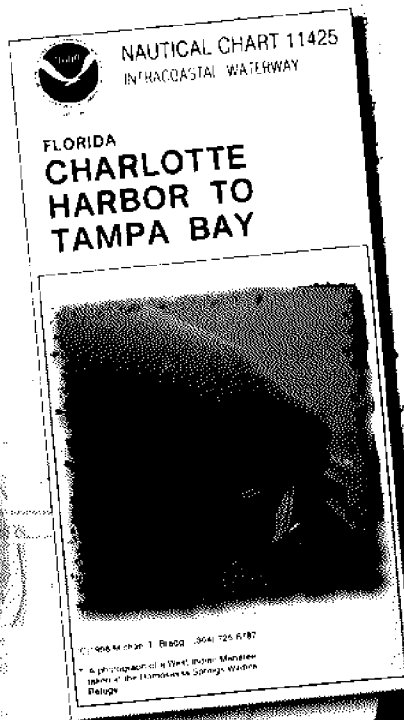


LOAN COPY ONLY

A Recreational Boater-Based Method for Re-designing the NOS Small-Craft Chart

Promoting Safe Navigation and Stewardship of Coastal Resources



by

**Gustavo Antonini
Niels West
Charles Sidman
Robert Swett**



Florida Sea Grant College Program
PO Box 110400
University of Florida
Gainesville, FL 32611-0400

(352) 392-5870

www.FLSeaGrant.org

This publication was supported by the National Sea Grant College Program of the United States Department of Commerce's National Oceanic and Atmospheric Administration under NOAA Grant #NA76RG-0120. The views expressed herein do not necessarily reflect the views of any of these organizations.

A Recreational Boater-Based Method for Re-designing the NOS Small-Craft Chart

Promoting Safe Navigation and Stewardship of Coastal Resources

by

**Gustavo Antonini
Niels West
Charles Sidman
Robert Swett**

December 2000

RECEIVED
NATIONAL SEA GRANT LIBRARY

FEB 16 2001

Pell Bldg. URI Bay Campus
Narragansett RI 02882 USA

Table of Contents

| | <u>Page</u> |
|--|-------------|
| LIST OF TABLES | vi |
| LIST OF FIGURES | vi |
| LIST OF PLATES | vi |
| ACKNOWLEDGMENTS | viii |
| EXECUTIVE SUMMARY | ix |
| 1. INTRODUCTION | 1 |
| 1. Project Background | 1 |
| 2. Goal and Objectives | 1 |
| 3. Project Design | 1 |
| 4. Report Outline | 3 |
| 2. PROTOTYPE CHART AND BOATER INFORMATION PRODUCTS | 4 |
| 1. Prototype Photo-Chart | 4 |
| a. Design Criteria | 4 |
| b. Layout and Content | 5 |
| c. Scale | 5 |
| d. Background Aerial Photography and Imagery | 7 |
| 2. Ancillary Boater Products | 7 |
| a. Guide to Anchorages in Southwest Florida, 2 nd Edition | 7 |
| b. Sarasota Bay Blue-ways Pocket Guide | 9 |
| c. Anchorage and Waterway Place-mat Photo-Maps | 9 |
| d. Internet Web Site for Southwest Florida Anchorages | 10 |
| 3. SURVEY DESCRIPTION AND IMPLEMENTATION SCHEDULE | 11 |
| 1. Boater Profile Survey | 11 |
| 2. Product Evaluation Survey | 11 |
| 3. Implementation Schedule | 12 |
| 4. METHODS | 15 |
| 1. Objective 1 | 15 |
| a. Sample Selection | 15 |
| b. Boater Participation in Surveys | 18 |
| c. Relation of the Boater Sample to the Boating Population | 18 |

| | <u>Page</u> |
|--|-------------|
| d. Compatibility of the Boater Profile and Boater Product Evaluation Surveys | 19 |
| 2. Objective 2 | 20 |
| a. Boater Profile Survey | 20 |
| b. Product Evaluation Survey | 21 |
| c. Methods | 21 |
| d. Findings | 23 |
| 3. Objective 3 | 23 |
| a. Readability Rating | 24 |
| b. Usefulness Rating | 25 |
| 4. Objective 4 | 27 |
| a. Impact Rating | 27 |
| 5. Objective 5 | 29 |
| a. Derivation of Total Boating Months Variable | 30 |
| b. Derivation of Total Boating Days Variable | 32 |
| c. Derivation of High Season Boating Hours Variable | 32 |
| d. Derivation of Weekday Boating Hours | 33 |
| e. Derivation of Week-end Boating Hours | 33 |
| f. Derivation of Holiday Boating Hours | 34 |
| g. Derivation of Boat Type Boating Pressure | 34 |
| h. Derivation of Activity Boating Pressure | 34 |
| i. Derivation of Ranked Choice of Boating Pressure | 35 |
| j. Estimation of Number of Boats Including Allocation of 'Unidentified Vessels' | 35 |
| k. Estimation of Allocation Factor | 36 |
| l. Estimation of Adjusted Boating Hours by Boat Type | 36 |
| m. Total Estimate of Number of Boating Hours by Boating Activity | 37 |
| 5. RESULTS | 38 |
| 1. Boats and Boaters | 38 |
| a. Boat Type | 38 |
| b. Boating Population | 39 |
| c. Boater Experience and Piloting Skills | 39 |
| d. Boating Patterns | 40 |
| e. Boating Pressure During the High Boating Season | 41 |
| 2. Prototype Photo-Chart | 42 |
| a. User Workshops as Basis for Changing Chart Content and Format | 42 |
| b. Evaluation Framework | 43 |
| c. Navigation Chart | 43 |
| d. Environmental and Boating Map Information Portion | 45 |
| e. Supplemental Boating Information Tables and Diagrams | 47 |

| | <u>Page</u> |
|--|-------------|
| f. Prototype Chart Format | 48 |
| 3. Other Boating Information Products | 48 |
| a. Contents | 48 |
| b. Product Use During Test Period | 48 |
| c. Usefulness | 48 |
| d. Relevance | 49 |
| e. Suggested Future Sources | 49 |
| 4. Boater Environmental Perception, Attitudes and Behavior | 49 |
| a. Awareness Before Exposure to Prototype Products | 49 |
| b. Impact of Prototype Products on Boating Practices | 50 |
| 5. Summary | 51 |
| a. Boating Profile | 51 |
| b. Prototype Chart and Other Information Products | 52 |
| c. Boater Environmental Perception, Attitudes and Behavior | 52 |
| 6. CONCLUSIONS AND RECOMMENDATIONS | 54 |
| 7. REFERENCES | 59 |
| 8. APPENDICES | |
| A. Prototype Photo-Chart 11425 | A-1 |
| B. Boater Survey Instruments and Correspondence | B-1 |
| 1. Cover Letter for Boater Profile Survey | B-2 |
| 2. Volunteer Participation Card | B-3 |
| 3. Boater Profile Survey | B-4 - B-16 |
| 4. Reminder Card to Return Survey | B-17 |
| 5. Cover Letter for Prototype Product Mail-Out | B-18 |
| 6. Change of Address Card | B-19 |
| 7. Reminder Card to Use Prototype Materials | B-20 |
| 8. Cover Letter for Product Evaluation Survey | B-21 |
| 9. Product Evaluation Survey | B-22 - B-41 |
| 10. Reminder Card to Return Product Evaluation Survey | B-42 |
| 11. Thank You Letter for Volunteer Participation | B-43 |
| C. Methods Tables | |
| 1. Recreational Boats in the Study Area | C-1 |
| 2. County Distribution of Boater Profile Surveys | C-1 |
| 3. Breakdown of VTRS Boat Sample by County and Class | C-1 |
| 4. Questionnaire and Volunteer Receipt and Return Rates | C-2 |

| | <u>Page</u> |
|--|-------------|
| 5. Differences Between Boater Profile Questionnaires Distributed and Returned | C-2 |
| 6. Comparing Boat-Type Ratios Between Boater Profile And Product Evaluation Surveys | C-2 |
| 7. Chi-Square Summary Table with Boat-Type As the Dependent Variable | C-3 |
| 8. Chi-Square Summary Table with Education As the Dependent Variable | C-3 |
| 9. Student-T Summary Table with Boat-Type As the Dependent Variable | C-3 |
| 10. Student-T Summary Table with Education As the Dependent Variable | C-4 |
| | |
| D. Results Tables | |
| 1. Weighted Summed Scores and Ranked Top Three Boating Activities | D-1 |
| 2. Weighted Summed Scores and Ranked Top Five Reasons for Selecting a Boating Locale | D-2 |
| 3. Weighted Summed Scores and Ranked Top Five Reasons For Selecting an Anchorage Locale | D-3 |
| 4. Boat Types by Boating Time for the Sample Population During the March - May Season | D-4 |
| 5. Boaters' Experience by Boating Time for the Sample Population During the March - May Season | D-4 |
| 6. Boaters' Household Income by Boating Time for the Sample Population During the March - May Season | D-4 |
| 7. Boaters' Employment Status by Boating Time for the Sample Population During the March - May Season | D-4 |
| 8. Boating Activities by Boating Time for the Sample Population During the March - May Season | D-5 |
| 9. Weighted Summed Scores of Hours Engaged in All Boating Activities for the Sample Population During the March - May Season | D-6 |
| 10. Estimated On-the-Water Boating Time by All Boaters In the Study Region During the March - May Season | D-7 |
| 11. Users' Workshop Results for Defining Prototype Chart Content and Format | D-8 |
| 12. Readability of the Navigation Panels on the Prototype Chart ... | D-9 |
| 13. Usefulness of the Navigation Panels on the Prototype Chart ... | D-9 |
| 14. Readability of the Environmental and Boating Information Panels on the Prototype Chart | D-10 |

| | <u>Page</u> |
|--|-------------|
| 15. Usefulness of the Environmental and Boating Information Panels on the Prototype Chart | D-10 |
| 16. Usefulness of the Other Prototype Boating Information Products | D-11 |
| 17. Summary Statistics for Natural Resource Variables | D-12 |
| 18. Natural Resource Responses | D-13 |
| 19. Summary Statistics for Pollution Variables | D-14 |
| 20. Pollution Responses | D-15 |
| 21. Comparison of the Prototype Products' Impacts On Boating Practices | D-16 |

LIST OF TABLES

| | |
|---|----|
| Table 1. Computation of Composite Score Statistic for Panels 3-A and 4 | 25 |
| Table 2. Computation of Usefulness Rating Statistic | 26 |
| Table 3. Computation of Weighted Rank Score for Impact Rating Statistic | 28 |

LIST OF FIGURES

| | |
|--|----|
| Figure 1. A Boater-Based Study Method for Designing and Evaluating Prototype Chart and Guide Information Products | 2 |
| Figure 2. Photo-Chart Layout | 6 |
| Figure 3. Survey Implementation Time-line | 13 |
| Figure 4. Boating Pressure Model | 31 |

LIST OF COLOR PLATES

| | |
|--|---|
| Plate 1. Panels 1, 2 and 3B: Bathymetry Shown as Spot Soundings Over White (Greater Than 6 Feet) and Blue (Less than 6 Feet) Depth Ranges | 8 |
| Plate 2. Panel 5: Bathymetry Shown as Spot Soundings Over Color-Shaded 3-Foot Depth Ranges | 8 |
| Plate 3. Panels 3-A and 4: Land and Water Shown by Color Infra-Red Imagery That Has Been Converted to Natural Color | 8 |

| | <u>Page</u> |
|---|-------------|
| Plate 4. Panel 6: Land and Water Shown by Color Infra-Red Imagery | 8 |
| Plate 5. Panels 1, 2, and 3B: Land Shown by a Composite Satellite Image (EOSAT IRS-1C) Fused with Aerial Photography | 8 |

Acknowledgments

This multi-faceted project relied upon the individual contributions of various team members. Gustavo Antonini, Florida Sea Grant, served as Principal Investigator and was responsible for overall administration and design of the boater surveys. Niels West, University of Rhode Island, was Co-Principal Investigator and directed the statistical analysis. Charles Sidman, Florida Sea Grant, coordinated the boater surveys and data base management. Robert Swett, Florida Sea Grant, was responsible for the cartographic and geographic information systems (GIS) liaisons with NOAA agencies. Marine agents, Rich Novak (Charlotte County) and John Stevely (Manatee and Sarasota Counties) coordinated the focus group workshops and assisted with implementing the transient boater survey. David Fann, Florida Sea Grant, edited the manuscript. The 132 boater volunteers, who stayed with the project through the various survey and field evaluation stages, deserve special acknowledgment.

Project partner organizations and individuals provided valuable contributions. NOAA's Marine Chart Division, Products Branch E (Gulf Coast), Ed Martin and Roger Johnson, provided technical support and coordinated the Division's resources for compiling and printing the Prototype Photo-Chart; the Division also provided copies of the prototype and conventional charts for evaluation purposes. NOAA's Coastal Services Center, Cindy Fowler, provided technical support in GIS matters; and Nina Petrovich assisted with the survey design and questionnaire development. Boaters' Action and Information League, Barbara Harris, supervised the revision of the Anchorage Guidebook for Southwest Florida, with collaboration from the Regional Harbor Board, and made copies of the 2nd Edition Guidebook available for evaluation by project volunteers. Sarasota Bay National Estuary Program, Jamie Doubek, supervised production of the Sarasota Bay Blue-ways Pocket Guide, and made copies available as well. The West Coast Inland Navigation District, Charles Listowski, networked the project with county, regional and state marine resource management units in the study area, and provided access to GIS waterway coverages, such as bathymetry, aids to navigation, and boating facilities, compiled by Florida Sea Grant.

Source data, imagery and GIS coverages for the Prototype Photo-chart were provided by the following agencies: U.S. Coast Guard, Oak Ridge National Laboratory, West Coast Inland Navigation District (Florida), Florida Marine Research Institute, Southwest Florida Water Management District, and ImageLinks.

A special note of thanks to Jim Cato, Florida Sea Grant Director, Margaret Davidson, Director of NOAA's Coastal Services Center, and David MacFarland, NOAA's Director of Coast Surveys, for their unstinting encouragement and support.

Executive Summary

1. Project Background

NOAA's Small-Craft Charts were first developed to serve the needs of recreational boaters, inshore fishers, and other users operating in close proximity to the shore. Since then, few conceptual changes have been made to these charts even though there has been a dramatic increase in the number and types of recreational users. Today, the small-craft chart is being used in ways that could not be envisioned when these charts were first produced: diving, racing, nature-touring, wildlife-viewing are current boating activities, in addition to traditional uses, such as sailing, fishing, anchoring and cruising. The need to promote safe navigation, the primary goal of charting, is being challenged by the numbers and varied types of contemporary recreational users. Furthermore, the conventional small-craft chart does not contain information needed to make current users aware of coastal resources. NOAA and other federal agencies, states and local municipalities, are increasingly concerned about the environmental impacts caused by recreational boating.

This project was designed to determine the chart information needs of boaters which satisfy safe navigation and promote stewardship. Study objectives include: identifying the information needed by today's boater to promote safe navigation and stewardship; developing a prototype small-craft chart, and ancillary map/guide products, which include information identified by recreational boaters, fishers, divers, resource managers and environmentalists, to modernize a new generation chart; evaluating the utility of the additional information provided on the prototype products through a boater survey; and analyzing whether the new information contained on the prototype chart and ancillary products can change boater's environmental perception, attitudes, behavior, and knowledge on-the-water.

2. Prototype Photo-Chart

The prototype chart was produced for study purposes by NOAA's Marine Chart Division in collaboration with the University of Florida Sea Grant Program and NOAA's Coastal Services Center. The design was based on recommendations from boaters and marine industry representatives who attended workshops in southwest Florida in May 1998. The chart covers the southwest Florida coast from lower Tampa Bay to Charlotte Harbor. Each side of the Prototype Photo-Chart is divided into top and bottom half-sections, which are further subdivided into panels.

Navigation chart panels are found on the bottom portion of both sides. Side A uses color symbols to distinguish marsh (green) and spoil (blue) areas from the water. Spot soundings are depicted over a white background and are shown as on the conventional chart. Side B uses several methods to depict bathymetry and habitat: there are panels that render water areas less than 6 ft in a blue color, deeper water is white and sea grass is green, as on the conventional chart; another panel renders water areas in blue-shaded 3 ft increments with spot soundings shown as on a conventional chart.

Environmental and boating map panels are presented on the top portion of both sides and include: anchorage locations, bridges, boat ramps, sea grass, marsh, shellfish harvesting, depth zones, and speed zones. Boating tables and diagrams also are included: anchorage characteristics, navigation rules, flags for vessel maneuverability, and weather pennants.

Background aerial photography and imagery is an important additional feature of the prototype photo-chart. Several types are included: 4-meter resolution, digital infra-red, aerial ortho-photography, converted to natural color; 2-meter resolution, infra-red color photography; and 5-meter resolution, composite satellite imagery color-fused with aerial photography. There are examples of background imagery covering both land and water, as well as color imagery only covering land.

The prototype photo-chart is 30" x 60" with a triple-fold, one-third larger than the conventional small-craft chart, though both products fold to 5" x 10" size.

8. Ancillary Boater Information Products

Four other information products were developed, distributed and evaluated.

Guide to Anchorages in Southwest Florida, 2nd Edition was produced by the Boaters Action and Information League (BAIL) in association with Florida Sea Grant, the Florida Department of Environmental Protection, the Southwest Florida Regional Planning Council, and the West Coast Inland Navigation District. The guidebook provides information on 47 popular anchorages, such as photographs with superimposed course lines, chart-lets with preferred course and buoys, anchorage descriptions, boating and anchoring tips, a link to the Florida Sea Grant Web Site for Southwest Florida Anchorages, and large-scale photo-maps of selected anchorages.

Sarasota Bay Blueways Pocket Guide was produced by the Sarasota Bay National Estuary Program. The guide's map is designed to help the boater learn more about and enjoy Sarasota Bay by locating main channels, sea grass, artificial reefs, bird-viewing areas, boat ramps and canoe/kayak launches, fishing piers, marinas and dockside restaurants. The guide also includes information on bay habitats, flora and

fauna, boating safety tips, and a resource directory.

Six Anchorage and Waterway Photo-Maps of popular boating locales were prepared as place-mats for waterfront businesses by Florida Sea Grant. The place-mats show depths, bottom sediments, sea grass, selected navigation aids, and boating hazards. In addition, channel center-line routes are marked, for approaching and transiting the anchorages.

The Florida Sea Grant Anchorage Web Site was designed and produced in coordination with the Regional Harbor Board for Southwest Florida and with the cooperation of the West Coast Inland Navigation District. The web site contains a virtual tour of "A Guide to Anchorages in Southwest Florida 2nd Ed," information on the Regional Harbor Board of Southwest Florida, resource information to help boaters select and enjoy many popular anchorages, and information on local restrictions, maps and photos, hot links to weather, tides, and chart updating, and related program information pertaining to anchorage management and monitoring publications.

9. Boater Surveys

Two mail surveys were implemented to profile boaters and to obtain product feedback. The Boater Profile Survey was developed to characterize the boating population of the region covered by the prototype photo-chart and to encourage boaters to use and evaluate the prototype chart and ancillary information products. Another objective of this survey was to determine the extent to which perceptions, attitudes and behavior differ among discrete boating populations. The survey instrument included questions regarding boat type, draft, mooring location, preferred boating activities, manner of use and type of navigational/piloting equipment, as well as a series of attitudinal-type questions which posed hypothetical boating situations.

A Product Evaluation Survey was mailed to 481 volunteers who completed the Boater Profile Survey, and volunteered to use the prototype products during a three-month test period (February - April, 1999). This survey instrument included questions regarding the content, format and usefulness of the prototype information products. The survey objectives were to obtain feedback from boaters regarding the content and cartographic representation of the prototype chart, to determine which information products – prototype chart, pocket guide, place-mats, anchorage guide, anchorage web site – were most or least useful to boaters, and to test if such products can change the environmental perception, attitudes, and behavior of boaters.

The opinion and evaluation surveys were administered using established mail survey and convenience sampling procedures. The Boater Profile Survey questionnaire was mailed to 3000 resident boaters; 828 individuals returned the questionnaire, and 417 volunteered to use and evaluate the prototype chart and other

information products. Another 250 Boater Profile Survey questionnaires were distributed to transient boaters; 87 returned the questionnaire, and 64 volunteered to use and evaluate the prototype products. The number of questionnaires received by boaters was 3018, and the number completed was 915 (828 resident, 87 transient); this represents a 30 percent return rate. Of those boaters who completed this questionnaire, 53 percent (481) volunteered to use and evaluate the prototype products (417 resident, 64 transient). There were 132 volunteers who completed the second survey – Boater Product Evaluation Survey – questionnaire; this represents a 27 percent rate of return.

10. Results

Boating Profile

About half of the boats are small outboard vessels and another quarter are large trawlers and cabin-cruisers; 17 percent are sailboats, and the remaining 8 percent are personal water-craft, kayaks, canoes and rowboats. These are shallow-water vessels: over half draw less than 2 ft, 30 percent have 2-3 ft drafts, and 16 percent have drafts between 3 and 4 ft. Over 60 percent of the boats are moored at private docks.

Eighty-five percent of the boaters have 10 or more years of experience, and spent, on average, about 51 hours on-the-water during the March - May boating season. Over two-thirds have taken some formal boater education courses, such as introductory boating safety and seamanship as well as intermediate or advanced courses in piloting and navigation. Overall, 90 percent have no perceived difficulties in carrying out navigation and piloting operations.

The average boater is 58 years of age, white, male, and college educated. Fifty-nine percent are partially or fully retired. Over 60 percent have household incomes of \geq \$50,000, and 13 percent have \geq \$150,000 incomes. Those with the lowest incomes ($<$ \$20,000 which is 3 percent of the boaters) spend 131 hours on-the-water during the high boating season, compared with 154 hours of boating time by the majority with higher incomes. Most boating time by the employed occurs on the weekend (68.7 percent) in contrast to fully retired individuals who spent 50.8 percent of their boating time on weekdays.

Stand-out reasons why people boat are for fishing and cruising. During the March - May season, the average boater spent 46.70 hours on-the-water, engaged in activities ranging from a high for inshore fishing (60.75 hours/boater) and cruising (55.78 hours/boater) to a low of 17.22 hours/boater for ocean racing. About 50 percent of boating time is spent in pursuit of fishing, while cruising accounts of 29 percent of the boating time. The top three reasons for boating in one area over another are its scenic beauty, clean waters and fishing opportunities. Main reasons for selecting an anchorage locale are its bottom-holding, storm protection, fishing opportunities, and

calm waters. Results of the boating pressure model show that on a hours/acre basis, the greatest pressure is exerted by sailboats (93.81 hours/acre), followed by speed-boat type (58.17 hours/acre), personal water-craft (24.75 hours/acre), cabin-cruisers (18.82 hours/acre), and row-boat type (8.01hours/acre). It should be noted that not all boat types have the same impact, per hour/acre, on the resource.

Prototype Chart and Other Information Products

The most readable navigation panels on the prototype chart showed composite color-fused imagery only over land areas, with spot soundings and conventional supplemental contours over water areas. The most useful navigation information was depths in general and soundings by color-shading, land photo images, shore features and the shoreline. The principal problems with the navigation panels related to background colors of the imagery and their cluttered appearance. The most readable and useful environmental and boating information panels on the prototype chart showed sea grass and mangrove coverages and symbols for anchorage, ramp and bridge features. Three-quarters of the boaters concurred that the supplemental boating information tables and diagrams (bridge, anchorage, facilities, aids to navigation, etc.) should be included on the prototype chart. About two-thirds of the boaters found the triple-fold chart size acceptable. About two-thirds of those who considered the chart size unsatisfactory, said that a 'track ticket' format would be more suitable.

The four other information products – Pocket Guide, Place-mats, Anchorage Guide, Web Site – were evaluated for their usefulness and relevance. The Anchorage Guide had the highest scores: top rated features were photographs with superimposed course lines and chart-lets with preferred courses and buoys. Only half of the boaters have access to a home computer which may explain the low score for the Web Site product.

Boater Environmental Perception, Attitudes and Behavior

The test of boater responses, to a series of natural resource and pollution-related incidents while underway or at anchor, showed that an overwhelming proportion know how to boat in an environmentally appropriate manner. Responses to hypothetical environmental situations showed a high proportion of 'appropriate' responses with answers ranging from 75.6 percent (disturbing sea grass) to a high of 99.6 (encountering manatees). The answers to questions on 'wakes' and 'vessel grounding' were also very high. More than 97 percent indicated an 'environmentally appropriate' response. Responses to hypothetical pollution situations also showed appropriate responses ranging from 47.1 percent in the case of head-discharging to 98.6 percent for encountering a floating plastic bag. These responses to hypothetical situations, however, may or may not reflect the actual behavior of boaters if and when confronted with such situations on-the-water.

The prototype products did influence boating practices and the quality of boating

experiences. The prototype chart had the greatest impact of all test products in affecting decisions to avoid adverse impact on the environment. The Anchorage Guidebook had the highest impact, followed closely by the prototype chart, in enhancing awareness of boating safety, reducing potential conflicts, and increasing on-the-water enjoyment.

11. Conclusions

The conclusions are summarized with respect to each of the study's goals.

Determine the chart information needs of boaters which satisfy safe navigation and promote stewardship.

Findings

1. Shallow water areas (less than three feet) should be highlighted on charts. The analysis indicates that the most frequented boating zones are shallow water areas. The current NOS charts highlight deeper water; shallow water areas are understated.
2. Land is best depicted by composite color-fused imagery. However, boaters felt that the resolution might be improved. The majority of boaters surveyed thought that spot soundings and other information was difficult to read and interpret when displayed over digital imagery. The overall impression was that the prototype photo-chart was "cluttered".
3. Bathymetry is best depicted by spot soundings and conventional supplemental contours, or as color-coded depth ranges with supplemental spot soundings. An equal numbers of boaters favored one or the other combination.
4. The use of red ink should be minimized, and the text increased in size. Many recreational boats are equipped with a red light for nighttime navigation which makes it difficult to see shades of red on charts.
5. The most readable and useful environmental and boating information panels on the prototype chart showed sea grass and mangrove coverages and symbols for anchorage, ramp and bridge features. Three-quarters of the boaters concurred that the supplemental boating information tables and diagrams (bridge, anchorage, facilities, aids to navigation, etc.) should be included on the prototype chart. About two-thirds of the boaters found the triple-fold chart size acceptable. About

two-thirds of those who considered the chart size unsatisfactory, said that a 'track ticket' format would be more suitable.

6. Four ancillary information products – Pocket Guide, Place-mats, Anchorage Guide, Web Site – were evaluated for their usefulness and relevance. The Anchorage Guide had the highest scores: top rated features were photographs with superimposed course lines and chart-lets with preferred courses and buoys. Only half of the boaters have access to a home computer which may explain the low score for the Web Site product.

Determine if chart information needs vary with boater education and with boat type.

Findings

1. Results from the statistical analysis strongly suggest that a respondent's type of boat and education had no appreciable impact on the boater's chart information needs. This finding is surprising since the general perception by most boaters is that boating knowledge, behavior and overall use of the environment vary with respect to the respondent's boat type and education. A number of factors may have influenced the responses:
 - a. The boating population tested may be unique to southwest Florida or to the State of Florida.
 - b. The respondents' age is decidedly older than the average for the U.S. population.
 - c. Many boaters go through 'stages', the first is usually a small run-about, succeeded, over the years, by larger and larger boats. As a boater approaches middle age, and then retirement, (s)he continues to boat, usually moving from sail to power vessels where the operation requires less physical energy on behalf of the crew. This means, of course, that most individuals have had not only extensive experience with boating but also in operating different types of vessels. Since questions that might query the respondents in this manner were not included, this hypothesis could not be validated by this study.

Determine if the incorporation of data derived from GIS, GPS and remote-sensing is an effective way to modernize the NOS chart.

Findings

1. Digital imagery, as a backdrop for land areas, was well received by the boaters. The background imagery enhanced navigation by providing boaters with a heightened sense of location with respect to the coastline and urban features.
2. Bathymetric mapping with a GPS allowed for the inclusion of detailed depth-range contours for near-shore areas.
3. The use of GPS is proven to be an efficient and accurate method for collecting and updating chart information (signage, anchorages, boat ramps, marinas, spot soundings).
4. The prototype charting effort was greatly enhanced by the ability to utilize and incorporate GIS databases (bathymetry, mangrove, sea grass, shellfish harvest areas, speed zones, etc.), available from state and local agencies.

Determine if the incorporation of environmental history and boating geography information onto chart products could instill stewardship.

Findings

1. An analysis of boater responses to how they would react when confronted with hypothetical boating situations indicated that boaters have a keen awareness of the appropriate action that should be taken to minimize environmental impacts. Results showed that an overwhelming proportion know how to boat in an environmentally appropriate manner. However, responses to hypothetical situations may not reflect the actual behavior of boaters if and when confronted with such situations on-the-water.
 - a. Responses to hypothetical situations which could impact the environment showed a high proportion of 'appropriate' responses with answers ranging from 75.6 percent (disturbing sea grass) to a high of 99.6 (encountering manatees).
 - b. The answers to questions on 'wakes' and 'vessel grounding' were also very high. More than 97 percent indicated an 'environmentally

appropriate' response.

- c. Responses to hypothetical situations which could pollute the environment also showed appropriate responses ranging from 47.1 percent in the case of head-discharge, to 98.6 percent for encountering a floating plastic bag.
2. The prototype products did influence boating practices and the quality of boating experiences. The prototype chart had the greatest impact of all test products in affecting decisions to avoid adverse impacts on the environment. The Anchorage Guidebook had the greatest effect, followed closely by the prototype chart, in enhancing awareness of boating safety, reducing potential conflicts, and increasing on-the-water enjoyment.

The study findings suggest that we have taken an important first step in developing a universally acceptable chart for recreational boaters. This southwest Florida test of the prototype chart does affirm the overall objective that boater attitudes and practices are positively affected by these new kinds of chart information. But, is southwest Florida representative of the range of boater activities, experience and practices found throughout the U.S.? Our study findings show a somewhat older boating population, a large number of smaller power boats, a year-round boating season, and a diversity of boat types and operators, all of which may contribute to a unique set of conditions compared to other boating regions in the country. Given the substantial commitment in manpower and costs that will be required should NOAA's Marine Chart Division adopt our recommendations, we strongly suggest that the study findings be tested in other boating regions of the U.S.

