternoon. Linear regressions were used to determine which factors had what effects, and to what degree these effects were felt. Spontaneity--perhaps the most important determinant of angler participation--is not measurable, and high R^2 values were not expected in regression results. However, certain coefficients were anticipated to be both significant and consistent among alternative formulations.

Table 5.6. A List of Complaints by Percent[a].

Complaint Category	Percentage of Responses
Stocking (not enough)	48.7
Uncleanliness	8.2
Permit Cost	8.2
Motorized Model Boats on the Lake	7.6
Not Enough Trees	6.3
Needs More Patrolling	6.3
Limits Are Too Low	4.4
Lake is Too Small or Shallow	3.8
Too Many Kids	2.5
Miscellaneous	4.0
TOTAL	100.0

[a] Sixty-three percent of the sample had comments, 23 percent of those who commented had some complaints.

Table 5.7 Participation by Sex at Chaparral and Lakeside by Month, 1977-78.

Month	Chaparral		Lakeside	
	Female	Male	Female	Male
	percent			
July	18.7	81.3	12.4	87.6
August	27.0	73.0	17.1	82.9
September	33.6	66.4	21.0	79.0
October	34.7	65.3	25.0	75.0
November	24.9	75.1	14.0	86.0
December	14.5	85.5	14.0	86.0
January	14.4	85.6	11.2	88.8
February	14.8	85.6	18.4	81.6
March	16.9	83.1	16.7	83.3
April	24.9	75.1	24.5	75.5
May	27.4	72.5	31.3	68.7
June	19.6	80.4	12.5	87.5

Table 5.8. Participation by Age at Chaparral and Lakeside by Month, 1977-78.

Month	Chaparral		Lakeside	
	Under 14	Over 14	Under 14	Over 14
	percent			
July	43.1	56.9	34.9	65.1
August	35.4	64.6	33.3	66.7
September	21.7	78.3	26.0	74.0
October	26.8	73.2	25.0	75.0
November	33.6	66.4	29.0	71.0
December	41.1	58.9	22.0	78.0
January	23.3	76.7	13.6	86.4
February	23.6	76.4	20.3	79.7
March	25.9	74.1	5.8	94.2
April	26.2	73.8	20.7	79.3
May	21.4	78.6	26.5	73.5
June	38.9	61.1	47.0	53.0

Data were collected and categorized from the short form tally sheets and daily temperature charts for both Tucson and Scottsdale were consulted for weather statistics. Regressions were run using the PLANETS regression program with the number of participating adults as the dependent variable. A listing of independent variable abbreviations is in Table 5.9. The five best regression functions for each case are on Tables 5.10 through 5.17; Table 5.18 shows coefficient variability.

Chaparral Results, Participation

For catfish season of 1977, all coefficients in Table 5.10 consistent and the daytime (DA) and weekend (WE) coefficients and the constant term are always significant to the 96 percent level. The average percent deviation from the mean of all estimators is less than ten percent. Signs of coefficients show positive or negative influences on adult participation. People are averse to fishing during the daytime hours and fish less as the number of days since the last plant increases (the greater the number of days since the last plant, the greater the negative influence on participation for that day), but participation is positively related to whether it is a weekend or holiday. The R^2 values of the best five euqations range from a high of .334 to a low of .318. The Durbin-Watson statistic shows that there is no problem with autocorrelation.

Variable coefficients for the trout season of 1977 (Table 5.11) though generally consistent (ten percent or less variability from the mean) are not significant. Only the constant terms show any degree of reliability at the 96 percent level, and the only coefficients meeting

Table 5.9. Definitions of Adult Participation Variable Abbreviations

Abbreviation	Definition
AD(-1)	Adults tallied from last count; a "habit formation" variable.
CONSTANT	The constant term of the equation.
DA	Dummy variable, 1 if between 10 a.m. and 6 p.m., 0 otherwise.
DP	Number of days since the last plant of fish.
DP/x,x,both/	Almon lag of degree x, length x, both endpoints on DP.
DP(-x)	DP lagged x periods.
LNDP	Natural logarithm of the number of days since the last plant of fish.
MO	Dummy variable, 1 if before 10 a.m., 0 otherwise.
NO	Dummy variable, 1 if between 10 a.m. and 2 p.m., 0 otherwise.
NT	Dummy variable, 1 if after 6 p.m., 0 otherwise.
RD	Dummy variable, 1 if raining, 0 otherwise.
SU	Measure of fishing success (independent of participation) dependent on fishing conditions of the day.
TEMP	Temperature in degrees Fahrenheit.
TEMP(1)	Trend forward of temperature (getting colder or warmer).
TD(x)	Deviation in degrees from x degrees Fahrenheit.
WE	Dummy variable, 1 if a weekend or holiday, 0 otherwise.

Table 5.10. Adult Participation as a Function of the Listed Independent Variables; Chaparral, Catfish Season, 1977[a].

RANK	CONSTANT	DA	WE	DP	DP(-1)	LNDP	AD(-1)	TD90	TD100	TEMP	R^2	DW
1.	19.379	-10.879	6.458	-0.283			0.113		0.036		.334	1.841
	(5.402) *	(-4.336) *	(2.548) *	(-1.769)			1.015		(-1.203)			
2.	16.190	-10.683	6.662	-0.288			0.115			0.028	.330	1.887
	(4.370) *	(-4.364) *	(2.690) *	(-1.798)			(1.041)			(0.954)		
3.	20.063	-10.770	6.361	-0.278							.332	1.592
	(7.594) *	(-4.440) *	(2.601) *									
4.	19.197	-10.905	6.511	-0.252	-0.045		0.110	-0.036			.321	1.828
	(5.297) *	(-4.300) *	(2.532) *	(-1.142)	(-0.026)		(0.961	(-1.175)				
5.	20.889	-10.818	6.441			-1.953					.318	1.624
	(6.800) *	(-4.443) *	(2.629) *			(-1.683)						

[a] Equations are ranked by adjusted R^2 and significance of coefficients. T-statistics are in parentheses below each coefficient. Coefficients with asterisks are significant at the 96 percent level.

Table 5.11. Adult Participation as a Function of the Listed Independent Variables; Chaparral, Trout Season, 1977[a]

RANK	CONSTANT	NO	NT	WE	DP	DP(-1)	AD(-1)	TD72	TD72(1)	R_c^2	DW
1.	12.833	6.788	-11.985	7.111	-.101				-.513	.478	1.920
	(3.715)*	(1.815)	(-1.576)	(2.333)*	(-.272)				(-2.164)		
2.	11.813	7.099	-12.543	7.291			.010		-.487	.471	1.782
	(3.360)*	(1.905)	(-1.618)	(2.160)			(.049)		(-1.801)		
3.	13.520	6.674	-13.345	5.288	-.088			-.529		.469	1.705
	(3.917)*	(1.770)	(-1.732)	(1.625)	(-.235)			(-2.075)			
4.	13.296	7.019	-13.018	5.820			-.054	-.536		.467	1.558
	(3.532)*	(1.877)	(-1.676)	(1.652)			(-.254)	(-1.760)			
5.	11.220	5.657	-13.612	6.521	-.140	.289		-.505		.406	1.680
	(1.946)	(1.186)	(-1.603)	(1.665)	(-.267)	(.592)		(-1.514)			

[a] Equations are ranked by adjusted R^2 and significance of coefficients. T-statistice are in parentheses below each coefficient. Coefficients with asterisks are significant at the 96 percent level.

the criteria for significance at the 90 percent level are the top two weekend (WE) coefficients and the TD72(1) coefficient of the first equation. Much the same can be said about results for trout season of 1978 (Table 5.12)--low confidence levels but fairly consistent, except that R^2 values are lower.

