

Clean Vessel Act/Michigan Boating Study, 1994-95: REPORT 2

1994 Michigan Boating Survey

Daniel J. Stynes, Tsung Chiung Wu and Edward M. Mahoney

TABLE OF CONTENTS

	Page
List of Tables	iii
List of Figures	v
Introduction	1
Study Objectives	2
Methods	2
The Population of Active Registered Pleasure Craft	3
Sampling Design	4
Measurement	7
Data Gathering	8
Survey Response	
Response Rate	9
Inactive Boats	11
Weights	12
Success of the Questionnaire	14
Results: Fleet and Owner Characteristics	14
Boat Owners	14
The Michigan Active Registered Pleasure Boating Fleet	15
Boat Segments	19
Boating Activity	22
Boating Use in 1994	25
Boating Spending	27
Toilet Facilities	29
Summary of Boat Use and Characteristics by Segment	32
Regional Distribution of Use	36
The Approach	36
Results	41
Trends in Boating Activity	51
Number of Active Craft	51
Days of Use	54
Other Trends	55
Recommendations	56
Boat Owner Survey Design	57
A Statewide Boating Information System	58
References	60

LIST OF TABLES

1. Number of registered watercraft (summer 1994) by region of registration and size class	4
2. Distribution of sample by size class and region of registration	5
3. 1994 Michigan boater survey response rate	9
4. Response rates by region of registration and boat size class	10
5. Completed sample of active boats by region of registration and boat size class	11
6. Percentage of registered boats inactive in 1994 by boat size class	12
7. Number of active watercraft (summer 1994) by region of registration and size class	12
8. Weights to adjust the sample to michigan's active registered fleet	13
9. Weighted sample by region of registration and size class	13
10. Multiple boat ownership	14
11. Boat owner characteristics by type of boat	16
12. Boat type and storage by size of boat	17
13. Size of boat by boat type and storage	18
14. Boat segments	20
15. Boat owner characteristics by segment	21
16. Types of boating use by segment and size class	22
17. Transporting and launching by segment and size class	23
18. Temporary use of marina spaces by segment and size class	24
19. Frequency of boat use by segment and size class	26
20. Boat use by great lakes vs. inland locations	26
21. Boat operating expenses by size of boat	27
22. Annual boat operating expenses by segment	28
23. 1994 Michigan registered boat fuel use by size class	29
24. Number of boats with toilet facilities by segment and size class	30
25. Toilet use by boat size class	31
26. Summary by boat size class	33
27. Summary by boat storage categories	34
28. Summary by great lake vs. inland usage	35
29. Number of boats by segment and region where the boat is kept during the boating season ...	38
30. Number of boats by segment and county where the boat is kept	39
31. Total boat days by segment and region where the boat is kept	42
32. Total great lakes boat days by segment and region where the boat is kept	43
33. Total inland boat days by segment and region where the boat is kept	43
34. Number of boats stored at seasonal homes by segment and region where the boat is kept	44

LIST OF TABLES (Continued)

35. Number of boats stored at marinas by segment and region where the boat is kept	44
36. Number of boats with installed toilets (head) by segment & storage region	45
37. Number of times pumped out by segment and region where the boat is kept	45
38. Total boat operating expenses by segment and region where the boat is kept (\$millions).....	46
39. Gallons of boat fuel purchased by segment and region where the boat is kept (millions)	46
40. Estimates of boat use by county where the boat is kept	47
41. Boats with installed toilets (head) and total pumpout use by county where the boat is kept	48
42. Boats stored at seasonal homes and marinas by county where the boat is kept	49
43. Boat operating expenses and fuel purchases by county where the boat is kept	50
44. Trends in boating activity, 1971-1994 (unadjusted)	52
45. Trends in boating activity, 1971-1994 (adjusted)	52

LIST OF FIGURES

1. 1994 Michigan Boat registrations by month	3
2. Sampling regions	6
3. Survey response by date of return	9
4. Boating regions for estimating use and needs	37
5. Trends in boating activity in Michigan, 1971-1994	53

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INTRODUCTION

The 1994 Michigan Boating Survey was conducted in conjunction with a broader effort to assess both boating supply and demand in order to guide development, planning and management of facilities for boaters throughout the state. The purpose of the registered boat owner survey is to measure patterns of boating activity as a basis for evaluating current and anticipated future needs. The 1994 survey extends the series of statewide boater surveys in Michigan dating back to 1965. In addition to gathering current information about general patterns of boating activity around the state, the 1994 survey focuses especially on Great Lakes boating and boater use of marinas and sanitation facilities.

The mailed survey of a representative sample of almost 4,000 boat owners (returns) provides projectible totals of days of boat use on both Great Lakes and inland waters and precise estimates of the number of craft with portable and installed toilets. Models estimated from the survey data provide projections of the number of craft, days of boating, and use of dump stations and pumpout facilities down to a county level. Assessments of needs for marina and pumpout facilities around the state are presented in separate reports. The approach is to combine quantitative demand estimates from the registered boater survey (this report) with supply data from a comprehensive statewide inventory of marinas (Report 1) to assess needs for Great Lakes marina facilities and pumpouts (Report 3). The quantitative needs analysis is supplemented by more qualitative information about boater attitudes and behavior gathered in a follow-up to the general boater survey and in focus groups around the state (Report 3).

In this report, we present the methods and results of the general boat owner survey. Readers are reminded that the study covers only boats that were registered in Michigan during the 1994 boating season. Smaller unpowered craft and boats visiting Michigan waters from out of state are not included in the study population. The survey does, however, include some 34,000 boats that are registered in Michigan from out-of-state origins. These are primarily boats owned by non-residents that are berthed at marinas or seasonal homes in Michigan and used principally in Michigan waters.

STUDY OBJECTIVES

1. Describe the characteristics of boats and boat owners. Develop market segments that are useful for characterizing the fleet and estimating demands for boating facilities and services.
2. Estimate boating activity in Michigan for 1994 including:
 - Great Lakes and inland boat days by origin and destination regions.
 - Boat days by boat size and storage class.
 - Use of marinas, launch sites and pumpout facilities by boat size and storage categories.
3. Estimate boater operating expenses in 1994 for equipment, repairs, insurance, storage and fuel.
4. Identify the number, types and spatial distribution of boats with toilet facilities (fixed and portable) and estimate boater use of pumpout facilities in Michigan.
5. Identify trends in boating activity in Michigan via comparisons with previous surveys.

METHODS

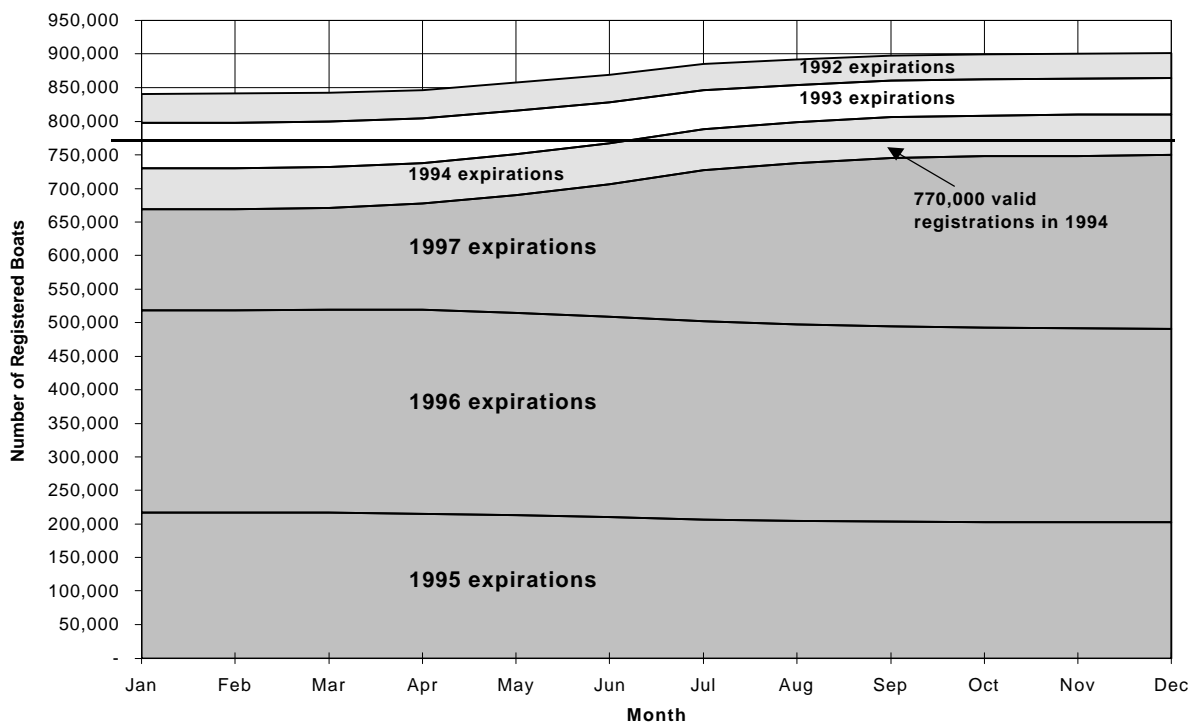
The procedures follow those of previous boater surveys in Michigan to provide comparable results and make use of tested designs. An end-of-season mailed survey is used to gather information from a stratified random sample of registered boat owners. Some adjustments were made in the previous mailed survey instrument to accommodate questions related to the Clean Vessel Act and focus more attention on Great Lakes boating use and

facility needs. The approach to gathering the number of days a boat was used was also modified somewhat from previous designs to avoid potential double counting.

The Population of Active Registered Pleasure Craft

The study population consists of all non-commercial watercraft with valid Michigan registrations as of July 1, 1994. The computer file of registered watercraft maintained by Michigan’s Secretary of State provides a convenient sampling frame, though it includes a number of boats that were inactive in 1994 or had expired registrations. The number of registered craft on the monthly reports of registrations for 1994 increased from 840,760 in January to 901,480 in December (Figure 1). These counts include commercial and other non-pleasure boats as well as about 100,000 registrations that had expired in 1992 and 1993.

Figure 1. Michigan Boat Registrations by Month, 1994



We estimate the number of valid registrations for the 1994 boating season at about 770,000 boats. This is a sum of the December count of watercraft with registrations expiring in 1995, 1996 or 1997 plus one-third of the 1994 expirations remaining in December. The 60,898 craft with 1994 expirations in December are boats with registrations that had not yet been renewed by the end of 1994. Based on previous years, we estimate that up to a third could be included in our sample of boats with valid registrations as of July 1994. Note that no boats with 1992

or 1993 expirations were included in our sample. The December count of boats with 1997 expirations includes all boats newly registered in 1994 and all of the boats with 1994 expirations that were renewed. Multiplying the 770,000 valid registrations by the percentage of registered boats classified as pleasure craft (97.35 percent) yields 749,518 pleasure craft with valid Michigan registrations in 1994 (Table 1).

Table 1. Number of registered watercraft (summer 1994) by region of registration and size class.^a

REGION ^b	SIZE OF BOAT (feet)				Total
	<16'	16 to 20'	21 to 28'	>29'	
Southeast Michigan	13,769	74,747	46,615	12,262	247,393
Southwest Michigan	79,598	33,873	15,020	2,062	130,553
West Central Michigan	58,952	25,471	11,609	2,776	98,808
Thumb Region	50,694	27,209	12,734	2,035	92,672
Northeast Michigan	17,731	9,229	3,868	276	31,105
Northwest Michigan	35,893	16,068	6,895	1,033	59,890
Straits	13,585	5,079	2,633	461	21,758
U.P. Lake Superior	16,677	4,925	1,538	247	23,387
U.P. Lake Michigan	6,298	1,883	491	120	8,792
Out of state	17,060	9,806	5,579	1,929	34,374
Missing registration county	<u>362</u>	<u>221</u>	<u>151</u>	<u>52</u>	<u>786</u>
Total	410,619	208,512	107,134	23,253	749,518

a. Includes only boats with valid registrations during the summer of 1994.

Estimated from March registration statistics by county and size class provided by Michigan Secretary of State.

b. Sampling regions are shown in Figure 2.

Sampling Design

A stratified random sample of approximately 10,000 boats was drawn by the Secretary of State's office from the list of valid registrations on July 1, 1994. We then sampled from this list of names and addresses to obtain the desired sample size of 6,000 boats. The sample is stratified by four boat size classes (<16 feet, 16 to 20 feet, 21 to 28 feet and 29 feet and over) and 10 boating regions (see Figure 2). The boating regions were developed in the 1980 Michigan Boater Survey (Stynes and Safronoff, 1982) to capture Great Lakes market regions. As in previous boater surveys, we intentionally oversampled larger craft and regions with smaller population sizes to have adequate subsamples to make estimates by size class and region. The oversampling of larger boats was also

designed to assure adequate numbers of boats stored at marinas, boats using Great Lakes waters and boats having toilet facilities on board. These subgroups of boaters are particularly important to assess marina and pumpout facility needs.

A sample of 6,000 boats was selected from the names and addresses provided by the Secretary of State to yield roughly 1,500 boats within each of the four size classes (see Table 2). Because pontoon boats are primarily used on inland waters, they were sampled at half the rate of other craft to yield 560 pontoon boats in the final sample. The sampling unit is the boat, not the boat owner. For boaters owning more than one registered boat, we requested that they report only for the boat that was sampled. The type and size of the boat were printed on the mailing label to identify the boat for which we were requesting information. By matching survey responses with the registration information, we were able to verify that subjects reported for the boat that was sampled. Owners reporting for more than one boat were excluded from the analysis.

Table 2. Distribution of sample by size class and region of registration.

REGION ^a	SIZE OF BOAT (Feet)				Total	Percent
	<16'	16 to 20'	21 to 28'	>29'		
Southeast Michigan	350	209	357	329	1,244	21%
Southwest Michigan	267	211	122	224	824	14%
West Central Michigan	213	169	144	193	719	12%
Thumb Region	201	230	177	238	846	14%
Northeast Michigan	98	114	79	78	369	6%
Northwest Michigan	190	202	155	190	737	12%
Straits	60	98	92	99	349	6%
U.P. Lake Superior	45	115	118	64	342	6%
U.P. Lake Michigan	14	44	48	29	135	2%
Out of state	<u>26</u>	<u>137</u>	<u>129</u>	<u>145</u>	<u>437</u>	<u>7%</u>
Total	1,463	1,528	1,420	1,588	6,000	100%
Percent	24%	25%	24%	26%	100%	

a. Sampling regions are shown in Figure 2.



Figure 2. Sampling Regions

Measurement

A four-page mailed questionnaire, similar to those used in previous boater surveys, was used to gather the information. The questionnaire (see Appendix A) was developed by making adjustments to the 1980 (Stynes and Safronoff, 1982) and 1986 (Talhelm et al., 1988) Michigan boater survey instruments. Information gathered included:

- Characteristics of boats, boat owners and boating households.
- Information on where the boat is kept during the boating season and the use of marinas and launching facilities.
- Boating use for 1994 divided between Great Lakes and inland waters and reported by county.
- Annual expenses on the boat for equipment, repairs, insurance, storage and fuel.
- Presence of toilet facilities on the boat and use of pumpouts.

The most notable changes from previous boater surveys were:

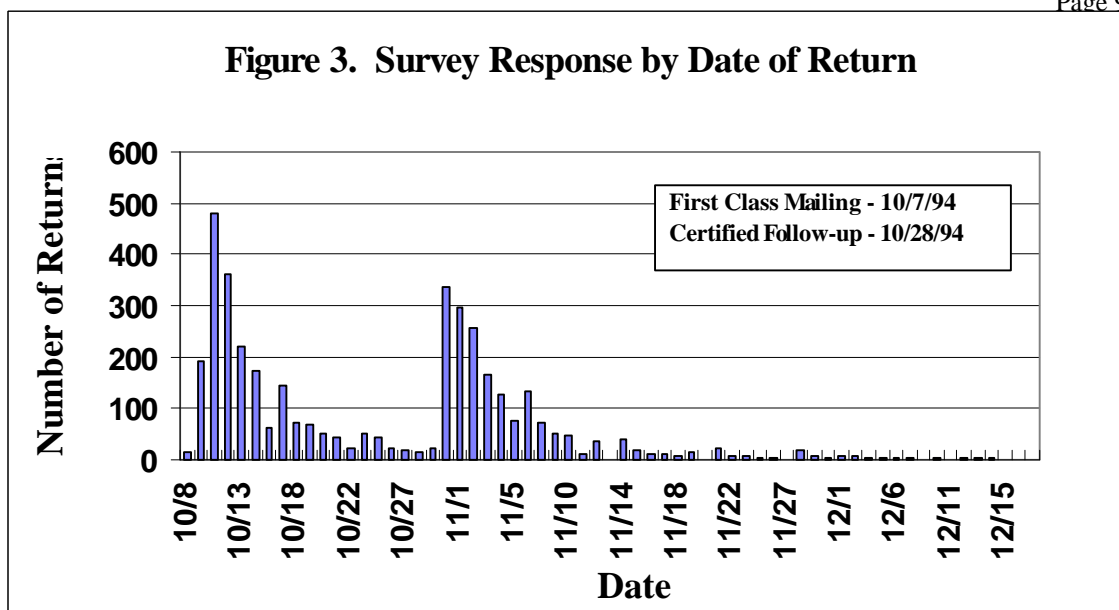
1. Categories identifying where the boat is kept during the boating season were expanded to further differentiate types of marinas (public, commercial, dockaminium and yacht/boat clubs) and to better cover dry stack facilities and other kinds of storage.
2. Measures of boating use by county on Great Lakes and inland waters were adjusted to reduce potential double counting and assure consistent totals. In 1980, separate tables were used to report Great Lakes and inland use (inland lake, river or stream). A third table was added in 1986, separating use of rivers and streams from use of inland lakes. In the 1980 and 1986 surveys, total use was estimated by adding up the use reported by county under Great Lake, inland, and stream categories. Given the difficulty in distinguishing between the three categories, particularly when boating in Michigan's drowned river mouths and Great Lakes connecting waters, some double reporting likely occurred. Double counting also could occur when boaters report use in more than one county on a given day.

