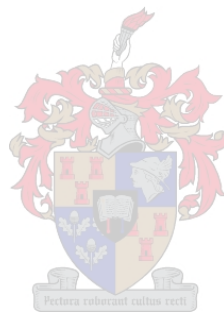


**THE IMPACT OF STATE-OF-RIVERS REPORTING ON PEOPLE'S
ATTITUDES TOWARDS RIVER CONSERVATION: A CASE STUDY
OF THE BUFFALO AND HARTENBOS & KLEIN BRAK
CATCHMENTS IN SOUTH AFRICA**

Wilma Fernanda Strydom



Thesis submitted in partial fulfilment of the requirements for the degree of

Master of Science

University of Stellenbosch

Supervisors:

Prof K J Esler and Dr A Leslie

March 2009

Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.



2009-03-02

.....

Signature

.....

Date

Ms. W.F. Strydom

.....

Name

Abstract

During 2007, two evidence-based studies were undertaken in two catchment areas in South Africa. The first study ascertained the relationships between demographic attributes and general awareness, human impacts, attitudes and water use behaviour. The second study determined whether or not State-of-River (SoR) materials developed for foundation phase learners (grades 1 to 3) improved their understanding of and influenced their attitudes towards river conservation. Surveys were conducted amongst learners (n=1178) and parents (n=1144) from different cultures and socio-economic backgrounds. Questionnaires were available in three languages, namely English, isiXhosa and Afrikaans.

The SoR reporting materials were not adequately distributed. The first study could therefore not ascertain whether increased awareness or attitudinal and behavioural changes could be ascribed to SoR reporting in the catchments. The majority of respondents (82 %) indicated that there was a need for more information on rivers and 60 % of the respondents indicated that they would participate in a follow-up survey. Thirty percent of respondents from the Buffalo catchment and 22 % of respondents from the Hartenbos and Klein Brak catchment indicated that they use water very sparingly. Respondents from urban areas scored higher in their attitudes towards river conservation and were more aware of water issues than those from rural areas. Both attitudinal and awareness scores did not align with water use behaviour, with rural respondents using water more sparingly. Attitude and awareness improved with increased education levels. Respondents who indicated that they would rather pay more for water than change their water use behaviour showed the lowest score for attitude towards river conservation.

Learners from the Buffalo rural area showed a significant increase in understanding the benefits that healthy rivers provide, and this can be ascribed to the distributed SoR activity book and poster. A survey consisting of quantitative and qualitative items, as well as participatory evaluations determined learners' level of understanding of human impacts on rivers. The quantitative study showed learners from the Hartenbos and Klein Brak area as well as the Buffalo rural area improved the most over time. The qualitative items showed a 35 % and 40 % increase in the number of correctly listed items as either making a river happy (healthy) or sad (unhealthy) after exposure to SoR materials. Respondents from both catchments taking part in the participatory evaluations displayed an overall increase in their understanding of good practices, as well as the negative impact of human activities on rivers. Those learners that scored low in the participatory evaluations at time 1 showed the most improvement over time, concluding that those learners who knew the least at the start of the study, gained the most understanding of human impacts on rivers. All schools in the Hartenbos and Klein Brak catchment, with the exception of one, showed a slight increase in understanding of human impacts on rivers. Results from the schools in the Buffalo catchment were more variable. Data gathered demonstrated that the SoR materials helped learners to better understand benefits from clean rivers as well as human impact on rivers. Although the learners from urban areas had a better understanding of the concept of river conservation before contact with the SoR materials, learners from the rural areas showed the most

improvement over time. There was an increase in the number of learners that showed a willingness to take responsibility for their actions that could impact on river health. Far more learners mentioned remediation types of actions than protection or preventative actions.

A change in peoples' attitudes and behaviour is needed to ensure adequate protection of South Africa's natural water resources. Imprinting values and perceptions that would last into adulthood need intervention at an early age and throughout children's' formative years.

Opsomming

Gedurende 2007, twee bewysgebaseerde ondersoeke is in twee wateropvangsgebiede in Suid Afrika gedoen. Die eerste studie was gerig op die bepaling van die verband tussen demografiese kenmerke, algemene bewustheid, menslike impak, houdings en waterverbruik. Die tweede studie het bepaal of die Stand-van-Rivier (SvR) inligtingsmateriaal wat vir grondslagfase leerlinge (graad 1 tot 3) ontwikkel is, bygedra het tot hulle begrip van en houding jeens die bewaring van riviere. Steekproeftrekkings het leerlinge (n=1178) en ouers (n=1144) vanuit verskillende kultuur- en sosio-ekonomiese agtergronde betrek. Vraelyste was in drie landstale naamlik Engels, Xhosa en Afrikaans beskikbaar.

Die SvR kommunikasie materiaal is nie toereikend versprei nie. Die eerste studie kon derhalwe nie bepaal of groter bewustheid of veranderings in houding en gedrag in hierdie opvangsgebiede aan die SvR verslaggewing toegeskryf kon word nie. Die meerderheid respondente (82 %) het aangedui dat daar 'n tekort aan rivierinligting is en 60 % van die respondente het hulself bereidwillig verklaar om aan 'n opvolgstudie deel te neem. Dertig persent van die respondente uit die Buffels- en 22 % uit die Hartenbos- en Klein Brak-opvangsgebiede het aangedui dat hulle water spaarsamig gebruik. Respondente afkomstig van stedelike gebiede het beter rivierbewaringshoudings getoon en was meer bewus van wateraangeleenthede as die van landelike gebiede. Houdings en bewustheidsvlakke het nie ooreengestem met waterverbruik nie – landelike respondente gebruik water meer spaarsamig. Beide houdings en algemene bewustheid het toegeneem met hoër onderwysvlakke. Respondente wat aangedui het dat hulle eerder meer vir water sal betaal as om hulle verbruik te verminder, het die swakste houding jeens die bewaring van riviere getoon.

Leerlinge uit die landelike gebiede van die Buffels opvangsgebied het groter begrip getoon vir die voordele wat gesonde riviere inhou, en dit kan toegeskryf word aan die aktiwiteitsboek en SvR plakkaat wat onder hulle versprei is. 'n Steekproef bestaande uit kwantitatiewe en kwalitatiewe items, sowel as deelnemende evaluasies is gebruik om leerlinge se vlak van begrip van menslike impak op riviere te bepaal. Die kwantitatiewe studie het aangedui dat die begrip van leering van die Hartenbos en Klein Brak sowel as die van die landelike Buffelsrivieropvangsgebiede oor tyd die meeste toegeneem het. Op die vraag wat riviere gelukkig (gesond) of hartseer (ongesond) maak, het die kwalitatiewe items, na blootstelling van die leerders aan die SvR materiaal, 'n toename van

35 % en 40 % in korrekte antwoorde getoon. In die deelnemende evaluasie het respondente van beide opvangsgebiede 'n toename in begrip van goeie praktyke sowel as die negatiewe impak van menslike aktiwiteite op riviere getoon. Leerlinge wat swak gevaar het in die deelnemende evaluasie gedurende die eerste rondte het die meeste vordering getoon. Die gevolgtrekking is dus dat leerlinge wat die minste geweet het aan die begin van die studie, die meeste geleer het oor menslike impak op riviere.

Op een na, het alle skole in die Hartenbos- en Klein Brakrivieropvangsgebied 'n geringe verhoging in begrip van menslike impak op riviere getoon. Resultate van skole uit die Buffelsopvangsgebied het meer gevarieer. Data versamel het gedemonstreer dat die gebruik van die aktiwiteitsboek en plakkaat gelei het tot 'n beter begrip by leerders van die voordele van skoon riviere asook van menslike impak op riviere. Alhoewel die leerlinge van stedelike gebiede beter begrip getoon het oor rivierbewaring voor kontak met die SvR material, het die landelike leerlinge die grootste toename in begrip oor die verloop van die studie getoon. Daar was ook 'n toename in die aantal leerlinge wat bereid was om verantwoordelikheid vir hulle aktiwiteite wat 'n impak op riviergesondheid kon hê, te aanvaar. Veel meer leerlinge het tydens die tweede fase verwys na herstel eerder as beskermings of voorkomende gedrag.

'n Verandering in mense se houdings en gedrag is noodsaaklik om genoegsame bewaring van Suid Afrika se natuurlike waterhulpbronne te verseker. Waarde sisteme en persepsies wat met volwassewording steeds geldig sal wees, word reeds teen 'n vroeë ouderdom, gedurende kinders se vormingsjare, vasgelê.

Dedication

This thesis is dedicated to my late father, Zybrandt Lourens Lombaard, who always believed in the value of a good education.

Acknowledgements

My sincere thanks and appreciation go to the following people:

Professor Karen Esler and Dr Alison Leslie for their guidance, support and advice as supervisors to this study and their encouragement when times were tough

External reviewers Dr. Rudi Pretorius and Dr. Heidi Prozesky

Dr Pete Ashton for reading numerous chapter versions

Gillian Maree and Devlyn Hardwick for the GIS maps

Dr Martin Kidd for advice on structuring the questionnaires and statistical analyses of the data

Rene Koen for advice on structuring the questionnaires used for the pilot study

Friends, family members and colleagues for their encouragement during difficult times

My children, Jurgen and Anria, for bearing with me and dealing with my long absences from home while gathering data in the field

Finally, I also acknowledge the CSIR for contributing towards my time and expenses to finish this project successfully.