Catfish season 1978 (Table 5.13) results are poor. R^2 levels are very low, few coefficients are significant at the 96 percent level, and estimators are only somewhat consistent. The DA coefficient has changed sign--a complete reversal from catfish season of 1977--but the WE coefficient average has remained relatively stable from 6.487 in 1977 to 5.361 in 1978.

Lakeside Results, Participation

Regression results for catfish season of 1977 (Table 5.14) show that people are averse to fishing between ten in the morning and six in the evening--the hottest part of the day in the southwestern desert summers--and to fishing in the rain. Coefficients of these two variables are consistent and the coefficient for the rain day (RD) variable is significant to the 99 percent confidence level. People also prefer days soon after the last plant: the DP coefficient is negative and significant to the 96 percent level most of the time. Conversely, anglers prefer fishing on holidays and weekends--the coefficient of WE is not only consistent but also significant. R^2 values range from .325 to .301 and the Durbin-Watson statistic shows no autocorrelation in any of the equations.

Table 5.12. Adult Participation as a Function of the Listed Independent Variables; Chaparral, Trout Season, 1978[a].

RANK	CONSTANT	NO	NT	WE	DP	DP(-1)	TD78	TD78(1)	TD72	AD(-1)	R_c^2	DW
1.	28.217	10.714		8.022	-1.094			-.603			.307	1.773
	(4.429) *	(1.942)		(1.577)	(-2.234)			(-2.006)				
2.	30.210	8.757	-5.775	7.744	-1.071			-.669			.303	1.822
	(4.474) *	(1.476)	(-.911)	(1.515)	(-2.180)			(-2.159)				
3.	18.616	12.710		8.315					-.385	.106	.255	1.991
	(2.633) *	(2.243)		(1.592)					(-1.198)	(.678)		
4.	25.989	11.517	-1.507	7.731	-.931		-.467				.245	1.762
	(4.112) *	(1.941)	(-.249)	(1.482)	(-1.873)		(1.549)					
5.	22.859	12.256		7.461	-.887	-.136			-.476		.245	1.760
	(3.917) *	(2.148)		(1.376)	(-1.602)	(-.239)			(-1.559)			

[a] Equations are ranked by adjusted R^2 and significance of coefficients. T-statistics are in parentheses below each coefficient. Coefficients with asterisks are significant at the 96 percent level.

Table 5.13. Adult Participation as a Function of the Listed Independent Variables; Chaparral, Catfish Season, 1978[a].

RANK	CONSTANT	DA	NT	WE	DP	DP(-1)	LNDP	R^2	DW
1.	13.833	2.608		5.475			-2.571	.185	2.017
	(4.709)*	(1.420)		(2.295)			(-1.858)		
2.	13.075	2.861		5.255	-.515			.182	1.982
	(4.932)*	(1.590)		(2.194)	(-1.825)				
3.	15.120		-2.287	5.336	-.533			.166	1.820
	(6.942)*		(-1.330)	(2.171)	(-1.869)				
4.	13.675	2.670		5.833	-.206			.164	2.004
	(4.505)*	(1.423)		(2.205)	(-.261)				
5.	11.422	3.591		4.905		-.279		.128	1.974
	(4.048)*	(2.000)		(1.900)		(-.907)			

[a] Equations are ranked by adjusted R^2 and significance of coefficients. T-statistics are in parentheses below each coefficient. Coefficients with asterisks are significant at the 96 percent level.

Table 5.14. Adult Participation as a Function of the Listed Independent Variables, Lakeside, Catfish Season, 1977. [a]

RANK	CONSTANT	DA	WE	DP	DP(-1)	DP(-2)	DP < 3, 3, BOTH > [b] DP	DP(-1)	DP(-2)	SOW	RD	R^2_c	DW
1.	11.333	-2.713	5.287				-.535	-.092	.397	0.231	-16.279	.325	1.852
	(5.070)*	(-1.360)	(2.789)*				(-3.114)	(-1.222)	(2.347)	(-1.222)	(-3.844)*		
2.	12.785	-3.159	6.104	-.388							-14.113	.132	1.884
	(5.323)*	(-1.546)	(3.101)*	(-2.292)*							(-3.355)*		
3.	9.645		5.429				-.505	-.071	.399	-.177	-14.944	.311	1.784
	(5.138)*		(2.840)*				(-2.924)	(-.948)	(2.338)	(-.948)	(-3.592)*		
4.	10.533	-2.419	5.267	-.530	.394						-16.011	.309	1.861
	(4.719)*	(-1.211)	(2.744)*	(2.789)*	(2.103)						(-3.742)*		
5.	9.112		5.403	-.500		.400					-14.852	.301	1.793
	(4.773)*		(2.804)*	(-2.644)*		(2.124)					(-3.542)*		

[a] Equations are ranked by adjusted R^2 and significance of coefficients. T-statistics are in parentheses below each coefficient. Coefficients with asterisks are significant at the 96 percent level.

[b] Almon lag of degree three, length three, and both endpoint restrictions on the variable DP.

Trout season of 1977 (Table 5.15) results, though relatively good overall, are far less consistent than those of the previous season. The constant term is neither consistent nor significant, as is the case for DA, AD(-1), RD, TD78, and TD75. However, these variables make valuable contributions to the R^2, and the signs of the coefficients make sense. That is, if these variables are omitted from the equation, R^2's drop dramatically, and the signs of, say RD, are always negative. People prefer fishing during the daytime as nights are longer colder, and participation is negatively correlated with the deviation from "ideal" temperatures of 78°F, 75°F, and 72°F. As during catfish season, people fish more frequently on weekends and the the coefficient of the WE variable is acceptable to the 96 percent level. Success (SU)--a proxy for DP--is a measure of fishing success independent of the number of anglers present. This is the only season that it entered into any of the five best equations. R^2 values ranged from .722 to .602; these equations have no autocorrelation problems.

Trout season of 1978 (Table 5.16) results, with the exception of the constant term, are consistent. Both DA and RD coefficients are significant to the 96 percent confidence level. There is no autocorrelation; R^2's ranged from .402 to .376.

Returning to catfish season (Table 5.17), one notices a striking similarity in the two dominant variables RD and WE with those of the catfish season of 1977. Even though the WE variable coefficients of 1978 are not significant, values are close to those of the previous warm-water season. The averages for the RD coefficients vary from

Table 5.15. Adult Participation as a Function of the Listed Independent Variables; Lakeside, Trout Season, 1977[a].

RANK	CONSTANT	DA	WE	AD(-1)	RD	SU	TD78	TD75	TD72	R_c^2	DW
1.	1.780	5.073	10.965	.201		20.770			0.648	.722	2.224
	(.517)	(1.542)	(3.216)*	(1.591)		(2.643)*			(-2.780)		
2.	2.464	4.524	10.852	.135		19.187		-.457		.622	2.236
	(.550)	(1.233)	(2.857)*	(.896)		(2.130)		(-1.634)			
3.	4.939	9.023	14.445		7.561			-.500		.621	2.073
	(1.192)	(2.006)	(3.139)*		(1.181)			(-1.412)			
4.	2.166	4.604	10.794	.139		19.098	-.347			.618	2.222
	(.407)	(1.173)	(2.615)*	(.837)		(1.916)	(-1.161)				
5.	6.330	5.975	14.422			9.491		-.614		.602	1.578
	(1.659)	(1.310)	(3.047)*			(.889)		(-1.838)			

[a] Equations are ranked by adjusted R^2 and significance of coefficients. T-statistics are in parentheses below each coefficient. Coefficients with asterisks are significant at the 96 percent level.

