韓國林學會誌 81(3) : 203-213. 1992
Jour. Korean For. Soc. 81(3) : 203-213. 1992

Visitor Segmentation as a Means of Reducing Variance in spending profiles Corps of Engineers Lakes[1]

Ju Hee Lee and Dennis B. Propst[2]

美國工兵隊 관할 호수에 수반되는 여행비용의 분산 감소를 위한 시장분할법

李周熙 · Dennis B. Propst[2]

ABSTRACT

The purpose of this study is to segment recreationists into groups which are homogeneous with respect to their spending patterns and trip characteristics. Date were derived from a larger study aimed at developing nationally representative expenditure profiles for recreation visitors to Corps of Engineers projects. Segmentation of these data reduces variance and helps to identify distinctive final demand vectors for input - output applications. A - priori and cluster analysis approaches for identifying segments are compared. The a - priori segmentation approach identified 12 segments and the cluster analysis approach identified 3 segments. The 3 nonresident clusters - labeled "day use", "overnight", and "overnight camping" - show lower mean squares within groups than the a - priori segments on almost all nonresident spending categories with an exception of boating expenses. For the Corps of Engineers, implications of these findings for the estimation of economic impacts are discussed.

Key words : Economic impacts of outdoor recreation, segmentation, a - priori approach, cluster analysis approach, final demand vectors.

要 約

본 硏究의 目的은 休養客들을 消費패턴과 旅行특성을 기준으로 유사한 소그룹으로 分割하는 데 있다. 이를 위한 자료는 美 聯邦政府機關인 美工兵隊가 管掌하는 12곳의 休養地 방문客들을 대상으로 조사를 실시함으로서 미국 全域에 있는 美工兵隊 管轄湖水를 방문한 휴양객들의 일반적인 消費行動을 類推하는 硏究 프로젝트의 일환으로 蒐集되었다. 휴양객들의 分割은 그들의 여행비용 分散을 줄임과 동시에 휴양객의 消費에 근거한 휴양지역의 經濟的 效果를 算定하는 데 사용되는 最終需要 벡터를 分割하는데 도움이 된다.

본 연구에서는 휴양객들의 分割을 위해 A - priori 분석방법과 군집분석방법을 비교 · 사용하였다. A - priori 분석방법으로는 12개의 小그룹 中 他지역에서 온 休養客 6개 그룹이 군집분석방법으로는 3개의 소그룹이 策定되었다. 3개의 소그룹을 "一日 利用客", "宿泊 보트 利用客", "宿泊 野營 利用客"으로 분류한 결과 A-priori 분석방법보다는 보트 사용비용을 제외하고는 휴양객의 모든 費用項目에서 平均平方(Mean Spuare)이 작다는 것을 확인할 수 있었다. 연구결과를 토대로 하여 휴양객의 經濟效果 測定에 대한 適用 및 考慮事項들이 언급되었다.

[1] 接受 1992年 1月 22日 Recieved on January 22, 1992.

[2] Ju-Hee Lee, Department of Forestry, College of Agriculture, Taegu University, Kyungsanbukdo, Korea and Dennis B. Propst, Department of Park and Recreation Resources, College of Agriculture, Michigan State University, East Lansing, MI. U.S.A.

INTRODUCTION

Economic impacts of outdoor recreation have continued to grow with increasing participation in outdoor recreation activities(Alward, 1986). There are two types of such impacts. The primary economic impacts on a region's economy are from initial outdoor recreation users' expenditures. Secondary economic impacts on a region include changes in business output or sales, employment, net income, tax revenue, and government spending resulting from the primary spending. Through these two types of economic impacts, it is possible to estimate the contribution of outdoor recreation to a region(Propst & Gavrilis, 1987 ; Mak, 1989).

There are two challenges in estimating the economic impacts of recreation : 1) collecting reliable spending and visitation date, and 2) conducting appropriate analyses to provide valid impact estimates. An initial attempt to meet these challenges was the 1985 Public Area Recreation Visitor Survey (PARVS). The PARVS was a coordinated multi-regional data collection effort among federal and state agencies. A primary objective of the PARVS was to obtain nationwide information about the use of public recreation areas. Another important objective was to generate the spending data needed to estimate the economic impacts of visitors to public recreation areas(Alward & Lofting, 1985 ; Propst, 1988). Through revisions of the PARVS design, the Corps of Engineers Recreation Spending Study (CERSS) was developed. The primary purposes of the CRESS 1) to estimate total resident and nonresident recreation expenditures associated with Corps of engineers projects, 2) to develop a representative set of spending profiles for visitor segments that are homogeneous with respect to spending patterns, and 3) to derive regional I/O models to estimate economic impacts(Propst & Stynes, 1988).

