A Survey of Methods for

Characterizing Recreational Boating

In Charlotte Harbor, FL

Charles Sidman Richard Flamm

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by

Charles Sidman Research Associate Florida Sea Grant University of Florida Gainesville

Richard Flamm
Research Associate
Florida Marine Research Institute
St. Petersburg

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The Authors

Introduction

Background

Florida is experiencing tremendous population growth. The environmental and social consequences of this growth on Florida's marine resources are not well understood. The Florida Blueways initiative seeks to clarify these consequences (Florida Marine Research Institute, 1999). The Florida Blueways initiative considers management needs through the application of ecological principles to characterize and assess human-environmental interactions for the management and stewardship of coastal resources. An evaluation of human and natural system dynamics is predicated on characterizing important human uses of coastal resources. Recreational boating-related activities, which include fishing, anchoring, pleasure cruising, and nature viewing, are considered to be important human-uses of Florida's coastal resources (Bell, 1994; Antonini, Bell, Kampert, Sidman, Swett, and Tupper, 1997; Swett, Fann, Antonini, and Alexander, 2000).

One high-density boating area is Southwest Florida - (Manatee, Sarasota, Charlotte, Lee, and Collier counties). Today there is an estimated 97,628 registered pleasure boats in this region (Florida Bureau of Economic and Business Research, 1990). This represents a 405 percent increase since 1970. According to 1998 boat registrations almost one-half (44,026) of the recreational boats in Southwest Florida are registered in the current Blueways study area of Charlotte and Lee counties, the two counties surrounding Charlotte Harbor.

One of the objectives of Blueways is to identify and map high-use areas that could be interpreted as hotspots. Hotspot is a general term that is specified depending upon the characterization's objective, typically in terms of some attribute greatly exceeding the average. For example, Prendergast, Quinn, Lawton, Eversham, and Gibbons (1993a) defined diversity hotspots as the top five percent of record-containing 10-km squares that were ranked by the number of species per square. Other applications include species richness, taxonomic criteria like concentrations of endemic species, or the extent of threats present (Prendergast, Wood, Lawton, and Eversham, 1993b; Myers, 1990). Blueways extends the list of applications to include concentration and diversity of human uses, human-use conflicts, and temporal human-use patterns. More specifically, in this study we considered concentrations of boats and areas where crowding is perceived.

Characterizing recreational boating is complex. Activities, vessel types, and attitudes of boaters vary considerably, each uniquely contributing to the spatial and temporal boating pattern. Therefore, in this study three sampling procedures were implemented, each focusing on unique aspects of boating. The first, aerial reconnaissance, is a well-established way to map boat locations (Ashton, 1971; Gorzelaney, 1998). Aerial surveys provide a "snapshot" of boat locations, source data for calculating boat densities. Second, workshops were used to delineate high-

use areas for specific boating-related activities because many boating activities cannot be identified from the air. Third, telephone and mail surveys of a random sample of boaters in the area were used to ascertain favorite destinations, perceived crowding, activities, and motivations behind the observed spatial patterns (West, 1982; Feitelson, 1991). The three methods provide a "value-added" blend of objective observation, independent local knowledge, and behavioral information.

Goals and Objectives

The goal of this study was to utilize several survey methods to generate spatial and temporal recreational boating use and activity profiles for Charlotte Harbor, Florida, that can be interpreted in terms of use hotspots and potential for crowding. Specific objectives include: (1) mapping boat locations using aerial surveys; (2) identifying areas where specific recreational boating activities occur by interviewing local boating experts and resource managers; (3) estimating boat densities in expert-defined activity areas; (4) identifying primary activities and temporal usage through a telephone survey of area boaters; and (5) identifying favorite boating locales, identifying reasons for selecting travel routes and favorite locales, and estimating crowding potential through a mail survey of area boaters.

Methodology

Survey Methods

Three methods were selected to provide complementary information for characterizing recreational boating and identifying areas of highest use and crowding potential. Aerial reconnaissance was selected to map the location of individual boats on selected dates and times. Workshops brought together local boating experts to identify areas where recreational boating and associated activities typically occur. A combined telephone / mail survey was implemented to identify favorite boating areas, seasons, and areas of perceived crowding. This section describes how each survey procedure was carried out.

Aerial Surveys

The aerial surveys provided a series of "snapshots" of boating in Charlotte Harbor that was integrated with expert-defined activity areas for visualizing densities in areas where specific activities were believed to predominate. As of the submittal of this report, four aerial surveys were completed for the Charlotte County portion of the study area: March 30, April 18, April 29, and May 17, 2000 (three weekdays, one weekend day). Two were morning flights, and two were afternoon. Aerial surveys for the Lee County portion of Charlotte Harbor were flown in 1998 (Gorzelany, 1998). Aerial surveys for Charlotte Harbor are continuing in order to complete one year of flights, which is necessary for capturing the seasonal variability of boating and to match the sampling protocols used by Gorzelany for Lee County.

Surveys in Charlotte Harbor were flown over all navigable waters in a Cessna 172 aircraft at an altitude of 500 feet. A single observer/videographer was seated in the right front seat of the survey aircraft. An image-stabilizing digital Hi8-mm Sony camcorder with date and time stamp recorded all vessels in-use while flying a standard flight path. Starting and ending locations in Charlotte County were varied for each survey.

Once completed, each vessel observed on the video footage was plotted and recorded on ArcView® GIS 3.2 survey maps. Attribute data included vessel type, size, whether the boat was moving or not, direction of travel (if any), and a unique alphanumeric code for each vessel observed. Vessels were classified either as big powerboats, small powerboats, sailboats, or personal watercraft (PWC). Additionally, environmental conditions, including weather, wind speed and direction, and Beaufort sea-state value were recorded.

Workshops

The objective of the workshops was to have local boating experts draw areas on a map of Charlotte Harbor and characterize each area with respect to boating

activities (jet skiing, sailing, fishing, cruising, nature touring, diving), crowding, and nighttime use. Six meetings were held over two days. Three two-hour meetings were held at the Regional Planning Council Building in North Fort Myers on May 9, 2000 and three meetings were held at the Charlotte Harbor Environmental Center in Punta Gorda on May 10, 2000. Twenty-four of the 66 experts invited attended the meetings. Affiliations included representatives from estuary programs, regional planning councils, marine industries, fishing clubs, guides, captains, the West Coast Inland Navigation District, Florida Sea Grant, county government, Florida Department of Environmental Protection, dive clubs, and environmental organizations.

Each two-hour session began with a half-hour overview of the project, instructions for the participants, and a short question/answer period. During the remaining time the experts drew activity areas on maps (see Appendix B for an example of the survey map) and described each area by filling out an accompanying data sheet. Specifically, participants described each area for its primary boating activity, secondary boating activities, times of greatest crowding (times of the day, days of the week, months of the year, etc.), and the number of boats present that, in their opinions, would constitute crowding. The primary activity was defined as the experts' perspective of a predominant boating-related human use occurring within the delineated area. Only one primary activity could be selected per area, and all attributes describing the area were related to the primary activity. Secondary activities were those, in addition to the primary activity, that the expert considered to be noticeable or "likely to be observed." High crowding was defined as the number of boats that would lead to a change in boating pattern, such as leaving an area earlier in the day than usual (Drogin, 1991). Moderate crowding was defined as more boats than one would prefer, but would not lead to a change in boating pattern.

Telephone and Mail Surveys

The objective of the telephone and mail surveys was to identify popular boating activities, reasons for selecting travel routes and destinations, favorite boating areas, and areas of perceived congestion (Heatwole and West, 1982). The telephone survey elicited information regarding boat type, draft, length, common activities (including fishing, anchoring, nature-viewing, and cruising), and the day and time that outings took place. Telephone respondents were asked if they would be willing to participate in a follow-up mail survey (Dillman, West and Clark, 1994). Respondents who agreed to participate were mailed a detailed map of Charlotte Harbor, depicting 35 boating regions and the locations of marinas and boat ramps, along with a questionnaire. The mail survey elicited information regarding where boaters go (destinations and travel routes), areas of greatest congestion, reasons for selecting travel routes, and attitudes towards other boaters. The mail survey was used to characterize boater attitudes towards congestion and the motivation behind boating decisions, as a complement to aerial and telephone surveys (see Appendix B for copies of the telephone and mail surveys and associated correspondence).

A stratified random sample of 500 recreational boaters in Charlotte and Lee counties was selected from the 1998 Florida Vessel and Title Registration System (VTRS), which is currently being updated and maintained by the Florida Department of Transportation. The sample size of 500 provides better than a +/- 5 percent margin of error with a 95 percent confidence level based on the entire boating population (roughly 44,000 boat registrations in Charlotte and Lee Counties). A boat class -- (a) kayak, row, canoe, (KRC); (b) sail; (c) power boats; (d) big powerboats; (e) personal watercraft (PWC) - - was assigned to each of the records, based on an interpretation of the "make," "model," and "length" fields contained in the VTRS. The random sample was drawn first by county in proportion to the total two-county boat population. This was followed by a sample allocation by boat class that was proportionate to the number of owners who live in each respective county (Table 1). Names and addresses were used to obtain telephone numbers for the sample.

Telephone and mail surveys were administered using established survey procedures (Dillman, 1978, 1991). The telephone survey was pre-tested by a sample of Charlotte County boaters who had participated in a prior survey (Antonini et al., 2000). Telephone interviews were conducted in May and June 2000 by the Florida Survey Research Center (FSRC), in the Department of Political Science University of Florida.

	Lee			Charlotte				
boat class	all records	%class total	sample n	all records	%class total	sample n	proportion	Totals
			by class			by class	of 500	
*KCR	1095	0.58	12	780	0.42	9	21	1875
Sail	1509	0.60	17	993	0.40	11	28	2502
Power	22384	0.66	254	11371	0.34	129	383	33755
**Big Power	1007	0.65	11	535	0.35	6	18	1542
Jet Ski	3233	0.74	37	1119	0.26	13	49	4352
Totals	29228		331	14798		168	500	44026

^{*}KCR is Kayak/Row/ Canoe. ** Big powerboats are > 26 feet long and have a draft >= 3 feet).

Table 1. Sample Breakdown by Boat Class.

