HUMAN DIMENSIONS OF WILDLIFE
https://doi.org/10.1080/10871209.2018.1461962

Routledge
Taylor & Francis Group

Snorkeling and scuba diving with manta rays: encounters, norms, crowding, satisfaction, and displacement

Mark D. Needham[a], Brian W. Szuster[b], Laura Lesar[c], Camilo Mora[b], and Daniel P. Knecht[b]

[a]Department of Forest Ecosystems and Society, Oregon State University, Corvallis, Oregon, USA; [b]Department of Geography and Environment, University of Hawaii, Honolulu, Hawaii, USA; [c]School of Travel Industry Management, University of Hawaii, Honolulu, Hawaii, USA

ABSTRACT

This research note examined encounters, norms, crowding, satisfaction, and displacement among people snorkeling and scuba diving with manta rays at sites in Hawaii. These sites are popular with up to 30 tour boats and 300 participants each day. Data from a survey of 444 participants showed that 82% felt crowded by snorkelers, 78% felt crowded by boats, and 69% felt crowded by scuba divers when viewing manta rays. In reporting their norms, participants stated they would accept seeing an average of no more than 52 snorkelers, 32 scuba divers, and 11 boats at one time. However, 77% of respondents encountered more snorkelers than their norm for seeing snorkelers, 67% saw more scuba divers than they would accept, and 68% encountered more boats than their norm. These participants were more crowded, less satisfied, and more likely to become displaced (not visit again) compared to those who encountered fewer than their norms.

KEYWORDS

Crowding; displacement; encounters; manta rays; marine wildlife viewing; norms; satisfaction

Introduction

The popularity of viewing wildlife in marine areas is increasing (Higham & Lück, 2007; Markwell, 2015). Whale watching, for example, increased from five million participants in 65 countries in 1994 to more than 13 million participants in 119 countries in more recent years (Higham, Bejder, & Williams, 2014; O'Connor, Campbell, Cortez, & Knowles, 2009). Stingrays and manta rays are also popular species for viewing with more than one million people snorkeling and scuba diving with manta rays each year, generating U.S. $140 million in economic impacts worldwide (e.g., Newsome, Lewis, & Moncrieff, 2004; O'Malley, Lee-Brooks, & Medd, 2013). Popular locations for viewing manta rays include Japan (O'Malley et al., 2013), the Maldives (Anderson, Adam, Kitchen-Wheeler, & Stevens, 2011), Mozambique (Tibiriçá, Birtles, Valentine, & Miller, 2011), and Hawaii (Needham, Szuster, Mora, Lesar, & Anders, 2017; Osada, 2010).

Studies have documented some impacts on rays caused by snorkelers and scuba divers (e.g., stress, disease, injury, feeding changes, and habituation; Osada, 2010; Semeniuk, Bourgeon, Smith, & Rothley, 2009). These viewing activities can also have social impacts because people may behave in ways that are considered to be unacceptable by other users. Social impacts include conflict among activity groups (Graefe & Thapa, 2004; Needham

CONTACT Mark D. Needham mark.needham@oregonstate.edu Department of Forest Ecosystems and Society, Oregon State University, Corvallis, Oregon 97331, USA

et al., 2017) and crowding (Manning, Valliere, Minteer, Wang, & Jacobi, 2000; Vaske & Shelby, 2008). Studies have examined crowding and encounters with other users in several marine areas (e.g., Anderson & Loomis, 2011; Bell, Needham, & Szuster, 2011; Bentz, Rodrigues, Dearden, Calado, & Lopes, 2015; Ceurvorst & Needham, 2012; Inglis, Johnson, & Ponte, 1999; Lankford, Inui, & Whittle, 2008; Manning, Johnson, & VandeKamp, 1996; Needham, 2013; Needham & Szuster, 2011; Needham, Szuster, & Bell, 2011; Szuster, Needham, & McClure, 2011; Vaske, Heesemann, Loomis, & Cottrell, 2013; Ziegler, Dearden, & Rollins, 2016). Little research, however, has examined reported encounters and perceptions of crowding in the context of viewing manta rays.

Reported encounters are subjective counts of the number of other people that an individual remembers seeing in a setting (Vaske & Donnelly, 2002). *Perceived crowding* is a negative evaluation that this number of encounters or people observed is excessive (Manning et al., 2000; Vaske & Shelby, 2008). Understanding encounters and crowding, however, may not reveal an acceptable or tolerable threshold of use, or an understanding of how this use should be managed and monitored (Needham, Rollins, & Wood, 2004). The concept of *norms* offers a theoretical and applied basis for considering these issues (Vaske & Whittaker, 2004). One line of research commonly defines norms as standards that individuals use for evaluating conditions, activities, or management actions as good or bad, better or worse; norms clarify what people believe conditions should or should not be in a given location or context (Shelby, Vaske, & Donnelly, 1996; Vaske & Whittaker, 2004). Measurement of a social norm is usually derived from averages of evaluations provided by individuals in a population (Shelby et al., 1996).

