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ABSTRACT

The primary purpose of this study is to develop a system of models based on boat storage segments that can generate different estimates of boating use for regions and counties. It is based on the premise that models that incorporate market segmentation are more efficient and generate more accurate estimates of recreational use when a market is comprised of identifiable market segments. The results show that incorporating storage segments as part of the system of models improves estimates of both the amount and spatial distribution of boating use. The boating use estimates generated by the system of models captures the predominate spatial patterns that characterize boating use in Michigan. Model generated estimates of boating use in regions of the state are within 10% of direct survey based estimates for most regions. Model based estimates of both the number of boats in different types of storage and number of boating days are reasonably close to survey estimates for counties where there was an adequate number (30) of questionnaires returned.

INTRODUCTION

The concept of market segmentation has been extensively applied in tourism and recreation marketing, and to a much lesser extent in recreation management. Previous recreation and tourism related segmentation researches have focused primarily on: (1) variables used as segmentation bases, (2) statistical methods to disaggregate and aggregate customers into segments, (3) the differences (e.g., characteristics, consumption patterns, response elasticities) between segments, and (4) the exploitability of the market segmentation results (1, 3, 4, 6, 7, 9, 11, 12, 15, 19, 20). However, segmentation has not been extensively employed or evaluated as a method for improving model generated estimates of the recreational use or the spatial distribution of use.

The primary purpose of this study is to develop a system of models based on boat storage segments that can generate different estimates of boating use (e.g. boating days) for regions and counties. It is based on the premise that models that incorporate market segmentation are more efficient and generate more accurate estimates of recreational use when a market is comprised of identifiable market segments. Also, that models capable of generating comparative estimates and predictions for different market segments provide information that is more useful to recreation managers, planners and marketers than aggregate market predictions. Information on use behaviors of different segments (e.g., trip length, spending amounts) also provides more accurate information for estimating economic impacts associated with different types of tourists and recreational facilities and activities.

THE SYSTEM OF MODELS

A system of models is developed to produce reliable regional and county estimates of (1) the number of recreational boats kept in Michigan counties during the boating season (2) the number of boats in different types of storage, and (3) boat days in counties by boat storage segments. The system of models includes a classification (discriminant) model, trip generation models, and trip distribution models (see figure 1). A discriminant analysis is used to classify registered boats into (type of) storage segments--marinas, second homes, permanent waterfront homes, and permanent non-waterfront homes. Boats in each storage segment are then allocated to the counties where they are stored using a set of allocation models. The number of boat days in (destination) counties by boats in different storage segments is estimated by a trip generation model and a set of trip distribution models. A trip generation model is used to predict number of boat days in the county of storage. Then those boat days are distributed to the destination counties by trip distribution models for bats at each storage segment. The models are all linked together; the estimates from one model are the input for the next model in the system.

There were several reasons for using *"type of storage"* as the "segmentation base" and basis for the models. First, previous studies and preliminary descriptive analyses of the data used to develop the system of models indicated important differences in amount of boating and spatial patterns of use between boats kept in different types of storage (2, 5, 8, 10, 13). Second, previous research found significant differences in spending (i.e., amounts, distribution across spending categories) by owners of boats in different storage segments (16, 17, 18). Finally,

estimates of the amount of boating use occurring in different counties by boats in different types of storage provided much better information to assess needs and feasibility of marinas, boat launches and boating services.

DATA SOURCES

The system of models utilizes and combines a variety of different types and sources of "demand" and "supply" data including: (1) 1994 Michigan Boating Survey, (2) Michigan Secretary of State Boat Registrations, and (3) 1994 Michigan Great Lakes Marinas Census. A 1994 state-wide mail survey of registered boat owners generated 2,980 usable responses. The survey response rate was 69%. It provided the data for the segmentation analyses and model estimation. Preliminary analyses of the survey data revealed that about 60% of registered boats are kept at permanent residences during the boating season and trailed to use locations, 25% are kept at second homes, and 12% are stored at marinas, dockominiums or yacht clubs. Boats stored at marinas are on average larger, they are operated more days, and their owners spend significantly more (500%+) on operations and maintenance compared to owners of boats stored at permanent or second homes. The type of boating activities (e.g., fishing, cruising) also differ across storage segments (see Table 1).

BOAT STORAGE SEGMENTATION

A discriminant analysis was performed on the survey data. Type of storage used during the boating season was the dependent variable--marinas, second homes, permanent waterfront homes, and non-waterfront homes. The independent variables included length of boat, type of boat, location of the owners residence, whether the boat owner also owned a second home, and the income and age of the owner.

