

**Analysis of Hurricane Andrew Economic Damage  
and Recovery Options for the Boating,  
Marina and Marine Service Industries**

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## **1.0 Introduction**

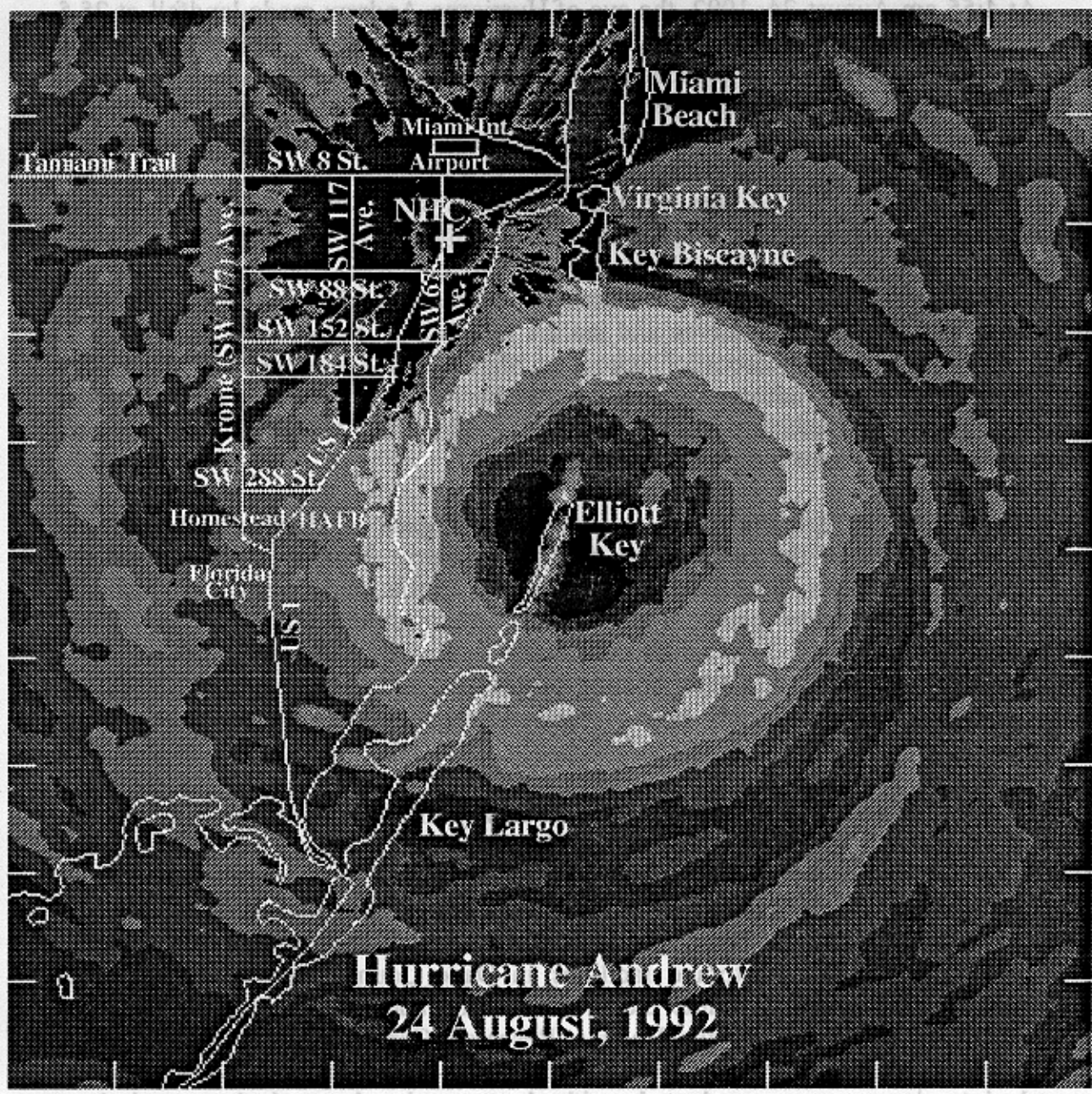
At 4:55 am August 24, 1992, the eye of Hurricane Andrew made landfall at 25.5 degrees north latitude in Dade County, Florida. A radar image of the storm from the National Weather Service Miami radar just before landfall is presented in Exhibit 1.1. The hurricane had a devastating effect on the recreational boating industry in South Florida impacting boaters, marinas, boat yards, boat dealers, and boat manufacturers. A map the boat storage facilities in Dade County with over 100 wet or dry slips is presented in Exhibit 1.2. A similar map of boat yards, boat dealers and boat manufacturers contacted in this study is shown in Exhibit 1.3.

In response to the devastation of Hurricane Andrew, Florida Sea Grant convened a meeting of industry representatives and marine researchers on September 29, 1993 at the University of Miami's Rosenstiel School of Marine and Atmospheric Science. Sea Grant agents and marine industry researchers together with the industry representatives enumerated several immediate needs of the industry. This study was undertaken to meet several of the needs identified at the meeting.

The purpose of this study was to analyze the impact of Hurricane Andrew on three distinct sectors of the recreational boating industry: boaters, marinas, and the marine services industries. Specifically the objectives of this study were: 1) to evaluate the hurricane preparedness plans of the boaters, marinas and other marine related businesses in Dade County, 2) to assess the damage caused by Hurricane Andrew to the boats, marinas, boat yards, and other boating businesses, and 3) to determine the future boating activities of Dade County boat owners and the rebuilding plans of the marine businesses.

To accomplish these objectives, various survey methodologies were employed. First with regard to boaters, a longitudinal study was conducted from a baseline survey of hurricane evacuation plans of berthed boat owners in Dade County conducted in 1990. In addition to these results, a survey questionnaire was mailed to a stratified random sample of the general boater population in the county. Second, a post-hurricane survey of marinas and boat storage facilities in Dade County was conducted. This survey utilized as a sampling frame the inventory of Dade County marinas and boat storage facilities completed by the Boating Research Center in July of 1992, three weeks prior to Hurricane Andrew. Finally, mail and telephone surveys as well as personal interviews were conducted with boat yards, boat dealers and boat manufacturers in Dade County.

A detailed description of the methods employed in each phase of the study and their results are presented in the remainder of this report. After this introductory section, Section 2.0 describes the longitudinal survey of berthed boat owners in Dade County, as well as the results of the survey of the general boating population. Section



Digitized radar image of the core of Hurricane Andrew at 0835 UTC on 24 August, 1992. The radar data was collected by the Hurricane Research Division of NOAA from the Miami, Florida NWS office located at the National Hurricane Center (NHC). The image shows Andrew's eye and eyewall just before landfall near Homestead Air Force Base (HAFB). The gray scale (from dark to light) represents reflectivities of <15, 15-25, 25-33, 33-40, 40-45, and >45 dBZ. North is at the top and the domain is 100 by 100 km with 10 km tic spacing.

**Exhibit 1.1**

Source: Hurricane Research Division, NOAA

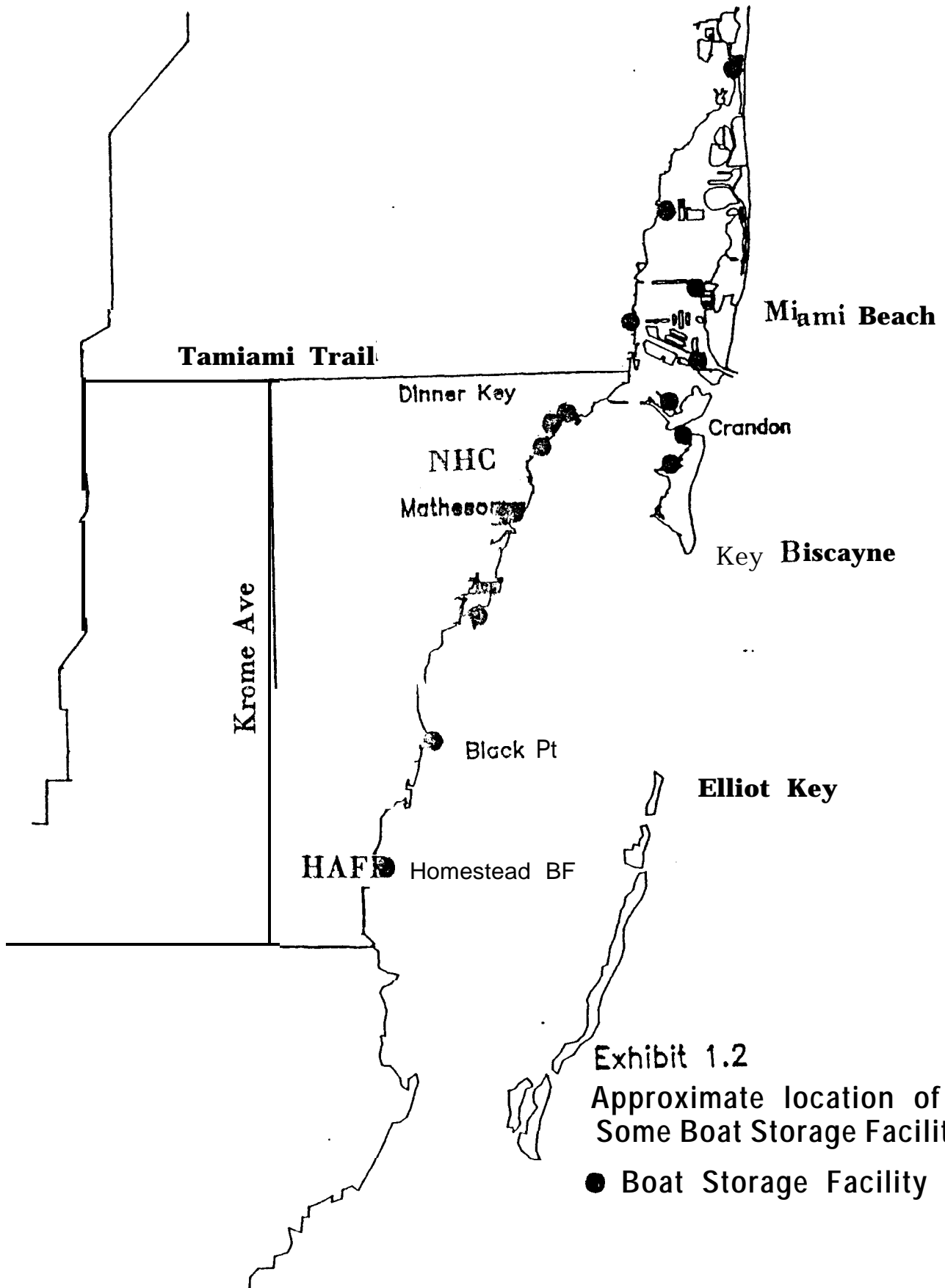


Exhibit 1.2  
Approximate location of  
Some Boat Storage Facilities  
● Boat Storage Facility