There are a number of characteristics of a social norm, including its minimum acceptable condition, prevalence, and crystallization (Manning, 2011; Needham, 2013; Needham, Haider, & Rollins, 2016; Shelby et al., 1996; Vaske, Donnelly, & Bingül, 2016). The *minimum acceptable condition* is the point where respondents perceive that conditions are no longer acceptable or impacts should not be allowed. *Norm prevalence* is the percentage of respondents who are able to specify a minimum acceptable condition (i.e., provide a norm). If prevalence is low, the issue may not be relevant to respondents or the measurement technique may be confusing or difficult. If prevalence is high, the issue is likely salient. *Crystallization* measures normative consensus or the level of agreement among respondents regarding acceptable and unacceptable conditions.

To understand and manage social impacts related to use, research has shown that it is helpful to identify relationships between the number of people that users report encountering and their normative evaluations of use-related conditions they feel should and should not be allowed to occur (Manning, 2011; Needham, 2013). Understanding these relationships is important because users who encounter more people than their normative tolerance level (i.e., their minimum acceptable condition) may feel more crowded compared to situations when they encounter fewer than their norm (Needham, Vaske, Whittaker, & Donnelly, 2014). Theory suggests that when users perceive a setting as crowded, they have at least implicitly compared conditions they experienced (e.g., number of encounters) with their normative evaluations of conditions they believe should or should not be allowed to occur in the area (Vaske & Donnelly, 2002). A comparative analysis of 13 studies involving more than 10,000 respondents, for example, consistently demonstrated that when people reported fewer encounters than their norm they felt not at all crowded, whereas those who encountered more than their norm felt slightly to

moderately crowded (Vaske & Donnelly, 2002). This finding has been replicated in more recent studies in other contexts (e.g., Bell et al., 2011; Needham, 2013; Needham et al., 2004, 2014).

These relationships among encounters, norms, and crowding have also been extended to other evaluative outcomes such as satisfaction (Needham et al., 2014). *Overall satisfaction* involves a positive response from engaging in activities and represents the degree an individual is content or pleased with his or her overall experience (Manning, 2011). Needham et al. (2014) found that anglers who experienced more impacts from social (e.g., being within sight and sound of others) and resource (e.g., litter) conditions than their norms for these conditions were less satisfied than those who encountered fewer impacts than their norms. These findings illustrate the concept of *norm congruence* where respondents judge conditions less positively (e.g., dissatisfied, crowded) after experiencing conditions (e.g., encounters) that violate their norms (Manning et al., 1996). In addition to feeling less satisfied and more crowded, it is possible that people who encounter conditions that violate their norms may also become displaced. *Displacement* involves a change in behavior (e.g., not participate or visit again in the future) that stems from adverse changes in conditions at a particular location (Anderson & Brown, 1984; Manning, 2011).

Encounters, norms, crowding, satisfaction, and displacement have usually been studied individually and in isolation in marine areas. Less is known about relationships among these concepts or characteristics of these relationships in places where viewing manta rays is popular. This is important because if people encounter conditions that violate their norms and also experience more negative outcomes (e.g., crowding, dissatisfaction, and displacement), the long-term sustainability and management of specific marine wildlife viewing opportunities may be compromised (Higham & Lück, 2007). This research note, therefore, examined relationships among these concepts for people snorkeling and scuba diving with manta rays in Hawaii. Three research questions were addressed. First, what are the encounters, norms, crowding, satisfaction, and potential displacement of these participants? Second, what proportion of participants encounter more people and boats than their norms? Third, to what extent do these participants who encounter more than their norms feel more crowded, less satisfied, and more likely to become displaced (i.e., not visit again) compared to those who encounter fewer than their norms?

Methods

In Hawaii, the most popular sites for viewing manta rays are Keauhou Bay (i.e., "Manta Village") and Hoona Bay and adjacent Makako Bay (i.e., Garden Eel Cove or "Manta Heaven"). Both sites are offshore of Kailua-Kona on the west coast of the Big Island of Hawaii, and are accessed mainly by tour boats from nearby harbors (e.g., Keauhou and Honokohau). Snorkeling and scuba diving began at these sites in 1984, and increased dramatically over time with at least 42 operators presently conducting manta ray tours at these sites using boats ranging in capacity from 6 to 40 passengers (Marine Science Consulting, 2015). On average, 12 or 13 boats visit each site at a time, although the maximum number of boats at the busiest times can be double this average (26–30 boats for 5%–10% of the time; Marine Science Consulting, 2015). Most tours last 3–5 hours, cost an average of U.S. $110 per person, and the number of participants at each site can range from 100 to more than 300 at a time (Marine Science Consulting, 2015). The Hawaii

Department of Land and Natural Resources has jurisdiction over these resources, but there has been relatively unregulated growth and minimal enforcement at these sites. In response, tour operators established voluntary safety and stewardship guidelines to control boat mooring practices and human interactions with manta rays, but these guidelines do not directly address excessive crowding or encounters among users (Manta Pacific Research Foundation, 2013).

Viewing occurs in the evening after sunset with scuba divers sitting on the seafloor surrounding strong light sources provided by the tour operators, and snorkelers floating and swimming at the surface of the ocean. Participants are also provided with underwater flashlights. Manta rays enter the water column between these two activity groups to feed on the zooplankton that are drawn to all of these lights. Groups from each tour boat rarely operate in their own separate areas. Instead, most participants share a relatively small localized area near the light sources, which causes most scuba divers, snorkelers, and boats to be within relatively close proximity (Manta Pacific Research Foundation, 2013; Marine Science Consulting, 2015).

