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Normative Standards for Coral Reef Conditions: A Comparison of SCUBA Divers by Specialization Level

Laura E. Anderson
The University of Vermont

David K. Loomis
East Carolina University

Abstract

Previous research suggests that recreationists develop preferences for certain resource characteristics as they become more specialized. In this study, normative standards for resource conditions at coral reefs in the Florida Keys were compared among three specialization groups of SCUBA divers. Norm intensity was significantly greater among more specialized divers for three of four resource conditions studied—coral bleaching, algae cover, and presence of fish. Likewise, evaluations for individual conditions were generally more extreme among specialized divers for the same three resource conditions. However, divers differed significantly by specialization in their evaluations of just one underwater visibility condition. Study findings point to a connection between specialization level and social norms for resource conditions that are compatible with a healthy reef ecosystem.

KEYWORDS: Recreation specialization, resource condition norms, coral reefs, SCUBA diving

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Laura Anderson is a postdoctoral associate in the Rubenstein School of Environment and Natural Resources at the University of Vermont.

David Loomis is an associate professor in the Department of Recreation and Leisure Studies at the Institute for Coastal Science and Policy at East Carolina University.

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Please address correspondence to Laura Anderson, 81 Carrigan Drive, The University of Vermont, Burlington, Vermont 05405, landers2@uvm.edu.

Introduction

Recreation specialization provides a way to segment recreationists into meaningful subgroups along a continuum from low to high involvement. A number of studies have examined the connection between specialization and preferences, attitudes, support for management actions, and behaviors related to resource protection. These studies suggest that recreationists develop preferences for, or are aware of, certain resource characteristics as they become more experienced and/or specialized (Ditton, Loomis & Choi, 1992; Whittaker & Shelby, 2002; Vaske, Donnelly, & Heberlein, 1980; Virden & Schreyer, 1998; Lee, Graefe, & Li, 2007). Furthermore, concern about environmental impacts and environmentally responsible behaviors may be greater among more specialized individuals (Oh & Ditton, 2006; Dyck, Schneider, Thompson, & Virden, 2003; Oh, Ditton, Anderson, Scott, & Stoll, 2005; Hvenegaard, 2002; Thapa, Graefe, & Meyer, 2005 & 2006).

Another approach to understanding recreationists would be to consider how normative evaluations for resource conditions differ among specialization groups. Unlike measures of attitudes, preferences, and behaviors, normative approaches provide a way of understanding how conditions "ought to be" according to a social group. Normative standards have been examined in a variety of contexts, including stream flows (Whittaker & Shelby, 2002), trail conditions (Kim & Shelby, 2005; Lawson & Manning, 2002), ecological impacts to lakes (Smyth, Watzin, & Manning, 2005), and campsite conditions (Lawson & Manning, 2002). However, less attention has been given to the connection between experience/specialization and resource condition norms. This study seeks to better understand this connection by focusing on resource conditions in an ecologically sensitive environment—Florida Keys coral reefs—within the context of recreation specialization.

Literature Review

Recreation Specialization

Recreation specialization was first proposed by Bryan (1977) as "a continuum of behavior from the general to the particular, reflected by equipment and skills used in the sport and activity setting preferences" (p. 175). Trout anglers were classified into four groups based on their equipment, participation history, fishing partners, and species, catch, setting, and management preferences. Groups ranged from the least specialized "occasional fishermen," to "generalists," "technique specialists," and the highly specialized "technique-setting specialists."

Since its introduction, recreation specialization has been applied to a number of topics, including bridge (Scott & Godbey, 1994), hunting (Miller & Graefe, 2000), camping (McFarlane, 2004), whitewater rafting (Kuentzel & McDonald, 1992; Bricker & Kerstetter, 2000), and birdwatching (Scott, Ditton, Stoll, & Eubanks, 2005; Lee & Scott, 2004; Hvenegaard, 2002). Recreation specialization has been used to predict a variety of items, ranging from preferences for management action (Kuentzel & McDonald, 1992) to conservation involvement (Hvenegaard, 2002), place attachment (Bricker & Kerstetter, 2000), environmental behavior (Thapa et al., 2005, 2006), camping site choice (McFarlane, 2004), and attitudes

toward marine protected areas (Salz & Loomis, 2005). Likewise, approaches to measuring recreation specialization have varied considerably. While early studies relied on a single measure of specialization, such as participation frequency, others have involved the development of indices based on concepts proposed by Bryan (1977), including centrality of the activity to a person's life, equipment used, skill level, experience, and economic commitment (see Scott et al., 2005 for a review of measurement approaches).

