Public perception of shark management in the False Bay region

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Abstract

Using data captured by Pardoe and Husband in 2014, this study investigated the publics' perception of how the risk of a shark attack in False Bay has been managed. The data, that was collected in wave 1 (2014) and wave 2 (2015), was subjected to single factor analysis of variance tests and thereafter incorporated in a logit model to explain satisfaction levels towards shark management. The results indicated that the majority of respondents were satisfied with shark management, more so than they were in 2014. However, a large proportion of respondents indicated that there was not enough information available to the public.

Introduction

Human-Wildlife Conflict has become a significant and growing phenomenon that places both humans and wildlife at risk (Crossley, et al., 2014). Moreover, shark conservation has become increasingly more important amongst scientists, resource managers, politicians and the general public (Heupel & Simpfendorfer, 2009). This is evident in the case of False Bay, where two measures of shark management, namely the Shark Spotters Program and the shark exclusion net on Fish Hoek beach, have been implemented with the sole purpose of mitigating shark-human conflict in the waters of False Bay. The Shark Spotters programme was adopted and implemented in 2004 by the City of Cape Town in response to an increase in shark sightings in the waters of False Bay. With the aim of mitigating a shark-human interaction, the Shark Spotters program attempts to improve the safety of beach users through shark warnings and emergency assistance in the event of a shark attack. Although proven to be very successful in warning beach users of shark sightings, the Shark Spotter program has not succeeded in preventing every shark attack due to human error, weather and sea conditions (Shark Spotters, 2015). As a result, the City Of Cape Town, in collaboration with the Shark Spotters program, adopted the trial of a shark exclusion net on Fish Hoek beach to reduce the risk of a shark-human encounter in 2013. When deployed, the net encloses a small section of the beach front to create a safer swimming area. Cognisant of potential marine life entanglement, the net is deployed and removed on a daily basis. Furthermore, deployment times of the net are subject to weather conditions (Shark Spotters, 2015). Since its implementation in March 2013, the trail phase of the exclusion net has proven to be a cost-effective, non-lethal shark safety measure with minimal impact on marine life (Lewis, 2014).

Literature has suggested that sharks suffer from a negative public image which could be attributable to their ability to inflict severe harm to a human. As a result of these negative public perceptions of sharks, shark conservation efforts worldwide have been hindered (Crossley, et al., 2014). Consequently, understanding public perception towards mitigating shark-human conflict has become fundamental to many shark management programmes worldwide who aim to protect beach uses from sharks whilst promoting their conservation. For that reason, the main aim of this paper is to identify variables that can account for the general publics' perception towards shark management in False Bay.

This paper served as a follow up study done by Pardo & Husband (2014) on the 'Public opinion of Fish Hoek's shark exclusion net and shark management in False Bay'. Moreover, the overall focus of this paper was on the public's perception of shark management and how satisfaction levels towards shark management was influenced. Negative perceptions were expected from individuals whom suggested the use of lethal measures to mitigate shark-human conflict. Similarly, those who felt that there was not not enough information available about how the exclusion net functions were expected to have a negative perception towards shark management.

Methods

This study constitutes a follow up analysis on data that was captured by Pardoe and Husband in 2014. Pardoe and Husband (2014) were specifically interested in the public's perception of the shark exclusion net and shark management on Fish Hoek beach. Together with the Shark Spotters program, they developed a survey that consisted of eleven questions. The purpose of the survey was to determine the level of support of the exclusion net amongst beach goers. The survey consisted of questions relating to shark management satisfaction (section one) and respondents personal profile (section two). Section one comprised of questions pertaining to: respondent's perceived risk of a shark attack, availability of information about net, main sources of information, animal entanglement concern, treknet fisher's income concern, responsibility for shark management, acceptable control measures to reduce shark attacks, size and deployment of net and its permanency. Section two comprised of personal profile questions pertaining to the respondent's place of residence, age, gender, level of education and occupation. Furthermore, the respondent was asked whether or not they swam and whether or not they knew the difference between the exclusion net in Fish Hoek and the gill net in Kwazulu-Natal (Pardoe & Husband, 2014). This study has adopted the survey developed by Pardoe and Husband, however, it has shifted its focus towards the public's perception of general shark management in False Bay.

