BOATER COMPLIANCE BEHAVIOR IN MANATEE CONSERVATION ZONES: RECREATION SPECIALIZATION, ATTITUDES AND SITUATIONAL FACTORS

By

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Marine conservation attitudes Respondent's agreement with manatee protection and protection strategies, as well as general boat management strategies. Items were adapted from Aipanjiguly (2001).

Observed speed discrepancy Observed speed minus the maximum allowable speed per boat speed restriction zone. This calculation served to standardize observed vessel speeds within both idle and slow speed zones, and also represented the degree to which a boat operator was compliant or non-compliant with speed restrictions. Vessel speeds are defined by Sarasota County (2006) according to the following: Idle zone: generally not to exceed 3 mph; Slow zone: generally not to exceed 7 mph.

Party size The number of people in an observed vessel, including vessel operator.

Prior exposure to manatees An evaluation of the number of times a boater has seen a manatee during the previous 12 months.

Prior ticketing Evaluation of whether a respondent had been previously ticketed for violating boat speed restrictions.

Recreation specialization Continuum of behavior exhibited from novice to expert. Specialization was measured by items within the behavioral, cognitive and affective domains, both as individual additive indices as well as a composite index.

Self-reported compliance behavior Based upon a boater's agreement with full vessel speed compliance during most recent boat outing

Situational factors Refers to time, date, presence of law enforcement and weather (estimated % cloud cover; precipitation, ambient temperature). Criteria were adapted from Gorzelany (1999, 2001, 2004).

Theory of reasoned action A theory that frames human behavior in terms of the relationships between beliefs, attitudes and intentions (Fishbein & Ajzen, 1975; Ajzen and Fishbein, 1980). Items were adapted from Aipanjiguly (2001).

Law enforcement presence Observation of the presence or absence of law enforcement officials.

Vessel attributes Refers to boat type (pontoon, sail, ski, johnboat, runabout, fish, yacht/cruiser, other and boat length (less than 12 feet, 12 to 15 feet, 16 to 25 feet, 26 to 39 feet, 40 to 64 feet, 64 to 109 feet, greater than 109 feet). Adapted from Gorzelany, 1996, 2001, 2004).

Zone sign assessment Boater's assessment of speed zone signage and zone delineation effectiveness.

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By

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Chair: Brijesh Thapa
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My study investigated the factors associated with compliant and non-compliant vessel speeds in speed-restricted manatee conservation zones on the St. John's River, Florida during the summer and fall of 2006. Recreation specialization theory, theory of reasoned action (TRA), marine conservation attitudes, boater knowledge and situational factors were examined as predictor variables to vessel speed discrepancies (observed vessel speed minus maximum allowable per zone). The study was conducted by first observing vessel speed and vessel and operator attributes, after which a mail survey was sent to the vessel operator observed on the water.

Recreation specialization was found to be poorly associated with vessel speed discrepancy, and found to be negatively associated with marine conservation attitudes. Marine conservation attitudes were also found to be poorly associated with vessel speed discrepancy. However, marine conservation attitudes had a strong positive influence on behavioral intention to fully comply with vessel speed zones during next outing.

Although most respondents self-reported being in full compliance with boat speed restrictions during their last boat outing, these responses were weakly associated with observed

vessel speed compliance. In this investigation, self-reported behavior served as poor proxy to actual behavior.

Vessel length was poorly associated with conservation attitudes, although mean vessel speed discrepancies were found to differ among various boat lengths. Operators of longer vessels and non-rental vessels were found to violate speed restrictions to a greater extent than those of shorter vessels or rentals.

Within the TRA progression, past behavior (self-reported compliance behavior) and attitudes were unique contributors to behavioral intentions to fully comply with speed restrictions during next boat outing. Past behavior (self-reported compliance behavior) was found to have a strong negative influence on attitudes. Past behavior in the form of observed vessel speed discrepancy was weakly associated with attitudes, subjective norms, and behavioral intentions.

Fewer than half of the vessels observed for this investigation were in full compliance with speed restrictions. As with past studies, approximately one-third of the respondents in this investigation disagreed or strongly disagreed with on-water boater informational signage (both in manatee and general boat safety speed zones) as easy to read, easy to see or effectively delineating manatee and general boat speed zones. Results of the study suggest that a more efficacious approach to reducing vessel speeds may be necessary in critical manatee conservation areas. Furthermore, management strategies designed to change boater attitudes may be most effective in encouraging compliance with manatee speed zones.

CHAPTER 1
INTRODUCTION

Concern over the health, integrity and management of Florida's aquatic resources has grown in concert with the state's population growth during the last several decades. Much attention has been focused on habitat loss, reduced water quality, invasive species and declining wildlife populations. Few issues have been as contentious as the protection of the West Indian manatee (*Trichechus manatus latirostris*).

In Florida, cold stress, hurricanes, red tide poisoning and a variety of other maladies negatively impact manatees. Manatees are also affected by human-induced phenomena including crushing in locks and flood gates, fishing line and net entanglement and ingestion of man-made debris (Florida Fish and Wildlife Commission (FWC), 2006a). However, propeller wounds, hull impacts and crushing by recreational watercraft have been the single greatest cause of mortality from 1974-2005. Data suggests that approximately 24% of manatee deaths have been caused by watercraft strikes (FWC, 2006b). Furthermore, 97% of surviving manatees listed in the scar identification catalog possess hull and prop scar patterns indicating multiple vessel strikes (O'Shea, Lefebvre & Beck. 2001).

The manatee is currently protected under both the Endangered Species Act (ESA) of 1973 (Florida Rule 68A-27.003, Florida Administrative Code) (FWC, 2005) and the Marine Mammal Protection Act (MMPA) of 1972. To facilitate recovery of the species, the Federal Manatee Recovery Plan (FMRP) specifically focuses on reducing watercraft-induced mortality. Under the umbrella of the FMRP, the State of Florida has implemented manatee protection through the use of manatee counts and mortality data to direct county protection plans and boat speed regulatory zones (Reynolds, 1999). Despite these efforts, manatee deaths as a result of watercraft-induced injury have increased 10% per year, on average, over the past decade (FWC,

2006b). If growth in the Florida boating population is commensurate with the projected 80% general population growth by the year 2030 (U.S. Census Bureau, 2006), then a future decline in manatee numbers can reasonably be expected (FWC, 2005).

Recreational boating is one of the pervasive elements of Florida's aquatic environment with more than 1,000,000 registered pleasure boats in the state (Florida Department of Highway Safety and Motor Vehicles, 2006). Furthermore, Florida ranks as the number one marine recreation destination in the United States (Leeworth & Wiley, 2001). With manatee habitat often coinciding with recreational boating areas, manatee conservation zones that effectively reduce vessel speeds may be crucial to the long-term survivability of the species.

Vessel speed reduction has been preliminarily shown to reduce manatee mortality (Laist & Shaw, 2006). In Florida, compliance with boat speed restrictions is facilitated primarily through 1) informational signage delineating manatee habitat that indicate permissible vessel speeds (usually in the form of qualitative categories such as "idle" and "slow, 2) law enforcement officers covering large areas and 3) boat no-entry zones.

Several qualitative boater compliance studies have been performed in Florida's waterways with similar results. For example, Gorzelany's (2004) compilation of several compliance studies (which included some quantitative speed assessments) conducted in the late 1990s evaluated 26,000 vessels in Sarasota and Lee counties and found 63% and 58% compliant respectively (17% and 16% blatantly noncompliant). His compilation also demonstrated that compliance varied significantly with the presence of law enforcement, boater activity, vessel type, vessel composition, size and site location. Other compliance studies such as Tyson and Combs' (1999) evaluation of Banana River (Florida) boaters have found similar levels of compliance.

Boater compliance can be examined from an environmental attitudinal and behavioral framework; however, the general body of environmental attitude and environmental behavior literature remains varied, both in focus and findings, especially pertaining to outdoor recreation participation. Dunlap and Heffernan (1975) were first to test the hypothesis that contact with nature as a result of outdoor recreation participation was positively associated with environmental concern. They found, 1) associations between outdoor recreation participation and general environmental concern were mixed, 2) general environmental concern was more positively associated with "appreciative" recreation than with "consumptive" recreation [1], and 3) concern for the environment was more strongly associated with the specific environment where one's outdoor recreation takes place than for general environmental issues (i.e., concern was site specific). Utilizing a refined measure of environmental concern (the New Environmental Paradigm Scale), Dunlap and Van Liere (1978), and Van Liere and Noe (1981) found little corroboration with Dunlap and Heffernan's (1975) conclusions. In contrast, Jackson (1986) substantiated their second and third hypotheses, most notably in that recreationists engaged in appreciative behavior had higher environmental attitudes than those participating in consumptive activities. Jackson (1986) also concluded that appreciative recreationists possessed stronger preservation orientations than did consumptive and mechanized recreationists who demonstrated stronger pro-development orientations. Other researchers have found the hypothesized association between outdoor recreation participation and pro-environmental attitudes to be weak or nonexistent (Geisler, Martinson & Wilkening. 1977; Pinhey & Grimes, 1979; Thapa, 2000),

[1] "Consumptive activities, typified by hunting and fishing, involve taking something from the environment and thus reflect a "utilitarian" orientation toward it. In contrast, appreciative activities (e.g., hiking, camping and photography) involve attempts to enjoy the natural environment without altering it. Such activities are thus compatible with the "preservationist" orientation which attempts to maintain the environment in its natural state." (Dunlap & Heffernan, 1975, p19-20).

with these studies concluding environmental concern more a function of individual characteristics than types and levels of recreational activity.

Similarly, researchers have utilized self-reports to examine whether outdoor recreation participation leads to various pro-environmental behaviors. Nord, Luloff and Bridger (1998) found that forest recreation was positively associated with pro-environmental behaviors such as reducing reliance on lawn chemicals. Similarly, Theodori, Luloff and Willits (1998) found evidence that participation in outdoor recreation was positively associated with pro-environmental behaviors such as contributing money or time to an environmental or wildlife conservation group, attending a public meeting about the environment and others. Specifically, they found that appreciative-type recreation activities (e.g., hiking and camping) were more strongly associated with pro-environmental behaviors than were resource-utilization activities (e.g., hunting and off-road vehicle use). They also reported that participation in fishing was more strongly associated with pro-environmental behavior than was mountain biking, skiing and picnicking, possibly due to the involvement in catch and release fishing among those sampled. Thapa (2000) also found that recreationists engaged in appreciative activities reported greater participation in several pro-environmental behaviors, such as recycling and green purchasing, than those involved in consumptive activities.

In contrast to pro-environmental behaviors, depreciative behavior within natural resource settings is important due to its negative impacts upon the sustainability of natural ecosystems (Cole, Hammond & McCool, 1997). Depreciative behaviors in natural settings may also degrade visitor experiences (Christensen, Johnson & Brookes, 1992), increase operating and mitigation costs (Winter, Sagarin, Rhoads & Barrett, 2000) and play a principal role in manatee deaths when in the form of non-compliant boat speeds (Laist & Shaw, 2006). Much of the depreciative

behavior literature has focused on the effectiveness of various forms and applications of media in decreasing vandalism and other unwanted behavior in terrestrial parks and built settings, with some demonstrating reductions in destructive behavior (Cole, et al., 1997; Oliver, Roggenbuck & Watson, 1985). Other researchers have found combinations of personal and printed communication are most effective in conveying messages and changing visitor behavior (Cockrell, Bange & Roggenbuck, 1984; Olson, Bowan & Roth, 1984; Roggenbuck & Berrier, 1982). Although personal communication stands as the preferred method of communication for some visitors (Knopf & Dustin, 1992; Vander Stoep & Roggenbuck, 1996), costs and logistical issues often prevent its wholesale use as a means of reducing depreciative behaviors in outdoor settings.

Efforts to reduce unwanted behaviors in outdoor settings often fail due to poor understanding of the communication process (Absher & Bright, 2004; Jacobson, 1999; Manfredo, 1992). Along this line, important shortcomings in efforts to communicate messages to Florida boat operators have been demonstrated. For example, boaters may prefer better information about waterway rules and speed zone delineations (Aipanjiguly, 2001; Aipanjiguly, Jacobson & Flamm, 2003; Parker & Wang, 1996; Swett, Fann & DeLaney, 2005), and report a deficiency in their understanding of rules, laws, regulations, speed zone boundaries and channel messages (Aipanjiguly, 2001; Aipanjiguly et al., 2003; Confer, Holland & Grist, 2003).

Much of the human-element research in recreation has occurred under the guise of developing informational strategies to influence behavior and philosophical positions (Fishbein & Manfredo, 1992). Congruent with the need to understand why a person may or may not engage in particular behaviors, the Theory of Reasoned Action (TRA) model (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980) frames behavior as a function of attitudes, subjective norms and

intentions. The TRA has been utilized to explore a variety of natural resource-related behaviors including citizen voting behavior with respect to a proposed animal trapping amendment (Manfredo, Fulton & Pierce, 1997), public support for a National Park Service controlled burn policy (Bright, Fishbein, Manfredo & Bath, 1993), attitudes influencing decisions to engage in consumptive outdoor recreation activities (Fulton, Manfredo & Lipscomb, 1996), understanding of outdoor recreation behavior (Young & Kent, 1985), and beliefs, attitudes and behavioral intentions among Florida boaters (Aipanjiguly, 2001; Aipanjiguly et al., 2003). The TRA has generally been found to be a robust model to explain and predict intentions to perform future behavior due to its reliance on understanding an individual's beliefs and attitudinal position. Furthermore, TRA has also been expanded to incorporate past behavior as a predictor of intentions and future behaviors. Although such research has been utilized in the public health discipline (, Albarracin, Fishbein, Johnson and Muellerleile, 2001), it is generally lacking in outdoor recreation and natural resource management research. Given its applicability in outdoor recreation research, utilization of past behaviors to predict intentions and future behaviors offers an important opportunity to further examine outdoor recreationists.

Influencing visitor beliefs, attitudes and behavior is important in the management of natural resource recreation areas; however, simply providing information may result in limited success (Jett, 2000; Manfredo, 1992). Boater non-compliance in Florida suggests that the current reliance on on-water signage as the primary strategy of reducing vessel speeds may be somewhat ineffective. Petty and Cacioppo (1986) emphasize the importance of understanding one's knowledge and experience to frame issues in which attitudes and behaviors can be effectively shaped. Boater behavior in manatee conservation zones suggests that a better understanding of boater attributes is warranted.

Recent research about boater attributes, attitudes and behaviors have established several interesting associations. For example, based on empirical research conducted among boat operators in south Florida boat operators, Futerfas, Gladwin and Flamm (2003) found:

1. Boater experience was positively associated with opinions that manatee speed zones were too strict.
2. Boater experience was negatively associated with agreement with manatee rights.
3. Boaters who were not members of boating organizations, as well as those who had no exposure to boating publications, were more likely to agree with manatee rights and to favor stricter boat zone rules.
4. Boaters who had taken a boater education class favored less strict zone rules.
5. Boat length was negatively associated with attitudes toward manatee rights.

Furthermore, boater compliance research has generally found operators of personal watercraft and other small vessels to be less compliant than operators of larger watercraft (Gorzelany, 1996, 2001, 2004; Shapiro, 2001; Tyson & Combs, 1999). Other studies such as Cottrell's (1993) examination of self-reported boater behaviors established that boat length (negatively associated), boat type (non motorized less compliant than motorized), years of boating (negatively associated) and site-specific boating experience (positively associated) were predictors of environmentally compliant boating behaviors as measured by intent to use mandatory sewage pumpout stations. Attributes such as vessel size, vessel composition, boater experience, membership in activity organizations, publication subscriptions and agreement with and adherence to management rules may be representative of the degree of "specialization" a recreational boater has attained.

Recreation specialization theory has been examined in a variety of contexts and in a number of ways since its formal introduction by Bryan (1977) as a means of explaining the continuum of recreationist behavior and advancement from entry-level beginner to seasoned

expert. Based on his observation of anglers, Bryan's initial proposal on the theory suggested that one's progression from low to high specialization was, over time, accompanied by an increase in experience with and commitment to a specific activity, as well as change in behaviors, attitudes and preferences. More specifically, Bryan discovered an attitude shift from resource (fish) consumption to preservation, as well as preference for management interventions that favored healthy native fish populations. Since its formal introduction, recreation specialization theory has been utilized to assess a wide variety of recreation participants and activities (Scott & Shafer, 2001).

Although recreation specialization theory has been extensively incorporated in empirical research, there is much debate about the operationalization and analysis of the construct. In general, the specialization construct has evolved from behavioral measures to multiple-item indices that comprise behavioral, psychological and cognitive components (Scott & Shafer, 2001). The behavioral domain has focused on familiarity with and investment in an activity, frequency of participation, number of sites visited and years of experience; whereas, the psychological (affective) dimension has been utilized to assess how central an activity is to one's life. The cognitive dimension has focused on participant skill and knowledge (either self-reported or as indicated by certification or other objective measure). As the construct has been refined, the psychological domain has been expanded to include an "enduring involvement" dimension, which includes attraction to an activity, self-affirmation and centrality to lifestyle (McIntyre & Pigram, 1992).

Despite advancement, evaluation of the specialization construct remains an unresolved issue. Several researchers have relied on a single, and multiple-item additive index as measures of specialization (, Donnelly, Vaske & Graefe, 1986; Wellman, Roggenbuck & Smith, 1982;

Virden & Schreyer, 1988), while others have demonstrated that an examination of individual domains may offer better predictive validity as it avoids the masking effect of a composite index (Bricker & Kerstetter, 2000; Kuentzel & McDonald, 1992; Lee & Scott, 2004; McFarlane, 2004; McFarlane, Boxall & Watson, 1998; Meyer, 2002; Thapa, Graefe & Meyer, 2006). In summary, Kuentzel and McDonald (1992) submit that, "a composite index treatment of specialization may miss much of the explanatory detail available from a separate analysis of multiple underlying constructs" (p.283).

Researchers have used recreation specialization theory to examine environmental and conservation attitudes (Dyck, Schneider, Thompson & Virden, 2003; Katz, 1981; Kauffman, 1984; McFarlane, 1994; Meyer, 2002; Mowen, Williams & Graefe, 1997; Thapa, 2000; Virden & Schreyer, 1988), management preferences (Bricker, 1998) and depreciative behaviors (Bireline, 2005; Meyer, 2002; Wellman, Roggenbuck & Smith, 1982). Findings support the general contention that as recreationists proceed through the specialization continuum (from low to high) they concomitantly report higher levels of general environmental concern (Katz, 1981; Kaufman, 1984; Mowen et al., 1997), site-specific environmental concern (Mowen et al., 1997) and support for resource management rules and regulatory procedures (Ditton, Loomis & Choi 1992). Similarly, support for waterway management rules in the form of fishing regulations have been found among the most specialized anglers (Chipman & Helfrich, 1988; Salz et al., 2001). Also, a greater reception of and support for management approaches such as harvest limits designed to mitigate user impacts have been identified (Oh & Ditton, 2006). However, poor support for access-denial regulations has also been found among anglers, regardless of their level of specialization (Chipman & Helfrich, 1988; Salz et al., 2001; Salz & Loomis, 2005).

Despite the fact that depreciative behavior is an increasingly important and expensive issue in park and natural settings (Cole et al., 1997), rarely has it been examined using recreation specialization theory. In one of the few studies, Wellman et al. (1982) found a weak relationship between level of specialization and recreationists' norms of depreciative behavior, although the findings may have been compromised by methodological concerns and a small sample size. Similarly, Thapa (2000) found weak relationships between recreation specialization and self-reported pro-environmental behavior. However, Meyer's (2002) study of self-reported behaviors among SCUBA divers demonstrated that those who were highly specialized were more likely to be engaged in environmentally friendly diving behaviors. Contrastingly, Bireline (2005) found that highly specialized birders reported to be more likely than less specialized birders to rely on depreciative methods such as "pishing" (a noise made by a birder to attract birds) to facilitate bird viewing.

Generally, recreation specialization and environmental behavior research has tended to rely on self-reported rather than investigator-observed behaviors (Bireline, 2005; Cottrell, 1993; Choi, Loomis & Ditton 1994; Cottrell & Graefe, 1997; Donnelly, Vaske & Graefe, 1986; Meyer, 2002; Nord et al., 1998; Thapa, 2000; Theodori et al., 1998; Sutton & Ditton, 1992). Self-reports of behavior represent a limitation in specialization research as self-reports may poorly reflect actual behavior and may bias research results. Overall, there is a paucity of research with respect to the relationship between recreation specialization and depreciative behaviors. Additionally, the few studies have all relied on self-reported behaviors.

Statement of Problem

The current tertiary strategy for protecting Florida's West Indian manatee relies on boater compliance with manatee speed zones. Although speed reduction has been shown to reduce manatee mortality (Laist & Shaw, 2006), limited research has demonstrated that fewer than 60%

of Florida's boaters typically comply with established speed restrictions (Gorzelany, 1996, 2001, 2004; Tyson & Combs, 1999). Boater regulation compliance has been shown to vary according to boater/boat attributes such as boat length, type of vessel, observed activity and knowledge of the local environment and regulations (Cottrell, 1993; Gorzelany, 2004; Tyson & Combs, 1999).

Recreation specialization theory posits that as a recreationist becomes more highly specialized he/she congruently indicates greater support for the rules, norms and regulatory procedures set forth by resource managers (Ditton et al., 1992). Several angler studies on catch and release and size limits generally support this proposition (Bryan, 1977; Chipman & Helfrich, 1988; 1982; Salz et al., 2001); however, the hypothesized relationship may deteriorate when management rules prohibit access (spatially or temporally) to boating activities or resources (Chipman & Helfirch, 1988; Salz & Loomis, 2005; Salz et al., 2001). Furthermore, the relationship between specialization and support of boat speed reduction as a marine conservation strategy remains unknown.

Past research demonstrates inconsistencies in the association between recreation specialization and pro-environmental behaviors (Bireline, 2005; Meyer, 2002; Thapa, 2000). Besides Wellman et al.'s (1982) examination of canoeist's norms of depreciative behaviors, Meyer's (2002) investigation of SCUBA divers and Bireline's (2005) study of birders, little research has been conducted on recreation specialization and depreciative behaviors, and none have utilized observational methods. Poor compliance implies that the current information provided to boaters may be ineffective, boaters may be choosing to ignore the information or that they are devoid of the skill or knowledge to behave appropriately. Therefore, a better understanding of boater behavior is warranted.

Purpose of Study

Based on the paucity of research and recommendations from the literature, the purpose of this study was to examine relationships between observed vessel speeds in manatee conservation zones, recreation specialization, marine conservation attitudes, self-reported compliance behavior, speed zone sign assessment, TRA, and vessel and operator attributes (Figures 1-1 and 1-2). More specifically, the research was designed to:

1. Compare reported with observed compliance behavior.
2. Determine how vessel speeds and situational factors were associated.
3. Determine how vessel speeds differed between slow and idle speed zones.
4. Evaluate Theory of Reasoned Action as it related to both in-situ observation and self-reports of compliance.
5. Reexamine the general hypothesis that a positive association exists between level of specialization and pro-environmental behavior as demonstrated by observed boat speed in manatee conservation zones.
6. Assess the associations between level of specialization and boater's marine conservation attitudes.
7. Assess the association between marine conservation attitudes and observed boat speed.
8. Employ path analysis to determine the predictive validity between recreation specialization, marine conservation attitudes, behavioral intentions, self-reported compliance behavior and observed speed discrepancy.

Research Questions

1. Does boat speed violation ticketing history influence speed [1]?
2. Does boater speed discrepancy differ between idle and slow speed zones?
3. Does boat party size influence speed discrepancy?
4. Does vessel length influence speed discrepancy?

[1] Speed discrepancy defined as observed vessel speed minus the maximum allowable per zone.

5. Does vessel type influence speed discrepancy?

6. Does boater's history with seeing manatees influence speed discrepancy?

7. Does boater's speed zone signage assessment influence speed discrepancy?

8. Does boater's level of recreation specialization influence speed zone signage assessment?

9. Are the relationships between past behavior (observed and self-report) attitudes, norms and intentions consistent with the TRA model.

Hypotheses

Recreation Specialization

H1: There is a negative association between boater specialization and observed speed discrepancy.

H2: There is a positive association between boater specialization and self-reported compliant behavior .

H3: There is a positive association between boater specialization and marine conservation attitudes.

H4: There is a positive association between boater specialization and intention to comply with manatee speed zone restrictions.

Self-Reported vs. Observed Compliant Behavior:

H5: There is a negative association between self-reported compliant behavior and observed speed discrepancy.

Marine Conservation Attitudes:

H6: There is a negative association between marine conservation attitudes and observed speed discrepancy.

H7: There is a positive association between marine conservation attitudes and intention to comply with manatee speed zone restrictions.

H8: There is a positive association between marine conservation attitudes and self-reported compliance behavior.

Behavioral Intentions:

H9: There is a positive association between intention to comply with manatee speed zone restrictions and self-reported compliance behavior.

H10: There is a negative association between intention to comply with manatee speed zone restrictions and observed speed discrepancy.

Path Analysis

A path analysis will be employed to determine the predictive validity between recreation specialization, marine conservation attitudes, behavioral intentions, self-reported compliance behavior and observed speed discrepancy (Figure 1-1).

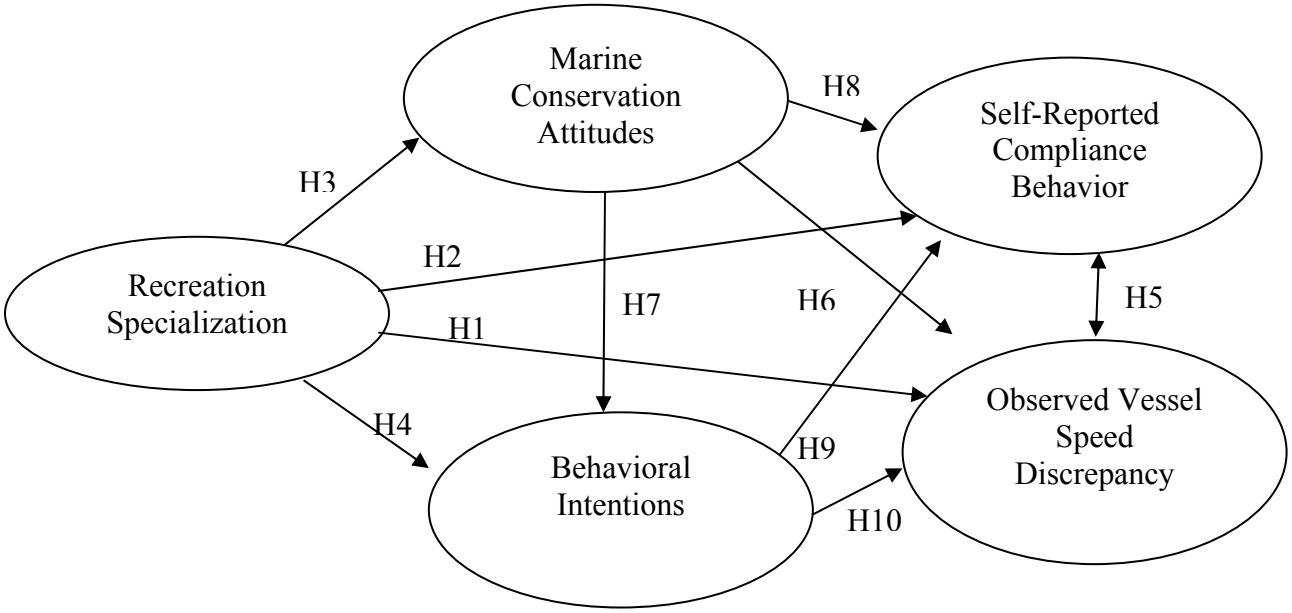


Figure 1-1. Hypothesized conceptual model

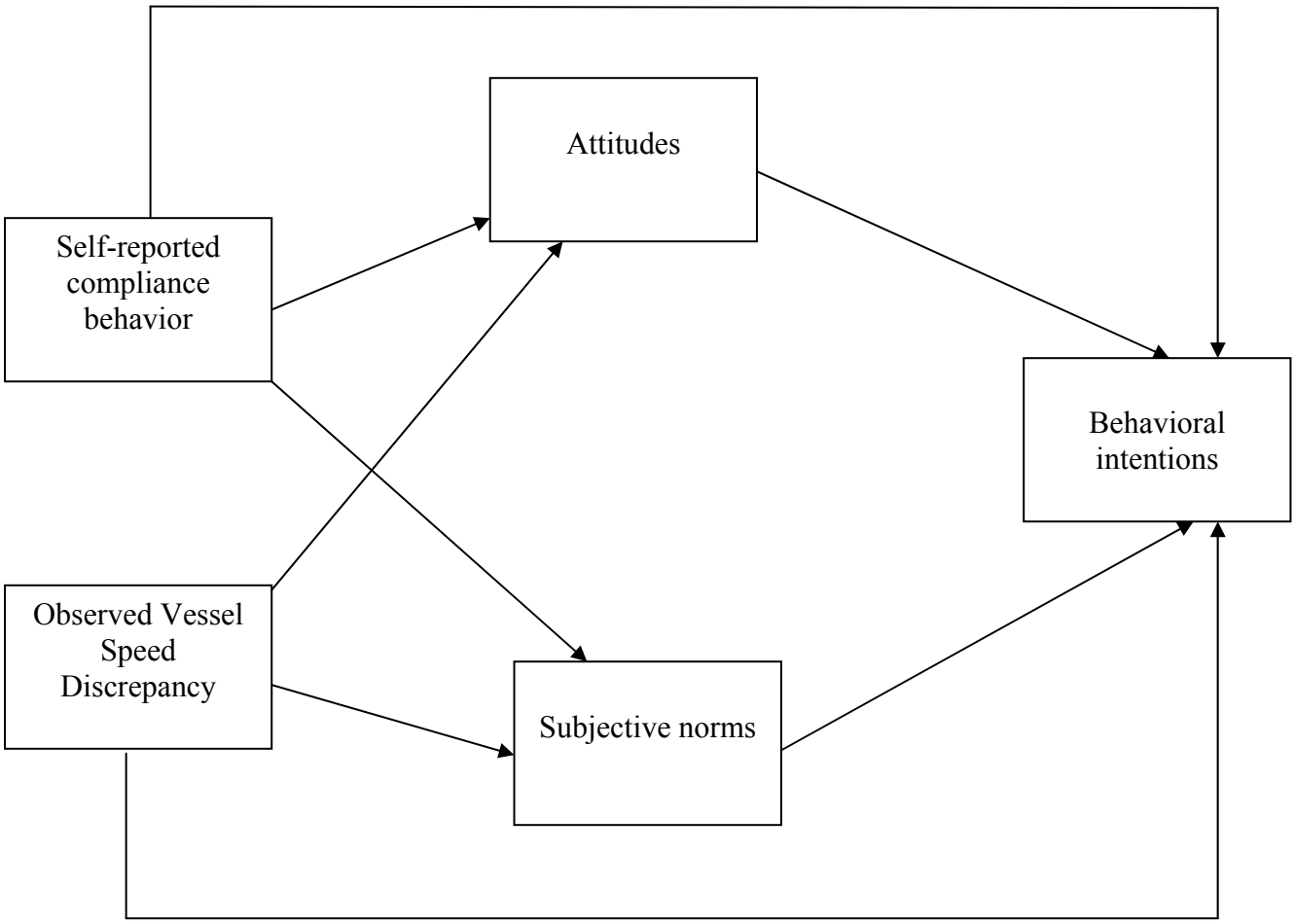


Figure 1-2. Theory of reasoned action (Adapted from Albarracin et al., 2001).

CHAPTER 2
REVIEW OF LITERATURE

Motorized Travel and Wildlife Impacts

Terrestrial wildlife

An examination of the negative impact of roads and vehicle traffic on terrestrial animals serves as a corollary to the manatee-watercraft issue. Roads can be an important factor in the ecology of an area, especially with respect to animal movement and mortality (Trombulak & Frissell, 2000). An estimated one million vertebrates are killed on U.S. roads every day (Lowy, 2001) and several approaches have been employed in an effort to reduce the magnitude of the problem, including structures such as culverts, overpasses, fences, flashing lights and signage, among others. It is generally thought that signs combined with speed limits and flashing lights have been successful in reducing collisions, although not as successful as physical deterrents (Banks, Irwin, Evink, Gray, Hagood, Kinar, Levy, Paulson, Ruediger & Sauvajot, 2002).

Due to the number of threatened and endangered species residing within its borders, Florida is thought to be a leader in wildlife collision mitigation (Schrag, 2003). In demonstrating the crucial need for effective mitigation, 44 of the endangered Florida panther (*Felis concolor coryi*) have been killed by vehicle collisions since 1972 (FWC, 2001). As a result, wildlife crossings, fencing and reduced nighttime speed limits were put into place on a particularly deadly 40-mile stretch of highway, with the result that no further panther impacts occurred. Although the approach appears to have reduced panther collisions, FWC (2001) notes that it is impossible to evaluate the impacts of such zones, as it is not known how many deaths would have resulted absent any intervention. Furthermore, they indicate that panthers have been killed by very slow moving vehicles (<25 mph), and suggest that "education and enforcement of speed

zones probably only has a temporary effect on reducing speeds and speed itself may not be the sole determinant of panther roadkills" (p.1).

As the Florida black bear (*Ursus americanus floridanus*) is a much more widely dispersed species than the Florida panther, strategies to reduce mortality from vehicle strikes have faced considerable challenges. The threatened black bear has suffered substantially from vehicle traffic, with 84% of bear mortality due to vehicle collisions. However, the large geographic distribution has precluded wholesale management approaches such as erecting barrier fencing (FWC, 2006e). Instead, black bear protection has primarily been facilitated by warning signs, reduced speed zones and the strategic placement of wildlife underpasses. Despite these interventions, and perhaps due to a variety of factors, bear deaths have steadily risen since 1976 (FWC, 2006e), and although it appears that these strategies have not been particularly effective, they have not been formally evaluated (Sorice, Flamm & McDonald, 2004).

In Florida, wildlife along a two-mile stretch U.S. Hwy 441 through Paynes Prairie State Preserve, Alachua County, have suffered high levels of vehicle-induced mortality for 80 years (Barichivich & Dodd, 2002). In an effort to reduce the large number of deaths, a 1.1 m high concrete barrier wall was built to guide animals to an animal underpass. Although meant primarily as a method of funneling small amphibians and reptiles across the highway, it was discovered that the wall also discouraged mammals from entering the highway and similarly guided them to the underpass and to safety. Overall, the barrier and culvert system resulted in a 41% reduction in traffic-related wildlife mortality on this particular stretch of highway.

Finally, Florida's Key deer (*Ococoileus virginianus clavium*) is compromised by vehicle collisions, which account for approximately 67% of the known deaths of the endangered animal. Although land ownership along the Highway US 1 corridor confounds the use of fencing and

other physical approaches in most of the habitat, deer grating, underpasses and fencing is utilized wherever possible (Lopez, Silvy, Owen, Irwin, 2003). To further minimize collisions, strictly enforced speed reduction zones are in place throughout important Key deer habitat (U.S. Fish and Wildlife Service, 1999). However, as with the Florida black bear, these mitigation strategies do not appear to have been evaluated since the program was instituted.

Despite considerable effort at reducing wildlife collisions, attempts to modify driver behaviors with awareness strategies may be marginally successful (Romin & Bissonette, 1996). The exception to this may be in active awareness strategies in which animals are electronically detected on the roadside and drivers made aware of collision potential through flashing lights, etc. (Newhouse, 2003). Due to the general lack of success with this approach, the prevailing methods of reducing collisions relies on physical designs such, as underpasses, fencing or other means of segregating wildlife from automobile traffic. Although physical design strategies may be the preferred approach in terrestrial settings, the vertical and horizontal dimensions of the water column and often dispersed nature of marine animals such as manatees limit this approach from being widely utilized in aquatic environments.