The discriminant analysis correctly classifies 69% of registered boats into the correct storage segments. It correctly classifies 84% of boats that are stored at second homes, 76% of boats kept at marinas, 69% of boats stored at non-waterfront permanent homes, and 44% of boats at permanent waterfront homes. A reason why the discriminant analysis misclassifies a high percentage of boats stored at permanent waterfront homes is that these boats and their owners share similar characteristics to boats in other storage segments. This discriminant analysis was evaluated using two different criteria--*maximum chance criteria* and *proportional chance criteria.* Both criteria indicate that the discriminant analysis adequately predicts boats in different storage segments (see Table 2). Wilks Lamda and Partial F statistics show length of boat, ownership of a second home, and whether the boat is powered by an outboard engine to be the independent variables that contribute most to the classification/segmentation.

SEGMENTATION BASED MODELING

After classifying registered boats into four storage-type segments, the second stage of the system of models is to develop a set of storage allocation models to allocate boats within each storage segments to the counties where they are kept during the boating season. Boats are first allocated to one of the regions where the boats are kept, and then to the counties within each region based on county's share of boat storage opportunities available in the region. The

storage allocation models generate estimates of the number of boats stored in different regions and counties for each segment.

The third stage of the system of models consists of a trip generation model and a set of trip distribution models. The function of these models is to (1) estimate the number of boat days in (destination) counties by boats in different types of storage, and (2) model trip patterns from origin counties (boat storage locations) to destination counties (boat use locations).

The trip generation model estimates the number of boat days generated by boats stored in each county by storage segments. Total days by boats in each storage segment is computed by multiplying the average number of boat days within different size classes and storage segments times the number of boats kept in each county.

The trip distribution models distribute these boat days to different (destination) counties within each storage segment. Different approaches are employed for boats in different storage segments. For boats stored at second homes and permanent waterfront homes, the models distribute all boat days to counties where they are kept, because almost all of these boat days are inside the county where they are stored during the boating season. A more complex two-step trip distribution model is used for boats stored at marinas in Great Lakes counties and boats stored at permanent non-waterfront homes. The two step approach first distributes boat days to concentric (destination) zones around each (storage) county and then to the counties within these zones. An estimated distribution of boat days within different destination zones is used to distribute days of boating to each destination zone. Those boat days are then distributed to counties within a destination zone based on the county's share of boating use opportunities available in the zone.

EVALUATION OF THE SYSTEM OF MODELS

This section evaluates the overall performance of the system of models including the spatial patterns and the boating use estimates predicted by the system of models. The results show that incorporating storage segments as part of the system of models improves estimates of both the amount and spatial distribution of boating use. Use estimates for different storage segments are also more useful than aggregate estimates of the total, or average number of boating days by all boats. The information produced by the segmentation based models is more relevant and useful for determining needs for different types of boating facilities and services. The additional precision also improves estimates of spending and economic impacts.

The boating use estimates produced by the system of models capture the spatial patterns of Michigan boating use. The predominant "south-to-north" spatial patterns predicted by the system of models confirm similar travel patterns observed in previous Michigan boating studies. The system of models shows that the "south-to-north" spatial patterns occur when boats are moved from the owner's residence to locations where boats are kept during the boating season. The pattern also exists when boats are moved from their storage locations to the (use) destinations. The models also reveal that southern Michigan has the largest number of boats registered, the largest number of boats kept in the region during the boating season, and the largest number of boat days (used) in the region.

It is difficult to assess the accuracy of boating use estimates produced by the system of models because there is no reliable secondary source of information on boating use--boats stored or used in regions or counties. Direct estimates from the 1994 Michigan Boating Survey were compared with the model estimates, but direct survey estimates of boating use in eighty-three Michigan counties are subject to sampling errors. These sampling errors can be significant for counties in which 30 or less surveys were returned. These sampling errors, and the very large sample size that would be required to avoid the biases, is a primary reason for developing models to assist in estimating boating use.

A comparison of model predictions with direct survey based estimates shows that the model estimates of boating use are within 10% of survey estimates for most regions of the state. Regional estimates of boating days by boats stored in marinas produced by the models are within 10% of direct survey estimates for every region of the state except one. The estimates of days by boats kept at non-waterfront homes are within 10% of survey estimates for each region, except the south-west region. Regional estimates by overall trip distribution model are within 12% of survey estimates, except for the central-east and north-east regions (see Table 3). Model estimates that differ more than 10% from survey estimates are for regions where a relatively small number of 1994 surveys were returned. Model based estimates of both the number of boats in different types of storage and number of boating days are reasonably close to survey estimates for counties where there was an adequate number (30) of questionnaires returned.