The 1994 instrument first asks for the total number of days the boat was used in Michigan waters in 1994. The boat owner then divides this use between Great Lakes and inland waters, and then in a table itemizes the number of days within each county (see question 10 on questionnaire).

3. Our definition of boating use on Great Lakes waters was “any day the boat was underway on the Great Lakes and connecting waterways (Lakes Huron, Superior, Erie, Michigan and St. Clair; and the St. Mary’s, St. Clair and Detroit Rivers), including lakes and rivers that provide access to the Great Lakes.” Our intent was to include boating use on river mouths and lakes that provide direct access to the Great Lakes as Great Lakes use, because many facilities for Great Lakes boaters are located here and boaters will frequently use both Great Lakes waters and these connecting lakes and streams on a single day. Some confusion likely remains between “Great Lakes” and “inland waters”, but the revised procedures appear to improve the reliability and validity of the use measures. In particular, we can guarantee that for each boater, the estimates of Great Lakes and inland use by county add up to the total days reported.
4. Several questions were added to gather information relative to Michigan’s efforts to determine needs for pumpout facilities and dump stations (questions 16a-d). The objectives for the registered boater survey include estimating the number and types of watercraft with portable or fixed toilet facilities, the frequency of use of on-board toilet facilities, and the use of pumpout facilities and dump stations. A follow-up survey of a sample of boaters agreeing to complete an additional questionnaire gathered more detailed attitudinal information about boaters’ use of toilets and pumpout facilities (see Report 3). Data from the registered boater survey are combined with results of the follow-up survey and focus group interviews in Talhelm et al. (Report 3) to assess needs for pumpout facilities and educational and other programs.

Data Gathering

A first-class mailing to the sample of 6,000 boat owners was followed by a certified letter to those who had not responded within three weeks. Questionnaires were numbered sequentially to trace returns for follow-ups and to match the returns with data on the registration file. A business reply return address was printed on the questionnaire. The initial questionnaires were mailed October 7 by first-class mail. A cover letter explained the study, noted that participation was voluntary and explained procedures for assuring confidentiality of the responses. Three weeks later, a second complete mailing was sent by certified letter to all subjects who had not yet responded (4,000). Surveys were coded and cleaned as they were received using the SPSS Data Entry software. Figure 3 shows the pattern of survey response by week.



SURVEY RESPONSE

Response Rate

Approximately 2,000 responses were received within three weeks of the initial mailing and another 2,277 after the follow-up mailings for an overall response rate of about 70 percent of the deliverable surveys (6 percent of mailings were returned as undeliverable because of faulty addresses). About 20 percent (743 responses) of the boat owners returning usable surveys indicated that their boats were not used in 1994; another 83 boaters reported for more than one boat. Omitting inactive craft, multiple-boat responses, and other unusable returns resulted in a sample of 2,980 boats for our primary analyses (Table 3).

Table 3. 1994 Michigan boater survey response rate.

	Total Questionnaires Mailed		Pct of deliverable
	N	Pct of total	
Total questionnaires mailed	6,000	100.0%	
Not deliverable	362	6.0%	
Delivered	5,638	93.9%	100.0%
Returned surveys	3,909	65.1%	69.3%
Active boats	2,980	49.6%	52.9%
Inactive boats	743	12.4%	13.2%
Non-usable questionnaires ^a	186	3.1%	3.3%
Nonresponse	1,729	28.8%	30.7%

a. The 186 non-usable questionnaires included 25 incomplete surveys, 78 boats that had been sold or disposed of in 1994 and 83 boat owners who reported for more than one boat.

Rates of response are fairly uniform across counties and size classes. As in previous surveys, response rates are slightly lower in southeastern Michigan. The sample includes higher proportions of boats in larger size classes and from northern Michigan to yield adequate samples for the Great Lakes counties and regions (Table 4)

The sampling plan succeeded in obtaining good size samples in all of our key subgroups. The sample includes more than 700 boats in each size class, almost 1,000 boats stored at marinas, 1,500 boats kept at Great Lakes waterfront sites, 650 boats kept at inland waterfront sites, 650 boats at non-waterfront sites, 1,260 boats with toilet facilities and 900 boats with a installed heads. The regional distribution of responses provides samples ranges from 724 in southeastern Michigan to 95 in the Lake Michigan section of the Upper Peninsula (Table 5). A sample of 3,000 boats yields sampling errors of plus or minus 1 percent (95% confidence interval) on binomial distributed variables (yes or no); subgroups of 1,000 are accurate to plus or minus 2 to 3 percent and subgroups of 500 within plus or minus 5 percent. Models are estimated from the survey data and applied to registration statistics to increase the reliability of estimates at the county level.

Table 4. Response rates by region of registration and boat size class.

	Mailings	Returns ^a	Undeliverable	Response rate ^b
SAMPLING REGION				
Southeast Michigan	1,244	724	100	63%
Southwest Michigan	824	531	44	68%
West Central Michigan	719	497	36	73%
Thumb Region	846	559	44	70%
Northeast Michigan	369	251	20	72%
Northwest Michigan	737	475	45	69%
Straits	349	243	19	74%
U.P. Lake Superior	342	233	16	71%
U.P. Lake Michigan	135	95	6	74%
Out of State	437	297	35	74%
BOAT SIZE CLASS				
Less than 16'	1,463	948	83	69%
16 to 20'	1,528	1,022	76	70%
21 to 28'	1,420	911	93	69%
Larger than 29'	1,588	1,024	113	69%
Total	6,000	3,909	365	69%

a. Four surveys were returned without numbers to identify the registration county.

Table 5. Completed sample of active boats by region of registration and boat size class.

REGION	SIZE OF BOAT (feet)				Total ^a
	<16'	16 to 20'	21 to 28'	>29'	
Southeast Michigan	145	90	152	151	538
Southwest Michigan	112	99	63	139	413
West Central Michigan	104	85	71	123	383
Thumb Region	78	92	93	138	401
Northeast Michigan	46	54	45	45	190
Northwest Michigan	79	99	81	101	360
Straits	24	46	59	63	192
U.P. Lake Superior	18	58	71	41	188
U.P. Lake Michigan	6	24	25	19	74
Out of state	<u>12</u>	<u>78</u>	<u>77</u>	<u>70</u>	<u>237</u>
Total	624	725	737	890	2976

a. Four surveys were returned without numbers to identify the registration county.

Inactive Boats

Not all registered boats were active in 1994. Active craft were defined as boats used in Michigan waters at least once in 1994. Boat owners were asked to check a box at the top of the questionnaire if their boat was not used in Michigan in 1994. About a quarter of all registered boats were inactive in 1994 (Table 6). The percentage of boats that were inactive varied by size class, dropping from 30 percent for boats under 16 feet in length to 25 percent for boats 16 to 20 feet, to 15 percent for boats 21 to 28 feet to 10 percent for boats over 29 feet. Rates of inactivity could be slightly higher, given that owners of inactive boats may have been less likely to return the survey instrument.

The rate of inactivity is up somewhat from 1980, when 14.5 percent of the boat owners sampled reported their boats were not used in that year (Stynes and Safronoff, 1982). The 1980 figure, however, was not adjusted for the disproportionate sampling across size classes. The 1980 rate would be comparable to the raw percentage of inactive boats in the 1994 sample, about 20 percent. The rate of inactivity in the 1986 survey appears to have been considerably underestimated at 6.5 percent. An aging boating fleet and boat owner population are factors likely contributing to somewhat higher rates of inactivity in 1994.

Applying the rate of inactivity for each size class to the number of registered pleasure craft (Table 1) yields a population of 555,188 active pleasure craft with valid registrations. The number and distribution of these boats by size class and region in Table 7 is the population of boats to which survey estimates are expanded

Table 6. Percentage of registered boats inactive in 1994 by boat size class.

BOAT SIZE CLASS	Usable returns ^a	Inactive boats	Active boats ^a	Pct inactive ^b
Less than 16'	893	269	624	30%
16 to 20'	968	243	725	25%
21 to 28'	866	129	737	15%
Larger than 29'	<u>992</u>	<u>102</u>	<u>890</u>	<u>10%</u>
Total	3,723	743	2,980	25%

a. Four surveys were returned without numbers to identify the registration county.

b. Inactive percent = inactive/ (active+inactive).

Weights

Because we sampled disproportionately across regions and size categories, weights are needed to adjust the final sample of completed boater surveys to the population of active pleasure craft with valid Michigan registrations during the summer of 1994. The distribution of boats in the population by size, type and county of registration is known, so we can adjust for the disproportionate sampling to provide estimates that will represent the registered boating fleet as a whole. Weights are assigned for each boat size class, region and type to expand the final completed sample to the population of active registered watercraft. The weights for pontoon boats and non-pontoon boats are shown in Table 8 for each size class and region. These weights are

Table 7. Number of active watercraft (summer 1994) by region of registration and size class.^a

REGION	SIZE OF BOAT (feet)				Total	Percent
	<16'	16 to 20'	21 to 28'	>29'		
Southeast Michigan	79,498	55,983	39,671	11,001	186,154	34%
Southwest Michigan	55,620	25,370	12,783	1,850	95,625	17%
West Central Michigan	41,194	19,077	9,880	2,491	72,644	13%
Thumb Region	35,423	20,379	10,838	1,825	68,469	12%
Northeast Michigan	12,390	6,912	3,292	248	22,847	4%
Northwest Michigan	25,081	12,035	5,868	927	43,917	8%
Straits	9,493	3,804	2,241	414	15,958	3%
U.P. Lake Superior	11,653	3,688	1,309	221	16,880	3%
U.P. Lake Michigan	4,401	1,411	418	108	6,346	1%
Out of state	11,921	7,344	4,748	1,731	25,754	5%
Unknown	<u>253</u>	<u>166</u>	<u>129</u>	<u>46</u>	<u>594</u>	<u>0%</u>
Total	286,927	156,168	91,175	20,862	555,188	100%
Percent	52%	28%	16%	4%	100%	

a. Includes only registered boats that were used at least once in Michigan waters in 1994.

derived by first dividing the cell counts in Table 7 by the number of completed surveys in each corresponding category from Table 5. Resulting weights were then further adjusted to correct for disproportionate sampling of pontoon boats. The distribution of the final weighted sample by region of registration and size class is shown in Table 9. Comparison of Tables 7 and 9 shows that the weighting scheme successfully adjusts the sample to the 1994 active registered boating fleet.

Table 8. Weights to adjust the sample to Michigan's active registered fleet.

REGION	NON-PONTOON BOATS Size of boat (feet)				PONTOON BOATS Size of boat (feet)			
	<16'	16 to 20'	21 to 28'	>29'	<16'	16 to 20'	21 to 28'	>29'
Southeast Michigan	692	502	245	68	158	545	500	69
Southwest Michigan	539	243	127	13	287	170	385	14
West Central Michigan	475	219	108	20	164	151	194	20
Thumb Region	519	213	95	14	219	103	250	13
Northeast Michigan	315	155	44	6	95	99	69	6
Northwest Michigan	372	113	53	10	219	125	96	9
Straits	432	74	29	7	305	240	80	7
U.P. Lake Superior	583	60	14	6	497	126	40	5
U.P. Lake Michigan	635	66	13	7	163	20	47	6
Out of state	<u>982</u>	<u>98</u>	<u>45</u>	<u>25</u>	<u>132</u>	<u>105</u>	<u>135</u>	<u>25</u>
Average weight	531	209	94	22	219	149	223	90

Table 9. Weighted sample by region of registration and size class.

REGION	SIZE OF BOAT (feet)				Total	Percent
	<16'	16 to 20'	21 to 28'	>29'		
Southeast Michigan	79,555	56,098	39,636	10,822	186,111	34%
Southwest Michigan	55,709	25,422	12,809	1,777	95,717	17%
West Central Michigan	41,247	19,116	9,900	2,511	72,774	13%
Thumb Region	35,363	20,421	10,657	1,849	68,290	12%
Northeast Michigan	12,394	6,926	3,299	243	22,861	4%
Northwest Michigan	24,997	12,059	5,880	944	43,880	8%
Straits	9,525	3,812	2,245	426	16,008	3%
U.P. Lake Superior	11,686	3,696	1,312	229	16,922	3%
U.P. Lake Michigan	4,457	1,413	418	123	6,412	1%
Out of State	11,945	7,359	4,554	1,740	25,599	5%
Unknown	<u>0</u>	<u>568</u>	<u>0</u>	<u>45</u>	<u>612</u>	<u>0%</u>
Total	286,878	156,891	90,711	20,708	555,188	100%
Percent	52%	28%	16%	4%	100%	

Success of the Questionnaire

The questionnaire and overall approach worked well. The use of a single certified mailing for follow up was very effective though it generated a number of complaints from boat owners about inconvenience or use of public monies. The certified letter doubled the response rate and actually cost less than multiple postcard and first-class mail reminders would have.

The most significant problems in the instrument itself were respondents reporting for more than one boat and use estimates not consistently adding to the totals. Eighty-three respondents reported for more than one boat in spite of the instructions in the survey instrument and the cover letter. Reports of boat use in 1994 were carefully checked and edited to assure that Great Lakes and inland estimates add up to totals and boat use by county adds to this same total. Careful examination of the responses to the 1994 questionnaire suggests that double counting problems may have been considerable in previous surveys. There remains some inevitable fuzziness in respondents' understandings of distinctions between public and commercial marinas and what constitutes Great Lakes and connecting waters vs. inland waters.

RESULTS: FLEET AND OWNER CHARACTERISTICS

Boat Owners

To describe boat owners, we must first adjust the sample for multiple boat ownership. The 555,000 active boats are owned by 439,000 boat owners. Owners with more than one registered boat would have a greater chance of being chosen in our sample than owners of a single boat, so cases were weighted inversely to the number of boats owned. Eighty percent of the boat owners own single boats, while 15 percent own two boats and 5 percent more than two (Table 10).

Table 10. Multiple boat ownership.^a

Number of boats owned	Percent	Number of owners
1 boat	80%	351,857
2 boats	15%	65,773
3 boats	4%	15,966
4 or more boats	1%	5,329
	100%	438,925

a. Unit of analysis in this table is the boat owner. The sample of boats was weighted inversely to the number of boats owned by each respondent.

Boat ownership cuts across a wide spectrum of demographic and socioeconomic groups. Boat owners are considerably older than Michigan's population and have somewhat higher incomes. The median age of boat owners is 56 and the median income is just under \$40,000 a year. About half of all boat-owning households have one or more children in the household. Almost a third of boat owners own seasonal homes (Table 11). The geographic distribution of boat owners reflects Michigan's population distribution, though per capita rates of boat ownership are lower in southern, inland and metropolitan regions (see Table B4 in Appendix B). The number of active registered boats as a percentage of the number of residents of the county varies from 2 percent in Wayne County to more than 20 percent in Roscommon and Leelanau counties. These differences in part capture the greater propensity to own boats in areas with ample boating opportunities, but they also result from inconsistency in whether boat owners choose to register their boats from their permanent residences or in the counties where they keep the boats -- i.e., at seasonal homes or marinas.

Owner characteristics vary quite a bit with type of craft. More than half of pontoon boat owners are over 60 years of age, compared with 31 percent of sailboat and inboard owners. Sailboat owners have the highest incomes of owners, followed closely by owners of inboards (Table 11).

The Michigan Active Registered Pleasure Boating Fleet

The active registered fleet is made up mostly of smaller craft. Eighty percent of all active registered boats are 20 feet or less in length. Four percent of registered craft are over 29 feet. More than half of all registered craft are outboards; 24 percent are inboards (including inboard/outboards). Sailboats make up 6 percent of the fleet, pontoons 8 percent and canoes/row boats another 7 percent. Sailboats are slightly underrepresented in the sample. Unpowered craft under 16 feet do not need registrations and, therefore, are not included in this study (Table 12).

Sixty percent of boats are kept at the owners' permanent residences during the boating season, a fourth at seasonal homes, and about 11 percent at marinas or yacht clubs. Marinas provide storage primarily for larger boats. The percentage of craft kept in a marina or yacht club increases from 1 percent for boats under 16 feet, to 10 percent for boats 16-20 feet long, to 31 percent for boats 21 to 28 feet long to 78 percent for boats over 29 feet in length. Just under 40 percent of boats are kept in the water during the boating season, 55 percent on land, and small percentages in dry stack and other locations. Two out of five boats are kept at non-waterfront locations and

transported to boating sites. Over a third are kept at inland waterfront sites (lake or river) and almost a fourth are kept at Great Lakes waterfront sites (Table 12).