There have been a substantial number of recreation spending studies, but most are not focused on applying economic impact analysis. The studies typically describe aggregate or total visitor spending rather than estimate employment and income effects (Henderson, Cooper, 1983, Hogan & Rex, 1983, Rose, 1981, Jordan & Talhelm, 1985 ; Stynes & Mahoney, 1986).

Input-output(I/O) models are used to derive the regional economic impacts of recreation industries or activities. However, the credibility of these impacts has been questioned(Pedersen, 1990). Possible reasons for inaccurate estimates of impacts include a lack of : 1) detailed estimates of recreation use and 2) accurate estimates of user expenditures. These two variables are the basic components for deriving recreation expenditure profiles used in I/O analysis. For example, Micro-IMPLAN, an I/O analysis system in common usage, requires input in the form of "vectors of final demand". In the case of recreation, a final demand vector consists of spending means for various goods and services multiplied by the total visitation to a given resource(Tyrrell, 1985) :

Final demand Vector for recreation = Total Visitation * Average Recreation Spending

Average recreation spending often displays high variance because : 1) recreation products and services are diverse and 2) spending for goods or services often includes many zeros and extremely large outliers. Segmentation of recreationists is one way to reduce variance and to identify more realistic and distinctive spending profiles(Stynes and Chung, 1986). This is because segmentation can produce groups which are homogeneous with respects to their spending patterns. Thus, final demand vectors can be derived for various segments and generalization across populations can then be made on the basis of a given mix of segments. To illustrate, local day users and nonresident overnight users on extended trips are two distinct segments that clearly have unique spending patterns and vary greatly in terms of total amounts spent. Combining these two segments merges significant reports of zero spending (day user) with a number of large outliers(long trip overnight nonresidents), thereby increasing variation about the mean. Splitting the sample into two segments that are more homogeneous with respect to their spending patterns reduces the variance in each group.

It is assumed that economic impact results may be

sensitive to the formulation of "final demand" specifications, which, in turn, will depend upon the segmentation of recreationists. Therfore, the research question is : How should recreationists be segmented so that the vectors of final demand can be produced with the least amount of variance ? Since these vectors are key requirements of I/O software, such as Micro-IMPLAN, this question is central to assuring accurate economic impact estimates.

The primary aim of this paper is to test methods for segmenting recreationists based on activities, origins, duration, spending, and other trip characteristics. In this way, the study seeks to provide a segmentation analysis method for I/O applications. This paper deals only with variable trip costs for nonresidents, not durable goods expenditures or expenses incurred by local residents.

METHODS

During the summers of 1989 and 1990, visitors to twelve Corps lakes nationwide were sampled (Propst et al., 1991). A two-step procedure involving both on-site interviews and mailback questionnaires was employed. Spending for durable goods (e.g., boats and recreation vehicles) and tirp characteristics (e.g., length of stay) were measured in conjunction with the on-site interview. Spending for non-durable, trip related goods and services (e.g., food, gas, and lodging) was measured through a mailback questionnaire distributed to the on-site interview respondents at the completion of the interview.

Two segmentation approaches were used to define visitor segments : 1) an a-priori approach 2) a statistical approach. The a-priori approach involved consultation with Corps staff and a review of literature, which identified four key variables needed to describe water-based recreation segments that are homogeneous with respect to their spending patterns. These 4 variables are : camping participation, boating participation, duration of stay, and visitor origin.

As a statistical approach, cluster anslysis was used to form visitor segments based on one or more similar criteria, such as the respondents' spending patterns. The intent was to identify clusters that show high internal (within cluster) homogeneity and high external (between clusters) heterogeneity. Cluster analysis groups all possible pairs of individuals/objects based on their distance from each other in terms of various statistical properties. Methods commonly used for measuring distance for cluster analysis are : 1) Euclidean distance, 2) Squared Euclidean distance, 3) Manhattan or city-block distance, 4) Minkowski distance, and 5) Mahalanobis D^2 (Norusis, 1986). Euclidean distance is the most common approach.

