

EVALUATION OF BOATER COMPLIANCE WITH SPEED REGULATIONS IN SARASOTA COUNTY, FLORIDA

Final Report

Submitted To:

**The Florida Department of Environmental Protection
Bureau of Protected Species**

The West Coast Inland Navigation District

Sarasota County Natural Resources Department

Submitted By:

**Jay F. Gorzelany, M.S.
Senior Biologist
Principal Investigator**

**Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, FL 34236**

April 11, 1996

**Suggested reference Gorzelany MS. 1996.
Evaluation of boater compliance with speed
regulations in Sarasota county, Florida. Florida
Department of Environmental Protection. West Coast
Inland Navigation District. Sarasota County Natural
Resources Department. Mote Marine Laboratory
Technical Report no 465. 106 p. and appendices
Available from: Mote Marine Laboratory Library.**

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	iii
ACKNOWLEDGEMENTS	V
INTRODUCTION	1
METHODS	2
Task 1: Evaluation of Boater Compliance in Selected Important Areas	2
Task 2: Evaluation of Boater Compliance Utilizing Manatee Aerial Surveys	7
Task 3: Determination of Boater Compliance in Speed-Restricted vs. Areas	7
Task 4: Evaluation of Boater Compliance During Non-Peak Boating Hours	14
Data Collection	14
Manatee Sightings	27
Data Analysis	27
Quality Assurance	28
RESULTS	29
Task 1	29
Task 2	79
Task 3	82
Task 4	94
Enforcement Activity	98
Manatee Sightings	98
DISCUSSION	102
LITERATURE CITED	106

EXECUTIVE SUMMARY

A one-year study was conducted in Sarasota County from January through December, 1995 in order to evaluate the level of boater compliance in conjunction with current posted speed zones. More than 1,200 hours of field data were collected from boat and land-based observations, aerial surveys, and use of a laser-targeted speed gun, resulting in 32,780 observations. From five selected important areas (New Pass, Pansy Bayou/City Island Grassflats, Skiers Island, Venice Inlet, and the Myakka River, a total of 22,324 vessels were evaluated. For all sites combined, it was determined that 62.7% of vessels observed were compliant, 20.4% were technically non-compliant, and 16.9% were blatantly non-compliant.

Among the significant findings of this study were:

While an overall level of compliance in the five selected study sites was determined to be 62.7%, a high level of variability was observed from one site to another. Differences in sites were determined to be statistically significant, as were comparisons between compliance and vessel type, size, and activity.

Areas with the lowest level of compliance and the highest level of blatant non-compliance were observed in the vicinity of Skiers Island, Roberts Bay. A high proportion of non-compliance was also observed in the Pansy Bayou/City Island Grassflats area.

While a relatively low level of compliance was observed for vessels skiing within the Water Sports Area at Skiers Island, an even lower level of compliance was observed for boats traveling through restricted speed areas to the north and south of Skiers Island.

Similarly, a lower level of compliance was observed in areas immediately adjacent to the Water Sports Area near Pansy Bayou compared with recreational activities within the Water Sports Area.

While a relatively low number of vessels were observed at Pansy Bayou and the Myakka River, these areas are of special concern with regard to vessel compliance due to the high frequency of manatee sightings.

The least amount of blatant non-compliance was observed for study sites at the tidal inlets (New Pass and Venice Inlet). Venice Inlet also had the highest level of boater compliance overall (greater than 70%). Enforcement vessels were seen most frequently in these two areas.

The vessel type with the lowest level of compliance and highest level of blatant non-compliance was Personal Watercraft. Overall levels of blatant non-compliance for these vessels was substantially higher than for any other vessel type observed.

A high level of variability in vessel compliance in other portions of Sarasota County was observed from aerial survey data. In general, these data supported the findings of land and boat-based survey data in areas such as Pansy Bayou, Skiers Island, and Venice Inlet.

No significant difference was observed in targeted boat speeds between unrestricted and 25 mph speed-restricted portions of the Intracoastal Waterway in Sarasota County. Mean vessel speeds, along with the number of vessels traveling in excess of 25 mph was actually higher in the speed-restricted areas.

A low level of compliance was observed during non-peak boating hours in New Pass (2000 hrs through 0800 hrs), however the results were inconclusive due to the relatively low level of boat traffic observed during these hours.

Boater-specific compliance was indicated based upon multiple resightings of the same vessel. In most instances, the compliance level of a given vessel was the same or similar in repeated observations.

Enforcement was shown to play an important role in the level of compliance in an area. Allocation of additional funds, personnel, and resources would likely enhance the level of compliance, which is particularly needed in ecologically sensitive areas.

This study has demonstrated that the collection of boater compliance data can provide important supplemental information to recreational management plans. With concerns over the increasing amount of additional restrictions in Florida coastal waters, boater compliance studies can be used to help “fine tune” current plans without necessarily placing additional restriction on waterways. As speed zones and management plans are modified, the repetition of a boater compliance study should be considered in order to evaluate any new modifications.

ACKNOWLEDGEMENTS

I would first like to thank the volunteers of the Mote Marine Laboratory Mammal Program for their assistance with the substantial amount of field data collected during this project. My sincere appreciation to Sarah Broecker, Kim Bassos-Hull, Petra Cunningham, Angela Dukeman, Elisha Freifeld, and Jessica Koelsch for their excellent work in the coordination and implementation of various portions of this study. Many thanks to all state and local law enforcement agencies for their input and assistance, with special thanks to the Sarasota County Sheriff's Department and Officer Ken Tuttle for their indispensable help. Special thanks to the Fulford Family for their cooperation in providing access to their property at the Myakka River Site. Data input and/or final report preparation was accomplished with tremendous assistance from Donna Jayroe, Elisha Freifeld, Sarah Broecker, Jenny Litz, Amy Hawkins, Lou Pugliani, Jay Sprinkel. Finally, I would like to acknowledge the support of the Florida Department of Environmental Protection Bureau of Protected Species, The West Coast Inland Navigation District, and Sarasota County for their help during this project, and for their ongoing endeavors to make Florida coastal waters a resource that we can responsibly manage and appreciate.

INTRODUCTION

The cumulative effect from both natural and human-related mortalities, combined with habitat loss and low reproductive capacity, continue to jeopardize the long-term existence of the Florida manatee population. The adverse impact of watercraft on manatees is well-documented. It has been demonstrated that the vast majority of adult manatees in Florida bear wounds that are representative of either single or repeated collisions with watercraft (Reynolds and Gluckman, 1988), and a positive correlation between the number of registered vessels in Florida and the number of watercraft-related manatee mortalities has been shown to be statistically significant (Ackerman et al., 1995). While additional research on manatees is vital to the overall protection of the species, the evaluation of current management strategies, including the establishment of speed-restricted zones and manatee sanctuary areas, is also necessary in order to provide for effective future recreational management plans.

Prior to 1980, limited information was available on manatee abundance and distribution in the Sarasota Bay area. As a result of low-level aerial surveys conducted between 1985 and 1990 (Nabor and Patton, 1988; Kadel and Patton, 1991), Sarasota County was recognized as an important manatee area and subsequently added to the list of key counties in the State of Florida requiring the development of a comprehensive manatee protection plan. In 1991, new boat speed zones were established in Sarasota County, and sign placement was completed in 1993.

Growth and development along the west central and south central Florida coast is occurring at an alarming rate, with a projected population increase in Sarasota County by as much as 25 percent within the next ten years (Sarasota Bay NEP, 1992). Increased use of Sarasota Bay has resulted not only in environmental conflicts, but also in conflicts between various recreational user groups (anglers vs. skiers, boaters vs. swimmers, etc.). The recent implementation of boat speed regulations in Sarasota County represents the most comprehensive attempt at boating management in this area. As a result, a study designed to test the effectiveness of the current posted speed zones and placement of signage will provide valuable information necessary in the future management of the coastal waters in Sarasota County. In addition, the obtained results may be broadly applicable to other areas of Florida. With this in mind, Mote Marine Laboratory implemented a comprehensive 12-month study in order to evaluate boater compliance in Sarasota County.

METHODS

A twelve-month study was developed in order to determine the level of compliance with boat speed restrictions in Sarasota County. The study was divided into four specific tasks, listed below:

Task 1: Evaluation of Boater Compliance in Selected Important Areas.

Task 2: Evaluation of Boater Compliance Utilizing Manatee Aerial Surveys.

Task 3: Determination of Boater Compliance in Speed-Restricted vs. Non-Restricted Areas.

Task 4: Determination of Boater Compliance During Non-Peak Boating Hours.

Methodologies for each task are outlined below:

Task 1: Evaluation of Boater Compliance in Selected Important Areas

Current speed restrictions in Sarasota County are provided in Appendix A, and the five study sites selected for Task 1 are provided in Figures 1-3. These sites are currently designated with varying levels of boat speed restriction in Sarasota County, and are described below

Study Site 1: New Pass Inlet

Current Designation: Idle Speed Zone

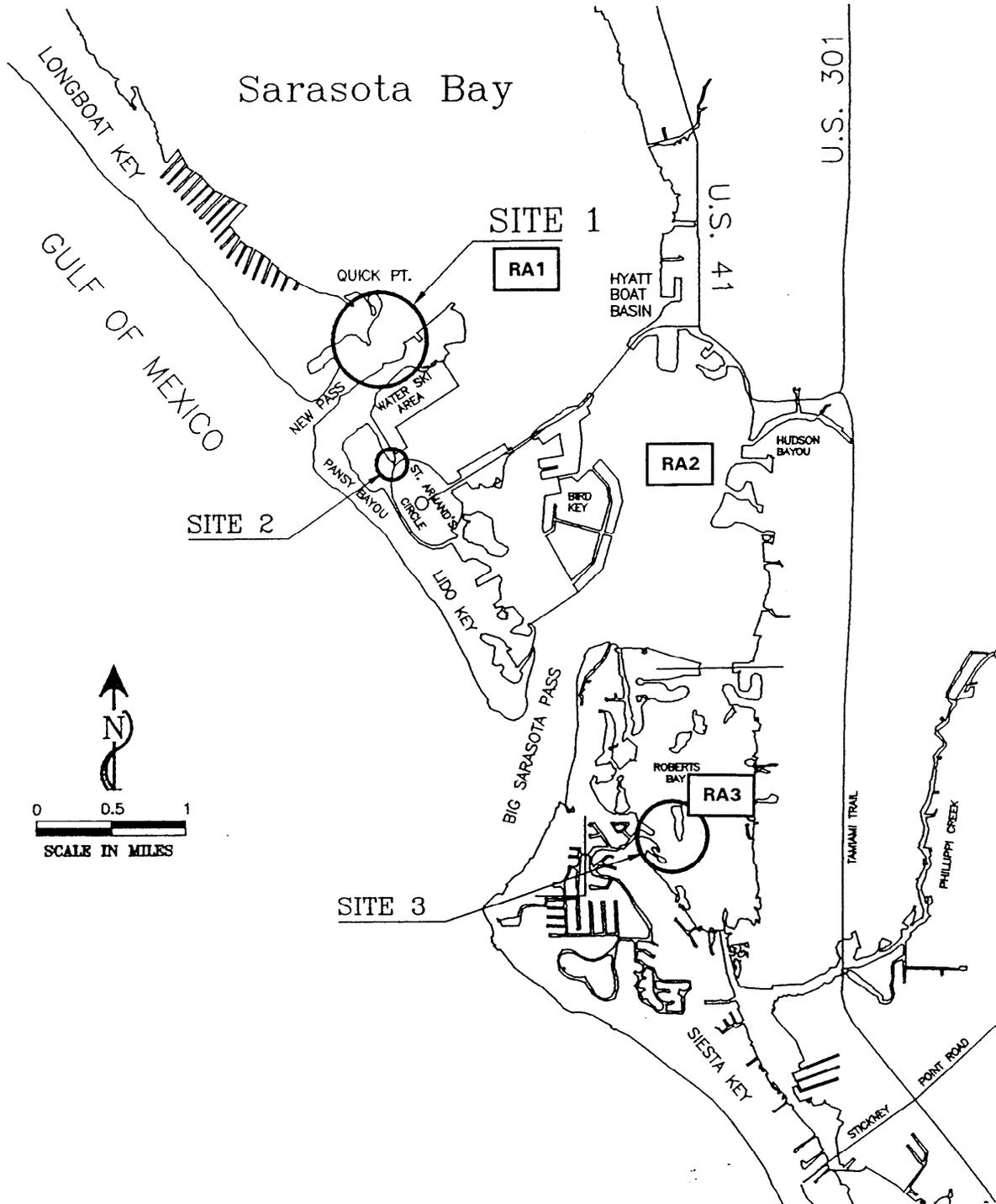
New Pass is a federally-maintained narrow inlet in northern Sarasota Bay. The Pass is subject to frequent shoaling, and is periodically dredged every three to seven years (Roat and Alderson, 1990). Manatee sightings in and around the New Pass area compiled from MML aerial survey data and citizen reports, indicate that New Pass is likely used as a travel corridor to and from Sarasota Bay and the Gulf of Mexico. This inlet is fairly constrictive in certain areas, and is occasionally subjected to a relatively high volume of boat traffic. This site was examined in order to assess boater compliance with the current idle speed restriction in effect for a portion of the inlet.

Study Site 2: City Island Grassflats / Pansy Bayou

Current Designation: Water Sports Area / Slow Speed Zone / No Entry Zone

This study area, particularly Pansy Bayou, is one of the most important manatee habitats in the Sarasota area (Kadel and Patton, 1991). A portion of the City Island Grassflats is currently exempt from boat speed restriction, and is posted as a 35 mph Water Sports Area. The Water Sports Area extends southward to the entrance of Pansy Bayou. Monitoring of this study site assessed the level of compliance by boats entering and departing from the Water Sports Area in the vicinity of this important manatee habitat.

Figure 1. Location of Study Sites 1,2 and 3 (Task 1) and RA1, RA2, RA3, and RA4 (Task 3).

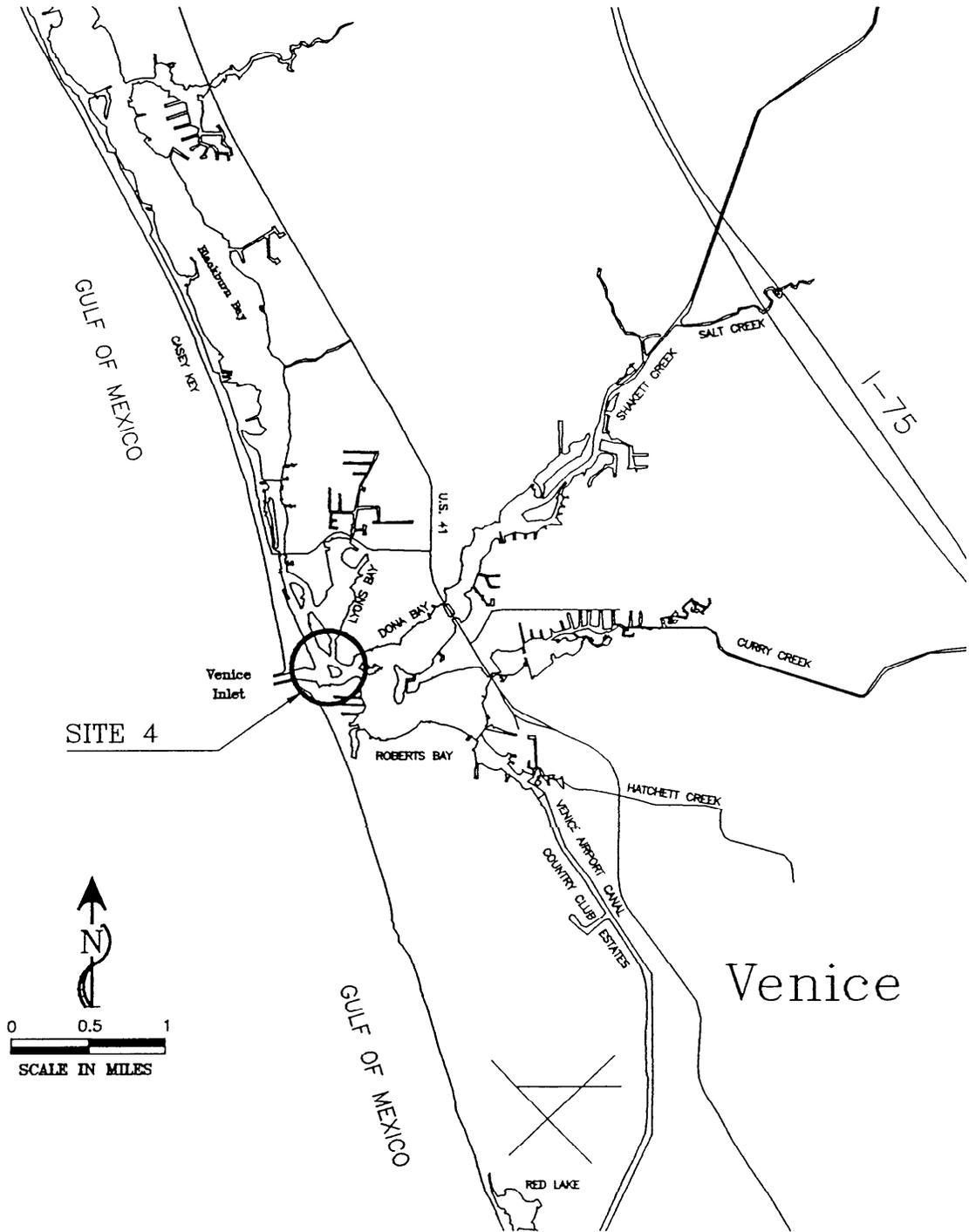


SITE MAP 1

RA4

AIRP1.DWG

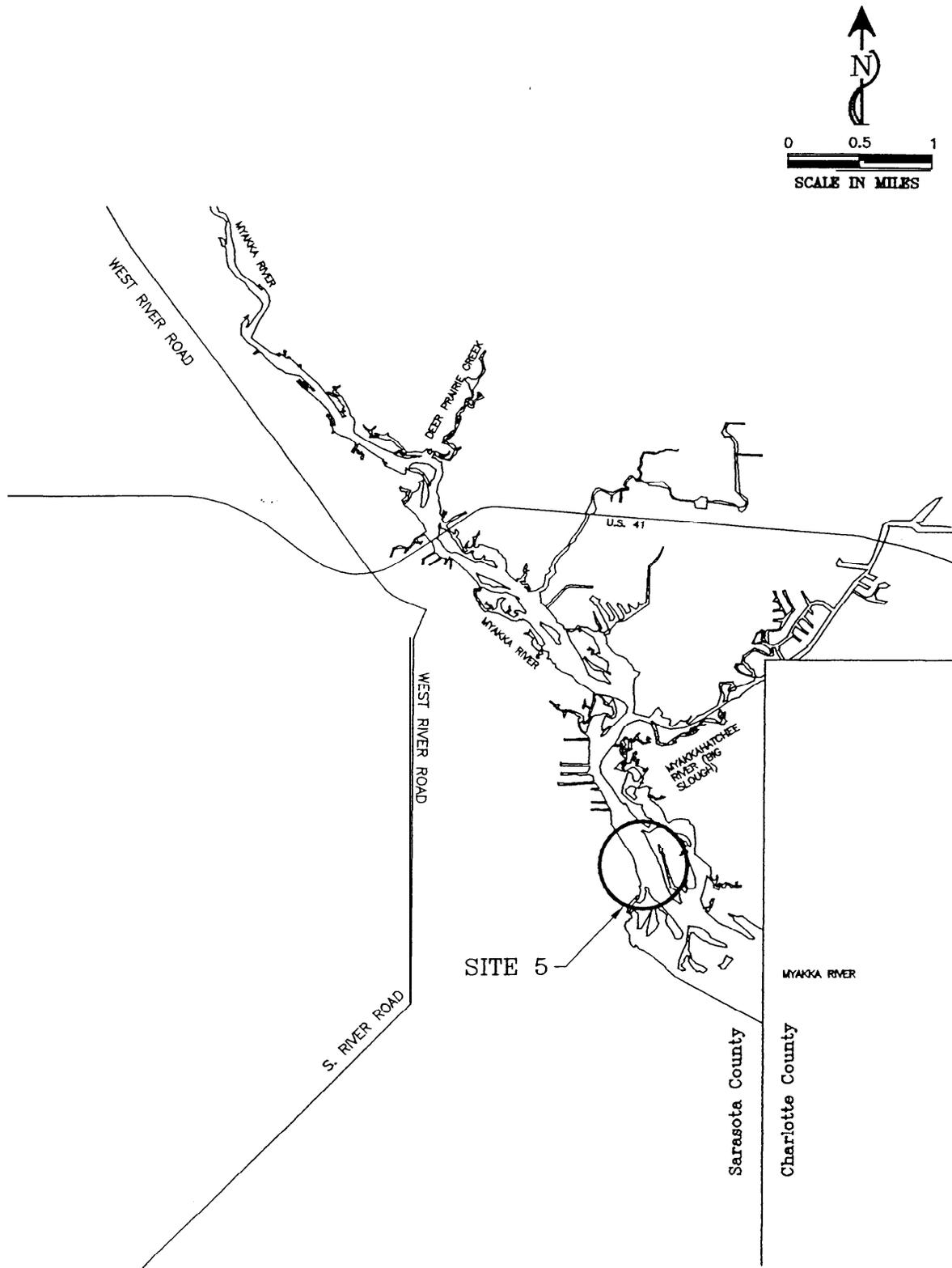
Figure 2. Location of Study Site 4 (Task 1).



SITE MAP 2

SITEMAP.DWG

Figure 3. Location of Study Site 5 (Task 1).



SITEMAP3.DWG

SITE MAP 3

Study Site 3: Skiers Island / Roberts Bay

Current Restriction: Water Sports Area / Slow Speed Zone

Roberts Bay, east of northern Siesta Key, is a marked Channel Exempt Slow Speed Zone with a 35 mph Water Sports Area around a spoil island known locally as Skiers Island. The study area includes both the Water Sports Area and the slow speed zones adjacent to it. This site was monitored in order to determine if boats are complying with the slow speed regulations in and around the Water Sports Area.

Study Site 4: Venice Inlet

Current Restriction: Slow Speed Zone

Venice Inlet is a narrow inlet separating Casey Key from the Venice headland. It serves as entry point into the Intracoastal Waterway (Lyons Bay, Dona Bay, and Roberts Bay) from the Gulf of Mexico, and typically experiences moderate to heavy boat traffic. Boaters transitioning to and from the unrestricted Gulf of Mexico and the Slow Speed Minimum Wake designation inside the inlet were evaluated at this location.

Study Site 5: Myakka River

Current Restriction: Slow Speed Zone

The Myakka River is a relatively long, meandering tidal river located in southern Sarasota County. Based upon recent aerial survey data, the Myakka River has recently been recognized as an important manatee area, and supports a year-round population of animals. An observation site located downstream of the US 41 bridge evaluated the compliance of boaters transitioning along a Slow Speed restricted portion of the river.

Four of the five observation sites were land-based, while observations at the Skiers Island Site were made from a boat. Sampling was conducted discreetly from each observation site so as not to influence the speed or behavior of boaters in the study area. Three 4-hour observation periods were conducted per month at each site, including two weekend days (Saturday-Sunday) and one weekday (Monday-Friday) for twelve consecutive months. Each of the five sites was sampled similarly, with an identical number of sampling days on weekends and weekdays. Each site was also sampled equally among three different four-hour time windows (0900-1300 hrs, 1100-1500 hrs, and 1300-1700 hrs). A total of 144 field sampling hours were conducted per site during this task.

Task 2: Determination of Boater Compliance Utilizing Aerial Surveys

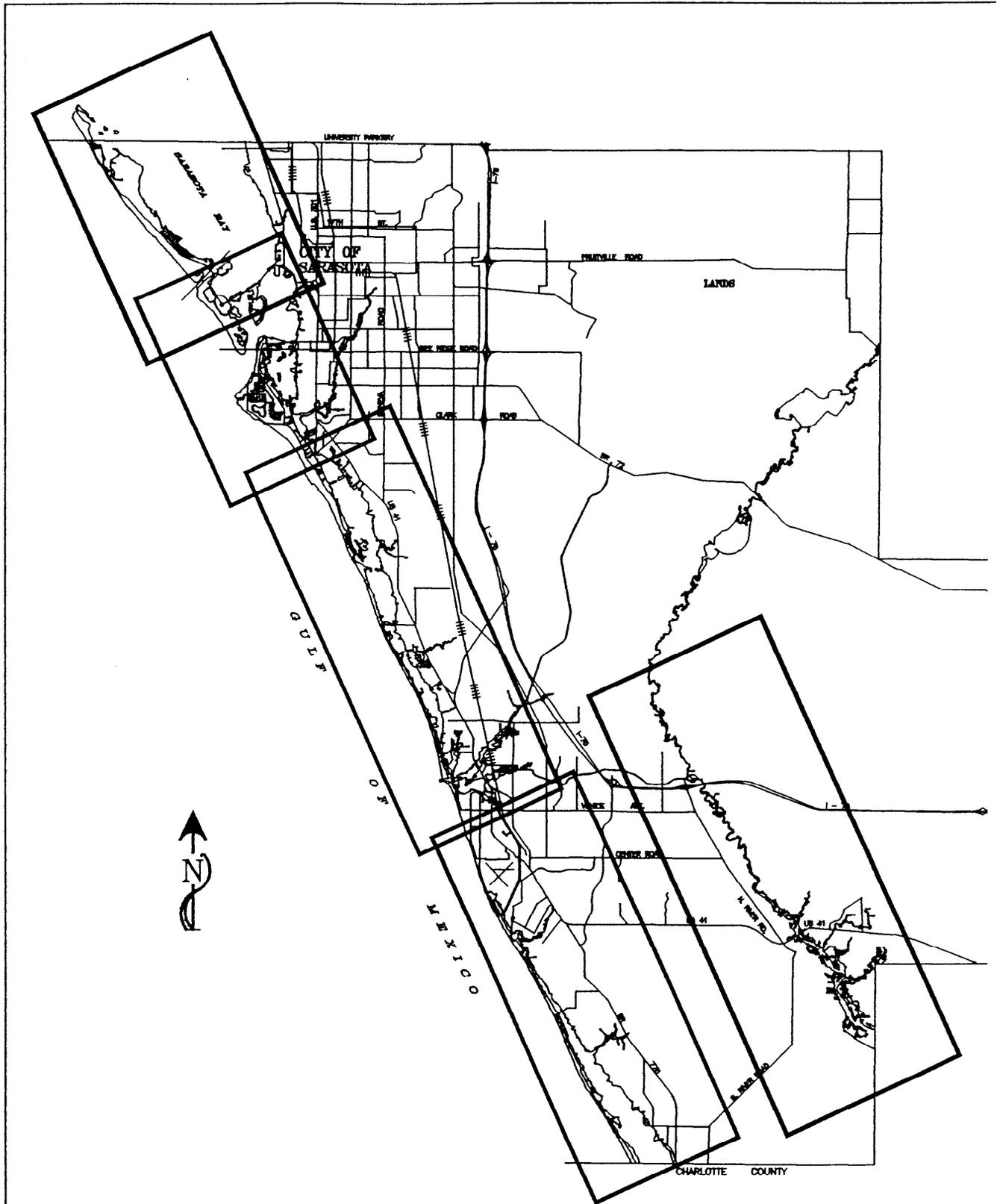
Low-level manatee aerial surveys of Sarasota County coastal waters have been regularly performed by Mote Marine Laboratory since 1985. These surveys continued through 1995, utilizing a Cessna 172 fixed wing aircraft at an altitude of 152 meters and a speed of 145-167 kilometers/hr. While a primary observer in the right front seat collected data on manatees, a second observer located in the right rear seat collected data on vessels in-use in speed restricted portions of Sarasota County. Surveys were conducted on both weekends and weekdays, with at least one flight performed during each day of the week and weekend. Approximately 50 survey hours were performed during this task. Locations of study zones for Task 2 is provided in Figures 4-9.

Task 3: Comparison of Boater Compliance in Restricted vs. Unrestricted Speed Areas

This task, referred to as the Radar Task, determined the speed of vessels traveling along portions of the Intracoastal Waterway (ICW) in Sarasota County. For comparative purposes, boat speeds were recorded in both restricted and unrestricted areas of the ICW. Speeds were measured using an infrared Prolaser lidar speed gun typically used for law enforcement (courtesy of the Florida DEP Bureau of Protected Species). During September, October, and November, a Marine Falcon radar gun (courtesy of the Sarasota County Sheriff's Department) was used while the Prolaser gun was being serviced. All study sites under Task 3 were sampled equally with both speed guns. With assistance from the Sarasota County Sheriff's Department, a field comparison of the two devices revealed that speed values were essentially the same for both guns, although the target range was greater for the Marine Falcon, and the ability to distinguish between multiple targets was superior for the Prolaser.

Four sampling sites were selected for the Radar Task (Figure 1). Criteria for selection was based upon: 1) volume of boat traffic; 2) close proximity to approaching boat traffic; and 3) similarity of sites between unrestricted and restricted speed areas. Two unrestricted speed sites (RA1 and RA2) were chosen in northern Sarasota County. Site RA1 was located along the intersection of the New Pass access channel and the Intracoastal Waterway in Sarasota Bay. Site RA2 was located along the Intracoastal Waterway south of the Ringling Causeway, adjacent to Big Sarasota Pass. To the south, two sites within the 25 mph speed-restricted portions of the ICW in Roberts Bay (RA3) and Little Sarasota Bay (RA4) were also selected. Each of the four radar locations was sampled monthly during alternating morning (0900-1200 hrs) and afternoon (1300-1600 hrs) 3-hour time windows. While sampling was conducted in the same general area at each site, the precise sampling locations were slightly modified on occasion in order to provide better opportunities for targeting oncoming boat traffic.

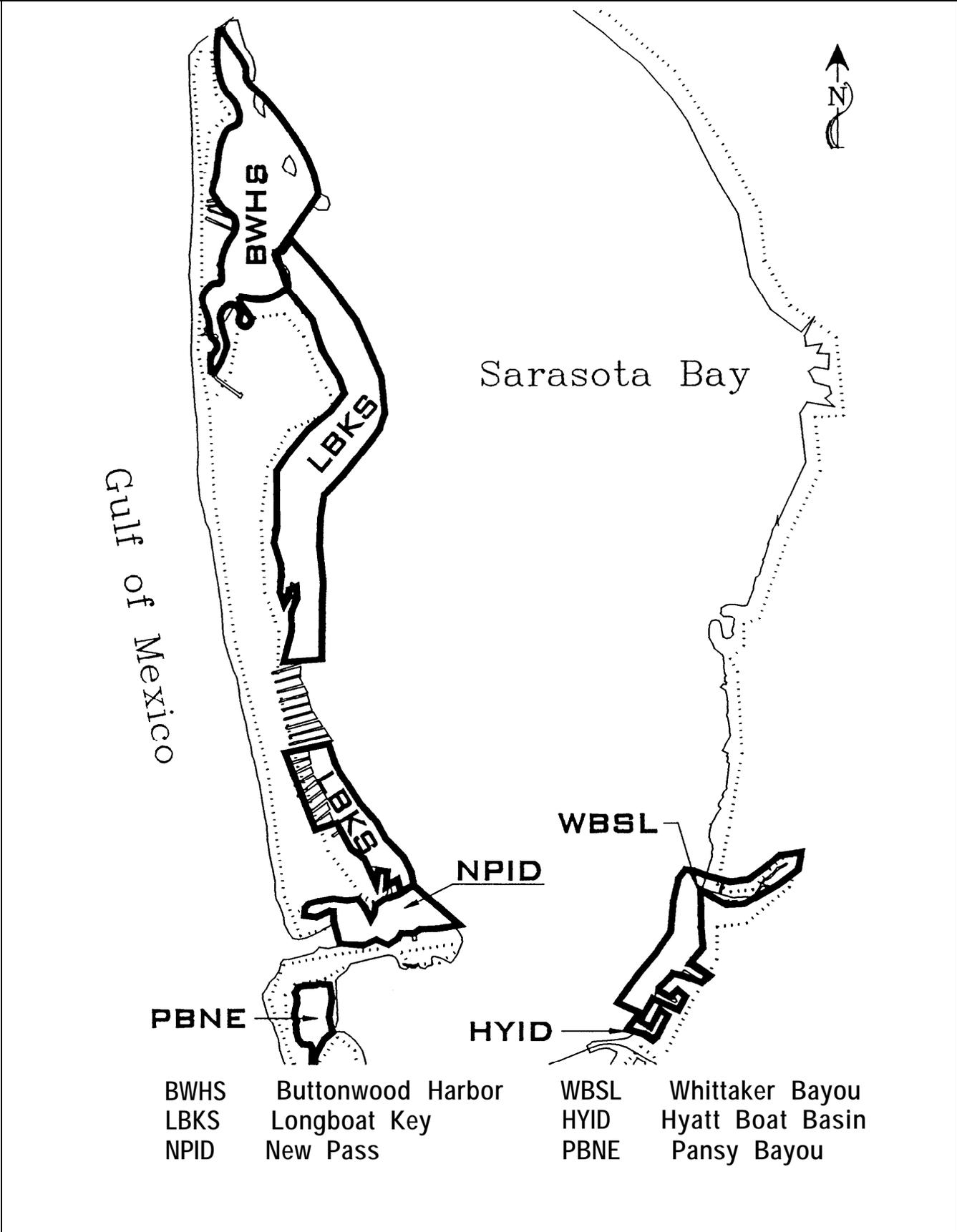
Figure 4. Key map to aerial survey study zones (Task 2).



SPEEDKE.DWG

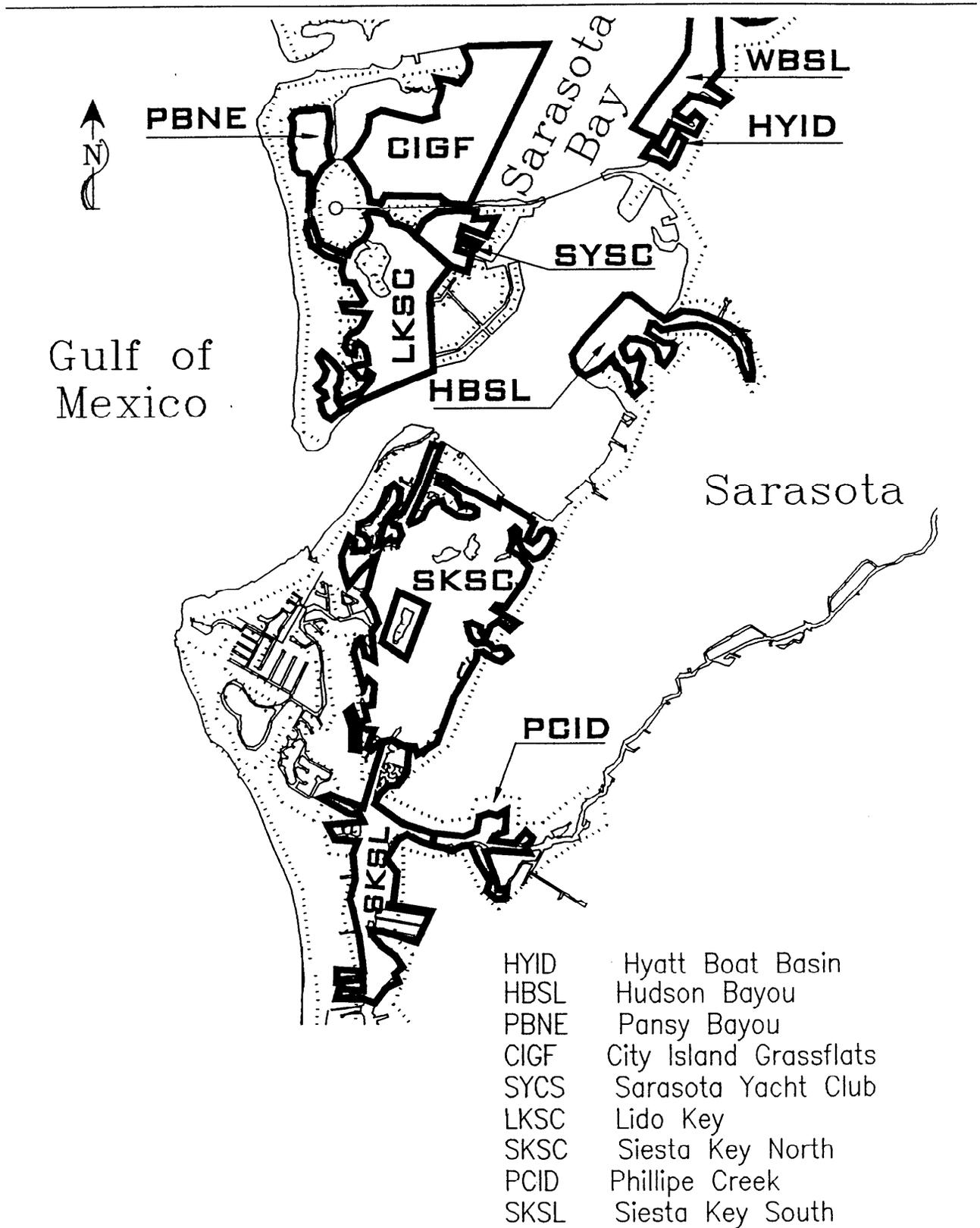
KEY MAP

Figure 5. Aerial survey study zones (Task 2).