Data were obtained from an onsite (i.e., face-to-face) survey of snorkelers and scuba divers participating in manta ray tours at the Garden Eel Cove ("Manta Heaven") site. Questionnaires were administered nightly at Honokohau harbor, which is the main departure point for most tour boats. Only a small number of tour boats utilize Keauhou harbor to visit the "Manta Village" site. Immediately prior to the departure of tour boats, passengers were briefed by researchers and encouraged to complete a questionnaire after their trip. Upon their return, passengers were approached by researchers and asked to complete a questionnaire using a lighted clipboard because it was dark by that time. Administering questionnaires immediately after the activity minimizes recall bias. Questionnaires were completed by 444 participants (89% response rate, ± 4.6% margin of error at the 95% confidence level). Of these participants, 284 (64%) were snorkeling and 160 (36%) were scuba diving during their tour, which is relatively proportionate to the overall distribution of use at this site (Marine Science Consulting, 2015).

Consistent with previous research (Manning, 2011; Vaske & Donnelly, 2002), *reported encounters* were measured in the questionnaire by asking respondents "how many of each of the following did you see on this evening's trip to see manta rays" and then providing open-ended response options (i.e., write numbers on lines) each for snorkelers, scuba divers, and boats. *Norms* were measured by asking respondents to write a number in response to the question "what is the maximum number of snorkelers that you would accept seeing at one time on a trip to see manta rays on the Kona coast" followed by "it is OK to see a maximum of _____ snorkelers." The word "snorkelers" was replaced with "scuba divers" and "boats" for questions measuring the maximum numbers of scuba divers and boats they would accept seeing. These norm questions also provided respondents with options to indicate that this "matters to me, but I cannot specify a number" or "does not matter to me." This approach for measuring norms has been used extensively (Manning, 2011; Shelby et al., 1996; Vaske & Donnelly, 2002; Vaske et al., 2016). *Perceived crowding* was measured by asking how crowded respondents felt by other snorkelers, scuba divers, and boats during their trip to see manta rays. Responses to each of these activities were on the 9-point crowding scale of 1 "not at all crowded" to 9 "extremely crowded," which has been used extensively and tested rigorously (Vaske & Donnelly, 2002; Vaske & Shelby, 2008). Consistent with previous research (Manning, 2011), *overall*

satisfaction was measured by asking "overall, how satisfied or dissatisfied are you with this evening's trip to see manta rays" with responses on a 5-point scale of 1 "very dissatisfied" to 5 "very satisfied." To measure potential *displacement*, respondents were asked if they were to experience more people than they would tolerate at this site, how likely would they "never visit again because of the situation." Responses were on a 4-point scale of 1 "very unlikely" to 4 "very likely."

Results

In total, 52% of respondents were male and 48% were female. Slightly more snorkelers were female (51%), whereas more scuba divers were male (58%). The mean (M) ages were 37 years old for snorkelers and 35 years old for scuba divers. Only 10% of respondents were from Hawaii; 66% lived in other states and 24% in other countries. Snorkelers (70%) were slightly more likely than scuba divers (60%) to live in states other than Hawaii, whereas scuba divers (29%) were slightly more likely than snorkelers (20%) to be from other countries. Most respondents (81%) were on their first tour to view manta rays on the Kona coast; 19% were repeat visitors. Slightly more scuba divers (21%) were repeat visitors compared to snorkelers (19%). All of these slight differences between the two activity groups were not, however, statistically significant, χ^2 and t = 0.34 – 4.24, p = .076 – .562, effect sizes = .03 – .10 (phi [Ø], Cramer's V, and point-biserial correlation [r_{pb}]).

On average, respondents encountered about 62 snorkelers (median = 50), 33 scuba divers (median = 30), and 12 boats (median = 10; Table 1). Both snorkelers and scuba divers saw an average of 11–12 boats. Snorkelers, however, encountered more snorkelers (M = 69.28) than did scuba divers (M = 47.61), and scuba divers encountered more divers (M = 43.01) than did snorkelers (M = 27.87). These differences between activities were significant, t = 4.35–6.90, p < .001. Using guidelines from Vaske (2008) for interpreting effect sizes, the r_{pb} = .21–.33 effect sizes suggest these differences were "typical." In addition, 82% of all respondents felt crowded by snorkelers (3–9 on scale), 78% felt crowded by boats, and 69% felt crowded by scuba divers. Respondents felt moderately

Table 1. Descriptive results for encounters, crowding, satisfaction, and displacement among respondents.

	Snorkelers		Scuba divers		Total				
	M	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	Statistical test (*t*)	*p*	Effect size (r_{pb})
Encounters with other [1]									
Snorkelers	69.28	(48.49)	47.61	(45.76)	61.70	(48.61)	4.35	< .001	.21
Scuba divers	27.87	(20.79)	43.01	(21.57)	33.29	(22.27)	6.90	< .001	.33
Boats	11.87	(5.27)	11.01	(4.79)	11.56	(5.12)	1.59	.113	.08
Felt crowded by other [2]									
Snorkelers	6.66	(1.88)	3.68	(2.39)	5.61	(2.52)	13.27	< .001	.57
Scuba divers	3.53	(2.18)	4.68	(2.13)	3.97	(2.23)	5.28	< .001	.25
Boats	4.56	(2.33)	4.47	(2.19)	4.53	(2.27)	0.41	.683	.02
Overall satisfaction [3]	4.58	(1.06)	4.70	(0.98)	4.63	(1.03)	1.14	.256	.05
Displacement [4]	1.79	(0.92)	1.59	(0.75)	1.71	(0.87)	2.29	.023	.11

