NORMATIVE TOLERANCES FOR SCUBA DIVERS AND SNORKELERS: AN APPLICATION OF THE POTENTIAL FOR CONFLICT INDEX$_2$

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Abstract.—This study examines Florida Keys snorkeler and SCUBA diver encounter norms using the Potential for Conflict Index$_2$ (PCI$_2$). Snorkelers and SCUBA divers evaluated the acceptability of encountering a specific number of other snorkelers and SCUBA divers on a 7-point scale ranging from extremely acceptable (3) to extremely unacceptable (-3). Statistical analysis results were put into PCI$_2$ templates to construct a graphic display of encounter norms for each recreation group. According to both snorkelers and SCUBA divers, as encounters increase, acceptability evaluations decrease. In addition, acceptability starts to decline at an encounter level of 5, not 0, which may be a function of safety. All recreationists consider a large number of snorkelers to be more acceptable than the same number of SCUBA divers, possibly due to their location in the water column.

1.0 INTRODUCTION

Social scientists use the concept of norms to understand and explain human behavior. Norms can refer to what most people are doing (a descriptive norm) or to what people should do (an injunctive norm) in a given situation (Cialdini et al. 1991). Social norms are standards shared by the members of a group (Vaske et al. 1986), while personal norms are an individual's own expectations learned from shared expectations (Schwartz 1977). Norms vary by the proportion of people who hold them, their strength in an individual or group, the level of agreement about them, their influence on behavior, and their wider enforcement of social regularities. Norms, however, are not static within or across people, or situations. Because norms are multi-faceted, the concept is used differently within the social sciences and in their applications to natural resource issues. For example, one conceptual tradition is descriptive, emphasizing the structural characteristics of norms (e.g., prevalence, range of tolerable conditions, intensity, crystallization), which provide a framework for evaluating behaviors in a social setting (Shelby et al. 1996, Donnelly et al. 2000, Vaske and Donnelly 2002, Vaske and Whittaker 2004).

Each year, more than 3 million tourists travel to the Florida Keys to participate in water-based recreation (Park et al. 2002). Although water-based recreation is extremely popular, relatively few studies have focused on SCUBA divers and snorkelers. The literature has examined SCUBA diver or snorkeler specialization (Todd et al. 2000, Thapa et al. 2006), carrying capacity (Davis and Tisdell 1995), motivations and expectations (Lusby and Cottrell 2008), and conflict (Lynch et al. 2004). Even norms-based literature on these groups (Inglis et al. 1999) does not compare the norms of each. This paper uses the structural norm approach to better understand SCUBA diver and snorkeler evaluations of differing numbers of encounters with other recreationists. The Potential for Conflict Index$_2$ (PCI$_2$), which is grounded in the theoretical logic of the Theory of Reasoned Action, is used to display respondents' level of agreement regarding acceptable encounter levels (Fishbein and Ajzen 1975).

1.1 The Structural Norm Approach

The structural norm approach focuses on the characteristics of social norms through use of a graphic device that Jackson (1965) initially described as the Return Potential Model (i.e., impact acceptability curves). When this approach is applied to environmental conditions, impacts are displayed on a horizontal axis while evaluation (e.g., acceptability) is displayed on the vertical axis. The curves depict social norms as aggregate averages of personal norms, but they can also describe evaluations for an individual (a personal norm curve).

Interpretation of the curve is provided by Shelby et al. (1996).

> The curve can be analyzed for various normative characteristics… The high point of the curve shows the optimum or best situation... The relative distance of the curve above or below the neutral line defines the range of tolerable conditions. Finally, the variation among evaluations at each impact level shows the amount of agreement or crystallization. Evaluative standards for backpacking in a wilderness setting, for example, often have an optimum of zero encounters, a low range of tolerable contacts, high intensity, and high crystallization while norms for hiking in a developed recreation area tend to show a greater tolerable range, lower intensity, and less agreement… For deer hunting…, too few people can be evaluated as negatively as too many; hunters want enough people to move deer, but not so many as to compete for resources.

This structural norm approach is powerful because it facilitates the development of standards for acceptable social and physical conditions that are central to management frameworks such as Limits of Acceptable Change, Visitor Impact Management, or Visitor Experience and Resource Protection (Shelby and Vaske 1991). Although the visual approach has proven useful for understanding a wide range of natural resource topics, crystallization is typically not presented. To overcome this limitation, this paper incorporates the PCI_2 into the structural norm methodology. The PCI_2 provides a way to display group agreement and the other structural characteristics of norms.