While several researchers have measured and applied recreation specialization, the concept could not be empirically advanced due to circular reasoning in Bryan's original definition (Ditton et al., 1992). To address this shortcoming, recreation specialization was re-conceptualized as "a process by which recreation social worlds and subworlds segment and intersect into new recreation subworlds and the subsequent ordered arrangement of these subworlds and their members along a continuum" (Ditton et al., 1992, p. 33). In this definition, social worlds consist of individuals who share common beliefs, attitudes, and motivations. Furthermore, members of a recreation social world can be placed in subgroups that range from low to high involvement based on four characteristics: 1) orientation, 2) experiences, 3) relationships, and 4) commitment (Unruh, 1979).

Identifying recreation specialization groups based on concepts from the social worlds literature allowed for the development of a number of propositions for theory testing and advancement (Ditton et al., 1992). For example, it was predicted that centrality of the activity, interaction with media sources pertaining to the activity, and investments of time and money would all increase with specialization. Two other propositions relate to the condition of resources. First, dependency on a specific resource should increase with specialization. Second, acceptance and support for activity rules, norms, and procedures are likely to increase with specialization, a proposition tied to specialists' interest in seeing their activity continue into the future in a quality way.

A number of studies have supported these two recreation specialization propositions. In a study of Texas anglers, it was found that highly specialized anglers were more supportive of management practices that were likely to reduce the negative environmental impacts on the resource than were low specialization anglers (Oh & Ditton, 2006), suggesting that more highly specialized recreationists may be more sensitive to environmental degradation. A study of Massachusetts anglers also found that more specialized anglers were more supportive of management tools and regulations that might help to ensure the continuation of the activity (Salz, Loomis, & Finn, 2001).

In another study, visitors who had been coming to the Apostle Islands National Lakeshore for a longer time were more sensitive to resource degradation than were visitors who came to the lakeshore more recently (Vaske et al., 1980). The early visitors more strongly agreed with statements indicating that resource conditions at the lakeshore had declined, including "excessive litter," "overuse of campsites," "trampling of natural vegetation," and "poor water quality" (p. 376). Sensitivity to resources was also demonstrated in a study of backcountry hikers, in which a number of significant relationships between specialization level and preferences for physical settings were found (Virden & Schreyer, 1988). In another

study, a connection between specialization and resource conditions was found among wind surfers, who differed in their preferences for wind velocity, season, and crowding (Ninomiya & Kikuchi, 2004).

Normative Standards

A number of studies have considered resource conditions in the context of social norms (Whittaker & Shelby, 2002, Kim & Shelby, 2005, Smyth et al., 2005, Lawson & Manning, 2002). Largely developed out of carrying capacity frameworks to consider issues of use, normative methods have been applied to a number of management issues (Manning, 2004). Social norms can be understood in the context of the Cognitive Hierarchy Model, as an intermediary between values, which are few in number and slow to change, and behaviors, which are many in number and quick to change (Vaske & Donnelly, 1999). Social norms are important in that they reflect how conditions "should" or "ought" to be according to a social group. When social norms are violated, recreationists may become dissatisfied and/or be displaced from a recreation site (Manning, 1999).

While there are a variety of approaches for measuring recreation norms, much research has focused on the development of structural characteristics models, or norm curves (Vaske and Whittaker, 2004; Manning, 1999). Using a "long-format" question approach, respondents are asked to evaluate the acceptability of a series of conditions (e.g., increasing numbers of encounters with other recreationists or increasing levels of resource degradation). Conditions presented to respondents represent a range of plausible scenarios. For example, in a study of crowding norms at Sand Beach in Acadia National Park, respondents were asked to rate conditions that ranged from seeing 0 to 860 people (Manning, 2009). Average responses are calculated and may be plotted on a graph to form a social norm curve. Normative methods have been used to determine a variety of items, including the acceptability of different fire management scenarios (Kneeshaw, Vaske, Bright, & Absher, 2004), instream flow conditions (Whittaker & Shelby, 2002), national forest management (Vaske, Donnelly, Williams, & Jonker, 2001), and wildlife management actions (Zinn, Manfredo, Vaske, & Wittmann, 1998).