7. Recommendations

1. Redesign the small-craft chart #11425, the focus of this study, incorporating volunteer boater recommendations, and publish it for general distribution and use. Boaters preferred the new, prototype chart format and additional information contained within it. This improved information will promote safer navigation and environmental stewardship in southwest Florida.
2. Conduct multi-regional surveys (East Coast, Gulf Coast, West Coast, Great Lakes) of NOS/recreational boater chart users, to determine their chart information needs to satisfy safe navigation and promote stewardship. The southwest Florida boater survey found a decidedly older boating population than the national population average. Age may have contributed to the fact that many survey respondents felt that the map was "too cluttered" and that spot soundings and other information were "difficult to read and interpret". Boater characteristics, such as education, type of boat and demography may differ significantly from the general boating

population, thereby contributing to special information needs and cartographic presentation.

3. Produce prototype photo-charts for other boating areas, using the methodology developed in this pilot study and relying on results from multi-regional survey (Recommendation 2 above). Representative regional test locations could include Rhode Island, Washington, and Michigan. Sea Grant could oversee and implementation of these boater surveys. The NOAA Coastal Service Center could collaborate in meeting this objective.
4. Refine the Boating Pressure Model developed in this study and improve data applied to the model. This model should be expanded to characterize boating pressure over the calendar year - the current model utilizes only seasonal data. Suggested refinements also should include more precise definitions of water depth (1 ft resolution) and an examination of the relation of habitat (e.g., sea grass, marsh, mangrove) to boating pressure zones. Such an analysis would further quantify how boating activities potentially impact resources and how information needs within these boating pressure zones relate to safe navigation and stewardship.

Introduction

Introduction

1. Project Background

NOAA's small-craft charts were first developed to serve the needs of recreational boaters, inshore fishers, and other users operating in close proximity to the shore. Since then, few conceptual changes have been made to these charts, even though the number and types of recreational users have dramatically increased. Today, the small-craft chart is being used in ways that could not be envisioned when these charts were first produced: diving, racing, nature-touring, and wildlife-viewing are current boating activities, in addition to traditional uses, such as sailing, fishing, anchoring, and cruising. The need to promote safe navigation, the primary goal of charting, is being challenged by the numbers and varied types of contemporary recreational users. Furthermore, the conventional small-craft chart does not contain information especially tailored to make users aware of coastal resources. NOAA and other federal agencies, states, and local municipalities are increasingly concerned about the environmental impacts caused by recreational boating. Public agencies—particularly at the local level—and the private sector have developed products, such as guidebooks and charts, to meet the growing demand for additional boating information. Preparation of these products, typically re-formatted extracts from existing NOAA publications, has not systematically solicited information from the boating public or evaluated the usefulness of the information to users.

2. Goal and Objectives

The goal of this project is to identify information that small-craft charts can convey to enable safe navigation and to promote environmental stewardship. Study objectives include: (1) identifying the information needed by today's boater to promote safe navigation and stewardship; (2) developing a prototype small-craft chart that includes information identified in the first objective—using technologies, such as GIS, GPS, and remote sensing—to modernize the next-generation chart; (3) evaluating, through a boater survey, the utility of the additional information provided on the prototype, and (4) analyzing whether the new information contained on the prototype chart can change boaters' on-the-water environmental perception, attitudes, behavior, and knowledge.

3. Project Design

An underlying concern of NOAA is that the next generation of small-craft charts

reflects the views and needs of the recreational boating community. In deference to this concern, the project design relied on the user (consumer) as an active participant in the formulation, design, and evaluation of the prototype products. The boater-based study method is diagrammed in Figure 1. Prototype chart design relied on a

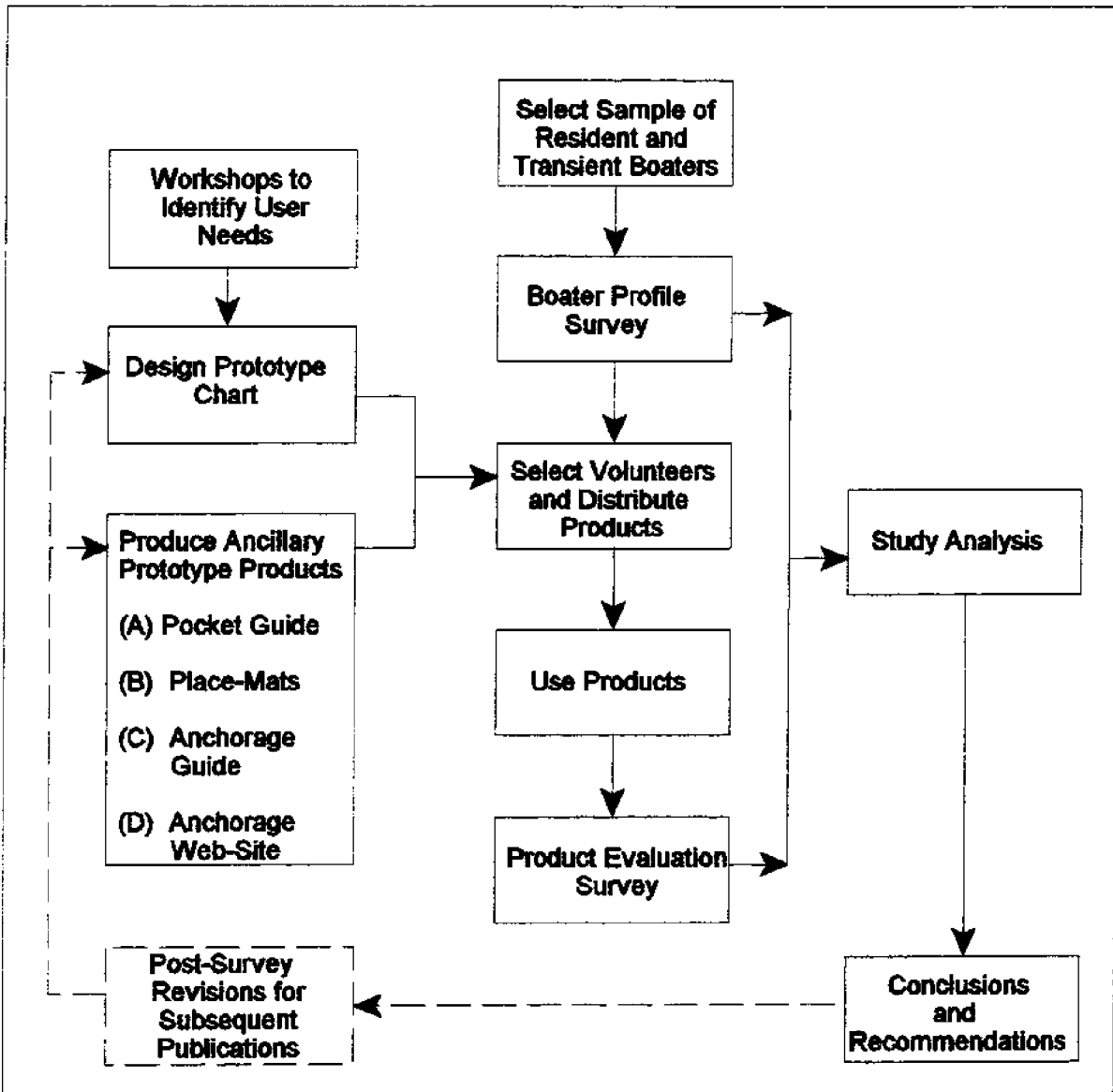


Figure 1. A Boater-Based Study Method for Designing and Evaluating Prototype Chart and Guide Information Products.

needs-assessment, by a cross-section of boaters, fishers, divers, resource managers, and environmentalists, who critiqued the conventional small-craft chart and determined which elements were essential and could not be changed, what existing information

could be improved upon, and what new information should be included, and in what form. Results of this needs–assessment determined that the prototype chart should incorporate digital imagery and blend traditional navigation elements with contemporary environmental and boater information.

An important study element was to select a representative sample of resident and transient boaters who would agree to participate in various stages of the project. A Boater Profile Survey, “The How, When and Why of Recreational Boating in Southwest Florida,” was distributed to this sample of boaters in order to characterize the boating population. Some of the individuals who completed the survey also volunteered to participate in follow–up project tasks. A number of boater volunteers were given copies of the prototype chart and ancillary prototype information products (Pocket Guide, Place–mats, Anchorage Guide, Anchorage Web Site) for use during a three–month boating season. A Product Evaluation Survey was completed by the boater volunteers. Both surveys provided information needed to analyze the study objectives. Conclusions and Recommendations are drawn from this analysis, and the entire project is described in this report. The results of this study provide the basis for revising the prototype products for subsequent publications; Figure 1 shows the feedback as a dashed line.

4. Report Outline

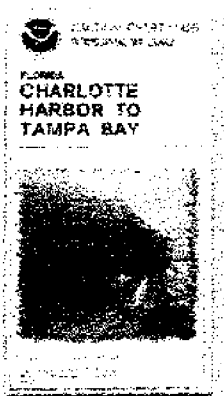
This report describes the background, methods, and results of a two–year project sponsored by NOAA’s Marine Chart Division and Coastal Services Center and the Florida Sea Grant Program. An Executive Summary precedes this Introduction (1). Prototype Chart and Boater Information Products, in Section 2, includes a description of the compilation features of the prototype chart (design criteria, layout, content, scale, background aerial photography and imagery), as well as the salient characteristics of the ancillary boater products (Pocket Guide, Place–mats, Anchorage Guide, Anchorage Web Site). Section 3 presents the Boater Profile Survey, the Product Evaluation Survey, and the implementation schedule used to administer the various survey elements. The Methods Section (4) is divided into the project’s operational objectives and discusses the analytical approaches used. Results (Section 5) characterize the boats and boaters, report on the volunteer assessments of the prototype photo–chart and other boating information products, and identify the boaters’ environmental awareness before exposure to prototype products as well as the impact of these products on intended boating practices. Conclusions and Recommendations are in Section 6.

Prototype Chart and Boater Information Products

This section provides a detailed description of the prototype products that were distributed to and evaluated by the volunteer boaters. Special attention is given to the prototype small-craft nautical chart, and each panel of the chart is highlighted and explained in detail. A copy of the prototype chart is included in Appendix A. Products evaluated include the following:

- (1) Prototype photo-chart (covering the area of NOAA Small-Craft Chart 11425)
- (2) Six place-mat size photo-maps of these boating locales:
 - Emerson Point and DeSoto Point
 - Longbeach/Longboat Pass
 - Buttonwood Harbor
 - Big Pass/Otter Key
 - Sarasota/Island Park
 - Boca Grande/Grand Bayou
- (3) A Guide to Anchorages in Southwest Florida
- (4) Sarasota Bay Blueways: Recreational Opportunities for the Boater
- (5) Florida Sea Grant Web site home page for southwest Florida anchorages.

Prototype Photo-Chart



The prototype chart was produced for study purposes by NOAA's Marine Chart Division, in collaboration with the University of Florida Sea Grant Program and NOAA's Coastal Services Center. The following organizations contributed to its development: U.S. Coast Guard, Oak Ridge National Laboratory, West Coast Inland Navigation District, Florida Marine Research Institute, Southwest Florida Water Management District, and ImageLinks.

Design Criteria

Prototype photo-chart #11425 was designed based on recommendations from boaters and marine industry representatives who attended workshops in southwest Florida in May 1998. These workshops invited local boaters, fishers, divers, resource managers, and environmentalists to critique the existing small-craft chart and determine which elements were essential and could not be changed, which information could be improved cartographically, what new information should be included, and how that new information should be depicted. Participants also provided general guidance in chart design. Florida Sea Grant and

NOAA Coastal Service Center staff served as facilitators and guided group discussions.

Layout and Content

Prototype Photo-Chart #11425 covers the southwest Florida coast from lower Tampa Bay to Charlotte Harbor. Each side is divided into top and bottom half-sections, which are further subdivided into panels. Side A shows the Charlotte Harbor to Venice Inlet area, and Side B shows the area from Venice Inlet to lower Tampa Bay. Figure 2 is a diagram of the Photo-Chart panel layout.

Navigation panels are found on the bottom portion of Sides A (Panels 3-A, 4, 6) and B (Panels 1, 2, 3-B, 5, 7). Side A uses color symbols to distinguish marsh (green) and spoil (blue) areas from the water. Spot soundings are depicted over a white background and are shown as on the conventional chart. Side B uses several methods to depict bathymetry and habitat. Panels 1, 2, and 3-B render water areas less than 6 ft in a blue color, deeper water is white, and sea grass is green (Plate 1, page 8), as on the conventional chart. Panel 5 renders water areas in blue-shaded 3 ft increments with spot soundings shown as on a conventional chart (Plate 2, page 8).

Environmental and boating map information is presented on the supplemental map panels, found on the top portion of Sides A and B. Supplemental map panels include the following information: Anchorage locations, bridges, boat ramps, sea grass (shown two ways, as 'continuous or patchy', or only as 'general presence'), marsh, shellfish harvesting (shown as prohibited, conditionally approved, approved), depth zones (shown two ways, as supplemental map information, and as navigation chart information), and speed zones.

Supplemental boating tables and diagrams also are found on the top portions of Sides A and B. Tables include anchorage characteristics, bridge information, tidal current data, and boating facility characteristics. Supplemental diagrams show: buoyage (shown three ways, as U.S. Aids to Navigation System, a Fictitious Nautical Chart, and a Visual Buoy Guide), a Navigation Rules diagram depicting vessel crossing and overtaking situations, flags for vessel maneuverability, and weather pennants.

Scale

Side A of the Photo-Chart contains two large navigation chart panels, which depict the area from lower Tampa Bay to Venice inlet (Panels 3A and 4) at a scale of 1:40,000. An inset (Panel 6) depicts Venice Inlet at a scale of 1:20,000. Side B of the Photo-Chart contains three large navigation chart panels that show the area from Venice Inlet to Gasparilla Sound (Panels 1, 2 and 3B) at a scale of 1:40,000. A supplemental chart covers the Manatee River (Panel 7) at a scale of 1:40,000. An inset chart (Panel 5) depicts Island Park, Sarasota at a scale of 1:20,000.

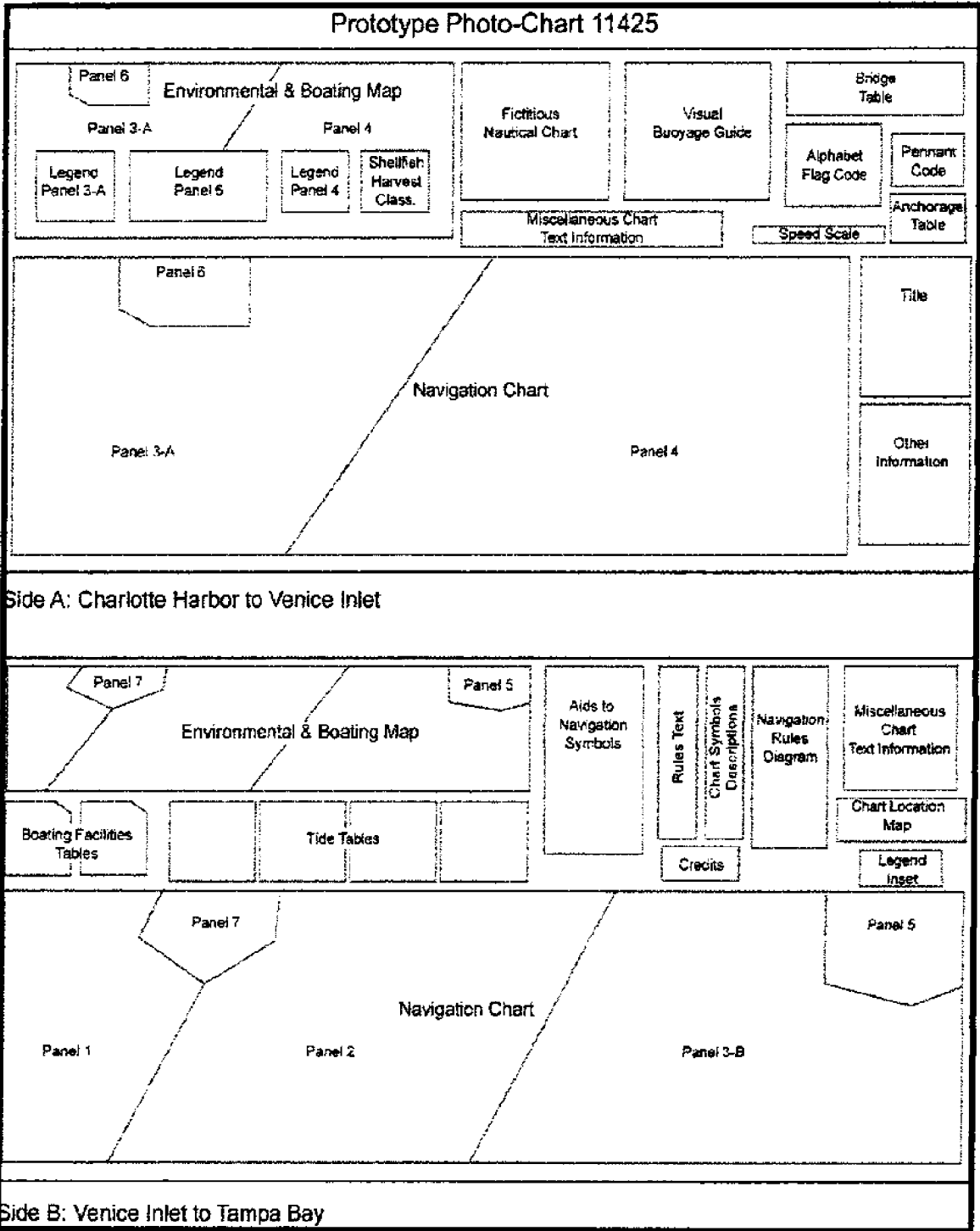


Figure 2. Photo-Chart Layout.

Background Aerial Photography and Imagery¹

Side A (Panels 3–A and 4) uses 4–meter resolution, digital infra–red, aerial ortho–photography, converted to natural color (Plate 3, page 8). The infra–red color photography in Panel 6 (Venice Inlet) has 2–meter resolution (Plate 4, page 8). The background imagery covers both water and land. Side B uses 5–meter resolution, composite satellite imagery (EOSAT IRS–C), color–fused with aerial photography (Plate 5, page 8).

Ancillary Boater Products

This section describes the other information products that were distributed to and reviewed by volunteer boaters.

Guide to Anchorages in Southwest Florida, 2nd Edition



A boaters' guide to popular recreational overnight anchorages in Southwest Florida, entitled "A Guide to Anchorages in Southwest Florida, 2nd Ed." (1998), was produced by the Boaters Action and Information League (BAIL), in association with Florida Sea Grant, the Florida Department of Environmental Protection, the Southwest Florida Regional Planning Council, and the West Coast Inland Navigation District. The guidebook organizes 47 popular anchorages into four boating regions: (1) Capri Pass to the Okeechobee Waterway; (2) Sanibel to north Charlotte Harbor; (3) Boca Grande to Big Sarasota Pass; and (4) Big Sarasota Pass to

south Tampa Bay. Anchorages within regions 3 and 4 are situated in the area covered by the prototype chart.

The guidebook features photographs with superimposed course lines, chart–lets with preferred course and buoys, anchorage descriptions, boating and anchoring tips, a

¹The digital photography and satellite imagery are made up of a very large number of grid cells, called pixels, each of which contains a picture signature record. The computer has been used to process and enhance the digital pixel values; different images have been combined (fused), and color values substituted. Some imagery is responsive to infrared light which gives a 'false–color' characterization of the earth; healthy vegetation shows up as red and urbanized areas display as tones of blue and gray. Some of the infra–red imagery has been converted to approximate normal color. The prototype chart uses ortho–photographs that are distortion–free and show true positions of all ground features. Image resolution is related to the size of the area on the ground associated with each digital pixel measurement. Thus, a smaller pixel size equals higher resolution, greater clarity and more detail.

Color Plates

Illustrations of Background Imagery Types and Bathymetric Mapping



Plate 1. Panels 1, 2 and 3B.
Bathymetry shown as spot soundings over white (greater than 6 feet) and blue (less than 6 feet) depth ranges.

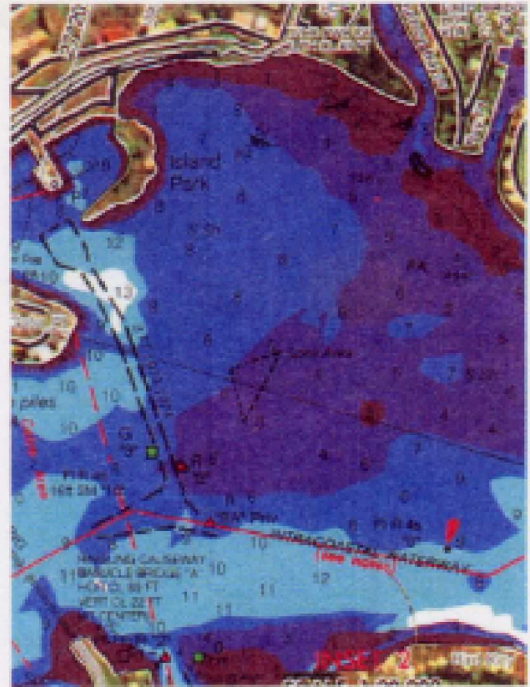


Plate 2. Panel 5. Bathymetry shown as spot soundings over color-shaded 3-foot depth ranges.

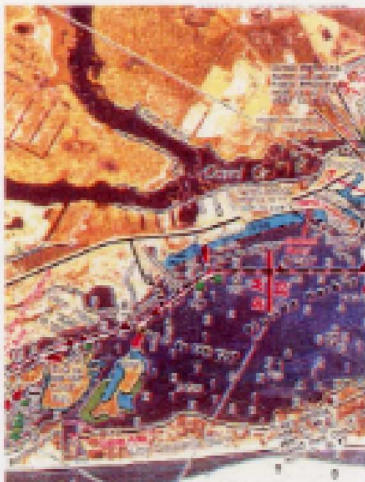


Plate 3. Panels 3A and 4 where land and water are shown by color infra-red imagery that has been converted to natural color.



Plate 4. Panel 6 where land and water are shown by color infra-red imagery.

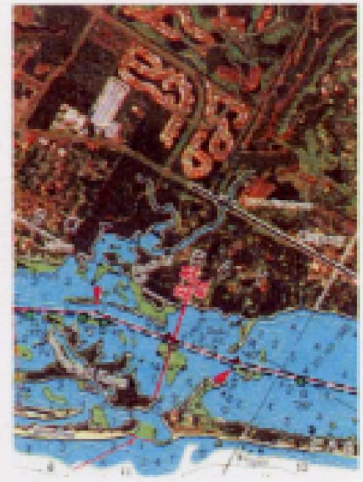
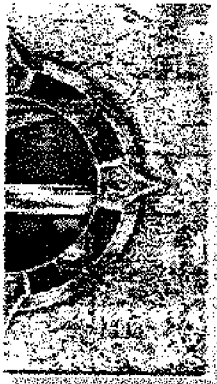


Plate 5. Panels 1, 2, and 3B where land is shown by a composite satellite image (EOSAT IRS-C) fused with aerial photography.

link to the Florida Sea Grant Web Site for Southwest Florida Anchorages, and large-scale photo-maps of selected anchorages. Each anchorage received the following treatment: (1) color oblique aerial photograph; (2) chartlet, with map symbols for anchorage, navigation aids, special hazards, reference points and names, graphic scale; (3) description of sensitive habitats if present, and shore services where available; (4) approach channel and anchorage minimum depths; (5) distances to and from adjacent anchorages; (7) reference to appropriate NOS chart; and (8) location (latitude, longitude).

Sarasota Bay Blueways Pocket Guide



The Sarasota Bay Blueways: Recreational Opportunities for the Boater, is a pocket guide produced by the Sarasota Bay National Estuary Program. The following organizations contributed to the guide: Florida Sea Grant; Sarasota County Department of Natural Resources; Manatee County Department of Environmental Management; Florida Department of Community Affairs Coastal Management Program; Florida Department of Environmental Protection; Florida Marine Research Institute; Sarasota Power Squadron; Venice Power Squadron. The guide is designed to help the boater learn more about and enjoy Sarasota Bay by locating main channels, sea grass, artificial reefs, bird-viewing areas, boat

ramps and canoe/kayak launches, fishing piers, marinas and dockside restaurants. The guide also includes information on bay habitats, flora and fauna, boating safety tips, and a resource directory. A diagram depicting popular sport fish, and identifying fishing seasons, habitat and fishing tips, is also included.

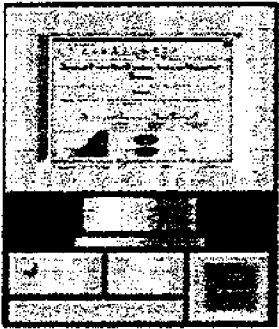
Anchorage and Waterway Place-Mat Photo-Maps



Six photo-maps of popular boating locales, located within the area covered by the Prototype Navigation Chart #11425, also were reviewed by volunteer boaters. These photo-maps were prepared as place-mats for waterfront businesses by Florida Sea Grant with support from the West Coast Inland Navigation District, Florida Department of Environmental Protection Southwest Florida

Aquatic Preserve, and the NOAA Coastal Service Center. The place-mats show depths (as color-shaded depth ranges), bottom sediments, sea grass, selected navigation aids, and boating hazards. In addition, channel center-line routes are marked, for approaching and transiting the locales.

Internet Web Site for Southwest Florida Anchorages



The Florida Sea Grant Anchorage Web site was designed and produced in coordination with the Regional Harbor Board for Southwest Florida and with the cooperation of the West Coast Inland Navigation District. The Web site (<http://flseagrant.org/science/anchorage>) provides a bibliography of boater-related publications available from Florida Sea Grant. The anchorage inventory link contains a virtual tour of the publication "A Guide to Anchorages in Southwest Florida 2nd Ed.," described above. Also included is information on the Regional Harbor Board of Southwest

Florida, describing its goals and bylaws, and resource information to help boaters select and enjoy many popular anchorages. Other Web site features include information on local restrictions; maps and photos; links to weather, tides, and chart updating; and related program information pertaining to anchorage management and monitoring publications.

Survey Description and Implementation Schedule

Two mail surveys were implemented to profile boaters and to obtain product feedback. This section describes the two surveys and provides the implementation schedule.

1. Boater Profile Survey

The Boater Profile Survey was developed to characterize the boating population of the region covered by the prototype 11425 chart and to encourage boaters to participate in the follow-up project activities, namely, to use and evaluate the prototype chart and ancillary information products. Another objective of this survey was to determine the extent to which perceptions, attitudes, and behavior differ among discrete boating populations.

The survey instrument included questions regarding boat type, draft, mooring location; preferred boating activities; and manner of use and type of navigational/piloting equipment. In addition, a series of attitudinal-type questions posed hypothetical boating situations such as,

"You are underway and you notice one of your passengers tossing a beer can overboard. Do you."

1. Continue on your course
2. Double back trying to retrieve the beer can
3. Talk with your passenger about what to do and what not to do while on the water
4. Say nothing

These questions tested the respondent's knowledge about operating boats in an environmentally responsible manner. Other questions sought information about the boaters' socioeconomic characteristics, such as age, sex, education, employment, income, and residence. See Appendix B, for the Boater Profile Survey, "The How, When and Why of Recreational Boating in Southwest Florida, November 1998".

2. Product Evaluation Survey

A Product Evaluation Survey was mailed to 481 volunteers who completed the Boater Profile Survey and volunteered to use the prototype products during a three-month test period (February-April, 1999). This survey instrument included questions regarding the content, format, and usefulness of the prototype information

products. The survey objectives were to obtain feedback from boaters regarding the content and cartographic representation of the prototype chart, to determine which information products—prototype chart, pocket guide, place—mats, anchorage guide, anchorage Web site—were most or least useful to boaters, and to test if such products can change the environmental perception, attitudes, and behavior of boaters.

The Product Evaluation Survey was divided into three parts. Part 1 contained questions regarding the amount of time spent boating in the area covered by the prototype chart and the use of the prototype products during the survey period.

Part 2 focused on the individual map panels and supplemental information tables and diagrams (buoyage, navigation rules) contained on the prototype chart. Boaters were asked to rate the “usefulness” and “readability” of the background imagery; bathymetric display; environmental information (sea grass, shellfish harvesting, and mangrove areas); supplemental diagrams; and anchorage, bridge, and boat ramp information.

Part 3 centered on an evaluation of the use and relevance of the ancillary boater products, including the pocket guide, place—mats, anchorage guidebook, and anchorage Web site. In addition, boaters were asked the extent to which the prototype products influenced their boating practices, such as enhancing awareness for boat safety, reducing potential conflicts, increasing boating enjoyment, and affecting decisions to avoid adverse environmental impacts. See Appendix B for the Product Evaluation Survey, “Prototype Photo—Chart, Map, and Guidebook Evaluation, April 1999”.

3. Implementation Schedule

The opinion and evaluation surveys were administered using established mail survey procedures (Dillman, 1978)². A pre—test of the survey took place at Longboat Key Moorings. A time—line for the survey implementation is presented in Figure 3. The Boater Profile Survey questionnaire was mailed to a random sample of 1500 boaters selected from the Florida Vessel and Title Registration System in early—November, 1998. An invitation to use and evaluate the prototype—chart and other information products was included in that initial mailing. In mid—November, a “reminder” postcard was mailed to survey recipients who had not yet completed and returned the survey. An accounting of returned surveys and volunteer invitation cards revealed lower than anticipated response and volunteer rates. It was determined that a mail—out to 1500 additional boaters would provide better results than a second mailing to those boaters from the first selection who had not returned the survey or volunteer card. As a result, a pre—survey questionnaire and volunteer invitation was mailed, in mid—December, to an

² Samples of survey instruments, the trip log, reminder cards, and accompanying correspondence are provided in Appendix B.