Mail surveys were pre-tested by local boating experts and resource managers at workshops held in Fort Myers and Punta Gorda. The names and addresses of participants who agreed to complete the mail survey were supplied to us on a weekly basis by the FSRC. Survey packets were promptly mailed and included a postage-paid envelope and a copy of "A Historical Geography of

Southwest Florida Waterways: Volume One, Anna Maria Sound to Lemon Bay" (Antonini et al., 1999). A reminder card was mailed in late June to those individuals who had not yet returned questionnaires. The FSRC conducted reminder calls in conjunction with the reminder mailing.

Five hundred individuals participated in the telephone interviews and 354 agreed to complete a mail survey. Two hundred and fifteen usable mail surveys were returned (Table 2). A proportionate ratio of the mail sample to the telephone sample of both Charlotte and Lee counties was maintained for all boat types except the jet-ski category (under-represented by 4%) and the sailboat category (over-represented by 3%).

Telephone Surveys Completed			, Mail Surveys Sent			Mail Surveys Completed					
	Lee	Charlotte	TOTAL		Lee	Charlotte	TOTAL		Lee	Charlotte	TOTAL
Jet Ski	23	13	36		17	7	24		3	4	7
*KCR	11	8	19		10	6	16	117	3	3	6
**Power	266	149	415	11	182	109	291	**	113	69	182
Sail	17	13	30	11)	10	13	23	4	7	13	20
TOTAL	317	183	500	in the	219	135	354		126	89	215

^{*}KCR is Kayak/Row/ Canoe. ** The power category includes the big powerboat class.

Table 2. Breakdown of Telephone and Mail Survey Completions.

Mapping High-Use Areas

This section describes methods selected to map data obtained from each of the three survey methods. Methods used to integrate data also are presented.

Mapping Relative Boat Densities from Aerial Survey Data

Boat location data for each survey date and county were combined and partitioned into weekend and weekday data layers. Differences in the sampling intensity between the two counties were not considered. Relative boat density was computed using a Voronoi diagram (also called *Thiessen polygons*), which is an expression of natural neighbor relationships in two dimensions (Boots and Getis, 1988; A Okabe, Boots, Sugihara, Chiu, and M Okabe, 2000). The Voronoi diagram was constructed using the Arc/Info THIESSEN command (Enviornmental Systems Research Institute, Redlands, Cal.). Voronoi polygons were converted to a raster data layer of 25x25 meter cell size. Each cell was classified according to the size of the polygon from which it was derived.

Voronoi polygons were generated to estimate boating densities by calculating areas around boats interpreted from aerial videography. In this type of analysis, greater concentrations of boats result in a dense Voronoi diagram (small polygons), whereas low concentrations of boats generate large Voronoi polygons, indicating greater vessel dispersion. Areas of highest vessel concentration were mapped according to the polygon size. Class intervals were defined as Voronoi polygons less than 1000 cells (highest relative boat density; greatest vessel concentration); polygons from 1000 to 4999 cells (moderate relative boat density); and those polygons 5000 cells or more (lowest relative boat density; greatest vessel dispersion). The Voronoi representation of boating-use (Figure 1; page 12) identifies areas of highest relative boating density and serves as one interpretation of high-use areas or use-hotspots in exclusion of the other methods.

Mapping Expert-Defined Fishing Areas

The primary intention of the workshops was to have experts define areas for which boating densities could be calculated. Fishing was the primary use most selected by experts so subsequent analyses focused on fishing. Areas of greatest overlap (expert consensus) could be interpreted as predominant fishing locales (hotspots). Each boating area identified by an expert was digitized into Arc/Info and assigned a unique number that linked it with attributes on a corresponding data sheet (Appendix A). Expert- defined fishing areas were selected out and combined in Arc/Info. Areas of greatest primary fishing-area overlap reflect greatest expert consensus (Figure 2; page 13). Mapping intervals reflect equal division of the data range (least to greatest expert consensus).

Mapping Favorite Fishing Areas Identified by Mail Survey Respondents

Mail survey recipients were asked to identify their favorite boating destinations ("Place an X at your favorite boating areas") on a map provided with the survey (Appendix B, Map A). Survey maps contained a detailed shoreline and a one-second grid to help respondents locate their favorite destinations as accurately as possible.

Each favorite location was digitized using a bathymetric map that included the shoreline and a one-second grid for orientation, to ensure the most accurate interpretation and digitization of survey data. Boaters' favorite spots were classified according to their favorite activity (Figure 3; page 15). Fishing was also the primary activity most selected by boaters, so this analysis also focused on fishing. The DENSITY command in ArcView was used to generate a GRID interpreted as being favorite fishing areas. An output grid with a cell size of 400 feet and a search radius of 3000 feet was a density map that most accurately reflected the distribution of favorite fishing areas. Areas of highest density reflect popular destinations and one interpretation of fishing hotspots (Figure 4; page 16).

Mapping High-Use Areas Through Data Integration

The three methods selected were chosen to provide complementary types of boating data. Each method can be used independently as the basis for identifying hotspots. However, data from aerial surveys, workshops, and telephone and mail surveys also can be integrated for more robust characterizations.

First, weekend boating densities in expert defined fishing areas (fishing hotspots) are mapped by integrating results from workshops and aerial surveys. Weekends were selected to better portray peak-use periods (telephone and aerial survey results show weekends as being peak-use times). Aerial survey data for Lee and Charlotte counties were combined into a single Arc/Info coverage. This data layer was then split into weekend and weekday flights. Expert-defined fishing areas were stored as individual data layers, one layer per expert. A program was written that calculated the frequency, total number, mean density, standard deviation, and maximum value of activities and boat types observed for each expert-defined region for both weekends and weekdays. Weekend vessel counts were aggregated within expert-defined fishing areas for mapping high-use fishing areas according to relative densities (Figure 5; page 18).

A second integration involves combining expert-defined fishing areas with favorite fishing spots identified by mail survey respondents. Each expert-defined fishing area was combined such that areas containing the greatest overlap (expert consensus) received higher values. Areas were converted to grids and reclassified by equal interval to identify low, medium, and high consensus. A similar procedure was used to classify boater-defined favorite fishing areas. The two grid layers were combined to reveal a multi-overlay composite that also identifies high-use fishing areas (Figure 6; page 19).

Use Profiles for Boaters and Regions

A profile of boaters offers insight into motivations that underlie observed/mapped boating patterns. A clustering technique (Kachigan, 1986) was used to profile boaters and regions within Charlotte Harbor. Due to the preponderance of small powerboats in the sample (the sample was weighted to survey a representative number of boaters by county and type), this type was analyzed separately from the other boat types (big power, sail, Personal Watercraft (PWC), and kayak/row/canoe (KRC).

Cluster analysis is a statistical procedure used to group and/or classify individual observations in a data set according to their similarities. Individual observations that are deemed "similar" are grouped together to form clusters of observations (that can be differentiated from other observations or clusters). The K-mean, also called K-group, cluster method used in this analysis combines observations with respect to K-means (or average cluster position). Initially, the number of clusters (K) is set at a minimum (in this case 3) and increased iteratively

until the procedure ceases to produce large and significantly different clusters. Significantly different clusters are based upon the relationship between the total sum of squares (TSS), the within-group sum of squares (WSS), and between group sum of squares (BSS), where TSS = WSS+BSS.

First, the TSS for all variables selected (i.e., boat type versus favorite time of day, favorite boating location, etc.) is computed identifying three initial clusters. More clusters are added, one at a time, until there is no significant decrease in WSS. Next, the mean for each cluster is computed. Individual observations are then assigned to a cluster based upon Euclidean distance from the TSS mean. Individual observations are therefore assigned to a cluster for which the TSS distance is smallest: (i.e., WSS is minimized and BSS is maximized).

An analysis of variance (ANOVA) is performed on each run to determine the overall statistical significance of the cluster configuration(s) using the F-statistic to highlight the amount of total variation accounted for by the BSS. A cluster profile is revealed, identifying outcomes that best differentiate one cluster from another.

Dependent variables included boat type and location. Independent variables included: time(s) of day; day(s) of week; month(s) of year of preferred usage; favorite activities; favorite reason for selecting a destination or travel route; and the most congested time(s) of day, day(s) of week, and month(s) of the year. The boater profile is based on the following five boat types: Power, big power (powerboats greater than 26 feet in length and having a draft of greater than 3 feet), sail, personal-watercraft (PWC), and kayak/row/canoe (KRC).

To meet minimum observation requirements the cluster analyses required that the original 35 boating areas depicted on the mail questionnaire (Appendix B) be collapsed to 10 regions. Summary statistics were used to corroborate cluster analyses results.

Perceived Crowding

Perceived crowding was addressed through the use of a mail survey that included a map identifying 35 boating regions (Appendix B, Map B). Boating regions where crowding is perceived to exist are identified by summarizing responses to the following survey question:

In which areas, if any, (identified on Map B) have you experienced the
greatest amount of boat congestion? Congestion refers to the presence of
more boats than you prefer.
Most congested area.
Second most congested area.

Areas of perceived crowding are mapped as a function of the standard deviation from the mean number of mail survey respondents who selected a particular region (identified on Map B, Appendix B) as being the first or second most congested (Figure 7; page 22). Crowding is more likely occur within regions that exhibit a 2 to 3, or > 3 standard deviation higher than the average. Perceived crowding is also addressed by identifying changes in behavior. For example, mail survey respondents were asked if they had, in the past year, avoided or left their favorite areas because there were too many boats there, or if they had tolerated too many boats in their favorite areas.

Crowding can also be a function of the diversity of proximate activities. Boaters' favorite activity spots (Figure 3; page 15) were used to identify areas that contain the greatest activity diversity. Proximate activities included anchoring, cruising, sailing, fishing, and nature viewing. Activity diversity is measured by the number of proximate activities located within one square mile of each other. Areas that contained the greatest activity diversity were compared with regions of greatest perceived congestion (Figure 7) to identify possible crowding hotspots (Figure 8; page 23).

Results

Mapping High-Use Areas

Mapping Relative Boat Densities From Aerial Survey Data

A relative density map (Figure 1) summarizes boat locations in Charlotte Harbor. Relative densities are greatest in the Caloosahatchee River, the Intracoastal Waterway within Pine Island Sound, Matlacha Pass, Boca Grande Pass, and several smaller fishing and recreation areas. Middle Charlotte Harbor exhibits the lowest relative boating density (see Appendix B, Maps A and B for place names). Lower boating densities were calculated for much of the Charlotte County portion of the study area. The reason for this is that, to date, only 4 flights were completed for Charlotte County (16 were completed for the Lee County portion) and the data were not adjusted for sampling intensity.