Table 5.16. Adult Participation as a Function of the LIsted Independent Variables; Lakeside, Trout Season, 1978[a].

RANK	CONSTANT	DA	WE	AD(-1)	RD	TD78	TD78(1)	TD75	TD72	R_c^2	DW
1.	2.755	13.786	7.027	.262	-20.628					.402	2.085
	(.825)	(3.307)*	(1.863)	(1.741)	(-3.116)*						
2.	5.478	13.471	6.652	.225	-18.376			-.257		.395	1.915
	(1.195)	(3.203)*	(1.743)	(1.433)	(-2.574)*			(-.873)			
3.	5.040	13.321	6.847	.234	-18.470	-.200				.389	1.888
	(1.090)	(3.123)*	(1.792)	(1.498)	(-2.521)*	(-.723)					
4.	4.376	13.767	6.660	.241	-19.630				-.171	.383	2.072
	(.977)	(3.252)*	(1.715)	(1.531)	(-2.820)*				(-.554)		
5.	.349	14.740	7.219	.268	-25.262		.242			.376	2.145
	(.070)	(3.223)*	(1.821)	(1.718)	(-2.627)*		(.687)				

[a] Equations are ranked by adjusted R^2 and significance of coefficients. T-statistics are in parentheses below each coefficient. Coefficients with asterisks are significant at the 96 percent level.

Table 5.17. Adult Participation as a Function of the Listed Independent Variables, Lakeside, Catfish Season, 1978[a].

RANK	CONSTANT	MO	NO	WE	DP	RD	TD90	TD90(1)	TEMP	R^2_c	DW
1.	13.238	-7.040	6.076	4.350	.148	-16.102		-.404		.400	2.399
	(4.279)*	(-2.051)*	(1.779)	(1.454)	(.339)	(-3.350)*		(-2.321)*			
2.	14.674	-8.995		5.816		-16.404		-.380		.374	2.476
	(5.790)	(-2.755)*		(2.018)		(-3.827)*		(-2.210)			
3.	27.441	-11.237		6.352		-17.791		-.178		.308	2.250
	(2.187)	(-3.112)*		(2.074)		(-3.836)*		(-1.360)			
4.	31.332	-10.028		6.242		-18.548			-.158	.301	2.258
	(2.725)*	(-2.941)*		(2.085)		(-3.871)*			(-1.349)		
5.	68.559	-10.065		6.286		-18.652	-12.850			.295	2.239
	(1.477)	(-2.934)*		(2.089)		(-3.818)*	(-1.258)				

[a] Equations are ranked by adjusted R^2 and significance of coefficients. T-statistics are in parentheses below each coefficient. Coefficients with asterisks are significant at the 96 percent level.

-15.240 to -17.499 for 1977 and 1978 respectively, and for WE, change from 5.498 in 1977 to 5.809 in 1978. These two variables in both seasons were also quite consistent.

Coefficient Consistency

Table 5.18 summarizes the consistency of the major dependent variables of the participation equations for each lake and season. The fourth column lists the highest value of a coefficient, the fifth gives the lowest value of a coefficient, and the sixth column shows the mean value of a variable coefficient. Variance was derived by the formula:

$$\sum_{i=1}^{n} \frac{[(\text{coefficient value})_i - \text{mean coefficient value}]^2}{n - 1}.$$

The last column of the table lists the average deviation of a coefficient from its mean in percent. Consistency was arbitrarily defined as an average deviation in percent of ten or less.

Given the definition of consistency, Chaparral coefficients for all seasons are typically more stable than those for Lakeside. However, R^2 values for Lakeside were generally higher than those for Chaparral. Within equations for each lake, as R^2 increases, consistency of coefficients generally decreases.

The fishing season and year do not have any particular bearing on the consistency of a set of coefficients for that season or year. For example, the most consistent set of variable coefficients for Chaparral were for catfish season of 1977, while those for Lakeside occurred in trout season of 1978.

Table 5.18. Variability of Coefficients of Adult Participation Equations[a].

Lake	Season	Variable	High Value	Low Value	Mean	Variance	Average Deviation in Percent
Chaparral	Catfish, 77	CONSTANT	20.889	16.190	19.144	2.535	6.16
		DA	-10.683	-10.905	-10.811	0.006	0.64
		WE	6.662	6.361	6.487	0.010	1.22
		DP	-0.252	-0.288	-0.275	0.000	4.28
		AD(-1)	.115	.110	.113	0.000	1.50
Chaparral	Trout, 77	CONSTANT	13.520	11.220	12.546	0.778	6.50
		NO	7.099	5.657	6.647	0.269	6.00
		NT	-11.985	-13.612	-12.901	0.337	3.90
		WE	7.291	5.288	6.406	0.577	12.30
		DP	-0.088	-0.140	-0.110	0.000	18.50
		TD72	-0.505	-0.536	-0.523	0.000	2.30
Chaparral	Trout, 78	CONSTANT	30.210	18.616	25.124	16.992	14.40
		NO	12.710	8.757	11.191	1.940	10.40
		WE	8.315	7.461	7.855	0.084	3.20
		DP	-0.887	-1.094	-0.966	0.008	8.70

Table 5.18, continued

Lake	Season	Variable	High Value	Low Value	Mean	Variance	Average Deviation in Percent
Chaparral	Catfish, 78	CONSTANT	15.120	11.422	13.525	1.447	7.00
		DA	3.591	2.608	2.932	0.153	11.20
		WE	5.833	2.905	5.361	0.093	5.20
		DP	-0.206	-0.533	-0.418	0.022	33.80
Lakeside	Catfish, 78	CONSTANT	12.785	9.112	10.682	1.682	17.70
		DA	-2.419	-3.159	-2.754	0.093	9.50
		WE	6.104	5.267	5.498	0.756	4.40
		DP	-0.388	-0.530	-0.473	0.004	11.90
		RD	-14.113	-16.279	-15.240	0.636	4.72
Lakeside	Trout, 77	CONSTANT	6.330	1.780	3.536	3.176	57.40
		DA	9.023	4.524	5.840	2.799	22.70
		WE	14.445	10.794	12.296	3.050	13.90
		AD(-1)	0.201	0.135	0.158	0.001	17.90
		SU	20.770	9.491	17.136	19.927	22.30
		TD75	-0.457	-0.614	-0.524	0.004	11.50

Table 5.18, continued

Lake	Season	Variable	High Value	Low Value	Mean	Variance	Average Deviation in Percent
Lakeside	Trout, 78	CONSTANT	5.478	.349	4.151	3.801	36.80
		DA	14.740	13.321	13.817	0.244	2.70
		WE	7.219	6.652	6.881	0.047	2.80
		AD(-1)	0.268	0.225	0.246	0.000	6.20
		RD	-18.376	-25.262	-20.473	6.416	9.70
Lakeside	Catfish,	CONSTANT	68.559	13.238	31.049	401.094	48.70
		MO	-7.040	-11.237	-9.473	1.983	12.26
		WE	6.352	4.350	5.809	0.568	10.00
		RD	-16.102	-18.652	-17.499	1.133	5.70
		TD90(1)	-0.178	-0.404	-0.321	0.010	29.60

[a] Only variables found in three or more equations are analyzed; variance is defined as the sum over n variables of the difference squared of Z less the average of Z divided by n - 1.