[1] Cell entries are number of people encountered in activity group.
[2] Cell entries on a 9-point scale of 1–2 "not at all crowded," 3–4 "slightly crowded," 5–7 "moderately crowded," 8–9 "extremely crowded."
[3] Cell entries on a 5-point scale of 1 "very dissatisfied," 2 "dissatisfied," 3 "neither," 4 "satisfied," 5 "very satisfied."
[4] Cell entries on a 4-point scale of 1 "very unlikely," 2 "unlikely," 3 "likely," 4 "very likely" to "never visit again because of the situation experienced."

crowded by snorkelers (M = 5.61) and slightly crowded by scuba divers and boats (M = 3.97–4.53). Snorkelers felt most crowded by other snorkelers (M = 6.66, 96% felt crowded) and scuba divers felt most crowded by other divers (M = 4.68, 82% felt crowded). These difference were significant with "typical" to "substantial" (Vaske, 2008) effect sizes, t = 5.28–13.27, p < .001, r_{pb} = .25–.57. There were no differences between the two activities in their perceptions of crowding by boats (M = 4.47–4.56). Overall satisfaction was high (M = 4.63) and there was no difference between the activities. Potential for displacement was unlikely (M = 1.71) and snorkelers (M = 1.79) were slightly more likely than scuba divers (M = 1.59) to become displaced, t = 2.29, p = .023, r_{pb} = .11.

For norm prevalence, 42% of respondents specified a norm (i.e., number representing a minimum acceptable condition) for encountering other snorkelers, 38% gave a norm for seeing other scuba divers, and 52% reported a norm for boats (Table 2). Overall, between 68% and 77% either reported a norm or said the issue matters to them, but they could not provide a specific number. Less than one-third (23%–32%) said it does not matter. The largest proportion of snorkelers (49%) was able to report a norm for seeing other snorkelers, whereas 53% of scuba divers said the number of snorkelers did not matter. Similarly, the largest proportion of scuba divers (44%) was able to report a norm for seeing other divers, whereas 41% of snorkelers said the number of scuba divers did not matter. These differences between activities were significant with "typical" to "substantial" (Vaske, 2008) effect sizes, χ^2 = 18.82–70.23, p < .001, V = .20–.41. There were no differences between activities in their norm prevalence for boats.

On average, respondents who reported a norm would accept seeing a maximum of about 52 snorkelers (median = 40), 32 scuba divers (median = 25), and 11 boats (median = 10; Table 2). There were no differences between snorkelers and scuba divers

Table 2. Descriptive results for normative evaluations among respondents.

	Snorkelers	Scuba divers	Total	Statistical test	p	Effect size
Normative evaluations of other snorkelers						
Prevalence [1]				70.23	< .001	.41
Reported a norm	49	28	42			
Matters, but cannot specify a number	36	19	30			
Does not matter	15	53	28			
Norm (minimum acceptable condition) [2]	54.01	44.87	51.73	1.42	.157	.11
Crystallization [3]	40.38	26.45	37.54	3.71	.042	–
Normative evaluations of other scuba divers						
Prevalence [1]				18.82	< .001	.20
Reported a norm	32	44	38			
Matters, but cannot specify a number	27	36	30			
Does not matter	41	20	32			
Norm (minimum acceptable condition) [2]	25.91	41.01	32.40	4.25	< .001	.33
Crystallization [3]	17.44	25.37	22.54	4.40	.038	–
Normative evaluations of boats						
Prevalence [1]				3.20	.202	.09
Reported a norm	50	57	52			
Matters, but cannot specify a number	25	24	25			
Does not matter	25	19	23			
Norm (minimum acceptable condition) [2]	11.18	11.90	11.47	0.50	.617	.03
Crystallization [3]	9.85	11.80	10.66	0.24	.625	–

[1] Cell entries are percentages (%). Statistical test is chi-square (χ^2) and effect size is Cramer's V.
[2] Cell entries are means (M) for maximum number of people in activity group that respondents would accept seeing at one time. Statistical test is independent samples t-test and effect size is point-biserial correlation (r_{pb}).
[3] Cell entries are standard deviations (SD) for maximum number of people in activity group that respondents would accept seeing at one time. Statistical test is Levene's F test for homogeneity.

in the maximum number of boats or snorkelers they would accept encountering. Compared to snorkelers (M = 25.91), however, scuba divers would accept encountering a greater number of other divers (M = 41.01), t = 4.25, p < .001, r_{pb} = .33. There was significantly more crystallization (i.e., lower standard deviation [SD]) among scuba divers (SD = 26.45) than snorkelers (SD = 40.38) regarding the maximum number of other snorkelers they would accept, Levene's F = 3.71, p = .042. Likewise, there was more crystallization among snorkelers (SD = 17.44) than scuba divers (SD = 25.37) for the number of other divers they would accept, Levene's F = 4.40, p = .038. There was no difference between activities in their degree of consensus regarding the number of boats they would accept seeing.