IMPLICATIONS

The system of models shows that type of storage is very useful for segmenting boating markets and for predicting the type, amount, and spatial distribution of boating activities. There are significant differences in size and type (e.g., inboards, sail) of boats kept in different types of storage during the boating season. The models reveal that boats in different storage segments have distinct use patterns including the location (county) where they are kept during the season, use locations, average number of annual boat days, and average travel distance. Incorporating types of storage as the basis of models improves the estimates of both amount and spatial distribution of boating use.

Producing separate use estimates for boats in different storage segments also provides better information to assist public or private agencies with planning and management decisions. For example, the number of boats stored at marinas in a county is much more useful in determining the feasibility of proposed new marina or marina expansions than aggregate estimates of all boats stored or registered in the county. Similarly, the spatial distribution of use by boats stored at non-waterfront homes is especially relevant for assessing the need of additional public access sites. The models provide important segment specific-information for management, marketing and economic impact assessment. Model produced estimates of the number of boats kept in different counties and the number of boat days by boats kept in different types of storage can be used to assess the current adequacy and "need" for a variety of different boating services. The Michigan Legislature and Department of Natural Resources also require reliable estimates of the amount and locations of boating use to formulate and

assess proposed regulations and policies. Origin and destination patterns are essential information for the design of marketing and management strategies aimed at attracting or discouraging different types of boaters and boating use.

The system of models can be the bases for a recreational boating information system to support planning and management decisions. Such an information system can serve the Michigan boating industry and management agencies by providing reliable boating use information more conveniently and by matching information with the need of planers and managers. Additional programming is currently in progress to make the system more "user friendly" including: (1) the capability to generate standard reports, (2) the ability to modify model parameters, (3) updating data on which the models are based, and (4) providing different estimates and information options for users.

REFERENCES

1. R. J. Calantone and J. S. Johar, Seasonal Segmentation of the Tourism Market Using a Benefit Segmentation Framework, Journal of Travel Research, Vol. 23(3), pp. 14-24, 1984.

2. M. Chubb, Outdoor Recreation Planning in Michigan by a System Analysis Approach. Part III - The Practical Application of "Program RECSYS" and "SYSMAP", Michigan: Recreation and Research and Planning Unit Department of Resource Development, MSU, 1968.

3. M. R. Crask, Segmenting the Vacationer Market: Identifying the Vacation Preferences, Demographics, and Magazine Readership of Each Group, Journal of Travel Research, Vol. 20(2), pp. 29-34, 1981.

4. R. B. Ditton, T. L. Goodale, and P. K. Johnson, A Cluster Analysis of Activity, Frequency, and Environment Variables to Identify Water-based Recreation Types, Journal of Leisure Research, Vol. 7(4), pp. 282-295, 1975.

5. M. P. Donelly, J. J. Vaske, and A. R. Grafe, Degree and Range of Recreation Specialization: Toward a Typology of Boating Related Activities, Journal of Leisure Research, Vol. 18(2), p. 81095, 1986.

6. D. R. Fesenmaier and B. Johnson, Involvement-based Segmentation: Implications for Travel Marketing in Texas, Tourism Management, Vol. 10(4), p. 293-300, 1989.

7. D. D. Fodness, A Perceptual Mapping Approach to Theme Park Visitor Segmentation, Tourism Management, Vol. 13(1), pp. 95-101, 1992.

8. R. Jaakson, Recreation Boating Spatial Patterns: Theory and Management, Leisure Service, Vol. 11(2), p. 85-98, 1988.

9. H. Kikuchi, Segmenting Michigan's Sport Fishing Market: Evaluation of Two Approaches, Unpublished doctoral dissertation, Michigan State University, 1986.

10. B. Lentnek, C. S. Van Doren, and J. R. Trail, Spatial Behavior in Recreational Boating, Journal of Leisure Research, Vol. 1(2), pp. 103-124, 1969.

11. L. E. Loker and R. R. Perdue, A Benefit-based Segmentation of a Nonresident Summer Travel Market, Journal of Travel Research, Vol. 31(1), pp. 30-35, 1992.

12. J. A. Mazahec, How to Detect Travel Market Segments: A Clustering Approach, Journal of Travel Research, Vol. 23(1), pp. 17-21, 1984.

13. R. A. Meganck, Recreational Boat Transportation in Michigan: A Study of Use Patterns and Characteristics of Boaters who Transport their Boats, Unpublished Master's thesis, Michigan State University, East Lansing, 1971.

