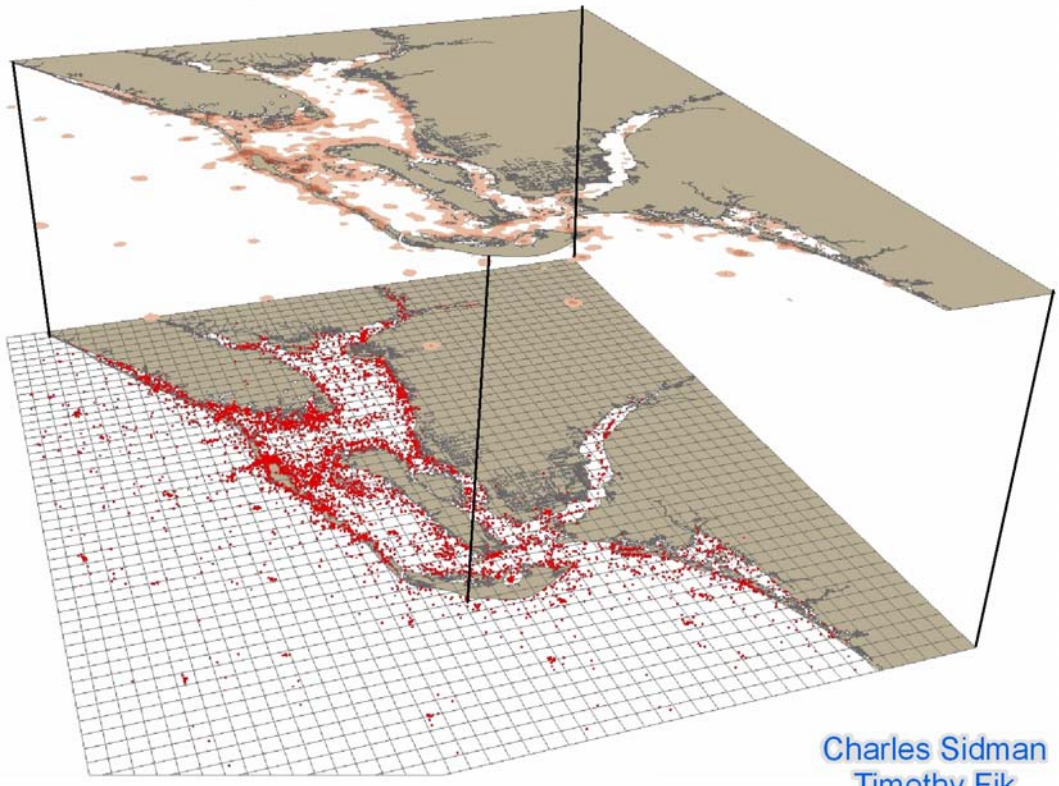
Greater Charlotte Harbor

A Comparison of Boating Patterns by Season



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Acknowledgements

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The success of this project relied upon the individual contributions of various team members. Principal Investigators Charles Sidman and Robert Swett (Florida Sea Grant) were responsible for project administration, overall design of the questionnaire and correspondence, sample selection, the GIS database design, spatial analyses, and reporting. Timothy Fik (Department of Geography, University of Florida) performed the statistical analyses. Bill Sargent (FWRI) served as project liaison, and contributed to the questionnaire, survey design, and reporting. David Fann and was responsible for the questionnaire map layout and design, and cartography. Jim Joseph of FantaSea Scuba (Englewood, Florida) and Lana Carlin conducted the marina surveys. Jim Joseph conducted the ramp surveys. Smart Mail Inc. (Alachua, Florida) implemented the mailing. Susan Fann, Matt Purdy, Gabriel Bolden, Corina Guevara, and Misty Sabina processed attribute and spatial data from the returned questionnaires. Susan Fann (Florida Sea Grant) provided valuable editorial comments and suggestions.

We especially thank the many boaters who donated their time to complete and return the questionnaire. It is our intention that this effort will be translated into planning strategies and informational products of benefit to the Greater Charlotte Harbor boating communities.

Abstract

During the past five years, the Florida Fish and Wildlife Conservation Commission has supported a series of characterizations aimed at developing a profile of the behavioral and spatial aspects of recreational boating in Florida. A map-based mail survey method was chosen to capture the variety of information required to fulfill the characterization. Previous recreational boating characterizations implemented for Tampa and Sarasota Bay, Sarasota County, and the Greater Charlotte Harbor each relied upon the distribution of a single wave of mail surveys. This study extends the characterization effort for the Greater Charlotte Harbor region by implementing two additional waves of mail surveys to evaluate seasonal boating patterns.

Chapter 1. Introduction

1. Background

During the past five years, the Florida Fish and Wildlife Conservation Commission has supported a series of characterizations aimed at developing a profile of the behavioral and spatial aspects of recreational boating in Florida. A map-based mail survey method was chosen to capture the variety of information required to fulfill the characterization. The mail-survey method relied upon field surveys of vessels stored at marinas and of automobiles and trailers observed at boat ramps. Vessel and boat trailer registration numbers collected at area marinas and boat ramps were used to obtain names and mailing addresses from the State's Vessel Title Registration System (VTRS) for marina and ramp samples. Names and mailing addresses for waterfront parcel owners obtained from County tax records were compared to the VTRS to identify the dock sample (i.e., those waterfront parcel owners who also owned a boat).

Previous recreational boating characterizations implemented for Tampa and Sarasota Bay (Sidman, Fik, and Sargent, 2004), the Greater Charlotte Harbor (Sidman, Fik, Swett, Fann, Fann, and Sargent, 2005a), and Sarasota County (Sidman, Swett, and Fik, 2005b) each relied upon the distribution of a single wave of mail surveys. This study extends the characterization effort for the Greater Charlotte Harbor region (Figure 1) by implementing two additional waves of mail surveys to evaluate seasonal boating patterns. To this end, a map-based questionnaire was mailed to those boaters who returned the initial questionnaire (mailed in May of 2005) and who agreed to participate in follow-up surveys. These boaters were mailed an abridged version of the questionnaire in December 2005 and again in March 2006. In addition, full length questionnaires were also mailed to boaters using ramps during random weekend observations from July of 2005 through February of 2006, and who were not already on the spring 2005 mailing list.

While it is widely accepted that recreational boating in the Greater Charlotte Harbor region is a year-round activity, temporal and/or seasonal variations may exist in the use of coastal waterways by boaters in response to access preferences, physical conditions, weather, perceived congestion, activity preference(s), and/or other factors. This report presents summary statistics and a spatial analysis to determine the extent to which seasonal differences in boating patterns exist for the Greater Charlotte Harbor region. This report is intended to be a companion to the "Recreational Boating Characterization for the Greater Charlotte Harbor," published as Florida Sea Grant Technical Paper 150.[1]

[1] The survey instrument, sampling methods, and a descriptive analyses of questionnaires pertaining to the May 2005 mailing can be found in Sidman, Swett, Fik, S. Fann, D. Fann, and Sargent, 2005. "A Recreational Boating Characterization for the Greater Charlotte Harbor". Florida Sea Grant TP-150. University of Florida, Gainesville, Florida.

Figure 1. The Greater Charlotte Harbor Study Area.

2. Mail Survey Instrument

The survey questionnaire developed for this study was patterned after similar, previous studies (Falk et al., 1992; Sidman & Flamm, 2001; Sidman, Fik, & Sargent, 2004; West, 1982;) and was designed to (1) capture spatial information regarding trip departure sites, favorite boating destinations, intervening travel routes, and congested areas; (2) characterize boaters with respect to the types of vessels owned and used, activity preferences, and the timing, frequency and duration of their recreational outings; and; (3) identify problems and needs from the perspective of the boating community (see Appendix A for the survey instrument).

The survey instrument was a two-sided 17 X 22 inch questionnaire that folded in quarters to 8.5 X 11 inches. The questionnaire contained a map (1:160,000 scale; 1 inch is about 2.5 miles) of the Greater Charlotte Harbor region on one side; the reverse side consisted of 27 questions divided into the following topical areas:

1. Description of primary vessel
2. Description of last two pleasure boating trips
3. Description of favorite boating destinations and activities
4. Description of survey respondent
5. Open questions to identify perceived problems and needs

The following additional items were included with each mailed questionnaire.

1. A cover letter that explained the study
2. A Charlotte Harbor Boater's Guide developed by the FWRI
3. A postage paid return envelope with postal permit indicium
4. A mailing envelope that included return address and postage permit indicium

In addition, a 4 X 6 card was mailed approximately two weeks after each mailing as a reminder to survey recipients to complete and return the questionnaire.

The questionnaire asked survey recipients to mark on the map the location of the trip departure sites, travel routes, and favorite destinations associated with their last two pleasure boating trips. They were also to mark areas characterized by boat congestion experienced at any site on the map. Complementary questions allowed recipients to characterize their last two trips according to vessel type, the departure date and time, and the total time spent on the water. In addition, recipients were asked the number of days per month that they operated their boat(s) in the past year and the primary activity(ies) engaged in while on a typical boating trip. They were also asked to identify and rank reasons for selecting departure sites (where appropriate) and travel routes. Finally, open-ended questions invited a discussion of perceived problems and needed improvements in their boating experience. The abridged version of the questionnaire contained the map portion but only a subset of questions pertaining to the last two trips taken.

3. Sample Selection (Ramp, Dock, and Marina Users)

Boat Ramp Users

During the period of February 2005 through February 2006, Florida Sea Grant personnel repeatedly visited 20 area ramps, ultimately obtaining 3,863 unique boat owner license plate numbers from the boat trailer and/or the towing vehicle (Figure 2). User acquisition was continued after defining the initial spring study group, as this population was considered less static than dock or marina users and, therefore, more amenable to continued capture of unique users. Observations were conducted randomly, typically during weekends and on a monthly basis (August the exception). This tag information was compared to the Vessel Title Registration (VTRS) database maintained by the Department of Highway Safety and Motor Vehicles and yielded 3,119 VTRS matches for names and mailing addresses (Table 1).

Table 1. Seasonal Breakdown of Unique Tag Numbers Collected and VTRS Matches by Ramp.

County	**Ramp Name**	**Spring 2005**		**Summer2005 - Winter 2006**	
		Unique Tag #;s	**VTRS Matches**	**Unique Tag #'s**	**VTRS Matches**
Charlotte	Placida	287	195	250	232
	El Jobean	54	41	65	61
	Laishley Park	96	66	80	71
	Ponce De Leon Park	65	51	39	38
	Spring Lake Park	39	28	49	46
	Port Charlotte Beach	40	28	54	50
	Ainger Creek Park	18	14	72	67
	TOTAL	599	423	609	565
Lee	Burnt Store Marina	41	28	27	24
	Burnt Store Road Ramp	16	9	23	23
	Cape Coral Yacht Club	126	86	115	110
	Centennial Park Marina	82	50	39	35
	Bokeelia/Harbor Hideaway	112	85	117	114
	Horton Park	95	60	69	62
	Imperial River	44	33	18	17
	Lovers Key	249	188	145	130
	Matlacha Park	153	111	135	129
	Pineland Marina	238	170	166	155
	Punta Rassa	232	167	175	157
	Sanibel Island	42	27	13	13
	D&D Gulf Gateway	82	50	106	98
	TOTAL	1,512	1,064	1148	1067

Figure 2. Greater Charlotte Harbor Public Ramps Surveyed.

Dock Users

Names and mailing addresses for waterfront parcel owners obtained from county tax records were compared to the VTRS to identify the private dock sample. Specifically, the mailing addresses contained in the VTRS were matched to waterfront parcel addresses obtained from Sarasota, Lee and Charlotte county property tax records. Matches ensured that only those waterfront parcel owners who also owned boats were sampled (Table 3). To achieve an even spatial representation, an ArcGIS program, downloaded from the ESRI website, was used to select a random spatial sample of 2000 private dock owners from the 9,794 VTRS matches (Figure 3). The size of the dock samples was increased by 15 percent to ensure that minimum sample sizes were retained after implementing address validation procedures.

Table 2. Dock Sample Selection.

Docks County	**VTRS Matches**	**% Total**	**Sample Needed**	**# of 2000**	**15% Add**	**Total Sub-Sample**
Sarasota	218	2%	2000	40	46	44
Charlotte	4,274	44%		880	132	1,012
Lee	5,302	54%		1,080	162	1,242
TOTALS	9,794	100%		2,000	340	2,300

Marina Users

During February and March of 2005, personnel contracted by Florida Sea Grant visited 50 marinas (Figure 4) located in Charlotte and Lee Counties to record bow numbers from vessels stored in wet slips and in dry stack storage facilities. Bow numbers were logged from 1,283 vessels moored in wet slips and 3,870 vessels kept in dry storage facilities (Table 4). The names and hailing ports of documented vessels were also used to acquire additional owner names and addresses from the Coast Guard documented vessel database. In addition, one marina provided a list of names and addresses for its patrons, and two marinas stipulated that they generate mailing lists and conduct the mailing. These three marinas did not distinguish between wet-slip or dry-storage type. As such, a total of 1,069 vessels were placed in an ‘unknown’ marina storage type category.

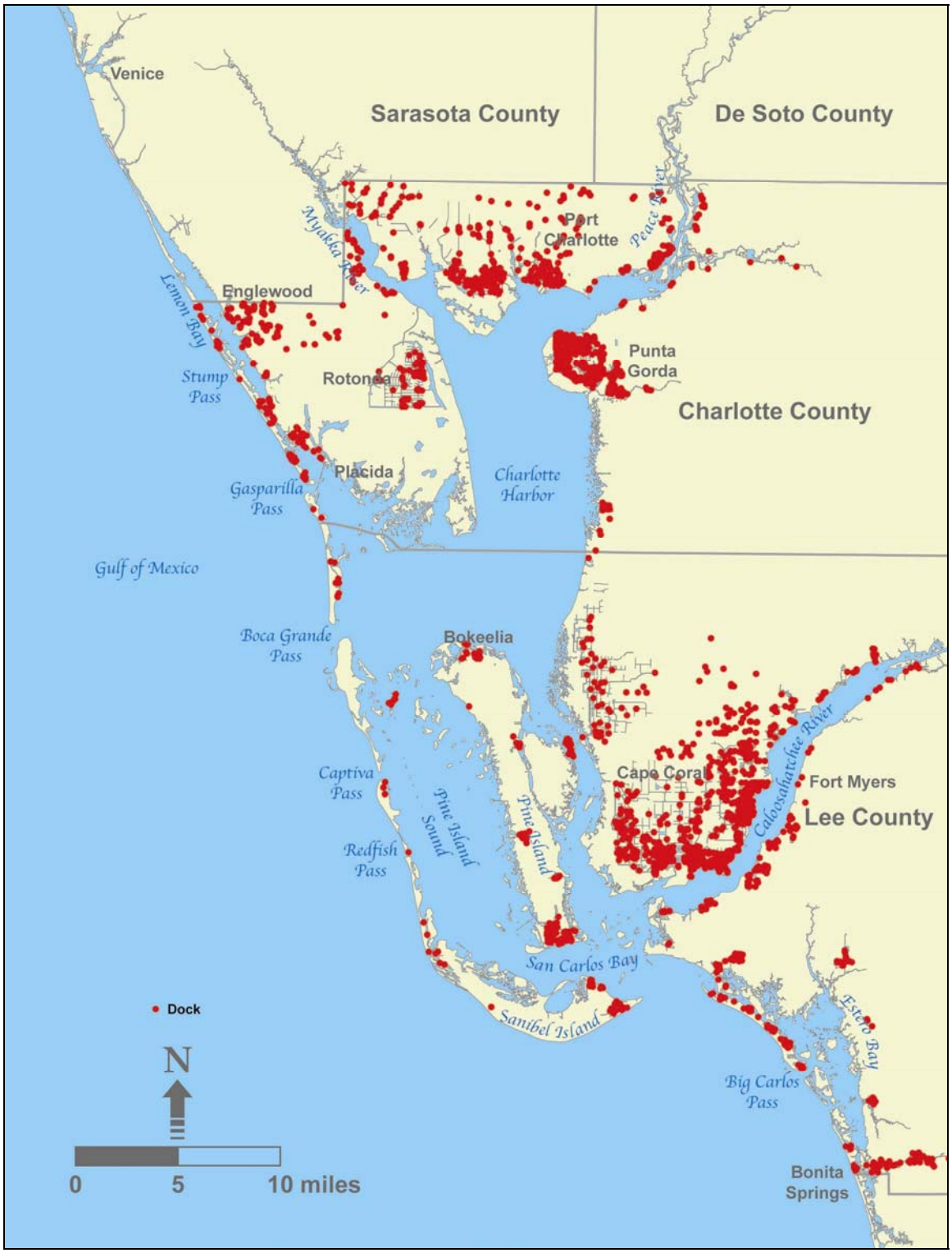

Figure 3. Spatial Distribution of the Greater Charlotte Harbor Private Dock Sample.

Table 3. Breakdown of Vessel Bow Numbers Collected from Marinas.

County	Marina Name	Wet Slip	Dry Storage	Unknown*
Charlotte	Ainger Creek Marina	5	0	
	Cape Haze Marina Bay	32	83	
	Chadwick Cove Marina	8	0	
	Fishermen's Village	3	0	
	Gasparilla Marina	88	385	
	Gator Creek Marine	0	21	
	Gulf Coast Marine Center	0	37	
	Marine Max	2	17	
	Palm Island Marina	42	115	
	Punta Gorda Marina	6	22	
	Stump Pass Marina	0	197	
	Weston's Resort	9	0	
	TOTALS	195	877	
Lee	Boca Grande Marina	6	0	
	Bonita Bay Marina Club	41	340	
	Burnt Store Marina	0	0	671
	Caloosa Isle Marina	6	62	
	Cape Coral Yacht Basin	56	0	
	Centennial Harbour Marina	50	0	
	Ft. Myers Yacht Basin	110	0	
	Deep Lagoon	0	248	
	Fish Tale Marina	0	0	298
	Fish Trap Marina	8	0	
	Ft. Myers Beach Marina	22	118	
	Gulf Gateway Marina	8	22	
	Gulf Star/Dumont Marine	9	41	
	Harbor Hideaway	8	0	
	Jack's Marine South	5	12	
	Jensen's Twin Palm Marina	10	0	
	Marinatown Marina	0	0	
	Mc Carthy's Marina	6	0	
	Olde Fish House Marina	0	3	
	Paradise Yacht Club	0	0	
	Peppertree Point Marina	0	0	
	Pineland Marina	3	16	
	Prosperity Pointe Marina	32	0	
	Rialto Harbor Marina	8	0	
	Salty Sam's Marina	41	130	
	Sanibel Marina	32	17	
	Semmer Docks	19	0	
	Snook Bight Marina	41	57	
	St. James Marina	3	0	
	Sweetwater Landing	0	0	100
	Tarpon Point Marina	91	0	
	The Inn Marina	10	88	
	The Marina at Cape Harbour	51	85	
	Tween Waters Inn	8	0	
	Uncle Henry's Marina	6	0	
	Viking Marina	0	0	
	Whidden's Marina	8	0	
	TOTALS	1,088	2,993	1,069

*Marina wet slip or dry storage

Figure 4. Greater Charlotte Harbor Marinas Surveyed.

4. Survey Return Breakdown

The map-based questionnaire described above (see also appendix A) was mailed in May 2005 to a sample of 6,494 marina, ramp and dock users. Those survey recipients who agreed to participate in follow-up surveys (n = 1,013) were mailed an abridged version of the questionnaire in December 2005, and, again, in March 2006 to report additional trips taken during the summer and fall/2005 and winter 2005/2006 periods. In addition, questionnaires that contained the full complement of questions were mailed to newly identified ramp users, who had not yet received a survey and were observed using ramps in the interim periods (n = 912 in 12/2005 mailing and n = 702 in 3/2006 mailing).

A breakdown of mailings and returns for the three waves of surveys is presented by waterway access group (i.e., marina, ramp, and dock users) in Table 5. A total of 2,787 surveys were returned by June, 2006. This translated to an overall return rate of about 26% for the three waves of surveys.

Table 4. Survey Return Breakdown.

Waterway Access Group	May 2005		December 2005		March 2006		Total Mailings	Total Returns
	Mailed	Returned	Mailed	Returned	Mailed	Returned		
Marina	3,440	736	464	250	464	206	4,368	1,192
Ramp	1,504	337	1,159	255	1,024	247	3,687	839
Dock	2,000	413	306	185	302	154	2,608	752
TOTAL	6,944	1,486	1,929	690	1,790	607	10,663	2,787

Chapter 2. Boater Group Seasonal Characteristics

I. Defining the Boating Seasons

Monthly trip data were examined to identify the number and duration of boating seasons based upon the average number of trips taken by boaters during each month. Trip frequency counts – *the number of reported boating days* – were obtained from responses to Question 7 of the mail survey instrument (see appendix A for the survey instrument).

Question 7. Please indicate, in the boxes below, the number of days per month that you operate your boat in the Greater Charlotte Harbor mapped areas.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

For the purposes of this analysis, a *boating season* is defined as a grouping of "like" consecutive months based on the reported trend in use and monthly trip frequency counts. The average reported typical boat trips per month are shown in Table 5 and Figure 5. Summary statistics are presented for all survey respondents and for each of four distinct waterway access groups – comprised of boaters accessing the water from marina wet slips, marina dry storage facilities, public boat ramps, and private docks.

Visual inspection of the average number of trips for all waterway access groups (Figure 5) exposes a pattern that is consistent with defining *boating seasons* in relation to the conventional 4 seasons. Identifiable clusters of months are observed based on similarities in trip frequencies, suggesting peak(s) and off-peak periods and the existence of four distinct boating seasons.

(1) a "primary peak season" centered about the month of April (running from March through May) where the average trip count per boater is significantly greater than the overall average of 4.34 trips per month;

(2) a "shoulder" season that bridges the primary and secondary peak seasons (comprising the summer months—June, July, and August); and

(3) a "secondary peak" centered about the month of October (covering a period that spans from September through November);

(2) a low-use, "off-peak" season that spans from December through February.

The average reported trip counts for the months of March, April, and May all exceed the overall monthly average of 4.34 trips. It can be argued that this three-month cluster defines the "peak" boating season in the region. This primary peak is centered about the

month of April – the peak-use month. For each of these three months, the lower limit of the 95% confidence intervals for the mean exceeds the monthly average of trips for the entire year. The "shoulder" period, from June to August, exhibits a decline in the average reported trip counts per month, with a 3-month mean that is exactly equal to the overall monthly mean of 4.34. The declining monthly trip counts associated with all users levels off in September, with a subtle subsequent rise or "secondary peak" period (from September through November) centered about the month of October. The 95% confidence intervals for the mean reported trips during the months of October (4.03-4.44) and November (3.98-4.40) contain the overall monthly average of 4.34. Hence, the months of October and November, as part of a secondary peak, are not significantly different from an average boating month at the 95% confidence level By contrast, the "off-peak" months – December through February – are characterized by significantly lower-than-average monthly trip counts. The 95% confidence intervals for mean monthly trip counts in December (3.40-3.80), January (3.56-3.96), and February (3.89-4.31) do not attain the overall monthly average of 4.34 trips per month.

Table 5. Average Number of Reported Trips by Month and User Category.

Average Number of Reported Trips

Month	All	Ramp	Dock	Marina Wet Slip	Marina Dry Storage	95% confidence internal (mean) All Users
January	3.76	3.10	3.81	5.18	3.77	(3.56 – 3.96)
February	4.10	3.28	4.12	5.81	4.29	(3.89 – 4.31)
March	4.90	4.09	4.91	6.16	4.95	***(4.67 – 5.12)***
April	5.23*	4.83	5.38	6.15	5.09	***(5.01 – 5.45)***
May	5.09	5.24	5.38	4.70	4.77	***(4.86 – 5.32)***
June	4.70	5.27	4.97	3.37	4.31	***(4.47 – 4.93)***
July	4.33	4.96	4.66	2.72	3.90	**(4.11 – 4.55)**
August	3.99	4.62	4.25	2.45	3.59	**(3.77 – 4.21)**
September	3.95	4.47	4.26	2.63	3.51	**(3.74 – 4.15)**
October	4.23**	4.26	4.59	3.92	3.94	**(4.03 – 4.44)**
November	4.19	3.60	4.49	5.41	4.02	**(3.98 – 4.40)**
December	3.60	3.19	3.82	4.76	3.19	(3.40 – 3.80)
Monthly Avg.	4.34	4.25	4.55	4.49	4.11	(4.17 – 4.51)
(overall) N =	1,595†	564	457	222	339	1,595

* Primary peak; ** Secondary peak (based on the reported trips of boaters from all four users).
† N includes 13 additional boaters that launched from a shoreline, causeway, or other location. Note: 95% Confidence Intervals (shown in parentheses) are interpreted as follows:

Bold: if interval contains the mean of 4.34 trips
Bold and Italic: if the lower limit of the interval > 4.34

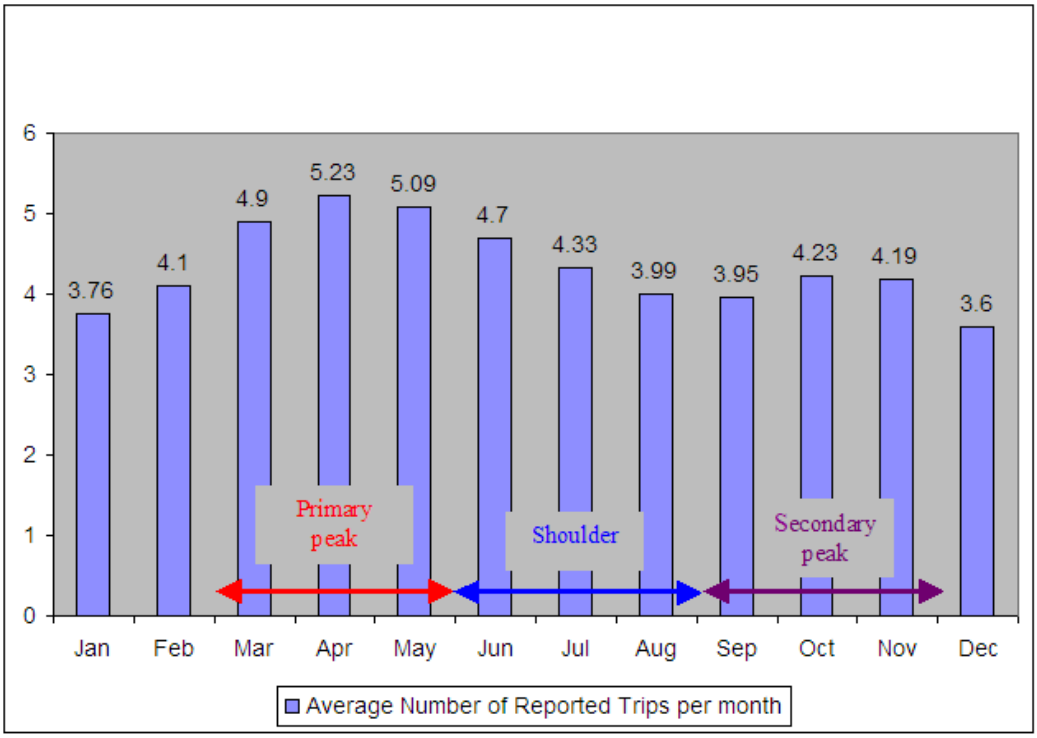

Figure 5. Mean Monthly Trip Counts (All Respondents).

