AN ECONOMIC EVALUATION OF THE ST. LAWRENCE RIVER-EASTERN LAKE ONTARIO BASS FISHERY

The St. Lawrence River-eastern Lake Ontario bass fishery has long been known as one of the finest sport fisheries in North America. Despite its well-documented popularity, there has been little research on this recreational fishery's economic value. Furthermore, recent interest has focused on the fishery's trout and salmon angling opportunities, which have been significantly enhanced since the early 1970's through the management efforts of New York's Department of Environmental Conservation. This study provides information on the economic importance of the bass fishery, considered by many to be one of the best smallmouth bass fisheries in the world. The economic value of this recreational fishery should be taken into account in decisions affecting use of the St. Lawrence River and for planning and evaluating management of this resource.

The current study estimated the economic value of the St. Lawrence River-eastern Lake Ontario bass fishery to licensed New York resident anglers. Benefits to out-of-state anglers (including Canadians) and nonlicensed anglers were not evaluated, nor were Canadian sites in the region included in this study. In addition, general recreational benefits of the fishery to tourists and others were not considered. Though a recreational fishery may be of value from a number of perspectives, it has long been established on conceptual grounds that economic evaluation of recreation benefits should be based on the willingness of users to pay for services provided. However, willingness to pay for outdoor recreation facilities cannot be estimated through the normal procedure of observing market demand because the typical practice is to provide these facilities to users free of charge.

This study used the so-called travel cost method to estimate demand for the angling services of the St. Lawrence River-eastern Lake Ontario bass fishery. The first section of this article discusses the method that was used to estimate the fishery's economic value. It includes a description of the fishery and a discussion of the travel cost method and the data. The second section presents the empirical findings. The concluding section discusses the implications of the results for management policy.

Methods

Determining the Value of Recreation Facilities

There is a substantial body of literature on estimating economic value to users of outdoor recreation. Two approaches have been widely used to obtain information for estimating economic value. The first asks individuals to reveal directly their willingness to pay for use of a recreation site. An important problem with this approach is the incentive to misstate true preferences, possibly leading to inaccurate estimates of economic value (Freeman 1979). The other procedure for estimating economic value is the travel cost method, first applied to outdoor recreation by Clawson (1959) and Clawson and Knetsch (1966). The hypothesis of the travel cost method is that outdoor recreation demand can be estimated by observing how visitation to a specific site varies with differences in costs of traveling to the site. Travel costs are viewed as a charge for use of a resource's services, and the pattern of visitation by geographical area indicates the willingness to pay for its use.

The travel cost method is a two-stage estimation procedure. The first stage predicts site visitation as a function of travel costs and other explanatory factors. Then a demand curve is derived showing how visitation would vary in response to a price (or entrance fee) charged for use of the site, assuming that users view an increase in price as equivalent to the additional costs needed to travel greater distances to the site. The site's net economic value (NEV) in its current use is equal to the area under the demand curve above the level of travel costs (Clawson and Knetsch 1966; Dwyer et al. 1977).[1]

The Participation Equation

Visitation patterns to the St. Lawrence River-eastern Lake Ontario area (Fig. 1) during the 1976-77 year form the basis for this analysis. The equation for predicting visitation to the fishery was based on a survey of licensed New York resident anglers (New York Department of Environmental Conservation 1976). The sample was limited to 904 anglers (from 51 of New York's 62

[1]The travel cost method assumes that users derive benefits from the recreation site itself rather than the trip (Brown et al. 1965).