14. R. R. Perdue, Traders and Nontraders in Recreational Destination choice, Journal of Leisure Research, Vol. 18(1), p. 12-25, 1986.

15. D. J. Snepenger, Segmenting the Vacation Market by Novelty-seeking Role, Journal of Travel Research, Vol. 26(2), pp. 8-14, 1987.

16. D. J. Stynes, Spending Patterns and Economic Impacts of Michigan Registered Boat Owners, Ann Arbor, Michigan, Michigan Sea Grant, 1983.

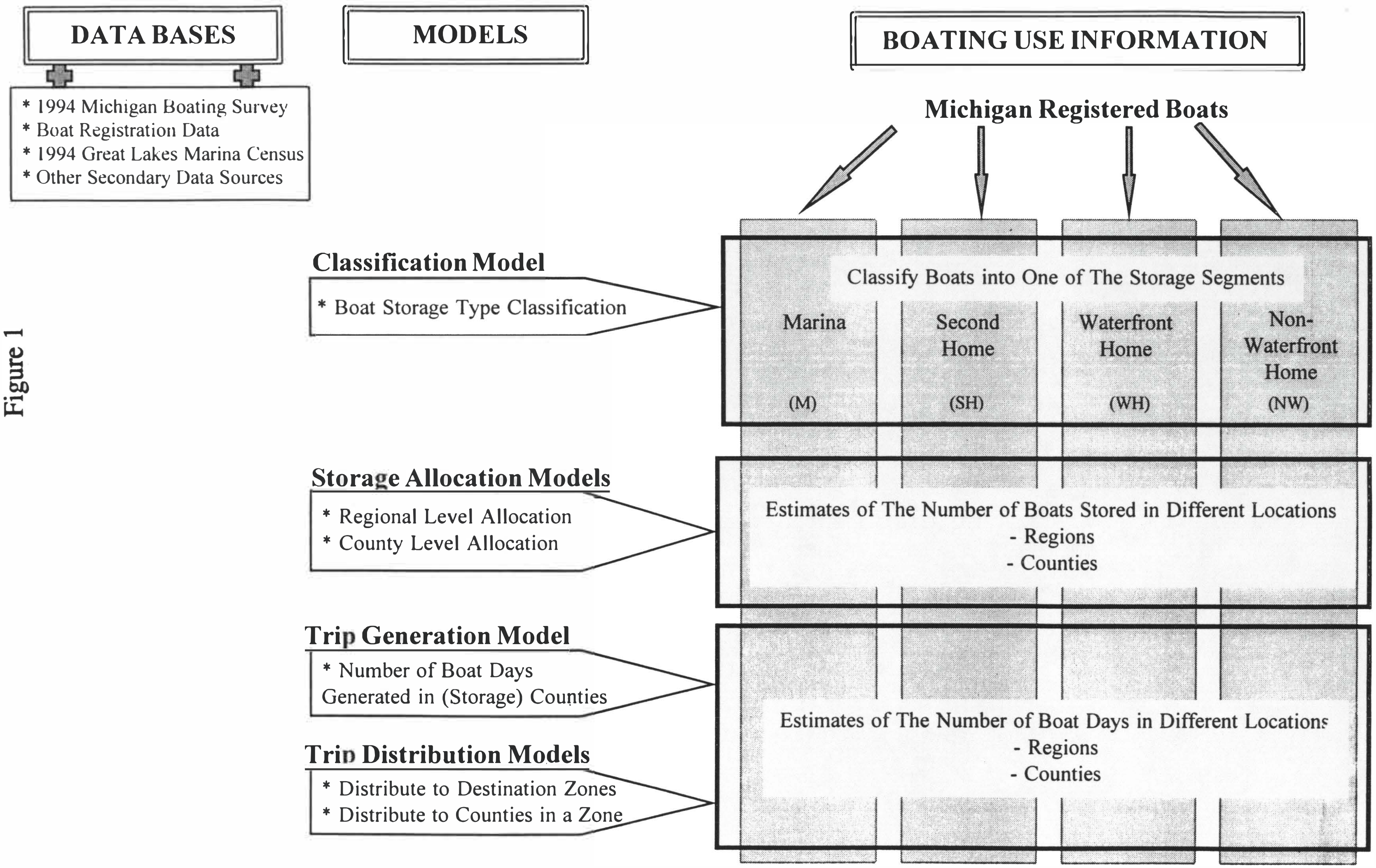
17. D. J. Stynes, T. C. Wu and E. M. Mahoney, 1994 Michigan Boating Survey, East Lansing, Michigan State University, Department of Park, Recreation and Tourism Resources, 1995.