Manatees

Manatees are large herbivorous marine mammals of up to three meters in length and weighing between 360 and 544 kilograms. As a migratory species, manatees tend to concentrate in the relatively warm waters of Florida in the winter and are found during summer months from Texas to Virginia, as well as waterways in both Central and northern South America (Save the Manatee Club, 2006). Manatees occupy a wide variety of habitats including the many shallow, slow-moving rivers, bays, canals and coastal waters of Florida.

Manatees have enjoyed protection in the state of Florida since 1893 when killing of manatees was outlawed (FWC, 2005). In 1978, with the acknowledgement that the manatee

population was in precipitous decline, additional sanctuaries and state protections were constructed in areas where manatees were likely to be encountered or otherwise deemed essential for the survival of the species (U.S. Fish and Wildlife Service, 2001). Between 1979 and 2005 a large number of safe havens and boating speed-restricted areas were added to Florida's waterways (FWC, 2005). The manatee was listed as endangered in 1967 under the Endangered Species Preservation Act, a precursor to the Endangered Species Act under which it now resides. At the time of my research, the manatee was downlisted at the state level from endangered to threatened status.

Under the umbrella of the Federal Manatee Recovery Plan (FMRP), the State of Florida has implemented manatee protection through the use of manatee counts, county protection plans and boat speed regulatory zones (Reynolds, 1999), though this approach has met numerous impediments. At the core of the FMRP lies the task of obtaining manatee count data. However, accurate long-term manatee population viability estimates are difficult to ascertain, with some scientists (Miller, Ackerman, Lefebvre & Clifton, 1998) suggesting that population surveying limitations preclude an accurate understanding of population trends altogether.

Both aerial and ground counts are currently the primary source for population trend estimations. Although much effort has been conducted to understand population dynamics since the 1970s, scientists have been relatively unsuccessful in developing a useful means of monitoring population trends in the southeastern United States (O'Shea, 1988; Lefebvre, Ackerman, Portier & Pollock, 1995). Researchers such as Lefebvre et al. (1995) and Miller et al. (1998) submit that the many uncontrolled variables related to this method limit their use in accurate population modeling.

Although current population data suggests that the *total* number of manatees has risen since the 1970's (O'Shea 1988, O'Shea & Ackerman, 1995, Runge, Langtimme & Kendall, 2004), data reveals substantial degree of variability between geographically separate subpopulations (FWC, 2005). A cursory review of the data indicates that 10-year population growth trend estimates for the Atlantic subpopulation are between -1.2% to 2.0% (95% CI), although not significantly different from zero (Runge et al., 2004). However, more recent data (5-year) suggests that the subpopulation may be in decline (95% CI: -6.2% to -.2%) (FWC, 2005). Contrastingly, the Northwest subpopulation (currently the second smallest subpopulation) has demonstrated growth of between 1.6% - 5.6% (95% CI) over the past 10 years (Runge et al., 2004). The largest subpopulation (Southwest Florida) has been found in general decline over the eight years prior to 2002 (95% CI: -5.4%-2.4%), while the Upper St. John's River subpopulation has shown generally strong growth over the past 10 years (95%CI: 1.6%-5.6%) (Runge et al., 2004). Although the Upper St. John's River subpopulation numbers are thought to be on the rise, its relative contribution to the total manatee population is small (FWC, 2005). According to Deutsch, Ackerman, Pitchford and Rommel (2002), "A gradual decline in survival over the next half century is conceivable given the high rate of increase (10.3% per year) in watercraft-related deaths range-wide over the past decade" (p.10) (Deutsch, C. J., Ackerman, B.B., Pitchford, T.D., and Rommel, S.A. (2002). Trends in Manatee mortality in Florida. Manatee Population Ecology and Management Workshop, Gainesville, FL. April 1-4, 2002).

Boating has exacted a considerable toll on the Florida manatee, with 1385 known animals killed by watercraft since 1974 when carcass salvage began (FWC, 2006b). The annual number of animals killed by watercraft has increased approximately 5.3% per year from 1986-1992

(Ackerman, Wright, Bonde, Odell & Banowetz, 1995), 6.9% per year from 1993 to 2005 (FWC, 2006b), and current estimates suggest that the percentage of manatee deaths caused by vessel collisions has remained approximately 24% since record keeping began (FWC, 2006b). As recreational boats are now designed with greater power and ability to traverse shallow water, it is reasonable to expect vessel strikes to continue to be an important cause of manatee mortality, especially given the dramatic increase in vessel numbers in Florida.

Boating in Florida

Proliferation

Current human population trends suggest that nearly 5.5 million people will be added to Florida's borders in the next 25 years (U.S. Census Bureau, 2006), with many of these new arrivals living close to coastal or other waterways. Boating in Florida has resulted in both positive economic and negative environmental impacts across many of the state's waterways (Leston, 2002), with manatees being one of the most affected.

Recreation boating is one of the essential elements of Florida's aquatic environment with over one million registered pleasure boats in the state (Florida Department of Highway Safety and Motor Vehicles, 2006). Furthermore, Floirda ranks as the number one marine recreation destination in the United States (Leeworth & Wiley, 2001). There currently exists approximately one registered boat for every 17 Florida residents, and more than 22 million people are either directly or indirectly involved with boating in the state (Leeworth & Wiley, 2001). With manatee habitat often coinciding with recreational boating areas, manatee speed zones have been implemented congruent with manatee habitat and movement patterns, boat traffic, geographic and habitat conditions, as well as public comment. With so many vessels plying Florida's waterways, speed zone compliance is deemed important to the long-term survivability of the manatee (Laist & Shaw, 2006).

Implementation of speed zones as a manatee recovery strategy was first established in 1989 in 13 Florida counties. Boat speed and regulation zones are configured and defined in a variety of ways including channel-exempt (slow speeds that only apply outside of marked channels), shoreline speed zones (reduced speeds apply to certain distances from shore) and channel-inclusive zones (slow speed applies within and outside of marked channels) (FWC, 2006c; Laist & Shaw, 2006). Within each of these zone types, various vessel speed limits are imposed including idle, slow and specific speed (e.g., 25 mph) (FWC, 2006c), with each configuration based upon manatee, vessel traffic and habitat variables.

Boater Compliance with Speed Zones

Speed reduction as a strategy within the FMRP is based upon the assumptions that, 1) slower watercraft create less physical damage to the animal if struck and 2) slow moving watercraft allow both boater and animal increased time for avoidance maneuvering (Laist & Shaw, 2006; O'Shea, 1995). Boater compliance within manatee zones is currently enforced through law enforcement ticketing; however, insufficiently-funded law enforcement efforts and the absence of a general boater licensing program both serve to reduce the effectiveness of this approach (FWC, 2005).

Several boater compliance studies performed on Florida's waterways demonstrate that absence law enforcement, approximately 54 to 63% of boat operators fully comply with speed zones, 20 to 51% are technically non-compliant (see Table 2-1 for speed categories), and the rest are blatantly non-compliant (Gorzelany 1996, 2001; Shapiro, 2001). For example, in 1995 Gorzelany (1996) conducted a one-year evaluation of boater compliance in Sarasota County using a subjective qualitative categorization for various important manatee sites (22,324 vessels recorded), quantitative radar gun readings (4,881 vessels recorded), qualitative aerial surveys (1,662 vessels recorded) and qualitative 44-hour sampling to evaluate off-peak hours (3,913

vessels recorded). Surveying was performed on weekend and weekdays during all months of the year. Chi-square analyses suggested significantly different levels of compliance existed between sites ($p<.0001$), although compliance among the three most common types of vessels (fishing, ski/runabout and yacht/cruiser) were similar and not statistically different. Personal watercraft and johnboats demonstrated lower levels of compliance than did the other vessel types, with two of every three personal watercraft sightings evaluated as blatantly non-compliant at one site. Consistent with this, a distinct trend was noted toward decreasing compliance and boat size. Boater compliance with respect to weekend versus weekday sampling was significantly related to site ($p<.0001$ for all sites combined), and compliance and time of day was significant for all sites combined ($p<.0001$). The presence of law enforcement resulted in the highest level of compliance (74%), and the lowest level of blatantly non-compliant behavior (8%). Finally, although compromised by the small amount of data collected during nighttime hours, analysis suggested a significant reduction in boater compliance from 2000-2359 hours and 0000-0359 hours.

To determine if law enforcement presence has a lasting effect, Gorzelany (2001) evaluated boater compliance before and after a two-week period of law enforcement presence in idle and 25 mph speed zones in Southwest Florida. He used qualitative evaluations of boater compliance for: 1) four weeks prior to officer presence (pre-treatment), after which 2) officers were then instructed to actively enforce boat speeds for two weeks (treatment) and then 3) compliance evaluations continued for another four weeks (post-treatment). Boaters were surveyed during week and weekend days between 0900 and 1600 hours and at times when speeds did not appear to be influenced by heavy boat traffic. Physical attributes such as weather, wind speed and boating conditions were logged within the two sites sampled, with 3,000 boats observed in one

and 2,594 observed in the other. Pre-treatment compliance within the idle speed zone demonstrated a moderate degree of variability, with 13-21% of all vessels blatantly non-compliant, 43-51% technically non-compliant and 29-44% compliant. Dramatic differences were observed during the two-week treatment period, with compliant rates increased to 64-73%, while technical and blatant non-compliant behavior decreased. By week nine of the post-treatment period (weeks 7-10), compliance and non-compliance rates had returned to pre-treatment levels for both weekend and weekday rates. Analysis indicated that compliance levels were significantly different between pre-treatment weeks (1-4) and weeks 5-8.

Results for the 25 mph zone were similar to those for the idle speed zone: there was 70% compliance during the treatment period versus 44 to 52% during the pre-treatment period. Blatant non-compliance ranged from 6 to 12% during pre-treatment and declined to less than 2% during the treatment period, with analyses demonstrating the halo effect (the lasting influence boat operator behavior beyond the point and time when enforcement is applied or when an officer or other law enforcement symbol is observed) that was again present during weeks 7-9. Gorzelany noted that media coverage and the unexpected additional law enforcement with the 25 mph zone may have influenced boater behavior during weeks 8 and 0, thus confounding the results.

Gorzelany (2004) summarized his prior evaluations of 26,000 vessels in Sarasota and Lee counties between 1995 and 1998 and found 63% and 58% compliance respectively (17% and 16% blatantly noncompliant), with compliance varying significantly with vessel type and size. Gorzelany's summary also revealed a high degree of inter-county compliance variability (40-71% in Sarasota County; 30-77% in Lee County). It should be noted that although his research has contributed important insight into compliance behavior, Gorzelany's (1996, 2001, 2004)

reliance on chi-square analyses with large sample sizes may have resulted in a greater number of statistically significant relationships than might be found with more appropriate analytical methods such as Analysis of Variance.

Other studies such as Tyson & Combs' (1999) qualitative evaluation of Banana River (Florida) boaters found similar levels of manatee zone non-compliance (9.2% blatantly non-compliant and 22.6% technical non-compliance). A qualitative investigation of boaters in Brevard County b y Tyson (2001) revealed an overall compliance rate of 70.8% in Haulover Canal (range from 45% to 80.7%), with 26.0% technically non-compliant and 1.0% blatantly non-compliant, and overall compliance of 67.8% in the Canaveral Barge Canal. As with previous studies, Tyson (2001) found that compliance varied with vessel length; however, contrasting others, she found that larger vessels were less compliant than vessels under 25 ft. in length.

Lending insight into possible factors behind boater non-compliance, Aipanjiguly (2001) and Aipanjiguly et al. (2003) determined that roughly one third of Florida boaters surveyed in their study indicated that manatee speed zones were inadequately marked, a point substantiated by Confer et al.'s (2003) finding that 49% of Timucuan Preserve (Florida) boaters surveyed strongly disagreed, disagreed, or were neutral in their response to the statement "I can always tell when I'm in a manatee zone" (p.136). While boater non-compliance can be regarded as depreciative behavior, the above findings suggest that some may engage in this depreciative behavior due partly to a lack of awareness of, or an boat speed zone signage or zone delineations.

Shapiro (2001) summarized the state of knowledge with regard to boat zone compliance:

1. Compliance is dependent on vessel type and size, with blatant non-compliance decreasing with increasing vessel size (a conclusion that contrasts with Tyson, 2001).

2. Seasonal variation in compliance is site-specific.

3. Boat traffic is higher on weekends and during the afternoon, and, at many sites, compliance is higher on the weekends due in part to higher traffic volumes equating to a higher likelihood of ticketing by law enforcement.

4. Rental, commercial and vessels registered out of state vessels are more likely to violate zone speeds.

5. The presence of law enforcement negates the influence of other variables on compliance. Compliance significantly increases when law enforcement is present.

6. The residual effect (halo effect) of law enforcement presence on compliance seems inconclusive.

7. The complexity of the issue dictates that compliance be evaluated on a per site basis.

Furthermore, Shapiro (2001) states:

> "To reduce boat speeds and increase compliance in manatee speed zones, we may be able to borrow some speed-reducing techniques historically utilized by the police and highway patrol. These techniques may provide a cost-effective alternative to the very labor-intensive patrols necessary to produce a time-halo effect, and include the use of feedback signs, personalized advisory letters, replica patrol cars, roadside speedometers, and highly integrated education and enforcement programs" (p.10).

Florida Vessel Title Registration System (VTRS)

There is an increasing need to better understand boat attributes and boat mooring and docking locations within the state of Florida. To this end, the Florida Vessel Title Registration System (VTRS) has been shown to be an efficient method of obtaining spatially accurate boat and boater information. The VTRS is a database of registered boats that is continuously updated. Boat owners in Florida are required to register their boats with the state on an annual basis, and to affix a Florida registration number decal (at least 3" high letters) to the bow of their boat (FWC, 2006c). Notable exemptions to this registration requirement include 1) non-motorized vessels, 2) vessels only operated on private ponds or lakes, 3) U.S. Government-owned vessels,

4) lifeboats for ships and 5) vessels from other states that are temporarily (fewer than 90 consecutive days) using Florida waters (Swett, Sidman, Fik & Sargent, 2004).

Swett et al. (2004) examined the utility of the VTRS to facilitate a spatial inventory of watercraft based on the mailing addresses of boat owners. They evaluated the accuracy and reliability of vessel location and attribute information contained in the VTRS by assessing the congruency between an on-water census of vessels and VTRS records for a variety of waterways in Lee and Manatee counties. The VTRS captured the highest percentage of the boat population (80% compared with 60% for the on-water census). Furthermore, a 92% agreement was found between the boat owner address listed in the VTRS (based upon hull number query) and actual owner address established by telephone interview. The authors concluded that the VTRS was a viable method of describing boats locations.

Outdoor Recreation and Association with Environmentalism

Environmental Attitudes / Environmental Behavior

Compliance within manatee speed zones can be considered pro-environmental behavior and non-compliance, depreciative behavior. Even though widely researched, the general body of environmental attitude and environmental behavior literature remains varied both in focus and findings.

Dunlap and Heffernan (1975) were among the first to formally test the hypothesis that outdoor recreation participation might foster environmental concern. They asked subjects to indicate frequency of participation in a variety of activities in order to evaluate three hypotheses related to the association between: 1) outdoor recreation and environmental concern, 2) appreciative versus consumptive recreation activities and environmental concern and 3) outdoor recreation and protecting particular outdoor areas necessary for specific activities and outdoor recreation. Weak support was found for the first hypothesis, modest support for the second and

somewhat stronger support for the third. Recreationists engaged in appreciative activities demonstrated greater environmental concern than those engaged in consumptive activities; and subjects indicated more concern for environments in which their activities relied than for general environmental issues such as water pollution. After controlling for the effects of age, income, education, residence and gender, the authors concluded that "there is a non-spurious relationship between involvement in outdoor recreational activities (especially appreciative activities) and environmental concern" (p.25).

Although groundbreaking, Dunlap and Heffernan's (1975) study was not without limitations. Their operationalization of environmental concern (eight items total) was incomplete and focused on issues relating to subjects' concern for pollution (five items) and commitment towards nature (three items). Also, only one of the three items within the commitment domain pertained to nature for nature's sake (commitment toward protection of wildlife and endangered species).

In a study designed to reassess Dunlap and Heffernan's (1975) findings, Geisler et al. (1977) further refined the measure of recreationists by including a consumptive orientation (motorized recreation in the form of snowmobiling). Nine measures of environmental awareness were included: stream, lake, noise and air pollution, trash, erosion, wildlife impoverishment, overcrowding and people living too close to recreation areas. Strong support was found for Dunlap and Heffernan's (1975) first hypothesis, weak support for the second, while the third was not tested. Additionally, they concluded that recreationists were more influenced by individual characteristics than by their chosen activity. Their study, while important, was limited in its operationalization of environmental concern by focusing on human-induced problems and anthropocentric issues rather than nature's inherent value.

Advancing the line of inquiry, Van Liere and Noe (1981) expanded the participation component of Dunlap and Heffernan's original hypotheses by including average number of hours and number of days engaged in a particular activity at Cape Hatteras National Seashore. Most importantly though, the authors utilized the New Environmental Paradigm (NEP) created by Dunlap and Van Liere (1978). The 12-item, 4 point Likert scale NEP expanded the contracted nature of prior environmental concern instruments by moving beyond an anthropocentric view of environmental issues (i.e., how environmental issues relate to or impact humans) to that of general biocentric viewpoints. Nevertheless, Van Liere and Noe's (1981) investigation failed to support Dunlap and Heffernan's (1975) first hypothesis and demonstrated only moderate support for the second. The authors concluded that frequency or type of activity disregards crucial personal factors influencing one's interpretation of a particular recreational experience.

Contrastingly, Jackson's (1986) examination of Canadian residents, with slight modifications to Van Liere and Noe's (1981) approach, found support for both the second and third hypotheses. Jackson's methods differed from previous approaches by combining participation categories into participants and non-participants. He also measured environmental attitudes with items from the Environmental Attitudes Scale (including items from the NEP), the Dominant Social Paradigm Scale (Dunlap & Van Liere, 1978), and other items derived from the environmental literature. Recreation attitudes were measured with the Recreation Attitude Scale (Knopp & Tyger, 1973), which evaluated one's control of recreation activity as related to environmental factors and wilderness development. Jackson's results showed that participants engaged in appreciative recreation such as canoeing, hiking and skiing had higher scores than fishing and boating participants in both environmental and recreational attitude measures. Moreover, he found that fishing and boating participants differed little in attitude from those

engaged in snowmobiling, hunting or biking. Due in part to inconsistencies in approach, outdoor recreation-environmental attitude research has been problematic and inconclusive. The environmental behavior literature has seemingly faired no better.

Nord et al. (1998) attempted to determine if forest recreation and pro-environmental behaviors were positively associated by testing Dunlap and Heffernan's (1975) first two hypotheses and then adding a third, namely, that pro-environmental behavior was positively associated with appreciative forest recreation. The authors measured environmental concern with one item (importance of the quality of environment); pro-environmental behavior with several items (e.g., purchasing behavior influenced by environmental impacts of a product); and outdoor recreation operationalized by frequency of forest visits as well as types of activities engaged in. Their findings suggested a positive association between forest recreation and environmental behaviors (self-reported), although a weak relationship was found between forest recreation and environmental concern. Nord et al. (1998) concluded, "It is quite possible that outdoor recreation leads to pro-environmental behavior, even though it does not lead to environmentalism as measured by attitude" (p.12).

Expanding this line of research, Theodori et al. (1998) assessed the relationship between outdoor recreation participation and pro-environmental behaviors, with the added dimension of activity orientation (appreciative to utility, where utility was similar to consumptive). They evaluated participation by asking respondents to indicate frequency of participation among nine different outdoor recreation activities. The authors further divided activities into appreciative, slight utility and moderate to intensive utility categories, while environmental behavior was evaluated by asking respondents to check (yes/no) whether they had participated in any or all of seven listed behaviors (e.g., green voting, environmentally friendly consumer behaviors,

engagement in reading environmentally oriented literature). Their findings suggested that self-reported pro-environmental behaviors were more positively associated with activities on the appreciative end of the recreation participation scale than with activities on the moderate to intensively utilitarian end, but only to a point. That is, the significant differences in pro-environmental behavior between appreciative and consumptive recreationists became insignificant after controlling for age, gender, education, income and political ideology. Despite this detail, their results generally supported Dunlap and Heffernan's (1975), Van Liere and Noe's (1981), and Jackson's (1986) findings that the outdoor recreation-environmental attitude associations were non-spurious after age, gender, education, income and political ideology were controlled. Jackson concluded that socio-economic characteristics of individual recreationists accounted for differences in engagement with pro-environmental behaviors rather than the activities in which they participated.

Tarrant and Green (1999) similarly examined outdoor recreation and its influence on the predictive validity of environmental attitudes. More specifically, they examined three explanations for the generally poor attitude-behavior consistency found within environmental behavior literature. Their objective was to investigate both the moderating and mediating effects of different types of outdoor recreation (consumptive, appreciative and motorized) on attitude as a consistent predictor of behavior. The authors measured general environmental attitudes using the New Environmental Paradigm scale (12 items), the EC (16 items), the ROPER (9 items), the AC (9 items) and a version of the FV scale (8 items), with each respondent randomly assigned to one of the environmental attitude scales. Environmental behavior was assessed using a single behavioral index created by asking respondents how often, in the past two years, they had participated in recycling, environmentally friendly purchasing, carpooling, watching

environmental programs and reading environmental literature. Participation in outdoor recreation was evaluated based upon yes/no responses to having participated in various recreation activities in the past 12 months. Participation was categorized as appreciative (e.g., birdwatching and hiking) and consumptive (e.g., hunting and motorboating) behaviors. Results suggested that moderating effects were weak or non-existent, although poor internal reliability measures may have compromised the results. Contrastingly, participation in appreciative outdoor recreation was shown to mediate the environmental attitude-environmental behavior relationship, though participation in motorized and/or consumptive recreational activities did not. Although the results offer important insight into the relatively poor attitude-behavior consistency found within the environmental behavior literature, the study may have been compromised by a relatively low telephone survey response rate and no examination of non-response bias was provided. Despite the limitations, the findings suggest that participation in appreciative forms of outdoor recreation may act as a mediator of the attitude-behavior relationship, therefore improving the predictive ability of environmental behaviors.

In reexamining the effect of appreciative, consumptive and motorized forest recreation on environmental attitudes and behaviors, Thapa (2000) found that participation orientation (appreciative, consumptive and motorized) acted as a mediating effect on certain pro-environmental consumer behaviors as assessed by self-reports. The author treated both environmental attitudes and behaviors as multidimensional constructs (ecocentric, dualcentric and technocentric), and measured outdoor recreation participation using the most important activity reported from a list of activities rather than generic participation. Similar to prior research, Thapa found that forest recreationists who engaged in appreciative activities demonstrated stronger pro-environmental orientations than did those engaged in consumptive or

motorized activities. By utilizing factor analysis, the author extended the literature by dividing environmental behavior into five separate dimensions (political activism, recycling, educational, green consumerism and community activism) and demonstrating that behavioral indices were influenced by activity orientation (e.g., those involved in consumptive activities were more likely to participate in political activities than those engaged in appreciative activities).

Aside from the outdoor recreation literature, the body of research regarding general pro-environmental behavior is varied and mostly beyond the scope of this review. However, a cursory review of the types of inquiries that have been conducted lends insight into the myriad lines of research.

Much of the environmental behavior research has focused on personality and demographic characteristics of those reporting pro-environmental behavior. Contrasting, Geller's (1981) findings that citizen education on specific behaviors to reduce one's ecological footprint did not lead to energy conservation or other pro-environmental behaviors, Hines et al. (1986) concluded that education level and pro-environmental behaviors were positively associated. Similarly, Cottrell (1993) and Cottrell and Graefe (1997) found that environmental knowledge was a predictor of pro-environmental boater behavior such as using sewage pumpout stations. Additionally, in a reevaluation of his 1993 study, Cottrell (2003) concluded that income and age were negative predictors of self-reported environmentally responsible concern (attitudes) as measure by the New Environmental Paradigm scale. In his study, verbal commitment (intentions) variables explained roughly 24% of the variability in self-reported responsible environmental behavior (operationalized based on 10 questions evaluating the extent respondents would go to protect the environment). His results also demonstrated that the predictive ability of verbal commitment increased when sociodemographic variables were added to the regression

model. Finally, self-reported environmental knowledge (4 self-assessment items regarding knowledge of water pollution, raw sewage, local environmental issues and knowledge of ecology) were also found to be significant predictors of self-reported responsible environmental behavior.

Exemplifying environmental attitude-behavior association research, Tarrant and Cordell (1997) examined self-reports of general environmental behavior and their associations with five environmental concern scales. Based on Fishbein and Ajzen's (1975) assertion that attitudes are beliefs about a particular object that predispose a person to behaving in a consistent way toward that object, their research employed an 11-item self-reported behavior index that asked respondents to indicate their agreement with participating in specific behaviors such as recycling, carpooling and others. Of the five established environmental scales that were examined, the New Environmental Paradigm (measuring broad-based beliefs regarding the spaceship earth metaphor) and Awareness of Consequence scales were most strongly associated with general environmental behavior. Though compromised by a somewhat low response rate (44%) their research demonstrated that associations between general environmental behaviors and attitudes decreased as income increased, education decreased and one became more politically conservative.

Perhaps the most robust body of literature along this line of inquiry stems from the general examination of cognitive, psychological and social variables associated with environmental behavior. Studies within this realm have included costs and benefits (real and perceived) of performing various behaviors (De Young, 1990); the knowledge required and/or difficulty in performing behaviors (De Young, 1989); barriers and inconveniences to environmentally friendly actions (Derksen & Gartrell, 1993); attitudes toward behaviors (e.g. Hines et al., 1986);

relationships between awareness of impacts and pro-environmental behaviors (Shultz & Zeleny, 1998); and sense of place and various behaviors (Cantrill, 1998; Vaske & Kobrin, 2001).

Of primary focus within the attitude-behavior debate is whether or not attitudes influence overt behavior (Manfredo, Fulton & Pierce, 1997). Manfredo, et al. (1997) suggested that the generally weak attitude-behavior associations found in research conducted during the 1960s and 1970s served to fuel the debate among psychologists as to the utility of the attitude model. The authors also stated that contemporary advancements in theory and methodology served to improve predictions of behavior based on attitudes, and that the relationship had been further accepted.

Depreciative Behavior in Outdoor Settings

Natural resource managers spend millions of dollars each year attempting to persuade visitors to minimize impacts on the social and/or physical environment and otherwise follow rules set forth by managing agencies. Researchers have devised a host of direct and indirect management techniques to reduce unwanted visitor behaviors. Indirect techniques such as, communication designed to educate, persuade and otherwise change behaviors have generally been preferred in park settings (Hendee & Dawson, 2002; Manning, 1999; Roggenbuck, 1992). Indirect techniques are considered to be most cost-effective, most likely to result in enduring visitor behavior changes and consistent with the freedom tenet of outdoor recreation (Clark, Hendee & Burgess, 1972). However, sanctions or punitive approaches are also relied upon when unwanted behavior is especially costly. Regardless of the approach used to reduce or otherwise control unwanted behaviors in outdoor settings, depreciative behavior remains a persistent issue among managers.

Depreciative behavior (anti-environmental behavior) is generally understood as an act or action that negatively impacts the social or physical environment (Clark et al. 1972), as

contrasted with vandalism, which is a willful act of damage to some facet of the environment (Knudson, Cable & Beck, 1995). Depreciative behavior within natural resource settings is important due to its negative effects on the sustainability of natural ecosystems (Cole et al., 1997), degraded visitor experiences (Christensen, Johnson & Brookes, 1992) and resulting mitigation costs (Winter, Sagarin, Rhoads, Barrett & Cialdini, 2000).

Researchers have examined depreciative behavior since Clark et al.'s (1972) application of social science theory (in the form of stimulus-reward and norm manipulation) as a means to reduce specific park visitor behaviors such as littering. Since then, researchers have investigated a range of issues relating to depreciative behavior, with most examinations focused on methods of alleviating unwanted behavior.

Gramman and Vander Stoep (1987) were the first to put forward a taxonomy of depreciative behavior, which offered theoretical insight into indirect management techniques for reducing unwanted visitor actions. According to their taxonomy, *unintentional violations* occur from a lack of knowledge or understanding of appropriate behavior, and may be the most common and most easily remedied cause of unwanted behavior. The second type of normative violation, *releaser-cue,* is derived from the field of ecological psychology and suggests that environmental cues in the form of others' activities or social attributes can invite unwanted behaviors. Third, *uninformed violations* occur when visitors are unaware that their behaviors cause damage or other negative social or environmental impacts. The fourth type of violation, *responsibility-denial*, occurs when an actor employees a defense mechanism to reduce cognitive dissonance such as might occur when a rule is deemed unreasonable or impossible to abide by. The fifth violation type, *Status confirming*, occur when individuals identify strongly with a group displaying deviant behavior, or otherwise utilize deviant behavior to confirm their group status.

The last and most difficult from a managerial perspective, *willful* violations, are those committed by individuals as a means of "financial gain, ideological protest, malice, revenge, or the desire to inspire fear or respect in observers" (p.73).

Since its introduction, Gramann and Vander Stoep's taxonomy has gained wide acceptance within the park and recreation field. Another classification system put forth by Hendee, Stankey and Lucas (1990), which focuses less on depreciative behavior and vandalism and more on general resource impacts, has met similar acceptance. Hendee et al. (1990) distilled the spectrum of undesirable visitor actions into: illegal, careless, unskilled, uninformed and unavoidable and as such, is similar in approach to Gramann and Vander Stoep's taxonomy.

Since the introduction of both taxonomies, resource managers and researchers have shifted somewhat from the visitor as perpetrator of depreciative behavior, to the role played in the facilitation of depreciative behavior by poor site design, environmental factors and site upkeep (Knopf & Dustin, 1992; Vande Kamp, Johnson & Swearingen, 1994). In their review of the depreciative behavior literature, Knopf and Andereck (2004) present the following overarching interventions as a means of minimizing the expression of unwanted behavior (pp. 308-311):

1. Focus on the causes of depreciative behavior rather than the perpetrator.
2. Eliminate environmental cues.
3. Manage social norms by modeling or otherwise fostering desired norms.
4. Effectively communicate rules and regulations.
5. Provide insight and information into the consequences of unwanted behavior.
6. Provide reasonable options to unwanted behaviors.
7. Utilize positive rather than negative overtones.
8. Utilize personal rather than impersonal communication whenever possible.
9. Transmit messages as close, temporally and spatially, to the unwanted behavior.
10. Utilize uniformed personnel at high risk or highly valuable areas.
11. Institute appropriate reward system.
12. Utilize direct coercion only as a last resort.

Both taxonomies of depreciative violations and the list of overarching interventional principles (above) provide insight into non-compliant behavior in natural resource settings,

especially pertaining to the importance of clear messaging. Much of the depreciative behavior literature has focused on the effectiveness of alleviating vandalism and other unwanted behavior in terrestrial parks and built settings by employing various forms and applications of media (mostly print), with some demonstrating notable reductions in depreciative behavior.

Oliver, Roggenbuck and Watson (1985) determined that littering and tree damage were reduced substantially by visitor brochures containing messages and sketches abut these unwanted behaviors and their associated impacts and costs. The application of their treatment resulted in a 15% reduction in the number of camping groups that littered and a 19% reduction in the number of groups who damaged one or more trees.

Vander Stoep and Gramann's (1987) test of message effectiveness (personally delivered messages) relied on three message types: awareness of consequences; awareness of consequences plus resource protector; and awareness of consequences plus resource protector plus incentive. Resource protection involved telling subjects they were important in the overall operation and protection of the onsite assets, whereas incentives were comprised of group awards. They found that even basic interpretive messaging resulted in a reduction of child-induced vandalism to cannons, statues and monuments within the Shiloh National Military Park, and that the three message methodologies did not differ in their results (all achieved nearly 88% reduction in depreciative behavior).

By integrating an awareness of consequences component into their examination of recreationist behavior, Gramann, Bonifield and Kim (1995) found that visitors were significantly impacted when messaging included both a rationale for established rules and an explanation of the consequences to the physical or social environment when rules were not followed. They specifically found that those visitors exposed to the awareness of consequences message were

significantly more likely to indicate an intention to obey the rules than those not receiving the message.

Widner and Roggenbuck (2000) conducted an experiment designed to test the effectiveness of three different interventions on reducing theft of petrified wood at the Petrified Forest National Park. They found no difference in effectiveness among a signed pledge from visitors, presence of an onsite park ranger and an interpretive sign placed at the trailhead. They found that the interpretive sign was just as effective at reducing the amount of petrified wood removal as the onsite ranger, but at a much-reduced cost. Importantly, the authors attribute their results to a well-designed, well-written interpretive sign that that simply sate that "Removal of petrified wood is prohibited." This research was eventually extended by Cialdini, Demain, Sagarin, Barrett, Rhoads and Winter (2006) who examined message typologies with regard to their effectiveness at reducing removal of researcher-placed faux petrified wood. They found that a negatively worded injunctive message "Please don't remove the petrified wood from the park" accompanied by a picture of someone stealing wood from the park produced greater success than did a descriptive normative message "Many past visitors have removed the petrified wood from the park, changing the state of the Petrified Forest" along with a picture of three visitors taking wood.

In a similar study, Duncan and Martin (2002) exposed 237 participants to a series of slides depicting an outdoor hiking experience intermixed with slides of sanction messages (e.g., mention of fines for campfires) and interpretive messages (e.g., paragraph how firewood collection robs trees of nutrients), as well as a control set of slides containing no message. Subjects were then administered a questionnaire in which they were given four different yet likely hiking scenarios: firewood collection, human waste disposal, cultural artifact removal and

food scrap disposal. After slide exposure, each respondent was then asked their likelihood of performing the desirable behavior with respect to each scenario. They found interpretive messaging to be just as effective as sanction messaging overall and more effective than sanction messaging with respect to the firewood collection scenario.

Adherence to boating rules has also been assessed as related to interpretive intervention. Utilizing posters, signs, decals, newspaper articles and localized radio broadcasts pertaining to boater safety, U.S. Army Corps of Engineers employees were able to increase boater compliance on Detroit Lake. As a result of their interpretive efforts, boater compliance with water safety markers increased, and boats intruding into marked danger zones decreased (both 53%). Additionally, water skiing violations dropped 77%, with posters and signs having the greatest overall effect on increasing compliance (Fritschen, 1984 as cited by Knudson et al., 1995).

Exemplifying yet another line of research, Gorzelany (2004) evaluated boater compliance with manatee speed zones on several Florida waterways and found that on-water law enforcement presence had significant impact on boater compliance. In Sarasota County he found a statistically significant 13% increase in overall boater compliance and a 10% decrease in blatantly noncompliant boater performance. He found a 10% increase in overall compliance and a 6% decrease in blatant noncompliance in Lee County. Other such traffic related studies have focused on automobile travel, and results suggest that the presence of law enforcement on roads and highways substantially increases speed compliance (Edwards & Brackett, 1978; Graham, 1992; Leggett, 1996).