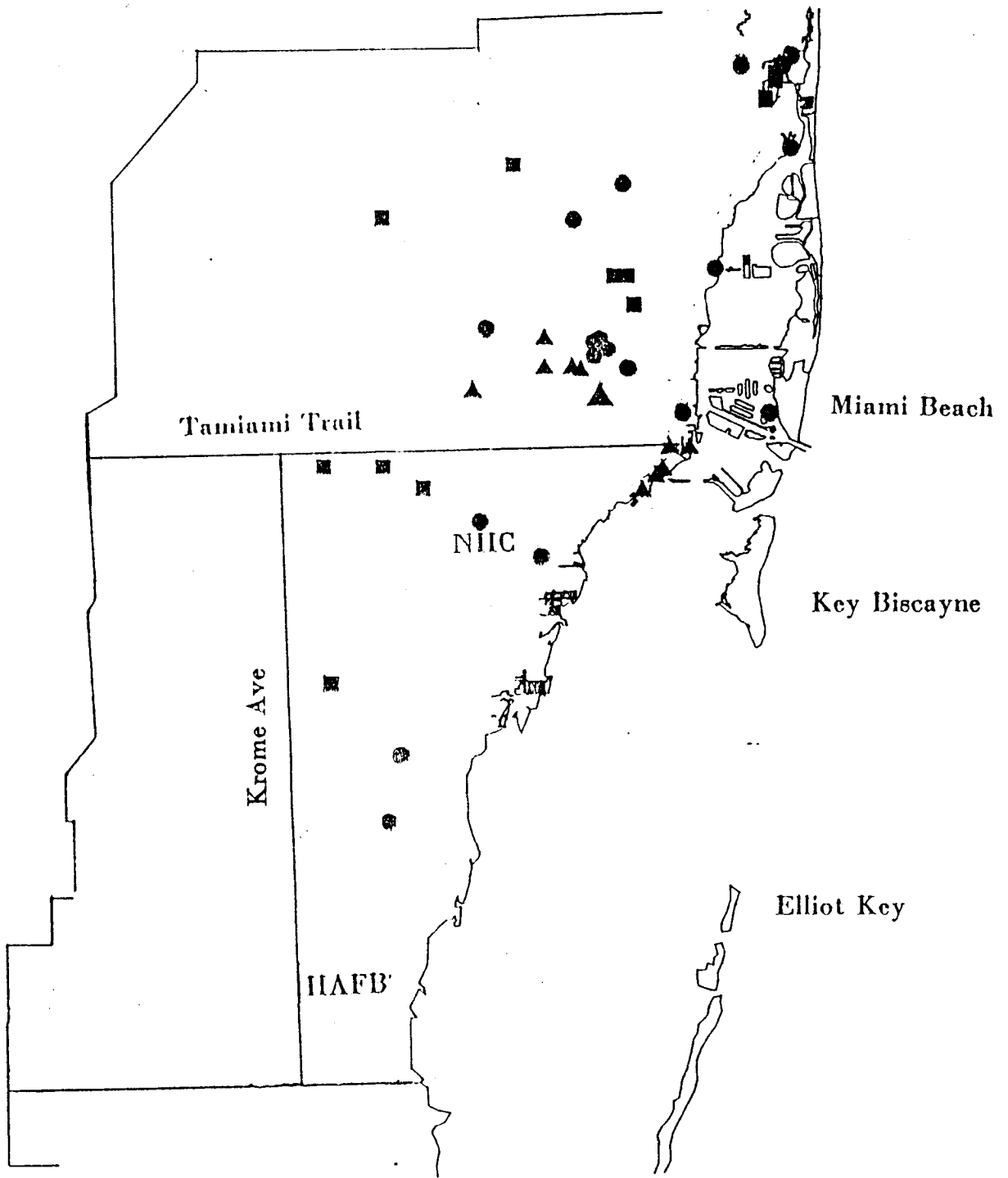


Exhibit 1.3

Approximate Location of Boat Yards  
 Boat Dealerships and Boat Manufacturers

- ▲ Boat Yard
- Boat Dealerships
- Boat Manufacturers

3.0 describes the survey of the Dade County marinas and boat storage facilities, making comparisons to the inventory completed by the University of Miami's Boating Research Center just prior to the occurrence of Hurricane Andrew. Section 4.0 presents the survey conducted of the boat yards, boat dealers, and boat manufacturers in Dade County. The summary and conclusions of this study are presented in section 5.0.

## **2.0 Survey of Boat Owners in Dade County, Florida**

The purpose of this phase of the study was to evaluate the success or failure of the hurricane plans of boat owners in Dade County, Florida as executed prior to landfall of Hurricane Andrew at 4:55 am on August 24, 1993. The study was designed not only to evaluate the hurricane plans of boat owners, but also to determine the extent of advance preparation that was taken. Additionally, the study wished to assess the damages, if any, that were incurred by the boats and to determine the effects of the hurricane on the boat owners' future boating plans.

Prior to Hurricane Andrew, Dade County had not been struck by a major hurricane since 1965. During this time, the number of boats berthed in both county and privately owned marinas had increased substantially. In light of this increase and with the occurrence of Hurricane Hugo in September 1989, the Dade County Office of Emergency Management asked in 1990 for a re-evaluation of the County's Hurricane Evacuation Plan for berthed boats. Of particular interest was the Plan's ability to address the problems and concerns associated with advising the public about moving their boats to a safe harbor.

Under the policy in effect in 1990, when a hurricane warning was issued, all county marinas, and some private marinas, required boat owners to remove their boats. During the hurricane warning period, boat owners have a very few hours in which to move their boats safely. As a hurricane approaches, sea, wind, and other conditions may inhibit or prohibit boat movements. For example, when sustained winds reach 35 miles per hour, bascule bridges are locked in the down position preventing many sailboats from entering certain waterways.

An additional concern among boat owners was simply identifying and locating areas considered as safe refuge in a hurricane. Areas well known by the public may not be available in time of emergency. Dade County's best known hurricane refuge, the Miami River, for example, is estimated to have capacity for about 4000 boats. Unfortunately, recent changes in the flood control policies of the South Florida Water Management District have made the river unsuitable as safe haven in the event of a hurricane. Additionally, a proposed flotilla plan using the Miami River under the direction of the United States Coast Guard had been abandoned.

The problems associated with the search for safe harbor are exacerbated by the facts that a substantial number of boats in wet storage are owned by non-Dade County residents and that many berthed boat owners have never experienced a hurricane in Dade County. The lack of time for preparation and the possible unavailability of space for safe haven could be catastrophic if a major hurricane were to strike the area.

As a first step in addressing these concerns, the Metro Dade Planning Department, the Office of Emergency Management, and the University of Miami Boating Research Center obtained a Coastal Zone Management Grant to obtain primary data on the hurricane evacuation plans and experiences of the berthed boat owners in Dade County, Florida. The results of this study were published in a report in December of 1990 and served as a baseline from which the current survey results were analyzed.

## **2.1 Review of the 1990 Study**

### **2.1.1 Target Population**

In the spring of 1990, the Dade County Planning Department provided the Boating Research Center with an inventory of marinas with ten or more berths and a list of berthed-boat owners in those marinas. The inventory included 88 public and private marinas. The list included the names of 3007 berthed boat owners.

The Boating Research Center verified the list of berthed boat owners in the marina inventory provided by the County by cross-referencing the number of wet slips in the marinas, the number of berthed boats in each marina, and the number of names of berthed boat owners in each marina. The file of owners of berthed boats in county marinas was then merged with the 1989 Florida vessel registration file. The merging was done to validate the boat characteristics and the names and addresses of boat owners in the inventory. The merging of the files resulted in a total of 1760 records with names, addresses and boat characteristics that were used in the sampling frame for the study.

### **2.1.2 Development and Validation of the Survey Questionnaire**

Using standard survey design methodology, the Boating Research Center developed a preliminary questionnaire for the mail survey. The questionnaire was then given to the Office of Emergency Management and Dade County Planning Office for comments and suggestions. The changes proposed by these offices were discussed and considered and incorporated into the questionnaire for presentation at a Hurricane Preparedness Workshop. The comments of attendees at the workshop were also included in the final questionnaire.

A pilot study was conducted to estimate the response rate of the questionnaire, to measure significant variances in the survey responses, to assess the ambiguities in the prepared questionnaire, and to examine the necessity of stratifying the sampling frame according to geographical location and type of boat.

The pilot survey was mailed and a thirty four percent response rate was realized. Several points were noted. First, stratification of the population by geographic region was needed as hurricane refuge sites were found to be dependent upon marina location. Second, it was found that stratification of the sample by boat type was not required. Third, ambiguities were found to exist in several questions of the questionnaire and these were rectified.

Of 1000 questionnaires mailed in the 1990 study, 350 responses were received. Fifteen of these questionnaires were disregarded because they were not adequately completed by the respondents. Of the 335 remaining, only 323 were legible and consistent.

### **2.1.3 Results of the 1990 Survey**

A frequency analysis of the survey data revealed that the typical respondent's boat was 30 to 40 feet in length with a 6 to 10 foot beam. The most likely draft was 3 feet. Clearly 57 percent of the respondents were sailboat owners. Almost 95 percent of the boats were constructed of fiberglass. The typical boat of the respondents was of the 1970 to 1980 model vintage, and had been purchased within the last four years.

Over 65 percent of the berthed boat owners in Dade County have been boat owners for more than five years. They have typically kept their boat in the marina in which it is currently berthed for more than five years.

Most of the berthed boats were not trailerable. Only 24 percent of the respondents had trailerable boats. Of those who could trailer their boats, 68 percent owned a trailer. Twelve percent of the respondents indicated that they would trailer their boat in the event the threat of a hurricane required marina evacuation.

The boat owners of the 1990 study were generally aware whether or not their marina required evacuation if a hurricane threatened. At the time of the survey, 73 percent responded that their marina required evacuation and 67 percent said they intended to move their boat. Of those intending to move their boat, 64 percent planned to move their boat more than 48 hours before the expected landfall of the storm.

Although a high percentage of berthed boat owners planned to move their boats

when a hurricane threatens, 39 percent did not know where to move them. Of those respondents who specified a destination in their evacuation plan, 17.8 percent chose the Miami River, 8 percent chose the Coral Gables Waterway, 3.7 percent specified inland canals, and 3 percent indicated Biscayne Bay.

Only ten percent of those who intended to move their boats had a written contract for a hurricane mooring. Only 50 percent of the 1990 respondents had arranged for pickup from their safe refuge moorings; only 59 percent had conducted a dry run.

The analysis of the cross-tabulations of the data from the survey of berthed boat owner hurricane evacuation plans revealed several interesting results. First, as noted in the pilot study, there exist three distinct geographic areas with respect to berthed boats in Dade County. For the purposes of this study the three areas were denoted north, central, and south. The north region begins at the mouth of the Miami River and continues north to the Broward County line. The central region begins at the Miami River and continues south to Southwest 88th Street. The south region begins at Southwest 88th Street and continues south to the Monroe County line. These boundaries are visible on the map presented in Exhibit 1.1. The mouth of the Miami River empties into Biscayne Bay at 27.77 degrees north latitude. Southwest 88th Street may be seen approximately two miles north of the north eye wall of Hurricane Andrew.

A second point revealed by the cross-tabulations was that the three geographic regions in the County differed not only in the typical types of boats in their marinas, but also in the planning and preparation of their boat owners for hurricane evacuation. Finally, traits that are not significantly different across the various marinas included the length of boat ownership, the decision of when to move the boat if it is to be moved, and the acquisition of insurance coverage.

The types of boats berthed in the marinas of the different geographic regions were found to be significantly different. In the northern region, which follows the intercoastal waterway, most of the marinas are small privately owned facilities. The typical boat in this area is a power boat. In the central and south regions, which have direct access to Biscayne Bay, the predominant mode of propulsion is sail. The sailboats tend to be taller, have less horsepower, and are not trailerable.

An examination of hurricane evacuation plans in the three geographic regions revealed several significant differences. First, with regard to whether or not the owners planned to move their boats, the owners in the central region, i.e. marinas in Key Biscayne and Coconut Grove, overwhelming said they would move their boats, while in the north and the south the majority of owners said they would not. In fact, the majority of owners in the northern region responded that they were not required to move their boat. In the southern region, although owners admitted that they were required to move their boats, the majority said that they did not intend to do so.

Thorough preparation for an evacuation prior to a hurricane includes a practice run to the refuge site and arranging for someone to pickup the boat captain and bring them to their home. The responses were again significantly different on these issues. First, only a majority of owners in the central region responded that they had made a dry run and that they had arranged a pickup. Neither the majority of owners in the north nor south region had made such arrangements.

Finally it was noted in the responses of the berthed boat owners that the amount of information on hurricane evacuation available at the various marinas was perceived to be significantly different. The owners in the central region believed that information was generally available, while the owners in the northern region were evenly split between available and not available. The owners in the southern region did not find that hurricane evacuation information was generally available.

#### **2.1.4 Marine Traffic Modeling in the 1990 Study**

In an effort to use the data obtained in the 1990 survey of berthed boat owners to evaluate different hurricane evacuation plan scenarios, a marine traffic model was developed utilizing a geographic information system. The movement of boats from marinas to safe harbors in the model was accomplished through the use of a network flow model. In the network model, each marina becomes a source node supplying boats to the network. Each safe harbor becomes a potential destination for boats in search of a safe harbor. Connecting the sources and destinations is a marine traffic network containing arcs that represent the legs of navigable marine routes.

The marine traffic flow model was then run to determine the marine traffic patterns that would disperse all the boats to safe harbor in a minimum total distance. A run of the model was made for each marina and the results combined to determine the total number of boats seeking safe harbor at a particular location and to determine where congestion may exist along the marine traffic network.

Three scenarios were proposed and executed using the marine traffic network model. The first scenario was descriptive of the intended hurricane evacuation plans of the boat owners as measured in their survey responses. The last two scenarios were prescriptive as assumptions are made concerning the capacities of the safe harbors and, once that capacity is reached, boat owners must seek alternative moorings.

The results of the marine traffic modeling showed that the intentions, plans, and preparations of berthed boat owners differed significantly across the natural geographic strata of the County's water resources. Berthed boat owners north of the mouth of the Miami River occupying private slips did not intend to move their boats in the event of a hurricane. Berthed boat owners in the region from the Miami River south to

Southwest 88th Street were generally aware of the requirement to move their boat, were prepared to move, and had made a practice evacuation run. Owners in the county marinas south of Southwest 88th Street, however, generally knew of the requirement to evacuate their marina, but had no intention of doing so. Judging from the tone of the written comments on the survey forms, many of the southern region owners felt that their marinas were safe refuge sites and that they could not improve their condition by evacuating.

In many cases, information, or the lack thereof, was an important factor. The survey results found that berthed boat owners had significantly different perceptions of the availability of information concerning hurricane evacuation procedures. Only those owners in the central region felt that they had been given adequate information. Many of the respondents asked for any additional information that may be available and even offered to pay for it. Additionally, the population had not made adequate preparation in securing mooring agreements, making practice evacuation runs, and arranging pickup at the safe refuge site.