Table of Contents

Chapter 1	General Introduction	1
1.1	Background	1
1.1.1	The purpose statement/Rationale for conducting this study	2
1.1.2	Aims and objectives	2
1.1.2.1	The hypotheses	3
1.1.2.2	The research questions	3
1.2	Study area	4
1.2.1	Catchment characteristics and land-use	4
1.2.1.1	The estuaries	4
1.2.1.2	Hartenbos and Klein Brak River catchment	5
1.2.1.3	Buffalo River catchment	7
1.2.2	Socio-economic profile	8
1.2.2.1	Hartenbos and Klein Brak River catchment	8
1.2.2.2	Buffalo River catchment	9
1.2.3	Literacy and formal schooling	12
1.2.4	SoR reporting material	14
1.3	Research method	16
1.4	Reference List	17
Chapter 2	Literature Review	19
2.1	Introduction	19
2.2	The interaction between society and science	19
2.2.1	Communicating scientific information	20
2.2.2	Understanding and awareness	20
2.3	Attitude and behaviour	21
2.3.1	Human behaviour – the theory	21
2.3.1.1	Motivation to act	25
2.4	Variables	26
2.4.1	Independent variables	26
2.4.1.1	Demographics	26
2.4.1.2	Knowledge, awareness and social influences	27
2.4.2	Dependent variables	27
2.4.2.1	Attitude	28
2.4.2.2	Behaviour	28
2.5	Discussion	29
2.6	Conclusion	30
2.7	Reference List	32
Chapter 3	Peoples' awareness of and attitude towards river conservation in the Buffalo and Hartenbos & Klein Brak catchments	38
3.1	Abstract	38
3.2	Introduction	39
3.3	Methods	41
3.3.1	Approach	41
3.3.2	Research design	41
3.3.2.1	Questionnaire design	42
3.3.2.2	Study area and population profile	43
3.3.2.3	Sampling selection and sampling method	43

3.3.2.4	Measuring attitude and behaviour	44
3.3.2.5	Data analysis	45
3.4	Results	45
3.4.1	Representation	45
3.4.2	Information dissemination	45
3.4.3	Constructs and reliability of data (Cronbach alpha)	46
3.4.4	Behaviour related to water use	47
3.4.5	Attitude, awareness, behaviour and knowledge	48
3.4.6	The relationship between the dependent variables, attitude, awareness and behaviour, and the independent demographic and socio-economic variables	48
3.4.7	Comparing equity, ecological and financial orientation	49
3.4.8	Information needs and future participation	50
3.5	Discussion	50
3.6	Conclusions and recommendations	52
3.7	References	54
Chapter 4	River conservation - effectiveness of State-of-Rivers communication material in education	59
4.1	Abstract	59
4.2	Introduction	59
4.3	Methods	61
4.3.1	Aim/objectives	61
4.3.2	Approach	61
4.3.2.1	Pre-study	62
4.3.2.2	Pilot study	62
4.3.3	Research design	63
4.3.3.1	Study area and sample selection	63
4.3.3.2	Facilitation	63
4.3.3.3	Data collection methods	64
4.3.3.4	Grade 1 to 3 questionnaire	64
4.3.3.5	Participatory evaluations	66
4.4	Data Analysis and Results	67
4.4.1	Pre-study	67
4.4.2	Pilot study	67
4.4.3	Sample size	67
4.4.4	Reliability analysis	68
4.4.5	Understanding the benefits that healthy rivers provide	68
4.4.6	Understanding human impact on rivers	70
4.4.6.1	Quantitative items	70
4.4.6.2	Qualitative items	70
4.4.6.3	Participatory evaluations	72
4.4.7	Knowledge	74
4.4.8	Changing attitudes of grade 1 to 3 learners	74
4.4.8.1	Conserve our rivers	74
4.4.8.2	Take responsibility	75
4.5	Discussion	77
4.6	Conclusion	80
4.7	Reference List	81
Chapter 5	Conclusion and Recommendations	85
5.1	Key findings and key messages	85
5.2	Sources of error	87

5.2.1	Dissemination and availability of SoR reporting material	89
5.2.2	Learner facilitation.....	90
5.3	Recommendations	91
5.4	Future studies and burning issues.....	91
5.5	References	93

List of Figures

Fig 1.1	The study area comprising of the Hartenbos and Klein Brak and the Buffalo catchments, indicated in red, representing Water Management Area numbers 16 and 12, respectively.....	5
Fig 1.2	The study area comprising the Hartenbos and Klein Brak River catchment included the town of Mossel Bay.	6
Fig 1.3	The study area comprising the Buffalo River catchment, showing the Buffalo River, major tributaries, dams and the major towns.	7
Fig 1.4	Population density of the Hartenbos and Klein Brak River catchment (A) and the Buffalo River catchment (B) (Stats-SA 2001).	9
Fig 1.5	The access to sanitation situation in the Mossel Bay municipal area (Stats-SA 2001).....	10
Fig 1.6	The access to piped water situation in the Mossel Bay municipal area (Stats-SA 2001).....	10
Fig 1.7	The access to piped water situation in the Buffalo City municipal area (Stats-SA 2001).....	11
Fig 1.8	The access to sanitation situation in the Buffalo City municipal area (Stats-SA 2001).....	11
Fig 1.9	Map of the Buffalo River catchment showing the location of the 289 primary, secondary and combined schools in the area (Department of Education 2006).....	13
Fig 1.10	Map of the Hartenbos and Klein Brak River catchment showing the location of the 19 primary and secondary schools in the area (Department of Education 2006).....	14
Fig 1.11	State-of-Rivers reporting material for use in the Hartenbos and Klein Brak River study. Clockwise from top left is the State-of-Rivers Report: Hartenbos and Klein Brak River Systems (A) (RHP 2003); A summary of the 2003 State-of-Rivers Report (B) (RHP 2006); activity book for grade 1 to 3 learners, an isiXhosa, (C), an Afrikaans (D) and an English version (E) (RHP 2006); and, a River Health poster designed for the Free State area (F) (RHP 2006).	15
Fig 1.12	State-of-Rivers communication products to be evaluated for the study in the Buffalo River catchment. Clockwise from top left is the State-of-Rivers Report: Buffalo River System (A) (RHP 2004); a bilingual poster (English and isiXhosa) explaining the SoR reporting concept targeting senior secondary phase learners (B); a River Health fun poster of the Buffalo River catchment (C) (RHP 2006); and, an activity book for grade 1 to 3 learners (D) (RHP 2006).	16
Fig 2.1	A schematic presentation of the conceptual framework for the prediction of intentions and behaviours, also called the Theory of Reasoned Action, adapted from Fishbein and Ajzen (1975).....	22
Fig 2.2	Diagram based on Ajzen and Fishbein's (1980) model for determining a person's behaviour. The external variables on the left side of the diagram show the indirect effects these variables have on behaviour.....	23
Fig 2.3	Schematic depiction of the Theory of Planned Behaviour, adapted from Azjen and Madden (1986). According to the Theory of Planned Behaviour, perceived behavioural control not only correlates with both the subjective norm and the attitude towards the behaviour, but also affects the intention to behave independently and the behaviour itself directly.....	24
Fig 2.4	The model of environmental behaviour as proposed by Grob (1995) includes an emotional component.	24

Fig 2.5	The flow of behavioural change model, adapted from Geller (2002).	25
Fig 3.1	Responses indicating the level of awareness of and knowledge of the River Health Programme and State-of-Rivers reporting	46
Fig 3.2	Reported personal water use of respondents in both the Hartenbos & Klein Brak (n=574) and Buffalo (n=462) catchments.	47
Fig 3.3	The relationship between attitude and respondents' inclination towards using less water (n=725).	49
Fig 3.4	The attitude (n=663), awareness (n=359) and behaviour (n=851) scores of respondents wishing to receive river information.	50
Fig 4.1	RANOVA results indicating the difference in <i>understanding of the benefits that healthy rivers provide</i> amongst the groups and locations. Subgroups B Urban n=96; B Rural n=136; M Urban n=283; M Rural n=248. p=0.01. Vertical bars denote 95 % confidence intervals.....	69
Fig 4.2	RANOVA results indicating the differences in understanding of the benefits that healthy rivers provide amongst the groups and locations over time (phase 1 and phase 2). For the subgroups B Urban n=96; B Rural n=136; H Urban n=283; H Rural n=248. p<0.01. Vertical bars denote 95 % confidence intervals.....	69
Fig 4.3	Group, location and time RANOVA correlations, showing the results of a quantitative analysis to determine learners' <i>understanding of human impacts on rivers</i> (p<0.01). Vertical bars represent 95 % confidence intervals.....	71
Fig 4.4	The relationship between time and initial score (≤ 5 and ≥ 20) as reflected by the participatory evaluations of groups H and B.....	73
Fig 4.5	The change in learners' understanding of human impacts on rivers over time, expressed as a mean score per school.....	74
Fig 4.6	Comparison of four categories of responses to questions why rivers should be conserved. Data from the two phases of the study. (n=582).....	75
Fig 4.7	Relative frequency of responses to the question: 'What can you do to make sad rivers happy, healthy rivers again?' allocating responsibility to the proposed actions. (n=582)	76

List of Tables

Table 1.1	Catchment characteristics of the Hartenbos and Klein Brak (RHP 2003) and Buffalo rivers (RHP 2004). _____	8
Table 1.2	Population figures per age group, as well as formal schooling levels per age group, for both the Mossel Bay and Buffalo City municipal areas (Stats-SA 2001). _____	12
Table 3.1	Reliability of the results was tested by calculating the Cronbach alpha values of five constructs. _____	46
Table 3.2	The relationship between attitude, awareness and behaviour and the method of domestic water supply. _____	47
Table 3.3	The relationship between respondents' attitudes towards river conservation, awareness of general water issues, and behaviour towards water use, and the knowledge constructs. Unreliable results are shaded in grey. (ns = not significant) _____	48
Table 3.4	The perspectives of respondents towards water use and water conservation. _____	49
Table 4.1	The <i>knowledge of learners</i> construct was measured by two items. _____	65
Table 4.2	The <i>understanding benefits that healthy rivers provide</i> construct was measured by four items. _____	65
Table 4.3	The <i>understanding human impact</i> construct was measured by four items. _____	65
Table 4.4	The open-ended questions that measured learners' understanding of human impacts on rivers and their attitudes. _____	65
Table 4.5	The reliability of the constructs as set out in the quantitative section of the grade 1 to 3 questionnaire was tested and presented with Cronbach alpha scores. _____	68
Table 4.6	Percentage change in the number of correct items listed between phase 1 and phase 2, measuring learners change in understanding of human impact on rivers. (n = 471) _____	71
Table 4.7	Means and distributions of participatory evaluation results before and after contact with State-of-Rivers activity books designed for grades 1 to 3. _____	72
Table 4.8	Means and distributions of participatory evaluation results of learners scoring very low and very high during phase 1, showing change over time. _____	73
Table 4.9	Relative frequency (%) with which items were selected by learners at each location during the two phases of the study. (n = 582) _____	75
Table 4.10	Items frequently listed by grade 1 to 3 learners as actions to be done to change unhealthy rivers to healthy rivers, in descending order of greatest change. (n=582) _____	76
Table 5.1	Sampling possibilities: the advantages and disadvantages of the different methods. _____	90