It is important to standardize criteria variables before running the cluster analysis because attempting to group variables that are scaled differently or vary in units of measure will otherwise lead to confusing and misleading results. Grouping procedures used in the cluster analysis are identified as : single linkage (nearest neighbor), complete linkage (maximum distance or furthest neighbor), average linkage (average distance), Ward's distance (minimum variance), and the centroid method (distnace between menas) (Norusis, 1986).

Although cluster analysis seeks to group relatively homogeneous sets of individuals/objects without requiring any prior classification of the sample, there are a number of theoretical concerns. First, cluster analysis is not supported by an extensive body of statistical reasoning or rationale. Second, different clustering methods may generate different solutions within a single date set. Third, it is often hard to interpret the result of cluster analysis (Aldenderfer & Blashfield, 1989).

The present analysis utilized a Quick Cluster Procedure in SPSS PC+. This procedure can be used to cluster large number of cases efficiently without requiring substantial computer resources. The rationale is based on nearest centroid sorting (Anderberg, 1973) where a case in assigned to the cluster for which the distance between the case and the center of the cluster (centroid) is the smallest.

The cluster variables included : the four variables which were used in the a-priori segmentation approach, total average spending per party per trip, and average spending on each spending category per party per trip. In addition, raw spending variables

and transformed spending variables were tested. Thus, the final cluster variables were nine spending categories which consisted of variable trip costs for : 1) lodging, 2) food and beverage, 3) auto and R.V., 4) boats, 5) fishing, 6) entertainment, 7) miscellaneous[2], 8) other[3], and 9) average nonresident trip spending within 30 miles of the study areas. Nonresident spending was selected because I/O analysis usually requires vectors of final demand which represent injections of new money into a study region. The mean squares within the nine variables were compared using the two segmentation approaches described earlier. Since the raw data had many zeros in each spending category and some large outliers, log transformations were performed by adding 1 cent to the cases which had zero in each spending category. Everitt(1980) recommends a log transformation when the normality of variable is in question.

RESULTS

Over 3,100 on-site interviews and 2,100 mailback questionnaires were collected. The overall response rate across all twelve lakes was approximately 70 percent with several lakes generating response rates in excess of 80 percent(Table 1).

When parties who spent zero on their trips are included, average variable trip spending ranged from $105 per party/trip at Lake McNary(Washington/Oregon) to $498 per party/trip at Lake Cumberland(Kentucky) (Propst et al., 1991).

The a-priori segmentation approach using four different segment variables identified twelve segments. The four variables used to define visitor segments were measures of participation in camping and boating activities, duration of stay, and visitor origin. These variables were selected to describe water-based recreation segments thought to be homogeneous with respect to their spending patterns.

ual lakes, the percentage of boaters ranged from 25 percent at Lake Mendocino to 91 percent at Lake Dworshak. Nearly half(47%) of all visitors were nonresidents. Lake Cumberland, located in a rural tourism region, had the highest proportion of nonresident visitors(78%). Priest Lake, located partially within the City of Nashville, received 13 percent nonresident visitation. The pattern of day vs. overnigh visitors reflects the difference in visitor origins, with Lake Cumberland having the highest proportion of overnight users, and Lake Priest the lowest. Other lakes in the sample show similar patterns, with a high proportion of nonresident visitors associated with a high proportion of overnight visitors, and vice versa.

All four variables were recoded to dichotomous values : "0"(no) or "1"(yes). For example, a "0" for camping participation identifies the party as non-campers, whereas a "1" identifies the party as having camped. Likewise, a visitor origin of "0" identifies a party whose permanent residence was more than 30 miles from the lake.

This a-priori segmentation approach using four different variables results in 16 different combinations from the following formula :

$$S = C + 2 * D + 4 * R + 8 * B$$

Where S = given visitor segment
C = camper or not a camper
D = day user vs overnight visitor
R = Resident vs non-resident
B = boater or not a boater

The visitor segment variable (S) has a range from 0 to 15. Four of the sixteen segements are illogical, and have been excluded. These excluded segments are the combination of campers (1) and day user (0). Because a camper is supposed to be an overnight user, it is illogical if the case was coded "1" (yes) for camping and "0" (no) for overnight. Consequently, 12 visitor segments were remained for the analysis.