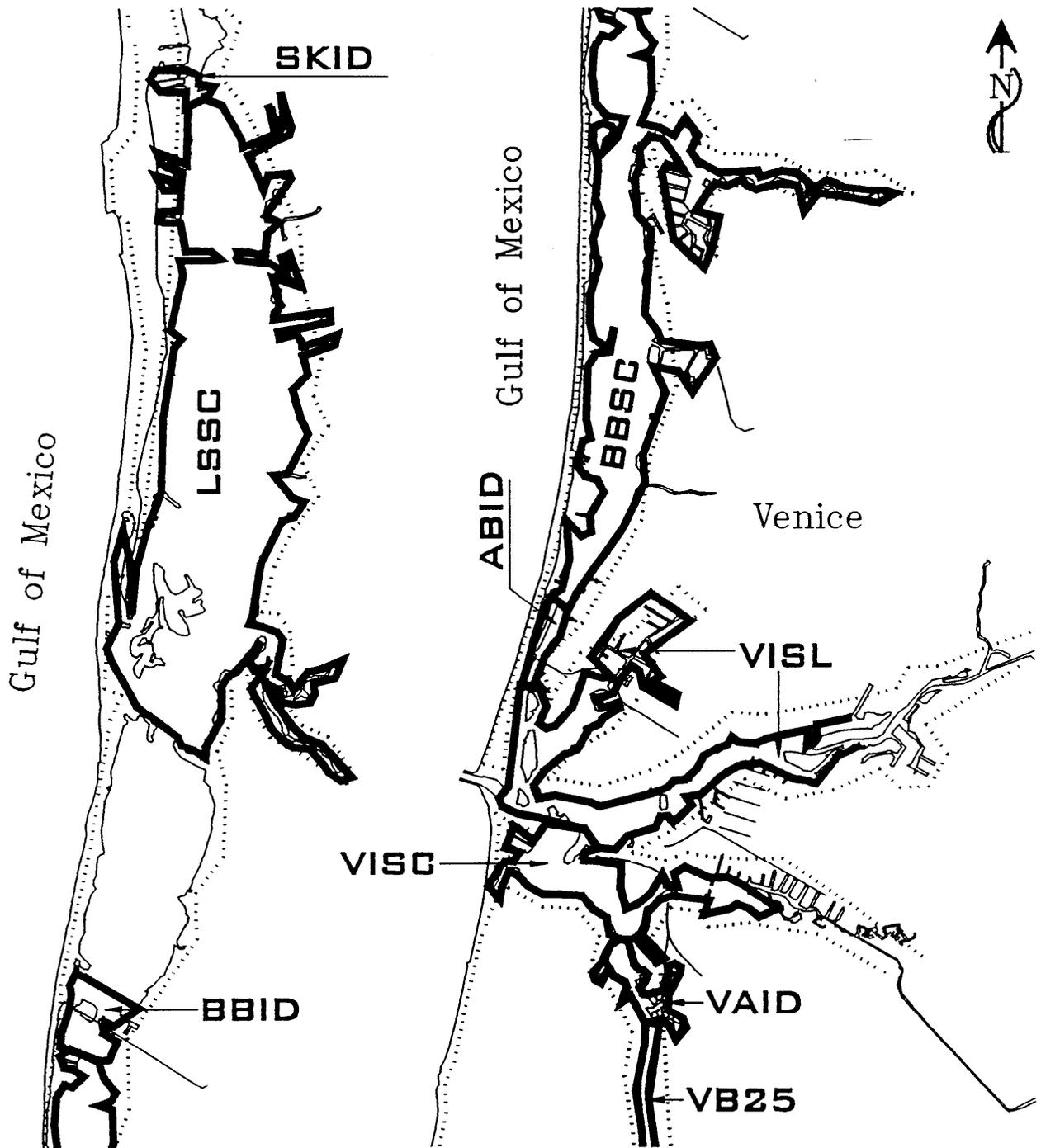
SPEED1.DWG

Figure 6. Aerial survey study zones (Task 2), continued.



SPFFD2.DWG

Figure 7. Aerial survey study zones (Task 2), continued.



- | | | | |
|------|-----------------------|------|-------------------|
| SKID | Stickney Point Bridge | BBSC | Blackburn Bay |
| LSSC | Little Sarasota Bay | ABID | Albee Road Bridge |
| BBID | Blackburn Bridge | VISL | Venice Inlet |
| | | VISC | Venice Inlet |
| | | VAID | Venice Avenue |
| | | VB25 | Venice By-Pass |

SPEED3.DWG

Figure 8. Aerial survey study zones (Task 2), continued.

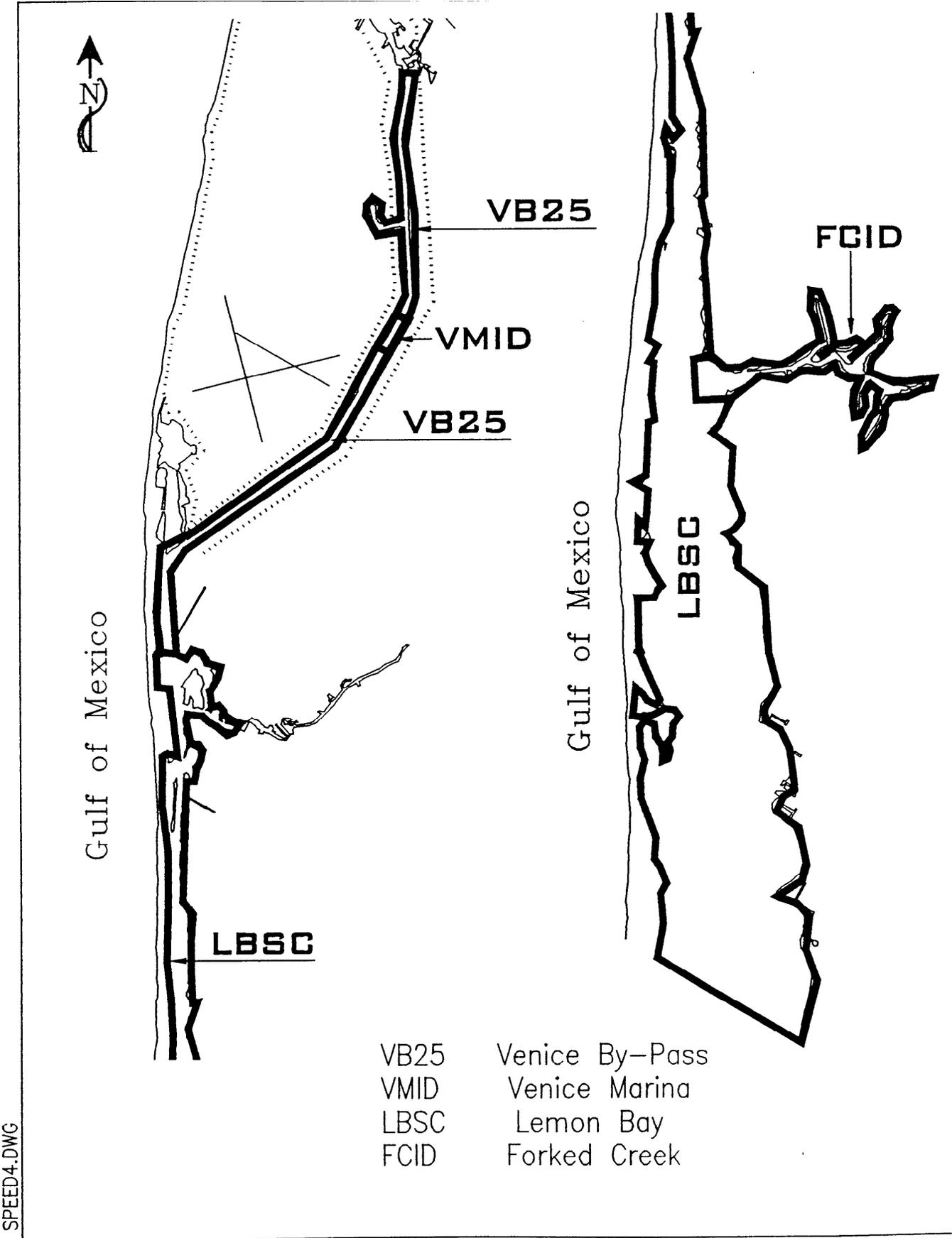
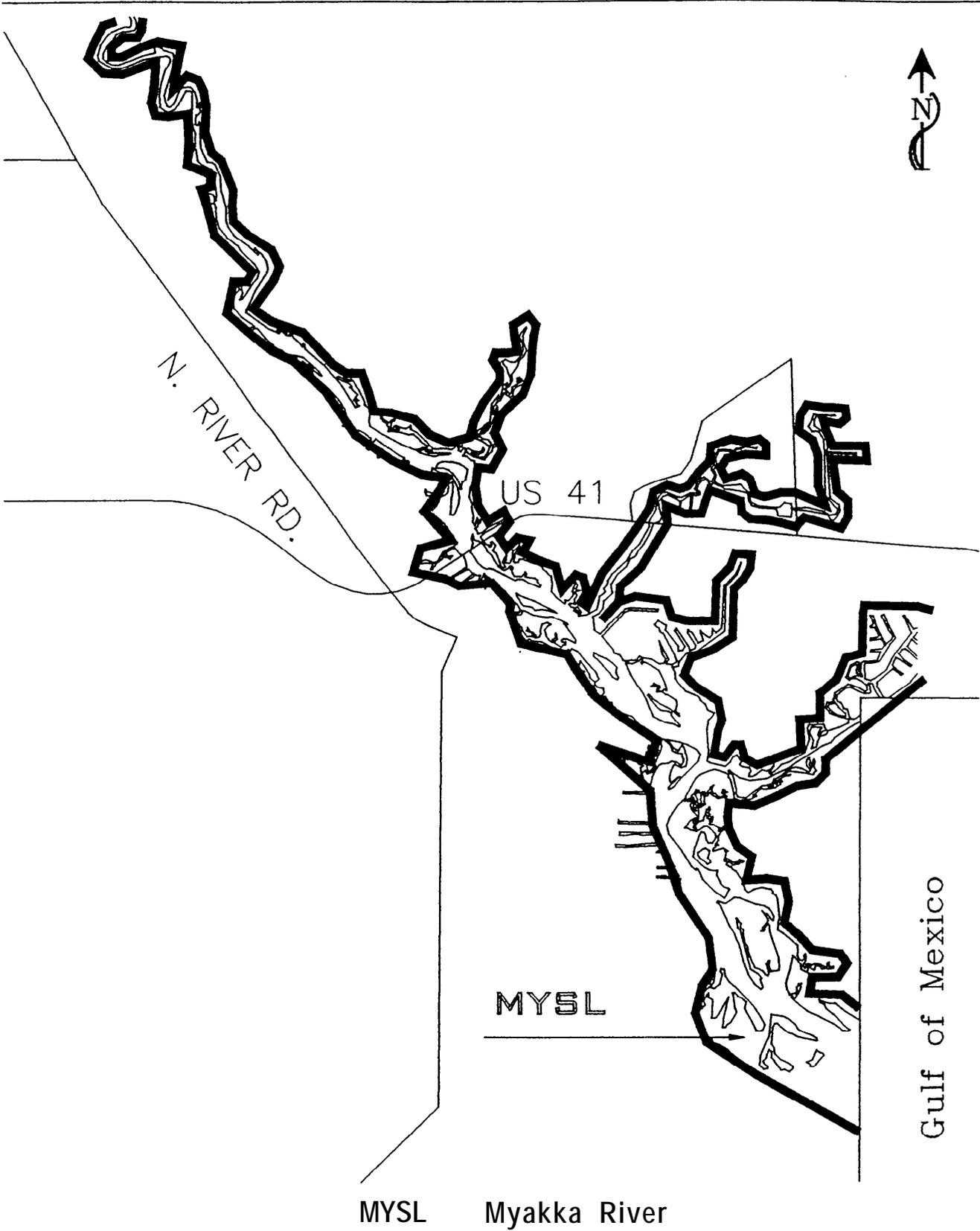


Figure 9. Aerial survey study zones (Task 2), continued.



SPEED5.DWG

Although observers were anchored in close proximity to the Intracoastal Waterway, sampling was conducted as discreetly as possible so as not to influence the speed of approaching vessels. When possible, boats were targeted both during their approach and retreat, with the higher of the two readings selected. In most cases, identical or nearly identical readings were obtained in both directions. Each of the four radar sites was sampled monthly from January through December, 1995. An equal number of weekdays and weekend days were performed at each of the four sampling sites. Similarly, an equal number of morning and afternoon sampling periods were conducted at each site. A total of 36 field sampling hours per site were completed during this task.

Task 4: Determination of Boater Compliance During Non-Peak Hours

An additional consideration in the evaluation in boater compliance is that there may be an inherent bias in focusing sampling activity during peak boating hours. A possibility exists that the level of compliance may be different during non-peak hours, as boaters may assume that there is a lower level of enforcement early in the morning, in the evening, or at night. In order to evaluate this, teams of observers stationed at the New Pass observation site monitored boater compliance over a 24-hour period, one day per month, from January through December, 1995. Methodologies for this task were identical to those discussed for the New Pass Site in Task 1.

Data Collection

Field data for each task were collected on standardized data sheets (Figure 10). The following is a description of field codes used during the study:

Vessel Type

Boat type, or style, was recorded for each observed vessel. Nine categories of **vessels** were established and are listed below:

<u>code</u>	<u>description</u>
JN =	Jonboat/Rowboat
OF =	Open Fisherman
SK =	Ski/Sport/Runabout
YT =	Yacht/Cruiser
PT =	Pontoon/Platform
PS =	Personal Watercraft/Jet Ski
SC =	Scarab/Cigarette
SA =	Sailboat
OT =	Other

For vessels coded as "Other", a description of the vessel was required. Vessels in this category included inflatables, barges, tugboats, trawlers, and other miscellaneous vessels that did not clearly fall into one of the designated categories.

Additional codes were added to the above vessel type codes to further describe certain vessels, as follows:

E	=	Law enforcement vessels
C	=	Commercial vessels
R	=	Rental boats

For example, an Open Fisherman-style boat which could be clearly identified as a rental boat would be coded as "OF/R".

Vessel Size

Vessel size codes were chosen to correspond with standard Florida Marine Patrol size class designations, as follows:

<u>code</u>	<u>description</u>
11 =	all vessels under 12 feet in length
12 =	all vessels from 12 feet to 15 feet in length
16 =	all vessels from 16 feet to 25 feet in length
26 =	all vessels from 26 feet to 39 feet in length
40 =	all vessels from 40 feet to 64 feet in length
65 =	all vessels from 65 feet to 109 feet in length
110 =	all vessels greater than 109 feet in length

Boat Activity

Activity was identified for each vessel, and coded as follows

<u>code</u>	<u>description</u>
T =	Travel
P =	Pleasure
S =	Skiing
F =	Fishing
C =	Commercial
O =	Other

“Travel” was defined as the principle movement of a vessel in a single direction. In contrast, “Pleasure” activity was defined as recreational, multi-directional movement, and was recorded for vessels such as personal watercraft, which may be moving in a variety of different directions without any distinct pattern of travel. “Skiing” and “Fishing” were recorded only for vessels which were actively engaged in these activities. Ski activity also included vessels which were towing kneeboards, surfboards, inner tubes, etc. “Commercial” activity was recorded primarily for vessels engaged in commercial fishing operations, but also included sightseeing and charter fishing boats, and marine towing vessels. “Other” was recorded primarily for law enforcement vessels which appeared to be in pursuit of another vessel or involved in some type of enforcement-related activity. A non-commercial vessel towing another vessel was also coded as “Other”.

Vessels engaged in “Skiing” as an activity were described in more detail, due to the possible influence of the skier being towed. A fallen or dropped skier, for instance, will likely affect the activity (and possibly the compliance) of a vessel, as it turns to recover the skier. For this reason, all vessels engaged in skiing as an activity were also noted with the information, “skier up” or “skier down”.

Origin/Destination

For Tasks 1 and 4, the origin and destination of each vessel were recorded. Origin and destination information was unique for each field site, and ranged in complexity from the Myakka River site, (which had only three possible directions of travel) to New Pass, which had seven different possible directions of travel. Field codes and descriptions for each site are as follows:

New Pass / 24 Hour New Pass

BS = Sarasota Bay/New Pass Inlet south

Boats transitioning to and from Sarasota Bay along the southern (City Island) channel in New Pass

BN = Sarasota Bay/New Pass Inlet north

Boats transitioning to and from Sarasota Bay along the northern (Longboat Key) channel in New Pass

G = Gulf of Mexico

Boats transitioning to and from the Gulf of Mexico

GW = Gulfwind Marina (portion of Gulfwind Marine)

Boats originating from, or terminating at a small marina within New Pass along the southern (City Island) shore.

SD = Salty Dog Restaurant / Gulfwind Marine fuel dock

Boats originating from or terminating at a small restaurant/fuel dock area within New Pass along the southern (City Island) shore.

BT = New Pass Bait Shop

Boats originating from or terminating at a small bait shop within New Pass at the southern end of the New Pass Bridge.

BR = New Pass Bridge

Boats originating from or terminating at the New Pass Bridge.

Pansy Bayou

PB = Pansy Bayou

Boats observed entering or departing Pansy Bayou.

WS = Water Sports Area

Boats observed transitioning to and from the southwest portion of the City Island Water Sports Area.

ST = St Armands Key

Boats observed transitioning to and from the northern St Armands Key shoreline opposite the Water Sports Area.

GF = City Island Grassflats

Boats observed transitioning over the City Island Grassflats, outside of the posted Watersports Area.

Skiers Island

GC = Grand Canal

Boats observed transitioning to and from the Siesta Key Grand Canal.

N = Skiers Island North

Boats transitioning to and from the northern portion of the study area, north of Skiers Island.

WSN = Water Sports Area North

Boats originating or terminating at the northwest portion of the Skiers Island Watersports Area.

WSS = Water Sports Area South

Boats originating or terminating at the southwest portion of the Skiers Island Watersports Area.

S = Skiers Island South

Boats transitioning to and from the southern portion of the study area, south of Skiers Island.

Venice Inlet

G = Gulf of Mexico

Boats transitioning to and from the Gulf of Mexico

LB = Lyons Bay

Boats observed transitioning to and from Lyons Bay

DB = Dona Bay

Boats observed transitioning to and from Dona Bay

M = Crows Nest Marina

Boats originating from or terminating at a small marina/dockage area within Venice Inlet along the southern shore.

Myakka River

U = Upstream

Boats observed transitioning to and from upstream of the observation area.

D = Downstream

Boats observed transitioning to and from downstream of the observation area.

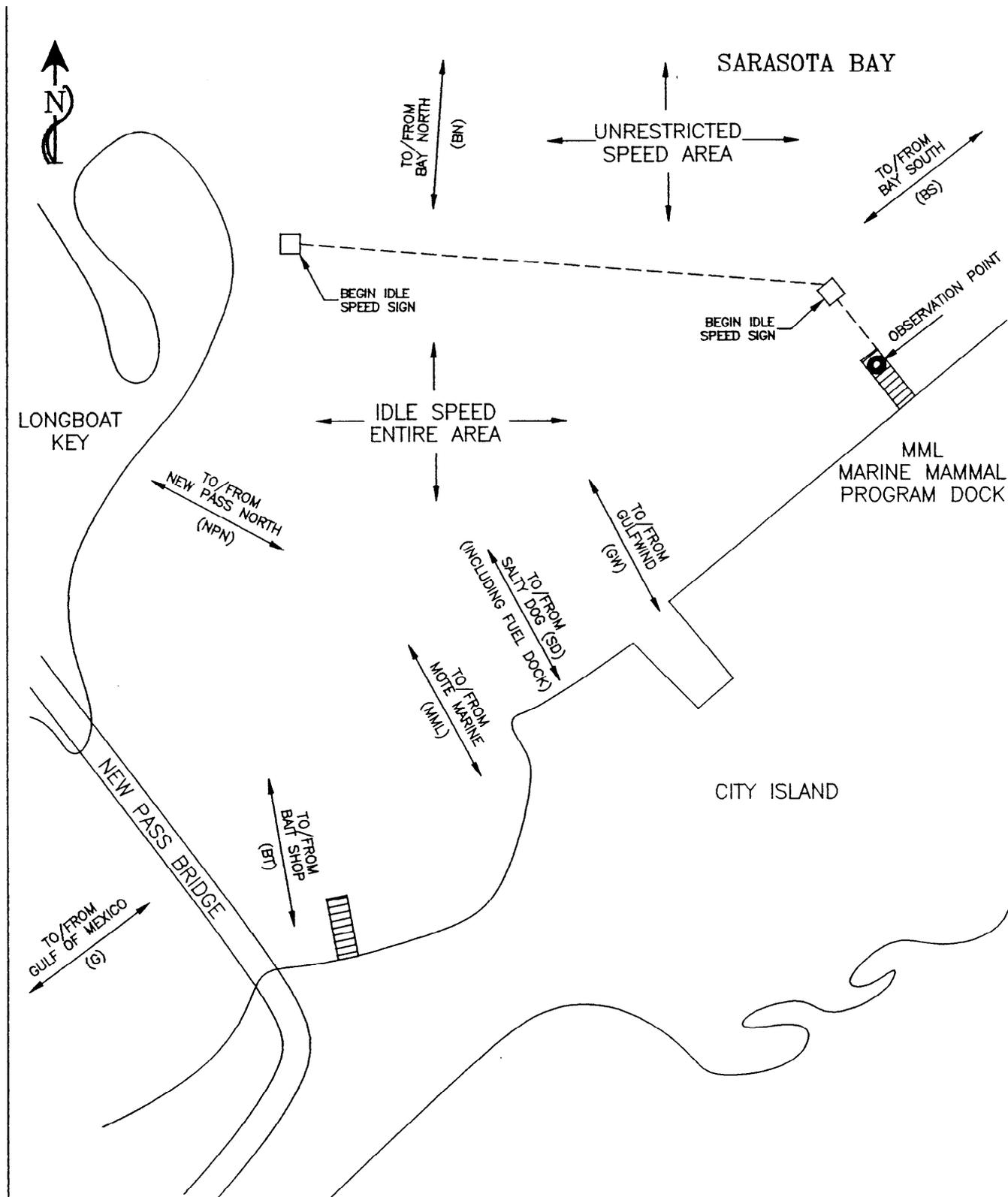
C = Tidal Cut

Boats observed transitioning to and from a small tidal cut located across from the observation site.

A diagram of each data collection site, with origin/destination locations, is provided in Figures 11-15.

Origin/destination codes for Task 2 (Aerial Task) and Task 3 (Radar Task) were recorded as compass headings (N,S,E,W, etc.)

Figure 11. Task 1; Diagram of New Pass Study Site.



SITE1.DWG

SITE 1: NEW PASS

Figure 12. Task 1; Diagram of Pansy Bayou Study Site.

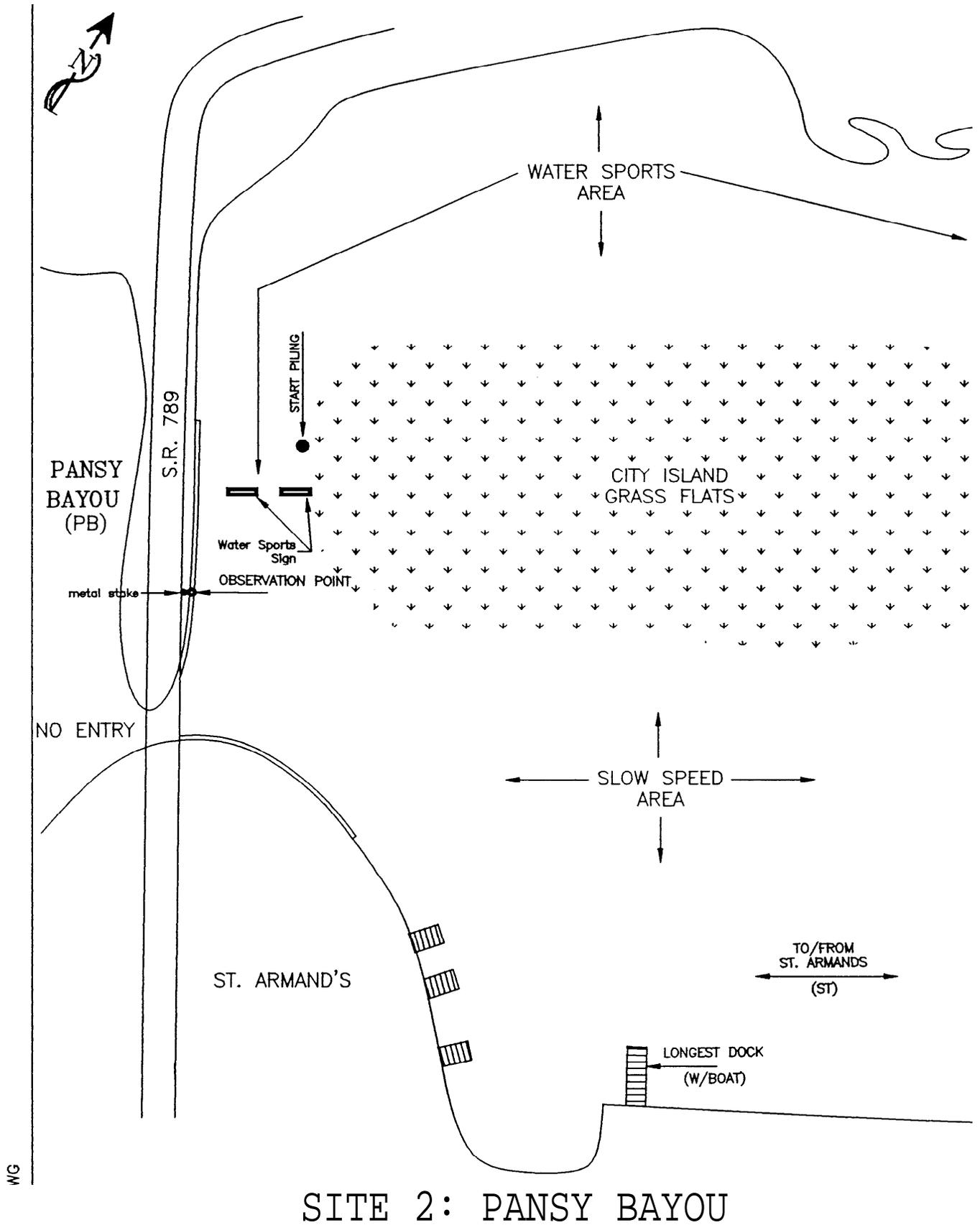


Figure 13. Task 1; Diagram of Skiers Island Study Site.

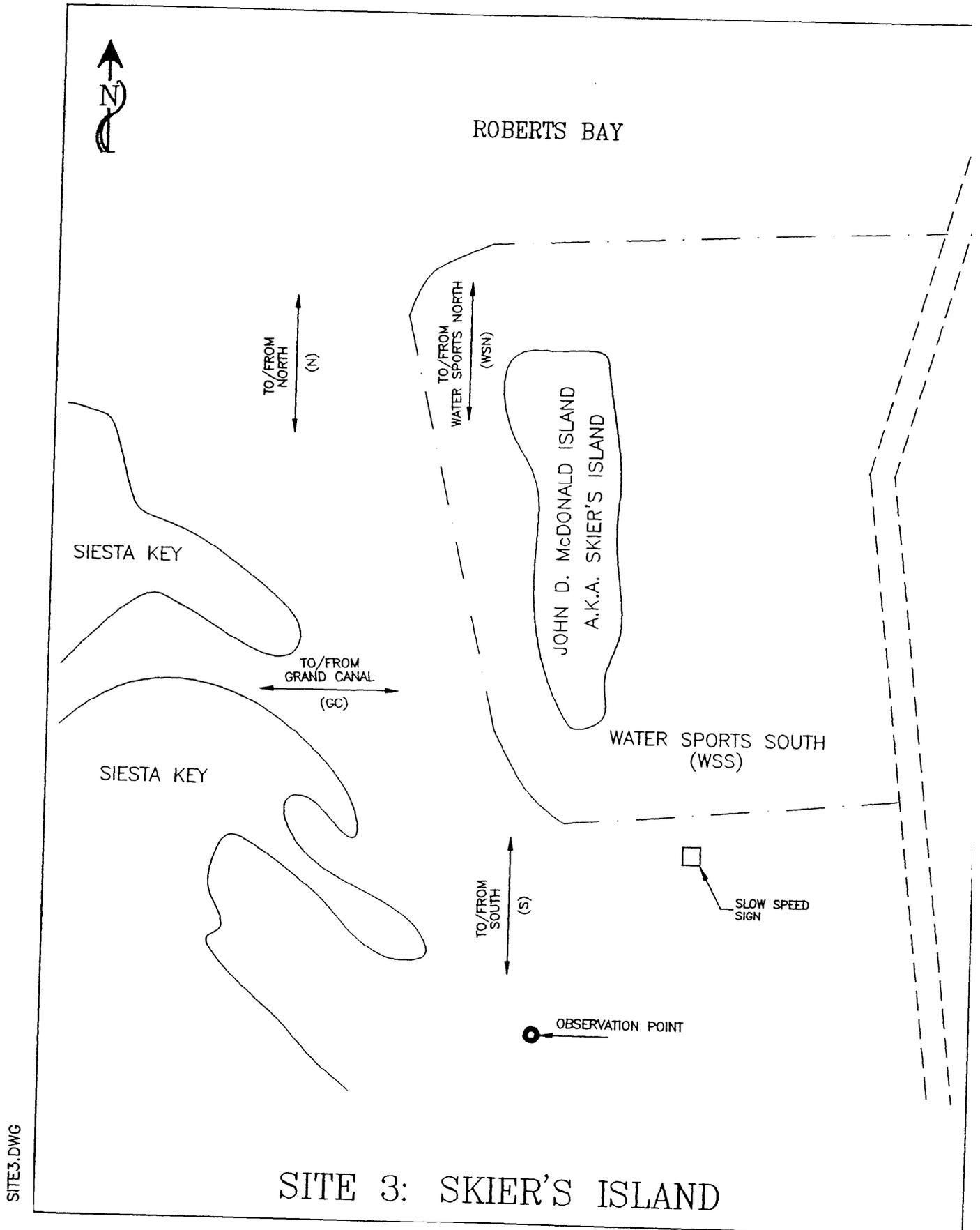
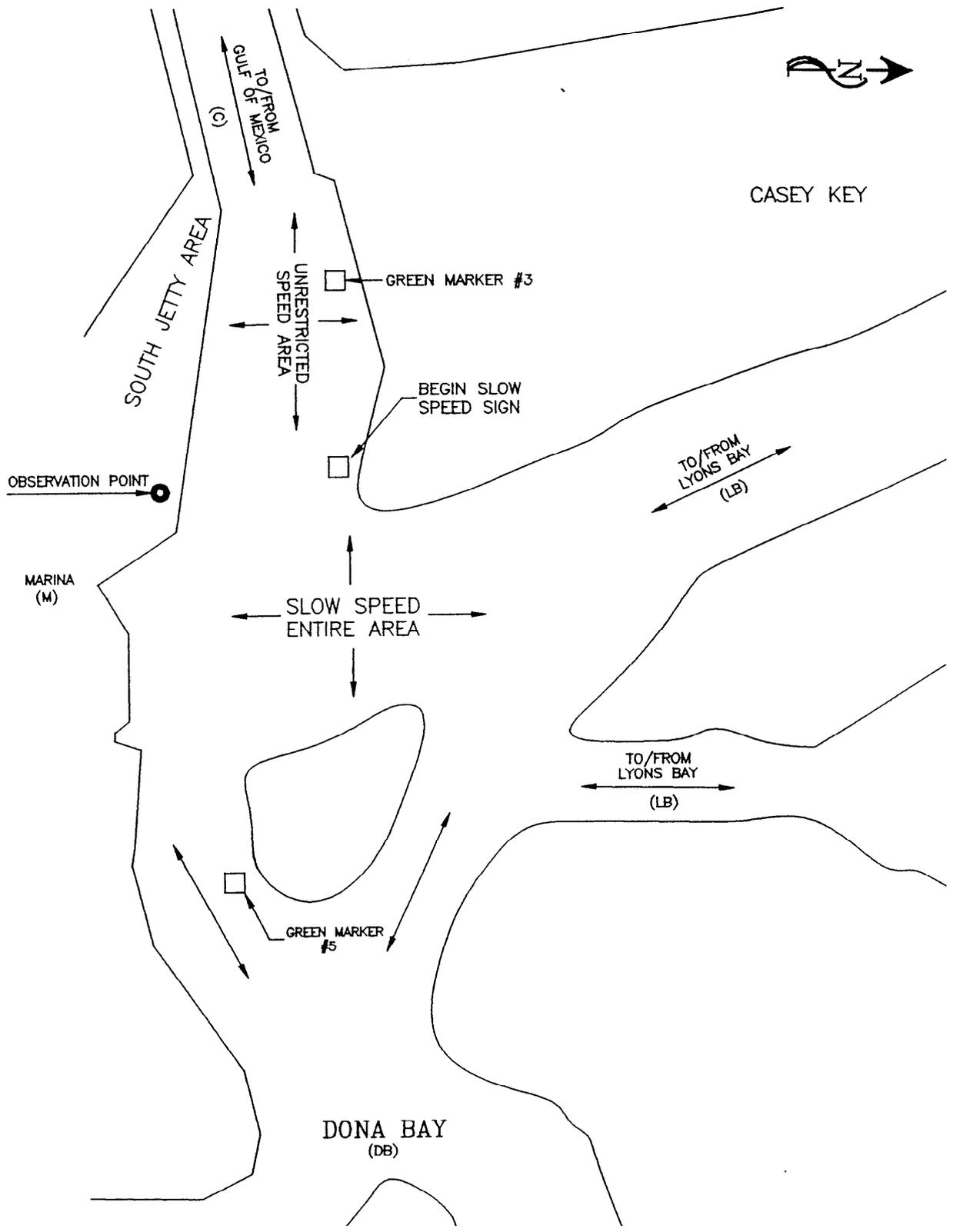


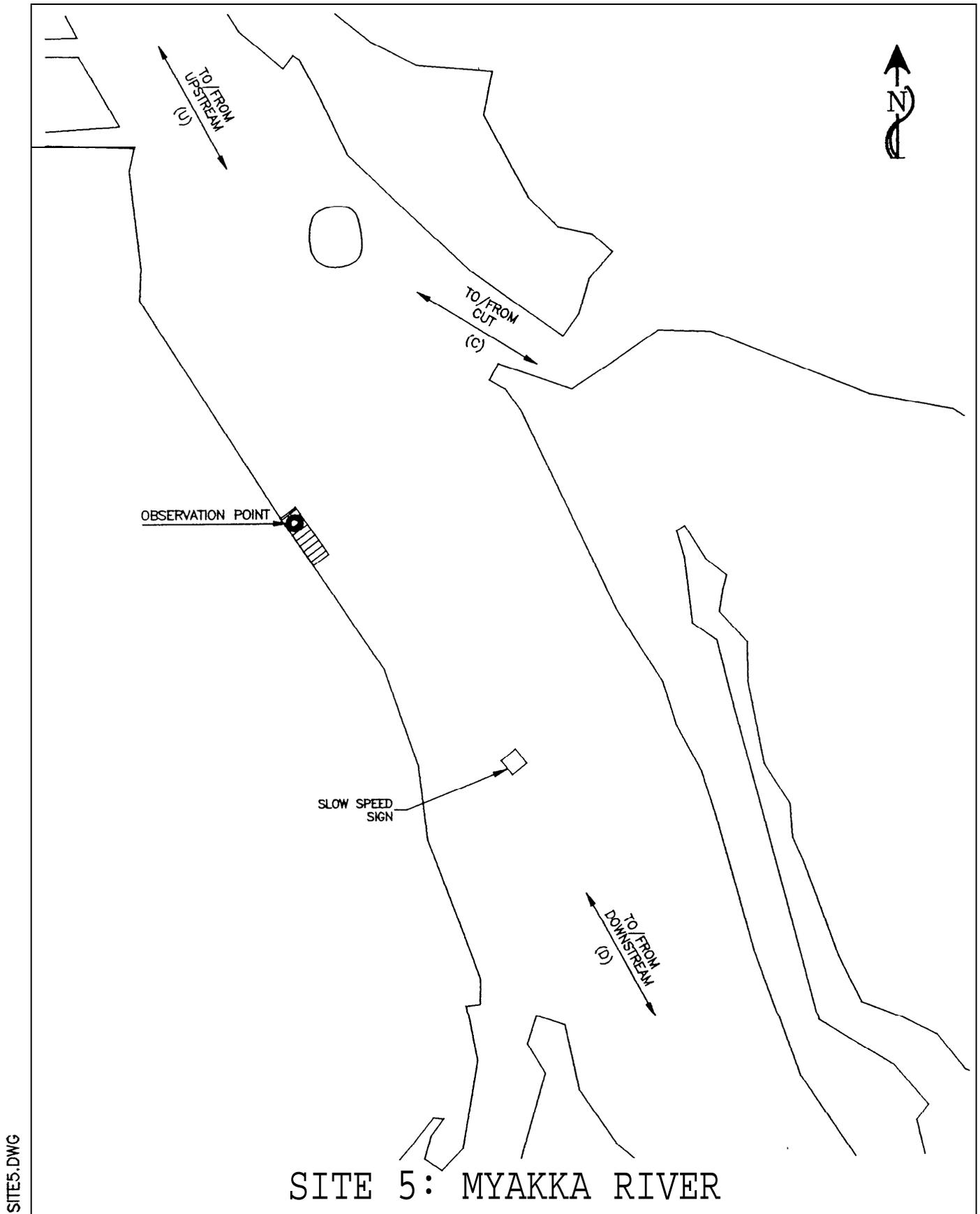
Figure14. Task 1; Diagram of the Venice Inlet Study Site.



SITE4.DWG

SITE 4: VENICE INLET

Figure 15. Task 1; Diagram of the Myakka River Study Site.



Vessel Speed

Boat speed was evaluated qualitatively for Tasks 1,2, and 4 for each vessel observed. Field codes for speed categories are defined as follows:

ID = Idle Speed

Idle Speed was defined as “the minimum speed that will maintain the steerageway of a motor boat (62N-22 Florida Administrative Code), or as “speed at which you normally dock your vessel”. Typically, very little or no water displacement at either the bow or the stern is observed, and the boat is level in the water at all times. This speed has also been defined as approximately 1-3 miles per hour (Sarasota County, 1994).

SL = Slow Speed

Slightly faster than Idle Speed, Slow Speed was defined as the speed at which all vessels are completely off plane and fully settled in the water (62N-22 Florida Administrative Code). Some water displacement may be observed at either the bow or the stern, or both. This speed has also been defined as approximately 5-7 miles per hour (Sarasota County, 1994).

PW = Plowing Speed

Boats evaluated as plowing were traveling at an intermediate speed between slow speed and planing speed. The bow of the vessel is typically riding higher than the stern, and a substantial amount of water displacement can be seen as the boat plows through the water. Depending on the size and type of vessel, plowing may occur at a variety of speeds but was observed most typically between 10-20 mph.

PL = Planing Speed

In contrast to plowing through the water, boats that were at planing speed maintained sufficient velocity to raise up out of the water during travel. The speed of boats on plane will vary widely, but would most typically occur at speeds greater than 20 mph.

HS = High Speed Planing

This category was limited to boats on a plane which were traveling at extreme speeds (greater than approximately 35 miles per hour). This was seen in Scarab/Cigarette-style boats, and enforcement boats in pursuit. Some personal watercraft, ski boats and open fisherman-type boats were observed traveling at high speeds as well.

Because the determination of boat speeds for Tasks 1,2 and 4 was subjective, a clear distinction between boat speeds was difficult in certain instances. On occasions when observers were undecided between two speed categories, they were instructed to select the more conservative, or slower speed. This provided a potential underestimate rather than an overestimate of non-compliance during this study.

Evaluation Of Compliance

Level of compliance was determined based upon a comparison of observed speed within the study area and the posted speed limit in that area. Field codes for the three compliance designations are defined **as** follows:

C = Compliance

Any vessel in-use which was determined to maintain a speed that was consistent with the posted speed at a study site.