Through the long-format measurement approach, a number of norm characteristics can be identified, including norm intensity, crystallization, the range of acceptable conditions, the optimal condition, and the minimum acceptable condition (Manning, 2007). Norm intensity, or salience, is a measure of norm strength and is determined by calculating the difference between the conditions receiving the most positive and negative evaluations. Norm intensity reflects the degree to which the variable being evaluated is important to recreationists' experiences. Norm crystallization reflects the degree to which recreationists agree in their evaluations of norm conditions and is calculated using standard deviation and related measures of agreement. The condition receiving the most positive evaluation is the optimal condition, while all positively evaluated conditions fall within the range of acceptable conditions. The minimum acceptable condition is the location on the norm curve where evaluations cross from positive to negative.

A few studies have considered the connection between experience/specialization and social norms, with mixed results. A study of hikers at alpine ski areas demonstrated a positive relationship between skill level and normative agreement

and intensity for a series of photographs showing different numbers of hikers at the site. Conversely, a negative relationship was found between specialization and the acceptability of higher hiker densities (Needham, Rollins, & Vaske, 2005). Likewise, a review of normative studies related to instream flows demonstrated a connection between skill level and normative evaluations for different flow levels (Whittaker & Shelby, 2002). Two other studies found little connection between measures of experience and normative standards. A study of wilderness users showed few significant differences between wilderness involvement and standards for a range of social conditions (Young, Williams, & Roggenbuck, 1991). Similarly, a study of encounter norms among mountain bikers found no relationship between specialization and norm crystallization, intensity, and acceptability ratings for photographs depicting different numbers of bikers (Needham et al., 2005).

Experience/Specialization and Coral Reef Diving

In 2008, an estimated 3.2 million Americans participated in SCUBA diving (Outdoor Foundation, 2009). Much of this activity took place on or around coral reefs (Thapa et al., 2005). Known as the tropical rainforests of the ocean, coral reefs are highly productive and diverse ecosystems. While they comprise a small percentage of the ocean floor, coral reefs provide essential habitat for marine life, protecting coastal lands from extreme weather events and serving as a support system for local economies, particularly through tourism (Hoegh-Guldberg, 1999). In south Florida, which hosts North America's only barrier reef, visitation to coral reefs is a significant part of the tourist industry. Activities like SCUBA diving can provide an economic incentive for tourist communities to protect the coral reef environment (Dearden, Bennett, & Rollins, 2006).

Previous research suggests that divers are sensitive to the health of coral reefs, and that reef health is directly related to the quality of the diving experience (Shafer & Inglis, 2000; Sorice et al., 2005). In a study of tourism at the Great Barrier Reef in Australia, it was found that experiencing nature, particularly corals and fish, most positively influenced snorkelers' experiences at the reef (Shafer & Inglis, 2000). Conversely, Great Barrier Reef divers were less accepting of the presence of human structures (i.e., buoys) (Inglis et al., 1999). In another study, divers in Texas preferred to see increased education efforts related to protecting reef health before dive sessions, with some divers indicating that they preferred to have dive masters supervising diver behavior in order to protect corals (Sorice, Oh, & Ditton, 2005). Divers surveyed in Florida reported that they usually engaged in environmentally responsible behaviors while diving (Thapa et al., 2006), suggesting awareness of the environmental sensitivity of coral reefs.

Studies conducted in New York and Florida found viewing of underwater plant and animal life to be a key motivation for SCUBA divers (Todd, Graefe, & Mann, 2002; Meisel-Lusby and Cottrell, 2008; Meyer, Thapa, & Pennington-Gray, 2002). However, the relationship between diver motivations for seeing underwater life and specialization level is less clear. In a study of divers in Phuket, Thailand, it was found that the importance of viewing underwater plants and animals increased with specialization level (Dearden et al. 2006). However, in surveys of Florida Keys and New York State divers, no significant differences were found in this motivation by specialization level (Todd et al., 2002; Meisel-Lusby & Cottrell, 2008).