### **2.1.5 Recommendations and Policy Decisions as a Result of the 1990 Study**

The following recommendations were made as a result of the 1990 study and hence had some influence on what occurred in 1992 during Hurricane Andrew. First, it was recommended that the county engage in a concerted program of education of its berthed boat owners with regard to its emergency management plan. If all county marinas were to require the evacuation of berthed boats in the event of a hurricane, then the County should make every effort to inform each owner of this intention, and of the consequences should this policy not be abided. Second, the procedures for locating a safe refuge and securing one's boat should be readily available to all owners facing mandatory evacuation. Finally, it was hoped that the results of this study may also be used to assist the County in the determination of the efficacy of a mandatory berthed boat evacuation plan. The current policy was widely misunderstood by berthed boat owners and many aware of the mandatory evacuation policy intended to ignore it.

As a consequence of the 1990 study of the hurricane evacuation plans of berthed boat owners in Dade County, Florida and other factors, the County Planning Department changed its policy requiring mandatory evacuation of the County's marinas. The Department also published and distributed a brochure to all boat owners in the county providing current information on hurricane procedures.

## **2.2 Assessment of Hurricane Evacuation Plans - Post Andrew**

Subsequent to the occurrence of Hurricane Andrew, two surveys were conducted

to evaluate the effectiveness of the hurricane preparedness and/or evacuation plans of the boat owners in Dade County, Florida. The boat owners were considered in two groups: 1) the berthed boat owners surveyed in the 1990 study, and 2) boat owners from the population in general. Although the results of both survey groups are considered here, we first focus on the contrasts of the responses and actions of the berthed boat owners surveyed in 1990.

## **2.2.1 Post-Andrew Responses of the Berthed Boat Owners Surveyed in 1990**

An attempt was made to trace each of the 323 berthed boat owners who responded to the 1990 survey through their Florida Boat Registration Number or through their address. From the 323 original respondent surveys, 247 mailing addresses were obtained. Each of these boat owners was sent a personalized cover letter and copy of the 1992 post-hurricane survey questionnaire. A copy of a sample cover letter and survey questionnaire are presented in Appendix A. In all, 128 boat owners responded to the 1992 survey. This is an overall response rate of 51.8 percent. Of the 128 total responses, 10.2 percent were from the northern region of the county, 57 percent were from the central region, and 32.8 percent were from the southern region. The actual percentages of all berthed boats in each of the regions from the 1990 study were 9.5, 66.3, and 24.2 respectively.

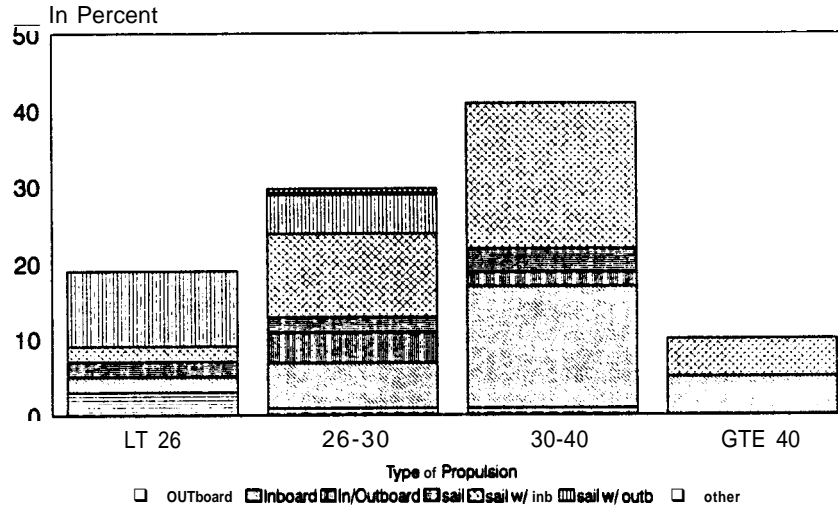
The 1992 survey addressed issues of boat characteristics, pre-hurricane boat use patterns, hurricane planning and preparation, damage assessment, and post-hurricane plans for boat repair, replacement and usage. Each of these issues is discussed in the sections immediately following. A summary of the survey responses is presented in Appendix B.

### **2.2.1.1 Boat Characteristics**

The boat characteristics of the respondents of the 1992 study were obviously very similar to those of the 1990 study. The frequency analysis of the responses from the 1992 survey revealed that 41 percent of the respondents' boats were 25-40 feet in length and the majority were powered by inboard engines or a combination of inboard and sail. The majority of boats were of model years between 1970 and 1985. The percentages of 1990 berthed boat owners by length and by propulsion is presented in Exhibit 2.1.



## Exhibit 2.1 Boat Characteristics, Berthed Boat Owners

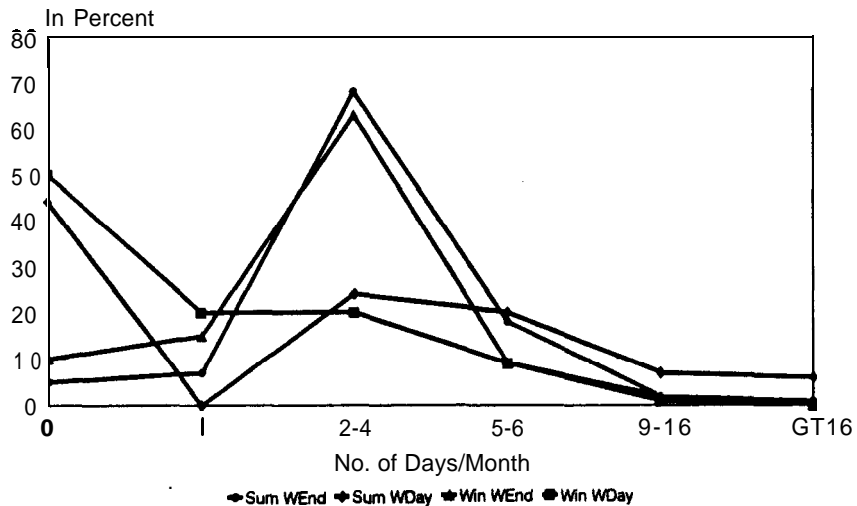


All of the boats were originally believed to be wet berthed, however, three of the respondents indicated boats in dry storage and twelve respondents did not respond to the question. On average, the respondents had stored their boats in their current location for more than five years.

### 2.2.1.2 Pre-Hurricane Usage Patterns

The pre-hurricane usage patterns of the 1990 berthed boat owners are presented in Exhibit 2.2. For the summer season (April through September), most respondents used their boats 2-4 weekend days a month. Usage on summer weekdays was less, with 41 percent of the respondents saying that they did not use their boat on any summer weekdays. For the winter season (October through March), the most frequently occurring response was 2-4 weekend days per month. The winter weekday pre-hurricane usage was also less, with 50 percent of the respondents reporting that they used their boat zero winter weekdays.

**Exhibit 2.2**  
**Berthed Boat Owners, Pre-Hurricane Boat Use Patterns**



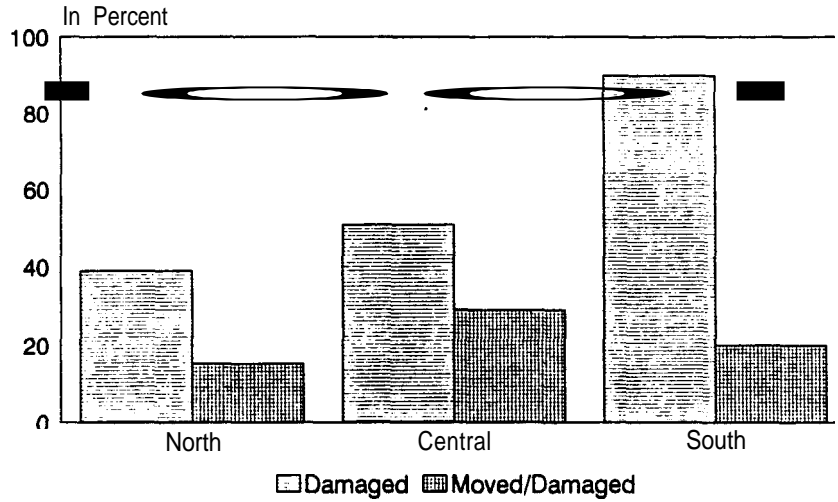
**2.2.1.3 Hurricane Planning and Preparation**

When asked whether they moved their boat prior to Hurricane Andrew, 53 percent replied they did, while 45 percent said they did not. Two percent did not respond to this question. Of the 68 respondents who moved their boat, 86 percent of these said they moved their boat within 48 hours of the hurricane’s landfall. Of those who moved their boat, 46 percent said they incurred damage. Of the respondents who did not move their boat, 81 percent incurred damage.

**2.2.1.4 Hurricane Damage and Assessment**

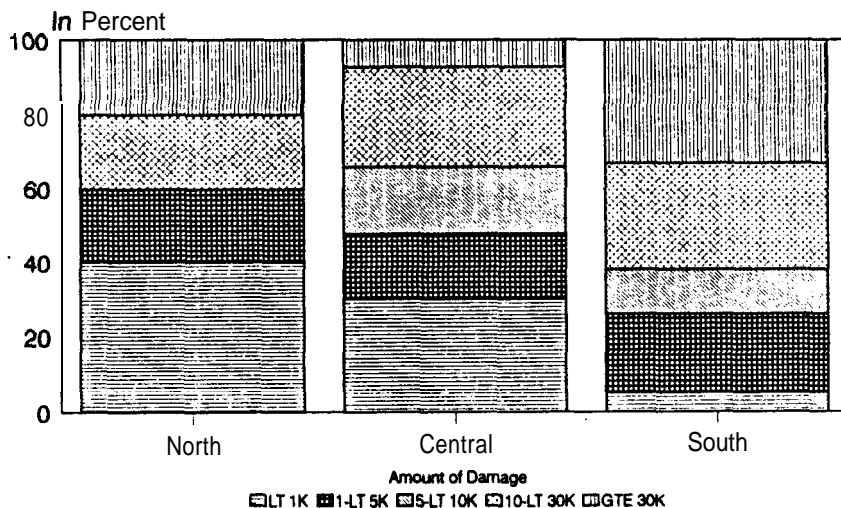
The damage that was incurred by boats was dependent upon the geographic region in which the boat was stored during the hurricane. Exhibit 2.3 shows the percentage of berthed boats damaged by Hurricane Andrew by geographic region and by whether or not the boats were moved.

### Exhibit 2.3 Berthed Boats, Damage During Hurricane Andrew



A profile of the damage incurred by the 1990 berthed boat owners by geographic region is presented in Exhibit 2.4. The average amount of damage incurred was least in the central region and greatest in the southern region. For those responding, the average amount of damage in the northern region was \$25,625, in the central region \$21,753, and in the southern region \$29,056.

### Exhibit 2.4 Berthed Boats, Amount of Damage

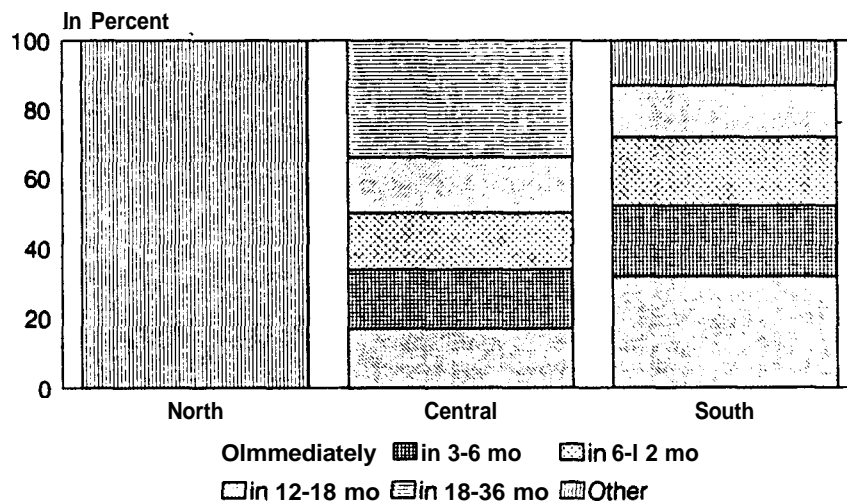


### 2.2.1.5 Future Boating Plans

With regard to their future boating plans, 92 percent of the 1990 berthed boat owners said they would continue to use their boat, five percent said they would not. Twenty six people reported that they lost their boat in the storm. Of these 26, 17 said they would replace their boat with a used one of equivalent or greater value, two said they would replace their boats with new ones, five said they would not replace their boat, and two had other responses.