T = Technical Non-Compliance

A vessel which was considered to be in technical violation of the posted speed at a study site, as defined by:

- 1) A vessel in-use transitioning at a speed which was determined to be one (1) speed category faster than the posted speed limit (Example: a vessel traveling at Slow Speed in an Idle Speed Zone, or a vessel traveling at Plowing Speed in a Slow Speed Zone).
- 2) A vessel in-use at any excessive speed, but for only a relatively small distance within the posted area (Example: a speeding vessel extending a short distance into a posted Slow or Idle Speed Zone before slowing to the posted speed, or a vessel which accelerates out of a Slow or Idle Speed Zone before technically leaving the posted area).

B = Blatant Non-Compliance

Blatant non-compliance was defined as a vessel in-use at a speed greater than one (1) speed category faster than the posted limit for a significant portion of the posted area. (Example: a vessel traveling at Planing Speed in a Slow Speed Zone or a vessel traveling at either Plowing or Planing Speed through an Idle Speed Zone).

Comments

The Comments section of the field data sheet was included primarily for any additional information related to the identification of individual boats. In many cases, the name of the vessel was recorded (if a name was visible), in order to compare the activity of the same vessel during subsequent sightings at other times or locations. For multiple verified sightings of an unnamed vessel, a unique alphanumeric code name was given to that vessel, comprised of the station location, date, and time of initial observation. For example, a boat coded as "VI10070900" was observed at Venice Inlet on October 7 at 0900 hours. Only vessels observed and recorded more than once received this alphanumeric designation.

Information regarding the identification of law enforcement vessels in the study area was also recorded under comments. For each enforcement vessel, the time of entry and exit from the area was used to establish the duration of time that an enforcement presence was observed at each study site.

Additional comments were also used to describe in further detail when necessary, any vessel observations that required additional explanation.

Physical/Environmental Data

Physical and environmental data were collected during each sampling period for all tasks. These data included general information related to weather conditions, wind speed and direction, wave height, and general boating conditions, which were subjectively rated as "Poor", "Fair", "Good", or "Excellent". If conditions were evaluated as "Poor" for more than one hour during any sampling period, the sampling was cancelled and rescheduled for a different day.

Manatee Sightings

Sightings of manatees at each study site were also compiled and documented on field data sheets. Total number of individuals (adults and calves), identifiable scars, activity, and direction of travel were noted for each sighting. Manatees observed in the vicinity of boater compliance study sites during Mote Marine Laboratory aerial surveys and photo-identification surveys were also compiled, along with total sightings of manatees in Sarasota County during 1995.

Data Analysis

Field data was entered into an IBM compatible 486DX personal computer using Microsoft Excel Version 5.0. Once entered, original field data sheets were collated and stored in three-ring binders for future reference, if needed. Data was compiled, organized, and analyzed graphically utilizing Microsoft Excel. Statistical analysis was also performed using an IBM compatible PC and the software program SigmaStat[®].

Final analysis of field data for this project focused on the evaluation of boater compliance in Sarasota County as related to:

- 1) Vessel Type
- 2) Vessel Size
- 3) Vessel Activity
- 4) Time Of Day
- 5) Day Of The Week
- 6) Level Of Enforcement
- 7) Geographic Region
- 8) Direction Of Travel
- 9) Speed Of Travel
- 10) Multiple Observations Of The Same Vessel

Statistical analysis was performed utilizing a chi-square test with contingency tables, which compute the expected number of observations (such as compliance or non-compliance) if a given parameter (such as boat type) has no effect. The chi square value summarizes the difference between expected and observed frequencies and determines significance.

Radar data, comparing boat speeds by study area, was analyzed by one-way analysis of variance. Boat speeds were also compared with presence and absence of enforcement, weekday vs. weekend, and morning vs. afternoon utilizing a two sample t-test. All statistical analysis was performed using Sigma Stat[®] for Windows (SigmaStat, 1994).

Quality Assurance

Several attempts were made to ensure the overall quality and consistency of data collected during this study. Prior to the commencement of the study, field observers were required to attend an orientation/training session in order to become familiarized with field codes and to standardize the collection of field data. Along with detailed discussions of various field sampling protocols, both 35mm slides and video footage were used to define and describe the different categories of vessels and speed designations. In order to ensure consistency of data collection between sampling sites and tasks, the Principal Investigator participated in at least one, and as much 50 percent of field data collection at individual study sites.

At the completion of each field sampling, a Field Coordinator designated for each task was required to review the data for accuracy and completeness. Any observed vessels which did not have a complete data set (time, type, size, activity, origin, destination, speed, and compliance) were eliminated. Once reviewed, the field data sheets were delivered to Mote Marine Laboratory for computer entry. Before computer analysis of boater compliance data, a review of at least 5 percent of computer-entered data against the original field data sheets was performed in order to ensure accuracy in data transfer. Backup copies of all field data files were created.

RESULTS

A total of 32,780 vessels were observed, documented, and evaluated during the study. This included 22,324 vessels under Task 1 (Selected Important Sites); 1,662 vessels under Task 2 (Aerial Surveys); 4,881 vessels under Task 3 (Radar); and 3,913 vessels under Task 4 (24-Hour). All scheduled field work was successfully completed during each month of 1995. A total of 36 field days (12 weekdays and 24 weekend days) were completed for each sampling site (New Pass, Pansy Bayou, Skiers Island, Venice Inlet, and Myakka River) under Task 1, with sampling periods distributed evenly among three 4-hour time windows. A total of 24 aerial surveys (including both weekdays and weekend days) were completed for Task 2, twelve sampling days (6 weekend days and 6 weekdays) were completed for each of 4 radar stations under Task 3, and twelve 24-hour sampling periods were completed on a combination of weekends and weekdays under Task 4. Dates and time windows for all completed sampling periods are provided in Tables 1 and 2.

Abbreviated surveys occurred on only three occasions during the study. Radar site RA1 was shortened by slightly less than one hour due to severe weather, and two sampling dates at Skiers Island were shortened by less than 30 minutes due to severe weather and a response to a manatee in distress.

Surveys were conducted under optimal weather conditions when possible. Boating conditions were rated as "Good" or "Excellent" during at least 75 percent of total survey time at each sampling site. "Poor" conditions were recorded 4 percent of the time at the Myakka River Site, and 1 percent or less at all other sampling sites, including study sites for Tasks 2, 3, and 4.

Task 1

A total of 22,324 vessels were observed and evaluated during Task 1. This included 6,385 vessels at New Pass; 920 vessels at Pansy Bayou; 4042 vessels at Skiers Island; 10,454 vessels at Venice Inlet; and 523 vessels in the Myakka River. Distribution of boat traffic at each site by month is presented in Figure 16. In general higher levels of boat traffic were noted during the spring and summer, with decreases at most sites during the fall and early winter. No clear seasonal distribution, however, was observed. This is likely due in part to short-term variations in boating conditions on different days or at different locations. Such conditions included wind speed and direction, wave height, water temperature, and levels of red tide which occurred sporadically during the summer and fall of 1995 in Sarasota Bay. These conditions most noticeably affected activities such as water skiing and use of personal watercraft. Boat activity varied seasonally at the Pansy Bayou and Skiers Island stations, due to the fact that these stations are associated with recreational boating activities.

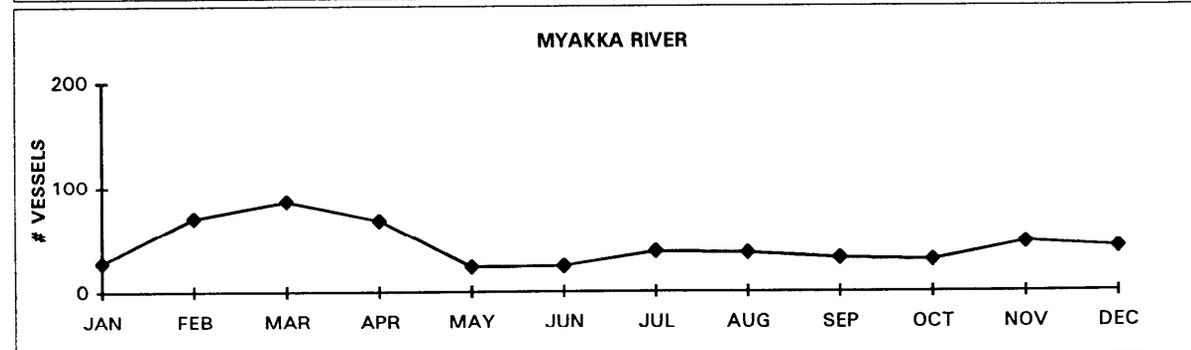
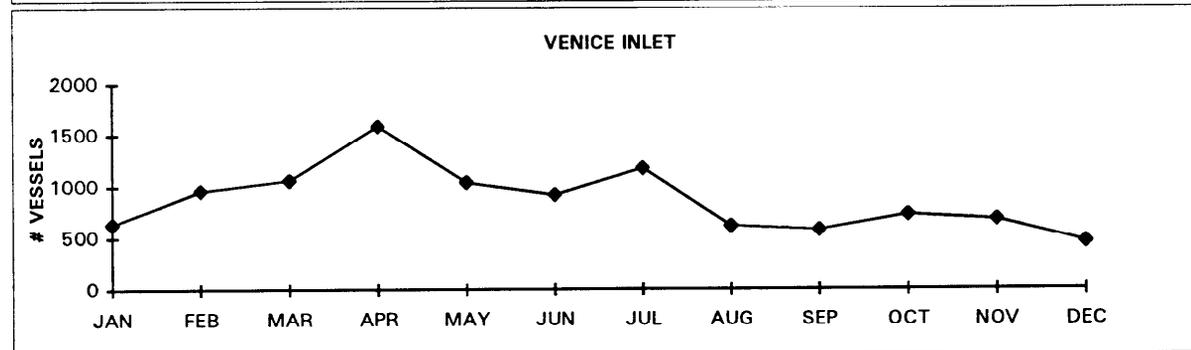
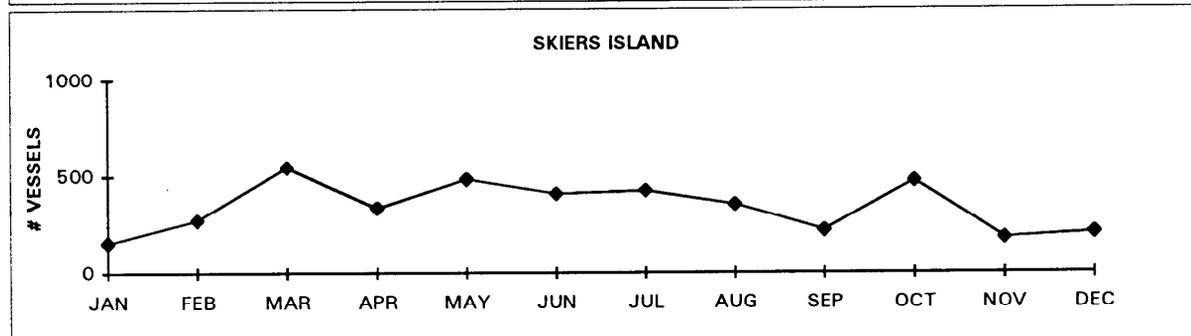
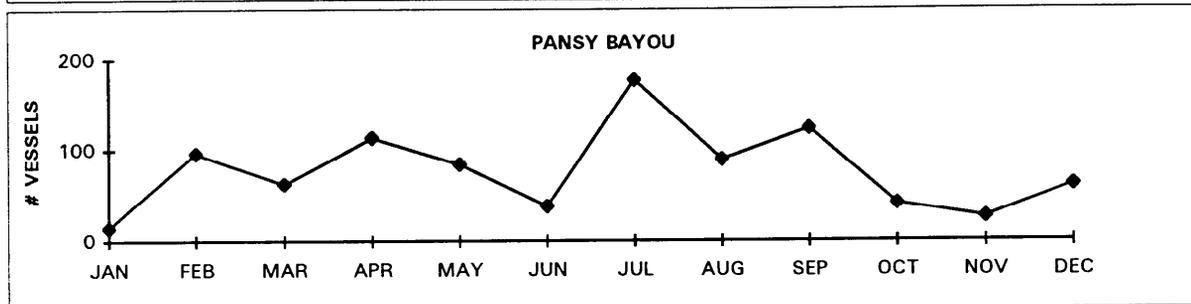
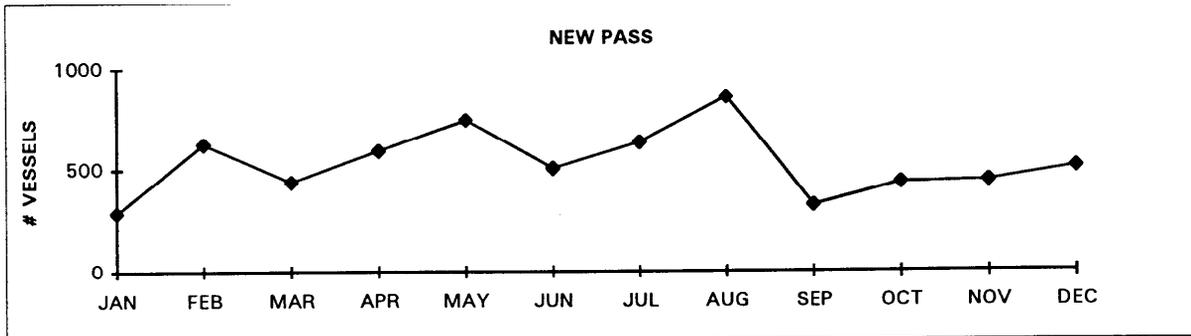
Table 1. Completed field sampling dates and time windows for all sites under Boater Compliance Project Task 1.

NEW PASS		PANSYBAYOU		SKIERS ISLAND		VENICE INLET		MYAKKA RIVER	
Sampling Date	Time Window								
16-Jan	1300-1700	10-Jan	1300-1700	12-Jan	1300-1700	13-Jan	1100-1500	20-Jan	1100-1500
21-Jan	0900-1300	21-Jan	1100-1500	28-Jan	1100-1500	22-Jan	0900-1300	21-Jan	1300-1700
22-Jan	1100-1500	28-Jan	0900-1300	29-Jan	0900-1300	28-Jan	1300-1700	28-Jan	0900-1300
3-Feb	1100-1500	18-Feb	1300-1700	18-Feb	0900-1300	18-Feb	0900-1300	11-Feb	1100-1500
11-Feb	0900-1300	19-Feb	1300-1700	19-Feb	1300-1700	19-Feb	1100-1500	17-Feb	0900-1300
26-Feb	1300-1700	22-Feb	1100-1500	23-Feb	1100-1500	22-Feb	0900-1300	26-Feb	1300-1700
11-Mar	1100-1500	12-Mar	0900-1300	5-Mar	1100-1500	16-Mar	1300-1700	12-Mar	0900-1300
12-Mar	0900-1300	10-Mar	1100-1500	20-Mar	0900-1300	18-Mar	0900-1300	15-Mar	1300-1700
16-Mar	0900-1300	30-Mar	0900-1300	25-Mar	1300-1700	19-Mar	1300-1700	26-Mar	1100-1500
2-Apr	0900-1300	8-Apr	1100-1500	14-Apr	0900-1300	8-Apr	1100-1500	8-Apr	0900-1300
8-Apr	1300-1800	9-Apr	1300-1700	22-Apr	0900-1300	9-Apr	1100-1500	23-Apr	1100-1500
27-Apr	1100-1500	27-Apr	0900-1300	23-Apr	0900-1300	27-Apr	0900-1300	27-Apr	1300-1700
5-May	0900-1300	7-May	0900-1300	7-May	1300-1700	6-May	1100-1500	14-May	0900-1300
7-May	1300-1700	20-May	1300-1700	13-May	1100-1500	24-May	1300-1700	22-May	1100-1500
20-May	1300-1700	26-May	1100-1500	30-May	1100-1500	27-May	1100-1500	27-May	1300-1700
7-Jun	1300-1700	3-Jun	0900-1300	17-Jun	1300-1700	11-Jun	0900-1300	24-Jun	1100-1500
17-Jun	1100-1500	8-Jun	1300-1700	25-Jun	0900-1300	18-Jun	1300-1700	25-Jun	1100-1500
25-Jun	0900-1300	11-Jun	1100-1500	28-Jun	1300-1700	29-Jun	1100-1500	27-Jun	0900-1300
7-Jul	0900-1300	4-Jul	1300-1700	8-Jul	0900-1300	8-Jul	0900-1300	1-Jul	1300-1700
9-Jul	1100-1500	15-Jul	0900-1300	9-Jul	1100-1500	14-Jul	1100-1500	9-Jul	1300-1700
29-Jul	1100-1500	23-Jul	0900-1300	24-Jul	1100-1500	16-Jul	1100-1500	24-Jul	1100-1500
4-Aug	0900-1300	13-Aug	1300-1700	19-Aug	0900-1300	13-Aug	0900-1300	12-Aug	0900-1300
6-Aug	1100-1500	19-Aug	1100-1500	27-Aug	1100-1500	26-Aug	1300-1700	23-Aug	0900-1300
20-Aug	1300-1700	29-Aug	1100-1500	30-Aug	1100-1500	28-Aug	1300-1700	27-Aug	1300-1700
2-Sep	0900-1300	2-Sep	1300-1700	2-Sep	1100-1500	16-Sep	1100-1500	2-Sep	1100-1500
16-Sep	1300-1700	4-Sep	0900-1300	14-Sep	0900-1300	17-Sep	1100-1500	17-Sep	1100-1500
25-Sep	1300-1700	24-Sep	1100-1500	16-Sep	1300-1700	19-Sep	0900-1300	19-Sep	1300-1700
7-Oct	1100-1500	14-Oct	0900-1300	1-Oct	1300-1700	8-Oct	1300-1700	8-Oct	0900-1300
8-Oct	0900-1300	26-Oct	0900-1300	8-Oct	0900-1300	21-Oct	1300-1700	11-Oct	1100-1500
23-Oct	1100-1500	28-Oct	1300-1700	24-Oct	1300-1700	24-Oct	0900-1300	21-Oct	1100-1500
4-Nov	0900-1300	5-Nov	0900-1300	10-Nov	1300-1700	5-Nov	0900-1300	12-Nov	1300-1700
19-Nov	1100-1500	11-Nov	1100-1500	11-Nov	1300-1700	18-Nov	0900-1300	18-Nov	0900-1300
21-Nov	1100-1500	17-Nov	1100-1500	12-Nov	1300-1700	30-Nov	1100-1500	24-Nov	1300-1700
3-Dec	1300-1700	3-Dec	1300-1700	3-Dec	1100-1500	2-Dec	1300-1700	3-Dec	0900-1300
9-Dec	1300-1700	13-Dec	1300-1700	9-Dec	1100-1500	10-Dec	1300-1700	9-Dec	1300-1700
12-Dec	1300-1700	17-Dec	1100-1500	13-Dec	0900-1300	11-Dec	1300-1700	21-Dec	0900-1300

Table 2. Completed sampling dates and time windows for Boater Compliance Project Tasks 2, 3, and 4.

RADAR TASK		RADAR TASK		RADAR TASK		RADAR TASK		AERIAL SURVEYS	
STATION RA1		STATION RA2		STATION RA3		STATION RA4		AERIAL SURVEYS	
Sampling Date	Time Window	Sampling Date	Time Window	Sampling Date	Time Window	Sampling Date	Time Window	Sampling Date	Time Window
26-Jan-95	0900-1200	26-Jan-95	1300-1600	31-Jan-95	0900-1200	31-Jan-95	1300-1600	16-Jan	0902-1151
17-Feb-95	1300-1600	17-Feb-95	0900-1200	24-Feb-95	1300-1600	24-Feb-95	0900-1200	22-Jan	1005-1332
5-Mar-95	0900-1200	19-Mar-95	0900-1200	5-Mar-95	1300-1600	19-Mar-95	1300-1600	7-Feb	1023-1259
15-Apr-95	1300-1600	20-Apr-95	0900-1200	15-Apr-95	0900-1200	20-Apr-95	1300-1600	22-Feb	0925-1224
31-May-95	1300-1600	6-May-95	1300-1600	31-May-95	0900-1200	6-May-95	0900-1200	22-Mar	1030-1434
10-Jun-95	0900-1200	11-Jun-95	1300-1600	10-Jun-95	1300-1600	11-Jun-95	0900-1200	27-Mar	1107-1440
16-Jul-95	1300-1600	22-Jul-95	0900-1200	16-Jul-95	0900-1200	22-Jul-95	1300-1600	3-Apr	930-1109
18-Aug-95	1300-1600	13-Aug-95	1300-1600	18-Aug-95	0900-1200	13-Aug-95	0900-1200	19-Apr	0909-1227
24-Sep-95	0900-1200	23-Sep-95	0900-1200	24-Sep-95	1300-1600	23-Sep-95	1300-1600	15-May	0929-1243
7-Oct-95	1300-1600	9-Oct-95	0900-1200	7-Oct-95	0900-1200	9-Oct-95	1300-1600	23-May	0930-1320
7-Nov-95	0900-1200	7-Nov-95	1300-1600	30-Nov-95	1300-1600	30-Nov-95	0900-1200	10-Jun	0931-1247
4-Dec-95	0900-1200	6-Dec-95	1300-1600	4-Dec-95	1300-1600	6-Dec-95	0900-1200	29-Jun	0919-1444
								10-Jul	1221-1241
								31-Jul	0923-1206
								5-Aug	0915-1320
								17-Aug	0950-1336
								21-Sep	1031-1333
								13-Oct	1030-1331
								22-Oct	0959-1150
								3-Nov	0931-1345
								22-Nov	0940-1305
								6-Dec	0917-1325
								30-Dec	1349-1515
24 HOUR NEW PASS									
Sampling Date									
27-Jan-95									
23-Feb-95									
13-Mar-95									
15-Apr-95									
23-May-95									
27-Jun-95									
12-Jul-95									
18-Aug-95									
14-Sep-95									
1-Oct-95									
18-Nov-95									
4-Dec-95									

Figure 16. Task 1; Distribution of boat traffic by site for each month.



The number of boats associated with skiing activities at Skiers Island varied from an average of 14 boats per survey during the January, February, November, and December, to an average of 102 boats per survey during the months of March through October. A similar increase, though not as dramatic, was also observed at Pansy Bayou (9 boats per survey vs. 15 boats per survey). Vessels engaged in other activities at these sites, primarily travel, were noted as essentially similar in abundance throughout the year.

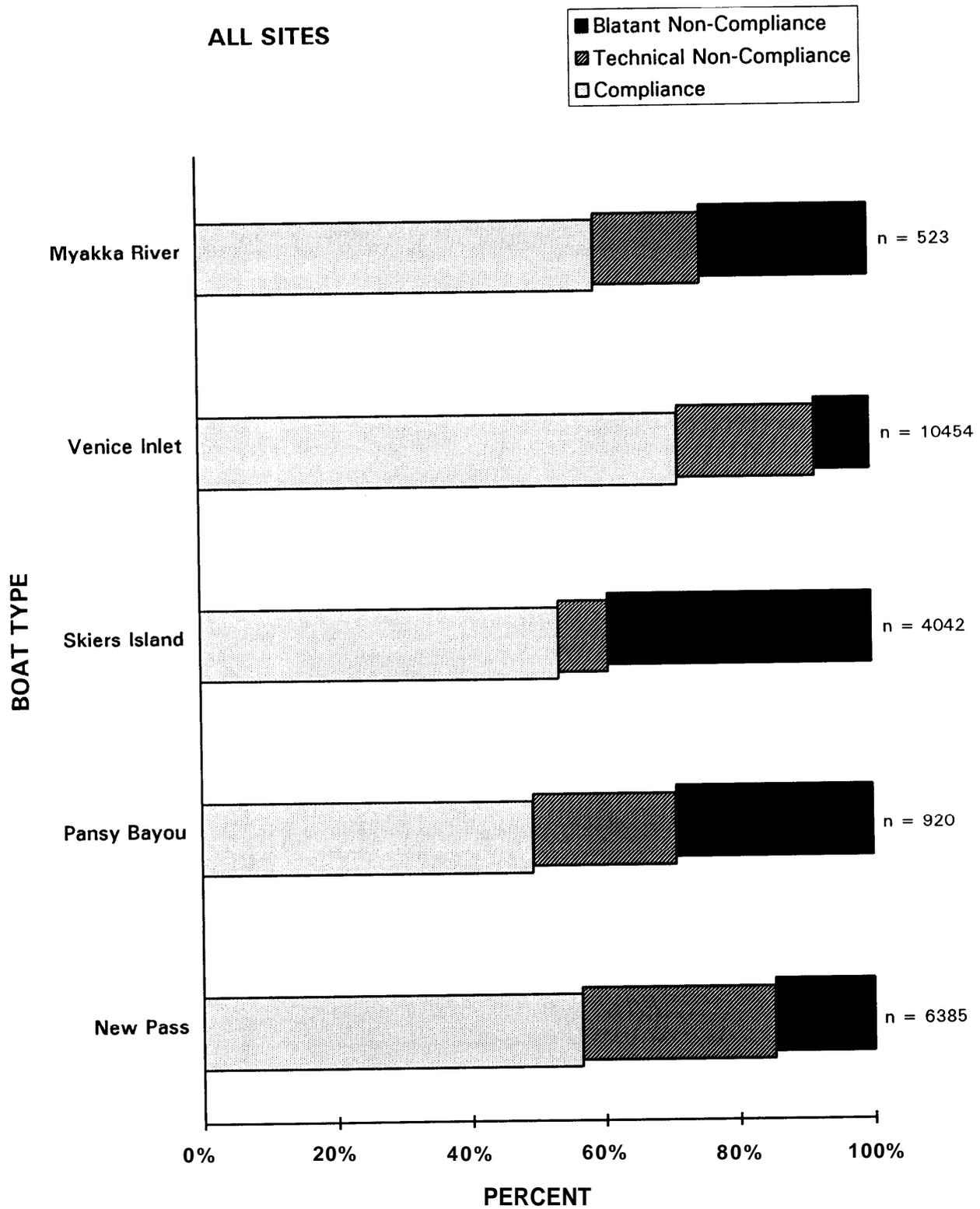
Of the 22,324 vessels evaluated from all five observation sites (New Pass, Pansy Bayou, Skiers Island, Venice Inlet, and Myakka River), 13,997 vessels (62.7%) were evaluated as compliant with speed regulations, 4,542 vessels (20.4%) were evaluated as technically non-compliant, and 3,785 vessels (16.9%) were evaluated as blatantly non-compliant. Variations in levels of compliance by study site are discussed in the next section.

Compliance by Study Site

Overall vessel compliance by study site is presented in Figure 17. Highest levels of overall compliance (71.4%) were observed at the Venice Inlet site. Lowest levels of compliance (50.7% and 53.4%) were observed at the two study sites associated with Water Sports Areas (Pansy Bayou and Skiers Island, respectively). Highest levels of blatant non-compliance were also observed at Skiers Island (39.2%) and Pansy Bayou (29.2%). For Skiers Island, more than 1,500 vessels were observed on plane through the posted Slow Speed Zone during the 12 month study, or an average of 44 blatant violations per 4-hour survey. Pansy Bayou, a substantially less-active boating area, averaged 7.5 blatant violations per survey. Overall, however, more than 50% of the boat traffic observed in the Pansy Bayou/City Island Grassflats Area was non-compliant, with the majority on plane through the posted Slow Speed Zone. Although a relatively low amount of boat traffic was observed in the Myakka River, the level of blatant non-compliance was relatively high (130 out of 523 vessels, 24.8%). Non-compliance was less frequently observed at the tidal inlet sites, New Pass and Venice Inlet. At Venice Inlet, only 859 out of 10,454 vessels were evaluated as blatantly non-compliant (8.2%). At New Pass, 941 out of 6385 vessels were evaluated as blatantly non-compliant (14.7%). More technical non-compliance than blatant non-compliance was observed at both New Pass and Venice Inlet. Blatant non-compliance exceeded technical non-compliance at all other study sites.

A statistical comparison of boater compliance by study site utilizing chi-square contingency tables determined that there was a highly significant difference between sites ($P < 0.0001$). Statistical results are presented in Appendix B.

Figure 17. Task 1; Level of boater compliance at each study site.



Compliance by Vessel Type

The three most common vessel types encountered during Task 1 were Open Fisherman (6,089 observations), Ski/Sport/Runabout (5,760 observations), and Yacht/Cruiser (5,208 observations). Relative abundance of the most common vessel types varied somewhat between sites. The three most common types of vessels at each site are listed in Table 3. As expected, vessels in the Ski/Sport/Runabout category were the most abundant vessels observed at Skiers Island and Pansy Bayou, while vessels in the Open Fisherman and Yacht Cruiser categories were most abundant at the tidal inlet sites. Only at Pansy Bayou was personal watercraft among the three most abundant vessel types, and only along the Myakka River was the Pontoon/Platform-type vessel among the three most abundant vessel types. Open Fisherman and Ski/Sport/Runabout boats were among the three most abundant vessel types at each of the five study sites.

Overall compliance by vessel type (all five study sites combined) is shown in Table 4 and Figure 18. Level of compliance among the three most common types of vessels was essentially similar, with Open Fisherman and Ski/Sport/Runabout style vessels nearly identical (Both at 63% compliance, 20% technical non-compliance, and approximately 17% blatant non-compliance). Substantially lower levels of compliance were observed for Personal Watercraft (36% compliance, 20% technical non-compliance, and 44% blatant non-compliance, 2,037 observations). Jonboat style vessels also had a relatively low level of compliance (59% compliance, 17% technical non-compliance, 24% blatant non-compliance, 544 observations). Highest levels of compliance, as expected, were observed among sailboats (93% compliance, 7% technical non-compliance, 0% blatant non-compliance; 946 observations). Other vessel types (Pontoon/Platform, Scarab/Cigarette, and Other) had levels of compliance similar to that of the most common vessels.

Similar trends in compliance among vessel types were noted at each study site (Table 4, Figures 19-23). Consistently higher levels of non-compliance among different types of vessels were observed at Skiers Island. This included the three most common vessel types observed during the study (Open Fisherman, Ski/Sport/Runabout, and Yacht/Cruiser) which all had highest levels of non-compliance at Skiers Island. With the exception of Sailboat and Other categories, the levels of blatant non-compliance exceeded 33% for all vessel types at Skiers Island,

Two out of every three sightings of personal watercraft at Pansy Bayou were evaluated as blatantly non-compliant, and more than half of personal watercraft sightings at all other sites except Venice Inlet were evaluated as blatantly non-compliant. While high levels of non-compliance were noted for personal watercraft and certain other vessel types in the Myakka River, such as Scarab/Cigarette, sample sizes for these types was relatively small and may not be as significant as results for other sites.

Table 3. Rank order abundance by vessel type, size, and activity for each site under Task 1.

	BOAT TYPE	BOAT SIZE	BOAT ACTIVITY
Rank	NEW PASS	NEW PASS	NEW PASS
1	Open Fisherman (31 %)	16 - 25 ft (71 %)	Travel (98%)
2	Yacht/Cruiser (28%)	26 - 39 ft (16%)	Pleasure (1%)
3	Ski/Sport/Runabout (22 %)	< 12 ft (8%)	Other (1 %)
Rank	PANSY BAYOU	PANSY BAYOU	PANSY BAYOU
1	Ski/Sport/Runabout (57%)	16-25 ft (71%)	Ski (52%)
2	Personal Watercraft (19%)	< 12 ft (21%)	Travel (37%)
3	Open Fisherman (11%)	12-15 ft (8 %)	Pleasure (9%)
Rank	SKIERS ISLAND	SKIERS ISLAND	SKIERS ISLAND
1	Ski/Sport/Runabout (39%)	16 - 25 ft (79%)	Ski (46%)
2	Open Fisherman (33%)	< 12 ft (9 %)	Travel (45%)
3	Yacht/Cruiser (11 %)	12-15 ft (6 %)	Pleasure (8%)
Rank	VENICE INLET	VENICE INLET	VENICE INLET
1	Yacht/Cruiser (28%)	16 - 25 ft (64%)	Travel (99%)
2	Open Fisherman (24%)	26 - 39 ft (16%)	Other (1 %)
3	Ski/Sport/Runabout (20%)	< 12 ft (10%)	
Rank	MYAKKA RIVER	MYAKKA RIVER	MYAKKA RIVER
1	Open Fisherman (26%)	16 - 25 ft (81 %)	Travel (97 %)
2	Pontoon/Platform (26%)	12-15 ft (17%)	Other (2%)
3	Ski/Sport/Runabout (22%)	26 - 39 ft (1%)	Pleasure (1%)
	ALL SITES COMBINED	ALL SITES COMBINED	ALL SITES COMBINED
1	Open Fisherman (27%)	16 - 25 ft (69%)	Traveling (87%)
2	Ski/Sport/Runabout (26%)	26 - 39 ft (13%)	Skiing (10%)
3	Yacht/Cruiser (23%)	< 12 ft (9 %)	Pleasure (2%)

Table 4. Task 1. Comparison of compliance by boat type for each study site, and for all five sites combined.

Station	Open Fisherman	Ski / Sport	Yacht/Cruiser	Personal Watercraft	Pontoon / Platform	Scarab / Cigarette	Jon Boat	Sail Boat	Other
New Pass									
Compliance	1166 (59%)	785 (55%)	1141 (63%)	115 (24%)	88 (52%)	155 (63%)	63 (51%)	62 (87%)	30 (45%)
Technical Non-Compliance	572 (29%)	474 (33%)	523 (29%)	86 (18%)	53 (31%)	72 (29%)	28 (23%)	9 (13%)	22 (33%)
Blatant Non-Compliance	244 (12%)	175 (12%)	147 (8%)	282 (58%)	29 (17%)	18 (7%)	32 (26%)	0 (0%)	14 (21%)
Pansy Bayou									
Compliance	53 (53%)	294 (56%)	11 (69%)	39 (22%)	21 (64%)	9 (38%)	13 (54%)	0 (0%)	14 (58%)
Technical Non-Compliance	25 (25%)	139 (26%)	3 (19%)	20 (11%)	3 (9%)	3 (13%)	4 (17%)	0 (0%)	0 (0%)
Blatant Non-Compliance	22 (22%)	92 (18%)	2 (13%)	115 (66%)	9 (27%)	12 (50%)	7 (29%)	0 (0%)	10 (42%)
Skiers Island									
Compliance	706 (54%)	883 (57%)	238 (53%)	149 (41%)	80 (50%)	17 (39%)	36 (47%)	16 (84%)	34 (67%)
Technical Non-Compliance	90 (7%)	117 (7%)	43 (10%)	10 (3%)	18 (11%)	7 (16%)	6 (8%)	3 (16%)	5 (10%)
Blatant Non-Compliance	518 (39%)	561 (36%)	168 (37%)	208 (57%)	62 (39%)	20 (45%)	35 (45%)	0 (0%)	12 (24%)
Venice Inlet									
Compliance	1829 (72%)	1581 (74%)	2079 (72%)	426 (42%)	354 (71%)	166 (86%)	175 (71%)	805 (94%)	54 (61%)
Technical Non-Compliance	522 (20%)	391 (18%)	682 (24%)	283 (28%)	107 (21%)	21 (11%)	43 (17%)	51 (6%)	26 (20%)
Blatant Non-Compliance	207 (8%)	152 (7%)	116 (4%)	300 (30%)	40 (8%)	7 (4%)	28 (11%)	0 (0%)	9 (10%)
Myakka River									
Compliance	82 (60%)	66 (57%)	50 (91%)	0 (0%)	79 (59%)	1 (20%)	32 (43%)	0 (0%)	0 (0%)
Technical Non-Compliance	14 (11%)	18 (16%)	1 (2%)	2 (50%)	36 (27%)	0 (0%)	12 (16%)	0 (0%)	0 (0%)
Blatant Non-Compliance	39 (29%)	32 (28%)	4 (7%)	2 (50%)	19 (14%)	4 (80%)	30 (41%)	0 (0%)	0 (0%)
TOTAL ALL SITES									
Compliance	3836 (63%)	3609 (63%)	3519 (68%)	729 (36%)	622 (62%)	348 (68%)	319 (59%)	883 (93%)	132 (57%)
Technical Non-Compliance	1223 (20%)	1139 (20%)	1252 (24%)	401 (20%)	217 (22%)	103 (20%)	93 (17%)	63 (7%)	53 (23%)
Blatant Non-Compliance	1030 (17%)	1012 (18%)	437 (8%)	907 (44%)	159 (16%)	61 (12%)	132 (24%)	0 (0%)	45 (20%)

Figure 18. Task 1; Level of compliance by vessel type; All five sites combined.

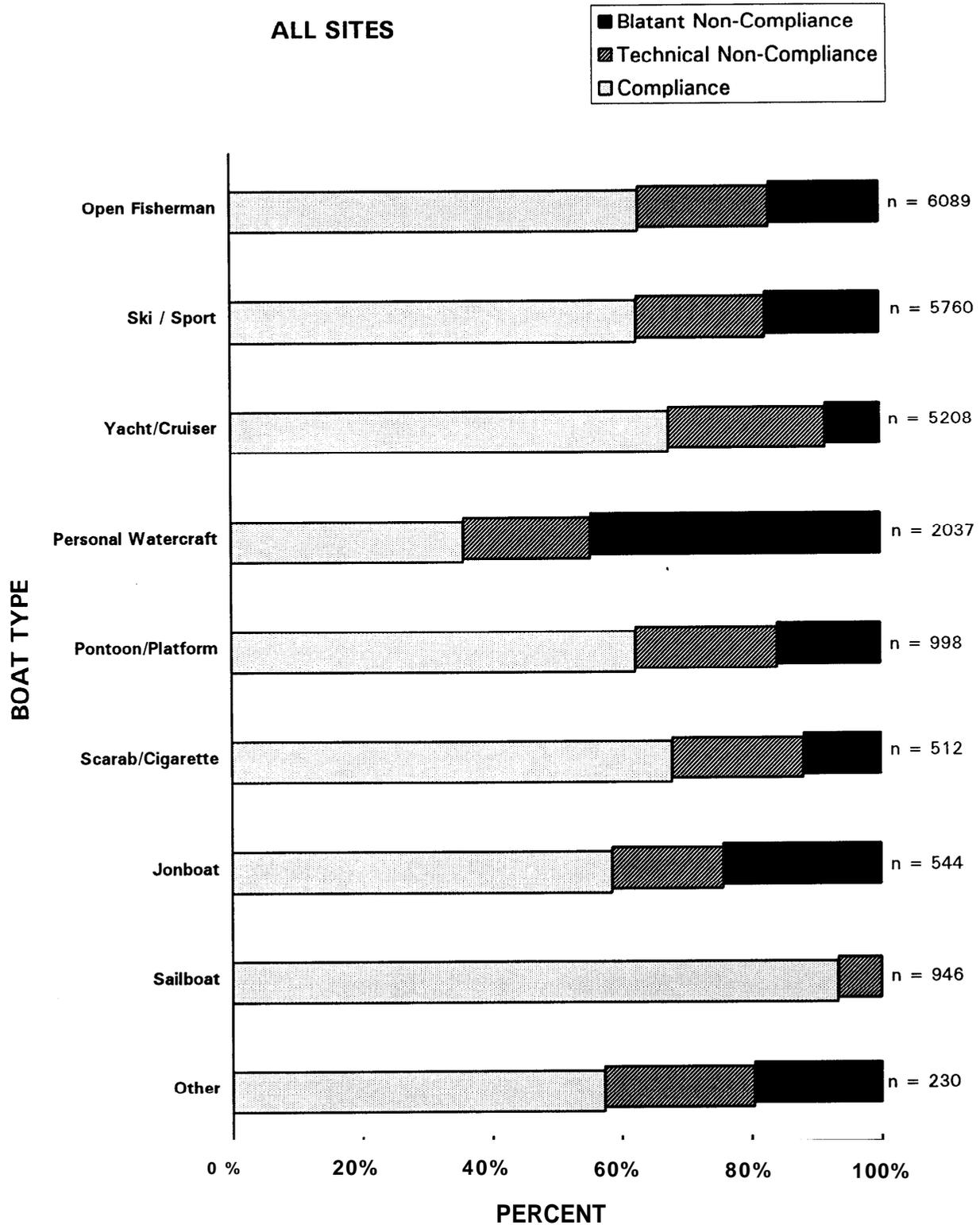


Figure 19. Task 1; Level of compliance by vessel type at New Pass.

