ASSESSING THE ENHANCEMENT OF AWARENESS OF CONSERVATION ISSUES USING CROSS-SECTIONAL AND LONGITUDINAL SURVEY DESIGNS

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Two survey designs were used to assess the enhancement of awareness of conservation issues in visitors to South African nature reserves: a longitudinal design, in which one sample was interviewed on their arrival and again on their departure, using matched questionnaires; and a cross-sectional design, in which two samples were selected, the first being interviewed on their departure and the second on their arrival, using one questionnaire. No statistical difference was found in the results using the two survey designs. The cross-sectional design is considered the better choice.

The awareness of conservation issues amongst visitors to three South African nature reserves was assessed by means of before-and-after surveys to ascertain whether their awareness of conservation issues had been enhanced as a result of their visits (Preston & Fuggle, in press; Preston, 1983). Two survey designs were used. This paper compares the results of the cross-sectional and the longitudinal survey designs.

The two survey designs were used in each of two nature reserves administered by the Natal Parks, Game and Fish Preservation Board: Hluhluwe Game Reserve, a lowveld reserve in Zululand which accommodates a maximum of 66 overnight visitors, and Giant's Castle Game Reserve, a mountain reserve in the Natal Drakensberg which accommodates a maximum of 66 overnight visitors. Only the longitudinal design was used in the third reserve studies, Londolozi Private Game Reserve.

METHOD

Survey design

A longitudinal survey design was logistically preferable in each of the three reserves studied. Visitors to the reserves were questioned on their arrival, and again on their departure, using two different but matched questionnaires. A control group was used to indicate "what would have happened to the experimental group if it had not been subjected to the experimental variable" (Oppenheim, 1966, p.18).

A weakness in longitudinal designs is that "if the respondents are aware that they are participating in a survey or experiment, this in itself will produce certain changes" (Oppenheim, 1966, p.17). To test for such an effect, an independent cross-sectional survey design was utilized at two of the reserves studied (Hluhluwe and Giant's Castle) in addition to the longitudinal design. In these reserves a second sample was surveyed, using the 'before' questionnaire of the longitudinal design only on their departure.

In order to be able to isolate an independent variable it is necessary to control for other variables that could influence the dependent variable (Babbie, 1973). This was achieved by randomizing such variables as sex, age, language, occupation, education and length of stay in the reserve, and by excluding others (e.g. by only interviewing South African residents and by using an age cut-off).

The recommended sample size for a population of 20 000 (and more), taking a 95% confidence interval with a precision of 10%, is 100 respondents (Yahame, 1967). In this study a sample size of 150 respondents was selected.

Data collection

Fieldwork was completed in the three nature reserves between 27th June and 10th October 1982. Respondents were surveyed using self-administered questionnaires, completed in the presence of the researcher.

All South African residents over the age of 14 years who stayed overnight in the reserves were approached. Respondents were interviewed as soon as possible after their arrival in the reserves, and as late as possible before their departure. They were interviewed in their home language, and respondents visiting the reserve(s) more than once during the period of research were only interviewed once. The response rate at Hluhluwe, using the longitudinal design, was 78% (154 respondents). Using the cross-sectional design, the before responses were those from the longitudinal design, and the after responses were from a sample yielding an 81% response rate (159 respondents). The respective figures for Giant's Castle were 79,6% (148 respondents) and 85,4% (151 respondents).

Questionnaire design

A battery of 50 matched questions were devised to assess awareness of conservation issues. The design of the questions was such that approximately 40% of responses were likely to be scored positively. This allowed for increases to be easily noted, without the questionnaires being demoralizingly difficult. In each questionnaire two dummy questions that allowed respondents to answer with absolute certainty were interspersed amongst the other questions. One question was repeated in the before and after questionnaires as a reliability check (Bailey, 1978). This question was not scored. As a further check respondents were invited to elaborate on their replies to selected questions after they had completed the questionnaire. This provided a direct check that the respondents had in fact understood the questions and their responses.

Closed response categories were used, respondents answering on a slightly modified Likert scale: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, Don't Know. Abbreviations were used (i.e. SA, A, N, D, SD, DK), rather than numbers. This aided respondents by making the response categories easier to remember and reduced the 'halo effect' (Meyers & Grossen, 1974). The issues covered in the before questionnaire were covered in the same sequence in the after questionnaire.