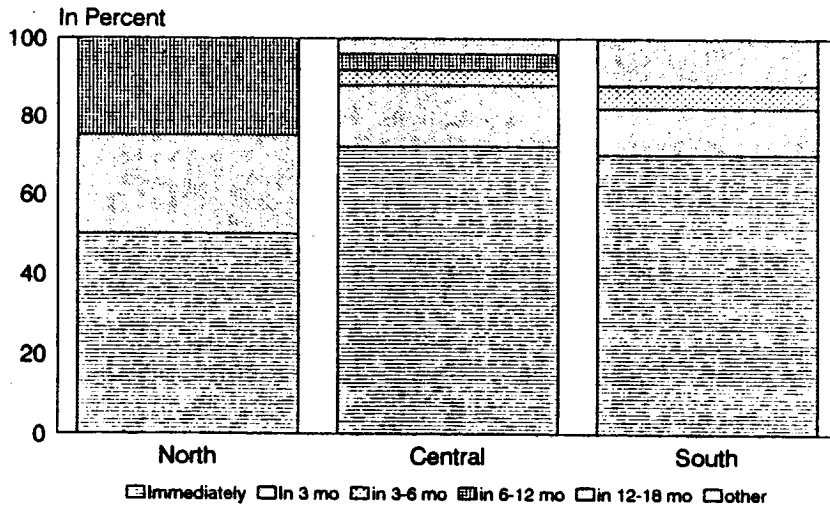
The time frame for the replacement of the boats varied for the respondents. Twenty five percent of the respondents said they would replace their boat immediately, no respondent said replacement would occur in three months, 33 percent specified three to twelve months, 25 percent specified within one to three years, and the remainder of the respondents did not specify a time frame. The time frame for boat replacement of the 1990 berthed boat owners is presented in Exhibit 2.5.

**Exhibit 2.5  
Berthed Boats, When Boats Replaced**



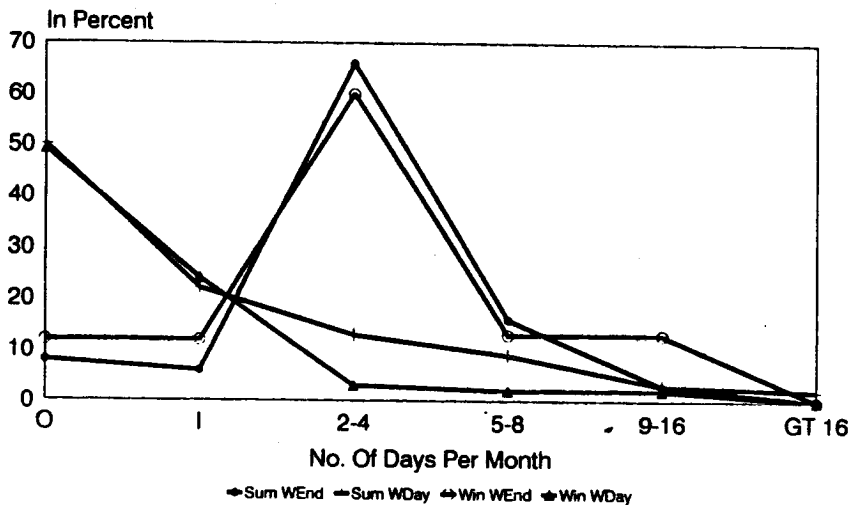
Of the 45 respondents who specified a time frame for the repair of their boat, 71 percent wanted to repair their boats immediately, with another 16 percent wanting to make repairs in less than three months. Eighty seven percent of those responding said they intended to have their boat repaired in Dade County versus outside the county. The time frame for boat repairs of the 1990 berthed boat owners is presented in Exhibit 2.6.

## Exhibit 2.6 Berthed Boats, When Boats Repaired



The post-hurricane usage patterns of the 1990 berthed boat owners are presented in Exhibit 2.7. In general the distribution of boat usage patterns specified by the berthed boat owners in the post-hurricane survey were slightly less than the usage specified as pre-hurricane usage. For the summer season (April through September), most respondents said that they would use their boats 2-4 weekend days a month. Usage on summer weekdays was less, with 88 percent of the respondents saying that they would use their boat on zero or one summer weekday per month.

## Exhibit 2.7 Berthed Boats, Post-Hurricane Boat Use Patterns



For the winter season (October through March), the most frequently occurring response was 2-4 weekend days per month. The winter weekday post-hurricane usage was also less, with 73 percent of the respondents reporting that they would use their boat zero or one winter weekdays.

## **2.2.2 Post-Andrew Responses of Boat Owners in General**

Although the longitudinal study of berthed boat owners allowed insights to be gained as to changes in hurricane planning and preparation, the majority of berthed boats were greater than 26 feet in length. Since the majority of the Dade County boat population is less than 26 feet, a second survey was conducted that targeted the smaller boats.

A survey questionnaire similar to that sent to the berthed-boat owners was developed and mailed to a stratified random sample of boaters in the Dade County. The questionnaire and the accompanying cover letter are presented in Appendix C. The survey addressed the issues of boat characteristics, hurricane preparation and planning, hurricane damage, and possible changes in boat use patterns. A summary of the survey responses for the general boat owners is presented in Appendix D.

### **2.2.2.1 Boat Characteristics**

The majority of the respondents to the survey owned boats that were less than 26 feet in length. The majority of the smaller boats had outboard propulsion, while the larger boats tended to be inboard or inboard/outboards. The distribution of boats by length and propulsion is presented in Exhibit 2.8.

Sixty one percent of the respondents said their boats were trailerable, and 41 percent actually owned a trailer. These figures by length are shown in Exhibit 2.9.

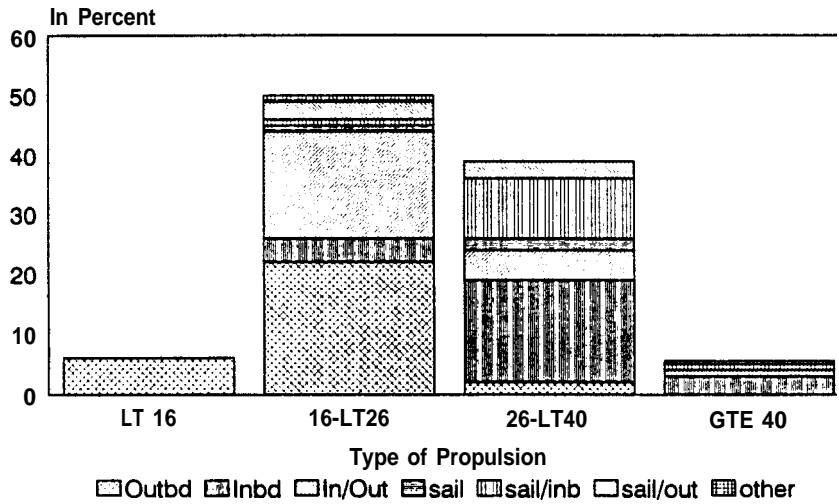
The boats were typically of a model year prior to 1980 and were stored at the owner's home. The average time the boat had been stored in that location was more than five years. Boats less than 26 feet are predominantly stored at home, while boats larger than 26 feet are increasingly likely to be wet berthed.

### **2.2.2.2 Hurricane Preparation and Planning**

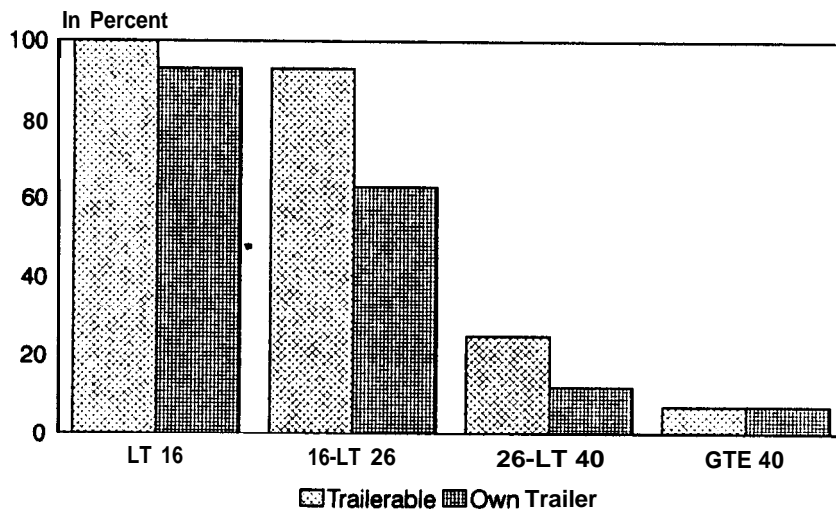
With regard to having a hurricane plan, 66 percent of the respondents said that they did, 19 percent said that they did not, and 15 percent did not respond. The percentage of boat owners with hurricane plans by length of boat is shown in Exhibit

2.10. Forty three percent of those in storage facilities who responded said that their marina provided them with hurricane information and 40 percent of the respondents said that they were required to move their boats in the event of a hurricane. These data are displayed in Exhibits 2.11 and 2.12.

**Exhibit 2.8  
Boat Owners, By Boat Length and Propulsion**

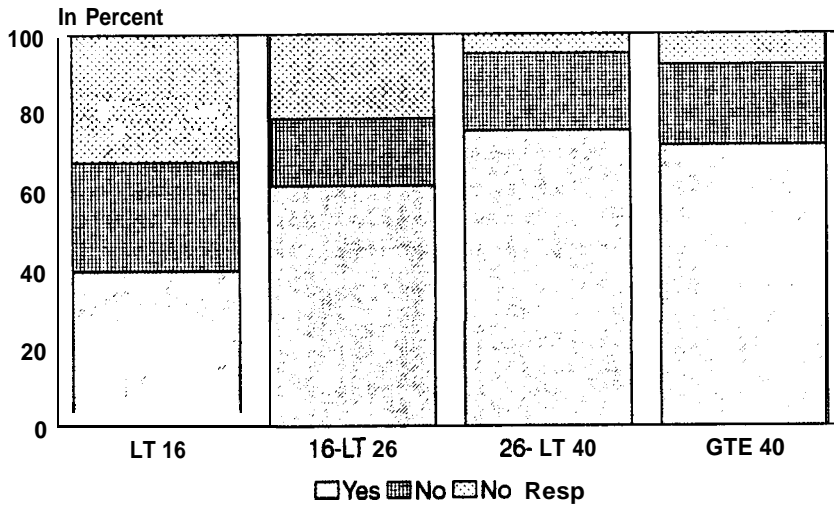


**Exhibit 2.9  
Boat Owners, Boat Trailers**

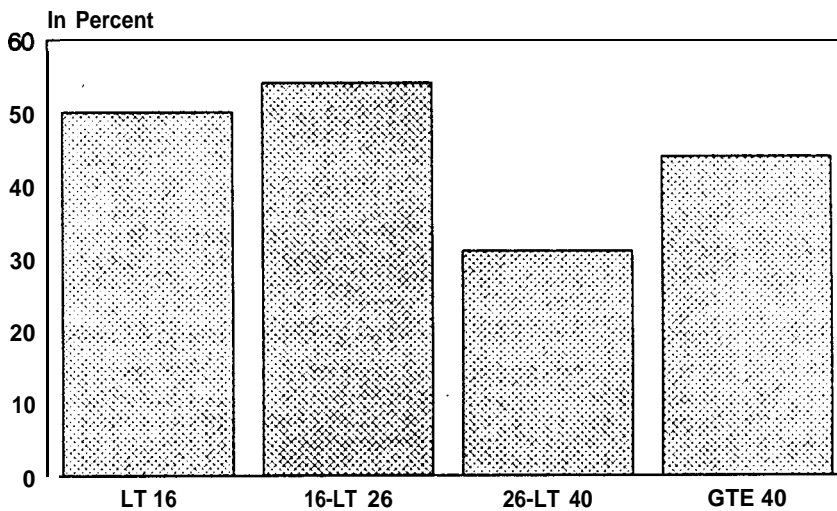


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### Exhibit 2.10 Boat Owners, Hurricane Plan



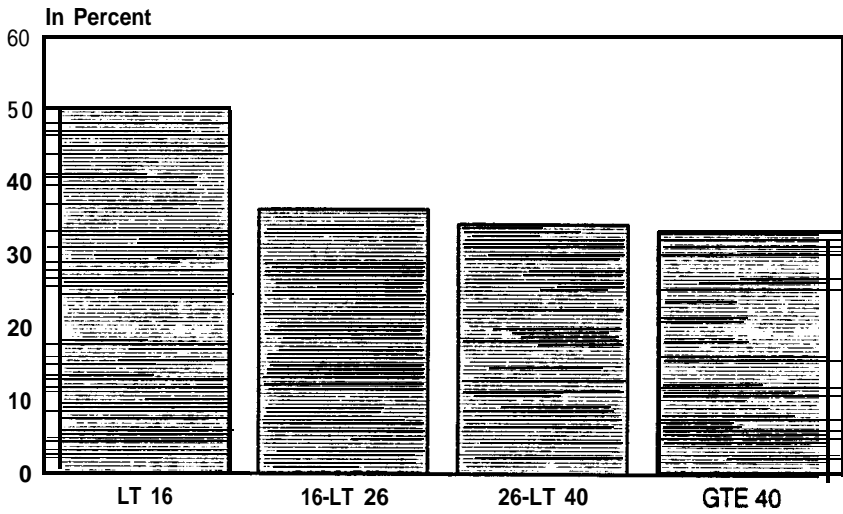
### Exhibit 2.11 Boat Owners, Marina Information