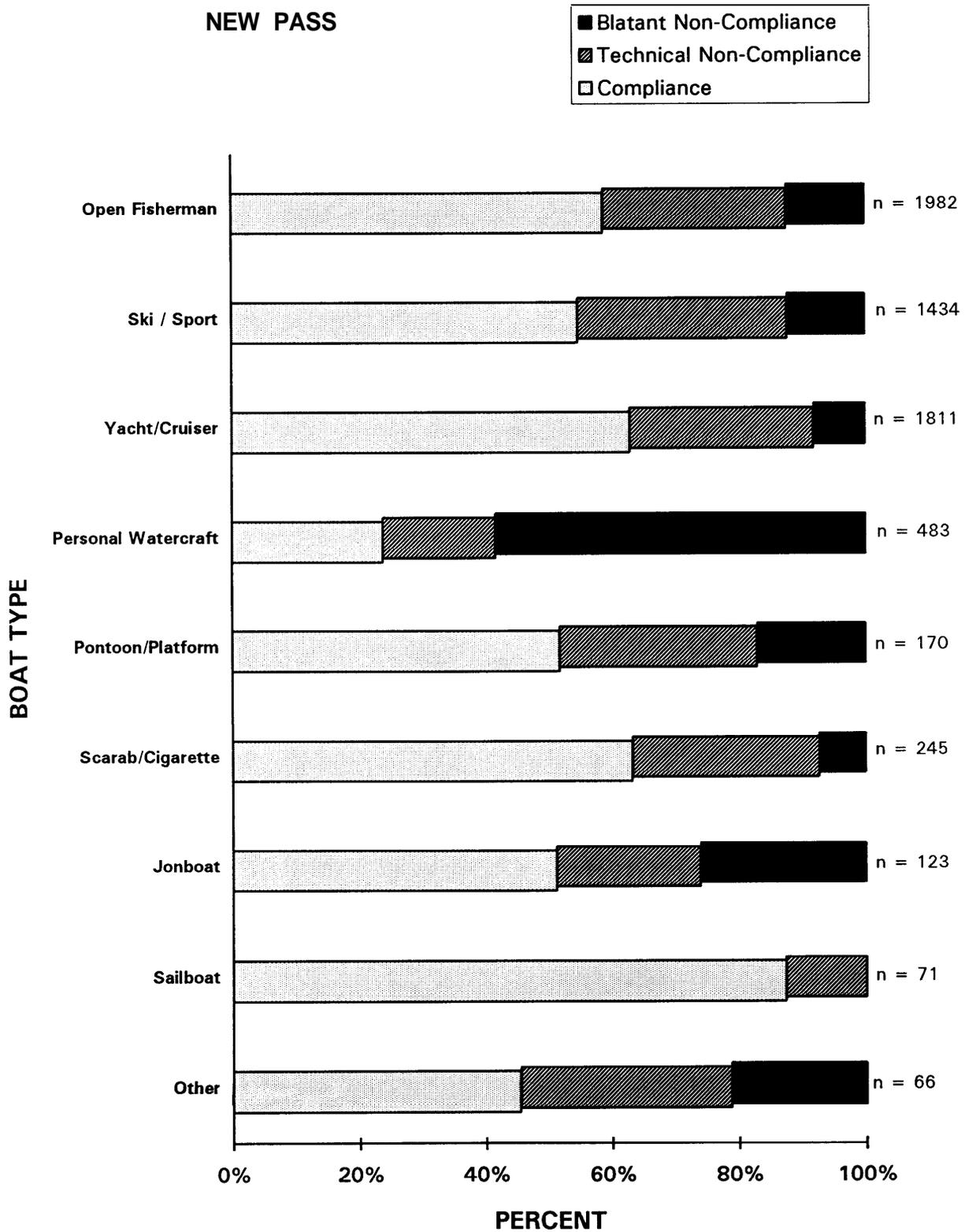


Figure 20. Task 1; Level of compliance by vessel type at the Pansy Bayou Site.

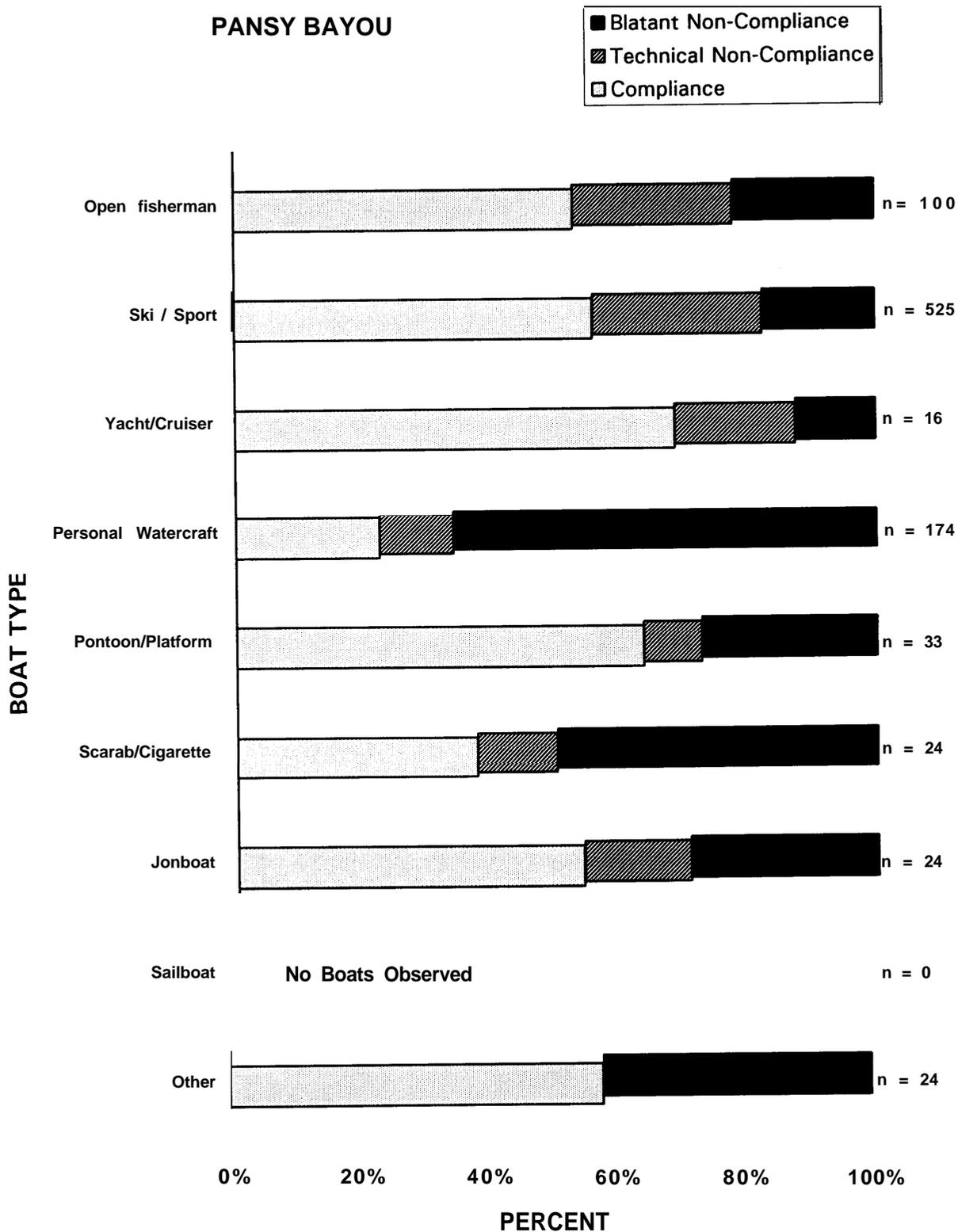


Figure 21. Task 1; Level of compliance by vessel type at Skiers Island.

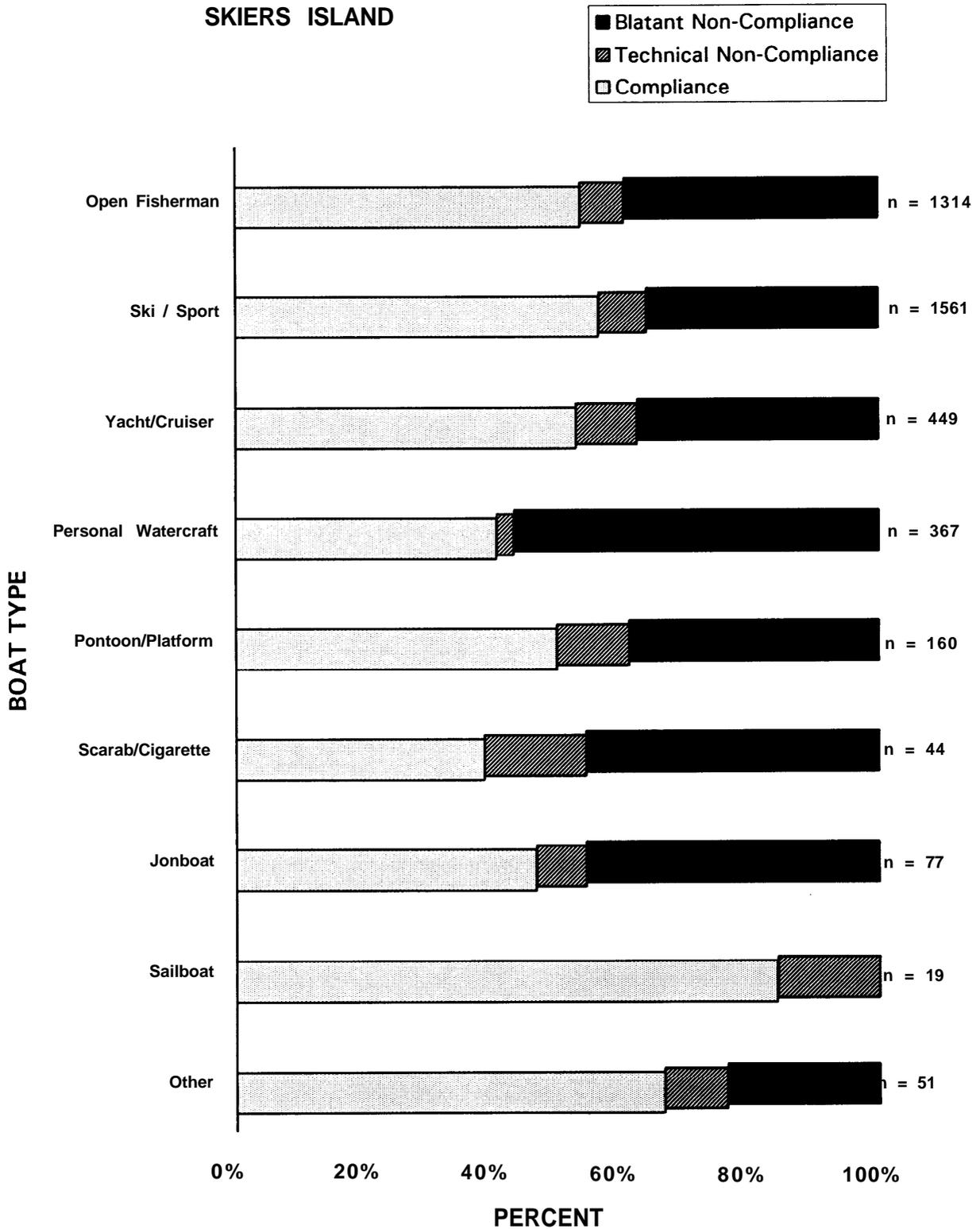


Figure 22. Task 1; Level of compliance by vessel type at Venice Inlet.

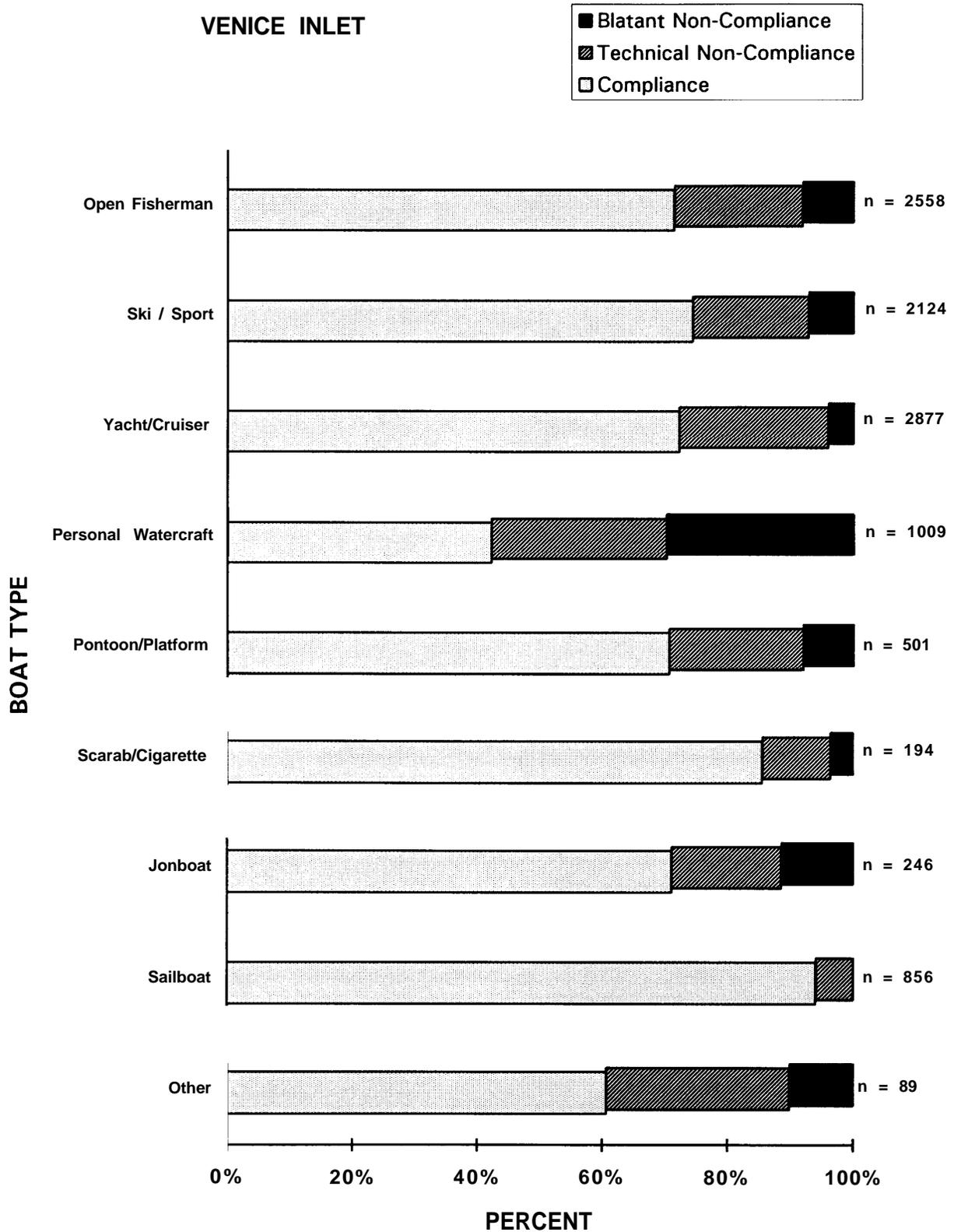
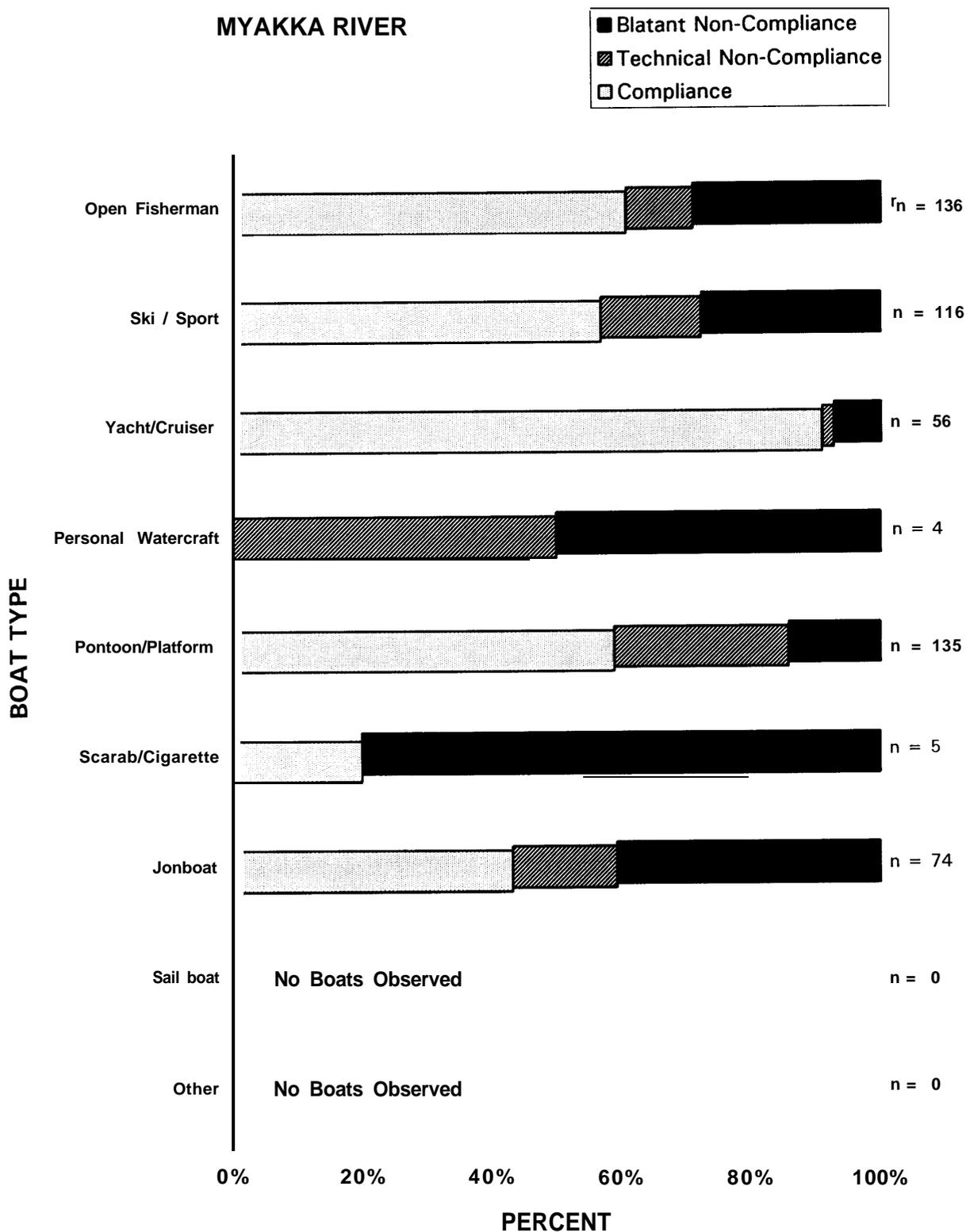


Figure 23. Task 1; Level of compliance by vessel type in the Myakka River.



Levels of compliance for certain vessel types varied greatly among study sites. Scarab/Cigarette-type vessels had a much higher level of compliance at New Pass (63%) and Venice Inlet (86%) than at Skiers Island (39%), Pansy Bayou (38%) and the Myakka River (20%).

Jonboat-type vessels also varied greatly from site to site, with levels of compliance ranging from 71% at Venice Inlet to 43% in the Myakka River and 47% at Skiers Island.

Highest levels of compliance for each vessel type (excluding Other) were observed at Venice Inlet. In general, each vessel type had both a higher level of compliance and a lower level of blatant non-compliance at Venice Inlet when compared with other study sites.

A highly significant statistical difference related to vessel type and compliance was observed at each of the five study sites ($P < 0.001$) and for all five sites combined ($P < 0.0001$). Chi-square contingency tables are shown in Appendix B.

Compliance by Vessel Size

The most common size classes of vessels observed by study site and for all sites combined is shown in Table 3. At each site and for all sites combined, vessels in the 16-25 foot category were the most common vessels observed. The second most abundant size category was 26-39 feet, with highest relative abundances at New Pass and Venice Inlet. The smallest size classification, less than 12 feet, was the third most common vessel overall, and the second in overall abundance at Skiers Island and Pansy Bayou. Few vessels larger than 25 feet were observed at Skiers Island, Pansy Bayou, or the Myakka River due to shallow water depths in those areas. Vessels larger than 25 feet comprised only 6% of observed vessels at Skiers Island, 1% of vessels in the Myakka River, and less than 1% of vessels at Pansy Bayou. Largest vessels were observed at Venice Inlet, with more than 400 boats larger than 40 feet in length, 71 boats larger than 65 feet in length, and 5 boats larger than 110 feet in length. Only one vessel larger than 65 feet was observed at the New Pass site.

In evaluating the level of compliance with boat size, (all five study sites combined) a distinct trend toward decreasing levels of compliance with decreasing boat size is seen (Table 5, Figure 24). In particular, levels of blatant non-compliance range from a low of 0%, 3%, and 2% for the three largest vessel size classifications to a high of 15%, 23%, and 44% for the three smallest vessel size classifications. Increasing levels of non-compliance, particularly blatant non-compliance, with decreasing vessel size was observed at each of the five sampling sites as well (Figures 25-29).

Table 5. Task 1; Comparison of compliance by boat size for each study site, and for all five sites combined.

Station	< 12'	12' - 15'	16' - 25'	26' - 39'	40' - 64'	65' - 109'	> 109'
New Pass							
Compliance	124 (25%)	160 (57%)	2569 (57%)	676 (67%)	75 (74%)	1 (100%)	0 (0%)
Technical Non-Compliance	89 (18%)	75 (27%)	1392 (31%)	261 (26%)	22 (22%)	0 (0%)	0 (0%)
Blatant Non-Compliance	283 (57%)	45 (16%)	543 (12%)	66 (7%)	4 (4%)	0 (0%)	0 (0%)
Pansy Bayou							
Compliance	49 (26%)	36 (52%)	362 (56%)	7 (88%)	0 (0%)	0 (0%)	0 (0%)
Technical Non-Compliance	22 (12%)	8 (12%)	167 (26%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Blatant Non-Compliance	120 (63%)	25 (36%)	123 (19%)	1 (13%)	0 (0%)	0 (0%)	0 (0%)
Skiers Island							
Compliance	154 (41%)	119 (48%)	1743 (55%)	140 (59%)	3 (43%)	0 (0%)	0 (0%)
Technical Non-Compliance	10 (3%)	16 (6%)	252 (8%)	18 (8%)	3 (43%)	0 (0%)	0 (0%)
Blatant Non-Compliance	208 (56%)	112 (45%)	1185 (37%)	78 (33%)	1 (14%)	0 (0%)	0 (0%)
Venice Inlet							
Compliance	447 (43%)	339 (72%)	4958 (74%)	1329 (78%)	342 (79%)	49 (69%)	5 (100%)
Technical Non-Compliance	287 (28%)	78 (17%)	1330 (20%)	328 (19%)	83 (19%)	20 (28%)	0 (0%)
Blatant Non-Compliance	307 (29%)	55 (12%)	450 (7%)	38 (2%)	7 (7%)	2 (3%)	0 (0%)
Myakka River							
Compliance	0 (0%)	45 (50%)	263 (62%)	2 (28%)	0 (0%)	0 (0%)	0 (0%)
Technical Non-Compliance	2 (50%)	13 (14%)	68 (16%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Blatant Non-Compliance	2 (50%)	32 (36%)	91 (22%)	5 (71%)	0 (0%)	0 (0%)	0 (0%)
TOTAL ALL SITES							
Compliance	774 (37%)	699 (60%)	9895 (64%)	2154 (73%)	420 (78%)	50 (69%)	5 (100%)
Technical Non-Compliance	410 (19%)	190 (16%)	3207 (21%)	607 (21%)	108 (20%)	20 (28%)	0 (0%)
Blatant Non-Compliance	920 (44%)	269 (23%)	2394 (15%)	188 (6%)	12 (2%)	2 (3%)	0 (0%)

Figure 24. Task 1; Level of compliance by vessel size; all five sites combined.

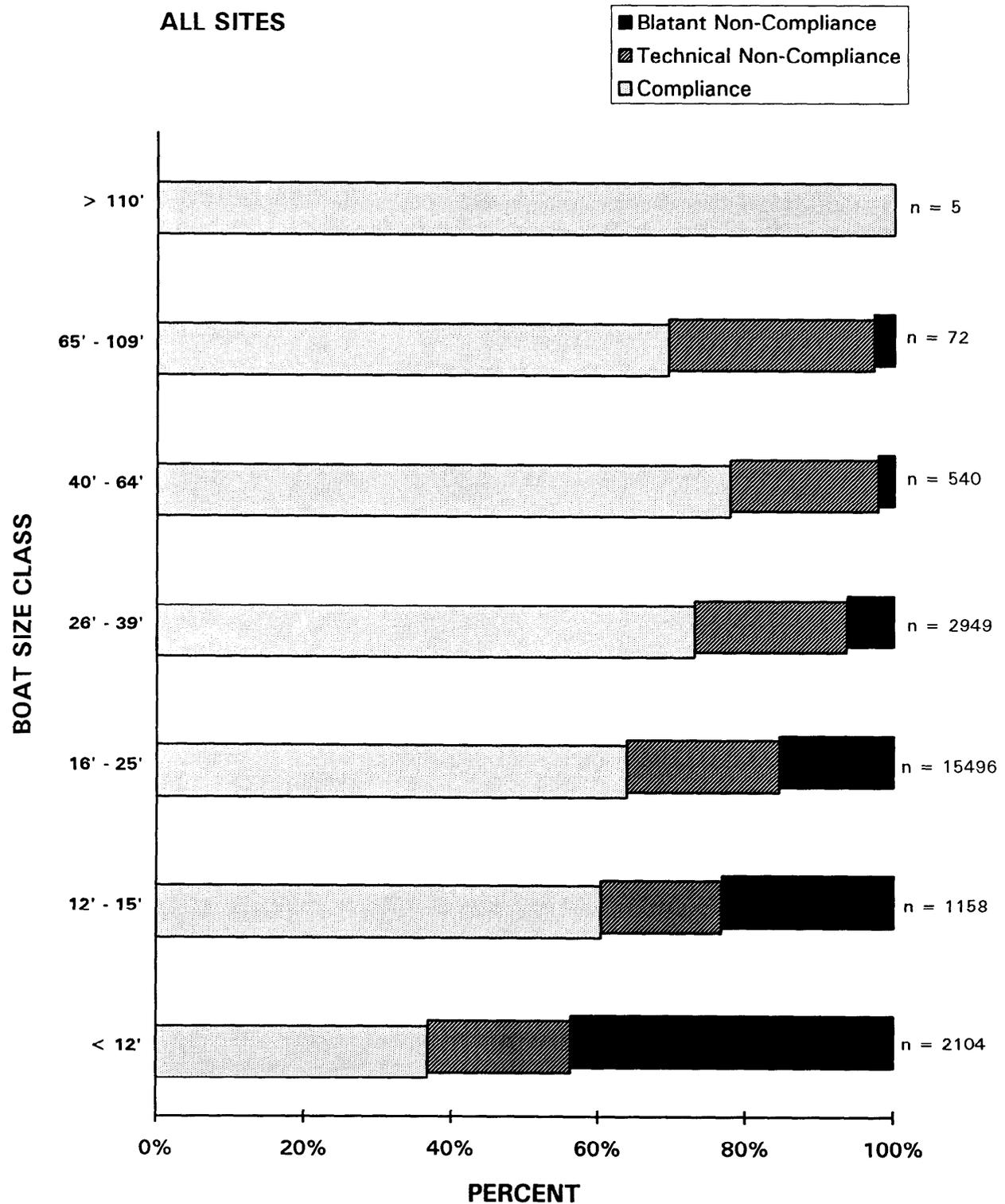


Figure 25. Task 1; Level of compliance by vessel size at New Pass.

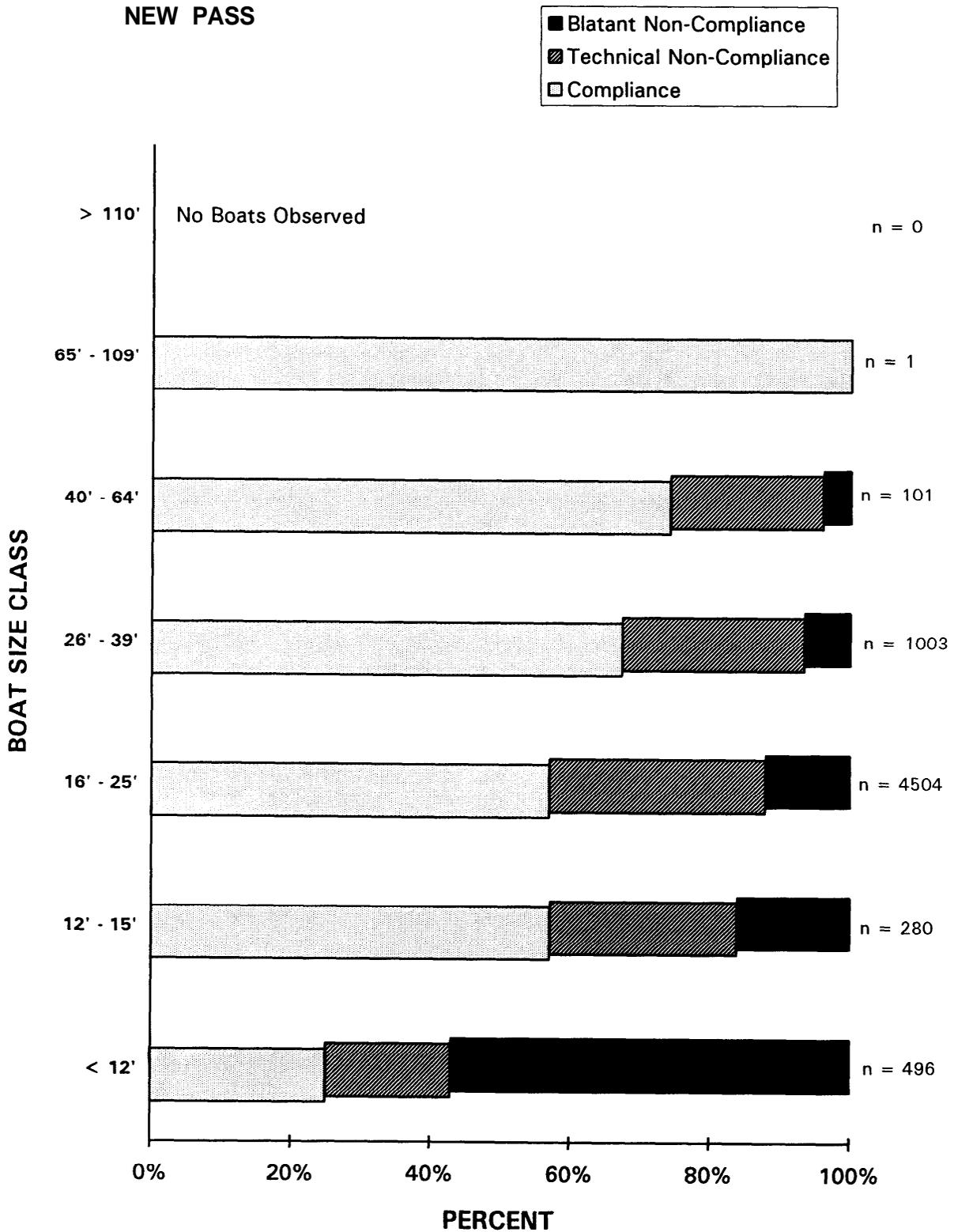


Figure 26. Task 1; Level of compliance by vessel size at the Pansy Bayou Site.

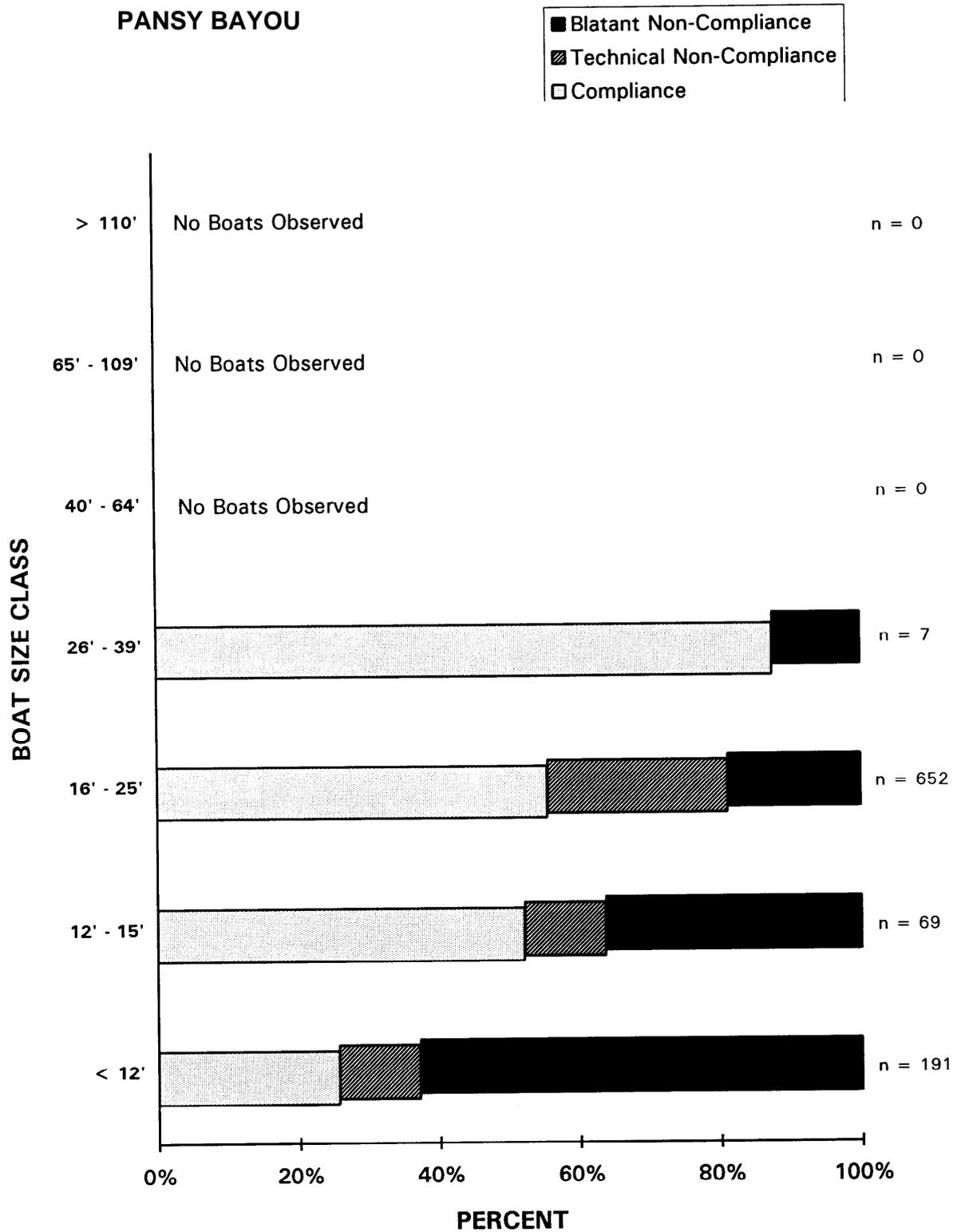


Figure 27. Task 1; Level of compliance by vessel size at Skiers Island.