List of Appendices

Appendix A	The pre-survey questionnaire to determine the extent to which the SoR reporting material has been distributed and whether formal dissemination strategies were followed. _____	A1
Appendix B	The combined English and isiXhosa questionnaire used for measuring relationships/correlations between independent variables and the behaviour, attitude, awareness and knowledge of people living in the study area _____	B1
Appendix C	Grade 1 to 3 questionnaire _____	C1
Appendix D	Reasons for smaller sample size than planned _____	D1
Appendix E	Results from the qualitative study indicating what grade 1 to 3 learners think make rivers happy/healthy and sad/unhealthy _____	E1
Appendix F	Facilitator questionnaire: phase 1 _____	F1
Appendix G	Facilitator questionnaire: phase 2 _____	G1

Chapter 1

General Introduction

1.1 Background

In 1992, delegates to the Earth Summit in Rio de Janeiro agreed on the need for scientifically credible environmental information to support decision-making and to inform the public (UNCED 1992). This decision supported and strengthened the work of organisations such as GRID-Arendal¹ that had been actively involved in environmental reporting since 1989 (Tveitdal 2001). Numerous other organisations adopted the environmental reporting format. The need for credible communication was mirrored in South Africa by the Department of Environmental Affairs and Tourism, who initiated the first National State of Environment Report in 1999 (DEAT 1999). Since then, several provincial and local Government departments have produced local and provincial State of Environment reports. In addition, a number of sectoral reports were produced, including the State of the Estuaries report (Harrison *et al.* 2000) and 11 State-of-Rivers reports (Strydom *et al.* 2006). Examples of the State-of-Rivers reports are the Letaba and Luvuvhu River Systems 2001 (WRC 2001), the Hartenbos and Klein Brak River Systems 2003 (RHP 2003), the Buffalo River System 2004 (RHP 2004) and Greater Cape Town's Rivers 2005 (RHP 2006).

State-of-Rivers (SoR) reporting is one of the key communication tools of South Africa's River Health Programme. The River Health Programme (RHP), a national biomonitoring programme, was initiated in 1994 by the Department of Water Affairs and Forestry in response to the growing public need for more information on the state of South Africa's aquatic ecosystems. The RHP was designed to support informed river ecosystem management through improved understanding of these river ecosystems. The primary objectives of the RHP (Roux 1997) are to:

- Measure, assess and report on the ecological state of aquatic ecosystems;
- Detect and report spatial and temporal trends in the ecological state of aquatic ecosystems;
- Identify and report emerging problems regarding aquatic ecosystems;
- Ensure that all aquatic ecosystem health reports provide scientifically relevant information that will enable successful management of aquatic ecosystems; and
- Create public awareness of aquatic environmental issues and solicit public engagement in conservation activities at all levels.

¹ GRID-Arendal is an official United Nations Environment Programme (UNEP) collaborating centre, supporting informed decision-making and awareness-raising through: environmental information management and assessment; capacity building services; outreach and communication tools, methodologies and products. (<http://www.grida.no/about>)

The SoR report is presented in a user-friendly and easy to understand format and compliments the formal technical reporting on river ecosystems (Strydom 2003). Other related SoR-reporting products are designed to enhance comprehension and awareness of the ecological state of river ecosystems as well as human impacts on these systems. These include the SoR posters and other “soft” communications, e.g. the activity books for foundation phase learners (RHP 2008). All these products are aimed at making the relevant information available, comprehensible and accessible to a wider audience. This audience ranges from politicians and water resource managers to communities who live next to the river, and to the general public (Strydom 2003).

1.1.1 The purpose statement/Rationale for conducting this study

Information gathered on the state or health of South Africa’s river systems will not add any value or ensure sustainable development unless it is communicated to, understood and then applied by water resource managers, relevant organisations and affected communities.

Goodrum *et al.* (2000) reasoned that improved scientific literacy would help people understand the world around them and enable them to engage in science-related discussions. It would enable them to question the basis of scientific claims and empower them to investigate claims and make their own informed decisions – not only about the environment, but also about their health and well-being. The value of public support in “advancing” environmental objectives should not be underestimated (Stern *et al.* 1999). Brown *et al.* (2004) noted that public opinion drives public policy, and that the scientific community tends to underestimate this fact. Similarly, it can be expected that if members of the public were well informed about river health issues, they would participate in water resource management debates with confidence. State-of-Rivers reports provide the public with the relevant information they require to constructively engage in river management debates and solicit participation in the activities of river forums. The impact of environmental information on decision-making is not very clear (Denisov & Christoffersen 2001) and wider access to improved information is not always directly linked to successful environmental management (Denisov & Christoffersen 2001).

1.1.2 Aims and objectives

The primary purpose of this study was to determine the impact of the distribution of SoR reporting: how widely the SoR materials were distributed in the catchments; whether the recipients of the SoR material gained new knowledge of the factors that negatively impact on rivers; and whether they gained a better understanding of the importance of prudent river management and conservation. This study also attempts to determine whether attitudes² and human behaviour changes took place and if they were linked to SoR reporting in the catchments.

² Definition of attitude: “Attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour” (Eagly & Chaiken 1993).

1.1.2.1 *The hypotheses*

Based on available literature and the author's knowledge of State-of-Rivers reporting in South Africa, several hypotheses were formulated. For this study only hypothesis one was investigated. Hypotheses 2 to 4 are listed below as topics for possible future investigation.

1. *The current format of State-of-Rivers reporting³ has a positive and sustained impact on the attitudes of people⁴ towards river management and conservation issues in South African river catchments⁵.*
2. Water resource managers make effective use of the information provided in SoR reports to manage water resources.
3. If the public of South Africa are well informed about the state of their rivers, and if they have knowledge on which organisations to approach, they will engage in the activities of river forums and other institutions, as well as with regional and local government, to ensure proper water resource management.
4. State-of-Rivers reporting changed people's attitudes to water resource management issues and also has the potential to change the behaviour of society towards river management and river conservation.

1.1.2.2 *The research questions*

The following key questions were derived from hypothesis one:

1. Do demographic attributes, geographic locality, and social and economic issues influence people's awareness⁶ of and attitudes towards river conservation issues?
2. Do State-of-Rivers reporting materials provide sufficient information in an appropriate format and language to improve people's understanding of the benefits that goods and services of rivers provide, increase their awareness of adverse impacts on river systems, and change their attitudes towards river conservation?
3. Is there a correlation between the degree to which a community depends on a river system for its livelihoods and the attitudes expressed by individuals in that community?
4. Do individuals feel that, if they formed a group, their collective engagement as a group would have a larger impact on river management and conservation than if each individual attempted to achieve this on his/her own?
5. Do individuals/communities understand:
 - a. the negative impacts on their rivers and know why and how to take action, e.g. stop pollution, stop activities that damage the ecosystem, eradicate alien plants, etc.?

³ State-of-Rivers reporting includes State-of-Rivers reports, SoR posters, and activity books

⁴ The term 'people' includes water resource managers, politicians, decision-makers, commercial farmers, subsistence farmers, educators, school children, members of the lay public

⁵ Hartenbos and Klein Brak catchment, Western Cape and Buffalo catchment, Eastern Cape

⁶ Awareness is a consciousness or perception that does not imply that an understanding exists.

- b. the identity and role of different institutions and how best to engage with them?
- 6. Would improved knowledge on the state of their local rivers encourage individuals to engage with river management institutions more confidently; would this increased participation put pressure on government (regional and local) to act on issues relating to poor water resource management?
- 7. How do water resource managers use SoR information to facilitate changes in the water resource management arena?
- 8. Is there evidence that awareness of and positive attitudes towards river management and river conservation eventually lead to a positive change in the behaviour of individuals?

Two studies, preceded by a pre-study and a pilot study, were conducted to address the first two research questions, namely question 1 (Chapter 3) and question 2 (Chapter 4). Research questions 3 to 8 are not addressed in this study but are included to point out the vast opportunities for further research. Chapter 2 provides theoretical background to understanding the psychological influences that drive environmental change. The concluding remarks and recommendations are presented in Chapter 5. The two data chapters, chapters 3 and 4, are presented as papers and therefore some information overlap might occur.

1.2 Study area

South Africa is divided into 19 Water Management Areas (WMAs). The study areas selected to address the hypotheses and questions above represent two of these areas. The Hartenbos and Klein Brak River catchment is situated in WMA number 16 (the Gouritz Water Management Area (WMA)), and the Buffalo River catchment in WMA number 12 (the Mzimvubu to Keiskamma WMA) (Figure 1.1).

1.2.1 Catchment characteristics and land-use

Both catchments have upper reaches that are in a good ecological state; commercial forestry in their upper reaches; farming activities and villages along the banks. Both East London and Mossel Bay are harbour towns. The Buffalo estuary is the East London harbour and the Klein Brak and Hartenbos estuaries are impacted by development. The rural population of the Buffalo catchment is high when compared to that of the Hartenbos and Klein Brak catchment. The following sections compare the catchment characteristics, the socio-economic profile of the inhabitants and their education levels.