Reflecting on the concept of a shifting baseline, one study of divers in Thailand hypothesized that newer divers, lacking previous experience or a point of reference, may be more satisfied with degraded ocean conditions than their more experienced counterparts (Meisel-Lusby and Cottrell, 2008). It was found that less specialized divers were more satisfied with their dive trip overall, and particularly with seeing plant and animal life, underwater visibility, and the variety of marine life seen. A study of New York divers found greater environmental consciousness among saltwater divers than those who had dived in freshwater or in both (Todd & Graefe, 2004). Among Florida divers, environmentally responsible behavior was positively related to specialization (Thapa et al., 2006).

While previous studies have examined the relationship between diver specialization and motivations, satisfaction, and behavior, little attention has been given to the relationship between diver specialization and social norms. Social norms differ from these other measures in that they provide insight into how conditions "should" or "ought" to be according to a social group. In one normative study of divers on the Great Barrier Reef, Australia, specialized marine recreationists were found to exhibit higher norm intensities when evaluating different numbers of snorkelers in photographs. Additionally, highly specialized recreationists were less accepting of the presence of human structures (Inglis et al., 1999).

Conceptual Framework

This study considers the relationship between recreation specialization and resource condition norms, an area that has received limited attention in previous research. This connection is based on the view that activity participants are members of a social world who share a common social identity (Ditton et al., 1992; Unruh, 1979). By extension, participants along the recreation specialization continuum are also members of a social subworld. While all activity participants should share norms for resource conditions, these norms are likely to vary among specialization subgroups.

Furthermore, resource condition norms should vary by specialization level in a predicted direction. Recreation specialization predicts that more highly specialized recreationists will have greater support and acceptance for rules, norms, and procedures that ensure their activity will continue into the future (Ditton et al., 1992). It also predicts that more highly specialized recreationists will be more dependent on a specific resource.

In the context of this study, specialized divers should be more dependent on healthy ecosystems and have greater concern about seeing their activity continue in a quality way into the future. Thus, normative evaluations of resource conditions should be more extreme among more specialized users. This connection is tested by comparing 1) norm intensity and 2) individual evaluations of various resource conditions by specialization level.

Methods

Sampling

A sample of SCUBA divers was identified through in-person intercepts in the Florida Keys as part of a larger study focused on diving, snorkeling, and fishing

(Loomis, Anderson, Hawkins, & Paterson, 2008). Intercepts were designed to collect a representative sample of divers who visit coral reefs on the southeastern side of the Florida Keys. Inshore, mid-channel, and reef margin/fore-reef zones were included in the study area, which extends from the ocean side of the keys island chain to a water depth of 30 meters. Divers were sampled in conjunction with snorkelers over the course of a year, with intercepts conducted one week each month from June 2006 to June 2007.

To ensure that the sample included individuals who access coral reefs on private and rented boats as well as those who dive with commercial tour companies, intercepts were conducted both at reef sites and on land. On-water intercepts were conducted through daylong boat "patrols" of the study area. All groups encountered on-water were approached by boat and asked to participate in the study. On-land intercepts were scheduled around the departure and arrival times of commercial dive boat companies, and occurred on docks before and after dive trips. Divers on commercial boats not visiting coral reefs (e.g., wreck trips) were not asked to participate in the study. Because the length of the Florida Keys exceeds 100 miles, sampling trips alternated between the upper keys and the middle/lower keys. Once intercepted, divers were asked to participate in a mail survey by providing their name and mailing address. One name and mailing address was collected for each diving group from the individual with the most recent birthday.

Data Collection

Questionnaires were mailed to those identified during the intercepts in several waves following the Dillman (1978) Total Design Method. Following each intercept period, all potential study participants were sent a packet of survey materials that included a cover letter thanking them for their participation and ensuring confidentiality, a questionnaire, and a postage-paid business reply envelope. One week after mailing the initial packet, all potential respondents were sent a postcard that reminded them about the study, emphasized the importance of their participation, and thanked them for completing the survey if they had already done so. Three weeks after the initial mailing, potential respondents who had not returned a questionnaire were sent a second packet of survey materials. For this mailing, the packet materials were the same as in the first mailing, except that the cover letter was revised slightly to further emphasize the importance of their participation. Six weeks after the initial mailing, all potential respondents who had not returned a survey were sent a third packet of materials, with a cover letter that further emphasized the importance of their participation. To further encourage response, all letters and post-cards were addressed and stamped by hand.