Table 11. Boat owner characteristics by type of boat.^a

	Inboard ^b	Outboard	Boat type			Total
			Sail	Pontoon	Canoe/row	
	percent					
AGE OF BOAT OWNER						
younger than 40	22	22	19	11	21	21
41-50	26	16	31	15	20	19
51-60	21	17	19	17	12	17
61-65	9	10	11	15	11	11
66-70	10	15	7	17	16	14
Older than 70	<u>12</u>	<u>21</u>	<u>13</u>	<u>24</u>	<u>20</u>	<u>19</u>
	100	100	100	100	100	100
NO. OF ADULTS IN THE HOUSEHOLD						
1	17	17	28	17	21	18
2	70	71	66	72	64	70
3	8	8	3	8	12	8
4	4	3	3	2	3	3
5 or more	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
	100	100	100	100	100	100
HOUSEHOLDS WITH CHILDREN						
no children	51	53	54	68	53	53
1 child	20	21	18	16	17	20
2 children	17	15	18	10	20	15
3 children	9	8	7	4	6	8
more than 4 children	<u>4</u>	<u>3</u>	<u>3</u>	<u>1</u>	<u>3</u>	<u>4</u>
	100	100	100	100	100	100
HOUSEHOLD INCOME						
Under \$20,000	10	28	7	21	21	22
\$20,000-\$39,999	27	36	17	41	41	34
\$40,000-\$59,999	26	22	27	22	18	23
\$60,000-\$99,999	22	13	29	12	20	16
Over \$100,000	<u>15</u>	<u>2</u>	<u>20</u>	<u>5</u>	<u>1</u>	<u>6</u>
	100	100	100	100	100	100
SEASONAL HOME						
Own a seasonal home in Michigan	32	29	20	42	38	31
Do not own a seasonal home in Michigan	<u>68</u>	<u>72</u>	<u>80</u>	<u>59</u>	<u>62</u>	<u>69</u>
	100	100	100	100	100	100

a. Unit of analysis in this table is the boat owner. The sample of boats was weighted inversely to number of boats owned by each respondent.

b. Includes Inboard/outboard.

Almost 70 percent of boats kept at non-waterfront sites are less than 16 feet long. Marinas in general and dockaminiums and yacht clubs in particular house the largest boats. Boats at Great Lakes waterfront sites tend to be significantly larger than those at inland sites (Table 13). Boat storage locations are important because they are the best predictors of where boats are used and, along with boat size, explain the types and amounts of use. Boat summer storage locations and size therefore provide the basis for the primary segmentation of boats used throughout this report.

Table 12. Boat type and storage by size of boat.

	Size of boat				Total
	<16'	16 to 20'	21 to 28'	>29'	
	column percent				
BOAT TYPE					
Inboard	1.1	28.4	45.5	65.6	18.5
Inboard/outboard	0.8	12.5	8.7	3.4	5.5
Outboard	81.5	43.9	6.2	0.8	55.5
Sail, unpowered	0.9	2.0	1.3	1.3	1.3
Sail, with power	0.0	0.6	9.0	27.4	2.7
Pontoon	0.6	9.1	29.1	1.3	7.7
Canoe or rowboat	14.2	3.2	0.1	0.0	8.2
Personal watercraft	0.4	0.2	0.0	0.0	0.3
Other	<u>0.5</u>	<u>0.2</u>	<u>0.1</u>	<u>0.2</u>	<u>0.3</u>
	100.0	100.0	100.0	100.0	100.0
STORAGE FACILITY					
Permanent residence	68.4	60.6	39.7	13.4	59.4
Cottage or second home	26.6	25.4	24.0	5.1	25.0
Public marina	0.1	3.2	6.3	12.6	2.5
Rented space in commercial marina	0.2	4.6	19.5	37.9	6.1
Owned space in marina/dockaminium	0.5	0.5	0.6	9.0	0.8
Yacht/boat club	0.3	1.1	4.7	18.4	1.9
Other	<u>4.0</u>	<u>4.5</u>	<u>5.2</u>	<u>3.6</u>	<u>4.3</u>
	100.0	100.0	100.0	100.0	100.0
STORAGE LOCATION					
On land	74.7	49.3	14.8	3.0	55.0
In a dry stack facility	0.5	2.1	1.5	0.3	1.1
In the water (wet slip, mooring or dockside)	18.7	44.8	78.9	95.7	38.8
Attached to or on a larger boat	1.3	0.2	0.0	0.2	0.7
Other	<u>4.8</u>	<u>3.6</u>	<u>4.8</u>	<u>0.8</u>	<u>4.3</u>
	100.0	100.0	100.0	100.0	100.0
TYPE OF STORAGE LOCATION					
A waterfront site w/ Great Lakes access	9.9	20.3	54.8	96.4	23.5
An inland lake waterfront site	32.4	37.5	31.5	1.4	32.5
A river or stream waterfront site	2.4	3.6	3.3	2	2.9
A non-waterfront site	<u>55.3</u>	<u>38.5</u>	<u>10.4</u>	<u>0.3</u>	<u>41.1</u>
	100.0	100.0	100.0	100.0	100.0

Table 13. Size of Boat by Boat Type and Storage

	Size				Total
	<16'	16 to 20'	21 to 28'	>29'	
	row percents				
BOAT TYPE					
Inboard	3.0	43.6	40.2	13.2	100
Inboard/outboard	7.8	64.1	25.7	2.3	100
Outboard	75.7	22.4	1.8	0.1	100
Sail, unpowered	36.4	43.6	16.3	3.6	100
Sail, with power	0.0	6.1	55.5	38.4	100
Pontoon	3.8	33.6	62.0	0.6	100
Canoe or rowboat	88.8	11.0	0.2	0.0	100
Personal watercraft	78.2	21.8	0.0	0.0	100
Other	77.8	13.6	6.0	2.6	100
STORAGE FACILITY					
Permanent residence	59.0	29.1	11.0	0.9	100
Cottage or second home	54.4	29.0	15.8	0.8	100
Public marina	2.7	36.8	41.4	19.0	100
Rented space in commercial marina	1.6	21.8	52.9	23.7	100
Owned space in marina/dockaminium	29.0	16.2	13.1	41.7	100
Yacht/boat club	6.6	17.0	40.3	36.1	100
Other	47.2	29.7	19.9	3.2	100
STORAGE LOCATION					
On land	70.0	25.4	4.4	0.2	100
In a dry stack facility	24.4	52.5	22.0	1.1	100
In the water (wet slip, mooring or dockside)	24.9	32.7	33.3	9.1	100
Attached to or on a larger boat	89.6	9.4	0.0	1.0	100
Other	57.6	23.6	18.1	0.7	100
TYPE OF STORAGE LOCATION					
A waterfront site w/ Great Lakes access	21.7	24.5	38.3	15.5	100
An inland lake waterfront site	51.2	32.7	15.9	0.2	100
A river or stream waterfront site	42.9	35.7	18.8	2.6	100
A non-waterfront site	69.2	26.6	4.1	0	100
ALL BOATS	51.7	28.3	16.3	3.7	100

Boat Segments

To help describe and explain patterns of boating use, we divide Michigan's registered boating fleet into 11 segments based on location (Great Lakes waterfront, inland waterfront or non-waterfront), size class and use of a marina. There are five Great Lakes waterfront segments, three inland waterfront segments and three non-waterfront segments.

GREAT LAKES WATERFRONT SEGMENTS

<u>SEGMENT #</u>	<u>Size</u>	<u>Storage location</u>
1	29 feet or longer	Permanent or seasonal waterfront home
2	29 feet or longer	Marina
3	21-28 feet	Permanent or seasonal waterfront home
4	< 29 feet	Marina
5	< 21 feet	Permanent or seasonal waterfront home

INLAND WATERFRONT SEGMENTS

6	21 feet or longer	Permanent or seasonal waterfront home
7	< 21 feet	Permanent or seasonal waterfront home
8	Any size	Inland marina

NON-WATERFRONT SEGMENTS

9	< 16 feet	Non-waterfront site
10	16-20 feet	Non-waterfront site
11	21 feet or longer	Non-waterfront site

Table 14 presents both weighted and unweighted frequencies by segment from the sample. The unweighted figures show the actual number of boats of each type in our sample. Larger craft were intentionally oversampled to develop reliable estimates of demand for marina slips and pumpout facilities. This sampling

strategy resulted in more than 170 boats in each of our segments with the exception of boats larger than 21 feet at non-waterfront sites (n=101) and boats kept at inland marinas (n=70).

The weights adjust the sample to represent the active registered fleet. More than half of all registered boats fall into two segments -- 29 percent are smaller (<21 feet) boats kept at inland waterfront sites, and 28 percent are small boats (<16 feet) kept at non-waterfront sites. The largest Great Lakes segment is also smaller craft -- boats under 21 feet kept at Great Lakes waterfront homes represent 9 percent of the active pleasure fleet. In total, Great Lakes waterfront segments constitute about 23.7 percent of the fleet, inland waterfront segments 35.7 percent and boats stored at non-waterfront sites 40.7 percent. Though the larger craft are small percentages of the overall fleet, their impacts on Great Lakes marina and pumpout facilities are substantial, as is their economic impact. Table 15 profiles the characteristics of boat owners in each of the 11 segments.

Table 14. Boat segments.

SEGMENT	Unweighted sample		Weighted sample	
	N	Percent	N	Percent
Great Lakes waterfront segments	1,499	51.7%	126,828	23.7%
29'+ GL waterfront home	171	5.9%	4,198	0.8%
29'+ GL marina	660	22.7%	15,548	2.9%
21 to 28' GL waterfront home	230	7.9%	25,842	4.8%
<28' GL marina	266	9.2%	34,903	6.5%
<21' GL waterfront home	172	5.9%	46,337	8.6%
Inland Lake waterfront segments	737	25.4%	191,320	35.7%
21'+ IL waterfront home	196	6.8%	26,684	5.0%
<21' IL waterfront home	471	16.2%	155,482	29.0%
IL marina	70	2.4%	9,154	1.7%
Non-waterfront segments	666	22.9%	217,920	40.7%
<16 non-waterfront site	289	10.0%	149,560	27.9%
16 to 20' non-waterfront site	276	9.5%	57,746	10.8%
21'+ non-waterfront site	101	3.5%	10,614	2.0%
Boats with missing data	78		19,118	
Total	2,980	100.0%	555,188	100.0%

Table 15. Boat owner characteristics by segment.^a

	Great Lakes waterfront				Inland waterfront				Non-waterfront			Total
	29'+ Home	29'+ Marina	21- 28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina	<16' Boats	16- 20' Boats	>20' Boats	
percent												
AGE OF BOAT OWNER												
younger than 40	20	16	20	22	18	13	11	18	28	33	28	21
41-50	22	28	25	25	17	18	16	21	19	20	25	19
51-60	25	27	18	17	24	16	16	28	16	16	18	17
61-65	17	13	13	13	12	17	13	9	8	9	7	11
66-70	8	5	11	11	15	10	18	6	13	10	8	14
Older than 70	<u>8</u>	<u>12</u>	<u>12</u>	<u>11</u>	<u>14</u>	<u>26</u>	<u>27</u>	<u>18</u>	<u>16</u>	<u>13</u>	<u>14</u>	<u>19</u>
	100	100	100	100	100	100	100	100	100	100	100	100
NO. OF ADULTS IN THE HOUSEHOLD												
1	20	16	19	22	18	19	21	16	16	12	25	18
2	67	69	65	68	73	69	68	71	72	71	59	70
3	8	11	11	8	8	10	7	0	9	9	12	8
4	5	4	5	2	1	2	3	12	3	8	3	3
5 or more	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>	<u>1</u>
	100	100	100	100	100	100	100	100	100	100	100	100
HOUSEHOLD WITH CHILDREN												
no children	60	56	61	52	48	67	63	64	40	43	40	53
1 child	12	19	17	26	18	11	19	20	26	21	21	20
2 children	17	14	16	15	16	16	9	10	23	19	21	15
3 children	9	7	4	5	15	4	6	3	7	14	16	8
more than 4	<u>2</u>	<u>5</u>	<u>2</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>4</u>	<u>4</u>	<u>2</u>	<u>4</u>
	100	100	100	100	100	100	100	100	100	100	100	100
HOUSEHOLD INCOME												
Under \$20,000	4	3	11	9	24	20	23	12	27	19	25	22
\$20,000-\$39,999	21	18	26	31	30	33	32	27	40	37	30	34
\$40,000-\$59,999	38	25	27	29	20	20	23	21	20	29	19	23
\$60,000-\$99,999	23	33	24	18	18	13	17	24	13	14	22	16
Over \$100,000	<u>13</u>	<u>21</u>	<u>11</u>	<u>13</u>	<u>9</u>	<u>13</u>	<u>5</u>	<u>16</u>	<u>1</u>	<u>2</u>	<u>4</u>	<u>6</u>
	100	100	100	100	100	100	100	100	100	100	100	100
OWN SEASONAL HOME IN MICHIGAN												
Yes	24	15	33	21	45	48	55	22	13	13	20	31
No	<u>76</u>	<u>85</u>	<u>67</u>	<u>79</u>	<u>55</u>	<u>52</u>	<u>45</u>	<u>78</u>	<u>87</u>	<u>87</u>	<u>80</u>	<u>69</u>
	100	100	100	100	100	100	100	100	100	100	100	100

a. Unit of analysis in this table is the boat owner. The sample of boats was weighted inversely to number of boats owned by each respondent.

BOATING ACTIVITY

The two most frequent uses of boats are fishing from boats (56 percent) and pleasure cruising (39 percent). Smaller craft kept at non-waterfront sites are used mainly for fishing while owners of larger craft report more pleasure boating than fishing. Boats at inland waterfront sites are more likely to be used for fishing and water-skiing than boats kept at Great Lakes waterfront sites (Table 16)

We estimate that almost 2.5 million launchings of boats occurred on inland waters and 1.4 million launchings took place on Great Lakes waters in 1994. Boats kept at non-waterfront sites account for 80 percent of the launchings at Great Lakes sites and 90 percent of the launchings at inland sites. Sixteen-to- twenty foot boats kept at non-waterfront sites account for the highest numbers of Great Lakes launchings, while smaller craft (under 16 feet) kept at non-waterfront sites report the most launchings at inland lakes and streams (Table 17).

Table 16. Types of boating use by segment and size class.

	Pleasure boating	Fishing from boat	Waterskiing	Other
SEGMENT				
29'+ GL waterfront home	87%	12%	0%	1%
29'+ GL marina	91%	7%	0%	2%
21 to 28' GL waterfront home	76%	21%	1%	1%
<28' GL marina	70%	27%	1%	2%
<21' GL waterfront home	46%	47%	4%	3%
21'+ IL waterfront home	67%	30%	2%	1%
<21' IL waterfront home	44%	48%	6%	1%
IL marina	67%	24%	6%	3%
<16 non-waterfront site	10%	88%	0%	1%
16 to 20' non-waterfront site	34%	60%	5%	1%
21'+ non-waterfront site	34%	56%	3%	7%
SIZE				
<16'	19%	77%	1%	2%
16 to 20'	51%	40%	8%	1%
21 to 28'	69%	27%	2%	2%
>29'	90%	8%	0%	2%
All boats	39%	56%	3%	2%

Table 17. Transporting and Launching by Segment and Size Class.

	AT SITES WITH ACCESS TO THE GREAT LAKES				AT SITES ON INLAND LAKES OR RIVERS				
	Pct launching at least once	Average times launched	Total (000's) launchings	Percent	Pct launching at least once	average times launched	Total (000's) launchings	Percent	
SEGMENT									
29'+ GL waterfront home	19%	1.3	1	0.1%	1%	2.6	0	0.0%	
29'+ GL marina	13%	1.2	2	0.2%	1%	1.0	0	0.0%	
21 to 28' GL waterfront home	23%	4.8	29	2.0%	0%	2.0	0	0.0%	
<28' GL marina	31%	2.5	29	2.0%	7%	1.0	14	0.5%	
<21' GL waterfront home	33%	8.5	134	9.3%	16%	6.3	50	2.0%	
21'+ IL waterfront home	3%	2.3	2	0.1%	32%	1.4	13	0.5%	
<21' IL waterfront home	6%	9.5	91	6.3%	27%	4.0	174	7.0%	
IL marina	12%	14.9	16	1.1%	51%	1.9	9	0.4%	
<16 non-waterfront site	32%	9.1	446	31.0%	83%	13.4	1,726	69.4%	
16 to 20' non-waterfront site	70%	13.7	576	40.0%	62%	12.8	477	19.2%	
21'+ non-waterfront site	87%	11.8	114	7.9%	32%	6.5	23	0.9%	
SIZE									
<16'	21%	8.9	548	38.0%	55%	12.0	1,885	75.8%	
16 to 20'	39%	12.2	757	52.5%	43%	8.2	557	22.4%	
21 to 28'	24%	6.0	130	9.0%	17%	2.9	43	1.7%	
>29'	14%	2.0	6	0.4%	2%	1.6	1	0.0%	
Total	27%	9.7	1,440	100.0%	43%	10.4	2,486	100.0%	

To assess demand for temporary storage at marinas, boaters were asked how many nights they occupied a marina space on a temporary basis in 1994. All size craft and segments reported some temporary use of marina slips, though larger craft were more likely to use temporary slips than smaller craft. In total, 41,000 boats or about 7 percent of active craft used marina slips on a temporary basis, accumulating a total of 315,000 nights in marinas in 1994 (Table 18). This estimate is about three times the number of transient boat nights reported by Michigan's public marinas in 1993, suggesting that private facilities, including yacht clubs, provide about two-thirds of the transient boat nights.

Table 18. Temporary use of marina spaces by segment and size class.