Due to the nature of this study, further ethics clearance from the UCT Ethics in Research Committee was not required. The 71 surveys administered by Pardoe and Husband (2014) have been used in this study, alongside a further 20 uncaptured surveys from 2014, to create a wave of responses for 2014 consisting of 91 surveys, hereon referred to as wave one. Furthermore, this paper will use an addition of 64 surveys that has been captured in 2015 to create a wave of responses for 2015, hereon referred to as wave two. The surveys administered in wave two were conducted in collaboration with the Shark Spotters program on Fish Hoek beach on the 21st March 2015. A total of 155 surveys have been administered with 91 surveys administered in wave one and a further 64 surveys administered in wave two, all of which were usable.

Table 1: Details of Explanatory variables used in the analysis of variance model to assess factors influencing satisfaction levels towards shark management in False Bay

Variable name	Definition
Management	Two-level factor of satisfaction with shark management (1=yes, 0 = no)
Risk	Likert scale measuring perceived risk of shark attack (1= no risk,10 = severe risk)
Info	Two-level factor of satisfaction with amount of information available (yes, no, unsure)
Infosource	Categorical variable indicating source of information regarding net
Entanglement	Three-level factor measuring concern with marine entanglement (yes, no, unsure)
Treknet	Three-level factor measuring concern with impact on treknet fishers income (yes, no, unsure)
Control Measure	Categorical variable indicating the most appropriate control measure for shark attacks
FhvKzn	Two-level factor indicating whether respondents know the difference between Fish Hoek shark net and KZN gill nets (yes or no)
Children	Integer indicating number of children in respondents party
2014 wave	Indicates the satisfaction levels in 2014 (wave 1)
2015 wave	Indicates the satisfaction levels in 2015 (wave 2)
Demographics	
Age	Integer indicating respondents age
Gender	Two level dummy variable (1= male, 0 =female)
Education	Four-level factor indicating respondent's education level (Incomplete, Matric, College, University)
Occupation	Categorical variable indicating respondents occupation

Various dummy variables were created for some of the categorical variables stated in table 1. Instead of capturing the main source of information about shark management in False Bay as a single categorical variable, Pardoe and Husband (2014) constructed a dummy variable for each item. Moreover, appropriate control measures have been captured by constructing a dummy variable for each item (Cull for population control, Kill for population control, Kill for population control). Similarly for education, dummy variables were constructed for incomplete high school, matric, college and university. Furthermore, occupation was captured by constructing dummy variables for each item

This paper has adopted two analytical approaches. The first approach consisted of conducting a series of one way analysis of variance tests in excel to investigate the proposed univariate relationships between stated satisfaction levels with shark management in False Bay and various independent explanatory variables. Thereafter, a multivariate logit model was conducted using the significant variables.

The logit model, given by $\log\left(\frac{P_{it}}{1-P_{it}}\right) = X\beta_i + \varepsilon_{it}$, was run as a maximum likelihood routine using Stata 13. The model explained the probability (P_{it}) of satisfaction levels with shark management in False Bay by using a matrix (X) of explanatory variables to which a scalar (β) of coefficients were fitted, whilst the marginal effects were calculated at the mean. Pardoe and Husband (2014) found that the number of children a respondent has doesn't influence their perception of shark management in False Bay. However, using a much larger sample size, it was hypothesized that respondents with children

influenced the way they perceived shark management in False Bay. Furthermore, it was expected that those respondents who rated risk of a shark attack in False Bay most highly to have a low satisfaction level for shark management in False Bay. Moreover, it has been hypothesized that satisfaction levels towards shark management in 2014 have increased in 2015 due to exclusion net having successfully completed its trial phase at Fish Hoek beach (Lewis, 2014).