Recreation Specialization Index

Recreation specialization level was measured using the recreation specialization index developed by Salz et al. (2001) and further modified by Salz and Loomis (2005). The index has been shown to be an internally valid and reliable measure of specialization that has been applied across a variety of contexts (Hawkins, Loomis, & Salz, 2009). The index measures four characteristics from the social worlds construct (orientation, experience, relationships, and commitment to the activity), and is designed to segment recreationists into four unique subgroups (Table

1). Each response item in the index is ordered from least specialized (answer = "1") to most specialized (answer = "4"). To determine specialization level, the answers for all four items are added to determine a cumulative score ranging from "4" to "16." In earlier applications of the index, respondents scoring between "4" and "6" have been labeled "least specialized," while respondents with scores between "7" and "10," "11" and "13," and "14" and "16" have been labeled "moderately," "very," and "most" specialized, respectively.

Table 1

Recreation Specialization Index Items

A) Orientation	When I participate in the sport of SCUBA diving I feel like:	1	a beginner. I don't really feel like I am part of the SCUBA diving scene.
		2	an occasional or irregular participant. Sometimes it is fun, entertaining or rewarding to go SCUBA diving.
		3	a habitual and regular participant in the sport of SCUBA diving.
		4	an insider to the sport. SCUBA diving is an important part of who I am.
B) Experience	During a SCUBA diving experience I can best be described as:	1	having very little understanding of SCUBA diving. I am often unsure about how to do certain things when I go SCUBA diving.
		2	having some understanding of SCUBA diving, but still in the process of learning more about the sport. I am becoming more familiar and comfortable with the activity.
		3	being comfortable with the sport. I have a good understanding of what I can do while SCUBA diving, and how to do it.
		4	a knowledgeable expert in the sport. I encourage, teach and enhance opportunities for others who are interested in SCUBA diving.
C) Relationships	My relationships with others who SCUBA dive are:	1	not established. I really don't know any other people who SCUBA dive.
		2	very limited. I know some other SCUBA divers by sight and sometimes talk with them, but I don't know their names.
		3	one of familiarity. I know the names of others who SCUBA dive, and often speak with them.
		4	close. I have personal and close relationships with other SCUBA divers. These friendships often revolve around the sport.
D) Commitment	My commitment to SCUBA diving is:	1	very slight. I have very little connection to the sport. I may or may not continue to participate in the sport in the future.
		2	moderate. I will continue to go SCUBA diving as long as it is entertaining and provides the benefits I want.
		3	fairly strong. I have a sense of being a member of the activity, and it is likely that I will continue to SCUBA dive for a long time.
		4	very strong. I am totally committed to SCUBA diving. I encourage others to participate in the sport and seek to ensure the activity continues into the future.

Applications of this index in previous studies have yielded a small number of recreationists in the least specialized category (Salz et al., 2001; Salz & Loomis, 2005; Salz, Loomis, Ross, & Steinback, 2001). This may be partially explained by the wording used for the second item of each of the social worlds characteristics. While designed to distinguish "moderately" specialized individuals from "low" specialization respondents, the language used suggests a relatively low degree of specialization (see Table 1). For example, a respondent who indicates that he or she is an "occasional or irregular participant" in an activity could be categorized as being "moderately" specialized using the protocol described above. Given these considerations, the two lowest specialization groups (scores "4" to "10") were combined into one specialization category ("less specialized") in this study.

Social Norm Measures

Resource condition norm questions were designed around four items that are considered important in biological coral reef research: coral bleaching, algae presence, underwater visibility, and fish presence (FRRP, 2006). Coral bleaching occurs when warm water temperatures disturb the relationship between coral polyps and the symbiotic algae that provide food to corals through photosynthesis. In the absence of photosynthetic algae, corals appear white and are at increased risk of disease and death (Gillis, 2010). Likewise, excessive amounts of algae—linked to overfishing, sewage, and agricultural runoff—can be indicative of an unhealthy coral reef system. Bacteria that feed off of sugars produced by algae can kill corals by depleting oxygen (Aguilera, 2006). Underwater visibility, which may be reduced by pollution and sedimentation, is tied to the amount of light reaching corals. Without adequate sunlight, corals may starve (NOAA, 2010). Finally, coral reefs are highly productive and biologically diverse ecosystems. Reef health is partially reflected by the presence of many diverse fish species.