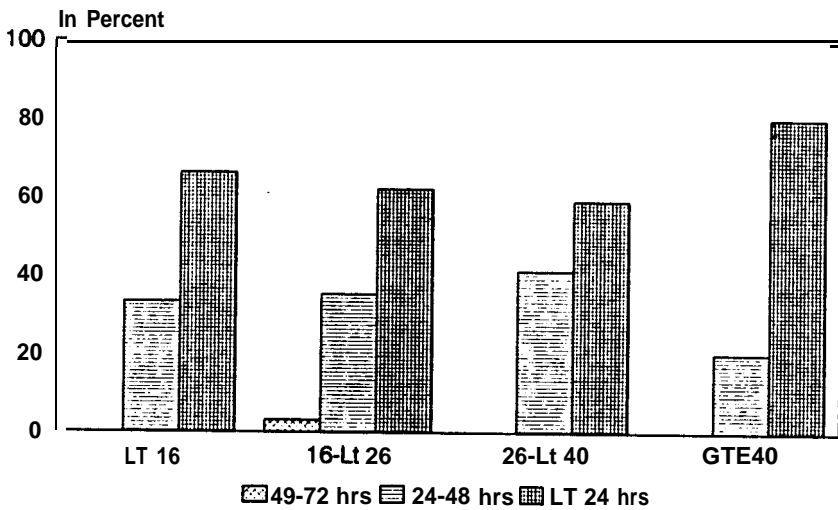
Of the 250 respondents, 85 said they moved their boat prior to Hurricane Andrew, while 146 did not. Nineteen did not respond. Only three boats were moved more than 48 hours before the hurricane struck. Exhibit 2.13 shows the distribution by length of when the boats were moved.



**Exhibit 2.12**  
**Boat Owners, Boats Required to be Moved**



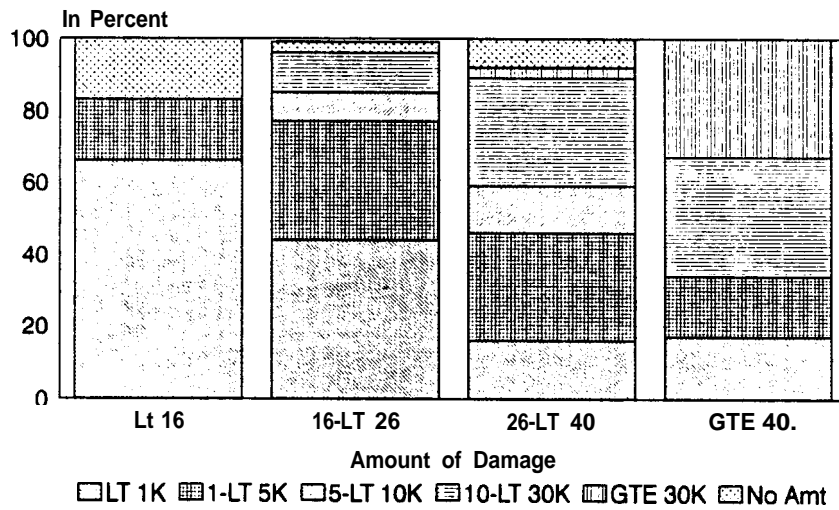
**Exhibit 2.13**  
**Boat Owners, When Boats Were Moved**



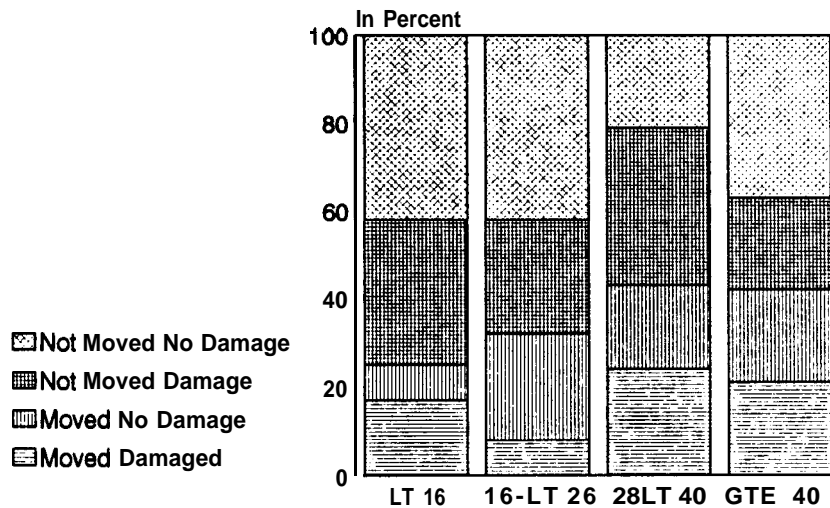
### 2.2.2.3 Hurricane Damage and Assessment

Forty four percent of the boat owners who responded to the survey said that their boats were damaged by Hurricane Andrew. Of those boat owners who moved their boat, 44 percent had damage and 56 percent did not. Of those who did not move their boat, 49 percent had damage and 51 percent did not. For those who moved their boat, the average damage claim was \$ 10,612, while for those who did not move their boat the average damage claim was \$ 8,854. Exhibits 2.14 and 2.15 display the distribution of damages incurred by boat length and whether or not the boat was moved.

**Exhibit 2.14**  
**Boat Owners, Amount of Boat Damage**



**Exhibit 2.15**  
**Boat Owners, Moved Boat**



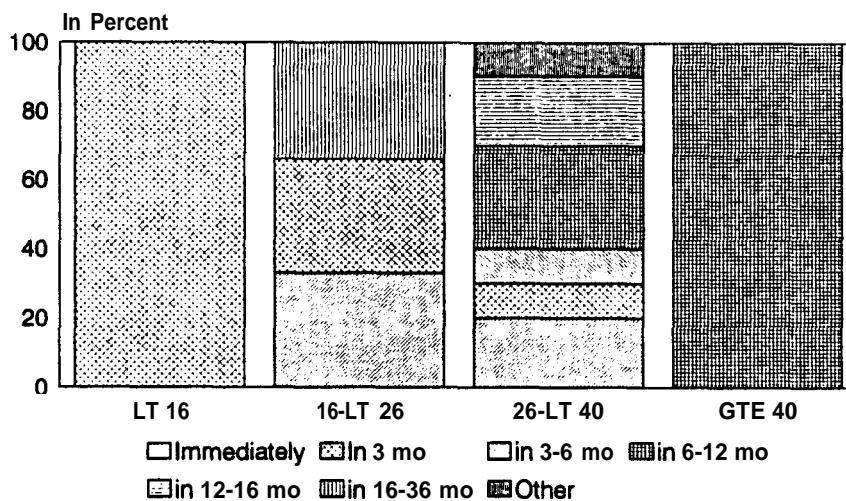
Forty four percent of the respondents said that they had insurance on their boat, but only 16 percent said they thought the insurance would cover the damage incurred.

Of the 15 respondents who lost their boat in the hurricane and are planning to replace their boat, only two plan to replace their boat with a new boat, while eleven plan to replace with a used boat. Eighty percent of the respondents said they plan to replace their boat with one of equal or greater value.

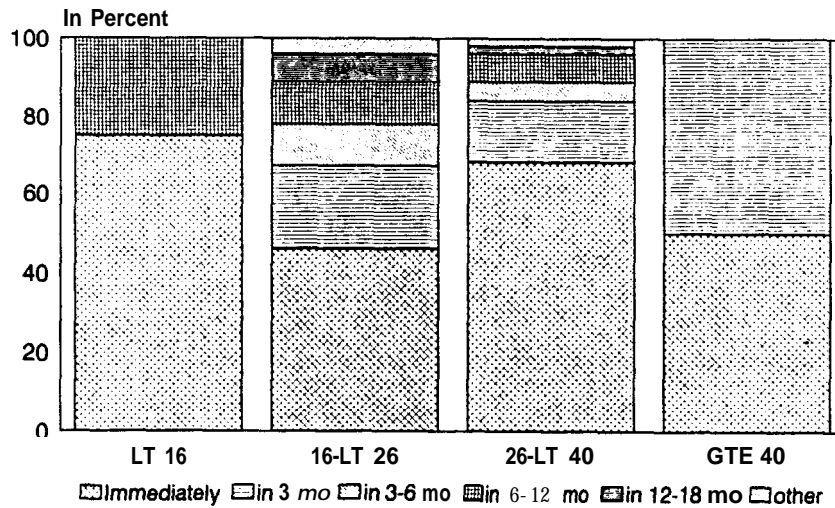
Of the fifteen respondents planning to replace their boat and specifying a time frame, only three said they would replace the boat immediately, eight specified from three to twelve months, and four from one to three years.

With regard to boat repairs, 68 percent of the respondents said they would have their boat repaired in Dade county. Of all respondents 60 percent said they would have the repairs done immediately and the rest within one year. The time frames for the replacement and repair of boats by length are presented in Exhibits 2.16 and 2.17.

**Exhibit 2.16  
Boat Owners, When Will Boats Be Replaced**



### Exhibit 2.17 When Will Boats Be Repaired

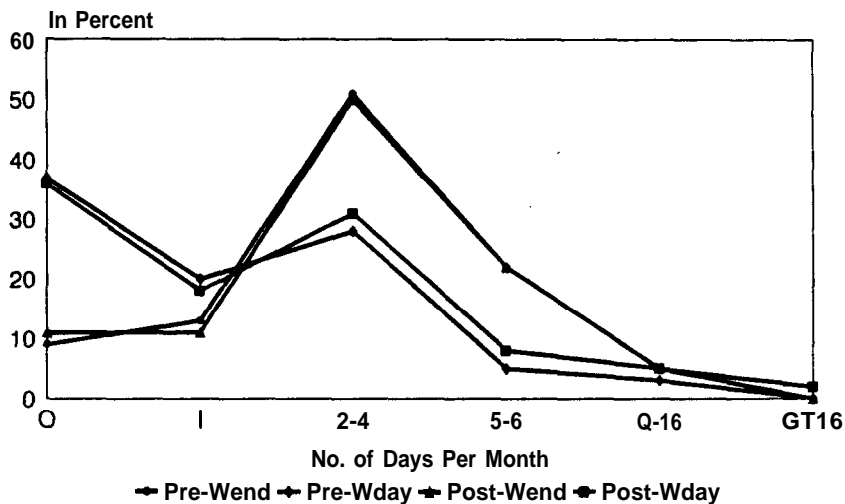


#### 2.2.2.4 Future Boating Plans

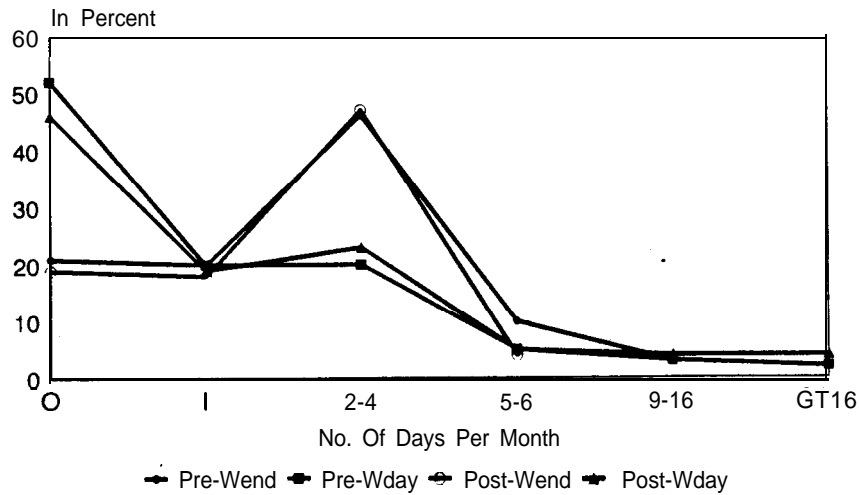
With regard to future boating plans, 88 percent of the respondents said that they would continue to use their boat. Eighty seven percent of all respondents said they would have a hurricane plan in the future.

The post-hurricane usage patterns of the general boat owners in, Dade County are presented in Exhibits 2.18 (Summer) and 2.19 (Winter). The distribution of pre- and post-hurricane boat usage patterns specified by the general boat owners are virtually identical.

### Exhibit 2.18 Boat Owners, Post-Hurricane Summer Boat Use Patterns



**Exhibit 2.19**  
**Boat Owners, Post-Hurricane Winter Boat Use Patterns**



The frequencies of both the summer and winter usage patterns for the general population of boat owners show similar patterns over the range of values surveyed. The patterns are also similar to the patterns specified by the berthed boat owners. The frequency of use of the berthed boat owners, however, is slightly greater than that of the general boating population. The fact that boat usage has in fact remained constant has been corroborated by data obtained from talking with dockmasters in the county.