Table 3 shows the distribution of these segments across the 12 lakes.

Spending estimates for aggregated categories of trip-related expenses are shown in Table 4. Thirty-six specific trip expenses were combined to produce these 10 larger categories. Table 4 also displays the expenditure means and standard errors for the 12

[2] camera film video tape purchase and developing, souvenir & gift, footwear, and clothing.
[3] haircut, perm, laundry and the like, physicians, dentists, hospitals, and other expenses not listed in the questionnaire.

Table 1. Survey locations, dates and mailback questionnaire response rates : Corps of Engineers national visitor spending study, 1989-1990.

Project Name(State)	Survey Dates	Number Rec.areas Surveyed	Number Survey Locations[3]	Sample Size			Mailback Response Rate(%) B/A*100
				On-Site	Mailback Frame[4] A	Mailbacks Returned B	
	1989						
J. Percy Priest(TN)	8/10-9/4	15	15	323	308	159	52
McNary/Ice Harbor(OR, WA)	8/3 -8/20	12	15	194	194	88	45
Mendocino(CA)[1]	8/24-9/21	4	12	103	100	66	66
Oahe(ND & SD)	7/23-9/14	25	25	236	233	135	58
Raystown(PA)	7/25-10/1	13	13	416	415	279	67
Shelbyville(IL)	7/21-8/6; 9/7 -9/14	13	13	266	260	165	63
1989 Total		82	93	1538	1510	892	59
	1990						
Cumberland(KY)	8/4 -8/20;						
	9/18-9/22	17	22	250	250	194	78
Dworshak(ID)	8/4 -9/3	7	7	190	190	168	89
Lanier(GA)	6/21-7/28;						
	8/31-9/16	35	42	289	285	201	71
Milford(KS)	6/22-7/30	12	22	329	326	268	82
Ouachita(AK)	8/3 -8/26	17	17	221	219	175	80
Willamette(OR)[2]	6/26-7/29	11	16	368	364	292	80
1990 Total		99	126	1647	1634	1298	79
GRAND TOTAL		181	219	3185	3144	2190	70

[1] Relatively low number of interviews due to large portion of interview period in non-peak season and loss of approximately 40 interview forms in the mail.

[2] "Willamette"includes Fern Ridge, Cottage Grove, and Fall Creek Reservoirs. These reservoirs were grouped for subsequent analyses due to close proximity and similarities in size and visitor use patterns.

[3] A given recreation area that is relatively large and/or complex(e. g., state park) was divided into several surbey locations(e. g., campground, boat launch area, beach).
Thus, the number of locations where interviews occured exceeds the number of recreation areas.

[4] These are the number of on-site parties interviewed who also agreed to return the mailback questionnaire.

Source : Propst, Stynes, and Lee(1991).

segments. For example, overnight nonresident boaters(O/NR/NC/B) spent an average of $182 per party per trip for lodging(n=253). Also, Table 4 shows the proportion of spending that occurred within the study area(within 30 miles of the project). To illustrate, seventy-eight percent of overnight, nonresident boater spending occurred within 30 miles of study areas. In terms of variance, standard error of mean is expressed as a percentage. For example, the standard error is 8 percent of the mean for food and beverage(M=$140). Thus, with 95 percent confidence, the true mean of food and beverage ranges between M−M*2*.08 to M+M*2*.08 per party per trip, which is $118 to $162.

Using Kruskal-Wallis one-way ANOVA, the twelve segments were tested for significant differences in terms of average spending within 30 miles of the study areas. These was a significant effect over-

Table 2. Percentage of four key segmentation variables for Corps of Engineers National Visitor Spending Study, 1989-1990.