2. Sample Size Considerations

Average monthly trip counts are based on user information obtained exclusively from the long questionnaire version (Question 7), in which survey respondents were asked to report the number of boating trips taken during each month of the year. The observed maximum estimated standard deviation s_{max} for monthly trip counts of all respondents was 4.66 trips per month. This value implies that a minimal required sample size (n*) of approximately 334 to be within an acceptable margin of error – plus or minus .5 trips per month – when estimating the mean monthly trip count at the 95% confidence level. As such, the sample of 1,595 survey respondents far exceeds the number required to meet the specified margin of error when generating estimates for the average number of monthly trips for all respondents.

Questions may arise, nonetheless, concerning individual sample sizes associated with the various waterway access groups. There is statistical evidence to suggest that an adequate sample size for each user group was obtained based on the estimated standard deviations associated with reported monthly trip counts. For example, consider that for a j-th user category (j=1,…4) and k-th month (k = 1,…12), the average estimated standard deviation of reported monthly trip counts (s^*_{jk}) is approximately 4.50. This value implies that a minimum sample size of approximately n*=312 is required for each user group to be within the prescribed margin of error. This sub-sample target is somewhat overstated as it does not take into account the finite nature of the various boater populations. The required sample size of 312 observations is exceeded for all user categories with the exception of boaters in the

marina wet slip category. Adjusting for the finite nature of the boating population within this category, based on a rough estimate of wet slip availability within the region (Table 3) and the standard deviation in monthly trip counts, the estimated minimum required sample size is approximately 270 (at the 95% confidence level) and 198 (at the 90% confidence level) to fall within an acceptable maximum margin of error – plus or minus .5 trips per month. Although the sample size for marina wet slip users obtained from the long survey (n=222) is less than required at the 95% confidence level, it is adequate at 90% confidence.

3. Validation of the Designated Boating Seasons

The designated boating seasons described above were validated by the results of a cluster analysis. Several hierarchical clustering routines were run using monthly data for the variables listed in Table 6, each yielding consistent results. The clustering routines were constrained to search for an optimal number of clusters c*, based upon an inspection of natural breaks found within the trip data and with the imposed minimum of two clusters and a maximum of five clusters in the identification of 'like months.' Hierarchical clustering routines were chosen given that the variables used to describe the trends in Figure 5 were measured at a variety of different scales (i.e., the analysis involved the use of nominal, ordinal, and interval scale data).

Hierarchical clustering methods were used to identify clusters of months that exhibited 'similar' characteristics in terms of the average reported trips, the relative position of months with respect to the primary and secondary peaks, the monthly average in comparison to the overall average, and monthly average-trip rankings. Similarity, and hence the clustering of 'like months,' is determined by the shortest "distance" by which months or clusters of months are linked together in relational space (as measured in either Euclidean or Manhattan metric terms). In other words, individual months and clusters of months are linked in a manner that is efficient in terms of accounting for variation, dissimilarities, and/or differences in the values of the monthly observations for all variables listed in Table 6.

Cluster routines are typically accompanied by a dendrogram – a graph that displays the distance (or dissimilarity) between clusters, and the distance at which individual objects or clusters are joined. This device offers a way in which to map the distances at which various clusters join. It also allows for the identification of break points that exist between various cluster groupings and an historical account of the clustering process. Distances and break points are the basis by which an optimal number of clusters can be determined.

A summary of the cluster analysis is provided in Table 7. In all routines employed, the algorithms produced identical groupings or clusters of months based on the variables listed in Table 6. Furthermore, each cluster routine produced a cophenetic correlation coefficient that exceeded .80 – indicating that the identified cluster grouping are strong in terms of representing the dissimilarities that exist in the values of the variables associated with different months or clusters.

A more detailed account of the step-by-step clustering process is provided by the dendrogram shown in Figure 6 (based on Ward's Minimum Variance approach).

The vertical axis of the dendrogram represents the distance between months or clusters of months. The various gaps may be thought of as measures of dissimilarity between months or clusters. The horizontal axis provides a platform for viewing the positioning of each object as it is clustered and, in this case, how months and clusters of months are arranged in relational space.

The dendrogram is useful in visualizing the distance at which any two months and/or clusters are fused together and the degree of dissimilarity between those months or clusters. For example, the dendrogram in Figure 6 suggests that the months of September, October, and November are very dissimilar to the months of March, April, and May; as these two clusters are the last to be joined together at a distance of 2.004. The month of November is more like the month of December (joined at a distance of 1.269) than it is like the month of June (which is joined with November at a distance of 1.300). November, however, is more like the months of October and September than it is to December, as it joins with those months at a distance of .576. In addition, there is a large natural break between the cluster of "fall" months (which contains November) and the cluster of "winter" months (which contains December). Months that are most alike (or least dissimilar) form the "early clusters" located at the bottom of the dendrogram; at distances that are relatively close to zero. For example, consider the pairings of April and May (at a distance of .479) or that of June and July (at a distance of .536). In short, dissimilarity between any two months or clusters of months increases as distance between those months or clusters increases.

The results of the cluster analysis suggest that the optimal number of clusters is 4, with groupings that match those identified by visual inspection. The cluster analysis also provides statistical validation for the designated groupings of months that define each of the four boating seasons. It is interesting to note that the clusters do conform to conventional seasonal classifications. This statistical correspondence may suggest that trip propensity by month may be affected by physical conditions (e.g., weather patterns), residence status, or behavioral factors –boaters' perceptions and expectations regarding conditions associated with each season. The results of this analysis form the foundation for subsequent seasonal analyses in which the boating seasons will be referred to as "winter," "spring," "summer," and "fall."

Table 6. A Listing and Description of Variables Used in the Hierarchical Cluster Analysis.

Cluster/Label Variable: ***MONTH*** (month of the year): January – December

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*Variables used to cluster ***MONTH***

ANRT	Average Number of Reported Trips (per month)
DP1	Distance from peak #1 -- absolute number of months
DP2	Distance from peak #2 -- absolute number of months
Rank	Rank of ANRT (in descending order → 1=high; 12=low)
MA3_Rank	Moving Average of Rank (order 3, centered)
INC_ANRT	Increase in ANRT (over previous month)
ADIFF_P1	Absolute Difference in ANRT (from primary peak value)
ADIFF_P2	Absolute Difference in ANRT (from secondary peak value)
DIST_P	Distance from Peak (absolute number of months)
AATM	Above-Average Trip Month (1=yes; 0=no)

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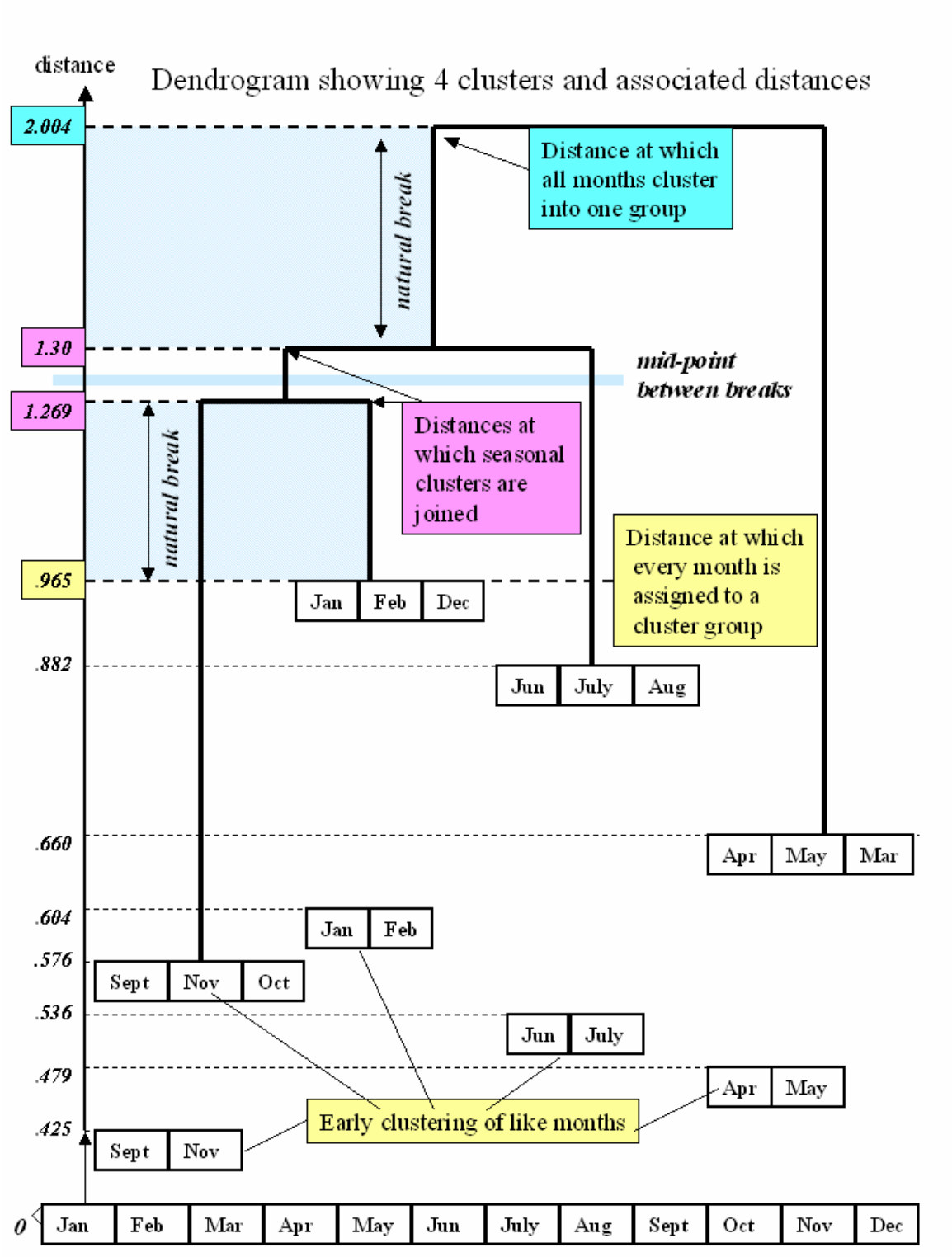
*Note that the variables listed above are measured at a variety of scales, including the nominal, ordinal, and interval scale.

Table 7. Results of Cluster Analysis in the Designation of Boating Seasons.

	Distance Values for Clusters and Cluster Links			
Routine →	Ward's	Complete	**Pair Group**	
	Min.Variance†	Linkage	Un-weighted	Weighted
Distance type →	(Manhattan)	(Euclidean)	(Euclidean)	(Euclidean)
Cluster(s) identified				
1 September				
1 October	.4072	.5761	.6275	.5269
1 November				
2 March				
2 April	.4052	.6608	.7793	.6346
2 May				
3 June				
3 July	.5995	.8823	.8877	.7460
3 August				
4 December				
4 January	.6204	.9658	.9706	.7895
4 February				
Cluster links				
4-3	1.2655	1.2695	1.0960	1.0201
4-3-1	1.5424	1.3003	1.1328	1.0431
4-3-1-2	3.5671	2.0047	1.7520	1.4489
Cophenetic Correlation	.8126	.8104	.8079	.8071
Suggested # of clusters	4	4	4	4

Cluster routines were run using ***NCSS 2000***; scale type: standard deviation.
† The same cluster designations were also produced using Ward's Minimum Variance Method (Euclidean distance), with a cophenetic correlation of .778.

Figure 6. Distance and Break-Point Identification: Step-wise Results for Ward's Minimum Variance Cluster Routine.



II. Seasonal Analysis by Boater Group

For the purposes of the following seasonal analyses, four waterway access "*user groups"* are identified: Marina wet slip, marina dry storage, ramp, and dock. Table 8 highlights various summary statistics as they pertain to average and median trips per season (from survey Question 7), using the designated seasons identified by the cluster analysis. The box plots in Figure 7 show the distributions of trips per season and outliers. The red markings contained within the yellow boxes highlight the 25-th, 50-th (median), and 75-th percentile values (moving up from the bottom), with outliers (>2.0s) shown in green and severe outliers (>3.0s) shown in red. It can be noted that all seasonal distributions of reported trips were positively skewed and shown to be significantly different from a "normal distribution" at the 95% confidence level. Histograms showing the distributions of trips by season are Figures 8a through 8d.

Table 8. Seasonal Breakdown of the Mean and Median Number of Trips by Boater Group.

Season:	**All Respondents**	**Ramp**	**Dock**	**Marina Wet**	**Marina Dry**
Winter	***11.46*** 9	**9.56** 6	**11.75** 8	**15.76** 12	**11.26** 9
Spring	***15.22*** 12	**14.18** 12	**15.60** 12	**17.62** 13	**14.83** 13
Summer	***13.03*** 10	**14.85** 12	**13.90** 11	**8.55** 4	**11.81** 10
Fall	***12.38*** 10	**12.35** 10	**13.35** 10	**11.98** 8	**11.49** 10
Season (Overall)	13.00 10.25	12.75 10	13.67 10.75	13.47 10	12.35 10.75
N* =	1,595*	564	457	222	339
	Percentage of N*	35.3%	28.7%	13.9%	21.3%

Mean shown in bold type; median in non-bold type.

* Sample contains survey respondents classified as "Other" – boaters launching from Beach, Shoreline, or Causeway – accounting for 13 additional survey respondents or .8% of the total number of survey respondents that answered Question 7.

Note: Underlined median values are found to be significantly different from the overall median for all users during the season in question (based on non-parametric test results carried out at the 95% confidence level).

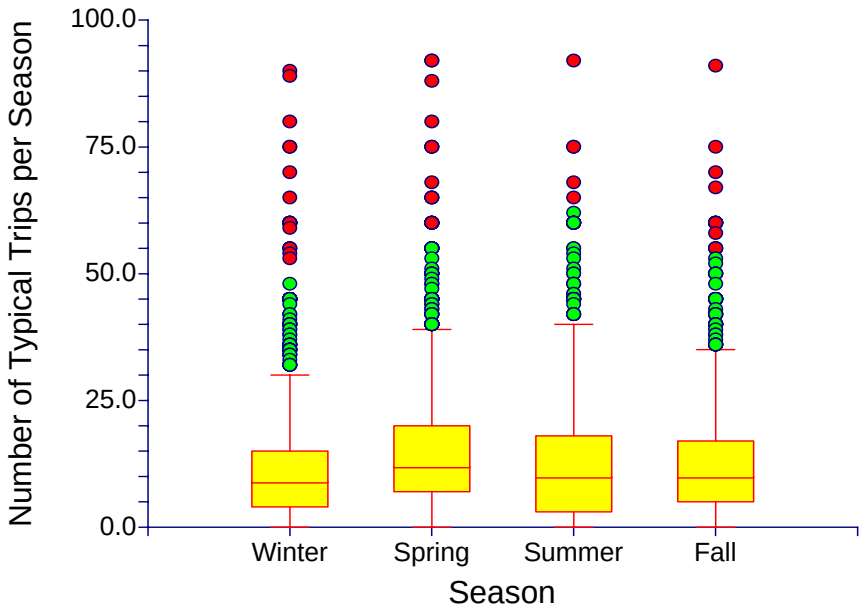


Figure 7. Box Plots for Trips by Season.

Figure 9 illustrates the mean number of trips per season (for all waterway access groups) in comparison to the overall mean of 13.0 trips per season. Given that the seasonal trip distributions were found to be non-normal, a Kruskal-Wallis (KW) ANOVA and a mean Rank Sum Test were used to evaluate the hypothesis of "equality of medians" of trip counts across seasons and waterway access groups. The test results for the seasonal comparisons are shown in Table 9. KW-ANOVA test results lead to rejecting the null hypothesis of equality of medians at the 95% confidence level. Furthermore, it is shown that the median number of trips taken during the fall and winter (with 10 and 9 trips, and Z-values of –2.04 and –7.25, respectively) are significantly less than the overall seasonal median of 10.25 trips at the 95% confidence level.

Figure 8a. Histogram of Reported Trips for the Winter Boating Season (December through February).

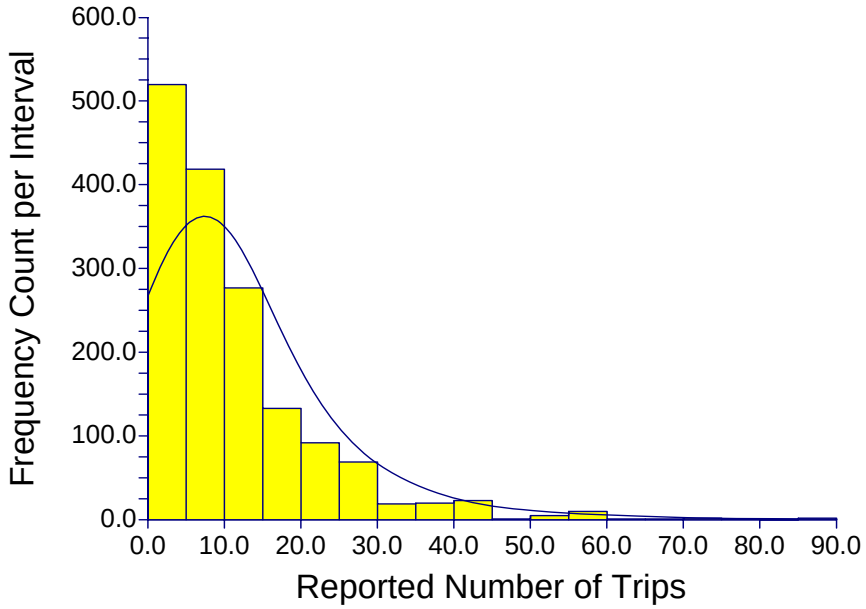


Figure 8b. Histogram of Reported Trips for the Spring Boating Season (March through May).

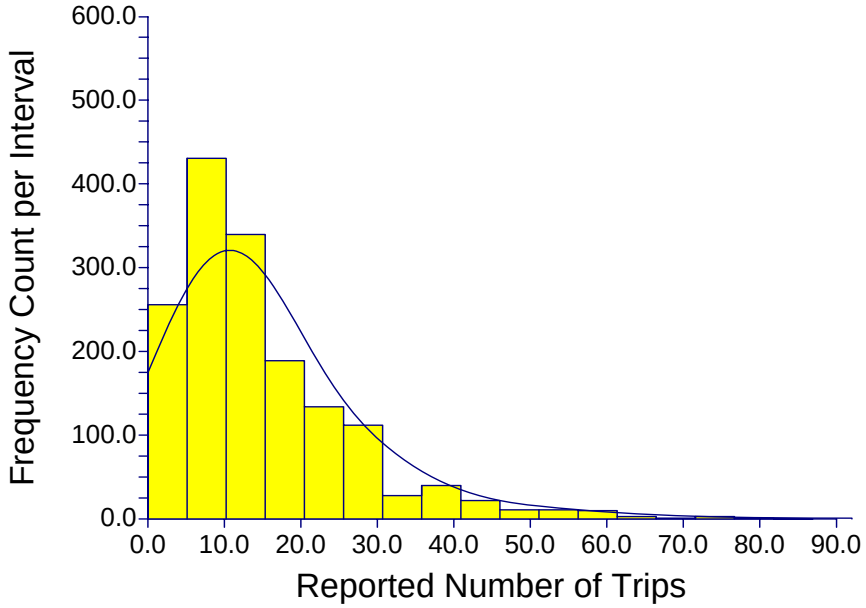


Figure 8c. Histogram of Reported Trips for the Summer Boating Season (June through August).

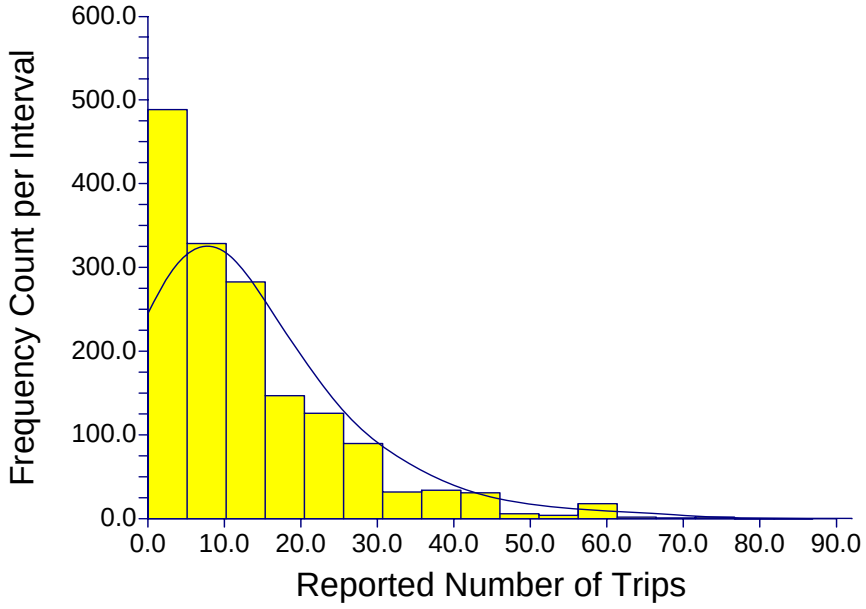


Figure 8d. Histogram of Reported Trips for the Fall Boating Season (September through November).

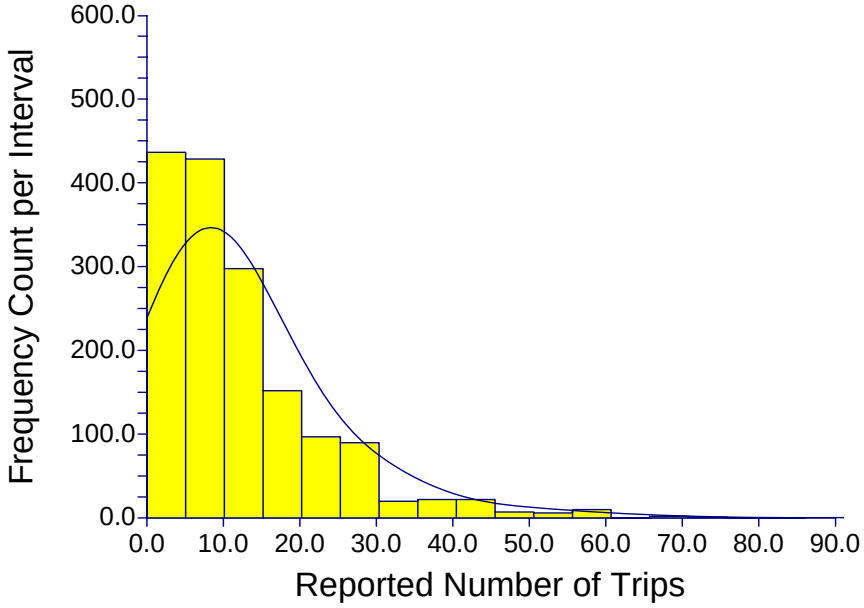
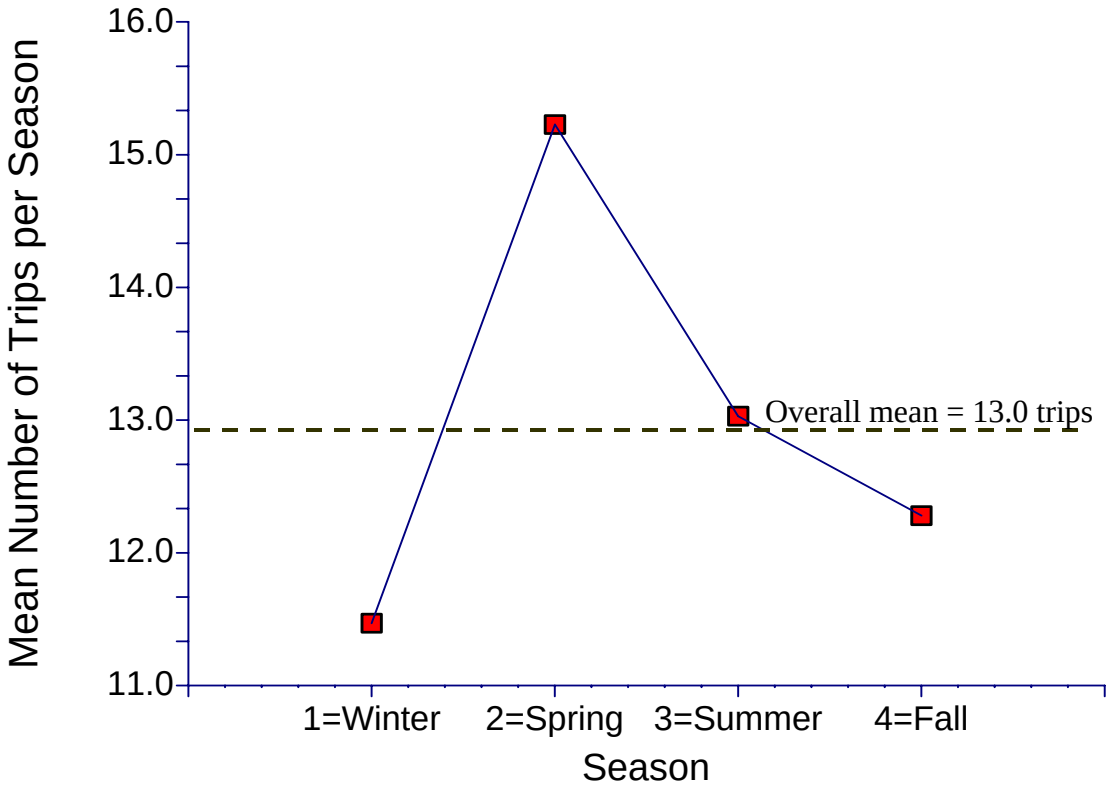


Figure 9 Mean Trip Counts per Season.



While the average number of trips reported during the summer months is very close to the overall mean for an average season, it does not necessarily provide a good representation of an "average" or typical boating season in terms of trip generation when closer inspection is paid to trips associated with each of the various user groups. In fact, a fair amount of variability in seasonal trip patterns can be found when one compares trip statistics across user groups (see the statistics presented in Table 8 and the distributions illustrated by Figures 10a through 10d and Figures 11 and 12). Thus, the importance of examining seasonal trends by waterway access group must not be understated.