**3.0 Survey of Dade County Marinas and Boat Storage Facilities**

The inventory of marinas used in this study was the result of three previous reports. First, the Submerged Lands Section of the Division of State Lands of the Bureau of State Lands Management prepared a report entitled “An Inventory of Multi-Slip Docking Facilities in Florida” in 1984. This document listed all marinas in the state at that time, reporting number of slips, wet and dry, occupancy rates, and services available. The second data source employed was a May 8, 1992 draft of the Dade County Manatee Protection Plan prepared by the Department of Environmental Resources Management. This report listed number of slips and occupancy rates for all marinas, boat yards, and ports in the county. Finally, a marina inventory used as part of a marina siting study performed by the Boating Research Center at the University of Miami was utilized. This final study, completed in July of 1992, considered only wet and dry berthed marinas. Boat yards and the Port of Miami were not included in this listing. As a validation measure, all county and city owned marinas and all privately owned marinas with more than 100 slips were surveyed by telephone to confirm the number of slips, wet or dry, and the pre-hurricane occupancy rates. This final inventory

was then used as the sampling frame for this phase of the study.

The pre-hurricane inventory of the boat storage facilities in Dade County is presented in Exhibit 3.1. The inventory lists all boat storage facilities in the county with 10 or more slips. Nine publicly owned and 83 privately owned facilities are listed. The inventory reveals 2070 publicly owned slips with a 79% occupancy rate. The inventory also includes 8,112 privately owned slips with a 76% occupancy rate. A total of 92 boat storage facilities encompassing 10,143 slips were included in the inventory.

Each of the 92 boat storage facilities in the inventory was mailed a survey questionnaire. A copy of the questionnaire is presented in Appendix E. The questionnaire, designed in cooperation with members of the marine industry, requested each facility to respond in six general areas: 1) facility characteristics, 2) pre-hurricane operations, 3) hurricane preparedness, 4) the effects of Hurricane Andrew, 5) rebuilding plans, and 6) post-hurricane operations. Each of these areas is reviewed in the sections which follow.

### **3.1 Facility Characteristics**

Thirty boat storage facilities responded to the survey questionnaire. Four surveys were completed during site visits to the facilities and five surveys were completed over the telephone. For the 39 survey respondents the pre-hurricane facility characteristics are presented in Exhibit 3.2. The respondents include all nine of the publicly owned marinas in the county and 30 of the 83 privately owned facilities. The respondents represent 7,594 of the 10,143 available slips in Dade County prior to Hurricane Andrew.

The post-hurricane characteristics of the respondent boat storage facilities are presented in Exhibit 3.3. The reported number of wet slips extant decreased from 3,925 before the hurricane to 2,817 after the hurricane. The occupancy rate for wet slips increased from 70% to 75%. Additionally, the number of dry slips decreased from 3,434 to 3,029, while the occupancy rate for dry slips decreased from 80% to 78%. The number of long term “dead” trailer storage spaces decreased from 235 to 113. Overall, the total number of slips in the facilities responding decreased from 7,594 to 6,005. In percentage terms, overall occupancy remained essentially constant at 76%.

### **3.2 Pre-hurricane Operations**

The percentages of respondent boat storage facilities offering various services are presented in Exhibit 3.4. The average pre-hurricane price for the storage of a boat in a wet slip was \$ .23 per linear foot per day in county owned marinas and averaged \$ .30 per linear foot per day in privately owned marinas. The price for dry storage was reported to be \$ 75 per month (up to 29 feet) in county owned marinas and \$ .24 per linear foot per day in private facilities. Although the data reported was not complete for

**Exhibit 3.1**  
Pre-Hurricane Andrew Inventory of  
Boat Storage Facilities, Dade County

<b>City/Cnty Owned Facilities</b>	<b>No. of Slips</b>	<b>%Occupied</b>
Black Point	209	0.92
Crandon Park	414	1.00
Dinner Key Marina	582	0.93
Haulover Park	44	0.39
Homestead Bayfront	194	0.44
Matheson Hammock	323	0.95
Miamarina	167	0.15
Pelican Harbor	98	0.25
<b>Subtotal</b>	<b>2031</b>	<b>0.79</b>

<b>Other Facilities</b>	<b>No. of Slips</b>	<b>%Occupied</b>
5660 Collins Condo	10	0.00
Apache Marine	12	1.00
Aranow Power Boats	10	1.00
Aventura Marina	27	0.89
Bal Harbour Yacht Club	37	0.50
Banyan Bay Apts	50	0.26
Basset Sea Ray Marina	32	0.63
Biscayne Bay Marriot Marina	221	0.60
Biscayne Bay Yacht Club	123	1.27
Blue Marlin Marina	10	1.00
Brickell Bay Village	13	0.62
Brickell Biscayne Bay Condo	17	1.00
Brickell Harbor Condo	12	1.00
Brickell Place Marina	67	0.75
Carriage House Condo	13	1.00
Castaways Marina	13	0.46
Causeway 79 Marina	267	1.00
Coastal Towers	33	0.94
Coconut Grove Sailing Club	244	1.00
Cocoplum Yacht Club	176	0.82
Commodore Towers Plaza	20	0.50
Coral Reef Yacht Club	169	1.00
Costa Brava	30	0.20
Eden Rock Hotel	17	0.82
Fisher Island Club and Marina	106	0.28
Fort Apache Marina Inc	204	0.65
Forte Towers	12	1.00
Fountainbleau Hotel	23	0.00
Four Ambassadors Marina	36	0.61
FPL Docking Facilities	89	1.00
Gables Harbor Condo	23	1.00
Gables Waterway Exec. Center	31	1.00
Gables Waterway Towers	27	1.00
Grove Isle Marina	85	0.69
Grove Key Marina	328	1.00
Harbor West Apts	33	0.73
Haulover Resort Marina	325	0.80
Hi Lift Marina	269	0.82
Imperial House Condo	10	0.80
Indian Creek Club and Marina	12	0.17
International Yacht Harbor	376	0.30
Jockey Club	40	0.66
Key Biscayne Yacht Club	100	1.00
Keystone Point Marina	475	0.95
King Cole condo	32	0.31
Kings Bay Yacht Club	290	0.90

Little River Marina	20	1.00
L'Hermitage	15	0.40
Manhattan Towers	16	0.69
Marine Management	300	0.91
Marine Plaza Apts	22	1.00
Mariners Bay Condo	28	0.50
Maule Lake Marina	375	0.60
Miami Yacht Club	212	1.00
Monty Trainers Dock and Bar	150	0.93
Morton Towers	26	0.19
Nine Island Ave.	36	1.00
Palm Bay Yacht Club	43	0.33
Pirate Spa Marina	45	1.00
Racquet Club	19	0.68
Rickenbacker Marina	170	0.60
River Run Marina.	81	1.00
Royal Harbor Yacht Club	49	0.90
Seacoast East Condo	10	0.00
Seacoast Towers	15	0.20
Seacoast Towers South	22	0.27
Snapper Creek Marina	50	0.94
Snug Harbor Townhouse	25	0.28
South Bay Condo	15	0.93
South Gate Towers	15	0.93
Spinnaker Marina	487	0.67
Sunny Isles Marina	282	0.90
Sunset Harbor Marina	125	0.44
Tower House Condo	17	0.29
Towers of Quayside	63	0.32
Turnberry Isle Yacht Club	117	0.26
Villa Regina Condo	43	0.47
Virginia Key Marina	460	0.70
Waterways Marina	99	0.72
Water's Edge Condo	18	1.00
Watson Island Marina	43	1.00
Winston Towers Yacht Basin Inc	50	0.90
<b>Subtotal</b>	<b>8112</b>	<b>0.76</b>
<b>Total</b>	<b>10143</b>	<b>0.77</b>

Data Based on:

1. "1984 Inventory of Multi-Slip Docking Facilities in Florida" by the Division of State Lands, Bureau of State Lands, Bureau of State Lands Management, Submerged Land Section.
2. "Draft of Dade County Manatee Protection Plan" by Dade County Department of Environmental Resources Management, May 8, 1992.
3. "Marina Siting Evaluation Model Study" of Boating Research Center, University of Miami-RSMAS, May-July 1992.



**Exhibit 3.2**  
Pre-Hurricane No. of Available Slips  
and Occupancy Rates, Boat Storage Facilities

Storage Facilities	Wet	%Occ	Dry	%Occ	Other	%Occ	Total	%Occ
	Slips	Rate	Slips	Rate	Storage	Rate		Rate
Biscayne Bay Marriot	160	54	40	53			200	54
Black Point/Marine Mgt	178	100	300	94	31	100	509	97
Brickell Bisc. Condo	17	100					17	100
Coconut Grove YC	244	100					244	100
Costa Brava Condo	30	20					30	20
Crandon Marina	234	100	128	100	58	100	420	100
Dinner Key	582	92					582	92
Fisher Island Club	120	33					120	33
Fountainbleau	23	13					23	13
Gables Harbor Condo	22	100					22	100
Gables Waterways	27	100					27	100
Grove Key Marina	3	100	325	95			328	95
Haulover Resort			285	74	50	100	325	80
Haulover Park	44	40					44	40
Hi-Lift Marina	9	22	280	89			289	87
Homestead Bayfront	173	74	21	86			194	75
Jockey Club Marina	40	50					40	50

Storage Facilities	Wet	%Occ	Dry	%Occ	Other	%Occ	Total	%Occ
Key Biscayne YC	100	100	40	100			140	100
Keystone Point	25	68	450	93			475	92
Marine Plaza Apts	30	100					30	100
Matheson Hammock	252	98			71	100	323	99
Maule Lake Marina	175	54	200	30			375	41
Miami Beach Marina	395	65					395	65
Miami Marina	160	33					160	33
Miami Yacht Club	44	100	180	92			224	93
Morton Tower	48	17					48	17
Nine Island Condos	36	22					36	22
Palm Bay Marina	43	37					43	37
Pelican Harbor	98	23					98	23
Royal Harbor YC	48	88					48	88
Rickenbacker Causeway	170	55					170	55
River Run YC	81	100					81	100
Spinnaker Marina	20	100	425	53	25	60	470	55
Sunny Isles Marina	20	100	250	92			270	93
Sunset Harbor Marina	125	64	50	100			175	74
* Villa Regina								
Virginia Key			460	72			460	72
Waterways Marina	99	42					99	42
Winston Towers	50	40					50	40
Total	3925	70	3434	80	235	96	7594	76

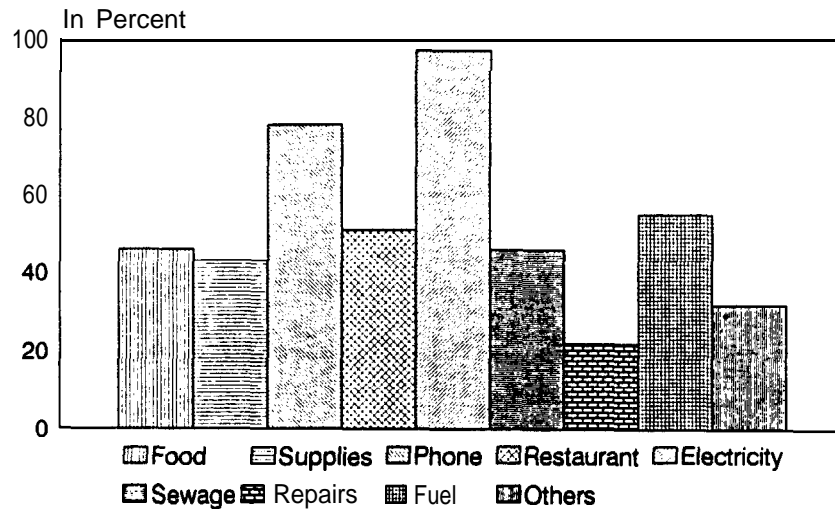
**Exhibit 3.3**  
**Post-Hurricane No. of Available Slips**  
**and Occupancy Rates, Boat Storage Facilities**

Storage Facilities	Wet	%Occ	Dry	%Occ	Other	%Occ	Total	%Occ
Biscayne Bay Marriot	140	62	40	53			180	60
Brickell Bisc. Condo	17	71					17	71
Coconut Grove YC	244	94					244	94
Costa Brava Condo	30	20					30	20
Crandon Marina	242	100	130	100	38	100	410	100
Dinner Key	100	100					100	100
Fisher Island Club	121	50					121	50
Fountainbleau	23	13					23	13
Gables Harbor Condo	22	100					22	100
Gables Waterways	27	100					27	100
Grove Key Marina	3	100	325	90			328	95
Haulover Resort			225	71	50	100	275	76
Haulover Park	44	40					44	40
Hi-Lift Marina	9	22	280	89			289	87
Homestead Bayfront	159	38	20	40			179	39
Jockey Club	60	42					60	42
Key Biscayne YC	100	100	40	100			140	100

Storage Facilities	Wet	%Occ	Dry	%Occ	Other	%Occ	Total	%Occ
Keystone Point	25	80	450	96			475	95
Marine Plaza Apts	30	100					30	100
Maule Lake Marina	165	55	200	30			365	41
Miami Beach Marina	395	75					395	75
Miami Yacht Club	44	100	180	56			224	64
Morton Tower	48	17					48	17
Nine Island Condos	36	22					36	22
Palm Bay Marina	22	5					22	5
Pelican Harbor	98	59					98	59
Royal Harbor YC	48	94					48	94
Rickenbacker Causeway	170	100					170	100
River Run YC	81	100					81	100
Spinnaker Marina	20	100	425	65	25	60	470	68
Sunny Isles Marina	20	100	250	100			270	100
Sunset Harbor Marina	125	100	50	100			175	100
* Villa Regina								
Virginia Key			460	61			460	61
Waterways Marina	99	42					99	42
Winston Towers	50	60					50	60
Total	2817	70	3029	78	113	91	6005	76

all survey respondents, the average number of full-time employees per facility was eight, while the average number of part-time employees was two.