1.2 The Potential for Conflict Index$_2$

Many research studies in leisure, recreation, and human dimensions of natural resources apply survey methodologies and quantitative analytical techniques to improve understanding of complex concepts such as motivations, attitudes, and norms (Vaske 2008). The goal is to provide information that can inform and improve decisionmaking. When communicating results to nontechnical audiences, however, it is important that researchers clearly convey the meaning of the quantitative analyses and the statistical and practical implications of findings. Basic summary statistics, for example, describe a variable's distribution in terms of central tendency (e.g., mean), dispersion (e.g., standard deviation), and shape (e.g., skewness). Although these statistics provide useful information, an accurate understanding of a distribution requires consideration of all three indicators simultaneously. The challenge of communicating statistics to non-technical audiences is compounded by the complexity of concepts investigated (e.g., attitudes, norms) and measurement scales used. The PCI_2 and an associated graphic technique for displaying results were developed to facilitate understanding and interpreting statistical information (Manfredo et al. 2003, Vaske et al. 2006). This approach requires little statistical training to understand results, minimizes effort required to process information, and increases comprehension (Vaske et al., in review).

To facilitate visual understanding of social survey data, PCI_2 results are displayed as bubble graphs that simultaneously describe a variable's form, dispersion, and central tendency (see Figs. 1 and 2). The PCI_2 ranges from 0 (complete agreement, consensus) to 1 (complete disagreement, no consensus). The least amount of consensus and greatest potential for conflict (PCI_2 = 1) occurs when responses are equally divided between the two extreme values on the scale (e.g., 50 percent highly unacceptable and 50 percent highly acceptable). A distribution with 100 percent at any one point on the response scale yields a PCI_2 value of 0 and suggests complete consensus and no potential for conflict. Therefore, the size of the bubble depicts the magnitude of the PCI_2 and indicates degree of dispersion (e.g., extent of potential conflict regarding acceptance of a management strategy). A small bubble (e.g., PCI_2 = .04) suggests little potential for conflict (i.e., high consensus); a larger bubble (e.g., PCI_2 = .74) suggests more potential for conflict (i.e., less consensus). The center of the bubble is plotted on the *y*–axis corresponding to the mean value (i.e., central tendency). Given a zero neutral point for a variable, the bubble's location shows whether respondents' average evaluations are above, below, or at the neutral point or acceptable, unacceptable, or neutral, respectively. Information about a distribution's skewness is conveyed by the position of the bubble relative to the

neutral point. Bubbles at the top or bottom of the graph are more skewed than bubbles that are centrally located.

1.3 The Logic of the PCI_2

The PCI_2 formulation assumes that conflict or a lack of consensus arises because people take opposing positions on issues. As described in the Theory of Reasoned Action (TRA), people partially base their positions on subjective norms about what they think other people believe they should or should not do in a given situation (Fishbein and Ajzen 1975). Therefore, in responding to survey questions about cognitions (e.g., norms, attitudes, behavior), some people may form their evaluations relative to where they perceive others are on the topic. The "location" of one person (person *x*) relative to another person (person *y*) might be approximated as the distance between their responses (r_x and r_y). In the PCI_2, the distance, $d_{x,y}$, between people contributes to a potential for conflict that can be specified as $f(r_x,r_y)$. There are alternative ways, however, to formulate $d_{x,y}$. For example, $d_{x,y}$ can be defined as the absolute value of *x*'s response (r_x) minus *y*'s response (r_y) (i.e., $d_{x,y} = |r_x - r_y|$). Logic, however, suggests two problems with this formulation. First, two people with responses of –3 and –2 are not necessarily in conflict; they both find the situation unacceptable and differ only slightly in the degree to which their views are held. Second, people with negative or positive responses may perceive no conflict with a person who is neutral on the topic. Thus, a $d_{x,y} > 0$ may exist only between any negative response and any positive response. Thus, one possible formulation of $d_{x,y}$ (i.e., *D1*) can be defined by:

$D1 = d_{x,y} = (|r_x - r_y| - 1)$ if $\text{sign}(r_x) \neq \text{sign}(r_y)$ (e.g., $r_x = -3$ and $r_y = +1$)

otherwise $d_{x,y} = 0$

where:

$d_{x,y}$ = distance between people on a variable
r_x, r_y = response x and response y, respectively
sign = the sign for a positive or negative number (+ or –)

D1 does not include "neutral" responses in the calculation of distance. The distance from a person who has a negative evaluation to a person who has a positive evaluation is calculated as if there were no neutral category by subtracting 1 (e.g., distance from –2 to +1 is 2, not the algebraic difference of 3).