Lake	Boaters	Non-Boaters	Residents	Non-Residents	Day Users	All Overnight	Campers	Other over-night	Sample Size
McNary	45	55	77	23	69	31	22	9	194
Mendocino	25	75	29	71	35	65	56	9	103
Oahe	62	38	45	55	44	56	30	26	236
Priest	28	72	87	13	80	20	11	9	32
Raystown	75	25	31	69	31	69	53	16	416
Shelbyville	52	48	59	41	59	42	22	20	266
Cumberland	77	23	22	78	15	85	39	49	250
Dworshak	91	9	27	73	32	68	64	4	190
Lanier	61	39	76	24	35	64	37	28	289
Milford	67	33	44	56	25	75	69	6	329
Ouachita	80	20	29	71	22	78	35	43	221
Willamette	59	41	82	18	77	23	22	1	368
1989 Average	52	48	55	45	53	47	32	15	1538
1990 Aberage	67	27	46	48	32	61	42	19	1647
12 Lake Average	61	39	53	47	45	55	38	17	3185

Source : Propst, Stynes, and Lee(1991).

all($p=0.00$). Furthermore, based on the Mann-Whitney test, ten pairs of segments were not significant($p=0.21$ to 0.84). This also means that these ten pairs were not different from each other at the 0.05 significance level.

Cluster analysis identified three clusters which are distinct in terms of frequency of cases in each group and ability to assign a distinct label. Cluster group 1 show relatively high lodging, food and beverage, auto/RV., and Miscellaneous expenses. Cluster group 1's expenditures on lodging and food & beverage were somewhat lower than cluster group 3 which is described as overnight boaters. Cluster group 3 indicates high expenditures on lodging, food & beverage, boating, and other expenses. Cluster group 2 had the lowest average spending pattern in every category except boat and fishing expenses. This cluster can be interpreted as a day user group including day use boaters, the largest number of parties in the sample.

As a comparison of the a-priori approach and the cluster analysis approach, Table 6 presents the mean squares of the log transformed spending category averages within groups. Mean squares are indicators degree of within group variance for the 6 nonresident segments identified by the a-priori approach and 3 segments developed by cluster analysis. With the exception of boating expenses, the three clusters show lower mean square differences than the 6 segments on all spending categories.

DISCUSSION

The high response rates associated with this study are gratifying given the relatively low response rates in other recreation spending studies employing mail-back questionnaires. Furthermore, variances on spending means, typically high in most recreation spending studies, were reduced by the segmentation procedures.

The spending data were consistent with variations in regional characteristics. That is, visitors to Corps lakes in primarily urban areas displayed the lowest average trip spending, reflecting primarily day use activities by local residents. On the other hand, visitors to more remote, rural lakes spent higher average amounts on a per trip basis, indicating more overnight trips of longer duration.

For input-output purposes, cluster analysis is superior to analysis of variance because the entire spending profile can be considered in detail rather than just the overall mean across all spending items

Table 3. Distribution of visitor segments across 12 Corps lakes(Summers 1989-90 Expenditure Study) : Mailback Surveys.

MAILBACK SURVEY

Lake	Mcnary		Mendocino		Oahe		Priest		Raystown		Shelbyville		Cumberland		Dworshak		Lanier		Milford		Ouachita		Willamette		Total	
	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT	N	PCT
Day Users																										
D/R/B	27	31	2	3	18	13	52	33	47	17	52	32	12	6	25	15	35	17	30	11	14	8	128	44	442	20
D/R/NB	21	24	13	20	23	17	73	46	16	6	33	20	12	6	2	1	34	17	18	7	7	4	70	24	322	15
D/NR/B	5	6	0	0	5	4	1	1	17	6	3	2	3	2	23	14	5	2	8	3	11	6	18	6	99	5
D/NR/NB	1	1	9	14	7	5	1	1	10	4	10	6	1	1	2	1	1	0	3	1	3	2	15	5	63	3
Overnight Users (Residents)																										
O/R/C/B	4	5	0	0	3	2	5	3	12	4	4	2	8	4	20	12	28	14	38	14	15	9	16	6	153	7
O/R/NC/B	1	1	0	0	4	3	4	3	1	0	4	2	7	4	0	0	26	13	6	2	12	7	1	0	66	3
O/R/C/NB	15	17	0	0	3	2	3	2	10	4	8	5	3	2	1	1	26	13	22	8	3	2	21	7	115	5
O/R/NC/NB	0	0	0	0	1	1	2	1	2	1	2	1	2	1	0	0	3	1	0	0	0	0	0	0	12	1
Overnight Users (Nonresidents)																										
O/NR/C/B	1	1	15	23	24	18	0	0	108	39	10	6	41	21	78	47	5	2	95	36	35	20	12	4	424	19
O/NR/NC/B	3	3	3	5	36	27	1	1	29	10	15	9	76	39	4	2	20	10	11	4	53	31	2	1	253	12
O/NR/C/NB	8	9	20	30	9	7	9	6	22	8	11	7	21	11	10	6	12	6	36	14	13	8	7	2	178	8
O/NR/NC/NB	2	2	4	6	1	1	7	4	5	2	10	6	9	5	1	1	7	3	0	0	8	5	0	0	54	2
valid cases	88	100	66	100	134	100	158	100	279	100	162	100	195	100	166	100	202	100	267	100	174	100	290	100	2181	100
missing	0		0		1		1		0		3		0		0		0		0			0		0		5
TOTAL	88		66		135		159		279		165		195		166		202		267			174		290		2186