In total, 77% of respondents encountered more snorkelers than their norm for seeing snorkelers, 67% saw more scuba divers than their norm for divers, and 68% encountered more boats than their norm for seeing boats (Table 3). Only 23%–33% of respondents encountered fewer snorkelers, scuba divers, and boats than their norms. Among snorkelers, 81% encountered a greater number of other snorkelers than their maximum tolerance limit (i.e., their norm). Likewise, 68% of scuba divers saw more divers than their norm. Across all activity comparisons, perceived crowding was significantly higher for respondents who reported more encounters than their norms (M = 4.58–7.26) compared to those who saw fewer than their norms (M = 3.04–5.60), t = 2.45–5.91, p = .047 to < .001. The effect sizes (r_{pb}) ranged from .27 to .45, suggesting the strength of these relationships among encounters, norms, and crowding for each activity can be characterized as "typical" to "substantial" (Vaske, 2008).

This pattern extended to satisfaction and displacement. Across all activity comparisons, overall satisfaction was lower for respondents who reported more encounters than their norms (M = 4.30–4.67) compared to those who saw fewer than their norms (M = 4.57–5.01; Table 4). This pattern among encounters, norms, and satisfaction was significant for five of nine comparisons, t = 2.14–3.30, p = .045 to < .001, r_{pb} = .13–.29. Similarly,

Table 3. Relationships among encounters, norms, and crowding.

	Encounters compared to norm [1]		Mean crowding with activity group [2]				
	Saw fewer than norm	Saw more than norm	Saw fewer than norm	Saw more than norm	Statistical test (t)	p	Effect size (r_{pb})
Snorkeler evaluations of other							
Snorkelers	19	81	5.60	7.26	4.59	< .001	.37
Scuba divers	33	67	3.04	4.85	3.37	< .001	.36
Boats	26	74	3.97	5.66	3.75	< .001	.33
Scuba diver evaluations of other							
Snorkelers	37	63	3.19	4.58	2.45	.047	.27
Scuba divers	32	68	3.67	5.51	3.22	.002	.37
Boats	41	59	3.50	5.55	4.43	< .001	.45
Total evaluations of other							
Snorkelers	23	77	4.66	6.74	5.07	< .001	.38
Scuba divers	33	67	3.32	5.15	4.66	< .001	.36
Boats	32	68	3.73	5.62	5.91	< .001	.39

[1] Cell entries are percentages (%) who encountered either fewer than or more than their norm (minimum acceptable condition).

[2] Cell entries are mean crowding scores on a 9-point scale of 1–2 "not at all crowded," 3–4 "slightly crowded," 5–7 "moderately crowded," 8–9 "extremely crowded" for those who encountered either fewer than or more than their norm (minimum acceptable condition).

Table 4. Relationships among encounters, norms, and overall satisfaction.

	Encounters compared to norm [1]		Mean overall satisfaction [2]				
	Saw fewer than norm	Saw more than norm	Saw fewer than norm	Saw more than norm	Statistical test (t)	p	Effect size (r_{pb})
Snorkeler evaluations of other							
Snorkelers	19	81	4.76	4.37	2.89	.045	.13
Scuba divers	33	67	4.57	4.35	0.83	.408	.09
Boats	26	74	4.70	4.48	0.99	.321	.09
Scuba diver evaluations of other							
Snorkelers	37	63	5.00	4.30	2.55	.017	.29
Scuba divers	32	68	5.01	4.44	2.93	.005	.24
Boats	41	59	4.76	4.67	0.41	.684	.05
Total evaluations of other							
Snorkelers	23	77	4.85	4.36	3.30	< .001	.18
Scuba divers	33	67	4.76	4.39	2.14	.034	.15
Boats	32	68	4.73	4.54	1.18	.238	.08

[1] Cell entries are percentages (%) who encountered either fewer than or more than their norm (minimum acceptable condition).

[2] Cell entries are mean overall satisfaction scores on a 5-point scale of 1 "very dissatisfied," 2 "dissatisfied," 3 "neither," 4 "satisfied," 5 "very satisfied" for those who encountered either fewer than or more than their norm (minimum acceptable condition).

Table 5. Relationships among encounters, norms, and displacement.

	Encounters compared to norm [1]		Mean displacement [2]				
	Saw fewer than norm	Saw more than norm	Saw fewer than norm	Saw more than norm	Statistical test (t)	p	Effect size (r_{pb})
Snorkeler evaluations of other							
Snorkelers	19	81	1.68	1.78	0.47	.637	.04
Scuba divers	33	67	1.60	1.92	2.02	.048	.17
Boats	26	74	1.69	1.94	1.27	.206	.12
Scuba diver evaluations of other							
Snorkelers	37	63	1.36	1.92	2.76	.009	.36
Scuba divers	32	68	1.43	1.73	2.27	.043	.19
Boats	41	59	1.37	1.80	2.48	.016	.28
Total evaluations of other							
Snorkelers	23	77	1.56	1.81	1.54	.127	.12
Scuba divers	33	67	1.52	1.84	2.05	.042	.17
Boats	32	68	1.53	1.89	2.73	.007	.20

[1] Cell entries are percentages (%) who encountered either fewer than or more than their norm (minimum acceptable condition).