Urban Fishing--An Inferior Good?

To determine the status or urban fishing as a normal or inferior good (an inferior good is a good that, as income rises, the demand for that good decreases) willingness-to-pay and willingness-to-sell were regressed stepwise using the SPSS regression program against other variables including the income of an angler, the income area in which the angler lives, and whether or not the individual was gainfully employed. Income related variables such as being on welfare, unemployed, and student status were entered as dummy variables--one if the variable applied, and zero otherwise. Since t-statistics and R^2 values were very low, the order in which a variable entered an equation was assumed to be indicative of its importance as an explanatory variable.

The inferior good status of urban fishing was assumed when signs of income variables were negative. For willingness-to-pay, this means that as income rises, willingness-to-pay for an urban fishing permit drops. Negative coefficients of income variables for willingness-to-sell indicates that urban fishing is of less value to wealthier anglers than to poorer anglers.

Dummy variable coefficients signs show the reverse. That is, if the sign of say, the welfare variable coefficient were to be positive, then an angler would be willing to pay (or sell for) more if he were on welfare than if he were not. The net effect of the variables on urban fishing is derived by the size of the coefficient. For example, if the unemployed variable coefficient is 3.2 and the student variable coefficient is -.69, then the net effect is "an inferior good" since

the weight of the unemployed coefficient is greater than that of the student coefficient. Naturally, income coefficients carry the greatest weight since income is a very large number (thousand of dollars) and, when multiplied by its coefficient--however small--has a large impact on willingness-to-pay or -sell. Dummy variables--student, welfare, and unemployed--are given less importance as they are equal to one less than ten percent of the time while income was greater than zero over 90 percent of the time. For brevity and since it is assumed that adults are more cognizant of financial matters, only adult willingness-to-pay for 1977-78 conditions and adult willingness-to-sell (showing value to angler given no income constraint) for 1977-78 are analyzed. Results are shown in Table 5.19.

Area income--the mean income of the area in which the angler lives--was taken from data found in Inside Phoenix, 1978 and Tucson Trends, 1978. Nearly 75 percent of the time, the coefficient of area income was negative, indicating that as the mean income of an angler's area of residence increases the angler's willingness-to-pay decreases. Ergo, urban fishing in terms of area income, and perhaps peer pressure, is an inferior good.

Income figures were taken from the Bureau of Labor Statistics income levels for specific occupations broken down by national regions (the southwest United States region was used); occupation of an angler was taken from the questionnaire. As was the case for area income, estimated actual income upheld the inferior good status of urban fishing 75 percent of the time. There was no multicollinearity between Income and Area Average Income.

Table 5.19. Willingness-to-Pay[a] and Willingness-to-Sell as Functions of Income and Income-Related Variables for Adults, 1977-78.

Lake	Year	Willingness-to	Variable	Rank of Entry	Coefficient	Signifies	Net Effect
Chaparral	1977	Pay	Area In-[b] come	1	-0.15E-03	inferior good	
			Student[c]	8	1.09	inferior good	
			Welfare[d]	11	-1.24	normal good	
			Income[e]	12	0.18E-04	normal good	
							indeterminate
Chaparral	1978		Student	6	-1.38	normal good	
			Area In-come	8	-0.62E-04	inferior good	
			Unemployed[f]	12	-0.46	normal good	
			Income	13	-0.16E-04	inferior good	
							inferior good

Table 5.19, continued. -Pay and -Sell as Functions of Income.

Lake	Year	Willingness-to	Variable	Rank of Entry	Coefficient	Signifies	Net Effect
Lakeside	1977	Pay	Unemployed	1	3.21	inferior good	
			Income	3	-0.35E-04	inferior good	
			Student	11	-0.69	normal good	
			Area Income	13	0.17E-04	normal good	inferior good
Lakeside	1978	Pay	Area Income	1	0.27E-03	normal good	
			Difference[g]	2	-0.79E-04	inferior good	indeterminate

Table 5.19, continued. -Pay and -Sell as Functions of Income.

Lake	Year	Willingness-to	Variable	Rank of Entry	Coefficient	Signifies	Net Effect
Chaparral	1977	Sell	Area Income	5	-0.02	inferior good	
			Welfare	8	-640.20	normal good	
			Student	10	-317.14	normal good	
			Difference	11	-0.02	inferior good	
			Unemployed	13	-248.65	normal good	
							inferior good
Chaparral	1978	Sell	Difference	2	0.03	normal good	
			Unemployed	4	429.41	inferior good	
			Student	5	199.42	inferior good	
			Area Income	8	-0.02	inferior good	
							inferior good

Table 5.19, continued. -Pay and -Sell as Functions of Income.

Lake	Year	Willingness-to-	Variable	Rank of Entry	Coefficient	Signifies	Net Effect
Lakeside	1977	Sell	Student	1	-596.34	normal good	
			Area Income	2	-0.30E-01	inferior good	
			Difference	5	-0.12E-01	inferior good	
			Unemployed	13	-60.64	normal good	inferior good
Lakeside	1978	Sell	Difference	1	-0.01	inferior good	
			Income	11	-0.30E-02	inferior good	inferior good

a Willingness-to-Pay under 1977-78 Conditions.
b Average Income of the Area in which the angler lives.
c Dummy Variable, 1 if angler is a student, 0 otherwise.
d Dummy Variable, 1 if on Welfare, 0 otherwise
e Estimated Income from Bureau of Labor Statistics income levels for various occupations.
f Dummy Variable, 1 if angler is unemployed, 0 otherwise.
g Difference between income and area average income.

A third direct income measure was the difference between income and area income. If this value was positive then an individual was living in an area where more than half of the people in that area have incomes lower than his and vice versa. Consequently, if the sign of the coefficient is negative, then a relatively wealthier angler would be willing to pay less than a relatively poorer angler and urban fishing would again be considered an inferior good. Eighty percent of the time, the difference coefficient was negative indicating an inferior good.

The net effect of all income variables shows urban fishing is an inferior good. However, 75 percent of the time the coefficients of dummy variables indicate that urban fishing is a normal good. Since income is the dominant factor, the total effect is that urban fishing may, indeed, be an inferior good.

Participation by Area of Residence

In predicting angler participation, the influence of two major independent variables was explored. Distance from residence to the lake and the income of permit holders are thought to be the most important of all variables in predicting participation. The purpose of this section is to determine the effects on permit sales and participation of stocking another lake in addition to the existing stocked lakes.

The socioeconomic areas defined in Tucson Trends 1978 and Inside Phoenix '78 were used as districts of permit holders' residences. Using street addresses supplied on the questionnaires, each first-time interview was plotted on metropolitan area maps and the number of plots per cluster area was determined. The number of permits was divided by district population to calculate permits per ten thousand (P/10K) for each district as well as the metropolitan area as a whole.