Notes :

D : Day users

O : Overnight users

R : Resident(permanent home located within 30 miles of project)

NR : Nonresident(permanent home located more than 30 miles from project)

C : Campers

NC : Overnight users who stay overnight in hotels/motels, with family/friends, or on a boat

B : Boaters(users who participate in boating activities on the project)

NB : Nonboaters(users who participate in recreation activities other than boating on the project)

Source : Propst, Stynes, and Lee(1991).

Table 4. Mean trip spending by 12 segments for all 12 lakes.

Segment	D/R/B					D/R/NB				
# of cases	442					322				
Spending category	MEAN	% OF CATE GORY	% OF ZERO SPEN DING	% IN REG ION	% SE MEAN	MEAN	% OF CATE GORY	% OF ZERO SPEN DING	% IN REG ION	% SE MEAN
Lodging	0.00	0				0.00	0			
Food & beverage	16.80	22	27.4	93	8	10.48	25	35	90	9
Auto & RV	12.98	17	19	92	11	7.07	17	31	86	19
Boat	24.96	33	17.2	95	12	7.57	18	91	100	46
Fish	1.41	2	76.5	99	12	1.03	2	84	92	22
Hunt	0.38	1	99.1	95	66	0.26	1	99	100	73
Entertainment	2.27	3	95.5	89	40	2.73	6	94	77	33
Misc.	8.45	11	82.4	75	27	10.52	25	85	74	31
Other	7.81	10	95	97	45	2.60	6	95	97	53
Total	75.06	100	2.9	92	11	42.26	100	17	85	18
Segment	O/NR/B					D/NR/NB				
# of case	99					63				
	MEAN	% OF CATE GORY	% OF ZERO SPEN DING	% IN REG ION	% SE MEAN	MEAN	% OF CATE GORY	% OF ZERO SPEN DING	%IN REG ION	% SE MEAN
Lodging	0.00	0				0.00	0			
Food & beverage	24.11	30	22	45	15	26.11	40	13	69	18
Auto & RV	25.78	32	14	24	26	13.29	20	22	43	16
Boat	22.98	29	20	40	20	1.14	2	91	59	42
Fish	2.09	3	72	68	32	0.10	0	97	100	70
Hunt	0.00	0	100			0.00	0	100		
Entertainment	1.1	1	96	72	51	2.62	4	94	14	71
Misc.	3.19	4	79	28	26	19.90	31	78	26	50
Other	0.34	0	98	56	71	1.73	3	91	78	53
Total	79.62	100	6	38	13	64.89	100	6	49	17
Segment	D/R/C/B					O/R/C/NB				
# of cases	153					115				
Spending category	MEAN	% OF CATE GORY	% OF ZERO SPEN ION	% IN REG	% SE MEAN	MEAN	% OF CATE GORY	% OF ZERO SPEN DING	% IN REG ION	% SE MEAN
Lodging	21.97	12	33.3	99	11	19.37	12	37	84	16
Food & beverage	72.61	39	12.4	88	8	58.47	35	20	74	11
Auto & RV	27.95	15	9.2	82	9	51.25	31	10	55	38
Boat	34.38	18	23.5	81	17	0.73	0	95	97	48
Fish	5.52	3	55.6	95	27	2.19	1	73	69	29
Hunt	0.00	0				0.00	0			
Entertainment	1.83	1	94.8	46	58	2.79	2	96	95	65
Misc.	15.01	8	62.1	94	28	10.22	6	62	89	27
Other	9.31	5	86.9	82	43	20.03	12	87	93	73
Total	188.58	100	0.7	87	9	165.03	100	2	73	24
Segment	O/NR/C/B					O/NR/C/NB				
# of cases	424					178				
Spending category	MEAN	% OF CATE GORY	% OF ZERO SPED DING	% IN REG ION	5 SE MEAN	MEAN	% OF CATE GORY	% OF ZERO SPEN DING	% IN REG ION	% SE MEAN
Lodging	39.15	13	25	89	9	53.62	16	22	41	24
Food & beverage	95.65	32	10	61	5	100.06	30	12	50	10
Auto $ RV	57.21	19	6	44	6	101.65	30	10	36	16
Boat	60.60	20	18	76	13	2.67	1	96	95	63
Fish	7.06	2	55	70	16	2.57	1	74	73	19
Hunt	0.00	0				0.00	0			
Entertainment	4.52	2	86	68	23	13.67	4	75	51	21
Misc.	26.50	9	49	54	17	39.02	12	51	30	29
Other	9.54	3	86	70	28	24.89	7	83	15	57
Total	300.23	100	0	64	6	338.14	100	2	40	17