1.4 Calculating the PCI_2

For an *i*–value scale with *k* levels (e.g., $k = -3$ to $+3$), let n_k be the number of respondents for each scale value and n_h be the number of respondents at other scale values. For $k \neq h$, n_k respondents are at some distance from n_h respondents. If distances are assumed to be symmetric (i.e., $d_{h,k} = d_{k,h}$), each of the n_k respondents are a distance, $d_{h,k}$, from n_h respondents. There are $n_h n_k$ distances from "h" to "k" and the same number from "k" to "h." Therefore, $2n_h n_k$ distances contribute to a total. Consider two matrices with elements that are distances and products (e.g., $n_h n_k$). The diagonals of the matrices contain people with the same response, so total distance associated with the diagonal is 0. Other distances are 0 except those associated with a negative-positive rating combination (e.g., –2 and +3). The PCI_2 for an *i*–value scale, therefore, can be defined as:

$$PCI_2 = \frac{\sum n_k n_h d_{k,h}}{\delta} \text{ for } k = 1 \text{ to i and } h = 1 \text{ to i}$$

where:

n_k = number or respondents at each scale value
n_h = number of respondents at other scale values
$d_{k,h}$ = distances between respondents
δ_{max} = maximum distance between extreme values multiplied by the number of times this distance occurs

2.0 METHODS

2.1 Sample Design

The data were obtained from individuals who were SCUBA diving or snorkeling on the Florida Keys' reefs. Intercept surveys were conducted on the water at reef locations and at dive and snorkel businesses. When sampling occurred on the water, all reefs in the area were visited during a "patrol." On days when sampling occurred on land, all participating businesses in a region were visited at some point during the day. Interviewers attempted to intercept all parties at that location at that time. For each group, one name and address per household was obtained from the person over 18 with the most recent birthday. This phase of data collection

occurred 1 week per month between June 2006 and July 2007 and yielded 2,867 names and addresses. These individuals received a mail survey. After three follow-up mailings to non-respondents, 1,591 completed surveys were returned (response rate = 58 percent).

2.2 Variables Measured

Independent variable. Snorkelers and SCUBA divers received the same survey. Respondents were asked to classify themselves as either snorkeler or SCUBA diver, the independent variables in this article.

Dependent variables. Respondents evaluated encounters with 0, 5, 10, 15, 20, 25 and 25+ SCUBA divers (and snorkelers) on 7-point scales ranging from –3 (extremely unacceptable) to +3 (extremely acceptable), with 0 as the neutral point.

3.0 ANALYSIS

Independent-samples *t*-tests were performed between SCUBA divers and snorkelers on each of the 14 evaluation contexts (i.e., 7 ratings of encounters with SCUBA divers and 7 ratings for seeing snorkelers). Point biserial correlations (r_{bp}) were used as an indicator of effect size. Following the logic and labels suggested by Vaske (2008), a correlation of 0.1 was considered "minimal," 0.3 was "typical" and an $r_{bp} \geq 0.5$ was labeled "substantial."

Actual values of PCI_2 were computed using the SPSS macro described in Vaske et al. (in review) and available at http://welcome.warnercnr.colostate.edu/~jerryv. Using the actual distribution of responses for each of the 14 evaluation variables, the SPSS macro generated a simulation (n = 400) based on probabilities associated with the number of people reporting a particular response (i.e., –3, –2, –1, 0, 1, 2, 3). The standard deviations calculated from the simulation were used to compare the actual PCI_2 values with the following formula:

$$d = \frac{ABS(PCI_a - PCI_b)}{\sqrt{(PCI_{aSD})^2 + (PCI_{bSD})^2}}$$ where d is considered to be N(0,1)

where:
ABS = Absolute value
PCI_a = Actual PCI_2 for the first sample
PCI_b = Actual PCI_2 for a second sample
PCI_{aSD} = Standard deviation of the simulated PCI_2 distribution for the first sample
PCI_{bSD} = Standard deviation of the simulated PCI_2 distribution for the second sample

4.0 RESULTS

Both SCUBA divers and snorkelers ranked 0 encounters less positively than five encounters (Tables 1 and 2). Snorkelers evaluated five or more encounters with fellow snorkelers more positively than SCUBA diver encounters ($t \geq 7.90$, $p < .001$, $r \geq .53$ for all encounters greater than 5). SCUBA divers evaluated 10 or more encounters with other SCUBA divers less favorably than seeing comparable numbers of snorkelers ($t \geq 7.25$, $p < .001$, $r \geq .55$ for all encounters greater than 10). Snorkelers evaluated 10 SCUBA divers and 15 other snorkelers as acceptable, while SCUBA divers evaluated 10 snorkelers and 10 other SCUBA divers as acceptable. Both groups reported less consensus (larger PCI_2 values) for in-group encounters (especially 0 and 10 encounters) and there was greater consensus (smaller PCI_2) for higher encounter levels.