The mean distances travelled (DIS) to the lakes from each area were estimated along major thoroughfares. It was discovered that, for both Phoenix and Tucson, the income of an angler was highly correlated with distance from the lakes. In fact, both cities' incomes are laid out in almost functional form with respect to the lakes--average income increases as one goes north by northeast from the lakes, and average income drops as one goes east by southeast from the lakes. Hence, only distance was used to describe the relationship with permits per ten thousand population.

Regressions were run with the PLANTES (OLS) program. Five possible models of permits per ten thousand population (P/10K) as a function of distance (DIS) were estimated and examined. These forms were:

(1) $P/10K = a + b(DIS)$,

(2) $P/10K = a + b(\ln(DIS))$,

(3) $\ln(P/10K) = a + b(DIS)$,

(4) $\ln(P/10K) = a + b(\ln(DIS))$,

(5) $P/10K = a + b(DIS^{-n})$.

It is assumed that: (1) the popular response to the two lakes is identical regardless of differences in population size between the two metropolitan areas, and consequently, (2) the functional forms are the same although different coefficients are expected.

The "best" function is the best common relationship both statistically and intuitively. The "best" equation is equation (5) where n is equal to -0.5. For Chaparral, the equation is:

$$P/10K = -5.118 + 39.111(DIS^{-.5})$$

(-3.228) (6.482)
/99%/ /99%/

R^2(corrected): .719
DW : 2.448 N
df : 16

and for Lakeside, the equation is:

$$P/10K = -3.092 + 25.176(DIS^{-.5})$$

(-1.808) (6.837)
/90%/ /99%/

R^2(corrected): .821
DW : 1.086 U
df : 10

where

R^2(corrected) is the percentage of the error taht can be explained by the function corrected for degrees of freedom,

DW is a measure of autocorrelation, N showing no autocorrelation, and U meaning uncertain whether there is or is not correlation.

df is degrees of freedom.

T-statistics are in parentheses below the coefficient, and the level of significance of the coefficient is below the T-statistic.

An Alternative Source of Urban Fishing--Procedure and Illustration

What might happen if another lake in the same city were to be stocked exactly like the original lake? To illustrate a possible solution, an analysis is made for Kennedy Lake, a potential new site for urban fishing in Tucson and almost a mirror image of Lakeside in terms of location.

The procedure is as follows:

(1) Estimate distances to each lake from each area of residence whose population might be attracted to the new fishing site,

(2) Find the breakpoint line at which, because of equal distance, an angler would be indifferent to going to either lake,

(3) Recalculate new participation rates (P/10K) for the two fishing areas using the original equation based on the assumptions that

  (a) people will functionally react to Kennedy as they responded to Lakeside, and

  (b) any crossing of the "distance indifference barrier" will be nonexistant or in steady-state

(4) Recalculate the permits per area, and

(5) Recalculate the permits per metropolitan area as a whole.

Figure 5.3 shows the plot scatter, the socioeconomic districts, and the indifference line. Areas two, three, ten and eleven are entirely on the Kennedy side of the indifference line. Districts one and six straddle the Kennedy side of the indifference line and, therefore, proportions of anglers going to each lake are determined based on the amount of area on either side of the line. For district one, about one-third of the anglers would go to Kennedy and the rest to Lakeside. For district six, about 25 percent would go to Kennedy and the remainder to Lakeside.

Using the estimated relationship between P/10K and DIS, new values of P/10K after the stocking of Kennedy Lake can be derived given new distance figures for the affected areas. Multiplying the new P/10K by the area's population yields a new permit estimate by area. These permit estimates can then be summed and divided by the total Tucson population to determine the increase or decrease of permits over the entire metropolitan area if both Kennedy and Lakeside are stocked.

Results are found in Table 5.20. The first column grouping shows the permits per ten thousand population as it was with only Lakeside stocked; the second grouping gives results of stocking both Lakeside and Kennedy.

As can be seen from the Table, sales would be expected to increase by 23 percent if both Kennedy and Lakeside were to be stocked. This may be, however, an underestimate of predicted sales since the model does not take into account that urban fishing may be an inferior good. Since Kennedy Lake is close to the very low income areas of Tucson and assuming Lakeside anglers from the immediate Lakeside area would not change their habits, sales could be expected to rise somewhat higher than shown.

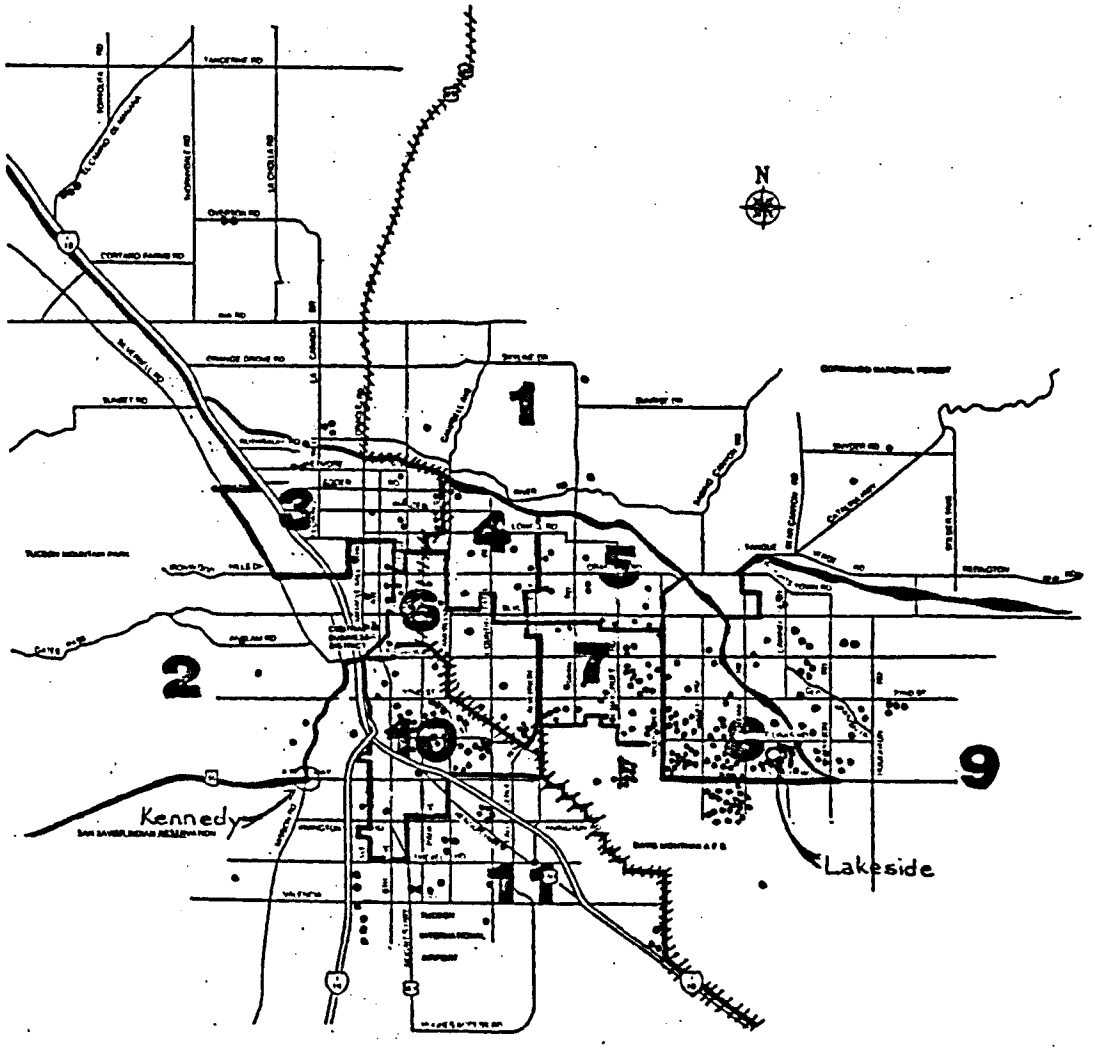

Figure 5.3. Lakeside Participation in 1977-78, Plot Showing Scatter, Metropolitan Socioeconomic Districts, and Indifference Barrier.