1.2.1.1 The estuaries

The East London harbour is located in the Buffalo River estuary, while the Mossel Bay harbour is located about 10 km from the Hartenbos river mouth. The Hartenbos estuary is a medium size (2 – 150 ha) closed estuary. Both the Klein Brak and Buffalo estuaries are classified as open barred

estuaries with medium to high average annual runoff (Harrison *et al.* 2000). The Klein Brak River mouth is usually open but closed three times during the 20th century.

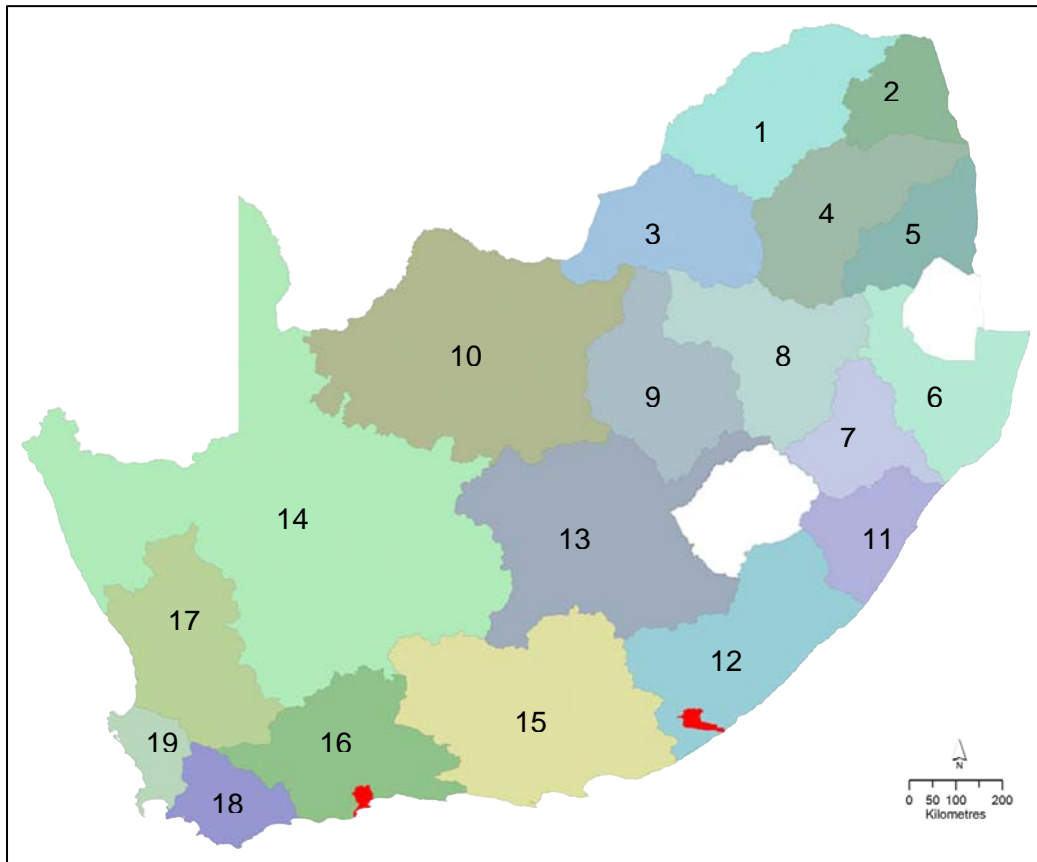


Fig 1.1 The study area comprising of the Hartenbos and Klein Brak and the Buffalo catchments, indicated in red, representing Water Management Area numbers 16 and 12, respectively.

1.2.1.2 Hartenbos and Klein Brak River catchment

The upper tributaries of the Klein Brak River rise to altitudes of between 1200 and 1500 meters a.m.s.l. in the mountainous Southern Folded Mountains ecoregion (Figure 1.2). From here the peat-coloured streams flow rapidly down steep gradients to approximately 600 meters a.m.s.l., entering the plains of the Southern Coastal Belt ecoregion. The Hartebeeskuil Dam is the only dam in the Hartenbos River and due to its brackish content, the water is unfit for human consumption. The Klipheuwel Dam is situated on a tributary of the Klein Brak River. Water is abstracted from the Moordkuils River, transferred to the Klipheuwel Dam and from there supplied to Mossel Bay for domestic use.

Grain-growing activities dominate the upper reaches of the Hartenbos catchment, but game farming has increased in popularity in recent years. The lower Hartenbos catchment is used for cattle, sheep and ostrich farming. The main farmland uses in the Brandwag area are dry land and irrigated crop farming and cattle grazing. Forestry and nature conservation dominate in the upper reaches of the Moordkuil tributary and mixed crops, game and cattle farming dominate the lower reaches of the tributary.

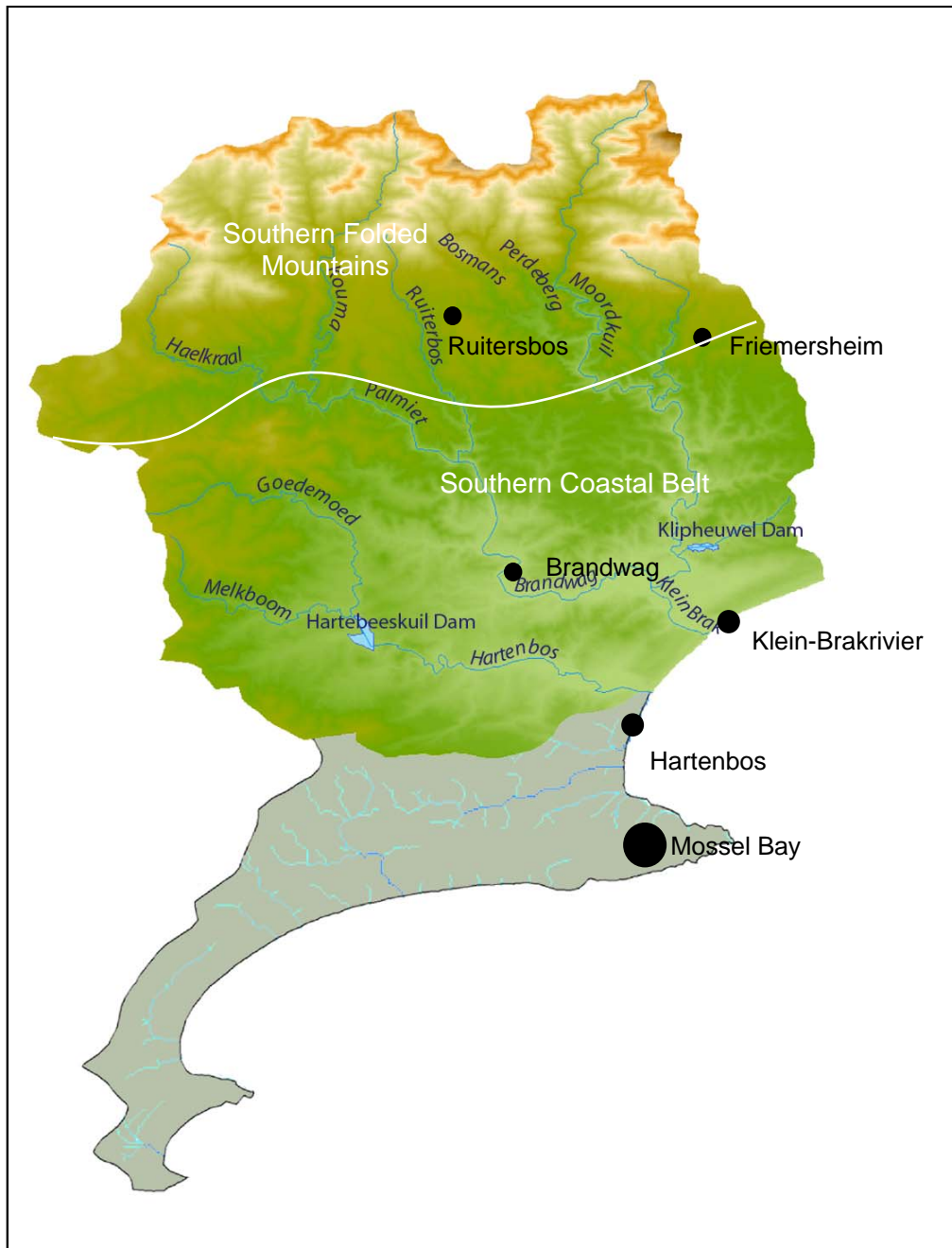


Fig 1.2 The study area comprising the Hartenbos and Klein Brak River catchment included the town of Mossel Bay⁷.

⁷ The grey area, although officially part of this catchment, does not fall within the actual boundaries of the Hartenbos River catchment. Since the majority of schools are situated in town, Mossel Bay was included in the study. See Fig. 1.10 for location of schools in the area.

1.2.1.3 Buffalo River catchment

Rising at an altitude of about 1 200 meters a.m.s.l., the Buffalo River crosses two ecoregions, the South Eastern Upland and the Eastern Coastal Belt. Dams, tributaries and other catchment characteristics are listed in Table 1.1. The Yellowwoods River, from the north, joins the Buffalo River between Zwelitsha and Laing Dam (Figure 1.3). A small inter-basin water transfer scheme transfers water via an upper tributary of the Yellowwoods River from the Wriggleswade Dam on the Kubusi River, a tributary of the Great Kei River. To date, this water transfer scheme is only used during exceptionally dry periods (RHP 2004).



Fig 1.3 The study area comprising the Buffalo River catchment, showing the Buffalo River, major tributaries, dams and the major towns.

Indigenous afromontane and closed canopy forests on the mountain slopes cover about 7 % of the Buffalo catchment, while pine and blue gum plantations cover another 4 %. Invasive black wattle trees are being removed on the border of the indigenous forests to restore the natural grasslands. Downstream of the Bridle Drift Dam, coastal forest dominates, with 560 ha of these natural forests being conserved in the Umtiza Coastal Nature Reserve.