**Exhibit 3.4**  
**Boat Storage Facilities, Services Offered**

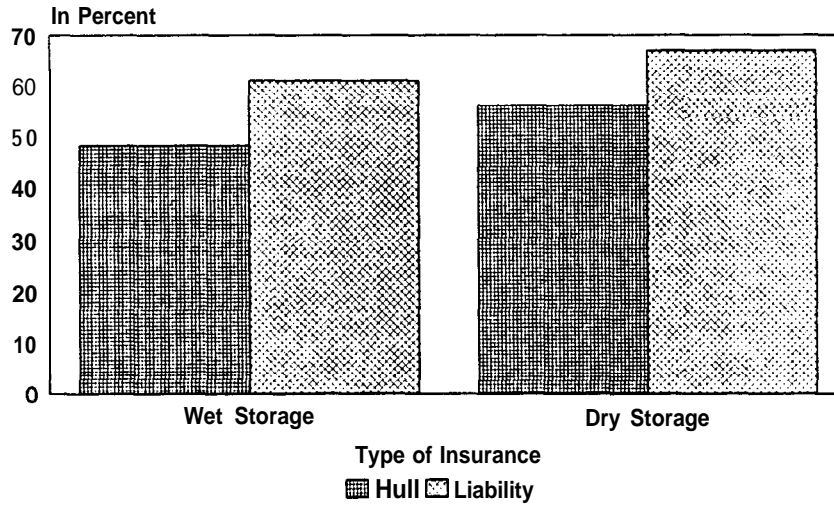


### 3.3 Hurricane Preparedness

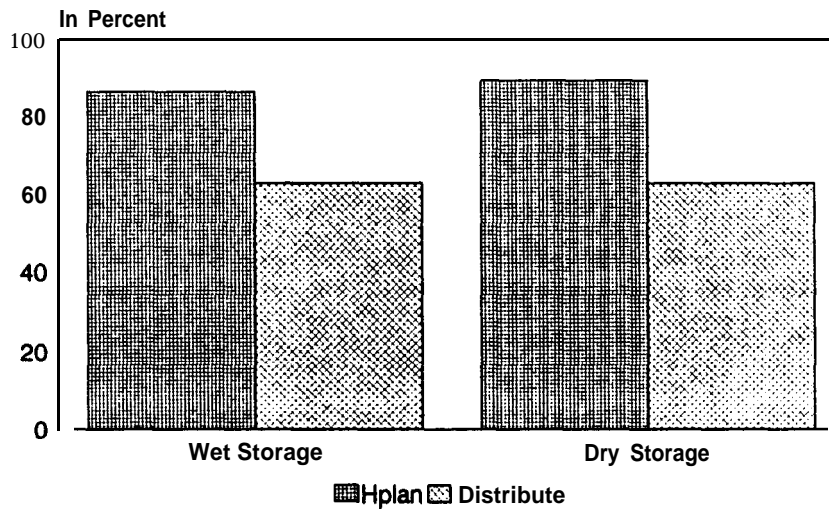
The hurricane preparedness section of the survey investigated the boat storage facilities' requirements of boat owners as to insurance, hurricane plans, and evacuation procedures. The facilities' requirements for the boat owners' insurance is shown in Exhibit 3.5. Hull insurance was required by 48 percent of the wet berth facilities and 56 percent of the dry berth facilities. Liability insurance was required by approximately 61 percent of the wet storage facilities and 67 percent of the dry storage facilities responding.

In terms of having a hurricane plan, 85 percent of the wet berth facilities and 89 percent of the dry storage facilities reporting said that they had a hurricane plan. Of those facilities with a plan, 62.5 percent of both the wet berth and the dry storage facilities said they distributed their plan to the boat owners. These results are shown in Exhibit 3.6.

**Exhibit 3.5  
Boat Storage Facilities, Insurance Requirements**

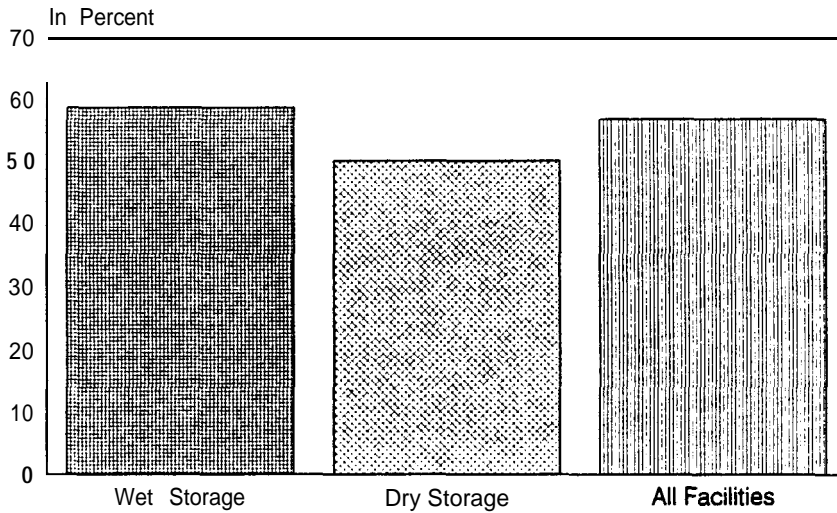


**Exhibit 3.6  
Boat Storage Facilities, Hurricane Plan**



A majority of the wet berth facilities responding required the boat owners to move their boats prior to the hurricane. Of the dry storage facilities reporting, 50 percent had a similar requirement. These results are shown in Exhibit 3.7.

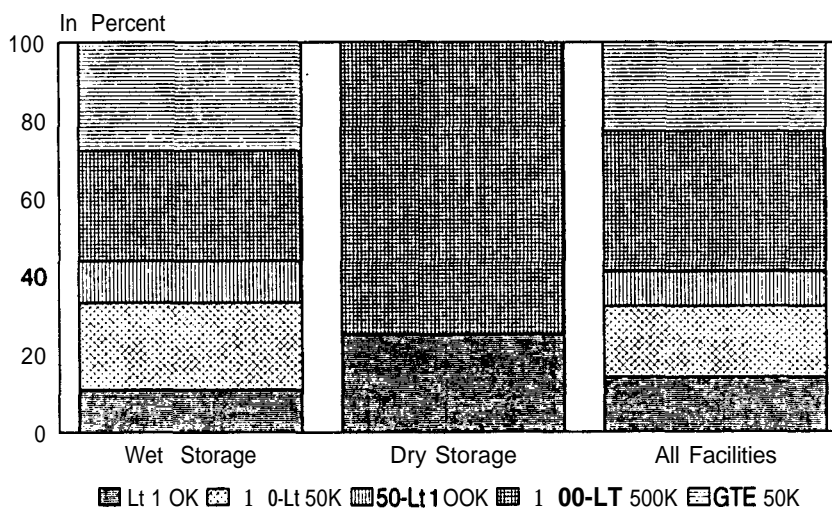
### Exhibit 3.7 Boat Storage Facilities, Require Move Boats



### 3.4 The Effects of Hurricane Andrew

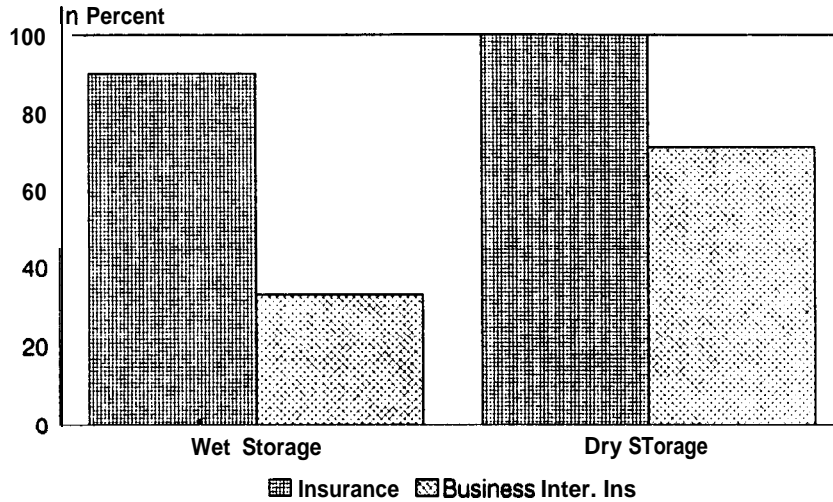
Of the boat storage facilities responding, 80 percent of the wet berth facilities and 77 percent of the dry storage facilities incurred damage. The amount of damage incurred by the facilities was dependent upon many factors and thus ranged from no damage to several millions of dollars. Of the boat storage facilities reporting, 32 of 39 said they had damage. Of those reporting damage, 18 specified an amount. A profile of the amounts of damage reported by the respondents is presented in Exhibit 3.8.

### Exhibit 3.8 Boat Storage Facilities, Amount of Damage



Generally, the boat storage facilities had insurance to help cover their damages. Ninety percent of the wet berth facilities had insurance, while 100 percent of the dry storage facilities reporting had insurance. Although the facilities frequently had liability coverage, a lesser number had business interruption insurance. These insurance figures are presented in Exhibit 3.9.

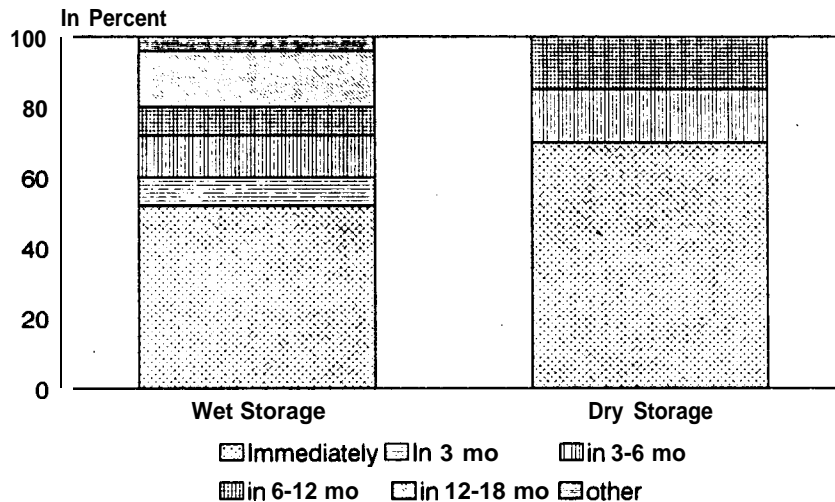
**Exhibit 3.9**  
**Boat Storage Facilities, Insurance Coverage**



### 3.5 Rebuilding Plans

All of the boat storage facilities responding to the survey said that they would rebuild their facilities damaged by Hurricane Andrew. Uniformly the dry storage facilities said that they would rebuild immediately. The wet berth facilities also intended to rebuild quickly. Fifty-two percent of the wet berth facilities responding said they would rebuild immediately and the rest within 18 months. These statistics are reported in Exhibit 3.10.

**Exhibit 3.10**  
**Boat Storage Facilities, Rebuilding Plans**





## **4.0 Boat Yards, Boat Dealers, and Boat Manufacturers**

With the help of marine industry representatives questionnaires were designed to be sent to boat yards, boat dealers, and boat manufacturers in Dade County, Florida. Reasonable results were obtained from the boat yards, however, the response rate was extremely low and questionnaires were often only partially completed from the boat manufacturers, and no responses were received from the boat dealers. Each of the industry sectors is considered below.

### **4.1 Boat Yards**

Seventeen boat yards were identified in Dade County, Florida and each was sent a survey questionnaire. The list of boat yards surveyed is presented in Exhibit 4.1. A copy of the survey questionnaire is presented in Appendix F. Eight responses were received from the boat yard population for a 47 percent response rate. The questionnaire addressed the areas of boat yard characteristics, pre-hurricane operations, Hurricane Andrew damage assessment, rebuilding plans, and post-hurricane operations.