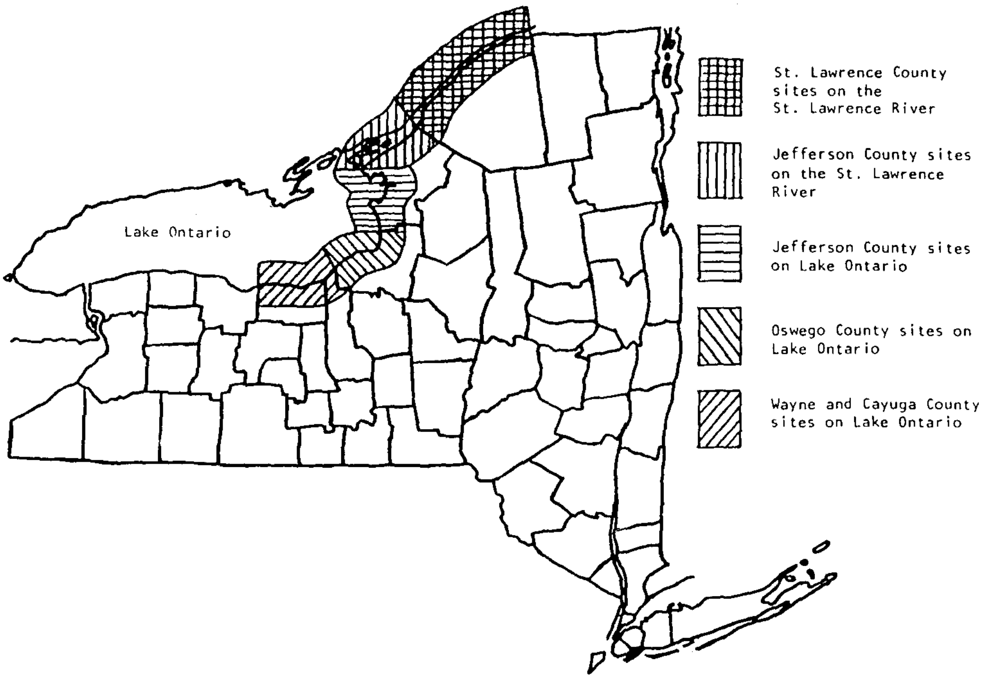

FIGURE 1.—Map of St. Lawrence River-eastern Lake Ontario bass fishery.

counties) who spent >5% of their time fishing for either smallmouth or largemouth bass at one of the designated sites. The study area comprised five sites chosen on the basis of geography, availability of data, and observed visitation. Two sites were on the St. Lawrence River and three were on eastern Lake Ontario.

The participation equation is equivalent to an ordinary demand function for a marketed commodity where quantity (visits to a site) is a function of prices (travel costs), income, and qualitative characteristics. The participation equation for the bass fishery was:

$$D_{ij} = f(TC_{ij}, I_i, PF_i, S_i, A_j, TC_{ik}) \qquad (1)$$

where
- D_{ij} = total days angling at site j by respondents from county of origin i for the 1976-77 fishing season
- f = a symbol representing an explicit functional relationship between D_{ij} and the explanatory variables
- TC_{ij} = travel costs from county of origin i to site j; calculated by measuring road distance from the midpoint of each county to the midpoint of each site and multiplying the measured distance by an estimate of the cost per mile
- I_i = average annual income of anglers from county of origin i
- PF_i = average preference level for bass of anglers from county of origin i; preference level represents the percentage of total angling time spent fishing for the species of interest
- S_i = number of anglers to whom the questionnaire was sent in county of origin i; a constant percentage of the angler population across all counties
- A_j = relative attractiveness of site j; the amount of shoreline miles at site j relative to the total miles available at all sites
- TC_{ik} = an index of travel costs from county of origin i to substitute angling sites in the study area.

This demand function relates participation at sites not only to their own prices and quality, but also to the attributes of comparable substitute sites. Travel costs were assumed to be a function of both monetary expenditures and the cost of travel time.[2] Ignoring time costs will cause biased estimates of demand and economic value (Cesario and Knetsch 1970). Cost of travel time was calculated by multiplying estimated travel time en route to the site by an hourly wage rate (Knetsch et al. 1976). Sample size was included as an independent variable in the participation equation because others have found that visitation increases at a nonlinear rate with increases in population (Cesario and Knetsch 1976; Grubb and Goodwin 1968). Travel costs to substitute sites, TC_{ik}, were represented in an index of travel costs reflecting the availability of substitute angling opportunities.[3] The attractiveness of available recreation sites can also be an important determinant of visitation patterns. The decision to visit a particular site depends, in part, on the attractiveness of that site compared with other available sites. Site attractiveness measures used by others have included angling success rates (Stevens 1966), size of the recreation area (Ravenscraft and Dwyer 1978), congestion at the site (McConnell 1977), and accessibility (Cesario and Knetsch 1976). Data limitations reduced the possible choices for attractiveness variables in this study to fishing success rates and shoreline distance.