Table 5. Final cluster centers for log transformed spending categories.

Spending catergory	Final cluster centers 1	2	3
Number of cases	127	754	193
Lodging	3.79	1.66	4.59
Food & beverage	4.96	3.17	5.13
Auto & R.V.	4.58	2.87	4.23
Boating	1.28	1.90	4.10
Fishing	0.57	0.62	1.97
Entertainment	2.44	0.25	0.76
Misc.	4.00	0.81	2.74
Other	0.64	0.15	1.15
Total within 30 mi.	5.13	3.60	6.14

Note : This cluster analysis is based on the nonresident spending (N = 1074).

The segments developed by cluster analysis were more internally homogeneous and more distinct each other than the a-priori approach. Compared to the a-priori approach, the cluster analysis approach results in fewer and more simplified segments : overnight campers, overnight boaters, and day users. Furthermore, the mean squares within the spending variables for the 3 clusters are generally less than those of the a-priori segmentation approach, indicating some improvement in homogeneity of spending. On the other hand, the a-priori approach can provide more specific final demand vectors for economic impact analysis than the cluster approach. In other words, the a-priori approach may provide more clearly identifiable final demand vectors for the economic impact analysis than the cluster analysis approach. Also, the a-priori approach is based on variables used in COE management and planning purposes, and thus is more practical than the cluster analysis. The challenge provided by the cluster analysis approach is to establish the operational usefuleness of the clusters.

Lake characteristics may account for the further variation in average trip spending. In particular, average trip spending may have been affected by the type of accommodations available. It may help to explaining some differences in segments.

CONCLUSIONS

To produce vectors of final demand for I/O analysis, average spending is multiplied by total visitation to derive total spending. This means that visitation data must be provided for the same set of segments for which average spending was measured. For the Corps of Engineers, a redesign of the use estimation procedures may be necessary. Cluster analysis of over 1,000cases for which trip spending was measured indicates 3 broad segments of visitors sharing similar spending patterns : 1) overnight boaters, 2) overnight campers, and 3) day users. Furthermore for I/O purpose, it is essential to distinguish between residents and nonresidents. Presently. visitation data for 2 segments are segments are routinely collected by the Corps of Engineers : 1) day users and 2) campers. "Day use' visitation figures include overnight non-campers(i.e., those who stay in hotels, with friends and relatives, at second home or on a boat). Therefore, multiplying these routinely collected, Corps "day use" visitation figures by average day user spending per trip exaggerates real day use total spending. Expanding use estimation procedures to identify boaters, overnight noncampers, and non-

Table 6. The comparison of mean of squares of two segmentation approaches.

Spending category	6 segment Mean Square	3 segment Mean Square
Lodging	3.60	3.07
Food & beverage	2.23	1.83
Auto & R.V.	1.73	1.44
Boating	2.15	3.00
Fishing	1.43	1.25
Entertainment	1.74	1.34
Misc.	3.20	1.99
Other	1.35	1.21
Total within 30 m	2.64	2.55
Average	2.23	1.97

Note : All spending categories are log transformed based on the nonresident spending (N = 1074).

residents will provide more accurate estimates of total economic impacts.