18. D. R. Talhelm, S. W. Jordon, and D. F. Holeck, 1986 Michigan Recreational Boating Survey-Special Report, East Lansing, Michigan, Department of Park, Recreation and Tourism Resources, 1988.

19. P. A. Weaver and K. W. McCleary, A Market Segmentation Study to Determine the Appropriate Ad/model Format for Travel Advertising, Journal of Travel Research, Vol. 23(1), pp. 12-16, 1984.

20. A. G. Woodside, E. M. Moore, M. A. Bonn, and D. G. Wizeman, Segmenting the Timeshare Resort Market, Journal of Travel Research, Vol. 24(3), pp. 6-12, 1986.

Figure 1



DATA BASES
* 1994 Michigan Boating Survey
* Boat Registration Data
* 1994 Great Lakes Marina Census
* Other Secondary Data Sources
MODELS
BOATING USE INFORMATION
Michigan Registered Boats
Classification Model
* Boat Storage Type Classification
Classify Boats into One of The Storage Segments
Marina
(M)
Second Home
(SH)
Waterfront Home
(WH)
Non-Waterfront Home
(NW)
Storage Allocation Models
* Regional Level Allocation
* County Level Allocation
Estimates of The Number of Boats Stored in Different Locations
- Regions
- Counties
Trip Generation Model
* Number of Boat Days Generated in (Storage) Counties
Trip Distribution Models
* Distribute to Destination Zones
* Distribute to Counties in a Zone
Estimates of The Number of Boat Days in Different Locations
- Regions
- Counties

Table 1

Characteristics of Boats in Different Storage Segments

	Permanent Residence 59%	Second Home 25%	Marina 12%	All Boats*
BOAT LENGTH (feet)	18.58	20.28	30.77	23.59
DISTANCE TRAVELED				
From residence location to storage location	NA	255.33	86.85	82.56
From storage location to boating destinations	47.15	22.54	32.64	38.20
AVERAGE BOATING DAYS OF USE				
Total boat days	22.2	25.0	31.3	24.2
Great Lake boat days	6.6	5.5	24.4	8.7
Inland boat days	15.6	19.4	6.9	15.4
TYPES OF BOATING ACTIVITIES				
Pleasure Boating	29%	48%	73%	39%
Fishing	66%	45%	23%	56%
Waterskiing	3%	4%	2%	3%
Other	1%	2%	2%	2%
ANNUAL OPERATING EXPENSES				
Boating equipment	$133	$148	$419	$182
Repair & maintenance	$129	$138	$515	$183
Seasonal slip rental or dry stack	$11	$28	$799	$115
Off-season storage	$16	$18	$75	$26
Put in and hull out fees	$23	$47	$330	$68
Fuel	$76	$70	$288	$101
Boating insurance	$47	$64	$253	$79
Total	$431	$525	$2,730	$753

*All boats include boats stored at permanent homes, second homes, marinas and other storage facilities.

Table 2

Classification Matrix for Comparing Number of Boats in Storage Segments Predicted by the Model with 1994 Michigan Boating Survey

	DISCRIMINANT ANALYSIS Predicted Segment Members				
1994 Survey Results	Marina	Second Home	Waterfront Home	Non-waterfront Home	Total
Marina	748	102	112	22	984
(pct.)	76%*	10%	11%	2%	
Second Home	42	481	18	33	574
(pct.)	7%	84%*	3%	6%	
Waterfront Home	107	83	260	143	593
(pct.)	18%	14%	44%*	24%	
Non-Waterfront Home	10	71	106	416	603
(pct.)	2%	12%	18%	69%*	
Model Predicted (total)	907	737	496	614	2,754

SUMMARY STATISTICS

Percent of cases correctly classified	69.17%
Maximum chance criterion	35.70%
Proportional chance criterion	26.49%

*Percent correctly classified.

Table 3

Boat Days by County of Destination: A Comparison of Survey and Model Estimates

REGIONS	Marina Segment (boats stored at marinas)	Non-waterfront Home Segment (boats stored at non-waterfront home *(percent difference)*	All Boats
Southeast	-3%	0%	-12%
Central East	9%	-1%	21%
Northeast	1%	3%	23%
Northwest	1%	-3%	2%
Central West	-1%	2%	5%
Southwest	5%	-11%	-10%
South Inland	NA	5%	1%
North Inland	NA	1%	1%
S. Upper Peninsular	14%	-6%	-7%
N. Upper Peninsular	1%	5%	-1%