Site Demand and Economic Value

The second step of the travel cost method derives the demand for and economic value of the recreation site from the participation equation. The usual procedure is to derive a demand curve for a specific site by estimating demand from each origin and aggregating over all origins for each increment of a hypothetical fee until aggregate demand for the resource is reduced to zero (Grubb and Goodwin 1968; Cesario and Knetsch 1976; Knetsch et al. 1976). This study estimated NEV for each origin using a separate site-specific demand curve. Then the site's total NEV was found by numerical aggregation across all origins. This procedure estimates NEV more accurately than the usual procedure because there is less aggregation in deriving the site demand curve (McConnell and Norton 1976; Menz and Wilton 1982).[4] Demand was estimated from the participation equation for each site with the following:

$$D_{ij} = C_{ij} + \beta_1 (TC_{ij} + p) + \epsilon \qquad (2)$$

where D_{ij} = the observed days of participation when the fee is zero[5]
TC_{ij} = travel costs from county of origin i to site j
C_{ij} = the composite of all other variables
p = the hypothetical fee charged for use of the site
ϵ = an error term.

The site's NEV to anglers in each origin was obtained by integrating the demand equation between the limits of current travel costs and the cost at which D_{ij} would become zero.

Results

Some anglers may fish exclusively for smallmouth bass, others for largemouth bass, and some may be unconcerned about the specific type of bass caught. Therefore, three separate analyses were conducted: one each for the smallmouth and largemouth bass fisheries and one for the "combined" bass fishery. The value of the combined fishery was determined in a separate analysis because addition of the smallmouth and largemouth bass results would double-count anglers who fish for both species. The same fishing sites were used for each analysis.

Characteristics of anglers and sites are presented in Tables 1 and 2. Smallmouth and large-

[2]Travel costs were converted to price per angler day by taking into account travel distance and whether lodging expenditures were reported by anglers. Analysis of the survey data indicated that anglers who resided at a (one-way) distance between 125 and 175 mi from the site generally incurred lodging expenditures, indicating an overnight stay at the site. Accordingly, price per angler day was assumed to equal one-half the estimated travel costs for anglers residing more than 150 mi from a site. For anglers closer to the site, price per angler day was assumed to equal estimated travel costs. Monetary costs were assumed to be 10¢/mile. Travel time costs were calculated by multiplying estimated travel time at 50 mph by a value equal to 35% of the wage rate in the angler's county of origin. Hotel costs were not included in the cost estimates since they could not be determined on a per angler day basis.

[3]Use of an index reflects the overall availability of substitutes. Dividing the index by four would give the average price of a substitute site in this fishery. A generalized approach to the treatment of substitute sites is preferable to a specific substitute site in a regional travel cost model (Cesario and Knetsch 1976; Dwyer et al. 1977; Ravenscraft and Dwyer 1978).

[4]This method will be more accurate than if an aggregate demand curve were used, but it will not provide as accurate an estimate of economic value as aggregation of individual economic values (Brown et al. 1965; Smith 1975a).

[5]The value of D_{ij} was set equal to zero whenever a negative quantity resulted from the calculation.

TABLE 1.—Characteristics of New York resident anglers in the St. Lawrence River-eastern Lake Ontario bass fishery, 1976.

	Combined bass		Smallmouth bass		Largemouth bass	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Preference (%)	37.8	23.7	30.6	14.5	27.8	13.3
Experience (No. of years)	29.7	14.3	31.8	23.9	22.9	15.3
Education (No. of years)	13.3	2.9	13.3	2.9	13.2	2.9
Annual income ($)	18,100	9,500	18,600	9,900	16,900	8,500

TABLE 2.—Characteristics of sites and angler participation in St. Lawrence River-eastern Lake Ontario bass fishery, 1976.

		Angler participation				
		Distance traveled (mi)		Success rate (fish per angler day)		
Site	Shoreline (mi)	Mean	Standard deviation	Smallmouth	Largemouth	Combined
St. Lawrence River:						
St. Lawrence County (Site 1)	64	171	93.3	0.85	0.20	0.84
Jefferson County (Site 2)	48	149	69.8	0.88	0.31	1.03
Lake Ontario:						
Jefferson County (Site 3)	63	99	63.8	1.30	0.31	1.39
Oswego County (Site 4)	24	62	57.5	0.64	0.26	0.71
Wayne & Cayuga Counties (Site 5)	32	35	29.7	0.73	0.25	0.80
Entire fishery	231	110	82.0	0.94	0.27	1.02

mouth bass anglers were similar in socioeconomic characteristics, but the average smallmouth bass angler had more angling experience. Average one-way distance traveled by anglers to the sites varied from 35 mi for the Wayne and Cayuga County sites on Lake Ontario to 171 mi for the St. Lawrence County sites on the St. Lawrence River. Angling success rates were highest at the Jefferson County sites on Lake Ontario.