Displaying these results graphically using the PCI_2 clarifies the relationships. Snorkelers ranked 0 SCUBA divers as being the most acceptable density, 15 as unacceptable, and 25 SCUBA divers as the least acceptable number of encounters (Fig. 1). Snorkelers' evaluation of other snorkelers is slightly different. While there is a steady decline in acceptability evaluations as encounters increase, this decline does not occur until encounter level 5, which receives the highest acceptability rating and the most consensus about the mean. Also, consensus increases as encounters increase and acceptability decreases. All encounter levels are significant at $p<.05$ except 5 and 15.

For SCUBA divers, the PCI_2 model shows that five is the most acceptable number of encounters with other SCUBA divers (Fig. 2). The most consensus also occurs at this encounter level. From this encounter level, acceptability declines until unacceptability emerges at 15. The most acceptable number of snorkelers according to SCUBA divers is 0. At that density, as number of encounters increases, acceptability declines and consensus increases. All encounter levels are significant at $p<.05$ except 5 and 10.

Table 1.—Snorkeler evaluations of SCUBA diver and snorkeler density

	Snorkeler's Acceptability of: [a]				
Density	SCUBA Divers	Snorkelers	*t*-value	*p*-value	*r*-value
0	1.59	1.32	3.93	<.001	.667
5	1.36	1.89	10.00	<.001	.537
10	.25	1.33	16.17	<.001	.525
15	-.52	.53	15.94	<.001	.614
20	-1.20	-.35	13.28	<.001	.640
25	-1.56	-.98	10.16	<.001	.670
>25	-1.95	-1.55	7.90	<.001	.720

[a] Mean values. Variables coded on a 7-point scale: 3= extremely acceptable, 2= very acceptable, 1= somewhat acceptable, 0= not sure, -1= somewhat unacceptable, -2= very unacceptable, -3= extremely unacceptable.

Table 2.—SCUBA Diver evaluations of SCUBA diver and snorkeler density

	SCUBA Diver's Acceptability of: [a]				
Density	SCUBA Divers	Snorkelers	*t*-value	*p*-value	*r*-value
0	1.21	2.00	11.32	<.001	.501
5	1.76	1.69	1.65	.100	.482
10	.36	.78	7.25	<.001	.548
15	-.78	-.08	11.96	<.001	.577
20	-1.55	-.82	13.17	<.001	.582
25	-2.03	-1.30	13.93	<.001	.576
>25	-2.32	-1.64	13.02	<.001	.548

[a] Mean values. Variables coded on a 7-point scale: 3= extremely acceptable, 2= very acceptable, 1= somewhat acceptable, 0= not sure, -1= somewhat unacceptable, -2= very unacceptable, -3= extremely unacceptable.

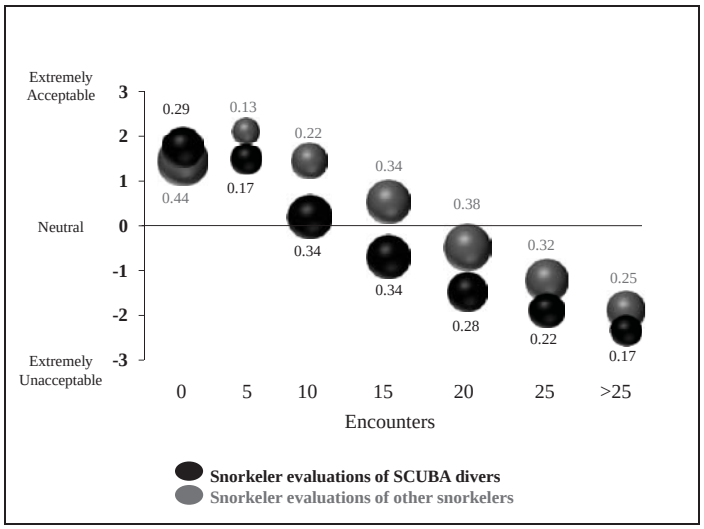

Figure 1.—Potential for Conflict Index$_2$ model illustrating snorkeler encounter norm evaluations. (PCI$_2$ values are significant at p <.05 for 0, 10, 20, 25, and >25 encounters.)