Six distinct seasonal user patterns emerge:

(1) During the winter boating season (December through February), marina wet slip users tend to take a significantly greater number of boat trips than do boaters from other user groups, with a mean of 15.7 trips and a median of 12 trips, in comparison to the overall mean of 11.4 trips and median of 9 trips for all survey respondents;

(2) Ramp users tend to take significantly fewer trips in the winter, with a median of only 6 trips (in comparison to the overall median of 9 trips during that period for all user groups);

(3) No discernable differences in the estimated mean or median number of trips for the various user groups are observed during the peak-use Spring boating season (i.e., the

mean or median number of trips per user group are shown not to be significantly different from one another or from the overall mean or median Spring value for all survey respondents;

(4) During the summer boating season (June through August), the mean and median number of trips for ramp and dock users–14.8 and 13.9 trips respectively--are shown to be significantly greater than the overall mean of 13.0 trips and median of 10 trips for all survey respondents.

(5) The mean and median number of trips reported by boaters accessing the water from marina wet slips is lower during the summer boating season, with only 8.5 and 4 trips respectively, reported during this 12-week period. These mean and median values are found to be significantly less than the overall mean of 13.0 trips and median of 10 trips for all survey respondents that reported taking trips during that season; and

(6) The mean number of trips for each user group? in the fall boating season (spanning the months of September through November) is not significantly different than the mean number of trips for all user groups during this period; although the median number of trips reported by marina wet slip users in the fall (8 trips) is found to be significantly less than the overall median for the fall (10 trips).

In short, marina wet slip users tend to be more active during winter and spring, less active during fall, and least active during summer in comparison to other user groups.

Table 9. Kruskal-Wallis ANOVA and Mean Rank Sum Test Results.

Kruskal-Wallis One-Way ANOVA on Ranks
Hypotheses
Ho: All medians are equal (across the designated boating seasons)
Ha: At least two medians are different (across the designated boating seasons)

Test Results

Method	DF	Chi-Square (H)	Probability Level	Decision*
Not Corrected for Ties	3	138.6721	0.000000	Reject Ho
Corrected for Ties	3	139.0983	0.000000	Reject Ho
Number Sets of Ties	59			

* 95% confidence level

Test Result: ***Reject*** the null hypothesis of equality of medians at 95% confidence level.

Mean Rank Sum Test
Group Detail

Season	Count	Sum of Ranks	Mean Rank	Z-Value	Median
Fall	1594	4954468.00	3108.20	-2.0476**	10
Spring	1595	5799149.50	3635.83	11.1644***	12
Summer	1595	4969238.50	3115.51	-1.8654****	10
Winter	1595	4626154.00	2900.41	-7.2518**	9

Note: Overall median value for a typical boating season = 10.25 trips per season.

** Significantly less than the overall median of 10.25 at 95% confidence
*** Significantly greater than the overall median of 10.25 at 95% confidence
****Significantly less than the overall median of 10.25 at 90% confidence

These results are consistent with paired (equality of means) t-tests and the conclusion reached by comparing confidence intervals for the mean number of observed trips per season by user group at the 95% confidence level.

Figure 10a. Box Plots of Winter Trips by User Group.

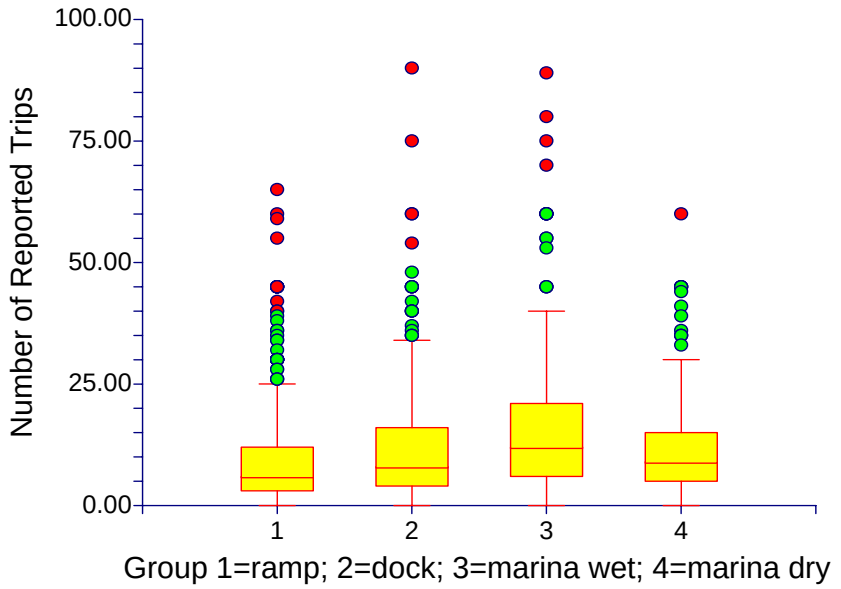


Figure 10b. Box Plots of Spring Trips by User Group.

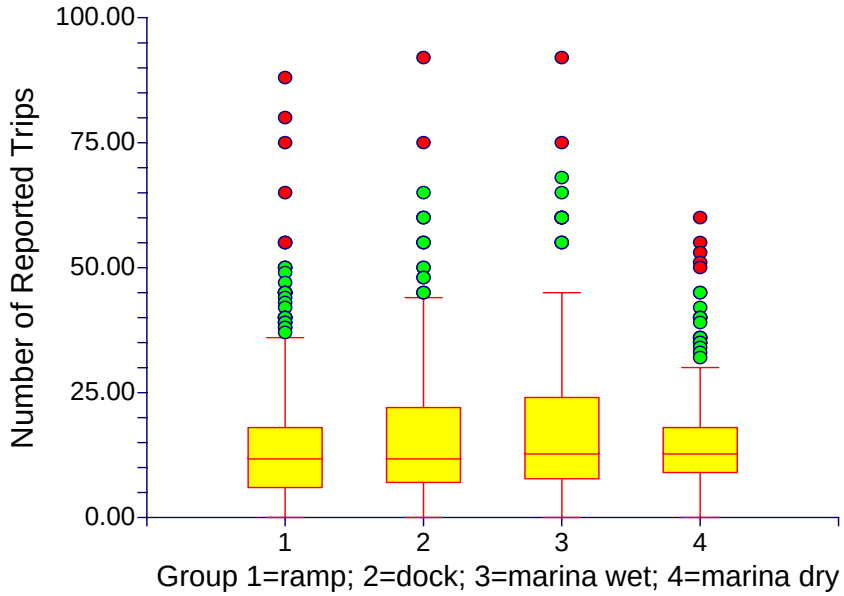


Figure 10c. Box Plots of Summer Trips by User Group.

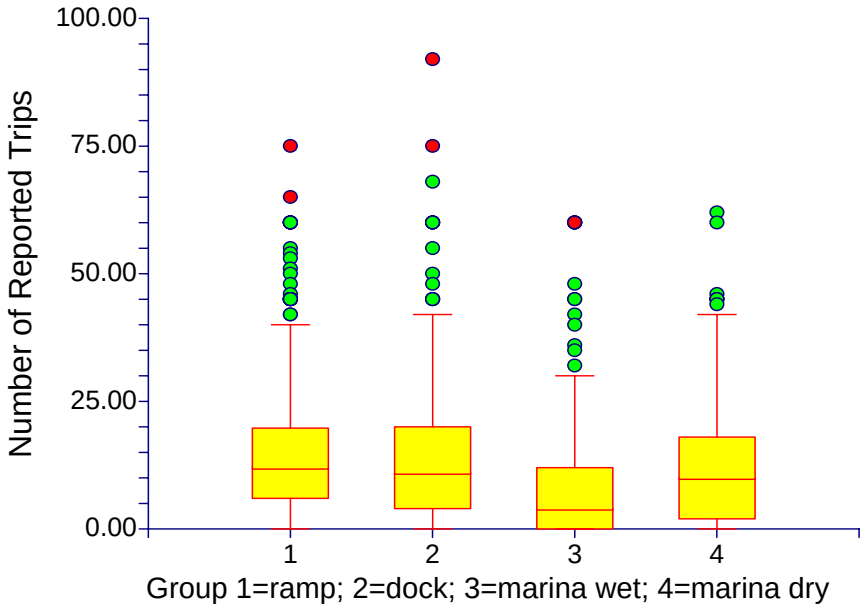


Figure 10d. Box Plots of Fall Trips by User Group.

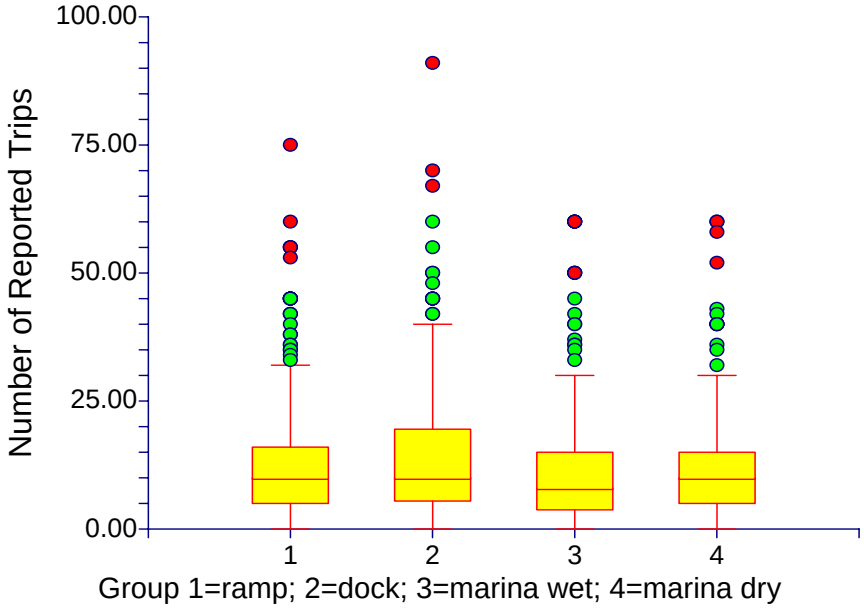


Figure 11. Average Trip Counts by Season and User Group.

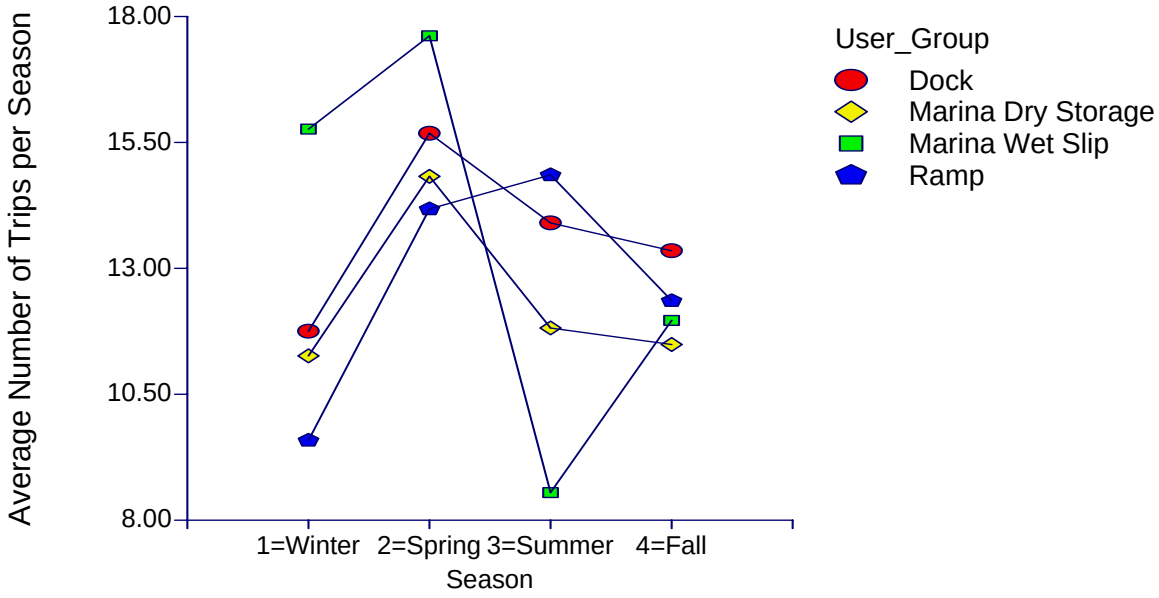
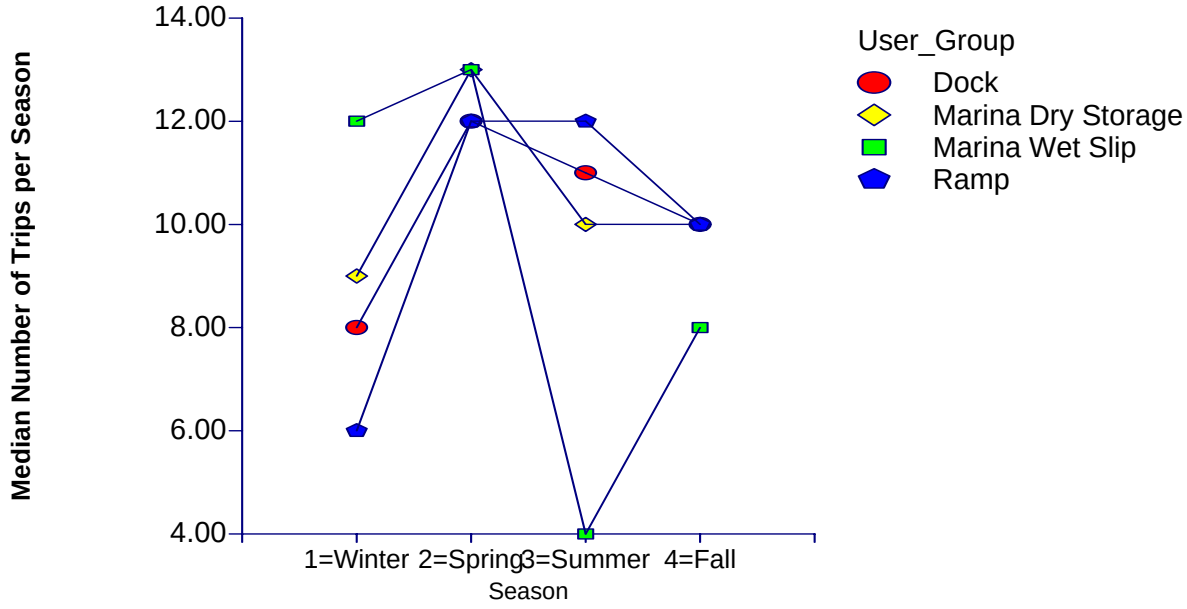


Figure 12. Median Trip Counts by Season and User Group.



III. Seasonal Trip Characteristics

This section examines seasonal boating trip characteristics using the information pertinent to the "last two" trips taken by survey recipients. The analysis used data reported by boaters responding to either long or abridged versions of the questionnaire[2]. The analysis focuses on seasonal variations in the following trip-related attributes: AM and PM departure time, trip duration, weekend versus weekday trip proportions, residency status of boaters in the study region (based on the number of months boaters reside in the state of Florida), and reported trip activities.

Long and short questionnaire information was combined for the subset of attributes that comprised the various trip characteristics to be evaluated seasonally. A breakdown of reported trips that took place during a given boating season is shown in Table 10. A total of N=5,062 trips were reported from both long and short versions of the questionnaire. Roughly 48% of the reported trips occurred during the spring. The large number of reported spring boating trips is likely an outcome of both the timing of the various survey waves (i.e., when the questionnaires were mailed out to boaters in the region) and the peak-use characteristics of the spring boating season. Despite the heavy orientation of the sample toward spring trips, adequate samples were also obtained for the winter, summer, and fall seasons, as well as most season and user group combinations.

[2] Data obtained from the short version of the survey could not be used in the identification of boating seasons as Question 7 was only included on the long version of the survey.

Table 10. Seasonal Survey Participation Among User Groups.

Season:	**All Users**	**Ramp**	**Dock**	**Marina Wet**	**Marina Dry**	**Other**
Winter	852 (16.8%)	274 (17.3%) **(32.1%)**	237 (14.7%) **(27.8%)**	157 (20.3%) **(18.4%)**	167 (15.8%) **(19.6%)**	17 **(2.0%)**
Spring	2,457 (48.5%)	686 (43.5%) **(27.9%)**	780 (48.4%) **(31.7%)**	396 (51.2%) **(16.1%)**	578 (54.7%) **(23.5)**	17 **(< 1%)**
Summer	1,028 (20.3%)	380 (24.1%) **(37.0%)**	356 (22.1%) **(34.6%)**	96 (12.4%) **(9.3%)**	186 (17.6%) **(18.1%)**	10 **(1%)**
Fall	725 (14.3%)	237 (15.0%) **(32.7%)**	238 (14.8%) **(32.8%)**	123 (16.0%) **(17.0%)**	125 (11.8%) **(17.2%)**	2 **(< 1%)**
N =	5,062	1,577	1,611	772	1,056	46
	Percentage of all users*	31.1%	31.8%	15.3%	20.8%	

* Survey respondents classified as "Other" – boaters launching from Beach. Shoreline, or Causeway.

Percentages (%) shown in parentheses, are as follows:
% of user group in non-bold type; % of season total in bold type.

Trip Departure-Time Statistics

Departure time statistics are derived from an analysis of responses to survey Question 2.

> **Question 2**. About what time did you get on the water for each of the two trips that you drew on the map? *(For example, 7:30AM)*

First Trip (**solid line**)
Second Trip (**dashed line**)

Summary statistics for reported AM departure times by season and user group are presented in Table 11[3]. The results are based on information obtained from the N=4,204 survey respondents (representing 85.1% of the total reported trips). The mean AM departure time of trips reported by survey respondents was 8:41AM. The average summer departure time of 8:16AM was found to be significantly earlier than the average departure times during the winter, spring, and fall boating seasons (8:46AM, 8:48AM, and 8:50AM, respectively) and significantly earlier than the yearly average.

Relative frequency histograms highlighting the distributions of reported AM departure times by season are shown in Figures 13a through 13d. The histograms and summary statistics reveal several interesting features that are worthy of discussion.

(1) First, the distribution of AM departure times during the winter boating season is "tri-modal." In other words, there are three distinguishable peaks in the distribution of AM departure times. This suggests the presence of three waves of AM departure-time boaters: (a) those that start their trips early (around or before 8:00AM); (b) a second wave that leaves around the mean departure time (somewhere between 8:00 and 8:40AM); and (c) a third group that departs around or after 9:00AM.

(2) Second, the AM departure-time statistics in Table 11 show that ramp users begin their trips earlier than other user groups, especially during the winter season (departing at approximately 8:05AM on average, with a 95% confidence interval for mean launch time that spans from 7:52AM to 8:18AM). Boaters accessing the waterways from marina wet slips reported start times that were significantly later than other user groups during the winter and fall; with an average winter AM start time of 9:19AM (median start time of 10:00AM), and an average start time of 9:09AM (median start time of 9:30AM) during the fall boating season.

[3] Spring and summer departure times may be somewhat understated and fall and winter departure times overstated due to complications the arise with the conversion to Daylight Savings Time.

(3) Third, multi-modal distributions for AM departure times are observed for reported trips associated with the spring and fall boating seasons (see Figures 13b and 13d), suggesting two peak AM departure periods – a before-9:00AM group and an after-9:00AM group.

(4) Fourth, the histogram of AM departure times for reported trips during the summer boating season (see Figure 13c) is noticeably flatter than those found in the other seasons. The distribution of summer AM trip departure times shows more variability about its mean and median.

Morning (AM) departure times by season and user group are highlighted in Figure 14. Substantial differences can be seen between the average AM departure times of ramp users versus those of the other "late departure" groups. Notwithstanding, the seasonal trends in departure times are similar, with the earliest AM departure times occurring during the summer boating season and, on average, the latest AM departure times observed during the fall. Of the three late-departure groups, marina dry storage facility users show the greatest seasonal variability in AM departure time, with an up-and-down seasonal pattern reminiscent of ramp users but with AM departure times that are approximately 45 minutes to 1 hour later.

Table 11. AM Departure Time by Season and User Group.

Season:	**All Users**	**Ramp**	**Dock**	**Marina Wet**	**Marina Dry**	**Other**
Winter	***8:46AM*** 9:00 (678)	**8:05**† 7:30*† (223)	**9:02** 9:30 (177)	**8:58** 9:00 (125)	**9:19**†† 10:00†† (137)	(16)
Spring	***8:48AM*** 9:00 (2,045)	**8:08**† 8:00† (591)	**8:57** 9:00 (630)	**9:09** 9:30†† (332)	**9:09** 9:30†† (479)	(13)
Summer	***8:16AM**** 8:30* (871)	**7:37***† 7:30*† (336)	**8:43*** 9:00 (290)	**8:48*** 9:00 (79)	**8:31*** 9:00 (158)	(8)
Fall	***8:50AM*** 9:00 (610)	**8:20**† 8:00† (204)	**9:06** 9:00 (199)	**9:01** 9:00 (101)	**9:09** 9:30†† (104)	(2)
Typical Season (year)	***8:41AM*** 9:00 N=4,204	***8:02AM*** 8:00 (1,354)	***8:57PM*** 9:00 (1,296)	***9:03AM*** 9:30 (637)	***9:04AM*** 9:30 (878)	(39)

Note: Mean shown in bold type; median in non-bold type. Sub-sample sizes are shown in parentheses.

* Significantly less (earlier) than values observed from the same user group or the overall mean or median value during other seasons at the 95% confidence;
† Significantly less (earlier) than values observed in other user groups or the overall mean or median value during the same season at the 95% confidence level;
†† Significantly greater (later) than values observed for other user groups or the overall mean or median value during the same season at 95% confidence.

Figure 13a. Histogram of AM Departure Time – Winter.

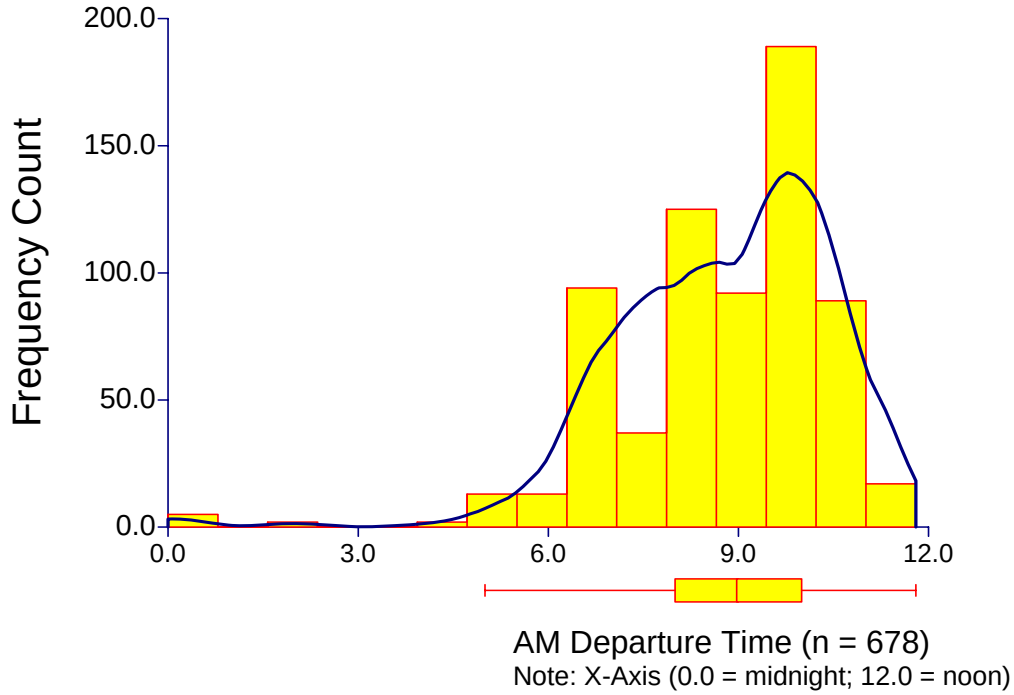


Figure 13b. Histogram of AM Departure Time – Spring.

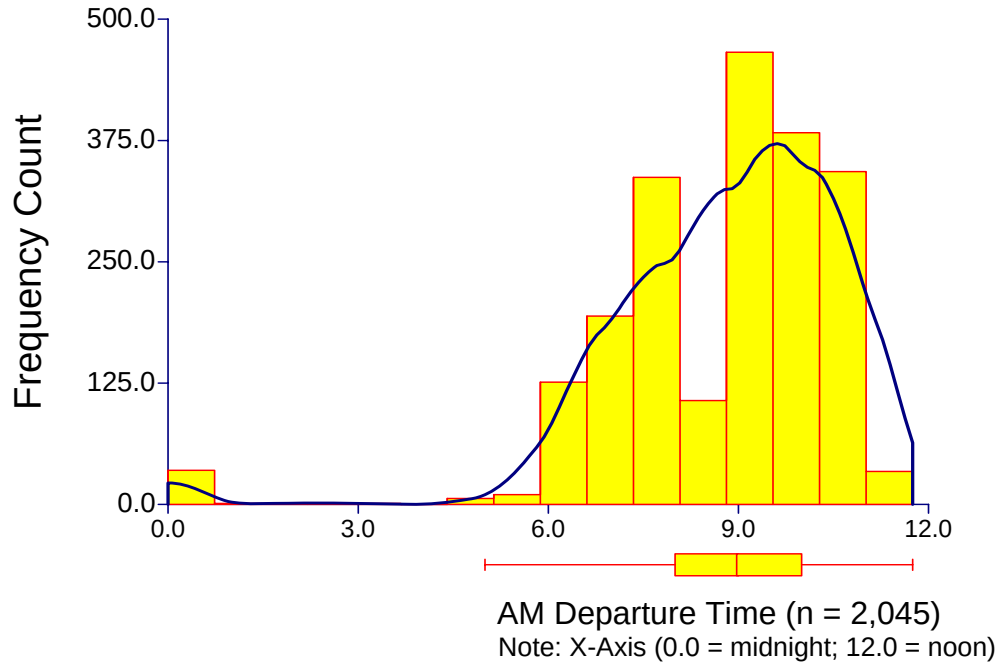


Figure 13c. Histogram of AM Departure Time – Summer.

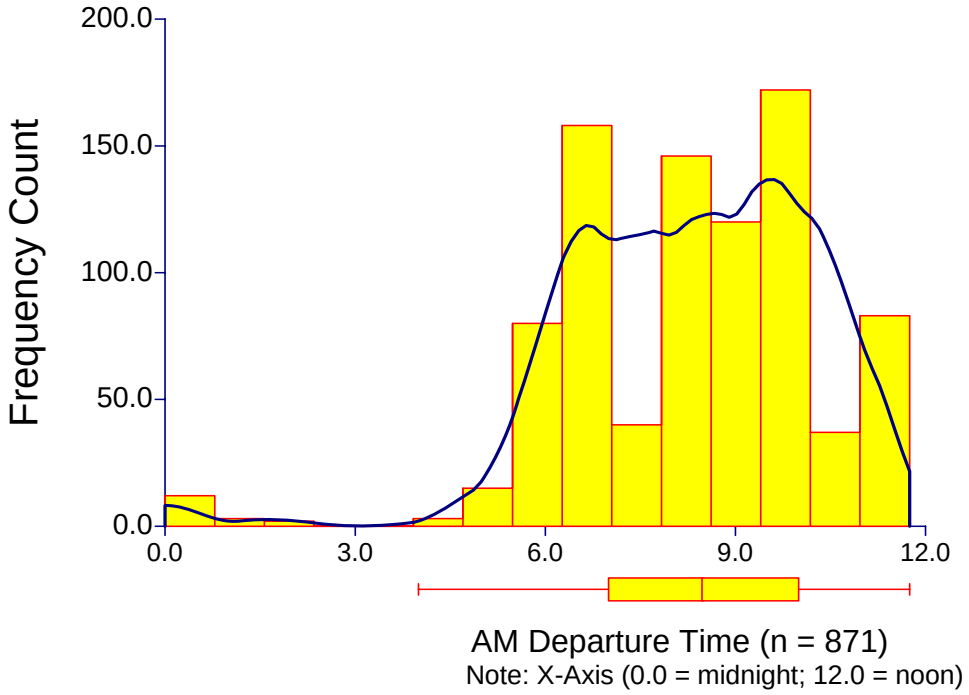


Figure 13d. Histogram of AM Departure Time – Fall.