The Participation Equation

There does not appear to be any theoretical justification for a particular functional form of the relationships for estimation (Smith 1975b). Various functional forms of the participation equation (Equation (1)) were estimated. The final form was as follows:

$$\log(D_{ij} + 0.8) = \beta_0 + \beta_1 \log TC_{ij} + \beta_2 \log I_i + \beta_3 \log PF_i + \beta_4 \log S_i + \beta_5 \log A_j + \beta_6 \log TC_{ik} + \epsilon \quad (3)$$

where the β terms are parameters to be estimated and ϵ is the random component.[6] The double logarithmic model produced more significant parameter estimates and also exhibited greater explanatory power than linear and semilogarithmic forms, so it was used to derive the estimates for this part of the analysis.[7]

The results for the participation equation (Equation (3)) are presented in Table 3. Because assumptions about monetary and time costs of travel could influence the results, alternative participation equations were estimated using different values for these cost components. The results are also shown in Table 3. The effect and significance of the explanatory variables remained virtually unchanged, suggesting that confidence can be placed in the results from this stage of the analysis.

The estimates are consistent with theoretical expectations and are similar for the three fishery specifications. Most of the estimated coefficients were statistically significant at the 1% level and

[6]The quantity, 0.8, in Equation (3) is added to the fee to prevent the use of the logarithm of zero. All logarithms are natural logarithms.

[7]The objective in specifying the participation equation was to obtain reliable estimates of parameters rather than a high R^2 (Gum and Martin 1975). Other studies that have used the double log format are Grubb and Goodwin (1968), Smith (1975b), and Smith and Kopp (1980).

TABLE 3.—Estimated parameter values for participation equations for days of angling for St. Lawrence River-eastern Lake Ontario bass fishery.[1]

Parameter	Assumption for cost of travel and time[2]: 10¢/mi and 35% of wage rate			15¢/mi and 35% of wage rate			10¢/mi and 50% of wage rate		
	Smallmouth	Largemouth	Combined	Smallmouth	Largemouth	Combined	Smallmouth	Largemouth	Combined
Travel cost to site (TC_{ij})	−1.452	−1.426	−1.487	−1.455	−1.428	−1.488	−1.448	−1.424	−1.486
	(−4.97)	(−4.98)	(−5.07)	(−4.98)	(−4.79)	(−5.08)	(−4.95)	(−4.97)	(−5.07)
Income (I_i)	0.851	1.494	0.935	0.665	1.294	0.730	1.025	1.686	1.127
	(2.55)	(4.17)	(2.80)	(2.05)	(3.72)	(2.25)	(2.98)	(4.57)	(3.27)
Preference (PF_i)	0.447	0.337	0.470	0.446	0.334	0.471	0.447	0.332	0.470
	(1.99)	[3](1.39)	[3](1.95)	(1.99)	[3](1.38)	[3](1.96)	(1.99)	[3](1.37)	[3](1.95)
Sample size (S_i)	1.162	1.078	1.159	1.166	1.081	1.162	1.159	1.075	1.158
	(8.25)	(7.86)	(8.48)	(8.28)	(7.88)	(8.50)	(8.23)	(7.84)	(8.47)
Site attractiveness (A_j)	1.444	0.814	1.458	1.444	0.815	1.458	1.444	0.813	1.458
	(5.53)	(3.12)	(5.78)	(5.54)	(3.72)	(5.78)	(5.53)	(3.12)	(5.78)
Substitute travel costs (TC_{ik})	−0.598	−0.853	−0.799	−0.599	−0.857	−0.802	−0.599	−0.851	−0.798
	(−2.27)	(−3.27)	(−3.10)	(−2.27)	(−3.28)	(−3.11)	(−2.28)	(−3.27)	(−3.10)
Intercept	−4.243	−9.667	−3.839	−1.881	−7.092	−1.217	−5.622	−11.199	−5.368
	(−1.33)	(−3.06)	(−1.23)	(−0.60)	(−2.28)	(−0.39)	(−1.75)	(−3.51)	(−1.70)
F	33.10	27.21	36.76	33.20	27.29	36.82	32.99	27.12	36.70
R^2	0.455	0.434	0.471	0.456	0.435	0.471	0.454	0.433	0.470

[1]Each equation has the form of Equation (3); dependent variable is days of angling for bass anglers.
[2]Figures in parentheses are t-values.
[3]Not significant at the 5% level.

all except those noted as such in Table 3 were significant at the 5% level. Travel costs from origin i to site j (TC_{ij}) and the measure of site attractiveness (A_j) were found to be highly significant determinants of participation. The effect of substitutes on site visitation depends on their location and attractiveness relative to the site being studied (Burt and Brewer 1971; Cicchetti et al. 1976; Dwyer et al. 1977). The negative and statistically significant coefficient for TC_{ik} suggests that the sites in this fishery serve as complements for one another and that anglers are drawn to the fishery as a whole instead of to a particular site.