#### **Exhibit 4.1 List of Boat Yards Surveyed**

Anchor Marine	Grove Key Marina
Atlantic Aero Marine Assoc.	Jones Boat Yard & Dry Dock
Atlantic Marine Boat Yard	La Coma Marine, Inc.
Bimini Boat Yard of Miami	Las Americas Marine Inc.
Bojean Boat Yard	Merrill-Stevens Dry Dock Co.
Coastal Marine Ways	Dinner Key Boatyard
Coffey's Marine, Inc.	Norseman Shipbuilding Corp.
Glass Tech Corp.	Nuta's Boat Yard
	Poland Yacht Basin

#### **4.1.1 Boat Yard Characteristics and Pre-hurricane Operations**

Of the eight boat yards responding to the survey, six are located along the Miami River. The number of full-time employees at the facilities ranged from three to seventy. The number of part-time employees ranged from zero to twenty. The monthly salaries paid by the boat yards responding ranged from \$4,400 to \$270,000 per month. The average number of repairs made per month prior to Hurricane Andrew ranged

from six to thirty three. There were insufficient data to report typical figures for the average cost of a repair made. The sources of materials and supplies used in the repairs were approximately equally obtained from Dade and Broward counties, however, one yard reported obtaining 25 percent of its materials from out of state.

#### **4.1.2 Hurricane Andrew Damage Assessment and Rebuilding Plans**

With regard to damages incurred during Hurricane Andrew, the property damage assessments ranged from zero to \$120,000 with a median of \$6,000. Exactly half of the survey respondents had property insurance, covering from fifty percent to 100 percent of the damage incurred. Only 25 percent of the facilities had business interruption insurance. One facility reported being closed for one month, another reported being without electricity for two weeks.

Of the three facilities responding that rebuilding was necessary, two planned to rebuild immediately and the other within twelve to 18 months.

#### **4.1.3 Post-Hurricane Andrew Operations**

All of the respondents had hired more full-time employees in their post-hurricane operations. The range of full-time employees was from four to 90. Each of the facilities responding was able to identify hurricane related repairs above their regular level of repair and maintenance work. The reported percentages of hurricane related business to total business varied from 33 percent to 71 percent. For those facilities providing pre-hurricane and post-hurricane repair data, the number of repairs was up 13 percent after the hurricane. The timing of the repairs showed that there was a dramatic increase in the month of September, however, the repairs in October and November were less than the previous year. Repairs for December through January were again above the pre-hurricane levels.

### **4.2 Boat Dealers**

With the help of marine industry representatives, 15 boat dealerships were identified for the purposes of this study. Each dealership was contacted by phone to verify their efficacy and to establish a personal contact. Each dealership was then sent a survey questionnaire by mail or, as nine dealers had requested, the survey was sent by FAX. The list of boat dealers surveyed is presented in Exhibit 4.2. A copy of the survey questionnaire and the accompanying cover letter is presented in Appendix G. The questionnaire addressed the areas of boat yard characteristics, pre-hurricane operations, Hurricane Andrew damage assessment, rebuilding plans, and post-hurricane operations.

## **Exhibit 4.2**

### List of Boat Dealership Surveyed

ABC Marine	Fisherman's Paradise
Bassett Boat Co.	Gables Marine
Bayflite Marine, Inc.	Gateway Marine
Boat Center of Miami	Hilift Marina
Bob Hewes Boats	Johnson-Kirby, Inc.
Champion Marine, Inc.	Langer's Marine
D.O.S. Marine	Performance Marine
Dixie Marine	Sunny Isles Marina

Despite the efforts of the researchers, no completed surveys were returned. Immediately following all FAX transmissions, follow-up phone calls were conducted to encourage responses. Telephone follow-up calls were made ten days later to all boat dealers who had not responded. At that time, questionnaires were resent and phone interviews were conducted to determine the reason for the lack of responses.

The reasons for the lack of response were varied, however, several common themes emerged. First, the dealerships felt they were too busy to take the time to complete the survey. Second, the owners were often out of town and the employees did not have access to the needed information. A final reason was that the survey was not applicable because the dealership had experienced no serious damage from Hurricane Andrew and they saw no change in business since the hurricane. One boat dealer interviewed said he anticipated a positive business response, but that it would be delayed until boat owners had repaired the other pieces of their lives such as homes and businesses. This may be a topic for future investigation.

Dealerships form an important link in the chain of marine service industries. The lack of survey data from boat dealerships is a weakness of this study. Given the ineffectiveness of standard survey methodology in this case, future studies should seek to employ alternative methods to obtain information on the boat dealer sector of the recreational boating industry.

### **4.3 Boat Manufacturers**

With the assistance of the leaders of the recreational boat manufacturing industry in Dade County, a list of 81 boat manufacturers was compiled for this study. Each manufacturer was contacted by phone to inform them of the survey, to

verify their current address, and to identify a contact person for the mail survey.

Of the 81 manufacturers initially identified for the study, the list was eventually reduced to 34 participants. These reductions occurred for a number of reasons. First, a number of the manufacturers on the initial list were actually located outside of Dade County. Second, 16 businesses had disconnected telephones with no forwarding number. Finally, a few on the original list were small, one or two person, operations custom building 1-3 boats per year. A list of the manufacturers contacted in the study is provided in Exhibit 4.3.

### **Exhibit 4.3**

#### List of Boat Manufacturers Surveyed

Acrylicraft	Dusky Sport Fishing Boats
Airboat Headquarters	Great Boat Company
Angler Boat Corp.	International Marine Mfg
Answer Marine	Magnum Marine
Airboat Service	Novurania of America Inc.
Apache Performance Boats	P & D Classic
Advance Powerboats	Offshore Boat Corp.
Blackfin Yacht Corp.	Pantera Power Boats
Bobby Moore's Custom Marine	Phoenix Marine Inc.
Cigarette Racing Team	Sea Taxi Yachts
Contender Boats Inc.	Stapleton Boat Corp.
Corsa Marine Ltd.	Tamair Speed Marine
Crusader Boats	Mako Marine Inc.
Classic Water Craft	Avanti Powerboats Inc.
Concept Boats	Best Yacht Repair
Condor Powerboats Inc.	VIP Marine Industries Inc.
Dolphin Boat Mfg.	Whitewater

A copy of the survey questionnaire and the accompanying cover letter is presented in Appendix H. The questionnaire addressed the areas of boat yard characteristics, pre-hurricane operations, Hurricane Andrew damage assessment, rebuilding plans, and post-hurricane operations.

A telephone follow-up was conducted ten days after the initial mailing, to ensure that the manufacturers had received the survey questionnaire, to encourage manufacturers to respond to the survey, and to offer assistance in filling out the questionnaire. To further encourage responses, repeated telephone contact was made with the participating boat manufacturers and questionnaires were resent, after

addresses and contact names had been verified, to those who had lost them or did not recall receiving them. Ten days following the second mailing, final phone interviews were conducted with the manufacturers who had failed to respond and the researchers asked if the manufacturer would take a few moments to answer the most important questions on the survey over the phone and to determine the reason for the low response rate.

Despite the repeated efforts by the researchers only four survey questionnaires were eventually returned, and of the four only one was filled out entirely. The remaining three had only the basic data, and very little substantive economic information concerning pre and post-hurricane operations.

Of the remaining 30 manufacturers, six stated they had already sent the completed questionnaires back, three said they would not respond and gave no explanation, two said they had little physical damage and that most of their business was European and not effected by the hurricane, a few were located in north Dade County, had no damage and saw no change in business from the hurricane. Only one manufacturer targeted had gone out of business, and one had relocated because of the hurricane, but would not respond to the survey by mail or phone interview.

As in the case of the boat dealerships, the survey data obtained from the boat manufacturers in Dade County was insufficient for the purposes of this study. The surveys returned were not in sufficient number nor did they contain enough information to allow reliable inferences to be made as to how the general population of boat manufacturers was effected by Hurricane Andrew.

## **5.0 Summary and Conclusions**

This study was undertaken to analyze the impact of Hurricane Andrew on three distinct sectors of the recreational boating industry: boaters, marine storage facilities, and the marine services industries. Each of these sectors was surveyed with varying degrees of success. With regard to boaters, two studies were undertaken that were very successful, 1) a longitudinal study of hurricane evacuation plans of berthed boat owners in Dade County using a 1990 study as a baseline, and 2) a stratified random sample of the general boater population in the county. With regard to marinas and boat storage facilities, a sampling frame of Dade County marinas and boat storage facilities was completed by the Boating Research Center in July of 1992, three weeks prior to Hurricane Andrew and produced good results. Finally, surveys of boat yards, boat dealers and boat manufacturers in Dade County were conducted with lesser degrees of success.

The objectives of this study were three: 1) to evaluate the hurricane preparedness plans of the boaters, marinas and other marine related businesses in Dade County, 2) to assess the damage caused by Hurricane Andrew to the boats, marinas, boat yards, and other boating businesses, and 3) to determine the future boating activities of Dade County boat owners and the rebuilding plans of the marine businesses. Each of these areas is summarized below with regard to the various sectors of the recreational boating industry.

Among boaters in general, 66 percent said that they had a hurricane plan prior to Hurricane Andrew. After Andrew, 80 percent of all boaters, and 95 percent of berthed boat owners, had a hurricane plan. Prior to Andrew, 67 percent of the berthed boat owners said they planned to evacuate their marina, whereas 53 percent actually did evacuate. The evacuations came much closer to hurricane landfall than expected. Prior to the hurricane, 64 percent said that they would evacuate more than 48 hours before landfall, when actually only 32 percent of the berthed boat owners evacuated more than 48 hours before hurricane landfall. Many berthed boat owners located in the southern region of Dade County felt that their marina would be safe in a hurricane. This turned out not to be the case for Hurricane Andrew.

Of the berthed boat owners who responded to the survey, 64 percent incurred damage to their boats. For those berthed boat owners responding the average damage figure was approximately \$25,000. In the general boater population, 44 percent of those responding had damage to their boats. The average damage figure for these respondents was approximately \$9,160. The majority of boaters who lost their boats plan to replace them with boats of equal or greater value within one year. Of those boaters needing repairs, 68 percent said that they would have their boat repaired immediately using marine services within Dade County.

With regard to future boating plans, 88 percent of the respondents said that they would continue to use their boats. The usage patterns for the berthed boat owners, and the boat owners in general, indicated a post-hurricane usage rate about the same as the pre-hurricane rate. The frequency of use of the berthed boat owners, however, is slightly greater than that of the general boating population. The fact that boat usage has in fact remained constant after Hurricane Andrew has been corroborated by data obtained from talking with dockmasters in the county.

The survey of marinas and boat storage facilities investigated the requirements of boat owners as to insurance, hurricane plans, and evacuation procedures. Hull insurance was required by 48 percent of the wet berth facilities and 56 percent of the dry berth facilities. Liability insurance was required by approximately 61 percent of the wet storage facilities and 67 percent of the dry storage facilities responding.

In terms of having a hurricane plan, 85 percent of the wet berth facilities and 89 percent of the dry storage facilities reporting said that they had a hurricane plan. Of those facilities with a plan, 62.5 percent of both the wet berth and the dry storage facilities said they distributed their plan to the boat owners. A majority of the wet berth facilities responding required the boat owners to move their boats prior to the hurricane. Of the dry storage facilities reporting, 50 percent had a similar requirement

Of the boat storage facilities responding, 80 percent of the wet berth facilities and 77 percent of the dry storage facilities incurred damage. The amount of damage incurred by the facilities was dependent upon many factors and thus ranged from no damage to several millions of dollars. Ninety percent of the wet berth facilities had insurance, while 100 percent of the dry storage facilities reporting had insurance. Although the facilities frequently had liability coverage, few had business interruption insurance.

All of the boat storage facilities responding to the survey said that they would rebuild their facilities damaged by Hurricane Andrew. All of the dry storage facilities responding said that they would rebuild immediately. The wet berth facilities generally intended to rebuild quickly, with 50 percent of the respondents saying they would rebuild immediately.

Of the boat yards surveyed in Dade County, the number of formal hurricane plans was not reported. Exactly half of the survey respondents had property insurance, covering from fifty percent to 100 percent of the damage incurred. Only 25 percent of the facilities responding had business interruption insurance.

With regard to damages incurred by boat yards during Hurricane Andrew, the property damage assessments reported ranged from zero to slightly over one hundred thousand dollars. One facility reported being closed for one month, another reported being without electricity for two weeks. Of the three facilities responding that rebuilding was necessary, two planned to rebuild immediately and the other within twelve to 18 months.

In their post-hurricane operations, all of the boat yards responding had hired more full-time employees. Each of the facilities responding was able to identify hurricane related repairs above their regular level of repair and maintenance work. For those facilities providing pre-hurricane and post-hurricane repair data, the number of repairs was up 13 percent after the hurricane. The timing of the repairs

showed that there was a dramatic increase in the month of September, however, the repairs in October and November were less than the previous year. Repairs for