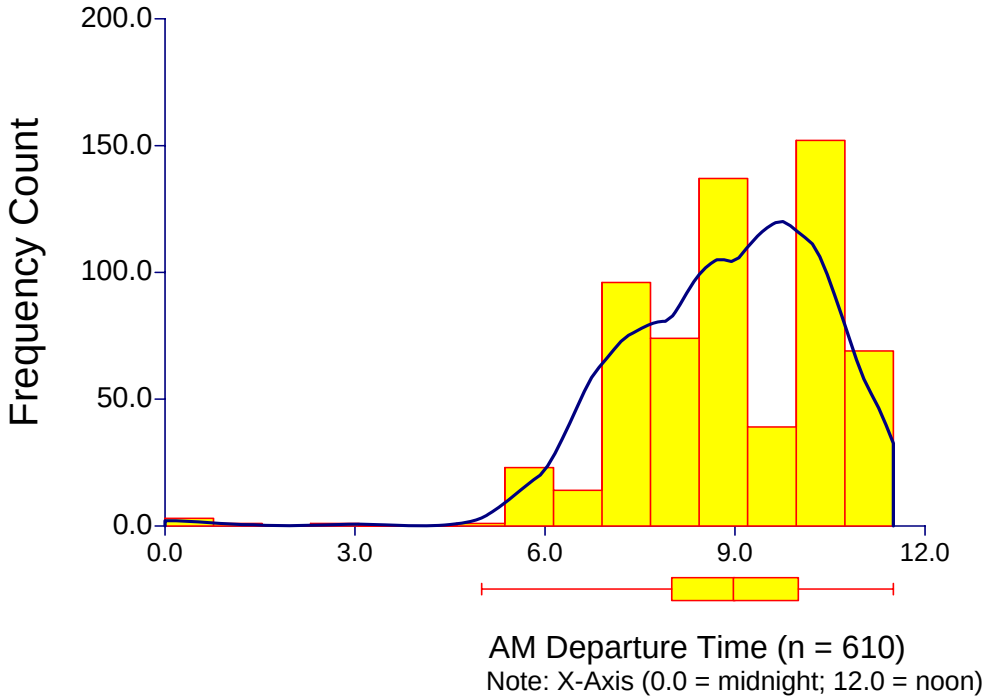
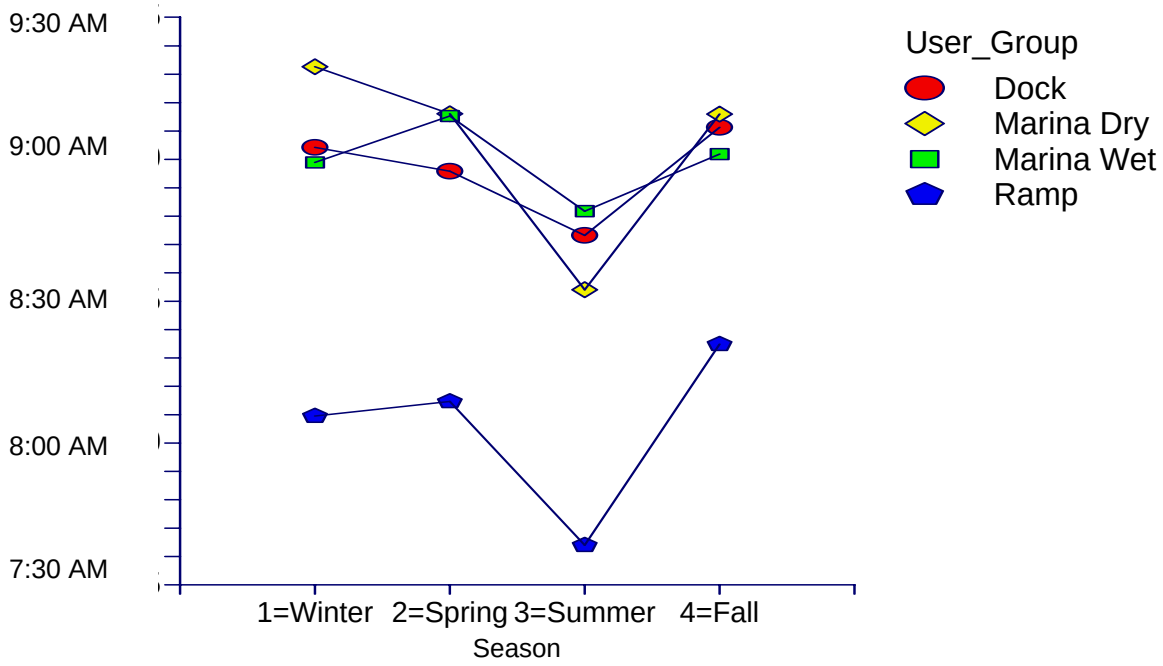


Figure 14. Seasonal AM Departure Times by User Group.



Seven hundred and thirty-four (734) survey respondents reported trips with PM departure times. This sub-sample represents 14.9% of the total reported trips from the combined surveys. The distribution of PM departure times is shown in Figure 15[4]. The distribution is positively skewed, showing a multi-modal tendency, with two noticeable peaks centered between 1:00-1:30PM and 4:00-4:30PM. The time periods associated with these peaks represent two distinct waves of PM departures: (1) a primary wave that peaks by 1:30PM and dampens shortly after 3:00PM; and (2) a lesser but relevant secondary peak that rises around 4:00PM and declines by 6:00PM.

A seasonal summary of PM departure times for user groups is given in Table 12. The average PM departure time is 2:30PM with a median departure time of 2:00PM. The reported PM launch time for trips that occurred during the summer is shown to be significantly later than the PM launch times for other seasons with a mean of 3:01PM and a median of 2:30PM.

Several distinctions are identified when departure times are summarized by user group. The reported trips of ramp users show a PM launch time that is significantly later than other user groups during the winter and spring boating seasons. In addition, ramp users tend to launch earlier in the afternoon during the fall boating season in comparison to other times of the year. Both dock and marina wet slip users tend to have PM departure times that are significantly later in the summer than those observed in winter, spring, or fall boating seasons. During the fall boating season, marina dry storage users reported trips with PM launch times that are significantly later than those reported by the other user groups.

[4] Caution should be exercised in analyzing the trends in PM launch times as described in this section, due to the fact that relatively small sample sizes are associated with many of the statistical comparisons.

Figure 15. Frequency Distribution of PM Launch Times for Reported Trips.

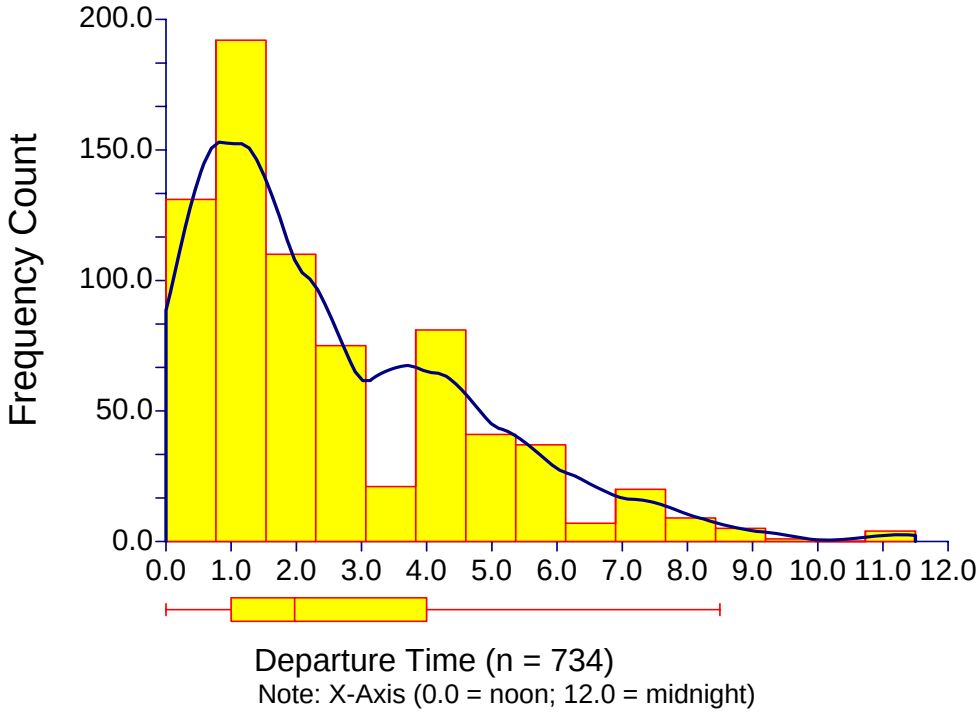


Table 12. PM Departure Time by Season and User Group.

Season:	**All Users**	**Ramp**	**Dock**	**Marina Wet**	**Marina Dry**	**Other**
Winter	***2:34PM*** 2:00 (157)	**3:27***† 2:45*† (46)	**2:08** 1:30 (54)	**2:01** 1:00 (30)	**2:25** 1:15 (26)	 (1)
Spring	***2:24PM*** 2:00 (360)	**2:51**† 2:30† (84)	**2:06** 1:30 (131)	**2:04** 1:30 (56)	**2:37** 2:00 (85)	 (4)
Summer	***3:01PM**** 2:30* (125)	**3:11*** 2:45* (32)	**3:03*** 2:30* (55)	**2:57*** 2:30* (14)	**2:52*** 2:30 (22)	 (2)
Fall	***2:10PM*** 1:45 (92)	**2:01**** 1:00** (22)	**2:00** 1:45 (36)	**1:54** 1:00 (17)	**2:58***† 2:00† (17)	 (0)
Typical Season (year)	***2:30PM*** 2:00 N=734	***2:58PM*** 2:30 (184)	***2:17PM*** 2:00 (276)	***2:08PM*** 1:15 (117)	***2:40PM*** 2:00 (150)	 (7)

Note: Mean shown in bold type; median in non-bold type. Sub-sample sizes are shown in parentheses.

* Significantly greater (later) than values observed from the same user group during other seasons at the 95% confidence level;

** Significantly less (earlier) than values observed from the same user group during other seasons at the 95% confidence level;

† Significantly greater (later) than values observed in other user groups during the same season at the 95% confidence level.

Seasonal Analysis of Trip Duration

Short-Trips: Reported Trips of 24 Hours or Less

Trip duration statistics are derived from an analysis of survey Question 3.

Question 3. About how long were you on the water on each of the two trips that you drew on the map? *(Please write in the number of hours **or** days.)*

First Trip (**solid line**)	Hours	Days
Second Trip (**dashed line**)	Hours	Days

A seasonal comparison was made of trip durations of n=4,166 reported trips of 24 hours or less (representing 83.3% of the total number of trips reported by survey respondents). The analysis revealed no discernable or significant statistical differences in the mean or median number of hours spent on the water across the four designated boating seasons when responses from the four user groups were combined. Seasonal differences in the duration of day trips are observed, however, between marina wet slip, marina dry storage, ramp and dock user groups.

The summary results for trip duration are presented in Table 13 for "day trips" – reported trips $\leq$ 24 hours. Supporting graphics for this section are shown in Figures 16a through 16h. Reported day trips averaged about 5.34 hours, with an observed median of 5 hours. Note the median trip duration of 5 hours is consistent across all seasons. It can be shown that the 95% confidence interval for the mean reported duration of day trips is between 5.26 hours and 5.43 hours. The limited range of this interval (approximately .17 hours or 10 minutes) indicates that reported trip durations are compactly distributed about the mean and median despite the presence of outliers (see the box plot drawn below the histogram in Figure 16h).

The box plots presented in Figure 16a show that the distributions of trip duration by boating season (for reported trips of 24 hours or less) are very similar in shape, with only subtle and statistically non-significant differences. Nevertheless, several interesting differences in reported trip durations by user group were uncovered. For instance, the average reported trip duration for ramp users was 6.39 hours, with a median trip duration of 6 hours – values that are significantly greater than those observed for the other user groups in any of the boating seasons (see box plots in Figures 16c through 16f, and the seasonal user group comparison shown in Figure 16g). Ramp users tended to stay out on the water anywhere from approximately 45 minutes to 1.5 hours longer than boaters from other categories. Day trips in general are of shorter duration for marina dry storage users (Figure 16g). Day trips taken by marina wet slip users tend to be shorter in spring and fall than their trips in summer and winter and dock owners take shorter day trips in the winter.(compare season-specific box plots shown in Figures 16c, 16d, 16e and 16f and statistics highlighted in Table 13).

While the mean and median day trip duration of boaters that responded to the survey does not vary across season (and is generally around 5 hours), significant differences were observed once trips were categorized by both season and user group. This result supports the notion that boaters associated with the various user groups constitute distinct statistical populations in terms of trip duration characteristics.

Table 13. Mean and Median Trip Durations (in hours) by Season and User Group of Reported "Day Trips" (Trips ≤ 24 Hours).

Season:	**All Users**	**Ramp**	**Dock**	**Marina Wet**	**Marina Dry**	**Other**
Winter	***5.14 hrs*** 5 hrs (686)	**5.98**† 6† (231)	**4.71** 4††** (198)	**5.20** 4.5 (99)	**4.33**†† 4.5 (148)	(10)
Spring	***5.34 hrs*** 5 hrs (2013)	**6.51**† 6† (592)	**5.16** 5 (641)	**4.45**††** 4††** (237)	**4.64**†† 4.5 (532)	(11)
Summer	***5.61 hrs*** 5 hrs (886)	**6.70**†* 6† (328)	**5.15** 5 (301)	**5.03** 5 (70)	**4.63**†† 5 (180)	(7)
Fall	***5.25 hrs*** 5 hrs (583)	**6.04**† 6† (210)	**5.24** 5 (200)	**4.85** 4†† (61)	**4.00**††** 4††** (110)	(2)
Typical Season (year)	***5.34 hrs*** 5 hrs N=4168	***6.39*** (1361)	***5.10*** (1340)	***4.75*** (467)	***4.52*** (970)	(30)

Note: Mean shown in bold type; median in non-bold type. Sub-sample sizes are shown in parentheses.

* Significantly greater (longer) than values observed from the same user group during other seasons at the 95% confidence level;
** Significantly less (shorter) than values observed from the same user group during other seasons at the 95% confidence level;
† Significantly greater (longer) than values observed in other user groups during the same season at the 95% confidence level;
†† Significantly less (shorter) than values observed in other user groups during the same season at the 95% confidence level.

Figure 16a. Box Plots of Day Trip Duration by Season (Trips ≤ 24 Hours).

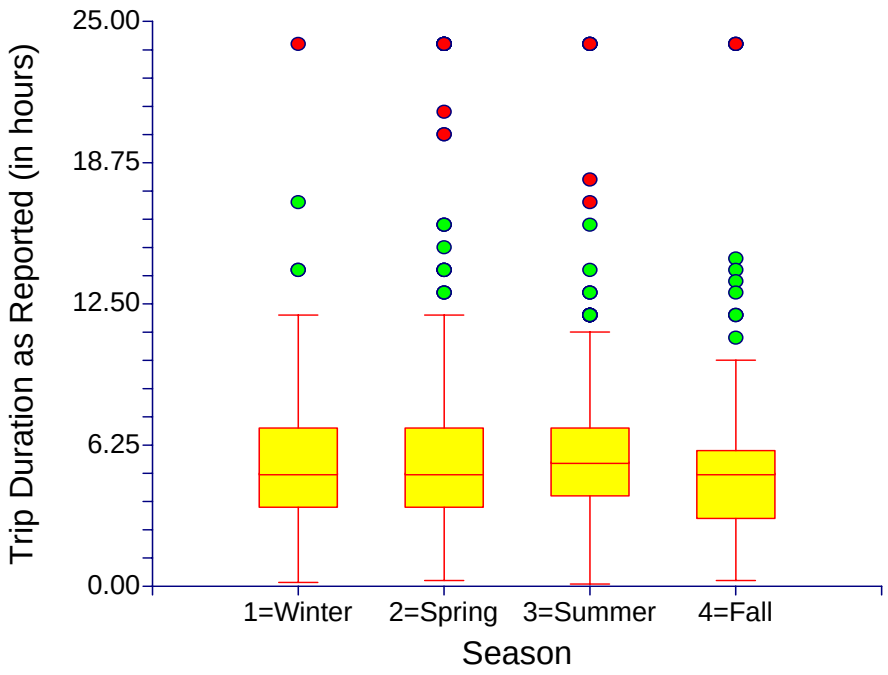


Figure 16b. Box Plots of Day Trip Duration by User Group (Trips ≤ 24 Hours).

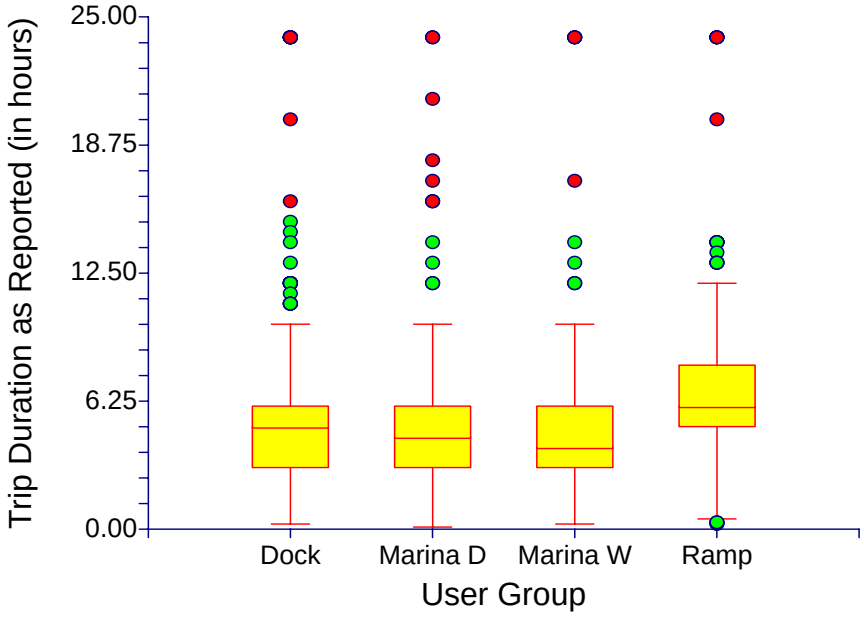


Figure 16c. Box Plots of Winter Day Trip Duration (Trips ≤ 24 Hours) by User Group.

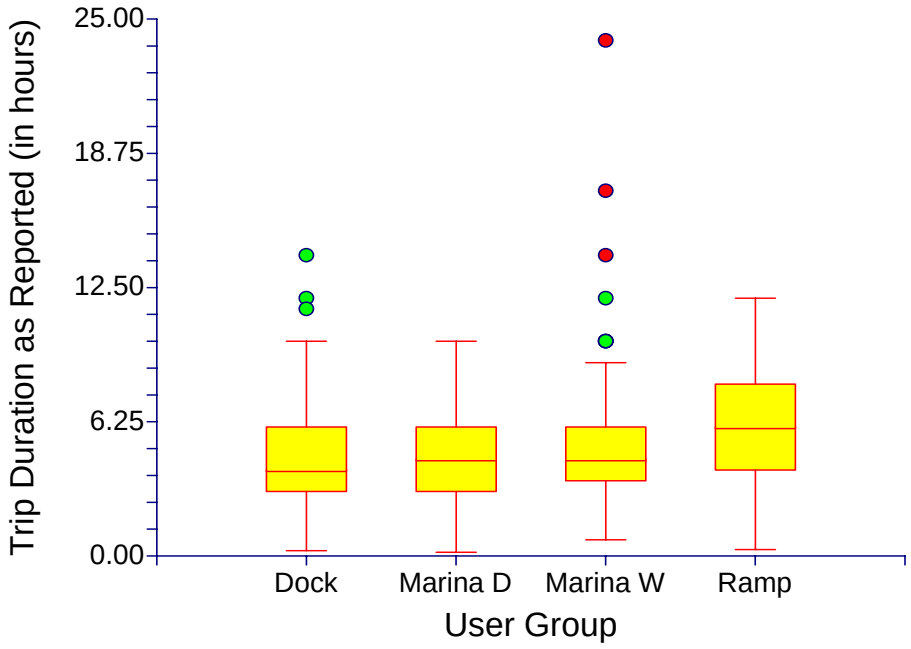


Figure 16d. Box Plots of Spring Day Trip Duration (Trips ≤ 24 Hours) by User Group.

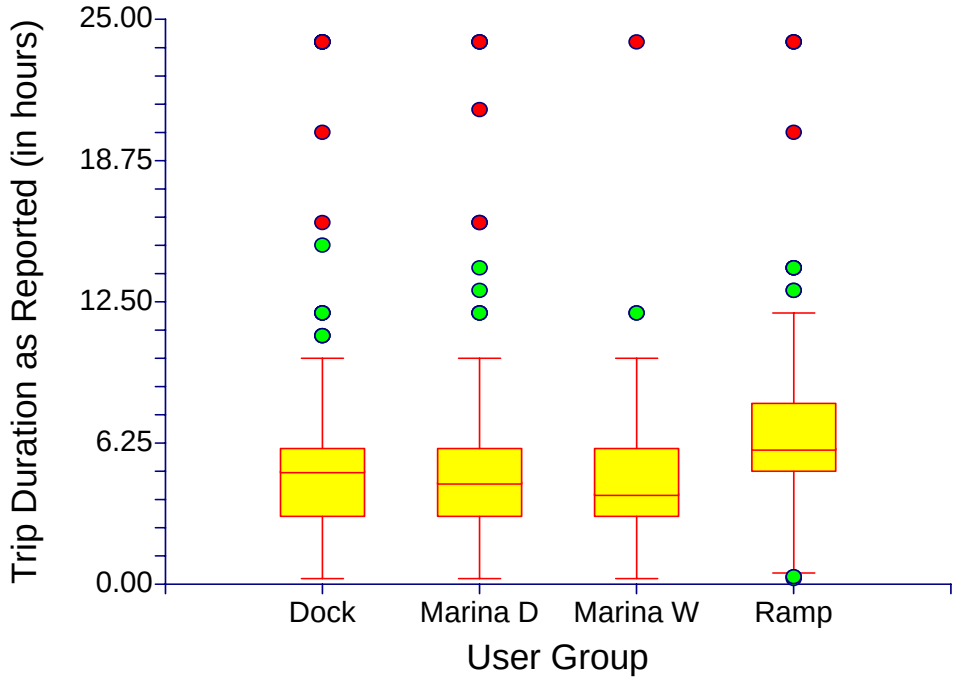


Figure 16e. Box Plots of Summer Day Trip Duration (Trips ≤ 24 Hours) by User Group.

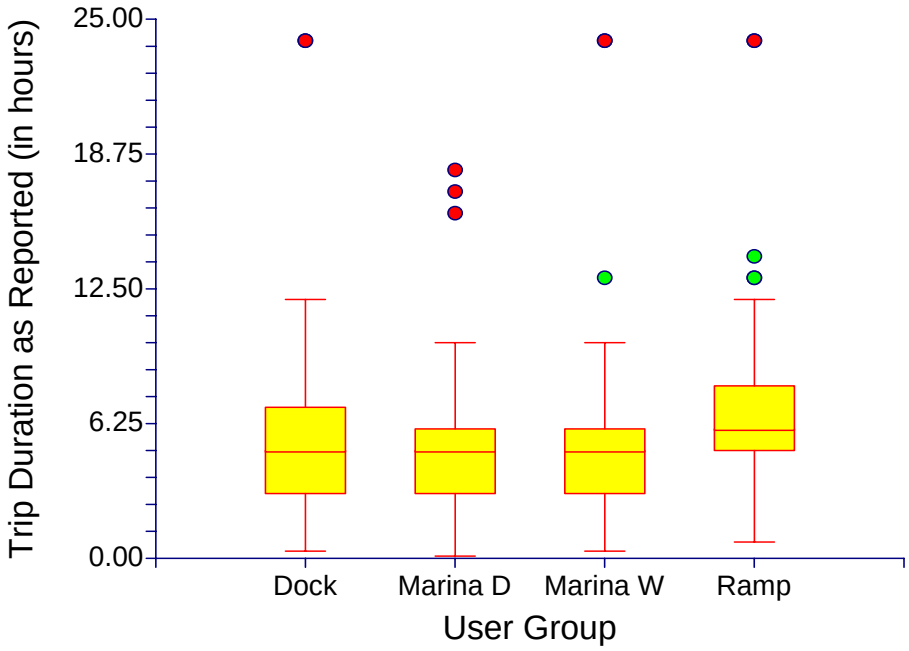


Figure 16f. Box Plots of Fall Trip Duration (Trips ≤ 24 Hours) by User Group.

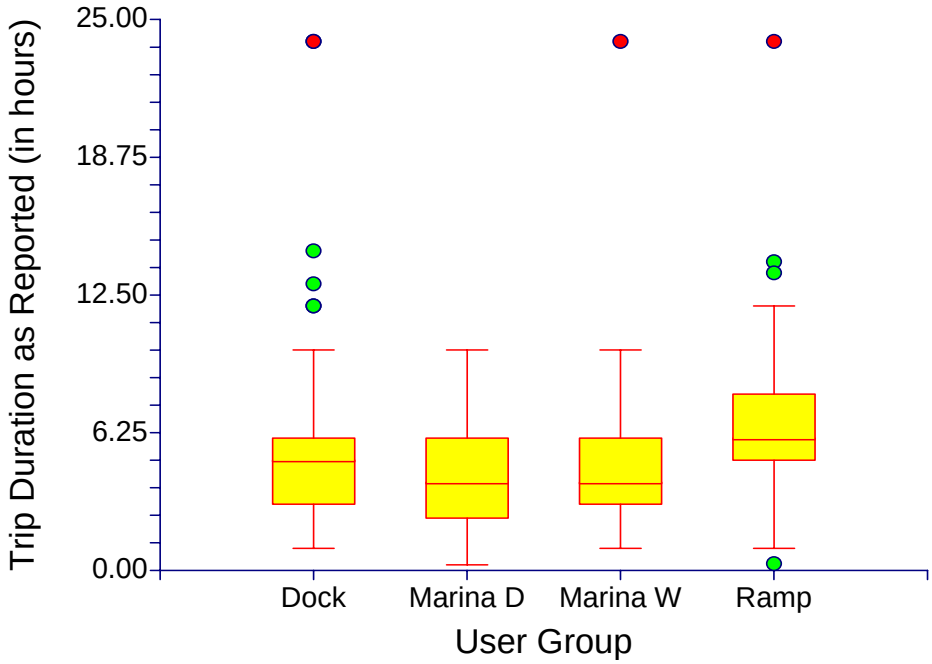


Figure 16g. Average Reported Duration of Day Trips by Season/User Group.