Mapping Expert-Defined Fishing Areas

Fishing was considered to be the primary or predominant activity in 136 areas (Table 3); personal watercraft (PWC) was the most prominent secondary activity (107).

Primary activity	Count	Secondary Activity	Count
Water-skiing	12	Water-skiing	21
Nature-touring	52	Nature touring	63
Diving	3	Diving	12
Sailing	16	Sailing	38
Fishing	136	Fishing	59
PWC	13	PWC	107

Table 3. Breakdown of Primary and Secondary Activities in Expert-Defined Boating Areas.

Expert-defined fishing areas are shown in Figure 2. Lighter shades of red denote lower expert consensus and darker shades of red illustrate areas of greater expert consensus regarding predominant fishing locales. The greatest number of expert- defined fishing areas that overlapped was 13. Thus, expert consensus was mapped as: lowest consensus (1-4) experts agreeing; moderate consensus (5-8) experts agreeing); greatest expert consensus (9-13) experts agreeing). Fishing hotspots can be interpreted from high expert consensus.

Mapping Favorite Fishing Areas Identified by Mail Survey Respondents

Mail survey volunteers were asked to place an X at their favorite boating spots. Favorite spots were digitized into an Arc/Info point data layer (Figure 3).

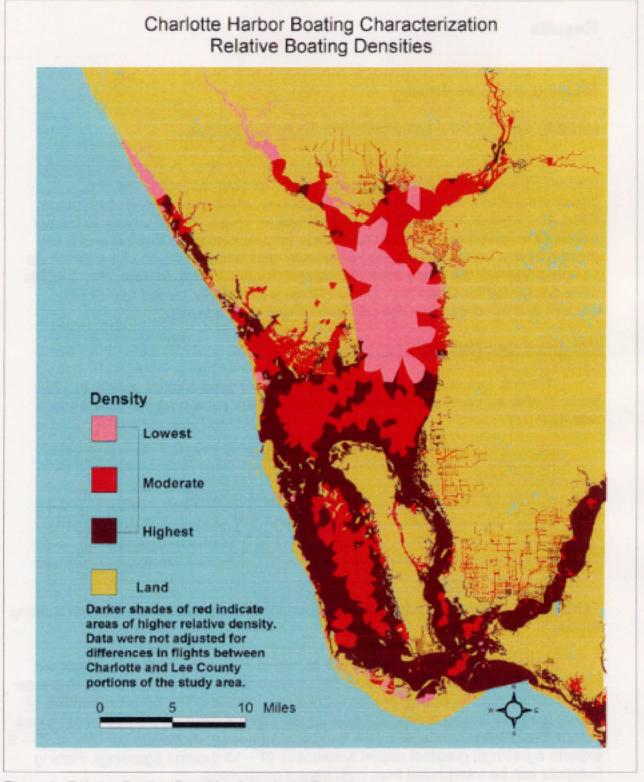


Figure 1. Relative Boating Densities from Aerial Surveys.

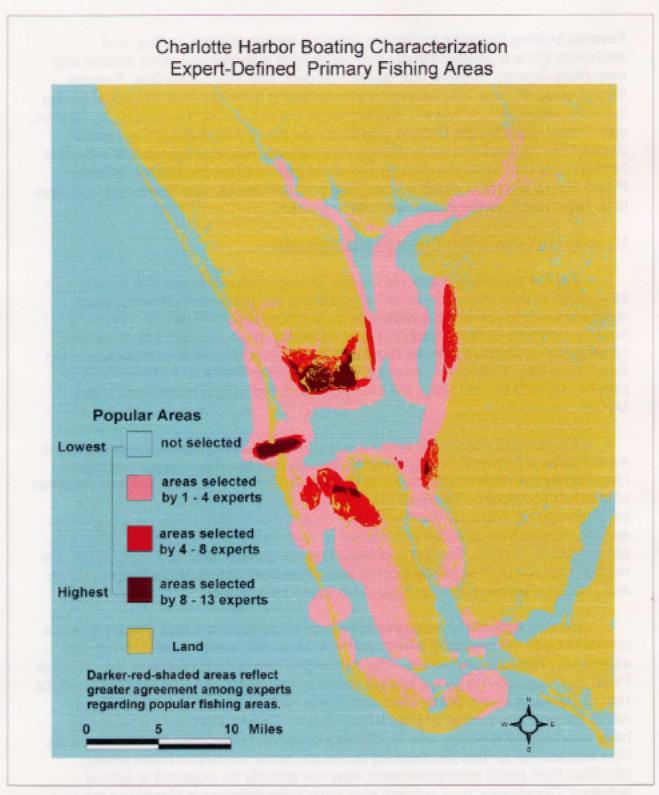


Figure 2. Fishing Areas as Defined by Experts.

Favorite boating locations for fishing, cruising, nature viewing, sailing, and anchoring show a greater density and diversity of activities occurring around and near Boca Grande, Captiva and Redfish passes, and San Carlos Bay. Favorite fishing areas (Figure 4) are mapped by calculating densities from individual fishing locations displayed in Figure 3. Darker shades of red around Boca Grande, Captiva, and Redfish passes, the Useppa and Cabbage Key areas, Pelican Bay, and St. James City, illustrate important fishing destinations. Also highlighted are important fishing spots bordering the eastern portion of middle Charlotte Harbor between Punta Gorda Isles and Pirate Harbor, and tidal flats areas near Turtle and Bull Bays (see Appendix B, Maps A and B for place names).

Mapping High-Use Areas Through Data Integration

For the purposes of this report, two fishing representations that illustrate an integration of data from several survey methods are presented. The first maps weekend boating densities in expert-defined fishing areas (Figure 5). Weekend boating in expert- defined fishing areas is greatest at Gasparilla Pass, Shell Point (confluence of Caloosahatchee River and San Carlos Bay) and near spoil areas in San Carlos Bay. High densities are also calculated for Boca Grand and Captiva passes, Turtle Bay, and along the sea grass flats from Cape Haze north to the McCall Sand Flats.

The second integration offers a composite analysis (Figure 6) that combines expert-defined 'primary' fishing areas (Figure 2) with favorite fishing destinations identified by mail survey respondents (Figure 4). Darker shades of red identify areas of greatest congruence between experts and boaters. Integration of data from several methods expands the range of popular fishing destinations, and highlights specific locales that could be considered as high-use areas or hotspots. High-use areas include Redfish, Captiva and Boca Grande passes, Bull and Turtle Bays, the northern portion of Pine Island Sound, and areas near the small mangrove islands and tidal flats between Punta Gorda Isles and Pirate Harbor.

Experts accurately portrayed the range of fishing-use areas (Figure 2) when compared with the results of boater surveys. However, expert -aerial composite scores may have underestimated the intensity of use in certain locales (i.e., Redfish Pass, Bull Bay, the mangrove islands and tidal flats along the east bank of Charlotte Harbor between Punta Gorda Isles and Pirate Harbor, among the many islands within the northern portion of Pine Island Sound). Expert composite scores may have overestimated fishing use in Placida Harbor and Gasparilla Sound (Figure 5). One explanation for this discrepancy is that the many vessels in those areas, identified from aerial reconnaissance, may not actually be engaged in fishing activities. Conversely, mail surveys may have been deficient in identifying the McCall Sand Flats area and Gasparilla Pass as popular fishing and boating locales (Figure 4).

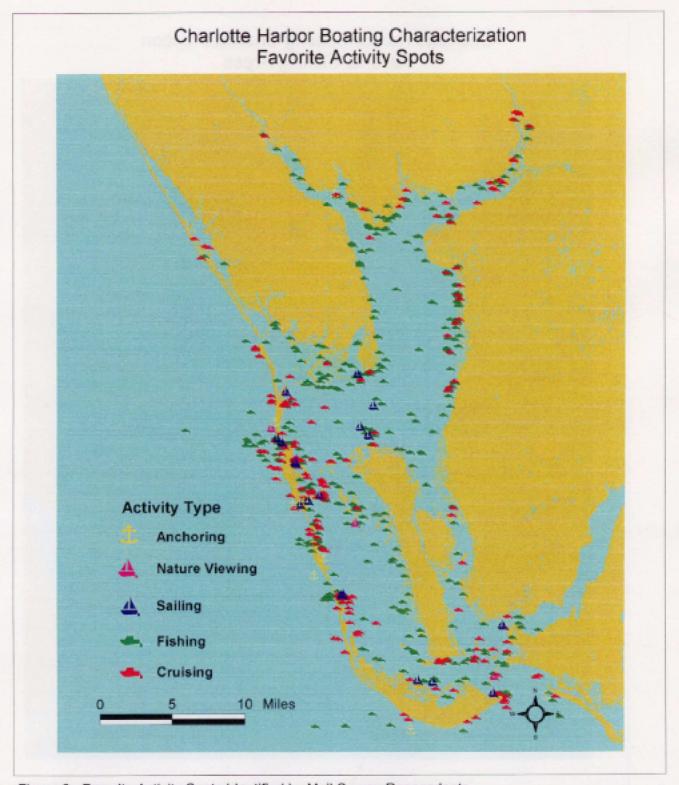


Figure 3. Favorite Activity Spots Identified by Mail Survey Respondents.

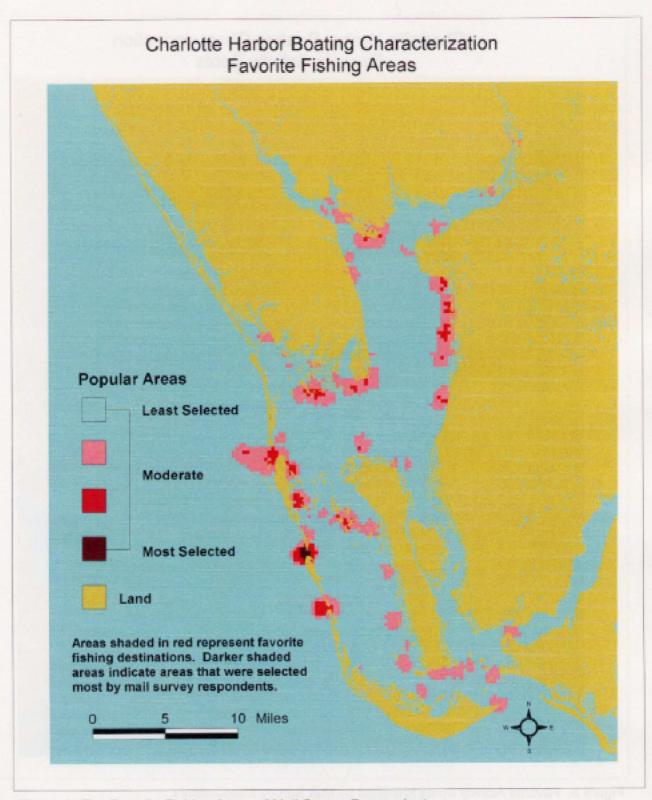


Figure 4. The Favorite Fishing Areas of Mail Survey Respondents.