TEMPORARILY KEPT THE BOAT OVERNIGHT AT A MICHIGAN MARINA					
	Percent of all boats	# Boats using temp. space	Avg. nights used ^a	Total nights	Percent
SEGMENT					
29'+ GL waterfront home	43%	1,908	10	19,541	6.2%
29'+ GL marina	55%	8,796	10	92,175	29.3%
21 to 28' GL waterfront home	24%	6,410	6	35,345	11.2%
<28' GL marina	19%	6,929	8	56,746	18.0%
<21' GL waterfront home	4%	1,767	8	14,244	4.5%
21'+ IL waterfront home	3%	767	2	1,545	0.5%
<21' IL waterfront home	1%	995	7	7,163	2.3%
IL marina	10%	971	14	14,035	4.5%
<16 non-waterfront site	3%	4,302	9	37,927	12.1%
16 to 20' non-waterfront site	10%	5,701	3	19,445	6.2%
21'+ non-waterfront site	24%	2,674	6	16,462	5.2%
SIZE					
<16'	2%	4,837	8	39,947	12.7%
16 to 20'	6%	9,802	6	63,515	20.2%
21 to 28'	18%	15,957	6	102,494	32.6%
>29'	51%	10,516	10	108,673	34.5%
Total	7%	41,084	8	314,629	100.0%

a. Average number of nights at a temporary marina in Michigan in 1994.

Boating use in 1994

Boating use is measured as the number of days a boat was underway in 1994. Boating use questions were modified slightly from previous surveys to reduce potential double counting. For example, boaters who boated in more than one county or on both Great Lakes and inland waters on the same day could have been counted for more than one day of boating in the 1986, 1980 and previous Michigan boater surveys. In 1994, boaters were asked to first report total days of boating and then to divide use between Great Lakes and inland waters, counting any day in which all or part of the day was spent on the Great Lakes and connecting waters as a Great Lakes boat day. These procedures yield more conservative and, we believe, more accurate estimates of actual boating use. Readers are cautioned, however, that the modification in the questions yields results that are not directly comparable with those of previous studies. These changes may in part explain lower estimates of inland boat use in 1994. In the "Trends" section we suggest some adjustments to estimates of previous studies to facilitate comparisons.

Craft registered in Michigan logged an estimated 13.4 million days of boating in 1994, 4.8 million on Great Lakes waters and 8.6 million on inland waters (Table 19). Boat use increases with size of the boat from 20 days a year for boats under 16 feet to 33 days for boats over 29 feet. Boats kept at Great Lakes or inland waterfront sites average about 29 days of use per year, with the preponderance of use on the bodies of water where the boats are kept. Boats kept at non-waterfront sites averaged about 17 days of use in 1994. These boats used both Great Lakes and inland waters, with the percentage of use on the Great Lakes increasing with the size of the boat (Table 19).

The majority of boats use either Great lakes (28 percent) or inland waters (58 percent) exclusively. Only 14 percent of boats use both Great Lakes and inland waters. Great Lakes boaters averaged about 26 days of use in 1994, compared with 23 days for inland boaters. Boaters using both Great Lakes and inland waters averaged 25 days of boating in 1994, split about two fifths to Great Lakes and three-fifths to inland waters (Table 20).

Table 19. Frequency of boat use by segment and size class.

	Great Lakes boat days			Inland boat days			All boat days		
	Days per boat	Total (000's)	Pct of total	Days per boat	Total (000's)	Pct of total	Days per boat	Total (000's)	Pct of total
SEGMENT									
Great Lakes waterfront segments	27.2	3,532	73%	2.2	289	3%	29.3	3,831	29%
29'+ GL waterfront home	32.6	144	3%	1.4	6	0%	33.3	150	1%
29'+ GL marina	31.1	497	10%	1.3	21	0%	32.5	519	4%
21 to 28' GL waterfront home	30.2	800	17%	1.0	28	0%	31.4	830	6%
<28' GL marina	27.4	989	20%	2.6	93	1%	30.1	1,085	8%
<21' GL waterfront home	23.1	1,103	23%	2.9	141	2%	26.1	1,247	9%
Inland Lake waterfront segments	0.6	112	2%	28.2	5,573	65%	28.8	5,676	42%
21'+ IL waterfront home	0.1	3	0%	27.9	772	9%	28.2	774	6%
<21' IL waterfront home	0.6	89	2%	28.0	4,488	52%	28.5	4,569	34%
IL marina	2.1	20	0%	33.2	313	4%	35.3	332	2%
Non-waterfront segments	5.3	1,200	25%	12.0	2,702	32%	17.3	3,900	29%
<16 non-waterfront site	3.0	462	10%	14.0	2,155	25%	16.9	2,614	20%
16 to 20' non-waterfront site	10.1	602	12%	8.5	508	6%	18.5	1,110	8%
21'+ non-waterfront site	12.4	136	3%	3.5	39	0%	15.9	175	1%
SIZE									
<16'	3.2	930	19%	17.2	4,931	58%	20.4	5,868	44%
16 to 20'	10.8	1,711	35%	16.4	2,572	30%	27.2	4,282	32%
21 to 28'	17.3	1,573	32%	11.2	1,014	12%	28.6	2,584	19%
>29'	30.5	629	13%	2.2	46	1%	32.7	673	5%
TOTAL	8.7	4,843	100%	15.4	8,563	100%	24.2	13,406	100%

Table 20. Boat use by Great Lakes vs inland locations.

	Boating use			Total
	GL only	IL only	Both GL and IL	
No. of boats	157,648	319,663	77,877	555,188
Percent	28%	58%	14%	100%
AVERAGE DAYS OF USE				
Great Lakes use	26	0	10	9
Inland use	0	23	15	15
Total	26	23	25	24
TOTAL BOAT DAYS (000's)				
Great Lakes use	4,049	-	794	4,843
Inland use	-	7,428	1,135	8,563
Total	4,049	7,428	1,929	13,406
PERCENT OF TOTAL				
Great Lakes use	30%	0%	6%	36%
Inland use	0%	55%	8%	64%
Total	30%	55%	14%	100%

BOATER SPENDING

Michigan boaters reported spending \$418 million to operate and maintain their boats in 1994. This figure does not include purchases of new boats or, with the exception of spending on fuel for the boat, spending on boating trips. Expenses for equipment (24 percent) and repairs/maintenance (24 percent) are the largest shares of the \$418 million, followed by slip rental (15 percent). Boat insurance, fuel and storage/put-in/haul-out fees (combined) each accounted for about \$50 million in spending by boaters in 1994 (Table 21).

Boats stored at Great Lakes marinas have the largest economic impacts, accounting for about 40 percent of the \$418 million (Table 22). Boat owner spending increases with boat size from an average of \$205 a year to operate boats under 16 feet in length to \$4,500 to operate and maintain a boat over 29 feet. The average boat owner spends \$753 a year in operating expenses. Spending is broken down by the 11 segments in Table 22. Owners of boats over 29 feet kept at Great Lake marinas spend almost \$5,000 a year, including \$1,400 in slip fees and \$543 in boat fuel. At the other extreme are owners of craft under 16 feet kept at non-waterfront homes. These boaters spend about \$200 a year. Boaters on inland lakes spend considerably less than Great Lakes boaters in corresponding length and storage categories.

Table 21. Boat operating expenses by size of boat.

	SIZE OF BOAT				All boats	Percent
	<16'	16 to 20'	21 to 28'	>29'		
AVERAGE SPENDING (\$ per boat)						
Boating equipment	\$93	\$251	\$221	\$631	\$182	24%
Repair and maintenance	\$39	\$231	\$353	\$924	\$183	24%
Seasonal slip rental or dry stack	\$9	\$58	\$288	\$1,129	\$115	15%
Put-in and haul-out fees	\$7	\$27	\$50	\$146	\$26	3%
Off-Season Storage	\$5	\$63	\$132	\$642	\$68	9%
Fuel	\$34	\$119	\$179	\$510	\$101	13%
Boat insurance	<u>\$18</u>	<u>\$97</u>	<u>\$140</u>	<u>\$463</u>	<u>\$79</u>	<u>11%</u>
Total	\$205	\$845	\$1,362	\$4,445	\$753	100%
FLEET TOTAL SPENDING (\$MM, 1994)						
Boating equipment	\$27.1	\$40.2	\$20.4	\$13.2	\$100.9	24%
Repair and maintenance	\$11.4	\$37.5	\$33.0	\$19.6	\$101.5	24%
Seasonal slip rental or dry stack	\$2.8	\$9.5	\$27.3	\$24.3	\$63.9	15%
Put-in and haul-out fees	\$2.1	\$4.3	\$4.6	\$3.1	\$14.2	3%
Off-Season Storage	\$1.4	\$10.3	\$12.4	\$13.8	\$37.9	9%
Fuel	\$9.9	\$18.9	\$16.4	\$10.6	\$55.8	13%
Boat insurance	<u>\$5.3</u>	<u>\$15.8</u>	<u>\$13.1</u>	<u>\$9.9</u>	<u>\$44.0</u>	<u>11%</u>
Total	\$60.5	\$136.8	\$127.0	\$94.1	\$418.3	100%
Percent	14%	33%	30%	22%	100%	

Table 22. Annual boat operating expenses by segment.

	BOATING-RELATED EXPENSES							Total	Percent
	Equipment	Repair and maintenance	Seasonal slip rental	Put-in & Haul-Out fees	Off-season storage	Fuel	Boat insurance		
AVERAGE SPENDING (\$ per boat)									
29'+ GL waterfront home	\$340	\$872	\$327	\$125	\$537	\$445	\$401	\$2,837	
29'+ GL marina	\$730	\$932	\$1,387	\$153	\$701	\$543	\$491	\$4,967	
21 to 28' GL waterfront home	\$179	\$442	\$160	\$61	\$150	\$257	\$157	\$1,407	
<28' GL marina	\$309	\$346	\$704	\$54	\$235	\$209	\$178	\$2,037	
<21' GL waterfront home	\$328	\$158	\$62	\$14	\$42	\$98	\$71	\$773	
21'+ IL waterfront home	\$80	\$175	\$8	\$23	\$29	\$78	\$75	\$469	
<21' IL waterfront home	\$110	\$104	\$5	\$9	\$28	\$61	\$52	\$378	
IL marina	\$340	\$477	\$317	\$36	\$110	\$112	\$167	\$1,631	
<16 non-waterfront site	\$98	\$43	\$0	\$6	\$1	\$33	\$13	\$201	
16 to 20' non-waterfront site	\$223	\$203	\$2	\$36	\$21	\$103	\$59	\$599	
21'+ non-waterfront site	<u>\$177</u>	<u>\$375</u>	<u>\$26</u>	<u>\$32</u>	<u>\$44</u>	<u>\$195</u>	<u>\$99</u>	<u>\$970</u>	
Total	\$182	\$183	\$115	\$26	\$68	\$101	\$79	\$753	
FLEET TOTAL SPENDING (\$MM, 1994)									
29'+ GL waterfront home	\$1.5	\$3.9	\$1.5	\$0.6	\$2.5	\$2.0	\$1.9	\$13.9	3%
29'+ GL marina	\$12.0	\$15.3	\$23.5	\$2.7	\$11.7	\$8.7	\$8.2	\$81.7	20%
21 to 28' GL waterfront home	\$4.9	\$12.0	\$4.5	\$1.8	\$4.2	\$6.8	\$4.4	\$38.5	9%
<28' GL marina	\$11.4	\$12.7	\$26.6	\$2.1	\$8.8	\$7.5	\$6.6	\$75.2	18%
<21' GL waterfront home	\$16.0	\$7.7	\$3.1	\$0.7	\$2.1	\$4.6	\$3.5	\$37.8	9%
21'+ IL waterfront home	\$2.3	\$4.9	\$0.2	\$0.7	\$0.8	\$2.2	\$2.2	\$13.4	3%
<21' IL waterfront home	\$18.1	\$17.1	\$0.9	\$1.5	\$4.7	\$9.7	\$8.8	\$61.0	15%
IL marina	\$3.3	\$4.6	\$3.1	\$0.4	\$1.1	\$1.1	\$1.6	\$15.1	4%
<16 non-waterfront site	\$15.6	\$6.8	\$0.1	\$1.0	\$0.2	\$5.1	\$2.1	\$30.9	7%
16 to 20' non-waterfront site	\$13.7	\$12.4	\$0.1	\$2.4	\$1.3	\$6.2	\$3.7	\$39.9	10%
21'+ non-waterfront site	<u>\$2.0</u>	<u>\$4.2</u>	<u>\$0.3</u>	<u>\$0.4</u>	<u>\$0.5</u>	<u>\$2.2</u>	<u>\$1.1</u>	<u>\$10.8</u>	<u>3%</u>
Total	\$100.9	\$101.5	\$63.9	\$14.2	\$37.9	\$55.8	\$44.0	\$418.3	100%
percent	24%	24%	15%	3%	9%	13%	11%	100%	

The estimates of spending on fuel by boat owners provide the basis for a fairly accurate estimate of boat fuel consumption in 1994. Assuming an average cost of marine fuel of \$1.50 a gallon, we estimate that Michigan registered boaters consumed 37 million gallons of fuel in 1994, about 67 gallons per active boat (Table 23). This estimate is consistent with a national study of boat fuel consumption conducted by Price Waterhouse in 1991 (U.S. Fish and Wildlife Service 1992).

Using diary methods and a sample of 3,122 Michigan registered boaters, Price Waterhouse estimated that 48.8 million gallons of fuel were purchased by boaters in Michigan in 1990. This estimate must be reduced first by 13 percent for the portion of boat fuel purchased by other than registered boat owners and then by another 14 percent for differences in assumptions about the number of active craft (we estimate 555,000 active craft in 1994, while Price Waterhouse estimates fuel use for 643,300 registered boats in 1991). After these adjustments, the corresponding Price Waterhouse estimate is just under 37 million gallons. Our estimates of fuel use per boat in total and by size class are quite consistent with Price Waterhouse's 1991 national averages.

Table 23. 1994 Michigan boat fuel use by size class.

	Boat size class (feet)				Total
	<16'	16 to 20'	21 to 28'	29+	
Active craft summer 1994	286,878	156,891	90,711	20,708	555,188
Average fuel spending 1994 (\$ per boat)	34.1	119.3	179.3	510.5	100.5
Total fuel spending (\$millions)	9.8	18.7	16.3	10.6	55.3
Total gallons (million) ^a	6.5	12.5	10.8	7.0	36.9

a. Total gallons estimated by dividing fuel spending in dollars by an average price of \$1.50

TOILET FACILITIES

There were 74,000 active registered craft with on-board toilet facilities in 1994, representing 13 percent of all active registered boats. Fifty-six percent of the boats with toilets had portable toilets and 45 percent had installed toilets. Virtually all boats over 29 feet have toilet facilities. The percentage of craft with portable or fixed toilets drops to 44 percent for boats 21 to 28 feet and to 7 percent for boats 16 to 20 feet. Smaller boats tend to use portable toilets. Of boats with toilet facilities the percentage with installed toilets rather than portables increases from 13 percent for 16 to 20 foot craft to 35 percent for 21 to 28 foot boats to 90 percent for boats over 29 feet (Table 24).

Boaters with toilet facilities were asked about their frequency of use of their on-board toilets and use of pumpout facilities and dump stations in Michigan. Almost half of boaters with installed toilets report using them

on most trips, compared with a quarter of boaters with portable toilets. Use of pumpout facilities for installed toilets increases from 2.2 times a year for 16 to 20 foot craft to 5.6 times for the largest boat size class. When asked about problems in finding or using pumpouts, almost half of boaters with installed toilet facilities reported that they “never encountered problems in finding or using pumpout facilities”, 29 reported reported “hardly ever” and 20 percent reported “sometimes”. Owners of larger craft were somewhat more likely to report problems. Portable toilets were used less frequently than installed toilets. Over half of boats with portable toilets reported they never or rarely use them. Portable toilets were generally emptied at a private home or cottage for smaller boats or at a dump station or public restroom for the larger boats (Tables 24 and 25).

Table 24. Number of boats with toilet facilities by segment and size class.

	No. of boats	INSTALLED TOILETS (HEAD)			WITH PORTABLE TOILETS		
		Pct with head	No. of boats	Percent of total	Pct with portable	No. of boats	Percent of total
SEGMENT							
29'+ GL waterfront home	4,442	79.1%	3,515	10.6%	14.1%	626	1.5%
29'+ GL marina	16,100	88.3%	14,215	43.0%	8.9%	1,436	3.5%
21 to 28' GL waterfront home	26,649	17.6%	4,688	14.2%	36.6%	9,763	23.8%
<28' GL marina	36,087	26.0%	9,373	28.4%	34.4%	12,399	30.2%
<21' GL waterfront home	47,746	1.2%	573	1.7%	3.0%	1,452	3.5%
21'+ IL waterfront home	27,759	0.2%	51	0.2%	5.0%	1,379	3.4%
<21' IL waterfront home	161,005	0.0%	-	0.0%	0.4%	609	1.5%
IL marina	9,438	1.8%	173	0.5%	6.4%	606	1.5%
<16 non-waterfront site	154,897	0.0%	-	0.0%	1.9%	2,883	7.0%
16 to 20' non-waterfront site	59,960	0.1%	67	0.2%	9.3%	5,568	13.5%
<u>21'+ non-waterfront site</u>	<u>11,104</u>	<u>3.6%</u>	<u>396</u>	<u>1.2%</u>	<u>39.4%</u>	<u>4,369</u>	<u>10.6%</u>
Total	555,188	6.0%	33,052	100%	7.4%	41,090	100.0%
SIZE							
<16'	287,032	0.0%	-	0.0%	1.1%	3,287	8.0%
16 to 20'	157,118	0.9%	1,365	4.1%	5.9%	9,238	22.5%
21 to 28'	90,496	15.3%	13,804	41.8%	29.1%	26,296	64.0%
<u>>29'</u>	<u>20,542</u>	<u>87.1%</u>	<u>17,883</u>	<u>54.1%</u>	<u>11.0%</u>	<u>2,268</u>	<u>5.5%</u>
Total	555,188	6.0%	33,052	100%	7.4%	41,090	100.0%

Table 25. Toilet use by boat size class.