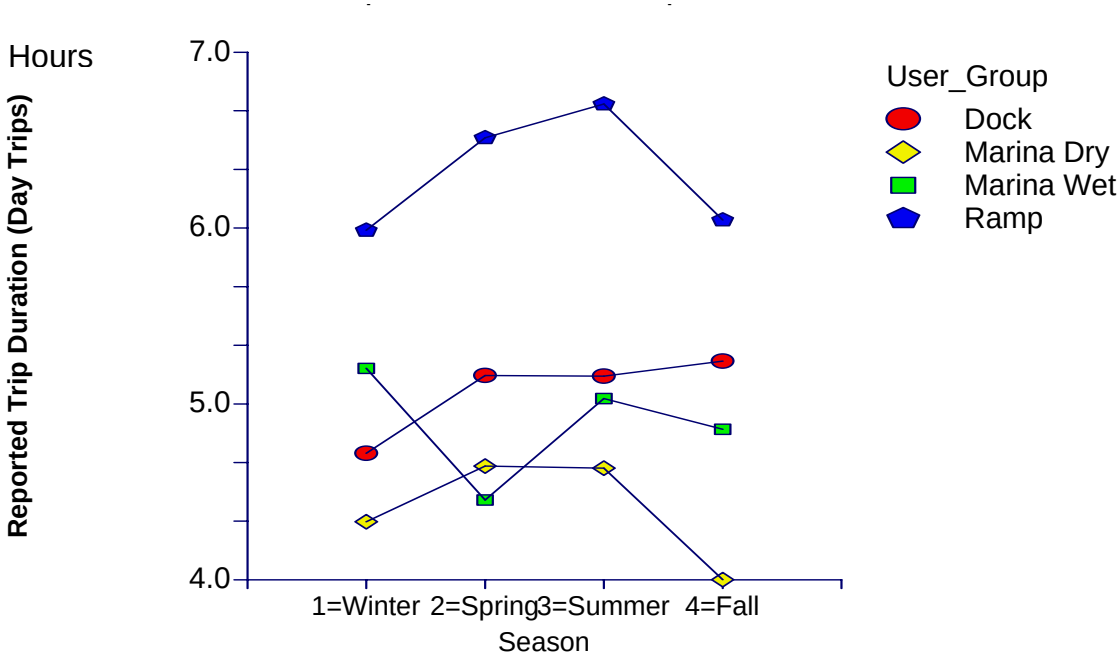
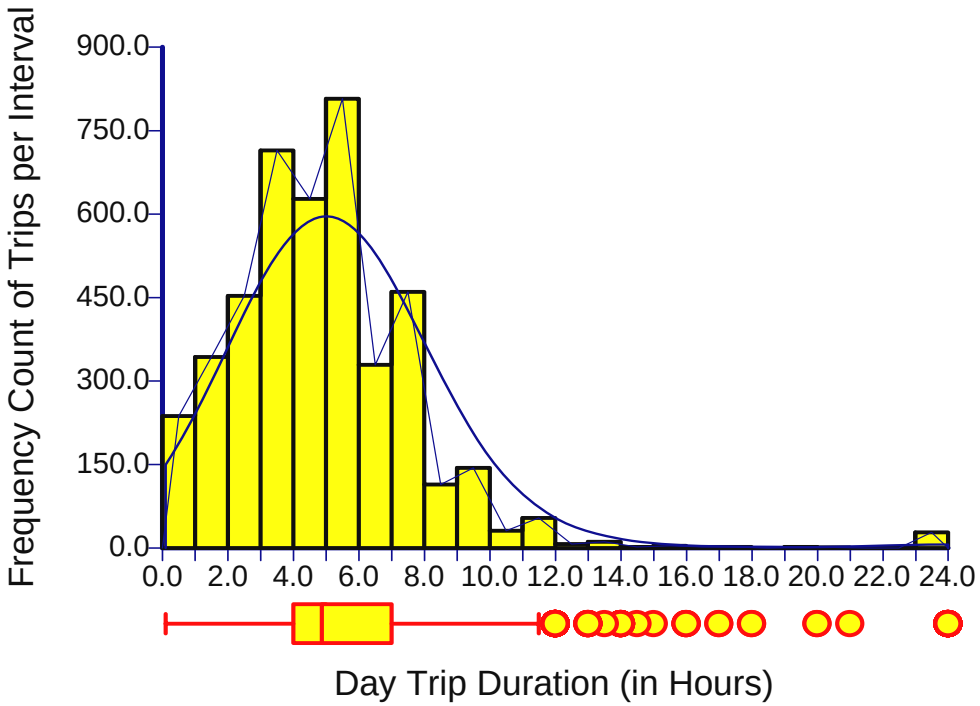


Figure 16h. Distribution of the Duration of Day Trips as Reported by Boaters from All User Groups.



Long-Trips: Reported Trips Greater than 24 Hours in Duration

A total of n=832 reported trips (or 16.7% of the total trips reported) were of a duration greater than 24 hours. For convenience, these trips have been labeled as “long trips” – trips that are in excess of a day, but not exceeding 30 days in length. Summary statistics for long trips by season and user group are provided in Table 14. Box plots for long trip duration by boating seasons are shown in Figure 17a, and a user-group comparison in Figure 17b. Figure 17c presents a comparison of the average long trip duration by season and user group.

The average reported long trip duration was 73.5 hours, and the median trip duration was 48 hours. The large gap in these measures of centrality highlight the highly skewed nature of the distribution of long trip duration values, and the presence of extreme outlying values at the tail end of the distribution (see Histogram and Dot Plot in Figure 17d).

The seasonal results combining all user groups suggest that duration of reported long trips is typically shorter during the summer boating season and of greater average duration during the spring boating season. Analysis by user group reveals that marina wet slip and dock users account for the preponderance of long duration boating hours across all seasons. With average trip durations of 94 and 84.2 hours respectively, these two user groups reported trips that were about twice as long or more, on average, than boaters launching from ramps or marina dry storage facilities. For each of these groups, the longest mean durations occurred in the spring. In comparison, long trips taken by boaters departing from a ramp or a dry storage facility averaged about 44 hours. Within the ramp user group, seasonal variation showed a significantly shorter “long trip” duration in the summer,

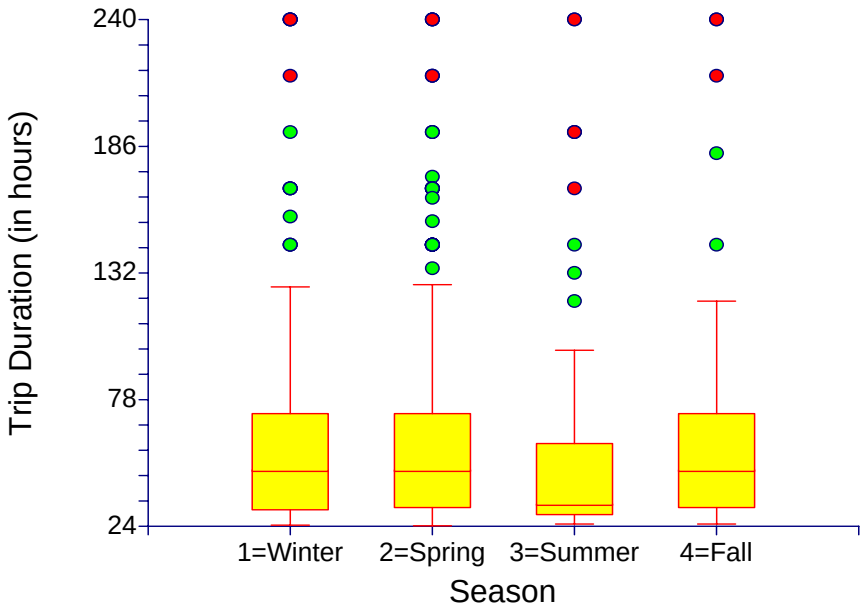
Table 14. Mean and Median Trip Durations (in hours) by Season and User Group of Reported "Long Trips" (Trips > 24 Hours, and ≤ 720 Hours).

Season:	**All Users**	**Ramp**	**Dock**	**Marina Wet**	**Marina Dry**	**Other**
Winter	***69.2 hrs*** 48 hrs (157)	**52.6*** 32†† (39)	**81.54** 51 (37)	**83.1**† 72† (57)	**37.7****†† 29.5**†† (19)	 (5)
Spring	***80.0 hrs**** 48 hrs (418)	**44.3**†† 32†† (90)	**92.1*** 54 (127)	**102.22***† 72† (150)	**47.4** 48 (45)	 (6)
Summer	***64.1 hrs**** 34 hrs** (127)	**36.9****†† 32 (48)	**78.4** 35.5 (48)	**97.1**† 72† (23)	**56.4*** 48 (5)	 (3)
Fall	***67.1 hrs*** 49.5 hrs (130)	**46.7** 41* (22)	**66.1**** 72* (35)	**82.2**† 72 (58)	**41.3**†† 28.5**†† (15)	 (0)
Typical Season (year)	***73.5 hrs*** 48 hrs N=832	***44.4*** 32 (199)	***84.2*** 51 (247)	***94.0*** 72 (288)	***44.7*** 31 (84)	 (14)

Note: Mean shown in bold type; median in non-bold type. Sub-sample sizes are shown in parentheses.

* Significantly greater (longer) than values observed from the same user group during other seasons at the 95% confidence level;
** Significantly less (shorter) than values observed from the same user group during other seasons at the 95% confidence level;
† Significantly greater (longer) than values observed in other user groups during the same season at the 95% confidence level;
†† Significantly less (shorter) than values observed in other user groups during the same season at the 95% confidence level.

Figure 17a. Box Plots of "Long Trip" Durations by Season.



Note: The Y-axis in Figures 17a and 17b was constrained to show trip durations of less than or equal to 240 hours to enhance the box plots (as a very small number of extreme outliers were observed).

Figure 17b. Box Plots of "Long Trip" Durations by User Group.

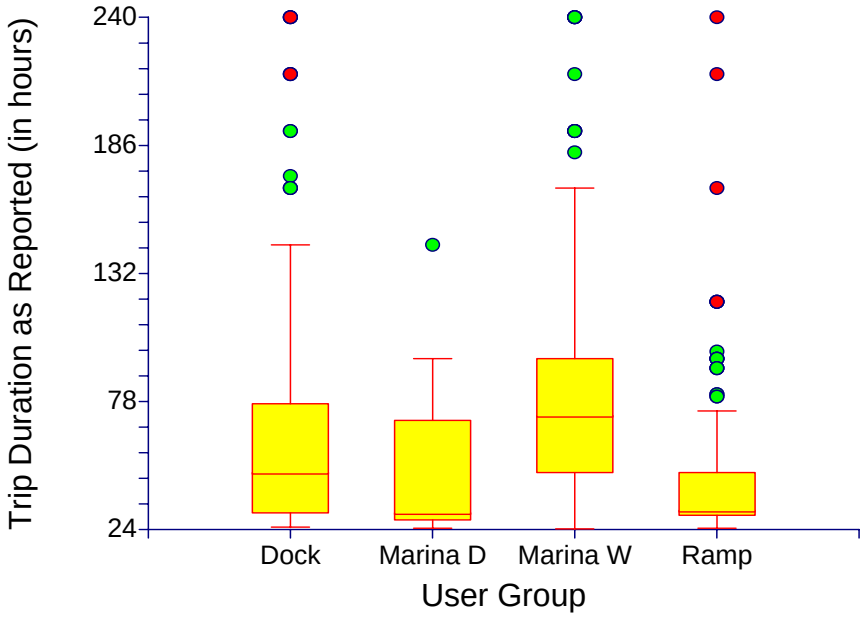


Figure 17c. Average Reported Duration of Long Trips by Season and User Group.

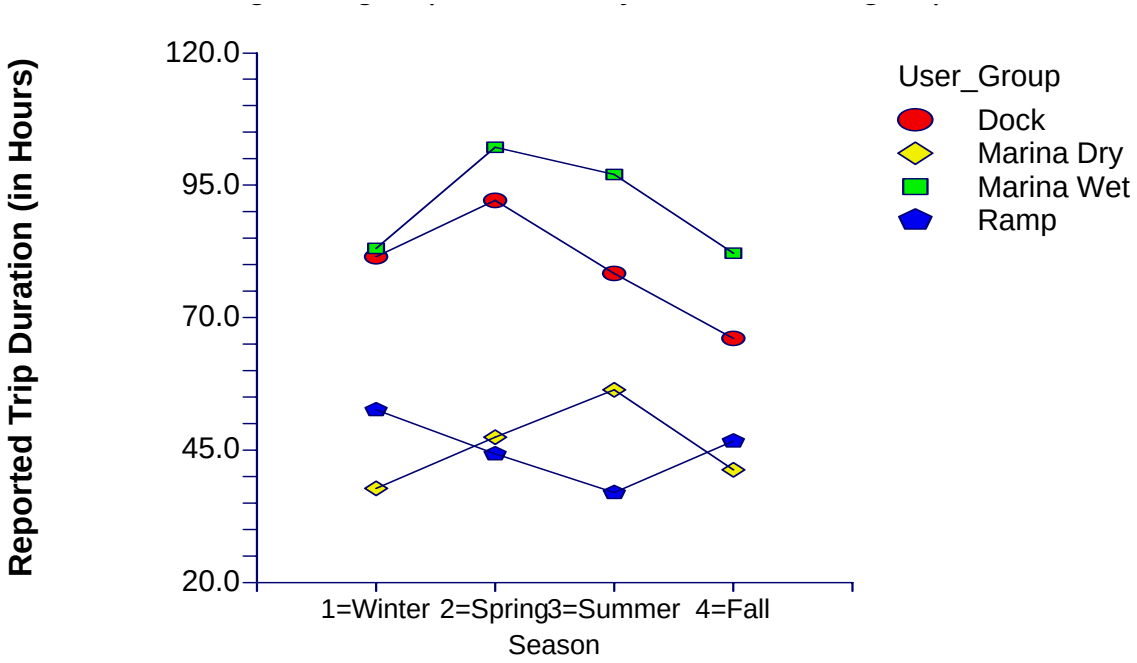
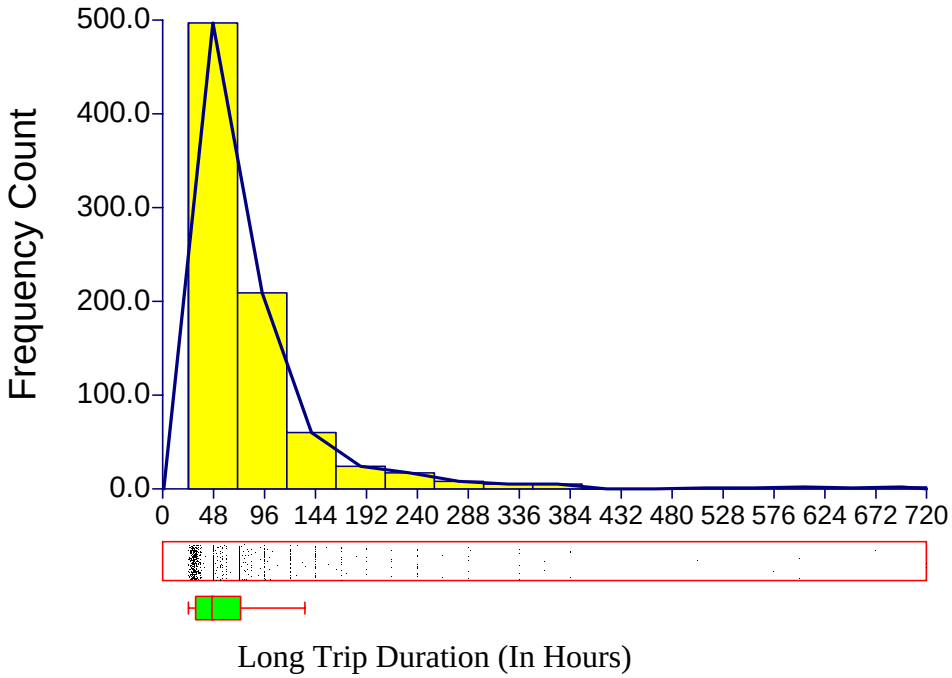


Figure 17d. Distribution of the Duration of Long Trips as Reported by Boaters from All User Groups.



Seasonal Analysis of Weekend vs. Weekday Trips

The summary statistics and charts highlighting the proportion of trips associated with weekend days (Saturday or Sunday) versus weekdays (Monday through Friday) are based on the responses to Question 4 of the survey. Of the n=4,955 reported trips, 2,139 trips fell on weekend days – yielding an overall proportion of .431. In other words, 43.1% of the reported trips were classified as weekend trips and 56.8% were classified as weekday trips.

Question 4. Please circle the day of the week that you took each of the two trips that you drew on the map.

First Trip (**solid line**)	Mon Tues Wed Thurs Fri Sat Sun
Second Trip (**dashed line**)	Mon Tues Wed Thurs Fri Sat Sun

A breakdown of the proportion of weekend trips by user group and season is presented in Table 15. Pie charts illustrating the proportions of weekend versus weekday trips are highlighted in Figures 18a through 18i. Ramp users had the highest proportion of reported trips falling on weekend days --.606, a value that is significantly greater than the average for all user groups (to what extent this was influenced by data acquisition methodology, with ramp user observations made only on the weekends, is not quantifiable but may be a potential bias in the statistical findings). For survey respondents representing docks, marina wet slips, and dry storage facilities the proportion of reported trips that fell on weekdays was significantly less than the average for all survey respondents (with observed weekend trip proportions of .384, .274, and .351, respectively).

The proportion of reported trips falling on weekend days during the summer boating season was .526, a value that is significantly greater than the overall average proportion of .431. This suggests that summer boating trips are more oriented toward weekend days in comparison to boat trips taken throughout the year. By contrast, the proportion of reported trips falling on weekend days was significantly lower during the spring – the peak boating season – with an observed proportion of .397. This suggests that peak-season boating trips (although much greater in number) are more evenly spread out over the course of the week in comparison to boat trips taken during the summer months. The proportions of weekend trips taken during the fall and winter boating seasons (.438 and .408) were not found to be significantly different from the overall average reported weekend trip proportion of .431.

With the exception of the summer boating season, dock users reported the second-highest proportion of weekend trips. Although these proportions did not exceed the average proportion of weekend trips for a given season, they were relatively high in comparison to boaters departing from marina wet slips or dry storage facilities. Marina dry storage users posted their highest proportion of weekend trips during the summer season, with .486 of their reported trips occurring on weekend days. Marina wet slip users tended to post the lowest overall weekend trip proportions regardless of season.

It should be noted that if all days of the week were equally likely in terms of observing a trip (that is, trips were equally spread out over the course of the week), the proportion of weekend trips would be 2/7 or .285. This represents a hypothetical benchmark by which to compare the proportion of reported trips by user group and/or season. In the vast majority of cases, users groups posted proportions that significantly exceeded this benchmark across all boating seasons– highlighting the weekend orientation of reported trips in this study region. Marina wet slip users were the only user group to report weekend trip proportions that fell below the benchmark of .285 during the winter, spring, and fall boating seasons. It must be noted, however, that these proportions were not significantly different from .285. In short, marina wet slip users reported substantially fewer weekend trips than their counterparts departing from ramps, docks, or marina dry storage facilities, with the exception of the summer boating season.

Table 15. Proportion of "Weekend Trips" by User Group and Season.

Season:	**All Users**	**Ramp**	**Dock**	**Marina Wet**	**Marina Dry**	**Other**
Winter	***.408***†† (832)	**.599*** (272)	**.366**** (232)	**.231**** (151)	**.306****†† (160)	(17)
Spring	***.397***†† (,2399)	**.568*** (679)	**.360** (758)	**.265**** (380)	**.334**** (565)	(17)
Summer	***.526***† (1,010)	**.648*** (376)	**.450****† (351)	**.377****† (90)	**.486****† (183)	(10)
Fall	***.438*** (714)	**.658***† (234)	**.380**** (234)	**.276**** (123)	**.289****†† (121)	(2)
Overall	***.431*** N=4,955	***.606**** (1,561)	***.384**** (1,575)	***.274**** (744)	***.351**** (1,029)	(46)

Note: Sample and sub-sample sizes shown in parentheses.

* Significantly greater than mean for the same season at the 95% confidence level;
** Significantly less than mean for the same season at the 95% confidence level;
† Significantly greater than mean for same user group at the 95% confidence level;
†† Significantly less than mean for same user group at the 95% confidence level.

Figure 18a. Weekend vs. Weekday Trips (All Seasons/All Users).

Figure 18b. Weekend vs. Weekday Trips (Ramp Users).

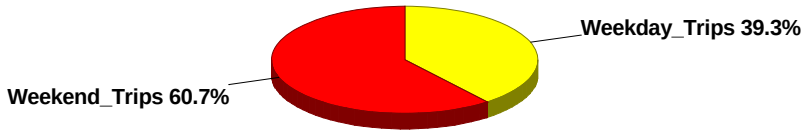


Figure 18c. Weekend vs. Weekday Trips (Dock Users).

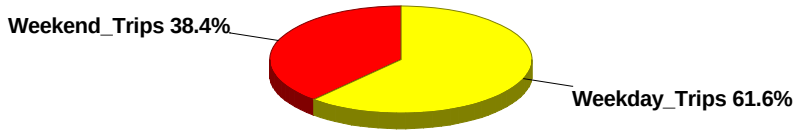


Figure 18d. Weekend vs. Weekday Trips (Marina Wet Slip Users).

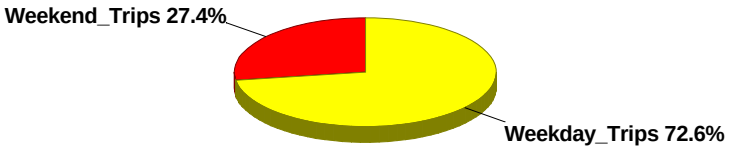


Figure 18e. Weekend vs. Weekday Trips (Marina Dry Storage Users).

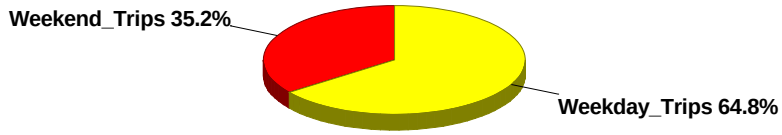


Figure 18f. Weekend vs. Weekday Trips (Winter).

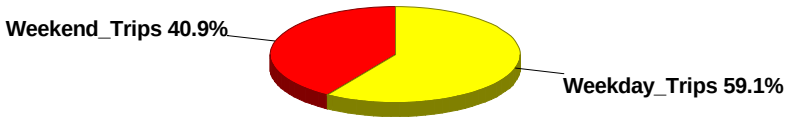


Figure 18g. Weekend vs. Weekday Trips (Spring).

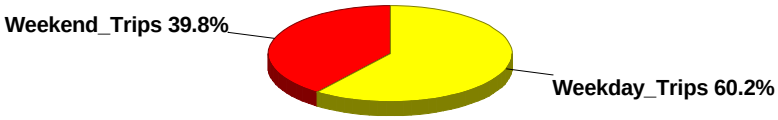


Figure 18h. Weekend vs. Weekday Trips (Summer).

Figure 18i. Weekend vs. Weekday Trips (Fall).

Seasonal Analysis by Florida Residency Status

The residency status of survey participants was also analyzed, based on information gathered from the n=1,413 responses to Question 21 of the survey.

Question 21. How many months per year do you live in Florida? _____(*Months*)

For the purposes of this study, residency status is defined as the number of months spent in Florida. Overall, survey respondents resided in the state of Florida for an average of 10.6 months. Summary statistics on residency are provided in Table 16. Box plots showing seasonal trends in residency are shown in Figure 19. The results are based on linking the number of months boaters reside in the state with the season in which their last reported typical trip took place.

The greatest variability in residency status is associated with survey respondents whose last typical trip was taken during the winter boating season (see Figure 19). Boaters associated with winter trips had residency values ranging from 1 month to 12 months, whereas boaters associated with trips occurring in spring, summer, and fall tended to be 12-month residents (as implied by the red line which encompasses all non-outlying values). It should be noted that boaters who reported taking their last trip during the winter boating season tended to be resident in the state for approximately 9 months on average, a value that is significantly lower than the overall average of 10.6 months and less than the average residency of boaters reporting trips during the spring, summer, or fall boating seasons (10.4, 11.5, and 11.0 months, respectively).

A seasonal comparison of residency by user group is illustrated in Figure 20. The graph suggests that the residency status of boaters varies throughout the year, with marina wet slip and marina dry storage users being the most transient boating groups. Ramp users tended to be the most ‘local’ of the user groups, followed by boaters who departed from docks.

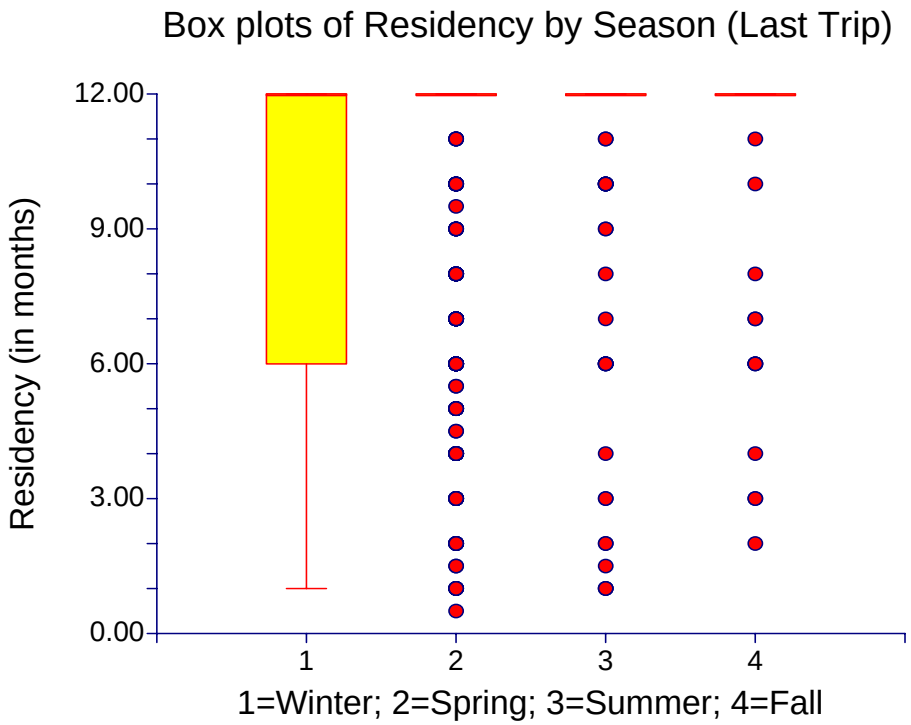
Table 16. Florida Residency of Boaters by Season and User Group (Mean Number of Months Residing in Florida for Season of Last Reported "Typical Trip").