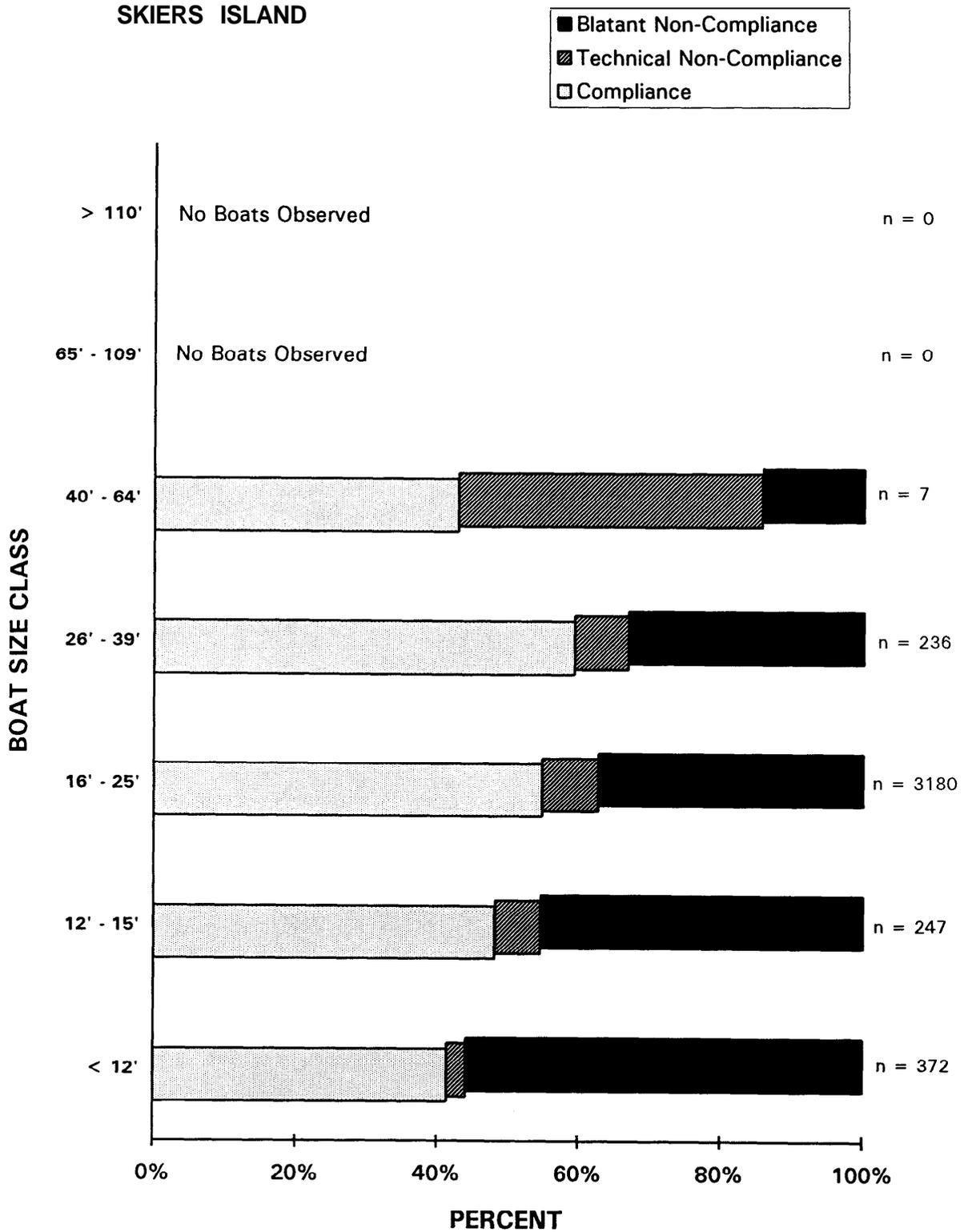


Figure 28. Task 1; Level of compliance by vessel size at Venice Inlet.

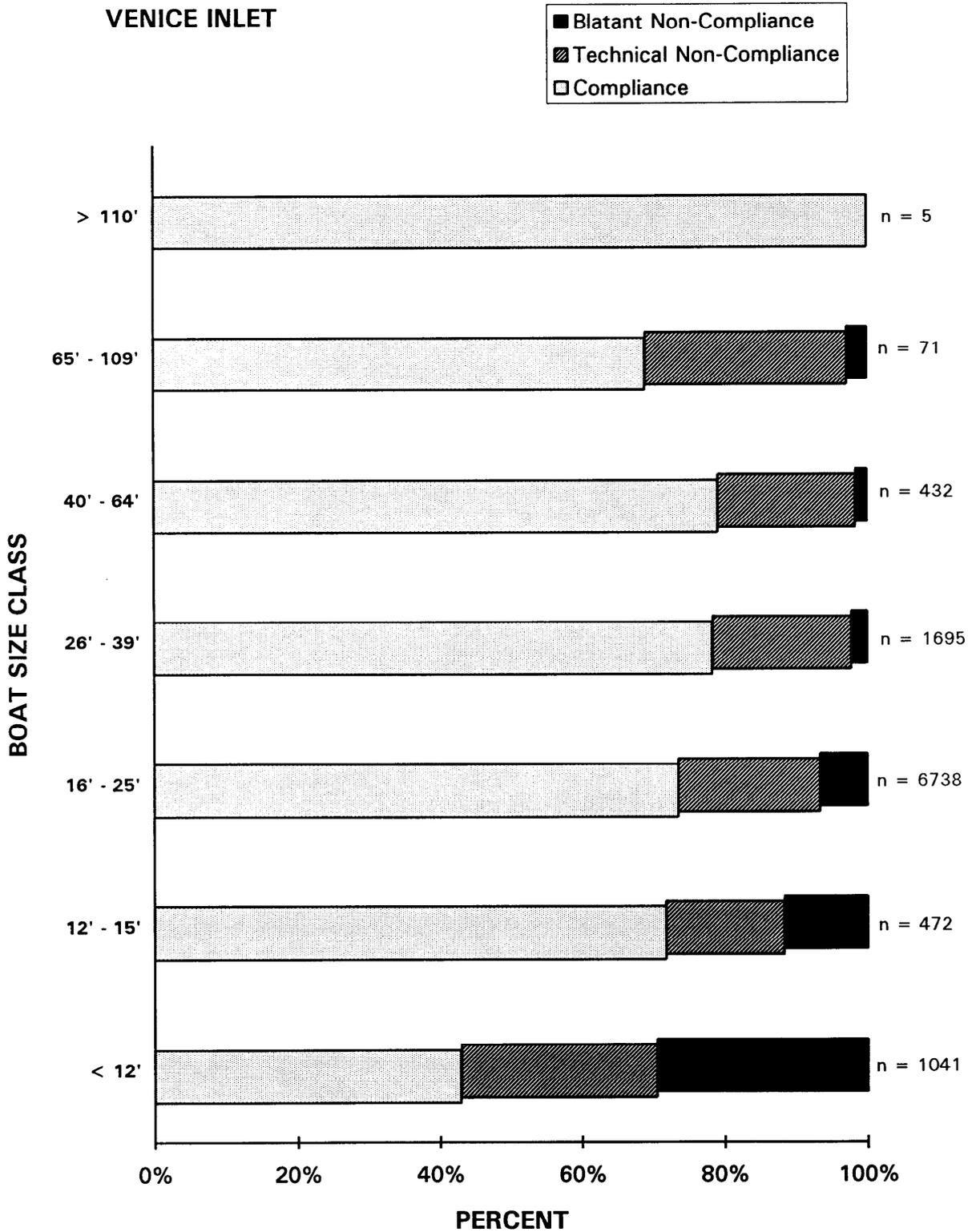
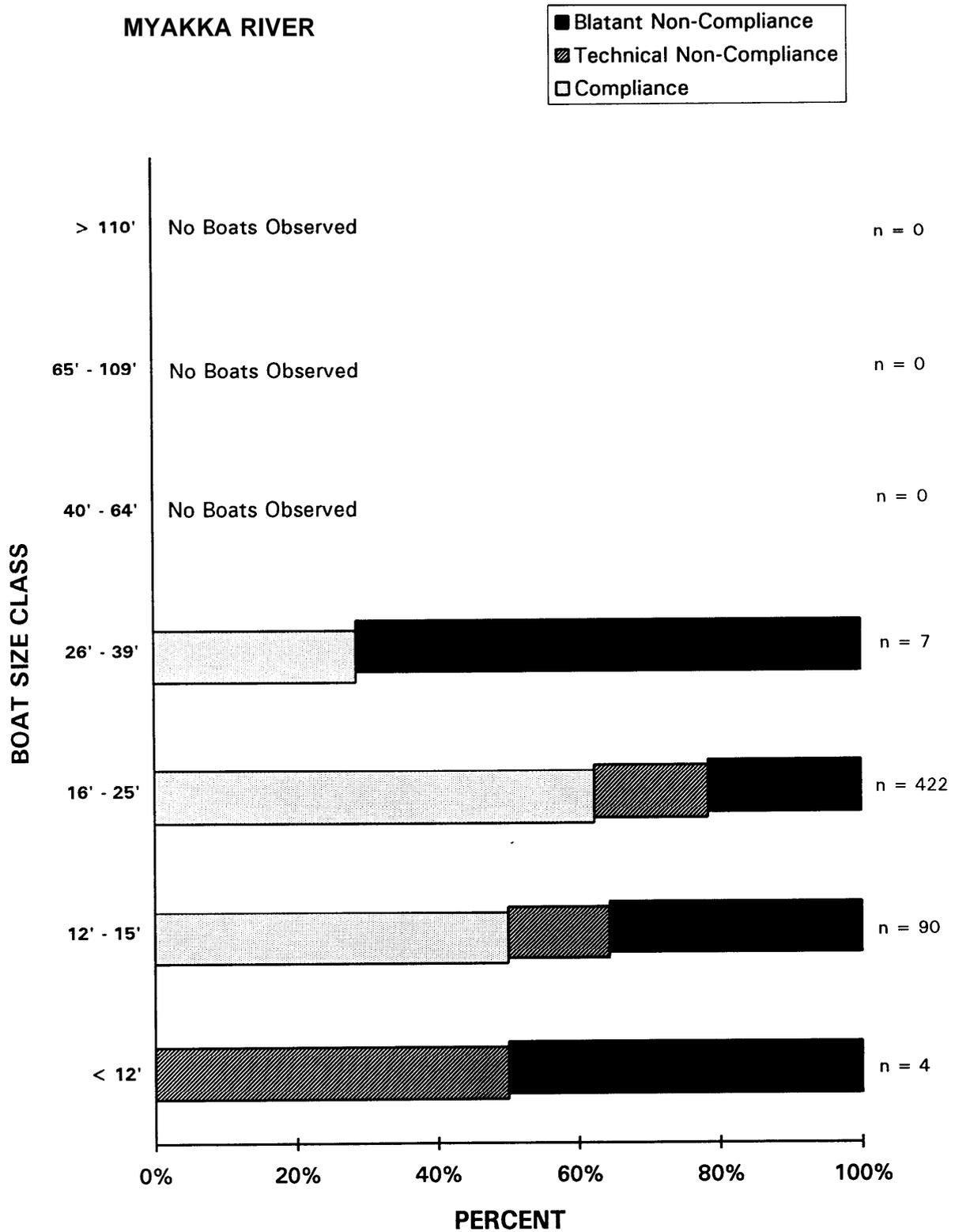


Figure 29. Task 1; Level of compliance by vessel size in the Myakka River.



Analysis of chi-square contingency tables (Appendix B) determined once again that the characteristics which define the contingency table (compliance and vessel size) are significantly related at each of the five study sites ($P < 0.001$ for New Pass, Pansy Bayou, Skiers Island, and Venice Inlet; and $P = 0.018$ for the Myakka River). A high level of significance was also observed for all five sites combined ($P < 0.0001$).

Compliance by Vessel Activity

Travel was the predominant boating activity at three out of the five study sites, and comprised 98% of all vessel activity at New Pass, 99% of all activity at Venice Inlet, and 97% of all activity at the Myakka River (Table 3). The predominant amount of traveling prohibited any meaningful comparison of vessel activity and compliance at these sites. Ski activity was the most common activity at both Pansy Bayou (52%) and Skiers Island (46%), followed by Travel (37% and 45% respectively) and Pleasure (9% and 8% respectively). Other vessel activity categories such as Fishing, Commercial, and Other, were observed in such low numbers overall (less than 1% of the total observations) that they were collectively categorized as Other activity.

Overall compliance by vessel activity for all five study sites combined is shown in Figure 30. Lowest levels of compliance were observed for vessels engaged in pleasure activity, (35% compliance, 3% technical non-compliance, and 62% blatant non-compliance). Travel had the highest level of compliance of the three primary categories (63% compliance, 22% technical non-compliance, and 15% blatant non-compliance). Ski activity was similar to travel activity with regard to overall compliance, however the level of blatant non-compliance associated with ski activity was much higher (36% vs. 15% respectively).

Levels of compliance by activity at Pansy Bayou and Skiers Island are shown in Figures 31 and 32. At both sites, the lowest levels of compliance were associated with Pleasure activity. In contrast to the data for all five sites combined, however, the levels of compliance associated with travel activity at Skiers Island were lower than the levels of compliance for ski activity (46% vs. 63% respectively). Results were similar for Pansy Bayou. While the levels of overall compliance related to ski and travel activities were similar (51% vs. 46% respectively), the levels of blatant non-compliance associated with travel activity were substantially higher than for ski activity (39% vs 19% respectively) at Pansy Bayou.

The influence of a skier being towed in relationship to boater compliance was also examined. Figure 33 shows the relationship between boater compliance and skier activity. When the skier remained up and skiing during the entire field observation, the level of compliance was lower than when a skier either fell or released from the vessel during a field observation. Similar results were observed at both Skiers Island and Pansy Bayou.

Figure 30. Task 1; Level of boater compliance by activity; all five sites combined.

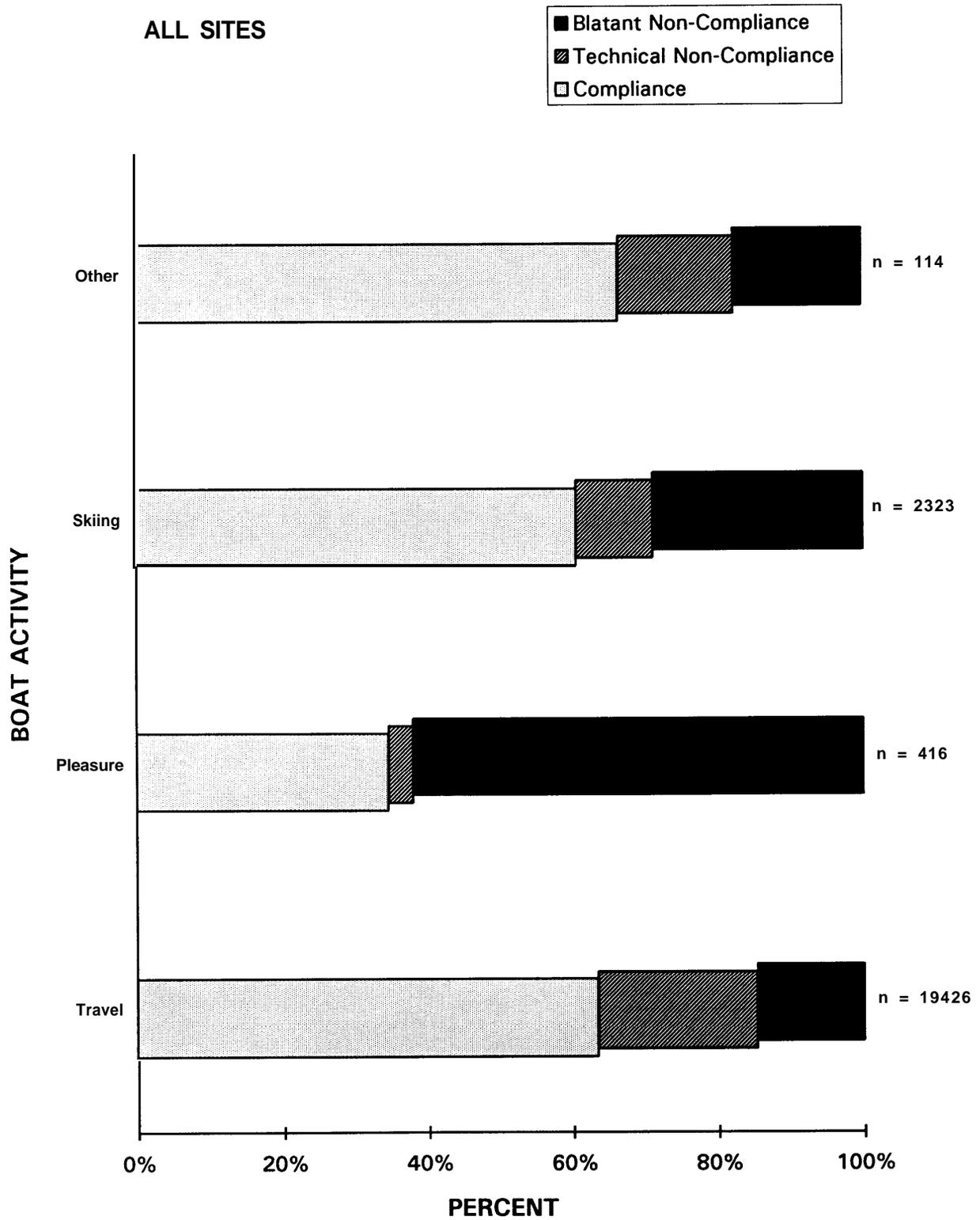


Figure 31. Task 1; Level of boater compliance by activity at Pansy Bayou.

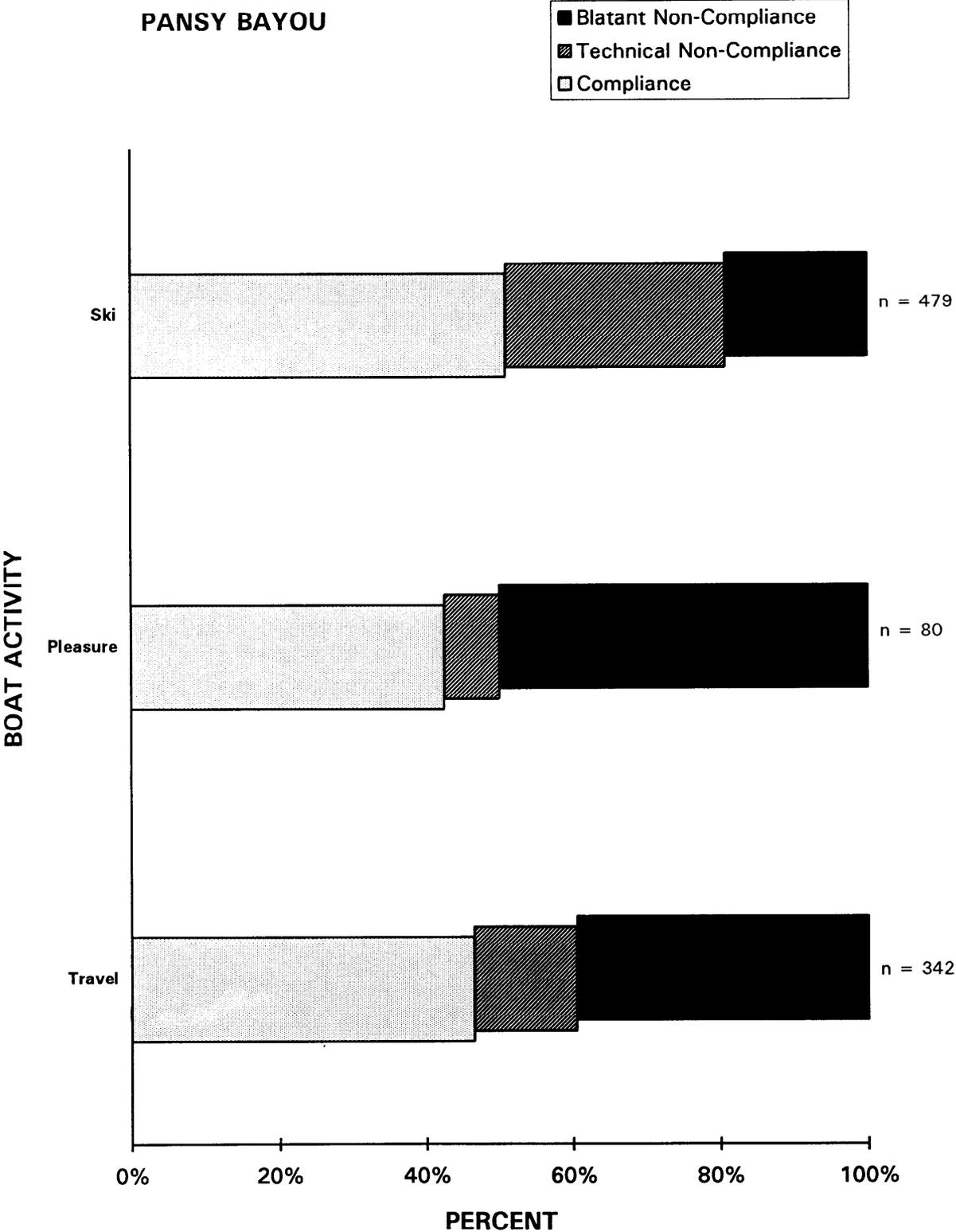


Figure 32. Task 1; Level of boater compliance by activity at Skiers Island.

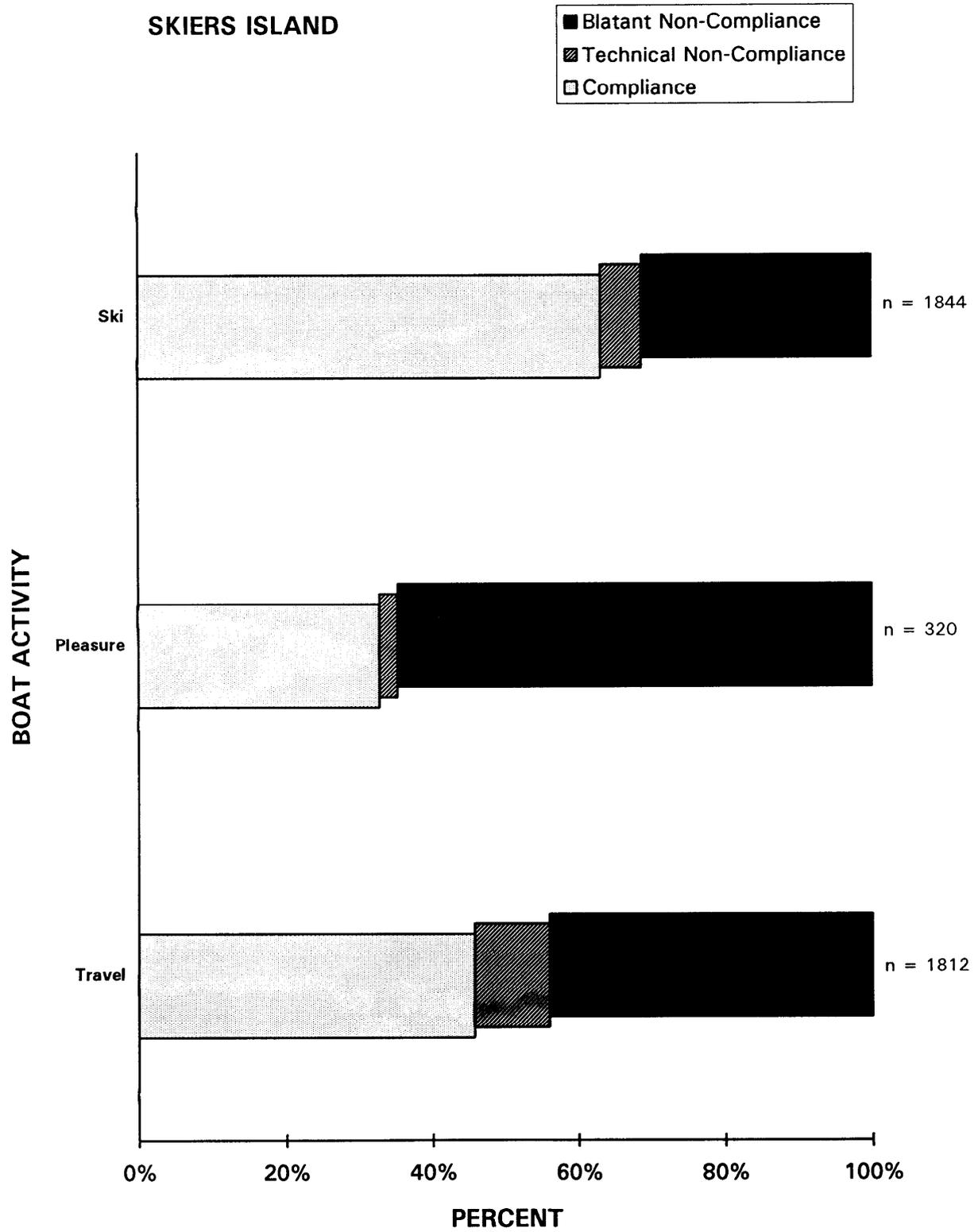
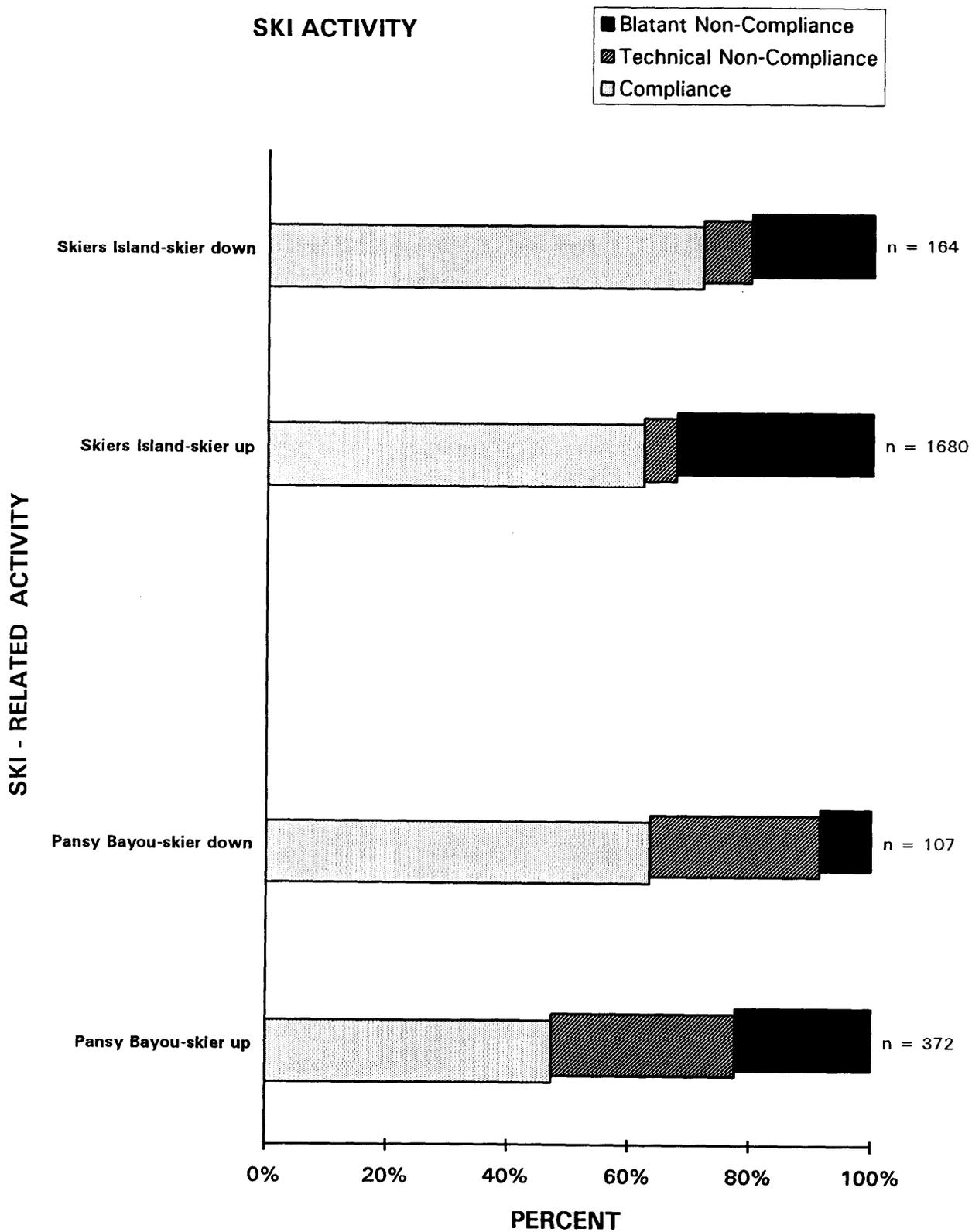


Figure 33. Task 1; Level of compliance related to skier activity at Skiers Island and Pansy Bayou.



Due to the absence of data for different activities at New Pass, Venice Inlet, and the Myakka River, statistical analysis comparing boat activity and compliance was only performed on data from Pansy Bayou and Skiers Island. Chi-square test results indicated that vessel activity and compliance were significantly related at both Skiers Island and Pansy Bayou ($P < 0.001$, Appendix B).

Compliance On Weekends vs. Weekdays

A total of 18,717 vessels (84% of total vessels) were observed on weekends, and 3,607 vessels (16% of total vessels) were observed on weekdays. A summary of boater compliance during weekend and weekday sampling periods for each study site and for all five sites combined is shown in Table 6. Overall the level of compliance was higher on weekends (64% vs. 58%), and the level of blatant non-compliance was higher during weekdays (20% vs. 16%). This trend was also observed at four of the five study sites. Only the Skiers Island Site had a lower level of compliance (52% vs 60%) and a higher level of blatant non-compliance (41% vs. 30%) on weekends.

Boater compliance and weekend/weekday samplings were determined to be significantly related at each site ($P < 0.001$ for New Pass, Pansy Bayou, Skiers Island, and Venice Inlet; $P < 0.002$ for the Myakka River. A high level of significance was also observed for all five sites combined ($P < 0.0001$, Appendix B).

Compliance by Time of Day

A total of 5,442 vessels were observed during the 0900-1300hr time window, 8,869 vessels were observed during the 1100-1500hr time window, and 8,013 vessels were observed during the 1300-1700hr time window. The level of boater compliance during each of the three time windows for each study site and for all five sites combined is summarized in Table 7. Overall, compliance was highest and blatant non-compliance lowest during the 1100-1500hr window. Compliance was lowest and blatant non-compliance was highest during the 1300-1700hr window. While some variation related to time of day was noted between sites, there was little variation related to time of day among sites, with differences in percent compliance, technical non-compliance, and blatant non-compliance among the three time windows varying less than 5% at each site in most instances.

A significant relationship between boater compliance and time of day was observed at 4 of the 5 study sites ($P < 0.001$ for Pansy Bayou, Skiers Island, and Venice Inlet, $P < 0.029$ at New Pass). Compliance and time were not significantly related in the Myakka River (Appendix B). For all sites combined, boater compliance and time were determined to be significantly related ($P < 0.0001$).

Table 6. Task 1; Comparison of weekend vs. weekday boater compliance for each sampling site and for all five sites combined.

Station	Compliance	Technical Non-Compliance	Blatant Non-Compliance
New Pass			
Weekend	3098 (57%)	1571 (29%)	750 (14%)
Weekday	507 (52%)	268 (28%)	191 (20%)
Pansy Bayou			
Weekend	371 (53%)	155 (22%)	180 (25%)
Weekday	83 (39%)	42 (20%)	89 (42%)
Skiers Island			
Weekend	1783 (52%)	235 (7%)	1399 (41%)
Weekday	376 (60%)	64 (10%)	185 (30%)
Venice Inlet			
Weekend	6397 (73%)	1708 (20%)	639 (7%)
Weekday	1072 (63%)	418 (24%)	220 (13%)
Myakka River			
Weekend	268 (63%)	60 (14%)	99 (23%)
Weekday	42 (44%)	23 (24%)	31 (32%)
TOTAL ALL SITES			
Weekend	11917 (64%)	3728 (20%)	3068 (16%)
Weekday	2080 (58%)	814 (23%)	717 (20%)

Table 7. Task 1; Comparison of compliance by time interval for each sampling site and for all five sites combined.

Station	Compliance	Technical Non-Compliance	Blatant Non-Compliance
New Pass			
0900 hrs - 1300 hrs	763 (53%)	430 (30%)	243 (17%)
1100 hrs - 1500 hrs	1330 (57%)	658 (28%)	335 (14%)
1300 hrs - 1700 hrs	1512 (58%)	751 (29%)	363 (14%)
Pansy Bayou			
0900 hrs - 1300 hrs	72 (38%)	54 (29%)	62 (33%)
1100 hrs - 1500 hrs	136 (57%)	53 (22%)	50 (21%)
1300 hrs - 1700 hrs	246 (50%)	90 (18%)	157 (32%)
Skiers Island			
0900 hrs - 1300 hrs	568 (57%)	71 (7%)	356 (36%)
1100 hrs - 1500 hrs	746 (54%)	133 (10%)	505 (36%)
1300 hrs - 1700 hrs	845 (51%)	95 (6%)	723 (43%)
Venice Inlet			
0900 hrs - 1300 hrs	1857 (70%)	588 (22%)	222 (8%)
1100 hrs - 1500 hrs	3490 (73%)	910 (19%)	358 (8%)
1300 hrs - 1700 hrs	2122 (70%)	628 (21%)	279 (9%)
Myakka River			
0900 hrs - 1300 hrs	96 (62%)	21 (13%)	39 (25%)
1100 hrs - 1500 hrs	102 (62%)	24 (15%)	39 (24%)
1300 hrs - 1700 hrs	112 (55%)	38 (19%)	52 (26%)
TOTAL ALL SITES			
0900 hrs - 1300 hrs	3356 (62%)	1163 (21%)	923 (17%)
1100 hrs - 1500 hrs	5804 (65%)	1778 (20%)	1287 (15%)
1300 hrs - 1700 hrs	4837 (60%)	1601 (20%)	1575 (20%)

Compliance As Related To Rental vs. Non-Rental Boats

A total of 413 vessels (1.8% of all vessels under Task 1) were identified as rental boats. Highest percentages of identifiable rental boats were observed at Venice Inlet (2.3% of all vessels) and Skiers Island (2.1% of all vessels). Only four rental boats were observed at Pansy Bayou (0.4% of all vessels at that site). No rental boats were identified at the Myakka River Site.

A summary of boater compliance for rental and non-rental boats at each study site and for all five sites combined is shown in Table 8. Overall, the level of compliance was higher and the level of blatant non-compliance was lower for rental boats.

It should be noted that these data evaluate only identifiable rental boats, and it is likely that a substantial number of additional unidentified rental boats exist in this data set. This is particularly true of personal watercraft, which are available for rent at a variety of locations in Sarasota County, but are not readily recognizable from non-rental personal watercraft.

A less significant statistical relationship was observed between rental boats and boater compliance. Although a significant relationship was observed overall ($P = 0.005$), there was no apparent relationship at either New Pass or Venice Inlet (Appendix B). Neither Pansy Bayou or the Myakka River had an adequate number of vessels to be included in a statistical analysis for this category.

Compliance As Related To Enforcement Activities

A total of 3,248 out of 22,324 vessels under Task 1 were observed in the presence of at least one law enforcement vessel. Law enforcement presence was observed most often at New Pass (12.2% of total observation time) and Venice Inlet (11.9% of total observation time). Enforcement was observed much less often at Skiers Island (0.7% of total observation time) and the Myakka River (0.3% of total observation time). Although they are known to patrol the area on occasion and respond to reports of violators entering the No Entry Zone within Pansy Bayou, no enforcement vessels were observed at the Pansy Bayou site during the study (Table 9).

A summary of boater compliance in the presence and absence of law enforcement is shown in Table 10. Level of compliance was observed to be higher (74% vs. 61%) and the level of blatant non-compliance lower (8% vs. 18%) in the presence of enforcement vessels. Skiers Island was the only individual site that did not follow this pattern; however, this is probably not a meaningful trend due to the relatively small percentage of time that enforcement vessels were observed at Skiers Island.

Of the four primary field parameters evaluated (time of day, weekday vs. weekend, rental vs. non-rental boats, presence vs. absence of enforcement), the highest level of boater compliance (74%) and the lowest level of blatant non-compliance (8%) were both observed in the presence of law enforcement vessels.

Table 8. Task 1; Comparison of rental vs. non-rental boat compliance for each sampling site, and for all five sites combined.

Station	Compliance	Technical Non-Compliance	Blatant Non-Compliance
New Pass			
Rental	36 (46%)	31 (40%)	11 (14%)
Non-Rental	3569 (57%)	1808 (29%)	930 (15%)
Pansy Bayou			
Rental	4 (100%)	0 (0%)	0 (0%)
Non-Rental	450 (49%)	197 (22%)	269 (29%)
Skiers Island			
Rental	63 (72%)	6 (7%)	19 (22%)
Non-Rental	2096 (53%)	293 (7%)	1565 (40%)
Venice Inlet			
Rental	185 (76%)	39 (16%)	19 (8%)
Non-Rental	7284 (71%)	2087 (20%)	840 (8%)
Myakka River			
Rental	0 (0%)	0 (0%)	0 (0%)
Non-Rental	310 (59%)	83 (16%)	130 (25%)
TOTAL ALL SITES			
Rental	288 (70%)	76 (18%)	49 (12%)
Non-Rental	13709 (63%)	4466 (20%)	3736 (17%)

Table 9. Observed law enforcement presence at each sampling site under Tasks 1,3 and 4.

SITE	TOTAL SURVEY TIME	TOTAL TIME ENFORCEMENT PRESENT	PERCENT TIME ENFORCEMENT PRESENT
<u>TASK 1, SITE TASK</u>			
NEW PASS	144 HOURS	17 HOURS, 35 MINUTES	12.20%
PANSY BAYOU	144 HOURS	0 HOURS, 0 MINUTES	0.00%
SKIERS ISLAND	143 HOURS*	0 HOURS, 58 MINUTES	0.68%
VENICE INLET	144 HOURS	17 HOURS, 9 MINUTES	11.91%
MYAKKA RIVER	144 HOURS	0 HOURS, 26 MINUTES	0.30%
<u>TASK 3, RADAR TASK</u>			
RA1	35 HOURS*	0 HOURS, 50 MINUTES	2.38%
RA2	36 HOURS	0 HOURS, 40 MINUTES	1.85%
RA3	36 HOURS	0 HOURS, 77 MINUTES	3.56%
RA4	36 HOURS	0 HOURS, 62 MINUTES	2.87%
<u>TASK 4,24-HOUR TASK</u>			
0000-0359 hrs	48 HOURS	0 HOURS, 0 MINUTES	0.00%
0400-0759 hrs	48 HOURS	0 HOURS, 0 MINUTES	0.00%
0800-1159 hrs	48 HOURS	1 HOUR, 17 MINUTES	2.67%
1200-1559 hrs	48 HOURS	2 HOURS, 38 MINUTES	5.49%
1600-1959 hrs	48 HOURS	0 HOURS, 50 MINUTES	1.74%
2000-2359 hrs	48 HOURS	0 HOURS, 0 MINUTES	0.00%

* - One survey was abbreviated due to severe weather conditions

Table 10. Task 1; Comparison of boater compliance in the presence and absence of law enforcement at each sampling site, and for all five sites combined.

Station	Compliance	Technical Non-Compliance	Blatant Non-Compliance
New Pass			
Enforcement Present	590 (60%)	257 (26%)	135 (14%)
No Enforcement Present	3015 (56%)	1582 (29%)	806 (15%)
Pansy Bayou			
Enforcement Present	0 (0%)	0 (0%)	0 (0%)
No Enforcement Present	454 (49%)	197 (21%)	269 (29%)
Skiers Island			
Enforcement Present	31 (48%)	5 (8%)	29 (45%)
No Enforcement Present	2128 (54%)	294 (7%)	1555 (39%)
Venice Inlet			
Enforcement Present	1778 (81%)	317 (14%)	98 (4%)
No Enforcement Present	5691 (69%)	1809 (22%)	761 (9%)
Myakka River			
Enforcement Present	8 (100%)	0 (0%)	0 (0%)
No Enforcement Present	302 (59%)	83 (16%)	130 (25%)
TOTAL ALL SITES			
Enforcement Present	2407 (74%)	579 (18%)	262 (8%)
No Enforcement Present	11590 (61%)	3963 (21%)	3523 (18%)

Pansy Bayou and the Myakka River could not be tested statistically due to a lack of sufficient observations. For the three remaining sites, presence of enforcement and compliance were determined to be significantly related ($P < 0.0001$) although a significant relationship was not observed at Skiers Island, and a lower level of significance was calculated at New Pass ($P < 0.04$). A highly significant relationship between compliance and enforcement was observed at Venice Inlet ($P < 0.001$).