For each environmental characteristic, four possible conditions were created, ranging from the least biologically desirable (i.e., corals that are mostly white, high algae presence, low underwater visibility, and no fish) to more biologically desirable (i.e., few white corals, low algae presence, high underwater visibility, and many fish of many kinds). Respondents were asked to rate how acceptable they would find each condition during a typical dive on a 7-point scale ranging from "extremely unacceptable" to "extremely acceptable."

Results

A total of 3,092 divers and snorkelers were approached during in-person intercepts in the Florida Keys. Two hundred and twenty-five individuals refused to participate in the study (7.8% refusal rate), resulting in an initial sample of 2,867. Of this initial sample, 114 surveys were returned as nondeliverable, yielding an effective sample of 2,753. A total of 1,595 surveys were returned (57.9% response rate), and 975 of these surveys were completed by divers. Since a respondent's status as a diver or a snorkeler was determined by a question on the survey instrument, the separate response rate for each activity is not known.

Specialization Level

A total of 959 divers answered all four questions in the recreation specialization index. Divers in the sample clustered towards the higher end of the special-

ization continuum, with 42.3% of divers (n=412) and 30.3% of divers (n=291) falling into the two highest specialization levels. These categories are labeled as "specialized" and "most specialized," respectively. Two hundred fifty six divers (26.7%) were classified as "less specialized." This latter group included 225 divers that scored between "7" and "10" on the specialization index and 31 divers with a score of "6" or less. A factor analysis was conducted to confirm that the four index items (orientation, experiences, relationships, and commitment) measured a single latent construct. The factor analysis yielded a one factor solution (eigenvalue = 2.68) that explained 67.1% of the variance. A Cronbach's alpha value of 0.831 suggests high internally consistency among index measurement items.

Diver Characteristics

Survey respondents ranged in age from 18 to 76, with a mean age of 43 (SD = 11.9). Most divers were visitors to the Florida Keys (91%) and classified themselves as white (98%). A majority were male (73%), married (61%), and earned an annual household income of $75,000 or more (64%).

Diver residence, gender, and age differed slightly among specialization groups. A higher percentage of Florida Keys residents belonged to the "most specialized" and "specialized" groups than the "less specialized" group (16%, 8%, and 1%, respectively). Likewise, "most specialized" divers were more likely to be male (80%, compared with 70% for "specialized" and "less specialized"). Additionally, "most specialized" divers were slightly older (mean = 44) than "less specialized" divers (mean = 41). Specialization groups did not differ in income level, marital status, or racial/ethnic group composition.

Normative Evaluations

Overall, divers gave positive acceptability ratings to resource conditions that reflect a healthy coral reef ecosystem (Table 2). These include seeing no white coral, almost no algae, and many kinds of fish and experiencing underwater visibility of 25 feet or greater. Negative evaluations were given to conditions that involve the presence of white coral and algae, a lack of fish, and limited underwater visibility. In addition, norm intensity, or salience, differed across the four resource categories measured (Table 3). Findings suggest that fish and underwater visibility are highly salient among divers. Evaluations for seeing no fish and many fish of many kinds were rated as extremely unacceptable and extremely acceptable, respectively. Likewise, divers evaluated underwater visibility of 75 feet as extremely acceptable. However, moderate norm intensity was found for the white coral and algae conditions. For both resource categories, evaluations for seeing no algae or white coral were moderately acceptable, while evaluations for seeing nearly 100% algae cover and mostly white coral were moderately unacceptable. Similarly, norm consensus was slightly higher for the fish and underwater visibility attributes than for the algae and white coral attributes, with average standard deviations of 1.07, 1.23, 1.54, and 1.76, respectively.

Comparisons of norm intensity by specialization level yielded significant results for three of the four attributes studied (Table 3). In particular, norm intensity was positively related to specialization level for white coral cover, algae presence, and fish presence. Underwater visibility norm intensity did not differ significantly by specialization level.