Table 5.20. Results of Stocking Lakeside Only and Lakeside and Kennedy Together.

Region	Lakeside Only				Lakeside and Kennedy Lakes			
	P/10K	Population in Ten Thousands	Permits	Distance[b] in Miles	P/10K	Population in Ten Thousands	Permits	Distance[b] in Miles
9	15.04	4.92	74.0	3.0	15.04	4.92	74.0	3.0
8	19.95	4.26	85.0	1.0	19.95	4.26	85.0	1.0
7	12.20	3.69	45.0	4.5	12.20	3.69	45.0	4.5
5	5.67	3.00	17.0	7.0	5.67	3.00	17.0	7.0
6[c]	3.38	3.85	13.0	8.0	6.42	2.89	18.6	7.0
6[d]					7.64	0.96	7.3	5.5
1[c]	2.68	5.97	16.0	10.0	6.78	3.98	27.0	6.5
1[d]					4.87	1.99	9.7	10.0
4	2.41	2.90	7.0	10.0	2.41	2.90	7.0	10.0
10	8.84	4.30	38.0	8.0	7.45	4.30	32.0	5.7
11	4.63	6.70	31.0	12.0	8.28	6.70	55.5	4.9
3	3.58	3.63	13.0	14.5	5.25	3.63	19.1	9.1
2	3.04	4.28	13.0	14.0	9.34	4.28	40.0	4.1
TOTALS	7.41	47.50	352.0	-	9.20	47.50	437.2	-

Table 5.20, continued.

Actual Sales in Tucson	5,904.0
Chartered Permits	352.0
Predicted Permits, if Kennedy Stocked	437.2
Increase	23.4%
Predicted Total Permits Sales, if Kennedy Stocked	7,287.0

[a] Regions listed from east to west.
[b] Distance in Miles from place of residence to the nearest stocked lake.
[c] Section that would fish at Lakeside.
[d] Section that would fish at Kennedy.

Anglers That Did Not Return

The Arizona Department of Game and Fish noticed that there was an unexpectedly low rate of returning anglers in the 1978 season. Only 28.2 percent of adults and 19.8 percent of juveniles who purchased permits in 1977 also purchased them in 1978. The Department mailed a questionnaire, a copy of which is in the Appendix, to those individuals who did not buy an urban fishing permit the second time. Results are in Table 5.21.

The primary reason anglers did not purchase the urban license was, quite predictably, that success was not high enough to warrant purchase of another permit. However, the second most common response was less expected--that people didn't have enough time to fish. The next common response was that the price of the permit was too high. In the second and third most frequent responses, then, the two basic constraints on recreation participation are seen: time constraints and budget constraints.

Between lakes, cost of permit ranked fourth at Chaparral and third at Lakeside which may reflect the slightly greater affluence of the Scottsdale/Phoenix area compared to Tucson. The least common major complaint was park location--only 0.9 percent of Chaparral users and 0.9 percent of Lakeside patrons claimed they did not like the park location.

Anglers were not precluded from checking more than one reason, ergo the sums of percents may not total 100 percent.

Table 5.21. Reasons for Not Buying an Urban Permit for the Second Period (January through June, 1978) if an Angler Purchased a Permit in the First Period (July through December, 1977) in Percent[a].

Reason[b]	Total				
	Adult		Juvenile		
	Male	Female	Male	Female	Total
Success Not Good Enough	46.9	12.4	31.6	9.1	25.6
No Time to Fish	43.4	13.9	31.0	11.6	15.0
Price of Permit Too High	47.4	19.0	23.6	9.7	8.8
Lake Too Far From Home	38.3	8.9	44.4	8.4	7.3
No Transportation to Lake	19.3	6.2	58.5	15.9	6.0
Moved from Area	33.1	8.4	45.2	13.2	5.7
Did not Like Fish Stocked	42.6	8.6	41.4	7.4	5.5
Daily Limit Too Small	41.5	11.1	41.5	5.9	4.6
Too Many People at Park	48.1	5.4	33.3	13.2	4.4
Did Not Enjoy Urban Fishing	47.2	3.8	45.3	3.8	1.8
No Reasons	19.3	3.2	67.7	9.7	1.2
Did Not Like Park Location	41.7	4.2	50.0	4.2	0.3
Other Reasons	49.5	12.4	28.9	9.3	13.3

[a] Percents do not add to 100% as more than one response was allowed

[b] Reasons ranked in order by total responses for both lakes.

Table 5.21, continued

Reason[b]	Chaparral				
	Adult		Juvenile		
	Male	Female	Male	Female	Total
Success Not Good Enough	46.8	10.8	33.2	9.2	23.9
No Time to Fish	43.9	13.3	31.0	11.7	16.5
Price of Permit Too High	52.3	14.7	22.0	11.0	7.0
Lake Too Far From Home	39.9	8.4	42.0	9.7	9.2
No Transportation to Lake	17.9	6.6	60.4	15.1	6.8
Moved from Area	28.7	10.2	45.4	15.7	7.0
Did Not Like Fish Stocked	46.8	6.4	41.9	4.8	4.0
Daily Limit Too Small	44.8	10.4	40.3	4.5	4.3
Too Many People at Park	49.1	6.8	27.1	16.9	3.8
Did Not Enjoy Urban Fishing	45.5	4.5	45.5	4.5	1.4
No Reasons	23.8	0.0	66.7	9.5	1.4
Did Not Like Park Location	41.7	0.0	58.3	0.0	0.8
Other Reasons	48.8	13.1	25.8	12.2	13.8

[a] Percents do not add to 100% as more than one response was allowed.

[b] Reasons ranked in order by total responses for both lakes.

Table 5.21, continued

Reason[b]	Lakeside				
	Adult		Juvenile		
	Male	Female	Male	Female	Total
Success Not Good Enough	47.0	14.0	30.1	9.0	27.5
No Time to Fish	42.6	14.7	31.1	11.5	13.3
Price of Permit Too High	44.3	22.1	24.8	8.7	10.8
Lake Too Far From Home	35.2	9.8	49.3	5.6	5.2
No Transportation to Lake	21.4	5.7	55.7	17.1	5.1
Moved From Area	41.4	5.2	44.8	8.6	4.2
Did Not Like Fish Stocked	40.0	10.0	41.0	9.0	7.3
Daily Limit Too Small	32.2	11.8	42.6	7.3	4.9
Too Many People at Park	47.2	4.3	38.6	10.0	5.1
Did Not Enjoy Urban Fishing	48.4	3.2	45.2	3.2	2.2
No Reasons	10.0	10.0	70.0	10.0	0.7
Did Not Like Park Location	41.7	8.3	41.7	8.3	0.9
Other Reasons	50.3	11.4	32.6	5.7	12.7

[a] Percents do not add to 100% as more than one response was allowed.

b Reasons ranked in order by total responses for both lakes.