Compliance As Related To Direction Of Travel

The level of compliance as related to origin and destination of travel was also evaluated at each of the five study sites. In general, these data demonstrated a high level of variation in compliance depending on the direction of travel of a vessel at a given site. Results for each site are as follows:

New Pass

A total of 33 possible origin/destination combinations were observed at New Pass. Of these, the 15 most common combinations (minimum of 80 observations) are displayed in Figure 34. The most common patterns of travel in New Pass were vessels transitioning to and from the Gulf of Mexico (**G**) and Sarasota Bay along the southern portion of New Pass (**BS**). The second most common pattern of travel was vessels transitioning to and from the Gulf of Mexico (**G**) and Sarasota Bay along the northern portion of New Pass (**BN**). These origin/destination combinations (**G** to **BS** = 1,502 observations, **BS** to **G** = 1,623 observations, **G** to **BN** = 364 observations, and **BN** to **G** = 332 observations) were the four most common travel patterns at New Pass, and comprised nearly 60% of all observations at the New Pass site.

In general, vessels traveling to and from Sarasota Bay along the northern portion of New Pass (**BN**) had consistently lower levels of compliance and higher levels of blatant non-compliance when compared with other areas at this site. In particular, a noticeably higher level of blatant non-compliance (21%) was observed for vessels traveling either to or from **BN**, when compared with all other travel combinations at New Pass (12%). This can also be seen graphically in Figure 35, which compares the level of compliance for vessels traveling either to or from **BN** with all other origin/destination combinations at New Pass. No noticeable difference in compliance was apparent for vessels traveling to or from **BN**.

Higher levels of compliance in general were observed for vessels originating or terminating from within New Pass at locations **SD** (Salty Dog Restaurant) and **GW** (Gulfwind Marine). Transition **GW** to **G**, for instance, had an 88% level of compliance, and transitions **SD** to **G** and **G** to **SD** both had an 84% level of compliance.

Figure 34. Task 1; Level of compliance by origin/destination at New Pass.

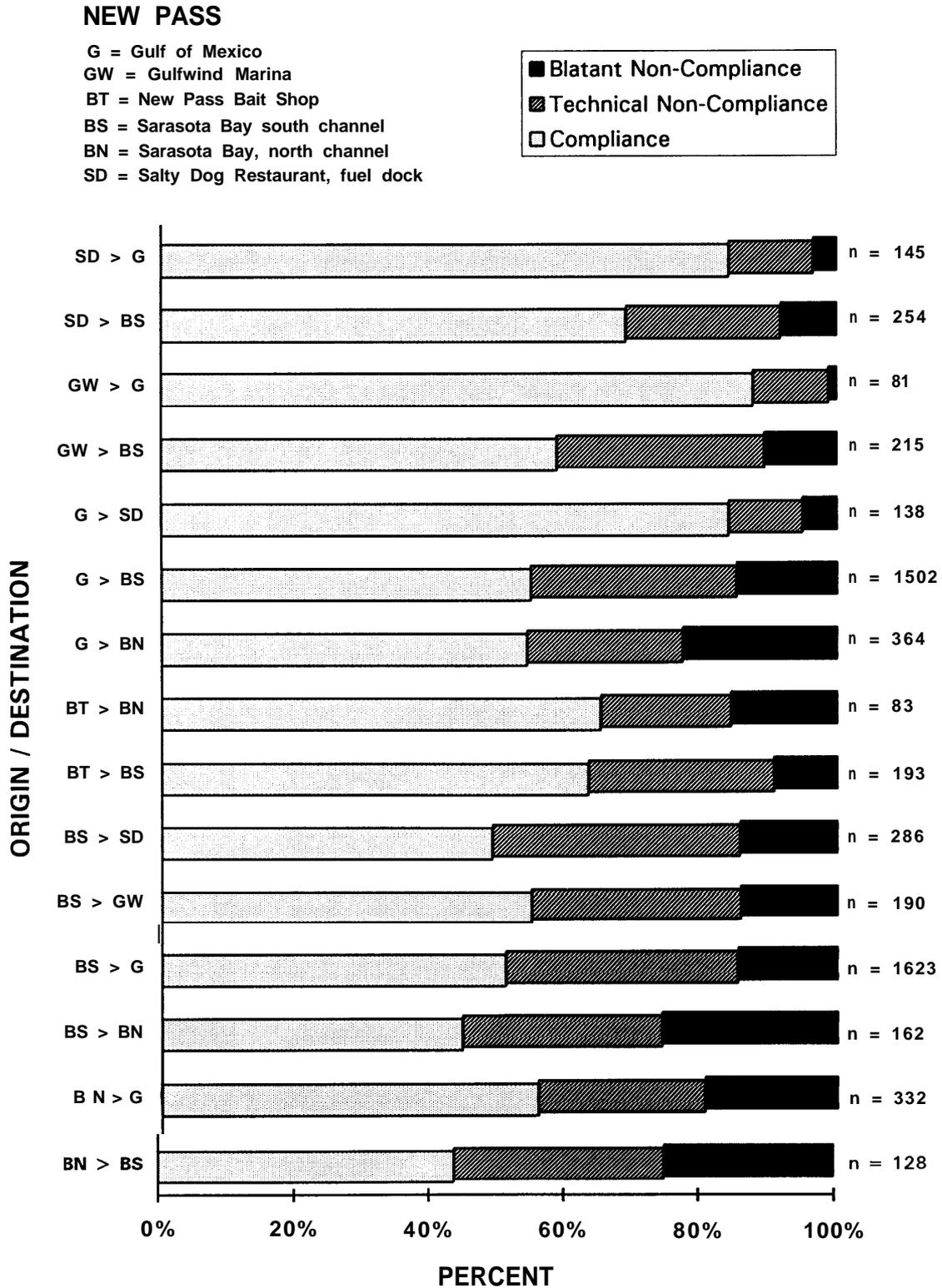
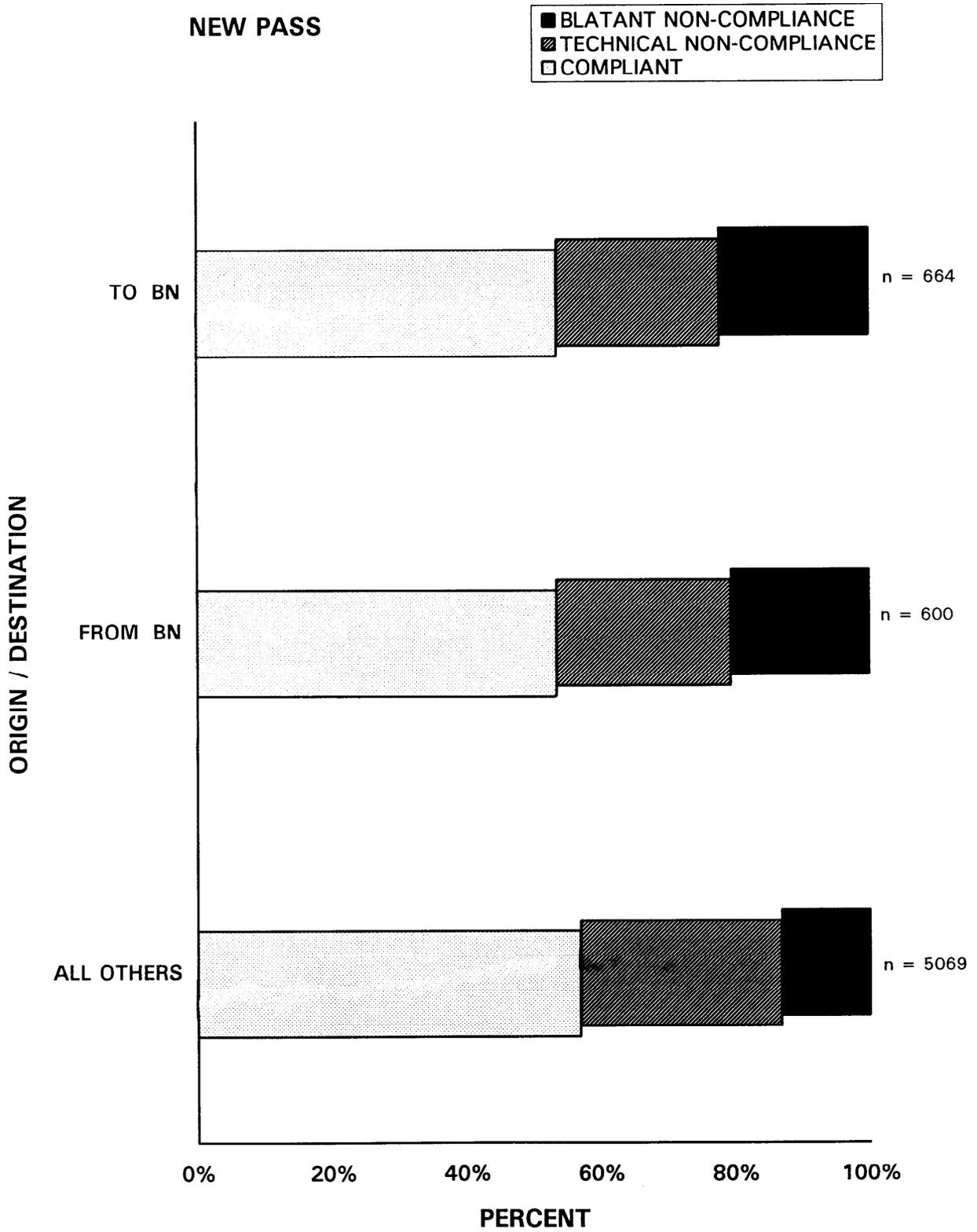


Figure 35. Level of compliance for boats entering and departing from New Pass area BN (Sarasota Bay North) and all other origin/destination areas at New Pass.



Pansy Bayou

A total of 15 possible origin/destination combinations were evaluated at Pansy Bayou, with vessels transitioning back and forth along the posted Water Sports Area (**WS**) comprising the majority of observations (65%) in the area. Vessel traffic to and from the Water Sports Area (**WS** to **WS**) constituted the vast majority of ski activity at this site, while all other combinations comprised the majority of travel and pleasure activity.

Figure 36 displays the level of boater compliance for the eight most common origin/destination combinations at the Pansy Bayou Site. The lowest level of compliance observed was from vessels transitioning over the City Island Grassflats region (**GF**). Vessels observed traveling back and forth across this area were compliant on only 3 of 20 observations (15%), and blatantly non-compliant during 17 of 20 observations (85%). Vessels observed transitioning to and from the Water Sports Area and the City Island Grassflats were also compliant during only 3 of 20 observations (15%), and blatantly non-compliant during 15 of 20 observations (75%). In contrast, greater than 60% compliance was observed for vessels transitioning to and from St Armands Key (**ST**) and Pansy Bayou (**PB**).

A 53% level of compliance was observed for vessels transitioning back and forth within the Water Sports Area (**WS** to **WS**). Lower levels of compliance and higher levels of non-compliance were observed for vessels entering and exiting the Water Sports Area. Transition **WS** to **ST**, for instance, had a 44% compliance level, and transition **ST** to **WS** had a 40% compliance level. Transition **WS** to **GF**, as previously mentioned, only had a 15% compliance level. Overall, a high degree of variability related to travel patterns and compliance were observed at this site.

Skiers Island

Vessels were observed transitioning through a total of 25 origin/destination combinations at the Skiers Island site, with more than 100 observations for 13 different combinations (Figure 37). Like Pansy Bayou, a high level of variability in boater compliance was observed in different areas. The most common transition was between the northern and southern portions of the Water Sports Area (**WSN** to **WSS**), with 921 observations. This transition, which was primarily related to ski activity, was among the highest in boater compliance (84%). Other transitions within the Water Sports Area, such as **WSN** back to **WSN** and **WSS** to **WSN**, were also relatively high in compliance (77% and 89%, respectively). As was the case with Pansy Bayou, a marked decrease in compliance occurred for vessels transitioning to and from the Water Sports Area and adjacent areas. Vessels transitioning from the Water Sports Area to the north (**N**) and south (**S**) were compliant less than 20% of the time, and blatantly non-compliant more than 75% of the time. Consistently low levels of compliance were also observed for vessels originating and terminating from the Siesta Key Grand Canal (**GC**). Overall, less than 50% of vessels observed traveling to or from **GC** were compliant, and more than 40% were blatantly non-compliant. A

Figure 36. Task 1; Level of compliance by origin/destination at the Pansy Bayou Site.

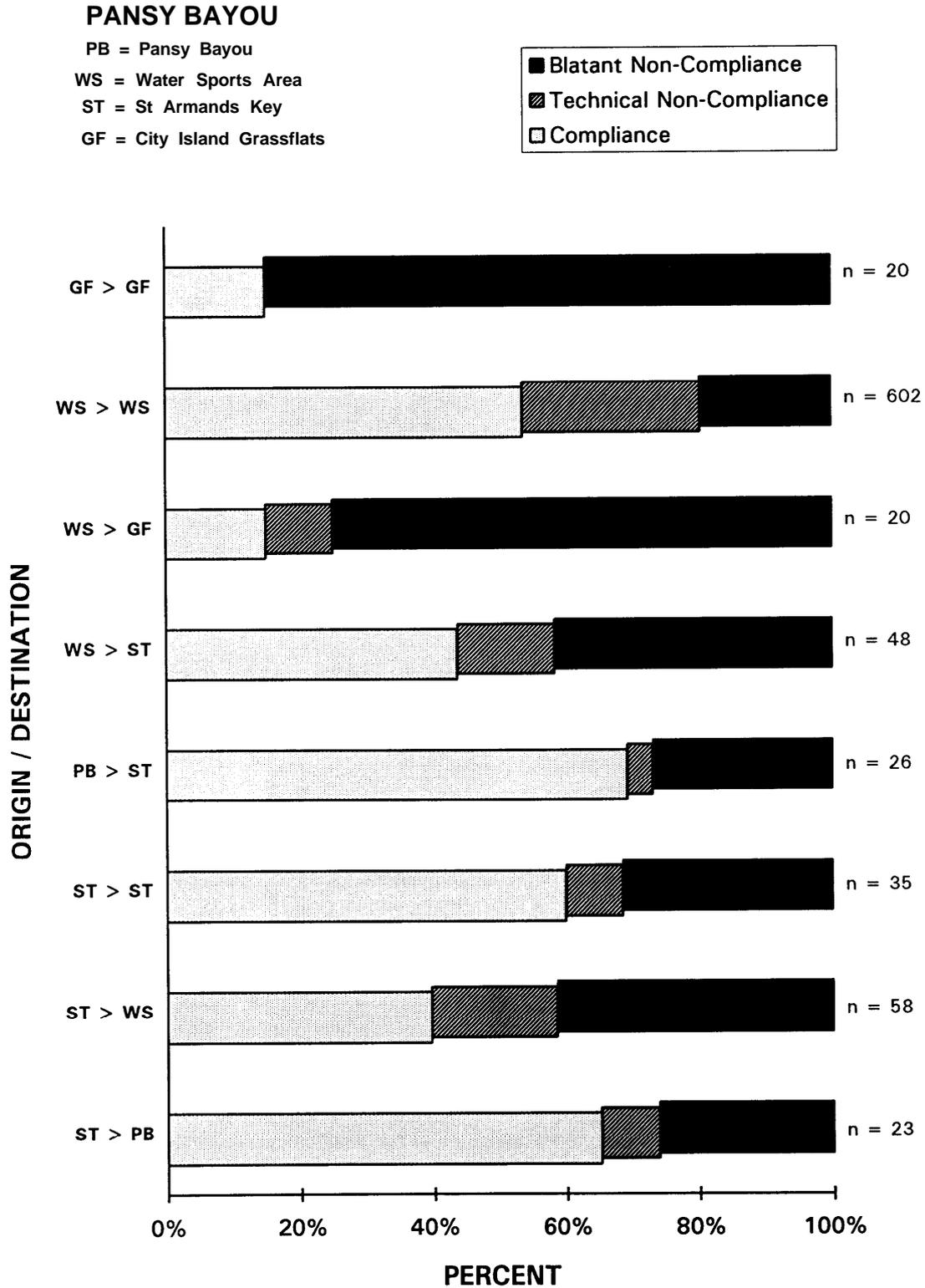
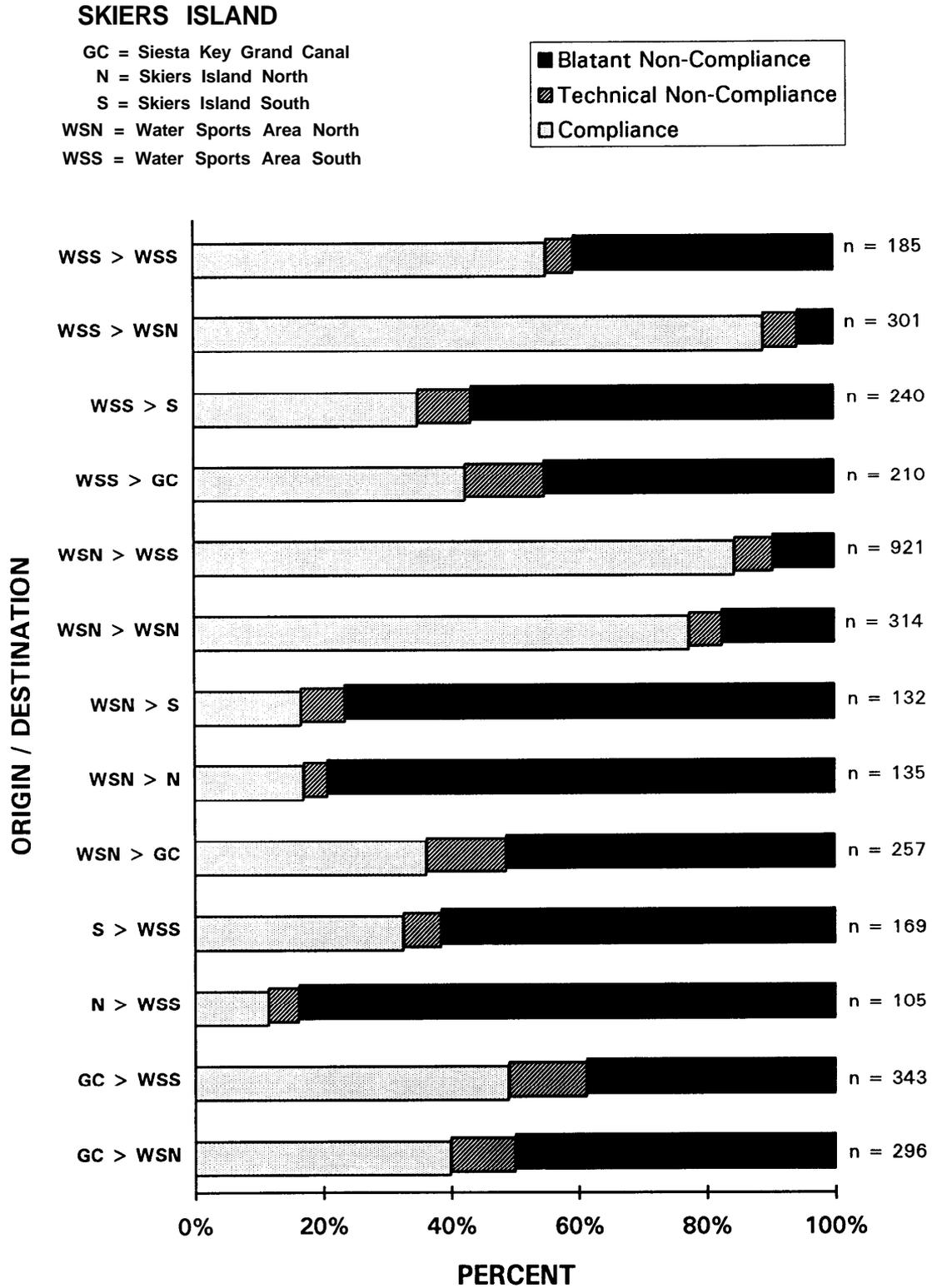


Figure 37. Task 1; Level of compliance by origin/destination at Skiers Island.



comparison of boater compliance for vessels transitioning within the Water Sports Area, and vessels transitioning to and from the Water Sports Area and adjacent areas at the Skiers island Site is shown in Figure 38.

Myakka River

Although eight possible origin/destination combinations were observed at the Myakka River only two combinations, Upstream (**U**) to and from Downstream (**D**), were observed more than ten times and accounted for more than 93% of the total number of observations. Level of compliance for these two combinations is displayed in Figure 39. These data indicate that the level of compliance in the Myakka River is essentially the same for both directions of travel in the vicinity of the observation site (60% compliance, 25% blatant non-compliance for vessels traveling upstream, and 59% compliance, 24% blatant non-compliance for vessels traveling downstream).

Venice Inlet

A total of 16 different origin/destination combinations were evaluated at Venice Inlet, with six combinations comprising more than 93 percent of all observations. These six primary transitions are displayed in Figure 40, and include transitions to and from the three primary bodies of water; Lyons Bay (**LB**), Dona Bay (**DB**) and the Gulf of Mexico (**G**). Unlike the previous study sites, compliance through the various transitional areas at Venice Inlet was relatively consistent, with greater than 60% compliance and less than 20% blatant non-compliance observed in all areas. The level of blatant non-compliance to and from Lyons Bay and the Gulf of Mexico, however, was somewhat higher than through other areas, with nearly twice the percentage of vessels on plane than were observed in other portions of the inlet.

A summary table of compliance by origin/destination combinations with more than 50 observations is shown in Table 11. The nine transitions with the lowest levels of compliance were all at the Skiers Island Site, and primarily included movement in and out of the Water Sports Area into the adjacent Slow Speed Zone.

Not surprisingly, a highly significant relationship between vessel compliance and direction of travel was observed at four of the five study sites ($P < 0.0001$ for New Pass, Pansy Bayou, Skiers Island, and Venice Inlet). As expected, no significant relationship was observed between compliance and direction of travel in the Myakka River (Appendix B).

Figure 38. Level of compliance for boats transitioning to and from the Skiers Island Water Sports Area and adjacent areas, compared with boat activity within the Skiers Island Water Sports Area.

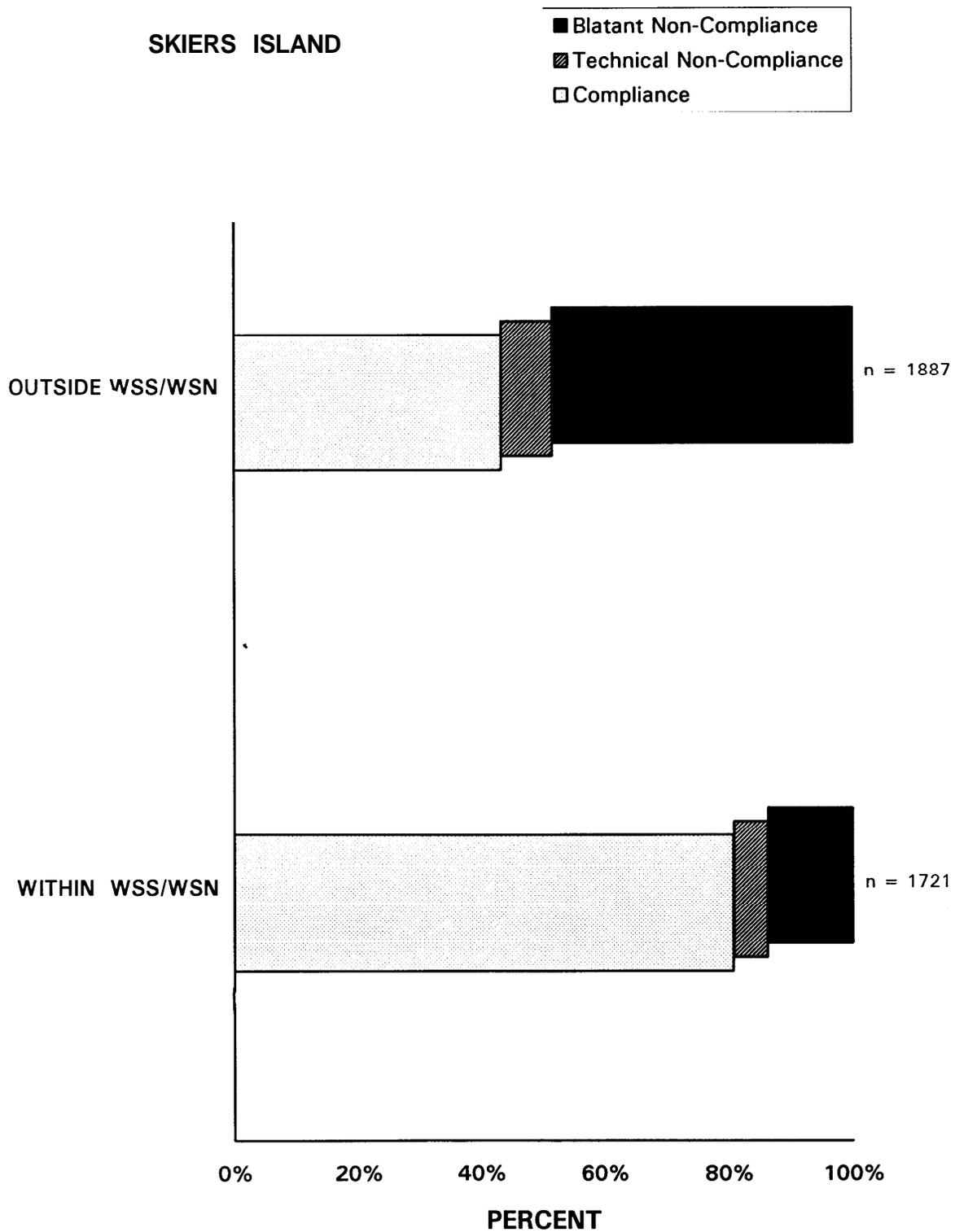


Figure 39. Task 1; Level of compliance by origin/destination in the Myakka River.

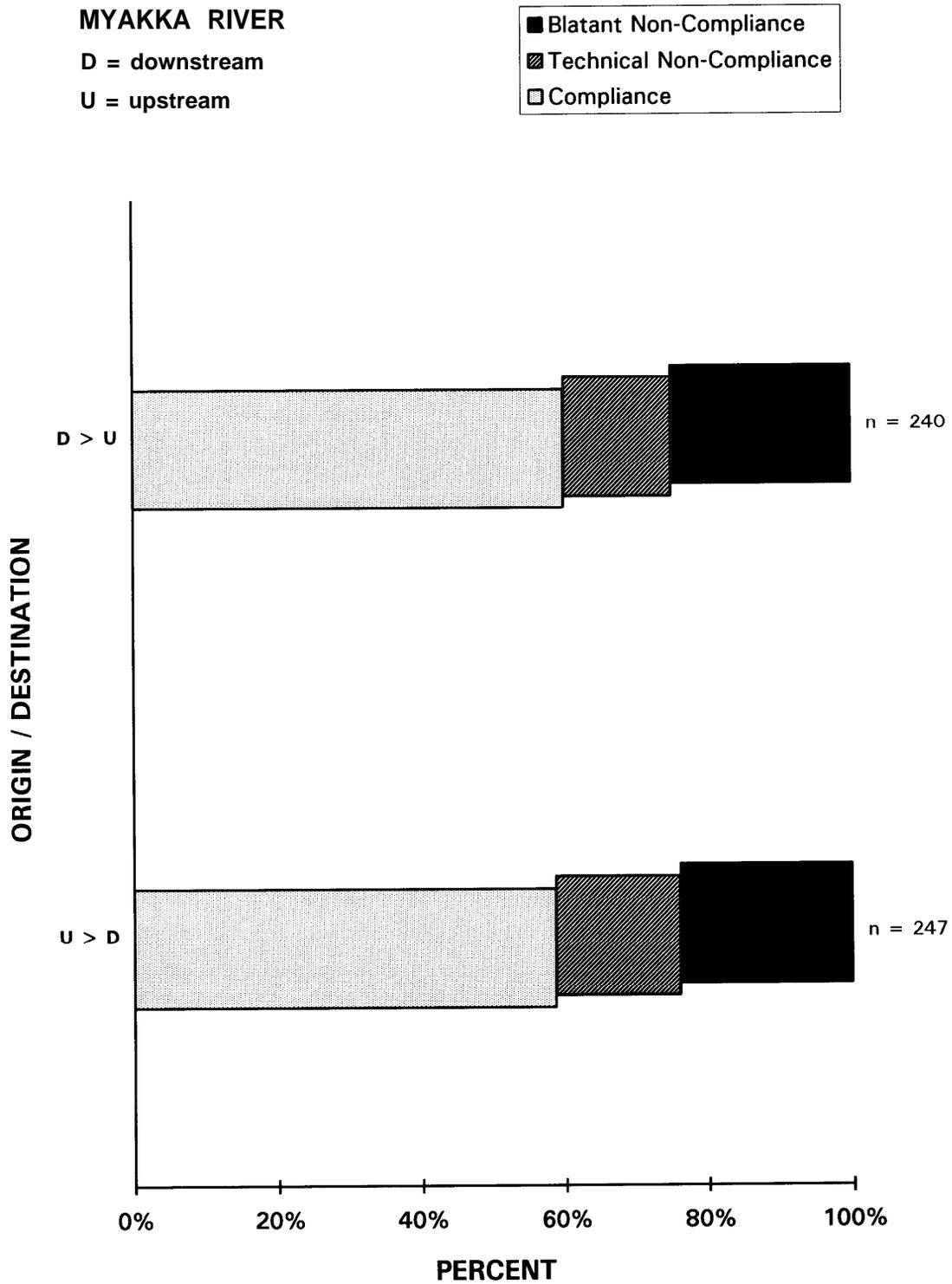


Figure 40. Task 1; Level of compliance by origin/destination at Venice Inlet.

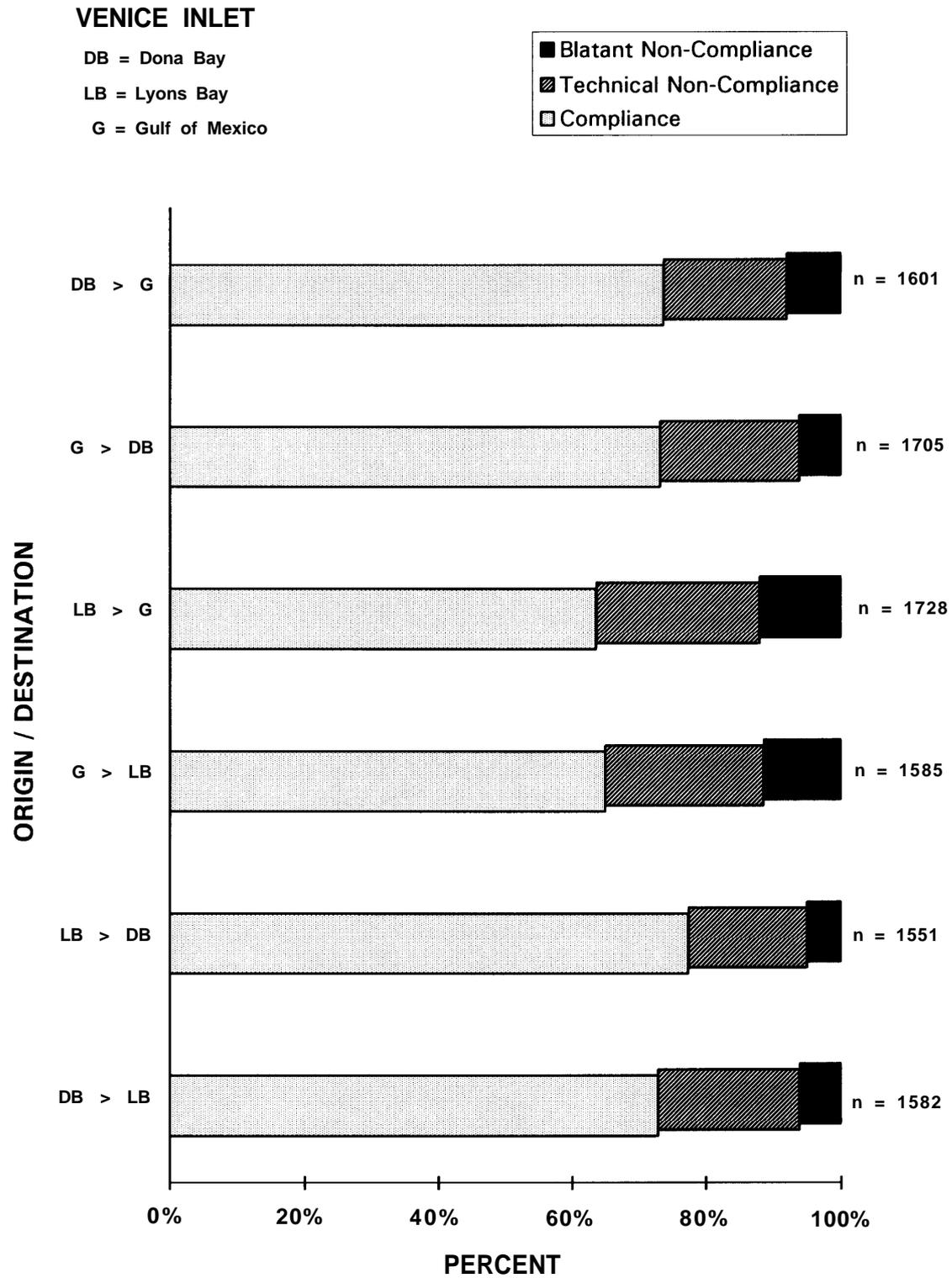


Table 11. Level of compliance for all origin/destination combinations with more than 50 observations.

LOCATION	ORIGIN	DESTINATION	COMPLIANT	NON-COMPLIANT	TOTAL OBSERVATIONS	PERCENT COMPLIANCE
SK	N	N	1	51	52	1.92
SK	WSS	N	6	56	62	9.68
SK	N	WSN	7	59	66	10.61
SK	N	WSS	12	93	105	11.43
SK	S	WSN	9	51	60	15.00
SK	WSN	S	21	108	129	16.28
SK	WSN	N	23	112	135	17.04
SK	S	WSS	54	112	166	32.53
SK	WSS	S	82	148	230	35.65
VI	G	G	26	46	72	36.11
SK	WSN	GC	93	164	257	36.19
SK	GC	WSN	115	178	293	39.25
PB	ST	WS	23	35	58	39.66
SK	WSS	GC	89	121	210	42.38
NP	BN	BS	56	72	128	43.75
NP	BS	BN	72	90	162	44.44
SK	GC	WSS	166	175	341	48.68
NP	BS	SD	140	146	286	48.95
NP	BS	G	826	979	1623	50.89
NP	BS	BT	129	114	243	53.09
PB	WS	WS	323	279	602	53.65
NP	BS	BS	46	39	85	54.12
NP	G	BN	197	167	364	54.12
NP	G	BS	821	681	1502	54.66
NP	BS	GW	104	86	190	54.74
SK	WSS	WSS	101	83	184	54.89
NP	BN	G	185	147	332	55.72
NP	GW	BS	126	89	215	58.60
MY	U	D	146	103	249	58.63
MY	D	U	145	97	242	59.92
NP	BT	BS	122	71	193	63.21
NP	BN	BT	43	25	68	63.24
VI	LB	G	1099	629	1728	63.60
VI	G	LB	1029	556	1585	64.92
NP	BT	BN	54	29	83	65.06
NP	SD	BS	175	79	254	68.90
VI	DB	LB	1152	430	1582	72.82
VI	G	DB	1247	458	1705	73.14
VI	DB	G	1179	422	1601	73.64
VI	LB	DB	1200	351	1551	77.37
SK	WSN	WSN	243	71	314	77.39
VI	M	G	57	16	73	78.08
VI	LB	LB	80	17	97	82.47
NP	G	SD	116	22	138	84.06
NP	SD	G	122	23	145	84.14
SK	WSN	WSS	778	143	921	84.47
VI	DB	DB	62	11	73	84.93
NP	GW	G	71	10	81	87.65
SK	WSS	WSN	268	33	301	89.04
NP	G	GW	51	6	57	89.47
VI	G	M	54	3	57	94.74
VI	DB	M	59	3	62	95.16

Evaluation Of Boat-Specific Compliance

Confirmed resightings of the same vessel were observed on 2,154 occasions during Task 1. Resightings of the same vessel were observed at each of the five study sites, with the largest number of resightings overall at New Pass (732). Skiers Island had the largest number of replicate sightings of the same vessel seen more than 5 times (152), and Pansy Bayou and Skiers Island had the largest number of replicate sightings of the same vessel seen more than 10 times (57 and 18, respectively). Skiers Island also had the two largest number of resightings of the same vessel, with one boat observed on 51 different occasions and one boat observed on 82 different occasions (Table 12). Replicate sightings occurred most often on the same day, but were also observed on different days and locations during the study. The large number of vessel resightings at Pansy Bayou and Skiers Island is largely due to multiple observations of vessels engaged in ski activity.

The largest number of verified resightings in situations where vessels were repeatedly non-compliant (i.e., “repeat offenders”) was at Skiers Island, where a repeat vessel was observed to be non-compliant on as many as 65 different occasions (Table 13). Several vessels were non-compliant numerous times at Pansy Bayou as well. Numerous replicate non-compliant observations were also documented at New Pass and Venice Inlet, however, vessels were non-compliant on fewer occasions.

Individual resightings of the same vessel were compiled in order to estimate the overall level of compliance for a given boat. The results, shown in Table 14, demonstrate a high level of dissimilarity from a normal distribution. For the 2,154 vessels observed at least twice, more than 75% were either consistently compliant or consistently non-compliant in replicate observations. Individual resightings were also compiled for the same vessel, transitioning through the same area, at the same study site. A total of 1,031 vessels met this criteria. Results were again suggestive of boater-specific compliance, with a high percentage of vessels either consistently compliant or consistently non-compliant with repeated observations.

Table 12. Task 1; Total number verified repeat sightings of the same vessel at each of the five study sites.