Table 2

Mean Acceptability Evaluations of Resource Conditions by Diver Specialization Level

	All Divers	Less Specialized	Specialized	Most Specialized	F	p
Coral bleaching						
Coral reefs that are mostly white	2.71*	3.42[a]	2.77[b]	2.02[c]	35.34	0.000
Coral reefs that are 60% white	2.87	3.50[a]	2.95[b]	2.22[c]	40.88	0.000
Coral reefs that are 30% white	3.44	3.80[a]	3.50[b]	3.03[c]	19.23	0.000
Reefs with no white coral present	5.34	4.83[a]	5.28[b]	5.83[c]	18.92	0.000
Algae cover						
Nearly 100% algal cover	2.33	2.66[a]	2.36[a]	2.01[b]	10.88	0.000
60% algal cover	2.77	3.08[a]	2.81[a]	2.45[b]	12.44	0.000
30% algal cover	3.61	3.89[a]	3.68[a]	3.27[b]	12.77	0.000
Almost no algae present	5.50	5.23[a]	5.55[a,b]	5.61[b]	3.75	0.024
Fish presence						
Seeing no fish at the reef site	1.37	1.39[a,b]	1.44[a]	1.25[b]	4.49	0.011
Seeing many fish, but of few kinds	3.65	3.69[a,b]	3.76[a]	3.48[b]	3.12	0.044
Seeing few fish, but of many kinds	4.34	4.40[a]	4.47[a]	4.11[b]	5.68	0.004
Seeing many fish, of many kinds	6.82	6.79	6.81	6.86	1.04	0.354
Underwater visibility						
Visibility of about 10 feet	2.35	2.44	2.31	2.36	0.72	0.486
Visibility of about 25 feet	4.01	4.22[a]	3.99[a,b]	3.87[b]	3.55	0.029
Visibility of about 50 feet	5.84	5.97	5.78	5.80	2.64	0.072
Visibility of about 75 feet	6.64	6.68	6.61	6.67	0.83	0.438

*Mean scores are based on a 1-7 scale, with the categories 1 = "extremely unacceptable," 2 = "very unacceptable," 3 = "somewhat unacceptable," 4 = "not sure," 5 = "somewhat acceptable," 6 = "very acceptable," and 7 = "extremely acceptable." Means with different superscripts are significantly different at alpha = 0.05, according to Tukey's post-hoc test.

Table 3

Resource Condition Norm Intensity by Diver Specialization Level

	All Divers	Less Specialized	Specialized	Most Specialized	F	p
Presence of white coral	2.63*	1.43 [a]	2.51 [b]	3.81 [c]	30.44	0.000
Presence of algae	3.16	2.57 [a]	3.19 [b]	3.59 [b]	7.65	0.001
Presence of fish	5.45	5.40 [a,b]	5.37 [a]	5.61 [b]	4.25	0.015
Underwater visibility	4.29	4.24	4.30	4.30	0.14	0.873

*Mean scores are the difference between high and low points on norm curve for each attribute. Means with different superscripts are significantly different at alpha = 0.05 according to Tukey's post-hoc test.

Significant differences in normative evaluations by specialization level were found for 12 of the 16 resource conditions studied (Table 2). All four of the white coral conditions varied in the direction predicted, with more highly specialized divers giving more extreme ratings than their less specialized counterparts. In particular, acceptability ratings for seeing no white coral increased with specialization level. For the three conditions that were evaluated as unacceptable by divers (corals that are 30%, 60% or mostly white), unacceptability increased with specialization. Results for the four algae presence conditions followed a similar pattern, with "most specialized" divers giving more extreme evaluations than "less specialized" and "specialized" divers. Two of the fish presence conditions—no fish and many fish of few kinds—also varied in the direction predicted, with "most specialized" divers giving more extreme unacceptability ratings than "specialized" divers. However, "less specialized" divers did not differ significantly from the "specialized" or "most specialized" groups for these two fish presence conditions. Furthermore, norm strength, while significant, did not vary in the direction predicted for the few fish of many kinds condition. With values falling around the neutral mark, "most specialized" divers found this condition slightly less acceptable than divers with lower levels of specialization. The one significant underwater visibility condition—25 feet—followed a similar pattern, with "most specialized" divers rating this condition as slightly unacceptable and "less specialized" divers rating this visibility level as slightly acceptable.

Discussion

This study considered the connection between recreation specialization and social norms for resource conditions among recreationists who dive on coral reefs in the Florida Keys. Divers were segmented into three specialization groups ("less specialized," "specialized," and "most specialized") and resource condition norms for the presence of white coral, algae, and fish and underwater visibility were determined for each group. Based on propositions from specialization theory related to resource dependency and a desire to see the activity continue, it was expected that each specialization subgroup would have a slightly different set of norms for how physical conditions ought to be in the coral reef environment. In particular,

it was predicted that 1) resource conditions would be more salient among divers with higher specialization levels and 2) more specialized divers would be more dependent on an ecologically healthy reef (indicated by a lack of white coral and algae, many fish of many kinds, and good underwater visibility.)