[2] Cell entries are mean potential displacement scores on a 4-point scale of 1 "very unlikely," 2 "unlikely," 3 "likely," 4 "very likely" to "never visit again because of the situation experienced" for those who encountered either fewer than or more than their norm (minimum acceptable condition).

potential displacement was higher across all comparisons for those who experienced more encounters than their norms (M = 1.73–1.94) compared to those who saw fewer than their norms (M = 1.36–1.69; Table 5). This pattern was significant for six of nine comparisons, t = 2.02–2.76, p = .007–.048, r_{pb} = .17–.36.

Discussion

Taken together, 82% of respondents felt crowded by snorkelers, 78% felt crowded by boats, and 69% felt crowded by scuba divers. In addition, 77% encountered more snorkelers than their norm for seeing snorkelers, 67% saw more scuba divers than they would accept, and 68% encountered more boats than their norm. Among snorkelers, 81% encountered more snorkelers than their maximum tolerance and these individuals felt moderately to extremely crowded. For scuba divers, 68% saw more divers than their norm and they felt moderately crowded. These users who experienced conditions that violated their norms were more crowded, less satisfied, and more likely to avoid visiting again. Participants' average normative thresholds of about 52 snorkelers, 32 scuba divers, and 11 boats were also lower than what they reported encountering (62 snorkelers, 33 divers, and 12 boats) and actual conditions observed by other research at this site (e.g., 100–300 people at a time, 12–13 boats on average, and 26–30 boats for 5%–10% of the time; Marine Science Consulting, 2015). The relatively high degree of norm prevalence (e.g., 68%–77% either reported a norm or said it matters) also suggests these use-related issues are salient at this site. These findings have implications for both management and research.

From a management perspective, these results suggest that encounters and crowding at this site are problematic and likely exceeding social carrying capacity (i.e., level of use beyond which social impacts such as crowding exceed acceptable levels specified by evaluative standards or norms; Shelby, Vaske, & Heberlein, 1989). Shelby et al. (1989) and Vaske and Shelby (2008) recommended that when 65%–80% of users feel crowded, conditions are "more than capacity" or "overcapacity," respectively. Crowding from boats and scuba divers at this site fit these categories. If more than 80% feel crowded, such as crowding from snorkelers at this site, conditions are "much more than capacity" or "greatly overcapacity." Although there is no "one size fits all" solution, a number of possible interventions exist for managers of this site, each with advantages and disadvantages (see Needham et al., 2017 for a review). Temporal zoning (e.g., operators alternating nights they visit the site instead of most visiting every night, or staggering visit times throughout the evening rather than most visiting at the same time) could be implemented alongside fee increases to reduce use while maintaining tour operator access and profitability. In addition, interpretation at the beginning of the tour could be enhanced to educate participants about conditions they will likely encounter. If these interventions are unsuccessful, then managers could increase user fees and implement quota limits through a licensing or permit system to reduce numbers of snorkelers, scuba divers, and/or boats while maintaining operator access and profitability. Spatial zoning to physically separate users may not be feasible because: (a) it would be challenging to monitor given that use occurs in the dark and there is minimal regulation and enforcement by managers, and (b) users are encouraged to remain in close proximity to each other for safety reasons and to concentrate their lights to attract zooplankton and manta rays.

Regardless of the strategies adopted, implementation must be followed by periodic monitoring and research to assess change over time. In doing so, it is important to measure multiple concepts (e.g., encounters, norms, and crowding) to inform management of standards related to visitation and social capacity. Encounters, for example, describe existing conditions, whereas evaluations such as perceived crowding can describe user feelings about these conditions. These concepts do not, however, reveal thresholds

where conditions become unacceptable (Needham, 2013). Norms facilitate an understanding of appropriate and inappropriate conditions, thereby providing a basis for informing management responses (Manning, 2011; Shelby et al., 1996).

From a research perspective, results confirmed that when encounters exceeded norms, crowding was higher and overall satisfaction was lower compared to when encounters were less than norms. These findings parallel past research and illustrate the concept of norm congruence (Bell et al., 2011; Manning et al., 1996; Needham, 2013; Needham et al., 2004, 2014; Vaske & Donnelly, 2002). This article expanded this relationship to displacement by showing that those who encountered more than their norms were also more likely to become displaced (i.e., not visit again). Although satisfaction was lower and displacement was higher for users who encountered more than their norms, satisfaction remained relatively high (M = 4.30–4.67 on scale where 5 = "very satisfied") and likelihood of displacement was still quite low (M = 1.73–1.94 where 1 = "very unlikely") even for users whose norms were violated. This finding is consistent with studies showing that overall satisfaction usually remains high and people are still likely to return despite reporting substantial encounters or crowding because the overall experience of recreating in nature (e.g., seeing manta rays, being in the ocean, and enjoying views) often drives satisfaction and overpowers concerns about some specific events that happened during the experience (Manning, 2011; Needham et al., 2016).

Although the patterns were consistent across all activity comparisons, these relationships among encounters, norms, and overall satisfaction were statistically significant for only five of nine comparisons, and relationships among encounters, norms, and displacement were significant for six of nine comparisons. Tests of statistical significance are, however, often influenced by sample size (Cohen, 1988; Vaske, 2008). Although the total sample for this study was quite large (n = 444), the analyses required segmenting the sample by activity group (i.e., snorkelers, scuba divers), if they specified a norm (i.e., norm prevalence), and whether they encountered more or less than this norm. This reduced some cell counts, thereby decreasing statistical power. Of the 444 respondents, for example, there were 160 scuba divers, but only 21 of them both reported a norm for seeing other scuba divers and encountered fewer divers than this norm. Future research, therefore, should collect data from even larger samples to confirm relationships among concepts.