	BOAT SIZE CLASS ^a			Total
	16 to 20'	21 to 28'	>29'	
 percents			
BOATS WITH INSTALLED TOILETS (HEAD)				
FREQUENCY OF USING HEAD				
Most trips	37.4	27.7	62.9	47.2
Some trips	-	21.1	18.9	19.0
Rarely	37.4	30.5	14.7	22.2
Not used	25.2	20.7	3.4	11.5
PROBLEM IN FINDING OR USING PUMPOUT FACILITIES				
Most of the time	-	4.1	1.1	2.3
Sometimes	47.2	17.7	19.2	19.5
Hardly ever	-	27.8	31.3	28.8
Never	52.8	50.4	48.3	49.3
BOATS WITH PORTABLE TOILETS				
FREQUENCY OF USING PORTABLE TOILET				
Most trips	20.0	17.5	54.6	24.7
Some trips	13.9	25.5	19.8	20.8
Rarely	54.5	46.7	22.1	45.0
Not used	11.6	10.3	3.6	9.5
PLACES FOR DISCHARGING PORTABLE TOILET				
At a dump station	14.0	22.7	31.0	20.5
In a public restroom	4.1	8.1	21.8	8.7
At a home or cottage	80.2	66.2	36.4	66.4
In the water	0.9	-	-	0.2
Other	0.7	1.0	1.2	2.3
More than two places	-	2.1	9.6	1.9
PROBLEM IN FINDING OR USING DUMP STATIONS				
Most of the time	8.8	3.4	6.6	4.3
Sometimes	6.0	5.6	23.8	6.3
Hardly ever	15.8	23.6	24.1	20.2
Never	69.4	67.4	45.6	69.2

SUMMARY OF BOAT USE AND CHARACTERISTICS BY SEGMENT

We have consistently reported most of the key variables from the 1994 boater survey broken down by both size class and the 11 size and storage segments. In Tables 26-29, we provide comparable data for three simple segmentations of boats: size class, storage type and use of Great Lakes or inland waters. We have already discussed the patterns of ownership and use by size class. Bringing the variables together in a single table helps to show the importance of boat size in explaining patterns of boating use and needs for facilities and services. The number of boat days, proportion of pleasure cruising, use of temporary marina slips, spending, use of pumpout facilities and boat owner incomes all increase with the size of the boat (Table 26).

In Table 27, boats stored at permanent homes are compared with those stored at seasonal homes or marinas. Days of use, percent pleasure boating and spending increase across these three storage categories. Fishing is the most prominent use of boats kept at permanent residences. Boats kept at seasonal homes are used about equally for fishing and pleasure cruising, while boats at marinas devote only a quarter of their use to fishing.

Another useful way of segmenting boats is by use of Great Lakes vs. inland waters (Table 28). The majority of boats are used either on the Great Lakes (28 percent of all boats) or on inland waters (58 percent). Boats that use both (14 percent) divide their use 10 days to Great Lakes and 15 days to inland lakes and streams. These boats are mostly stored at non-waterfront homes and account for the vast majority of launchings at both Great Lakes and inland sites. Fishing is a popular activity for these more mobile boats. Though generally somewhat smaller craft than those used solely on the Great Lakes, boats used on both waters account for a substantial number of temporary overnights at Great Lakes marinas.

Table 26. Summary by boat size class.

	BOAT SIZE CLASS				
	<16'	16 to -20'	21 to 28'	>29'	All boats
AVERAGE BOATING DAYS OF USE					
Total boating days	20.4	27.3	28.6	32.7	24.2
Great Lakes boating days	3.2	10.8	17.3	30.5	8.7
Inland boating days	17.2	16.4	11.2	2.2	15.4
TYPES OF BOATING					
Pleasure boating	19%	51%	69%	90%	39%
Fishing	77%	40%	27%	8%	56%
Waterskiing	1%	8%	2%	0%	3%
Other	2%	1%	2%	2%	2%
TIMES TRANSPORTED & LAUNCHED AT					
Great Lakes sites	1.9	4.8	1.4	0.3	2.6
Inland sites	6.6	3.6	0.5	0.0	4.5
TEMPORARY USE OF MARINA SPACE (pct.)	2%	6%	18%	51%	7%
ANNUAL OPERATING EXPENSES					
Boating equipment	\$93	\$251	\$221	\$631	\$182
Repair and maintenance	\$39	\$231	\$353	\$924	\$183
Seasonal slip rental or dry stack	\$9	\$58	\$288	\$1,129	\$115
Put-in and haul-out fees	\$7	\$27	\$50	\$146	\$26
Off-season storage	\$5	\$63	\$132	\$642	\$68
Fuel	\$34	\$119	\$179	\$510	\$101
Boat insurance	<u>\$18</u>	<u>\$97</u>	<u>\$140</u>	<u>\$463</u>	<u>\$79</u>
Total	\$192	\$833	\$1,367	\$4,436	\$753
BOATS WITH TOILETS					
Installed toilet (head)	0%	1%	15%	87%	6%
Portable toilet	1%	6%	29%	11%	7%
AGE OF BOAT OWNER (years)	57	54	54	53	55
HOUSEHOLD INCOME DISTRIBUTION					
Under \$20,000	23%	15%	10%	3%	18%
\$20,000-\$39,999	32%	27%	26%	16%	29%
\$40,000-\$59,999	18%	21%	23%	24%	20%
\$60,000-\$99,999	13%	16%	18%	29%	16%
Over \$100,000	2%	9%	14%	19%	7%
OWN A SEASONAL HOME IN MICHIGAN	34%	35%	35%	19%	34%

Table 27. Summary by boat storage categories.

	Permanent residence	Second home	Marina	All boats
AVERAGE BOATING DAYS OF USE				
Total boating days	22.2	25.0	31.3	24.2
Great Lakes boating days	6.6	5.5	24.4	8.7
Inland boating days	15.6	19.4	6.9	15.4
TYPES OF BOATING				
Pleasure boating	29%	48%	73%	39%
Fishing	66%	45%	23%	56%
Waterskiing	3%	4%	2%	3%
Other	1%	2%	2%	2%
TIMES TRANSPORTED & LAUNCHED AT				
Great Lakes sites	3.7	0.6	1.2	2.6
Inland sites	6.8	1.3	0.4	4.5
TEMPORARY USE OF MARINA SPACE (pct.)	6%	2%	26%	7%
ANNUAL OPERATING EXPENSES				
Boating equipment	\$133	\$148	\$419	\$182
Repair and maintenance	\$129	\$138	\$515	\$183
Seasonal slip rental or dry stack	\$11	\$28	\$799	\$115
Put-in and haul-out fees	\$16	\$18	\$75	\$26
Off-season storage	\$23	\$47	\$330	\$68
Fuel	\$76	\$70	\$288	\$101
Boat insurance	<u>\$47</u>	<u>\$64</u>	<u>\$253</u>	<u>\$79</u>
Total	\$431	\$525	\$2,730	\$753
BOATS WITH TOILETS				
Installed toilet (head)	2%	2%	39%	6%
Portable toilet	6%	2%	23%	7%
AGE OF BOAT OWNER (years)	54	59	53	55
HOUSEHOLD INCOME DISTRIBUTION				
Under \$20,000	20%	16%	7%	18%
\$20,000-\$39,999	32%	25%	23%	29%
\$40,000-\$59,999	21%	16%	23%	20%
\$60,000-\$99,999	13%	20%	21%	16%
Over \$100,000	4%	11%	14%	7%
OWN A SEASONAL HOME IN MICHIGAN	14%	89%	22%	34%

Table 28. Summary by Great Lakes vs. inland usage.

	Inland use only	GL use only	Both IL & GL use	All boats
AVERAGE BOATING DAYS OF USE				
Total boating days	23.3	25.8	24.6	24.2
Great Lakes boating days	0.0	25.7	10.2	8.7
Inland boating days	23.3	0.0	14.6	15.4
TYPES OF BOATING				
Pleasure boating	35%	53%	28%	39%
Fishing	60%	42%	67%	56%
Waterskiing	4%	1%	3%	3%
Other	1%	2%	3%	2%
TIMES TRANSPORTED & LAUNCHED AT				
Great Lakes sites	0.1	4.6	8.6	2.6
Inland sites	5.5	0.3	9.3	4.5
TEMPORARY USE OF MARINA SPACE (pct.)				
	1%	18%	14%	7%
ANNUAL OPERATING EXPENSES				
Boating equipment	\$114	\$294	\$223	\$182
Repair and maintenance	\$105	\$340	\$174	\$183
Seasonal slip rental or dry stack	\$15	\$341	\$55	\$115
Put-in and haul-out fees	\$11	\$53	\$26	\$26
Off-season storage	\$24	\$168	\$41	\$68
Fuel	\$47	\$205	\$105	\$101
Boat insurance	<u>\$43</u>	<u>\$152</u>	<u>\$72</u>	<u>\$79</u>
Total	\$349	\$1,571	\$664	\$753
BOATS WITH TOILETS				
Installed toilet (head)	0%	20%	3%	6%
Portable toilet	2%	20%	7%	7%
AGE OF BOAT OWNER (years)				
	57	55	48	55
HOUSEHOLD INCOME DISTRIBUTION				
Under \$20,000	19%	15%	16%	18%
\$20,000-\$39,999	32%	24%	28%	29%
\$40,000-\$59,999	17%	22%	32%	20%
\$60,000-\$99,999	15%	18%	12%	16%
Over \$100,000	6%	10%	5%	7%
OWN A SEASONAL HOME IN MICHIGAN				
	38%	31%	21%	34%

REGIONAL DISTRIBUTION OF USE

The Approach

An important objective of the 1994 survey is to develop improved procedures for estimating boating use and facility needs at the county level. Patterns of use and facility needs are explained to a considerable degree by the size of boat and type of storage (i.e., our boat segments). The location of boat use is explained largely by where the boat is kept. Boat registration statistics are a misleading indicator of the locations of use because many boats are registered from the owner's permanent residence but stored and used at a seasonal home or marina in a different county or region. A key to developing reliable estimates of boating use at the county level is, therefore, to adjust the registration counts by size and county to reflect where boats are stored during the boating season. With this information, boating use and facility needs can be predicted more accurately.

We use a three-step approach to estimate boat use and facility needs at the county level. First, we estimate the number of craft kept in each region within the 11 boat market segments (Table 29). Ten in-state boating regions, as defined in Figure 4, are used in this analysis. Coastal counties are grouped into eight regions. Inland counties are divided into a northern and a southern region. The original sampling regions (Figure 2) are not used in this analysis to discriminate between coastal and non-coastal counties. The regions for this analysis overlap somewhat with the sampling regions, so an additional weight was applied to adjust the sample within each region to the county distribution of registered boats.

The second step is to allocate boats within each region and segment to individual counties. Distinct allocation schemes are used for each segment. Boats in non-waterfront segments were distributed to counties within each region in proportion to the county's share of registered boats in the region. The rationale here is that boats at non-waterfront homes will mostly be registered in the same county where they are kept. Boats in Great Lakes marina segments were distributed according to the county's share of seasonal marina slips in the region (Report 1), assuming similar marina occupancy rates for counties within a given region. Distribution of craft in other segments was based on equal weight to the number of seasonal homes in the county and the number of registered boats in the county. The former captures boats stored at seasonal homes, and the latter, boats at permanent waterfront homes. Table 30 reports the result of applying these allocation rules to Table 29. This allocation scheme yields a complete accounting of active registered boats by the county where the boat is kept and by segments reflecting boat size and storage.

Table 29. Number of boats by segment and region where the boat is kept during the boating season.

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total kept	Kept/regs
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats		
TOTAL FLEET													
Southeast	2,660	8,855	15,145	17,155	11,711	-	2,522	259	19,417	12,682	3,788	94,194	0.9
East Central	87	1,215	1,321	5,347	4,284	-	1,204	28	8,325	4,583	1,140	27,534	1.9
Northeast	153	754	1,571	2,286	5,917	2,324	12,023	100	6,458	2,205	422	34,213	2.1
Northwest	665	1,508	1,889	4,020	5,552	2,916	20,149	2,111	10,495	4,233	481	54,018	1.8
West Central	416	1,856	2,276	3,126	2,431	413	2,767	21	7,754	5,107	907	27,075	1.0
Southwest	135	1,442	684	885	2,071	1,099	6,531	663	7,499	2,032	808	23,848	1.1
South Inland	-	-	-	-	-	12,875	68,573	5,130	72,648	21,757	2,929	183,912	0.7
North Inland	-	-	-	-	-	7,784	40,640	1,573	17,354	4,657	396	72,403	2.0
U.P. South	189	284	1,016	523	4,063	717	6,673	-	3,286	1,353	117	18,220	1.4
U.P. North	88	248	816	616	6,095	317	4,173	6	4,752	1,811	136	19,058	1.2
Out of state	<u>27</u>	<u>203</u>	<u>0</u>	<u>74</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>361</u>	<u>47</u>	<u>713</u>	0.0
Total	4,419	16,365	24,718	34,031	42,124	28,444	165,255	9,892	157,988	60,781	11,172	555,188	1.0
SEGMENT DISTRIBUTION (percent)													
Southeast	3%	9%	16%	18%	12%	0%	3%	0%	21%	13%	4%	100%	
East Central	0%	4%	5%	19%	16%	0%	4%	0%	30%	17%	4%	100%	
Northeast	0%	2%	5%	7%	17%	7%	35%	0%	19%	6%	1%	100%	
Northwest	1%	3%	3%	7%	10%	5%	37%	4%	19%	8%	1%	100%	
West Central	2%	7%	8%	12%	9%	2%	10%	0%	29%	19%	3%	100%	
Southwest	1%	6%	3%	4%	9%	5%	27%	3%	31%	9%	3%	100%	
South Inland	0%	0%	0%	0%	0%	7%	37%	3%	40%	12%	2%	100%	
North Inland	0%	0%	0%	0%	0%	11%	56%	2%	24%	6%	1%	100%	
U.P. South	1%	2%	6%	3%	22%	4%	37%	0%	18%	7%	1%	100%	
U.P. North	0%	1%	4%	3%	32%	2%	22%	0%	25%	10%	1%	100%	
Out of state	<u>4%</u>	<u>29%</u>	<u>0%</u>	<u>10%</u>	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>51%</u>	<u>7%</u>	<u>100%</u>	
Total	1%	3%	4%	6%	8%	5%	30%	2%	28%	11%	2%	100%	

Table 30. Number of boats by segment and county where the boat is kept during the boating season.