The middle reaches of the catchment are dominated by subsistence goat, cattle and sheep farming. Approximately 1 % of the catchment is under irrigation, producing fresh produce and other crops such as lucerne and 8 % of the catchment area is under dry land cultivation. Urban and industrial built-up areas cover 12 % of the catchment. The medium to high levels of natural erodability of the soil is aggravated by reduced vegetation cover over approximately 17 % of the catchment. This area is considered to be transformed and is classified as degraded.

Table 1.1 Catchment characteristics of the Hartenbos and Klein Brak (RHP 2003) and Buffalo rivers (RHP 2004).

Study Area	Hartenbos and Klein Brak Catchment	Buffalo Catchment
Rivers	Hartenbos Klein Brak	Buffalo
Main tributaries	Hartenbos: Goedemoed Melkboom Klein Brak: Palmiet Kouma Ruiterbos Brandwag Bosmans Perdeberg Moordkuil	Cwengcwe Izele Mgqakwebe Ngqokweni Yellowwoods
Catchment size	767 km ²	1287 km ²
Mean Annual Runoff	59 x 10 ⁶ m ³	109 x 10 ⁶ m ³
Mean Annual Precipitation	550 mm (400 – 680 mm)	700 mm (400 - >1000 mm)
Dams (capacity) [main uses]	Hartenbos: <ul style="list-style-type: none"> Hartebeeskuil (7.2 x 10⁶ m³) [irrigation of hardy crops, livestock drinking and recreation] Klein Brak: <ul style="list-style-type: none"> Klipheuwel (4.2 x 10⁶ m³) [MosselBay domestic] 	<ul style="list-style-type: none"> Maden (~0.5 x 10⁶ m³) [previously used to supply King William's Town] Rooikrantz (5 x 10⁶ m³) [King William's Town domestic] Laing (20 x 10⁶ m³) Bridle Drift (101 x 10⁶ m³) [East London, Mdantsane domestic]

1.2.2 Socio-economic profile

1.2.2.1 Hartenbos and Klein Brak River catchment

Mossel Bay is the largest town in the area. Hartenbos and Klein-Brakrivier are rapidly expanding coastal towns which developed south of the Hartenbos and east of the Klein Brak estuaries, respectively. Other small inland towns include Brandwag, Ruitersbos and Friemersheim.

The total human population of the Hartenbos and Klein Brak River catchment (excluding the southernmost area coloured grey in Figure 1.2) is 7 000, with some migration taking place from the rural to the coastal areas. About 20 % of the total population lives in the Klein Brak urban area and 45% in the rural area. Eight percent live in the Hartenbos rural area and the remaining 27 % in the urban Hartenbos area (Figure 1.4A). If Mossel Bay and surrounds are included, the population rises to almost 70 000 (see footnote 7, page 7). The economy of the region depends on agriculture (cattle,

sheep, poultry and game farming), forestry, nature conservation, commercial fishing, trade, services, property markets and tourism. The residents of this area speak Afrikaans, isiXhosa and English.

Many people in the Mossel Bay municipality area do not have access to a hygienic sanitation system (Figure 1.5). The biggest problem is due to informal settlements without sewage systems. Rural areas have the lowest levels of access to safe supplies of piped water (Figure 1.6).

1.2.2.2 Buffalo River catchment

With more than 500 000 inhabitants, the Buffalo River catchment has one of the highest population densities of all the Eastern Cape catchments (Figure 1.4B). Major towns in the area are Bhisho, King William's Town, Zwelitsha, Mdantsane and East London. The population density is highest in the middle and lower reaches, with up to 1000 people per square kilometre. More than a third of the population lives in low-density rural areas. According to Census 2001 data (Stats-SA 2001), 6 % of the population in the Buffalo catchment has no access to clean piped water (Figure 1.7), either supplied in the house or via a standpipe, and 8 % of the population has no access to proper sanitation (Figure 1.8). IsiXhosa and English are the most widely spoken languages in the area, with isiXhosa dominating in the rural areas.

The main employment sectors of the area are services, manufacturing, trade, construction, transport, agriculture, forestry and fishing.

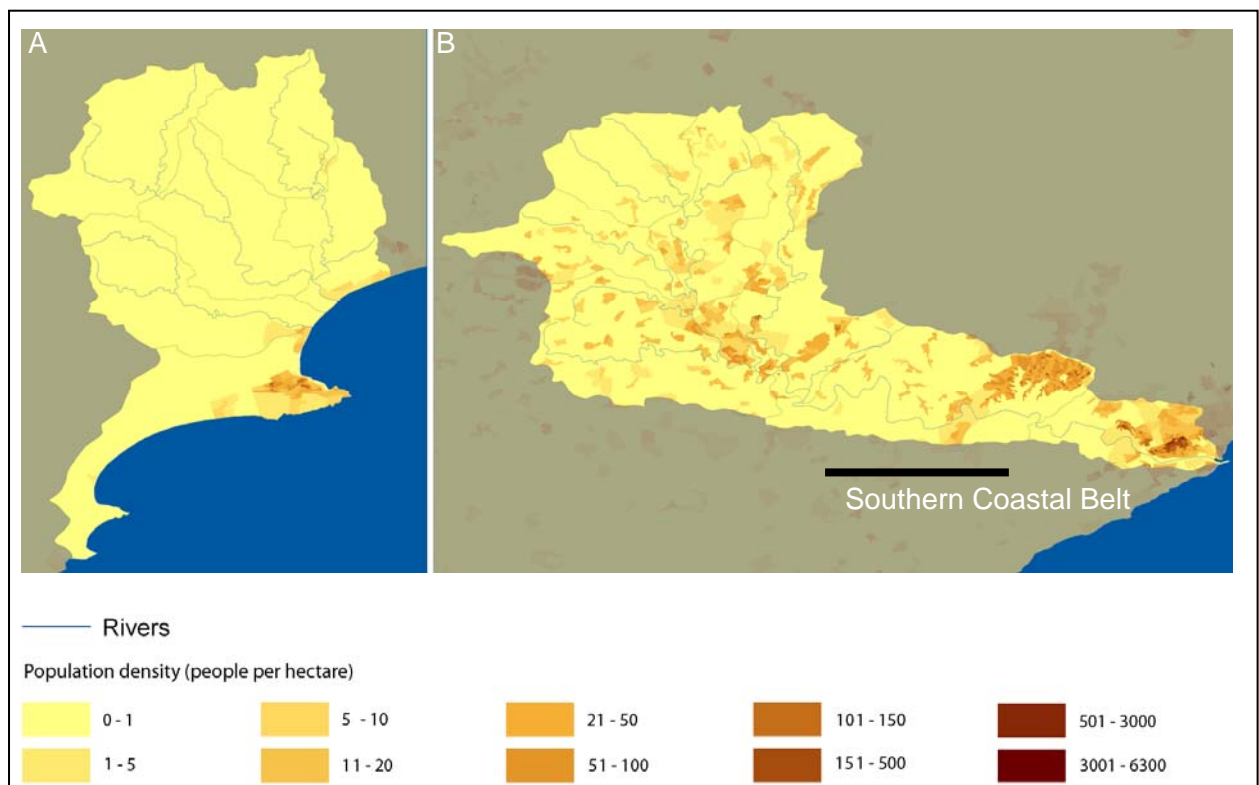


Fig 1.4 Population density of the Hartenbos and Klein Brak River catchment (A) and the Buffalo River catchment (B) (Stats-SA 2001).

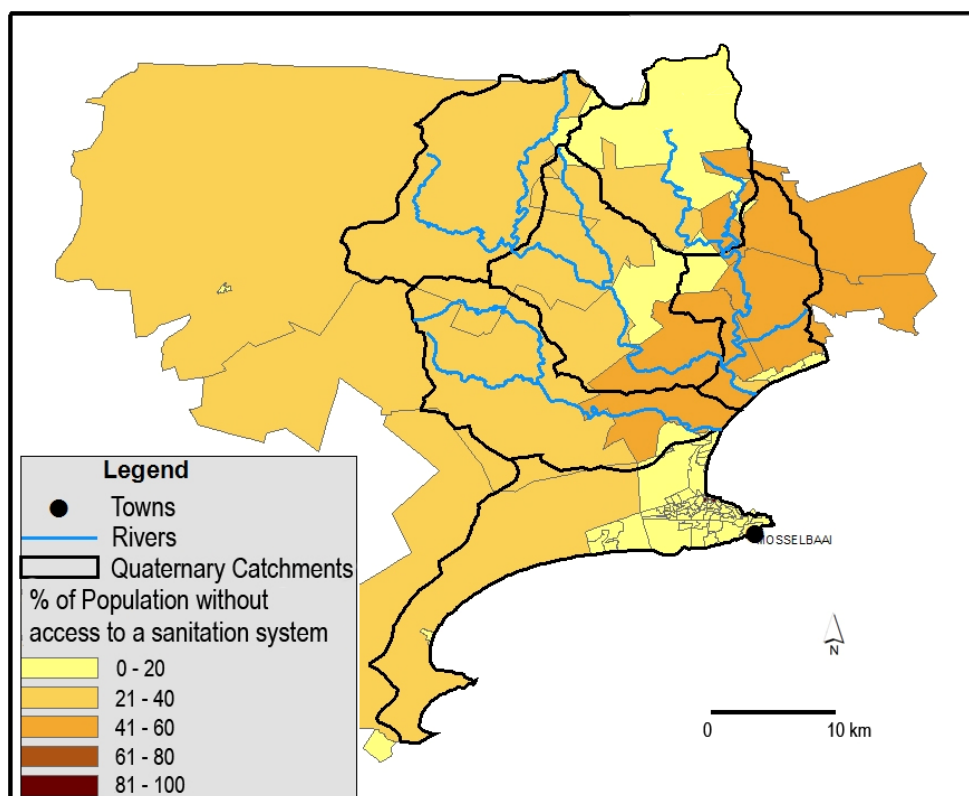


Fig 1.5 The access to sanitation situation in the Mossel Bay municipal area (Stats-SA 2001).