Oddments--Lakeside Observations

People who fished often at Lakeside, particularly during the catfish season of 1977, were highly protective of the lake. At one point in August, the city sold Lakeside water rights to a construction company. The company erected a pump and began to take water, much to the dismay of the anglers. In retaliation, the fishermen repeatedly sabotaged the pump, first by pushing it into the lake, and then by dumping sand into it. After the pumping stopped, the anglers were pacified.

Similar incidents occured when gas remote-control boats invaded the fishing domain at Stella and Pantano Roads. At times, irate anglers would deliberately snare a boat on their line, reel it in, and reduce the gadget to its basic components. The "boat people" as they were called, would retreat for about a month, only to return in triplicate. The wrath of the omnipresent fishermen, unfortunately, was underestimated by the boaters and eventually the feud led to fisticuffs.

The most pervasive passion one senses about the fishermen was their intense concern for the fish: "Will they have enough to eat in this muddy hole?" "Should we build a guard at the overhang to they don't fall over the dam during monsoon?" and "Will the parks people dredge the lake so the water will be cooler for them?" were heard more than once. When it was noticed in the spring that the fish had miraculously spawned (albeit the future fish would be bullheads), the ecstasy of the anglers paralleled that of a new father with his firstborn.

Many fishermen did indeed wish the program would continue. Letters were sent not only to the Arizona Department of Game and Fish, but also to the Arizona State Legislature. However, judging from the number who did not return to the program, this group would be a small but vociferous minority.

CHAPTER 6

CONCLUSION

Approaches to the Problem

The Clawson-Hotelling travel-cost approach did not give significant results due to the relatively small size of the area from which recreators were drawn. Most analysis for which travel-cost works well ecompasses very large areas--nations, states, or regions--and the consumer realizes substantial travel costs as well as time costs. However, the urban nature of the experimental urban fishing program reduces these costs to the point at which an angler realizes only the time cost of fishing rather than doing something else.

The willingness-to-pay approach circumvents the problems of the travel-cost approach; anglers declare an amount they would be willing to pay rather than forego the recreational opportunity of fishing at the lake. The willingness-to-pay value and the corresponding cumulative frequency of anglers willing to pay at least that amount are then used to derive demand curves for which consumers' surplus values and non-discriminating monopolist prices and values can be calculated.

Net Economic Benefits

For the experimental program of 1977-78, the program showed a net economic loss to society of over $12,000. This loss would be a gain of slightly more than $7,500 if the Arizona Department of Game and Fish were

to reduce costs by contracting for the fish. Benefits to society as a whole would increase by $21,740 if the limits on anglers' favorite fish were to be doubled in addition to the reduced costs. Game and Fish may, however, never show a profit from the sale of permits.

Non-discriminating monopolist prices of the urban fishing permit show that the 1977-78 permits cost just about the amount that would maximize revenues. Taking weighted averages of the estimated non-discriminating prices, one finds that this price would be $1.54 for adults and $1.18 for juveniles with total participation increasing by 34.2 percent from 1977-78. However, it appears that the lakes were being fished at capacity at the three dollar level for adults and one dollar level for juveniles. If true, then the price during the 1977-78 season would be so high as to make people averse to purchasing permits. Increasing the price of the permits would not increase revenues since elasticity (as a negative number--see Chapter 2, p. 7) decreases above the three dollar level (one dollar level for juveniles).

Non-Economic Objectives

Minority Usage

Minority usage is greatest during the warm-water season. Two reasons for this pattern--preference for warm-water varieties and budget constraints disallowing the purchase of the three dollar trout stamps--were explored, and it was hypothesized that the latter may have caused the former.

The adage "you don't miss what you never had" is apropos in this case. Since minorities--especially blacks--generally do not have time or

money to be able to fish for trout, they claim preference for the variety of fish they can afford, and consequently, with which they are most familiar: catfish and carp.

Comments and Complaints

Anglers overwhelmingly enjoyed the program. Those who had complaints usually accompanied their gripe with some praise. The most common shortcoming expressed by participants was the low success rate, which was also the predominant excuse for an angler's non-participation in 1978 if he fished in 1977.

According to Game and Fish records, success at Lakeside was somewhat less than at Chaparral. High lake turbidity as well as occasional flooding which carried fish over the dam and into the Pantano Wash may have caused the lower Lakeside catch rates. Both lakes were subjected to intense fishing pressure and were almost "fished out" soon after stocking.

Participation

Participation varied by lakes and season with respect to weather conditions, day since the last plant of fish, time of day, and whether or not the day was in the weekend or a holiday. The primary determinant--spontaneity--cannot, however, be measured and none of the derived participation equations explains more than 40 percent of the variance.

Implications for Future Programs

As shown in Chapter 5, urban fishing shows strong signs of being an inferior good. If future research upholds this hypothesis, then

relocation of the stocking to another lake in or near a low income area of a metropolitan region would result in increased fishing pressure, and increased revenues. Game and Fish, therefore, whould consider stocking a slightly larger lake in a low-income area if it is to continue the program in addition to cutting costs by opting for an alternative method of stocking.

The non-discriminating price for most of the demand functions was close to the actual price of the urban fishing permits in 1977-78. The price, then, should rise very little if at all. Since demand would increase at a lake in a low income area, revenues generated from the sale of permits would be greater than if lakes in higher income areas were to be stocked.

APPENDIX

QUESTIONNAIRES

(Yellow Questionnaire)
University of Arizona
and
Arizona Department of Game and Fish
Urban Lakes Study

1. Lakeside_____ Chaparral_____

2. Date___/___/___/ Time/___/___/___/___/
Mo. Day Year M N AN E

/ S / M / T / W / T / F / S /

3. Urban Waters Fishing Permit Number_____

4. Resident_____ Nonresident_____

Sex_____ Age_____

Anglo_____Mexican/Indian_____Oriental_____Black_____

Local Address_____Zip_____

Your Occupation_____

(or for anglers under 14)

_____ _____
(father's occupation) (mother's occupation)

5. How did you hear about the Urban Lakes Program?

a) Read about it in the paper___
b) Heard about it from friends, relatives or park personnel___
c) Heard about it on radio or TV___
d) Didn't hear about it until I got to the lake___
e) Read sign posted at the lake___

6. Since July 1st, 1977, how many times have you fished here?_____
or
How many times have you fished here since I last interviewed you?

7. How many times did you fish here in the year previous to July 1st, 1977?_____

8. Since July 1st, 1977, how many times have you gone fishing in other places?___

   or

   How many times have you gone fishing elsewhere since I last interviewed you?___

9. How many times did you fish in other places in the year previous to July 1, 1977?___

10. How far do you live from the lake?___miles or ___blocks

11. How did you get to the lake? ___car
    ___bus
    ___bicycle
    ___walk

12. Are you here fishing by yourself or as part of a group?

    ____self ___group ___number in group

13. Would you have come to the park today if you weren't going to fish? ___yes ___no

    If yes, other reasons_____

14. If you weren't fishing here today, what would you probably be doing?

    _____

15. How long have you fished here at the lake today? ___hours ___minutes

16. How many of each kind of the following fish have you caught here today? How many of each have you thrown back?

	Total Caught	Thrown Back
Tilapia		
Carp		
Catfish		
Trout		
Bass		
Bluegill		
Crappie		
Bullhead		
Other		

17. Of all these kinds of fish, which is your favorite to catch?

_____

18. Which is your second most favorite? _____

19. Which is your favorite to eat? _____

20. (If angler is under 14) Did you buy your Urban Waters Fishing Permit with your own money or did someone buy it for you?