County	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total Kept/ kept regs	
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boat	>20' Boats		
Alcona	26	7	266	21	1,002	394	2,036	17	659	225	43	4,696	2.8
Alger	7	4	65	11	487	25	333	1	331	126	9	1,400	1.2
Allegan	41	328	207	201	627	333	1,977	201	2,398	650	259	7,221	1.0
Alpena	20	49	206	150	775	305	1,576	13	1,251	427	82	4,854	1.5
Antrim	89	49	253	131	745	391	2,703	283	1,221	493	56	6,414	1.9
Arenac	19	228	192	691	725	285	1,472	12	957	327	63	4,970	2.0
Baraga	4	46	39	113	293	15	201	0	195	74	6	987	1.5
Barry	0	0	0	0	0	368	1,960	147	1,751	524	71	4,821	0.8
Bay	19	686	297	3,018	961	0	270	6	2,312	1,273	317	9,159	1.2
Benzie	61	149	175	396	513	269	1,862	195	865	349	40	4,875	2.0
Berrien	57	833	290	511	879	467	2,773	282	3,207	869	346	10,514	1.1
Branch	0	0	0	0	0	308	1,641	123	1,315	394	53	3,834	0.9
Calhoun	0	0	0	0	0	387	2,061	154	2,281	683	92	5,658	0.7
Cass	0	0	0	0	0	401	2,135	160	1,760	527	71	5,054	0.9
Charlevoix	76	436	216	1,163	634	333	2,302	241	1,074	433	49	6,957	2.3
Cheboygan	31	153	320	462	1,206	474	2,451	20	1,355	463	89	7,025	2.0
Chippewa	19	87	176	216	1,315	68	900	1	944	360	27	4,113	1.2
Clare	0	0	0	0	0	771	4,025	156	1,387	372	32	6,742	2.3
Clinton	0	0	0	0	0	208	1,106	83	1,270	380	51	3,098	0.7
Crawford	0	0	0	0	0	406	2,120	82	890	239	20	3,757	2.0
Delta	60	77	322	141	1,288	156	1,450	0	844	347	30	4,714	1.4
Dickinson	0	0	0	0	0	112	1,041	0	614	253	22	2,043	0.8
Eaton	0	0	0	0	0	291	1,548	116	1,759	527	71	4,311	0.7
Emmet	85	159	242	424	712	374	2,583	271	1,195	482	55	6,580	2.0
Genesee	0	0	0	0	0	1,124	5,985	448	6,751	2,022	272	16,601	0.7
Gladwin	0	0	0	0	0	615	3,209	124	1,500	403	34	5,885	1.9
Gogebic	10	10	95	25	710	37	486	1	521	199	15	2,110	1.2
Grand Traverse	140	78	399	209	1,173	616	4,258	446	3,022	1,219	139	11,701	1.4
Graiot	0	0	0	0	0	121	647	48	725	217	29	1,788	0.7
Hillsdale	0	0	0	0	0	226	1,205	90	985	295	40	2,842	0.9
Houghton	11	39	104	96	775	40	531	1	643	245	18	2,503	1.1
Huron	16	338	239	1,486	773	0	217	5	720	396	99	4,289	1.9
Ingham	0	0	0	0	0	588	3,132	234	3,548	1,063	143	8,708	0.7
Ionia	0	0	0	0	0	184	978	73	1,044	313	42	2,634	0.8
Iosco	38	304	393	922	1,481	582	3,009	25	1,456	497	95	8,803	2.4
Iron	0	0	0	0	0	114	1,057	0	458	189	16	1,834	1.0
Isabella	0	0	0	0	0	177	943	71	881	264	36	2,371	0.8
Jackson	0	0	0	0	0	595	3,171	237	3,254	975	131	8,364	0.8
Kalamazoo	0	0	0	0	0	670	3,566	267	3,990	1,195	161	9,848	0.7
Kalkaska	0	0	0	0	0	367	1,918	74	832	223	19	3,434	2.0
Kent	0	0	0	0	0	1,514	8,063	603	9,027	2,703	364	22,275	0.7
Keweenaw	3	4	31	9	235	12	161	0	77	29	2	564	2.4
Lake	0	0	0	0	0	596	3,109	120	697	187	16	4,725	3.3
Lapeer	0	0	0	0	0	247	1,314	98	1,354	405	55	3,473	0.8
Leelanau	83	238	236	634	694	364	2,518	264	1,191	481	55	6,757	2.0
Lenawee	0	0	0	0	0	373	1,986	149	1,807	541	73	4,928	0.8
Livingston	0	0	0	0	0	569	3,032	227	3,139	940	127	8,034	0.8
Luce	5	0	46	0	345	18	236	0	278	106	8	1,042	1.1
Mackinac	60	120	322	220	1,289	156	1,450	0	534	220	19	4,389	2.1
Macomb	856	3,015	4,874	5,841	3,769	0	812	83	6,347	4,146	1,238	30,980	0.9
Manistee	63	244	179	649	527	277	1,914	201	899	363	41	5,358	2.2
Marquette	23	47	212	116	1,582	82	1,083	2	1,497	570	43	5,257	1.0
Mason	66	155	188	414	554	291	2,009	211	1,027	414	47	5,377	1.9
Mecosta	0	0	0	0	0	478	2,495	97	1,520	408	35	5,032	1.6
Menominee	37	80	199	147	797	96	897	0	477	197	17	2,946	1.6
Midland	0	0	0	0	0	326	1,737	130	1,917	574	77	4,762	0.8
Missaukee	0	0	0	0	0	277	1,446	56	698	187	16	2,681	1.9
Monroe	190	1,851	1,080	3,587	835	0	180	18	1,381	902	269	10,293	1.4
Montcalm	0	0	0	0	0	328	1,749	131	1,375	412	55	4,050	0.9
Montmorency	0	0	0	0	0	435	2,271	88	713	191	16	3,714	2.5
Muskegon	146	657	797	1,107	852	145	969	7	2,950	1,943	345	9,919	1.0
Newaygo	0	0	0	0	0	690	3,604	139	2,078	558	47	7,117	1.6

Continued on next page

Table 30. Number of boats by segment and county where the boat is kept during the boating season (continued)

County	Great Lakes waterfront					Inland Waterfront			Non-waterfront			Total Kept/ Kept Regs	
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boat	>20' Boats		
Oakland	0	0	0	0	0	2,759	14,694	1,099	16,434	4,922	663	40,570	0.7
Oceana	60	41	329	69	351	60	400	3	557	367	65	2,302	1.2
Ogemaw	0	0	0	0	0	553	2,889	112	1,092	293	25	4,964	2.2
Ontonagon	5	12	47	29	352	18	241	0	266	101	8	1,081	1.2
Oscoda	0	0	0	0	0	397	2,073	80	625	168	14	3,358	2.6
Otsego	0	0	0	0	0	406	2,122	82	964	259	22	3,856	1.9
Saginaw	31	21	471	93	1,528	0	429	10	3,750	2,064	513	8,910	0.7
Saint Clair	285	1,735	1,621	3,361	1,253	0	270	28	1,860	1,215	363	11,988	1.2
Saint Joseph	0	0	0	0	0	342	1,822	136	1,774	531	72	4,678	0.8
Sanilac	11	86	164	379	532	0	149	4	502	276	69	2,170	1.4
Schoolcraft	32	8	172	15	690	83	776	0	358	148	13	2,295	1.7
Shiawassee	0	0	0	0	0	210	1,119	84	1,269	380	51	3,113	0.7
Tuscola	10	84	151	372	490	0	138	3	1,042	574	143	3,005	0.9
Van Buren	37	281	186	172	565	300	1,780	181	1,894	513	204	6,114	1.1
Washtenaw	0	0	0	0	0	559	2,978	223	3,236	969	130	8,095	0.8
Wayne	1,329	2,254	7,571	4,367	5,854	0	1,261	129	9,830	6,420	1,918	40,932	0.8
Wexford	0	0	0	0	0	399	2,081	81	1,467	394	33	4,454	1.5
Out of state	27	203	0	74	0	0	0	0	0	361	47	713	0.0
Total	4,419	16,365	24,718	34,031	42,124	28,444	165,255	9,892	157,989	60,781	11,172	555,188	

The third step in the approach to generating county-level estimates is to apply various boat use parameters estimated by segment from the survey to the distribution of boats by segment for each county. For example, to estimate total days of boating in a given county, we multiply the estimates of average days of boating by segment from Table 19 times the numbers of boats within each segment for the given county (from Table 30) and sum across segments. In a similar fashion, we estimate Great Lakes or inland boat days, number of boats with toilets, number of times boats pump out in each county, annual operating expenses of boaters in each county, etc.

This approach yields much more reliable estimates at the county level than would be obtained through direct crosstabulations of variables by county using the survey data set. Slightly fewer than 3,000 cases are inadequate to directly estimate boating activity at the county level. Larger samples, however, are not needed if one takes advantage of some predictable patterns of boaters and makes a few simplifying assumptions. Our approach makes three basic assumptions.

- We assume that Table 30 provides reliable estimates of the distribution of boats by segment and region where boats are kept. The survey provides adequate sample sizes to estimate the distribution of boats at the regional level for most regions. Estimates for the Upper Peninsula will have somewhat larger sampling errors than those for Lower Peninsula regions. Additional modeling is underway to further refine these procedures by modeling origin-destination patterns between regions.

- We assume that the rules for allocating boats to counties within each region capture the county-level distributions correctly. By using census information at a county level (registrations, seasonal homes, and marina slips), we are able to allocate boats to counties based on reasonably complete information.

Assumptions involved here are that seasonal homes in counties within a given region have similar likelihoods of providing storage for boats, that registration numbers for counties within a given region will reflect permanent home boat storage distributions, and that the county-level occupancy rates for marinas will not vary much within a given region. Also contributing to the robustness of the allocation procedure is that the Great Lakes regions are reasonably small (three to five counties) so that we cannot be too far off in allocating boats to counties within these regions. The larger inland regions will likely experience larger potential allocation errors. These errors will be less serious for estimating Great Lakes use and facility needs, our focus in the 1994 study.

- . We assume that the parameter estimates for average days of use, percentage of boats with toilets, etc., do not vary much spatially within our boat segments. Statistical tests performed on the survey data support the conclusion that most of the variation in the key parameters is explained by segment, not by region. Size of boat and type of storage --waterfront or not, marina, Great Lakes or inland -- explain which boats have toilets, which use Great Lakes or inland waters, the amount and type of use, spending, and the propensities to use marinas, pumpouts or launching sites. Nevertheless, there will be some spatial variations that our procedures will not capture.

Results

The numbers of active registered craft by segment and county where the boat is kept during the summer are reported in Table 30. The county-level estimates sum to regional and state totals. The column at the far right in Table 30 indicates which counties are importing or exporting boats, based on a comparison of the number of active boats kept in the county relative to active boats registered there. For example, Alcona County has 2.9 boats kept in the county for every boat registered there, because of large numbers of boats stored at seasonal homes that are registered in southern Michigan counties or from out of state. The regions with the highest ratios of boats stored in the region relative to the number registered there are Northeast Michigan (Region 3), the North Central inland region (Region 8) and the southern half of the Upper Peninsula (Region 9). These regions have almost twice

as many boats stored and used in the region as registered there. Table 30 provides the basis for all of the county and regional estimates that follow.

Based on the region where boats are kept, Tables 31-39 summarize the regional distributions by segment for total boat days (Table 31), Great Lakes boat days (Table 32), inland boat days (Table 33), boats kept at seasonal homes (Table 34), boats kept at marinas (Table 35), boats with installed toilets (Table 36), number of times boats used pumpouts (Table 37), total boat operating expenses (Table 38) and gallons of fuel purchased by boaters (Table 39). Corresponding tables at the county level by segment appear in Appendix B using corresponding table numbers, i.e., B31-B39. Estimates of total Great Lakes and inland boat days (Table 40), boats with toilets and pumpout use (Table 41), boats stored at marinas and seasonal homes (Table 42), and boat operating expenses and fuel purchases (Table 43) are summarized at the county level in Tables 40-43.

Table 31. Total boat days by segment and region where the boat is kept (000's)

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	88.7	288.1	475.0	515.7	305.7	-	71.7	9.1	328.1	235.1	60.1	2,377.4
East Central	2.9	39.5	41.4	160.7	111.8	-	34.3	1.0	140.7	85.0	18.1	635.4
Northeast	5.1	24.5	49.3	68.7	154.5	65.6	342.1	3.5	109.1	40.9	6.7	870.0
Northwest	22.2	49.1	59.2	120.8	144.9	82.3	573.3	74.5	177.3	78.5	7.6	1,389.8
West Central	13.9	60.4	71.4	94.0	63.5	11.7	78.7	0.7	131.0	94.7	14.4	634.3
Southwest	4.5	46.9	21.4	26.6	54.1	31.0	185.8	23.4	126.7	37.7	12.8	571.0
South Inland	-	-	-	-	-	363.4	1,951.0	181.1	1,227.6	403.4	46.5	4,173.0
North Inland	-	-	-	-	-	219.7	1,156.3	55.5	293.3	86.3	6.3	1,817.4
U.P. South	6.3	9.2	31.9	15.7	106.1	20.2	189.9	-	55.5	25.1	1.9	461.7
U.P. North	2.9	8.1	25.6	18.5	159.1	8.9	118.7	0.2	80.3	33.6	2.2	458.2
<u>Out of state</u>	<u>0.9</u>	<u>6.6</u>	<u>0.0</u>	<u>2.2</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>6.7</u>	<u>0.8</u>	<u>17.2</u>
Total	147.3	532.5	775.3	1,022.9	1,099.7	802.9	4,701.7	349.1	2,669.8	1,126.8	177.3	13,405.4

Table 32. Total Great Lakes boat days by segment and region where the boat is kept (000's).

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	86.7	275.3	457.9	470.0	270.5	-	1.4	0.5	58.3	128.2	46.8	1,795.8
East Central	2.8	37.8	40.0	146.5	99.0	-	0.7	0.1	25.0	46.3	14.1	412.2
Northeast	5.0	23.5	47.5	62.6	136.7	0.3	6.7	0.2	19.4	22.3	5.2	329.3
Northwest	21.7	46.9	57.1	110.1	128.2	0.4	11.2	4.4	31.5	42.8	5.9	460.3
West Central	13.6	57.7	68.8	85.7	56.2	0.1	1.5	0.0	23.3	51.6	11.2	369.7
Southwest	4.4	44.8	20.7	24.2	47.8	0.1	3.6	1.4	22.5	20.5	10.0	200.2
South Inland	-	-	-	-	-	1.6	38.1	10.8	218.2	220.0	36.2	524.8
North Inland	-	-	-	-	-	1.0	22.6	3.3	52.1	47.1	4.9	130.9
U.P. South	6.1	8.8	30.7	14.3	93.9	0.1	3.7	-	9.9	13.7	1.4	182.7
U.P. North	2.9	7.7	24.7	16.9	140.8	0.0	2.3	0.0	14.3	18.3	1.7	229.5
<u>Out of state</u>	<u>0.9</u>	<u>6.3</u>	<u>0.0</u>	<u>2.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>3.7</u>	<u>0.6</u>	<u>13.5</u>
Total	144.0	508.9	747.4	932.4	973.1	3.6	91.7	20.7	474.4	614.5	138.1	4,648.9

Table 33. Total Inland boat days by segment and region where the boat is kept (000's).

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	3.7	11.7	15.8	44.3	34.5	-	70.5	8.6	271.0	107.7	13.3	581.0
East Central	0.1	1.6	1.4	13.8	12.6	-	33.7	0.9	116.2	38.9	4.0	223.2
Northeast	0.2	1.0	1.6	5.9	17.4	64.8	336.1	3.3	90.1	18.7	1.5	540.8
Northwest	0.9	2.0	2.0	10.4	16.4	81.3	563.3	70.2	146.5	36.0	1.7	930.6
West Central	0.6	2.4	2.4	8.1	7.2	11.5	77.4	0.7	108.2	43.4	3.2	265.0
Southwest	0.2	1.9	0.7	2.3	6.1	30.7	182.6	22.0	104.6	17.3	2.8	371.2
South Inland	-	-	-	-	-	359.1	1,917.2	170.6	1,013.8	184.8	10.3	3,655.7
North Inland	-	-	-	-	-	217.1	1,136.2	52.3	242.2	39.6	1.4	1,688.7
U.P. South	0.3	0.4	1.1	1.3	12.0	20.0	186.6	-	45.9	11.5	0.4	279.3
U.P. North	0.1	0.3	0.9	1.6	18.0	8.8	116.7	0.2	66.3	15.4	0.5	228.7
<u>Out of state</u>	<u>0.0</u>	<u>0.3</u>	<u>0.0</u>	<u>0.2</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>3.1</u>	<u>0.2</u>	<u>3.7</u>
Total	6.1	21.6	25.8	87.9	124.1	793.4	4,620.2	328.9	2,204.7	516.4	39.2	8,768.0

Table 34. Number of boats stored at seasonal homes by segment and region where the boat is kept .

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	40	0	226	0	174	0	36	0	46	30	9	560
East Central	19	0	283	0	917	0	246	0	163	90	22	1740
Northeast	147	0	1509	0	5684	2128	11007	0	963	329	63	21830
Northwest	508	0	1444	0	4245	2125	14681	0	1280	516	59	24858
West Central	70	0	382	0	408	66	443	0	153	101	18	1641
Southwest	31	0	156	0	472	239	1420	0	287	78	31	2714
South Inland	0	0	0	0	0	980	5218	0	850	254	34	7336
North Inland	0	0	0	0	0	8557	44678	0	3111	835	71	57252
U.P. South	141	0	760	0	3042	478	4451	0	357	147	13	9389
U.P. North	57	0	525	0	3919	194	2557	0	483	184	14	7931
<u>Out of state</u>	13	0	0	0	0	0	0	0	0	29	4	46
Total	1025	0	5285	0	18863	14766	84736	0	7692	2593	337	135297

Table 35. Number of boats stored at marinas by segment and region where the boat is kept .

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	-	8,855	-	17,155	-	-	-	259	-	-	599	26,867
East Central	-	1,215	-	5,347	-	-	-	28	-	-	180	6,770
Northeast	-	754	-	2,286	-	-	-	100	-	-	67	3,207
Northwest	-	1,508	-	4,020	-	-	-	2,111	-	-	76	7,715
West Central	-	1,856	-	3,126	-	-	-	21	-	-	143	5,147
Southwest	-	1,442	-	885	-	-	-	663	-	-	128	3,117
South Inland	-	-	-	-	-	-	-	5,130	-	-	463	5,593
North Inland	-	-	-	-	-	-	-	1,573	-	-	63	1,635
U.P. South	-	284	-	523	-	-	-	-	-	-	18	825
U.P. North	-	248	-	616	-	-	-	6	-	-	21	891
<u>Out of state</u>	-	203.25	-	74.16	-	-	-	-	-	-	7.48	284.89
Total	-	16,365	-	34,031	-	-	-	9,892	-	-	1,765	62,053

Table 36. Number of boats with installed toilets (head) by segment and region where the boat is kept .

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	2,105	7,818	2,664	4,456	141	-	-	5	-	14	135	17,338
East Central	69	1,073	232	1,389	51	-	-	1	-	5	41	2,861
Northeast	121	666	276	594	71	4	-	2	-	2	15	1,752
Northwest	526	1,331	332	1,044	67	5	-	39	-	5	17	3,366
West Central	329	1,639	400	812	29	1	-	0	-	6	32	3,249
Southwest	107	1,273	120	230	25	2	-	12	-	2	29	1,800
South Inland	-	-	-	-	-	23	-	94	-	24	105	246
North Inland	-	-	-	-	-	14	-	29	-	5	14	62
U.P. South	149	251	179	136	49	1	-	-	-	2	4	770
U.P. North	70	219	144	160	73	1	-	0	-	2	5	673
<u>Out of state</u>	<u>21</u>	<u>179</u>	<u>0</u>	<u>19</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>222</u>
Total	3,497	14,449	4,349	8,839	506	52	-	181	-	68	399	32,339

Table 37. Number of times pumped out by segment and region where the boat is kept .