Use Profiles For Boaters and Regions

This section presents results of the cluster analysis employed to generate boater and regional use profiles.

Boater Profile

Boaters indicated a strong preference towards a morning launch. Owners of personal watercraft (PWC) prefer launching in the afternoon. Owners of small powerboats were split over weekday or weekend use preferences. Owners of big powerboats, sailboats, and KRC's preferred weekdays. Many indicated that it was less crowded then. PWC owners preferred weekend use.

The greatest proportion of survey respondents preferred to boat during the spring (39%; March, April, May) and summer months (29%; June, July, August). Smaller proportions preferred to boat during the fall (14% September, October, November) and winter months (18%; December, January, February). Some seasonal differences in use-preference are evident with respect to boat type. For example, owners of small powerboats indicated a strong preference for summer excursions. Owners of big powerboats and PWC indicated an equal preference for spring and summer. Sail-boaters favored winter and spring seasons. KRC operators indicated a strong preference for winter excursions.

The overwhelming majority of boaters (roughly 80 percent), regardless of the type of boat owned, indicated that they selected a travel route to reduce travel time to get to their favorite boating areas. Other significant reasons for selecting a travel route include avoidance of shallow water, scenic beauty, and preference for calm water. In addition to these preferences, KRC owners preferred travel routes that minimized contact with other boaters.

In response to the question, "What factors are important to you in selecting a travel route or favorite destination?" Less than five percent of respondents selected the "I don't have any favorite travel routes or destinations. I just cruise around." Instead, boaters indicate clear reasons for selecting travel routes and favorite destinations. Most boaters said they selected a destination for fishing access. Natural and scenic beauty, protected waters, and access to shore facilities and entertainment are also important reasons for selecting a destination.

In sum, results indicate that (1) boating is not "whimsical", and (2) boaters typically select the shortest route to a favorite destination. Boaters in the region may be "distance minimizers." Most respondents indicated that they select travel routes to reduce boat travel times (including avoiding speed and manatee zones) to their favorite destinations and choose destinations that are within close proximity to launch sites.

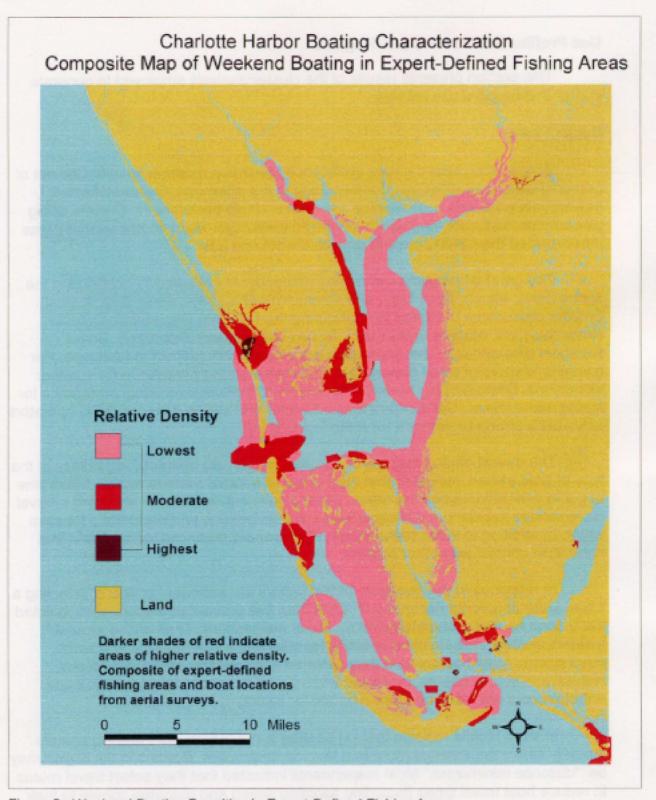


Figure 5. Weekend Boating Densities in Expert-Defined Fishing Areas.

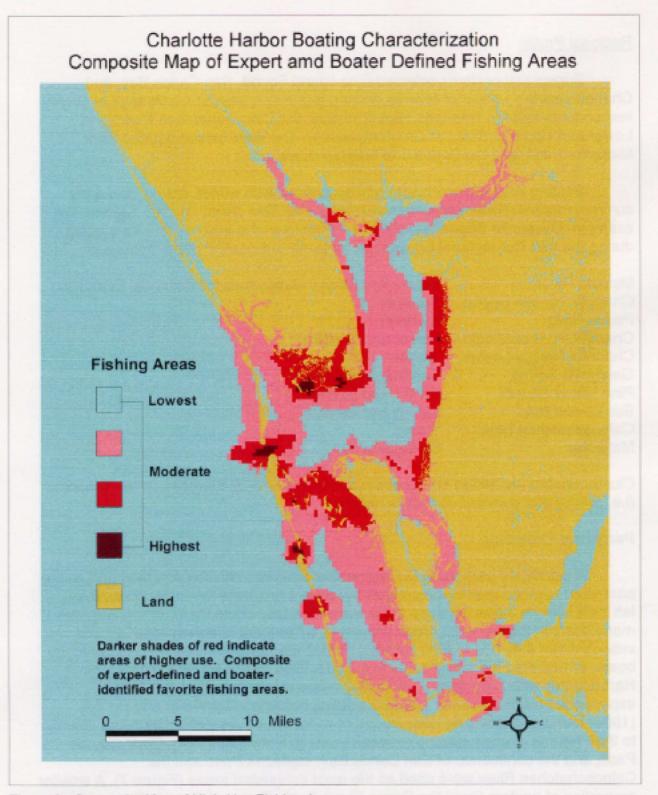


Figure 6. Composite Map of High-Use Fishing Areas.

Regional Profile

Survey respondents selected Pine Island Sound, San Carlos Bay, and Charlotte Harbor Lower as favorite boating regions. A smaller percentage of survey respondents favored Charlotte Harbor Middle, the Caloosahatchee River, and Lower and Upper portions of Charlotte Harbor. The least selected areas were Matlacha Pass, and the Peace and Myakka rivers.

Boating in all regions is strongly associated with winter, spring, and early summer months. Some seasonal variation is identified within specific regions. For example, Gasparilla Sound and Matlacha Pass are also associated with boating during the fall. The regional breakdown for preferred boating months follows:

Myakka River: Insufficient Survey Responses for Seasonal Evaluation

Charlotte Harbor Upper: Summer Peace River: Summer

Charlotte Harbor Middle Winter and Summer

Charlotte Harbor Lower: Winter

Gasparilla Sound: Summer and Fall Pine Island Sound: Winter and Spring San Carlos Bay: Spring and Summer

Caloosahatchee River: Spring

Matlacha: Spring and Fall

Cluster analysis revealed an equal association of several favorite boating seasons (i.e., winter and summer) for some regions.

Perceived Crowding

A significant proportion (33 percent) of boaters indicated that they had, in the past year, avoided their favorite areas because there were too many boats there, left their favorite areas because there were too many boats there, or tolerated too many boats in their favorite areas. However, 67 percent of survey respondents indicated that they had neither avoided nor left their favorite areas due to too many boats, or tolerated too many boats in any identified region within the Charlotte Harbor study area. Moreover, few survey respondents indicated that they experienced discourteous or reckless boating behavior. Gramman and Burdge (1984) found that crowding perceptions of water-based recreationists relate directly to their reports of encountering reckless boating. Notwithstanding, Boca Grande Pass, and the confluence of San Carlos Bay, Matlacha Pass and the Caloosahatchee River were cited as the most congested areas (Figure 7). A smaller proportion of boaters listed the Peace River, Turtle Bay, and Captiva Pass as being the most congested area. The lowest levels of perceived congestion were associated with Matlacha Pass; the Upper, Middle, and Lower portions of Charlotte Harbor; Gasparilla Sound; Tarpon Bay; and Ding Darling.

Potential crowding hotspots (Figure 8) can be identified by combining areas of perceived congestion (Figure 7) with an estimation of proximate activity diversity (Figure 3). Darker shades of red reflect potential crowding hotspots near Boca Grande Pass, Pelican Bay, and Shell Point; near spoil areas in San Carlos Bay, and near the Sanibel Lighthouse Pier Park (Point Ybel). In sum, a significant proportion (33 percent) of boaters are affected, in some way, by concurrent activities. Nevertheless, most boaters (67 percent) did not alter their behavior due to the presence of "more boaters than they would prefer." This suggests that most boaters do not perceive crowding (more boats than they would prefer) to be an issue at their favorite places. Nevertheless, boaters did identify San Carlos Bay, the Caloosahatchee River and the Intracoastal Waterway, within Pine Island Sound, as the most congested areas. Those areas also experience the greatest potential for activity diversity. This suggests that many boaters experience crowding and congestion at specific intermediate locales (restricted channels, passes) that are traversed en route to favorite destinations. Congestion is most often experienced on weekend afternoons during the late-spring and early-summer months (March through June). There does seem to be some regional differentiation in Charlotte Harbor with respect to seasonal peak-use periods and congestion. For example, in general, Charlotte County portions experience the greatest perceived congestion during the winter and summer months. Lee County portions experience the greatest perceived congestion during the spring.