The responses of Strongly Agree and Agree have been collapsed, as have those of Strongly Disagree and Disagree, for the purpose of analysis. It was felt necessary to offer respondents a wider range of options so as to increase the likelihood of their committing themselves to an opinion.

Statistical tests

Normality could not be assumed, and it was consequently necessary to adopt non-parametric tests. The test used for the longitudinal design was the McNemar Test of Symmetry, a non-parametric chi-squared test for matched pairs. The test used for

cross-sectional design was the Pearson's Chi-squared Test, a non-parametric test for independent samples.

Limitations of these techniques must be mentioned. The McNemar test is only concerned with what changes there have been, it is not sensitive to sample size if no changes occur. For example, the increase in both of the samples in Table 1 would be deemed statistically significant at a 95% significance level.

TABLE 1 *Illustration of the lack of sensitivity of the McNemar Test of Symmetry to the size of the 'no change' component in the analysis (p<0,05).*

		BEFORE					BEFORE		
		Neg	Pos	Total			Neg	Pos	Total
AFTER	Neg	4	12	16	AFTER	Neg	10 000	12	10 012
	Pos	31	3	34		Pos	31	3	34
	Total	35	15	50		Total	10 031	15	10 046
	n:			50			10 046		
	McNemar Value:			8,395			8,395		
	Critical region:			>3,841			>3,841		

The test is only concerned with the compartments where there has been a change - either negative to positive, or positive to negative.

A further limitation, and one that pertains to the Pearson's Chi-squared Test as well, is sensitivity to changes in sample size when examining ratios between compartments. If the ratios between the compartments are kept constant, and the frequencies are changed, the chi-squared value will change. This is of consequence when comparing sub-groups of different sizes.

Pre-tests and pilot studies

Ten pre-tests and three pilot studies were necessary to mould the questionnaires into two balanced before-and-after evaluations. The final pilot study was conducted at the Kirstenbosch National Botanical Gardens in Cape Town. This was for logistic convenience, the responses being taken to be equivalent to those of visitors to nature reserves. Respondents in the pilot study were selected so as to approximate the reserve sampling frames as closely as possible: i.e. be South African residents, over the age of 14 years, from the higher socio-economic brackets, and interested in nature (having visited or intending visiting a nature reserve). The before responses at Kirstenbosch were sufficiently similar to those in the three reserves to provide retrospective confidence in the use of the Kirstenbosch National Botanical Gardens as a pilot study venue.

The results of the final pilot study undertaken on 22nd June 1982, to test the null hypothesis that there is no difference between the the overall responses to the before and after questionnaires, is shown in Table 2.

TABLE 2 *Test for equivalence in before and after questionnaires using the McNemar Test of Symmetry (p<0,05; n = 42).*

		AFTER		<
		Negative	Positive	Total
BEFORE	Negative	483	132	615
	Positive	143	292	435
	Total	626	424	1 050
McNemar Value:		0,440		
Critical region:		>3,841		

The null hypothesis is accepted. Thus there is no difference between the responses to the two matched questionnaires when they were administered simultaneously.

RESULTS

The same null hypothesis was tested using both the longitudinal and the cross-sectional designs at Hluhluwe and Giant's Castle, viz. that there is *no* change in respondents' awareness of conservation issues as a result of their visit to the reserve. The results of the longitudinal survey design was administered at the two game reserves are given in Table 3.

TABLE 3 *Tests for a change in awareness of conservation issues amongst visitors to two game reserves using a longitudinal design and the McNemar Test of Symmetry (p<0,05).*

Hluhluwe (n = 154)

		AFTER		
		Negative	Positive	Total
BEFORE	Negative	1 723	677	2 400
	Positive	504	946	1 450
	Total	2 227	1 623	3 850
McNemar Value:		25,342		

Giant's Castle (n = 148)

		AFTER		
		Negative	Positive	Total
BEFORE	Negative	1 490	696	2 183
	Positive	524	993	1 517
	Total	2 014	1 686	3 700
McNemar Value:		23,468		
Critical region:		>3,841		

The tests for cross-sectional survey design administered at the two reserves are given in Table 4.