Season:	**All Users**	**Ramp**	**Dock**	**Marina Wet**	**Marina Dry**	**Other**
Winter	***9.0***** (130)	**11.3*** (51)	**10.7*** (22)	**6.1****†† (29)	**6.5****†† (25)	(3)
Spring	***10.4*** (824)	**11.7*** (245)	**10.9** (254)	**9.0**** (119)	**9.1**** (203)	(3)
Summer	***11.5**** (355)	**11.9** (140)	**11.3** (111)	**10.7****† (28)	**11.1**† (72)	(4)
Fall	***11.0*** (104)	**11.9** (65)	**10.5** (16)	**9.0**** (17)	**8.5**** (6)	(0)
Overall	***10.6*** N=1,413	***11.7**** (501)	***11.0*** (403)	***8.84**** (193)	***9.40**** (306)	(10)

Note: Sample and sub-sample sizes shown in parentheses.

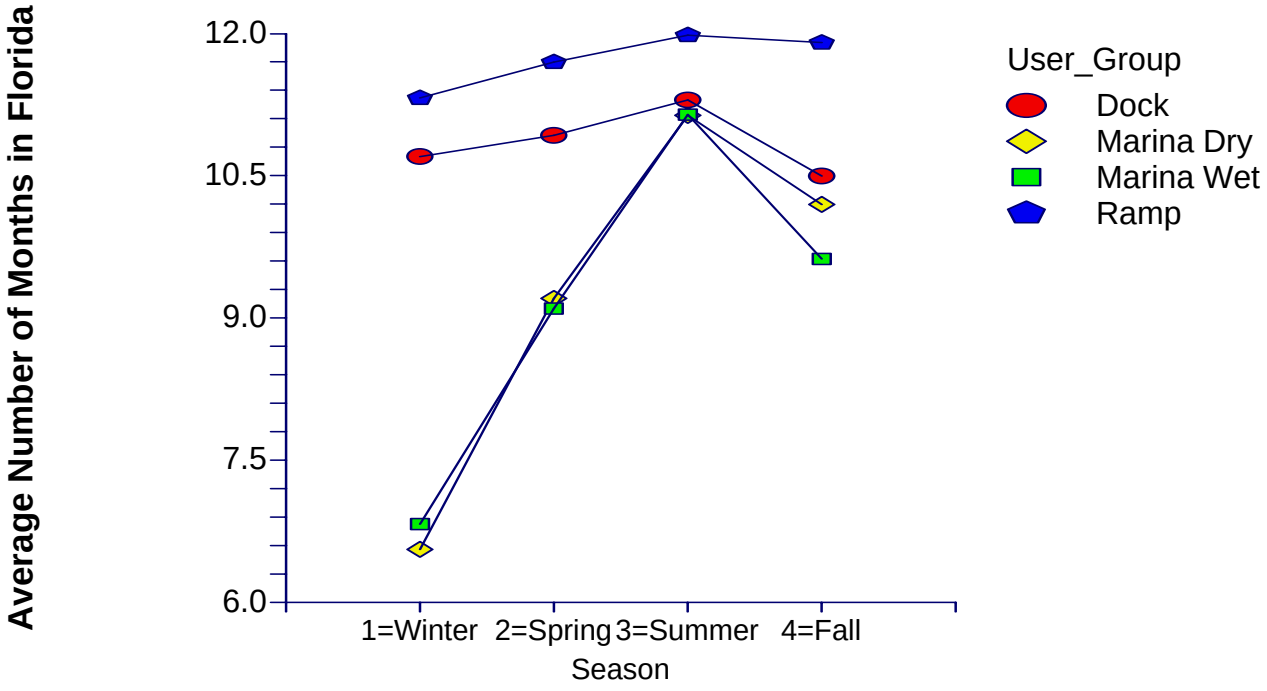
* Significantly greater than mean for the same season at the 95% confidence level;
** Significantly less than mean for the same season at the 95% confidence level;
† Significantly greater than mean for same user group at the 95% confidence level;
†† Significantly less than mean for same user group at the 95% confidence level.

Figure 19. Box plots of Residency Status of Survey Respondents by Season.



Note: Includes only those survey respondents that spent at least .5 months per year in the state of Florida.

Figure 20. Residency by Season and User Group as Associated with Last Reported Typical Trip (Long Survey).



Seasonal Analysis of Boating Activities

Information on travel routes, destinations, and boating activities by destination was also gathered from survey respondents, along with the months in which reported boat trips took place. The objective was to assess whether or not connections exist between various boating activities and the designated boating seasons. A list of 15 boating activities was provided in the survey (see Table 17). Survey respondents were asked to identify those boating activities that took place at destinations along reported trip routes. A total of 8,524 boating activities were identified for the 7,523 reported boating destinations. A sub-sample of 8,387 boating activities was then analyzed, using only those sample observations where respondents reported the month in which the boating trip and activities took place.

Table 18 provides a breakdown of the proportion of reported activities by season. This table also highlights proportions that differ from the overall proportion for the year (i.e., for all seasons) at the 95% confidence level. Fishing was the predominant activity of boaters who participated in the survey, accounting for approximately 52.0% (on average) of all reported activities across all seasons. Fishing as a relative proportion of all activities exhibited a tendency to be greatest during the winter and summer boating seasons – with proportions of .55 and .57, respectively (see Figure 21a). Fishing as a proportion of all boating activities reported by survey respondents showed a modest decline to just under 50% during the spring and fall; yet, it nevertheless yielded an activity count and proportion that was well over four times greater than the second-most reported activity, that of visiting restaurants. In fact, the sum of the proportions of the second-, third- and fourth-most reported activities is less than half of the proportion associated with fishing. In short, fishing is an activity that is dominant year-round, accounting for at least 50% of all on-water activity in the Charlotte Harbor region during any given season.

A comparison of the relative proportions of all activities, excluding fishing, is provided in Figure 21b. This bar chart represents the graphical counterpart to the data displayed in Table 18 for non-fishing related activities. Visiting restaurants was the second-most dominant activity reported by the survey respondents, accounting for approximately 11.5% of all boating activities (on average). As a relative proportion of all activities, restaurant visitation peaked during the spring (12.4%) and fall (13.0%), with relative proportions significantly greater than the yearly average of 11.5%. Restaurant visitation (as a relative proportion) dropped precipitously during the summer boating season, accounting only for about 8% of all summer boating activity. This decline may be due, in part, to the reported rise in other summer-time activities such as cruising, swimming, water sports, and diving (all of which showed higher-than-average proportions during the summer). The decline in restaurant visitation during the summer may also be due to the fact that this activity was popular among users of marina wet slips and dry storage facilities many of whom are transient and/or choose not to boat during the summer months (See Figures 11 and 20; see also Sidman, et al., 2005a, tables 22b and 22c). Sight seeing and nature viewing were the third- and fourth-most reported activities by survey respondents accounting for 7.1% and 5.0% of all reported activities, with summer peaks of 8.3% and 6.6%, respectively.

Each boating season has a fairly distinctive profile or "activity mix" when one compares the relative activity levels in each season to the activity level across all seasons (i.e., for the year as a whole).

An Overview of Seasonal Boating Activity:

(1) Winter boating activities are dominated by fishing (55%) – the only activity with a relative proportion that is significantly greater than its all-season average in this season. Nature viewing, beach picnicking and camping, diving, cruising, swimming, and water sports have proportions that drop significantly below their respective all-season averages during the winter.

(2) The percentages of reported boating activities in the spring tend to be fairly similar to their respective all-season (year-round) averages; although there is statistical evidence of a slightly greater than average tendency for boaters to engage in visiting restaurants, beach picnicking, beach camping, overnight anchoring, and swimming during this period..

(3) The summer boating season, though dominated by fishing (an activity that accounts for approximately 58% of all reported summer activities), also shows a discernable rise in the levels of cruising, swimming, water sports, and diving. Moreover, there is a noticeable drop in the levels of daytime and overnight anchoring, restaurant visitation, and nature viewing – activities which are associated with marina wet slip users who are more prevalent during the winter months.

(4) The fall boating season is one in which there is a distinct and noteworthy rise in several recreational boating activities; namely, sight seeing, nature viewing, and restaurant visitation. In addition, there is a significant rise in the relative proportions of sailing and anchoring activities when compared to levels that occur across all seasons.

Table 17. A List of Boating Activities (as provided in the Survey).

Activity Code	Activity Description	Activity Code	Activity Description
FH	Fishing	OA	Overnight Anchoring
SS	Sight Seeing	DA	Day Anchoring
NV	Nature Viewing	DV	Diving
BP	Beach Picnicking	JS	Jet Skiing
BC	Beach Camping	CR	Cruising
VR	Visiting Restaurants	SW	Swimming
SO	Socializing	WS	Water Sports/Skiing
SA	Sailing		

Table 18. Proportions of Reported Boating Activities by Season.

	Boating Seasons				
Activity Code	**All *Seasons***	**Winter**	**Spring**	**Summer**	**Fall**
FH	.5201	.5543*	.4936**	.5798*	.4979**
SS	.0717	.0796	.0682	.0683	.0831*
NV	.0503	.0406**	.0534	.0365**	.0663*
BP	.0442	.0360**	.0505*	.0418	.0327**
BC†	.0032	.0023**	.0046*	.0018**	.0016**
VR	.1146	.1141	.1235*	.0795**	.1301*
SO	.0358	.0375	.0376	.0335	.0328
SA	.0197	.0199	.0202	.0170**	.0218*
OA	.0481	.0513	.0536*	.0271**	.0537*
DA	.0237	.0253	.0219	.0235	.0277*
DV	.0069	.0007**	.0078	.0094*	.0075
JS†	.0039	.0053	.0028	.0053	.0034
CR	.0284	.0207**	.0295	.0353*	.0235
SW	.0254	.0107**	.0291*	.0359*	.0134**
WS†	.0034	.0015**	.0031	.0047*	.0042*
Total	.999	.999	.999	.999	.999
(N)	8,387	1,306	4,193	1,695	1,191

* Significantly greater than the estimated proportion for *All Seasons* at the 95% confidence level; and

** Significantly less than the estimated proportion for *All Seasons* at the 95% confidence level.

† Indicates small sample size.

Figure 21a. Fishing as a Proportion of Reported Boating Activities by Season.

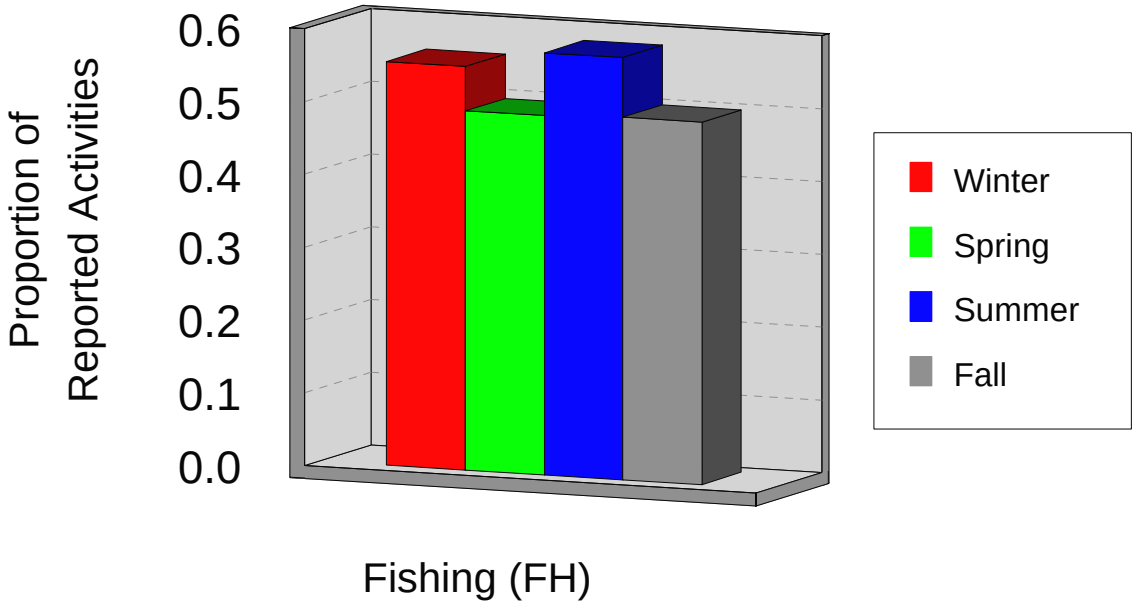
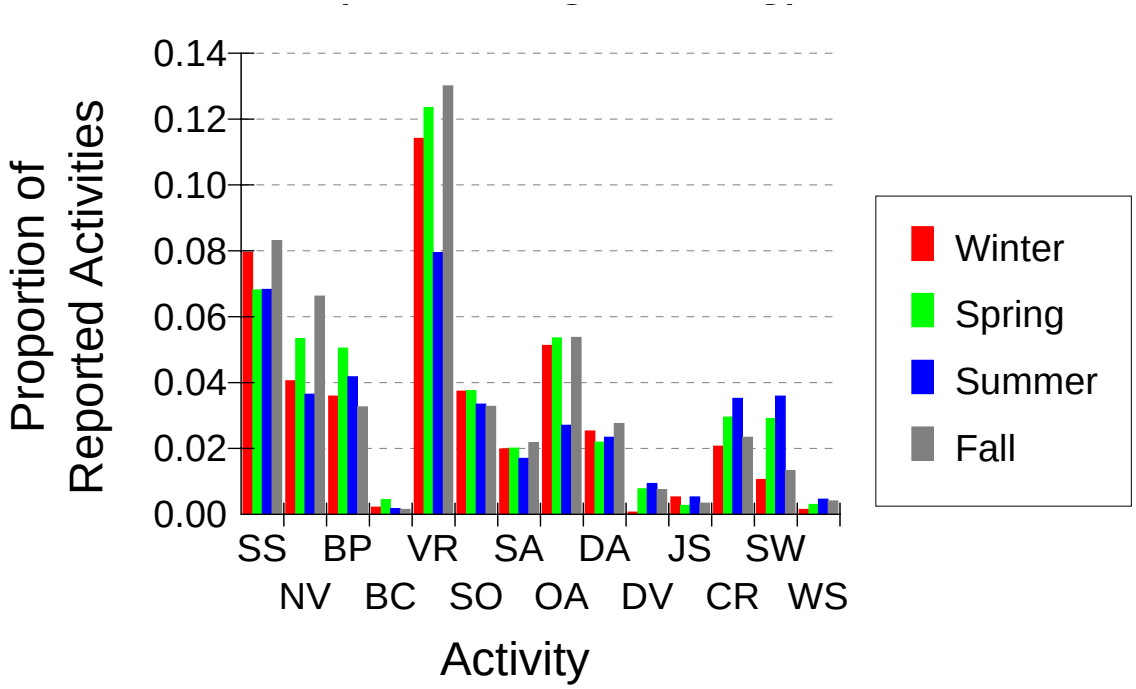


Figure 21b. Proportion of Reported Boating Activities by Season (Excluding Fishing).



Chapter 3. Seasonal Spatial Analysis of Mail Survey Data

1. Analysis of Proportions Method

This chapter presents the methods and results of an "Analysis of Proportions" to compare seasonal boating use patterns within the Greater Charlotte Harbor region.

Grid-Cell Size Determination

The spatial distribution of points (representing the locations of boating destinations) was analyzed for the N=7,644 destinations identified by Greater Charlotte Harbor mail survey respondents. Summary statistics revealed a second-order average nearest-neighbor distance of approximately 246 meters – indicating that a point or destination is, on average, approximately 246 meters away from its two nearest neighboring points or destinations. The "standard distance"[5] for the average second-order nearest-neighbor point distribution was found to be approximately 362 meters. The 95% confidence interval for the second-order mean nearest neighbor distance ranged from 0 meters to 970 meters (or a maximum distance of approximately 2,910 feet or .551 miles). This distance accounts for 95% of the two-nearest points/destinations from a typical point or destination within the study region. For a radius of .551 miles extending outward from a given point/destination, a circle of area $A= \pi(.551)^2 =$ .954 square miles was calculated. Rounding to the nearest tenth of a square mile yields an area of approximately 1 square mile. Hence, a 1x1 mile grid-cell size was chosen as a preferred size for the proportions analysis based on the spatial distribution of reported destinations. Given the results for the mean (second-order) nearest-neighbor distance and associated standard distance, it can be argued that the 1x1 mile cell size is representative of the spatial resolution at which the process of point/reported destination clustering is taking place within the region. The ArcInfo / ArcGIS GENERATE function was used to create a 1x1 square mile polygon grid for the Greater Charlotte Harbor boating region. The output polygon grid contained 2,340 1x1 square mile cells.

Summarizing Mail Survey Data

To analyze and map the spatial distribution of recreational boating use within the Greater Charlotte Harbor Region, frequency counts of boats **k(i)** for individual 1x1 mile cells (i) were determined from the reported trip features identified by mail survey respondents and observed number of boats identified in the aerial surveys. Frequency counts were calculated for all i=1,…N cells, where N= 2,340. To accomplish this, the GIS INTERSECT function was used to sum the number of points (reported destinations or aerial observations) and route segments (reported travel routes) within each grid cell (Figures 22 and 23). The INTERSECT function assigned the grid cell ID number to each point or line segment that fell within its 1x1 square-mile border. The SUMMARIZE function was then used to sum the number of times a grid cell ID occurred in the INTERSECT-derived output file. Lastly, the JOIN function linked the INTERSECT-derived summary file containing the counts of point or line segment features for each grid cell to the 1x1 square mile grid polygon theme.

[5] The standard distance is the spatial statistics equivalent of standard deviation.

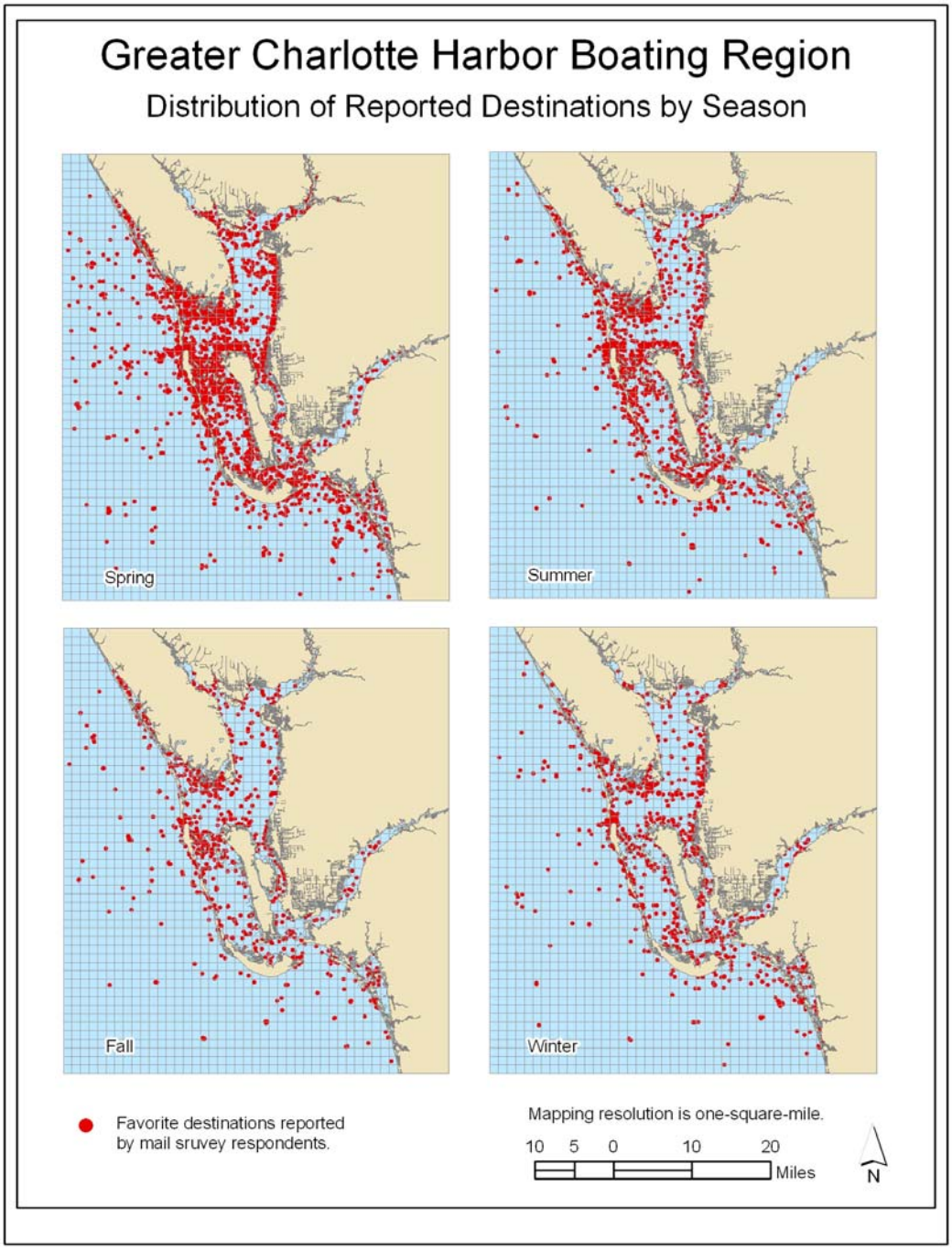


Figure 22. Distribution of Reported Destinations by Season.

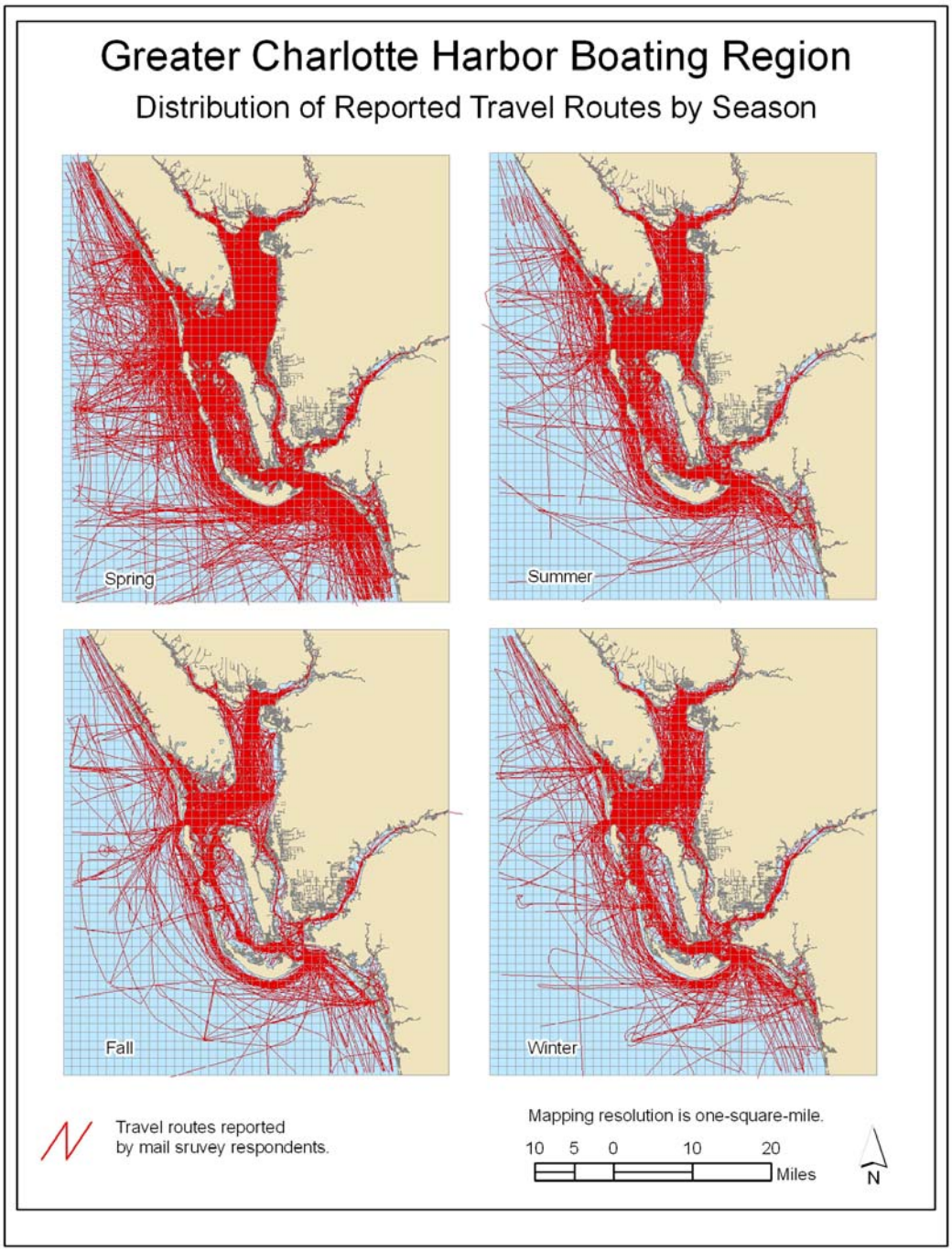


Figure 23. Distribution of Reported Trip Routes by Season.

Analysis of Proportions

The proportion of boats p(i) falling into each grid cell $p(i)=k(i)/\Sigma\, k(i)$ was computed for selected seasons and season/user group combinations. **Note that only cells with a p(i) greater than zero were used in the analysis.(cells with at least one reported boat).** For each scenario examined, the mean proportion p* was determined along with its 95% confidence interval. Cells with greater than average proportions were identified. Within this group, cells where the proportion of boats was found to be greater than one standard deviation s(p) above the mean—where $p(i)^* > p^* + 1s(p)$ were separately identified.

2. Mapping Relative Use Proportions

General Seasonal Patterns

A two-color choropleth mapping scheme highlights those cells where the proportion of boats was determined to be above-average,(where $p(i) > p^*$), shown in pink,, and cells which show a "high use" intensity ($p(i)^* > p^* +1s(p)$), shown in red. This analysis was carried out separately for reported boating destinations (Figure 24) and routes (Figure 25) reported on the mail survey. The choropleth maps are accompanied by tables that show the number of grid cells with reported trip features that were above average and cells that exhibited high-use based on the relative proportions by season. Each table consists of two parts. The first part identifies counts and percentages of high use cells that were spatially congruent between particular seasons (e.g., the number of cells that were spatially between spring and summer, etc.) relative to the total number of high use cells that occurred during either of the seasons of interest (e.g., spring and summer). The second part summarizes the number and percentage of above average cell matches between combinations of seasons. The tables highlight the degree to which there is spatial consistency of mapped features between seasons.