The breadth and depth of inquiry into depreciative behavior is impressive, and although approaches, results and opinions vary, several common themes have emerged. Swearingen and Johnson (1995) suggest that simple and well designed communication of agency rules,

regulations and desired behaviors can be effective in curbing all but the most malicious depreciative behavior, a position substantiated by several studies. Researchers have found that providing visitors with information about the impacts and costs associated with behaviors (Gramann et al. 1995; Oliver et al., 1985; Vander Stoep & Gramann, 1987; Widner & Roggenbuck, 2000) and rationale behind rules and regulations (Duncan & Martin, 2002; Gramann et al. 1995) is similarly effective in reducing unwanted behaviors. Other lines of examination of have focused on message typology and suggest that strongly injunctive messages may be more effective than descriptive messages (Cialdini et al., 2006), while others have found sanction messaging to be no more effective than interpretive messaging (Duncan & Martin, 2002). In general, emphasis within recent literature seems to have shifted from the visitor as perpetrator of depreciative behavior to poor site upkeep and design as factors facilitating unwanted behaviors (Knopf & Andereck, 2004; Knopf & Dustin, 1992; Vande Kamp et al., 1994).

Personal communication is favored by some for its efficacy in delivering messages most likely to result in positive attitudinal or behavioral change (Knopf and Dustin, Oliver et al. 1985; Vander Stoep & Roggenbuck, 1996). However, despite the fact that personal communication may be favored, high costs and logistical issues prevent the wide-scale use of personal communication as a means of educating visitors and reducing depreciative behaviors in most settings.

Given the constraints associated with personal communication, the most common approach to educating visitors has been to simply provide some kind of information to them, usually in print form. Many of the depreciative acts perpetrated by visitors may be a result of insufficient knowledge, lack of skill or carelessness in their natural resource recreation pursuits (Knopf &

Dustin, 1992). Research has shown that providing information that demonstrates the linkage between depreciative behavior and its impact is often sufficient to reduce the incidence of the behavior (Gramann & Vander Stoep, 1987; Oliver et al., 1985). However, the approach also may result in limited success. For example, although much money, time and effort has been spent to educate, inform and otherwise convince Florida boaters to abide by manatee speed zones, results have been disappointing (Flamm, pers. comm., 2005). Similarly, Jett (2000) found that despite a substantial regional and local campaign to educate river floaters about the Illinois River basin (Oklahoma), few floaters displayed more knowledge than would have been expected by chance.

Boating-related studies in Florida have demonstrated that boaters desire increased education and better information about boater and waterway rules and speed zone delineations (Aipanjiguly, 2001; Aipanjiguly et al. 2003; Swett et al., 2005). Boaters congruently indicate a limited understanding of waterway rules, laws, regulations and speed zone boundaries and channel signage messaging (Aipanjiguly, 2001; Aipanjiguly et al., 2003; Confer et al., 2003; Futerfas, 2003). These points are particularly salient when considered in relation to depreciative behavior literature suggesting that many unwanted behaviors can be eliminated by educating visitors to the rules of the area (Gramann & Vander Stoep, 1987; Oliver et al., 1985; Swearing & Johnson, 1995).

Failed attempts to educate visitors might be due, in part, to a poor understanding of the communication process and the art of persuasion (Absher & Bright, 2004). Consistent with the need for effective communication, three general models of persuasion have emerged in visitor communication studies: 1) central route, 2) peripheral routes to persuasion (Roggenbuck, 1992; Vande Kamp et al.1994) and 3) applied behavioral analysis (Manfredo, 1992). Effective visitor

management and/or educational strategies rely on one or more of the three general persuasion models to facilitate behavior change (Manfredo, 1992). Each model relies upon a slightly different mechanism and possesses a different level of complexity and receiver engagement.

Routes to Persuasion

Applied behavioral analysis utilizes environmental prompting, manipulation of the environment and rewarding or punishing of behaviors (Geller, 1987). The applied behavioral analysis approach is a relatively simple method of changing behavior by directly addressing problems rather than influencing attitudes, beliefs or values (Manfredo, 1992). Although the approach fails to address the "why" of a particular behavior, it is considered relatively effective in dealing immediately with unwanted behavior as it requires little or no understanding of the perpetrator.

Ham and Krumpe (1996) suggest that messages designed by resource managers often fail because they do not account for the beliefs of intended receivers and how they influence behavior. The field of social psychology provides insight into peripheral and central routes of persuasion, and the specific attributes and efficacy of each. The Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986), which formalizes this research, has been utilized to examine factors that cause individuals to carefully consider a message (i.e., elaboration), and whether a particular message results in attitudinal and/or behavioral change.

According to the ELM model, the central route to persuasion relies upon a receiver's experience and knowledge acting to facilitate attention to and consideration of issue-relevant messaging. The model suggests that when a message is internalized and evaluated positively it will result in enduring attitude and/or behavioral changes. A generally strong relationship between a visitor's response to persuasive messages and their prior experience and knowledge

has tended to bear this out (Manfredo & Bright, 1991). An understanding of visitor experience and knowledge is key to effective messaging via the central route to persuasion.

Contrastingly, the peripheral route to persuasion relies on source credibility, message attributes and cues rather than the message itself as a means of facilitating attitude and behavioral change, and is considered less enduring than the central route (Petty, McMichael & Brannon 1992). Despite being considered inferior for producing long-term behavioral changes, it is nevertheless commonly relied upon by resource managers (Reid & Marion, 2006). This approach often employs a well-known authority or spokesperson (perhaps a celebrity) conveying a simple message to visitors needing constant reinforcement to perform a certain way (Petty et al., 1992). Like applied behavioral analysis, behavior change facilitated by the peripheral route requires little insight into the visitor, nor is advanced knowledge of a particular issue required of the visitor. Importantly, although highly experienced recreationists tend to demonstrate predictable behavior, they may be more difficult to influence than those who are less experienced (Krumpe & Brown, 1982; Manfredo & Bright, 1991; Roggenbuck & Berrier, 1982). That is, attitudes and behaviors of those most experienced may be substantially influenced by a selective processing of informational inputs, which tend to reinforce their personal attitudes and beliefs (Vincent & Fazio, 1992).

Predictors of Behavior

Other theories have also been tested to better understand behavioral predictors. The Theory of Reasoned Action (TRA) and its successor the Theory of Planned Behavior (TPB) provide insight into visitor behavior as a function of the relationships among behavior, attitudes, beliefs, intentions and social norms (Fishbein & Azjen, 1975). TPB differs from TRA in that it adds a volitional control factor, an actor's belief that he/she has control over behavior. TRA and TPB marked an important turning point in attitude theory, with focus now on the strength of

associations between attitudes and behaviors, rather than a questioning of whether the association existed (Manfredo, Teel & Bright, 2004).

TRA has been used to predict and understand why people have engaged or not engaged in a wide variety of behaviors. In short, the theory assumes that individuals are rational, process available information and consider the implications of their actions prior to engaging in a particular behavior (Ajzen & Fishbein, 1980). The theory states that beliefs produce either a favorable or unfavorable attitude toward a particular behavior, and social conditions produce perceived social pressure to engage or not engage in a behavior (subjective norm). These two components combined lead to behavioral intention that is strengthened by favorable attitudes, and social pressure in the form of subjective norms (Ajzen, 1988; Fishbein & Manfredo, 1992). Within the literature, attitude has most often been measured by differential scales (e.g., it would be: good-bad; healthy-unhealthy to perform this behavior), whereas subjective norm have been measured by agreement with such statements as "those who are (important; near) me think I should perform this behavior (Ajzen & Fishbein 1980). As intentions are thought to be the best predictors of behaviors, the TRA requires that managers wanting to change or reinforce certain intentions must modify or reinforce visitor attitudes toward performing a particular behavior as well as change or otherwise control the normative pressure to perform that particular behavior (Fishbein & Manfredo, 1992).

TRA has generally been shown to be robust in its ability to predict or otherwise explain behavior vis-a'-vis intentions. For example, Bright et al. (1993) successfully used TRA to model behavioral change resulting from public perceptions of a National Park Service controlled burn policy. They administered "belief-targeted messages" (p.271) (e.g., controlled burns: improve conditions for wildlife, destroy natural settings, allows natural events to occur, affect private

property, etc.) to park visitors with diverse attitudinal positions and determined if the changes in attitudes and intentions resulted. They found that a change in intention to support a controlled burn policy was predicted by the level of attitude change and subjective norms.

In their study of citizen acceptance of forest fuel management techniques (prescribed burning, mechanical fuel reduction and defensible space ordinances), Vogt, Winter and Fried (2005) found similar success with a modified TRA model that excluded subjective norms as a way of demonstrating the attitude-intention association. They surveyed citizens in several states who lived at urban-wilderness interface and assessed their belief outcomes for various management techniques (e.g., impacts scenery, extracts usable wood products, creates more smoke in the short-term but less smoke over time, etc.). Measurements were made of negative or positive attitudes and approval intentions regarding implementation of the various management techniques. Additional variables outside the TRA model were measured including personal experience with various fuel management practices and measurement of personal importance each person attributed to each type of practice. The authors found that citizens with positive beliefs toward the use of various fuel management methods also tended to have positive attitudes toward their use. For example, homeowners who were most certain that management technique such as prescribed fires could be controlled (beliefs) had more positive attitudes toward prescribed fires. Additionally, while personal importance was a significant predictor of acceptance of various management methodologies, past experience with a particular fuel management technique was not.

Fulton, Skerl, Shank and Lime's (2004) examination of attitudes and beliefs about killing as a means of deer management utilized a mail survey of Ohio residents designed to evaluate attitudes toward, 1) no action and 2) reduction of deer population by lethal control. Attitudes

were assessed by respondents' agreement with each of the two methods of deer management. By examining public comment documents, the authors developed 10 belief items regarding the outcome of lethal deer control and included agreement with items such as taking no action (or taking action) would: reduce the risk of deer-car collisions; reduce damage from deer to shrubs, crops and gardens; decrease opportunities of seeing deer, etc. As with the prior study, subjective norms were not measured. Their results demonstrated that the differences in the acceptability of either lethal control or no action were strongly related to beliefs about the outcome of each strategy, thereby lending support for the TRA. The authors concluded by suggesting that as attitudes were associated with multiple beliefs, any communication strategy designed to change attitudes would necessarily require a focus on changing multiple beliefs.

Providing insight into motorized vehicle operation, TRA has been utilized to investigate driving behavior in terms of drinking and driving, tailgating, dangerous overtake and speeding. Parker, Manstead, Stradling, Reason and Baxter (1992) asked respondents to indicate intention to engage in various scenarios involving driving a car (by oneself or with passengers) and at different times of day with respect to the aforementioned violations to evaluate, 1) whether the attitude, subjective norm and perceived behavioral control (testing the TPB) predictor variables were stable across different scenarios and 2) whether the presence or absence of passengers increased the predictive ability of the model via the subjective norm. Lists of six positive and negative behavioral beliefs regarding the various violations were compiled for the study, and respondents asked to rate each (in terms of likely-unlikely and good-bad). Normative beliefs were measured with six items regarding how likely-unlikely it was that each of several referents would approve of the driving behavior as indicated in the various scenarios, and motivation to comply was measure by agreement with generally liking to drive in a way in which a referent

would approve. Additionally, intention to behave was ascertained by asking the respondent how likely-unlikely it was that they would engage in the violation as presented in each scenario. Analysis revealed that the subjective norm and attitudes toward speeding behavior accounted for 33% of the variability in intention to speed, and as the authors included control belief into the model, this improved the explained variance by 14.5%. In summary, attitude and subjective norm measures were significant predictors in the intention to perform non-compliant behaviors as presented in each scenario, as were control beliefs and age and sex variables. Perceived expectations of others as presented in each scenario and assessment of the ease in avoiding the non-compliant behaviors were important in their influence on intentions.

Finally, Aipanjiguly (2000) and Aipanjiguly et al. (2003) employed the TRA to investigate the relationships between boater attitudes toward speed zones, intentions to follow speed zones and subjective norms in Tampa Bay, Florida. Telephone interviews were administered to boaters with five-point Likert scale questions designed to evaluate 1) behavioral beliefs (for example, a boater's belief that ignoring speed restrictions facilitated reaching their destination more quickly); 2) boater attitudes with respect to statements about various behavioral actions such as "disregarding speed zones is…very good to very bad"; 3) subjective norms, ascertained through agreement with statements such as "most people who are important to me think that I should follow manatee speed zones"; and 4) behavioral intentions, such as "I intend to follow speed zones set forth for manatee protection" (Aipanjiguly et al., 2003, p.1100). Results suggested that behavioral beliefs toward disregarding speed zones were poorly correlated with attitudes toward disregarding speed zones, while attitudes toward disregarding speed zones were significantly correlated with intentions to comply ($r=.32$, $p<.001$). Moreover, normative beliefs toward following speed zones were significantly correlated with subjective norms toward following

speed zones (r=.45, p<.001), and that subjective norms toward following speed zones and behavioral intentions were significantly correlated (r=.70, p<.001). Normative pressures therefore exerted the strongest influence on intention to follow speed zones, with motivation to comply with law enforcement shown to be higher than motivation to comply with family, friends or other boaters.

Recreation Specialization

The protection of outdoor recreation area resources has become a persistent contemporary issue among resource managers. Successful efforts of reducing unwanted behavior and the fostering of appropriate modes of visitation often depend on strategic education and messaging based upon unique insight into visitor attributes and orientations (Jacobson, 1999). Recreation specialization has been examined in a variety of ways to better understand visitors and as a means of improving natural resource management (Table 2-2).

Recreation specialization was first introduced by Bryan (1977) to explain the continuum of behaviors from general to specific, with one's specialization level reflected in his/her skills, equipment and setting preferences. Bryan's seminal study was prompted by his participation in fly-fishing, and his subsequent observation of other fly fishermen. His formal examination of the nascent theory was conducted by interviewing and observing other anglers in Montana, Idaho and Wyoming, and was intended primarily as a means by which intra-group (fly fishermen) diversity could be explored.

Bryan (1977) assessed fishermen ideologies, values, attitudes and beliefs by asking questions concerning: "1) Fishing preferences, 2) orientation toward the stream resource, 3) history of interest and activity in the sport and 4) relationship of the leisure activity to other areas of life (family, career, other leisure activities)" (p.177). Supplementary data was also collected

as convenient and mostly based upon informal discussions. His analyses led him to propose four types of fly fishermen (p.177):

1. Occasional Fishermen – those who fish infrequently because they are new to the activity and have not established it as a regular part of their leisure, or because it simply has not become a major interest.

2. Generalists – fishermen who have established the sport as a regular leisure activity and use a variety of techniques.

3. Technique Specialists – anglers who specialize in a particular method, largely to the exclusion of other techniques.

4. Technique-Setting Specialists – highly committed anglers who specialize in method and have distinct preferences for specific water types on which to practice the activity.

Among his findings, Bryan (1977) noted that occasional fishermen had less particular equipment preferences than did generalists or specialists and that those most specialized typically relied on fewer but more expensive pieces of equipment. Occasional and generalist anglers also emphasized the quantity of fish caught whereas specialists emphasized fish size and setting attributes of the activity. Setting preferences also change along the continuum, with occasional fishermen preferring easy access (lake or stream), with specialists preferring spring-fed streams and whose fishing enjoyment was strongly associated with the setting. Bryan also noted that occasional and generalist anglers preferred an active stocking policy among management, with specialists indicating more interest in habitat management as a means of improving wild fish populations. Specialists were found to travel longer distances to access fishing resources than occasional or generalist fishermen, and were also more likely to take extended vacations.

Since Bryan's (1977) groundbreaking work, recreation specialization has been utilized to explore a wide range of activities and recreationists (Table 2-1). Since then the construct has been operationalized a number of different ways, with most defining specialization in terms of behavior, attitudes, or a combination of the two. An examination of norms of depreciative

behaviors by Wellman et al. (1982) was perhaps the first to measure the construct by creating an additive index from behavioral and attitudinal domains (measured by assessing respondent "river canoeing experience, equipment ownership, linkage to other canoeists through organizations, books, or periodicals, participation in canoe or kayaking building and formal canoeing instruction, 1979 expenditures, and a series of self-descriptions of the role of canoeing in the person's life" (p.327)). The study evaluated canoeists' perceptions of various depreciative behaviors by first compiling a list of depreciative canoeing behaviors (including personal safety, personal property, equipment related safety, damage to environment, drug and alcohol use, safety toward others and other issues) and then asking canoeists their opinions of the severity of the actions. The authors created an index of specialization by adding the standardized scores for all variables and specialization level grouped into high and low. Results demonstrated that specialization level had little effect on attitudes toward the seriousness of the depreciative behaviors listed. Lending possible explanations to the findings, the authors noted that canoeing may not have had sufficient time to for the activity to have developed a code of proper behavior among its participants.

While Wellman et al. (1982) utilized past experience as one domain toward the creation of the specialization index, others have opted to expand experience in an effort to capture its broader elements. The Experience Use History (EUH) represented an evolution toward a more sophisticated accounting of the intensity of behavioral involvement with one's activity. The EUH, as compiled by Schreyer and Lime (1984), included three variables to produce a composite index: 1) number of times respondents had floated rivers, 2) number of rivers one had floated and 3) total number of river trips one had made. Employing this methodology, the authors categorized river floaters as residing along the novice-beginner-local-collector-visitor-veteran

experience continuum. Other researchers have expanded the EUH concept to include a more robust evaluation of experience based upon cognitive (skill, knowledge and understanding and preference for setting attributes) and behavioral (experience with chosen activity and frequency of participation) dimensions in which the activity occurs (McIntyre & Pigram, 1992). In this regard, the EUH integrates the behavioral and cognitive dimensions of experience while ignoring the affective psychological dimensions of participation in a recreation activity (McIntyre, 1989; McIntyre & Pigram, 1992).

McIntyre (1989) was perhaps the first to formally examine the affective component of specialization with a study on campsite choice. Representing the personal meaning of an activity, "Enduring Involvement" (EI) was demonstrated by three dimensions: centrality, self-expression and attraction to the activity. In his study, McIntyre concluded that the centrality dimension of EI was the most important in determining campsite location choice among campers, and that high centrality scores were associated with campsite choices requiring high levels of self-reliance. The author also concluded that attraction, although probably important in the evolution toward higher levels of specialization, may not increase in tandem with higher levels of involvement, and that the self expression domain may be most important for activities which are highly individualistic such as rock climbing.

Specialization theory was further advanced with McIntyre and Pigram's (1992) proposed model of specialization that included both behavioral and affective dimensions (EI). Their model relied on the computation of a specialization index (termed recreation involvement) from the behavioral components (years involved in an activity and number of times visited the site) and multidimensional EI components: 1) attraction (enjoyment derived from the activity), 2) self-expression (freedom from everyday experiences and self-affirmation) and 3) centrality to

lifestyle (how central a role the activity is in one's life). McIntyre (1989) and McIntyre and Pigram (1992) ushered in a new way of operationalizing the construct. Despite this supposed advancement, McFarlane's (2004) examination of site choice among vehicle-based campers demonstrated that the self-expression items within EI, as proposed by McIntyre and Pigram (1992), may be unstable as an EI measure, perhaps reflecting differing affective dimensions across a geographic region or with respect to the different camping opportunities as represented by her study.

In their 1992 examination of white water recreationists, Kuentzel and McDonald (1992) found that the items used in their analyses factor analyzed into past experience, commitment and lifestyle dimensions. However, frequency of participation was found to be more associated with lifestyle than past experience, with the authors concluding frequency of participation more a function of one's identity as an active participant. Self-reported skill assessment was found to be associated with experience, and as skill is may be considered "less perishable than commitment of lifestyle involvement, and thus more closely associated with the temporal component of experience" (p.14) the role of skill within the specialization construct should be further explored. They further found that past experience was negatively associated with the environmental characteristics of the river in which the activity occurred, and that the commitment dimension was most strongly associated with such attributes as social interaction, water quality, fun, skill and others. Highly experienced users seemed to be aware that the river provided opportunities for high-density activities on within a somewhat unnatural river setting (a major highway runs parallel to the river). Lifestyle, past experience and commitment dimensions were found to be negatively associated with use limitations. Finally, the findings suggest that analyses based on separate domains may be superior to those based on a composite specialization index. The data

used in the examination did not demonstrate linear relationships between the separate domains of the specialization construct. In explaining this non-linearity, the authors suggest that having just purchased boats, paddles and other equipment, paddlers may score high on economic expenditure with entry into the activity while other specialization measures only increase with the passing of time. In this regard, Kuentzel and McDonald (1992) provided insight into both the need for analyzing individual domains, as well as the problems associated with behavioral and expenditure measures.

There is disagreement on whether measurement of specialization is best accomplished by combining the various dimensions into a single additive composite index as a means of depicting a continuum of specialization, or whether individual dimensions should be analyzed separately (Manning, 1999). Various authors have demonstrated that scores within separate domains vary differentially, thus suggesting that the additive index may not be the best measure of specialization. For example, Kuentzel and McDonald (1992) found little relationship among the lifestyle, commitment and experience dimensions of river paddlers, leading them to conclude that the separate dimensions did not necessarily increase linearly and congruently over time. Similarly, Scott and Godbey (1994) found that while bridge players may commonly progress in commitment toward their activity, many of them actually demonstrated low skill or knowledge of advanced bridge practices despite substantial experience. In other words, commitment was consistent with experience (time), while skill and knowledge was not. Kuentzel and Heberlein (1997) further added to this position by demonstrating that mean responses among boater types differed within the commitment, experience and frequency domains evaluated. Moreover, Bricker and Kerstetter (2001) demonstrated that whitewater recreationists varied in their responses within each of five dimensions studied (level of experience, skill level and ability,

centrality of lifestyle, enduring involvement and economic and equipment investment), and consequently so did their level of specialization. Thus, although the additive index has been widely relied upon, Scott and Shafer (2001) submit that the various measures of the specialization construct are likely to differ with respect to other dimensions of activity involvement, and therefore preclude its use.

Using confirmatory factor analysis, Lee and Scott (2004) utilized data from a behavior survey administered to the American Birdwatchers Association to test the three dimensional recreation specialization progression model put forth by Scott and Shafer (2001). The three domains examined for their contribution to specialization theory included behavior, skill and knowledge and commitment. Behavior was measured based on the number of trips taken in 2001 and the number of days pent on birding trips in that same year. Skill and knowledge was measured by self-reports of the number of birds one could identify without a book; by sound only; and by ability to observe and identify birds on a scale from novice to expert. Commitment was operationalized by asking agreement with items such as "Other leisure activities don't interest me as much as birding," and "I would rather go birding than do most anything else." Their results showed that each of the indicators uniquely loaded on respective factors they were meant to represent (included behavior, skill and knowledge and commitment) and that skill and knowledge was more representative of birder specialization than either behavior or commitment factors. Their results also demonstrated that the use of single additive indices of specialization may be inappropriate, and that the behavioral domain might be problematic when situations such as poor health prevent physical access to an activity although skill and commitment remain high.

Environmental Concern/Behavior

Among his other submissions, Bryan (1977) hypothesized that as one progressed through the specialization continuum within a specific activity, he or she would come to increasingly

accept the rules, norms and procedures of that activity as well as the development of a greater dependency on the resource (propositions 3 and 4, p.186):

3. As level of angling specialization increases, attitudes and values about the sport change. Focus shifts from consumption of fish to preservation and emphasis on the nature and setting activity. The experience becomes an end in and of itself.

4. The values attendant to specialization are inextricably linked to the properties of the resource on which the sport is practiced. As level of angling specialization increases, resource dependency increases.

Bryan found support for both hypotheses. Specifically, he found that those who were highly specialized shifted focus from fish consumption to preservation, and emphasized the nature and setting of the activity and become more dependent on the resource.

Researchers have examined the premise that specialization leads to pro-environmental attitudes and/or behaviors. Katz's (1981) study of fly fishermen empirically evaluated Bryan's (1977) third and fourth propositions and found that progress through the specialization continuum was accompanied by an increase in attitude toward conservation. Kauffman (1984) similarly explored Bryan's (1977) third and fourth propositions among canoeists on three rivers. To assess these propositions, Kauffman (1984) created an additive specialization index based upon participation, equipment, skill and centrality to lifestyle dimensions; while resource attitudes were measured by evaluating setting preference, setting canoed most often, setting selection factors, setting importance and environmental concern. The latter was evaluated by respondent's willingness to spend an extra $100 the next year to promote the wise use of resources. Kaufman's results supported Bryan's (1977) fourth proposition, with the most specialized respondents indicating the highest sense of environmental concern.

In their examination of backcountry hikers from three primitive areas, Virden and Schreyer (1988) posited two hypotheses: 1) that highly specialized hikers would be most likely to focus on

specific environmental attributes in which participation in their activity most depends and 2) that highly specialized hikers will be most extreme in their environmental attribute preferences. They measured specialization with an index based upon general and recent experience, equipment and monetary commitment and centrality to lifestyle domain items. Environmental preferences were operationalized with 38 setting attributes. Their findings supported the first hypotheses and limited support for the second, suggesting that specialized hikers placed emphasis on naturalistic components of the setting such as the presence of bears, rugged terrain and desert canyons and that they were most negatively impacted by the presence of consumptive activities such as logging and livestock grazing. Among the hikers, specialization level was significantly associated with one-half of the social and physical setting attributes listed, and 60% of the management attributes.

Mowen, Williams and Graefe (1997) surmised that outdoor recreation participants were more likely to be perceptive of the characteristics of the setting where an activity takes place. Their research was designed to better understand recreation specialization as it pertained to general and site-specific environmental attitudes. They operationalized specialization with an effective domain that included self-expression, centrality to lifestyle and attraction items and skill level with respect to their specific activity. A slightly modified New Environmental Paradigm scale as well as four site-specific environmental concern items were used to measure environmental concern. Results indicated that the affective dimension was a better predictor of environmental attitudes than skill (cognitive), and that those recreationists who were most specialized reported more concern with site-specific rather than broad-based environmental issues.

Recently, Thapa (2000) explored the mediation effect of forest recreationists' (appreciative, consumptive and motorized) specialization level on environmental attitudes and behaviors. Thapa computed a specialization index based upon behavioral, cognitive and affective (EI) domain items, and measured self-reported pro-environmental behavior in terms of involvement in political activism, recycling, education, green consumerism and community activism, within the appreciative, consumptive, motorized typologies. He found little evidence to suggest a positive association between specialization and pro-environmental attitudes or behaviors; however, he did find that forest recreationists engaged in appreciative activities were more likely to participate in select environmental behaviors in their daily lives. Thapa concluded that since specialization is a multidimensional construct, the use of a composite index maws a limitation, and also each activity may be most appropriately evaluated individually rather than collectively in terms of an appreciative, consumptive, motorized typology.

Hvenegaard (2002) examined the relationships between conservation involvement, motivations and demographics differ among specialization levels. Specialization was measured with economic commitment (3 items) and centrality to lifestyle (2 items). Based upon responses to specialization questions he categorized birders into advanced-experienced, advanced-active and novice groups. Hvenegaard found that although specialization level was positively associated with conservation group membership, specialization was not associated with actual or hypothetical financial contributions to conservation efforts. Age, income and percent male were found to be positively associated with specialization level; education and occupational level were not.

A further examination of recreation specialization and its association with environmental attitudes was conducted by Dyck, Schneider, Thompson and Virden (2003). Recreation

specialization was operationalized based on past experience (e.g., number of trips taken in past five years), economic investment (e.g., total money invested inn equipment) skill level (self-reported skill level with respect to rope skills, rock climbing techniques, etc.) and centrality to lifestyle items (e.g., agreement that one's life is organized around mountaineering) with each domain comprised of between three to five indicators, later combined into a composite specialization index. Environmental attitudes were measured via the New Environmental Paradigm scale, while attitudes toward low impact practices were operationalized by 14 questions written by the researchers. Results demonstrated that general environmental attitudes were not associated with recreation specialization level, which might partly have been explained by little variability in attitudes among respondents. However, attitudes toward low impact mountaineering were found to be associated with increasing levels of specialization. It should be noted that the scale created assess attitudes toward low impact mountaineering was not tested by other researchers, and thus it is not known how well it actually captured those attitudes.

Based on the previous work by Meyer (2002) showing that recreation specialization level was associated with self-reports of avoiding coral reef contact while SCUBA diving, Thapa, Graefe and Meyer (2005) further examined the moderator and mediator effects of specialization on the environmental knowledge-environmental behavior contingency among divers. Knowledge and behavior was measured with 16 items related to coral and reef ecology and human impacts on coral reefs as well as from diving codes of conduct manuals. Specialization was measured by items within the behavioral (5 items), cognitive (6 items, including diving certification level questions) and affective domains (6 items, which included 4 items relating to enduring involvement and 2 items relating to centrality to lifestyle). To most effectively examine the moderator and mediator effects of specialization, a composite additive specialization

index was computed. Results suggested that pro-environmental diving behaviors (from among questions related to contact diving behaviors, general diving behaviors and general educational behaviors) were more common for respondents with higher marine-based knowledge. Similarly, divers having higher levels of specialization also demonstrated higher levels of marine-based knowledge and pro-environmental behaviors. Specialization was found to be a mediator (one variable accounts for part of or all of the association between two other variables, Baron & Kenny, 1986)) but not a moderator (the association between two variables changes as a function of another variable) in the specialization, knowledge and behavior triad. That is, specialization played a more important role in predicting pro-environmental behavior among SCUBA divers than did marine-based knowledge, although both were significantly related to behavior.

Furthermore, in a related study, Thapa, Graefe and Meyer (2006) found that although the composite index and individual dimensions explained a similar amount of variance in environmental behaviors, analyses of individual specialization domains (behavioral, cognitive and affective) resulted in differential predictive strengths according to specific diving behaviors. Although low internal consistency among items (alpha = .68) may have hindered the analyses, the behavioral dimension of the specialization construct was found to be a poor predictor of depreciative diving behaviors (making contact with coral) and also a weak predictor of general diving and education behavior. Overall, the affective dimension proved to be an especially useful predictor of environmental behavior, with the authors suggesting the finding logical as strong emotional ties to diving might naturally lead to increased participation in activities such as reading diving books and participating in community clean up programs.

Depreciative Behavior in Outdoor Settings

Despite the substantial social, environmental and managerial impacts depreciative behaviors levy on outdoor recreation areas, few studies have examined the relationship between

depreciative behavior and recreation specialization. As previously discussed, Wellman et al. (1982) evaluated attitudinal norms toward depreciative behavior and found that highly specialized canoeists were very similar in their interpretation of the severity and importance of depreciative behaviors than were those low on the specialization continuum. Their research utilized past experience (total number of canoe trips, average number trips per year, total number rivers floated) and involvement (canoeing investment dimension – 3 items, centrality to lifestyle dimension – 4 items) to create an index of specialization. A list of depreciative behaviors which one might display or be exposed to on a river was compiled by perusing books, literature and by consulting expert river guides. Although no differences were found between specialization levels (high and low), their research was limited by a small sample size, and by the fact that most highly specialized canoeists might have viewed depreciative behaviors such as floating without a life vest to be unimportant due to their skill level in avoiding tipping. In other words, canoeing may not yet have developed a "code of proper behavior" (p.338). Additionally, Wellman et al. (1982) were perhaps the first to note the problematic use of an additive index: "It is also possible for a newcomer to canoeing to receive a high score on two of Bryan's three specialization dimensions (investment and centrality to lifestyle) and thus to receive a relatively high specialization index score" (p.339).

Meyer (2002) examined the relationship between recreation specialization, ecological knowledge and self-reported environmental behavior among SCUBA divers in Florida. Meyer's study relied on behavioral (5 items), cognitive (6 items) and psychological (EI and centrality, 6 items) domains to measure the specialization construct. She utilized four environmental behavior dimensions: 1) general environmental behavior (e.g., read books, watched programs about environment), 2) diver education (participation in refresher courses, teacher role), 3)

physical impact with coral/wrecks (behaviors participated in that might damage coral and other marine features) and 4) physical impact with marine life (general behaviors that may negatively impact marine life). Her findings suggested that highly specialized divers exhibited more environmentally responsible diving behaviors than those less specialized, with those scoring high in the cognitive dimension least likely to engage in depreciative behaviors. It is important to note that the development of SCUBA diving skills such as the ability to maintain neutral buoyancy might naturally lead to pro-environmental behavior by allowing a diver to avoid physical contact with coral and other marine resources.

Bireline (2005) evaluated potential bird impact behavior of Florida birders within the specialization construct. In his investigation specialization was measured via experience (8 items), equipment and economic commitment (4 items) and centrality (5 items) domains; while birder behavior measured based upon self-assessed participation in behaviors from a list of 20 potentially negative methods of facilitating bird viewing. Contradicting his primary hypothesis that advanced birders would demonstrate the lowest frequency of depreciative behavior, he found that highly specialized birders employed potentially negative behaviors such as "pishing" (noise made to draw birds close) more often than did others. Bireline concluded that "When looking further at the issue of severity of potential impacts, this study seemed to support an advanced birder belief that the perceived benefits of observing birds outweigh the perceived liabilities of birders' actions" (p. 10).

Boaters and Anglers

It may be logical to expect highly involved outdoor recreationists (i.e., high investment of time and money in a particular activity) to demonstrate support of natural resource management and to engage in environmentally friendly behaviors while in their recreation environment, if for no other reason than to preserve that in which their activity depends. In re-conceptualizing

recreation specialization, and borrowing from previous findings, Ditton et al. (1992) submitted eight propositions and definitions of the continuum. Among these, proposition four states that as recreational fishing specialization level increases, so too does acceptance and support for the procedures, rules, norms associated with angling. Ditton et al.'s sixth proposition postulated that as specialization in recreational fishing increases, so too does one's dependency on a specific resource.

Various examinations, both prior to and after Ditton et al. (1992) have demonstrated positive associations between specialized freshwater fishermen and attitudes toward mandatory catch and release areas, as well as minimum fish size restrictions (Bryan, 1977; Chipman & Helfrich, 1988; Salz, et al., 2001). Chipman and Helfrich (1988) investigated the effects of angler specialization on motivations, perceptions and preferences for management actions via on-site and mail surveying. Items within the resource use, experience, investment and centrality to lifestyle domains were utilized to classify angler specialization level. Cluster analysis was employed to identify six types of anglers, from low to high specialization levels, with the experience dimension explaining 24% of the variance, and a combination of resource, investment and centrality dimensions accounting for 48% of the variability in the data. The authors found that management preferences and perceptions of management were significantly related to specialization. They also demonstrated that specialization level was related to non-consumptive uses of the resource (appreciative uses), and that support for reduced bag limits and increased minimum length limits was highest among highly specialized fishermen. Similar to Bryan (1977), they found reduced support for fish stocking among those most specialized. More importantly, low support of closed fishing seasons was demonstrated across all specialization levels, a finding later supported by Salz et al. (2001) and Salz and Loomis (2005).

Salz et al. (2001) tested several hypotheses related to specialization and the use of specialization indices. Among those tested, they evaluated Ditton et al.'s (1992) fourth proposition that highly specialized recreationists would indicate greater support for regulations and management rules than would less specialized participants. The authors chose a unique approach in their development of the specialization index by categorizing participants as strangers, tourists, regulars and insiders within the orientation, experiences, relationships and commitment characteristics (domains) previously utilized by Unruh (1979). Statements that described a respondent's connection with a particular activity as related to a specific characteristic comprised the specialization measure and were ordered from least to most specialized. A random sample of Massachusetts anglers were administered the mail survey and asked to respond to question groups such as "Please indicate your general orientation to the sport of fishing," "Please indicate how you would best describe yourself during a fishing experience," "Please indicate how you would best describe your relationships with other anglers," and "Please indicate how you would best describe your commitment to fishing" (p.245). The authors chose eleven items to evaluate support for management regulations including: creel limits, no stocking allowed, maximum size, stocking non-native fish, minimum size limits, restricted fishing area, mandatory catch and release, stocking native fish, slot limits, voluntary catch and release and prohibiting the use of certain gear. Their findings lent support for Ditton et al.'s (1992) fourth proposition in that more specialized anglers indicated greater support for rules than those less specialized on 9 of the 10 significant items. Support for restricted fishing areas was found to be lowest among the most specialized.