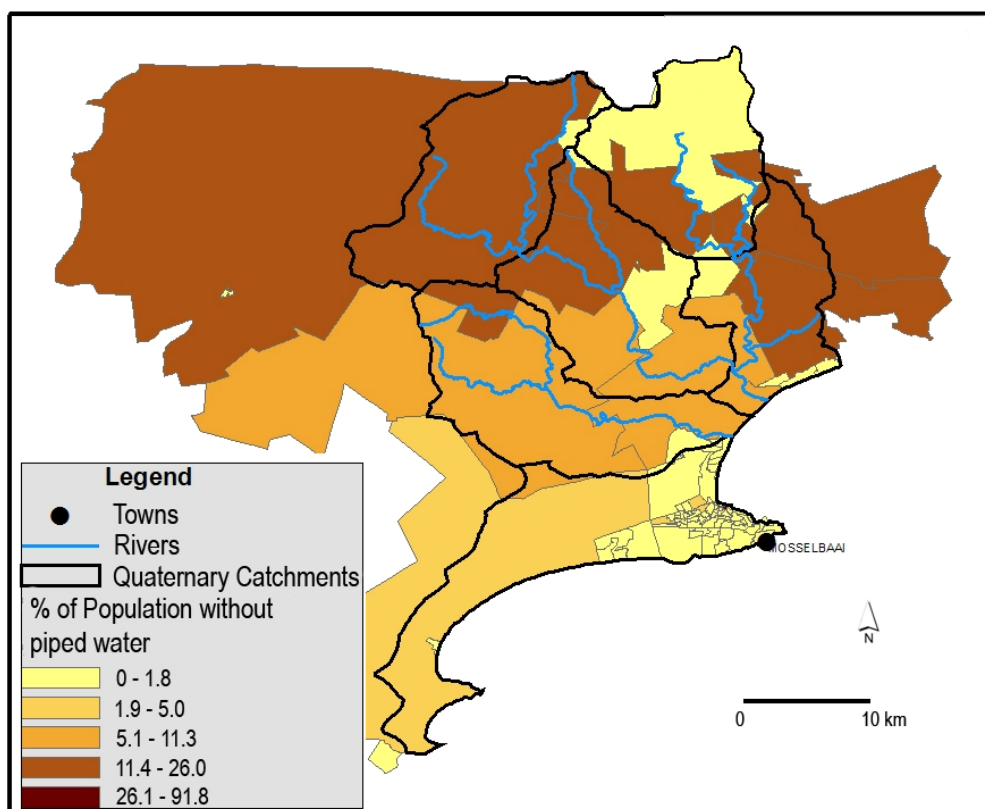


Fig 1.6 The access to piped water situation in the Mossel Bay municipal area (Stats-SA 2001).

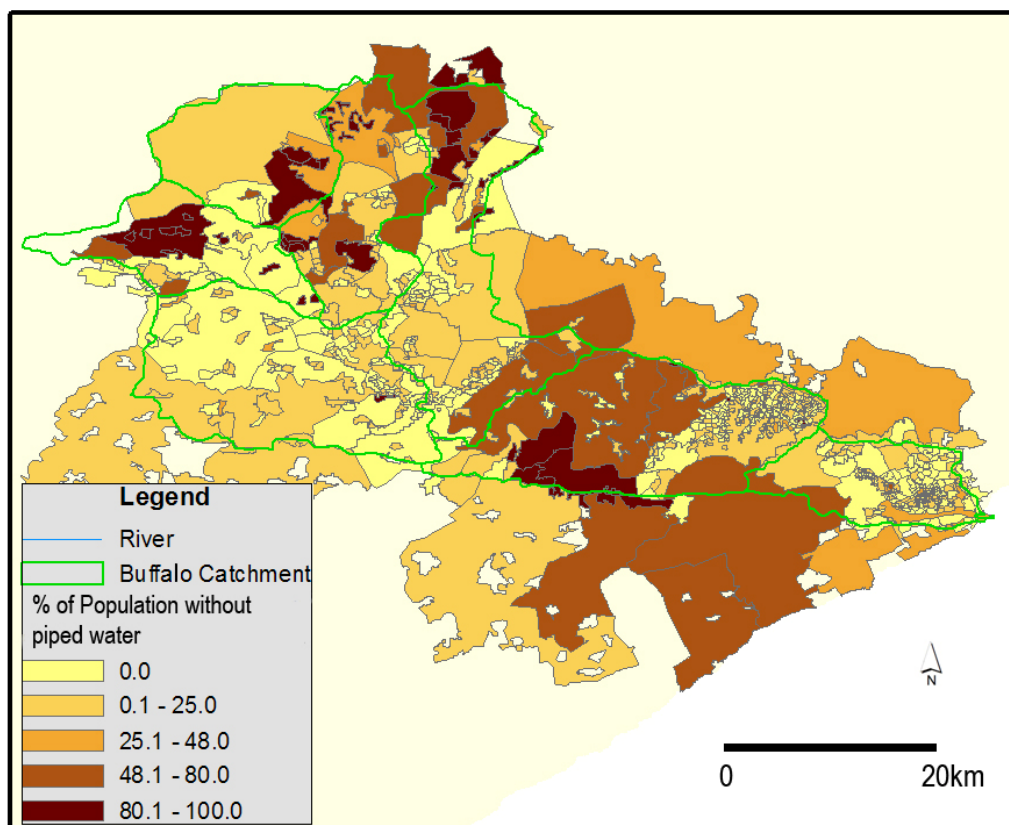


Fig 1.7 The access to piped water situation in the Buffalo City municipal area (Stats-SA 2001).

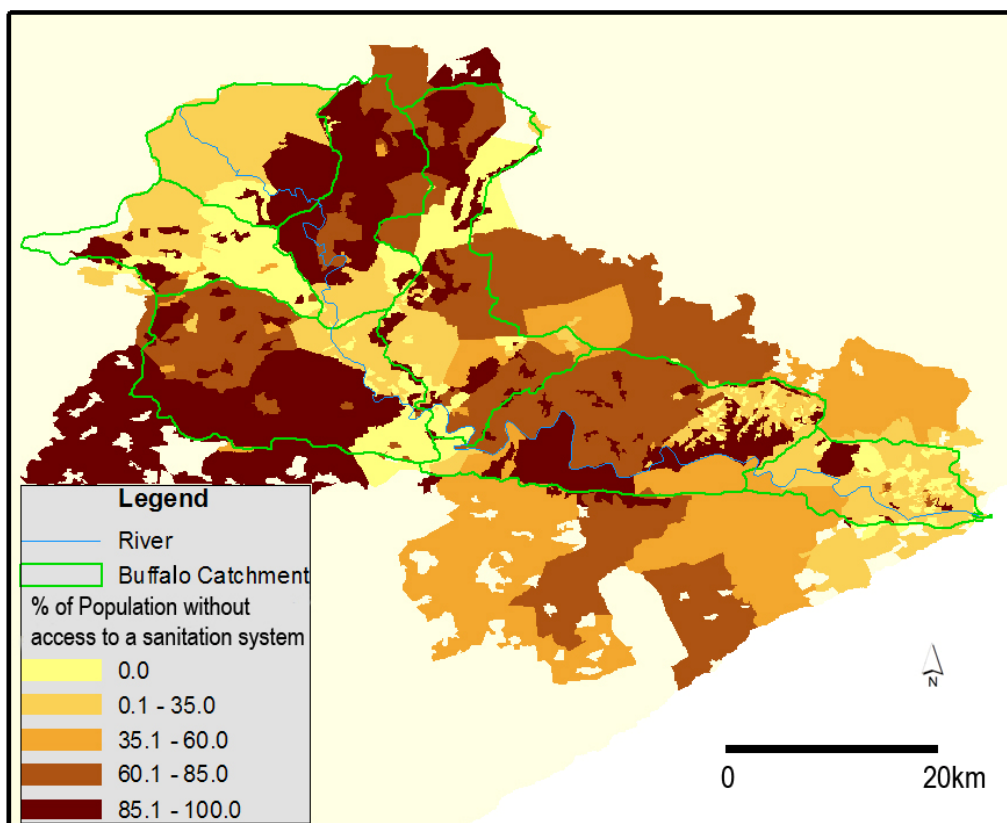


Fig 1.8 The access to sanitation situation in the Buffalo City municipal area (Stats-SA 2001).

1.2.3 Literacy and formal schooling

Table 1.2 gives a breakdown of the population figures per age group as well as highest level of formal schooling obtained per age group, for the municipal areas of Mossel Bay and Buffalo City. The largest discrepancies between the two municipalities lie within the literacy levels of those aged 10 and older. A significantly higher percentage of the Buffalo City population has had no formal schooling, as indicated in the grey areas of Table 1.2.

There are 15 primary schools and 4 secondary schools in the Hartenbos and Klein Brak study area, including the Mossel Bay area (indicated in grey in Figure 1.2). In the Buffalo catchment, 200 primary schools, 82 secondary schools and 7 combined schools provide schooling to more than 120 000 learners. Figures 1.9 and 1.10 show the location of the schools in the Buffalo River and Hartenbos and Klein Brak River catchments, respectively.

Table 1.2 Population figures per age group, as well as formal schooling levels per age group, for both the Mossel Bay and Buffalo City municipal areas (Stats-SA 2001).