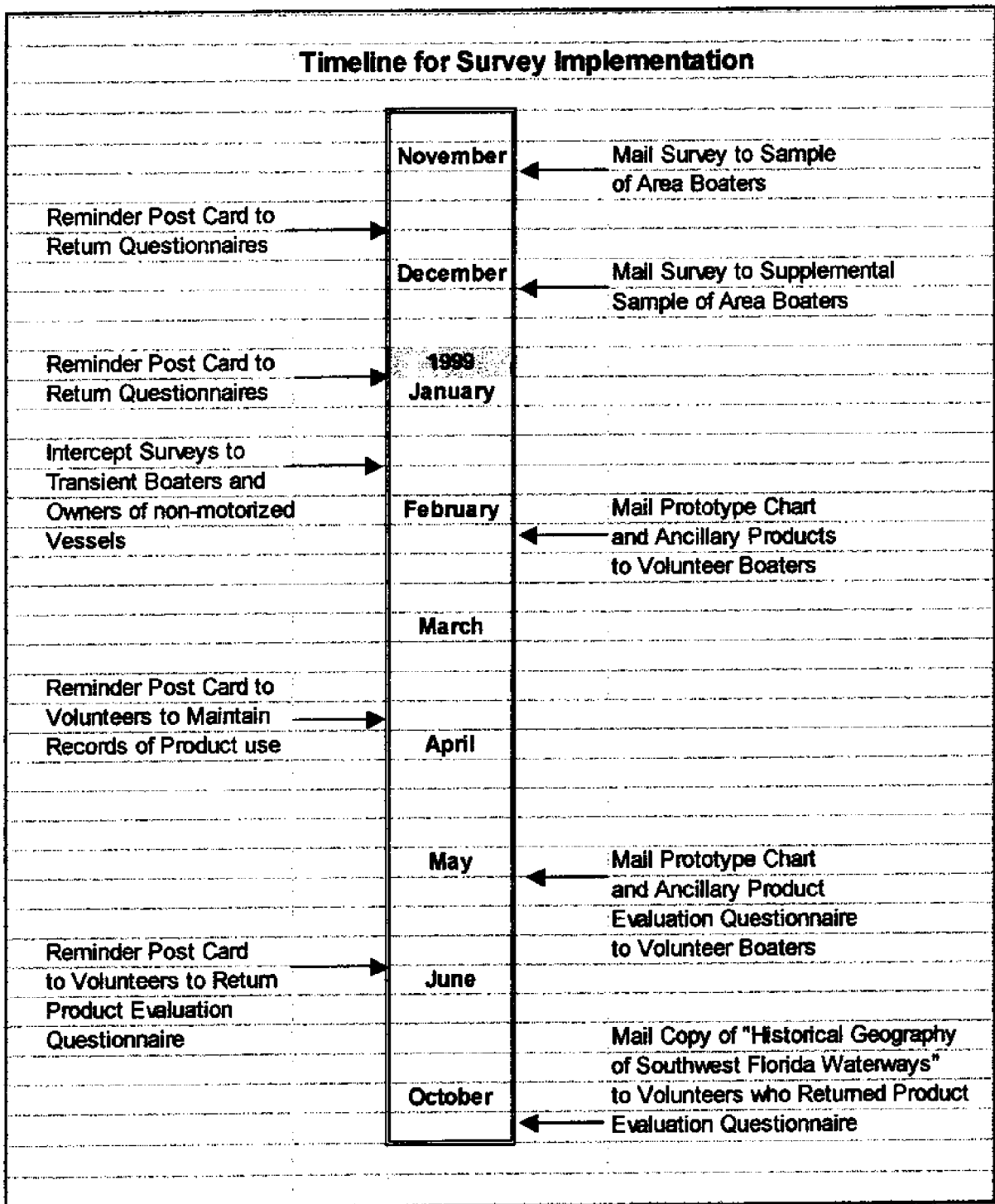


Figure 3. Survey Implementation Time-line.

additional stratified random selection of 1500 boaters in the tri-county study area. A "reminder" postcard was mailed, in late-December, to those boaters of the second sample who had not yet returned questionnaires and / or volunteer cards.

In early January, 250 field intercept surveys were conducted at boat ramps, access points for canoes and kayaks, and marinas in order to target transient boaters. In late January, each "volunteer" boater was mailed a package consisting of test instructions and a trip log, along with the prototype chart, a conventional chart 11425, photo-maps, a "Guide to Anchorages in Southwest Florida, 1st edition", a copy of the Anchorage Web Page, and a "Sarasota Bay Blueways Recreational Opportunities for the Boater" (pocket-size foldout map).

In late March, volunteers received a postcard reminding them about their obligation to maintain accurate trip log records of product use. In early May volunteers were mailed the Product Evaluation Survey questionnaire along with the second edition of the "Guide to Anchorages in Southwest Florida." A reminder postcard was mailed, in late May, to volunteers who had not yet returned evaluation surveys. Due to a delay in the printing of "A Historical Geography of Southwest Florida Waterways", this publication was not mailed, as a thank-you gift, to volunteer boaters until October, 1999.

Methods

The analysis section has the following objectives:

- (1) To verify that a representative sample was initially established and maintained throughout the boater profiling and product evaluation phases of the project;
- (2) To determine the extent to which environmental awareness and proto-type product information preferences varied among boating subgroups as defined by boat use types;
- (3) To determine what types of additional information are preferred by boaters
- (4) To determine if the prototype products can change boaters perceptions, attitudes and behaviors on the water; and,
- (5) To estimate the boating pressure within the study area covered by the prototype chart.

Each of these objectives is discussed and the methods or analytical approaches used to satisfy the objective are elaborated. The results of the analysis are described in the subsequent 'Results' section of the report.

1. **Objective 1. *To verify that a representative sample was initially established and then maintained throughout the boater profiling and product evaluation phases of the project.***

- a. Sample Selection

A prime objective of the analysis was to ensure that the sample drawn would be representative of the boating population operating in the region covered by the prototype chart. Related to this objective was the need to ensure that the Boater Profile Survey and Boater Product Evaluation Survey were internally compatible.

The initial research problem was to define the target population and to identify a sample of recreational boaters who use the waters covered by the prototype chart. The following two-step procedure was adopted to obtain a representative sample of resident boaters and a random sample of transient boaters:

Resident Boaters:

The 1998 Florida Vessel and Title Registration System (VTRS) was used to draw a stratified random sample of boaters who reside in the study region. There are 44,330 recreational vessels registered in the three counties covered by the prototype chart (Appendix C–Table 1). Since the VTRS does not catalog registered vessels by intended or primary use, each of the 44,330 registered vessels was classified into one of seven intended use boat types, based on an interpretation of the “make”, “model”, and “length” fields contained in the VTRS. Boat types include: (1) rowboat, canoe, kayak (motorized); (2) sailboat (non–motorized); (3) skiff, speed, john, utility, pontoon boat; (4) auxiliary–powered sailboat; (5) cabin–cruiser, trawler, houseboat; (6) personal watercraft; and, (7) other (unidentifiable). For example, a Beneteau 305 was classified as an auxiliary–powered sailboat. Powerboats, such as a Carver 380 and a Cruisers Esprit 370, were considered a cabin–cruiser/trawler/houseboat type, while a Gamefisher 15 was placed into the skiff/speed/john/utility/pontoon–boat type. It should be noted that there are obvious instances where vessels, especially powerboats, can be classified as more than one type, but it is assumed that these errors will be randomized over the entire sample population. This initial classification was necessary to target specific boating populations given that both surveys—Boater Profile Survey and Boater Product Evaluation Survey—hypothesized that differences would exist, on the basis of boat type or intended use, in environmental awareness, attitudes, and perceptions and in information preferences.

A stratified random sample of 3,000 resident boaters was drawn from the 44,330 vessels registered in the three counties of the prototype chart region. The sample was drawn proportional to the boat population and boat types in each county. The proportional distribution is shown in Appendix C, Table 2. The sample numbers, by county and by boat types (Appendix C, Table 3), were computed as follows. The values in the first column (Boat Type Totals) were obtained from the VTRS. The second column figures, Sample Proportion (of 3,000), were computed by calculating the percentage of each Boat Type Total for each activity, based on the total number of vessels (44,330) operating within the study region. An example of this calculation, for the rowboat/canoe/kayak type, is as follows:

$$\left(\frac{\text{Boat Type Total}}{\text{Boat Population}} \right) (\text{Sample Size})$$

or

$$\left(\frac{734}{44330} \right) (3000) = 50$$

Thus, 50 surveys were allocated for rowboat/canoe/kayak.

The County allocation of survey questionnaires was computed based on the respective percent Boat Type Total values (Manatee: 34 percent, Sarasota: 41 percent, and Charlotte: 25 percent) calculated for the rowboat/canoe/kayak category as follows:

$$\text{Percent Sample Allocation by County} = \frac{250}{734} 100 = 34\% \text{ Manatee County}$$

$$\text{Percent Sample Allocation by County} = \frac{185}{734} 100 = 25\% \text{ Charlotte County}$$

$$\text{Percent Sample Allocation by County} = \frac{299}{734} 100 = 41\% \text{ Sarasota County}$$

The County sample allocation for the rowboat/canoe/kayak category is determined as follows:

(Boat-type Sample) (% Sample Allocation by County)

or

$$\text{Manatee County} = \frac{(50) (34)}{100} = 17$$

$$\text{Sarasota County} = \frac{(50) (41)}{100} = 21$$

$$\text{Charlotte County} = \frac{(50) (25)}{100} = 12$$

Transient Boaters:

Two groups of boaters could not be captured through the VTRS selection method. They were transient boaters who either (1) trailered their boats or (2) sailed their vessels to southwest Florida. The method adopted to sample resident boaters could not be used to select a random sample of transient boaters because the actual number and location of transient boats in the study area is unknown. A convenience sampling approach was adopted. Owners of trailered vessels were contacted at popular ramps within the study region. Transient boaters who sailed to southwest Florida were contacted at marinas, anchorages, and yacht clubs. A total of 250 Boater Profile Survey questionnaires were distributed to these boaters.

Convenience sampling is a practical method which involves surveying available and willing participants. However, the sample is opportunistic and voluntary, which means that participants may be unlike most of the constituents in the target population. Despite these drawbacks, convenience sampling is appropriate in such cases where the target population is small and restricted to specific locales such as ramps, marinas, and yacht clubs (Fink, 1995).

b. Boater Participation in Surveys

The boater sample, described above, provided the baseline for the first survey, the Boater Profile Survey, which was undertaken primarily to characterize the boating population. A secondary objective of this first survey was to encourage boaters to participate in the follow-up project activities, namely, use of the prototype materials and their subsequent evaluation.

The Boater Profile Survey questionnaire was mailed to 3000 resident boaters; 828 individuals returned the questionnaire, and 417 volunteered to use and evaluate the prototype chart and other information products (Appendix C, Table 4). Of the 3000 questionnaires mailed to resident boaters, 232 were returned undelivered by the US Postal Service for incorrect address or because the boat owner had moved and left no forwarding address. Another 250 Boater Profile Survey questionnaires were distributed to transient boaters; 87 returned the questionnaire, and 64 volunteered to use and evaluate the prototype products. The number of questionnaires received by boaters was 3018, and the number completed was 915 (828 resident, 87 transient); this represents a 30 percent return rate: $(915/3018)*100$. Of those boaters who completed this questionnaire, 53 percent (481) volunteered to use and evaluate the prototype products (417 resident, 64 transient). For the second survey, the Boater Product Evaluation Survey, 132 volunteers completed the questionnaire; this represents a 27 percent rate of return.

Significant numbers of volunteers "dropped out" as the study progressed, due in part to the length of the three-month product evaluation period. Therefore, it was necessary to determine if the numbers of boats in the various type categories were maintained, and if not, to test if significant discrepancies in receipt / return rates would impact the study findings. Several tests were conducted to verify, first, that the Boater Profile Survey responses were compatible with, and representative of, the general boating population of the study area, and second, that the results from the first Boater Profile Survey and the second Boater Product Evaluation Survey were internally compatible and representative.

c. Relation of the Boater Sample to the Boating Population

Three thousand Boater Profile Survey questionnaires were mailed to a sample of resident boaters, and 250 were distributed at intercept locations to transient boaters, using established survey procedures (Dillman, 1978). A total of 828 usable Boater

Profile Survey questionnaires were returned from residents and 87 from transients (Appendix C, Table 4). Every effort was made to encourage participation from all boater types operating in the study region. Notwithstanding, fairly significant proportional differences are apparent for some boat types between the numbers of questionnaires distributed and those completed (Appendix C, Table 5). Sailboats, non-motorized and auxiliary-powered, make up 42.1 percent of the boating population, but account for only 15.5 of the completed questionnaires. The cabin-cruiser/trawler/houseboat type makes up 6.1 percent of the population, yet represents 23.5 percent of the responses. And the skiff/speed/john/utility/pontoon-boat type, which makes up 35.7 percent of the study region's boat population, amounts to 45.7 percent of the completed questionnaires. Some of these differences may be related to the nearly 6 percent of the boats in the VTRS database that were unidentifiable as to vessel type. Discrepancies may also be due in part to boaters who did not return the questionnaire.

Such differences do not, however, translate to statistical bias, due to the large sample size obtained for boat types showing the highest receipt/return discrepancies. Furthermore, the maintenance of relative boat type proportions is less important, given that the primary project objective is, simply, to have boaters "evaluate" products, such as the prototype chart. Even the boating pressure estimate should not be significantly affected since reliable overall estimates have been obtained for the proportional distribution of vessels operating in the study region.

d. Compatibility of the Boater Profile and Boater Product Evaluation Surveys

The recommendations made in this report are based in part on a statistical evaluation of the responses of the relatively small number (132) of boaters who completed both the Boater Profile Survey and the Boater Product Evaluation Survey questionnaires. Since the sample size of the Boater Product Survey is significantly smaller than the Boater Profile Survey (N = 132 versus N = 828), a composite data set was compiled to determine whether the sub-population of 132 (those who completed both survey questionnaires) is representative of the larger 828 sample (those who completed only the Boater Profile Survey questionnaire). Since all 132 respondents who completed the Boater Product Evaluation Survey questionnaire had also completed the Boater Profile Survey questionnaire, answers in both questionnaires can be analyzed for their compatibility (Appendix C, Table 6).

One question concerning boat type was included in both surveys: "What type of vessel do you spend most of your boating time?" (Boater Profile Survey), and, "What type of vessel did you use most often to test our charts, maps and guide materials?" (Boater Product Evaluation Survey). This question was used to test the similarity among boat types: the Boater Profile Survey respondents and the sub-population who answered both the Boater Profile Survey and the Boater Product Evaluation Survey. The six boat types used in the Boater Profile Survey question were reduced to four types in the Boater Product Evaluation Survey, by consolidating all sailboats, and by

including personal watercraft with the skiff/speed/John/utility/pontoon-boat type. An additional boat category—recreational fishing boat—was added to the skiff/speed/John/utility/pontoon-boat type in the Boater Product Evaluation Survey (please refer to Objective 2 for an explanation of why boat-types were collapsed for analytical purposes).

Differences in boat-type ratios between the respondents of the larger population (Boater Profile Survey, where N = 828) and the sub-population (volunteers who returned both surveys, where N = 132) are shown in Appendix C, Table 6. The large differences in the ratios for the two categories—skiff/speed/John/utility/pontoon type (20.2 percent), and cabin-cruiser/trawler/houseboat type (11.1 percent)—may be related to consolidating recreational fishing boats within the skiff/speed/John/utility/pontoon boat type, whereas some of these fishing boats may be more appropriately classed within the cabin-cruiser/trawler/houseboat type. Another notable difference in the boat type ratios is sailboats, 8.7 percent. Minor differences are noted for rowboat/canoe/kayak (0.6 percent), and personal watercraft (0.4 percent).

2. Objective 2. To identify the extent to which environmental awareness and prototype product information preferences varied among subgroups as defined by boat use types.

This section discusses the methods used to verify the extent to which environmental awareness, attitudes, and navigational skills (Boater Profile Survey) and information needs (Product Evaluation Survey) differed among boater sub-groups. Similar analytical methods were used to evaluate data from the two questionnaires.

a. Boater Profile Survey

An exploratory analysis of margin totals (simple tabulation of respondent answer choices differentiated by boat-type, ownership, gender, age, education, etc.) was used to identify similarities and differences in response profiles among boater sub-groups. Additionally, questions in the Boater Profile Survey that elicited boat type and sociodemographic information also were used as dependent variables in a chi-square analysis to describe how respondents in boater sub-groups reacted when confronted with various boating situations, such as:

Question 36. You are underway and you notice one of your passengers tossing a beer can overboard. Do you

Continue on your course

Double back trying to retrieve the beer can

Talk about what to do and what not to do while out on the water

Say nothing

b. Product Evaluation Survey

For the purpose of analysis, questions in the Boater Product Evaluation Survey were divided into two groups: (1) dependent variables that describe the respondents and are believed to influence boating activities, e.g., boat type, income, employment, age, employment status; and (2) independent variables, namely, answers to questions that describe the respondent's reaction to and use of the prototype information products.

All questions in the Boater Product Evaluation Survey were analyzed by two dependent variables, boat type and education. This initial analysis showed very few differences in the majority of approximately 200 independent cases that were examined. A subsequent, more comprehensive, analysis was undertaken which examined the relations between boat types and all 51 questions requiring a quantitative response.³ A total of 40 questions were analyzed using the N x N chi-square statistic. The 11 remaining questions were Likert-type questions in which the respondent is requested to rate a particular condition or situation on a scale from 1 to 9. These questions were analyzed using the Student's t-test.

c. Methods

One of the most robust non-parametric statistics is the N x N chi-square statistic (X^2). The statistical model appears below.

$$X^2 = \sum \sum \frac{(O_i - E_j)^2}{E_j}$$

where:

O_i = recorded observations which meet the conditions set by the column and row requirements

E_j = expected observations assuming random conditions computed by multiplying row total by column total of the respective cell divided by the overall sample size (N)

The chi-square model tests the extent to which a sample distribution varies from what would be expected under random conditions. In addition, this statistic also provides the analyst with direction by identifying which cells contribute most to the overall chi square statistic. Only nominal (categorical) data are required for this test. There are, however, two limitations imposed on this method commonly known as

³Of the original 60 questions included in the Boater Product Evaluation Survey nine required the respondent to write-in his or her answer. These responses are dealt with elsewhere in the report.

sparsity constraints. The first of these requires that no less than 20% of the cells can have fewer than 5 observations. Unfortunately, the Boater Product Evaluation Survey comprises a sample size of only 132 observations. A lack of observations for some questions (due to a small sample size of some boat type categories and to non-responses) posed significant limitations on the chi-square analysis. The second sparsity constraint requires that no cell in the contingency table can have zero observations. This also posed problems for the same reasons. Observation and sparsity problems were minimized by increasing the sample size for various dependent variable classes. This was accomplished by collapsing⁴ the original six boat types into four types and the education variable into three categories⁵.

The Student's t-test was applied to questions in the Boater Product Evaluation Survey that requested the respondent to evaluate the "usefulness" or "readability" of a product, on a scale of 1 through 9. This test assumes normally-distributed data and tests whether a sample distribution can reasonably be assumed to be representative of the universal population or an estimate of the universal population.

It may be recalled that Objective 1 evaluated and verified the compatibility of the Boater Profile Survey with the Boater Product Evaluation Survey and with the overall boating population in the study region. We assume, for Objective 2 analysis, that the results of the Boater Product Evaluation Survey are duly representative. The following discussion reports on test runs to determine whether each of the means and standard deviations of the sub-categories characterizing the two dependent variables (boat types and education) vary significantly from the mean estimates of the statistical universe (all recreational boaters in the study region).

The Students' t-test model appears below:

$$Student\ t\ Test = \frac{(X_{me} - \mu)}{\left[\frac{Std_x}{\sqrt{N - 1}} \right]}$$

where:

⁴ The original six boat type categories (kayaks, etc., non-powered sailboats, auxiliary-powered sailboats, speed boats, etc. personal watercraft (PWC), and cabin-cruisers etc. were grouped into four boat types (kayaks, etc., all sailboats, speed boats and PWC, and cabin-cruisers.

⁵ One group included those respondents who had completed high school. The next group included those who had completed four years of college, while the third group included those with post-graduate education.

X_{me} = mean of the sample

μ = universal mean

Std_x = Standard Deviation of the sample distribution

N = Number of observations

d. Findings

Two general observations can be made. First, of the more than 200 chi-square tests that were undertaken, only a handful of analyses (11) suggested the presence of a statistically significant relationship. Furthermore, the sparsity constraint was invoked in all of the tests undertaken when boat type was the independent variable (Appendix C, Table 7) and for a number of the contingency tables with education as the dependent variable (Appendix C, Table 8). This obviously limits the ability to statistically test relationships between dependent variables and responses to individual questions, although trends and general conclusions can be drawn. Appendix C, Tables 7 and 8, summarize chi-square tests which indicate the existence of statistically significant relationships between boat-type and education with the usefulness and readability of specific navigational chart panels and ancillary products.

The fact that few significant relationships were found raises an important consideration that relates to the alpha level (confidence interval) that was set at 0.05. This means that the analyst accepts the probability of accepting the results with a probability error of 5%. Since more than 200 chi-square tests were performed, it is quite possible that a significant number of those 11 tests, which indicate that a significant relationship does exist, might be spurious. Statistically significant relationships may be due to random error.

Significant Student t-test results are summarized for boat-type in Appendix C, Table 9, and for education in Appendix C, Table 10. Only 10 relationships—out of 101 individual analyses—were found to be statistically significant. This strongly implies that boat-type and education had no appreciable impact on how the respondent felt with respect to the navigational materials tested.

3. Objective 3. To determine what types of additional information are preferred by boaters.

The third objective sought to identify additional information preferred by boaters. This objective was addressed by questions contained in the Boater Product Evaluation Survey. A frequency-weighted rank score statistic was used to index boater responses to a list of choices regarding the readability and usefulness of prototype information. Tallies for each reason or choice criterion were ranked by their frequency of occurrence.

The frequency-weighted rank values were summed to obtain a score, and the scores were ranked. The advantage of the "composite score statistic" is that comparisons can be made of the results from different questions, regardless of the number of options included in the evaluation. Furthermore, this statistic is unaffected by the number of respondents answering the questions. This approach was used for two types of questions: readability rating and usefulness rating.

a. Readability Rating

Elements of the prototype chart that were evaluated for their readability included: imagery examples (infra-red color photography; infra-red color photography converted to normal color; and composite satellite imagery, color-fused with aerial photography); navigation information (chart panels with renderings of imagery, bathymetry, scale); and environmental and boating information (supplemental map panels with renderings of habitat anchorage, ramp, bridge features).

An example of these 'readability' questions appears below:

Q-11 Please rate the 'readability' of the information on the panels in the Navigation Chart portion (bottom section) of the Prototype. (For the panel(s) listed on each row, mark and 'X' in the box that best describes its readability.)

| <i>Chart Panels</i> | <i>Very Easy</i> | <i>Easy</i> | <i>With Some Effort</i> | <i>Great Effort</i> | <i>Impossible</i> |
|---------------------|------------------|-------------|-------------------------|---------------------|-------------------|
| <i>3-a and 4</i> | | | | | |
| <i>6</i> | | | | | |
| <i>1,2 and 3-b</i> | | | | | |
| <i>5</i> | | | | | |
| <i>6</i> | | | | | |

This readability analysis assumed that the quantitative differences between the response choices were identical. Thus, the difference between "Very Easy" and "Easy" would be identical to the difference between "Easy" and "With Some Effort." In short, we dealt with these questions as interval data. In Question 11, we were interested in identifying the composite score for panels 3a and 4, for panel 6, etc.

The composite score statistic was computed in the following way. Each of the column headings was assigned a value based on the number of response options presented. In the case of Question 11, a total of five options were presented to the respondent (Very Easy, Easy, With Some Effort, Great Effort, and Impossible). The highest value was assigned to the responses that the panel was "Very Easy" to read. A response indicating that a panel was "Easy" to read scored a value of four. The following table illustrate how the "composite score statistic" was computed for panels 3-a and 4.

The first column identifies the respondents who chose to answer this question. Let us assume that a total of 116 respondents⁶ answered this question, where the first boater rated Panels 3–a and 4 “Easy.” This response was accorded a score of 4. Respondent 2 scored Panels 3–a and 4 with “Great Effort.” This response contributed 2 points. The last respondent (the 116th) scored Panels 3–a and 4 “Easy,” which contributed 4 points to the “Easy” column. The last row in Table 1 is the sum of each of the five columns.

| Respondents (Count) | Very Easy (5) | Easy (4) | Some Effort (3) | Great Effort (2) | Impossible (1) |
|------------------------|------------------|-------------|-----------------------|---------------------|-------------------|
| 1 | | 4 | | | |
| 2 | | | | 2 | |
| 3 | 5 | | | | |
| . | 5 | | | | |
| . | | | 3 | | |
| . | | | | | 1 |
| . | 5 | | | | |
| 116 | | 4 | | | |
| Column Total | 310 | 78 | 37 | 14 | 7 |

Table 1. Computation of Composite Score Statistic for Panels 3–A and 4

The composite score statistic is computed by summing all five column totals (310 + 78 + 37 + 14 + 7 = 446). This value is divided by the maximum possible score that all 116 respondents rated the two panels (3–a and 4) “Very Easy.” This score totals 580 (5 x 116). The composite score statistic (76.9 percent) is the actual score expressed as a percentage of the maximum possible. In this way, composite scores for the various information presented can be cross–compared. A composite score of 100 percent represents an extremely readable element.

b. Usefulness Rating

The usefulness score was applied to each of the prototype information products: navigation ,environmental and boating information on the prototype chart; pocket guide map features; anchorage guide features; and anchorage Web site features. The usefulness analysis assumed that values in the scalar are equidistant from one another, that is, the difference in value between 1 and 2 on the scalar is identical to the difference in value between 2 and 3, and so on.

An example of a “usefulness” question appears below:

⁶ The numbers used for this question are presented for illustrative purposes only.

Q-33. The map in the Pocket Guide shows boating resources and facilities. Please rate this information from the most useful (1) to the least useful (9). (For each feature listed below, circle appropriate number.)

| Map Features | Usefulness Ratings (circle answer) |
|-----------------------------------|------------------------------------|
| | High Medium Low |
| Anchorage | 1 2 3 4 5 6 7 8 9 |
| Bay artificial reefs | 1 2 3 4 5 6 7 8 9 |
| Bird viewing | 1 2 3 4 5 6 7 8 9 |
| Boat ramps & canoe/kayak launches | 1 2 3 4 5 6 7 8 9 |
| Fishing piers | 1 2 3 4 5 6 7 8 9 |
| Marinas and dockside restaurants | 1 2 3 4 5 6 7 8 9 |

The usefulness statistic was developed as in the following example (Table 2). The highest value was assigned 9 and the lowest value was given 1. Thus, if the respondent indicated that the usefulness of the anchorage feature was 1 or "High," it was assigned a value of 9.

| High | | | Medium | | | Low | | | Scalar |
|------|-----|----|--------|----|----|-----|---|---|------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | # of Respondents (116) |
| 35 | 24 | 12 | 14 | 9 | 10 | 8 | 3 | 1 | |
| 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 315 | 192 | 84 | 84 | 45 | 40 | 24 | 6 | 1 | Value of Scalar (791) |

Table 2. Computation of Usefulness Rating Statistic.

Each of the numerical scale values was multiplied by the number of responses corresponding to it and the products were summed. The product sum represents the total score for all respondents for that question. In the example below, this value totals 791. The total number of respondents (116 in the example) was multiplied by the

highest value for that question. Assuming that the total number of respondents was 116, and the highest value was 9, the maximum “usefulness” score is 1044. The observed total (1044 in the example) is expressed as a percentage (75.8). This value represents the sum of all of the respondents’ scores on that question.

$$\text{Summary Score} = \frac{791}{1044} \times 100 = 75.8\%$$

4. Objective 4. To determine if the prototype products can change boaters perceptions, attitudes and behaviors on the water.

The fourth objective sought to determine the extent to which the boater’s perception and attitudes had been changed through the use of five prototype information products: photo-chart, pocket guide map, place-mats, anchorage guide, and anchorage Web site. A frequency weighted rank score statistic was developed, similar to the method for rating readability and usefulness, as described in Objective 3.

a. Impact Rating

This procedure, to compute the weighted rank score, covers Questions 31, 39, 44, 50, and 58 in the Boater Product Evaluation Survey. Under this objective, we wish to identify the extent to which the prototype products increase the boater’s awareness of boating safety, reduce boating-related conflicts, enhance the respondent’s boating enjoyment, and increase awareness of boating-related environmental impacts.

An example of an impact question is presented below.

Q-31. Did your use of the Prototype Photo-Chart affect the quality of your boating activities during the February-April test period? (Please mark an 'X' in the box that best describes your answer for each item below.)

| Types of Affected Boating Practices | A Lot | Some | Not Much | Not at All |
|--|-------|------|----------|------------|
| <i>Enhanced awareness for boat safety</i> | | | | |
| <i>Reduced potential conflicts</i> | | | | |
| <i>Increased boating enjoyment</i> | | | | |
| <i>Increased awareness about environmental impacts</i> | | | | |

There are four answer options: A Lot, Some, Not Much, and Not at All. The method assumes that the ratings are all equidistant on a four-point scale where "A Lot" is evaluated four times as much as the answer "Not at All." Each column is summed and all column totals are summed for a grand total. An illustration of how the impact rating statistic is computed is provided in Table 3.

| Respondents | A Lot (4) | Some (3) | Not Much (2) | Not at All (1) |
|-------------|--------------|-------------|-----------------|-------------------|
| 1 | 4 | | | |
| 2 | | | | 1 |
| 3 | | 3 | | |
| | | | | |
| | | | | |
| 121' | | | | |
| Total | 264 | 51 | 22 | 29 |

Table 3. Computation of Weighted Rank Score for Impact Rating Statistic.