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	10,800	43,902	2,959	15,647	251	-	-	54	-	-	146	73,760
East Central	353	6,025	258	4,877	92	-	-	6	-	-	44	11,655
Northeast	622	3,741	307	2,085	127	9	-	21	-	-	16	6,928
Northwest	2,699	7,476	369	3,666	119	11	-	442	-	-	19	14,801
West Central	1,689	9,202	445	2,852	52	2	-	4	-	-	35	14,280
Southwest	548	7,149	134	807	44	4	-	139	-	-	31	8,856
South Inland	-	-	-	-	-	48	-	1,073	-	-	113	1,234
North Inland	-	-	-	-	-	29	-	329	-	-	15	373
U.P. South	766	1,409	198	477	87	3	-	-	-	-	5	2,944
U.P. North	357	1,229	159	561	131	1	-	1	-	-	5	2,446
<u>Out of state</u>	<u>109</u>	<u>1,008</u>	<u>0</u>	<u>68</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>1,186</u>
Total	17,943	81,141	4,829	31,040	904	106	-	2,069	-	-	431	138,462

Table 38. Total boat operating expenses by segment and region where the boat is kept (\$millions)

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	7.5	44.0	21.3	34.9	9.1	-	1.0	0.4	3.9	7.6	3.7	133.4
East Central	0.2	6.0	1.9	10.9	3.3	-	0.5	0.0	1.7	2.7	1.1	28.4
Northeast	0.4	3.7	2.2	4.7	4.6	1.1	4.5	0.2	1.3	1.3	0.4	24.4
Northwest	1.9	7.5	2.7	8.2	4.3	1.4	7.6	3.4	2.1	2.5	0.5	42.1
West Central	1.2	9.2	3.2	6.4	1.9	0.2	1.0	0.0	1.6	3.1	0.9	28.6
Southwest	0.4	7.2	1.0	1.8	1.6	0.5	2.5	1.1	1.5	1.2	0.8	19.5
South Inland	-	-	-	-	-	6.0	25.9	8.4	14.6	13.0	2.8	70.8
North Inland	-	-	-	-	-	3.6	15.4	2.6	3.5	2.8	0.4	28.2
U.P. South	0.5	1.4	1.4	1.1	3.1	0.3	2.5	-	0.7	0.8	0.1	12.0
U.P. North	0.2	1.2	1.1	1.3	4.7	0.1	1.6	0.0	1.0	1.1	0.1	12.5
<u>Out of state</u>	<u>0.1</u>	<u>1.0</u>	<u>0.0</u>	<u>0.2</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.2</u>	<u>0.0</u>	<u>1.5</u>
Total	12.5	81.3	34.8	69.3	32.6	13.3	62.5	16.1	31.8	36.4	10.8	401.5

Table 39. Gallons of boat fuel purchased by segment and region where the boat is kept (million gallons).

Region	Great Lakes waterfront					Inland waterfront			Non-waterfront			Total
	29'+ Home	29'+ Marina	21-28' Home	<28' Marina	<21' Home	21'+ Home	<21' Home	Marina all sizes	<16' Boats	16-20' Boats	>20' Boats	
Southeast	0.8	3.2	2.6	2.4	0.8	-	0.1	0.0	0.4	0.9	0.5	11.7
East Central	0.0	0.4	0.2	0.7	0.3	-	0.0	0.0	0.2	0.3	0.1	2.4
Northeast	0.0	0.3	0.3	0.3	0.4	0.1	0.5	0.0	0.1	0.2	0.1	2.3
Northwest	0.2	0.5	0.3	0.6	0.4	0.2	0.8	0.2	0.2	0.3	0.1	3.7
West Central	0.1	0.7	0.4	0.4	0.2	0.0	0.1	0.0	0.2	0.4	0.1	2.6
Southwest	0.0	0.5	0.1	0.1	0.1	0.1	0.3	0.0	0.2	0.1	0.1	1.7
South Inland	-	-	-	-	-	0.7	2.8	0.4	1.6	1.5	0.4	7.3
North Inland	-	-	-	-	-	0.4	1.6	0.1	0.4	0.3	0.1	2.9
U.P. South	0.1	0.1	0.2	0.1	0.3	0.0	0.3	-	0.1	0.1	0.0	1.2
U.P. North	0.0	0.1	0.1	0.1	0.4	0.0	0.2	0.0	0.1	0.1	0.0	1.2
<u>Out of state</u>	<u>0.0</u>	<u>0.1</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.1</u>
Total	1.3	5.9	4.2	4.8	2.7	1.5	6.7	0.7	3.5	4.2	1.5	37.0

a. Assumes an average price of \$1.50 for marina fuel in 1994.

Table 40. Estimates of boat use by county where the boat is kept (000's).

County	Boat days of use (000's)			County	Boat days of use (000's)		
	Total	Great Lakes	Inland		Total	Great Lakes	Inland
Alcona	121.85	38.82	83.06	Lapeer	79.09	9.81	69.43
Alger	33.76	16.45	17.32	Leelanau	176.21	61.73	114.58
Allegan	170.35	56.30	114.20	Lenawee	113.99	13.26	100.92
Alpena	117.72	40.46	77.33	Livingston	182.82	22.73	160.42
Antrim	164.48	44.37	120.29	Luce	24.64	11.66	12.99
Arenac	127.34	57.01	70.31	Mackinac	115.30	56.08	59.22
Baraga	24.83	14.14	10.68	Macomb	783.26	593.02	190.00
Barry	111.76	12.88	99.08	Manistee	140.88	53.43	87.52
Bay	223.68	159.71	63.82	Marquette	123.48	59.75	63.79
Benzie	126.87	42.71	84.25	Mason	138.66	46.27	92.49
Berrien	254.23	95.74	158.63	Mecosta	121.68	10.76	111.09
Branch	90.08	9.80	80.43	Menominee	75.56	36.32	39.26
Calhoun	127.67	16.41	111.49	Midland	107.49	13.80	93.89
Cass	118.36	13.06	105.49	Missaukee	66.47	5.14	61.41
Charlevoix	185.35	79.10	106.27	Monroe	280.14	230.70	49.06
Cheboygan	178.17	67.29	110.91	Montcalm	95.39	10.27	85.28
Chippewa	100.44	52.25	48.20	Montmorency	95.84	5.78	90.17
Clare	172.61	10.98	161.83	Muskegon	230.03	132.63	97.54
Clinton	69.58	9.11	60.60	Newaygo	173.15	14.85	158.55
Crawford	94.46	6.74	87.84	Oakland	914.20	118.12	797.77
Delta	119.27	54.92	64.39	Oceana	55.32	29.61	25.75
Dickinson	48.21	5.26	43.04	Ogemaw	126.04	8.46	117.74
Eaton	96.94	12.62	84.50	Ontonagon	26.00	12.95	13.06
Emmet	170.51	54.29	116.35	Osceola	83.53	6.12	77.52
Genesee	373.69	48.48	325.90	Oscoda	86.93	5.12	81.90
Gladwin	146.38	11.12	135.46	Otsego	96.20	7.19	89.14
Gogebic	50.58	24.65	25.95	Ottawa	348.99	207.44	141.69
Grand Traverse	286.83	78.40	208.80	Presque Isle	96.79	31.33	65.50
Gratiot	40.29	5.21	35.15	Roscommon	237.08	16.02	221.35
Hillsdale	66.62	7.32	59.41	Saginaw	181.52	92.48	89.30
Houghton	59.98	30.19	29.81	St. Clair	318.83	255.79	62.74
Huron	111.30	84.33	26.84	St. Joseph	107.28	12.93	94.54
Ingham	195.91	25.47	170.80	Sanilac	52.62	35.88	16.72
Ionia	59.72	7.54	52.29	Schoolcraft	58.62	26.01	32.63
Iosco	228.13	94.44	133.67	Shiawassee	70.02	9.11	61.04
Iron	44.79	4.08	40.78	Tuscola	66.30	39.78	26.55
Isabella	54.67	6.45	48.32	Van Buren	146.40	48.15	98.38
Jackson	190.55	23.58	167.31	Washtenaw	183.09	23.32	160.10
Kalamazoo	221.89	28.67	193.63	Wayne	995.21	716.32	279.19
Kalkaska	86.06	6.26	79.92	Wexford	105.92	10.17	95.91
Kent	501.88	64.88	437.93	Out of state	17.18	13.46	3.73
Keweenaw	14.44	7.50	6.93				
Lake	125.02	6.23	118.92	Total	13,405.40	4,648.93	8,767.99

Table 41. Boats with installed toilets (head) and total pumpout use by county where the boat is kept.

County	Boats with Heads	Pumpout Uses	County	Boats with Heads	Pumpout Uses
Alcona	94	4	Lapeer	5	21
Alger	30	0	Leelanau	498	55
Allegan	432	42	Lenawee	7	31
Alpena	148	3	Livingston	11	47
Antrim	210	59	Luce	17	0
Arenac	441	3	Mackinac	283	-
Baraga	84	0	Macomb	5,809	17
Barry	6	31	Manistee	478	42
Bay	1,481	1	Marquette	148	0
Benzie	326	41	Mason	344	44
Berrien	995	59	Mecosta	4	20
Branch	5	26	Menominee	184	-
Calhoun	8	32	Midland	6	27
Cass	7	33	Missaukee	2	12
Charlevoix	800	50	Monroe	2,927	4
Cheboygan	355	4	Montcalm	5	27
Chippewa	196	0	Montmorency	3	18
Clare	6	33	Muskegon	1,148	2
Clinton	4	17	Newaygo	6	29
Crawford	3	17	Oakland	54	230
Delta	225	-	Oceana	167	1
Dickinson	1	-	Ogemaw	4	23
Eaton	6	24	Ontonagon	35	0
Emmet	377	57	Osceola	3	15
Genesee	22	94	Oscoda	3	17
Gladwin	5	26	Otsego	3	17
Gogebic	50	0	Ottawa	1,934	2
Grand Traverse	334	93	Presque Isle	83	3
Gratiot	2	10	Roscommon	8	44
Hillsdale	4	19	Saginaw	189	2
Houghton	97	0	St. Clair	2,944	6
Huron	752	1	St. Joseph	6	29
Ingham	12	49	Sanilac	221	1
Ionia	4	15	Schoolcraft	76	-
Iosco	631	5	Shiawassee	4	18
Iron	1	-	Tuscola	217	1
Isabella	3	15	Van Buren	373	38
Jackson	11	50	Washtenaw	11	47
Kalamazoo	13	56	Wayne	5,656	27
Kalkaska	3	16	Wexford	4	17
Kent	30	126	Out of state	222	-
Keweenaw	17	0			
Lake	4	25	Total	32,339	2,069

Table 42. Boats stored at seasonal homes and marinas by county where the boat is kept.

County	Number of boats stored at		County	Number of boats stored at	
	Seasonal homes	Marinas		Seasonal homes	Marinas
Alcona	5,764	51	Lapeer	143	107
Alger	897	17	Leelanau	4,303	1,144
Allegan	776	770	Lenawee	469	160
Alpena	1,103	225	Livingston	463	247
Antrim	4,403	472	Luce	620	2
Arenac	2,190	941	Mackinac	4,135	342
Baraga	409	160	Macomb	67	9,135
Barry	816	158	Manistee	2,099	1,100
Bay	46	3,760	Marquette	1,227	171
Benzie	3,128	746	Mason	1,994	788
Berrien	921	1,680	Mecosta	1,706	102
Branch	858	131	Menominee	823	230
Calhoun	67	169	Midland	97	142
Cass	1,114	171	Missaukee	1,732	58
Charlevoix	3,106	1,848	Monroe	47	5,500
Cheboygan	4,551	649	Montcalm	820	140
Chippewa	2,008	308	Montmorency	4,310	90
Clare	5,999	161	Muskegon	201	1,825
Clinton	10	91	Newaygo	3,252	147
Crawford	3,316	85	Oakland	342	1,204
Delta	1,303	222	Oceana	1,042	124
Dickinson	465	3	Ogemaw	4,065	116
Eaton	25	127	Ontonagon	466	42
Emmet	3,510	862	Osceola	1,891	75
Genesee	109	491	Oscoda	3,946	82
Gladwin	4,167	130	Otsego	2,592	86
Gogebic	941	38	Ottawa	398	3,197
Grand Traverse	2,315	755	Presque Isle	2,723	75
Gratiot	18	53	Roscommon	10,001	217
Hillsdale	442	96	Saginaw	25	205
Houghton	631	139	St. Clair	380	5,180
Huron	1,057	1,845	St. Joseph	428	148
Ingham	39	257	Sanilac	504	479
Ionia	76	80	Schoolcraft	1,664	25
Iosco	5,499	1,266	Shiawassee	20	92
Iron	998	3	Tuscola	107	482
Isabella	169	76	Van Buren	1,017	667
Jackson	391	258	Washtenaw	98	243
Kalamazoo	97	292	Wayne	66	7,053
Kalkaska	2,542	77	Wexford	1,285	86
Kent	224	661	Out of state	46	285
Keweenaw	733	13			
Lake	6,450	123	Total	135,297	62,053

Table 43. Boat operating expenses and fuel purchases by county where the boat is kept.

County	Total spending		Fuel		Total spending		Fuel	
		(\$MM)	(million gallons)	County	(\$MM)	(million gallons)		
Alcona		2.59	0.26	Lapeer	1.34	0.14		
Alger		0.82	0.08	Leelanau	5.71	0.49		
Allegan		5.28	0.48	Lenawee	1.93	0.20		
Alpena		2.84	0.28	Livingston	3.10	0.32		
Antrim		3.96	0.37	Luce	0.57	0.06		
Arenac		4.58	0.39	Mackinac	3.54	0.33		
Baraga		0.92	0.08	Macomb	44.47	3.87		
Barry		1.89	0.19	Manistee	4.99	0.42		
Bay		12.42	0.98	Marquette	3.19	0.30		
Benzie		3.93	0.34	Mason	4.24	0.37		
Berrien		9.66	0.83	Mecosta	1.91	0.20		
Branch		1.52	0.15	Menominee	2.31	0.21		
Calhoun		2.17	0.22	Midland	1.83	0.19		
Cass		1.99	0.20	Missaukee	1.04	0.11		
Charlevoix		7.49	0.61	Monroe	20.38	1.60		
Cheboygan		4.99	0.46	Montcalm	1.61	0.16		
Chippewa		2.99	0.27	Montmorency	1.48	0.15		
Clare		2.67	0.27	Muskegon	10.25	0.92		
Clinton		1.18	0.12	Newaygo	2.71	0.28		
Crawford		1.47	0.15	Oakland	15.54	1.60		
Delta		3.31	0.32	Oceana	1.83	0.19		
Dickinson		0.74	0.08	Ogemaw	1.95	0.20		
Eaton		1.65	0.17	Ontonagon	0.69	0.07		
Emmet		4.96	0.44	Osceola	1.30	0.13		
Genesee		6.35	0.66	Oscoda	1.34	0.14		
Gladwin		2.28	0.24	Otsego	1.50	0.15		
Gogebic		1.25	0.12	Ottawa	16.54	1.45		
Grand Traverse		6.78	0.65	Presque Isle	2.12	0.21		
Gratiot		0.68	0.07	Roscommon	3.68	0.38		
Hillsdale		1.12	0.11	Saginaw	4.89	0.52		
Houghton		1.68	0.16	St. Clair	21.12	1.73		
Huron		6.25	0.49	St. Joseph	1.82	0.19		
Ingham		3.33	0.34	Sanilac	2.27	0.20		
Ionia		1.01	0.10	Schoolcraft	1.44	0.14		
Iosco		7.33	0.65	Shiawassee	1.19	0.12		
Iron		0.67	0.07	Tuscola	2.54	0.23		
Isabella		0.92	0.09	Van Buren	4.55	0.41		
Jackson		3.23	0.33	Washtenaw	3.11	0.32		
Kalamazoo		3.77	0.39	Wayne	47.41	4.47		
Kalkaska		1.34	0.14	Wexford	1.67	0.17		
Kent		8.53	0.88	Out of state	1.50	0.12		
Keweenaw		0.37	0.04					
Lake		1.92	0.20	Total	401.46	36.96		

TRENDS IN BOATING ACTIVITY

Boating trends may be identified by comparing the 1994 survey results with those of previous surveys, particularly the 1980 and 1986 studies. In Table 44, we summarize trends in boating activity in Michigan as measured in boater surveys since 1971. Table 45 adjusts the estimates prior to 1994 to make them more comparable with the most recent estimates.

As always, trend identification is complicated by changes in survey methods over time. Differences in measures of boating use from one year to another can be due to actual changes in use, to sampling errors or to other changes in methods from one year to another. The 1994 survey paid particular attention to improving documentation of boats with invalid registrations and boats that were not active in 1994. The 1994 questionnaire also sought to reduce potential double counting of days of boating between inland and Great Lakes waters and days in which a boat was used in more than one county on a single day. Both of these refinements to earlier surveys would tend to reduce the estimates of boating activity.

Numbers of Active Craft

Though total registrations have grown by 27 percent since 1986, valid registrations have grown by 17 percent and the estimated number of active boats by only 11 percent. The evidence from earlier surveys suggests that rates of inactivity were reasonably stable up to 1980 at levels near 20 percent. Twenty-six percent of pleasure craft with valid registrations were estimated to be inactive in 1994. This is considerably larger than estimates of 14.5 percent in 1980 and 6.8 percent in 1986. Part of the difference is attributable to trends and part to improvements in the estimates. For example, the 1980 estimate is a raw percentage of returns that indicated the boats were not used in 1980. This corresponds to the 1994 raw percentage of 20 percent. Since both studies oversampled larger craft, which are more likely to be active, so the actual percentage of inactive boats is underestimated by the percentage of inactive returns. We adjust for this bias in 1994, yielding the higher rate of 26 percent of craft estimated to be inactive. The adjusted rate of inactivity for 1980 is about 19 percent, suggesting that the inactive percentage of the fleet has grown by about half a percent per year between 1980 and 1994 (Figure 5). A conclusion that the numbers of inactive craft are growing would be supported by the finding that both the fleet and boat owners are getting older.