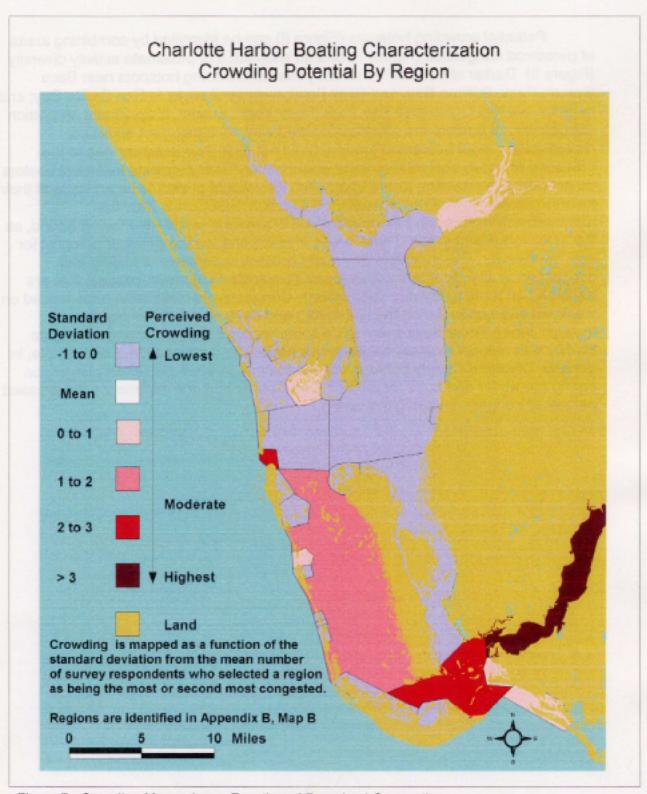


Figure 7. Crowding Mapped as a Function of Perceived Congestion

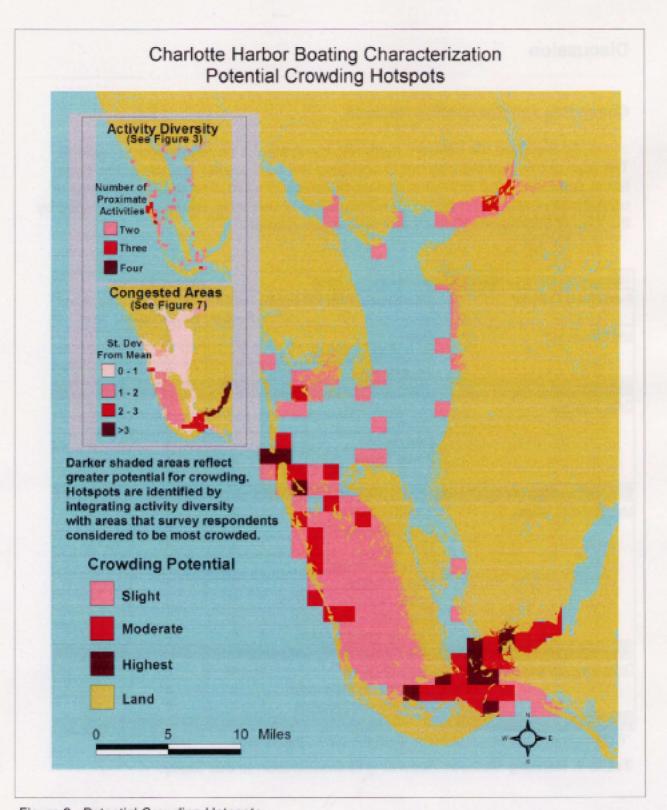


Figure 8. Potential Crowding Hotspots.

Discussion

Comparing and Contrasting Methods

To compare the different methods, we applied a ranking system (Table 4). The goal of this ranking was not to conclude the best overall method of the three, but to summarize the strengths and weaknesses of each. The appropriateness or usefulness of any one method, or combination of methods, would be determined by the kind of information needed for the characterization.

Ranking System:1= Wors		Survey Method			
Evaluation Criteria*	Characterization Elements	Aerial Recon	Expert Workshop	Telephone Mail	
<u>Implementation</u>	Cost	2	3	1	
	Human Effort (Ease)	2	3	1	
	Time Needed	1	3	2	
Implementation Total		5.3	9	4 = 4 4 4 4 4	
Data Themes	Boat Locations	3	1	2	
	Origins	1	2	3	
	Destinations	2	3	3	
	Travel Routes	2	1	3	
	Activity	1	3	3	
Data Theme Total		9	s = ±10 = ±	14 14 14	
Management Issues	Travel Corridors	3	1	2	
	Daily/Seasonal Use	1	3	3	
	Crowding	1	3	3	
	Distance Traveled	1	1	3	
	Boat Densities	3	1	1	
	Boater Motivations/Profile	1	2	3	
	Boat Type/Length/Draft	2	1	3	
	Favorite Boating Areas	1	3	3	
Management Issues Total		13	15	21	
Defensible / Repeatable	Representative	2	2	3	
	Flexibility (multiple uses)	2	2	3	
	Accuracy and Precision	2	2	2	
Defensible Total		6	5	**** 8 ****	

^{*}Rankings would change depending on the evaluation criteria.

Table 4. Ranking Methods According to Contribution to this Study.

Rank suggests that workshops are the most easily implemented of the three methods in terms of human effort, cost and time. Aerial surveys and the telephone/mail survey are similar. Telephone and mail surveys generated a greater variety of information (data themes) in support of management issues and for the

characterization of high-use areas and perceived crowding than did aerial surveys and expert workshops. Methods ranked similarly with respect to generating data that would be representative, flexible, and accurate.

Aerial Surveys

The value of aerial-video reconnaissance is that it provides a snapshot of boating distributions, boat types, whether boats are moving or not, and to a lesser degree boater activity. Surveying at different times of the year and different times of day can provide a fairly complete picture as to when and where boats are most prevalent. This method is best applied when project objectives require estimates of spatial distributions, boating densities, or maps of travel corridors. Motivations behind boater behavior (congestion or crowding), boat-trip origins, favorite areas and destinations, and distance traveled cannot be determined from this method.

Boat locations were digitized from videotape into ArcView®. The accuracy and precision of this approach has not been verified. The accuracy is considered acceptable, but precision, especially for moving watercraft, is probably highly variable. The positioning of moving vessels on the map depends on what part of the boat's travel path is selected by the analyst. This choice will likely vary among analysts, while locations mapped for stationary boats will be very similar.

The aerial survey characterization in this report relied on four flights conducted during the spring for the Charlotte County portion of the study area. Sixteen aerial surveys were conducted for Lee County. Thus, boat locations and densities calculated for Lee County better reflect seasonal and weekend-weekday variation. An additional 12 aerial surveys are needed for Charlotte County to match the methods used in Lee County so that the data from both counties are compatible and can be merged without seasonal or weekday-weekend bias.

The total cost of flying 16 aerial surveys and generating GIS maps in ArcView® was approximately \$16,000 (cost includes 75 percent overhead on Mote Marine Laboratory salaries). The expense associated with aerial videography can limit the number of flights, which can affect how well daily and seasonal fluctuations are captured in a characterization. Nevertheless, aerial reconnaissance, even constrained by cost, does provide important baseline information on the numbers, concentrations, and general activity of vessels on any given day. This method also provides a good source of boat-location data for calculating densities in expert-defined "predominant activity areas. Aerial surveys are also useful for determining or validating boat traffic corridors and for distinguishing "drifting" and "stationary" boats from moving ones. Concentrations of stationary vessels may reflect popular destinations.

Workshops

Expert workshops provided a framework for delineating and mapping boat activity areas. For this study, the principal value of expert input lay in identifying areas where activities that cannot easily be observed from the air (i.e., fishing or diving) are likely to take place. Holding meetings with sufficient representation for each boating activity and expertise for the different areas of the Harbor can provide a complete picture of where specific activities predominate. Soliciting expert knowledge is appropriate when objectives seek delineation of boating and activity areas. To a lesser extent, favorite areas and destinations and expected boat-trip origins for particular destinations can be compiled in these workshops. Spatial and temporal patterns of boating, distances traveled, and boater motivations cannot be estimated from this method.

Extensive planning for the workshops did not guarantee an adequate representation of all principal uses. Too few experts on diving, PWC use, and waterskiing participated in the meetings, prohibiting the use of these activity regions in the final characterization. To get a more complete representation of boating in Charlotte Harbor it would be necessary to focus activities to specific groups. For example, PWC users are not well organized; therefore, Florida Marine Patrol officers might be a suitable alternative to characterize PWC activity areas.

The accuracy and precision applied by the experts was variable. Some experts drew circles or squares while others drafted irregular shapes that they felt best reflected the predominant activity area. Some drew many small areas while others drew fewer large ones. In this study, an increase in the mapping precision of expert-defined areas was obtained by combining activity polygons for a specific use and designating boating-activity hotspots based on the frequency that an area was selected. We recognize that this method is biased due to the lack of expert participation or knowledge of specific boating activities. Activity bias can be reduced by balancing local expertise. This can be accomplished by including members of additional organizations such as the Florida Marine Patrol. In addition, navigation aids and/or a grid system could be included on the map to provide experts with more guidance in drawing their activity areas, or experts could select grid cells rather than delineating areas by freehand.

The resolution of expert-defined areas was a concern with respect to density calculations. Large areas tended to dilute densities derived from the aerial survey data and probably included areas where the activity does not take place. This phenomenon was noticed particularly in the lower Caloosahatchee River and Pine Island Sound. A solution might include using maps with more information so that activity areas can be drawn with greater precision. In addition, portions of expert defined areas can be included or excluded based on attributes of the landscape (e.g., land areas, depth, seagrass beds).

The cost to implement expert workshops is roughly \$10,000. This includes costs associated with planning and coordinating the workshops (phone calls to experts, invitation letters, follow-up contacts, etc.); developing the methodology (maps, data sheets, etc.); and conducting six separate meetings over two days. The cost per meeting decreases as more sessions are added, and more are needed in this study to compile the complete array boating activities. Overall, expert workshops provide valuable information for characterizing predominant activity areas and potential crowding, and they are excellent at capturing knowledge, such as boating activity, that is difficult or expensive to acquire from other methods. Expert knowledge also is well suited to be combined with other data such as boatlocation data from aerial surveys, because experts provide boundaries from which densities can be calculated. Expert opinion also is appropriately used to validate favorite areas identified by telephone/mail survey respondents.

Telephone and Mail Surveys

The combined telephone/mail survey provided valuable information from individual boaters regarding specific boat type, daily and seasonal use, favorite boating destinations and activities, crowding, and reasons for selecting travel routes and destinations. This information can be to identify high-use areas (favorite destinations/travel routes) and areas where crowding is perceived (areas of greatest congestion). Information regarding temporal use patterns can be used to describe use and crowding within the context of daily and seasonal patterns. Additional information relevant to characterizations but not utilized in this initial study (trip origins, exact travel routes, and distance traveled on the water) was also collected by this method.

The combined telephone and mail-survey approach was successful in soliciting information from the owners of powerboats and especially sailboats. Only a small percentage of PWC and KRC owners who agreed to complete mail surveys returned them. A different or supplemental survey method might be required to capture input from these important recreational boat users. The low response rate for PWC owners may be due to the transient nature of this population. Individuals who conducted the telephone interviews indicated that many of the PWC owners had frequently changed residence. PWC owners may not be as emotionally tied to the local boating community as long-standing residents. Furthermore, they may not consider their activity as boating.