Economic Value of the Fishery

Table 4 presents the estimated net economic benefits to New York resident bass anglers for the fishery. Values were estimated for each site and for each species of bass on a per angler day basis and as an annual total. The annual total for each site was calculated by multiplying the value per angler day by the estimated number of angling days as given in Table 5. B and C of Table 4 show the effect of alternative assumptions about distance and time costs.

It can be seen that the results vary widely from site to site and with different assumptions concerning the monetary component of travel costs. Variation among sites is due to the relative attractiveness of the sites, size of population in nearby counties, and other factors affecting visitation patterns. These factors affect the willingness of anglers to pay for the sites' services and the number of anglers attracted. Highest values per angler day were estimated for St. Lawrence County sites on the St. Lawrence River. At two sites the NEV per angler day for largemouth bass exceeded the NEV per angler day for smallmouth bass. However, due to a greater number of estimated angling days for smallmouth bass at these two sites, the total NEV of the smallmouth bass fishery exceeded that of the largemouth bass fishery for every site.[8] The value of the combined bass fishery at each site is less than the total of the individual smallmouth and largemouth bass values because the fisheries for

[8]It should be emphasized that the total value of the fishery equals the estimated number of angling days at each site times the per angler day value. This assumes that the angler day is entirely attributable to the site's bass fishery. To reduce possible bias from this assumption, the sample population was limited to anglers who fished at one of the five sites and indicated that they had spent more than 5% of their time fishing for bass.

TABLE 4.—Net economic value of the St. Lawrence River-eastern Lake Ontario bass fishery to New York resident anglers, 1976.

Type of fishery		Location Site 1	Site 2	Site 3	Site 4	Site 5	Total
A. Estimates using travel costs of 10¢/mile and a time cost of 35% of the wage rate:							
Smallmouth	Per day ($)	36.46	27.23	26.53	15.53	19.13	
	Total ($)	2,916,800	5,702,000	4,795,500	1,026,500	2,280,300	16,721,000
Largemouth	Per day ($)	33.24	25.28	24.32	15.67	19.29	
	Total ($)	1,652,000	2,818,700	1,459,200	659,700	2,044,700	8,634,300
Combined	Per day ($)	35.22	25.99	24.64	15.43	18.55	
	Total ($)	3,610,100	5,889,300	4,854,100	1,263,700	2,769,500	18,386,700
B. Estimates using travel costs of 15¢/mile and a time cost of 35% of the wage rate:							
Smallmouth	Per day ($)	47.36	35.40	34.46	20.07	24.69	
	Total ($)	3,788,800	7,412,800	6,182,100	1,326,600	2,943,000	21,653,300
Largemouth	Per day ($)	43.53	33.08	31.81	20.45	25.06	
	Total ($)	2,163,400	3,688,400	1,908,600	860,900	2,656,400	11,277,700
Combined	Per day ($)	46.03	33.94	32.18	20.14	24.06	
	Total ($)	4,718,100	7,690,800	6,341,400	1,649,500	3,592,200	23,992,000
C. Estimates using travel costs of 10¢/mile and a time cost of 50% of the wage rate:							
Smallmouth	Per day ($)	42.72	31.88	31.07	18.30	22.56	
	Total ($)	3,417,600	6,675,700	5,574,000	1,209,600	2,689,200	19,566,100
Largemouth	Per day ($)	38.69	29.42	28.31	18.30	22.64	
	Total ($)	1,922,900	3,280,300	1,698,600	770,400	2,399,800	10,072,000
Combined	Per day ($)	40.99	30.25	28.65	18.00	21.76	
	Total ($)	4,201,500	6,854,700	5,644,100	1,474,200	3,248,800	21,423,300

TABLE 5.—Visitation and expenditures by licensed New York resident bass anglers, 1976.[1]