	Mossel Bay (population ~ 70 000)					Buffalo City (Population ~ 700 000)				
Age group	0-4	5-9	10-14	15-19	20+	0-4	5-9	10-14	15-19	20+
Total	5 318	5 676	6 194	6 286	45 462	54 003	64 433	73 194	78 792	431 467
% of total population	7.7	8.2	9.0	9.1	65.9	7.7	9.2	10.4	11.2	61.5
Schooling: None	n/a	1 641	59	49	2 558	n/a	16 974	1 100	964	49 836
% of age group with no schooling	n/a	n/a	0.95	0.78	5.60	n/a	n/a	1.50	1.22	11.60
Some Primary	n/a	4 035	4 569	582	6 626	n/a	47 459	56 898	10 592	64 773
Primary	n/a	n/a	901	552	3 205	n/a	n/a	8 686	9 780	32 922
Some Secondary	n/a	n/a	665	4 239	15 081	n/a	n/a	6 510	49 889	151 195
Grade 12	n/a	n/a	n/a	792	11 198	n/a	n/a	n/a	6 725	90 324
Higher Education	n/a	n/a	n/a	72	6 794	n/a	n/a	n/a	842	42 417

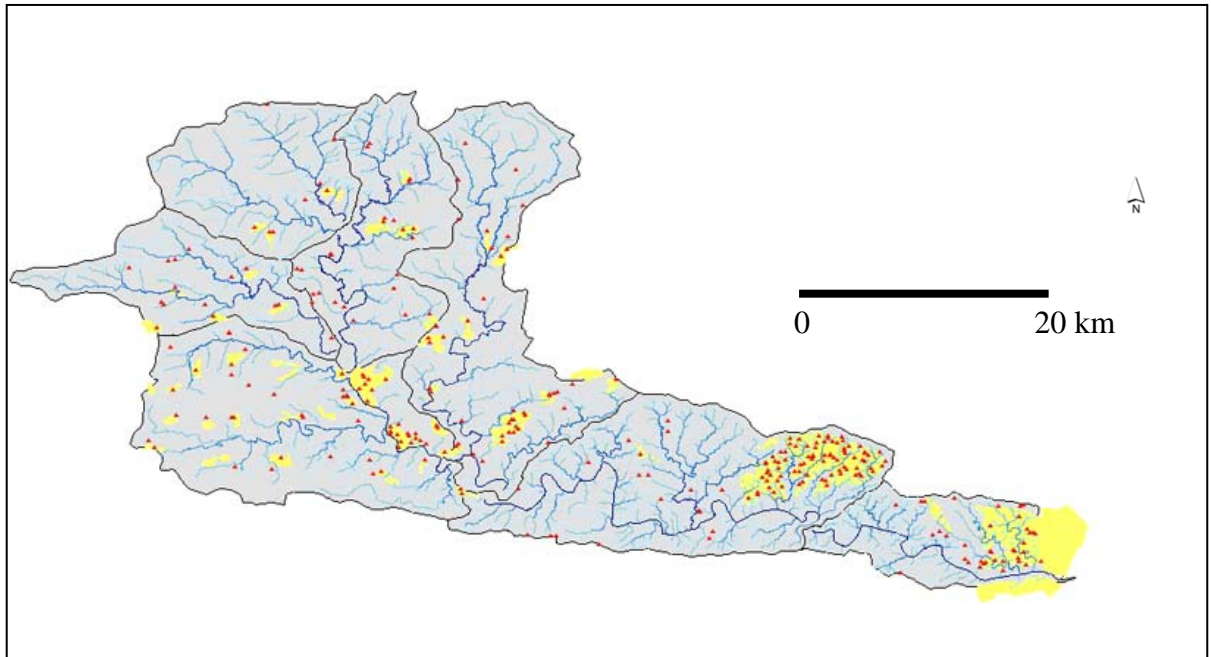


Fig 1.9 Map of the Buffalo River catchment showing the location of the 289 primary, secondary and combined schools in the area (Department of Education 2006).

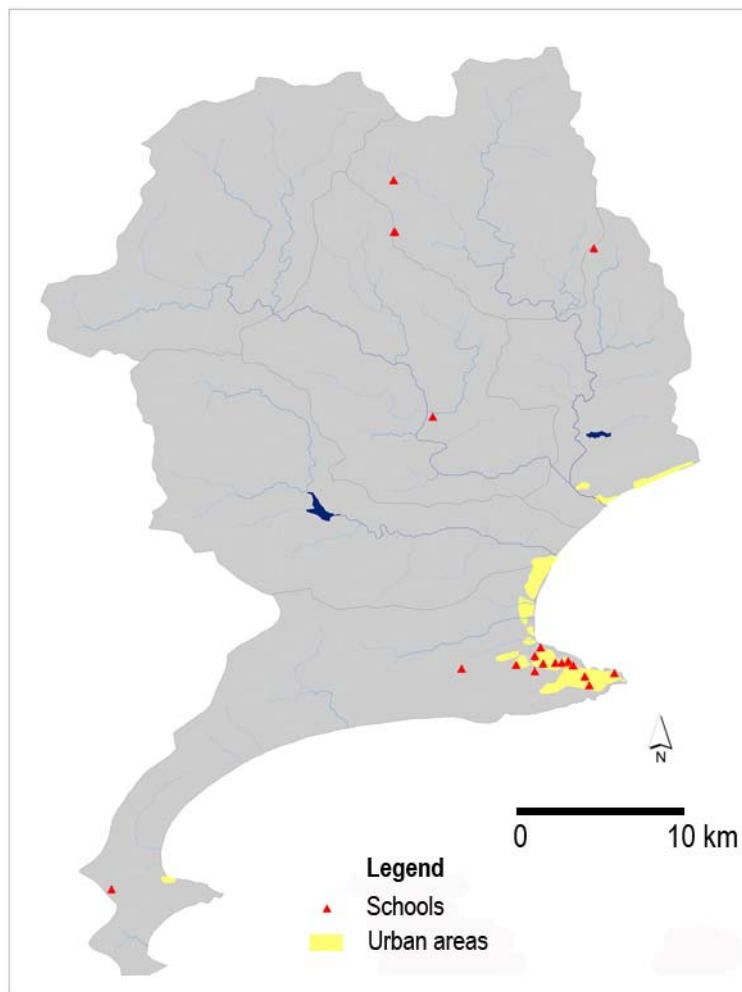


Fig 1.10 Map of the Hartenbos and Klein Brak River catchment showing the location of the 19 primary and secondary schools in the area (Department of Education 2006).

1.2.4 SoR reporting material

Several SoR reporting products⁸ were developed to improve communication in the respective catchments. These include a SoR report and a 4-page summary for the Hartenbos and Klein Brak River catchment (Figure 1.11). Other products used in this study were the River Health Poster and activity books for grade 1 to 3 learners in English, isiXhosa and Afrikaans. The SoR reporting material developed for use in the Buffalo River catchment consisted of the SoR report, a fun poster suitable for the illiterate, a poster explaining the SoR reporting concept, and an activity book for grade 1 to 3 learners (Figure 1.12). Due to funding and other logistical constraints, the SoR report and the activity book were only produced in English, not in isiXhosa.

⁸ The production of the SoR reports followed guidelines as prescribed in report series 17 of the River Health Programme (Strydom 2003). The researcher was also involved in the production of the mentioned SoR reporting materials.

Several government departments (national, provincial and local), organisations, boards, universities and consultancies participated in the production of the SoR reporting materials. The reports contain a comprehensive list of all participants and participating organisations (RHP 2008).



Fig 1.11 State-of-Rivers reporting material for use in the Hartenbos and Klein Brak River study. Clockwise from top left is the State-of-Rivers Report: Hartenbos and Klein Brak River Systems (A) (RHP 2003); A summary of the 2003 State-of-Rivers Report (B) (RHP 2006); activity book for grade 1 to 3 learners, an isiXhosa, (C), an Afrikaans (D) and an English version (E) (RHP 2006); and, a River Health poster designed for the Free State area⁹ (F) (RHP 2006).

⁹ In the absence of having a custom designed river health poster, the Free State poster was used for the study in the Hartenbos and Klein Brak catchments. Although the poster was designed for use in the Free State, the river health concepts depicted are generic and would be suitable for use in the Hartenbos and Klein Brak River catchments.



Fig 1.12 State-of-Rivers communication products to be evaluated for the study in the Buffalo River catchment. Clockwise from top left is the State-of-Rivers Report: Buffalo River System (A) (RHP 2004); a bilingual poster (English and isiXhosa) explaining the SoR reporting concept targeting senior secondary phase learners (B); a River Health fun poster of the Buffalo River catchment (C) (RHP 2006); and, an activity book for grade 1 to 3 learners (D) (RHP 2006).

1.3 Research method

The research method is discussed in detail in Section 3.3 (study 1) and Section 4.3 (study 2). Possible sources of error are addressed in Chapter 5.