The results indicate a high degree spatial uniformity in the travel routes of boaters across seasons. This result is not surprising given the limited number of channels and routing options which exist to access the various on-water destinations from the various launch sites. There is a consistent but weaker seasonal regularity among boating destinations. This outcome is explained by the fact that the number of preferred destinations identified by boaters is much greater that the number of on-water routes or corridors that lead to those destinations. These patterns are corroborated by above-average and high use cell count statistics that show a between-season spatial consistency ranging from between 73.9% and 80.0% for high use travel corridors (Table 19) and from 31.4% and 53.3% for high use destinations (Table 20). Locations that absorb above average and high use boating throughout the year are depicted in Figure 25. Areas that received the greatest amount of destination-oriented use throughout the year include the Charlotte Beach State Recreation Area in Englewood, Placida, Gasparilla Pass, Bull Bay, the Fisherman's Village area in Punta Gorda, Boca Grande Pass, Pelican Bay, the Useppa and Cabbage Key area, Redfish Pass, St. James City, and Ft. Myers Beach.

The most highly concentrated travel routes were found along marked Intracoastal Waterway channels and access corridors within the Caloosahatchee River, San Carlos Bay and Pine Island Sound are characterized by the greatest concentration of travel routes. In addition, the lower portion of Charlotte Harbor (from the Burnt Store Marina area to Boca Grande Pass) is also identified as a high use travel corridor (Figure 26).

Table 19. Travel Routes: Cell Matches Between Seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	133 / 168 (79.2%)		
Fall	126 / 163 (77.3%)	118 / 158 (74.7%)	
Winter	125 / 161 (77.6%)	116 / 157 (73.9%)	116 / 145 (80.0%)

Cell count matches / all high use cells identified for both seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	287 / 364 (78.8%)		
Fall	278 / 344 (80.1%)	267 / 352 (75.9%)	
Winter	256 / 341 (79.6%)	256 / 341 (75.1%)	252 / 316 (79.7)

Cell count matches / all above average cells identified for both seasons.

High-Use	$p(i)^* > p^* + 1s(p)$
Above Average	$p(i) > p^*$

Table 20. Destinations: Cell Matches Between Seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	32 / 60 (53.3%)		
Fall	21 / 50 (42.0%)	16 / 51 (31.4%)	
Winter	27 / 57 (47.4%)	26 / 54 (48.1%)	18 / 41 (43.9%)

Cell count matches / all high use cells identified for both seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	78 / 154 (50.6%)		
Fall	38 / 140 (27.1%)	34 / 106 (32.1%)	
Winter	74 / 160 (46.3%)	57 / 139 (41.0%)	38 / 104 (36.5%)

Cell count matches / all above average cells identified for both seasons.

High-Use	$p(i)^* > p^* + 1s(p)$
Above Average	$p(i) > p^*$

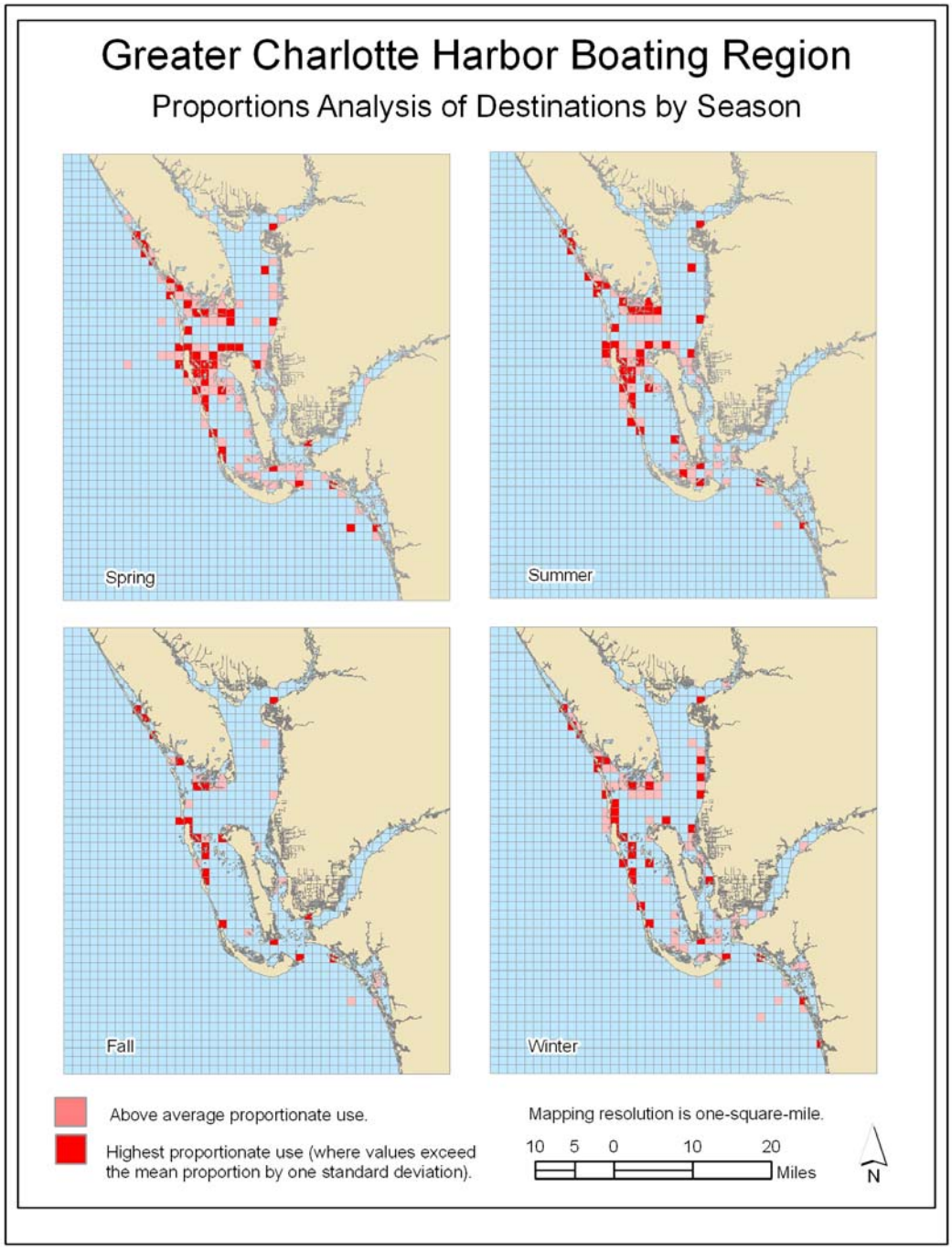


Figure 24. Proportions Analysis of Reported Destinations by Season.

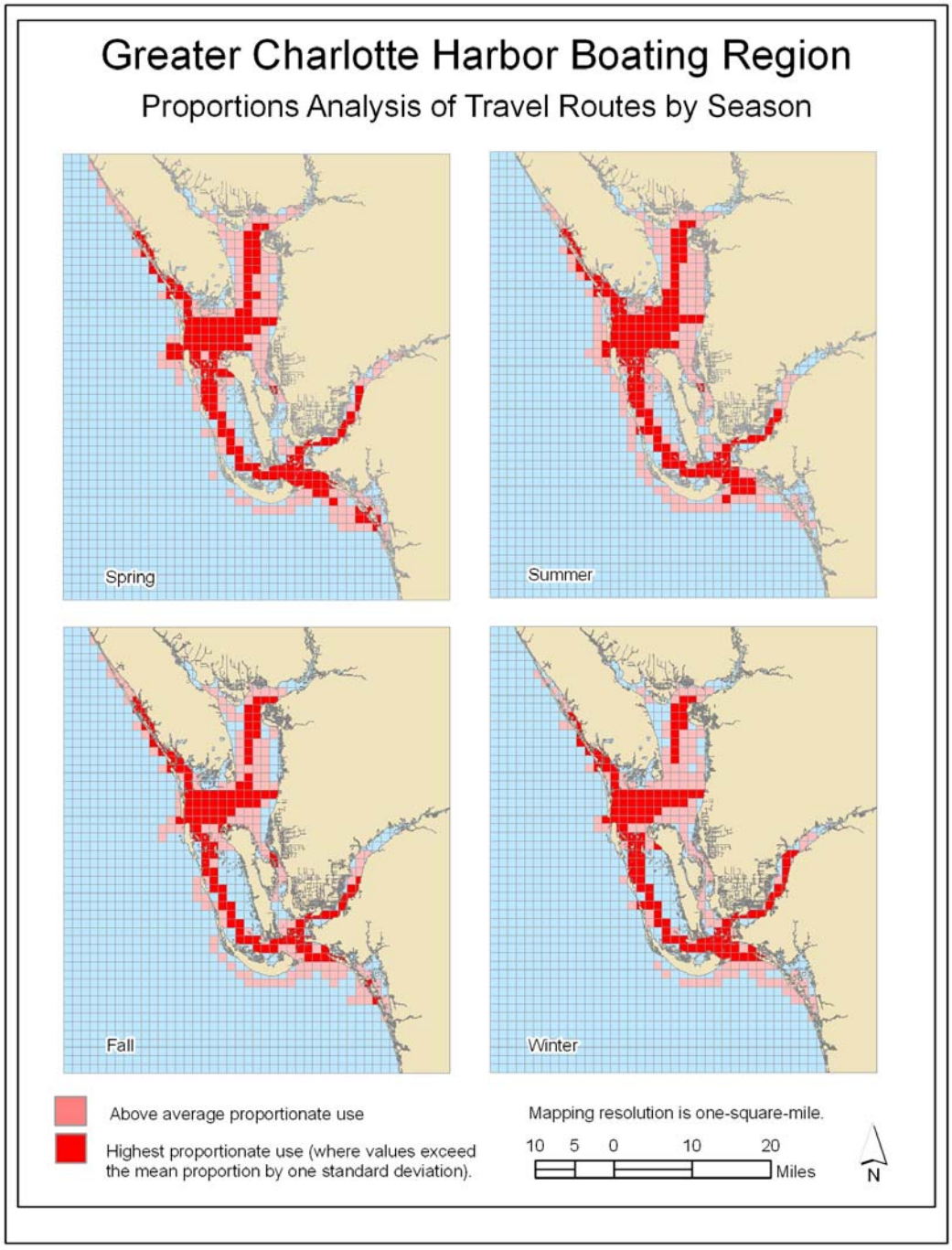


Figure 25. Proportions Analysis of Reported Trip Routes s by Season.

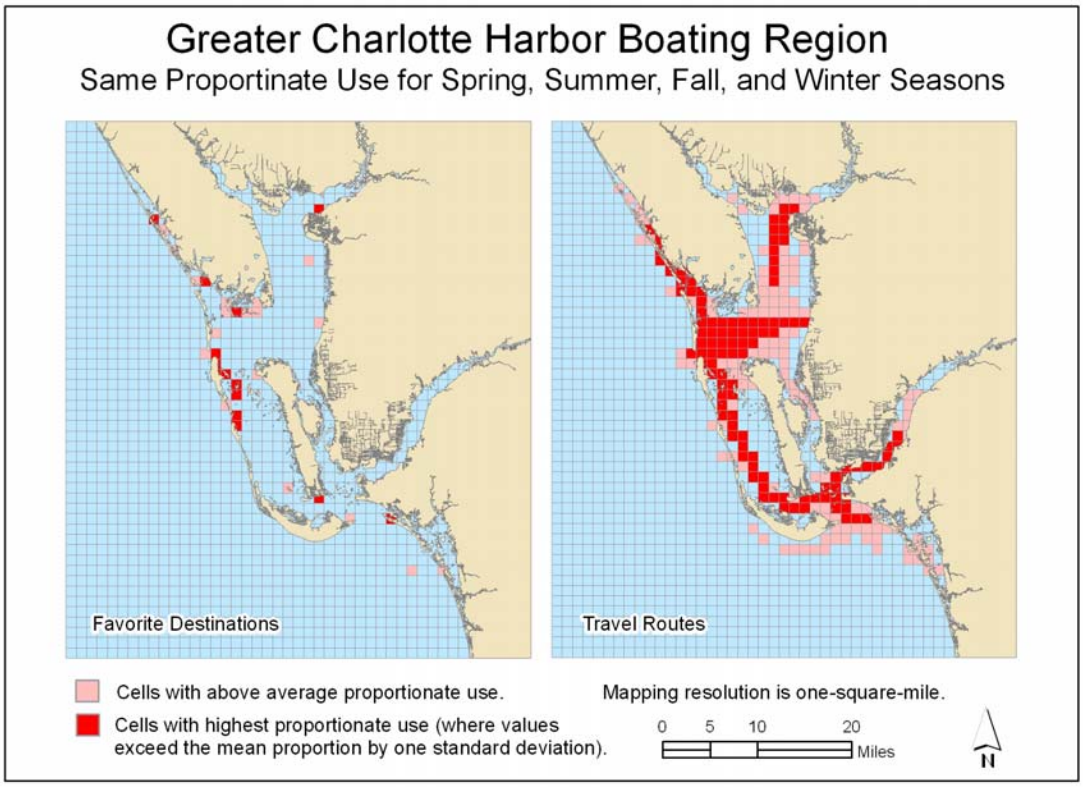


Figure 26. Areas Receiving Above Average or High Boating Use Through out the Year.

Seasonal Patterns by User Group

Choropleth maps were constructed to highlight spatial variability in use intensity by boater/user group (marina wet slip, marina dry storage, private dock, public ramp) for the spring, summer, fall and winter boating seasons (Figures 27, 28, 29, and 30). The analysis only considers the destination profile for each user group, since results show a high degree of travel route conformity between seasons. Each map is accompanied by a table that shows the number of cells that received comparable use intensity (above average or high use) between seasons (Tables 21, 22, 23, and 24).

The seasonal use profile for boaters departing from marina wet slips is depicted in Figure 27. The greatest diversity of destination choice is observed during the spring months, which is consistent with the spatial profiles of the other user groups. The spatial footprint of boating use that originates from marina wet slips appears to vary by season and is consistent with the graphed pattern in Figures 11 and 12, which show a peak period during spring and a sharp decline during the summer months. Cell match percentages show that the greatest degree of spatial conformity between high-use cells is between spring and fall months (47.1%) and is lowest between summer and winter seasons (8.3%). This finding is consistent with the use profile of marina wet slip users, which shows a preference for boating during the spring and fall months. Nevertheless, the Placida, Pelican Bay, and Useppa and Cabbage Key areas remain popular destination locales for marina wet slip users regardless of the season.

The boating patterns of dry storage facility users are most diffuse during the spring and summer months (Figure 28). During the spring, cells categorized as high use are quite prominent along much of the barrier island coastline from Lemon Bay south to Sanibel Island, as well as Fort Myers Beach and Lovers Key State Park in Estero Bay. However, the summer pattern is distinctly different, showing widespread above average use throughout the region, most notably at popular artificial reefs in the Gulf of Mexico. A few areas of high summer use are identified at Boca Grande Pass, Placida and Gasparilla Pass, Stump Pass, and Bull Bay. Fall and winter months are characterized by a much more localized pattern, with use that is largely constrained to areas along the northern barrier islands (e.g., Captiva Island, Cayo Costa, and Boca Grande Pass). To the south, the Lovers Key State Park and Fort Myers Beach areas also receive a relatively high degree of use during the fall and/or winter periods.

Cell count statistics for dry storage users reveal the greatest spatial consistency of high use cells between the summer and fall months (52.9%) – Table 22. The greatest seasonal discrepancy is found between summer and winter periods – characterized by a high use cell -matching rate of only 9.5%.

Table 21. Marina Wet Slip Use: Cell Matches Between Seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	2 / 16 (12.5%)		
Fall	8 / 17 (47.1%)	2 / 9 (22.2%)	
Winter	7 / 20 (35.0%)	1 / 12 (8.3%)	4 / 16 (25.0%)

Cell count matches / all high use cells identified for both seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	4 / 26 (15.4%)		
Fall	12 / 26 (46.2%)	4 / 14 (28.6%)	
Winter	12 / 31 (38.7%)	3 / 20 (15.0%)	8 / 23 (34.8%)

Cell count matches / all above average cells identified for both seasons.

High-Use	$p(i)^* > p^* + 1s(p)$
Above Average	$p(i) > p^*$

Boaters who access the water from private docks exhibit a seasonal profile that is more diffuse than marina wet slip and dry storage users. This is likely related to the spatial widespread distribution of dock users sampled throughout the study region. Still, in many areas, the seasonal patterns resemble that of the other user groups with high use cells clustering along the barrier islands from Gasparilla to Sanibel Island – with the heaviest concentrations in and around the northern portions of Pine Island Sound and Cayo Costa. In addition, a number of 'high use' cells are identified, during the spring season, in the upper (northern) reaches of Charlotte Harbor that includes lower portions of the Myakka River (Figure 30; Table 23).

The greatest seasonal consistency between destination locales for dock users is exhibited between the fall and winter periods, with a cell match percentage of 33.3% (high use) and 33.9% (above average) respectively. The lowest level of spatial regularity among destinations for dock users is between the winter and spring boating season (10.8%).

Table 22. Dry Storage Facility Use: Cell Matches Between Seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	6 / 51 (11.7%)		
Fall	10 / 48 (20.8%)	9 / 17 (52.9%)	
Winter	12 / 50 (24.0%)	2 / 21 (9.5%)	4 / 20 (20.0%)

Cell count matches / all high use cells identified for both seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	18 / 67 (26.9%)		
Fall	12 / 65 (18.5%)	6 / 38 (15.8%)	
Winter	15 / 62 (24.2%)	8 / 36 (22.2%)	5 / 31 (16.1%)

Cell count matches / all above average cells identified for both seasons.

High-Use	$p(i)^* > p^* + 1s(p)$
Above Average	$p(i) > p^*$

Table 23. Dock Use: Cell Matches Between Seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	13 / 53 (24.5%)		
Fall	16 / 51 (31.4%)	7 / 30 (23.3%)	
Winter	10 / 51 (19.6%)	5 / 26 (19.2%)	8 / 24 (33.3%)

Cell count matches / all high use cells identified for both seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	29 / 136 (21.3%)		
Fall	24 / 124 (19.4%)	19 / 56 (33.9%)	
Winter	14 / 130 (10.8%)	12 / 59 (20.3%)	12 / 54 (22.2%)

Cell count matches / all above average cells identified for both seasons.

High-Use	$p(i)^* > p^* + 1s(p)$
Above Average	$p(i) > p^*$

Ramp users tend to favor destinations located in the upper portions of Pine Island Sound and in Bull Bay, particularly during the spring, summer, and winter seasons (Figure 31). The spatial use pattern of boaters launching from ramps tends to peak during the spring

and summer seasons and drops off dramatically during the fall. This is consistent with the user profile illustrated in Figure 12. A notable exception to the seasonal use patterns exhibited by other user groups is that ramp users reported a higher relative proportion of destinations in Matlacha Pass and along the eastern Charlotte Harbor shoreline, principally during the spring and winter months).

The fall and spring seasons exemplify the highest level of spatial congruity for ramp users with a match rate of 36.3% between high use cells (Table 24). Moreover, almost one half (44.9%) of the above average destinations were consistent between spring and summer months. Seasonal combinations which are characterized by the lowest spatial consistency include summer and winter (11.6% of high use locales) and fall and summer (17.9% of high use areas).

Table 24. Ramp Use: Cell Matches Between Seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	13 / 51 (25.1%)		
Fall	16 / 44 (36.3%)	7 / 39 (17.9%)	
Winter	10 / 47 (21.3%)	5 / 43 (11.6%)	8 / 39 (20.5%)

Cell count matches / all high use cells identified for both seasons.

Seasons	Spring	Summer	Fall
Spring			
Summer	57 / 127 (44.9%)		
Fall	30 / 111 (27.0%)	30 / 107 (28.0%)	
Winter	42 / 126 (33.3%)	37 / 123 (30.0%)	26 / 91 (28.6%)

Cell count matches / all above average cells identified for both seasons.

High-Use	$p(i)^* > p^* + 1s(p)$
Above Average	$p(i) > p^*$

The results suggests that user groups tend to favor certain destinations during certain seasons and not in others. The spatial pattern of preferred destinations differs not only across seasons but also across user groups. Hence, each user group can be thought of as having fairly unique seasonal and spatial use-preferences for the various destinations within the study area. The results of the map comparison analysis were consistent with the seasonal use trends identified in Chapter 2, and findings that suggest that the four user groups constitute four distinct statistical populations. As such, user groups should not be lumped together when analyzing use patterns as they demonstrate temporal/seasonal and spatial differences in use patterns and destination preferences.

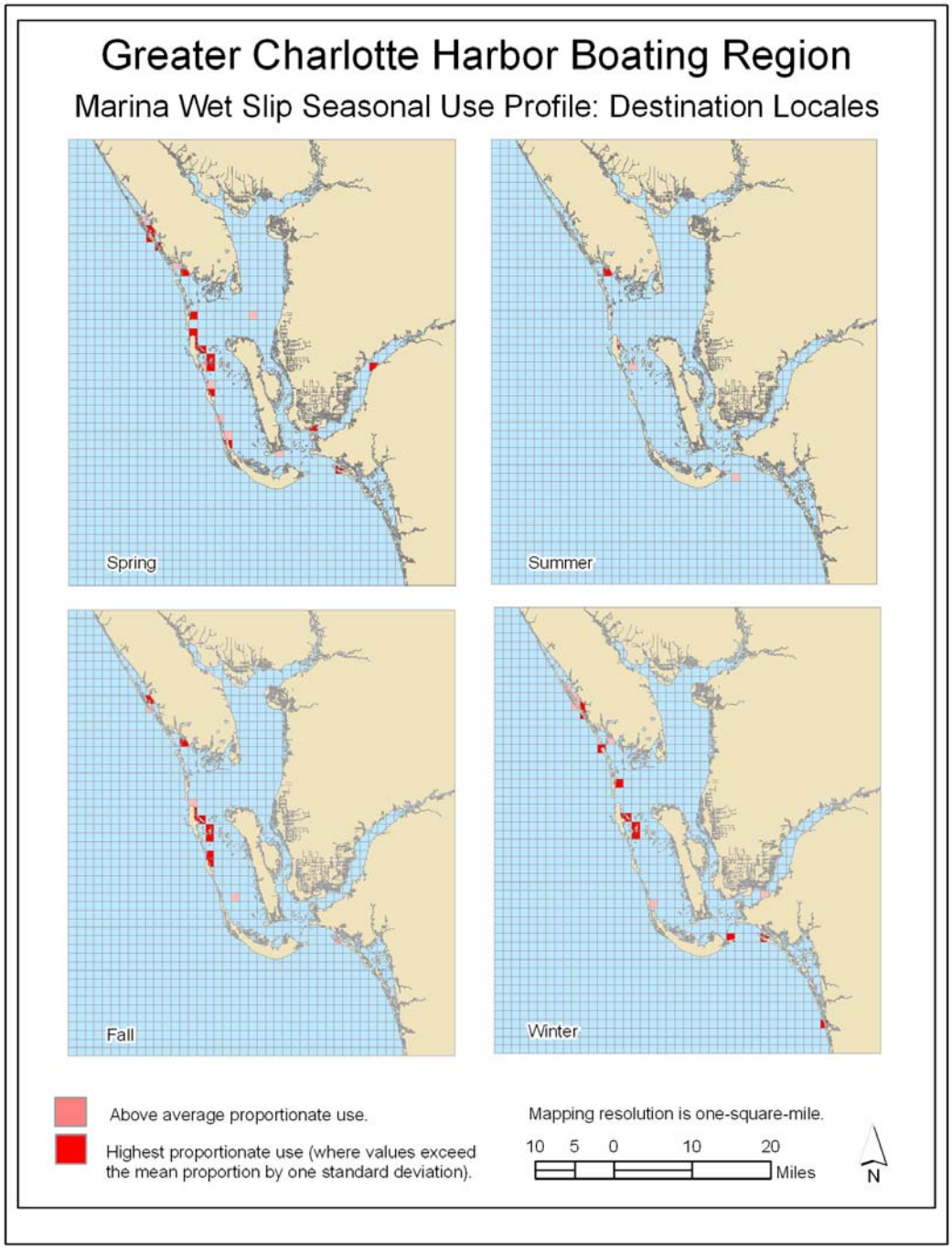


Figure 27. Marina Wet Slip Seasonal Use Profile.

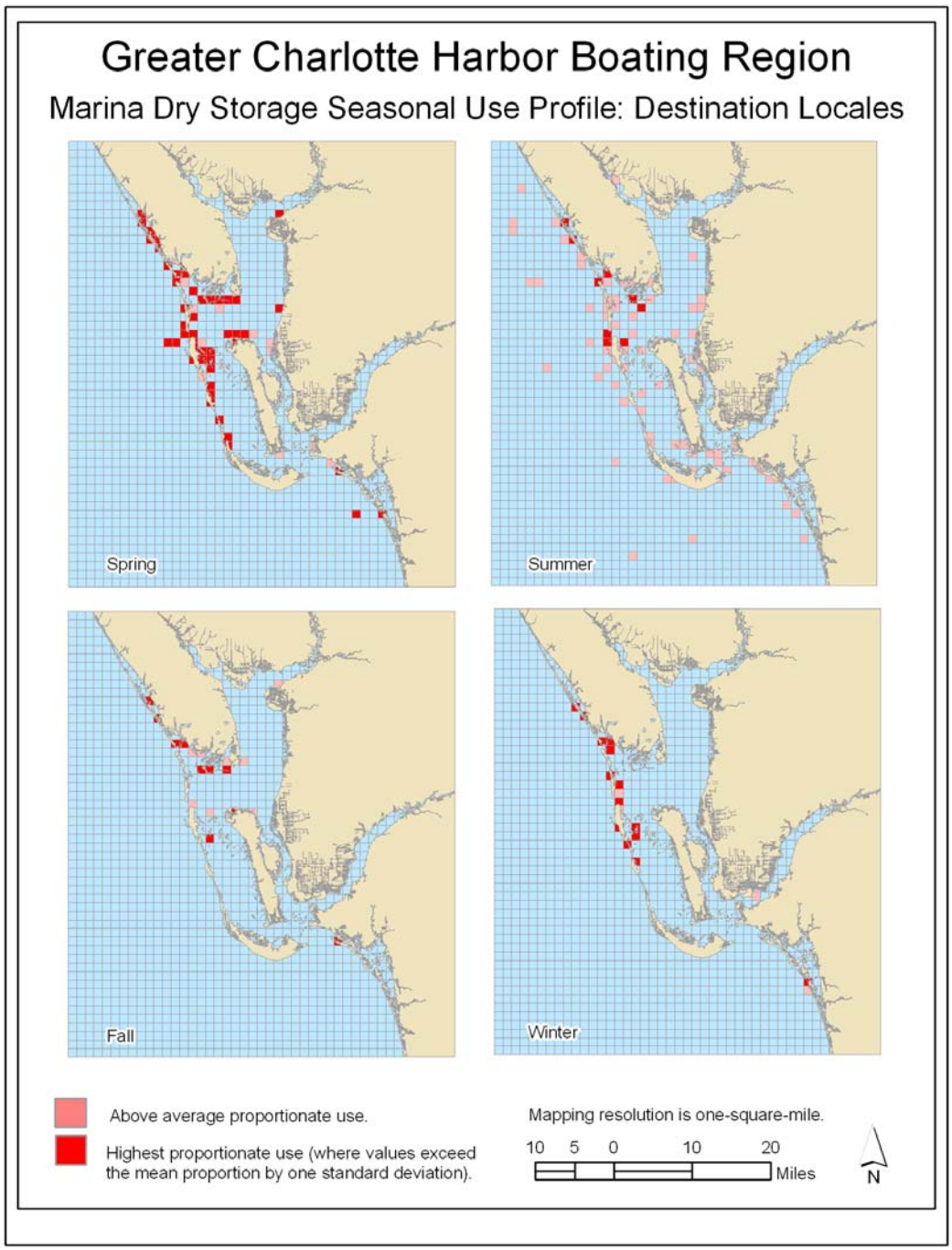


Figure 28. Marina Dry Storage Seasonal Use Profile.