Salz and Loomis (2005) further investigated Ditton et al.'s (1992) fourth proposition by evaluating angler attitudes toward, 1) restricted fishing areas and 2) mandatory catch and release

areas and their relationship to recreation specialization. Data were collected via mail survey, with survey questions designed to gather information on membership in fishing organizations, beliefs about recreational fishing, attitudes toward marine protected areas, recreation specialization level and fishing enthusiasm. Recreation specialization was operationalized in the same way as Salz et al.'s (2001) study, with segmented anglers with respect to "social world characteristics (i.e. orientation, experiences, relationships, and commitment)" (p.192). Two hypothetical marine protected areas were presented to respondents: 1) Type A – catch and release recreational fishing allowed, with no harvesting, and 2) Type B – no fishing allowed of any kind. Recreation fishing beliefs were measured by agreement with various fishing belief statements such as, for example, "By limiting recreational fishing catch today we can improve the quality of recreational fishing in the future," and "Recreational saltwater fish species abundance is determined more by natural fluctuations than by the number of fish caught by people" (p.194). No significant differences were found across specialization levels with respect to attitudes toward catch and release marine protected areas, with responses, on average, between oppose slightly and not sure/uncertain for all three specialization levels (moderately, very, most specialized). Although not statistically significant, mean responses for support of "no fishing" areas decreased with increased specialization, with mean responses low across levels (between moderately oppose and oppose slightly). Furthermore, the most specialized anglers also indicated the highest agreement with recreation fishing having a negative impact on marine ecosystems, and that raising minimum size limits would lead to healthier fish populations.

Oh and Ditton (2006) further examined angler preferences using recreation specialization theory. They sought to describe angler preferences for fish harvest restrictions by using a preference choice model within the specialization framework. Specialization was

operationalized by eight items within the behavior (2 items), skill and knowledge (3 items) and commitment dimensions (3 items). Findings suggest that acceptance and support of the rules and procedures set forth by the managing agency varied by specialization level, with the authors concluding that specialized anglers were likely had a more ecological view of the resource in which their fishing took place. Based upon their approach, high levels of specialization were associated with acceptance of more restrictive rules and less willingness to relax the rules and regulations of the resource.

Although not specifically designed to evaluate recreation specialization, Futerfas' (2003) study of boater attributes and manatee conservation attitudes among Florida boaters lends insight into boater attributes that are often utilized in specialization research. Futerfas specifically found:

1. The longer a person had been a boater the more likely they were to view zone/access rules as too strict.

2. The longer a person had been a boater the more likely they were to disagree with manatee rights to exist.

3. The longer the boat length the more likely to disagree with manatee rights to exist.
4. The higher the number of boating outings in summer the more likely to favor less strict access rules.

5. Boaters who had not been members of boating related organizations were more likely to agree with manatee rights to exist.

6. Boaters who had not received boating or nature publications are more likely to favor stricter zone and access rules.

7. Boaters who had not received boating or nature publications are more likely to agree with manatee rights to exist.

8. Boaters who had ever taken a boater education class were more likely to favor less strict zone/access rules.

9. Boaters who stated that the class taught something helpful or interesting about manatees were more likely to favor stricter zone/access rules.

10. Boaters who felt boating licenses should be required were more likely to favor stricter zone/access rules.

11. The older the boater the more likely s/he is to favor less strict zone/access rules.

12. The higher the income, the more likely the boater is to favor less strict zone/access rules.

13. The higher the income, the less likely the boater is to agree with manatee right to exist.

Futerfas' findings shed light onto the environmental attitude/behavior literature as related to recreation specialization, especially with respect to research that has demonstrated a positive association between specialization and environmental attitudes/behaviors (Bryan, 1977; Katz, 1981; Kauffman, 1984; Meyer, 2002; Virden & Schreyer, 1988). Her findings are also consistent with research that has found access-denial regulations generally unpopular among anglers (Chipman & Helfrich, 1988; Salz & Loomis, 2005; Salz et al., 2001). More specifically, her findings suggest that boaters: 1) with the most boating experience tend to demonstrate the lowest support of existing rules and regulations; 2) with the most experience tend to indicate the lowest conservation attitudes; 3) express reduced support for manatee rights if exposed to boater literature or who are members of boating organizations; and 4) who operate longer boats tend to disagree with manatee rights.

Reported Versus Actual Behavior

Studies examining environmental behaviors have mostly relied upon self-reports for their ease of use and cost-effectiveness in the data gathering process and within a wide variety of disciplines and examinations. Despite widespread use of the methodology, validity analysis is lacking from most of the literature, with the few studies specifically addressing the issue casting doubt on its usefulness.

Hagburg (1968) formally tested the validity of questionnaire data by comparing reported and observed behavior. The author distributed questionnaires to Union Leadership Program

students as a means of assessing the number of classes each student reported attending by responding to the question "How many Union Leadership Program classes did you attend the first eight weeks (and second eight weeks) of this year?" Actual observed attendance was obtained from attendance records kept by the instructor, with significant differences found between the actual and reported number of classes attended ($p<.001$). His results also suggested that temporal proximity (i.e. how soon after the eight week cycle the questionnaire was given) had little relationship to either accurate or over-reporting; however, it did decrease the incidence of under-reporting. The author concluded, "The data, in general, suggest that responses are in the direction of ideal norms, i.e. high attendance in an educational program in accordance with explicit expectations" (p.456).

In noting discrepancies in prior energy conservation behavior research, Warriner, McDougall and Claxton (1984) submitted that inaccurate self-reports might be due to accident, instrument design, or social norms of behavior. They further suggested that accurate self-reports rely on one's willingness to answer correctly in the face of cognitive dissonance, and that one must be given the ability to select the correct responses on a survey (i.e. clearly worded and appropriate questions and answers). To evaluate the congruency between reported and actual energy-consumption behavior, the authors asked telephone interview respondents to estimate how much money they had spent during the past year on home fuels, and compared these estimates to utility records. Overall, self-reported expenditures on energy-related fuels erred in both directions between 25% and 29% when compared to actual records, with households consuming large amounts of energy consistently underreporting their consumption and with higher error.

Reported behavior is often utilized as a means of determining patient baseline and risk factors, and as a means of creating and assessing individual health care strategies. Lichtman et al. (1992) examined the reasons behind patients' inability to lose weight despite reporting caloric restriction. The researchers divided their sample into two groups, each consisting of obese subjects. The first group consisted of individuals with a history of diet resistance (poor expenditure of energy in the form of food calorie), while the second group had no history of diet resistance, thus serving as a control. The experimental group was instructed to continue their dietary plan uninterrupted for 14 days with no modifications, while their actual energy intake and expenditure (calories) was periodically measured by calorimetry and body composition procedures. The second group was given no intervention. Their results demonstrated that there were no differences in the thermic effects of either food or exercise between the two groups, thus the authors rejected low energy expenditure as a factor in self-reported diet resistance. However, group 1 subjects overreported their physical activity by an average of 51% while underreporting their food intake by an average of 47%.

Social research has tended to rely heavily on reported attributes, attitudes and behaviors as assessed by surveys and questionnaires. Although rarely discussed, research results may be substantially biased from a general reluctance to divulge attitudes and behaviors that may appear socially marginal. Mick (1996) conducted two separate studies to examine the self-report methodology in light of socially desirable responding (SDR) (overreporting desirable and underreporting undesirable behaviors) with respect to "dark-side" consumer behaviors. The first study focused on the reporting of materialism and self-esteem by distributing questionnaires to mall shoppers. Materialism and compulsive buying were measured via existing 18-item and 7-item scales, respectively, while an existing 10-item scale measured self-esteem. Socially

desirable responding was assessed with a 33-item scale which was similarly pre-existent. The findings of his first study suggested that materialism, compulsive buying and self-esteem were all significantly related to SDR, with SDR biasing materialism and compulsive buying downward. While the results are intriguing, the author points out that subjects may have perceived a lack of survey anonymity, a factor which has apparently been implicated in SDR bias.

Mick's (1996) second study extended the first by including the same variables and methodology, a more refined scale of SDR, plus three additional components of materialism: neuroticism ("tendency to experience aversive emotional states" (p. 112)), self-actualization and impulse buying. Additionally, the author extracted a subset of respondents for later contacting as a means of evaluating their perceptions of anonymity, which were found to be inconsequential to both studies. Results of his second study suggested that materialism, compulsive buying and impulsive buying were negatively correlated with SDR measures; that is, respondents biased their scores downward in an effort to look better. Respondents in the second study tended to underreport their materialism, compulsive buying, impulsive buying and neuroticism values while concomitantly overreporting their self esteem and self-actualization values, resulting in "measurement contamination" (p. 114). In summary, the author submits that despite the general debate surrounding SDR measurement, SDR bias is important in social research relying on questionnaires to assess attitudes, beliefs and/or behaviors. Furthermore, he suggests that despite its potentially profound impact on data integrity, little effort has been conducted to consider how such self-report bias may influence dark side and/or prosocial behavioral research (e.g., pro-environmental behavior).

Summary

Motorized transportation can be an important factor in animal movement and mortality (Trombulak & Frissell, 2000) with current estimates suggesting that as many as one million vertebrates are killed by vehicles daily on U.S. roads (Lowy, 2001). Similarly, motorized aquatic transportation can exact an important toll on marine life, as evidenced by the fact that vessel strikes are currently the single most important cause of manatee mortality in Florida (FWC, 206b). Despite indications that Florida's West Indian Manatee population may be stable or increasing (O'Shea 1988, O'Shea & Ackerman, 1995, Runge et al., 2004), the large degree of geographic variability in the data (FWC, 2005) and difficulties associated with manatee counts (Lefebvre et al., 1995; Miller et al., 1998; O'Shea, 1988) preclude claims of success. While the Upper St. John's and Northwest subpopulations have likely experienced growth in numbers over the past 10 years (Runge et al., 2004), these subpopulations are small relative to the Atlantic and Southwest populations, which are thought to be in decline (FWC, 2005; Runge et al., 2004, respectively). Vessel strikes currently comprise 25-30% of all manatee deaths in Florida (Ackerman et al., 1995), and as a result, Deutsch et al. (2002) suggests that a decline in manatee survival over the next 50 years is conceivable.

Vessel strikes have played prominently in historical manatee population declines, and a significant correlation has been found to exist between the number of registered boats in the state and number of vessel-induced deaths (Ackerman et al., 1995). From 1978 to present a substantial number of sanctuaries and speed restricted areas have been added to Florida's waterways under the direction of the Federal Manatee Recovery Plan (FMRP) as a means toward population recovery (FWC, 2005; Reynolds, 1999). Speed reduction as the tertiary strategy within the FMRP is based on the assumption that slower vessels cause less physical harm to an animal and that reduced speeds allow both animal and boat operator more time for avoidance

(Laist & Shaw, 2006; O'Shea, 1995). Vessel speed reduction is facilitated by FWC-posted seasonal and permanent idle and slow speed zones, with enforcement occurring through violation ticketing. However, insufficient funding, large geographic areas, absence of a general boater education program and the ever-increasing number of watercraft plying Florida's waters all act to reduce the efficacy of this approach (FWC, 2005).

Recreation boating is, for some, a quintessentially Florida. There are nearly one million registered boats in Florida (Florida Vessel Title Registration System, 2006), and the state is an important marine recreation destination (Leeworth & Wiley, 2001), attracting boaters from many geographic regions. With so many vessels plying its waterways, boat use often coincides with manatee habitats in Florida. Therefore, as manatee speed zones have been demonstrated effective in reducing manatee mortality (Laist & Shaw, 2006), speed zone compliance may be crucial to a sustainable manatee population.

A limited number of manatee speed zone compliance studies have been conducted in the state. Poor speed zone compliance has generally been found, with fewer than 50%-60% of boaters fully obeying posted speed regulations (see Gorzelany, 1996, 2001, 2004; Shapiro, 2001; Tyson & Combs, 1999). Furthermore, these authors cite that between 9% and 16% of boat operators demonstrate blatantly non-compliant behavior in manatee speed zones. Confounding the issue, boat operators have indicated to have some difficulty in understanding manatee speed zone delineations and/or messaging (Confer et al., 2003; Aipanjiguly, 2000; Aipanjiguly et al., 2003). Regardless of whether boaters understand manatee zoning or not, research has generally found that operators of small vessels are less compliant than operators of larger watercraft (Gorzelany, 1996, 2001, 2004; Shapiro, 2001; Tyson & Combs) and that rental, commercial, out-

of-state registered vessels, personal watercraft and johnboats have been similarly found least compliant (Shapiro, 2001).

In other lines of inquiry such as Cottrell's (1993) examination of pro-environmental behavior among boaters, boat type (motorized most compliant), boat length (longer were least compliant), years of boater experience (most experienced were most compliant) and years of site-specific boating experience (positively associated) were variously associated with compliant use of environmentally friendly sewage pumpout stations. Equipment attributes such as boat length and type and recreationist experience may be representative of the degree of specialization as initially posed by Bryan (1977) and subsequently examined by numerous authors.

Recreation specialization was first proposed by Bryan (1977) to explore diversity among individuals engaged in a particular activity. Bryan submitted that specialization was a continuum of behavior from general to specific and reflected in one's skill level, equipment used and setting preferences with respect to a particular activity. Bryan's examinations lead him to infer a continuum of specialization levels reflected in a typology of anglers (p.177):

In addition, as one progressed through the continuum, a recreationist experienced corresponding changes in attitudes toward the resource in which the activity takes place, the activity itself and orientation toward the management of the resource. Since Bryan's (1977) research, other researchers have examined a variety of activity groups, and have utilized a variety of approaches to operationalize the construct.

Among others, recreation specialization has been utilized to explore recreationists' environmental attitudes, environmental behaviors and attitudes toward and engagement in depreciative behaviors, although approaches and findings differ markedly. Wellman et al. (1982) found that highly specialized canoeists differed little in their norms of depreciative

behavior from other less specialized canoeists, though methodological issues limited their findings. Thapa (2000) found little evidence to suggest a positive association between specialization and attitudes or self-reported behaviors among forest recreationists. Contrastingly, Meyer's (2002) examination of SCUBA diver behavior demonstrated that those most specialized reported engaging in the fewest depreciative behaviors in the form of touching or otherwise disturbing marine organisms while diving. Finally, Bireline (2005) determined that highly specialized birders were more likely to rely on depreciative methods of attracting birds into view than were less specialized birders.

Researchers have demonstrated negative associations between specialized fisherman and attitudes toward various fishing regulations (Salz & Loomis, 2005). Contrastingly, others have demonstrated positive associations between the two (Chipman & Helfrich, 1988; Salz et al., 2001), with the notable exception that anglers, regardless of specialization level, seem to poorly support access-denial regulations (Chipman & Helfrich, 1988; Salz et al., 2001; Salz & Loomis, 2005).

Nearly all of the attitudinal and behavioral studies included in this review have relied upon participant-reported rather than researcher-observed data gathering techniques. While self-reports lend simplicity and efficiency to the data collection process, various lines of inquiry have demonstrated that reliance on this method is a limitation in research (Lichtman et al., 1992; Mick, 1996; Warriner et al., 1984).

Table 2-1. Boater compliance criteria (Gorzelany, 1996, 1998)

Compliance	Any vessel in-use that was observed to maintain a speed consistent with the posted speed restriction in the sampling area, as defined by: (1) Idle Speed: 1-3 mph (1.6-4.8 km) (2) Slow Speed: 5 -7 mph (8 to 11.2 km)
Technical Noncompliance	Any vessel observed to be in violation of the posted speed at a sampling site as defined by: (1) transitioning to one speed category faster than the posted speed limit (2) excessive speed, but only for a relatively short distance within the posted area (3) traveling between 4-7 mph (6.4-11.2 km) if in Idle Speed zone (4) traveling between 8-15 mph (12.9-24 km) if in Slow Speed zone
Blatant Noncompliance	A vessel transitioning at a speed greater than one speed category faster than the posted limit through a significant portion of a speed-restricted area, or as defined by: (1) traveling between 8-15 mph (12.9-24 km) if in Idle Speed zone (2) traveling greater than 15 mph (24 km) if in Slow Speed zone

Table 2-2. Recreation Specialization: Activities Examined

Activity	Authors
Canoeing and river floating	Bricker, 1998; Bricker & Kerstetter, 2000; Bryan, 1979; Hammit & McDonald, 1983; Kauffman, 1984; Kuentzel & McDonald, 1992; Schreyer & Lime, 1984; Schreyer et al. 1984; Wellman et al. 1982 Williams et al. 1990
Hiking and backpacking	Bryan, 1979; Graefe et al. 1986; Virden & Schreyer, 1988; Williams & Huffman, 1986
Rock/mountain climbing	Bryan, 1979; Ewert, 1985; Merrill, 1996; Merrill & Graefe, 1998
Forest Recreation	Mowen et al. 1997; Thapa, 2000;
Mountaineering	Dyck et al. 2003
Birdwatching	Bireline, 2005; Bryan, 1979; Cole & Scott, 1999; Hvenegaard, 2002; Lee & Scott, 2004; Martin, 1997; McFarlane, 1994, 1996
Hunting	Kuentzel & Heberlein, 1992; Miller & Graefe, 2000
Bridge	Scott & Godbey, 1994
Boating and sailing	Cottrell, 1993; Cottrell et al. 2004; Donnelly et al. 1986; Kuentzel & Heberlein, 1997
Anglers	Bryan, 1977; Chipman & Helfirch, 1986; Choi et al. 1994; Ditton et al. 1992; Katz, 1981; Oh & Ditton, 2006; Salz & Loomis, 2005; Salz et al. 2001
Camping	McFarlane, 2004; McIntyre & Pigram, 1992
Mountain biking	Hopkin & Moore, 1995
Horseback riding	Hammit et al. 1989
SCUBA diving	Meyer, 2002; Thapa et al. 2005, 2006

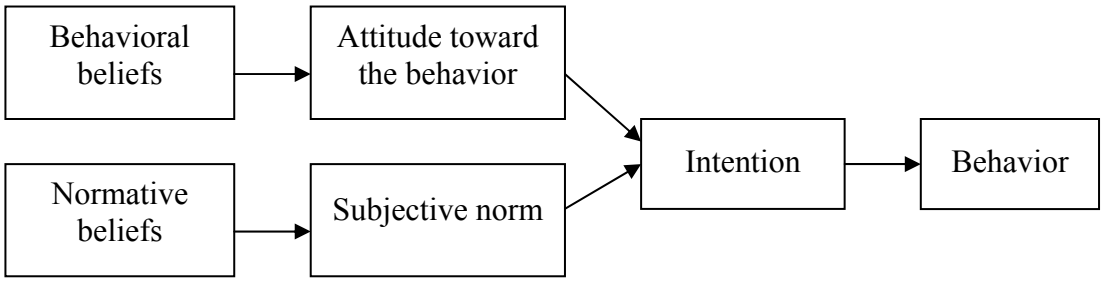


Figure 2-1. Theory of Reasoned Action

CHAPTER 3
PROCEDURES

This chapter is divided into the following sections: 1) Study sites, 2) Selection of subjects, 3) Operationalization of variables, 4) Data analysis, and 5) Telephone survey of non-respondents.

Study Sites

This investigation took place on the St. Johns River in southwestern Volusia County, Florida. Various manatee zone compliance studies have demonstrated that compliance varies from site to site and with respect to zone type (i.e., slow or idle). For this study, one idle (site 1) and one slow (site 2) speed zone were sampled, both of which were chosen due to their similar situational attributes such as, year-round presence of manatees and watercraft, channel width, depth, distance from zone signage and sufficiency of vessel traffic. Both sites were implemented in the early 1990s (Bill Flowers, pers. Comm..) and are located near Blue Spring State park in close proximity to one another (approximately 1409 m apart) (Figure 3-1).

Situated in the eastern half of the state of Florida, Volusia County is bordered on its western edge by the St. Johns River, which flows south to north past DeLand and Blue Spring State Park (Figure 3-1). Between the November and March, when river water drops below 68° Fahrenheit, Blue Spring becomes a vital warm water refuge for manatees (St. Johns River Water Management District (SJWMD), 2006). The spring boil and its 712meter run to the St. Johns River are designated Class III waters by the state, allowing recreation and providing for the maintenance of healthy fish and wildlife populations (SJWMD, 2006). The spring and its run are designated as critical manatee [1] by the United States Fish and Wildlife Service (USFWS), with manatee count data demonstrating an increase in the number of individuals observed from 28 in

[1] Critical habitat defined as an area necessary to the normal needs or survival of the species (USFWS, 2006).

1978 to 130 in 2004. Besides their winter presence in the spring and run, manatees are found throughout the entire stretch of St. Johns River in Volusia County during all months of the year. Since 2000, 30 manatee deaths have been attributed to vessel strikes in Volusia County (Florida Fish and Wildlife Conservation Commission (FWC), 2006a).

The St. Johns River is important for river transportation and recreational and commercial fishing. There are currently more than 30,000 registered vessels in Volusia County, representing a five percent increase in registrations since 2002 (Florida Department of Highway Safety and Motor Vehicles, 2006). In addition, boaters from other Florida counties as well as other states visit the river near Blue Spring State Park. Considerable daily use by watercraft in combination with the river's importance in manatee conservation has resulted in the official posting of 326 slow and idle speed zones in the county, with 92 located on the St. Johns River (FWC, 2006b).

This investigation obtained observational data from the banks of the St. Johns River for one slow speed zone and one idle speed zone (Figure 3-1). The idle speed zone, which encompassed site 1, extends approximately 804m north of the confluence of the St. Johns River and Blue Spring run (approximately 28°56'50.94" N, 81°20'22.52" W). Further, site 1 is located 18 m south of the entrance to a slow speed zone and 617m north of the confluence between the Blue Spring run and the St. Johns River. Site 1 observations were performed overlooking the water channel from east to west from a small sandy area among dense riparian vegetation. The setting allowed the researcher to blend with the surrounding elements while maintaining a wide view of boat traffic. The slow speed zone in which sampling site 2 was located extends approximately 603m south of the confluence between the Blue Spring run and the St. Johns River. Site 2 is located 189m south of the entrance to the idle speed zone and 792m south of confluence. Site 2 sampling was similarly performed with the observations over the water

channel from east to west. Access to sampling site 2 required the researcher to navigate with the use of a kayak south from the vicinity of site 1 to a small opening among the vegetation and trees. Once at the respective destination, the kayak was pulled into the forest, and observations were made with the researcher almost entirely hidden from the view of boaters. Channel widths at sampling sites 1 and 2 were 89m and 84m respectively.

Selection of Subjects

Field observations were performed to establish vessel speeds at sampling sites 1 and 2, to document various vessel, situational and party size attributes, and to obtain hull registration numbers of sampled boats. Observational data collection occurred on 17 days between July 29, 2006 - September 24, 2006 (see Table 3-1).

Field Observations

Based on a projected target population of 30,000 potential boaters within Volusia County, and the assumption that boaters from other counties do not likely use the river, a sample size of approximately 380 mail surveys were required to obtain a confidence interval of 5% and a confidence level of 95% (Agresti & Finlay, 1997). A minimum sample size of approximately 1000 vessel observations was targeted, and each vessel that passed through a sampling site was assessed. In total, 1669 vessels were observed, of which 150 were rental vessels, and 460 were either repeat observations or vessels that possessed missing, illegible or invalid Florida numbers. Rentals, repeat observations (hull numbers which had already been noted), and vessels with missing, illegible or invalid Florida registration numbers were eliminated from the pool of potential respondents.

Individual boats were only assessed upon their first pass, with subsequent passes ignored. Additionally, at the conclusion of weekend observations and prior to survey mail out, hull numbers were sorted to eliminate those vessels observed during prior outings. Law enforcement

and Coast Guard vessel speeds and attributes were not documented, although the presence of law enforcement vessels was noted when identified within the researcher's field of view.

One site was sampled each day on Saturdays and Sundays (one Friday and Monday were also sampled, the later of which was Labor Day), with most observations conducted between 9:00 AM and 4:00 PM. Water depth (7.9m site 1; and 8.5m site 2) and distance to speed zone signs (187m north of site 1, 189m north of site 2) were established during the first sampling event (Figure 3-1). Date, AM/PM, ambient temperature (degrees Fahrenheit), site number, speed posting (idle or slow), day of the week, and sky conditions (clear, partly cloudy, cloudy, rain) were noted for each observation (see Field Data Sheet - Appendix D).

Speed Calculation

Within each site, speed was assessed by first choosing two fixed markers (usually trees) on opposite banks from observer position, and the angle from observer to each point determined with hand held compass (Figure 3-2). Secondly, a laser range finder was utilized to determine the distance (in feet) from the observer to a vessel once a vessel had crossed a line-of-site to first fixed marker on the opposite bank. Once crossed, a stopwatch count was initiated until the observed vessel crossed a second fixed marker, at which time the stopwatch was stopped and another distance measurement conducted. Distance traveled was calculated according to cosine law (1), and then speed (mph) determined (2):

1. $a^2 = b^2 + c^2 - 2ac \cos \beta$
2. $(((a / \text{seconds}) * 60) * 60) / 5280 = \text{mph}$

Vessel speed determination was a crucial component of this research. Reliability data for vessel speed calculations was generated via 30 automobile observations conducted at known speeds. Speed calculations, as described above were then noted and the resultant speeds were analyzed against known automobile speeds to determine if statistical differences occurred. A

paired t-test between known and calculated speeds found no statistical difference ($t(29)=1.25$, $p=.221$).

Supporting Parameters

In addition to vessel speed parameters, supporting data were documented such as time of observation, boat type (pontoon, sail, ski, johnboat, runabout, fish, yacht/cruiser, other), boat length (less than 12 feet, 12 to 15 feet, 16 to 25 feet, 26 to 39 feet, 40 to 64 feet, 64 to 109 feet, greater than 109 feet), party size, presence/absence of law enforcement within site of observer, Florida hull registration number (for later querying), and whether or not the boat was a rental (if obvious). The distribution of observation times are illustrated in Table 3-2

As other investigators have found that boat length may be associated with compliance, boat length data was captured by estimates made during field observation and by responses to the mail survey. The relationship between observed and respondent-indicated vessel length was investigated using Pearson-r correlation. A positive and significant correlation between the two variables was found, indicating a fairly high degree of association between observed and reported vessel length ($r=.364$, $p<.01$).

Mail Survey

To facilitate the mail survey the Florida boat number was noted in the field used to obtain the name and mailing address of the boat owner from the VTRS. The survey instrument was mailed on the Monday or Tuesday immediately following weekend observations. In this way, observed vessel speed and boat/boater attributes could be matched on a 1:1 basis with the follow-up boater survey. It was assumed that individuals responding to the mail survey were those observed on the water, and that they had not boated since being observed. Both assumptions were evaluated with the mail survey instrument. Of the 236 surveys returned, 200 (85%)

indicated that their last boat outing corresponded to the date that they were observed on the water, with 203 (86%) noting that they were the primary operator of the vessel.

The mail survey instrument included questions (Appendix A) to evaluate boater: 1) recreation specialization level, 2) vessel attributes, 3) marine conservation attitudes, 4) self-reported compliance behavior, 5) speed zone signage assessment, 6) operator knowledge and history, 7) TRA, and 8) demographics. The mail survey used Dillman's (2000) method to maximize response rates. Additionally, a bolded red label was affixed to each envelope with the statement "Opinions needed for waterway management" as a means of generating interest in participating in the survey. A total of 1059 surveys were mailed, 23 were returned as undeliverable, and 236 were returned as useable resulting in a 23% response rate.

Operationalization of Variables

Vessel Use and Attributes

The question "When did you last operate your boat on the St. Johns River" was used to determine if the participant was providing responses relative to the outing in which they were observed on the water. Additionally, questions such as "Were you the primary vessel operator during the trip," "Where did you last operate your boat," and "When did you last operate your boat on the St. Johns River" helped to ascertain whether the respondent answered the survey questions relative to observed boating behavior.

Respondents were asked to denote the type of boat they used during their last outing as a means of determining whether certain vessel classes were more or less in violation of waterway speed limits. Respondents were given a list of vessel types such as "Pontoon," "Fish," "Personal Watercraft" and others (boat classes adapted from Gorzelany, 1996, 2001, 2004). Respondents were asked to indicate the length of the hull of the boat, since prior research indicated that vessel length is associated with manatee speed zone compliance (Gorzelany, 1996, 2001, 2004; Tyson

& Combs, 1999). In addition, a contingency question asked, "Does this boat have a speedometer," the lack of which may help to explain vessel noncompliance within speed-restricted areas.

Recreation Specialization

Recreation specialization was conceptualized based three dimensions: behavioral, cognitive and affective. Within each recreation specialization domain, several items were employed. Since the specialization items included a mix of ordinal, interval and ratio measures, a composite additive index was created using Z-score transformations for all specialization items. Furthermore, individual indices scores for the three domains (behavioral, cognitive and affective) were created utilizing Z-score transformations. This process has been employed by various researchers that have utilized the specialization construct (see Dyck et al., 2003; Meyer, 2002; Thapa, 2000; Virden & Schreyer, 1988; Wellman et al., 1982).

Behavioral Dimension

The behavioral domain consisted of four items adapted from the literature (Table 3-3). The internal consistency of the behavioral dimension items were analyzed using Cronbach's standardized alpha. The alpha value for this dimension was .62. Following reliability analysis, the values of the items were summed to create a behavioral domain index.

Cognitive Dimension

The cognitive domain also consisted of four items adapted from the literature (Table 3-3). The internal consistency of the cognitive dimension items were analyzed using Cronbach's standardized alpha. The alpha value for this dimension was .77. Following reliability analysis, the values of the items were summed to create a cognitive domain index.

Affective Dimension

The affective domain consisted of seven items adapted from the literature (Table 3-3). The internal consistency of the cognitive dimension items were analyzed using Cronbach's standardized alpha. The alpha value for this dimension was .75. Following reliability analysis, the values of the items were summed to create an affective domain index.

Composite Recreation Specialization Index

Similarly, the composite specialization index was tested for internal consistency for all 15 items using Cronbach's standardized alpha. Following the analysis, the composite index registered an alpha value of .81 (Table 3-3).

Marine Conservation Attitudes

Marine conservation attitudes were operationalized using four items tied to a 5-point Likert scale format, ranging from strongly disagree (1) to strongly agree (5). The items were based on two conceptual domains: attitudes toward manatee conservation (2 items); and attitudes toward general marine conservation (2 items). The four items were combined to create a composite marine conservation attitude index. Following the creation of the index, the items were subjected to a reliability analysis using Cronbach's alpha analysis. The standardized alpha value was .80.

Knowledge

In addition to marine conservation attitudinal items, several knowledge based questions with respect to manatees were asked of respondents. Recently, FWC passed a vote recommending that the manatee be downlisted in status from endangered to threatened at the state level, with much publicity and controversy surrounding the decision. In order to assess boater's knowledge of the current level of manatee listing, respondents were asked whether manatees were officially listed in Florida as "Species of special concern." "Threatened,"

"Endangered," or "Manatees are not listed." Additionally, boater knowledge of boat speed behavior in idle and slow speed zones was assessed by two questions: "When in an idle speed zone, a boater should," and "When in a slow speed zone, a boater should." Correct answers for each were based on state [2].

Non-Compliance/Compliance Behavior

Two items were used to ascertain boaters' self-reported level of compliance and non-compliance with vessel speed zones. The items were based on a five point Likert scale (1=strongly disagree to 5 = strongly agree), and prompted respondents to indicate their level of agreement with the statements, "I fully complied with manatee speed zones during my most recent boating experience," and "I fully complied with general (non-manatee) boat safety speed zones during my most recent boating experience." The items were subjected to a reliability analysis using Cronbach's alpha analysis. The standardized alpha value was .66. Following reliability analysis, the values of the items were summed to create a self-reported compliance index. Furthermore, based on a dichotomous (yes/no) format, boaters were also asked to report if they had ever been ticketed for violating boat speed restrictions.

Finally, boaters were asked to indicate the top five reasons for non-compliance with boat speed restrictions. For this question, respondents were given 14 potential reasons, whereby five ranked responses (1=most important, 2= second most important, etc.) were solicited. Questions were adapted from Futerfas (2003) (Table 3-5).

[2] "Any vessel operating in a speed zone posted as "Idle Speed – No Wake" must operate at the minimum speed that will maintain steerageway." "Any vessel operating in a speed zone posted as "Slow Down – Minimum Wake" must operate fully off plane and completely settled in water.

Speed Zone Signage Assessment

Speed zone signage assessment was operationalized using six items tied to a 5-point Likert scale format, ranging from strongly disagree (1) to strongly agree (5). The items were based on: signage assessment in manatee zones (three items adapted from Confer et al., 2003), and general boat safety zones (three items, researcher written).

Signage Assessment in Manatee Zones

Signage assessment in manatee zones was operationalized based on three items (Table 3-6). The items were subjected to a reliability analysis using Cronbach's alpha analysis. The standardized alpha value was .87. Following reliability analysis, the values of the items were summed to create a manatee zone signage assessment index.

Signage Assessment in General Boat Safety Zones

Signage assessment in general boat safety zones was operationalized based on three items (Table 3-6). The items were subjected to a reliability analysis using Cronbach's alpha analysis. The standardized alpha value was .88. Following reliability analysis, the values of the items were summed to create a general boat safety zone signage assessment index.

Composite Signage Assessment Index

A composite signage assessment index was also computed for the values of all six signage assessment items. Reliability analysis using Cronbach's alpha registered a standardized alpha of .91.

Theory of Reasoned Action

Theory of Reasoned Action was operationalized using nine items tied to a 5-point Likert scale format, ranging from strongly disagree (1) to strongly agree (5). The items were based on three conceptual domains: attitudes, subjective norm and intention. All but two items were adapted from Aipanjiuguly (2001).

Attitudes

Attitude assessment within the TRA construct was operationalized based on three items (Table 3-7). The items were subjected to a reliability analysis using Cronbach's alpha analysis. The standardized alpha value was .63. Following reliability analysis, the values of the items were summed to create an attitude index.

Subjective Norm

Subjective norm assessment within the TRA construct was operationalized based on three items (Table 3-7). The items were subjected to a reliability analysis using Cronbach's alpha analysis. The standardized alpha value was .62. Following reliability analysis, the values of the items were summed to create a subjective norm index.

Behavioral Intention

Behavioral intention assessment within the TRA construct was accomplished based on three items (Table 3-7). The items were subjected to a reliability analysis using Cronbach's alpha analysis. The standardized alpha value was .76. Following reliability analysis, the values of the items were summed to create a behavioral intention index.

Demographics

There were five demographic indicators used in the survey instrument. Items assessed were gender, age, education (categories: "Less than High School," "High School diploma," "Attended business/technical school," "Some college or 2-year degree," "Completed 4-year college degree," "Some graduate work," and "Completed graduate or advanced degree"), and income (categories: "Less than $14,999," "$15,000 to $34,999," "$35,000 to $49,999," "$50,000 to $64,999," "$65,000 to $99,999," "$100,000 to $149,999," $150,000 to $199,999," and "Over $200,000").

Supplemental Items

Two questions were additionally posed to respondents. The first question, "How do you feel about removing manatees from the endangered species list" was coded on a five point Likert scale format (1=strongly disagree with removing them, 2=disagree with removing them, 3=neither agree nor disagree with removing them, 4=agree with removing them, 5=strongly agree with removing them, and 6=not sure/nor response). The second question, "Please check the number of times you have seen manatee while boating during the past 12 months" (choices: "Never," "1 to 2 times," "3 to 4 times," "5 to 6 times," "7-8 times," "9-10 times," "Greater than 10," "Not sure") was adapted from Confer et al. (2003).