Results

It was found that 70 % of respondents were satisfied with the way in which the risk of a shark attack have been managed in False Bay, whereas 13 % were unsatisfied with shark management and the remaining 17% were unsure of how they felt about the way in which sharks have been managed in False Bay.

A series of ANOVA tests have been conducted and captured in table 2 in order to identify the significant explanatory variables. It was found that there was a partially significant relationship between the respondent's risk of a shark attack and their level of satisfaction with shark management ($F=1.79^{\dagger}$). It was interesting to note the change in perceived risk of a shark attack from 2014 to 2015. Pardoe & Husband (2014) found no significant correlation between the perceived risk and the satisfaction levels of shark management (F=0.91). It appeared that there has been a shift in pereived risk from 2014 to 2015 amongst beach goers. Similarly, it was found that there has been a structural change from 2014 to 2015 in satisfaction levels towards shark management. Respondents were 4 % more satisfied with shark management in 2015 than they were in 2014, whilst respondents were 6% less unsatisfied and 7 % less unsure about how they felt towards shark mamnagement in False Bay.

Given the strong suspicion that marine entanglement could impact satisfaction levels, a strong correlation between the concern for marine entanglement and satisfaction levels of shark management was found (F=3.63**). Marine entanglement concern appeared to be more prominent amongst those respondents whom were unsure (86%) of the way in which they felt about how shark attacks have been managed in False Bay. Regardless of how respondents felt towards shark management, a loss of treknet fisher income due to the exclusion net appeared to be a concern for most respondents, however, the relationship between treknet fisher concern and satisfaction levels were highly insignificant (F=0.25).

The second block of data in table 2 captured information pertaining to the respondent's demographics. There was no significant correlation between the respondents age and how they felt about shark management and it did not matter what level of education the respondent had received. Contrary to the belief that children would play a role in how respondents felt about shark management in False Bay, it was found that there is no correlation between the number of children a respondent has and their satisfaction levels of shark management (F=0.02). However, gender appeared to have a significant influence on satisfaction levels with shark management (3.3**). The majority of respondents unsatisfied with shark management appeared to be male (67%), where the majority of respondents unsure about how they felt about shark management appeared to be woman.

Table 2: Respondent profiles by level of satisfaction with shark management in False Bay

	Unsatisfied n=21	Satisfied n=108	Unsure n=26	ANOVA F stat
Risk of shark attack (out of 10)	6.7	5.8	6.7	1.79†
Marine entanglement concern	47%	65%	86%	3.63**
Treknet fisher concern	73%	72%	80%	0.25
2014 responses (wave 1)	15%	74%	20%	
2015 responses (wave 2)	9%	78%	13%	2.25†
Age in years	48.7	45.6	41.5	0.42
Gender (% males)	67%	53%	31%	3.3**
Education				
Incomplete high school	10%	6%	15%	1.44
Matric	19%	23%	23%	0.09
College	5%	16%	8%	1.32
University		9%	12%	1.18
Number of children in party	0.714	0.769	0.731	0.02
Occupation				
Student		9%	12%	1.18
Unemployed	10%	6%		1.13
Retired	24%	21%	15%	0.29
Home maker		7%	8%	0.83
Craftsman		3%		0.66
Independent businessmen	24%	14%	12%	0.81
Professional	33%	29%	42%	0.91
Retail	10%	3%	8%	1.29
Other occupation		8%	4%	1.18
Enough information about net		52%	20%	13.21***
Source of information				
Newspaper	19%	26%	35%	0.74
Internet	4%	11%	15%	0.67
Television	14%	5%	15%	2.45*
Billboards	14%	22%	27%	0.54
Pamphlets		4%	4%	0.4
Local talks	19%	9%	12%	0.86
Friends and family	24%	16%	12%	0.66
No useful info	10%	9%	8%	0.03
Appropriate control measure				
Cull for population control	10%	3%	12%	2.13†
Kill for population control	14%	6%	4%	1.28
Do nothing		6%	4%	0.8
FhvsKzn	29%	57%	31%	5.25***