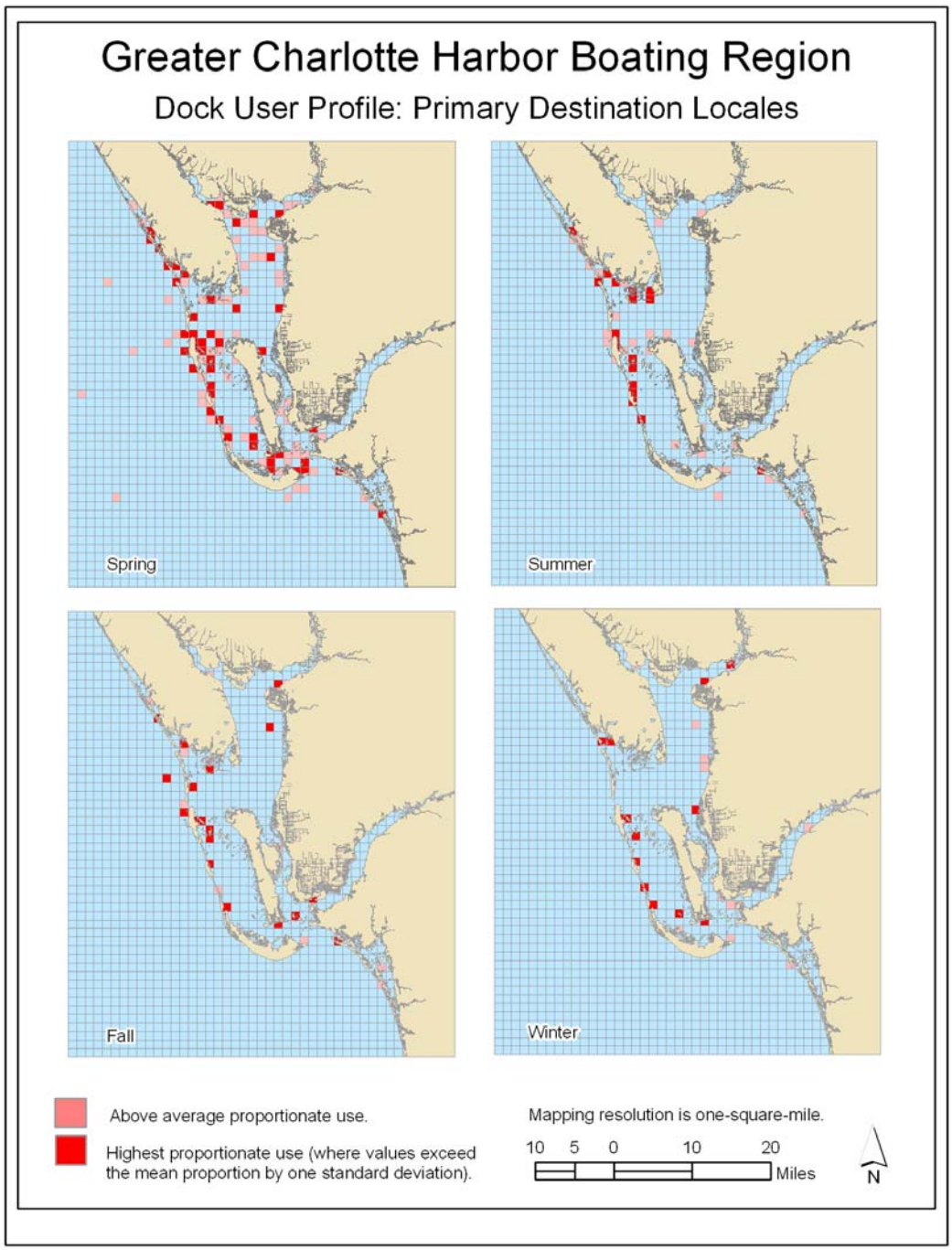


Figure 29. Dock User Seasonal Use Profile.

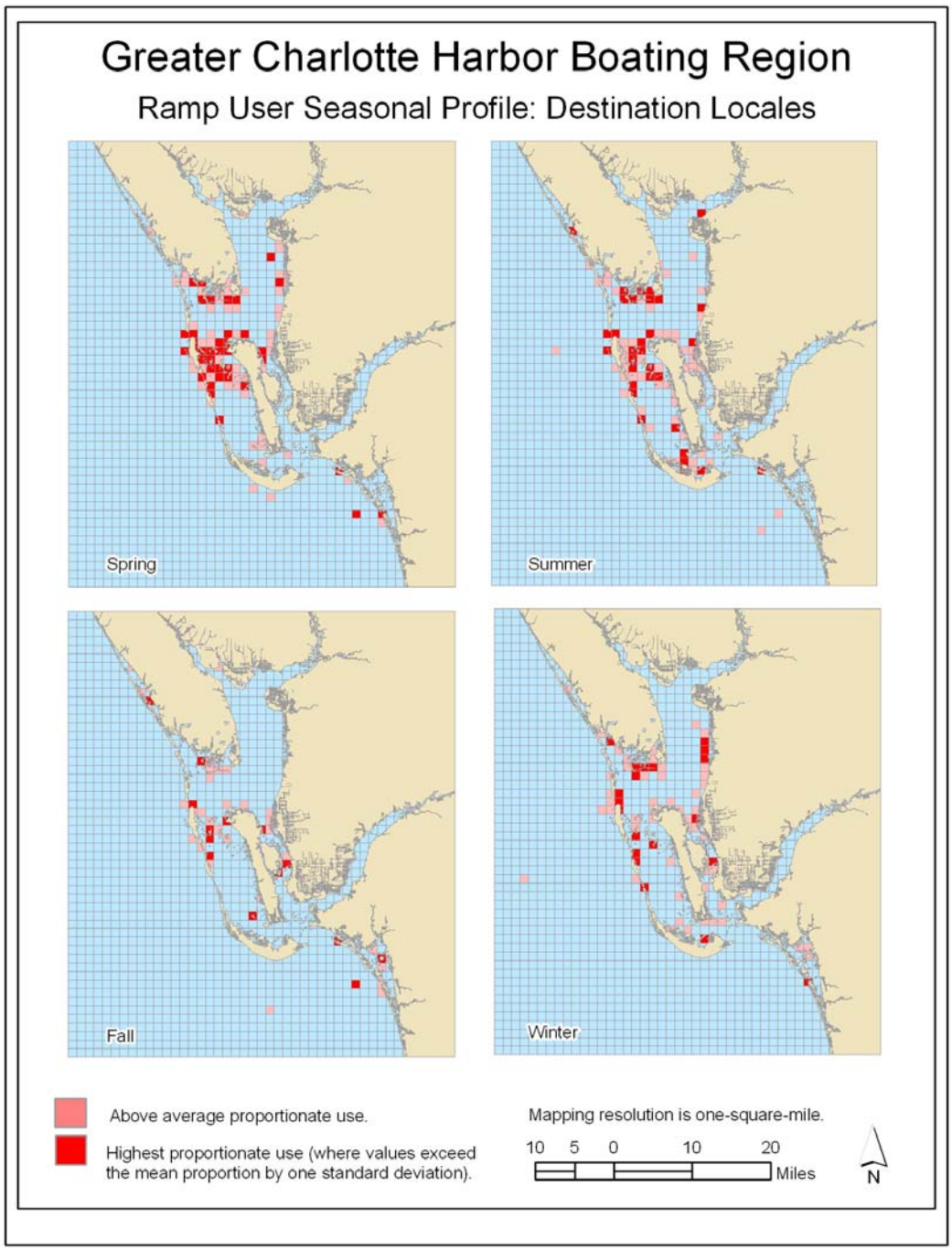


Figure 30. Ramp User Seasonal Use Profile.

Chapter 5. Summary and Conclusions

The goal of this study was to characterize the seasonal waterway use patterns of boaters that use coastal waterways within and around the Greater Charlotte Harbor. The seasonal analysis conducted relied upon information collected during three waves of mail surveys that targeted boaters who accessed the water from marina wet slips, dry storage facilities, public ramps, and private docks.

The seasonal analyses conducted for this study is divided into three parts. The first part involved the identification of the primary boating seasons by use of a cluster analysis based on the reported number of days per month spent boating. The cluster analysis revealed the presence of four distinct boating seasons, consistent with the popular convention of “spring”, “summer”, “fall” and “winter.”

The second component of the study evaluated general seasonal trends as well as seasonal trends among the four waterway access (user) groups, The analysis highlighted various trends in (a) trip departure time, (b) trip duration, (c) weekend versus weekday use patterns, (d) Florida residency status of boaters, and (e) boating activities.

The highly skewed distributions of seasonal trips taken reflect the fact that two general boating populations are represented: (a) typical users – those that conform to seasonal and yearly trip averages; and (b) power users – those that boat more frequently than a typical user. It is likely that mail survey method captured the use profiles of boaters that represent average and above average users. Boaters that may be characterized as infrequent users may not be adequately captured. Along this same line of reasoning, the possibility exists that boaters who completed and returned the survey (26 percent of the surveys mailed) may have provided significantly different responses to questions than would have been provided by boaters who did not respond (74 percent). Based on the analysis, it is believed that individuals who completed and returned surveys represent the more active users of Greater Charlotte Harbor waterways. This is corroborated by the fact that a number of survey recipients phoned or noted on returned unanswered surveys that they did not feel comfortable participating in the study since they were infrequent boaters. As such, the number of boating trips per month reported by respondents is likely to be more than the number taken by the average boat owner. In spite of potential for non-response bias, an argument can be made that the survey data and results reflect boaters who more frequently use the resource.

In general, the results of the seasonal analysis of trip behavior data (trip departure time, trip duration, day of the week, residency status, and activity preference) indicate only subtle variability across seasons. The greatest differences in behaviors across seasons are attributed to the type of access facility used. For example, the results indicate a strong seasonality of use among some groups of boaters that are winter-oriented and generally depart from marinas (wet slip and dry storage facilities); ramp use, however, peaks during the summer months. In addition, seasonal differences in the duration of day trips are observed, however, between marina wet slip, marina dry storage, ramp, and dock

user groups. Thus, if obtaining seasonal trends is important, the significance of examining seasonal trends by waterway access group must not be understated. This finding supports a primary objective of the recreational boating characterization effort – that is, to independently sample and survey users of the four primary waterway access facility types. This conclusion is further supported by the spatial analysis, which found a greater diversity in the boating patterns of the four user groups than that identified by a comparative analysis of the trip data aggregated by season.

The statistical evidence suggests a general consistency in reported activity levels across the various boating seasons. Nevertheless, those differences in the activity mix that were found from season to season can be attributed to more than just random variability. In other words, there are temporal patterns that suggest a season-specific orientation to various boating activities or, at least, a predisposition of boaters to engage more intensely in some boating activities during specific seasons (e.g., restaurant visitation). A further breakdown of seasonal activity by user group is recommended.

The third study element evaluated season-specific and group-specific boating patterns captured by the three mail survey waves. Rasters (i.e., grids or cells) were used to map and evaluate the routes and favorite destinations identified by mail survey respondents. Grid cells with statistically similar seasonal aerial and mail survey use profiles were considered to be congruent; those having statistically different use profiles were considered to be incongruent. The results of a spatial "Proportions Analysis" revealed a high degree uniformity of boating patterns throughout the seasons for travel routes and a weaker seasonal regularity among boating destinations. The spatial pattern of above average and high use destination cells is much less congruent when evaluated by waterway access/user group. This finding is consistent with the seasonal analysis of boater behaviors which showed greater variability in the seasonal use profile when broken down by user group. More importantly the analysis supports the presupposition of the importance of targeting the four waterway access groups – user groups that show considerable variability in habits and destination choice over the various boating seasons.

Future Research Opportunities

1. Compare spatial patterns found in this study to those generated from an earlier effort that randomly selected 500 boaters who registered their vessels in Charlotte and Lee County's (Sidman and Flann, 2001). If similarities in use patterns and boating behavior are found, it would support the implementation of a less intensive and less costly mail survey (fewer waves; fewer surveys distributed).

2. Compare behavioral and spatial information between the three waves of surveys to determine if the basic spatial pattern and boater profile can be obtained from fewer survey waves/mailings (based on the random selection of a subset of returned surveys from each of the three waves).

3. Conduct a survey non-response bias analysis to (a) determine if use patterns and trends of non-respondents differ significantly from boaters who were willing to participate in the survey; and (b) test various hypotheses as they pertain to the assumptions regarding willing participants as ‘power users’ and non-responders as ‘infrequent users’. Should a direct correlation between use frequency and willingness to participate be established, and concerns over potential non-response bias laid to rest, it would have great implications for streamlining the survey sample design and necessary mailings.

4. Evaluate the extent of geographic/boundary ‘spillover’ in coastal areas known to absorb boaters from external markets or contiguous political jurisdictions – the degree to which boaters from outside the region (e.g., from an adjacent county) contribute to the demand for waterway resources and/or congestion.

5. Estimate the “boating pressure” within the Greater Charlotte Harbor based upon the number of trips generated by particular boating groups over the course of a season or year. This would involve an analysis of both mail and aerial survey-derived data (number of trips reported, number of hours spent on the water, number of vessels observed, etc). The results also show a difference of one to two trips per boater, per season, as being significant. While, this number of trips might not seem like a large difference it can have a significant impact on the waterways when multiplied by the total number of trips taken over a particular season by a given user group.

Literature Cited

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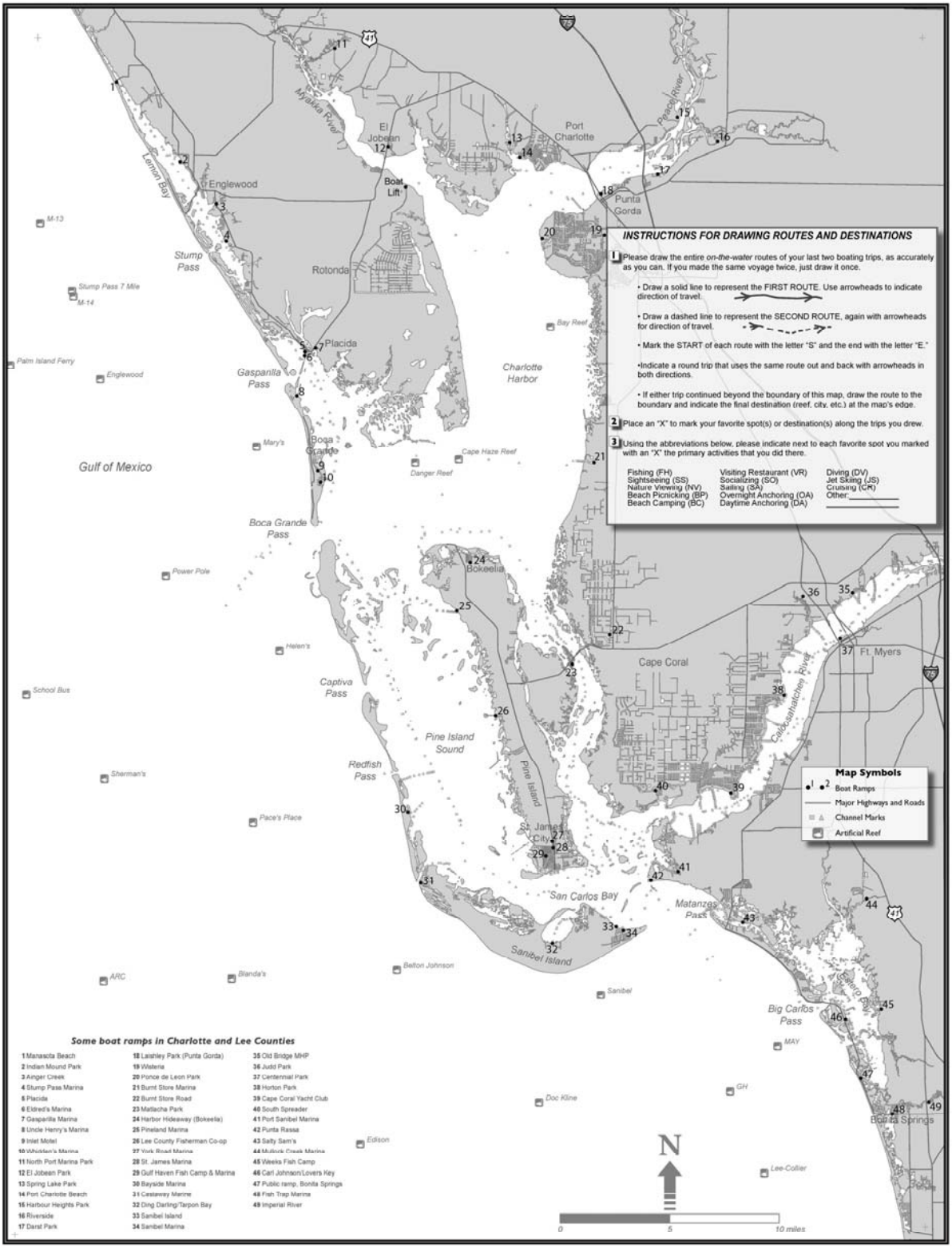
Sidman, C., Swett, R., Fik, T., Fann, S., and Sargent, B. 2005b. " A Recreational Boating Characterization for Sarasota County. Florida Sea Grant Publication. TP-152. University of Florida, Gainesville, Florida.

Appendix A. Questionnaire

Map Portion



Question Portion

PART 1. PLEASE DRAW THE ROUTE OF YOUR LAST TWO BOATING TRIPS

On the other side of this questionnaire is a map of the Greater Charlotte Harbor area, from Lemon Bay to Estero Bay. We would like you to provide information regarding your last two boating trips in this area. This will include marking your launch or departure sites, drawing your boating travel routes, and marking your favorite boating spots or destinations along those routes. ***Please refer to the instructions in the upper right portion of the map for completion of this part of the questionnaire. Thank you.***

PART 2. PLEASE DESCRIBE YOUR LAST TWO BOATING TRIPS

Question 1. Were the last two travel routes that you drew on the map typical, or not—do you travel these routes when boating in the Greater Charlotte Harbor areas depicted on the map more often than not? (*Please check the appropriate box for each travel route that you drew*)

First Trip (**solid line**)	Typical	☐	Not typical	☐
Second Trip (**dashed line**)	Typical	☐	Not typical	☐

Question 2. About what time did you get on the water for each of the two trips that you drew on the map? (*For example, 7:30AM*)

First Trip (**solid line**)	Second Trip (**dashed line**)

Question 3. About how long were you on the water on each of the two trips that you drew on the map? (*Please write in the number of hours or days.*)

First Trip (**solid line**)	Hours	Days
Second Trip (**dashed line**)	Hours	Days

Question 4. Please circle the day of the week that you took each of the two trips that you drew on the map.

First Trip (**solid line**)	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Second Trip (**dashed line**)	Mon	Tues	Wed	Thurs	Fri	Sat	Sun

Question 5. Please circle the month(s) in which you took each of the two trips that you drew on the map.

First Trip (**solid line**)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Second Trip (**dashed line**)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Question 6. From the list below, please check the box beside the vessel type that best describes the boat that you used on each of the two trips that you drew on the map.

Trip 1	Vessel Type	Trip 2
☐	Jet Ski / Personal Watercraft	☐
☐	Kayak / Row / Canoe	☐
☐	Sailboat (no cabin)	☐
☐	Sailboat (with cabin)	☐
☐	Speed: Runabout / Jet Boat (no cabin)	☐
☐	Speed: Scarab / Cigarette (with cabin)	☐
☐	Open Fisherman / Flats / Skiff / John boat	☐
☐	Offshore Sportfisherman (with cabin)	☐
☐	Power Cruiser (with cabin)	☐
☐	Deck Boat	☐
☐	Pontoon Boat	☐
☐	Other (specify)_____	☐

Question 7. Please enter the make/model, length, and draft of the boat(s) that you identified above. (*Draft is how far below the water surface your prop or hull extends.*)

	Make / Model	Length (feet)	Draft (*feet / inches*)
First Trip (**solid line**)			
Second Trip (**dashed line**)	Make / Model	Length (feet)	Draft (feet / inches)

PART 3. PLEASE DESCRIBE YOUR TYPICAL BOATING TRIPS

Question 8. in the boxes below, please write the number of days per month that you operate your boat in the Greater Charlotte Harbor mapped areas.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Question 9. Which of the following are important to you in selecting your typical boating routes? (*For a-k in the table below, check the box that best describes your opinion.*)

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a) I try to avoid congested areas / crowds.	☐	☐	☐	☐	☐
b) I try to avoid shallow water.	☐	☐	☐	☐	☐
c) The fishing is good.	☐	☐	☐	☐	☐
d) I prefer well-marked channels.	☐	☐	☐	☐	☐
e) I prefer calm protected waters.	☐	☐	☐	☐	☐
f) I try to avoid speed zones.	☐	☐	☐	☐	☐
g) None are important. I just cruise around.	☐	☐	☐	☐	☐
h) Easy access to supplies or fuel	☐	☐	☐	☐	☐
i) Quick access to my favorite boating spots	☐	☐	☐	☐	☐
j) I enjoy the scenic beauty.	☐	☐	☐	☐	☐
k) Other (*specify*)	☐	☐	☐	☐	☐

Question 10. From the list (*a–k*) above, circle the letter associated with the most important reason for selecting your favorite boating routes.

Question 11. Please check the box to the **left** of your typical departure site.

☐ Boat ramp	☐ Shoreline / causeway	☐ Marina wet slip
☐ Home dock	☐ Condominium dock	☐ Marina dry storage
☐ Other (*specify*) _____		

If you normally depart from a marina, the shoreline, or a ramp, please answer the following questions. If you normally depart from a residential or condominium dock, please skip to Question 18.

Question 12. What marina do you depart from most often? (*If you launch from a ramp, including a marina ramp, please skip to Question 14.*)

Name / Location _____

Question 13. About how long does it take to drive from your home to the marina that you depart from most often?

Hours _____ Minutes _____

Question 14. If you use the shoreline or boat ramps (*including marina ramps*), please identify your two most frequently used shoreline locations or ramps and the approximate number of times per year you use each. (*A list of some ramps is provided on the other side of this questionnaire.*)

Ramp or Shoreline Name/Location	Approximate times per year
First Choice	
Second Choice	

Question 15. About how long does it take to drive from your home to the shoreline locations or two ramps that you identified in Question 14?

Ramp Name/Location	Hours	Minutes
First Choice		
Second Choice		

Question 16. What is important to you in selecting a marina, shoreline, or ramp? (*For a-n in the table below, check the box that best describes how important it is to you, or leave blank if not applicable.*)

Statement	Very Important	Important	Neutral	Unimportant	Very Unimportant
a) Deep-water access	☐	☐	☐	☐	☐
b) Availability of restrooms	☐	☐	☐	☐	☐
c) No parking or launching fee	☐	☐	☐	☐	☐
d) Well-marked access channels	☐	☐	☐	☐	☐
e) Proximity to my favorite boating spots	☐	☐	☐	☐	☐
f) Adequate parking	☐	☐	☐	☐	☐
g) Availability of fishing supplies, bait	☐	☐	☐	☐	☐
h) Short wait to launch.	☐	☐	☐	☐	☐
i) Gas, pump-out, or maintenance service	☐	☐	☐	☐	☐
j) Nearby amenities (e.g., restaurant)	☐	☐	☐	☐	☐
k) Proximity to my home	☐	☐	☐	☐	☐
l) Ease of launching and retrieving boat	☐	☐	☐	☐	☐
m) Safe and secure parking area	☐	☐	☐	☐	☐
n) Other factor (*specify*)	☐	☐	☐	☐	☐

Question 17. From the list (*a–n*) above, please circle the letter associated with the most important reason for selecting a marina, shoreline, or ramp.

Question 18. What are your activities on your typical boating trips? (*Check all that apply.*)

☐ Beach Picnicking (**BP**)	☐ Nature Viewing (**NV**)	☐ Sightseeing (**SS**)
☐ Cruising (**CR**)	☐ Daytime Anchoring (**DA**)	☐ Socializing (**SO**)
☐ Diving (**DV**)	☐ Overnight Anchoring (**OA**)	☐ Visiting Restaurant (**VR**)
☐ Fishing (**FH**)	☐ Sailing (**SA**)	☐ Swimming (**SW**)
☐ Ski / Water Sports (**WS**)	☐ Other (**O**) (*specify*)_____	

Question 19. Based on your boating experiences **over the past year**, have you avoided or left your favorite spots or destinations because of too many other boaters? ☐ Yes ☐ No

Question 20. In which areas, if any, have you experienced the greatest amount of boat congestion? **Please mark congested areas on the map with the letter "C."** (*"Congestion" refers to the presence of more boats than you would prefer.*)

PART 4. PLEASE DESCRIBE YOURSELF

Question 21. How many months per year do you live in Florida? _____(*Months*)

Question 22. How long have you been operating a vessel in Florida's coastal waterways? _____(*Years*)

Question 23. Have you ever taken a boat safety or seamanship course? ☐ Yes ☐ No

Question 24. In what year were you born? _____

Question 25. Would you participate in a future internet and / or mail survey to provide further information on your boating experiences? **Internet** Yes ☐ No ☐ **Mail** Yes ☐ No ☐

Question 26. What detracts most from your boating experience?

Question 27. What is needed most to improve your boating experience?

PLEASE RETURN THE QUESTIONNAIRE AND MAP IN THE ENCLOSED POSTAGE-PAID ENVELOPE
THANK YOU VERY MUCH FOR YOUR TIME AND PARTICIPATION!

Questionnaire Control Number
(used only to keep track of survey returns)