Table 44. Trends in boating activity, 1971-1994 (unadjusted).

	1971	1974	1977	1980	1986	1994
Total registrations					710,000	900,000
% valid					89.9%	83.3%
Valid registrations	489,000	535,000	585,000	595,000	638,000	749,518
% inactive	20.0%	24.5%	27.7%	14.5%	6.3%	26.0%
Active boats	391,200	404,000	423,000	508,963	598,000	554,643
Avg. GL days	8.6	9.0	11.3	10.5	12.6	8.7
Avg. IL days	21.4	20.3	24.5	22.8	29.1	15.4
Avg. days (combined)	30.0	29.3	35.8	33.3	41.7	24.1
Total GL boat days	3,375	3,646	4,789	5,354	7,524	4,836
Total IL boat days	8,358	8,198	10,367	11,579	17,400	8,553
Total boat days	11,733	11,844	15,156	16,933	24,924	13,389

Table 45. Trends in boating activity, 1971-1994 (adjusted^a)

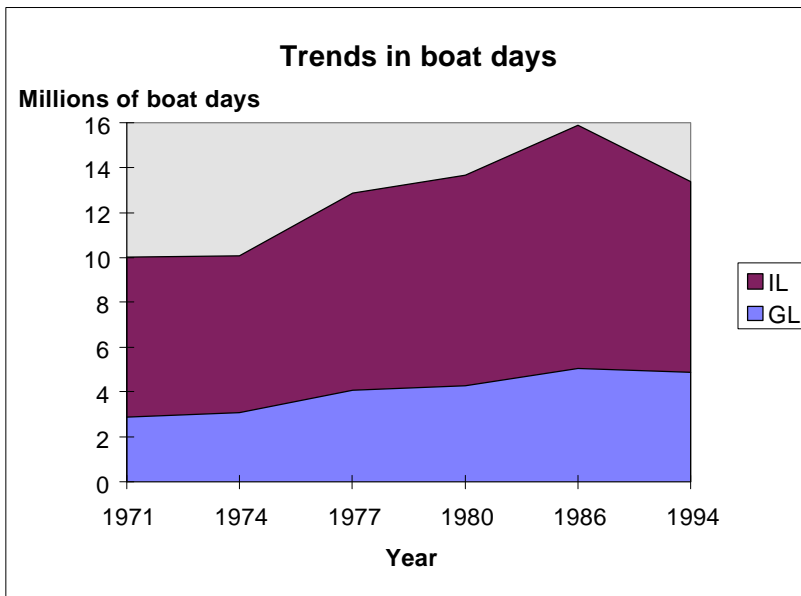
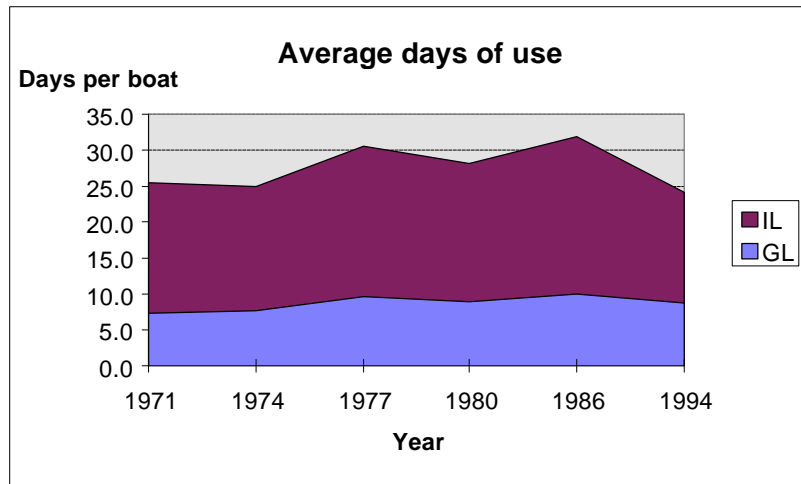
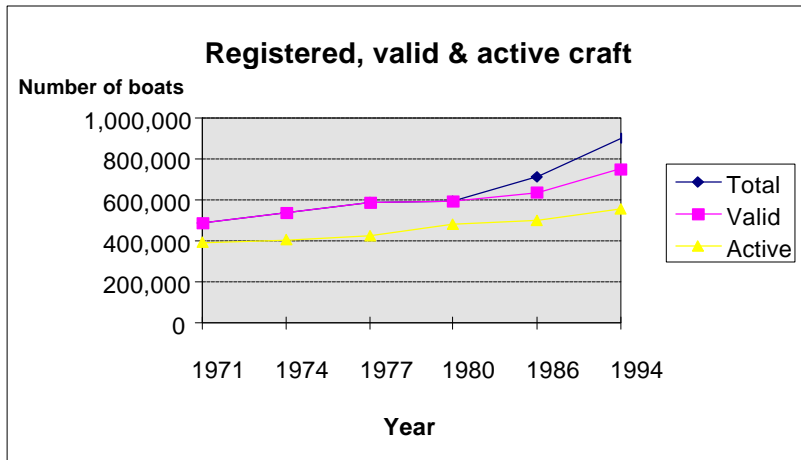
	1971 ^{a,c}	1974 ^{a,c}	1977 ^{a,c}	1980 ^a	1986 ^b	1994
Total registrations					710,000	900,000
% valid					89.9%	83.3%
Valid registrations	489,000	535,000	585,000	595,000	638,000	749,518
% inactive	20.0%	20.0%	20.0%	19.0%	22.0%	26.0%
Active boats	391,200	404,000	423,000	481,950	497,640	554,643
Avg. GL days	7.3	7.7	9.6	8.9	10.1	8.7
Avg. IL days	18.2	17.2	20.8	19.3	21.8	15.4
Avg. days (combined)	25.5	24.9	30.5	28.3	31.9	24.1
Total GL boat days	2,869	3,099	4,071	4,310	5,009	4,836
Total IL boat days	7,104	6,968	8,812	9,320	10,860	8,553
Total boat days	9,974	10,067	12,883	13,629	15,869	13,389

a. Boat days for 1980 and earlier reduced by 15 percent for double counting

b. Great Lakes boat days for 1986 reduced by 20 percent, inland by 25 percent for double counting

c. Inactivity rate assumed to be 20 percent prior to 1980.

Figure 5. Trends in boating activities in Michigan, 1971-1994.



Another potential source of errors is inconsistency in the handling of expired registrations. The Secretary of State keeps expired registrations on the file of registered boats for up to two years after the registration has expired. All registrations from the registration system prior to 1977 were purged in 1979, so the 1980 survey sampled only from valid registrations. The surveys in 1986 and 1994 also sampled only from non-expired registrations, though there may be inconsistencies in how expired registrations were determined. In 1994, we sampled registrations that were valid as of July 1, 1994, the 1986 sample was drawn in November of that year.

Days of Use

Reported estimates of average days of use per boat went from 33 days in 1980 to 42 days in 1986 to 24 days in 1994 (Table 44). Hidden in these numbers are some trends and some differences in methods. We believe that some double counting of boat days occurred in 1986, 1980 and earlier surveys. Boat owners could report the same day for both Great Lakes and inland waters or for two counties. Some evidence of double counting can be gleaned by comparing 1980 and 1994 results. The largest drop in reported use was for boats using both Great Lakes and inland waters (from 46 days in 1980 to 25 in 1994). Boaters in 1994 who used both waters reported about the same total use as boaters who used only inland or only Great Lakes waters, while in 1980 boaters using both Great Lakes and inland waters reported 33 percent higher rates of use. This suggests some boaters were likely reporting the same days in both places.

The potential for double counting was increased in 1986 by separating stream and river use from inland lakes. This change probably explains part of the growth in inland use reported in 1986. Lower response rates in the 1986 survey likely also contributed to some inflation in the 1986 use estimates.

Adjusting the estimates of use for 1980 and 1986 provides a better indication of trends (Table 45). In Table 45, we reduce boat days for 1980 and earlier by 15 percent. The 1986 survey results are reduced by 20 percent for Great Lakes use and 25 percent for inland use to adjust for likely double counting. Adjustments are greater for 1986 because of the additional double counting possible with river and stream use. A somewhat lower survey response rate in 1986 would also suggest some upward bias in the 1986 estimates.

After adjustments, the trend data indicate modest declines in frequency of boat use since 1986. The growth in the fleet has been offset somewhat by fewer days of use per boat. Average Great Lakes days dropped by 13 percent between 1986 and 1994, and average inland days by 29 percent. This resulted in an overall drop of 16 percent in total boat days. Great Lakes days dropped by only 3 percent between 1986 and 1994, while inland days dropped by 21 percent. Poor weather conditions in 1994 could partially explain some of the decline in boating activity. Differences between Great Lakes and inland trends are explained in part by the fact that inland lake users and their boats are older than their Great Lakes counterparts. The modification in questions for measuring boating days could also explain some of the differences in growth rates between Great Lakes and inland use. The phrasing of questions in 1994 counts any day in which the boat is used on Great Lakes or connecting waters, **including waters that provide access to the Great Lakes**, as a Great Lakes boat day. This phrasing could exclude some days reported as inland boating in previous surveys. Adjusted trends in boats and average and total boat days are plotted in Figure 5.

Other Trends

Since 1980, both boaters and the boating fleet have aged considerably. Nineteen percent of Michigan registered boat owners in 1994 were over 70 years of age and another 25 percent were over 60. This aging of owners and boats in part explains increasing rates of inactivity, declining rates of use, the drop in waterskiing and a greater percentage of boat operating expenses going to repair and maintenance. Launchings also experienced declines between 1980 and 1994 -- from 3.7 launches at Great Lakes sites per boat in 1980 to 2.7 in 1994. Launchings at inland sites also declined from 5.3 launches at inland sites per boat in 1980 to 4.4 in 1994. Boat storage locations have been reasonably stable since 1980. Modest growth in storage at Great Lakes waterfront sites between 1980 and 1994 is likely explained by differences in handling inactive boats in the two surveys. By applying differential rates of inactivity by size class in 1994, we obtain somewhat larger percentages of large boats among active craft, and these boats are more likely to be at Great Lakes sites.

With growth in the numbers of larger craft have come increases in the percentage of boats kept at marinas -- up from 5.7 percent in 1980 to 11 percent in 1994. Otherwise, the locations of populations, marinas and waterfront homes, including seasonal homes, lends considerable stability to the patterns of boat storage and use in Michigan. We are therefore refining models for predicting summer storage locations of boats from registration statistics as a means of better tracking trends between periodic statewide boater surveys.

A few questions about boater expectations in the 1994 survey also indicates considerable stability in the number of boats and storage locations. Ninety-four percent of active registered boaters intended to continue to use their boats in 1995, 7 percent expected to register another boat they did not own then, and only 4 percent indicated they might change the type or location of boat storage in 1995.

RECOMMENDATIONS

The registered boat owner survey provides quantitative estimates of boating activity in 1994 based on a carefully selected and representative sample of all registered craft. Needs for marina and pumpout facilities will be assessed by comparing the measures of boating use from this survey with quantitative supply data from the marina inventory and more in-depth information about boater attitudes and behavior from focus groups and other surveys. These recommendations are made in another report (Talhelm et al., 1995a), so we restrict our recommendations here to a few closing comments about the registered boat owner survey.

Boating is perhaps one of the best documented outdoor recreational activities in Michigan. Much of our information about boating in Michigan comes from the series of statewide boater surveys conducted since 1965. Survey procedures have been refined since 1965 to generate more reliable statewide and regional boating statistics while also reducing survey costs.

As both governmental budgets and the rates of growth in boating facilities have declined, time periods between major statewide surveys have increased from three years during the 1960s and 1970s to six years between the 1980 and 1986 surveys. The gap of eight years between the 1986 and 1994 studies

begins to complicate trend identification, particularly lacking alternative tracking systems to monitor boating activity between these major statewide surveys. We recommend that surveys like this one be conducted at roughly five-year intervals.

We also urge that monitoring systems be established to better track changes in boating activity around the state on at least an annual basis. In addition to periodic boater surveys, the boat registration files and harbor statistics on transient boating activity in major Great Lakes ports are important elements of a boating information system. Minor changes in the information gathered on registration forms could greatly increase the potential use of this information for planning, management and policy decisions. Perhaps the most useful change would be to identify the locations where boats are kept during the summer on the registration form. These locations are the best predictors of where boats are being used and hence where facilities and services are needed. The uncertainty in the current system about locations of boats, particularly those stored at marinas and seasonal homes, can introduce errors of from 10 to 50 percent in estimating use at destination counties from registration numbers. Though we have developed a tentative solution to this problem by modeling boat storage locations in the 1994 survey, directly gathering this information when boats are registered would be both more efficient and more reliable.

Boat Owner Survey Design

The general design for the statewide boater survey has been tested and refined over many years and works quite well. Better procedures for identifying boats that are inactive in a given year and some evaluation of measurement errors associated with recall of boating activity over a three- to five- month period would be useful supplements to the current procedures. We wish that we would have asked further questions of boaters who reported not using their boats in 1994 to better understand reasons for inactivity. Better documentation of reasons for getting into and out of the boating market along with general patterns of buying and selling would help the industry better track and respond to changes in the market.

In the 1994 survey instrument, we replaced a set of law enforcement questions with questions about the presence and use of portable and installed toilets on boats. We recommend that future studies continue to add new information to address current management, planning and policy issues as long as it

doesn't unduly interfere with the consistency of boating use estimates with previous surveys. Our approach in 1994 of inserting a small number of questions relative to the Clean Vessel Act on the general questionnaire and using a follow-up survey for more in-depth examination of attitudes was very effective. We recommend this model for future surveys. It permits detailed investigation of current topics without interfering with the general boater survey design. We do not recommend lengthening the current survey or adding subjects that might be more sensitive, because this would likely lower response rates and potentially bias the results.

The general statewide boater survey also must be supplemented periodically with surveys of boaters covering more focused topics. Surveys of transient boaters on the Great Lakes (Kinnunen and Schwartz, 1995; Stynes and Stewart, 1990; Stewart and Stynes, 1989) and boat show studies (Mahoney, Gartner and Holecek, 1980) are good examples. A more detailed examination of boaters in one or more subregions of the state is another possible variation on the statewide survey to help validate boating estimates at the regional and county levels and examine patterns of use in particular harbors or bodies of water.

A Statewide Boating Information System

A boating information system would help to identify gaps in existing information. It could also provide models to facilitate better integration of information and comparisons of data across distinct sources. For example, the question about temporary use of marina spaces in the 1994 survey can be partially validated using DNR harbor statistics. Harbor use statistics and survey data could be combined to develop models to predict patterns of cruising on the Great Lakes and associated facility needs and spending.

The modeling of summer storage locations for boats explains 80 to 90 percent of the spatial variations in boating activity because the vast majority of boating occurs where the boat is kept. The two major exceptions are cruising on the Great Lakes by larger boats and trailering of smaller craft from non-waterfront sites. We will be developing and evaluating models to predict these two components over the next six months.

The models for allocating boats from the county of registration to the storage locations where they are kept during the summer illustrates the potential to refine boating estimates and predictions by combining data across distinct sources. We have used counts of seasonal homes from the U.S. Census, registered watercraft from the Secretary of State and marina slips from the 1994 inventory to improve estimates of boating use at the county level. Data bases covering water resources, population, boating access sites and public harbor use statistics all offer further opportunities to improve boating information. Secondary sources that are reported regularly are particularly suited for tracking boating activity between major surveys. The ideal system combines some variables that are gathered on regularly with parameters that are estimated from survey data and updated periodically.

The boat registration file maintained by the Secretary of State is the most important regular source of data about the sizes, characteristics and geographic distribution of boats in Michigan. Considerably more information could be gleaned from this source by developing additional standard reports and better accounting for expired registrations. Applying parameters estimated in surveys --such as days of use, percentage of boats with toilets, fuel consumption and spending -- to the registration statistics could yield estimates of boating activity every year. New surveys are required about every five years to update the parameter estimates and identify any changes in patterns of use. Other information about the spatial distribution of water resources, boating facilities, seasonal homes, population, fishing activity and the like offer additional opportunities to refine the information base for boating-related decisions. Such a boating information system would increase the use and application of existing information while also targeting the specific information that is needed to answer key management, planning, policy, marketing and design decisions.

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Appendix A. 1994 Registered Boat Owner Survey Instrument

Appendix B. County Level Tables

- B1. Number of watercraft by county of registration and size.
- B2. Survey response rates by county.
- B3. Weighted and unweighted sample by county .
- B4. Number of registered boats per capita by county of registration.
- B31. Total boat days by segment and county where the boat is kept.
- B32. Total Great Lakes boat days by segment and county where the boat is kept.
- B33. Total inland boat days by segment and county where the boat is kept.
- B34. Number of boats stored at seasonal homes by segment and county where the boat is kept.
- B35. Number of boats stored at marinas by segment and county where the boat is kept.
- B36. Number of boats with installed toilets (head) by segment and county where the boat is kept.
- B37. Number of times pumped out by segment and county where the boat is kept.
- B38. Total boat operating expenses by segment and county where the boat is kept (\$millions).
- B39. Gallons of boat fuel purchased by segment and county where the boat is kept (millions).