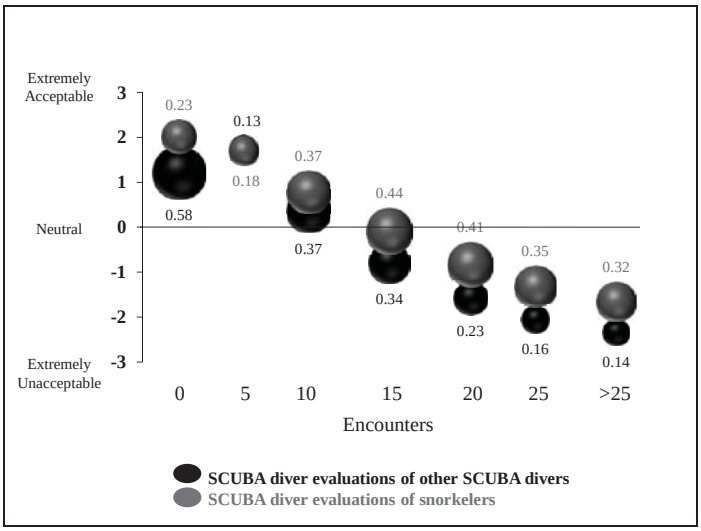

Figure 2.—Potential for Conflict Index$_2$ model illustrating SCUBA diver encounter norm evaluations. (PCI$_2$ values are significant at p <.05 for 0, 15, 20, 25, and >25 encounters.)

5.0 DISCUSSION

This purpose of this study was to analyze encounter norms between Florida Keys snorkelers and SCUBA divers. While snorkeler acceptability evaluations decrease as the number of other snorkelers increases, this decline does not occur at an encounter level of 0. Instead, five snorkelers are viewed as more acceptable than 0, with very high crystallization. This is also the case with SCUBA diver evaluations of other SCUBA divers. Therefore, while each group views 0 as the most acceptable number of recreationists from the other group, they both evaluate 5 as the most acceptable in-group encounter level. SCUBA diving and snorkeling can be dangerous activities. Therefore, it is a recommended and accepted practice that those activities are performed with a buddy (at least one other person). Therefore, the fact that 5 is the most acceptable in-group encounter level according to both groups may be a safety issue and a product of the buddy system. To test this claim, a duplicate study should be executed with encounter levels divided into smaller increments to determine precisely which encounter level is most acceptable.

When snorkelers evaluate SCUBA divers, acceptability ratings decrease as encounters increase. Also, as evaluation ratings decrease, consensus increases, meaning that as a group, snorkelers view more encounters of SCUBA divers as unacceptable. Snorkelers select 10 as the most acceptable number of SCUBA divers, but are more accepting of their own recreation group, evaluating 15 as the most acceptable number of snorkelers. Overall, when evaluating snorkelers and SCUBA divers, snorkelers repeatedly evaluate other snorkelers as more acceptable than SCUBA divers. Interestingly, SCUBA diver evaluations of snorkelers follow the same trends. SCUBA divers view 10 as the most acceptable number of other SCUBA divers, and while not fully tolerant of seeing 15 snorkelers in the water (SCUBA divers evaluate an encounter level of 15 snorkelers as unsure), they evaluate 15 as a definitively unacceptable number of SCUBA divers.

Analogous to results from snorkeler density evaluations, SCUBA divers evaluate snorkelers as more acceptable than other SCUBA divers, and do so with accord. A possible explanation for this response is the recreationists' location in the water column. Snorkelers, for the most part, stay at the surface of the water. Therefore, they are able to view most things beneath them, including SCUBA divers. Therefore, snorkelers may evaluate SCUBA divers as more unacceptable than snorkelers because divers could potentially be within their view. The presence of divers may prevent snorkelers from observing other things, such as coral or fish.

SCUBA diving allows humans to remain underwater at various depths for long periods of time. SCUBA divers may not be aware of what is at the surface of the water while they focus on what is at and below their depth. Once SCUBA divers are underwater, they are among other SCUBA divers and may not even see snorkelers. Thus, SCUBA divers also evaluate snorkelers as more acceptable than other SCUBA divers.

6.0 CONCLUSION

From a managerial standpoint, it is important to study the norms of recreationists who share resources in order to manage for individual recreation groups. If norms are violated and unacceptable encounter levels are experienced, the possibility for conflict may increase. However, SCUBA divers and snorkelers were consistent in their evaluations of each recreation group, which suggests that perhaps these recreationists can be managed collectively.

While norms research is important, it is done in vain if the results cannot be easily conveyed. The PCI_2 model graphically displays the results of norms studies, acceptability levels, and consensus, facilitating interpretation and communication.

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