Assume that 121 respondents answered Question 31. This table indicates that the first respondent ranked this question "A Lot," which contributed "four" value points to the weighted rank score, while respondents 2 and 3 rated the prototype photo-chart a "one" and "three," respectively. The sum of the column totals represents the raw score of the weighted rank score on Question 31, which totals 366.⁷

The weighted rank score statistic is expressed as a percentage of the recorded value and ranks the answer in relation to the theoretical maximum score, had all boaters responded "A Lot", i.e., 4 to the question. Assuming that 121 boaters answered Question 31, the maximum cumulative score would be $121 \times 4 = 484$. Further, assume that the sum of the four column totals was 366, made up of the following individual column totals (e.g., $264 + 51 + 22 + 29$). The two values—observed score and maximum score—can be expressed as a percentage:

$$\text{Weighted Rank Score} \left(\frac{366}{484} \right) 100 = 75.6\%$$

The advantage of a weighted rank score is that it can be compared, regardless of the number of observations in each of the five questions included in this analysis. The

⁷Numbers used in this table are for illustrative purposes only.

disadvantage is that the weighted rank score does not further an analysis of a specific question. Note, also, that this impact rating is limited to expressed—not actual (on-board)—behavior concerning each of the four areas related to the boating experience.

5. Objective 5. To estimate the boating pressure within the study area covered by the prototype chart

An estimate of the boating pressure by all 828 respondents who participated in the Boater Profile Survey is based on the ratio of respondents (N = 828) and the sub-sample of boaters who answered Questions 18, 19, 20, 21, 22, 23 (N = 107) on which the boat pressure procedure was based. The method developed has two parts. The first estimates the number of hours boaters actually spend on-the-water, and the information is drawn from the Boater Profile Survey (Equations 1–9). The second estimates the total boating pressure exerted on the study region, south Tampa Bay to north Charlotte Harbor (Equations 10–13). The final equation reports on-the-water time and boating pressure (hours/acre) by boat type for weekday, weekend, and holiday periods for the March–May season, inclusive.

Exceptions and exclusions include the following. First, no separate estimate has been made for transient boaters as there is no clear evidence of the proportion of boaters in this category; consequently, boaters captured by intercept surveys were analyzed as if their vessels were registered in Florida. Second, the analysis excludes live-aboards, boaters whose last trip on-the-water lasted in excess of 100 days or who appear to use their vessel as a primary or secondary residence. Third, the analysis is based on responses to six questions (18, 19, 20, 21, 22, 23) which were answered by 107 boaters of 828 in the Boater Profile Survey; we assume that the 107 boaters are representative of the 828 survey population. Boating pressure estimates are based on the boating season extending from March through May.

The specific questions used to calculate boating pressure included the following:

Question 18 *In what months are you most likely to take your boat out?*⁸

Question 19 *How many days ago did you last take your boat out?*

Question 20 *For day-trips, how long do you stay out when you participate in your most favorite boating activity.*

⁸ Each month was treated as a separate variable (e.g. Q18Mar, Q18Apr, etc.)

Question 21 *What proportion of your boating activity takes place on:*

_____ *Weekdays*
_____ *Weekends*
_____ *Holidays*

Question 22 *What are your top three boating activities? Please Choose from the following list. (Please use #1 for your favorite activity, #2 for your second favorite activity, #3 for your third favorite activity.*

| | | | |
|---------------------------|---------------------------|-------------------------------|---------------------|
| <i>daysailing</i> | <i>cruising</i> | <i>day racing</i> | <i>ocean racing</i> |
| <i>fishing (deep sea)</i> | <i>fishing (in-shore)</i> | <i>diving</i> | <i>wreck diving</i> |
| <i>speedboating</i> | <i>skiing</i> | <i>canoeing/row /kayaking</i> | |
| <i>other</i> | | | |

Question 23 *Using your top three favorite activities (question 22) what proportion of your total boating time do you spend with each?*

The boating pressure model is flow-charted in Figure 3. The diagram identifies the input variables for each equation and the linkages between the equations that make up the boating pressure model. The model was constructed as follows.

a. Derivation of Total Boating Months Variable (Equation 1)

First, an estimate of the total amount of time spent on-the-water was derived by summing the number of months the respondent went boating.

$$TotBotMon = (Q18Mar + Q18Apr + Q18May)$$

where:

TotBotMon = Total number of months all respondents went boating during the past high boating season.

Q18Mar-Q18May = The number of months a respondent went boating.

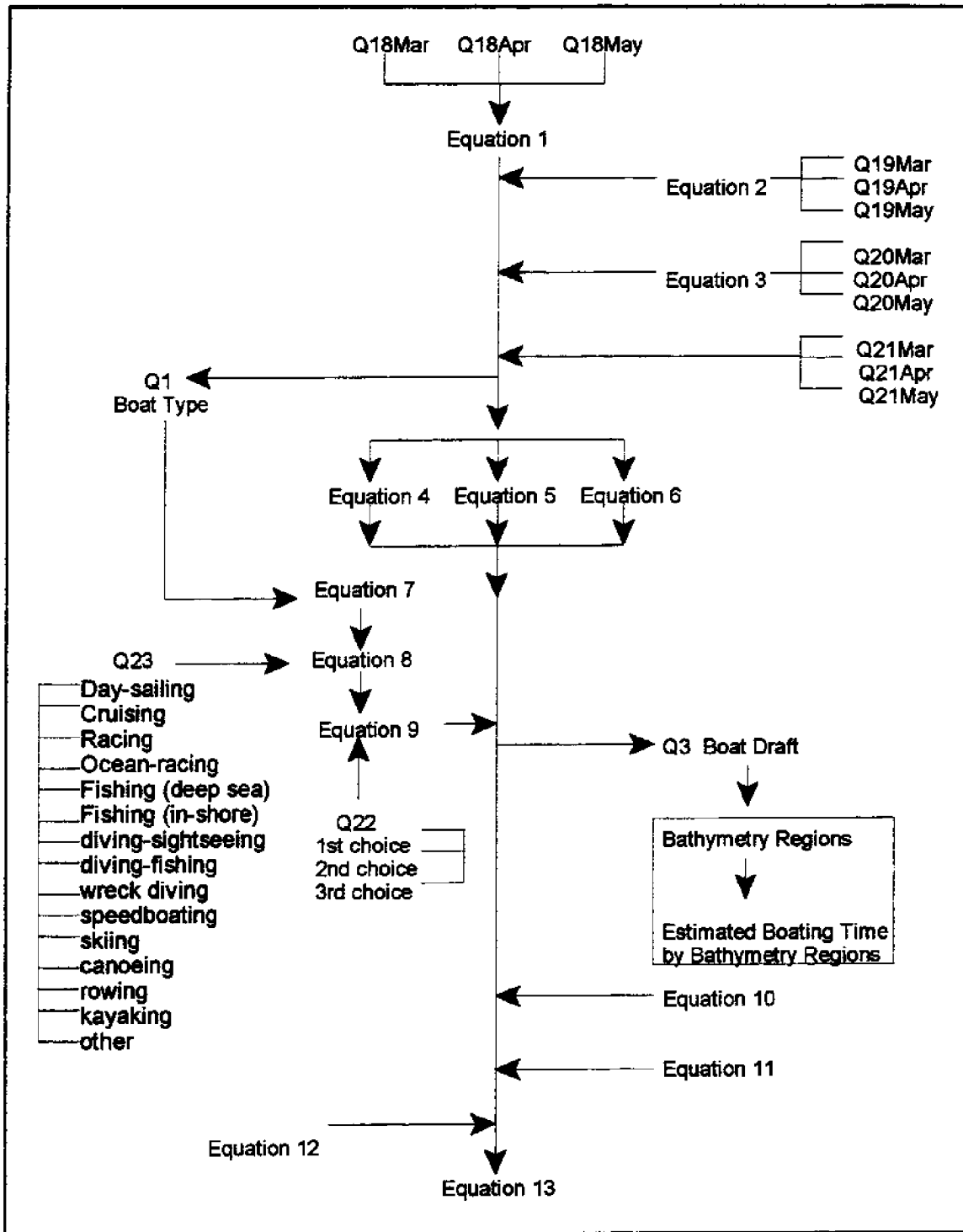


Figure 4. Boating Pressure Model.

b. Derivation of Total Boating Days Variable (Equation 2)

Daily boating is derived from Question 19 (Q19Days) in which respondents were asked the number of days since they last went boating.

$$TotBDays = \left(\frac{30}{Q19Days} \right) TotBotMon$$

where:

- TotBDays = converts the boating season by months into a boating season in days
- 30 = average number of days per month (rounded to the nearest day)
- Q19Days = number of days the respondent went boating last⁹

c. Derivation of High Season Boating Hours Variable (Equation 3)

Question 20 requested the respondent to provide information on the average trip length, in hours. The Total Boating Hours (TotBHour), estimated below, is the product of Equation 2 Total Boating Days (TotBDays) and Question 20 (Q20Dur) which asked the respondent to provide the average length of his or her boat trip.

$$TotBHour = (TotBDays) (Q20Dur)$$

where:

- TotBHour = Number of hours the respondent spent on the water
- TotBDays = as defined above
- Q20Dur = For day-trippers, the average number of hours spent on the water per trip

⁹ While the responses to this question would vary from boater to boater, it is assumed that the deviation is randomized over the total number of respondents.

Equation 3 above, is an estimate of the respondents boating time in the study region. However, boating pressure also is influenced by the time during the week the activity takes place. Therefore, the respondent's total boating hours (TotBotHour) were based also on the response to Question 21, total boating time spent on weekdays (Q21Botp1), weekends (Q21Botp2), and holidays (Q21Botp3). The following three equations allocate the total number of boating hours accordingly.

d. Derivation of Weekday Boating Hours (Equation 4)

$$WkDayBHR = \frac{(TotBHour) (Q21Botp1)}{100}$$

where:

WkDayBHR = Number of Hours the respondent boat on weekdays

TotBHour = As defined above

Q21Botp1 = Ratio of total boating time spent on weekdays

e. Derivation of Week-end Boating Hours (Equation 5)

$$WkendBHR = \frac{(TotBHour) (Q21Botp2)}{100}$$

where:

WkendBH = Number of weekend hours the respondent boats

TotBHour = As defined above

Q21Botp2 = Ratio of total boating time spent on weekends

f. Derivation of Holiday Boating Hours (Equation 6)

where:

$$HolidBHR = \frac{(TotBHour) (Q21Botp3)}{100}$$

HolidBH = Number of Hours the respondent boat on the weekend

TotBHour = As defined above

Q21Botp2 = Ratio of total boating time spent on weekends

g. Derivation of Boat Type Boating Pressure (Equation 7)

$$TotBotHr = \frac{BoatPop_i Pop}{TotBoat} TotBoatHr$$

where:

TotBotHr(i) = Projected Number of Boating Hours for boat-type (i)

BoatPop(i) = Total Number of respondent in boat type (i)

BoatPop(i) = Total Number of sub-sample respondents in boat-type (i)

TotBoatHr = Total estimated boat hours

h. Derivation of Activity Boating Pressure (Equation 8)

$$BHR(i) = [BActiv1(i) + BAct2(i) + Bact3(i)]$$

where:

BHrA(i) = Total number of boating hours for each of the thirteen boating activities identified in questions 22 and 23 and where (i) designates the specific boating activity (e.g. daysailing)

BActiv1,2,3 = Total number of respondent's first, second and third boating hours by ranked activity (i)

i. Derivation of Ranked Choice of Boating Pressure (Equation 9)

$$BAct1_j = \frac{[(TotBMon2) (Q23_r)]}{100}$$

where:

BAct1(i) = As defined above

TotBMon2 = As defined above

Q23(r)(i) = Percentage of thime of ranked (first, second and third) boating activity (i)

j. Estimate of Number of Boats Including Allocation of 'Unidentified Vessels' (Equation 10)

$$B-T_i = \left[\left(\frac{B-T}{TVI - U_v} \right) (U_v) \right] + B-T$$

where:

B-T_(i) = Number of boats in a given boat-type class in the Florida VTRS, including allocation of unidentified vessels

B-T = Number of boats in a boat-type class in the Florida VTRS

TVI = All vessels recorded within Sarasota Bay by the Florida VTRS

$U_{(v)}$ = Number of vessels recorded in the 'Unidentified' vessel category

k. Estimation of Allocation Factor (Equation 11)

$$A_i = \frac{B-T_i}{B-S_{ij}}$$

where:

$A_{(i)}$ = Allocation factor used to estimate total boat-type pressure on Sarasota Bay

$B-T_{(i)}$ = As defined Above

$B-S_{(i)}$ = Number of boats in a given boat-type class derived from the Boater Profile Survey

l. Estimation of Adjusted Boating Hours by Boat Type (Equation 12)

$$NBTHr_i = \left[\left(\frac{BTHr_i}{TBHr - U_{Hr}} \right) (U_{Hr}) \right] + BTHr_i$$

where:

$NBTHr_{(i)}$ = New adjusted boating hours for a given boat-type (i) including allocation of unidentified boating hours

$BTHr_{(i)}$ = Boating hours for a given boat-type (i) not including Boating hours allocated to boat-type (i)

$TBHr$ = Total number of boating hours estimated for Respondents participating in the Boater Profile Survey

$U_{(Hr)}$ = Number of boating hours allocated to 'Unidentified boats'

m. Total Estimate of Number of Boating Hours by Boating Activity (Equation 13)

$$TBHr_i = (A_i) (NBTHr_i)$$

where:

$A(i)$ = As defined above

$NBTHr(i)$ = As defined above

Results

1. Boats and Boaters

a. Boat Type

An estimated 52,153 boats ply the waters between Lower Tampa Bay and Charlotte Harbor in southwest Florida.¹⁰ About one-half are small, outboard-powered vessels (skiffs, speedboats, open-utilities, john-boats, or pontoon boats). About one-quarter are trawlers and cabin-cruisers, and 17 percent are sailboats (day-sail, racing, cruising). Others (personal watercraft, kayaks, canoes, and rowboats) make up less than 7 percent. Popular models are: Fiesta 18 Fundeck (small outboard), Bayliner 2885 Sunbridge (cabin-cruiser), Beneteau 398 Oceanis (sail), Mohawk 17 (canoe). The average length boat of each, respective, type is, 19 ft (small outboards), 30 ft (trawlers), 31 ft (sail), and 14 ft (others); the overall average is 26 ft.

Boat draft is a critical factor determining access to shallower bays and estuaries. Fifty-four percent of the boats draw less than 2 ft, 29.9 percent have 2–3 ft drafts, and 16.2 percent have drafts between 3 and 4 ft. Skiff-type boats have an average draft of 1.6 ft, whereas trawler and power-cruisers draw an average 2.9 ft. Sailboats are the deepest draft vessels, on the average drawing 3.7 ft. Personal watercraft, kayaks, canoes and rowboats have the shallowest drafts, on average less than 1.0 ft. Some vessels have the ability to modify their draft in order to accommodate shoal waters. Over 80 percent of the skiff-type boats and 40 percent of the cabin-cruisers can raise or lower their propellers and power units by as much as 0.5 ft and still maintain steerage. Some sailboats are equipped with centerboards, but they only represented 19.8 percent.

Almost two-thirds of the boats (64.6 percent) are kept either at home or at a private dock; another 15.3 percent are anchored (moored); 13.6 percent of the boats are maintained in slips at either public or private marinas; and 6.5 percent use dry-stack storage facilities. Over half of the vessels (53.8 percent) are stored on land when not in use, reflecting relatively small size (length). Eighty-six percent carry Florida vessel registration; 11.8 percent are U.S. Coast Guard documented vessels, and 2.3 percent are kayaks, canoes, and rowboats.

¹⁰Manatee, Sarasota and Charlotte counties extend throughout the area depicted in the Prototype Chart #11425, and the combined, resident, registered boat population is 44,330. We estimate that this represents approximately 85 percent of the recreational boats using the area. The balance (15 percent or 7,823 vessels) is made up of transient vessels, both small (< 26 ft) trailerable boats, and large (≥ 26 ft) boats.

b. Boating Population

The sample of southwest Florida boaters revealed a number of socioeconomic characteristics. Over 75 percent of the boaters are 50 years of age or older. The range in age is from 17 to 94 years of age, and the mean is 58.3 years. The dominant age cohort is 50–69 years, and a negligible number of individuals are less than 30 years old. More than 20 percent are 70 years of age or older. Ninety-one percent are Florida residents, and the average residency in the state is nearly 15 years. Seventy-five percent of all boaters have completed at least four years of college, and at least one-quarter have some graduate school education.

Fifty-nine percent of the boaters are retired full-time or retired but working part-time. Another 38.7 percent are employed full-time. Over 60 percent have ≥\$50,000 household incomes, and 14.2 percent have ≥\$150,000 incomes.¹¹ The profile of the average boater is 58 years of age, white, male, college educated, partially or fully retired, and has an annual income of \$50,000–\$75,000.

c. Boater Experience and Piloting Skills

Eighty-five percent of the boaters have 10 or more years of on-the-water experience, and the average length of time boating in Florida is just over 8 years.¹² About 46 percent have taken an introductory course in boating safety and seamanship and intermediate or advanced courses in piloting and navigation. Another 23.5 percent have received most of their boating training from an experienced boater. An additional 12.5 percent have gained boating experience in part from formal training in addition to training from an experienced boater. Only 16.7 percent claim that they are self-taught.

Three-quarters of all boaters have equipped their vessels with compass and depth finder; two-thirds have aboard NOAA small-craft charts and Tide Tables; half of the boaters have binoculars and global positioning systems (GPS) equipment; and one-third have cruising guidebooks. The principal water and shore features used by boaters for navigation are: aids to navigation (92.5 percent), soundings (79.4 percent), shore buildings and structures (44.0 percent), and coastal vegetation (41.6 percent).

Boaters were asked to characterize any difficulties in carrying out navigation and piloting operations. Overall, skill deficiencies reported were minimal: reading charts (9.8 percent); locating features on the water (4.5 percent) or along shore (4.3 percent each); or locating other boats on the water (1.6 percent).

¹¹There were 153 respondents (19.0 percent) who did not elect to answer this question. Percentages in the text include the non-respondents in the total.

¹²Only 69 percent of the respondents answered this question.

d. Boating Patterns

Boating is a year-round activity; over 50 percent of boaters are likely to boat in all months. July–September is the low season when ≤ 60 percent boat, whereas March–May is the high season with up to 80 percent on the water. It is a recreational activity that is fairly evenly distributed throughout the week: 54 percent occurs on weekdays and 48 percent on weekends. Holidays account for less than 14 percent of the total. Over half of the boaters are on-the-water at least once a week and another 25 percent boat every other week; 14 percent boat once per month. The average trip lasts about 8 hours.

A central objective of the study is “to determine what type of additional information is required by recreational boaters...” Boating means different things to different boaters. Reasons why one group may sail, whereas another may fish, or whether boaters anchor as a pastime or not, offer insights about the type of information that may be required on a new generation of charts. The survey presented boaters with a series of questions about their favorite boating activities, and asked why they choose one locale over another for boating and anchoring enjoyment.

Boaters were asked to identify their top three activities from a list of thirteen choices. Appendix D, Table 1 lists the ranked answers (descending order): fishing (1), cruising (2), day-sailing and racing (3), speed-boating and skiing (4), diving (5), other, such as nature touring, birding and beachcombing (6), and canoeing/kayaking/rowing (7). Results show: the stand-out top activities are (1 and 2); the next activity (3) is several orders of magnitude below the top group; there are three activities (4,5,6) one-half the weighted scores of second group; and (7) is at the bottom of the ranks, one-half, again, the weighted scores of the third group.

Boaters were asked to select from a list of eleven locale-quality features in identifying the top five reasons for selecting one boating area over another. Appendix D, Table 2 lists the ranked answers (descending order): fishing opportunities (1), scenic beauty (2), clean water (3), calm waters (4), tranquility (5), protected waters (6), observing wildlife (7), absence of other boaters (8), other, such as ease of access and marina facilities (9), diving opportunities (10), and challenging navigation (11). There is a pattern to these results: top group is (1,2,3); second group (4,5,6,7); third, lowest group (8,9,10,11).

Boaters were asked to select from a list of 21 site features in identifying the top five reasons for selecting one anchorage locale over another. Appendix D, Table 3 lists the ranked answers (descending order): bottom-holding (1), storm protection (2), fishing opportunities (3), clean water (4), scenic beauty (5), tranquility (6), beachcombing (7), swimming (8), environmental conditions (9), isolation (10), marina, fuel, pump-out (11), local hospitality, (12), access to shore entertainment (13), access to supplies (14), shore-side park (15), camaraderie (16), skiing (17), other, such as

wade-fishing and diving (18), dinghy sailing (19), rowing and sail-boarding (20). Bottom-holding is the top site selection criteria. Storm protection and fishing opportunities are a second important group. The third most important group of features include clean water and scenic beauty. Most other criteria are much below in ranked scores.

e. Boating Pressure During the High Boating Season

What is the relative pressure by different boating groups? The boating pressure model, described in the Methods section of this report, attempts to address this issue by relating the amount of time spent on-the-water to eight principal characteristics of the population (boat type, boater experience, boating season, income, employment, age, length of boat ownership, and preferred boating activity). Appendix D, Tables 4-9 summarize the results of this analysis for the Boater Profile Survey population and show numbers of boaters in relation to total boating hours during the March-May season on weekends, weekdays, and holidays. Appendix D, Table 10 estimates on-the-water time and boating pressure (hours/acre) by all boaters in the study region.

Nearly half of the total number of boating hours (49.5 percent) spent on-the-water is by small outboard-powered vessels; trawlers and cabin cruisers account for over one-quarter (29.5 percent); non-motorized boats (kayaks, canoes, rowboats) represent 3.4 percent; sailboats, 13.9 percent; and personal watercraft, 2.9 percent (0.8 percent of the respondents identified no vessel type). The amount of time spent on-the-water varies little between weekday and weekend. For example, sailors boat 46.1 percent of the time on the weekend and 43.6 percent during the weekdays. Personal watercraft time on-the-water varies from 40.3 percent on the weekend to 53.8 percent on weekdays. Little boating time, in relative terms, takes place during holidays (see Table 4).

When boaters' experience is related to time on-the-water, the mean values of the total boating time indicate that, as the boaters gain experience, they also tend to increase their time on-the-water (Appendix D, Table 5). Boaters with less than ten years' experience spend, on the average, from March to May, about 102.6 hours boating, compared with 141.6 hours spent by those with ten or more years experience. Differences when they boat are also insightful. Those with longer boating experience spend, on the average, more than double the time boating on the weekdays compared to those with less experience (69.7 hours versus 33.4 hours, respectively). A possible explanation may be that the more experienced group includes a greater number of retirees who have more flexible schedules and who may prefer to boat during the week when presumably there is less congestion. These differences are practically eliminated on holidays when those with less experience spend 8.1 hours compared to 10.5 hours. There are negligible differences between the two groups' activities on weekends, 61.1 hours compared to 61.4 hours.

The distribution of boating hours by income group does not show any discernible pattern (Appendix D, Table 6). The relation of employment status to time spent on-the-water boating is more revealing. Appendix D, Table 7 shows total boating hours for full-time employed, retired, semi-retired, home-makers, students, and unemployed. Most boating time by the employed was on the weekend (68.8 percent). In contrast, weekend boat for retirees is only 43.3 percent, and the semi-retired is even less, 23.0 percent of their boating time. Holiday boating time is more evenly distributed among the four groups.

The average boater during the March-May season spent 46.70 hours on-the-water (Appendix D, Table 8). The choice of time engaged in a preferred activity ranged from a low for ocean racing (17.22 hours/boater) to a high for inshore fishing (60.75 hours/boater). Indeed, inshore fishing (31.32 percent) and cruising (32.40 percent) account for almost two-thirds of boaters' time on-the-water (Appendix D, Table 8). The weighted summed scores of hours engaged in all boating activities are reported in Table 9 along with rankings of the cumulative observations. Eighty-five percent of boating hours during the March-May season are accounted for by: No. 1, fishing (inshore and deep-sea) which represents 39.34 percent of all time; No.2, cruising with 29.72 percent; and No.3, day sailing and racing 15.92 percent. The remaining on-the-water time includes No.4, speed-boating and skiing (5.51 percent), No.5, diving (5.34 percent), No.6, canoeing (3.05 percent), and No.7 other, such as nature-touring, birding, beachcombing (1.13 percent).

Hours boating on-the-water were extrapolated from the Boater Profile Survey population (828 observations) to the entire boat population (44,330) for the March-May season in order to determine the boating pressure on the bay water resource (Appendix D, Table 10). The total area of the study region covered by prototype chart 11425 is 55.15 square miles (35,299 acres), excluding the Manatee River and Gasparilla Sound. The boating area for each boat type (rowboat, sailboat, speedboat, personal watercraft, cabin-cruiser) was based on average draft/boat type. Since bathymetry data were available only for the depth ranges < 3 ft, ≥ 3-6 ft, > 6 ft, the following assumptions were made: (1) rowboat canoe, kayak and personal watercraft operate in 0-3 ft water depths; (2) skiff-type boats range over the entire area; and (3) power-cruiser-type and sailboats are limited to areas with 3 ft or greater water depths. On a hours/acre basis, greatest pressure is exerted by sailboats (93.81 hours/acre), followed by speedboat type (58.17 hours/acre), personal watercraft (24.75 hours/acre), cabin-cruisers (18.82 hours/acre), and rowboat type (8.01hours/acre). It should be noted that not all boat types have the same impact, per hour/acre, on the resource.

2. Prototype Photo-chart

a. User Workshops as Basis for Changing Chart Content and Format

Some forty boaters and representatives of the marine recreation industry

provided guidance for redesigning the NOS small-craft chart to promote safe navigation and stewardship of coastal resources. As participants in two workshops, held in May 1998, they offered suggestions on what changes would make the prototype chart more responsive to the needs of recreational boaters. These suggestions focused on the following chart elements: background imagery, both false-color and fusion normal-color; map scale, resolution, and format; piloting information; bathymetry; shore features and waterfront facilities; bridges; anchorages; and environmental features. Their ideas are summarized in Appendix D, Table 11, as recommended modifications or additions to the NOS small-craft chart; the table also includes information on whether and how these modifications ought to be adopted, either incorporated as part of the prototype photo-chart or in one of the other prototype products.

b. Evaluation Framework

Boater volunteers were asked to use a prototype photo-chart (#11425) and four other information products (pocket guide, place-mats, anchorage guide, anchorage Web site) during a test period (February–April 1999). An evaluation questionnaire was distributed to 481 volunteers and 132 completed the survey (27 percent rate-of-return). The results of the evaluation survey are presented below. Percentages are given and refer to the total number of responses for each answer. In cases where the answer options were within a range of values, a statistical score was developed and applied. Scalable questions deal with: readability (very easy, easy, some effort, great effort, impossible); impact (a lot, some, not much, not at all); usefulness (1–9, with 1–3 [low], 4–6 [medium], 7–9 [high]); relevance (1–9, with 1–3 [low], 4–6 [medium], 7–9 [high]).¹³

c. Navigation Chart

The navigation chart elements are found on the bottom half-sections of the prototype photo-chart, covering Charlotte Harbor to Venice Inlet (Side A) and Venice Inlet to lower Tampa Bay (Side B).

Side A of the Navigation Chart (Appendix A) incorporates digital, infra-red, aerial ortho-photographs. It has been converted to natural color on Panels 3–A and 4 and has a 4-meter resolution. The infra-red color photography in panel 6 (Venice Inlet) has a 2-meter resolution and has not been converted to normal color. Side A aerial photography covers water and land; color symbols are used only to distinguish marsh (green) and spoil (blue) areas from the water. Spot soundings are shown as on a conventional chart.

Side B of the Navigation Chart (Appendix A) uses a composite satellite image, color-fused with aerial photography, and has a 5-meter resolution. The color image

¹³A description of the procedure used to develop the statistical score is found in the Analysis section of this report.

only covers the land: Panels 1, 2, and 3–B render water areas less than 6 ft in a blue color, deeper water is white, and grass is green, as on conventional charts; Panel 5 renders water in 3 ft–shaded blue–colored increments; spot soundings are as on a conventional chart.

Imagery:

The preferred color–type imagery was composite, color–fused; it scored two–times higher than the infra–red color photography. The composite, color–fused type also had the highest overall score (77.4 percent) for providing adequate clarity to locate landmarks. Sixty percent said the imagery should portray land and water, as opposed to 33 percent, who said it should only be rendered over land areas.

Bathymetry:

Responses on how to show bathymetry were almost evenly divided between (a) spot soundings and conventional supplemental contours, without color imagery in the background; and (b) spot soundings and color–shaded depth ranges. Few individuals opted for spot soundings only, with color imagery in the background.

Readability:

Volunteers were asked to rate the readability of the eight navigation panels (1, 2, 3–a, 3–b, 4, 5, 6, 7). The scores range from 67.3 to 82.3 (Appendix D, Table 12). Panels 1, 2, 3–b received the highest ratings by showing composite color–fused imagery only over land areas, with spot soundings and conventional supplemental contours over water areas.

Problems affecting the readability of the navigation panels included: (a) too much information which made for cluttered appearance and confusion, and too much 'land' information as opposed to 'water' information, or information of 'marginal interest' (27.1 percent); (b) difficult to read in general, or specifically, depths and labels in water areas, or under dim light conditions, or over land areas (26.0 percent); (c) dark color water areas (15.6 percent); (d) not enough contrast, either in general, or between color shades, or between shallow water and developed land (14.3 percent); (e) no relevant information (6.5 percent); (f) too small–scale (5.2 percent); (g) information either too vague or lacking detail (5.2 percent).

Usefulness:

The usefulness of the eight navigation panels (1, 2, 3–a, 3–b, 4, 5, 6, 7) was also rated by the volunteers, and the scores range from 58.4 to 78.1 (Appendix D, Table 13). Panels 1, 2, 3–b received, as well, the highest ratings. The most useful features on the navigation panels are: (a) depths in general, and soundings by color–shading (38.1 percent); (b) land photo, shore features, or shoreline (17.4 percent); (c) sea grass (5.2 percent); (d) tables on anchorages, tides and currents (3.2 percent); (e) wrecks and fish havens (3.2 percent); (f) chart layout and design (2.6

percent); (g) all information, a generic comment (6.5 percent); and (h) miscellaneous features, such as bottom, headings, place names, road/ramp, speed zones (3.9 percent).