*** signifies p≤0.01, **signifies p≤0.05,* signifies p≤0.10,†signifies p≤0.20

Various differences across the satisfaction towards shark management for different types of occupations were found, however, these differences were not statistically significant. Furthermore, a strong relationship between the amount of information pertaining the exclusion net and level of satisfaction of shark management was found (F=13.21***). Indicating that an increase in information available to the public will correspond to an increase in satisfaction levels. It was found that 52% of those respondents who were satisfied with shark management felt that there was enough information pertaining the exclusion net, whereas 20% of respondents unsure of their feelings about shark management felt there was enough information and no respondent who was unsatisfied about shark management felt there was enough information about the exclusion net. Only 1 of the sources of variable dummy variable was found to be statistically significant (F=2.45*).

Moreover, the last block of data in table 2 captured what respondents thought were the best control measures for shark management. Very little support for culling and killing for population control was found. Those unsatisfied with shark management were found to prefer lethal control measures, with 10% in favour of culling and 14% in favour of killing for population control, while no respondent preferred doing nothing as a control measure. Despite these findings, the control measures variables were not found to be statistically significant. The variable indicating whether people knew the difference between the Kwazulu-Natal net and Fish Hoek net was found to be statistically significant (F=5.25**), indicating that the more aware of the difference respondents were, the more satisfied they were with shark management in False Bay. It was found that 57% of satisfied respondents were aware of the difference, whereas only 29% of unsatisfied respondents were aware of the difference.

Table 3 illustrates what significant explanatory variables were combined to run a multivariate logit model. Model 1 regressed satisfaction levels for shark management on the stated risk of a shark attack in False Bay. Model 1 passed Wald's joint specification test at $p<0.20$ and resulted in a coefficient on the risk variable that was also marginally significant at the $p<0.20$. Moreover, the marginal effect was found to be marginally significant at the $p<0.20$, indicating that satisfaction levels would decrease by approximately 2% with for each additional unit of risk. Model 1 resulted in a McFadden R-squared of 0.0184.

Model 2, which combined the risk and entanglement variable in the logit model, passed the Wald joint specification test at $p<0.10$ with a coefficient on the entanglement variable significant at $p<20$. Contrary to what one would expect, the marginal effect of entanglement was significant and positive at $p<0.20$, indicating that satisfaction levels would increase by 10% with an additional increase in the concern for marine entanglement. It was found that by running model 2, the McFadden's R-squared increased slightly to 0.0431.

Model 3 combined the risk variable with entanglement, while controlling for the gender of the respondent, to run a multivariate logit model. It was found to have passed the Wald joint specification test at $p<0.05$ and increased the McFadden R-squared to 0.0766. The coefficient on gender was significant at $p<0.10$, while the risk and entanglement variables were still significant at $p<0.20$. The marginal effect on gender was negative and significant at $p<0.10$, indicating that male respondents were approximately 1.2% less likely to be satisfied with the way the risk of shark attacks have been managed in False Bay than females.

Table 3: Multivariate model of satisfaction level of shark management in False Bay (coefficients and standard errors followed by marginal effects and their standard errors)

Explanatory variable	Model 1	Model 2	Model 3	Model 4
Risk	-0.0175†	-0.1485†	-0.1469†	-0.1272†
	0.0923	0.0989	0.0982	0.0992
	-0.0175†	-0.0185†	-0.0172†	-0.0135†
	0.0119	0.7611	0.0112	0.0105
Entanglement		0.7611†	0.8598†	0.8030†
		0.5107	0.5234	0.5431
		0.1017†	0.1098†	0.01932†
		0.7121	0.0704	0.0105
Gender			-1.0224*	-1.2154**
			0.5723	0.6034
			-0.01164*	-0.1258**
			0.0609	0.0578
fhvskzn				1.1929**
				0.5615
				0.1358**
				0.06445
Constant	2.449***	2.1827***	2.7647***	2.26***
	0.6524	0.7439	0.8316	0.8593
Observations	128	120	120	120
McFaddens's R-squared	0.0184	0.0431	0.0766	0.1227
Walds's chi squared	2.12	4.52	8.03	12.87
	p=0.1468	p=0.1044	p=0.0453	p=0.0119