	Site 1	Site 2	Site 3	Site 4	Site 5	Total
A. Smallmouth bass anglers:						
Number of anglers	6,700	16,000	10,800	5,100	8,000	46,600
Number of angler days	80,000	209,400	179,400	66,100	119,200	654,100
At-site expenditures per angler day ($)	6.05	10.14	8.20	3.62	3.35	7.21
Total expenditures per angler day ($)	9.46	13.39	12.17	6.01	4.68	10.24
B. Largemouth bass anglers:						
Number of anglers	4,100	8,700	4,100	3,400	6,400	26,800
Number of angler days	49,700	111,500	60,000	42,100	106,000	369,400
At-site expenditures per angler day ($)	6.95	9.04	6.85	3.78	2.04	5.79
Total expenditures per angler day ($)	11.64	12.37	10.38	5.02	3.17	8.47
C. Smallmouth and/or largemouth bass anglers:						
Number of anglers	8,400	18,200	12,400	6,900	9,900	55,800
Number of angler days	102,500	226,600	197,000	81,900	149,300	757,300
At-site expenditures per angler day ($)	6.18	10.10	8.47	3.93	2.95	7.07
Total expenditures per angler day ($)	10.83	13.38	12.41	6.15	4.41	10.10

[1]All values are based on the definition of bass angler for this study and are expanded from the survey sample to the angler population.

the individual species are not mutually exclusive. Addition of the economic value across sites yields a total annual value for the five sites of $18,386,700 for the combined bass fishery in 1976. This amount represents the annual NEV to licensed New York resident bass anglers in 1976 for the five sites that make up the St. Lawrence River-eastern Lake Ontario bass fishery. The effect of changes in travel cost assumptions can be seen by comparison of A, B, and C of Table 4. Changes in per mile monetary costs influence NEV less than changes in time costs.

The results reported in Table 4 and discussed above relate to the fishery's economic value to licensed New York resident anglers in 1976. For policy purposes, the current value of the recreational fishery would be more appropriate. The most accurate way to estimate the current value of the fishery would be to use current angler visitation and travel cost data, which are unavailable. It would be inappropriate to use current travel cost information with visitation data from 1976 to estimate current demand for the fishery because visitation patterns may have significantly changed since the earlier time period. The value of the fishery can be stated in terms of 1982 dollars by multiplying the results in Table 4 by 1.5, which represents the ratio of 1982 to 1976 price levels (Federal Reserve Bank of St. Louis 1982). Consequently, the NEV for the combined bass fishery per angler day ranges from \$23.14 at site 4 to \$52.83 at site 1 in 1982 dollars, while NEV ranges from \$1.9 million at site 4 to \$8.8 million at site 2. The NEV of the combined bass fishery to licensed New York resident anglers would be approximately \$27.6 million in 1982 dollars.

Conclusions

This paper has reported results of a study of the economic value of the St. Lawrence River-eastern Lake Ontario bass fishery to licensed New York resident anglers. A regional travel cost model was used to estimate demand and economic value for the sites that make up the fishery. The economic value of the fishery to anglers is considered to be the most appropriate measure of the fishery's contribution to economic welfare. Benefits to New York anglers are likely to be an important element of the fishery's recreational value.

The results of this study are important for policy concerning management of the fishery resource, but they should be interpreted cautiously for several reasons. First, there are benefits in addition to those considered here, including those to other anglers as well as to nonanglers. Second, there are possible errors in the benefit estimates either from misspecification of the underlying participation equation or from possible errors in the survey data. Third, an important issue in the valuation of recreational fisheries concerns the appropriate treatment of substitute sites. This study used an approach which considered substitution among a limited number of alternative bass fishing sites within the fishery, but did not consider all possible substitute sites or species because it would be impractical to do so. It should also be noted that the procedure used in this study allows the relative value of fish species to be compared (either within this study area or with bass fisheries elsewhere), but these results cannot be added to those for other species to determine their combined value. Despite these limitations, the results of this study of the St. Lawrence River-eastern Lake Ontario bass fishery should be useful for policy purposes. Many of the resource management options that are evaluated are likely to influence the quality of the fishery, and it is important that information on economic value be considered. Economic analysis is no panacea for resolving problems of alternative natural resource uses, but should play a part in informed policymaking.