Comparison of Prototype and Conventional Navigation Charts:

Volunteers were asked if they disliked any of the prototype features compared to the conventional chart. Fifty-four percent said "no." Of the 46 percent who answered "yes," the following negative features were noted: (a) background colors (35.2 percent); (b) cluttered appearance (18.3 percent); (c) background imagery (8.5 percent); (d) chart size too large (7.0 percent); (e) confusing (5.6 percent); and (f) complex (5.6 percent).

d. Environmental and Boating Map Information Portion

The top half-section, left-side, of the prototype photo-chart has supplemental map panels (see Products section for a description of each element).

Seventy-eight percent of the boaters said that environmental and boating information should be included on the NOAA small-craft chart, either in the manner displayed on the prototype, as separate map panels (46.9 percent) or on the main navigation chart (30.8 percent). Twenty percent said that it should not be included, because it is available elsewhere or because the information is not relevant, and 2.3 percent had 'no opinion'.

Anchorage, Bridge, and Boat Ramp Information:

Asked if this type of information was adequately represented, approximately three-quarters responded "yes." Specific problems reported include:

anchorages—(a) difficult to locate anchorage symbols on chart; (b) provide more information on approach channel; (c) include approach depth in table; (d) too small-scale; (e) reference anchorage to guidebook where detailed site information is available.

bridges—(a) difficult to find table on Panel 3b; (b) too small-scale; (c) include bridge name, radio call sign, vertical/horizontal clearances, time of opening in table.

ramps—(a) label ramps more clearly; (b) too small-scale; (c) include ramp name, street name and/or route number on table.

Sea Grass:

Eighty-five percent of the boaters said that sea grass should be shown somewhere/somewhat on the NOAA small-craft chart, either as on the prototype with patchy and continuous distinctions (36.2 percent), or without these distinctions (13.9 percent), or on the navigation portion of the chart (32.3 percent), or only in the

anchorage areas (2.3 percent).

Mangrove:

Sixty-two percent said mangrove should be shown on the NOAA small-craft chart: 35.4 percent concurred with how it is portrayed on the prototype, 24.6 percent felt that this information should appear on the navigation portion, and 1.5 percent suggested using a different color symbol.

Shellfish Harvesting:

A majority (55.8 percent) considered this information not necessary.

Depth Zones:

Bathymetry is portrayed on the environmental panels as well as on the navigation portion of the prototype chart. Forty-two percent of the respondents recommended changing the contour interval from 6 to 3 ft; others (33.9 percent) indicated the manner shown on conventional charts was adequate; fewer respondents (17.7 percent) suggested color tinting all depth zones less than 12 ft using a 3 ft contour interval; and a small number (6.2 percent) felt this information should be shown on a supplemental map.

Speed Zones:

Seventy-five percent of the boaters said speed zones should be shown, and a few suggested improving the rendering from the prototype by simplifying the symbols or by only showing the beginning and ending of the zones.

Other Additional Information:

When asked if any additional information ought to be shown, 86.0 percent said "no," and 14.1 percent recommended the following: live bottom features; bottom-holding conditions (anchorage table); boat facilities, e.g., fuel type (marina table); restaurant and boat supply retail locations; medical evacuation drop-off points, marine historical sites; dive locations; preferred water ski locations; and text with definitions of speed zones.

Readability:

Volunteers were asked to rate the readability of the eight environmental and boating information panels. The scores range from 72.6 to 81.4. Panel 1 (Side B) received the highest rating by showing general sea grass and mangrove coverages, and symbols for anchorage, ramp, and bridge features (Appendix D, Table 14).

Usefulness:

The eight environmental and boating panels were also rated for their usefulness. These scores range from 59.0 to 70.7. Panel 3-b (Side B) rated the highest by distinguishing patch/continuous sea grass coverages, in addition to including symbols

for anchorage, ramp, and bridge features (Appendix D, Table 15).

e. Supplemental Boating Information Tables and Diagrams

Additional information in tables and diagrams is situated on the top right portion of Sides A and B, as well as within the area of the navigation chart (bottom section) on Side A, and in the space between the navigation chart and environmental map panels on Side B. This includes boating tables, buoyage diagrams, navigation rules diagrams, flag and pennant codes, tide and tidal current tables (see Products section for a description of each element). Seventy-three percent of the boaters said "yes," that these tables and diagrams ought to be included on the small-craft chart.

A summary of the adequacy rating and explanation of additional needs for each table and diagram follows:

bridge table: OK as shown (85.0 percent); need to improve (12.1 percent), by such means as, larger format and font, names, clearances (vertical, horizontal), opening schedule, bridge tender telephone number and VHF hailing channel (additional bridge notations on chart suggested here, as bridge name, ICW mileage between bridges)

anchorage table: OK as shown (87.9 percent); need to improve (7.3 percent), by such means as, larger format and font, increase the number of locations

boating facilities table: OK as shown (87.0 percent); need to improve (6.5 percent), by such means as, larger format and font, update, missing ramps (public/private)

aids to navigation symbols: OK as shown (86.1 percent); need to improve (not specified)

fictitious chart: OK as shown (59.5 percent); not necessary (35.3 percent); need to improve (not specified)

visual guide: OK as shown (75.0 percent); not necessary (20.8 percent); need to improve (not specified)

navigation rules: OK as shown (82.8 percent); not necessary (14.8 percent); need to improve (2.5 percent), by such means as distinguishing between power and sail

flag codes: OK as shown (65.6 percent); not necessary (31.1 percent); need to improve (2.5 percent), by such means as showing only diving pennant and making larger

tide table: OK as shown (65.3 percent); not necessary (26.6 percent); need to improve (7.3 percent), by including up-to-date information

current table: OK as shown (73.0 percent); not necessary (22.1 percent); need to improve (4.9 percent), by including local variations

f. Prototype Chart Format

The prototype photo-chart is 30" x 60" with a triple-fold. It is one-third larger in size than the conventional small-craft chart (20" x 60"), though both products fold to 5" x 10" size. Sixty-three percent of the boaters said the prototype size is acceptable. For those respondents who considered the prototype size unsatisfactory (33.3 percent), 60.5 percent said that a "track ticket" format would be more suitable.¹⁴

3. Other Boating Information Products

a. Contents

Four other information products were provided to the boater volunteers for test evaluation purposes. These included: (1) the fold-out (Pocket Guide) publication "Recreational Opportunities for the Boater: Sarasota Bay Blueways," which contains maps showing boating resources and facilities and short descriptive commentaries on marine resources, wildlife and bay habitats; (2) six place-mat-sized photo-maps of specific waterways and anchorages (Place-mats); (3) the publication "A Guide to Anchorages in Southwest Florida" (Anchorage Guide); and (4) access to the Florida Sea Grant Web site for southwest Florida anchorages (Anchorage Web Site). See Products section for a description of each item.

b. Product Use During Test Period

The percent of boaters using these products ranged from: Anchorage Guide (80.0), Pocket Guide (55.7), Place-mats (32.1), to Anchorage Web Site (18.9).

c. Usefulness

Boaters were asked to evaluate the usefulness of features in each of the products, and their relative ratings (scored base = 100) are presented in Appendix D, Table 16. The Anchorage Guide scored the highest relative to the Anchorage Web Site and Pocket Guide. The top-rated features were: photographs with superimposed course lines and chart-lets with preferred courses and buoys. Bird viewing and fishing pier information had the lowest ratings, which may reflect their non-boating themes.

¹⁴The 'track ticket' is a progressive book chart of large sections of the waterway, at large-scale, small area, with more information that would be rendered with traditional charts and in imagery. Side-bars along the page margins would contain additional information, like oblique aerial and ground level photography of bridges, anchorages, and other prominent features, and information about facilities, boat ramps, boater education, and local environmental information.

d. Relevance

The relevance ratings of these other information products were: Anchorage Guide (80.0); Pocket Guide Map (73.8) and Text (69.0); Place–mats (67.0); and Anchorage Web Site (48.0). The low Web site score reflects the fact that 57.0 percent of the boaters did not have access to a home computer.

e. Suggested Future Sources

Boater opinion was fairly consistent, with 56.0 percent suggesting that NOAA ought to make the Pocket Guide and Place–mat information available either on the navigation chart or other map source. About one–quarter of the boaters thought that this information should be obtained from commercial sources and one–fifth had no opinion.

4. Boater Environmental Perception, Attitudes and Behavior

a. Awareness Before Exposure to Prototype Products

Ten questions were included in the Boater Profile Survey to evaluate how the sample of southwest Florida boaters would react to a series of hypothetical environmental “incidents” while underway or at anchor. The dependent variables in this test were: (a) type of boat used by the respondent; (b) boating knowledge; (c) preferred boating activity; (d) years of boating experience; (e) Florida residency in years; and (f) age of respondent. The independent variables—the “what would you do if...” statements—were: (a) banana peel tossed overboard; (b) cap lost overboard by crew member; (c) beer can tossed overboard by crew member; (d) floating plastic bag encountered along the path of the boat; (e) oil sheen displayed on discharged bilge water; (f) illegal discharge of effluent witnessed in an anchorage; (g) outboard–powered dinghy disturbing sea grass in a shallow water area; (h) vessel grounding; (i) vessel disregarding no wake zone; and (j) encountering manatees.

The ten questions were grouped into two categories, those addressing natural resource issues and those describing pollution–related activities. Natural resource responses dealt with: disturbing sea grass, vessel grounding, disregarding no wake zone, and encountering manatees. Pollution resources related to: losing overboard or encountering in the water a banana peel, cap, beer can, plastic bag, oiled bilge water, and flushing head. Responses were scored as: appropriate, questionable, or inappropriate.

The analysis was divided into two parts: the first was a description of all the responses; the second tested for differences among the dependent variables and the ten independent variables. The proportion of respondents indicating an “appropriate” response was high, with answers ranging from a low of 75.6 percent (disturbing sea grass) to a high of 99.6 (encountering manatees). The answers to questions on “wakes” and “vessel grounding” were also very high. More than 97 percent indicated an

“environmentally appropriate” response.

Results of the statistical analysis are shown in Appendix D, Tables 17–20. The eight “pollution” variables (banana peel, cap, beer can, plastic bag, oiled bilge water, and head flushing) represented a scale from relatively benign polluting incidents (e.g., lost cap overboard) to the much more severe incidents (e.g., discharge of oil-contaminated bilge water). The appropriate responses ranged from a low of 47.1 percent in the case of head discharging to a high of 98.9 percent for encountering a floating plastic bag. The relatively low appropriate response rate identified with head discharging may relate to potential conflicts that may arise from reporting such incidents to the authorities. Based on the high levels of knowledge related to appropriate environmental behaviors for all other environmental questions, it is suggested that the somewhat lower percentage recorded for this question has more to do with “I don’t want to get involved” than with the boater’s own on-board behavior. None of the dependent variables was able to discriminate environmental behaviors by: vessel type, preferred boating activity, length of boat ownership, manner of boat training, or respondent’s age.

Southwest Florida boaters, in conclusion, are very homogeneous in their intended environmental behaviors. An overwhelming proportion of all boaters appear to know what is correct behavior when confronted with situations that affect sustainable boating practices and sound environmental management.

b. Impact of Prototype Products on Boating Practices

The volunteer boaters used the prototype products during the February–April 1999 test period. The relative breakdown was: Prototype Photo–Chart Environmental and Boating Panels (66.4); Pocket Guide (map, 68.2, text, 56.0); Place–mats (33.6); Anchorage Guide (80.3); Web Site (18.6). Boaters evaluated whether the use of each of the prototype products affected the quality of their boating activities. Four potential impacts dealt with: (a) enhancing awareness for boat safety, (b) reducing potential conflicts among boaters and between boaters and shore residents, (c) increasing boating enjoyment, and (d) increasing awareness about environmental impacts. Impacts were expressed within a range of values as, a lot, some, not much, not at all. A statistical percentage score was developed to compare the four potential types of impact (see the Methods section of the final report for a description of the procedures). Appendix D, Table 21 gives the results and reports the percentage scores of the relative impacts of the five prototype products (rows) on the four boating practices (columns).

Enhanced awareness of boating safety:

There is a 13.5 percentage spread between the Anchorage Guidebook high score (65.4) and Web Site low score (51.8). The Prototype Photo–Chart is 3 percentage points below the High (62.4).

Reduced potential conflicts:

There is a 13.9 percent spread between the Anchorage Guidebook high score (65.4) and the Web Site low score (51.4). The Prototype Photo-Chart is 8 percentage points below the high (57.7).

Increased enjoyment:

There is a 20.1 percent spread between the Anchorage Guidebook high score (75.8) and the Web Site low Score (55.7). The Prototype Photo-Chart is 7.1 percentage points below the high (68.7).

Affected decisions to avoid adverse impact on the environment:

There is a 23.9 percentage spread between the Prototype Photo-Chart high score (74.4) and the Web Site low score (50.5).

5. Summary

a. Boating Profile

About half of the boats are small outboard vessels and another quarter are large trawlers and cabin-cruisers; 17 percent are sailboats, and the remaining 8 percent are personal watercraft, kayaks, canoes and rowboats. These are shallow-water vessels: over half draw less than 2 ft, 30 percent have 2-3 ft drafts, and 16 percent have drafts between 3 and 4 ft. Over 60 percent of the boats are moored at private docks.

Eighty-five percent of the boaters have 10 or more years of experience, and spent, on average, about 51 hours on-the-water during the March-May boating season. Over two-thirds have taken some formal boater education courses, such as introductory boating safety and seamanship as well as intermediate or advanced courses in piloting and navigation. Overall, 90 percent have no perceived difficulties in carrying out navigation and piloting operations.

The average boater is 58 years of age, white, male, and college educated. Fifty-nine percent are partially or fully retired. Over 60 percent have household incomes of \geq \$50,000, and 13 percent have \geq \$150,000 incomes. Those with the lowest incomes ($<$ \$20,000 which is 3 percent of the boaters) spent 131 hours on-the-water during the high boating season, compared with 154 hours of boating time by the majority with higher incomes. Most boating time by the employed occurs on the weekend (68.7 percent) in contrast to fully retired individuals who spent 50.8 percent of their boating time on weekdays.

The standout reasons people boat are for fishing and cruising. During the March-May season, the average boater spent 46.70 hours on-the-water, engaged in activities ranging from a high for inshore fishing (60.75 hours/boater) and cruising (55.78 hours/boater) to a low of 17.22 hours/boater for ocean racing. About 50 percent

of boating time is spent in pursuit of fishing, while cruising accounts of 29 percent of the boating time. The top three reasons for boating in one area over another are scenic beauty, clean waters, and fishing opportunities. Main reasons for selecting an anchorage locale are its bottom-holding, storm protection, fishing opportunities, and calm waters. Results of the boating pressure model show that on an hours/acre basis, the greatest pressure is exerted by sailboats (93.81 hours/acre), followed by speedboats (58.17 hours/acre), personal watercraft (24.75 hours/acre), cabin-cruisers (18.82 hours/acre), and rowboat type (8.01 hours/acre). It should be noted that not all boat types have the same impact, per hour per acre, on the resource.

b. Prototype Chart and Other Information Products

The most readable navigation panels on the prototype chart showed composite color-fused imagery only over land areas, with spot soundings and conventional supplemental contours over water areas. The most useful navigation information was depths in general and soundings by color-shading, land photo images, shore features, and the shoreline. The principal problems with the navigation panels related to background colors of the imagery and their cluttered appearance. The most readable and useful environmental and boating information panels on the prototype chart showed sea grass and mangrove coverages and symbols for anchorage, ramp, and bridge features. Three-quarters of the boaters concurred that the supplemental boating information tables and diagrams (bridge, anchorage, facilities, aids to navigation, etc.) should be included on the prototype chart. About two-thirds of the boaters found the triple-fold chart size acceptable. About two-thirds of those who considered the chart size unsatisfactory said that a "track ticket" format would be more suitable.

The four other information products—Pocket Guide, Place-mats, Anchorage Guide, Web Site—were evaluated for their usefulness and relevance. The Anchorage Guide had the highest scores: top rated features were photographs with superimposed course lines and chartlets of preferred courses and buoys. Only half of the boaters have access to a home computer, which may explain the low score for the Web site product.

c. Boater Environmental Perception, Attitudes and Behavior

The test of boater responses to a series of natural resource and pollution-related incidents while underway or at anchor showed that an overwhelming proportion know how to boat in an environmentally appropriate manner. Responses to hypothetical environmental situations showed a high proportion of "appropriate" responses with answers ranging from 75.6 percent (disturbing sea grass) to a high of 99.6 (encountering manatees). The answers to questions on "wakes" and "vessel grounding" were also very high. More than 97 percent indicated an "environmentally appropriate" response. Responses to hypothetical pollution situations also showed appropriate responses ranging from 47.1 percent in the case of head discharging to 98.6 percent for encountering a floating plastic bag. These responses to hypothetical

situations, however, may or may not reflect the actual behavior of boaters if and when confronted with such situations on-the-water.

The prototype products did influence boating practices and the quality of boating experiences. The prototype chart had the greatest impact of all test products in affecting decisions to avoid adverse impact on the environment. For enhancing awareness of boating safety, reducing potential conflicts, and increasing on-the-water enjoyment, the Anchorage Guidebook had the greatest effect, followed closely by the prototype chart.

Conclusions and Recommendations

This final section reviews the important findings of this study consistent with the stated project goals. Also presented are recommendations to further refine information needs on a national basis.

1. Conclusions

Goal 1. *Determine the chart information needs of boaters which satisfy safe navigation and promote stewardship.*

Findings

- a. Shallow water areas (less than three feet) should be highlighted on charts. The analysis indicates that the most frequented boating zones are shallow water areas. The current NOS charts highlight deeper water; shallow water areas are understated.
- b. Land is best depicted by composite color-fused imagery. However, boaters felt that the resolution might be improved. The majority of boaters surveyed thought that spot soundings and other information was difficult to read and interpret when displayed over digital imagery. The overall impression was that the prototype photo-chart was "cluttered".
- c. Bathymetry is best depicted by spot soundings and conventional supplemental contours, or as color-coded depth ranges with supplemental spot soundings. An equal numbers of boaters favored one or the other combination.
- d. The use of red ink should be minimized, and the text increased in size. Many recreational boats are equipt with a red light for nighttime navigation which makes it difficult to see shades of red on charts.
- e. The most readable and useful environmental and boating information panels on the prototype chart showed sea grass and mangrove coverages and symbols for anchorage, ramp and bridge features. Three-quarters of the boaters concurred that the supplemental boating information tables and diagrams (bridge, anchorage, facilities, aids to navigation, etc.) should be included on the prototype chart. About two-thirds of the boaters found the triple-fold chart size acceptable. About two-thirds of those who considered the chart size unsatisfactory, said that

a 'track ticket' format would be more suitable.

- f. Four ancillary information products – Pocket Guide, Place-mats, Anchorage Guide, Web Site – were evaluated for their usefulness and relevance. The Anchorage Guide had the highest scores: top rated features were photographs with superimposed course lines and chart-lets with preferred courses and buoys. Only half of the boaters have access to a home computer which may explain the low score for the Web Site product.

Goal 2. Determine if chart information needs vary with boater education and with boat type.

Findings

- a. Results from the statistical analysis strongly suggest that a respondent's type of boat and education had no appreciable impact on the boater's chart information needs. This finding is surprising since the general perception by most boaters is that boating knowledge, behavior and overall use of the environment vary with respect to the respondent's boat type and education. A number of factors may have influenced the responses:
 1. The boating population tested may be unique to southwest Florida or to the State of Florida.
 2. The respondents' age is decidedly older than the average for the U.S. population.
 3. Many boaters go through 'stages', the first is usually a small run-about, succeeded, over the years, by larger and larger boats. As a boater approaches middle age, and then retirement, (s)he continues to boat, usually moving from sail to power vessels where the operation requires less physical energy on behalf of the crew. This means, of course, that most individuals have had not only extensive experience with boating but also in operating different types of vessels. Since questions that might query the respondents in this manner were not included, this hypothesis could not be validated by this study.

Goal 3. *Determine if the incorporation of data derived from GIS, GPS and remote-sensing is an effective way to modernize the NOS chart.*

Findings

- a. Digital imagery, as a backdrop for land areas, was well received by the boaters. The background imagery enhanced navigation by providing boaters with a heightened sense of location with respect to the coastline and urban features.
- b. Bathymetric mapping with a GPS allowed for the inclusion of detailed depth-range contours for near-shore areas.
- c. The use of GPS is proven to be an efficient and accurate method for collecting and updating chart information (signage, anchorages, boat ramps, marinas, spot soundings).
- d. The prototype charting effort was greatly enhanced by the ability to utilize and incorporate GIS databases (bathymetry, mangrove, sea grass, shellfish harvest areas, speed zones, etc.), available from state and local agencies.

Goal 4. *Determine if the incorporation of environmental history and boating geography information onto chart products could instill stewardship.*

Findings

- a. An analysis of boater responses to how they would react when confronted with hypothetical boating situations indicated that boaters have a keen awareness of the appropriate action that should be taken to minimize environmental impacts. Results showed that an overwhelming proportion know how to boat in an environmentally appropriate manner. However, responses to hypothetical situations may not reflect the actual behavior of boaters if and when confronted with such situations on-the-water.
 - 1. Responses to hypothetical situations which could impact the environment showed a high proportion of 'appropriate' responses with answers ranging from 75.6 percent (disturbing sea grass) to a high of 99.6 (encountering manatees).
 - 2. The answers to questions on 'wakes' and 'vessel grounding' were also very high. More than 97 percent indicated an 'environmentally appropriate' response.

3. Responses to hypothetical situations which could pollute the environment also showed appropriate responses ranging from 47.1 percent in the case of head-discharge, to 98.6 percent for encountering a floating plastic bag.
- b. The prototype products did influence boating practices and the quality of boating experiences. The prototype chart had the greatest impact of all test products in affecting decisions to avoid adverse impacts on the environment. The Anchorage Guidebook had the greatest effect, followed closely by the prototype chart, in enhancing awareness of boating safety, reducing potential conflicts, and increasing on-the-water enjoyment.

The study findings suggest that we have taken an important first step in developing a universally acceptable chart for recreational boaters. This southwest Florida test of the prototype chart does affirm the overall objective that boater attitudes and practices are positively affected by these new kinds of chart information. But, is southwest Florida representative of the range of boater activities, experience and practices found throughout the U.S.? Our study findings show a somewhat older boating population, a large number of smaller power boats, a year-round boating season, and a diversity of boat types and operators, all of which may contribute to a unique set of conditions compared to other boating regions in the country. Given the substantial commitment in manpower and costs that will be required should NOAAs Marine Chart Division adopt our recommendations, we strongly suggest that the study findings be tested in other boating regions of the U.S.

2. Recommendations

- a. Redesign the small-craft chart #11425, the focus of this study, incorporating volunteer boater recommendations, and publish it for general distribution and use. Boaters preferred the new, prototype chart format and additional information contained within it. This improved information will promote safer navigation and environmental stewardship in southwest Florida.
- b. Conduct multi-regional surveys (East Coast, Gulf Coast, West Coast, Great Lakes) of NOS/recreational boater chart users, to determine their chart information needs to satisfy safe navigation and promote stewardship. The southwest Florida boater survey found a decidedly older boating population than the national population average. Age may have contributed to the fact that many survey respondents felt that the map was "too cluttered" and that spot soundings and other information were "difficult to read and interpret". Boater characteristics, such as education, type of boat and demography may differ significantly from the general boating population, thereby contributing to special information needs and cartographic presentation.

- c. Produce prototype photo-charts for other boating areas, using the methodology developed in this pilot study and relying on results from multi-regional survey (Recommendation 2 above). Representative regional test locations could include Rhode Island, Washington, and Michigan. Sea Grant could oversee and implement these boater surveys. The NOAA Coastal Service Center could collaborate in meeting this objective.
- d. Refine the Boating Pressure Model developed in this study and improve data applied to the model. This model should be expanded to characterize boating pressure over the calendar year - the current model utilizes only seasonal data. Suggested refinements also should include more precise definitions of water depth (1 ft resolution) and an examination of the relation of habitat (e.g., sea grass, marsh, mangrove) to boating pressure zones. Such an analysis would further quantify how boating activities potentially impact resources and how information needs within these boating pressure zones relate to safe navigation and stewardship.

References

Dillman, D.A. 1978. Mail and Telephone Surveys: The Total Design Method, John Wiley and Sons, Inc., New York.

Fink, A. 1995. How to Sample in Surveys. London. Sage Publication.

West, N. 1996. Applied Statistics for Marine Affairs Professionals. Westport Ct. Praeger.

Appendix A

Prototype Photo-Chart

Appendix B

Boater Survey Instruments and Correspondence



UNIVERSITY OF FLORIDA

Dr. Gustavo A. Antonini
Department of Geography
Florida Sea Grant Program
Cartographic Research Laboratory

407 NSB
PO Box 110405
Gainesville, FL 32611
Office Phone: (352) 392-6233
E-mail: Antonini@ufl.edu

November 2, 1998

Mr Boater
Anywhere Street
Florida City
Florida

Dear Boat owner

We are asking you to participate in a boating study being carried out in southwest Florida by the University of Florida Sea Grant Program. We hope this study will benefit boaters by providing a model for re-designing the small-craft navigation chart which the federal government has been producing for close to one hundred years. Your name was drawn in a random sample of southwest Florida boaters.

The study is in two parts. This letter and questionnaire represents Phase one. Our objective in this part is to learn about how the coastal waters are being used by resident and transient boaters. In Phase 2, a volunteer group of boaters will be asked to use and evaluate prototype charts and guidebook materials. At the conclusion of this project, the information that you and others provide will enable us to estimate the degree to which new chart products are needed to meet the demands of the boating public.

We are providing you with a stamped self-addressed envelope to return the completed questionnaire. It will take about 15 minutes to fill-out. You may be assured of complete confidentiality. A stamped number on the questionnaire and postcard allows us to check your name off a mailing list. Your name will never be placed on these materials. Individual responses will never be reported, nor will any information be made available to any group soliciting goods and services to boaters. The questionnaire data will be stored at the University of Florida, under the supervision of the project Principal Investigator. There is no anticipated risk nor personal benefit to be derived from this information.

If you are interested in participating in Phase 2, please complete and return the enclosed card. Persons volunteering for Phase 2 will be asked to (1) utilize the project's sample charts and guidebook materials, (2) maintain a log of their use of these materials during the January-April 1999 test period, and (3) complete an evaluation of the sample products at the end of the testing in May 1999. Please and return the enclosed postcard indicating your decision to participate in Phase 2.

We are most grateful for your assistance in this important project. Thanks for your cooperation.

Gustavo A. Antonini
Professor and Senior Scientist

Agreement to Participate in Chart Product Evaluation

Boater volunteers agreeing to participate in Phase 2 of this project will be asked to (1) use, (2) comment on, and (3) evaluate prototype chart products during 15 January - 15 April 1999. Only individuals who boat between Anna Maria and Gasparilla Sound should volunteer (test products only cover this 50 mile area). Volunteers will receive in early January the prototype chart materials along with instructions for recording comments. Please be sure the address you provide below is correct for the early January mailing. Thank you.

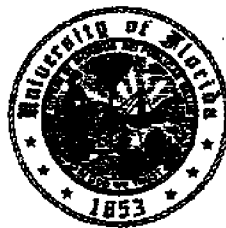
Volunteer Name: _____

Address: _____

City, State, Zip _____

Questionnaire Control Number: _____

**The How, When and Why of
Recreational Boating
In Southwest Florida**



**A survey conducted by the Florida Sea Grant Program
at the University of Florida
in collaboration with
the National Oceanic and Atmospheric Administration (NOAA)
Coastal Services Center and Marine Chart Division**

November 1998

B-4 – B-16

SOUTHWEST FLORIDA BOATER SURVEY

1) In what type of vessel do you spend most of your boating time? Please check one of the following

- Kayak, Canoe or Rowboat (non-motorized)
- Auxiliary powered sailboat
- Sail only
- Skiff, Speedboat, Open-utility, John-boat, or Pontoon boat
- Personal watercraft (e.g., jet-ski)
- Power cabin, Trawler or Houseboat

2) My boat is:

| | | |
|------|-------|------|
| Make | Model | Year |
|------|-------|------|

3) My boat's draft is _____ (feet). Note
For sailboats with keel/centerboards please give draft:

| | |
|---------------------|-----------------------|
| With centerboard up | With centerboard down |
| _____ ft | _____ ft |

For powerboats with outboards or outdrives, please give draft with:

| | |
|-----------------|---|
| Lower unit down | Lower unit partially raised to maintain steerage over shoals |
| _____ ft | _____ ft |

4) When not in use my boat is kept

- Permanent Mooring (Anchorage) maintained by Private Marina
- Permanent Mooring (Anchorage) maintained by local municipality
- Permanent Mooring (Anchorage) maintained by myself
- Marina Slip maintained by Private Marina
- Marina Slip maintained by local municipality
- Private slip
- Yacht Club Slip
- Dry Stack Storage
- Trailered /cartopped from my home
- In the Garage

5) Is your vessel? (Please check one of the following)

- Registered (State decal)
- Documented (Federal i.e. U.S. Coast Guard)
- Unregistered

6) In which state is your vessel registered? _____

7) Do you keep your boat in the water?

- Yes No

8) If your boat is kept in the water, where?

_____ _____ _____
Waterbody Municipality County

The following questions include information about your boating activities, manner of use, and the type of navigational/piloting equipment you routinely use while on the water.

9) How long have you been boating? (Please check one of the following)

- less than one year
- 1-4 years
- 5-9 years
- more than 10 years

10) Are you a Florida resident?

- Yes No

11) For Florida residents how many years have you been boating in Florida

_____ years

12) Are you visiting Florida

- Yes No

13) If you answered yes to question 12, how many years have you been in Florida visiting with a boat?