TOTAL REPLICATE SIGHTINGS	NEW PASS	PANSY BAYOU	SKIERS ISLAND	VENICE INLET	MYAKKA RIVER
2	495	66	92	356	110
3	115	19	77	93	6
4	47	22	66	46	3
5	30	6	29	28	0
6	13	9	24	12	1
7	12	4	21	6	0
8	11	6	19	2	0
9	2	3	18	6	0
10	1	3	12	4	0
11	2	3	10	1	0
12	0	2	8	0	0
13	1	4	5	1	0
14	0	4	7	0	0
15	0	2	2	1	0
16	1	2	3	0	0
17	0	1	4	1	0
18	0	1	0	0	0
19	0	0	1	0	0
20	0	0	2	0	0
21	1	0	0	0	0
22	0	0	2	0	0
23	1	0	2	1	0
24	0	0	0	0	0
25	0	0	1	0	0
26	0	0	2	0	0
27	0	0	1	0	0
28	0	0	2	0	0
29	0	0	1	0	0
30	0	0	1	0	0
31	0	0	0	0	0
33	0	0	1	0	0
34	0	0	1	0	0
36	0	0	1	0	0
40	0	0	0	1	0
42	0	0	0	1	0
51	0	0	1	0	0
82	0	0	1	0	0
TOTAL	732	157	417	560	120

Table 13. Task 1; Number of verified non-compliant resightings of the same vessel at each of the five study sites.

REPLICATE NON- COMPLIANT SIGHTINGS	NEW PASS	PANSY BAYOU	SKIERS ISLAND	VENICE INLET	MYAKKA RIVER
2	160	34	165	81	31
3	35	12	39	14	2
4	15	7	29	4	1
5	2	3	29	1	0
6	2	6	15	0	0
7	1	1	12	1	0
8	1	2	6	0	0
9	0	2	9	1	0
10	0	2	1	0	0
11	0	1	0	0	0
12	0	3	1	1	0
13	0	1	0	0	0
14	0	2	3	1	0
15	0	2	2	0	0
16	0	2	1	1	0
17	0	0	1	0	0
18	0	0	1	0	0
19	0	0	1	0	0
20	0	0	0	0	0
21	0	0	1	0	0
22	0	0	0	0	0
23	0	0	1	0	0
24	0	0	0	0	0
25	0	0	1	0	0
26	0	0	1	0	0
27	0	0	1	0	0
28	0	0	1	0	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
33	0	0	0	0	0
34	0	0	0	0	0
36	0	0	0	0	0
40	0	0	0	0	0
42	0	0	0	0	0
51	0	0	0	0	0
65	0	0	1	0	0
TOTAL	216	80	322	105	34

Table 14. Task 1; Percent compliance for resighted vessels at all sites, and for resighted vessels transitioning through the exact same area.

<u>Level Of Compliance for Vessels With Multiple Verified Sightings</u>	<u>Frequency</u>	<u>Percent</u>	
0-10%	416	19%	
11-20%	29	1%	
21-30%	45	2%	
31-40%	88	4%	
41-50%	457	21%	total vessels = 2154
51-60%	26	1%	
61-70%	116	5%	
71-80%	94	4%	
81-90%	49	2%	
91-100%	834	39%	

<u>Level Of Compliance for Vessels With Multiple Verified Sightings Transitioning Through The Same Area</u>	<u>Frequency</u>	<u>Percent</u>	
0-10%	216	21%	
11-20%	20	2%	
21-30%	16	2%	
31-40%	35	3%	
41-50%	179	17%	
51-60%	8	1%	total vessels = 1031
61-70%	47	5%	
71-80%	33	3%	
81-90%	20	2%	
91-100%	457	44%	

Task 2: Evaluation of Boater Compliance Utilizing Manatee Aerial Surveys.

Twice-monthly aerial surveys were conducted in the coastal waters of Sarasota County in order to evaluate the level of compliance in speed-restricted zones. A total of 1,662 observations were made in 25 different zones over 24 survey days (Table 15). Survey zones with the greatest number of boat observations were Lemon Bay (263), Little Sarasota Bay (230), Blackburn Bay (153), Venice Inlet (125), Roberts Bay (103), and the Intracoastal Waterway between Roberts Bay and Little Sarasota Bay (115).

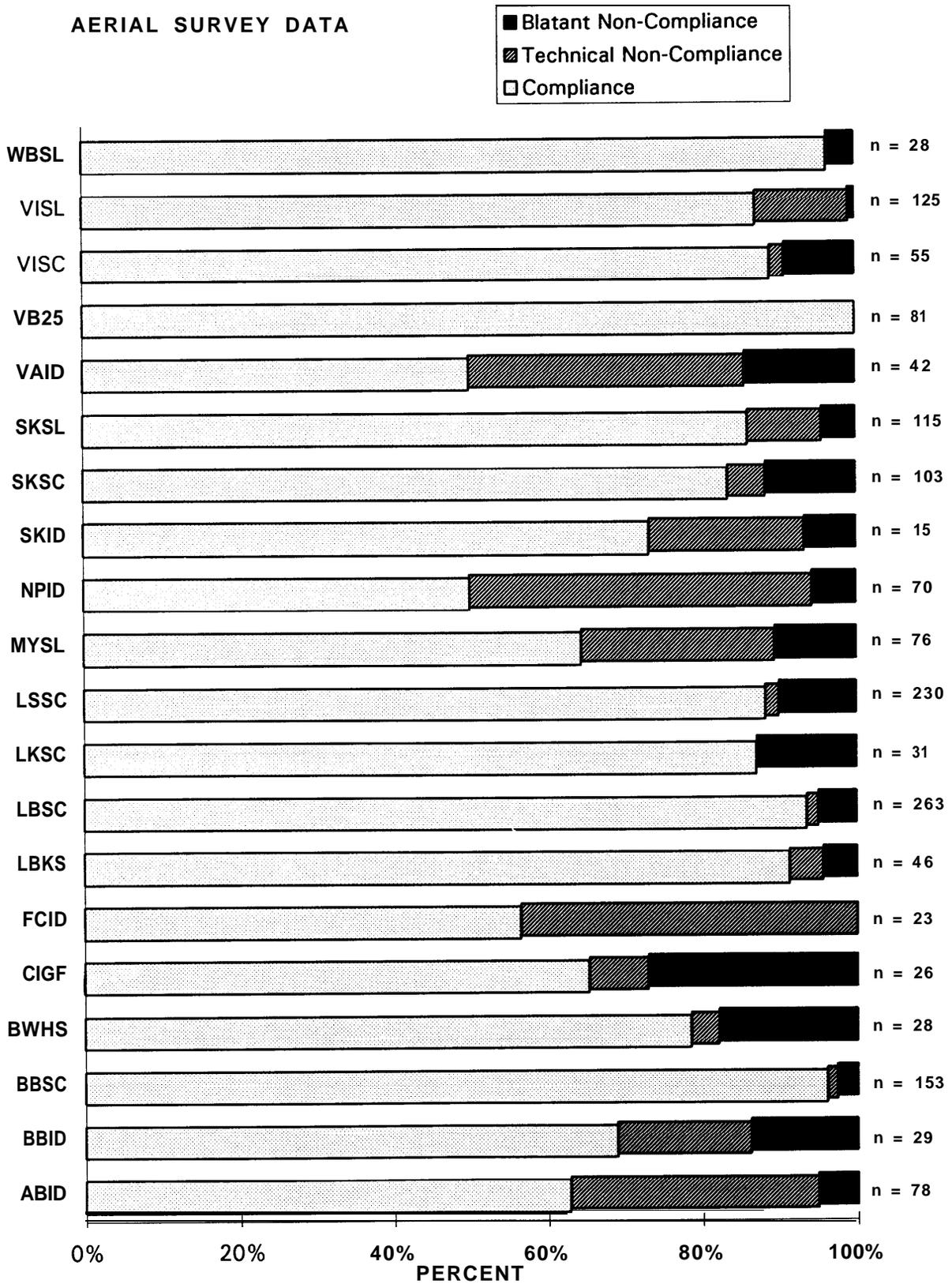
Level of boater compliance for all areas combined was 84%. Level of blatant non-compliance was 7%. At least 10 observations were made at 20 out of 25 aerial survey zones. The level of compliance at each of these 20 zones is shown in Figure 41. A high level of variability in compliance was demonstrated between the various survey zones. Relatively high levels of compliance (greater than 80%) were observed in several zones, including Whittaker Bayou, Venice Inlet, Venice By-Pass channel, Roberts Bay, Little Sarasota Bay, Sarasota Bay (Longboat Key), and Blackburn Bay. Relatively low levels of compliance (less than 60%) were observed at New Pass Inlet, Venice Avenue, and Forked Creek. Highest levels of blatant non-compliance (greater than 10%) were observed at Venice Avenue (14%), Roberts Bay/Skiers Island (12%), Sarasota Bay, Lido Key (13%), City Island Grassflats/Pansy Bayou (27%), Buttonwood Harbor (18%), and the Blackburn Bridge (21%). No clear pattern in compliance with regard to level of restriction (Idle Speed, Slow Speed, Slow Speed Channel Exempt, etc.) was apparent. Areas such as the Venice By-Pass Channel (25 mph speed limit), however, were more difficult to evaluate as non-compliant. As a result, vessels traveling along the ICW within a 25 mph zone were evaluated more conservatively, likely resulting in a higher level of compliance in these areas.

As expected, chi square distribution indicated a significant difference in compliance between survey zones ($P < 0.0001$).

Table 15. Task 2; Level of boater compliance by aerial survey zone.

CODE	LOCATION	SPEED RESTRICTION	COMPLIANCE	TECHNICAL NON-COMPLIANCE	BLATANT NON-COMPLIANCE
ABID	Albee Road Bridge	Idle Speed	49	25	4
BBID	Blackburn Bridge	Idle Speed	20	5	4
BBSC	Blackburn Bay	Slow Speed Channel Exempt	147	2	4
BWHS	Buttonwood Harbor	Slow Speed	22	1	5
CIGF	City Island Grassflats	Slow Speed	17	2	7
FCID	Forked Creek	Idle Speed	13	10	0
HBSL	Hudson Bayou	Slow Speed	10	0	0
HYID	Hyatt Boat Basin	Idle Speed	11	1	0
LBKS	Longboat Key	Slow Speed	42	2	2
LBSC	Lemon Bay	Slow Speed Channel Exempt	246	4	13
LKSC	Lido Key	Slow Speed Channel Exempt	27	0	4
LSSC	Little Sarasota Bay	Slow Speed Channel Exempt	203	4	23
MYSL	Myakka River	Slow Speed	49	19	8
NPID	New Pass	Idle Speed	35	31	4
PCID	Phillipi Creek	Idle Speed	6	4	0
SKID	Stickney Point Bridge	Idle Speed	11	3	1
SKSC	Roberts Bay	Slow Speed Channel Exempt	86	5	12
SKSL	Siesta Key South	Slow Speed	99	11	5
SYSC	Sarasota Yacht Club	Slow Speed	4	1	0
VAID	Venice Avenue	Idle Speed	21	15	6
VB25	Venice By-Pass	25 mph	81	0	0
VISC	Venice Inlet	Slow Speed Channel Exempt	49	1	5
VISL	Venice Inlet	Slow Speed	109	15	1
VMID	Venice Marina	Idle Speed	5	1	2
WBSL	Whittaker Bayou	Slow Speed	27	0	
TOTAL ALL ZONES			1389	162	111

Figure 41. Task 4; Level of boater compliance by survey area.



Task 3: Determination of Boater Compliance in Speed-Restricted vs. Non-Restricted Areas.

A total of 4,881 vessels were targeted during Task #3, with speeds recorded for 2,449 boats at the two unrestricted speed sites (RA1 and RA2), and 2,432 boats at the two 25 mph speed-restricted sites (RA3 and RA4).

Number of vessels targeted by boat type was essentially similar for each of the four radar sites (Table 16). Slightly higher percentages of Yacht/Cruiser vessels were observed at Sites RA1 and RA2, and somewhat higher percentages of Pontoon/Platform type vessels were observed at Sites RA3 and RA4. As with Task 1, the three most common vessel types encountered at each of the four radar sites were Open Fisherman, Ski/Sport/Runabout, and Yacht/Cruiser.

Mean boat speed recorded during this task (all four study sites combined) was 23.40 miles per hour, with a standard deviation of 8.8 miles per hour. Speeds ranged from a low of 5 miles per hour (the lower limit of the speed gun) to a high of 55 miles per hour. Median boat speed was 24 miles per hour.

A comparison of speeds by vessel type and size (all sites combined) is shown in Table 17. Highest mean boat speed (35.54 mph) and highest recorded speed (55 mph) was recorded for Scarab/Cigarette-style vessels. Along with Scarab/Cigarette, speeds greater than or equal to 50 miles per hour were recorded for Personal Watercraft (50 mph), Yacht/Cruiser (53 mph) and Open Fisherman (54 mph). Maximum speed recorded for a Ski/Sport/Runabout was 49 mph. Lowest mean speed (excluding Sailboat and Other) was recorded for Pontoon/Platform-type boats (18.5 mph). Vessels less than 12 feet in length (predominantly Personal Watercraft) had the highest mean boat speed (26.63 mph), while vessels greater than 40 feet in length had mean boat speeds less than 15 mph.

Mean boat speeds were similar among the four radar sites (Table 18). Highest mean boat speeds were recorded at radar site RA3 (23.98 mph). Lowest mean boat speeds were recorded at radar site RA4 (22.98 mph). Mean boat speeds among the four radar sites varied by less than 1 mph.

The distribution of recorded boat speeds in 5 mph increments demonstrated a high level of similarity between sites (Table 19 and Figure 42). At each of the 4 radar sites, the largest percentage of vessels were targeted at speeds between 15 mph and 35 mph (77% at RA1, 77% at RA2, 75% at RA3, and 76% at RA4).

A higher percentage of vessels traveling at speeds in excess of 25 mph were observed at Sites RA3 and RA4 (Figure 43). A total of 38% of all vessels targeted at both RA3 and RA4 were traveling at speeds in excess of 25 mph, compared to 36% and 33% at sites RA1 and RA2 respectively. The highest percentage of vessels traveling at speeds in excess of 35 mph was observed at radar site RA3 (8%). Lowest percentage of vessels traveling at speeds in excess of 35 mph was observed at site RA4 (5%). One-way analysis of variance, comparing boat speeds for all four

Table 16. Task 3; Total vessels, and percent composition by boat type, at at each radar site.

Total Vessels Observed

BOAT TYPE	RA1	RA2	RA3	RA4
Jonboat	8	2	6	10
Open Fisherman	306	342	362	213
Personal Watercraft	31	73	41	47
Pontoon/Platform	18	52	114	97
Scarab/Cigarette	37	45	45	22
Ski/Sport/Runabout	264	375	368	343
Yacht/Cruiser	364	433	395	310
Sailboat	38	30	27	20
Other	6	25	5	7
TOTAL	1072	1377	1363	1069

Percent Composition by Radar Site

BOAT TYPE	RA1	RA2	RA3	RA4
Jonboat	1%	0%	0%	1%
Open Fisherman	29%	25%	27%	20%
Personal Watercraft	3%	5%	3%	4%
Pontoon/Platform	2%	4%	8%	9%
Scarab/Cigarette	3%	3%	3%	2%
Ski/Sport/Runabout	25%	27%	27%	32%
Yacht/Cruiser	34%	31%	29%	29%
Sailboat	4%	2%	2%	2%
Other	1%	2%	0%	1%

Table 17. Task 3; Mean targeted speeds by vessel type and size, all radar sites combined.

RADAR TASK

BOAT SPEEDS (MILES PER HOUR) BY TYPE

TYPE	MIN	MAX	MEAN	SD
Open Fisherman	5	54	25.71	7.5
Ski/Sport/Runabout	5	49	24.23	7.4
Yacht/Cruiser	5	53	21.87	8.4
Pontoon	5	38	18.52	8.6
Personal Watercraft	5	50	26.63	8.3
Scarab/Cigarette	16	55	35.54	7.0
Jonboat	5	27	15.31	6.3
Sailboat	5	10	5.68	1.1
Other	5	32	12.63	7.7

BOAT SPEEDS (MILES PER HOUR) BY SIZE

SIZE	MIN	MAX	MEAN	SD
< 12'	5	50	26.63	8.3
12' - 15'	5	45	21.82	8.5
16' - 25'	5	55	24.15	8.2
26' - 39'	5	53	21.75	9.9
40' - 64'	5	45	14.96	8.0
65' - 109'	5	33	12.41	7.8
> 110'	5	5	5.00	0.0

Table 18. Task 3; Mean boat speeds at each radar station by category.

RADAR TASK

ALL CATEGORIES				
	MEAN	SD		
RA1	23.10	8.8		
RA2	23.40	8.6		
RA3	23.96	9.0		
RA4	22.98	8.6		

WEEKDAY		WEEKEND	
	MEAN	SD	
RA1	22.33	8.8	23.46 8.9
RA2	21.92	9.3	23.89 8.3
RA3	23.48	9.9	24.13 8.7
RA4	20.23	8.7	24.21 8.2

0900 - 1200 HRS		1300 - 1600 HRS	
	MEAN	SD	
RA1	22.72	9.0	23.38 8.7
RA2	22.93	8.5	23.72 8.7
RA3	23.46	9.1	24.24 9.0
RA4	22.22	9.0	23.35 8.4

ENFORCEMENT		NO ENFORCEMENT	
	MEAN	SD	
RA1	26.05	9.1	22.98 8.8
RA2	26.69	8.6	23.25 8.6
RA3	22.83	8.3	24.04 9.1
RA4	22.42	7.8	23.01 8.6

Table 19. Task 3; Number and percentage of boats targeted at each radar station in 5 mph increments.

Total Number Of Boats Targeted At Each Radar Site

RADAR STATION	0 - 5 mph	6 - 10 mph	11 - 15 mph	16 - 20 mph	21 - 25 mph	26 - 30 mph	31 - 35 mph	36 - 40 mph	41 - 45 mph	46 - 50 mph	> 50 mph	TOTAL
RA1	44	89	54	182	255	259	125	40	16	7	1	1072
RA2	45	97	83	224	371	301	159	66	20	8	3	1377
RA3	43	104	83	180	323	346	175	69	25	12	3	1363
RA4	34	94	81	152	246	288	123	33	12	5	1	1069

Percentage of Total Boats Targeted At Each Radar Site

RADAR STATION	0 - 5 mph	6 - 10 mph	11 - 15 mph	16 - 20 mph	21 - 25 mph	26 - 30 mph	31 - 35 mph	36 - 40 mph	41 - 45 mph	46 - 50 mph	> 50 mph	TOTAL
RA1	4	8	5	17	24	24	12	4	1	1	0	100
RA2	3	7	6	16	27	22	12	5	1	1	0	100
RA3	3	8	6	13	24	25	13	5	2	1	0	100
RA4	3	9	8	14	23	27	12	3	1	0	0	100

Figure 42. Task 3; Number of boats targeted at each radar station in 5 mph increments.

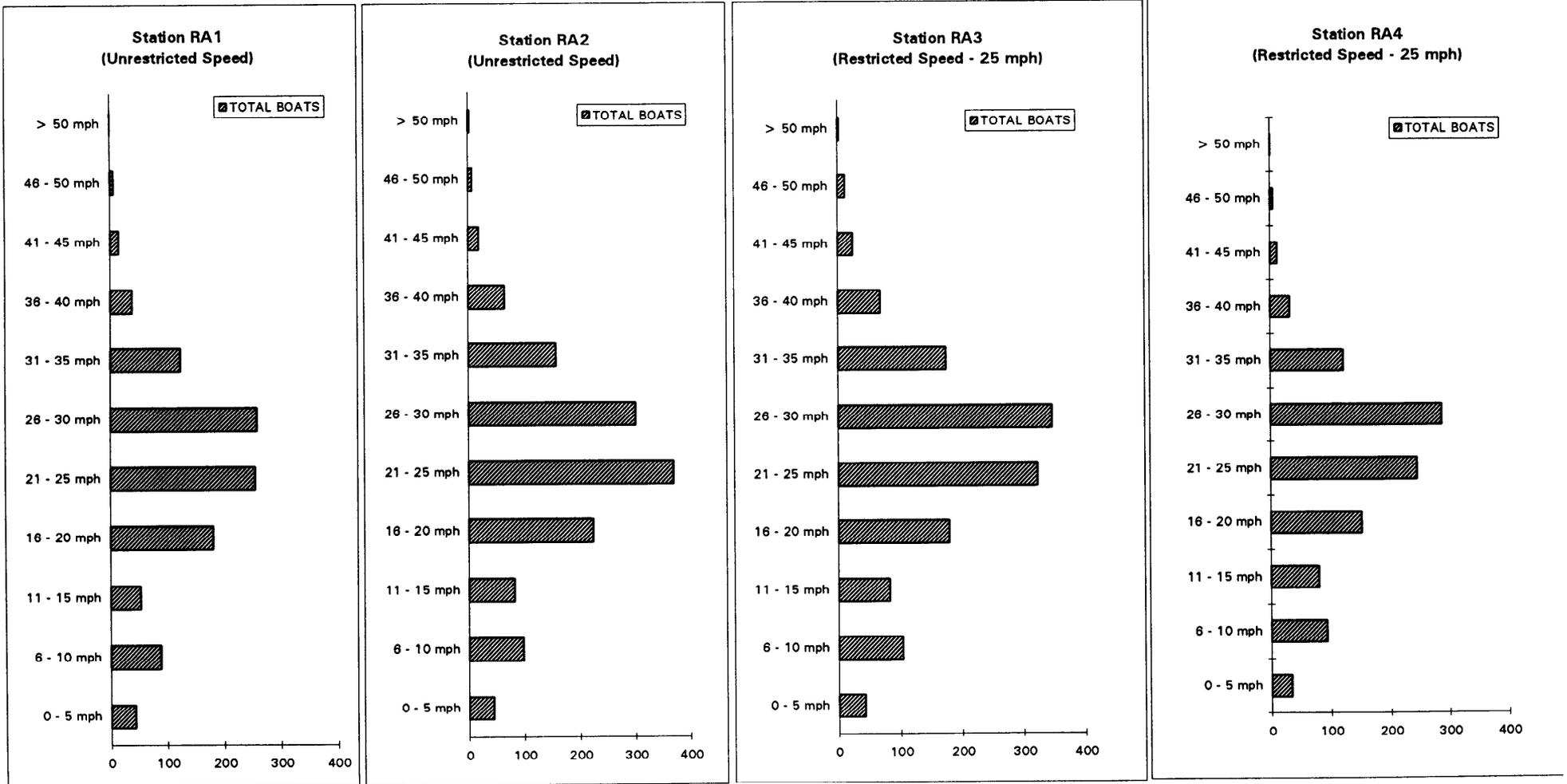
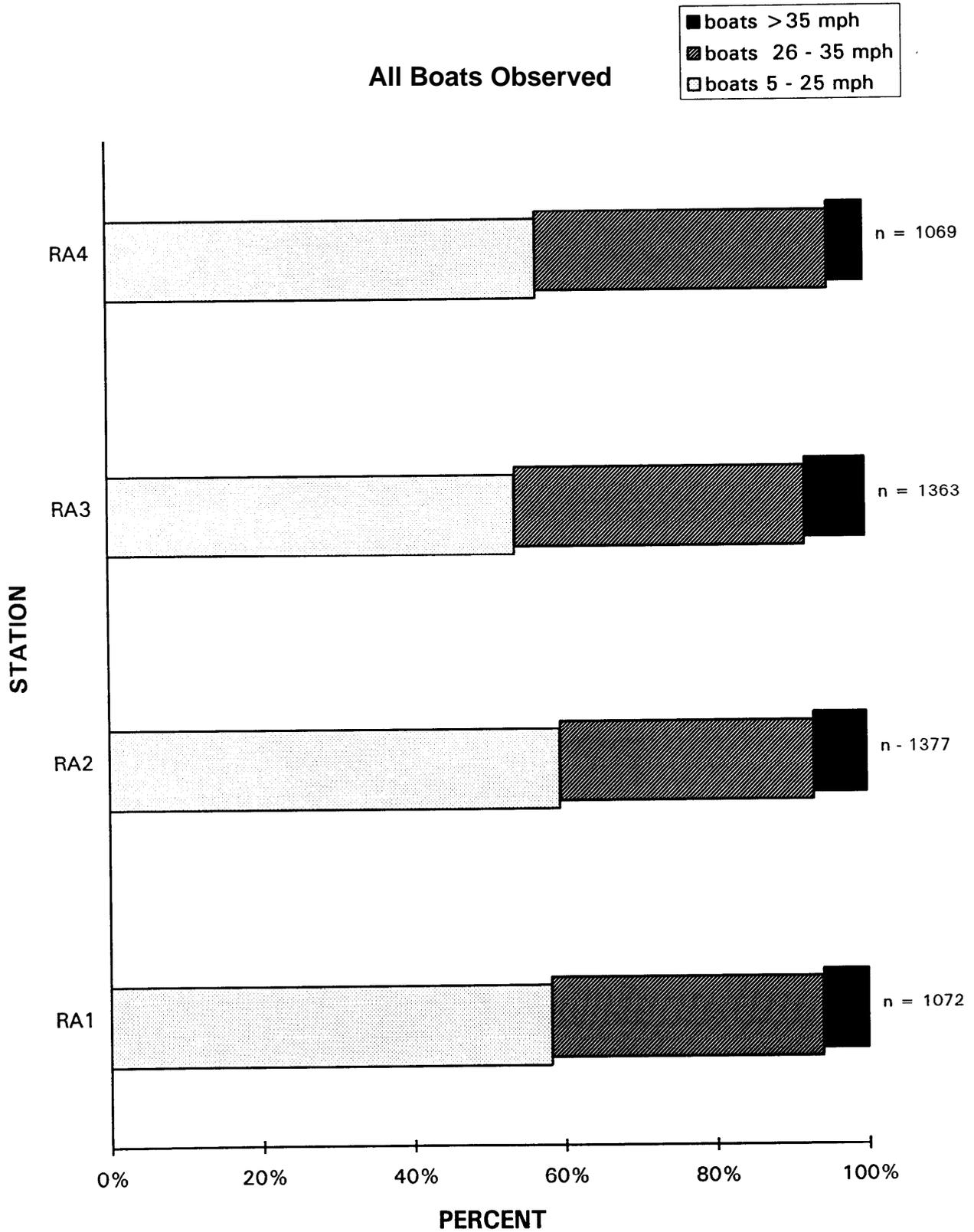


Figure 43. Task 3; Percentage of vessels traveling at speeds between 5 and 25 mph, 26 and 35mph, and greater than 35 mph at each radar site.



sites, determined that there was a statistically-significant difference ($p = 0.02$) between the sites. A multiple comparison procedure was used to isolate the different sites and determined that the greatest differences were between sites RA3 and RA4, and between sites RA3 and RA1. A two-sample t-test was also used to compare unrestricted speed sites (RA1 + RA2) with 25 mph restricted sites (RA3 + RA4). Results indicated that there was not a statistically significant difference between boat speeds in unrestricted vs restricted areas.

A comparison of boat speeds (25 mph and less, 26-35mph, and greater than 35 mph) on weekends vs. weekdays is shown in Figure 44. Mean boat speeds on weekends and weekdays are shown in Table 18. Mean speeds were higher during weekend sampling periods at each of the four radar sites, with the largest difference observed at site RA4 (20.2 mph weekday, 24.2 mph weekend). A higher percentage of vessels exceeding 25 mph were also observed on weekends, with the greatest difference at site RA4 (29.5% weekday, 49.4% weekend). A higher percentage of vessels in excess of 35 mph was observed during weekends at three out of four sites. Although Radar site RA3 had a slightly higher percentage of vessels in excess of 35 mph for weekdays (8.7% vs. 7.7%), the number of vessels observed exceeding 35 mph was greater on weekends (78 vs. 31). A two-sample t-test determined that there was a statistically significant difference between boat speeds on weekends vs. weekdays ($P < 0.001$).

Based upon a calculation of sampling time and number of vessels in violation of the 25 mph zone, it was determined that the posted 25 mph speed limit is exceeded by an average of 25.7 vessels per hour on weekends at Site RA3, and by an average of 20.2 vessels per hour on weekends at Site RA4. Vessels with speeds in excess of 10 mph over the posted 25 mph limit occurred an average of 4.3 times per hour at Site RA3 and 2.4 times per hour at Site RA4.

A comparison of boat speeds by morning vs. afternoon time window is shown in Figure 45 and Table 18. Overall vessel traffic in the Intracoastal Waterway was greater during the afternoon time window, with 3,016 vessels targeted between 1300 hrs and 1700 hrs, and 1,865 vessels targeted between 0900hrs and 1200 hrs. Although mean boat speeds were higher during afternoon sampling periods at each of the 4 sites, variations were less than 1 mph at sites RA1, RA2, and RA3, and less than 1.25 mph at site RA4. Distribution of boat speeds by time window was essentially the same at each site, with a slightly higher percentage of vessels traveling in excess of 25 mph during afternoon sampling periods. This trend was similar for boats in both restricted speed and unrestricted speed zones, and a two-sample t-test determined that there was a statistically significant difference between boat speeds during morning and afternoon sampling periods ($P = 0.002$)

A comparison of boat speeds in the presence and absence of law enforcement vessels is shown in Figure 46. Mean boat speeds in the presence and absence of enforcement are shown in Table 18. Interestingly mean speeds were higher in the presence of enforcement at sites RA1 and RA2 and lower in the presence of enforcement at sites RA3 and RA4. Similarly, the percentage of vessels traveling at speeds in excess of

Figure 44. Task 3; Comparison of boat speed intervals by weekend vs weekday sampling periods at each radar site.

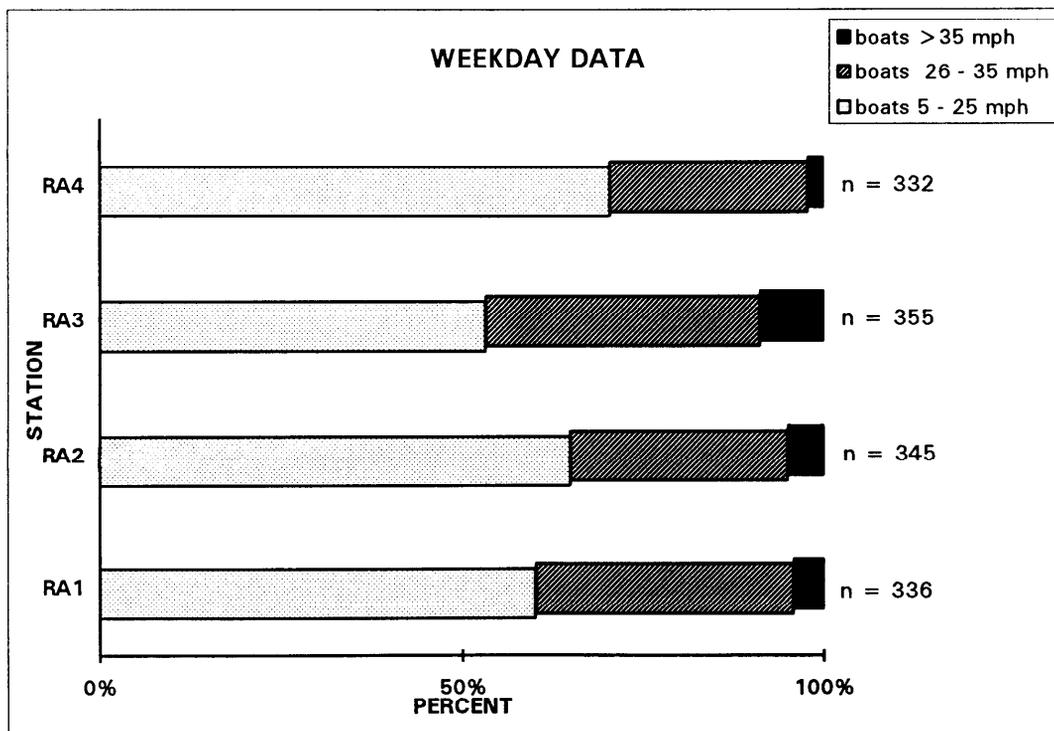
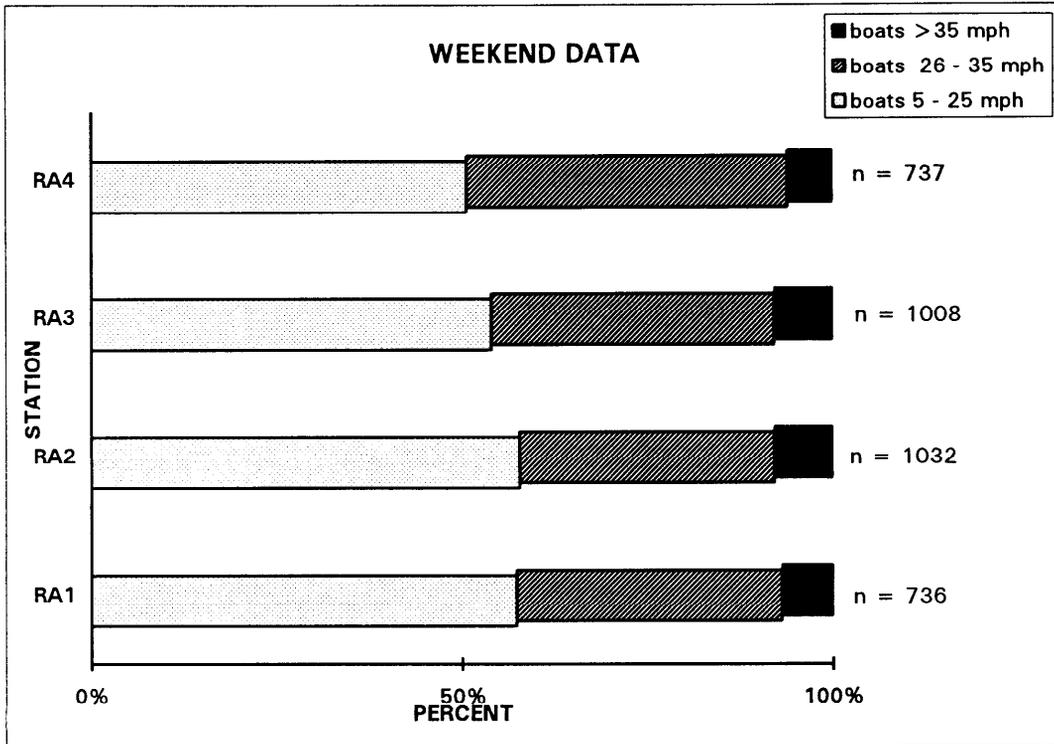


Figure 45. Task 3; Comparison of boat speed intervals by time window for each radar site.