Telephone Survey of Non-Respondents

Mail surveying is a heavily relied upon method for conducting social research; however, low response rates can be problematic. Low response rates in mail surveying may impart bias to a sample if non-respondents differ in characteristic from respondents, in which case sample means may differ from those of the population of interest. Although Babbie (2004) contends that a response rate of 50% is adequate for statistical analyses, there seems to be little consensus about an acceptable response rate for mail survey research (Dolsen & Machlis, 1991). For this particular study, a 23% response rate was achieved. Based on a procedure used by Cottrell (1993), non-response bias was evaluated by conducting a telephone survey of a random sample of non-respondents based on 14 questions from the mail survey instrument (Appendix B).

A systematic random sample of 40 vessel owners representing five percent (N=800, interval = 20) of all non-respondents were selected to be surveyed by telephone between November 27 and December 5, 2006. Telephone numbers of non-respondents selected for phone surveying were procured by searching the Internet based on the names and addresses generated for the initial survey mail out.

Fourteen telephone numbers could not be located, and as a result fourteen replacement names were randomly selected. Of these replacements, five telephone numbers could not be located, six refused the survey for various reasons, and four numbers were never found. In an effort to contact at least 30 non-respondents, a systematic random sample of 20 additional vessel owners was conducted. Of this sample, five phone numbers were never found, two were never reached and two declined the survey. In total, 36 telephone interviews were conducted, with the sample means and distributions of questions compared on a per question basis with the original mail survey results.

Variables examined in the phone survey analyses included 1) number of years a boater, 2) boat type, 3) hull length, 4) self-assessed general boating skill, 5) agreement with manatees being worth saving despite regulation, 6) agreement with boat safety zones causing too many inconveniences, 7) agreement with fully complying with manatee speed zones during most recent boating experience, 8) agreement with manatee speed zones being well marked, 9) general support for Florida's boating rules and regulations, 10) knowledge of idle speed zone definition, 11) ticketing history, 12) agreement with removing manatees from the endangered species list, 13) importance of having the freedom to get to a destination quickly while boating, and 14) intention to follow manatee speed zone restrictions the next time one boated. Both the question wording and response choices were identical to those of the mail survey instrument.

Results of the analyses are presented in Appendix C. Fourteen variables were examined for distribution and/or statistically significant differences between the mail survey and phone survey results. Of those tested for significance, six were found to differ at the .05 level of significance. Employing an independent samples t-test, significant differences were found between mail and phone respondents with respect to the number of years a boater ($t = -2.45$; p

<.05), with mail respondents boating more years (mean = 26 yrs) than phone respondents (mean = 19 yrs). The median vessel length was the same for both groups (both 3.0, indicated that the boats between the length of 16ft and 25ft were the most commonly used for both respondents and non-respondents). Mail respondents depicted themselves as having slightly higher general boating skills than telephone respondents, although the difference was not statistically significant. Mail respondents indicated significantly higher agreement with the statement that "Manatees were worth saving despite the need for regulations" (mean 3.9) than did phone respondents (mean 3.5) ($t = -2.21$; $p = <.05$). Similarly, mail and telephone respondents differed significantly in their agreement that "Boat safety zones caused too many inconveniences" ($t = 3.6$; $p<.05$), with mail respondents indicating much higher agreement (mean = 3.2) than did telephone respondents (mean = 2.5). Both groups were very similar in their high level of agreement with fully complying with manatee speed zones during their last boat outing, although the two groups differed significantly in their agreement with manatee speed zones being well marked (mean 3.0 and mean 3.5, phone and mail respondents, respectively) ($t = 2.92$; $p <05$). Mail respondents indicated significantly greater support for Florida's boating rules and regulations (mean = 3.9) than did those interviewed by telephone (mean = 3.5; $t = 2.94$; $p <.05$). Finally, mail respondents did not differ from telephone respondents in agreement with their feelings toward removing manatees from the endangered species list; importance in the freedom to get to one's boating destination; or intention to follow manatee speed zone restrictions during one's next boat outing.

Chi square analysis demonstrated that mail respondents had been ticketed more often than telephone respondents ($X^2 = 13.49$; $p <.05$). Boat types were then compared between mail and phone respondents. Although chi square analysis could not be utilized due to insufficient

expected cell frequencies, percentages of vessel types within each category did not differ greatly between mail and phone data. Twenty-three and 28% were fishing vessels (mail and phone responses, respectively); 5% and 11% were johnboats (mail and phone responses, respectively); 11% and 17% were yachts/cruisers (mail and phone responses, respectively); 25% and 17% were pontoons (mail and phone responses, respectively); 3% and 6% were personal watercraft (mail and phone responses, respectively); 25% and 14 % were runabouts (mail and phone responses, respectively); and about 8% were ski boats in both samples.

Responses to the question "when in an idle speed zone, a boater should…" was examined for both mail and phone respondents. Approximately four percent mail and eight percent of the phone respondents chose answer "A" ("Travel no faster than 5 mph"); 81% of mail and 72% of phone respondents chose correct answer "B" ("Create no wake"); 12% of mail and 11% of phone respondents chose "C" ("Create minimum wake"); and 3% of mail and 8% of phone respondents chose "D" ("Not sure"). A Chi-square test of independence suggests that the proportion of mail respondents who answered this correctly was not significantly different from the proportion of telephone respondents who answered correctly.

Data Analyses

Data was stored and analyzed with SPSS version 14.0, with all analyses evaluated at the .05 level of significance unless otherwise noted. In addition to research question and hypotheses testing, the sample of boaters and key constructs were first described by frequencies and other appropriate descriptive methods.

Specialization analyses were based on separate domain indices (behavioral, cognitive and affective) as well as a composite index. Similarly, marine conservation attitude analyses were based upon separate domain indices for analysis (attitudes toward manatee conservation, and attitudes toward general conservation) and a composite index. With the exceptions noted, all

Likert scale data generated by the survey instrument were converted to indices for analyses; therefore, parametric statistical methods were utilized (Agresti & Finlay, 1997).

Unless otherwise noted, vessel speed discrepancy (observed speed minus the maximum speed within the zone) was utilized as a response variable for those analyses relying on vessel speed. Utilizing speed discrepancies rather than absolute speeds served to standardize the data generated within the two different zones (Idle, site 1; and Slow, site 2). Furthermore, the speed discrepancy calculation allowed a full exploration of the degree to which a boater was compliant or non-compliant with boat speed restrictions.

In summary, the overarching purposes of the analyses that follow were to evaluate the relationships between observed vessel speed and recreation specialization, marine conservation attitudes and self-reported compliance behavior. Additionally, Theory of Reasoned Action, boat and boater attributes, and situational factors were examined as predictors of boater compliance within speed restricted manatee conservation zones.

Research Questions and Hypotheses Testing

Research question one was tested using an independent samples t-test to determine if mean speed discrepancy (observed speed minus maximum allowable speed) differed between those who had been ticketed and those who had not in the past for boat speed violations. Research question two also an independent samples t-test to evaluate whether mean speed discrepancy differed between the two sampling sites (slow and idle speeds). Question three used a regression analysis to evaluate whether or not speed discrepancy was influenced by vessel party size as observed on the water. For question four, one-way ANOVA was used to determine

[3] Maximum allowable vessel speeds are defined by Sarasota County (2006) according to the following: Idle zone: generally not to exceed 3 mph; Slow zone: generally not to exceed 7 mph.

if mean vessel speed discrepancy differed between the categories of vessel lengths. Similarly, for question five the mean difference in vessel speed discrepancy between the various vessel types (pontoon, fish, personal watercraft, runabout, johnboat, sail, yacht/cruiser, ski, and other) was evaluated with ANOVA. Research question six was evaluated with one-way ANOVA to determine if mean vessel speed discrepancy differed based on the number of times a manatee was observed while boating during the past 12 months. Research question seven used Pearson r correlation analysis to examine boater's assessment of on-water signage on vessel speed discrepancy. Similarly, for research question eight, a Pearson r correlation was used to examine the association between recreation specialization (behavioral, affective, cognitive, and composite specialization indices based on Z-scores) and speed zone signage assessment (manatee speed zones, general boat safety speed zones, and composite speed zone signage assessment indices). Finally, Research question nine was analyzed by first employing a series of Pearson r correlations between the TRA indices, after which multiple regression was performed between the same TRA indices.

Hypothesis 1, 2, 3 and 4 were testing using Pearson r correlations to determine if recreation specialization was associated with observed vessel speed discrepancy, self-reported compliance behavior, marine conservation attitudes, and behavioral intentions. Prior to hypothesis testing, responses to the recreation specialization items were first converted to Z-scores. Vessel speed discrepancy (observed speed minus maximum allowable) was used to standardize the different maximum allowable speeds within the slow speed and idle speed zones. Responses to questions within the recreation specialization, marine conservation attitude and behavioral intention domains were summed to create indices for hypothesis testing.

Pearson r correlation was employed to test Hypothesis five, which evaluated the association between the index self-reported compliance behavior and observed speed discrepancy. An independent samples t-test was additionally performed to determine if compliant boaters (as determined by field observation) differed from non-compliant boaters in their level of self-reported compliance behavior.

Hypotheses 6, 7 and 8 were tested using Pearson r correlations to evaluate the association between marine conservation attitudes, vessel speed discrepancy, behavioral intentions, and self-reported compliance behavior. Indices of marine conservation attitudes, behavioral intentions and self-reported compliance behavior were used for hypotheses testing.

Hypotheses 9 and 10 were tested using Pearson r correlations to evaluate the associations between behavioral intentions and self-reported compliance behavior and vessel speed discrepancy. Indices of behavioral intention and self-reported compliance behavior were used for hypothesis testing.

Prior to performing a path analysis to test the hypothesized associations presented in the proposed model (Figure 1-1), a confirmatory factor analysis (CFA) was performed to validate the scales used in the survey instrument. CFA was used to discern factor loading, and to determine item deletion due to cross loading on more than one factor (Pallant, 2005). As a result of the CFA analysis, number of boating-related magazine subscriptions and/or books, number of boating-related items, and number of boating-related clubs were dropped from the affective domain of the recreation specialization construct. Similarly, the affective domain item "Boating and boating-related activities are one of the most enjoyable things I do," the entire behavioral domain of the recreation specialization construct, and "I generally support Florida's boating rules and regulations" from marine conservation attitudes were deleted due to low convergent validity.

After model modification, a path analysis was performed to determine the predictive validity between recreation specialization, marine conservation attitudes, behavioral intentions, self-reported compliance behavior, and vessel speed discrepancy. AMOS 7.0 software was employed for both CFA and path analyses.

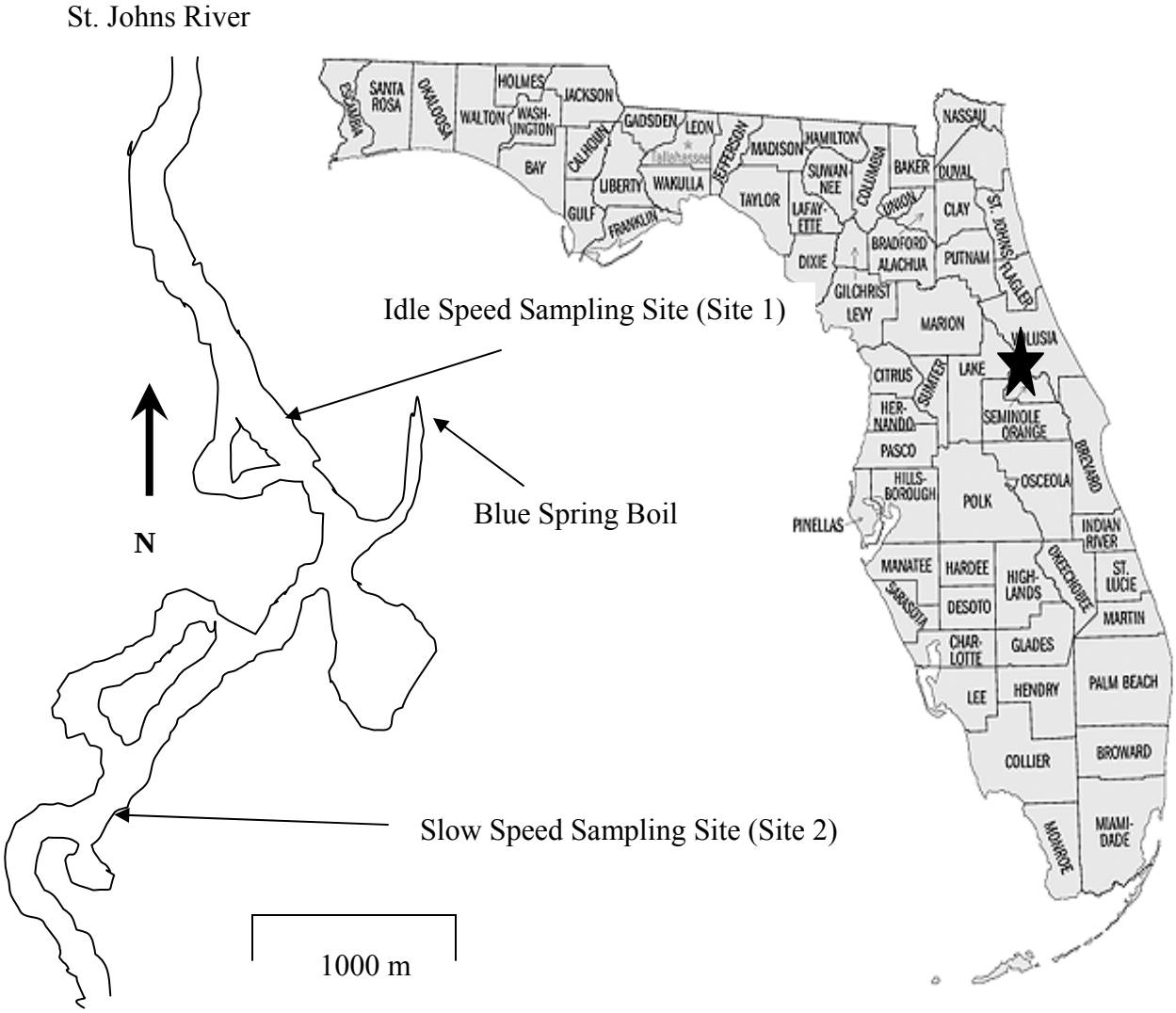


Figure 3-1. St. Johns River sampling sites

Table 3-1. Sampling schedule and observations

Date	Day	Zone type	Vessels observed
7/29/2006	Sat	Idle	146
7/30/2006	Sun	Slow	122
8/12/2006	Sat	Slow	148
8/13/2006	Sun	Idle	78
8/18/2006	Fri	Idle	13
8/19/2006	Sat	Idle	65
8/20/2006	Sun	Slow	127
8/26/2006	Sat	Slow	71
8/27/2006	Sun	Idle	79
9/2/2006	Sat	Idle	88
9/3/2006	Sun	Slow	145
9/4/2006	Mon	Idle	109
9/9/2006	Sat	Slow	84
9/16/2006	Sat	Slow	137
9/17/2006	Sun	Idle	87
9/23/2006	Sat	Idle	78
9/24/2006	Sun	Slow	87
	Total		1670

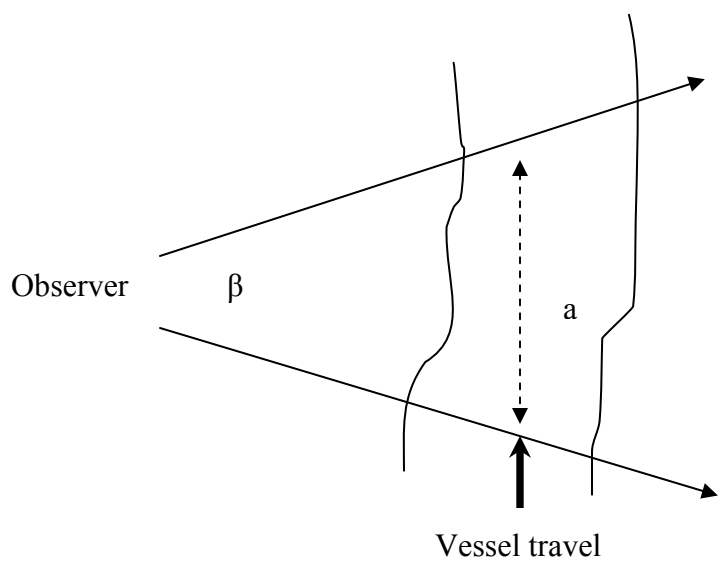


Figure 3-2. Vessel speed calculation

Table 3-2. Field observation attributes

Parameter	Frequency	Percent*
Time		
0900-0959	16	1
1000-1059	102	9
1100-1159	248	21
1200-1259	263	22
1300-1359	239	20
1400-1459	211	18
1500-1559	114	9
1600-1659	14	1
Vessel length (ft)		
<12	43	4
12-15	323	27
15.1-25	744	61
25.1-39	86	7
39.1-64	12	1
Vessel type		
Fishing	278	23
Johnboat	54	5
Yacht/cruiser	138	11
Pontoon	298	24
Personal watercraft	39	3
Runabout	299	25
Ski	92	8
Other	11	1

***** The valid percentages have been rounded to equal 100%

Table 3-3. Reliability analysis for recreation specialization

Recreation specialization	Corrected item total correlation	Alpha if item deleted	Corrected item correlation	Alpha if item deleted
Behavioral [a, 1]	Individual dimensions		Overall index	
Number of years a boater	.32	.61	.47	.80
Number of days boated in past 12 months	.66	.34	.53	.79
Number of days boated in Volusia County in past 12 months	.52	.46	.42	.80
Number of different water bodies boated during your life	.16	.71	.21	.82
Standardized item alpha	.62			
Cognitive [b, 2]				
My general boating skill level	.71	.49	.53	.79
My knowledge of general boating rules and regulations	.62	.53	.53	.79
My knowledge of Volusia County waterway rules and regulations	.31	.65	.33	.81
My comfort level with operating a boat 20 or more miles offshore	.43	.63	.48	.80
Standardized item alpha	.77			
Affective [c]				
Number of items owned which are related to boating, excluding tow vehicle [1]	.40	.73	.32	.81
Total number of boating magazine subscriptions and boating-related books [1]	.42	.73	.31	.81
Number of boating-related clubs [1]	.24	.77	.18	.82
I find that a lot of my life is organized around boating [3]	.49	.71	.40	.81
Boating and related activities are one of the most enjoyable things I do [3]	.58	.69	.57	.79
Boating is very important to me [3]	.54	.70	.49	.80
Boating says a lot about who I am [3]	.60	.68	.66	.80
Standardized item alpha	.75			
Composite index standardized alpha = .81				

[1] Based on total count
[2] Likert scale: 1 lowest to 10 highest
[3] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5
[a] Adapted from Donnelly et al. (1986), Virden & Schreyer (1988)
[b] Adapted from McIntyre & Pigram (1992), Meyer (2002)
[c] Adapted from Bricker & Kerstetter (2000), Donnelly et al. (1996), Hvenegaard (2000), Sutton & Ditton (2001), Virden & Schreyer (1988)

Table 3-4. Reliability analysis for marine conservation attitudes

Manatee conservation attitude	Corrected item correlation	Alpha if item deleted
	Overall index	
Manatees worth saving despite need for regulations [a, 1]	.62	.74
Boat speed reduction is an effective manatee protection strategy [a, 1]	.73	.67
Boat speed reduction is an effective general marine conservation strategy [1]	.60	.75
I generally support Florida's boating rules and regulations [1]	.50	.79
Composite index standardized alpha = .80		

[1] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5
[a] Adapted from Aipanjiguly (2001)

Table 3-5. Reasons for choosing non-compliance

Reasons you may not comply	Mean*
a. Gets too hot when boat goes slow	2.9
b. Need to get somewhere	2.9
c. Other boats are going fast	3.1
d. Other people on my boat want to go faster	3.7
e. It's fun to go faster	3.8
f. Those I learned from never complied	5.0
g. To get out of the rain	2.4
h. I don't care about speed zones	3.1
i. Bad zone signage/can't understand	2.0
j. I don't like being told how to operate my boat	3.8
k. I don't agree with the zone	2.5
l. I know that there are no officers in the area	4.5
m. Not paying attention	2.5
n. Other (please list) lightning most commonly cited	

* Number represents the mean response, with smaller means=more important

Table 3-6. Reliability analysis for speed zone signage assessment

Speed zone signage assessment	Corrected item total correlation	Alpha if item deleted	Corrected item correlation	Alpha if item deleted
Signage assessment in manatee zones [a, 1]	Individual dimensions		Overall index	
Manatees speed zones are well marked	.79	.79	.76	.89
Manatee speed zone signs are easy to read	.81	.78	.79	.89
I can always tell when I'm in a manatee speed zone	.68	.89	.72	.90
Standardized item alpha	.87			
Signage Assessment in General Boat Safety Zones [1]				
General boat safety speed zones are well marked	.81	.78	.82	.89
General boat safety speed zone signs are easy to read	.78	.82	.77	.89
I can always tell when I'm in a general boat safety zone	.71	.88	.59	.91
Standardized item alpha	.88			
Composite index standardized alpha = .91				

[1] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5

[a] Adapted from Confer et al. (2003)

Table 3-7. Reliability analysis for theory of reasoned action constructs

TRA	Corrected item total correlation	Alpha if item deleted
Attitudes [a, 1]		
Having the freedom to get to my destination quickly while boating is important	.34	.72
Having no threat of ticketing for disregarding boat speed zones is important	.50	.45
Having fun while on my boat is more important than obeying boat speed zones	.54	.45
Standardized item alpha	.63	
Subjective Norm [a, 1]		
When boating, I want to do what my family and friends think I should do	.63	.17
When boating, I want to do what other boaters think I should do	.68	.09
When boating, I want to do what law enforcement officers think I should do	.08	.87
Standardized item alpha	.62	
Behavioral Intentions [1]		
I intend to follow manatee speed zone restrictions the next time I boat [a]	.61	.73
I intend to follow general boat safety speed restrictions the next time I boat	.65	.64
Next time I boat I intend to boat in a way that will not harm the environment	.61	.68
Standardized item alpha	.76	

[1] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5
[a] Items adapted from Aipanjiuguly except those noted

CHAPTER 4
RESULTS

Field Observation

In situ speed, vessel and operator attributes were collected for boaters in Southwestern Volusia County, Florida during June 2006 - September 2006. Of the 1670 vessel observations made, 1059 were useable after the repeat observations, rentals and those with missing, illegible, or unlisted vessel numbers were removed from the database. Rental vessels comprised about 12% of the total useable sample, none of which where utilized for the mail survey portion of the investigation, as rental vessel operator names and addresses could not be queried with the Florida Vessel Title Registration System.

The mean party size observed in the vessels was about three people (median=3.0), with group sizes ranging from one to fifteen persons. However, most vessels (82%) had four passengers or fewer, including the operator. Most vessels were between 15.1-25 ft in length (60%), followed by 12-15 ft in length (30%) (Table 4-1). With respect to vessel types observed on the water, runabouts were the most common (28%), followed by fishing vessels (26%) and pontoons (16%).

Of the 1059 useable vessel observations, 633 (59%) were observed in the idle speed, and 426 (41%) were observed in the slow speed zones. Within the idle speed zone (maximum allowable speed = 3 mph), mean vessel speed was 4.22 mph (standard deviation = 1.31), with a range from 1 to 10 mph. Within the slow speed zone (maximum allowable speed = 7 mph), mean vessel speed was 6.42 mph (standard deviation = 4.00 mph), with a range from 1 to 36 mph. Rental vessels (n = 150) demonstrated a mean speed discrepancy (observed speed minus posted speed limit) of .35 mph, while non-rentals (n = 909) demonstrated a .50 mph discrepancy. A one-sample t-test was performed to determine if either of these two means was significantly

different from zero. Mean speed discrepancy for rentals was not significantly different from zero ($t(149) = 1.64$; $p = .102$); however, mean non rental vessel speed discrepancy was found to differ significantly from zero ($t(1058) = 5.67$; $p<.01$). Positive mean discrepancies for both groups indicate that on average, both groups violated speed limits; however, non-rental operators violated at higher speeds, on average, than rental vessel operators.

Profile of Subjects

Based on the vessel observations conducted on the St. Johns River, 1059 surveys were mailed to the respective boaters. Twenty-three surveys were returned as undeliverable and 236 completed surveys were received, for a 23% response rate.

There was a high degree of association between the date boaters were observed in the field and the date of their last boat outing as indicated on the mail survey (85%; n = 200). An insignificant independent sample t-test demonstrated that the mean self-reported compliance index did not differ between respondents who answered the survey questions with respect to the date they were observed on the water, or those who answered with respect to a more recent date. Consequently, respondents were analyzed as if the correspondence between the date boaters were observed in the field and the date of their last boat outing as indicated on the mail survey matched perfectly. Furthermore, 94% (n = 205) of the respondents indicated being the "primary" vessel operator during their last boat outing. However, it is not possible to be absolutely certain whether the person responding to the survey was, in fact, the person observed on the water. A majority (75%) of the respondents indicated that their vessels were equipped with speedometers.

The average respondent was male (90%), 52 years of age, fairly well educated with some college or a 2-year degree, with most (89%) having some education beyond a high school diploma. The average household income was between $65,000 to $99,000 per year, with 44 % earning $100,000 per year or more. DeLand, Florida was the single most cited place of

residence (20%). In addition to Deltona, Sanford, Apopka, and Orlando were also the most common Florida cities listed as the place of residence, all of which are within 45-minute driving distance from the sampling sites (Table 4-2).

With respect to manatee sightings during the past 12 months of boating, nearly 22% had never seen a manatee, and 35 % indicated seeing manatees between one and four times. Few boaters (19%) had been ticketed for speed violations while boating. Respondents belonged to few environmental organizations, with more than 78% noted to belong to none. Furthermore, 19% strongly disagreed with removing manatees from the endangered species list, while 24% agreed[1] with removing them.

Recreation Specialization

Recreation specialization was conceptualized based on three dimensions: behavioral, cognitive and affective. Following an examination of the distribution of each item within the three domains, responses were converted to Z-scores to create individual indices and a composite specialization index for testing of hypotheses.

Behavioral Domain

Four items were used for the behavioral domain, with mean responses presented in Table 4-3. Respondents had a mean of 25 years of boating experience, with 28% having boated for 10 or fewer years. Respondents had boated 47 days during the proceeding 12 months, with approximately 25% boating more than 55 times during that period. On average, boaters operated their vessels 29 days in Volusia County during the proceeding 12 months, and had boated on five different water bodies during that same period.

[1] Agreed reflects the combined responses for "Agreed" and "Strongly Agreed"

The ratio-scale data generated by the items within the behavioral domain measured different aspects of the boating experience, and thus generated widely varying results. For example, one person indicated being a boater for 50 years, while only boating once in the past 12 months. Another respondent indicated to have boated for 50 years, but had also boated 156 times during the past 12 months.

Cognitive Domain

The cognitive domain was operationalized using four items based on a likert scale format (1-10, with 10 the highest). Respondents were asked to rate their skill level with respect to: 1) general boating skill, 2) knowledge of general boating rules and regulations, 3) knowledge of Volusia County waterways, and 4) comfort in operating a boat 20 or more miles offshore. The mean values for the items are illustrated in Table 4-3. Respondents indicated a high average general boating skill level (mean = 8.5), and a high average knowledge of general boating rules and regulations (mean = 8.4). More than 80% responded with an "8," "9" or "10" to "General boating skill level," and "Knowledge of general boating rules and regulations."

Lower mean values were demonstrated for knowledge of Volusia County waterways (mean = 6.2), and comfort level with operating a boat 20 or more miles offshore (mean = 5.4). This suggests that while boaters may have a high degree of boating skill, some have unfamiliarity with Volusia County and offshore environments. Fifty two percent of the respondents indicated that their knowledge of Volusia County waterways was between "1" and "5" (i.e., relatively poor knowledge). Similarly, 51% of respondents rated their comfort level with operating a boat 20 or more miles offshore between "1" and "5."

Affective Domain

This domain was conceptually based on centrality to lifestyle (3 items) and enduring involvement (4 items), with mean responses presented in Table 4-3. Respondents reported a

wide range of boating magazine subscriptions and/or boating-related books currently owned (range 0-500). This had the effect of skewing the data somewhat, as the next lowest number was 50 items (mean, including outlier = 5.6, mode, including outlier = 1.0). Consequently, the outlier (500 items) was removed for the analysis. After its removal, 74 % indicated owning three, and 90% reported owning seven or fewer boating subscriptions and/or boating-related books (mean = 3.7). Similarly, the number of boating-related items owned was varied. The distribution was highly skewed due to the presence of several outliers (range 0-10,000; mean, including outlier = 120.5; mode, including outlier = 30.0). Thus, outliers greater than 200 boating-related items (10 respondents) were removed for the analysis. After the removal, nearly one half (47%) indicated to own 28 items or fewer, with 19% reported to own 100 items or more (mean = 46.2 items) (Table 4-3). Sixty one percent of respondents did not belong to any boating-related clubs, while 28% reported to belong to one club.

For the enduring involvement items within the affective domain, Likert-scale responses (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree) were used. Respondents indicated strong agreement with boating being one of the most enjoyable activity they participated in (mean=4.6), and also for boating being very important (mean=4.5). The questions, "Boating says a lot about who I am," and "I find that a lot of my life is organized around boating" both had lower means (mean=4.0 and 3.8, respectively).

Marine Conservation Attitudes

Marine conservation attitudes were conceptually divided into 1) manatee conservation attitudes (2 items), and 2) general marine conservation attitudes (2 items). The four items were tied to a Likert scale format (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree). Table 4-4 presents the distribution and means of these items. Overall results demonstrated that respondents generally possessed positive marine conservation attitudes. More

specifically, 71% [1] that manatees were worth saving despite the need for regulations, and a majority (81%) agreed that they supported Florida's boating rules and regulations. Despite these high percentages, only 47% of respondents agreed that boat speed reduction was as an effective manatee conservation strategy, and fewer (42%) agreed boat speed reduction was an effective general marine conservation strategy.

The highest mean value (3.9) (on a five point Likert scale) was identified for the item "I generally support Florida's boating rules and regulations," while the lowest mean value (3.0) was registered for "Boat speed reduction is an effective general marine conservation strategy." Additionally, respondents registered a mean of 3.2 for "Boat speed reduction is an effective manatee conservation strategy."

Knowledge

Boater knowledge of state manatee protection status and Florida boating speed restriction definitions was assessed by three questions. The first question, "In Florida, manatees are officially listed as," was answered correctly by only 34% of respondents, with most selecting "Endangered" as the incorrect choice (58%) (Table 4-5). The second question, "When in an idle speed zone, a boater should," offered respondents four possible answer choices. Respondents (81%) overwhelmingly selected the correct answer "Create no wake." The third knowledge question, "When in a slow speed zone, a boater should," was similarly answered correctly, "Create minimum wake," by most respondents (83%).

[1] Agreed reflects the combined responses for "Agreed" and "Strongly Agreed"

Non-Compliance/Compliance Behavior

With respect to self-reported compliant behavior, several questions were assessed of respondents. About 84% [1] that they fully complied with manatee speed zones during their most recent boating experience (mean = 4.3). An overwhelming majority (92%) agreed with fully complying with general (non-manatee) boat safety speed zones during their most recent boating experience (mean = 4.5). Responses to "Overall, how often do you comply with boat speed zones," garnered a very high mean score of 4.7 (out of 5), with 94% noting they complied more than half of the time, or all of the time. Furthermore, only 18% reported having been ticketed for violation of boat speed restrictions. These percentages and means of self-reported compliance behaviors are interesting considering the majority (55%) of observed boaters failed to fully comply with vessel speed limits.

With respect to lack of compliance with boat speed restrictions, respondents were asked to indicate the top five out of 14 reasons. Based on the responses, mean values were calculated, and smaller means represented those reasons of most importance, and larger means representing reasons of least importance. The results demonstrate that poor or unclear signage was the single most important reason for lack of full compliance (mean = 1.9). The second most important reason was to get out of the rain (mean = 2.4), while the third response was "other," in which respondents were asked to list other reasons for not fully complying as well as ranking its importance (mean = 2.5) (Table 4-6). Lightning and bad weather were listed by respondents as the most common reason within the "other" category (n = 20). Problems such as a sinking vessel or a poorly running engine were the second most commonly listed reason (n = 11). The third

[1] Agreed reflects the combined responses for "Agreed" and "Strongly Agreed"

reason for non-compliance within the "other" category was for medical emergencies (n = 9) (Table 4-7).

Speed Zone Signage Assessment

As the previous section noted, boaters may have difficulty reading or understanding boat speed restriction signs, and thus may not always have been aware of zone requirements. Two conceptual domains were employed to operationalize speed zone signage assessments: 1) manatee speed zones (3 items), and 2) general boat-safety zones (3 items). The six items were tied to a five point Likert scale format (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree) (Table 4-8).

Roughly 58% agreed[1] that manatee speed zones were well marked, and 59% agreed that manatee signs are easy to read. Forty seven percent agreed that they could always tell when they were in a manatee speed zone, while 48% agreed they could always tell when they were in a general boat safety zone. Fifty two percent agreed that general boat safety speed zones are well marked, and that general boat safety speed zone signs are easy to read.

Means for the all six zone assessment items were close to or slightly above 3.0 or "Neutral." For example, the item "Manatee speed zones are well marked," resulted in the highest mean (3.5). The lowest mean was identified for the question "I can always tell when I'm in a manatee speed zone" (3.1).

Theory of Reasoned Action (TRA)

Nine items tied to a five point Likert scale format (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree) were used to evaluate: 1) attitudes (3 items), 2) subjective norm (3 items), and 3) behavioral intentions (3 items). Frequency distributions and means are presented in Table 4-9.

Attitudes

Approximately 41%[1] that the freedom to get to one's destination quickly while boating was important. Few respondents (11%) agreed that an absence of a threat of ticketing for disregarding boat speed zones was important, and a very low percentage (3%) agreed that having fun while boating was more important than obeying boat speed zones. Low means were identified for both "Having fun while on my boat is more important than obeying boat speed zones" (1.7), and "Having no threat of ticketing for disregarding boat speed zones is important" (2.2).

Subjective Norm

About 21% agreed that when boating they wanted to do what family and friends thought they should do, and 19% agreed that they wanted to do what other boaters thought they should do when boating. Contrastingly, a strong majority (80%) agreed that they wanted to do what law enforcement officers thought they should do. Mean responses were also generated for the items that related to wanting to do what family and friends think they should do (2.4) and with what other boaters think they should do (2.3). However, a high mean was found with wanting to do what law enforcement officers wanted them to do (4.1).

Intentions

A majority of the respondents agreed (81%) that they intended to follow manatee speed zones during their next boat outing. Similarly, 94% agreed that they intended to follow general boat safety speed restrictions the next time they boated; and nearly all (97%) agreed that they intended to boat in a way that would not harm the environment during their next outing. Respondents generally demonstrated a high level of agreement with intentions to comply with

[1] Agreed reflects the combined responses for "Agreed" and "Strongly Agreed"

speed restrictions. For example, a high mean was identified for "Next time I boat I intend to boat in a way that will not harm the environment (4.5). Large mean responses were also found for intention to follow general boat safety speed zones (4.5), as well as intention to follow manatee speed zones during the next outing (4.2).

Results of Research Questions Tested

1. Does boat speed violation ticketing history influence speed discrepancy?

An independent samples t-test was performed to determine if mean speed [2] differed between those who had been ticketed for boat speed violations in their past, and those who had not. Only 45 respondents indicated to have been ticketed. The mean speed discrepancy did not differ significantly between those who had (mean = 1.03, SD = 2.61) and those who had not (mean = .48, SD = 3.31) been ticketed ($t(232) = -1.03$; $p=.30$). Therefore, prior boat speed violation ticketing history did not appear to have any influence on boater's vessel speed through manatee conservation zones.