_____ years

- 14) What time(s) of the year do you normally boat in Southwest Florida?
 _____ Year-round
 _____ Winter: From _____ (month) to _____ (month)
 _____ Spring From _____ (month) to _____ (month)
 _____ Summer: From _____ (month) to _____ (month)
 _____ Fall From _____ (month) to _____ (month)
- 15) Is the boat you are using now
 _____ owned by you
 _____ chartered/rented/leased/borrowed
- 16) If you own your own boat how long have you owned it?
 _____ Months
 _____ Years
- 17) How often do you take a boat out on the average (whether you own, rent or borrow?)
 _____ once a week
 _____ every other week
 _____ 3 – 5 times a week
 _____ once a month
 _____ every other month
 _____ quarterly
 _____ twice a year
- 18) In what months are you most likely to take your boat out?
 _____ Jan. _____ Feb. _____ Mar _____ Apr. _____ May _____ Jun.
 _____ Jul _____ Aug. _____ Sep. _____ Oct. _____ Nov _____ Dec
- 19) How many days ago did you last take your boat out?
 _____ days
- 20) For daytrips, how long do you stay out when you participate in your most favorite boating activity?
 _____ hours

21) What proportion of your boating activity takes place on:

Please write down
percentage of time

| | |
|-------|-----------|
| _____ | Weekdays |
| _____ | Week-ends |
| _____ | Holidays |
| 100% | Total |

22) What are your top three most favorite boating activities? Please chose from the following list? (Please use #1 for your most favorite activity, #2 for your second most favorite and #3 for your third most favorite activity)

| | |
|-------|--|
| _____ | daysailing |
| _____ | cruising |
| _____ | day racing |
| _____ | ocean racing (involving at least one overnight stay onboard) |
| _____ | fishing (deep sea) |
| _____ | fishing (inshore) |
| _____ | diving for sightseeing |
| _____ | diving for fishing |
| _____ | wreck diving |
| _____ | speedboating |
| _____ | skiing |
| _____ | canoeing/kayaking/rowing |
| _____ | other (please specify) |

23) Using your top three selected boating choices, (question 22) what proportion of your total boating time do you spend with each?

| Percent | |
|---------|--|
| _____ | daysailing |
| _____ | cruising |
| _____ | day racing |
| _____ | ocean racing (involving at least one overnight stay onboard) |
| _____ | fishing (deep sea) |
| _____ | fishing (inshore) |
| _____ | diving for sightseeing |
| _____ | diving for fishing |
| _____ | wreck diving |
| _____ | speedboating |
| _____ | skiing |
| _____ | canoeing/kayaking/rowing |
| _____ | other (please specify) _____ |
| 100% | Total |

- 24) When you boat (as opposed to anchor) which of the following considerations are important to you in deciding where to boat?

Please check all

- protected waters
- observing wildlife
- scenic beauty
- clean water
- tranquility
- challenging navigation
- calm waters
- absence of other boaters
- fishing opportunities
- diving opportunities
- other (please specify)

- 25) From the list of the checked items in question 24, please select the five most important conditions and rank each of your five choices in descending order of importance

| | |
|-------|-----------------------|
| _____ | most important |
| _____ | second most important |
| _____ | third most important |
| _____ | fourth most important |
| _____ | fifth most important |

- 26) When you anchor (as opposed to boat) which of the following considerations are important to you in deciding where to anchor? (Please check all that apply).

| | |
|---|--|
| <input type="checkbox"/> storm protection | <input type="checkbox"/> marina, fuel, pumpout |
| <input type="checkbox"/> bottom holding | <input type="checkbox"/> shoreside park |
| <input type="checkbox"/> scenic beauty | <input type="checkbox"/> camaraderie |
| <input type="checkbox"/> environmental conditions | <input type="checkbox"/> dinghy sailing |
| <input type="checkbox"/> clean water | <input type="checkbox"/> swimming |
| <input type="checkbox"/> tranquility | <input type="checkbox"/> rowing |
| <input type="checkbox"/> local hospitality | <input type="checkbox"/> skiing |
| <input type="checkbox"/> fishing opportunities | <input type="checkbox"/> sailboarding |
| <input type="checkbox"/> beachcombing | <input type="checkbox"/> access to shore entertainment |
| <input type="checkbox"/> access to supplies | <input type="checkbox"/> isolation |
| <input type="checkbox"/> other, (please specify) | _____ |

From the checked items in question 22, please select the five most important anchoring considerations and rank each of your five choices in descending order of importance

| | |
|-------|-----------------------|
| _____ | most important |
| _____ | second most important |
| _____ | third most important |
| _____ | fourth most important |
| _____ | fifth most important |

27) When boating which of the following navigation/piloting tools do you use (Please check all that apply)

- _____ NOAA small craft navigational chart
- _____ cruising guides
- _____ Local Notice to Mariners
- _____ Tide Tables
- _____ compass
- _____ Loran
- _____ Radar
- _____ GPS
- _____ SatNav
- _____ depthfinder
- _____ fishfinder
- _____ electronic chart display system
- _____ autopilot
- _____ knotmeter
- _____ binoculars
- _____ course plotter
- _____ dividers
- _____ parallel rulers
- _____ deviation table
- _____ lead line
- _____ other

28) Which of the following water and shore features do you use in piloting your boat (Please check all that apply).

- _____ navigational aids (buoys, day beacons and lights)
- _____ soundings
- _____ shore buildings/structures
- _____ coastal vegetation (trees and mangroves)
- _____ other (please specify): _____

- 29) Please rate your ability to do the following navigational/piloting operations, with one indicating excellent and five unable

I read chart symbols: (Please circle one answer)

Very Comfortable Quite Comfortable Comfortable Not very Comfortable Not at all Comfortable

I can locate features in the water: (Please circle one answer)

Very Comfortable Quite Comfortable Comfortable Not Very Comfortable Not at all Comfortable

I can locate features on the shore: (Please circle one answer)

With Great Ease With Ease Routinely With Some Difficulty Can't do

I can locate boats on the water

With Great Ease With Ease Routinely With Some Difficulty Don't know How

The next few questions describe hypothetical boating situations, some of which you may have actually encountered. Please indicate how you might deal with these situations.

- 30) When taking a family member or friend on your boat for the first time, do you try to orient them to the navigation rules (Rules of the Road)?

_____ Yes

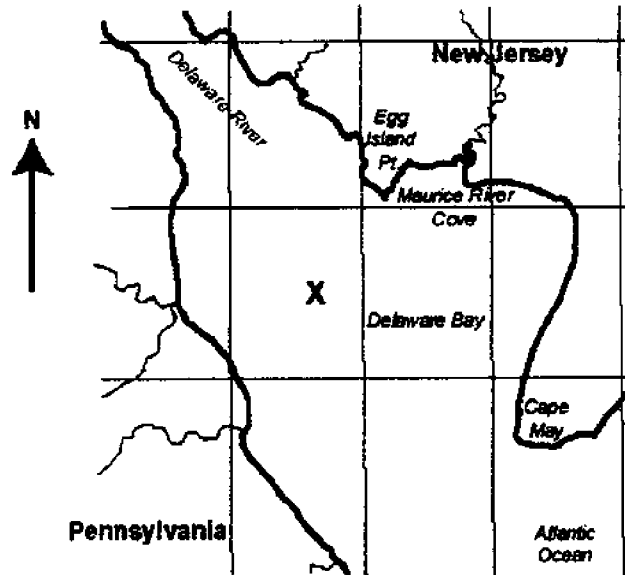
_____ No

If no, please go to question 32

- 30) If you answered Yes to the previous question, do you:(please check all that apply)

- _____ point out the safety features of the boat
- _____ ask if your passenger feels comfortable on the water
- _____ ask if your passenger can swim
- _____ for non-swimmers, request that they wear a PFD
- _____ explain channel markers
- _____ show how to dispose of trash
- _____ show how to operate the marine sanitation device (head)
- _____ explain when and where not to flush

- 32) It is late afternoon and a squall line is approaching from the Northwest. The NOAA regional weather forecast has issued a severe storm warning for the next three hours. Your present position would not enable you to reach a safe harbor before the storm. Your position on the map is designated by an X. Given these circumstances, what would you do? Please indicate your course immediately following the storm warning



- 33) After a day's boating activities you notice that the bilgewater has a slight sheen on it. What would you do? (Please check all that apply)

- Stop pumping and apply an "oilabsorb" to the bilge
- Stop pumping in an effort to identify and secure the leak
- Continue pumping, but keeping the bilge water onboard for appropriate on-land disposal
- Continue pumping outside of the state's coastal jurisdiction
- Continue pumping regardless of location

- 34) You are underway and you notice one of your passengers tossing a banana peel overboard. Do you:

- Continue on your course
- Double back trying to retrieve the banana peel
- Talk about what to do and what not to do while on the water
- Say nothing

- 35) You are underway and you notice one of your passengers tossing a beer can overboard. Do you
- Continue on your course
 - Double back trying to retrieve the banana peel
 - Talk about what to do and what not to do while on the water
 - Say nothing
- 36) You are underway and one of your passengers loses his/her cap overboard. Do you: (Please check all that apply)
- Continue on your course
 - Double back trying to retrieve the cap
 - Talk about what you should or should not do on the water
 - Say nothing
- 37) You are underway and you notice a large plastic bag partially inflated floating on the surface. The bag is located forward of your current course. What do you do? (Please check all that apply):
- Change course to avoid tangling with the plastic bag
 - Remain on course
 - Remain on course attempting to retrieve the bag
 - Remain on course attempting to retrieve the bag, but missing the bag, doubling back making a second attempt to retrieve the plastic bag
- 38) Assume for the moment you have an outboard powered tender and that you are in a new anchorage moving from your vessel to the shore. About half way to the shore you are in shallow water area sea grass when the outboard engine feels the bottom and quits running. In your own words, please describe what you would do under those circumstances.

39) You are powering in a restricted speed zone at a speed at or below the speed limit. A vessel under power is overtaking you at a speed well above the limit. What would you do? (Please check all that apply)

- Shake your head and with arm movements signal the skipper to slow down
- Yell at him to slow down
- Raise him on the radio and request that he slow down
- Report the offending vessel to the Coast Guard by radio
- Report the offending vessel to the Coast Guard if the opportunity arise
- Pray and bite your nails!
- Do nothing

40) You are anchored in your preferred anchorage and notice that a neighboring boat has just flushed the head. From the list below, please check those actions you would take.

- Dinghy over and inform the captain that flushing the head in coastal waters is illegal
- Report the incident to the local marine law enforcement officer if present
- Raise the Coast Guard on the radio and report the incident
- Raising the offending vessel on the radio and inform the skipper about the discharge
- Do nothing

41) You have arrived at your destination and dropped anchor. A short while later you discover that the boat is dragging anchor. Upon retrieving the anchor you notice that the anchor flukes are covered with seagrass. Please describe what you would do under those circumstances.

42) You are under power in close proximity to a mangrove shoreline and you discover two manatees swimming on the surface in the approximately the same direction you are moving. In your own words, describe what you would do.

43) You are traveling in the Gulf Intracoastal Waterway at between 7 and 8 knots and you are entering a speed restricted zone marked "*No Wake Zone, Reduce Vessel Speed to 5 Knots.*" What would you do?

- Proceed at 5 knots or less
- Proceed at current speed, but increase lookout
- Proceed at speed creating no wake whether or not the speed of the vessel is above or below 5 knots

Finally, we would like to ask you a few questions about yourself, so that we can better understand the range of boater needs and concerns. (All responses will be kept confidential).

44) What is the zip code of your permanent home address(5 digits only) _____

45) What is your gender (Please circle) M F

46) When were you born (Year): _____

47) Which of the following best describe your ethnic identity (Please check)

- | | |
|---|--|
| <input type="checkbox"/> White/Caucasian | <input type="checkbox"/> Hispanic-American |
| <input type="checkbox"/> Black/African American | <input type="checkbox"/> Asian-American |
| <input type="checkbox"/> Native American | <input type="checkbox"/> don't know |
| <input type="checkbox"/> Other (Please Specify) _____ | |
| <input type="checkbox"/> Don't care to answer this question | |

48) Have you taken any boating courses?

- introductory boating safety and seamanship
- intermediate or advanced piloting and navigation
- I was trained by an experienced boater
- none of the above

49) How many years did you go to school: _____

50) What is your employment status?

- full time employed
- not retired, working part time
- retired but still working
- retired
- homemaker
- student
- unemployed

51) What was your total household income (before taxes) in 1997 (Please check)

- | | |
|---|---|
| <input type="checkbox"/> less than \$10,000/year | <input type="checkbox"/> \$75,000 – 99,000/year |
| <input type="checkbox"/> \$10,000 - \$14,999/year | <input type="checkbox"/> \$100,000 - \$149,999/year |
| <input type="checkbox"/> \$15,000 - \$19,999/year | <input type="checkbox"/> \$150,000 - \$199,000/year |
| <input type="checkbox"/> \$20,000 - \$29,999/year | <input type="checkbox"/> \$200,000 - \$499,000/year |
| <input type="checkbox"/> \$30,000 - \$39,999/year | <input type="checkbox"/> \$ over \$500,000 |
| <input type="checkbox"/> \$40,000 - \$49,999/year | <input type="checkbox"/> have no idea |
| <input type="checkbox"/> \$50,000 - \$74,999/year | <input type="checkbox"/> don't want to answer |

**PLEASE RETURN QUESTIONNAIRE IN
THE ENCLOSED POSTAGE-PAID ENVELOPE**

THANK YOU FOR YOUR COOPERATION

November 11, 1998

Dear Boatowner

Last week we sent you a questionnaire seeking information on your boating activities as part of a project which will help NOAA's Marine Chart Division design a more utilitarian small-craft navigational chart.

If you have already completed and returned the questionnaire to us, please accept our heartfelt thanks. If not, we ask you to do so today. Because the questionnaire was sent to a small, but representative, sample of boaters living in Sarasota, Charlotte and Manatee Counties, it is extremely important that your questionnaire also be included in the study if the results are to accurately represent the boating activities in southwest Florida.

If by some chance, you did not receive the questionnaire, or if it got misplaced, please call us right now, collect, at (352) 392-6233, and we will get another questionnaire in the mail to you today.

Sincerely,

Gustavo A. Antonini
Professor and Project Scientist



UNIVERSITY OF FLORIDA

Dr. Gustavo A. Antonini
Department of Geography
Cartographic Research Laboratory
Florida Sea Grant Program

407 NSB
PO Box 110405
Gainesville, FL 32611
Office Phone and fax: (352) 392-6233
E-mail: antonini@ufl.edu

February 12, 1999

Dear Boatowner

Thank you for agreeing to participate in this important project. And, please accept our apology for the several-weeks delay in getting these products to you; many are "hot-off-the-press". We believe your use and evaluation of the enclosed materials will make a very important contribution to the next generation of NOAA's small-craft navigation charts and related boater information materials.

The following materials are enclosed with this letter:

- (1) prototype photo-chart (which covers the area of NOAA Small-Craft Chart 11425 and is not intended for navigational purposes);
- (2) NOAA's conventional Small-Craft Chart 11425;
- (3) six place-mat size photo-maps of
Emerson Point and DeSoto Point, Manatee River;
Longbeach/Longboat Pass;
Buttonwood Harbor;
Big Pass/Otter Key;
Sarasota/Island Park;
Boca Grande/Grand Bayou;
- (4) A Guide to Anchorages in Southwest Florida, 1st Ed. (2nd Ed. will be sent to you shortly);
- (5) Rec-Op Map (Sarasota Bay Blueways: Recreational Opportunities for the Boater (pocket guide);
- (6) Florida Sea Grant web site home page for southwest Florida anchorages
<http://flseagrants.org/ANCHOR.HTM>;
- (7) Volunteer Trip Log;
- (8) Pre-Paid Postcard (which we request that you fill out and return now, indicating your mailing address, if different from your current address, to which we can send in mid-April the Evaluation Questionnaire).

How will this study component function? We hope you will use the enclosed materials during the February - March 1999 test period, both for trip planning as well as when underway. We also ask you to use the Volunteer Trip Log to record when and how you use the enclosed products. The log provides you with a format on how to record your use of the materials.

In early April, we will mail to you an Evaluation Questionnaire. This will provide you with an opportunity to evaluate the existing prototype products and make recommendations on additional information which you think should be included. The only items we will request that you to return to us in mid-April are the Volunteer Trip Log and the Evaluation Questionnaire. All other materials are yours to keep.

Your response, together with the approximately 500 other boater responses, will be carefully analyzed, summarized and forwarded to NOAA. The combined experience of our project volunteers – power-boaters and sailors, individuals new to boating as well as more experienced boaters – will enable us to recommend to NOAA ways to improve the Small-Craft Chart for use in the 21st century. The contribution of each volunteer is very important.

We sincerely hope that you will find the enclosed materials useful, interesting and fun to use. Should you have any questions or concerns, we urge you to contact us by phone, letter or email. If you call and do not receive an answer, please leave a message where you can be reached and we will call you within 24 hours.

Alternate Mail Address for Chart Product Evaluation

It is important that we be able to correspond with you during the survey period (February - May, 1999). We will assume that this address, which you provided on the original volunteer card, is your permanent mailing address. However, please fill out the information below and return this card if you would like to receive future correspondence at an alternate address.

Volunteer Name: _____

Address: _____

City, State, Zip: _____

Date to begin correspondence

at alternative address _____

Dear boat owner:

March 30, 1999

Several weeks ago we sent you a package of prototype boating information materials and instructions for maintaining a trip log. This postcard is simply to remind you about the importance of maintaining a record of how you use the information for the upcoming evaluation, which will be mailed to you in May. If you have not received the materials, or have any questions on the materials, or if your mailing address will change in late April or early May, please call or write and let us know. Our telephone number is (352) 392-6233. Leave a message and we will promptly call you back.

Thank you again, for your participation in this important project.

Sincerely,

Gustavo Antonini
Professor and Senior Scientist



UNIVERSITY OF FLORIDA

407 NSB

PO Box 110405

Gainesville, FL 32611

Office Phone and Fax: (352) 392-6233

E-mail: Antonini@ufl.edu

Dr. Gustavo A. Antonini
Department of Geography
Florida Sea Grant Program
Cartographic Research Laboratory

May 4, 1999

Dear Volunteer Boater

We have come to that part of the Boating Study where we ask you to evaluate the prototype photo-chart, maps and guide materials which were sent to you in early February. The enclosed yellow-colored questionnaire will allow us to collect your critique in a step-by-step manner and will enable each of you to be part of the evaluation and editorial team. We intend to provide the National Oceanic and Atmospheric Administration (NOAA/ National Ocean Service) with the results of your collective evaluations for revising the small-craft navigation chart and improving its information service to the recreational boating community.

The questionnaire is divided into four parts: (1) General; (2) Prototype Photo-Chart, including Navigation Chart, Environmental and Boating Information Map Panels, and Supplemental Boating Information Tables and Diagrams; (3) Other Information Products, including Recreational Opportunities Map, Place-Mat-Photo-Maps, Anchorage Guidebook, and Anchorage Web-Site¹; and (4) Other Comments. You may wish to refer to your Volunteer Trip Log in answering some of these questions. Please return the yellow questionnaire and your volunteer trip log in the enclosed postage-paid envelope.

We are enclosing a complementary copy of the just-published 2nd Edition of "A Guide to Anchorages in Southwest Florida. You'll note that this edition includes several new features, namely fourteen photo-maps and various tables that outline anchorage site characteristics.

We also enclose a flyer announcing the forthcoming publication of an 80-page, full color atlas entitled "A Historical Geography of Boating in Southwest Florida", which we will mail to you if you complete and return the Trip Log and Evaluation Survey. Please take a little time to complete the survey and help influence the type of boating information that will soon be distributed around the country. Your assistance is greatly appreciated.

Gustavo Antonini
Professor and Project Senior Scientist

B-21

¹ The address is www.flSeaGrant.ANCHOR.HTM

Questionnaire Control Number: _____

Prototype Photo-Chart, Map and Guidebook Evaluation



**A survey conducted by the Florida Sea Grant Program
at the University of Florida
in collaboration with
the National Oceanic and Atmospheric Administration (NOAA)
Coastal Services Center and Marine Chart Division**

April 1999

B-22 – B-41

Dear Volunteer Boater:

You have participated in an important research project which seeks to foster safe navigation and promote stewardship by improving the nation's small-craft navigation charts to better reflect the needs of recreational boaters. Over the past several months, you have been utilizing various prototype charts, maps and guides, which have been developed by members of this project specifically for testing purposes. This questionnaire will allow you to evaluate these products. We intend to provide the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service with the results of your collective evaluations for revising the small-craft navigation chart and improving its information service to the recreational boating community.

To make useful revisions, we need to know how you have used the prototype chart and the other maps and guide materials. We also want to know what you think about the general concept of including information on environmental and boating resources in charts, maps and guide materials designed for the boating public. To collect your input in a standardized, manageable way, from over 500 volunteers, we have devised a step-by-step critique that will allow each of you to be part of the evaluation and editorial team.

Our desire is to make the new generation of chart products designed by and for boaters, and your critique is a vital part of this process. The reason we printed a **Prototype Edition** was to collect your thoughts on how to improve the test chart after it's been used.

Your insight may help influence the form and content of boating information that will soon be distributed around the country. Your time is valuable. Thank you in advance for your sense of stewardship and dedication to preserving the boating environment and the natural resources that boaters enjoy. Your assistance will improve information that will allow each individual boater to balance on-the-water recreation with wise use of the resources.

Gustavo Antonini
Professor and Principal Investigator

To show our appreciation for your participation, we will mail to those who complete and return the Trip Log and Evaluation Survey an 80-page, full color, atlas documenting the Historical Geography of Boating in Southwest Florida.

PART 1. WE WOULD LIKE YOU TO ANSWER SOME QUESTIONS ABOUT YOUR BOATING DURING THE FEBRUARY - APRIL TEST PERIOD.

A number of Project Volunteers indicated that they used more than one boat. In order to increase the value of this study, we would like you to answer the questions from the point-of-view of the vessel you used most often during the February - April 1999 period.

Q-1. What type of vessel did you use most often to test our charts, maps and guide materials? (Please circle appropriate number.)

1. rowboat, kayak, canoe
2. sail
3. speed, skiff, utility or pontoon boat
4. personal watercraft
5. recreational fishing boat
6. powerboat, cabin cruiser, trawler or houseboat

Q-2. What is the overall length of the boat you used most often during this test period? (Please fill-in the blank.)

_____ ft.

Q-3. Of your total time spent boating during the February - April test period, what proportion was spent within the area covered by the Prototype Chart, lower Tampa Bay to Charlotte Harbor? (Please fill-in the blank.)

_____ percentage

Q-4. The following is a list of the materials included in the package we sent to you in February. Please rank these materials in order of your use, starting with 1 as most often used, and 6 as least often used. (Please fill-in the blanks.)

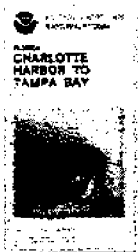
- _____ Prototype Photo-Chart 11425
- _____ Conventional Small-Craft Chart 11425
- _____ Place-Mat Photo-Maps
- _____ Sarasota Bay Blueways Recreational Opportunities for the Boater
- _____ Guide to Anchorages in Southwest Florida
- _____ Florida Sea Grant Web Site for Southwest Florida Anchorages

Q-5. When boating within the test area, from lower Tampa Bay to Charlotte Harbor, approximately how many times did you consult these materials? You may wish to refer to your Volunteer Trip Log. (Please fill-in the blank for each product.)

| Information Products | Number of Times Consulted |
|--|---------------------------|
| Prototype Photo-Chart | |
| Conventional Small-Craft Chart | |
| Place-Mat Photo-Maps | |
| Sarasota Blueways Pocket Guide | |
| Guide to Anchorages in Southwest Florida | |
| Florida Sea Grant Anchorage Web Site | |

Q-6. Boating means different things to different people. From the list below, please select *your* top three typical boating activities during the test period and rank them in descending order, e.g., #1 - the most typical. (Please fill-in the blanks.)

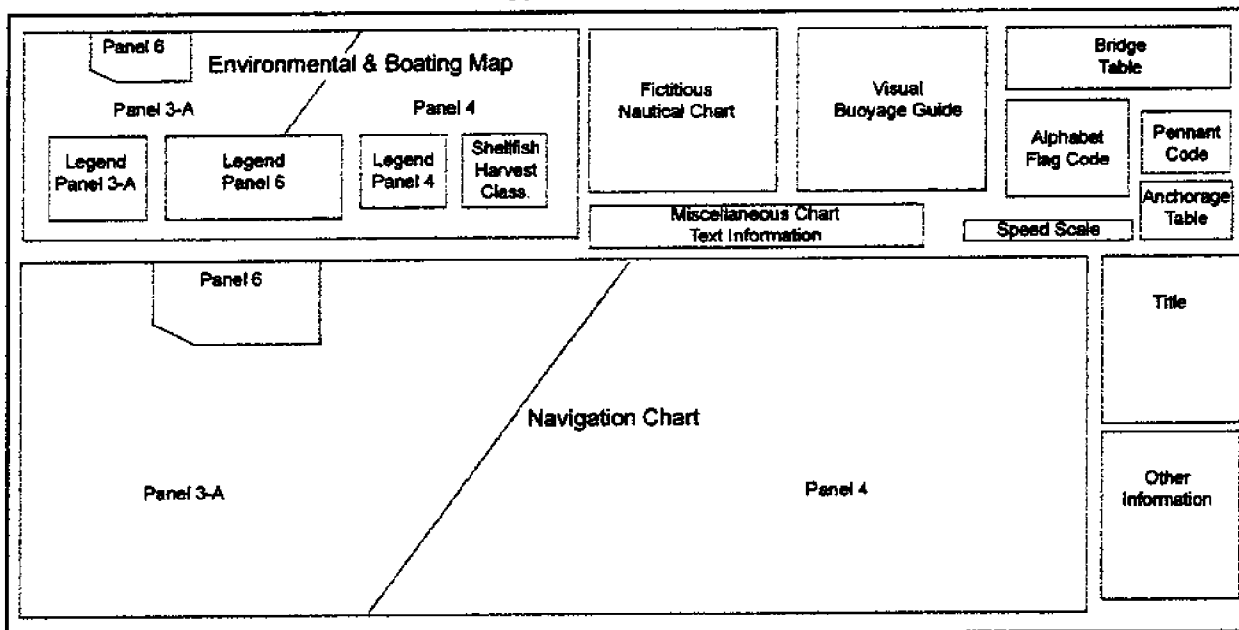
- _____ Rowing/paddling
- _____ Fishing
- _____ Diving
- _____ Sailing
- _____ Power-boating
- _____ Jet-skiing
- _____ Water-skiing
- _____ Nature-touring
- _____ Cruising and anchoring
- _____ Other (please specify)



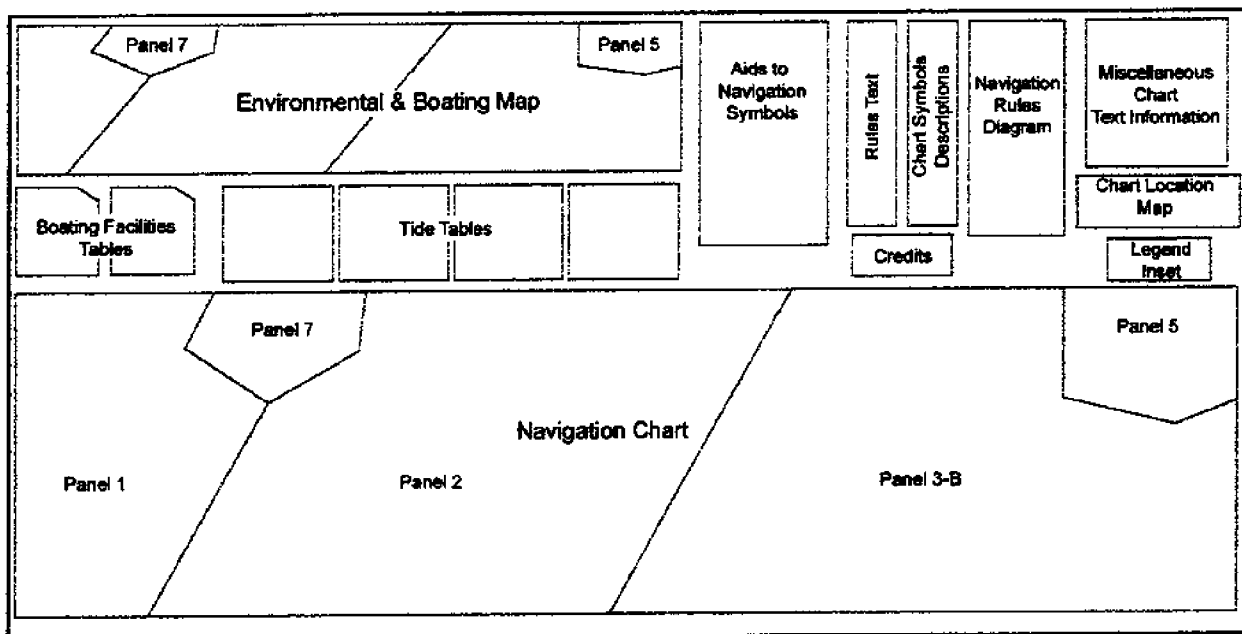
PART 2. NOW WE WOULD LIKE YOU TO EVALUATE THE PROTOTYPE PHOTO-CHART

The Prototype Photo-Chart #11425 covers the southwest Florida coast from Charlotte Harbor to lower Tampa Bay. Side A shows the Charlotte Harbor to Venice Inlet area; Side B shows the area from Venice Inlet to lower Tampa Bay. The Prototype Photo-Chart is divided into top and bottom half-sections, which are further subdivided into panels. The following figures show the layout of the panels on Side A and Side B, respectively. Please refer to these figures as a guide to locating the specific items addressed in the questions listed below.

Prototype Photo-Chart 11425



Side A: Charlotte Harbor to Venice Inlet



Side B: Venice Inlet to Tampa Bay

Part 2a. Let's begin with the Navigation Chart which is found on the bottom section, Sides A and B. Background aerial imagery has been added to the chart.¹

Side A of the Navigation Chart incorporates digital aerial infra-red ortho-photography. It has been converted to natural color on Panels 3-A and 4 and has a 4-meter resolution. The infra-red color photography in Panel 6 (Venice Inlet) has a 2-meter resolution and has not been converted to normal color. Side A aerial photography covers water and land; color symbols only are used to distinguish marsh (green) and spoil (blue) areas from the water. Spot soundings are shown as on the conventional chart.