___Own ___Other

21. (If angler is over 14) Would you buy an Arizona State Fishing License if there was no urban lake program?

___Yes ___No ___Pioneer License

22. Would you but a trout stamp if there was no urban lake program?

___Yes ___No

23. What is the most amount of money you would pay for your six month Urban Water Fishing Permit rather than not fish here at all? (In addition to the regular fishing license if angler is 14 or over)

$_____

24. If the limit on your favorite fish were twice as high, what is the maximum amount you would pay for your six month Urban Waters Fishing Permit rather than not fish here at all?

$_____

25. If the lake wasn't stocked, like last year, what is the maximum amount you would pay for your six month Urban Waters Fishing Permit?

$_____

26. What is the minimum amount that you would sell your Urban Waters Fishing Permit to someone else if you could not buy another one for six months?

$_____

27. Would you rather have the Game and Fish Department stock fish here of spend the same amount of money to stock trout in the White Mountains?

$_____

28. Would you rather have the Game and Fish Department stock fish here or spend the same amount of money to stock trout in

____Urban Lake

___Parker and Pena Blanca Lakes (for Tucson anglers)

___Canyon Lake and Salt River (for Scottsdale anglers)

29. Do you have any comments about the Urban Lake Fishing Program?

(Green Questionnaire)
University of Arizona
and
Arizona Department of Game and Fish
Urban Lakes Study

1. Lakeside_____ Chaparral_____

2. Date___/___/___/ Time/___/___/___/___/
Mo. Day Year M N AN E

/ S / M / T / W / T / F / S /

3. Urban Waters Fishing Permit Number_____

4. Resident_____ Nonresident_____

Sex_____ Age_____

Anglo_____Mexican/Indian_____Oriental_____Black_____

Local Address_____Zip_____

Your Occupation_____

(or for anglers under 14)

_____ _____
(father's occupation) (mother's occupation)

5. How did you hear about the Urban Lakes Program?

a) Read about it in the paper___
b) Heard about it from friends, relatives or park personnel___
c) Heard about it on radio or TV___
d) Didn't hear about it until I got to the lake___
e) Read sign posted at the lake___

6. Since July 1st, 1977, how many times have you fished here?
or
How many times have you fished here since I last interviewed you?___

7. How many times did you fish here in the year previous to July 1st, 1977?___

8. Since July 1st, 1977, how many times have you gone fishing in other places?___

   or

   How many times have you gone fishing elsewhere since I last interviewed you?___

9. How many times did you fish in other places in the year previous to July 1, 1977?___

10. How far do you live from the lake? ___miles or ___blocks

11. How did you get to the lake? ___car
    ___bus
    ___bicycle
    ___walk

12. Are you here fishing by yourself or as part of a group?

    ____self ____group ____number in group

13. Would you have come to the park today if you weren't going to fish? ___yes ___no

    If yes, other reasons_____

14. If you weren't fishing here today, what would you porbably be doing?

    _____

15. How long have you fished here at the lake today? ___hours___minutes

16. How many of each kind of the following fish have you caught here today? How many of each have you thrown back?

	Total Caught	Thrown Back
Tilapia	_____	_____
Carp	_____	_____
Catfish	_____	_____
Trout	_____	_____
Bass	_____	_____
Bluegill	_____	_____
Crappie	_____	_____
Bullhead	_____	_____
Other	_____	_____

17. Of all these kinds of fish, which is your favorite to catch?

_____

18. Which is your second most favorite? _____

19. Which is your favorite to eat? _____

20. (If angler is under 14) Did you buy your Urban Water Fishing Permit with your own money or did someone buy it for you?

____Own ____Other

21. (If angler is over 14) Would you buy an Arizona State Fishing License if there was no urban lake program?

____Yes ___No ___Pioneer License

22. Would you buy a trout stamp if there was no urban lake program?

____Yes ___No

23. If necessary, rather than not fish here at all, would you pay--
$5, - $10, - $15, - $20
(circle one)

for your six month Urban Waters Fishing Permit?

____Yes ___No

24. If the limits on your favorite fish were twice as high, would you pay--
$5, - $10, - $15, - $20, - $25
(circle one)

for your six month Urban Waters Fishing Permit?

____Yes ___No
(ask $5 more than in question 23 if they said yes to 23; ask same number if they said no)

25. If the lake wasn't stocked, like last year, would you pay--
$5, - $10, - $15, - $20
(circle one)

for your six month Urban Waters Fishing Permit?

___Yes ___No
(ask same number as in question 23 if they said yes to 23; ask $5 less or $1 if they said no)

26. What is the minimum amount that you would sell your Urban Waters Fishing Permit to someone else if you could not buy another one for six months?

$_____

27. Would you rather have the Game and Fish Department stock fish here or spend the same amount of money to stock trout in the White Mountains?

$_____

28. Would you rather have the Game and Fish Department stock fish here or spend the same amount of money to stock trout in

____Urban Lake

____Parker and Pena Blanca Lakes (for Tucson anglers)

____Canyon Lake and Salt River (for Scottsdale anglers)

29. Do you have any comments about the Urban Lake Fishing Program?

Ethnicity:[a] B____ A____

O____ MA___

Disabled_____

Male_____

Female_____

Date_____

S - M - T - W - T - F - S

Morning - Noon - Afternoon - Night

Instantaneous Count_____

(N A M E O F L A K E)

Angler Interview

Number in Party	Under 14	Over 14	Number Successful	Hours Fished	Carp	Carp Kept	Tilapia	Channel Catfish	Trout	Other
										TOTAL

[a] B denotes Black, A denotes Anglo, O denotes Oriental, and MA denotes Mexican-American

Arizona Game and Fish Department

P. O. Box 9099

Phoenix, Arizona 85068

942-3000

Dear Mr/s:

The ARIZONA GAME AND FISH DEPARTMENT is currently evaluating the Urban Fishing Program that was just completed in Scottsdale and Tucson. Our records indicate that you purchased a Chaparral/Lakeside Urban Fishing Permit for the period 1 July 1977 to 31 December 1977, but did not obtain a new one for 1 January 1978 to 30 June 1978. We are interested knowing why you did not buy one for the second six months.

Your answers to the following questions will be used to determine if there is a need and desire for this type of fishing program. Your cooperation will greatly appreciated.

Sincerely,
Fisheries Research
Arizona Game and Fish Department

1. Did you buy a regular state fishing license for 1978?
___YES ___NO

2. Although you did not buy an urban permit during the second period (1 Jan. - 30 June 78), would you buy one in the future if the program were expanded to include other public park lakes in the Phoenix/Tucson metropolitan area?
___Yes ___NO

3. I did not buy a second urban fishing permit for the following reason(s): (please X)
___a. I did not enjoy fishing in the middle of the city.
___b. I did not like the kinds of fish stocked.
___c. The fishing success was not good enough to warrant going back.
___d. The price of the permit was too high.
___e. There were too many people at the park each time I fished.
___f. The lake was too far away from my home.
___g. I did not have transportation to the lake.
___h. I did not have time to go fishing.
___i. I did not like the part where the lake was located.
___j. Daily limit was too small.
___k. I have moved from the area.
___l. Other reasons--please explain_____
_____

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