2. Does boater speed discrepancy differ between idle and slow speed zones?

An independent samples t-test was utilized to determine if mean vessel speed discrepancy differed between the two sampling sites (site 1, Idle speed, maximum allowable speed 3mph; and site 2, Slow speed, maximum allowable speed 7mph). A statistically significant difference in mean speed discrepancy was identified between site 1 (mean = 1.24, SD = 1.36) and site 2 (mean = -.623, SD = 3.81, $t(1207) = 10.4$; $p<.01$). The results suggest that vessel compliance differed on a per-site basis.

[2] Speed discrepancy defined as observed vessel speed minus the maximum allowable per zone.

3. Does party size influence speed discrepancy?

A regression analysis was performed between party size and speed discrepancy. Results indicate that speed discrepancy was not influenced by party size. Party size was a poor predictor of speed discrepancy, and explained less than one percent of the variability in speed discrepancy (B = -.04).

4. Does vessel length influence speed discrepancy?

A one-way ANOVA was employed to determine if mean vessel speed discrepancy differed between the observed vessel length categories (<12', 12'-15', 16'-25', 26'-39', 40'-64', >64') as documented in the field. Analysis revealed a significant difference in speed discrepancy between vessel lengths ($F = 2.62$, $p = .03$). A Bonferroni multiple comparison was also performed to determine differences within vessel length categories. Significant differences were found between vessel length category two (12'-15') and vessel length category three (16'-25') (mean speed discrepancy for category one = .06, category two = .61, $p < .05$). Operators of longer vessel were more likely than operators of small vessels to violate speed restrictions.

5. Does vessel type influence speed discrepancy?

A one-way ANOVA was utilized to determine if mean vessel speed discrepancy differed among vessel categories (pontoon, fish, personal watercraft, runabout, johnboat, sail, yacht/cruiser, ski, and other). Results identified that mean vessel speed discrepancy did not differ among the various vessel categories as the relationship was not statistically significant ($F(7, 1208) = .89$, $p=.52$).

6. Does a boater's history of seeing manatees influence speed discrepancy?

A one-way ANOVA was used to determine if mean vessel speed discrepancy differed based on the number of times a manatee was observed while boating during the past 12 months (Never, 1-2 times, 3-4 times, 5-6 times, 7-8 times, 9-10 times, >10 times, Not sure). Results of the analysis identified that the number of times a manatee had been observed by a boater had no influence on vessel speed discrepancy ($F(7, 228) = 1.6$, $p=.15$).

7. Does a boater's speed zone signage assessment influence speed discrepancy?

Pearson r correlations were performed between speed zone signage assessment (manatee zone, general boat safety zones and composite signage assessment index) and vessel speed discrepancy (Table 4-10). Results indicated that vessel speed discrepancy was not significantly associated with speed zone signage assessment. Neither the manatee sign assessment index ($r = -.07$), general boat safety speed zone index ($r = -.12$), nor the composite sign assessment index ($r = -.10$) were significantly associated with vessel speed discrepancy.

8. Does boater's level of recreation specialization influence speed zone signage assessment?

Pearson r correlations were performed between the three individual recreation specialization indices (behavioral, cognitive and affective), the composite specialization index, the two speed zone signage assessment indices (manatee zone, general boat safety zones), and the composite speed zone signage assessment index (Table 4-11). Results indicated that specialization level was significantly associated with speed zone signage assessment. For example, the behavioral index was negatively and significantly associated with the manatee zone signage assessment index ($r = -.16$, $p<.05$) and the composite signage assessment index ($r = -.13$, $p<.05$). The affective specialization index was negatively and significantly associated with the manatee zone signage assessment index ($r = -.20$, $p<.01$), general boat safety zone signage index

(r = -.19, p<.01), and the composite signage assessment index (r = -.21, p<.01). Although the cognitive specialization index was not found to be significantly associated with any of the signage assessment indices, the composite specialization index was significantly associated with the composite zone signage assessment index (r = -.22, p<.01). Therefore, as boaters become more specialized they concomitantly report a reduction in their assessment of boat zone signs.

9. Are the relationships between past behavior (observed and self-report) attitudes, norms and intentions consistent with Figure 4-1 (TRA)?

Based on the procedures by Alabarracin et al. (2001), the TRA model was evaluated by first employing a series of Pearson r correlations, after which a multiple regression was performed. The composite index (self-reported compliance behavior, attitudes, subjective norm, and behavioral intentions) was used for each analysis. The following steps were used to evaluate this research question, with the results of the tested model shown in Figure 4-1:

Correlations:

Step 1: Speed discrepancy (observed) and behavioral intentions.
Step 2: Speed discrepancy (observed) and subjective norms.
Step 3: Speed discrepancy (observed) and attitudes.
Step 4: Self-reported compliance behavior and behavioral intentions.
Step 5: Self-reported compliance behavior and attitudes.
Step 6: Self-reported compliance behavior and subjective norms.
Step 7: Attitudes and behavioral intentions.
Step 8: Subjective norms and behavioral intentions.

Results of the Pearson r correlations (Steps 1-8) suggest that part of the model is consistent with TRA theory. Specifically, results indicate:

Step 1: Speed discrepancy (observed) was not significantly associated with behavioral intention.

Step 2: Speed discrepancy (observed) was not significantly associated with subjective norm.

Step 3: Speed discrepancy (observed) was not significantly associated with attitude.

Step 4: Self-reported compliance behavior and behavioral intentions were significantly associated (r = .55, p<.01). Thus, an increase in self-reported compliance with speed-

restricted zones was significantly associated with an increase in intention to comply with speed zones during a boater's next outing.

Step 5: Self-reported compliance behavior and attitudes were significantly associated ($r = .44$, $p<.01$). An increase in self-reported compliance with speed-restricted zones was significantly associated with an increase in attitudes.

Step 6: Self-reported compliance and subjective norm were not significantly associated.

Step 7: Attitude and behavioral intentions were significantly associated ($r = .50$, $p<.01$). An increase in attitudes was significantly associated with intention to comply with speed zones during a boater's next outing.

Step 8: Subjective norm and behavioral intentions were not significantly associated.

Multiple Regression:

The multiple regression model employed attitudes, subjective norms, self-reported compliance behavior and vessel speed discrepancy as predictor variables and behavioral intentions as the criterion variable. The composite attitude, subjective norm, self-reported compliance, and behavioral intention indices were used for this analysis.

Results of the multiple regression analysis (Table 4-12) show that the model is a significant predictor of behavioral intention ($F = 41.63$; $p<.01$). The predictor variables explain about 43% of the variability in behavioral intentions. Results also demonstrate that self-reported compliance behavior contributes more to the predictive ability of the regression model (standardized beta = .42; $p<.01$) than do attitudes (standardized beta = -.37; $p<.01$). However, neither the subjective norm nor vessel speed discrepancy uniquely contributed to the predictive ability of the model.

The TRA model presented was found partially consistent with TRA theory. Specifically, self-reported compliance ($r = .55$, $p<.01$) and attitudes ($r = .50$, $p<.01$) were both significantly associated with behavioral intention to fully comply with speed zones during next boat outing. Self-reported compliance and attitudes were also significantly associated ($r = -.44$,

p<.01). Results of the multiple regression analysis demonstrate that attitudes and self-reported compliance combined to uniquely explain about 43% of the variability in behavioral intention. An examination of beta weights suggests that self-reported compliance weighted more heavily (*B* = .42) than did attitudes (*B* = -.37) on behavioral intentions.

Results of Hypothesis Testing

Recreation Specialization

H1: There is a negative association between boater's specialization level and observed speed discrepancy.

Pearson r correlations were performed between the three individual recreation specialization indices (behavioral, cognitive and affective), the composite specialization index, and observed vessel speed discrepancies (Table 4-13). Results indicated that neither the individual specialization domain indices nor the composite specialization index were statistically associated with speed discrepancies. Specifically, the Pearson r correlations between speed discrepancy and the behavioral index (r = -.07), affective index (r = .03), cognitive index (r = -.09), and composite index (r = .03) were all very small values. Therefore, the hypothesis was rejected as lack of negative associations existed between boater's specialization level and observed vessel speed discrepancies.

H2: There is a positive association between boater's specialization level and self-reported compliant behavior.

Pearson r correlations were performed between the three individual recreation specialization indices (behavioral, cognitive and affective), the composite specialization index, two self-reported compliance items, and a composite self-reported compliance index (Table 4-14). Self-reports of compliance within manatee zones were significantly associated with the behavioral (r = -.27, p<.01), cognitive (r = -.38, p<.01), and composite specialization indices (r = -.234, p<.01), but insignificantly associated with the affective index. Contrastingly, only the

cognitive index (r = -.19, p<.01) was significantly associated with self-reported compliance within general (non-manatee) boat safety speed zones. Further, the composite index of self-reported compliance was found to be significantly related to the behavioral (r = -.23, p<.01), cognitive (r = .34, p<.01) and the composite specialization indices (r = -.20, p<.01).

Correlations between the affective dimension of the specialization construct and measures of self-reported compliance were found to be statistically insignificant. However, all other correlations between the specialization dimensions and self-report measures were negative and statistically significant. In general, higher levels of boater specialization were associated with a reduction in the level of self-reported compliance. Thus, the hypothesis was rejected as a positive association between boater's specialization level and self-reported compliance did not exist.

H3: There is a positive association between boater's specialization level and marine conservation attitudes.

Pearson r correlations were performed between the two marine conservation attitude index and the three individual (behavioral, cognitive and affective) and composite specialization indices (Table 4-15). All correlations between marine conservation attitude indices and specialization indices were negative and statistically significant. For example, marine conservation attitudes were negatively and significantly associated with the behavioral index (r = -.35, p<.01), the affective index (r = -.30, p<.01), the cognitive index (r = -.37, p<.01) and the composite specialization index (r = -.43, p<.01). Overall, as respondents became more specialized they concomitantly demonstrated lower marine conservation attitudes. Therefore, this hypothesis was rejected, as a positive association did not exist between specialization level and marine conservation attitudes.

H4: There is a positive association between boater's specialization level and intention to fully comply with manatee speed zone restrictions.

Pearson r correlations were performed between the three individual recreation specialization indices (behavioral, cognitive and affective), composite specialization index, and a composite index of behavioral intention (Table 4-16). Results identified that behavioral intention was negatively and significantly associated with the behavioral ($r = -.23$, $p<.01$), cognitive ($r = -.27$, $p<.01$), and composite specialization indices ($r = -.17$, $p<.05$).

Findings suggest that an increase in boating specialization generally coincides with a decrease in intention to comply. The hypothesis was rejected as a positive association between specialization and intention to fully comply with speed restrictions did not exist.

Reported vs. Observed Compliance Behavior

H5: There is a negative association between self-reported compliant behavior and observed speed discrepancy.

Pearson r correlations were performed between the two self-reported compliance items, the self-reported compliance composite index and observed vessel speed discrepancy (Table 4-17). Results identified that reported behavior may be a poor proxy for actual behavior. For example, the correlation coefficient between observed speed discrepancy and agreement with full compliance with manatee speed zones during the most recent outing ($r = .03$), as well as agreement with full compliance in general boat safety speed zones ($r = -.05$), were both extremely weak, and statistically insignificant. Similarly, the correlation between observed speed discrepancy and composite of both self-reported compliance items was weak and statistically insignificant ($r = -.01$).

The hypothesis was rejected, as a negative relationship did not exist between observed speed discrepancy and reported compliance. Results of this analysis indicate that while respondents generally self-report a high level of manatee zone compliance (mean = 4.3 on a five

point scale), and general, non-manatee zone compliance (mean = 4.5 on a five point scale), their observed behavior suggest otherwise.

As a follow up, an independent samples t-test was performed to determine if [3] boaters differed from non-compliant boaters (observed) in their mean responses to the items, "I fully complied with manatee speed zones during my most recent boating experience," "I fully complied with general (non-manatee) boat safety speed zones during my most recent boating experience," and "Overall, how often do you comply with boat speed zones" (Table 4-18). The mean scores for each of the compliance measures did not differ significantly among compliant and non-compliant boaters (observed). The results further added evidence that self-reports may poorly represent actual behavior. In conclusion, hypothesis five and its ancillary hypothesis were both rejected.

Marine Conservation Attitudes

H6: There is a negative association between marine conservation attitudes and observed speed discrepancy

Pearson r correlations were performed between observed vessel speed discrepancy and the marine conservation attitude index. Results identified a weak and statistically insignificant association between observed speed discrepancy and marine conservation attitudes (r = .04). Therefore the hypothesis was rejected as a negative association between vessel speed discrepancies and marine conservation attitudes did not exist.

H7: There is a positive association between marine conservation attitudes and intention to fully comply with manatee speed zone restrictions.

A Pearson r correlation was performed between the marine conservation attitude index and the behavioral intention index. Results noted a positive and statistically significant association

[3] Compliant and non-compliant boaters as determined by field observations.

between intentions to fully comply with speed restrictions and marine conservation attitudes ($r = .44$, $p<.01$). The hypothesis was accepted, as a positive association existed between respondents' intention to fully comply with speed restrictions and marine conservation attitudes. Therefore, increases in marine conservation attitudes result in an increase in intention to fully comply with speed zones.

H8: There is a positive association between marine conservation attitudes and self-reported compliance behavior.

Pearson r correlations were performed between the marine conservation attitude index, individual self-reported compliance items as well as the self-reported compliance composite index (Table 4-19). Results identified that marine conservation attitudes were significantly associated with self-reported compliance. For example, the association between the marine conservation attitude index and the composite self-reported compliance index was positive and statistically significant ($r = .27$, $p<.01$). In fact, all the correlations were found to be positive and statistically significant.

The hypothesis was accepted as a positive association existed between marine conservation attitudes and self-reported compliance. Therefore, an increase in marine conservation attitudes results in an increase in the level of self-reported compliance.

Behavioral Intentions

H9: There is a positive association between intention to fully comply with manatee speed zone restrictions and self-reported compliance behavior.

A Pearson r correlation was performed between the behavioral intention composite index and self-reported compliance composite index. Results identified that the behavioral intention composite index was significantly associated with the self-reported compliance composite index ($r = .67$, $p<.01$). The hypothesis was accepted as a positive association existed between behavioral intention and self-reported compliance. An increase in intention to fully comply with

speed restrictions during next boat outing results in an increase in the level of self-reported compliance.

H10: There is a negative association between intention to fully comply with manatee speed zone restrictions and observed speed discrepancy.

A Pearson r correlation was performed between observed vessel speed discrepancies and the behavioral intention composite index. Results identified a very weak and statistically insignificant association between the two variables (r = .09). The hypothesis was rejected as a negative association behavioral intention and observed speed discrepancy did not exist.

Path Analysis

A path analysis was employed to determine the predictive validity between recreation specialization, marine conservation attitudes, behavioral intentions, self-reported compliance behavior and observed speed discrepancy. The proposed model was first examined through confirmatory factor analysis (CFA) to validate the indices. As a result of the CFA, poorly performing items were removed and the factor loadings were all significant ($p<.05$) (Table 4-20). Since all factor loading values were greater than thresholds set forth by Litwin (1995), the results demonstrated convergent validity.

Next, the overall model was tested and identified to be a reasonably good fit to the data as shown by the fit indices in Figure 4-2. For example, the X^2/df ratio of 2.7 was lower than the 3.0 suggested by Kline (1998). Additionally, the Comparative Fit Index (CFI) (.92) satisfied the .95 recommended cutoff, while the Root Mean Square Error of Approximation (RMSEA) value (.09) was slightly higher than .08 cutoff as suggested by Hu and Bentler (1999).

The proposed model was tested by Structural Equation Modeling (SEM). Results of the SEM demonstrate that the fit of the model was acceptable (X^2/df ratio = 2.7; CFI = .90; RMSEA = .09). However, the hypothesized path model was generally found to poorly explain the

relationships between the individual constructs (Figure 4-2). Results demonstrate that recreation specialization had a strong negative influence on marine conservation attitudes (*B* = -.57). That is, a one-unit increase in recreation specialization resulted in a .57 mean agreement decrease in marine conservation attitudes. Specialization was found to be a poor predictor of self-reported compliance behavior, behavioral intentions, and observed vessel speed discrepancy.

Marine conservation attitudes exhibited a strong positive influence on behavioral intentions (*B* = .33), which demonstrated that for every unit increase in marine conservation attitudes, mean behavioral intention increased by .33. Mean self-reported compliance behavior demonstrated an increase of .63 for every unit increase in behavioral intentions. However, a weak influence on observed speed discrepancy was identified. The postulated theoretical model was generally weak in accounting for the relationships between the latent variables.

Table 4-1. Vessel use and attributes from field observations

Vessel Attribute	N	Percentage*
Vessel Length (ft)		
<12	43	4
12-15	316	30
15.1-25	631	60
25.1-39	63	5
39.1-64	6	1
Vessel Type		
Fishing	272	26
Johnboat	50	5
Yacht/cruiser	135	13
Pontoon	165	16
Personal watercraft	37	3
Runabout	297	28
Ski	92	8
Other	11	1
Party Size		
1	84	7
2	426	35
3	238	20
4	246	20
5	100	8
6	57	5
7	25	2
8	16	1
9	9	1
>9	6	1
Observed Vessel Speeds – Idle Zone		
0-2 mph	43	6
2.01-4 mph	308	42
4.01-6 mph	307	43
6.01-8 mph	47	7
8.01-10 mph	6	1
10.01-12 mph	1	1
Observed Vessel Speeds – Slow Zone		
0-2 mph	5	1
2.01-4 mph	63	12
4.01-6 mph	240	49
6.01-8 mph	135	27
8.01-10 mph	23	5
10.01-12 mph	4	1
12.01-14 mph	4	1
>14 mph	20	4

*The valid percentages have been rounded to equal 100%

Table 4-2. Socio-demographic profile of respondents

	N	Percentage*
Gender		
Male	209	90
Female	24	10
Age		
20-30	10	5
31-40	33	14
41-50	60	26
51-60	81	35
61-70	28	12
>70	18	8
Education		
Less than High School	1	0
High school diploma	24	11
Attended business/technical school	28	12
Some college or 2-year degree	86	38
Completed 4-year degree	46	21
Some graduate work	10	5
Completed graduate or advanced degree	29	13
Income		
$15,000 to $34,999	9	4
$35,000 to $49,999	14	7
$50,000 to $64,999	49	24
$65,000 to $99,999	45	22
$100,000 to $149,999	55	26
$150,000 to $199,999	13	6
Over $200,000	22	11
Top five place of residence (all cities in Florida)**		
Deland	47	20
Deltona	15	7
Sanford	13	6
Apopka	12	5
Orlando	10	4

*The valid percentages have been rounded to equal 100%

**Percentages do not equal 100%

Table 4-3. Recreation specialization domains

Behavioral [1]	Mean
Number of years a boater	25.2
How many days did you boat during the past 12 months	46.9
How many days did you boat in Volusia County in the past 12 months	29.2
How many different water bodies have you boated on in the past 12 months	4.5
Cognitive [2]	
My general boating skill level	8.5
My knowledge of general boating rules and regulations	8.4
My knowledge of Volusia County waterway rules and regulations	6.2
My comfort level with operating a boat 20 or more miles offshore	5.4
Affective	
How may boating magazine subscriptions and/or boating-related books do you currently own [1]	3.7
Approximately how many items do you own that are directly related to boating, excluding tow vehicle [1]	46.2
How many boating-related clubs do you currently belong to [1]	.60
Boating and related activities are one of the most enjoyable things I do [3]	4.6
Boating is very important to me [3]	4.5
Boating says a lot about who I am [3]	4.0
I find that a lot of my life is organized around boating [3]	3.8

[1] Ratio-scale data
[2] Likert scale: 1=lowest to 10=highest
[3] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5

Table 4-4. Marine conservation attitude items

Marine conservation attitudes[1]**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean*
Manatees are worth saving despite the need for regulations	5%	7.7%	16.4%	37.7%	33.6%	3.8
Boat speed reduction is an effective manatee conservation strategy	12.7	18.6	21.4	34.5	12.7	3.2
Boat speed reduction is an effective general marine conservation strategy	12.3	22.7	22.7	36.4	5.9	3.0
I generally support Florida's boating rules and regulations	2.3	5.0	11.4	56.8	24.5	3.9

[1] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5
* "Not sure/no response" was combined into the "Neutral" category
**Percentages may not equal 100 due to rounding

Table 4-5. Boater knowledge

	Response choices			
Knowledge Item**	Travel no faster than 5 mph	Create no wake*	Create minimum wake	Not sure
When in an idle speed zone, a boater should	4.0%	81.4%	11.9%	2.6%
	Travel no faster than 10 mph	Create no wake	Create minimum wake*	Not sure
When in a slow speed zone, a boater should	6.8%	2.1%	83.2%	7.7%
	Species of special concern	Threatened*	Endangered	Manatees are not listed
In Florida, manatees are officially listed as	6.0%	34.3%	58.8%	<1%

* Correct response
** Percentages may not equal 100 due to rounding

Table 4-6. Reasons for non-compliance

Reasons	n	Mean *
Bad zone signage/can't understand	120	1.9
To get out of the rain	114	2.4
Other**	51	2.5
Not paying attention	96	2.5
I don't agree with the zone	81	2.6
Need to get somewhere	73	2.9
Gets too hot when boat goes slow	74	2.9
I don't care about speed zones	14	3.1
Other boats are going fast	44	3.1
Other people on my boat want to go faster	12	3.8
I don't like being told how to operate my boat	17	3.8
It's fun to go faster	22	3.8
I know that there are no officers in the area	25	4.5
Those I learned from never complied	5	5.0

* Small value equals greater importance
**Summarized in Table 4-7

Table 4-7. Reasons for non-compliance ("Other" category)

Other	Frequency
Lightning/bad weather	20
Problem with boat	11
Medical emergency	9
Bad signage/missing signage	6
Always comply	4
Manatees stay along banks	2
Time restrictions	1

Table 4-8. Sign zone signage assessment

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean*
Manatee zones[1]**						
Manatee speed zones are well Marked	6.3%	19.3%	16.1%	43.5%	14.9%	3.5
Manatee speed zone signs are easy to read	8.1	18.8	14.1	44.9	14.1	3.4
I can always tell when I'm in a manatee speed zone	9.9	28.3	14.6	38.2	9.0	3.1
General boat safety speed zones[1**]						
General boat safety speed zones are well marked	5.6	25.2	17.5	42.7	9.0	3.2
General boat safety speed zone signs are easy to read	5.1	23.1	20.1	40.2	11.5	3.3
I can always tell when I'm in a general boat safety zone	4.3	25.8	22.3	39.9	7.7	3.2

[1] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5
*Not sure/no response" was combined into the "Neutral" category
** Percentages may not equal 100 due to rounding

Table 4-9. Theory of reasoned action

TRA item[1]**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean*
Attitudes						
Having the freedom to get to my destination quickly while boating is important	11.8	18.6	28.5	31.6	9.5	3.1
Having no threat of ticketing for disregarding boat speed zones is important	30.5	39.5	19.3	6.3	4.5	2.2
Having fun while on my boat is more important than obeying boat speed zones	46.7	43.6	6.7	2.2	.9	1.7
Subjective norm						
When boating, I want to do what my family and friends think I should do	27.9	37.4	14.0	10.4	10.4	2.4
When boating, I want to do what other boaters think I should do	32.9	34.2	14.4	8.1	10.4	2.3
When boating, I want to do what law enforcement officers think I should do	2.7	4.4	12.4	44.4	36.0	4.1
Behavioral intentions						
I intend to follow manatee speed zone restrictions the next time I boat	1.5	7.1	10.4	32.0	49.1	4.2
I intend to follow general boat safety speed restrictions the next time I boat	0	1.3	4.3	38.2	56.2	4.5
Next time I boat I intend to boat in a way that will not harm the environment	.9	.4	1.3	40.3	57.1	4.5

[1] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5
*Not sure/no response" was combined into the "Neutral" category
** Percentages may not equal 100 due to rounding

Table 4-10. Zero-order correlations: vessel speed discrepancy and signage assessment

	Speed discrepancy	Manatee zone signage assessment index	General zone signage assessment index	Composite zone signage assessment index
Speed discrepancy	-			
Manatee zone signage assessment index	-.07	-		
General zone signage assessment index	-.12	.74*	-	
Composite zone signage assessment index	-.09	.94*	.93*	-

* Significant at the .01 level (2-tailed)

Table 4-11. Zero order correlations: recreation specialization and zone signage assessment

	Behavioral index	Affective index	Cognitive index	Composite specialization index	Manatee zone signage assessment index	General zone signage assessment index	Composite zone signage assessment index
Behavioral index	-						
Affective index	.31*	-					
Cognitive index	.45*	.39*	-				
Composite specialization index	.71*	.81*	.78*	-			
Manatee zone signage assessment index	-.16**	-.19*	-.13	-.44*	-		
General zone signage assessment index	-.09	-.19*	.02	-.32*	.74*	-	
Composite zone signage assessment index	-.13**	-.21*	-.06	-.41*	.94*	.93*	-

* Significant at the .01 level (2-tailed)
**Significant at the .05 level (2-tailed)

Table 4-12. Regression analysis summary for predicting behavioral intention

Predictor Variable	B	SEB	*B*
Attitudes	-.23	.03	-.37*
Subjective norms	.001	.03	.00
Self-reported compliance behavior	.57	.07	.42*
Observed vessel speed discrepancy	.04	.03	.07

*Significant at the .05 level (2-tailed)

Table 4-13. Zero-order correlations: speed discrepancy and recreation specialization

	Speed discrepancy	Behavioral index	Affective index	Cognitive index	Composite specialization index
Speed discrepancy	-				
Behavioral index	-.08	-			
Affective index	.02	.32*	-		
Cognitive index	-.07	.45*	.38*	-	
Composite specialization index	-.05	.70*	.82*	.77*	-

*Significant at the .01 level (2-tailed)

Table 4-14. Zero order correlations: self-reported compliance and recreation specialization

	Self-reported compliance in manatee speed zones	Self-reported compliance in general, non-manatee speed zones	Composite index of self-reported compliance	Behavioral index	Affective index	Cognitive index	Composite specialization index
Self-reported compliance in manatee speed zones	-						
Self-reported compliance in general, non-manatee speed zones	.64*	-					
Composite index of self-reported compliance	.91*	.89*	-				
Behavioral index	-.19*	-.12	-.17*	-			
Affective index	.03	.14**	.09	.32*	-		
Cognitive index	-.23*	-.14**	-.21*	.45*	.38*	-	
Composite specialization index	-.14**	-.02	-.09	.70*	.82*	.77*	-

* Significant at the .01 level (2-tailed)

**Significant at the .05 level (2-tailed)

Table 4-15. Zero order correlations: recreation specialization and marine conservation attitudes

	Behavioral index	Affective index	Cognitive index	Composite specialization index	Marine conservation attitude index
Behavioral index	-				
Affective index	.32*	-			
Cognitive index	.45*	.38*	-		
Composite specialization index	.70*	.82*	.77*	-	
Marine conservation attitude index	-.35*	-.30*	-.37*	-.43*	-

* Significant at the .01 level (2-tailed)

Table 4-16. Zero-order correlations: behavioral intention and recreation specialization

	Behavioral intention index	Behavioral index	Affective index	Cognitive index	Composite specialization index
Behavioral intention index	-				
Behavioral index	-.27*	-			
Affective index	.02	.32*	-		
Cognitive index	-.32*	.45*	.38*	-	
Composite specialization index	-.21**	.70*	.82*	.77*	-

*Significant at the .01 level (2-tailed)
**Significant at the .05 level (2-tailed)

Table 4-17. Zero order correlations: self-reported compliance and vessel speed discrepancy

	Speed discrepancy	Self-reported compliance in manatee speed zones	Self-reported compliance in general, non-manatee speed zones	Composite self-reported compliance index
Speed discrepancy	-			
Self-reported compliance in manatee speed zones	.05	-		
Self-reported compliance in general, non-manatee speed zones	-.08	.64*	-	
Composite self-reported compliance index	-.01	.91*	.89*	-

*Significant at the .01 level (2-tailed)

Table 4-18. Independent samples t-tests, reported compliance among compliant and non-compliant boaters

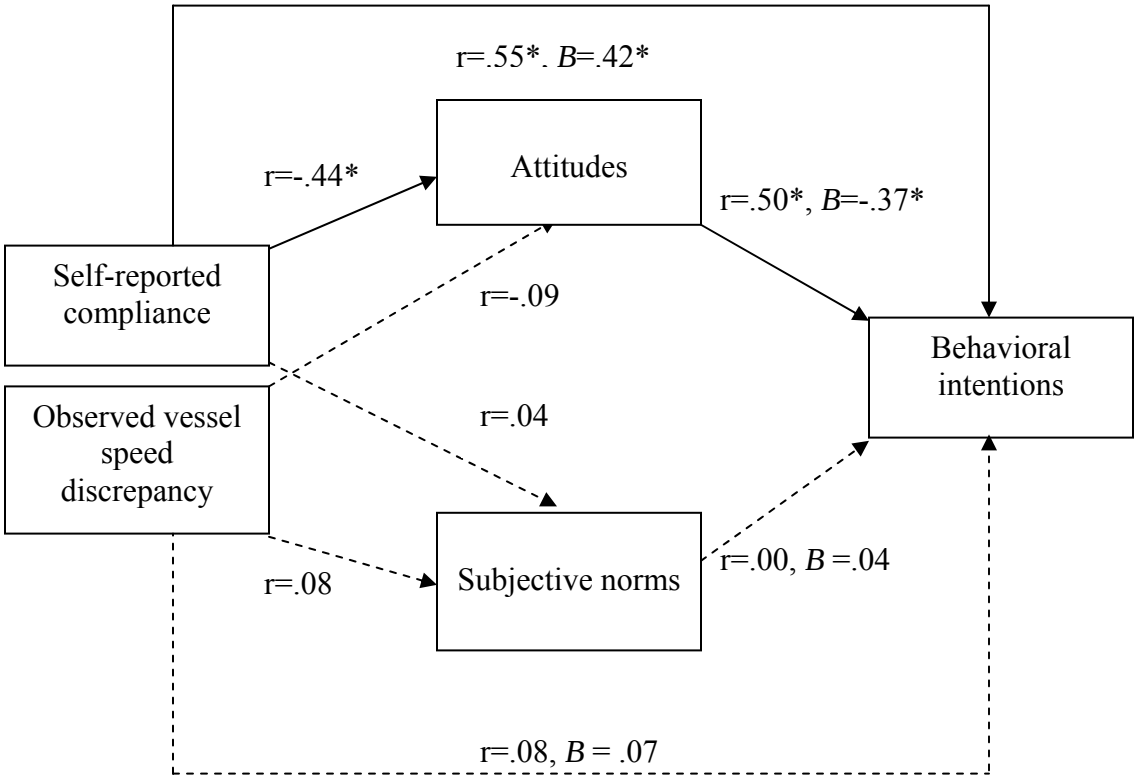
	Compliant (observed)		Non-compliant (observed)			
Self-Reported Compliance Items[1]	Mean	SD	Mean	SD	df	t*
I fully complied with manatee speed zones during my most recent boating experience	4.3	1.0	4.4	.95	229	-.94
I fully complied with general (non-manatee) boat safety speed zones during my most recent boating experience	4.5	.66	4.5	.79	230	.39
Overall, how often do you comply with boat speed zones	4.7	.67	4.7	.65	232	.16

[1] Likert scale: strongly disagree=1, disagree=2, neutral=3, agree=4, strongly agree=5
*None were significant at .05 level of significance

Table 4-19. Zero order correlations: marine conservation attitudes and self-reported compliance

	Marine conservation attitude index	Self-reported compliance in manatee speed zones	Self-reported compliance in general, non-manatee speed zones	Composite self-reported compliance index
Marine conservation attitude index	-			
Self-reported compliance in manatee speed zones	.32*	-		
Self-reported compliance in general, non-manatee speed zones	.16**	.63*	-	
Composite self-reported compliance index	.27*	.91*	.89*	-

* Significant at the .01 level (2-tailed)
**Significant at the .05 level (2-tailed)



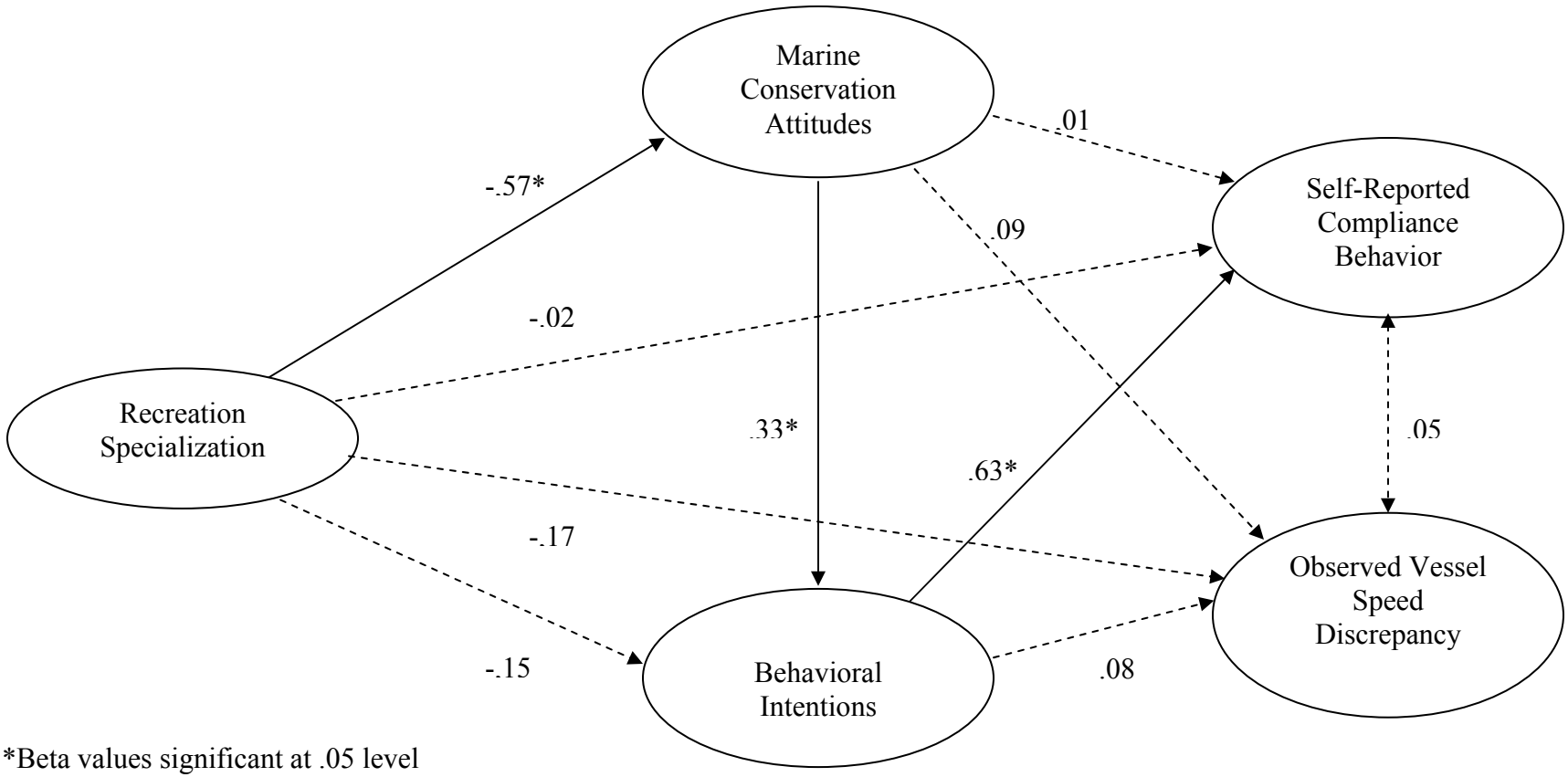
*Significant at the .01 level (2-tailed)

Figure 4-1. Theory of reasoned action

Table 4-20. Factor loadings and Cronbach's alpha

Scale items	α	Factor loading
Affective (recreation specialization)	.86	
I find that a lot of my life is organized around boating and boating-related activity		.91
Boating says a lot about who I am		.85
Boating is very important to me		.72
Cognitive (recreation specialization)	.81	
My general boating skill level		.90
My knowledge of general boating rules and regulations		.80
Comfort level with operating a boat 20 or more miles offshore		.60
Marine conservation attitudes	.79	
Boat speed reduction is an effective manatee protection strategy		.89
Manatees are worth saving despite the need for regulations		.70
Boat speed reduction is an effective general marine conservation strategy		.67
Behavioral intentions	.82	
I intend to follow general boat safety speed restrictions the next time I boat		.82
Next time I boat I intend to boat in a way that twill not harm the environment		.79
I intend to follow manatee speed zone restrictions the next time I boat		.72
Self-reported compliance behavior	.78	
I fully complied with manatee speed zones during my most recent boating experience		.87
I fully complied with general (non-manatee) boat safety speed zones during my most recent boating experience		.72

* All significant at .05 level



*Beta values significant at .05 level
Solid lines indicate paths that were significant at the .05 level
Dotted lines indicate paths that were not significant at the .05 level

Fit Statistics
X2/df = 2.7
CFI = .90
RMSEA = .90

Figure 4-2. Final structural model

CHAPTER 5
SUMMARY AND CONCLUSIONS

The purpose of this study was to examine relationships between observed vessel speeds in manatee conservation zones, recreation specialization, marine conservation attitudes, self-reported compliance behavior, speed zone sign assessment, TRA, and vessel and operator attributes. The study was based on the paucity of research and recommendations from the literature.