Acknowledgments

The research reported here was supported by funds from the New York Sea Grant Institute and the U.S. Department of Interior. T. L. Brown and J. K. Mullen provided helpful comments at various stages of the work. *Fishery Bulletin* reviewers provided helpful comments on an earlier version. Data were provided by the New York State Department of Environmental Conservation, Bureau of Fisheries.

Literature Cited

BROWN, W. G., A. SINGH, AND E. N. CASTLE.
1965. Net economic value of the Oregon salmon-steelhead sport fishery. J. Wildl. Manage. 29:266-279.

BURT, O. R., AND D. BREWER.
1971. Estimation of net social benefits from outdoor recreation. Econometrica 39:813-827.

CESARIO, F. J., AND J. L. KNETSCH.
1970. Time bias in recreation benefit estimates. Water Resour. Res. 6:700-704.
1976. A recreation site demand and benefit estimation model. Reg. Stud. 10:97-104.

CICCHETTI, C. J., A. C. FISHER, AND V. K. SMITH.
1976. An econometric evaluation of a generalized consumer surplus measure: The Mineral King controversy. Econometrica 44:1259-1276.

CLAWSON, M.
1959. Methods of measuring the demand for and value of outdoor recreation. Resources for the Future, Reprint 10, 36 p. Wash., D.C.

CLAWSON, M., AND J. L. KNETSCH.
1966. Economics of outdoor recreation. Johns Hopkins Press, Baltimore, 328 p.

DWYER, J. F., J. R. KELLY, AND M. D. BOWES.
1977. Improved procedures for valuation of the contribution of recreation to national economic development. Univ. Ill., Water Resour. Cent., Res. Rep. 128, 218 p.

FEDERAL RESERVE BANK OF ST. LOUIS.
1982. National economic trends, monthly report dated March, 1982. Fed. Reserve Bank St. Louis, St. Louis, Mo., 16 p.

FREEMAN, A. M., III.
1979. The benefits of environmental improvement, theory and practice. Johns Hopkins Univ. Press, Baltimore, 272 p.

GRUBB, H. W., AND J. T. GOODWIN.
1968. Economic evaluation of water-oriented recreation in the preliminary Texas water plan. Texas Water Development Board, Austin, Rep. 84, 21 p.

GUM, R. L., AND W. E. MARTIN.
1975. Problems and solutions in estimating the demand for and value of rural outdoor recreation. Am. J. Agric. Econ. 57:558-566.

KNETSCH, J. L., R. E. BROWN, AND W. J. HANSEN.
1976. Estimating expected use and value of recreation

sites. *In* C. Gearing, W. Swart, and T. Var (editors), Planning for tourism development: Quantitative approaches, p. 103-115. Praeger Publ., N.Y., 316 p.

McConnell, K. E.
1977. Congestion and willingness to pay: A study of beach use. Land Econ. 53:185-195.

McConnell, K. E., and V. J. Norton.
1976. An economic evaluation of marine recreational fishing. *In* R. H. Stroud (compiler) and H. Clepper (editor), Marine recreational fisheries, p. 12-28. Sport Fish. Inst., Wash., D.C.

Menz, F. C., and D. P. Wilton.
1982. Alternative ways to measure recreation values by the travel cost method. Clarkson College of Technology, Potsdam, N.Y., 19 p. [Mimeo.]

New York State Department of Environmental Conservation.
1976. 1976-1977 New York resident angler survey. Bur. Fish., Albany, 11 p.

Ravenscraft, D. J., and J. F. Dwyer.
1978. Reflecting site attractiveness in travel cost-based models for recreation benefit estimation. Univ. Ill., Dep. Forest., Forest. Res. Rep. 78-6, 7 p.

Smith, V. K.
1975a. The estimation and use of models of the demand for outdoor recreation. Appendix B, Assessing the demand for outdoor recreation, p. 91-123. Natl. Acad. Sci., Wash., D.C.
1975b. Travel cost demand models for wilderness recreation: A problem of non-nested hypotheses. Land Econ. 51:103-111.

Smith, V. K., and R. J. Kopp.
1980. The spatial limits of the travel cost recreational demand model. Land Econ. 56:64-72.

Stevens, J. B.
1966. Recreation benefits from water pollution control. Water Resour. Res. 2:167-182.

Fredric C. Menz

Department of Economics
Clarkson College of Technology
Potsdam, NY 13676

Donald P. Wilton

Graduate Student, School of Management
Clarkson College of Technology
Potsdam, N.Y.
Present address: *IBM Corporation*
VM Development/Test
Poughkeepsie, NY 12601