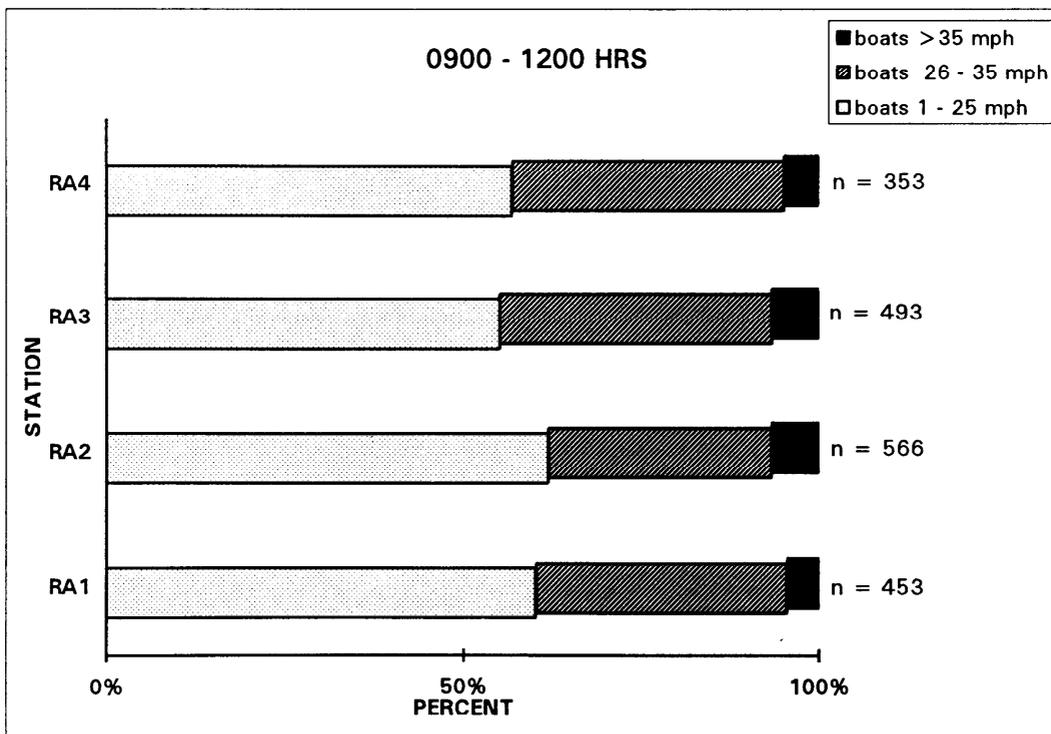
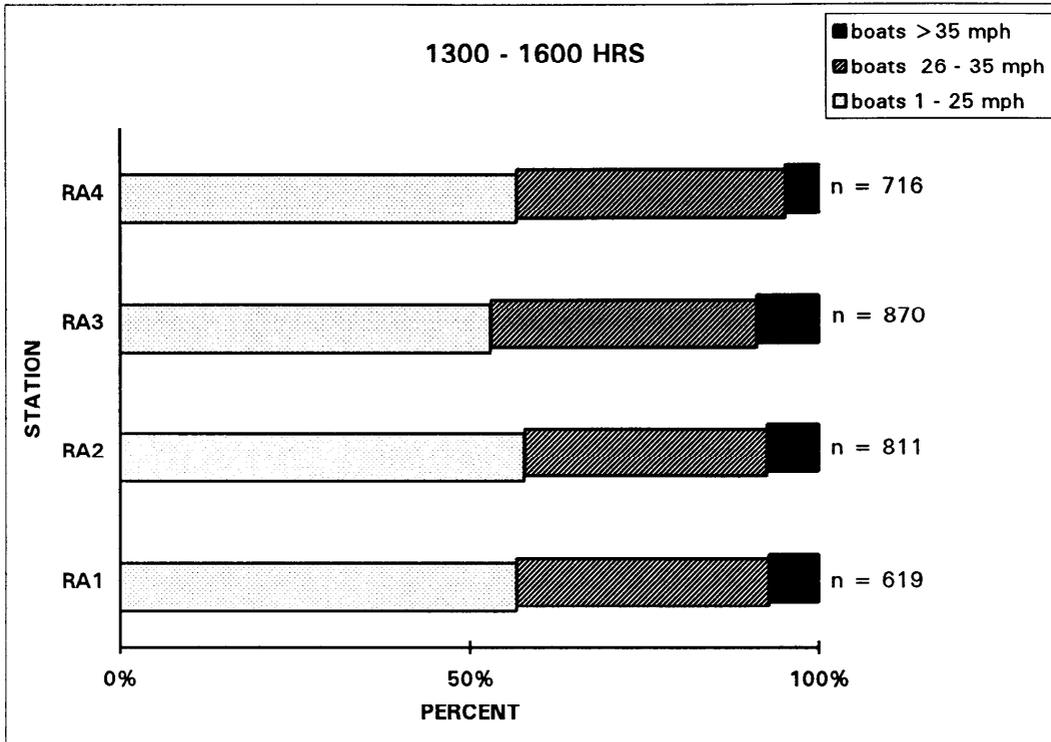
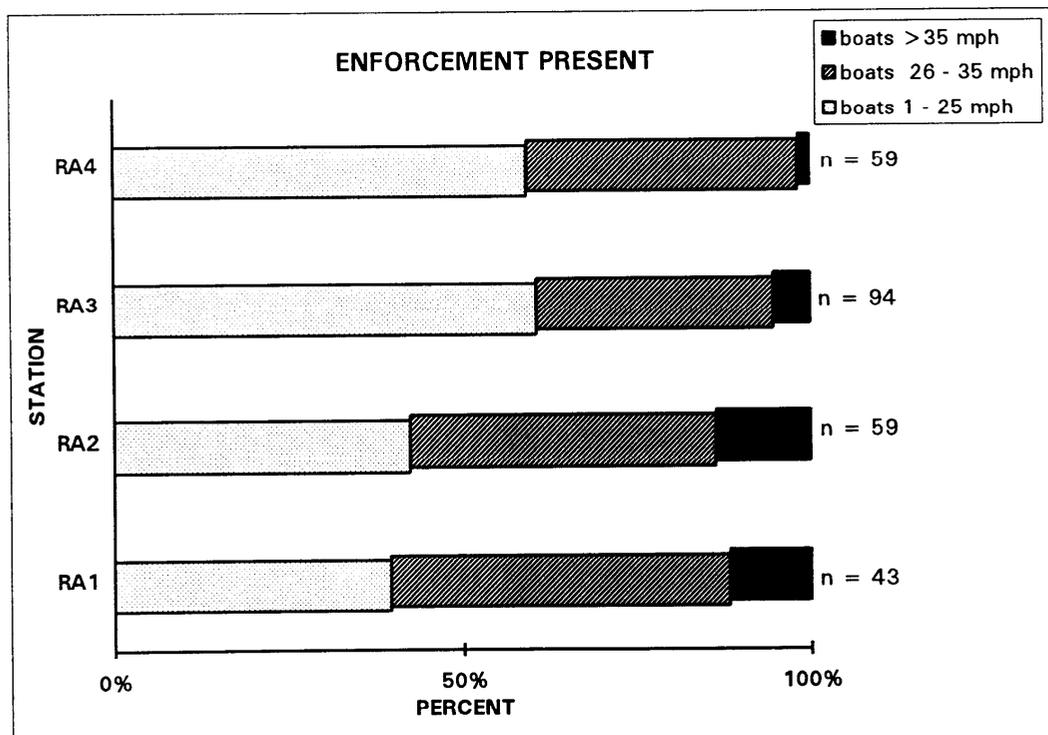
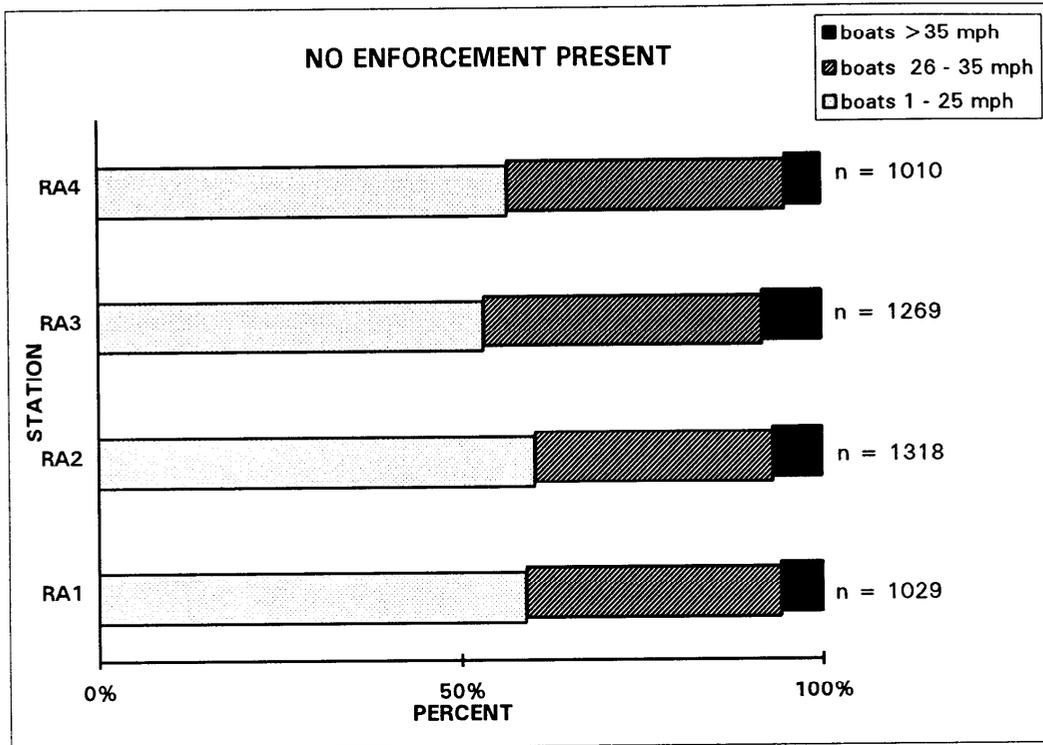


Figure 46. Task 3; Comparison of boat speed intervals by presence and absence of enforcement vessels at each radar site.



25 mph was greater in the presence of enforcement at Sites RA1 and RA2, and the percentage of vessels traveling at speeds in excess of 25 mph were greater in the absence of enforcement at Sites RA3 and RA4. Due to the fact that a disproportionately smaller number of vessels were targeted in the presence of enforcement (only 255 vessels out of 4,881 total vessels) during Task 3, results associated with enforcement activities should be interpreted cautiously. In addition, a two-sample t-test determined that there was not a statistically significant difference between boat speeds in the presence or absence of enforcement.

Slower-moving boat traffic which was approximated at 5 mph did not significantly influence the data. Only 167 out of the 4881 targeted vessels (3.4%) were in this category. If each of these vessels was recorded at 1 mph (the greatest possible error), mean boat speeds at each radar site would have varied only by 0.16 mph or less. Similarly, the inclusion of sailboats under power did not significantly influence the results. Only 115 sailboats (2.4% of all targeted vessels) were recorded. The removal of sailboat data from each radar site was found to increase mean boat speeds by less than 0.6 mph at station RA1, and by less than 0.4 mph at all other sites.

Task 4: Determination of Boater Compliance During Non-Peak Boating Hours.

A total of twelve 24-hour sampling periods were conducted at the New Pass Site. Sampling areas and all methodologies were identical to those described under Task 1.

Data from Task 4 was specifically targeted toward an evaluation of boater compliance by time based upon a 24-hour sampling period. Level of boat traffic in New Pass (mean number of vessels per hour) is displayed in Figure 47. Peak levels of boating activity occurred in New Pass between 1200 hrs and 1600 hrs. Very little boat traffic was observed between 2000 hrs and 0800 hrs (only 7% of total vessels observed), with no vessels observed between 0300 hrs and 0500 hrs during the 12-month study. As expected, enforcement activity diminished during non-peak boating hours. Enforcement was observed 2.7% of survey time between 0800 and 1159 hrs, 5.5% of survey time between 1200 and 1559 hrs, 1.7% of survey time between 1600 and 1959 hrs, and no enforcement presence was observed between 2000 hrs and 0800 hrs.

Level of compliance over a 24-hour period (all 12 sampling periods combined) is displayed in Figure 48. Compliance was essentially similar between 0700 hrs and 2100 hrs, with a decrease in the level of compliance and/or increase in the level of blatant non-compliance during non-peak hours (2100 hrs and 0200 hrs). A similar trend was observed when pooling compliance data into 4-hour time periods (Figure 49). A high level of similarity, particularly in levels of blatant non-compliance, was observed between 0400 hrs and 0759 hrs, 0800 hrs and 1159 hrs, 1200 hrs and 1559 hrs, and 1600 hrs and 1959 hrs. A noticeable decrease in boater compliance and increase in blatant non-compliance was observed from 2000-2359 hrs, and from 0000-0359 hrs.

Statistical analysis (chi-square test) indicated a significant relationship exists between time (in 4-hour periods) and boater compliance ($P < 0.001$). Results should be interpreted cautiously, however, due to the relatively small amount of data collected between 2000 hrs and 0400 hrs during Task 4.

Tabulated field data for each of the four tasks of this study is provided in Appendix C.

Figure 47. Task 4; Distribution of boat traffic at New Pass over a 24-hour period.

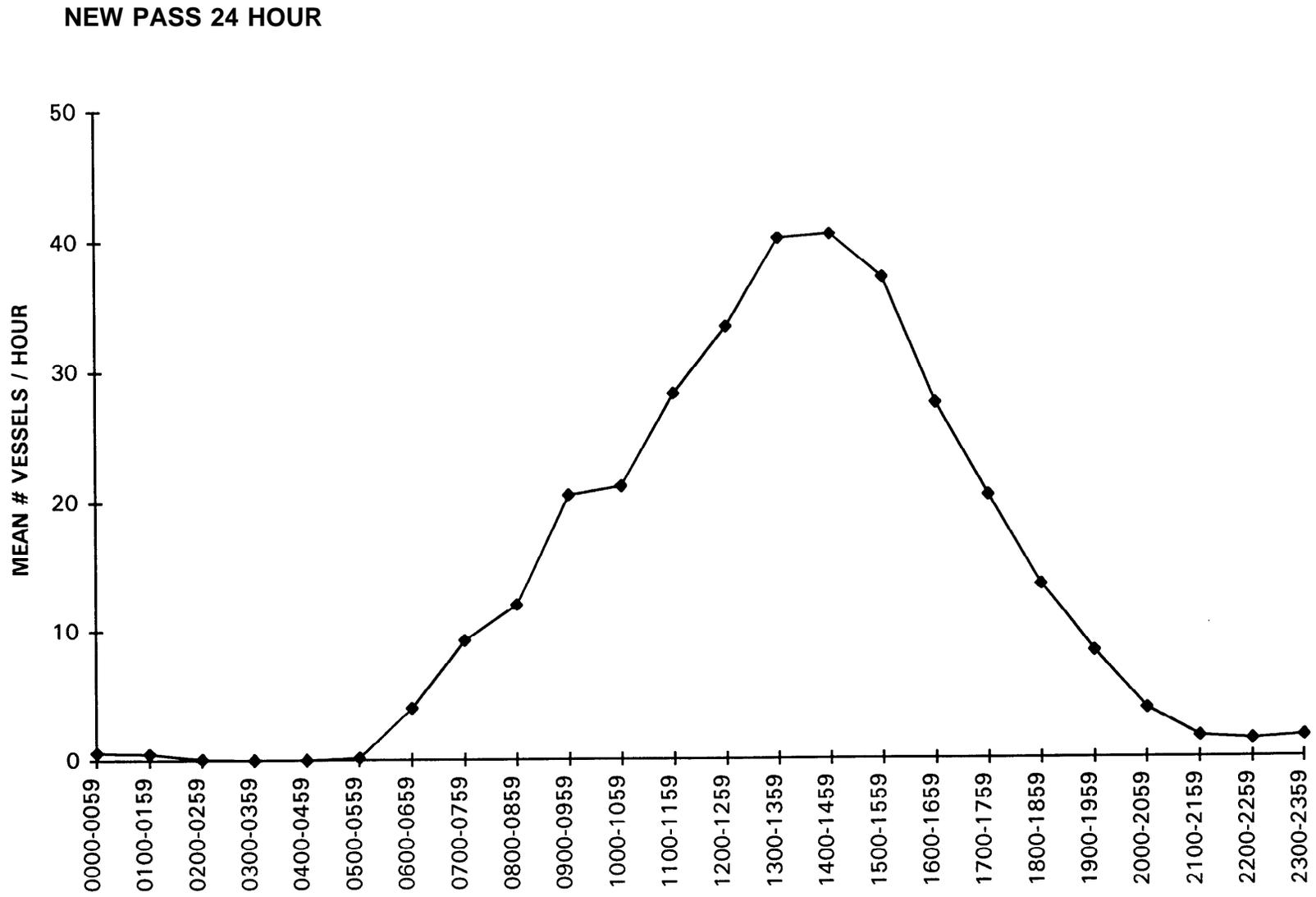


Figure 48. Task 4; Level of boater compliance at one-hour intervals.

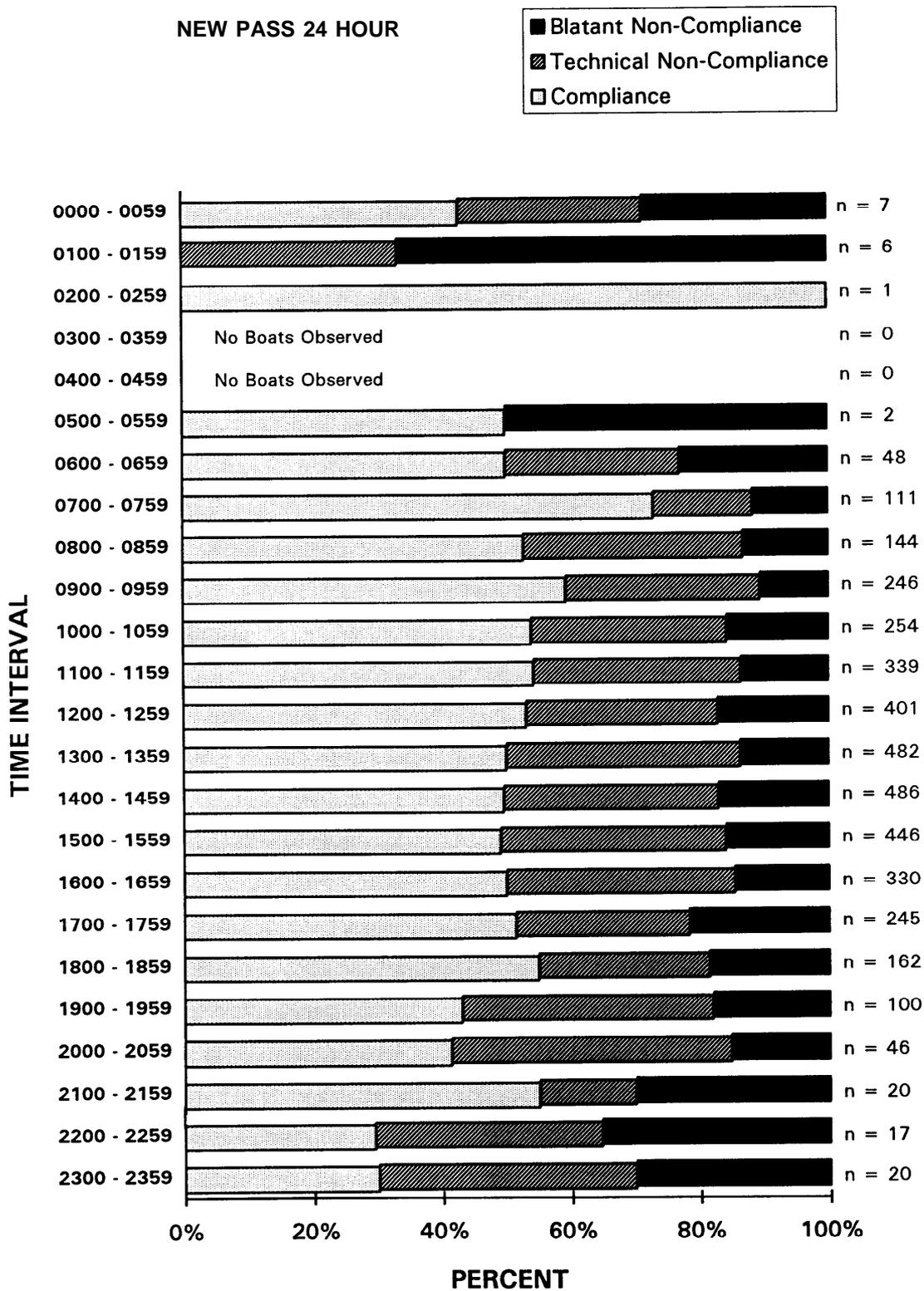
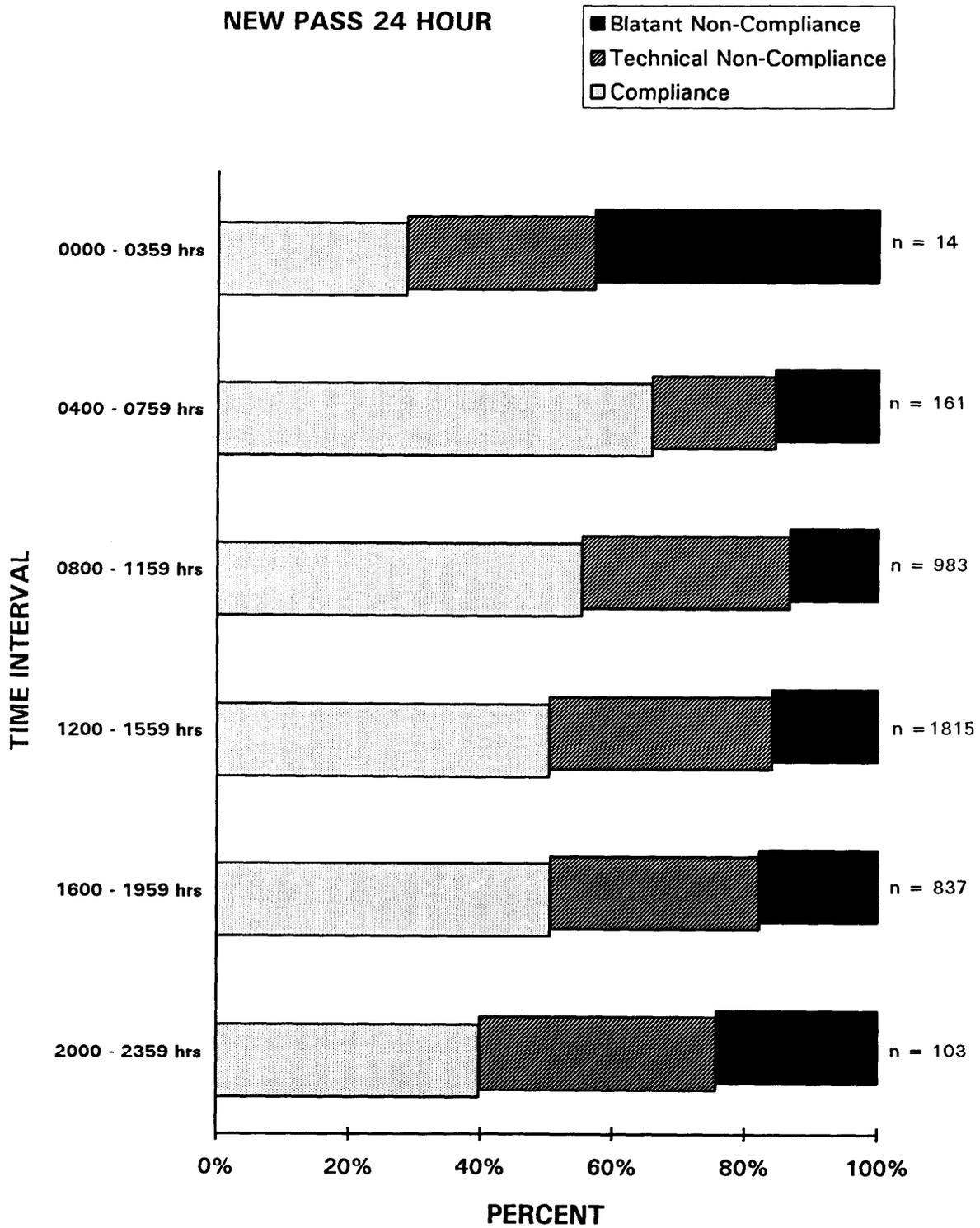


Figure 49. Task 4 ; Level of boater compliance at four-hour intervals.



Enforcement Activity

Frequent observations of activity by officers from each enforcement agency were observed during the study, including the pursuit of violators in various manatee zones and speed-restricted areas. Numerous warnings and citations were issued during 1995, however precise locations where violations occurred were only available from one enforcement agency (Venice Police). A compilation of available records on enforcement activity in Sarasota County during 1995 is presented in Table 20.

Manatee Sightings

A total of 398 manatee sightings were confirmed and documented in Sarasota County from twice-monthly aerial surveys conducted by Mote Marine Laboratory in 1995. Monthly sighting data is provided in Figure 50. In general, largest numbers of manatees in Sarasota County occurred from early spring through late fall. Confirmed manatee sightings (from both aerial survey data and boater compliance field data) in the vicinity of each boater compliance study area were also compiled and presented in Table 21.

Manatees were observed at each boater compliance site. The highest number of manatee sightings were documented at the Pansy Bayou Site (51 aerial survey sightings, 24 boater compliance field sightings) and the Myakka River Site (29 aerial survey sightings, 6 boater compliance field sightings). More than 50 additional manatee sightings were also documented in other portions of the Myakka River during 1995 aerial surveys (MML unpublished data, 1995). The lowest number of both sightings and numbers of animals was at the Venice Inlet Site. Of the four radar sampling sites, the largest number of manatee sightings were observed at Sites RA2 and RA4.

The importance of Pansy Bayou as a preferred site for manatees was also demonstrated during the 1995 photo-identification study conducted by MML in the Pansy Bayou/City Island Grassflats area. Manatees were sighted in Pansy Bayou during 60 out of 84 survey days between April and October, 1995. A total of 78 sightings (551 adults and 79 calves) were documented during this period. Within the City Island Grassflats area manatees were sighted on 38 out of 90 survey days, with a total of 52 sightings (142 adults and 19 calves).

Table 20. Available information on enforcement activity in Sarasota County, Jan - Dec., 1995

ENFORCEMENT AGENCY	WARNINGS ISSUED	CITATIONS ISSUED	COMMENTS
Longboat Key Police	51	10	Location information not available. No distinction between Manatee and Sarasota Counties.
Venice Police	110	0	Location information available, 79 warnings issued in the Venice Inlet area.
Sarasota Police	36	28	Location information not available.
Florida Marine Patrol	approx. 120	26	Location information not available, number of warnings estimated - no written record available.
Sarasota Sheriff	282	44	Location information not available.

Figure 50. Monthly manatee sightings (adults and calves) from 1995 Mote Marine Laboratory aerial survey data

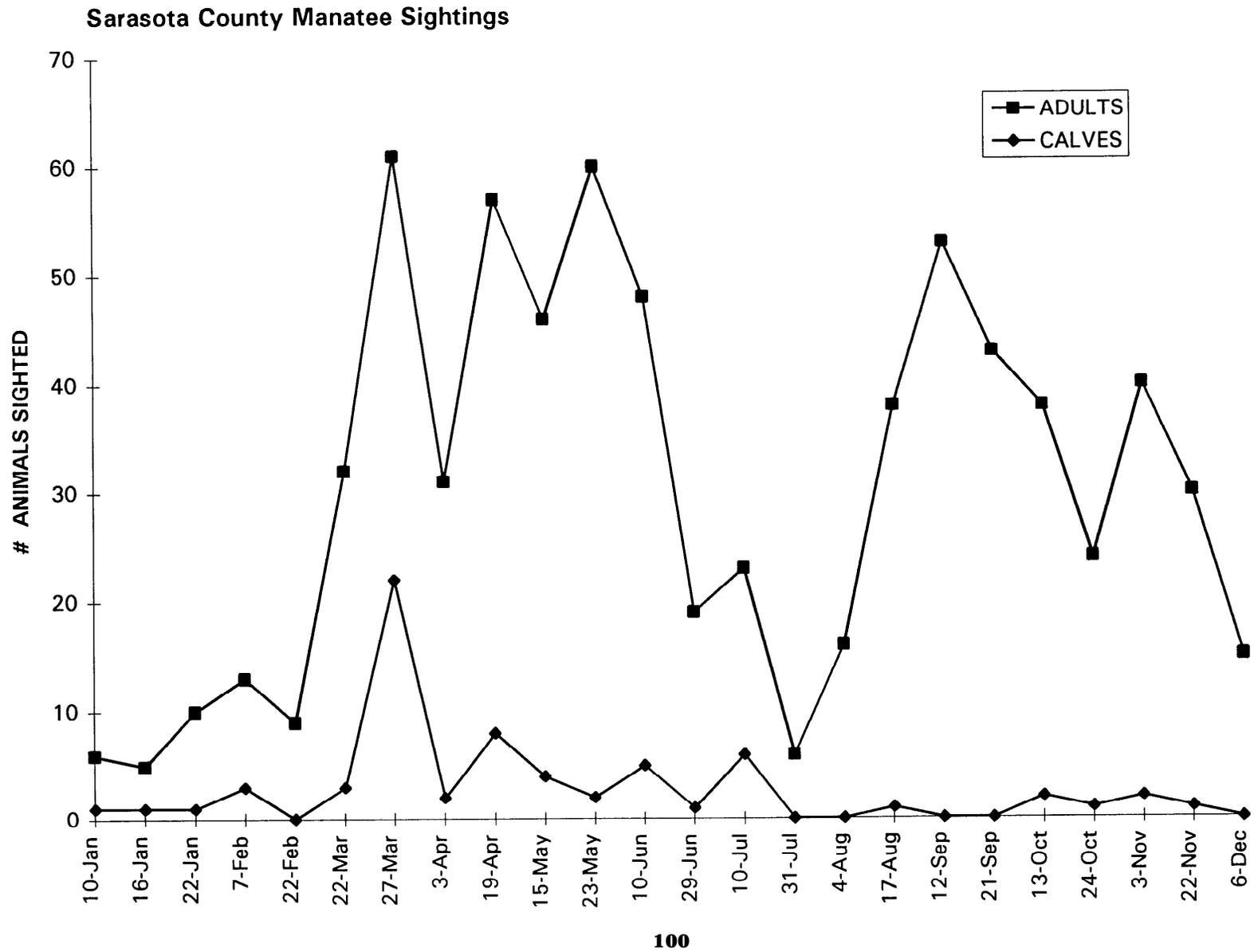


Table 21. Confirmed manatee sightings compiled from 1995 Mote Marine Laboratory aerial survey and boater compliance field data.

LOCATION	TOTAL SIGHTINGS	ADULTS	CALVES
NEW PASS (1995 Boater Compliance Data)	3	4	0
NEW PASS (1995 Aerial Survey Data)	5	6	0
PANSY BAYOU (1995 Boater Compliance Data)	24	39	5
PANSY BAYOU (1995 Aerial Survey Data)	51	110	15
SKIERS ISLAND (1995 Boater Compliance Data)	1	8	0
SKIERS ISLAND (1995 Aerial Survey Data)	3	6	0
VENICE INLET (1995 Boater Compliance Data)	1	1	0
VENICE INLET (1995 Aerial Survey Data)	2	4	0
MYAKKA RIVER (1995 Boater Compliance Data)	6	7	1
MYAKKA RIVER (1995 Aerial Survey Data)	29	44	4
RA1 (NEW PASS AREA)	6	10	1
RA2 (BIG SARASOTA PASS AREA)	10	31	0
RA3 (ROBERTS BAY)	7	12	1
RA4 (LITTLE SARASOTA BAY)	12	30	0
ALL SARASOTA COUNTY (1995 Aerial Survey Data)	398	723	66

DISCUSSION

While the methodologies implemented in the only other boater compliance study in Florida to date varied substantially, many similar results were observed between the current study and the Brevard County compliance study conducted by Morris (1994). Smaller vessels, primarily personal watercraft, were the least compliant of all vessels observed. Levels of compliance also varied by time, day, and location.

The portion of this study involving land or boat-based observation of vessels through a transitional speed area (Task 1) proved to be the most useful, and provided a substantial amount of data on vessel compliance related to a wide number of variables. While the evaluation of boater compliance utilizing aerial surveys provides a comprehensive view of a large study area, it may lack the detail necessary to provide an accurate measure of vessel compliance in some circumstances. Small differences in boat speeds (Idle Speed vs. Slow Speed, for example) are more difficult to identify by aircraft. High traffic areas such as tidal inlets are also difficult to evaluate by a single aerial observer (In areas such as Venice Inlet, land-based teams comprised of as many as six observers were needed at times to accurately collect compliance data). The relatively higher levels of compliance recorded for vessels observed under Task 2 may be indicative of a more conservative approach by aerial observers in evaluating the speed of vessels. Clearly, observers stationed at land-based sites had a better opportunity to evaluate boat speed due to proximity to vessels and duration of observation. Though aerial survey data may be useful in providing supplemental information on a wide variety of sites, land-based observations would seem to provide more accurate data in specific areas.

Among the most significant findings under Task 1 were the high levels of variation in compliance from site to site, with the Roberts Bay / Skiers Island area found to be the area with the most frequent and repeated number of violators. Of interest in this area was the fact that although there was a relatively high level of non-compliance associated with recreational activity within the posted Water Sports Area, there was an even higher level of compliance associated with vessels traveling in and around the Water Sports Area, not associated with ski activities. This non-compliant activity can be described as “short-cutting” through the Slow Speed Area to and from the Intracoastal Waterway and Siesta Key.

While overall trends in boater compliance were similar between the two tidal inlets (Venice Inlet and New Pass), the level of compliance was significantly greater at Venice Inlet. This is largely due to the fact that New Pass has a higher level of restriction than Venice Inlet (Idle Speed Zone vs. Slow Speed Zone). Combining the vessels observed in New Pass which were traveling at Slow Speed (technically non-compliant) with vessels traveling at Idle Speed would provide a level of compliance in excess of 80% (similar to Venice Inlet). In addition, higher levels of boat traffic occurred at Venice Inlet, forcing boats to slow down simply due to the level of congestion, particularly on weekends. Enforcement presence and activity at Venice Inlet is also likely a factor in the overall higher level of compliance at this site.

Noticeable differences in the level of compliance between the northern (BN) and the southern (BS) channels in New Pass was observed. One explanation for this difference is that the southern channel is in close proximity to several fishing piers, a marina, a fuel dock, and a restaurant, while the shoreline of the northern channel is uninhabited mangrove and sandy beach. Boaters traveling along the southern channel are probably more cognizant of scrutiny by others than they are when traveling along the northern channel, with the result being a higher level of compliance. A similar situation was observed at Venice Inlet, where a higher level of compliance was recorded along transitions which were in proximity to a marina and restaurant (transitions to and from the Gulf of Mexico and Dona Bay) than they were for transitions which border relatively undisturbed areas (transitions to and from the Gulf of Mexico and Lyons Bay).

Very little data was collected from the Myakka River Site, and it was suggested that the lower level of boat traffic in the river is in direct response to the recent slow speed restrictions. In many cases, slow speed is a necessity in the Myakka River due to the high proportion of shallow areas and occasional debris in the river. Quite possibly, the more non-compliant vessels in the river are also the boaters which have a greater local knowledge of the river.

While a relatively low level of boat traffic was observed in the vicinity of Pansy Bayou, it is an area of special concern due to the high frequency of manatee sightings during the warmer months of the year. The City Island Water Sports Area terminates in close proximity to Pansy Bayou, which has been identified as the single most important manatee area in Sarasota County, and is currently designated as a No Entry Zone. Field data from this study indicated that a substantial portion of vessels (46%) do not remain within the posted Water Sports Area, and that vessels which turn even slightly beyond the clearly-posted boundary of the Water Sports Area are an obvious threat to manatees traveling to and from the narrow entrance into Pansy Bayou. Manatees are also threatened by vessels which remain in the Water Sports Area, since frequent sightings of animals entering the Water Sports Area have been documented. At the very minimum, a larger “buffer zone” from the City Island Water Sports Area should be considered in order to decrease the risk of injury to manatees from recreational vessels.

The significant relationship between compliance and vessel type, between compliance and vessel size, and between compliance and vessel activity was influenced largely by personal watercraft. These vessels, always under 12 feet in length and most often engaged in “pleasure” as an activity, were observed to have the lowest level of compliance of all vessel types. Personal watercraft also had levels of blatant non-compliance which were 50% greater any other vessel type observed. Although the identification of rented personal watercraft was not possible, it can be assumed that a significant portion of the more than 2,000 personal watercraft observed during this study were rentals. This is due to the large number of rental facilities in Sarasota County. In the Pansy Bayou/City Island Grassflats area, a small, mobile rental outfit was set up on numerous occasions on weekends. Most noteworthy was the fact that this rental facility was set up within the Slow Speed Manatee Protection Zone.

While relatively limited data was collected from aerial surveys, some of the results were consistent with findings from Task 1. In particular, lower levels of compliance and higher levels of blatant non-compliance were observed within the Slow Speed Areas of Pansy Bayou/City Island Grassflats and Skiers Island. Similar to Task 1, an overall high level of compliance was also observed in the Venice Inlet area. Variability among the various aerial survey zones may be due in part to the wide variety of different speed restrictions among the zones, and the relatively few number of observations in certain areas.

A substantial amount of data related to boat speeds in the Intracoastal Waterway was collected under Task 3. While results indicated that boat speeds may be slightly higher in restricted-speed areas, it is clearly indicated that boat speeds are not slower in restricted speed areas. As a result, it can be concluded that the posted 25 mph speed signs along the Intracoastal Waterway in south Sarasota County are largely ineffective. Larger and/or more frequent signs, or possibly alterations in the wording of current signs may improve the level of compliance in these areas.

Less field data than expected involving compliance in association with non-peak boating hours was collected from Task 4. This may be due in part to coastal processes affecting vessel navigation in New Pass. As a result of recent, extensive shoaling, The US Coast Guard declared New Pass to be not navigable in 1995, and has replaced standard channel markers with shoal markers. Overall, this has resulted in a reduction in the number of vessels using New Pass as a corridor to and from Sarasota Bay and the Gulf of Mexico. Consequently, fewer vessels are utilizing the Pass at night when conditions are even more hazardous. New Pass is scheduled for re-dredging in 1996, and may provide additional information on boater compliance during non-peak hours in the future.

The levels of statistical significance associated with the various parameters of this study should be approached with some caution, as data sets with extremely large sample sizes (> 10,000) will tend to enhance the statistical significance of relatively small variations in data. A more important question than, "Are the results statistically significant?" may be, "Are the results statistically relevant?". Statistical significance was found, for instance, in comparing boater compliance with time of day, however a difference in compliance of 5% or less was observed between the three time windows analyzed. Significant differences were also determined under Task 3 for boat speed and time of day. While speeds were higher overall in the afternoon, the mean differences in speed between morning and afternoon sampling periods at each radar site varied by less than 1 mph.

Data collected from multiple observations of the same vessel provided interesting supplementary information during this study. Resighting data, however, should be used more as an ancillary, rather than a definitive tool on overall compliance for vessels sighted multiple times. Presumably many identical vessels were not recorded, particularly in locations of heavy boat traffic such as Venice Inlet. Conversely, vessels which were identified with a field code may have appeared on different days and were assigned a different field code, implying that a different vessel was seen. For these

reasons, the actual number of repeat vessels encountered during this study is likely inaccurate. As a supplementary tool, however, field data collected from multiple observations provided additional insight regarding vessel compliance. The data suggest that in many instances compliance tends to be boater-specific, and that the same boater will respond in the same way in multiple observations. Whether or not this is due to a lack of understanding of speed restrictions or a disregard of speed restrictions is unclear, and likely varies from person to person. The high level of repeat sightings (and repeat violations) at areas such as Pansy Bayou and Skiers Island may be helpful to law enforcement officials, who may be able terminate a significant amount of non-compliance in an area by targeting a single vessel or small number of vessels which repeatedly violate a posted speed zone.

Enforcement clearly plays an important role in the level of boater compliance in a given area, and indications are that law enforcement activities in Sarasota County are both active and efficient. They are, however, clearly overburdened by the tremendous amount of area that they need to patrol and responsibility that they have. Marine enforcement units understandably have little time or opportunity to monitor problem areas such as Skiers Island and Pansy Bayou, and must focus on higher traffic areas where boating safety may be a more critical issue. One obvious need, which has been suggested in the past, is a larger allocation of funds, personnel, and resources toward enhancing marine enforcement in Florida. Without a commitment to such resources, very little can be expected in terms of effective coastal waterway management.

Clearly, a recreational management plan does not end with the establishment of boat speed zones and sign plans in a given area, and this study has demonstrated that the field evaluation of boater compliance in conjunction with speed zones can be a useful management tool. With concerns over the increasing amount of additional restrictions in Florida coastal waters, such studies can be used to help “fine tune” current plans without necessarily placing additional restriction on waterways. As speed zones and management plans are modified, the repetition of a compliance study in the same area should be considered in order to evaluate the effectiveness of any new modifications.

LITERATURE CITED

Ackerman, B.B, S.D. Wright, R.K. Bonde, and D.K. Odell, and D.J. Banowetz. 1995. Trends and patterns in mortality of manatees in Florida, 1974-1992, in: Population Biology of the Florida Manatee, U.S. Department of the Interior Information and Technology Report 1, August 1995.

Florida Power and Light Co. 1987. Boater's Guide To Manatees. 29 pp.

Kadel, J.J. and G.W. Patton. 1992. Aerial studies of the West Indian manatee *Trichechus manatus* on the west coast of Florida from 1985-1990: a comprehensive six year study. Mote Marine Laboratory Technical Report #246. 43 pp.

Krebs. C.J. 1989. Ecological Methodology. Harper Collins Publishers New York, NY. ISBN 0-06-043784-7

Morris, J.G. 1994. An investigation of compliance to boat speed regulations in manatee protection zones in Brevard County, Florida. Final report submitted to the Florida Department of Environmental Protection. 74 pp.

Nabor, P.L. and G.W. Patton. 1988. Manatee aerial survey program 1987 final report: studies of the West Indian manatee, Anna Maria to northern Charlotte Harbor and the Myakka River. Mote Marine Laboratory Technical Report #127. 94 pp.

Roat, P. and M. Alderson. 1990. State Of The Bay report. Sarasota Bay National Estuary Program. 86 pp.

Sarasota Bay National Estuary Program. 1992. Framework for Action. 160 pp.

Sarasota County Natural Resources Dept. 1994. Boating Safety; Boat Speed Zones in Sarasota County, June, 1994.

Sigma Stat. 1994. Jandel Scientific. Sigma Stat Statistical Software Users Manual.

APPENDICES

A V A I L A B L E U P O N R E Q U E S T