Side B of the Navigation Chart uses a composite satellite image color-fused with aerial photography and has a 5 meter resolution. The color imagery only covers the land: Panels 1, 2, and 3-B render water areas less than 6 ft in a blue color, deeper water is white and grass is green, as on conventional charts; Panel 5 renders water areas in 3 ft-shaded blue-colored increments; spot soundings are shown as on a conventional chart.

Q-7. Which color-type imagery example did you like the best? (Please circle number that best represents your answer.)

1. digital infra-red ortho-photography converted to natural color (Panels 3-A & 4)
2. digital infra-red ortho-photography (Panel 6)
3. composite satellite color-fused imagery (Panels 1, 2, 3-B, 5)
4. none of the above; I prefer the traditional representation (Panel 7)

Q-8. Did the imagery examples provide you with adequate clarity to locate landmarks? (For the panel(s) listed on each row, mark an 'X' in the box that best describes its readability.)

Readability Ratings

| Chart Panels | Resolution | Very Easy | Easy | Some Effort | Great Effort | Impossible |
|-----------------|------------|-----------|------|-------------|--------------|------------|
| 3-A and 4 | 4 meters | | | | | |
| 6 | 2 meters | | | | | |
| 1, 2, 3-B and 5 | 5 meters | | | | | |

¹The digital photography and satellite imagery are made up of a very large number of grid cells, called pixels, each of which contains a picture signature record. The computer has been used to process and enhance the digital pixel values; different images have been combined (fused), and color values substituted. Much of this imagery is responsive to infrared light which give a 'false-color' characterization of the earth: healthy vegetation shows up as red and urbanized areas are tones of blue and grey; some of the infra-red imagery has been converted to appear as normal color in order to portray a scene as would be viewed by the human eye. The prototype chart uses ortho-photographs which are distortion-free and show true positions of all ground features. Image resolution is related to the size of the area on the ground associated with each digital pixel measurement: smaller pixel size equals higher resolution, greater clarity and more detail.

Q-9. Which area(s) should the imagery portray? (Please circle number that best represents your answer.)

1. land and water (e.g., Panels 3-A, 4, and 6)
2. land only (e.g., Panels 1, 2, 3-B)
3. water only (no example provided)

Q-10. How should bathymetry (water depths) be shown on the Navigation Chart (bottom section)? (Please circle number that best represents your answer.)

1. spot soundings only, with color imagery in background (e.g., Panels 3-A, 4, 6)
2. spot soundings and conventional supplemental contours, without color imagery in background (e.g., Panels 1, 2, 3-B and 7)
3. spot soundings and color-shaded depth ranges (e.g., Panel 5)

Q-11. Please rate the 'readability' of the information on the panels in the Navigation Chart portion (bottom section) of the Prototype. (For the panel(s) listed on each row, mark an 'X' in the box that best describes its readability.)

Readability Rating

| Chart Panels | Very Easy | Easy | With Some Effort | Great Effort | Impossible |
|--------------|-----------|------|------------------|--------------|------------|
| 3-A and 4 | | | | | |
| 6 | | | | | |
| 1, 2 and 3-B | | | | | |
| 5 | | | | | |
| 7 | | | | | |

Q-12. Please rate the 'usefulness' of the information on the panels in the Navigation Chart portion (bottom half) of the Prototype. Apply a scale of 1 to 9, with 1 being the most useful. (For the panel(s) listed on each row, circle the appropriate number that best describes the usefulness of the information.)

| Chart Panels | Usefulness Ratings (circle answer) | | | | | | | | |
|--------------|------------------------------------|---|---|---|--------|---|---|---|-----|
| | High | | | | Medium | | | | Low |
| 3-A and 4 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 6 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1, 2 and 3-B | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

Q-13. For those answers to Question 12 which are in the 6-9 range, please explain?

Q-14. What kinds of information did you find most useful on the Navigation Chart portion (bottom half) of the Prototype?

Q-15. In comparing the conventional chart with the prototype, did you dislike any of the prototype features?

1. no
2. yes (please specify or explain)

Part 2b. Now let's examine the Environmental and Boating Information Map Panels which are situated on the top left portion of Sides A and B.

Specific information themes are represented on the supplemental map panels found on the **top left portion** of Sides A and B. They include:

- (1) anchorages, bridges, and boat ramps, on Panels 3-A and 4 (Side A), and Panels 1, 2, 3-B and 7 (Side B);
- (2) sea grass, shown two ways, as 'continuous or patchy' on Panel 3-A (Side A) and Panels 3-B and 5 (Side B), and only as 'general presence' on Panel 1 (Side B);
- (3) mangrove, on Panels 1 and 3-B (Side B);
- (4) shellfish harvesting categories, on Panel 4 (Side A);
- (5) depth zones, shown in two ways, as supplemental map information on Panel 2, and as navigation chart information on Panel 5 (both on Side B);
- (6) speed zones, on Panel 6 (Side A)

Q-16. How many times did you refer to the Environmental and Boating Map Panels during the February - April test period?

- 1. I did not use this information during the test period
- 2. 1 - 3 times
- 3. 4 - 6 times
- 4. 7 - 10 times
- 5. more than 10 times

Q-17. In general, do you think environmental and boating information should be included on the chart? (Please circle number that best represents your answer.)

- 1. yes, as represented on the prototype, on separate map panels, is good
- 2. yes, but this information should be included on the main navigation chart
- 3. no, because this information should be available from other products
- 4. no, because this information is not relevant to my boating needs
- 5. no opinion

Q-18. Is the anchorage, bridge, and boat ramp information of sufficient detail and is it presented adequately? (Please mark an 'X' in the box that best describes your answer and specify any additional information needs.)

Adequacy Ratings

| Features | Not Necessary | OK as Shown | Need More Info | Explain Needs |
|------------|---------------|-------------|----------------|---------------|
| Anchorage | | | | |
| Bridges | | | | |
| Boat ramps | | | | |

- Q-19. Should sea grass information be shown on the chart? (Please circle number that best represents your answer.)
1. yes, I like the distinction between patchy and continuous
 2. yes, but the distinction between patchy and continuous is not necessary
 3. yes, but sea grass should be portrayed on the 'navigation' portion of the chart
 4. yes, but, I would like to see it represented by (fill-in_____)
 5. no, this is unnecessary information
- Q-20. Should mangrove information be shown on the chart? (Please circle number that best represents your answer.)
1. yes, I like the manner in which it is presented
 2. yes, but mangrove should be portrayed on the 'navigation' portion of the chart
 3. yes, but, I would like to see it represented by (fill-in_____)
 4. no, this is unnecessary information
- Q-21. Should shellfish harvesting information be shown on the chart? (Please circle number that best represents your answer.)
1. yes, I like the manner in which it is presented
 2. yes, but, I would like to see it represented by (fill-in_____)
 - c. no, this is unnecessary information
- Q-22. The traditional way of showing depth zones on conventional charts is by selected fathom intervals, e.g., 6, 12, 18, 24, 30 ft depths; in nearshore shallow water areas, an additional 3 ft. line may be shown as well. Water depths less than 6 ft are highlighted by a color tint. How should depth zones be portrayed? (Please circle number that best represents your answer.)
1. conventional navigation chart display is adequate, both the 6 ft interval lines and the less than 6 ft color tint
 2. depth lines should be increased on the navigation chart to show every 3 ft interval in shallow water areas, and, two depth zones should be color tinted: the 0 to 3 ft, and the 3 to 6 ft
 3. all depths less than 12 ft should be shown by graduated color tints at 3 ft intervals to supplement spot soundings on the navigation chart, as in Panel 5
 4. depth zones should be shown on a supplemental map, as in Panel 2
- Q-23. Should speed zones be shown on the chart? (Please circle number that best represents your answer.)
1. yes, I like the manner in which it is presented
 2. yes, but, I would like to see it represented by (fill-in_____)
 3. no, this is unnecessary information

Q-24. Is there any other information (theme) you would like to see represented on the supplemental map panels? (Please circle number that best represents your answer.)

1. no
2. yes (Please specify)

Q-25. Please characterize the 'readability' of the information on the Environmental and Boating Map Panels (top left portion on Sides A and B). (For the panels listed on each row, mark an 'X' in the box that best describes its readability.)

Readability Rating

| Map Panels | Very Easy | Easy | With Some Effort | Great Effort | Impossible |
|--------------|-----------|------|------------------|--------------|------------|
| 3-A (Side A) | | | | | |
| 4 (Side A) | | | | | |
| 6 (Side A) | | | | | |
| 1 (Side B) | | | | | |
| 2 (Side B) | | | | | |
| 3-B (Side B) | | | | | |
| 5 (Side B) | | | | | |
| 7 (Side B) | | | | | |

Q-26. Please rate the 'usefulness' of the information on the Environmental and Boating Information Map Panels (top left portion on Sides A and B) of the Prototype Chart. Apply a scale of 1 to 9, with 1 being the most useful. (For the panels listed on each row, circle the appropriate number that best describes the usefulness of the information.)

| Chart Panels | Usefulness Ratings (circle answer) | | | | | | | | |
|--------------|------------------------------------|---|---|---|--------|---|---|---|-----|
| | High | | | | Medium | | | | Low |
| 3-A (Side A) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 4 (Side A) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 6 (Side A) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 (Side B) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2 (Side B) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 3-B (Side B) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 5 (Side B) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 7 (Side B) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

Part 2c. Now, let's examine the Supplemental Boating Information Tables and Diagrams, which are placed on the top right portion of Sides A and B, as well as within the area of the Navigation Chart (bottom section) on Side A, and in the space between the Navigation Chart and Map Panels on Side B.

Information is represented in tables and diagrams and includes: boating tables (upper right of Side A), and boating facilities (upper left of Side B); buoyage diagrams, shown three ways, as: U.S. Aids to Navigation System, detailing lights, colors, and shapes of marks (Side B, mid-upper section); Fictitious Nautical Chart, showing nighttime characteristics in relation to channel location (Side A, mid-upper right); and Visual Buoy Guide, illustrating daytime characteristics of buoys shown on the Fictitious Nautical Chart (Side A, mid-upper left); navigation rules diagram, describing vessel crossing and overtaking situation, flags for vessel maneuverability, and weather pennants (Side B, upper right) flag and pennant codes (Side A, upper right); tide tables (Side B, mid-upper left) and tidal current tables (Side A, lower left inset on Navigation Chart Panel), as shown on the conventional chart.

Q-27. In general, should these tables and diagrams be included on the chart? (Please circle number that best represents your answer.)

1. yes, as represented on the prototype, is good
2. no, because this information should be available in other products
3. no, because the information is not necessary

Q-28. Is the information in these tables and diagrams necessary, and is it presented adequately? (Please evaluate each table-diagram theme by marking each row with an 'X' that best describes your response, and specify any additional information needs.)

Adequacy Rating

| Themes | Not Necessary | OK as Shown | Need More Info | Explain Needs |
|--------------------|---------------|-------------|----------------|---------------|
| Bridges | | | | |
| Anchorage | | | | |
| Boating facilities | | | | |
| U.S. Aids | | | | |
| Fictitious Chart | | | | |
| Visual Guide | | | | |
| Navigation Rules | | | | |
| Flag Codes | | | | |
| Tide Tables | | | | |
| Current Tables | | | | |

Part 2d. We would like to know your opinion regarding the format of the Prototype Chart

The conventional small-craft chart is 20" x 60" with a double-fold. The prototype is size 30" x 60" with a triple-fold. Both chart products fold to 5" x 10" size.

Q-29. Is the prototype chart size acceptable? In other words, can you manageably fold it and use it in the cockpit of your boat? (Please circle number that best represents your answer.)

1. yes
2. no
3. no opinion

Q-30. If you answered 'no' to question 28, would a 'track ticket' format be more suitable? The 'track ticket' is a progressive book chart of large sections of the waterway, at large-scale (small area with more information), which would be rendered with traditional charts and in imagery. Side-bars, along the page boundaries, would contain additional information, like oblique and ground level photography of bridges, anchorages and other prominent features, information about facilities and boat ramps, boater educational panels, and local environmental information. (Please circle number that best represents your answer.)

1. yes
2. no
3. no opinion

Q-31. Did your use of the Prototype Photo-Chart affect the quality of your boating activities during the February - April test period? (Please mark an 'X' in the box that best describes your answer for each item below.)

| Types of Affected Boating Practices | A Lot | Some | Not Much | Not at All |
|---|-------|------|----------|------------|
| Enhanced awareness for boat safety | | | | |
| Reduced potential conflicts | | | | |
| Increased boating enjoyment | | | | |
| Increased awareness about environmental impacts | | | | |

PART 3. NOW, WE WOULD LIKE YOU TO EVALUATE THE OTHER BOATER INFORMATION PRODUCTS WE PROVIDED TO YOU



Part 3a. The next several questions seek your evaluation of the fold-out (Pocket Guide) publication "Recreational Opportunities for the Boat: Sarasota Bay Blueways".

Q-32. How many times did you refer to the Pocket Guide during the test period? (Please circle your answer number.)

1. I did not use this map during the February - April test period
2. 1 - 3 times
3. 4 - 6 times
4. 7 - 10 times
5. more than 10 times

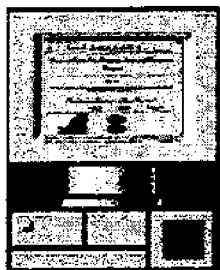
Q-48. The Anchorage Guide contains a number of features. (We ask you to please rate the **usefulness** of each of the main features on a scale of 1 to 9, with 1 being the highest.)

| Anchorage Guide Features | Usefulness Ratings (circle answer) | | | | | | | | |
|--|------------------------------------|---|---|--------|---|---|-----|---|---|
| | High | | | Medium | | | Low | | |
| Photographs with superimposed course lines | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Chart-lets with preferred course and buoys | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Text describing anchorage | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Boating and anchoring tips | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

Q-49. If your answers to Question 47 are in the 6-9 range, please explain?

Q-50. Did your use of the Anchorage Guide affect any of the following boating practices during the February - April test period? (Please mark with an 'X' the appropriate answer for each item below.)

| Types of Affected Boating Practices | A Lot | Some | Not Much | Not at All |
|---|-------|------|----------|------------|
| Enhanced awareness for boat safety | | | | |
| Reduced potential conflicts | | | | |
| Increased boating enjoyment | | | | |
| Affected decisions to avoid adverse environmental impacts | | | | |



Part 3d. The following questions concern the Florida Sea Grant web site for Southwest Florida Anchorages
[<http://flseagrant.org/Anchor.htm>] (Anchorage Web Site)

Q-51. Do you have access at home to a computer and the internet? (Please circle your answer number.)

1. yes
2. no

- Q-52. How many times did you access the Anchorage Web Site during the test period?
1. I did not use this during the February - April test period
 2. 1 - 3 times
 3. 4 - 6 times
 4. 7 - 10 times
 5. more than 10 times

- Q-53. On a scale of 1 to 9, with 1 being the highest, please rank the **overall relevance** of the Anchorage Web Site information. (Circle your answer number.)

| | | | | | | | | | |
|------|---|---|---|--------|---|---|---|---|-----|
| High | | | | Medium | | | | | Low |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |

- Q-54. If your answer to Question 52 is in the 6-9 range, please explain?

- Q-55. The Anchorage Guide contains a number of features. (We ask you to please rate the usefulness of each of the main features on a scale of 1 to 9, with 1 being the highest.)

| Anchorage Web Site Features | Usefulness Ratings (circle answer) | | | | | | | | |
|---|------------------------------------|---|---|--------|---|---|-----|---|---|
| | High | | | Medium | | | Low | | |
| Local restrictions | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Maps and photos | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Hot links to weather, tides, chart updating, etc. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

- Q-56. If your answers to Question 54 are in the 6-9 range, please explain?

- Q-57. Do you have suggestions on how the Anchorage Web Site can be improved?

Q-58. Did your use of the Anchorage Web Site affect any of the following boating practices during the February - April test period? (Please mark the an 'X' the appropriate answer for each item below.)

| Types of Affected Boating Practices | A Lot | Some | Not Much | Not at All |
|---|-------|------|----------|------------|
| Enhanced awareness for boat safety | | | | |
| Reduced potential conflicts | | | | |
| Increased boating enjoyment | | | | |
| Affected decisions to avoid adverse environmental impacts | | | | |

PART 4. OTHER COMMENTS

Q-59. We would be pleased to receive any general suggestions for improving the prototype chart and other map and guide materials. (Please specify the product you are referring to when providing comments.)

Q-60. Would you be interested in participating in any focus group workshops or other activities of limited scope we may conduct to finalize any improvements in the information products?

1. yes
2. no

**PLEASE RETURN THE EVALUATION QUESTIONNAIRE, AND YOUR VOLUNTEER TRIP LOG, IN THE ENCLOSED POSTAGE-PAID ENVELOPE
THANK YOU AGAIN FOR YOUR COOPERATION**

Dear boat owner:

May 20, 1999

A final product evaluation questionnaire was mailed to you several weeks ago. Many thanks to those 100 or so of you who have already returned your trip logs and product evaluations. This postcard is simply a reminder of the importance of completing and returning the trip log and final product evaluation. Your name was drawn by way of scientific sampling. Every boat-owner registered in Manatee, Sarasota and Charlotte Counties, had an equal chance of being selected. This means that each of the 480 volunteers in this study represents about 90 boaters using these waters. In order for the study to be truly representative of all boaters in the three county area, it is essential that each boater who volunteered to participate return their evaluation questionnaire and trip log. We place great importance in receiving the results of your evaluation. Please contact us by email antonini@ufl.edu or by phone (352) 392-6233 if you have questions or need another evaluation form.

Thank you again, for your participation in this important project.

Sincerely,

Gustavo Antonini
Professor and Project Senior Scientist

First Name Last Name
Title
Address
City State Zip

October, 1999

Dear

It is a pleasure to send you this complimentary copy of Florida Sea Grant Publication (SGEB-47), "A Historical Geography of Southwest Florida Waterways." This represents a jointly sponsored effort of research and public education by the National Oceanic and Atmospheric Administration (NOAA), the Florida Sea Grant College Program, the Coastal Services Center (Charleston, South Carolina), and the West Coast Inland Navigation District.

The book portrays the complex relationship between human dreams and an endlessly changing coastal environment of southwest Florida. It unveils a century of alterations to the coast and its waterways from Anna Maria Sound to Lemon Bay.

As a window to the past and present, this historical geography also provides insight into the future direction of shore development and waterway use. It recognizes a growing public awareness that the profound natural beauty of this region could easily be lost without a widespread feeling of stewardship and continuing efforts to restore and maintain the bay systems by public policies and private actions that foster sustainable use. Insights gleaned from this historical, geographical perspective of the region, we hope, can help lead us to attain a balance in which nature and people can coexist far into the future.

Sincerely,

Jim Cato, Director
Florida Sea Grant College Program
Home Page: <http://www.FLSeaGrant.org>

P.S.

Additional copies of the book can be obtained from the Florida Sea Grant College Program, P.O. Box 110409, Gainesville, FL 32611-0409. Please enclose a check or money order payable to the University of Florida in the amount of \$3.00 to cover postage and handling.

Appendix C

Methods Tables

| Counties | Number of Vessels | Percent of total |
|-----------|-------------------|------------------|
| Manatee | 13,243 | 29.5 |
| Sarasota | 17,634 | 40.0 |
| Charlotte | 13693 | 30.5 |
| Total | 44330 | 100.0 |

Table 1. Recreational Boats in the Study Area.

| County | Surveys Sent | Percent |
|-----------|--------------|---------|
| Manatee | 898 | 29.9 |
| Sarasota | 1176 | 39.2 |
| Charlotte | 926 | 30.9 |
| Total | 3,000 | 100.0 |

Table 2. County Distribution of Boater Profile Surveys.

| Boat Type | VTRS Totals | Sample Proportion (of 3000) | Manatee | | | Sarasota | | | Charlotte | | |
|---|---------------|-----------------------------|---------------|---------------|----------------------|---------------|---------------|----------------------|---------------|---------------|----------------------|
| | | | Class Total | % Class Total | Sample Size by Class | Class Total | % Class Total | Sample Size by Class | Class Total | % Class Total | Sample Size by Class |
| A | 734 | 50 | 250 | 34 | 17 | 299 | 41 | 21 | 185 | 25 | 12 |
| B | 3,162 | 214 | 879 | 28 | 60 | 1,219 | 39 | 82 | 1,064 | 34 | 72 |
| C | 15,933 | 1078 | 4,603 | 29 | 312 | 6,328 | 40 | 428 | 5,002 | 31 | 338 |
| Jet | 3,611 | 244 | 1,145 | 32 | 78 | 1,625 | 45 | 110 | 841 | 23 | 56 |
| D | 15,597 | 1056 | 4,877 | 31 | 330 | 5,813 | 37 | 394 | 4,907 | 31 | 332 |
| E | 2,678 | 182 | 664 | 25 | 44 | 1,111 | 41 | 76 | 903 | 34 | 62 |
| Other | 2,615 | 176 | 825 | 32 | 56 | 999 | 38 | 66 | 791 | 30 | 54 |
| Total | 44,330 | 3000 | 13,243 | | 898 | 17,394 | | 1176 | 13,693 | | 926 |
| A: Row-boat/Canoe/Kayak (motorized) B: Sailboat (non-motorized) C: Speed/Skiff/John/Utility/Pontoon Boat Jet: Personal Watercraft D: Sailboat (auxiliary-powered) E: Cabin-Cruiser/Trawler/Houseboat Other: Unidentified Boat | | | | | | | | | | | |

Table 3. Breakdown of VTRS Boat Sample by County and Class.

| Boater Profile Questionnaires | Resident | Transient | Questionnaires Distributed | |
|---|----------|-----------|----------------------------|---------|
| Mailed or Distributed | 3000 | 250 | 3018 | |
| Returned by Post Office as Undeliverable | 232 | 0 | | |
| Questionnaires Answered | Resident | Transient | Count | Percent |
| Boater Profile Survey | 828 | 87 | 915 | 30% |
| Volunteers Agreeing to Test and Evaluate Products | 417 | 64 | 481 | 53% |
| Product Evaluation Survey | 113 | 19 | 132 | 27% |

Table 4. Questionnaire and Volunteer Receipt and Return Rates.

| Boat Type | Questionnaires Distributed | | Questionnaires Returned | | Difference (Percent) |
|---|----------------------------|---------|-------------------------|---------|----------------------|
| | Count | Percent | Count | Percent | |
| Row-boat/Canoe/Kayak | 50 | 1.7 | 24 | 2.6 | +9 |
| Sailboat (non-motorized, auxiliary-powered) | 1270 | 42.1 | 142 | 15.5 | -26.6 |
| Speed/Skiff/John/Utility/Pontoon Boat | 1078 | 35.7 | 418 | 45.7 | +10.0 |
| Personal Water-craft | 244 | 8.0 | 29 | 3.2 | -4.8 |
| Cabin-Cruiser/Trawler/Houseboat | 182 | 6.1 | 215 | 23.5 | +17.4 |
| Unidentified Boat | 176 | 5.8 | N/A | N/A | N/A |
| Transient (all) | 250 | 8.2 | 87 | 9.5 | +1.3 |
| Undeliverable | 232 | -7.6 | N/A | N/A | N/A |
| Total | 3018 | 100.0 | 915 | 100.0 | |

*Class not included in the survey

Table 5. Differences Between Boater Profile Questionnaires Distributed and Returned.

| Boat Type | 1 | | 2 | | Difference Between 1 and 2 |
|---|---|-------|---|------|----------------------------|
| | Boater Profile Survey Sample N = 828 | | Product Evaluation Survey Sample N = 132 | | |
| | N | % | Percent | % | Percent |
| Row-boat/Canoe/Kayak | 24 | 2.9 | .1 | 3.0 | .1 |
| Sailboat (non-motorized, auxiliary-powered) | 142 | 17.1 | 8.7 | 25.8 | 8.7 |
| Speed/Skiff/John/Utility/Pontoon Boat | 418 | 50.5 | 20.2 | 30.3 | 20.2 |
| Personal Water-craft | 29 | 3.5 | .3 | 3.8 | .3 |
| Cabin-Cruiser/Trawler/Houseboat | 215 | 26.0 | 11.1 | 37.1 | 11.1 |
| Total | 828 | 100.0 | 132 | 100 | |

Table 6. Comparing Boat-Type Ratios Between Boater Profile and Product Evaluation Surveys.

| CHI SQUARE SUMMARY TABLE WITH BOAT TYPES THE DEPENDENT VARIABLE | | | |
|--|------------------------|------------------------|----------------|
| Question Summary | Question Number | Table Statistic | Signif. |
| Should Speed Zones be included on Chart | Q23 | .0018 | Yes |
| Is the Flag Code Information necessary | Q28 | .0375 | Yes |
| Enhanced Safety Awareness | Q31 | .0188 | Yes |
| Habitat and Env. Infor. On Pocket Guide | Q37 | .0084 | Yes |
| Suggestion about Place Mat Information | Q41 | .0348 | Yes |
| Affect decisions concerning adv. Env. Imp. | Q44 | .0261 | Yes |
| Enhanced Safety Info. Anchorage Guide | Q50 | .0093 | Yes |

Table 7. Chi-Square Summary Table with Boat-Type as the Dependent Variable.

| Question Summary | Question Number | Chi-Square Statistic | Significant (alpha .05) |
|---------------------------------------|------------------------|-----------------------------|--------------------------------|
| Ranking of Florida Sea Grant Web-Page | Q4 | .0241 | Yes |
| Readability of Panel 6 (Side A) | Q25 | .0434 | Yes |
| Do you have access to a home computer | Q51 | .0123 | Yes |
| Boca Grande/Grande Bayou Anchorage | Q40 | .0195 | Yes |

Table 8. Chi-Square Summary Table with Education as the Dependent Variable.

| Question Summary | Question Number | Question Category | Sub Question | Student -t Statistic | Significant (alpha .05) |
|---|------------------------|--------------------------|-----------------------|-----------------------------|--------------------------------|
| Usefulness of Environmental and Boating Information | Q26 | Speedboats | Pan.3A | 2.17 | Yes |
| | Q26 | Cabin Cruisers | Pan3A | 2.17 | Yes |
| Pocket Guide Resources and Facilities | Q33 | Kayaks, Row, Canoes | Marinas & Restaurants | 5.02 | Yes |
| | Q33 | Sailboats | | 2.02 | Yes |
| | Q33 | Speedboats | Art Reefs | 2.58 | Yes |
| | Q33 | Speedboats | Ramps | 2.16 | Yes |
| | Q33 | Cabin Cruisers | Marinas & Restaurants | 4.14 | Yes |
| Usefulness of Anchorage Guide | Q48 | Kayaks, Row, Canoes | Boat Trips | 3.19 | Yes |
| | Q48 | Sailboats | Photos | 2.72 | Yes |

Table 9. Student-T Summary Table with Boat-Type as the Dependent Variable.

| Question Summary | Question Number | Question Category | Sub Question | Student-t Statistic | Significant (alpha .05) |
|-------------------------------|------------------------|--|---------------------|----------------------------|--------------------------------|
| Usefulness of Anchorage Guide | Q55 | Respondents with primary through high school education | Maps and Photos | 2.3724 | Yes |

Table 10. Student-T Summary Table with Education as the Dependent Variable.

Appendix D

Results Tables

Table 1. Weighted summed scores and ranked top three boating activities

| Activity | Ratings | #1 | #2 | #3 | Raw Total | Weighted Total | Ranking |
|--|-----------------|------|-----|-----|-----------|----------------|---------|
| Fishing | Raw Counts | 354 | 292 | 175 | 821 | | |
| | Weights | 3 | 2 | 1 | | | |
| | Weighted Counts | 1062 | 584 | 175 | | 1821 | 1 |
| Cruising | Raw Counts | 285 | 191 | 119 | 595 | | |
| | Weights | 3 | 2 | 1 | | | |
| | Weighted Counts | 855 | 382 | 119 | | 1356 | 2 |
| Day Sailing & Racing | Raw Counts | 107 | 90 | 61 | 258 | | |
| | Weights | 3 | 2 | 1 | | | |
| | Weighted Counts | 321 | 180 | 61 | | 562 | 3 |
| Speedboating & Skiing | Raw Counts | 26 | 49 | 63 | 138 | | |
| | Weights | 3 | 2 | 1 | | | |
| | Weighted Counts | 78 | 98 | 63 | | 239 | 4 |
| Diving | Raw Counts | 16 | 51 | 85 | 152 | | |
| | Weights | 3 | 2 | 1 | | | |
| | Weighted Counts | 48 | 102 | 85 | | 235 | 5 |
| Other (birding, nature-touring, beach-combing) | Raw Counts | 30 | 44 | 52 | 126 | | |
| | Weights | 3 | 2 | 1 | | | |
| | Weighted Counts | 90 | 88 | 52 | | 230 | 6 |
| Canoeing | Raw Counts | 18 | 28 | 31 | 77 | | |
| | Weights | 3 | 2 | 1 | | | |
| | Weighted Counts | 54 | 56 | 31 | | 141 | 7 |

Tallies for each activity are ranked by their frequency of occurrence. Weighted rank values were assigned to each count: #1 boating activity = 3; #2 boating activity = 2; #3 boating activity = 1. The frequency-ranked weighted values were summed to obtain the score, and the scores were ranked, from 1 (highest) to 7 (lowest).