Summary of Procedures

Selection of Subjects: Observation

Data for this study were collected by on-site vessel observations and a subsequent mail survey. Vessel speeds (n=1670) within two delineated manatee protection zones were determined using on-site measurements and trigonometric calculation. The two sites were located on the St Johns River, near DeLand, Florida, with both sampled during June 2006 through September 2006. Besides vessel speed, data collected during field observations included, hull registration number, vessel length, vessel type, party size, presence of law enforcement, and supporting parameters such as percent cloud cover and observation time.

Of the 1670 vessels observed, 1059 were useable after repeat observations, rentals and those with missing, illegible, or unlisted vessel numbers were removed from the database. Of these, 633 (59%) were observed in the idle speed zone and 426 (41%) in the slow speed zones. Within the idle speed zone (maximum allowable speed = 3 mph), mean vessel speed was 4.2 mph (standard deviation = 1.3), with a range from 1 to 10 mph. Within the slow speed zone (maximum allowable speed = 7 mph), mean vessel speed was 6.4 mph (standard deviation = 4.0 mph), with a range from 1 to 36 mph. Rental vessels (n = 150), which were analyzed separately, demonstrated a mean speed discrepancy of .35 mph, while non-rentals (n = 909) were at .50 mph

discrepancy. Positive mean discrepancies (observed speed minus maximum [1]) for both groups indicate that on average, both violated speed limits, although non-rental operators violated at higher speeds, on average than rental vessel operators.

Seventy two percent of the on-site observations were made between the hours of 0900 and 1400, with nearly all completed by 1600, after which vessel traffic volume decreased considerably. Most vessels observed were between 15.1 and 25 ft in length (57%), followed by vessels between 12 and 15 ft in length (30%). Runabouts were the most commonly observed vessel type (28%), and fishing and pontoon vessels the second and third most common (26% and 16%, respectively). Finally, rental vessels comprised about 12% of the total useable sample. Fifty five percent of the observed vessels were non-compliant with maximum allowable speeds within the manatee zones.

Selection of Subjects: Mail Survey

Based on observed hull registration numbers, boat operators were mailed a survey instrument so that 1:1 analyses could be conducted between observed behavior and respondent's profile. Items within the survey instrument were adapted from previous research on recreation specialization, manatee conservation attitudes, manatee zone sign assessment, and TRA. In addition, several questions were related to self-reported compliance behavior, ticketing history, and knowledge of "idle" and "slow" speed zone definitions. A total of 236 completed surveys were returned, representing a 23% response rate. To examine non-response bias, a telephone survey (n=36) was also conducted between November 27 and December 5, 2006.

There was a high degree of association between the date boaters were observed in the field and the date of their last boat outing as indicated on the mail survey (85%; n = 200). The

[1] "Idle" speed estimated maximum allowable: 3 mph; "Slow" speed estimated maximum allowable: 7 mph (Sarasota County, 2006).

average respondent was male (90%), 52 years of age with some college or a 2-year degree, and a 2005 annual household income of $65,000 to $99,000. More respondents were from nearby DeLand, Florida than from any other city (20%). Despite their year round presence near both sampling sites and within the St Johns River in general, nearly 57% reported seeing a manatee four times or fewer during the previous 12 months of boating. Few respondents (19%) reported having been ticketed for speed violations while boating. Only 22% of respondents reported belonging to an environmental organization.

Respondents averaged 25 years of boating experience, while 12% indicated 40 years or more boating experience. On average, respondents boated 47 days during the proceeding 12 months, with approximately 25% that noted boating more than 55 times during that period. On average, boaters operated their vessels 29 days in Volusia County, while 42% had boated 10 days or fewer during the proceeding 12 months. Eighty two percent indicated to have boated on six different water bodies within the previous 12 months, with 13% reported to have boated only on the St Johns River.

The majority of respondents (90%) reported owning seven or fewer books and/or magazine subscriptions. About 50% said they owned 28 or fewer boating-related items, and 19% owned 100 items or more. Only 28% of respondents belong to a boating. Overall, boaters believed themselves to be highly skilled and knowledgeable, but much less so with respect to the either the specific waterway in which the study was conducted, or their ability to operate a vessel offshore.

Operationalization of Variables

Recreation specialization

Recreation specialization was conceptualized based on three dimensions: behavioral, cognitive and affective. To assess the behavioral dimension of recreation specialization, four

questions related to the number of years a boater, number of days boated in past 12 months, number of days boated in Volusia County in past 12 months, or number of water bodies boated during past 12 months were used. Cronbach's alpha analysis registered a standardized alpha value of .67.

The affective dimension of the recreation specialization construct was evaluated with seven questions, three of which generated ratio scale data, and four that generated Likert scale responses (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree). Cronbach's alpha analysis identified a standardized alpha value of 81.

For the cognitive domain, four Likert scale (1=lowest, 10=highest) items were employed to measure self-reported boating skill, knowledge of boating rules and regulations, experience with Volusia County waterways, and comfort level operating a vessel 20 or more miles offshore. Cronbach's alpha analysis of these items identified a standardized alpha value of .77.

A composite specialization was also calculated by adding individual domains indices. A Cronbach's alpha analysis for the composite specialization index registered a standardized alpha value of .81. Following an examination of the distribution of each item within the three domains, raw responses were converted to Z-scores to create individual indices and a composite specialization index for testing of hypotheses.

Marine conservation attitudes

Marine conservation attitudes were conceptually divided into 1) attitudes toward manatee conservation (3 items), and 2) attitudes toward general marine conservation (3 items). The six items were tied to a Likert scale format (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree). Three manatee conservation questions measured boater agreement with manatees worth saving despite the need for regulations, manatee protection causing too many inconveniences, and vessel speed reduction is an effective manatee protection strategy.

Three general marine conservation attitude items measured boater agreement with boat speed as an effective general marine conservation strategy, general support of Florida's boating rules and regulations, and boat safety speed zone causing too many inconveniences. Four items were combined to create a composite marine conservation attitude index as two items were dropped. A Cronbach's alpha analysis for the composite marine conservation attitude index registered a standardized alpha value of .80.

Knowledge

Boater knowledge of state manatee protection status and Florida boating speed restriction definitions were assessed by three multiple-choice questions: "In Florida, manatees are officially listed as," "When in an idle speed zone, a boater should," and "When in a slow speed zone, a boater should." The correct answer choices for the latter two questions were based upon official state definitions of compliance operation in each zone.

Non-compliance/compliance behavior

Two items were used to ascertain boaters' level of self-reported compliance and non-compliance with vessel speed zones. The items were based on a five point Likert scale (1=strongly disagree to 5 = strongly agree), and prompted respondents to indicate their level of agreement with the statements, "I fully complied with manatee speed zones during my most recent boating experience," and "I fully complied with general (non-manatee) boat safety speed zones during my most recent boating experience." The items were subjected to a reliability analysis using Cronbach's alpha analysis, with the standardized alpha value of .66. Following reliability analysis, the values of the items were summed to create a self-reported compliance index. Furthermore, based on a dichotomous (yes/no) format, boaters were asked to report if they had ever been ticketed for violating boat speed restrictions.

Boaters were also asked to indicate the top five reasons for non-compliance with boat speed restrictions. For this question, respondents were given 14 potential reasons, whereby five ranked responses (1=most important, 2= second most important, etc.) were solicited.

Speed zone signage assessment

Speed zone signage assessment was operationalized using six items tied to a 5-point Likert scale format, ranging from strongly disagree (1) to strongly agree (5). The items were based on: signage assessment in manatee zones, and signage assessment in general boat safety zones.

Signage assessment in manatee zones was operationalized based on three items: assessing how well manatee speed zones are marked, how easy the signs are to read, and ability to tell when in a manatee speed zone. Based on reliability analysis using Cronbach's alpha, a standardized alpha value of .87 was identified. Following reliability analysis, the values of the items were summed to create a manatee zone signage assessment index.

Signage assessment in general boat safety zones was operationalized based on three items, assessing how well general boat safety speed zones are marked, how easy the signs are to read, and ability to tell when in a general boat safety speed zone. Similarly, a reliability analysis using Cronbach's alpha analysis was conducted, with a standardized alpha value of .88 identified. Following reliability analysis, the values of the items were summed to create a general boat safety zone signage assessment index.

A composite signage assessment index was also computed for the values of all six signage assessment items. Reliability analysis using Cronbach's alpha registered a standardized alpha of .91.

Theory of reasoned action

Theory of Reasoned Action was operationalized using nine items tied to a 5-point Likert scale format, ranging from strongly disagree (1) to strongly agree (5). The items were based on three conceptual domains: attitudes, subjective norms and behavioral intentions.

Attitudes were operationalized based on three questions, relating to disregarding boat speed restrictions: "Having the freedom to get to my destination quickly while boating is important," "Having no threat of ticketing for disregarding boat speed zones is important," and " having fun while on my boat is more important than obeying boat speed zones." The items were subjected to a reliability analysis using Cronbach's alpha analysis, with the standardized alpha value of .63. Following reliability analysis, the values of the items were summed to create an attitude index.

Subjective norms within the TRA construct were operationalized based on three items, regarding perceptions of what referents want the respondent to do while boating: "When boating, I want to do what family and friends think I should do," "When boating, I want to do what other boaters think I should do," and " When boating, I want to do what law enforcement officers think I should do." The items were subjected to a reliability analysis using Cronbach's alpha analysis, with the standardized alpha value of .62. Following reliability analysis, the values of the items were summed to create a subjective norm index.

Behavioral intentions within the TRA construct was operationalized based on three questions regarding intention to follow vessel speed restrictions and boating in an environmentally responsible manner during next boat outing. The items were subjected to a reliability analysis using Cronbach's alpha analysis, with the standardized alpha value registering .76. Following reliability analysis, the values of the items were summed to create a behavioral intention index.

Summary of Findings

Results of Research Questions Tested

Mean speed discrepancy (observed speed minus maximum allowable) did not differ between those who had, and those who had not been ticketed for boat speed violations in the past. Mean speed discrepancy did differ significantly between the slow and idle speed zones, with mean vessel speed discrepancy higher in the idle speed zone than in the slow speed zone ($t(1207) = 10.4$; $p<.01$). Party size did not influence vessel speed discrepancy, nor did vessel type. However, mean speed discrepancy was significantly higher for vessel length of between 16'-25' than any of the other categories (<12', 12'-15', 26'-39', 40'-64', >64') ($F = 2.62$; $p<.05$). A Bonferroni multiple comparison was performed to determine differences within vessel length categories, with significant differences found between vessel length category two (12'-15') and vessel length category three (16' –25') ($p<.05$). Neither a boater's history with seeing manatees, nor their assessment of zone signage influenced vessel speed discrepancy.

A boater's level of specialization was significantly associated with zone signage assessment. An increase in recreation specialization was found to be associated with a reduction in zone signage assessment (e.g., composite specialization index and composite signage assessment index correlation: $r = -.22$; $p<.01$).

Telephone interviews used to examine non-response bias resulted in a significant difference in the level of agreement with the statement "Manatee speed zones are well marked," with non-respondents reporting lower agreement (3.0 of on a Likert scale format where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree) than respondents (3.5 of 5.0) ($p<.05$). The results suggest that the manatee and composite signage assessment indices may have differed between respondents and non-respondents.

Lastly, several of the TRA components were significantly associated with each other. An index of self-reported compliance behavior was significantly correlated with the behavioral intention index ($r = .55$; $p<.01$) as well as the attitudes index ($r = -.35$; $p<.01$). The attitude index was also significantly and negatively associated with behavioral intentions ($r = -.52$). Next, a multiple regression was employed, with results demonstrating that self-reported compliance was a stronger predictor of behavioral intentions (standardized beta = .42; $p<.01$) than were attitudes (standardized beta = -.37; $p<.01$). Neither subjective norms nor vessel speed discrepancy were significant predictors of behavioral intentions. In general, the results partially substantiate the TRA model.

Results of Hypotheses Tested

Recreation specialization

Recreation specialization was not found to be associated with vessel speed discrepancy (hence compliance), although the behavioral ($r = -.19$; $p<.01$), cognitive ($r = -.23$; $p<.01$), and the composite specialization indices ($r = -.14$; $p<.05$) were found to be significantly and negatively associated with self-reported compliance behavior in manatee speed zones. Self-reported compliance behavior within general, non-manatee speed zones was also found to be significantly associated with the affective ($r = .14$; $p<.05$) and cognitive indices ($r = -.14$; $p<.05$), and the composite index of self-reported compliance behavior was found to be significantly and negatively related to the behavioral ($r = -.17$; $p<.01$) and cognitive indices ($r = -.21$; $p<.01$). Marine conservation attitudes were found to be negatively and significantly associated with the behavioral index ($r = -.35$, $p<.01$), the affective index ($r = -.30$, $p<.01$), the cognitive index ($r = -.37$, $p<.01$) and the composite specialization index ($r = -.43$, $p<.01$). Similarly, behavioral intentions were found to be negatively and significantly associated with the behavioral ($r = -.23$, $p<.01$), cognitive ($r = -.27$, $p<.01$), and composite specialization indices ($r = -.17$ $p<.05$).

Telephone interviews conducted to examine non-response bias resulted in a significant difference in the number of years of boating experience, with non-respondents reporting fewer years experience (mean =19) than respondents (mean=26) ($p<.05$). The results suggest that the behavioral and composite recreation specialization indices may have differed between respondents and non-respondents.

Reported vs. observed compliance behavior

The statistically insignificant association between self-reported compliance behavior and observed vessel speed discrepancy suggest that self-reported compliance behavior was a poor proxy for actual (observed) boating behavior. Additionally, an independent samples t-test found that the mean scores for each of the compliance measures did not differ significantly among compliant and non-compliant boaters (observed), further demonstrating that self-reported compliance behavior did not accurately reflect observed behavior.

Marine conservation attitudes

A weak and statistically insignificant association between observed speed discrepancy and the marine conservation attitude index was found. However, results indicated a strong positive and statistically significant association between behavioral intentions to fully comply with speed restrictions and marine conservation attitudes ($r = .44$, $p<.01$). Similarly, the associations between the marine conservation attitude index and self-reported compliance behavior in manatee speed zones ($r = .32$; $p<.01$), general boat safety speed zones ($r = .16$; $p<.05$) and the composite self-reported compliance behavior index ($r = .27$; $p<.01$) were found to be positive and statistically significant.

Telephone interviews conducted to examine non-response bias resulted in a significant difference in the level of agreement with the statement "Manatees are worth saving despite the need for regulations," with non-respondents reporting lower agreement (mean=3.9 on a Likert

scale format where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree) than respondents (mean=3.5) ($p<.05$). Additionally, a significant difference in the level of agreement with "I generally support Florida's boating rules and regulations" was found to exist between non-respondents (mean=3.5) and respondents (mean=3.9) ($p<.05$). The results suggest that the general marine conservation attitude index and composite marine conservation attitude index may have differed between respondents and non-respondents.

Behavioral intentions

A positive and significant association between the composite behavioral intentions index and the composite index of self-reported compliance behavior was found ($r = .67$, $p<.01$). Despite this finding, behavioral intentions were found to be weakly associated with observed vessel speed discrepancy.

Path analysis

A confirmatory factor analysis (CFA) was performed to validate the scales. After dropping several poorly performing items, the results of the CFA demonstrated strong evidence of reliability and convergent validity.

Despite the model being a good fit to the data, the hypothesized path model was generally found to poorly explain the relationships between the individual constructs. Recreation specialization had a strong negative influence on marine conservation attitudes ($B = -.57$); marine conservation attitudes exhibited a strong positive influence on behavioral intentions ($B = .33$); and behavioral intentions had a strong positive influence on self-reported compliance behavior ($B = .63$). The postulated theoretical model was generally weak in accounting for the relationships between the latent variables.

Discussion

Watercraft-related impacts currently account for 24% of the deaths suffered by the federally listed endangered manatee (*Trichechus manatus latirostris*) (FWC, 2006b). Although the Federal Manatee Recovery Plan (FMRP) focuses on reducing watercraft-induced mortality through the use of boat speed regulatory zones, manatee deaths have increased 10% per year over the past decade (FWC, 2006b).

Although manatee speed zones have been preliminarily shown to reduce manatee mortality (Laist & Shaw, 2006), not all boaters comply with zone speed restrictions. Fifty five percent of the vessels observed in this study were non-compliant with maximum allowable speeds in their respective zones (slow and idle). The results of this study are remarkably similar to other compliance studies (mostly qualitative) that have been conducted in Florida (see Gorzelany, 2001, 2004; Tyson, 2001; Tyson & Combs, 1999). For example, Gorzelany's (2004) examination of the wake propagation of 26,000 vessels in southwest Florida found between 63% and 58% of vessel operators to be fully compliant with posted signage in Sarasota and Lee Counties, respectively. Previous researchers have found an association between vessel length and manatee zone non-compliance. For example Gorzelany (2004) found that the relative proportion of boaters who were fully compliant with speed restrictions decreased with decreasing vessel size. Thus, operators of shorter vessels such as personal watercraft and johnboats (often less than 12' in length) were generally found to be less compliant than operators of longer vessels such as cruisers and yachts. The present study found vessels between 16' and 25' to be the least compliant boat length category, and as such the results are contrary to some prior findings. In her study of Haulover Canal, Florida boaters, Tyson (2001) also found that compliance depended on vessel length; however, contrasting Gorzelany (2005) and consistent with the present study, she found that larger vessels tended to be less compliant than vessels

under 25' in length. The site-specific nature of boater compliance (Shapiro, 2001) may explain the apparent divergence. Incongruities in the compliance-vessel length association might also be related to channel morphology and boat density. Both factors might artificially inflate compliance levels among operators of longer vessels when boating in narrow, shallow or dense conditions, where maneuverability and safety necessitates slower vessel speeds.

Gorzelany's (1996) boater compliance study (which included a mix of qualitative and quantitative speed assessment) found that personal watercraft and johnboats were less compliant of manatee speed zones than the other vessel types observed, with two out of every three personal watercraft sightings evaluated as blatantly non-[2] at one site. Gorzelany also found considerable variability in compliance among vessel types when examined across different sites. The present study found vessel speed discrepancy (hence compliance) independent of boat type. This might be partly explained by the aforementioned finding that non-compliance was found to be higher among vessel lengths of between 16' and 25' than among shorter or longer vessels. Personal watercraft and johnboats, both of which were found least compliant in Gorzelany's (1996) study, tended to be shorter vessels (usually less than 15" in length). It is also worth noting that the results of the present study mirror Gorzelany's (1996) findings in that the level of compliance was found to be higher among operators of rental vessels than for operators of non-rental vessels. It is a logical assumption that those who rent vessels spend less time on the water than those who own their own vessels. Perhaps spending relatively less time boating results in a reduction in waterway familiarity and increased caution, which is manifested in reduced boat speeds.

[2] Blatantly non-compliant defined as a vessel transitioning at a speed greater than one speed category faster than the posted limit through a significant portion of a speed-restricted area, or as defined by 1) traveling between 8-15 mph if in Idle Speed zone, or 2) traveling greater than 15 mph if in Slow Speed zone (adapted from Gorzelany, 1996, 1998).

Gorzelany (1996) also found that boater compliance with respect to weekend versus weekday was significantly related to site for all sites combined, and that the presence of law enforcement resulted in the highest level of compliance (74%) and the lowest level of blatant non-compliant behavior (8%). On-water observations for the present study were conducted almost exclusively on weekends, and few officers were observed (43 of 1670 total vessel observations). Although weekend sampling and low frequency of officer presence serve to limit comparisons to his 1996 study, the present research found that self-reported ticketing history for boat speed violations had no bearing on observed vessel speeds.

Boater non-compliance can be considered a form of depreciative behavior. Direct and indirect management techniques have been employed in a variety of park and managed settings to reduce unwanted visitor behaviors. Indirect techniques such as communication designed to educate, persuade, and otherwise change behaviors have generally been the preferred method in park settings (Hendee & Dawson, 2002; Manning, 1999; Roggenbuck, 1992). Although indirect techniques such as on-water signage is thought to be most cost-effective and most likely to result in enduring visitor behavioral changes (Clark, et al., 1972), the communication circuit often fails due to poor understanding of the communication process (Absher & Bright, 2004).

Knopf and Andereck (2004) recommended that to minimize the expression of unwanted behaviors, resource managers should focus on the causes of the depreciative behavior rather than the perpetrator, and to effectively communicate the rules and regulations of the resource. In Florida, vessel speed reduction in manatee zones is primarily facilitated by on-water signage meant to communicate waterway speed limits and other restrictions to boaters. On average, about one-third of the boaters surveyed in this study either disagreed or strongly disagreed with manatee and general, non-manatee boat zone signs being well marked, easy to read, and zones

being delineated in such a way as to facilitate full understanding of being in a speed-restricted zone. Although speed zone signage assessment was not associated with vessel speed discrepancy, the signage assessment results are similar to Florida boater signage assessments by Aipanjiguly et al. (2003) and Confer et al. (2003). Considering these findings, boater non-compliance might partly be described as an "unintentional violation," which occurred as a result of a lack of knowledge or understanding of appropriate conduct (Gramman & Vander Stoep, 1987). If poor waterway sign cognition results in boater non-compliance (unintentional violation), then its presence may serve as a "releaser-cue" which invites increasing levels of non-compliance as the behavior becomes normalized (Gramman & Vander Stoep, 1987).

Various examinations of the validity of self-reports as a surrogate of actual behavior have demonstrated incongruity between what people report on surveys and their real behavior (Hagburg, 1968; Lichtman et al., 1992; Mick, 1996; Warriner, et al., 1984). Along this line, Mick (1996) evaluated self-reports of purchase behavior within the context of socially desirable response (general reluctance to divulge attitudes and behaviors that may appear socially marginal) (SDR). He concluded that SDR bias is important in social research that rely on questionnaires to assess attitudes, beliefs and/or behaviors. Mick also acknowledged that despite its potentially profound impact on data integrity, little effort has been conducted to determine how this self-report bias may influence depreciative and/or prosocial behavioral research (e.g., pro-environmental behavior).

This investigation examined the correspondence between self-reports of compliance behavior (compliance with manatee and general boat safety zones during one's last boat outing) and level of observed compliance measured as vessel speed discrepancy. The findings support the notion that self-reports of behavior may poorly reflect actual behavior. A very weak and

statistically insignificant association was found between observed boat speeds and self-reports of compliance behavior. The results lend credence to Mick's (1996) concept of SDR. While 55% of the boaters observed in this study were not fully compliant with on-water speed restrictions, most self-reported a very high level of agreement with fully complying with boat speed restrictions during their most recent boating experience. In fact, none strongly disagreed or disagreed with either of the self-reported compliance behavior items. Researchers such as Warriner at al. (1984) have suggested that accurate self-reports rely on one's willingness to answer correctly in the face of cognitive dissonance such as, when actual behavior clashes with social norms. The high level of self-reported compliance behavior and the lack of association between self-reported compliance behavior and observed behavior suggest that boaters may provide survey responses that are deemed to be socially desirable when their actual behavior conflicts with regulations or with their stated attitudinal positions.

Results of the path analyses suggest that behavioral intentions had a strong positive influence on self-reported compliance behavior. Consequently, it is possible that boaters possessed neither the skill nor the knowledge to know when they were not in full compliance with speed restrictions. If boaters fully intended to follow speed restrictions, but lacked the skill to do so, then non-compliance should be evaluated as a form of unskilled behavior and targeted with educational intervention (Hendee et al., 1990). The overall uncertainty of the non-compliance issue suggests that a better understanding of the psychological attributes leading to non-compliance is warranted.

TRA frames behavior in terms of attitudes, subjective norms, and behavioral intentions (Fishbein & Ajzen, 1975). TRA has generally been shown to be robust in its ability to predict or otherwise explain behavior visa-a'-vis intentions, as intentions are thought to be the single best

predictor of behavior. Although a few studies have examined the association between past behavior, attitudes, subjective norms, and behavioral intentions (Albarracin et al., 2001), the majority of the outdoor recreation literature lacks the past behavior variable in the TRA model. Given the applicability in outdoor recreation research, utilization of past behaviors to predict intentions and future behaviors offers an important opportunity to further examine outdoor recreationists.

The present study examined the associations between past behavior (self-reported compliance behavior as well as observed vessel speed discrepancy), attitudes, subjective norms and behavioral intentions. Attitudes were found to be a strong predictor of behavioral intentions to fully comply with speed restrictions during the next boat outing. Past behavior in the form of self-reported compliance was also found to be a strong predictor of behavioral intentions, although observed behavior (speed discrepancy, a past behavior) was not. Subjective norms were also identified to be a poor predictor of behavioral intentions.

Consistent with the present study, natural resource management research using the TRA has found that attitudes are often a strong predictor of behavioral intentions. For example, Bright et al.'s (1993) examination of public perceptions of a National Park Service controlled burn policy found that a change in intention to support a controlled burn policy was predicted by the level of attitude change. Bright et al. (1993) also found that subjective norms were a strong predictor of behavioral intentions. In contrast, Aipanjiugly (2000) concluded that both attitudes and subjective norms regarding manatee conservation were strong predictors of behavioral intentions among Florida boaters. Along this line, a general lack of consistency regarding the predictive ability of attitudes and subjective norms on behavioral intention is exemplified in automobile driving behavior research. For example, a study by Rothengatter et al. (1985)

demonstrated that attitudes explained 53% of the variation in intention to exceed posted roadway speed limits, whereas subjective norms explained 8% of the variation. Contrastingly, Parker et al. (1992) identified that subjective norms explained the majority of the variation in intention to speed on roads through built environments. Respondents in this study portrayed themselves as practically devoid of motivation to behave how referents (family, friends and other boaters) wanted them to behave while boating. This lack of motivation helps explain the poor predictive ability of subjective norms on behavioral intentions.

Within the TRA, past behavior in the form of self-reported compliance was found to be a strong predictor of behavioral intentions. Ouellette and Wood (1998) argue that past behavior tends to predict intentions and future behavior, although the argument is typically made with respect to behaviors that become habitual (e.g., smoking), and therefore automatic through rehearsal. Though the role that past behavior plays within the TRA model seems to have gained acceptance within the contemporary psychology literature (Albarracin et al., 2001; Ouellette & Wood, 1998; Conner, Sheeran, Norman & Armitage, 2000) rarely has it been examined within a natural resource context.

The results of the present study are consistent with Knussen, Yule, MacKenzie, and Wells (2004) who found that self-reports of past recycling behavior made a significant contribution to behavioral intention toward future recycling. In fact, very similar correlations were found to exist between past behavior and behavioral intentions among Knussen et al.'s (2004) study ($r = .67$) and the present study ($r = .55$). As a cautionary note, self-reports of behavior as a surrogate for actual behavior serve to limit the findings of each study. Additionally, recycling behavior is easily rehearsed on a daily basis, while boating behavior may not be due to the considerable time, effort and money required to transport and launch a vessel. Despite these limitations in

comparisons, past behavior in the form of self-reported compliant boat operation was found to be a strong predictor of intention to follow boat speed restrictions during future boat outings, and is thus consistent with the literature.

Concomitantly, it may be logical to expect a person with positive conservation attitudes to exhibit pro-environmental behavior. Marine conservation attitudes were found to be poorly associated with observed vessel speed discrepancy in this study. Although the association was found to be weak, marine conservation attitudes were found to be generally high. Consequently, boaters might not consider vessel speed violations, or lack thereof, a manifestation of their respective conservation attitudes, or boaters may exhibit compliant boating behavior only when convenient. Despite the poor association between marine conservation attitudes and vessel speeds, the findings are consistent with other researchers who have found similarly weak causal connections between conservation attitudes and self-reported behavior (Tarrant & Cordell, 1997; Thapa, 2000; Theodori et al., 1998; Van Liere & Dunlap, 1981).

In examining the general lack of association between conservation attitudes and pro-environmental behavior, Diekmann and Preisendorfer (1992) submit that people generally find a way to offer a favorable account of their behavior, regardless of their behavior; and that people follow their environmental concern by acting consistent with it only in "low cost" situations, and when convenient. Within the context of the present study, boaters may have reported that they were "pro-environment" (high marine conservation attitudes) regardless of their boating behavior. It is also possible that regardless of their overall desire to comply, boaters may not have possessed the skill or knowledge to operate their vessels in a "pro-environmental" (compliant) way. In fact, boaters may have been entirely unaware that they were in "violation" of speed restrictions. Boaters are not typically issued citations based upon miles-per-hour

violations while in "idle" and/or "slow" speed zones, but rather are ticketed based upon qualitative assessment of vessel [3] by law enforcement officers. Therefore, boaters may possess little understanding of how idle and slow speeds translate to miles-per-hour.

Diekmann and Preisendorfer (1992) further suggest that people act on environmental concern only when doing so represents little cost in terms of money, time or effort. Boaters surveyed in this study self-reported a high degree of compliance behavior and behavioral intention to boat in concert with speed restrictions during their next boat outing, with both attributes positively associated with marine conservation attitudes. Self-reported compliance behavior and behavioral intention may be an inexpensive way of demonstrating environmental concern. Despite generally reporting high degrees of marine conservation attitudes, behavioral intentions, and level of self-reported compliance behavior, these did not translate to actual compliance behavior on the water.

The lack of association between marine conservation attitudes and observed compliance behavior should be interpreted with caution. Owing to the difficulty of assessing environmental attitudes, several attitudinal scales have emerged. Scale development is a complex process and there seems to be evidence that different environmental attitude scales measure different underlying constructs (Stern & Oskamp, 1987). For example, Tarrant and Cordell (1997) examined the relationships between self-reported environmental behavior and five separate environmental attitude scales. Despite their use of well-established scales (e.g., the New Environmental Paradigm; and the Awareness of Consequences scales), three were found to be most strongly associated with behavior, and among those, two were significantly affected be

[3] Idle Speed: The minimum speed that maintains steerage of a vessel; little or no displacement of water is from either the bow or stern; vessel remains level in the water at all times. Slow speed: The speed at which vessels are completely off plane; fully settled in the water. Some minimal water displacement at either the bow or stern (or both) may be observed. Florida Administrative Code 62N-22.

respondent attributes. With respect to the present study, the use of different attitude items might have lead to substantially different results in the attitudes-behavior association. Weigel (1983) stated that the attitude-behavior correspondence might be weak for a variety of reasons, including reliance on "a poor quality attitude measure" (p.262). The attitude assessment items used within the present study were not subject to the rigorous testing required to create a high quality scale. Consequently, a lack of relationship between marine conservation attitudes and vessel compliance might be due, in part, to this lack of rigor.

Recreation specialization theory was tested within the context of vessel speeds, marine conservation attitudes, self-reported compliance behavior, and behavioral intentions. Bryan (1977) hypothesized that as an individual progressed through the specialization continuum (novice to expert) within a specific activity, he or she would increasingly accept the rules, norms and procedures of that activity and become more conservation oriented. There has existed an underlying assumption that highly specialized outdoor recreationists will possess a high level of concern for resource conservation. The reasoning behind this assumption is that highly specialized recreationists may be more cognizant of their own contributions to environmental impacts and will thus have greater concern for reducing impacts upon the resource with which their recreation depends (Bryan, 1977; Ditton et al., 1992).

Findings generally suggest that as recreationists proceed along the specialization continuum they concomitantly report higher levels of environmental concern (Katz, 1981; Kaufman, 1984; Mowen et al., 1997), site-specific environmental concern (Mowen et al., 1997), and support for resource management rules and regulatory procedures (Ditton et al., 1992). Additionally, although support for waterway management rules and regulations in the form of fishing limits have been found among the most highly specialized anglers (Chipman & Helfrich,

1988; Oh & Ditton, 2006; Salz et al., 2001), poor support for access-denial regulations has also been found among anglers regardless of their level of specialization (Chipman & Helfrich, 1988; Salz et al., 2001; Salz & Loomis, 2005).

Despite the advancements in recreation specialization research, previous examinations of the theory have all relied upon self-reports of behavior, and none have attempted to observe recreation participants while engaged in their respective activities. The present study uniquely observed recreationists while they were engaged in recreational boating. Results suggest that specialization had little to do with the manifestation (or lack thereof) of depreciative behavior in the form of non-compliant vessel operation.

Results also demonstrated that higher levels of recreation specialization were significantly and negatively associated with marine conservation attitudes. Though these results seem contrary to specialization theory, they are not surprising given that several of the marine conservation questions either directly or indirectly addressed agreement with access control in the form of speed restriction as a conservation strategy. Although it is not known how similar general boaters are to anglers in terms of their marine conservation attitudes, findings of the present study are consistent with angler research identifying access-denial restriction to be an increasingly unpopular issue with higher levels of specialization (Salz et al., 2001). Recreation specialization theory also predicts that as specialization level increases, so too does dependency on that specific resource (Bryan, 1977; Ditton et al., 1992). Therefore, dependency on the resource with increasing specialization level might result in a reduction in marine conservation attitudes when attitudes are assessed with access-denial issues.

Two recent studies have examined self-reports of specific depreciative behaviors as they relate to recreation specialization. For instance, Meyer (2002) found that the most highly

specialized SCUBA divers self-reported the fewest depreciative behaviors such as touching or standing on coral while diving. The cognitive dimension of the recreation specialization construct was found to be more useful in explaining general diving behaviors than the behavioral dimension, a logical conclusion as skill could be expected to increase one's ability to maintain neutral buoyancy and allow a diver to avoid coral contact. In a re-examination of this study, Thapa et al. (2006) concluded that the behavioral domain of the recreation specialization construct was a weak predictor of depreciative contact with coral while diving. The authors suggested that more experienced divers may have had more time to rehearse such negative behaviors, and then come to accept them as normal diving tradition. Similarly, the present study found that self-reported compliance behavior was negatively associated with the behavioral domain of the specialization construct. However, contrary to Thapa et al. (2006) findings, the cognitive domain was also found to be negatively associated with self-reported compliance behavior. Perhaps as boaters' self-perceived skill level increases, so too does the belief that speed restrictions become less important as evidenced by their willingness to disclose their non-compliance behaviors.