Consistent with previous research, this study used written formats (i.e., write a number) for measuring encounters and norms (Shelby et al., 1996; Vaske & Donnelly, 2002). Other studies have asked respondents to evaluate visuals, such as photographs and videos, as these can provide more realistic depictions of site conditions (Bell et al., 2011; Needham, 2013). Research has shown that visual or closed formats (i.e., circle a number) can produce more accurate results and make it easier for respondents to report their encounters and norms (Vaske et al., 2016). The largest proportions of users in this study were, however, able to specify norms and less than one-third said it "does not matter." This suggests that respondents were able to answer the written questions. Viewing manta rays at this site also occurs after sunset and depicting nighttime encounters and related conditions in visuals presents a unique challenge. Studies should explore this issue by using alternative approaches (e.g., video and virtual reality) to evaluate if they generate similar results.

Finally, these results are limited to snorkelers and scuba divers visiting this one particular site to view manta rays, and may not generalize to other areas or activity

groups. The locations on the west coast of the Big Island of Hawaii (i.e., "Manta Heaven" and "Manta Village") are among the most popular in the world for viewing manta rays in their natural habitat (Manta Pacific Research Foundation, 2013; Marine Science Consulting, 2015) and the applicability of these findings to other geographical settings represents a topic for additional empirical investigation.

References

Anderson, D., & Brown, P. (1984). The displacement process in recreation. *Journal of Leisure Research*, *16*, 61–73. doi:10.1080/00222216.1984.11969573

Anderson, L., & Loomis, D. (2011). Scuba diver specialization and behavior norms at coral reefs. *Coastal Management*, *39*, 478–491. doi:10.1080/08920753.2011.598813

Anderson, R., Adam, M., Kitchen-Wheeler, A., & Stevens, G. (2011). Extent and economic value of manta ray watching in Maldives. *Tourism in Marine Environments*, *7*, 15–27. doi:10.3727/154427310X12826772784793

Bell, C., Needham, M., & Szuster, B. (2011). Congruence among encounters, norms, crowding, and management in a marine protected area. *Environmental Management*, *48*, 499–513. doi:10.1007/s00267-011-9709-1

Bentz, J., Rodrigues, A., Dearden, P., Calado, H., & Lopes, F. (2015). Crowding in marine environments: Divers and whale watchers in the Azores. *Ocean and Coastal Management*, *109*, 77–85. doi:10.1016/j.ocecoaman.2015.03.001

Ceurvorst, R., & Needham, M. (2012). Value orientations and normative evaluations of individuals visiting coral reef areas in Hawaii. *Tourism in Marine Environments*, *8*, 111–126. doi:10.3727/154427312X13388607171204

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.

Graefe, A., & Thapa, B. (2004). Conflict in natural resource recreation. In M. Manfredo, J. Vaske, B. Bruyere, D. Field, & P. Brown (Eds.), *Society and natural resources: A summary of knowledge* (pp. 209–224). Jefferson City, MO: Modern Litho.

Higham, J., Bejder, L., & Williams, R. (2014). *Whale-watching: Sustainable tourism and ecological management*. New York, NY: Cambridge University Press.

Higham, J., & Lück, M. (2007). *Marine wildlife and tourism management: Insights from the natural and social sciences*. Cambridge, MA: CABI.

Inglis, G., Johnson, V., & Ponte, F. (1999). Crowding norms in marine settings: A case study of snorkeling on the great barrier reef. *Environmental Management*, *24*, 369–381. doi:10.1007/s002679900240

Lankford, S., Inui, Y., & Whittle, A. (2008). Exploring social carrying capacity based on perceived levels of crowding: A case study of Hanauma Bay, Hawaii. *Tourism in Marine Environments*, *5*, 43–53. doi:10.3727/154427308785855251

Manning, R. (2011). *Studies in outdoor recreation: Search and research for satisfaction*. Corvallis, OR: Oregon State University Press.

Manning, R., Johnson, V., & VandeKamp, M. (1996). Norm congruence among tour boat passengers to Glacier Bay National Park. *Leisure Sciences*, *18*, 125–141. doi:10.1080/01490409609513277

Manning, R., Valliere, W., Minteer, B., Wang, B., & Jacobi, C. (2000). Crowding in parks and recreation: A theoretical, empirical, and managerial analysis. *Journal of Park and Recreation Administration*, *15*(4), 57–72.

Manta Pacific Research Foundation. (2013). *Manta tour operator standards*. Retrieved from: http://www.mantapacific.org/manta-tour-operator-standards.

Marine Science Consulting. (2015). *Manta ray viewing boating operations and safety assessment*. Retrieved from: http://dlnr.hawaii.gov/dobor/files/2013/04/Manta-Ray-Viewing-Boating-Operations-and-Safety-Assessment_final.pdf.

Markwell, K. (2015). *Animals and tourism: Understanding diverse relationships*. Bristol, UK: Channel View.