Table 2. Weighted summed scores and ranked top five reasons for selecting a boating locale

| Boating Site Quality | Ratings | #1 | #2 | #3 | #4 | #5 | Raw Total | Weighted Total | Ranking |
|---|-----------------|------|-----|-----|-----|----|-----------|----------------|---------|
| Fishing | Raw Counts | 275 | 69 | 53 | 45 | 43 | 485 | | |
| Opportunities | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 1375 | 276 | 159 | 90 | 43 | | 1943 | 1 |
| Scenic Beauty | Raw Counts | 108 | 134 | 121 | 99 | 67 | 529 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 540 | 536 | 363 | 198 | 67 | | 1704 | 2 |
| Clean Water | Raw Counts | 101 | 142 | 116 | 106 | 60 | 525 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 505 | 568 | 348 | 212 | 60 | | 1693 | 3 |
| Calm Waters | Raw Counts | 79 | 92 | 85 | 61 | 40 | 357 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 395 | 368 | 255 | 122 | 40 | | 1180 | 4 |
| Tranquility | Raw Counts | 40 | 62 | 105 | 86 | 88 | 381 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 200 | 248 | 315 | 172 | 88 | | 1023 | 5 |
| Protected Waters | Raw Counts | 85 | 70 | 51 | 48 | 61 | 315 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 425 | 280 | 153 | 96 | 61 | | 1015 | 6 |
| Observing Wildlife | Raw Counts | 18 | 74 | 99 | 109 | 89 | 389 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 90 | 296 | 297 | 218 | 89 | | 990 | 7 |
| Absence of Other Boaters | Raw Counts | 34 | 57 | 60 | 63 | 65 | 279 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 170 | 228 | 180 | 126 | 65 | | 769 | 8 |
| Other (ease of access, marina facilities) | Raw Counts | 42 | 22 | 6 | 7 | 9 | 86 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 210 | 88 | 18 | 14 | 9 | | 339 | 9 |
| Diving | Raw Counts | 8 | 22 | 21 | 18 | 24 | 93 | | |
| Opportunities | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 40 | 88 | 63 | 36 | 24 | | 251 | 10 |
| Challenging Navigation | Raw Counts | 5 | 21 | 18 | 16 | 15 | 75 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 25 | 84 | 54 | 32 | 15 | | 210 | 11 |

Table 3. Weighted summed scores and ranked top five reasons for selecting an anchorage locale

| Anchoring Site Quality | Ratings | #1 | #2 | #3 | #4 | #5 | Raw Total | Weighted Total | Ranking |
|-------------------------------|-----------------|------|-----|-----|-----|----|-----------|----------------|---------|
| Bottom-Holding | Raw Counts | 212 | 199 | 52 | 22 | 19 | 504 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 1060 | 796 | 156 | 44 | 19 | | 2075 | 1 |
| Storm Protection | Raw Counts | 194 | 87 | 40 | 25 | 22 | 368 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 970 | 348 | 120 | 50 | 22 | | 1510 | 2 |
| Fishing Opportunities | Raw Counts | 215 | 38 | 37 | 28 | 30 | 348 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 1075 | 152 | 111 | 56 | 30 | | 1424 | 3 |
| Clean Water | Raw Counts | 31 | 84 | 101 | 90 | 41 | 347 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 155 | 336 | 303 | 180 | 41 | | 1015 | 4 |
| Scenic Beauty | Raw Counts | 57 | 65 | 87 | 70 | 65 | 344 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 285 | 260 | 261 | 140 | 65 | | 1011 | 5 |
| Tranquility | Raw Counts | 27 | 40 | 83 | 67 | 55 | 272 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 135 | 160 | 249 | 134 | 55 | | 733 | 6 |
| Beachcombing | Raw Counts | 30 | 38 | 40 | 58 | 44 | 210 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 150 | 152 | 120 | 116 | 44 | | 582 | 7 |
| Swimming | Raw Counts | 15 | 32 | 35 | 49 | 41 | 172 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 75 | 128 | 175 | 98 | 41 | | 517 | 8 |
| Environmental Conditions | Raw Counts | 13 | 23 | 36 | 31 | 28 | 131 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 65 | 92 | 108 | 62 | 28 | | 355 | 9 |
| Isolation | Raw Counts | 10 | 14 | 25 | 19 | 41 | 109 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 50 | 56 | 75 | 38 | 41 | | 260 | 10 |
| Marina, Fuel, Pumpout | Raw Counts | 15 | 14 | 18 | 17 | 15 | 79 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 75 | 56 | 54 | 34 | 15 | | 234 | 11 |
| Local Hospitality | Raw Counts | 8 | 5 | 23 | 18 | 18 | 72 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 40 | 20 | 69 | 36 | 18 | | 183 | 12 |
| Access to Shore Entertainment | Raw Counts | 9 | 15 | 7 | 12 | 20 | 63 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 45 | 60 | 21 | 24 | 20 | | 170 | 13 |
| Access to Supplies | Raw Counts | 3 | 10 | 17 | 11 | 18 | 59 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 15 | 40 | 51 | 22 | 18 | | 146 | 14 |
| Shoreside Park | Raw Counts | 1 | 5 | 10 | 13 | 8 | 37 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 5 | 20 | 30 | 26 | 8 | | 89 | 15 |
| Camaraderie | Raw Counts | 3 | 2 | 10 | 9 | 16 | 40 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 15 | 8 | 30 | 18 | 16 | | 87 | 16 |
| Skiing | Raw Counts | 1 | 6 | 5 | 4 | 5 | 21 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 5 | 24 | 15 | 8 | 5 | | 57 | 17 |
| Other (diving, wade-fishing) | Raw Counts | 5 | 2 | 1 | 2 | 1 | 11 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 25 | 8 | 3 | 4 | 1 | | 41 | 18 |
| Dinghy Sailing | Raw Counts | 0 | 1 | 1 | 3 | 3 | 8 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 0 | 4 | 3 | 6 | 3 | | 16 | 19 |
| Rowing | Raw Counts | 0 | 0 | 1 | 0 | 1 | 2 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 0 | 0 | 3 | 0 | 1 | | 4 | 20 |
| Sail-boarding | Raw Counts | 0 | 0 | 0 | 1 | 2 | 3 | | |
| | Weights | 5 | 4 | 3 | 2 | 1 | | | |
| | Weighted Counts | 0 | 0 | 0 | 2 | 2 | | 4 | 20 |

Table 4. Boat types by on-the-water boating time (hours) during the March - May season

| Boat Type | Boaters | | | Weekdays | | | Weekends | | | Holidays | | | Seasonal Total | | |
|-----------------------------|---------|--------|--------|----------|-------|------------|----------|-------|------------|----------|-------|------------|----------------|--------|------------|
| | Count | Col. % | Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours |
| Boat Type Not Recorded | 15 | 1.90 | 468 | 1.00 | 55.10 | 319 | 0.70 | 37.60 | 62 | 0.80 | 7.30 | 849 | 0.80 | 100.00 | |
| Non-motorized Boats | 23 | 3.00 | 1,709 | 3.50 | 49.70 | 1,407 | 3.10 | 40.90 | 325 | 4.30 | 9.40 | 3,441 | 3.40 | 100.00 | |
| All Sailboats | 124 | 16.20 | 6,497 | 13.30 | 46.10 | 6,132 | 13.60 | 43.60 | 1,437 | 19.20 | 10.20 | 14,066 | 13.90 | 99.90 | |
| Speedboats and Skiffs | 386 | 50.30 | 23,665 | 48.50 | 47.10 | 23,087 | 51.10 | 45.90 | 3,512 | 46.90 | 7.00 | 50,264 | 49.50 | 100.00 | |
| Personal Water Crafts | 27 | 3.50 | 1,565 | 3.20 | 53.80 | 1,173 | 2.60 | 40.30 | 170 | 2.30 | 5.80 | 2,908 | 2.90 | 99.90 | |
| Trawlers and Cabin Cruisers | 192 | 25.30 | 14,926 | 30.60 | 49.90 | 13,031 | 28.90 | 43.50 | 1,976 | 26.40 | 6.60 | 29,933 | 29.50 | 100.00 | |
| Total | 767 | 100.20 | 48,830 | 100.10 | | 45,149 | 100.00 | | 7,482 | 99.90 | | 101,488 | 100.00 | | |

Table 5. Boaters' experience by on-the-water boating time (hours) during the March - May season

| Boating Experience | Boaters | | | Weekdays | | | Weekends | | | Holidays | | | Season Total | | | | | |
|---|---------|--------|--------|----------|-------|------------|----------|--------|------------|----------|-------|------------|--------------|-------|------------|--------|--------|--------|
| | Count | Col. % | Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | | | |
| Boaters with less than ten years experience | 103 | 13.99 | 3,435 | 7.22 | 32.50 | 33.35 | 6,297 | 13.95 | 59.58 | 61.14 | 837 | 11.16 | 7.92 | 8.13 | 10,569 | 10.55 | 100.00 | 102.61 |
| Boaters with more than ten years experience | 633 | 86.01 | 44,131 | 92.78 | 49.23 | 69.72 | 38,850 | 86.05 | 43.34 | 61.37 | 6,660 | 88.84 | 7.43 | 10.52 | 89,641 | 89.45 | 100.00 | 141.61 |
| Total | 736 | 100.00 | 47,566 | 100.00 | 47.47 | 64.63 | 45,147 | 100.00 | 45.05 | 61.34 | 7,497 | 100.00 | 7.48 | 10.19 | 100,210 | 100.00 | | 136.15 |

Table 6. Boaters' household income by on-the-water boating time (hours) during the March - May season

| Annual Household Income Categories | Boaters | | | Weekdays | | | Weekends | | | Holidays | | | Seasonal Total | | | |
|------------------------------------|---------|--------|--------|----------|-------|------------|----------|-------|------------|----------|-------|------------|----------------|-------|------------|--------|
| | Count | Col. % | Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | |
| Less than \$20,000 | 57 | 9.18 | 3,987 | 10.05 | 53.55 | 69.95 | 2,894 | 7.57 | 50.76 | 564 | 6.67 | 7.58 | 7,445 | 8.62 | 99.00 | 130.62 |
| \$20,000 - 50,000 | 207 | 33.30 | 15,553 | 39.20 | 58.14 | 75.13 | 9,523 | 24.90 | 35.60 | 1,674 | 19.79 | 6.26 | 26,750 | 30.97 | 100.00 | 129.31 |
| \$50,001 - \$75,000 | 132 | 21.26 | 7,418 | 18.69 | 40.84 | 56.20 | 9,019 | 23.58 | 49.65 | 1,728 | 20.43 | 9.51 | 18,165 | 21.03 | 100.10 | 137.66 |
| \$75,001 - \$150,000 | 154 | 24.80 | 9,269 | 23.36 | 39.54 | 60.19 | 12,104 | 31.65 | 51.63 | 2,072 | 24.49 | 8.84 | 23,445 | 27.14 | 100.01 | 153.15 |
| \$150,001 - \$200,000 | 30 | 4.83 | 1,295 | 3.26 | 32.32 | 43.16 | 2,361 | 6.18 | 78.69 | 349 | 4.13 | 8.71 | 4,007 | 4.64 | 99.95 | 133.57 |
| More than \$200,001 | 41 | 6.60 | 2,153 | 5.43 | 32.76 | 52.08 | 2,348 | 6.14 | 35.72 | 2,072 | 24.49 | 31.52 | 6,573 | 7.61 | 100.00 | 115.67 |
| Total | 621 | 99.97 | 39,675 | 100.98 | | 38,249 | 99.02 | | 8,459 | 100.00 | | 86,383 | 100.01 | | | |

Table 7. Boaters' employment status by on-the-water boating time (hours) during the March - May season

| Employment Status | Boaters | | | Weekdays | | | Weekends | | | Holidays | | | Seasonal Total | | | | | |
|-------------------------------------|---------|--------|--------|----------|-------|------------|----------|-------|------------|----------|-------|------------|----------------|-------|------------|--------|--------|--------|
| | Count | Col. % | Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | Col. % | Row % | Mean Hours | | | |
| Employed Full-Time | 279 | 39.57 | 9,059 | 20.33 | 21.95 | 32.47 | 28,370 | 65.03 | 68.75 | 101.69 | 3,837 | 53.20 | 8.57 | 13.75 | 41,266 | 43.28 | 100.24 | 147.74 |
| Retired Full-time | 93 | 13.19 | 6,024 | 13.52 | 50.87 | 64.77 | 5,123 | 11.75 | 43.26 | 55.08 | 695 | 9.64 | 5.87 | 7.48 | 11,842 | 12.42 | 100.01 | 127.35 |
| Semi-retired | 319 | 45.25 | 29,207 | 65.55 | 73.82 | 91.56 | 9,496 | 21.79 | 23.03 | 29.77 | 2,536 | 35.16 | 6.15 | 7.95 | 41,239 | 43.25 | 100.00 | 130.11 |
| Homemakers, Students and Unemployed | 15 | 2.13 | 269 | 0.60 | 26.71 | 17.95 | 593 | 1.36 | 58.89 | 39.52 | 145 | 2.01 | 14.40 | 9.69 | 1,007 | 1.06 | 100.00 | 67.21 |
| Total | 705 | 100.14 | 44,559 | 100.00 | | 63.20 | 43,582 | 99.93 | | 64.82 | 7,213 | 100.01 | | 10.23 | 95,354 | 100.01 | | 135.25 |

Table 8. Boating activities by on-the-water boating time (hours) during the March - May season

| Activity | First Choice | | Second Choice | | Third Choice | | Total | | |
|--------------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|--------------|-------------------------------|
| | Boat Hours | N | Boat Hours | N | Boat Hours | N | Boat Hours | Percent | Mean Boat. Hours ¹ |
| Day Sailing | 8315.41 | 88 | 1988.23 | 139 | 446.21 | 17 | 10749.85 | 11.87 | 44.06 |
| Cruising | 20206.88 | 254 | 5609.80 | 170 | 3538.52 | 106 | 29355.20 | 32.40 | 55.78 |
| Day Racing | 836.87 | 7 | 364.15 | 10 | 232.77 | 32 | 1433.79 | 1.58 | 29.26 |
| Ocean Racing | 31.5 | 2 | 86.70 | 4 | 2.40 | 1 | 120.60 | .13 | 17.22 |
| Deep Sea Fishing | 8245.88 | 83 | 444.61 | 112 | 1127.19 | 61 | 9817.68 | 10.84 | 38.35 |
| Inshore fishing | 21406.83 | 226 | 5430.22 | 146 | 1536.88 | 95 | 28373.93 | 31.32 | 60.75 |
| Diving-Sightseeing | 869.80 | 9 | 726.34 | 25 | 1156.60 | 63 | 2752.74 | 3.04 | 28.38 |
| Diving-Fishing | 129.31 | 6 | 767.51 | 16 | 266.42 | 14 | 1163.24 | 1.28 | 32.30 |
| Wreck-Diving | 0 | 0 | 14.76 | 3 | 310.71 | 7 | 325.47 | .36 | 32.55 |
| Speed-Boating | 396.93 | 16 | 649.77 | 21 | 452.29 | 42 | 1498.99 | 1.65 | 18.97 |
| Water-Skiing | 424.13 | 9 | 342.99 | 24 | 296.83 | 17 | 1063.95 | 1.17 | 21.28 |
| Canoeing | 1815.84 | 15 | 574.13 | 25 | 308.21 | 29 | 2698.18 | 2.98 | 39.10 |
| Other | 0 | 0 | 0 | 0 | 1242.55 | 46 | 1242.55 | 1.37 | 27.01 |
| Total | 62679.38 | 715 | 16999.21 | 695 | 10917.58 | 530 | 90596.17 | 99.99 | 46.70 |

¹Mean Boating Hours are computed by summing the number of respondents citing first, second and third choices for each activity and then dividing this number into the total number of boating hours for each activity. For example, 10,749.85 hours were spent day-sailing by 244 respondents. The value of 44.06 hours was derived by the following computation: $10,749.85/244 = 44.06$.

Table 9. Weighted summed scores of hours engaged in all boating activities during the March - May season

| Activity | First Rank | | Choice Value | | Second Rank | | Choice Value | | Third Rank | | Choice Value | | Cumulative Observed Ranked Value | Ranked (listing) | Score (percent) |
|--------------------------|------------|------|--------------|------|-------------|-----|--------------|---|------------|---|--------------|--|----------------------------------|------------------|-----------------|
| | N | 3 | 2 | 1 | N | 2 | 1 | N | 2 | 1 | | | | | |
| Fishing | 309 | 927 | 258 | 516 | 156 | 156 | 1599 | 1 | 39.34 | | | | | | |
| Cruising | 254 | 762 | 170 | 340 | 106 | 106 | 1208 | 2 | 29.72 | | | | | | |
| Day-Sailing and Racing | 97 | 291 | 153 | 306 | 50 | 50 | 647 | 3 | 15.92 | | | | | | |
| Speed-Boating and Skiing | 25 | 75 | 45 | 90 | 59 | 59 | 224 | 4 | 5.51 | | | | | | |
| Diving | 15 | 45 | 44 | 88 | 84 | 84 | 217 | 5 | 5.34 | | | | | | |
| Canoeing | 15 | 45 | 25 | 50 | 29 | 29 | 124 | 6 | 3.05 | | | | | | |
| Other | 0 | 0 | 0 | 0 | 46 | 46 | 46 | 7 | 1.13 | | | | | | |
| Total | 715 | 2145 | 695 | 1390 | 530 | 530 | 4065 | - | 100.01 | | | | | | |

Table 10. Estimated on-the-water time and boating pressure (hours/acre) by all boaters in the study region

| Boat Type | Boating | | | Boating Area ¹ (Acreage) | Boating Pressure (Hours/Acre) |
|-------------------------------------|-----------|-----------|------------------|--|----------------------------------|
| | Weekday | Weekend | Hours Holiday | | |
| Row-boat, Canoe, Kayak | 56,049 | 46,125 | 10,601 | 14,074 | 8.01 |
| Sailboat (non-motorized, auxiliary) | 917,920 | 868,141 | 203,097 | 21,225 | 93.81 |
| Speed/Skiff/John/Utility/Pontoon | 967,137 | 942,497 | 143,736 | 35,299 | 58.17 |
| Personal Water-Craft | 187,424 | 140,394 | 20,206 | 14,074 | 24.75 |
| Cabin-Cruiser/Trawler/Houseboat | 199,281 | 173,722 | 26,358 | 21,225 | 18.82 |
| Total | 2,327,811 | 2,170,879 | 403,998 | 35,299 | 138.96 |

¹ Acreage from Antonini et al, "A Historical Geography of Southwest Florida Waterways," SGEB-47, 1999, Gainesville, Florida. Total water area ($0 > 6$ ft depth, mllw datum) for Prototype Chart 11425, excluding the Manatee River and Gasparilla Sound, is 35,299 acres (55.15 square miles). These data are available only for the depth ranges: < 3 ft, $\geq 3 - 6$ ft, > 6 ft. Assumptions are made that: (1) Row-boat, canoe, kayak and personal water-craft operate in 0 - 3 ft water depths; (2) skiff-type boats range over entire area; and (3) power-cruiser-type and sailboat are limited to areas with 3 ft or greater water depths.

² Column and row totals are not identical due to rounding errors in computing the weekday, weekend and holiday totals

Table 11. Users' workshop results for defining prototype chart content and format

| Chart Element | Modifications | Recommended by User Workshop | Portrayal of Information on Prototype Products (yes/no) |
|---|---|--|---|
| | | Additions | Prototype NOS Chart Other Prototype Product (specify)* |
| Back-drop Imagery | | DOCG (false-color) edge-matched imagery | yes (Side A) |
| | | Fusion normal-color imagery | yes (Side B) |
| | | Imagery as background for shoreline features | yes (Sides A, B) |
| | | Face-out image detail beyond line-of-eight | no |
| | | Compare color versus black-and-white | no |
| Map scale, resolution, format | | | no |
| | Increase scale and resolution | | yes (Sides A, B) |
| | Reference lines for cutting and realizing | | |
| | by individual users | | |
| | interior tick marks | | |
| Piloting Information | | | |
| | Waypoints for aids to navigation | | yes (Sides A, B) |
| | Course lines for channels | | yes (Sides A, B) |
| | Currents for critical locations | | no |
| | Enlarge symbols and alter color for readability | | no |
| Bathymetry | | | no |
| | | Supplement NOS sounding with new point data | no |
| | | Use contours and color-shaded depth ranges | yes (Panels 2,5) |
| Shore features and waterfront facilities | | | |
| | Improve annotation | | PM, AG, WS |
| Bridges | | | PM, AG, WS |
| | | Names | |
| | | Clearances (minimum and maximum) | yes (Side A table) |
| | | Bridge tender phone number | no |
| | | Statute miles to next bridge | yes (Side A table) |
| | | Restrictions and opening schedule | no |
| Anchorage | | | yes (Side A table) |
| | | Locations | yes (Sides A, B) |
| | | Reference ancillary large-scale maps | no |
| Environmental features | | | |
| | | Sea grass | yes (Panels 1, 3A, 3B, 5) |
| | | Speed zones | yes (Panel 6) |
| | | Signage | yes (Panels 3A, 4) |
| | | Artificial reefs | yes (Sides A, B) |
| | | Shellfish harvesting areas | yes (Panel 4) |
| | | Florida surface water quality areas | yes (Sides A, B) |
| | | Pump-out station locations | yes (Side B table) |
| | | State and local regulatory areas | yes (Sides A, B) |

*Other Products: Pocket Guide (PG), Place-mats (PM), Anchorage Guide (AG), Web Site (WS)

Table 12. Readability of the navigation panels on the prototype chart

| ID Number | Panel Description | Score |
|-----------|--|-------|
| 3-a, 4 | I-R converted to normal color on land with spot soundings | 70.00 |
| 6 | I-R on land and water, spot soundings only | 67.33 |
| 1, 2, 3-b | Composite color-fused, land only, spot soundings, conventional supplemental contours | 82.31 |
| 5 | Composite color-fused, spot soundings, color-shaded depth ranges | 71.33 |
| 7 | Spot soundings, conventional supplemental contours, no background color imagery | 80.00 |

Table 13. Usefulness of the navigation panels on the prototype chart

| ID Number | Panel Description | Score |
|-----------|--|-------|
| 3-a, 4 | I-R converted to normal color on land with spot soundings | 65.12 |
| 6 | I-R on land and water, spot soundings only | 58.38 |
| 1, 2, 3-b | Composite color-fused, land only, spot soundings, conventional supplemental contours | 78.05 |
| 5 | Composite color-fused, spot soundings, color-shaded depth ranges | 63.92 |
| 7 | Spot soundings, conventional supplemental contours, no background color imagery | 71.68 |

Table 14. Readability of the environmental and boating information panels on the prototype chart

| ID Number | Panel Description | Score |
|--------------|---|-------|
| 3-a (Side A) | Patchy/continuous sea grass; marsh; anchorage, ramp, bridge symbols | 78.15 |
| 4 (Side A) | Shellfish harvesting | 76.12 |
| 6 (Side A) | Speed zones | 72.56 |
| 1 (Side B) | General sea grass; mangrove; anchorage, ramp, bridge symbols | 81.37 |
| 2 (Side B) | Depth zones (3 ft. contour interval); anchorage, ramp, bridge symbols | 75.28 |
| 3-b(Side B) | Patchy/continuous sea grass; anchorage, ramp, bridge symbols | 77.80 |
| 5 (Side B) | Patchy/continuous sea grass | 74.76 |
| 7 (Side B) | Anchorage, ramp, bridge symbols | 78.90 |

Table 15. Usefulness of the environmental and boating information panels on the prototype chart

| ID Number | Panel Description | Score |
|--------------|---|-------|
| 3-a (Side A) | Patchy/continuous sea grass; marsh; anchorage, ramp, bridge symbols | 66.67 |
| 4 (Side A) | Shellfish harvesting | 58.95 |
| 6 (Side A) | Speed zones | 62.39 |
| 1 (Side B) | General sea grass; mangrove; anchorage, ramp, bridge symbols | 67.58 |
| 2 (Side B) | Depth zones (3 ft. contour interval); anchorage, ramp, bridge symbols | 66.67 |
| 3-b(Side B) | Patchy/continuous sea grass; anchorage, ramp, bridge symbols | 70.70 |
| 5 (Side B) | Patchy/continuous sea grass | 64.98 |
| 7 (Side B) | Anchorage, ramp, bridge symbols | 65.03 |

Table 16. Usefulness of Other Boating Information Products*

| Features | Score |
|---|-------|
| Pocket Guide | |
| Anchorage | 75.88 |
| Bay artificial reefs | 74.17 |
| Bird viewing | 56.43 |
| Boat ramps and canoe/kayak launches | 65.49 |
| Fishing piers | 59.16 |
| Marinas and dockside restaurants | 78.17 |
| Anchorage Guide | |
| Photographs with superimposed course lines | 89.66 |
| Chart-lets with preferred course and buoys | 89.49 |
| Text describing anchorage | 88.02 |
| Boating and anchoring tips | 80.34 |
| Anchorage Web Site | |
| Local restrictions | 77.43 |
| Maps and photos | 84.79 |
| Hot links to weather, tides, chart updating, etc. | 78.31 |

*Place-mats were not included in this evaluation

Table 17. Summary statistics for natural resource variables

| Dependent Variable | Independent Variable | Alpha | Significance |
|----------------------------|----------------------|--------|--------------|
| Vessel Type | Dinghy in Sea Grass | 0.24 | NSS |
| | Vessel Dragging | 0.26* | NSS |
| | No Wake | 0.06* | NSS |
| | Manatee Encounter | .046* | SS |
| Preferred Boating Activity | Dinghy in Sea Grass | 0.53 | NSS |
| | Vessel Dragging | 0.51* | NSS* |
| | No Wake | 0.91 | NSS |
| | Manatee Encounter | 0.004* | SS* |
| Boater Training | Dinghy in Sea Grass | 0.11* | NSS |
| | Vessel Dragging | 0.29* | NSS* |
| | No Wake | 0.15* | NSS* |
| | Manatee Encounter | 0.27* | NSS* |
| Number Years Boat Owner | Dinghy in Sea Grass | 0.63* | NSS* |
| | Vessel Dragging | 0.15 | NSS |
| | No Wake | 0.14 | NSS* |
| | Manatee Encounter | 0.001 | SS |
| Age of Respondent | Dinghy in Sea Grass | 0.63 | NSS |
| | Vessel Dragging | 0.97* | NSS |
| | No Wake | 0.18 | NSS |
| | Manatee Encounter | 0.69 | NSS |

*Sparsity constraints invoked which may make the analysis suspect (see Methods section findings)

Table 18. Natural resource responses

| Variable | Responses | N | Percent |
|---------------------|---|-----|---------|
| Dinghy in Sea Grass | Appropriate | 528 | 75.6 |
| | Inappropriate | 170 | 24.4 |
| Vessel Grounded | Anchor in non-sea grass area | 798 | 97.1 |
| | Use additional ground tackle | 24 | 2.9 |
| | Re-anchor in same area | 52 | 7.8 |
| No Wake | Proceed at 5 knots or less | 557 | 69.5 |
| | Proceed at current speed with increased lookout | 2 | 0.2 |
| | Proceed at whatever speed not producing a wake | 242 | 30.2 |
| Manatee Encounter | Appropriate | 795 | 99.6 |
| | Inappropriate | 3 | 0.4 |

Table 19. Summary statistics for pollution variables

| Dependent Variable | Independent Variable | Alpha | Significance |
|----------------------------|----------------------|-------|--------------|
| Vessel Type | Banana | 0.347 | NSS |
| | Cap | 0.032 | SS |
| | Plastic Bag | 0.43 | NSS |
| | Oil Sheen | 0.19 | NSS |
| | Head Flushed | 0.002 | SS |
| Preferred Boating Activity | Banana | 0.62 | NSS |
| | Beer Can | 0.44 | NSS |
| | Cap | 0.5 | NSS |
| | Plastic Bag | 0.85 | NSS |
| | Oil Sheen | 0.91 | NSS |
| Boater Training | Banana | 0.42 | NSS |
| | Beer Can | 0.45 | NSS |
| | Cap | 0.88 | NSS |
| | Plastic Bag | 0.56 | NSS |
| | Oil Sheen | 0.72 | NSS |
| Number Years Boat Owner | Banana | 0.75* | NSS |
| | Beer Can | 0.64 | NSS |
| | Cap | 0.34* | NSS |
| | Plastic Bag | 0.45* | NSS |
| | Oil Sheen | 0.31 | NSS |
| Age of Respondent | Banana | 0.16* | NSS |
| | Cap | 0.04 | SS |
| | Beer Can | 0.42 | NSS |
| | Plastic Bag | 0.59 | NSS |
| | Oil Sheen | 0.83 | NSS |
| Head Flushed | Plastic Bag | 0.88 | NSS |
| | Oil Sheen | 0.96 | NSS |
| | Head Flushed | 0.58 | NSS |

*Sparsity constraints invoked which may make the analysis suspect (see Methods section findings)

Table 20. Pollution responses

| Variable | Responses | N | Percent |
|--------------------------|---------------------------|-----|---------|
| Banana | Appropriate | 686 | 80.9 |
| | Inappropriate | 162 | 19.1 |
| Cap | Appropriate | 744 | 88.9 |
| | Questionable | 69 | 8.2 |
| | Inappropriate | 24 | 2.9 |
| Beer Can | Appropriate | 576 | 70.2 |
| | Questionable | 239 | 29.2 |
| | Inappropriate | 5 | 0.6 |
| Plastic Bag | Appropriate | 572 | 69.3 |
| | Questionable | 243 | 29.5 |
| | Inappropriate | 10 | 1.2 |
| Oil Sheen on Bilge Water | Appropriate | 758 | 94.9 |
| | Questionable | 8 | 1.0 |
| | Inappropriate | 33 | 4.1 |
| Flushing of Head | Inform the Offending Boat | 264 | 47.1 |
| | Call the Authorities | 173 | 30.9 |
| | Do Nothing | 123 | 22.0 |

Table 21. Comparison of product impacts on boating practices

| Information Products | Enhanced Awareness of Boating Safety | Reduced Potential Conflicts | Increased Employment | Affected Decisions to Avoid Adverse Impact on Environment |
|--------------------------|--------------------------------------|-----------------------------|----------------------|---|
| Prototype Chart | 62.40 | 57.66 | 68.65 | 74.40 |
| Pocket Guide (Blue-ways) | 58.11 | 53.04 | 64.78 | 61.15 |
| Place-mats | 54.49 | 52.35 | 63.25 | 57.76 |
| Anchorage Guidebook | 65.35 | 65.35 | 75.78 | 66.99 |
| Web Site | 51.84 | 51.42 | 55.66 | 50.48 |