In another study of depreciative behavior, Bireline (2005) demonstrated that highly specialized birders self-reported to employ potentially harmful methods to attract birds more frequently than did those lower on the specialization continuum. He concluded that highly specialized birders might consider personal lifelong birding "bag" lists to be more important than the potential harm done by "pishing" to attract birds for viewing. Bireline (2005) also acknowledged the limitation of reliance on self-reports of birding behavior.

Similarly, the present research demonstrated that self-reports of compliant boating behavior (compliant with boat speed restrictions) were lowest among the most highly specialized

boaters, as was intention to fully comply with boat speed restrictions. Progression through the continuum of specialization may be accompanied by feelings of, or desire to express one's autonomy. Indeed, boaters expressed little agreement with subjective norm items (i.e., desire to do what others wanted them to do), and generally portrayed themselves as highly independent. Alternatively, highly specialized boaters may consider vessel speed limits a form of access-denial, in which case the results are consistent with previous research demonstrating access restrictions to be generally unpopular among water-based recreationists (Chipman & Helfrich, 1988; Salz et al., 2001; Salz & Loomis, 2005).

This study also demonstrated that as boaters became more specialized they concomitantly reported a general reduction in their assessment of boat zone signs. Perhaps a higher level of specialization results in greater exposure to the myriad sign designs found throughout Florida's waterways, which in turn creates a certain level of confusion among waterway users. Highly specialized boaters might also report poor signage as a justification for failing to fully comply with speed restrictions.

Results of the present study are mixed when compared to previous specialization research. Differences may be attributed, in part, to the myriad ways in which specialization has been measured and analyzed. The instrumentation and analyses in this examination relied on individual specialization domains (behavioral, affective and cognitive) as well as a composite specialization index. Several researchers have relied on a single, multiple-item additive index as a measure of specialization (Donnelly et al., 1986; Wellman et al., 1982; Virden & Schreyer, 1988), while others have shown that an examination of individual domains may offer better predictive validity as it avoids the masking effect of a composite index (Bricker & Kerstetter, 2000; Kuentzel & McDonald, 1992; Lee & Scott, 2004; McFarlane, 2004; McFarlane et al.,

1998; Meyer, 2002). Although acceptance of examining individual domains seems to be growing among recreation specialization researchers, the individual domains, or the items that comprise the domains remains largely unresolved. Therefore, strong inference from the present study or recreation specialization research in general should be made with caution.

Secondly (to the author's knowledge), this study represents the first time behavioral observations have been used to examine recreation specialization and recreational behavior, as most have relied on self-reports (Bireline, 2005; Cottrell, 1993; Choi et at., 1994; Cottrell & Graefe, 1997; Donnelly et al., 1986; Meyer, 2002; Thapa, 2000). Consequently, the association between recreation specialization and environmental behavior has previously existed only insofar as self-reports accurately portray behavior. Like other research findings (Lichtman et al., 1992; Mick, 1996; Warriner et al., 1984) the study demonstrates the limitation of using self-reports as proxy for actual behavior.

Conclusions and Implications

The general inabilities to predict and shape recreational boating behaviors have had serious consequences in Florida, especially with respect to manatees. Collisions with motorized watercraft represent the single greatest cause of manatee mortality in Florida, with 24% of the deaths due to hull crushing or propeller wounds (FWC, 2006b). Although considerable effort has gone into reducing vessel speeds on waterways inhabited by manatees, various boater compliance studies (including the present investigation) have found substantial levels of non-compliance in speed-restricted zones. A better understanding of the factors behind this form of depreciative behavior is important in manatee conservation strategy.

This study introduced an improvement in the assessment of vessel compliance as conducted by previous researchers. Vessel compliance was not limited to a subjective, qualitative evaluation of wake propagation; rather, vessel speeds (mph) were generated based

upon trigonometric calculation. The study was unique in that it matched field observations of vessel speeds with a mail survey to better understand the predictors of vessel operation.

Although past behavior has recently gained acceptance within TRA (Albarracin et al., 2001; Ouellette & Wood, 1998; Conner, Sheeran, Norman & Armitage, 2000), rarely has it been examined from an outdoor recreationist behavioral perspective. This study uniquely integrated past behavior as both self-reported compliance behavior and observed vessel speed. Lending support to its usefulness within the TRA model, self-reported compliance behavior (past behavior) was found to be a strong predictor of behavioral intentions. Attitudes were also found to be a strong predictor of behavioral intentions, though observed vessel speed (past behavior) and subjective norms were not. The failure of the subjective norm to make a contribution to behavioral intention was not surprising since norms often explain less variability than attitudes (Armitage & Conner, 2001).

The lack of association between observed vessel speed and behavioral intention helps to elucidate the evolution of the TRA to that of the more recent Theory of Planned Behavior (TPB) (Ajzen, 1991). TPB integrates an assessment of perceived behavioral control (the extent to which an individual feels able to perform a particular behavior) into the existing TRA model. The reasoning behind the inclusion of PBC is that behavior may be influence by perceived behavioral control, particularly when the behavior is deemed (by the actor) to be difficult or complex (Knussen et al., 2004). For example, in their examination of citizen recycling (a relatively simple behavior) using past behavior and PBC, Knussen et al. (2004) found that both past behavior and PBC made significant contributions to intentions toward future recycling. Within the context of the present study, an examination of the extent boaters feel capable of operating their vessels in a compliant manner might provide additional insight into factors

behind non-compliance. Although past behavior in the form of observed vessel operation was found to be a poor predictor of behavioral intention, comparison to other studies may be somewhat inappropriate as most have tended to examine past behavior in terms of habitual patterns. As a complex behavior, boating requires that the operator continually adapt to changing environmental and social conditions, thereby preventing their actions from becoming routinized.

This study examined the assumption that self-reports of behavior accurately represent actual behavior. Although previous studies have shown how self-reports differ from actual behavior (Hagburg, 1968; Lichtman et al., 1992; Mick, 1996; Warriner, et al., 1984), environmental conduct is often difficult to directly observe, and reliance on self-reports remains high. Results of the present study demonstrate limitations on the correspondence between self-reports and actual behavior. Although boaters generally rated themselves as being highly compliant with manatee and general boat safety speed zones, more than 55% percent of the boaters failed to be in full compliance with vessel speed limits. While this incongruity appears egregious, it should be noted that boat speeds for this research were measured against estimated maximum speeds allowable for each zone category (idle and slow) as defined by Sarasota County (2006). Therefore, inference from this and other analyses relying on vessel speeds should be made within the context of estimated rather than strictly established maximum allowable speeds, as exact miles-per-hour speed limits are rarely applied to the definitions of "slow" and "idle" within Florida's waterways. Furthermore, a standard deviation of 2.72 among speed discrepancies meant that although 55% of boaters failed to fully comply with the strict speed limit definitions used in this study, the violations were rather small on average.

Although observed boater compliance was less than ideal, marine conservation attitudes among boaters were found to be high. Respondents generally agreed with manatees being worth

saving, and portrayed themselves of being strongly supportive of Florida's boating rules and regulations. Concomitantly, one-third considered vessel speed reduction to be ineffective as both a manatee and general marine conservation strategy. Therefore, conservation attitudes may be positive only to the extent that few behavioral sacrifices are required of boaters. As such, the results are consistent with angler and boater research showing the unpopularity of access-restrictions (Chipman & Helfrich, 1988; Futerfas, 2003; Salz et al., 2001; Salz & Loomis, 2005).

Highly specialized recreationists are assumed to be more aware of their contributions to environmental impacts than less specialized recreationists, and will thus have greater concern for mitigating impacts upon the resource with which their recreation depends (Bryan, 1977; Ditton et al., 1992). Although previous research has generally demonstrated an increase in resource conservation concern with increasing recreation specialization level (Hvenegaard, 2002; Virden & Schreyer, 1988), the present study demonstrated that specialization level had very little association with compliant vessel speeds and a strong negative association with marine conservation attitudes. Additionally, the negative bivariate associations between specialization, marine conservation attitudes, behavioral intentions, and self-reported compliance behavior contrast the aforementioned assumption that highly specialized recreationists have greater concern for their recreational resource than those less specialized. As further evidence of this, path analysis demonstrated that specialization had a negative, albeit statistically insignificant influence on behavioral intentions. While results of the study offer little support for the specialization-environmental concern association, they do demonstrate the general unpopularity of access-denial regulations in the form of vessel speed reduction.

With respect to recreation specialization, the predominant approach among recreation specialization researchers has been to focus on single recreationist typologies (e.g., anglers,

birders, canoists, hikers, SCUBA divers, etc.). The present study departed from past specialization research by examining boaters as a general recreationist type, within which a number of more specifically defined recreational pursuits (e.g., angling skiing, wildlife watching, etc.) may have existed. Within the context of the present study, it is not known how general boaters differed from these more explicitly defined boater subtypes.

Boater non-compliance remains a threat to the health and stability of manatee populations in Florida. If policy makers and resource managers are to effectively reduce vessel speeds within manatee conservation zones, they need to better understand the factors influencing both compliant and non-compliant behavior within specific sites. A better understanding of these factors might eventually lead to a more efficacious allocation of fiscal and personnel resources, with the ultimate goal of not necessarily adding boating restrictions to the waterways, but tailoring those interventions already in place to be more effective. Results obtained from this study were employed to test a predictive model of boater speed compliance within manatee conservation zones. In an attempt to provide a more holistic understanding of the boater compliance issue, this investigation adds insight into several modes of inquiry that proved effective, as well as several that need to be modified in future examinations.

From a practitioner's standpoint, the results of the study are consistent with previous Florida boater studies by demonstrating a generally poor level of compliance in critical manatee habitat. Assessing predictors of boater behavior, Gorzelany (1996, 2001) demonstrated that boater compliance with manatee conservation zone speed restrictions in southwest Florida was significantly improved in the presence of on-water law enforcement officers. Although the presence of law enforcement did not result in an appreciable reduction in observed vessel speeds in the present study, the absence of a significant reduction in vessel speeds may have been

attributed to the small number of officers observed in the study. In fact, only 43 of the total 1670 observations (2.5%) were law enforcement vessels in the present study, with 38 of those observations made during Labor Day weekend, 2006. Contrary to the present findings, other research has shown that boat operators are more likely to comply with speed restrictions when officers are present. Despite this, limited fiscal resources prevent a consistent policing presence on Florida's waterways. As a cost effective measure, perhaps the boating community should consider self-policing as a means of ensuring boater compliance. A model of self-policing is provided by the Florida Airboaters Association (FAA), which has adopted an "Airboaters Code of Ethics" as a way of formalizing the kind of good-will stewardship efforts needed to ensure their continued access to aquatic resources. Many of Florida's airboaters have embraced this code of ethics. Those behaving in a manner inconsistent with this code are subject to peer pressure as a means of ensuring compliance by all members of the airboating community. A fostering of boater compliance should be promoted among the motorized boating community through the acceptance of a similar code and encouraged and reinforced through boater networks. To facilitate this process, a small number of law enforcement officers or boating representatives should be employed to educate boaters and serve as ambassadors to ensure sustainable access by all interests.

The study also establishes that a more effective signage strategy to communicate boating rules and regulations may be needed. As a corollary, speed limit signage on America's highways is strictly uniform in design, with different geographic regions differing little in presentation. In contrast, boaters on Florida's waterways can encounter a variety of sign sizes, colors, types, placement locations and messages, all of which may create confusion. Perhaps in addition to the qualitative speed definitions associated with idle and slow speed designation, a miles-per-hour

speed limit should be included in sign design. Supporting this, 75% of the respondents in this investigation reported that their vessels were equipped with speedometers. The inclusion of a miles-per-hour speed limit on manatee zone signs would reduce the ambiguity of existing slow and idle speed definitions.

Borrowing from highway safety programs, several other cost-effective methods of encouraging vessel speed reduction may be considered. For example, Shapiro (2001) suggests: "…the use of feedback signs, personalized advisory letters, replica patrol cars, roadside speedometers, and highly integrated education and enforcement programs" (p.10). Poor boater compliance combined with the budget constraints faced by managing agencies indicates that these methods should be further examined for their efficacy in reducing vessel speeds in critical manatee habitat.

Additionally, results of the TRA demonstrate that management strategies designed to change attitudes might ultimately be more effective in influencing boater behavior than other interventions. The Airboaters Code of Ethics should be examined as a model of attitude change among waterway users.

Delimitations

The investigation was delimited to observed registered Florida boaters 18 years and older sampled during summer and fall, 2006 within two St. Johns River sampling sites in Volusia County, Florida.

Limitations

This study was limited by sampling only one waterway within one county in Florida; consequently, the results of the study may not be generalizable to the entire state. Manatee protection and boating are contentious issues, with periodic media coverage of the various factions and disputes related to the topic. For example, during the beginning phase of

observations for this investigation, a controversial vote to reduce the Florida manatee from endangered to threatened status was passed by FWC. The impact on the study as a result of the publicity surrounding the vote is unknown.

Sampling was predominantly performed during daylight hours on weekends, both of which may have served to limit the generalizability of findings. Self-reported compliance behavior relative to the date boaters were observed did not differ from those who reported having boated during a more recent date. Consequently, responses were analyzed as if the observation date and the date of their last boat outing as indicated on the mail survey matched perfectly. Although 86% (n = 203) of respondents indicated being the primary vessel operator during their last boat outing, it was not possible to know whether the person responding to the survey was, in fact, the person observed on the water. Furthermore, since boat owner data within the VTRS pertains only to registered vessels in Florida, observed boaters from other states and/or from rental facilities were not included in the follow-up mail sail survey.

A 23% response rate was generated in this study. An examination of non-response bias demonstrated several significant differences between mail and telephone survey respondents. To check for non-response bias, 36 telephone interviews were conducted, with the sample means and distributions of questions compared on a per question basis with the original mail survey results (Appendix C). Mail and telephone survey respondents differed significantly in their number of years boating, agreement with manatees worth saving despite the need for regulations, boat safety speed zones causing too many inconveniences (an item dropped from the primary analyses), manatee speed zones being well marked, and support for Florida's boating rules and regulations. The two respondent groups also differed in their reporting of the number of times ticketed for boat speed violations.

Recommendations for Future Research

The purpose of this study was to examine relationships between observed vessel speeds in manatee conservation zones, recreation specialization, marine conservation attitudes, self-reported compliance behavior, speed zone sign assessment, TRA, and vessel and operator attributes. Although recreation specialization was a predominant component of the research, there is little precedent in the literature for employing observed behavior within the context of specialization. Consequently, future research should continue to examine how observed recreational behavior fits into the framework of specialization theory.

While various authors may advocate that individual domains of recreation specialization should be analyzed separately due to the potential to vary relative to each other (Kuentzel & McDonald, 1992; Scott & Shafer, 2001; Thapa et al., 2006), operationalization of the construct remains largely unresolved. The behavioral domain within the present study failed to perform adequately and was ultimately dropped from the path analysis. Within this study, part of the failure of the behavioral domain was partially attributed to data skewness, outliers, and absence of normality. Furthermore, it may not be logical to include measures of behavior (e.g., number of years engaged in an activity; number of days engaged in an activity in the past year) within the specialization construct. For example, one boater within the present study reported to have more than 70 years boating experience, while having boated only once in the past 12 months. The behavioral measure may be more representative of the current personal constraint and situational factors influencing activity participation than level of specialization.

Similarly, three of the affective domain items, number of boating-related books owned, number of boating-related items owned, and number of boating-related club memberships, performed poorly and were removed from the path analysis. Although items such as the number of books and items owned have been commonly used by recreation specialization researchers,

responses to these items may be more a function of ability to pay than level of specialization. Further research is needed to more closely examine the efficacy of the behavioral and affective domains of the specialization construct.

TRA studies have relied heavily on self-reports of behavior. Behavioral intentions within the TRA model should be validated by future research to determine how intentions correspond to the actual performance of that behavior. Additionally, boater non-compliance should be further evaluated by employing measures of behavioral control as facilitated by the Theory of Planned Behavior (Ajzen, 1991). Expanded assessments of knowledge, experience, and skill might provide further insight into factors associated with depreciative boating behavior.

Consistent with the need to better understand behavioral control, an assessment of boater's knowledge of Florida Fish and Wildlife Conservation Commission (FWC) quantitative definitions of idle and slow speed zones should be offered. The present investigation demonstrated that respondents overwhelmingly understood the qualitative definitions set forth by FWC; however, their understanding of the quantitative definitions (mph) associated with these zone criteria remained unknown. Furthermore, as only 58% of respondents either agreed or strongly agreed that on-water manatee zone signage was easy to read or well marked, manatee conservation managers may want to place more emphasis on a uniform signage standard based upon further research into effective sign presentation.

An intriguing finding is that as boaters became more experienced, they concomitantly reported lower agreement with sign effectiveness in marine conservation and boat safety speed zones. Resource managers should focus on how to better inform vessel operators as to what is expected of them while boating. Knopf and Andereck (2004) suggested several overarching ways to minimize unwanted behavior in natural settings. Among these they list effective

communication of the rules and regulations as essential to visitor management. Effective communication as a means of reducing depreciative non-compliant behavior is especially important when the environment harbors endangered or threatened species such as those found in many Florida waterways. As this investigation and others have revealed that boaters may not fully understand zone signs and zone delineations, more research should be conducted to fully understand this lack of understanding.

Summarizing the boat zone compliance issue, Shapiro (2001) suggested that compliance varies by season, site, time, and days of the week. This examination was limited by sampling only two sites near Blue Spring State Park in DeLand, Florida during summer and fall months of 2006, and primarily on weekends between the hours of 0900 and 1600. Therefore, it is suggested that this type of study be conducted to capture different sites, months, days, and times to more fully understand the non-compliance issue.

In summary, understanding depreciative behavior such as boater non-compliance is a multifaceted and exceedingly complex task. Aquatic habitats, and the multitude of species that rely on them may best be preserved by understanding the attitudes, values, knowledge, and other factors that influence the way recreationists behave while engaged in aquatic recreation. While theories such as recreation specialization and TRA are valuable in framing behavior, much more research is needed to operationalize the constructs, and to ultimately integrate the findings into coherent and efficacious management strategy.

APPENDIX A
MAIL SURVEY INSTRUMENT

Florida Boater Profile Study

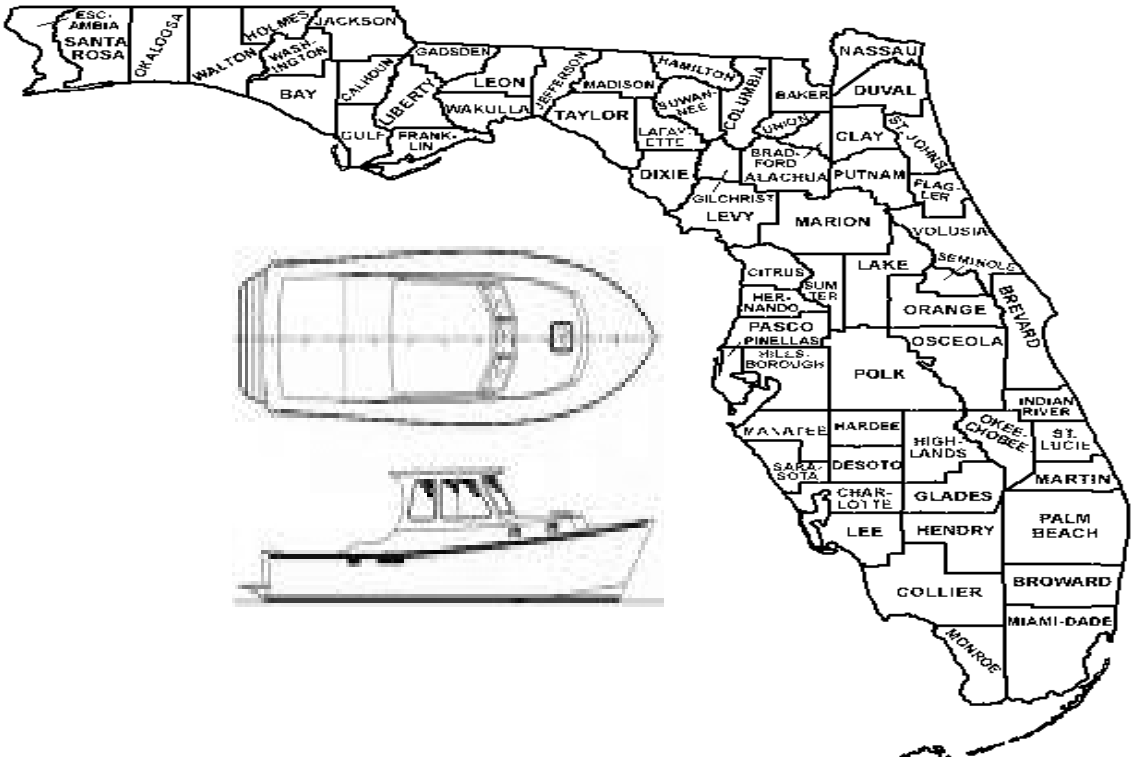
University of Florida
Department of Recreation, Parks and Tourism

Thank you for your interest in completing this survey!

The following questions pertain to you and your boating experience within Florida waters. This survey should take about 10 minutes to complete. Please fill out to the best of your ability, and be assured that your responses will be held in strict confidence and your anonymity is guaranteed. There are no anticipated risks associated with completing this survey, nor are there any compensations or direct benefits to you as a participant in this research. You do not have to answer questions you do not wish to answer. You may discontinue your participation at any time and without any consequence. Addresses for this study were obtained from boat hull registration numbers and the Vessel Title Registration System.

If you have any questions regarding this survey or the research objectives, please contact John Confer (supervisor) or John Jett (352) 392-4042 at PO Box 118208, University of Florida, Gainesville, FL 32611.

Thank you for your participation!



Experience

1. How many years have you been a boater?_____(**years**)

2. How many days did you boat during past 12 months?_____(**days**)

3. How many days did you boat in Volusia County in the past 12 months?_____(**days**)

4. How many different water bodies have you boated on in the past 12 months?_____(**number**)

5. Please **check** the number of times have you seen manatees while boating during the past 12 months.
   ____Never ____1 to 2 times ____3 to 4 times ____5-6 times
   ____7-8 times ____9-10 times ____greater than 10 ____Not sure

6. **When** did you last operate your boat on the St. Johns River?_____(**month/day/year**). Were you the primary vessel operator on this trip_____(**yes/no**)

7. **Where** did you last operate your boat?_____(**water body**)

Boating Equipment and Related Activity

8. What kind of boat did you use during your last outing? (**please check**)
   ___Pontoon ___Fish ___Personal watercraft ___Johnboat
   ___Sail ___Yacht/cruiser ___Ski ___Other (list)

9. How long is the hull of the boat you mentioned above (#8)?_____(**feet**). Does this boat have a speedometer?____(**yes/no**).

10. How many boating magazine subscriptions and/or boating-related books do you currently own?_____(**number**)

11. Approximately how many items do you own that are directly related to boating, excluding tow vehicle?____(**number**). **Items may include, for example, life vests, GPS unit, rod and reel, anchor, tie ropes, whistle, emergency buoy, tackle box, etc.

12. How many boating-related clubs do you currently belong to?_____(**number**)

13. How many environmental organizations do you currently belong to?_____(**number**)

Attitudes and Boating Skill

14. On a scale of 1 to 10 (with 10 being the highest), how would you rate each of the following?
    _____ My general boating skill level
    _____ My knowledge of general boating rules and regulations
    _____ My knowledge of Volusia County waterways
    _____ Comfort level with operating a boat 20 or more miles offshore

15. Please **circle** the response corresponding to your attitudes toward marine conservation issues and strategies. (SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree, NA=Not Applicable)

	SD	D	N	A	SA	NA
Manatees are worth saving despite the need for regulations	1	2	3	4	5	NA
Manatee protection causes too many inconveniences	1	2	3	4	5	NA
Boat speed reduction is effective manatee protection strategy	1	2	3	4	5	NA
Boat speed reduction is effective as a general marine conservation strategy	1	2	3	4	5	NA
I generally support Florida's boating rules and regulations	1	2	3	4	5	NA
Boat safety speed zones cause too many inconveniences	1	2	3	4	5	NA

16. Please **circle** the response corresponding to how boating and boating related activities fit into your life. (SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree, NA=Not Applicable)

	SD	D	N	A	SA	NA
Boating and boating-related activities are one of the most enjoyable things I do	1	2	3	4	5	NA
Boating is very important to me	1	2	3	4	5	NA
Boating says a lot about who I am	1	2	3	4	5	NA
I find that a lot of my life is organized around boating and boating-related activity	1	2	3	4	5	NA

17. Please **circle** your assessment of boat zones and your personal adherence to waterway rules and regulations. (SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree, NA=Not Applicable)

	SD	D	N	A	SA	NA
I fully complied with **manatee speed zones** during my most recent boating experience	1	2	3	4	5	NA
I fully complied with ***general* (non-manatee) boat safety speed zones** during my most recent boating experience	1	2	3	4	5	NA
Manatee speed zones are well marked	1	2	3	4	5	NA
Manatee speed zone signs are easy to read	1	2	3	4	5	NA
I can always tell when I'm in a **manatee speed zone**	1	2	3	4	5	NA
General boat safety speed zones are well marked	1	2	3	4	5	NA
General boat safety speed zone signs are easy to read	1	2	3	4	5	NA
I can always tell when I'm in a **general boat safety zone**	1	2	3	4	5	NA

18. When in an idle speed zone, a boater should (**please circle**):
    a. Travel no faster than 5 mph.
    b. Create no wake
    c. Create minimum wake
    d. Not sure

19. When in a slow speed zone, a boater should (**please circle**):
    a. Travel no faster than 10 mph
    b. Create no wake
    c. Create minimum wake
    d. Not sure

20. Overall, how often do you comply with boat speed zones? (**please circle**)
    a. Never
    b. Less than half the time
    c. About half the time
    d. More than half the time
    e. All of the time
    f. Don't know/no response

21. Have you ever been ticketed for violating boat speed restrictions? (**please circle**)
    a. Yes
    b. No
    c. Don't know/no response

22. In Florida, manatees are officially listed as? (**please circle**)
    a. Species of special concern
    b. Threatened
    c. Endangered
    d. Manatees are not listed

23. Indicate the **top five** reasons why you may not **fully** comply with boat speed restrictions. In the right column put a "1" for the most important reason, "2" for the second most important reason, and so on.

	Reasons you may not comply	**Order (top five)**
o.	Gets too hot when boat goes slow	
p.	Need to get somewhere	
q.	Other boats are going fast	
r.	Other people on my boat want to go faster	
s.	It's fun to go faster	
t.	Those I learned from never complied	
u.	To get out of the rain	
v.	I don't care about speed zones	
w.	Bad zone signage/can't understand	
x.	I don't like being told how to operate my boat	
y.	I don't agree with the zone	
z.	I know that there are no officers in the area	
aa.	Not paying attention	
bb.	Other (list)	

24. Please provide your opinion by **circling** the best response. (SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree, NA=Not Applicable)

	SD	D	N	A	SA	NA
I get where I `want to go more quickly on my boat if I disregard boat speed zones	1	2	3	4	5	NA
I will be fined if I disregard boat speed zones	1	2	3	4	5	NA
I have a greater chance of damaging my boat if I disregard boat speed zones	1	2	3	4	5	NA
Having the freedom to get to my destination quickly while boating is important	1	2	3	4	5	NA
Having no threat of ticketing for disregarding boat speed zones is important	1	2	3	4	5	NA
Having fun while on my boat is more important than obeying boat speed zones	1	2	3	4	5	NA
Family and friends think I should comply with boat speed zones	1	2	3	4	5	NA

Law enforcement officers think that I should comply with boat speed zones	1	2	3	4	5	NA
Other boaters think I should comply with boat speed zone	1	2	3	4	5	NA
When boating, I want to do what family and friends think I should do	1	2	3	4	5	NA
When boating, I want to do what other boaters think I should do	1	2	3	4	5	NA
When boating, I want to do what law enforcement officers think I should do	1	2	3	4	5	NA
I intend to follow **manatee** speed zone restrictions the next time I boat	1	2	3	4	5	NA
I intend to follow **general** boat safety speed restrictions the next time I boat	1	2	3	4	5	NA
Next time I boat I intend to boat in a way that will not harm the environment	1	2	3	4	5	NA

25. How do you feel about removing manatees from the endangered species list? (**please circle**)
    e. Strongly disagree with removing them
    f. Disagree with removing them
    g. Neither agree nor disagree with removing them
    h. Agree with removing them
    i. Strongly agree with removing them
    j. Not sure/no response

Information about Yourself

26. Where is your place of residence?_____(**city**)_____(**zip code**)

27. What is your gender? (**please check**) ___Male ___Female

28. What is your age?____ (**years**)

29. What is the highest education level you have attained? (**please check one**)
___Less than High School
___High School diploma
___Attended business/technical school
___Some college or 2-year degree
___Completed 4-year college degree
___Some graduate work
___Completed graduate or advanced degree

30. Which best describes your annual household income in 2005, before taxes? (**please check one**)
___Less than $14,999
___$15,000 to $34,999
___$35,000 to $49,999
___$50,000 to $64,999
___$65,000 to $99,999
___$100,000 to $149,999
___$150,000 to $199,999
___Over $200,000

Thank you for your effort in completing this survey!

If you have any questions regarding this investigation, please contact John Confer (supervisor) or John Jett

Department of Recreation, Parks and Tourism
PO Box 118209
University of Florida
Gainesville, FL 32611-8209
(352) 392-4042
Email: jconfer@hhp.ufl.edu or jjett@ufl.edu

Any questions regarding your rights as a research participant should be directed to the University of Florida Institutional Review Board, PO Box 112252, Gainesville, FL 32611, 352-392-0433

TO RETURN: Please fold the survey in half and staple or tape the two sides together so that the Business Reply address is shown on the outside. Thank You.

APPENDIX B
TELPHONE SURVEY INSTRUMENT

Non-respondent Telephone Survey
Florida Boater Compliance Study, 2006

Hello, may I please speak with Mr./Ms._____

Hi, my name is John Jett. I am a graduate student at the University of Florida where I am studying boating issues. A couple of months ago I sent you a mail questionnaire regarding your boating behavior and attitudes. A number of boat operators did not respond so now I would like to ask you a few questions to better understand why people did not respond to the initial survey. Are you willing to spend about five minutes to answer some very simple questions? Your participation is completely voluntary and your responses will be held in strict confidence.

_____Yes _____No

1. How many years have you been a boater?_____

2. What kind of boat did you use on your last outing?
    a. Pontoon
    b. Sail
    c. Fish
    d. Yacht/cruiser
    e. PWC
    f. Ski
    g. John
    h. Other_____

3. How long is the hull?_____

4. On a scale of 1-10 with 10 being the highest, how would you rate your general boating skill?_____

5. To what extent do you believe:

    a. Manatees are worth saving despite the need for regulation. (SD, D, N, A, SA, NA)
    b. Boat safety speed zones cause too many inconveniences. (SD, D, N, A, SA, NA)
    c. You fully complied with manatee speed zones during your most recent boating experience. (SD, D, N, A, SA, NA)
    d. Manatee speed zones are well marked. (SD, D, N, A, SA, NA)
    e. I generally support Florida's boating rules and regulations. (SD, D, N, A, SA, NA)

6. When in an idle speed zone, a boater should?
    a. Travel no faster than 5 mph
    b. Create no wake
    c. Create minimum wake
    d. Not sure

7. Have you ever been ticketed for violating a boat speed restriction? (Y, N, Don't know/no response)

8. How do you feel about removing manatees from the endangered species list?
    a. Strongly disagree with removing them
    b. Disagree with removing them
    c. Neither agree nor disagree with removing them
    d. Agree with removing them
    e. Strongly agree with removing them
    f. Not sure/ no response

9. Please tell my your level of agreement with:
    a. Having the freedom to get to me destination quickly while boating is important. (SD, D, N, A, SA, NA)
    b. I intend to follow manatee speed zone restrictions the next time I boat. (SD, D, N, A, SA, NA)

APPENDIX C
NON-RESPONSE BIAS ANALYSES

Table C1. Mail and telephone respondent t-tests

	Mail		Telephone			
Item	M	SD	M	SD	df	t
Years a boater	26.2	16.7	18.9	14.9	268	2.45*
Hull length (categories)	2.7	.67	2.5	.65	268	1.51
General skill	8.5	1.3	8.4	1.2	268	.37
Manatees are worth saving despite need for regulations	3.9	1.1	3.5	1.2	268	2.21*
Boat safety zones-too many inconveniences	3.2	1.3	2.5	1.0	268	3.61*
Fully complied with manatee speed zones last time boating	4.4	.98	4.1	.75	268	1.88
Manatee speed zones-well marked	3.5	1.2	3.0	.87	267	2.92*
Support of Florida's boating rules and regulations	3.9	.89	3.5	.70	268	2.94*
Feel about removing manatees from endangered species list	3.0	1.6	3.4	1.0	212	-1.88
Freedom to get to my boating destination quickly is important	3.1	1.2	3.1	.75	261	.22
Intend to follow manatee speed zone next time boating	4.3	1.0	4.1	.79	262	1.12

*Significant at .05 level (2-tailed)

Table C2. Mail and telephone respondent X^2 test

Item	Mail (n=234)	Telephone(n=36)	X^2
Have you ever been ticketed	19.2	13.9	13.49*

*Significant at .05 level (2-tailed)

APPENDIX D
FIELD DATA SHEET

Boater Compliance Research Data Sheet

Date: AM/PM: Sheet #: Notes:

Temp: Day: *circle one*

Site #: Speed Posting: Sky (clear, pcloudy, cloudy, rain, other)

Obs	Time	Boat type	Length	Activity	# in boat	Law	Elapsed	D. In	D. Out	FL Boat #	Rental	Comments
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Boat type: pontoon (pt); sail (s); ski (sk); johnboat (j); runabout (r); fish (f); yacht/cruiser (y); other (o)
Length: <12' (1); 12'-15' (2); 16'-25' (3); 26'-39' (4); 40'-64' (5); 64'-109' (5)
Activity: fishing (fish); pleasure (pl); skiing (ski); traveling (tr); other (ot)

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BIOGRAPHICAL SKETCH

John Jett was born on October 4, 1966 in Kansas City, Kansas. In 1989, Mr. Jett graduated from the University of Kansas with a bachelor's degree in environmental studies. Mr. Jett was then employed at an environmental testing and consulting firm in Kansas City until 1992, where he performed field sampling and testing as well as laboratory analyses and report preparation. After his employment in Kansas City, he went to work as a marine mammal behaviorist at Sea World in Orlando, Florida. There he conducted daily behavioral and physiological research with killer whales, sea lions, walruses, and otters. He also regularly performed educational presentations with killer whales, as well as regular husbandry and operative conditioning presentations to various professional groups and audiences.

In 2000, Mr. Jett received his master of science in environmental science from Oklahoma State University in Stillwater, Oklahoma. He accepted a position as director of environmental affairs at Stetson University in DeLand, Florida. At Stetson he was engaged in campus-wide environmental planning, energy efficiency monitoring, and a native landscape initiative. Mr. Jett also developed several interpretive programs, showcasing the campus as an environmental classroom, and played a key role in the design, construction, and certification of one of Florida's first certified "green" buildings.

In 2003, Mr. Jett began his doctoral program at the University of Florida in Gainesville, Florida. While there he taught a variety of courses and served as a research assistant for a number of projects including a Robert Wood Johnson Foundation grant; and helped in the development of a Waterway Master Plan for Alachua County, Florida. He received his Ph.D. in 2007.