Needham, M. (2013). Encounters, norms, and crowding at six coastal and marine areas in Hawaii. *Tourism in Marine Environments*, *9*, 19–34. doi:10.3727/154427313X13659574649902

Needham, M., Haider, W., & Rollins, R. (2016). Protected areas and visitors: Theory, planning, and management. In P. Dearden, R. Rollins, & M. Needham (Eds.), *Parks and protected areas in Canada: Planning and management* (pp. 104–140). Don Mills, ON: Oxford University Press.

Needham, M., Rollins, R., & Wood, C. (2004). Site-specific encounters, norms and crowding of summer visitors at alpine ski areas. *International Journal of Tourism Research*, *6*, 421–437. doi:10.1002/(ISSN)1522-1970

Needham, M., & Szuster, B. (2011). Situational influences on normative evaluations of coastal tourism and recreation management strategies in Hawaii. *Tourism Management*, *32*, 732–740. doi:10.1016/j.tourman.2010.06.005

Needham, M., Szuster, B., & Bell, C. (2011). Encounter norms, social carrying capacity indicators, and standards of quality at a marine protected area. *Ocean and Coastal Management*, *54*, 633–641. doi:10.1016/j.ocecoaman.2011.06.004

Needham, M., Szuster, B., Mora, C., Lesar, L., & Anders, E. (2017). Manta ray tourism: Interpersonal and social values conflicts, sanctions, and management. *Journal of Sustainable Tourism*, *25*, 1367–1384. doi:10.1080/09669582.2016.1274319

Needham, M., Vaske, J., Whittaker, D., & Donnelly, M. (2014). Extending the encounter – norm – crowding generalization to angler evaluations of other social and resource indicators. *Human Dimensions of Wildlife*, *19*, 288–299. doi:10.1080/10871209.2014.883654

Newsome, D., Lewis, A., & Moncrieff, D. (2004). Impacts and risks associated with developing, but unsupervised, stingray tourism at Hamelin Bay, Western Australia. *International Journal of Tourism Research*, *6*, 305–323. doi:10.1002/(ISSN)1522-1970

O'Connor, S., Campbell, R., Cortez, H., & Knowles, T. (2009). *Whale watching worldwide: Tourism numbers, expenditures and expanding economic benefits*. Yarmouth, MA: International Fund for Animal Welfare.

O'Malley, M., Lee-Brooks, K., & Medd, H. (2013). The global economic impact of manta ray watching tourism. *PLoS ONE*, *8*(5), e65051. doi:10.1371/journal.pone.0065051

Osada, K. (2010). *Relationship of zooplankton emergence, manta ray abundance, and scuba diver usage in Kona Hawaii*. Unpublished Masters thesis, University of Hawaii-Hilo.

Semeniuk, C., Bourgeon, S., Smith, S., & Rothley, K. (2009). Hematological differences between stingrays at tourist and non-visited sites suggest physiological costs of wildlife tourism. *Biological Conservation*, *142*, 1818–1829. doi:10.1016/j.biocon.2009.03.022

Shelby, B., Vaske, J., & Donnelly, M. (1996). Norms, standards, and natural resources. *Leisure Sciences*, *18*, 103–123. doi:10.1080/01490409609513276

Shelby, B., Vaske, J., & Heberlein, T. (1989). Comparative analysis of crowding in multiple locations: Results from fifteen years of research. *Leisure Sciences*, *11*, 269–291. doi:10.1080/01490408909512227

Szuster, B., Needham, M., & McClure, B. (2011). Scuba diver perceptions and evaluations of crowding underwater. *Tourism in Marine Environments*, *7*, 153–165. doi:10.3727/154427311X13195453162778

Tibiriçá, Y., Birtles, A., Valentine, P., & Miller, D. (2011). Diving tourism in Mozambique: An opportunity at risk? *Tourism in Marine Environments*, *7*, 141–151. doi:10.3727/154427311X13195453162732

Vaske, J. (2008). *Survey research and analysis: Applications in parks, recreation and human dimensions*. State College, PA: Venture.

Vaske, J., & Donnelly, M. (2002). Generalizing the encounter-norm-crowding relationship. *Leisure Sciences*, *24*, 255–269. doi:10.1080/01490400290050718

Vaske, J., Donnelly, M., & Bingül, M. (2016). Response format effects in encounter norm questions. *Leisure Sciences*, *38*, 284–294. doi:10.1080/01490400.2015.1092898

Vaske, J., Heesemann, L., Loomis, D., & Cottrell, S. (2013). Measuring variability in encounter norms among scuba divers and snorkelers: An application of the potential for conflict index$_2$. *Tourism in Marine Environments*, *9*, 69–90. doi:10.3727/154427313X13659574650027

Vaske, J., & Shelby, L. (2008). Crowding as a descriptive indicator and an evaluative standard: Results from 30 years of research. *Leisure Sciences*, *30*, 111–126. doi:10.1080/01490400701881341

Vaske, J., & Whittaker, D. (2004). Normative approaches to natural resources. In M. Manfredo, J. Vaske, B. Bruyere, D. Field, & P. Brown (Eds.), *Society and natural resources: A summary of knowledge* (pp. 283–294). Jefferson City, MO: Modern Litho.

Ziegler, J., Dearden, P., & Rollins, R. (2016). Participant crowding and physical contact rates of whale shark tours on Isla Holbox, Mexico. *Journal of Sustainable Tourism*, *24*, 616–636. doi:10.1080/09669582.2015.1071379