TABLE 4 *Tests for a change in awareness of conservation issues amongst visitors to two game reserves using a cross-sectional design and the Pearson Chi-square Test (p<0,05).*

Hluhluwe (n = 154 Before and 159 After)

	BEFORE	AFTER	TOTAL
NEGATIVE	2 400	2 354	4 754
POSITIVE	1 450	1 621	3 071
TOTAL	3 850	3 975	7 825
Pearson's Chi-square Value:	7,792		

Giant's Castle (n = 148 Before and 151 After)

	BEFORE	AFTER	TOTAL
NEGATIVE	2 183	2 136	4 319
POSITIVE	1 517	1 639	3 156
TOTAL	3 700	3 775	7 475
Pearson's Chi-square Value:	4,475		
Critical region:	>3,841		

The Pearson's chi-squared values for both reserves are greater than the critical value of 3,841 and the null hypothesis is rejected in both instances. Thus in both reserves both survey designs reveal a statistically significant increase (p<0,05) in awareness of conservation issues as a result of respondents visiting the reserve.

The after responses of the two designs can be tested for pre-test effect on the post-test: that is, to determine whether there is a difference between the results obtained using the longitudinal design and those obtained using the cross-sectional design. (Table 5).

TABLE 5 *Test for a statistically significant difference (p<0,05) between longitudinal and cross-sectional experimental designs to detect changes in conservation awareness in two game reserves.*

Hluhluwe

(n = 154 Longitudinal and 159 Cross-sectional)

	After		
	NEGATIVE	POSITIVE	TOTAL
LONGITUDINAL	2 354	1 621	3 975
CROSS-SECTIONAL	2 227	1 623	3 850
TOTAL	4 581	3 244	7 825

Pearson's Chi-square Value: 1,525

Giant's Castle

(n = 148 Longitudinal and 151 Cross-sectional)

	After		
	NEGATIVE	POSITIVE	TOTAL
LONGITUDINAL	2 014	1 686	3 700
CROSS-SECTIONAL	2 136	1 639	3 775
TOTAL	4 150	3 325	7 475

Pearson's Chi-square Value: 3,499

Critical region: > 3,841

As both chi-squared values are below the critical value of 3,841 the null hypothesis is accepted in both cases: there is no statistical difference between the results obtained using the longitudinal design and those obtained using the cross-sectional design.

DISCUSSION AND CONCLUSIONS

No statistical difference is found between the results of the longitudinal design and the cross-sectional design, both in Hluhluwe and in Giant's Castle. This verifies the pilot study, in which the before and after questionnaires were found to be equivalent measures of awareness of conservation issues for the longitudinal surveys. (They were always presented in the same order, so as to compensate for the pre-test effect on the post-test).

In the pilot study, which acted as the control, the before and after questionnaires were administered consecutively, without any 'experience' to change awareness. In the reserves the respondents had the length of their stay to (possibly) mull over the questions and issues raised. (There is no doubt that the before questionnaire occasionally stimulated interest and debate). This is thus an uncontrolled variable for which it is difficult to compensate - to have tested each questionnaire on independent samples would have neglected to allow for the pre-test effect on the post-test.

A second, more taxing problem in using a longitudinal design is the balancing of individual questions. As respondents in a nature reserve could discuss any question raised in the before questionnaire with an interpretive officer (or knowledgeable companion), the issue had to be addressed from a different perspective in the after questionnaire in order to be able to attribute any increase in awareness to their visit to the reserve, rather than to the influence of the survey. Balancing questions is exceptionally difficult, as ten pre-tests and three pilot studies attest, and certain issues were not questioned because of the difficulty involved. The cross-sectional design allows a wider and better graded range of questions to be used.

A third factor against the longitudinal design is the inherent weakness of the McNemar Test of Symmetry.

Fourthly, it is easier to directly compare individual issues using a cross-sectional design, provided that condition variables (e.g. demographic profiles) are successfully randomized. Analysis by condition variables is equally dependent upon samples being representative.

As the longitudinal design is logistically more demanding, the higher response rate using a cross-sectional design is to be expected. This enhances representative sampling. Furthermore, it may be that by only interviewing respondents once (using the cross-sectional design), co-operation and the quality of responses are also enhanced.

A disadvantage of cross-sectional designs is the length of time and the expense in sampling two representative samples from a population. The extended period of fieldwork necessary may create profile variables (e.g. school holidays, changes in the interpretive programme).

Given the above, it is recommended that a cross-sectional design be used in any similar survey. A consideration is to survey the 'after' sample (i.e. those leaving) first, so as to minimize any influence the survey may have on the interpretation in the reserve(s).

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