Previous research has demonstrated the importance of seeing underwater plants and animals to the diving experience (Meisel-Lusby and Cottrell, 2008; Meyer et al. 2002; Todd et al., 2002; Inglis et al. 2000). Using normative methods, this study builds upon earlier studies by identifying what these underwater conditions should look like according to members of the diving community. As a larger social group, Florida Keys divers gave positive normative evaluations to resource conditions that are characteristic of healthy reefs (i.e., no white coral or algae, a diversity of fish, and good underwater visibility). Normative values for healthy reef conditions would be expected given previous studies that have shown environmental awareness among divers (Sorice et al., 2005; Thapa et al., 2006).

When resource conditions norms were compared by specialization level, significant differences occurred in the predicted direction for three of four attributes measured. In general, more specialized divers felt more strongly about the acceptability (or unacceptability) of white coral, algae, and fish conditions. Furthermore, differences in norm intensity by specialization indicate that white coral, algae, and fish may be more important to the quality of the diving experience for more specialized divers—a finding that is in line with earlier studies demonstrating higher motivation levels and lower satisfaction among high specialization divers for seeing underwater plant and animal life (Dearden et al., 2006; Meisel-Lusby and Cottrell, 2008).

However, it should be noted that the magnitude of differences in norm intensity was greatest for white coral and algae conditions. While "specialized" and "most specialized" divers differed significantly in norm intensity for fish presence, this difference was relatively small. Furthermore, norm intensity did not differ significantly by specialization level for underwater visibility. The relative differences between the latter and former variables could relate to the level of knowledge needed to appreciate them. While fish presence and underwater visibility are straightforward concepts, understanding the importance of white coral and algae requires some degree of ecological knowledge. This could be likened to a hiker who is knowledge about invasive plant species. That individual may find the presence of invasive plants to be less acceptable than a hiker who does not share the same knowledge. Previous research has found a connection between environmental knowledge and specialization (Thapa et al., 2005), a variable that may have played a role in this study.

The lack of significant differences by specialization level for underwater visibility conditions may also be explained by the degree to which it is a reflection of resource dependency. Underwater visibility, which can vary based on wind direction or season, may not be the most appropriate measure of resource dependency. On any given day, poor visibility conditions could exist at a healthy coral reef. Likewise, a coral reef that is in poor condition could have excellent underwater visibility (Chris Bergh, personal communication, 2007). If visibility is not a good indicator of resource dependency, this may help to explain the lack of variation in these acceptability ratings by specialization level.

The characteristics of social norms could be explored further in a future study of recreation specialization and resource conditions. In addition to norm intensity and individual evaluations of conditions, comparisons by specialization level could be made for the range of acceptable conditions, the minimum acceptable condition, and crystallization. In this survey, four descriptive conditions were measured for each attribute, limiting the ability to determine an exact overall minimum acceptable condition. A future study could quantify the conditions, an approach that may be more easily accomplished through the use of visual research methods (Manning & Freimund, 2004). For example, rather than a basic description of the number and types of fish, a series of images could be created in which a known number of fish and mixture of types are varied.

Future research could also focus on the connection between resource condition norms and the other dimensions of recreation specialization. For example, are differences in normative evaluations of resource conditions connected to a desire to see that activity continue in a quality way into the future? This could be addressed by also measuring support for management actions designed to protect coral reefs. Likewise, it is plausible that knowledge plays a role in normative evaluations of complex resource conditions. A future project on resource condition norms should measure knowledge in conjunction with specialization.

Findings from this study support the application of social norms to the proposition that dependency on a specific resource increases with specialization level (Ditton et al. 1992). As members of a larger social world, divers followed a similar pattern in their evaluations of resource conditions, demonstrating positive normative values for conditions that reflect a healthy coral reef ecosystem. However, with one exception, the strength of these evaluations was tied to specialization. This was particularly the case when the biological implications of the resource condition being examined were less obvious. These findings have implications both for managing the quality of recreation experiences and for protecting the environmental resources on which these experiences depend.

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