Information obtained from the telephone/mail surveys may include a seasonal bias. Boaters were asked to draw the travel routes and favorite destinations of their last two boating outings. It is assumed that boaters have better recall for tracing the exact routs of recent trips. As such, the mapped information best reflects the spatial patterns of boating during the spring and summer months. Questionnaires were distributed in May and June and most were returned before August.

The cost associated with implementing telephone and mail surveys was roughly \$25,000. This figure includes costs associated with questionnaire development, coordinating and implementing the survey, data processing and initial analysis. Benefits of this dual method were that telephone interviews not only obtained information regarding boat type, favorite activities, launching times, and daily and seasonal use, but also validated current mailing addresses and confirmed volunteer participation in the follow-up mail survey. Over 70 percent (354) of those who participated in the telephone interviews agreed to complete the mail survey. This cost-saving method increased mail survey return rates (over 60 percent of those who agreed to complete a mail survey returned the survey), thereby reducing the number of mailings that would have otherwise been required to capture a representative sample.

In sum, telephone surveys combined with a coordinated follow-up mail survey generated high return rates and is a good way to obtain information directly from boaters that is both temporal and spatial in nature. This method has the additional strength of providing behavioral information important to explaining motivations behind a boater's identification of a congested area, or selection of a favorite travel route or destination.

Conclusions

Aerial reconnaissance, workshops, or telephone/mail surveys can be used as a primary method for boat characterization studies. Selection of a method or combination of methods would depend on the project goal, objectives, and available funding.

The integrated telephone/mail survey is most flexible in terms of being able to generate multiple data themes that can be used to address a wide variety of management issues. As a result, the integrated telephone and mail survey method may offer the best overall approach for a 'stand-alone' defensible recreational boating characterization. Notwithstanding, aerial reconnaissance may be the most appropriate method depending on the type of question asked. As a primary method, aerial surveys are best reserved for objective measurements, such as estimating traffic volume and determining traffic flows, where subjective interpretations of quality' or 'experience' are not required. Aerial surveys also are well suited for characterizing general spatial and temporal boating patterns, where a precise determination of crowding potential, boat type, activity, and origins and destinations, is not of concern. Expert meetings are the most cost-effective method, but due to issues concerning sample size they are more appropriately used to integrate with or to corroborate findings from telephone\mail or aerial surveys. Expert meetings did however, generate a good representation of general boating areas, but may be less reliable for identifying intensity of use for specific locales.

Characterizations that are based on all or a combination of aerial surveys, boater surveys, and local expert knowledge, have a 'value-added' advantage

derived from combining the strengths of several methods. Such analyses highlight important use areas and hotspots that would not otherwise be revealed, thereby yielding a more robust and defensible boating characterization.

Future Research Opportunities

Scientific study of any facet of reality starts with descriptions and inventories of facts, observations, and measurements (Casetti, 1993). This initial boating characterization represents an important first step in the scientific process by utilizing several survey methods to characterize boats and boaters; identify high-use locales; and identify areas of possible crowding. The logical next steps involve explanation and prediction (Thrall, 1995). For example, an important finding of this research is that area boaters may be distance minimizers (i.e., most respondents choose water-based routes that reduce travel times to their favorite recreation destinations). If this is the case, then the results can help explain why certain areas are more heavily used than others. Boater-travel distances have important implications for the siting of new marinas and boat ramps. Travel distances can be estimated for boat types and favorite activities by digitizing travel routes.

The information collected in this research also can be used to predict and map "what if" scenarios (i.e., What is the boating impact or boating "sphere of influence" resulting from the development of a new boat ramp at such and such a location?). With these data, we can compare and map current use profiles with what might result after the introduction of a marina or boat ramp. Using the previous example, a statistical model could be developed that estimates maximum distance traveled as a function of (1) season; (2) boat type; (3) years of boating experience; (4) frequency of use, (5) point of launch origin (private dock, marina, ramp); (6) location of farthest distance traveled on the water; and (7) distance traveled from home to launch origin. This model could be used to estimate a distance travel value for specific boat or activity types. Travel estimates can be used to generate distance-use contours from popular launch areas. Areas where contours overlap would indicate higher use or the potential for activity conflicts. Predictive models lead naturally to computer simulations of boating use-patterns within the Charlotte Harbor area.

Another important area for future research is in devising a strategy to better capture information related to personal watercraft (PWC) and kayak, row, and canoe (KRC) usage. The methods developed for this study were deficient in capturing a representative sample of PWC and KRC boaters. The telephone survey and expert meeting methods offer the greatest potential for soliciting information from these boater groups. Intercept surveys may be useful in soliciting information about these important user groups.

A closer examination of crowding potential is also warranted. The initial analysis of mail survey responses in which activity diversity was compared with areas of greatest congestion identifies several areas (confluence of the

Caloosahatchee River and San Carlos Bay; Boca Grande Pass; Pelican Bay) where crowding may be an issue. Aerial survey data shows that these areas also experience the highest densities of boats. An additional analysis would integrate measures of density, diversity, and congestion to generate a more robust analysis of crowding potential. In addition, the perception of crowding may be different for channels, such as the ICW, versus specific locales. Travel routes identified by survey respondents can be digitized and compared with "moving vessel" locations identified by aerial reconnaissance to delineate high-use travel corridors. High-use travel corridors can be integrated with areas of perceived congestion and locales that experience the greatest density and diversity of activities to more precisely identify the range of possible crowding hotspots.

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Appendices

Appendix A. Expert Meetings: Invitation Letter and Data Sheet

April 7, 2000

Name Address Address

Dear,

You are invited to participate in a workshop to identify and describe boating regions in Charlotte Harbor and Lee County. You were selected to attend because of your boating knowledge and experience in the area or your role in coastal planning and marine management. This workshop is part of a larger effort to characterize recreational boating uses of the Charlotte Harbor area and is a joint effort among Florida Fish and Wildlife Conservation Commission, Florida Sea Grant, and Mote Marine Laboratory.

At the workshop you will be asked to identify boating areas on maps and to relate these areas to recreational boating uses, such as fishing, cruising, sailing, water skiing, diving, nature touring, and use of personal watercraft. We will also ask you to give us your opinion regarding the degree to which these areas are used by boaters.

We are scheduling six workshop sessions spread over two days: May 9th and 10th. Participants need only attend ONE of the 2-hour workshop sessions. Sessions will be 9:30am-11:30am, 1:00pm-3:00pm, and 5:30pm-7:30pm. On Tuesday May 9th, workshop sessions will be held at the Regional Planning Council in North Fort Myers. On Wednesday May 10th, sessions will be held at the Charlotte Harbor Environmental Center near Punta Gorda.

Please let us know if you can attend the workshop and which of the sessions is most convenient for you. We can be reached by phone at (727) 896-8626 or by email at richard.flamm@fwc.state.fl.us. A map to each workshop location is on the back of this announcement. Refreshments and snacks will be provided.

Sincerely,

Richard Flamm
Research Associate
Florida Marine Research Institute
Phone(727)-896-8626, X192
richard.flamm@fwc.state.fl.us

Charles Sidman Research Associate Florida Sea Grant cccf@ufl.edu

Characterization of Boating in Charlotte Harbor and Lee County

Night Use for primary activity Circle all that apply	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
MEDIUM crowding MONTHS for all uses Circle all that apply	Jan Feb Mar Apr J May Jun Jul Aug N Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug N Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Nose Oct Nov Dec	Jan Feb Mar Apr J May Jun Jul Aug N Sep Oct Nov Dec	Mar Apr Jul Aug Nov Dec	Mar Apr Jul Aug Nov Dec	Jan Feb Mar Apr J May Jun Jul Aug N Sep Oct Nov Dec S	Jan Feb Mar Apr J May Jun Jul Aug N Sep Oct Nov Dec S	Jan Feb Mar Apr J May Jun Jul Aug N Sep Oct Nov Dec S
HIGH crowding MONTHS for all uses Circle all that apply	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
CIMES of day of HIGH crowding for primary activity	Morning ay Atternoon ng Night	Moming ay Afternoon ng Night	Morning ay Afternoon ng Night	Morning ay Afternoon ng Night	Morning ay Afternoon ng Night			Moming sy Afternoon ng Night	Moming by Afternoon ng Night
	்ஜ்≊ம்	Dawn Mid-day Evening							
Minimum # of boats for area to be Highly Moderate		† 1	: 	 - 	1	1 1	i		
Other noticeable Activities Circle all that apply	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Safling Fishing	Water-skiing Diving Nature-touring PWC Salling Fishing	Water-sking Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-sking Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-fouring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing
Primary Activity Circle 1 activity	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skling Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing	Water-skiing Diving Nature-touring PWC Sailing Fishing
Poiy #	!] 	}] [I I	H 1		 - -	1
Map #		1	l, I	B ;	 	1	1	 	

Map number: Number in upper left corner of map.

Minimun<u> # of boats for area to be crowded</u>: High crowding occurs when boaters change behavior. Moderate crowding is more boats present than boaters would prefer. Polygon number: Number polygons sequentially beginning with 1 for each map.

<u>Primary Activity</u>: Choose that activity within your expertise that occurs within the polygon.

<u>Other notceable activities</u>: Choose other activities that noticeably contribute to crowding within the polygon.

<u>Times of day of HIGH use for primary activity</u>: Select those parts of the day when the primary use is at its greatest. <u>High crowding by month:</u> From the perspective of the primary activity...Circle those months where crowding results in change of behavior by primary activity.

Moderate crowding by morth: From the perspective of the primary activity... Circle those months where crowding is more boats present that boaters involved in the primary activity would prefer.

Night time use for primary activity: Circle any month where night-time use occurs.