*** signifies p≤0.01, **signifies p≤0.05,* signifies p≤0.10,†signifies p≤0.20

Model 4 was a multivariate logit model that was run by combining the risk, entanglement, gender and fhvskzn variables. It was found that by running model 4, the McFadden R-squared improved to 0.1227. Moreover, model 4 passed Wald's joint specification test at $p<0.05$, indicating that model 4 was the better model in terms of overall goodness of fit. It was found that the coefficient on the fhvskzn variable was significant at the $p <0.05$ while the marginal effect of fhvskzn was also significant at $p<0.05$. The marginal effect of a one unit increase in the amount of respondents whom knew the difference between the Fish Hoek exclusion net and the Kwazulu-Natal gill net would result in a 14% increase of satisfaction levels of shark management in False Bay.

Discussion and conclusion

The aforementioned results have shown some discrepancies between beliefs and facts. Furthermore, they have shown disparities between the respondents' perception of shark attack risk and the level of satisfaction of shark management in False Bay. It was found that the majority of respondents were fearful of sharks, however, more than half of the respondents were satisfied with the manner in which shark attack risks have been managed in False Bay. Risk management theory has suggested that reactions to low probability events (such as a shark attack) are relatively sensitive to the possibility of strong negative consequences, irrespective of its probability (Loewenstein, et al., 2001; Crossley, et al., 2014). Low propbability-high consequence incidents, such as a shark attack, are vivid in nature, thus they tend to skew risk perceptions of respondents (Sustein, 2002; Crossley, et al., 2014). Evidence from the data analysis in this study suggested that respondents had skewed risk perceptions because it was found that an increase in the perceived risk of a shark attack would result in a fall in satisfaction levels toward shark management in False Bay.

Moreover, it was found that marine life entanglement was a pressing concern for the majority of respondents. As a result, satisfaction levels have been found to be explained by how respondents perceive shark management's impact on the marine life. However, despite the current concern for marine life, respondents were generally satisfied with the management of sharks in False Bay, suggesting that they were cognisant of the minimal impact on marine life from the shark exclusion net on Fish Hoek beach. An alarming result found was that a large proportion of respondents felt that there was not enough information available to the public. It was found that television played some role in influencing the public's perception about shark management. Literature supports this finding as it was argued by Crossley et al (2014) that public perceptions of outcomes from a shark attack have been socially constructed and emphasised by causal stories in movies and media, resulting in the rejection and fear of sharks. Amongst the unsatisfied respondents, 14% got their source of information pertaining shark management from television. Fishbein and Ajzen (1975) argued that conventional attitude theory assumed attitude to be a function of the respondent's beliefs and values. It was therefore expected that the lethal mitigation measures (culling and killing) perceived as appropriate and efficient by respondents would lead to them to being unsatisfied with shark management in False Bay. However, no relationship between mitigation measures and satisfaction levels of respondents were found by this study. Furthermore, it was found that respondents who were cognisant of the difference between the shark net in Fish Hoek and the gill net in Kwazulu-Natal were more satisfied about how sharks have been managed. This study found a general improvement in the public's perception towards shark management from 2014 to 2015. This was an interesting transformation, particularly because respondents felt that there was not enough information available for the public.

Given the findings of this study, it appears the only way in which the general perception towards the way in which sharks have been managed in False Bay would be through providing more information pertaining to how the risk of a shark attack have been managed. Furthermore, education may help improve the attitudes of those respondents whom were found to be unsatisfied with shark management. It may help to educate the public via television about the difference between the nets used in Fish Hoek and Kwazulu-Natal and their respective impact on marine life.

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