The results presented in this paper have strong implications for policy evaluation within the Corps of Engineers. The use of segmentation and the existence of reliable data base will permit generalization to other lakes which were not surveyed but which possess characteristics similar to a class of lakes contained in the study. In addition, the Corps will be able to estimate the effects of proposed new recreation developments or management scenarios in terms of employment and household income. Thirdly, the Corps will be able to compare recreation impacts to equivalent impacts of other water uses, such as commercial navigation and hydroelectric power production.

Literature cited

1. Aldenderfer, M.S. and R.K. Blashfield. 1989. Cluster analysis for applications. New York : Academic Press.
2. Alward, G.S. 1986. Local and regional economic impacts of outdoor recreation development. In the President's Commission on Americans Outdoors. USDA Forest Service, Fort Collins, Colorado. rocky Mountain Forest and Range Experiment Station, Value 47-57.
3. Alward, G.S. and K. Despotakis.(no date). IMPLAN Version 2.0 : Data reduction methods for constructing Agriculture, Forest Service, Rocky Mountain Forest Experiment Station. 100+pp.
4. Alward, G.S. and E.M. Lofting. 1985. Opportunities for analyzing the economic impacts of recreation and tourism expenditures using IMPLAN. Paper prepared for the Regional Sciencen Association Meeting, Philadelphia, PA, November, 25pp.
5. Anderberg, M. 1973. Cluster analysis for applications, New York : Academic Press.
6. Everitt, B. 1980. Cluster analysis. New York : Halsted.
7. Henderson, K. and R. Cooper. 1983. Characteristics of campers in private and state-owned campgrounds in Wisconsin. Journal of Travel Research, pp.10-14.
8. Hogan, T.D. and T.R. Rex. 1984. Monitoring current activity in Arizona with a quarterly tourism model. Journal of Travel Research, pp. 22-26.
9. Jordan, S.W. and D.R. Talhelm. 1985. Economics of sport fishing in Delta county : A study of the Lake Michigan Fishery from January 1983 to December 1983. Michigan State University, Department of Fisheries and Wildlife, East Lansing.
10. Mak, J. 1989. The economic contribution of travel to state economies. Journal of Travel Research, 28(2), 3-5.
11. Norusus, M.J. 1986. SPSS/PC+ advanced statistics, Chicago, IL : SPSS Inc.
12. Pedersen, L.D. 1990. Use of IMPLAN to estimate economic impacts stemming from outdoor recreation expenditures in the Upper Lake States. Department of resource Development, Michigan State University, E. Lansing.
13. Propst, D.B.(compiler) 1985. Assessing the economic impacts of recreation and tourism. Conference and Workshop, May 14-16. 1984, held at michigan State university. U. S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 64.pp.
14. Propst, D.B. 1988. Use of IMPLAN with public area recreation visitor survey(PARVS) pretest data : Finding and recommendations. Miscellaneous paper R-88-1, Vicksburg, MS : U. S. Army Engineer Waterways Experiment Station.
15. Propst, D. B. and Gavrilis, D. G. 1897. Role of economic impact assessment procedures in recreational fisheries management. Transaction of the American Fisheries Society, 116 : 450-460.
16. Propst, D.B. and D.J. Stynes. 1988. Collecting and analyzing corps of engineers recreation spending data. Final Report : U.S. Army Engineer Waterways Experiment Station, Environmental Laboratory, Vicksburg, MS.
17. Propst, D.B., D.J. Stynes, and Ju-Hee Lee. 1991. Nationally representative spending profiles for recreation visitors to Corps of Engineers projects : Draft Final Report, U. S. Army Engineer Waterways Experiment Station, Vicksbur-

g, MS.
18. Rose, W. 1981. The measurement and economic impact of tourism on Galvaston, Texas : A Case study. Journal of Travel Research, pp.3-11.
19. Stynes, D.J. and W. Chung. 1986. Resistant measures of recreation and travel spending. Paper presented at NRPA Leisure Research Symposium, Anaheim, CA. October, 1986.
20. Stynes, D.J. and E.M. Mahoney. 1986. 1984 Michigan commercial campground marketing study. Department of Park and Recreation Resources, Michigan State University, pp.42.
21. Tyrrell, T. J. 1985. Data considerations in assessing economic impacts of recreation and tourism : Pages 40-46 in D. B. Propst(Ed.), Assessing the economic impacts of recreation and tourism. East Lansing : Michigan State University.