Appendix B. Telephone and Mail Su	rveys: Questionnaires	and Correspondence

Time began Time ended Total time	No Int. No					
Boatin	g survey					
Hello, my name is and I am calling from the F In cooperation with the Florida Marine Research Institute we are is not a sales call and your answers will be completely confident should only take about minutes. May I speak to the perso AVAILABLE, PLEASE GET A NAME AND TIME TO CALL BA	e conduct tial. You i on in you	ting a short may choose	survey of recreation to end this survey	onal boat users. This / at any time. This		
Do you currently own a boat or personal watercraft? (IF no, end call and mark sheet NB)	Yes	No	Don't know	Ref		
,	2	1 (If no, th	8 ank you, have a r	9 nice day)		
Do you use your boat or personal watercraft in Charlotte Harbor, Pine Island Sound or nearby areas?	Yes	No	Don't know	Ref		
,	2	1 (If no, tha	8 ank you, have a n	9 ice day)		
Next I would like to ask you some questions about the boats you	ı own.	<u> </u>	 · · · · · · · · · · · · · · · · · · 			
First I am going to read you a list of types of boats that you may own.				-		
3. Is your most frequently used boat a? (Select one only)	Yes	No	Don't know	Ref		
A. Kayak, canoe or rowboat (non- motorized) B. Auxiliary powered sailboat	2	1	8	9		
C. Sail only	2	1	8	9		
D. Skiff, speedboat, open-utility, John-boat, or pontoon boat	2	1	8	9		
E. Personal watercraft (jet ski)	2	1	8	9		
F. Power cabin, trawier or houseboat	2	1	8	9		
G(Int. describe boat, if	2	i	8	9		
can't classify)	2	1	8	9		
(If respondent indicates that he/she owns a boat(s):						
3a. How many feet does the hull or propeller on the boat you use most frequently drop below the water line? (Int.: Prop may be deeper than the hull)			DK Ref			
•	<u> </u>		_inches			
3b. How many feet long is your boat?			_feet 8	9		
	<u>-</u>		DK Ref 8	9		

4. Where do you currently store your boat? Please be as	in your yard/garage1	
specific as possible.	At a dock at your home2	
	At a marina or Yacht Club3 (go to	
	Permanently moored at an 4a)	
	anchorage4	
	Other5	
	Don't know8	
	Refused9	
4a. What is the name of the marina/yacht club where you store your boat?		
	Gulfwind Marine at P.I.	14
Ainger Creek Marina 01	Harbor Hideaway Marina	15
Boca Grande Pass Marina 02	Jug Creek Marina	16
Bocilla Marina 03	Kevin's Place	17
Burnt Store Marina 04	Miller's Marina	18
Chuck's Marina, Inc. 05	Pineland Marina	19
C.K. Marine Services 06	Punta Gorda Marina	20
Eldred's Marina 07	Riviera Marina	21
Englewood Bait House 08	Royal Palm Marina	22
Fisherman's Village Yacht 09	Stump Pass Marina	23
Four Winds Marina 10	The Boatworks	24
Gasparilla Marina 11	The Inn Marina	25
Gator Creek Marina 12	Uncle Henry's Marina	26
Gulf Coast Marine Center 13	Whidden's Marina	27
	Other	
5. In the past year, did you use a boat ramp to launch your	Yes No DK Ref	
boat into Charlotte Harbor, Pine Island Sound or nearby	2 1 8 9	
areas?	(If no, skip to Q6)	
5a. What ramp did you use most frequently? (Int: Prompt		
for one most frequently used)	Placida Ramp	11
_ , , ,	Ponce de Leon Park	12
Cape Coral Ramp 01	Port Charlotte Beach	13
Cape Coral Yacht Club 02	Punta Rassa	14
Darst Park 03	Sanibel Island Ramp	15
Deep Creek Ramp 04	Spring Lake Park	16
El Jobean Park 05	Tom Adams Bridge	17
Harbour Heights Park 06	Wisteria Ramp	18
Indian Mound Park 07	Other	19
Laishfey Park 08	Other	(3
Matlacha Park 09	DK Ref	
North Port Marina Park 10	8 9	
	0 4	
5b. About how many times did you use that ramp in the past	1	
year?		

Next I would like to ask you some questions about how frequently you use your **(Boat type)**. in the Charlotte Harbor, Pine Island Sound or nearby areas.

····					<u> </u>
6a. In the past year about how many times did you start boating in the morning?			DK 8	Ref 9	
6b. In the past year about how many times did you start boating in the afternoon?	·		DK 8	Ref 9	
6c. In the past year about how many times did you start boating after dark?			DK 8	Ref 9	
6d. In the past year about how many of those times were you out during the weekend?			DK 8	Ref 9	
7. Which of the following holidays, if any, did you sail your boat?	Yes	No	DK	Ref	
Easter	2	1	8	9	
Memorial Day	2	1	8	9	
Labor Day	2	1	8	9	
4 th of July	2	1	8	9	
During the past year in which three months did you use your boat most frequently in Charlotte Harbor, Pine Island Sound and nearby areas?	January February March April May June July August September October November. December		02 03 04 05		

Next I would like to ask you some questions about the types of activities you participate in while boating in the Charlotte Harbor, Pine Island Sound, or nearby areas.

9. Which of the following activities do you participate in while boating? (Read and check all that apply)		Question 9			Question 9A			
Near shore fishing	Yes	No	DK	REF	М	ost Fr	eq. D	K REF
	2	1	8	9	1	0	8	9
Cruising	2	1	8	9	1	0	8	9
Speed boating/racing	2	1	8	9	1	0	8	9
Nature viewing	2	1	8	9	1	0	8	9
Diving	2	1	8	9	1	0	8	9
Water skiiing	2	1	8	9	1	0	8	9
Anchoring	2	·	8	9				
Deep sea fishing		1			1	0	8	9
Sailing	2	1	8	9	1	0	8	9
Other	2	. 1	8	9	1	0	8	9
9a. Which do you participate in most frequently?	specify							
9b. About how long are you out when you participate in this activity? (Int: Record hours, days or weeks)	DK RefHours 8 9DaysWeeks							
Now just a few more questions for statistical purposes.								
now just a lew more questions for statistical perposes.								
10. Are you a year round Florida resident?	Yes 2		N o 1		OK B		REF	
11. What year were you born?		_						
12. How many years have you been boating?		<u></u>						
13. How many years have you been boating in the Charlotte Harbor area?	<u></u>							
14. Have you taken a boat safety or seamanship course?	Yes 2		No 1		OK 3		REF	
15. Have you taken an advanced navigation, piloting, or chart reading course?	Yes 2		No 1		—— ЭК 3		REF	

16. Are you considering purchasing another boat or watercraft in the next year?	Yes 2 (Go to 16a)	No 1 (Go to 17)	DK 8	REF 9
16a. What type of boat or personal watercraft?	Yes	No	DK	REF
Kayak, Canoe, or rowboat (non-motorized)	2	1	8	9
Auxiliary powered sailboat Sail only	2	1	8	9
Skiff, speedboat, open-utility, John-boat, or pontoon	2	1	8	9
boat	2	1	8	9
Personal watercraft (Jet ski) Power cabin, Trawler, or houseboat	2	1	8	9
Other	2	1	8	9
16b. Will the boat have a deeper draft than your existing boat?	Yes 2	1 No 1	8 DK 8	9 REF 9
16c. Will the boat be larger/longer than your existing boat?	Yes 2	No 1	DK 8	REF 9
17. Would you be willing to answer a few more questions	Yes	No	DK	REF
and plot the course lines of your last two trips on a detailed map of the Charlotte Harbor and Pine Island Sound areas if we mail you a map with a postage-paid, self-addressed,	2	1	8	9
return envelope?	(If yes,	get addres	s, record o	on separate sheet)

Thank you very much for participating in our survey. Have a nice day!

Questionnaire Control Number: _____

Recreational Boating Experiences in Coastal Southwest Florida



A survey conducted by the Florida Sea Grant Program at the University of Florida in collaboration with the Florida Marine Research Institute and the West Coast Inland Navigation District

May 2000

May, 2000

Dear Boat Owner / Operator,

Thank you for completing our recent telephone interview and agreeing to participate in this component of our survey, which deals with your recreational boating in the Charlotte Harbor, Pine Island Sound, and Matlacha areas. This survey should take about 25 minutes to complete. We would appreciate it if you could complete and return it to us, along with the map, as soon as possible. We have provided a self-addressed, postage-paid return envelope.

In the telephone interview you provided us with information about your boat, when you boat, and your favorite boating activities. In this portion of the survey we are seeking information about your boat travel routes, favorite boating areas, and your boating experiences.

Please be assured that the information you provide will be held in the strictest confidence. Answers will in no way be traced to individual respondents. Your name, address or telephone number will not be made available to anyone else. Please skip any question(s) that you do not wish to answer. I would be pleased to answer any questions you may have concerning research procedures. My phone number is (352) 392-6233. Leave a message and I will promptly return your call. I can also be reached by email at cccf@ufl.edu. If you have questions about your rights as a participant in this survey, please contact the University's Institutional Review Board at P.O. Box 112250, University of Florida, Gainesville FL 32611-2250.

This research is funded by the Florida Marine Research Institute and the West Coast Inland Navigation District, and conducted by the Florida Sea Grant College Program at the University of Florida. The information you provide will be used for marine research and management, and to develop boaters' guides and other educational materials. We are enclosing a copy of "A Historical Geography of Southwest Florida Waterways: Volume I", published this past year by Florida Sea Grant, to thank you for participating in this survey.

Thank you for contributing to this boating research project.

Charles Sidman Ph.D. Research Associate Florida Sea Grant P.O Box 110405 University of Florida Gainesville, FL 32611

Part 1. Draw Your Last Two Travel Routes (Map A)

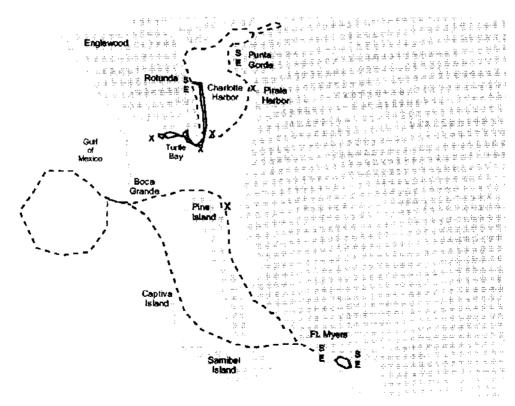
On the enclosed map **(Map A)** of the Charlotte Harbor, Pine Island Sound, Matlacha areas, carefully plot the course, from start to finish, of your last two boating trips (if you made the same trip twice, just plot it once). In answering this question please follow our guidelines as carefully as possible. If you were sailing, tacking, or cruising around in some areas, and no longer remember the exact course, draw a straight line for those portions of your trip. If your last two trips included cruising around or fishing in specific local areas, please circle those, as well. Also, if any portion of your last two trips continued beyond the boundary of the map, please plot your course to the boundary and indicate your final destination on the edge of the map.

Instructions

Please draw, on **Map A**, the routes you traveled and / or circle the places you cruised on your last two boating trips. Use a <u>dashed line</u> to represent one trip and a solid line for the other.

- 1. Please indicate by the letter S the starting point of each of the two trips.
- 2. Please indicate by the letter E the ending point of each of the two trips. The end may be the same location as the start of the trip.
- 3. Please place an X at your favorite area(s) along the route(s) you traveled.

Examples of Travel Routes



Q1.		ease circle the number corresponding to each option that you consider to be important in our decision to select a travel route.
	1.	Proximity to my favorite boating area(s)
	2.	Reduce travel time to get to my favorite boating area(s)
	3.	Scenic beauty
	4.	Avoid shallow water
	5.	Challenging navigation
	6.	Calm waters
	7.	Absence of other boaters
	8.	Presence of other boaters
	9.	THE THE HELD COLOR
	10.	, a opcob 20/103
	11.	
	12.	None are particularly important. I just cruise around.
	13.	Other (PLEASE SPECIFY)
Q2.		w, from the circled reasons in Question 1, list the first and second most important reasons selecting a travel route. (Please place the number of the reasons selected in Question 1 he blank).
	1 2	Most important reasonSecond most important reason
<u>Part 2</u>		ur Favorite Boating Areas (Map B)
40 .		ase list your two favorite boating areas from the areas identified on Map B.
	1. 2.	Favorite boating area
		Second favorite boating area
Q4.		at factors are important to you in <u>selecting a favorite boating destination or cruising area?</u> in the following list circle the number corresponding to each option that you consider to important in your decision to select a favorite boating area.
	1.	Calm waters
	2.	Protected waters
	3.	Observing wildlife
	4.	Scenic beauty
	5.	Tranquility
	6.	Absence of other boaters
	7.	Presence of other boaters
	8.	Fishing opportunities
	9.	Swimming and or shelling opportunities
	10.	Natural or undeveloped shoreline
	11.	Access to shore entertainment and restaurants
	12.	Access to supplies or marina
	13.	I don't have any favorite destinations. I just cruise around.
	14.	Other PLEASE SPECIFY

Q5. Now, from the circled reasons in Question 4, list the first, and second most important reasons for selecting a travel route. (Please place the number of the reasons selected in Question 4, in the blank).

1.____Most important reason

2. ____Second most important reason

Part 3. Boating Experiences in Your Favorite Areas

For each boat type listed, please circle the numbers for Part A and Part B that best describes your boating contact experiences over the past year.

Q6. Part A:

In your favorite boating areas, how often, on average, were you within talking distance (20 yards) of a:

Part B:

How did this affect your enjoyment?

imining diotalioo (Eo y	a. 00, 0, u.				Did Not	
	Never	Occasionally	Often	Add	Matter	Detract
Power-boat moving	1	2	3	1 1	2	3
Sail-boat moving	1	2	3	1 1	2	3
Anchored boat	1	2	3	1 1	2	3
Jet ski	1	2	3	1 1	2	3
Drift-fishing boat	1	2	3	1	2.	3

Q7. Part A:

In your favorite boating areas, how often, on average, did you observe discourteous boating behavior by a:

Part B:

How did this affect your enjoyment?

•		•			Did Not	
	Never	Occasionally	Often	Add	Matter	Detract
Power-boat moving	1	2	3	1	2	3
Sail-boat moving	1	2	3	1 1	2	3
Anchored boat	1	2	3	1	2	3
Jet ski	1	2	3	1	2	3
Drift-fishing boat	1	2	3	1	2	3

Q8. Part A:

In your favorite boating areas how often, on average, did you observe unsafe or reckless boating operation by a:

Part B:

How did this affect your enjoyment?

				Did Not				
	Never	Occasionally	Often	Add	Matter	Detract		
Power-boat moving	1	2	3	1	2	3		
Sail-boat moving	1	2	3	1	2	3		
Anchored boat	1	2	3	1	2	3		
Jet ski	1	2	3	1	2	3		
Drift-fishing boat	1	2	3	1	2	3		

<u>Part 4.</u>	Boat Traffic Congestion	<u>1</u>								
	Based on your boating agreement or disagree	experiences or ment with each	er the past year, of the following s	please rate (circle) yo statements.	our level of					
Q9.	In the past year I have avoided my favorite areas because there were too many boats there									
	Agree		Undecided	Disagree						
Q10.	In the past year I have	left my favorite	areas because th	ere were too many bo	oats there.					
	Agree		Undecided	Disagree						
Q11.	In the past year I have	tolerated too m	any boats in my fa	avorite areas.	_					
	Agree		Undecided	Disagree	 ▶					
Q12.	Which areas, if any, (ide congestion? Congesti are congested, skip to d	on refers to th	B) have you exp e presence of m	erienced the greatest ore boats than you p	amount of boat prefer. If none					
	1	Most cor Second r	ngested area most congested a	rea						
Q13.	What time of day have your choice)	you experience Morning	d the greatest bo Afternoon	at congestion? Evenings	(Please circle					
Q14.	What day(s) of the wee days that apply)	k have you exp Mon Tues We	erienced the grea d Thurs Fri Sat	itest boat congestion? Sun	(Circle all					
Q 15.	What month(s) have you experienced the greatest boat congestion. (Circle all that apply) Jan Feb Mar Apr May Jun July Aug Sep Oct Nov Dec									
Q16.	How far (in feet), on ave following activities:	erage, do you li	ke to remain from	other boaters engage	ed in the					

Activity	Restricted Channel (Distance in Feet)	Open Water (Distance in Feet)
Larger power cabin boat under-way		
Small power boat under-way		
Sail boat under sail		
Jet Skiing		
Anchored boat		
Drift-fishing or anchored-fishing		<u> </u>

PLEASE RETURN THE QUESTIONNAIRE AND MAP IN THE ENCLOSED POSTAGE-PAID ENVELOPE

THANK YOU AGAIN FOR YOUR COOPERATION

Reminder Post Card

Dear Boat or Personal Watercraft owner:

June 12, 2000

Several weeks ago Florida Sea Grant mailed you a questionnaire that asks about your recreational boating experiences in coastal southwest Florida. The questionnaire supplements the information you provided during the telephone interview. We are writing because we have not received your completed questionnaire. We place great importance on your input. In order for the study sample to be truly representative of all boaters and PWC owners in Charlotte and Lee counties, it is essential that each person who agreed to participate promptly return the questionnaire. Please call (352) 392-6233 if you misplaced your questionnaire or have not received one. We will promptly send another.

Thank you for agreeing to participate in this study.

Sincerely,

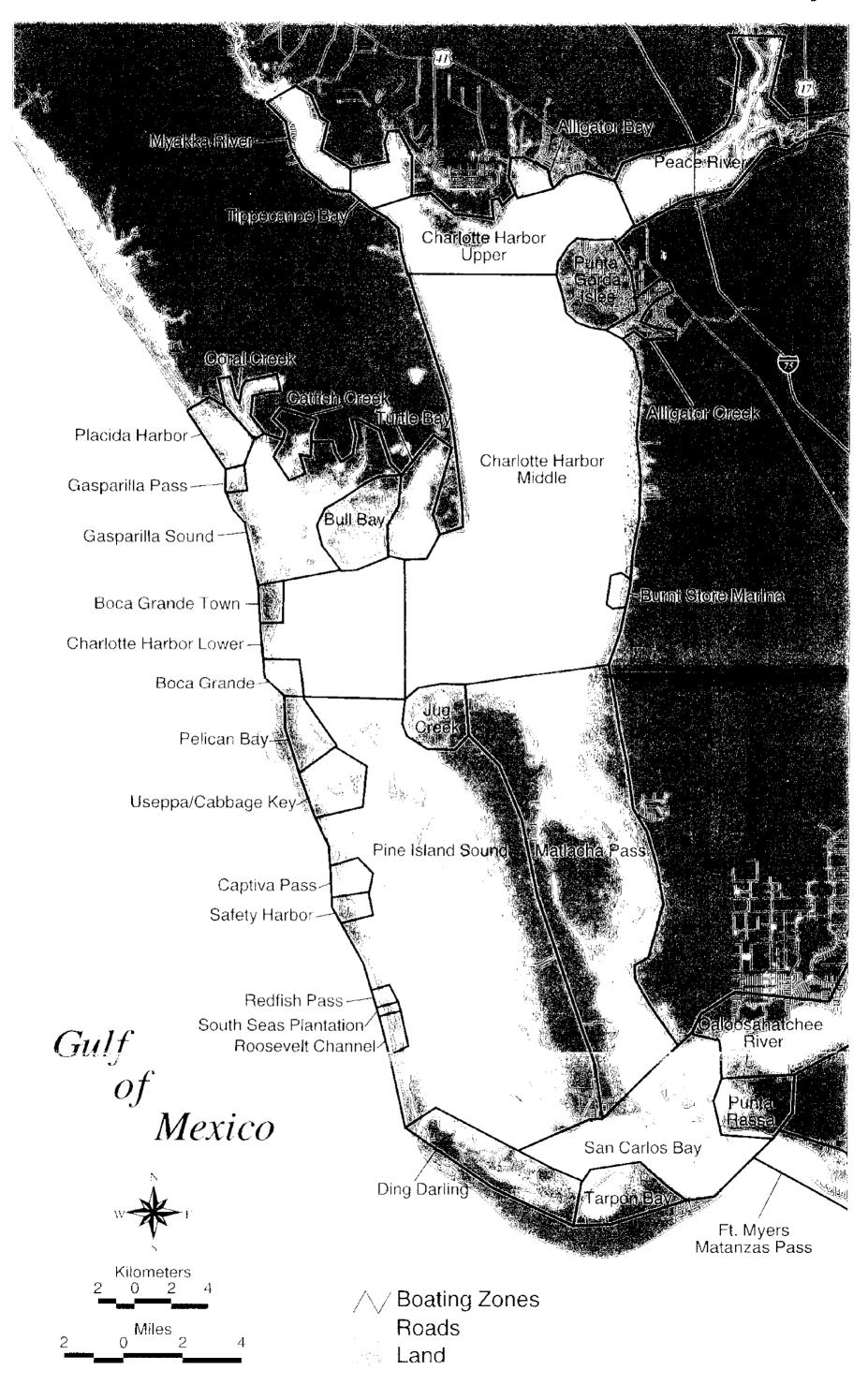
Charles Sidman, Ph.D. Project Scientist Florida Sea Grant

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Charlotte Harbor Recreational Boater Survey



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