1.4 Reference List

- Brown, C.P., Propst, S.M. & Woolley, M. (2004) Report: Helping researchers make the case for science. *Science Communication*, **25**, 294-303.
- DEAT (1999) *National State of the Environment Report*. Department of Environmental Affairs and Tourism, South Africa. Available from: <http://www.environment.gov.za/soer/nsoer/index.htm> (accessed April 2006).
- Denisov, N. & Christoffersen, L. (2001) *Impact of Environmental Information on Decision-making Processes and the Environment*. UNEP/GRID-Arendal Occasional Paper 01 2001. Available from: www.grida.no/impact (accessed April 2006).
- Eagly, A.H. & Chaiken, S. (1993) *The psychology of attitudes*. Wadsworth, Belmont.
- Goodrum, D., Hackling, M. & Rennie, L. (2000). *DETYA Report: The Status and Quality of Teaching and Learning of Science in Australian Schools: A Research Report Prepared for the Department of Education, Training and Youth Affairs*. Department of Employment, Training and Youth Affairs, Australia.
- Harrison, T.D., Cooper, J.A.G. & Ramm, A.E.L. (2000) *State of South African Estuaries: Geomorphology, Ichthyofauna, Water Quality and Aesthetics*. Prepared by CSIR, Department of Water, Environment and Forestry Technology for Department of Environmental Affairs and Tourism, Pretoria, South Africa.
- RHP (2003) *State of Rivers Report: Hartenbos and Klein Brak Rivers*. Department of Water Affairs and Forestry, Pretoria. Available from: <http://www.csir.co.za/rhp/> or <http://www.dwaf.gov.za/iwqs/rhp/> (accessed December 2008).
- RHP (2004) *State of Rivers Report: Buffalo River System*. Department of Water Affairs and Forestry, Pretoria. Available from: <http://www.csir.co.za/rhp/> or <http://www.dwaf.gov.za/iwqs/rhp/> (accessed December 2008).
- RHP (2006) *State of Rivers Report: Greater Cape Town's Rivers*. Department of Water Affairs and Forestry, Pretoria. Available from: <http://www.csir.co.za/rhp/> or <http://www.dwaf.gov.za/iwqs/rhp/> (accessed December 2008).
- RHP (2008) River Health Programme. Available from: <http://www.csir.co.za/rhp/> or <http://www.dwaf.gov.za/iwqs/rhp/> (accessed December 2008).
- Roux, D.J. (1997) Overview of the design process and guidelines for implementation. Health Programme Report Series No 6. Available from: <http://www.dwaf.gov.za/iwqs/rhp/> or <http://www.csir.co.za/rhp/reports/reportseries6.pdf> (accessed December 2008).
- Statistics South Africa (Stats-SA) (2001). South African Population Statistics: Census 2001. Available from: <http://www.statssa.gov.za/census01/html>. (Accessed August 2007).
- Stern, P.C., Dietz, T., Guagnano, G.A. & Kalof, L. (1999) A value-belief-norm theory of support for social movements: the case of environmentalism. *Human Ecology Review*, **6**, 81-97.

- Strydom, W.F. (2003) *Compiling State-of-Rivers Reports and Posters: A Manual*. River Health Programme Report Series No 17. Available from: <http://www.dwaf.gov.za/iwqs/rhp/> (accessed December 2008) or <http://www.csir.co.za/rhp/reports/reportseries17.pdf> (Accessed May 2006).
- Strydom, W.F., Hill, L. & Eloff, E. (2006) *Achievements of the River Health Programme 1994 -2004: A national perspective on the ecological health of selected South African rivers*. River Health Programme, Department of Water Affairs and Forestry. Pretoria. ISBN 0-620-36168-9
- Tveitdal, S. (2001) Foreword. *Impact of Environmental Information on Decision-making Processes and the Environment* (eds N. Denisov. & L. Christoffersen). UNEP/GRID-Arendal, Arendal.
- UNCED (1992) Earth Summit Agenda 21. *The United Nations Programme of Actions from Rio. United Nations Conference on environment and development (UNCED)*, Rio de Janeiro, Brazil, 3 to 14 June 1992. Geneva: United Nations, Department of Public Information.
- WRC (2001) *State of Rivers Report: Letaba and Luvuvhu River Systems*. WRC Report No TT 165/01. Water Research Commission, Pretoria. Available from: <http://www.csir.co.za/rhp/> or <http://www.dwaf.gov.za/iwqs/rhp/> (accessed December 2008).

Chapter 2

Literature Review

2.1 Introduction

It is vital that natural scientists understand the causes of human behavioural change if they wish to change peoples' attitudes and behaviour towards the environment. Natural scientists that venture into cross-cutting fields, such as sustainability, conservation and impact studies on communities, should similarly have a fair understanding of attitude and behaviour science to ensure relevance of their work (Robinson 2006, Saunders *et al.* 2006). Natural scientists seldom consider the effects of psychological, social psychological and sociological factors on their subject matter. The objective of this review is to understand some of the causes of attitudinal and behavioural change, and the relationship between attitude and behaviour.

Research questions of interest in this study include the following:

- Do SoR reporting materials contain information in an appropriate format and language to improve non-scientists' understanding of ecosystem services, increase their awareness of adverse impacts on river systems, and change their attitudes, and possibly behaviour, towards river management and conservation?
- To what extent do demographic attributes, geographic locality, and social and economic issues influence people's attitudes towards river management and conservation?

This literature review is not comprehensive. It provides only a brief overview of key psychology and social psychology theories. It was conducted to assist the author in understanding the psychological powers (or influences) behind human attitudes and behaviour that, in turn, drive environmental change. The first sections examine the interaction between society and science as well as the need for communication to bridge the gap between science and the public. Some of the main theories and models developed to assist the understanding of human attitudes and behaviour are referred to, and the roles of various dependent and independent variables, as found in the literature are discussed.

2.2 The interaction between society and science

With human impacts on nature and the resulting global changes increasing, scientists are challenged to meet the needs of society (Lubchenco 1998). Gregory and Miller (1998) quoted a 1950s statement by Warren Weaver, a board member of the American Association for the Advancement of Science: "it is absolutely essential that science... be better understood by government officials, business men and indeed by all people". Trudgill (1990) noted that the understanding of science should not only be improved, but science should also be environmentally and socially acceptable and enhance the quality of life of people. In the late 1990s it was already acknowledged that a completely new

approach was needed to understand the interaction between society and science: economic development, social equity and international peace and security cannot and should not be separated from environmental issues (Lubchenco 1998). In the governance Trialogue Model¹⁰ (Turton *et al.* 2007), the interface or interaction between science and society plays an equally important role, together with the interface between science and government and government and society, in the success of governance as a process. According to the Deficit Model¹¹ there is a widespread assumption that the public simply does not understand science-related issues. The public's ability to understand science is linked to the ability of scientists to deliver to specific public needs and preferences (Wynne, 1992). The ability of scientists to understand the public is thus as important as the public's understanding of science (LaFollette 1992; Jasanoff 1997).

2.2.1 Communicating scientific information

The communication of scientific information, and the use of appropriate communication tools, is fundamental in providing useful information to stakeholders, decision-makers and the public (Lubchenco 1991; Lubchenco 1998; Dawson 2000; Christoffersen *et al.* 2000; Santi & Grenna 2003). In "The Sustainable Biosphere Initiative: An Ecological Research Agenda" report, the Ecological Society of America specifically called for improved communication between ecologists and decision-makers as well as the public, through improved ecological education and cooperation with the mass media (Lubchenco 1991). While the traditional science culture seldom encourages communication beyond the science sphere (Moser 1999; Brown 2004; Mathews *et al.* 2005), several scientists have created and supported specific science communication efforts directed at the lay public (Lewenstein 1992)¹².

2.2.2 Understanding and awareness

An awareness of scientific issues requires a level of understanding of science and technology. Jasanoff and co-workers (1997) and Boulter (1998) acknowledged that public understanding of science and technology was one of the key issues facing the adoption of scientific concerns by society. A public awareness of science stimulates positive attitudes towards science (Burns *et al.* 2003). In turn, positive attitudes towards science potentially lead to improved scientific skills as well as positive or improved behavioural responses (Gilbert *et al.* 1999). According to Hersey *et al.* (1996), it is easier to change knowledge than attitude, because attitude has an emotional component which could be either positive or negative. If it is true that the provision of information is a way to change attitude (Winter *et al.* 2005) and that together, knowledge and attitude guide behaviour

¹⁰ The Trialogue Model describes the relationships between government, society and science as three corners of a triangle with the relationships between them represented by the three sides of the triangle.

¹¹ The Deficit Model depicts communication as a one way flow from science to the public (TW Burns, DJO Conner and SM Stoklmayer In: *Public Understanding of Science*, 2003). The Deficit Model assumes that the public simply does not know (S Jasanoff In: "*Conversations with the Community: AAAS at the Millennium*", 1997).

¹² These proceedings of a workshop on the Public Understanding of Science and Technology capture several examples of science communications.

(Denisov *et al.* 2005), then it can then be assumed that the promotion of knowledge, problem awareness and favourable attitudes in the public would lead to behavioural changes. In turn, such behavioural changes would potentially have positive impacts on ecosystems and their components (Winter *et al.* 2005). Geller (1995) acknowledges the role of human behaviour in the environment: *“The critical role of humans in the health of our planet cannot be denied. Indeed, human behaviour contributes significantly to the degradation of our environment, and certain changes in human behaviour can contribute significantly to environmental protection.”*

2.3 Attitude and behaviour

Several theories and definitions related to the general behaviour of individuals, and the behaviour of individuals towards the environment, have been developed over the past decades. This section highlights a few of these theories and definitions that, from the author’s perspective, could add value towards understanding human attitudes, intentions and behaviour towards our natural environment. In short, it is vital to understand what characteristics drive behaviour that is beneficial to our natural environment.

2.3.1 Human behaviour – the theory

Kurt Lewin is considered to be the “founder of modern social psychology” (Worchel *et al.* 1991). With his background in applied psychology and knowledge of the deductive scientific method, Lewin brought theory into social psychology (Lewin 1952). He postulated that a person’s behaviour is driven by both personal needs and/or motives reflected in a person’s personality and the situation or environment in which the person resides. Based on field theory, his equation for a person’s behaviour (B) at a given time (t) is a function of the situation (S), where the situation includes both the person and his psychological environment:

$$B^t = f(S^t)$$

Lewin’s theory also acknowledges the role ‘time’ plays (Lewin 1952):

“behavior depends neither on the past nor on the future but on the present field...[The present field] includes the ‘psychological past,’ ‘psychological present,’ and ‘psychological future’...This is in contrast both to the belief of teleology that the future is the cause of behavior, and that of associationism that the past is the cause of behavior.”

Based on work done by Dulany (1968), and given that, up to this point, very little evidence was found that attitudinal change will result in behavioural change, Ajzen and Fishbein (1973) isolated two major factors which determine behavior intentions. These are a personal factor, or an attitudinal factor, and a social or normative factor. The equation for behaviour thus became:

$$B \sim BI = [Aact]w_0 + [NB(Mc)]w_1$$

B = overt [evident] behaviour;

BI = the intention to behave in a certain way;

Aact = the attitude towards the act;

NB = the normative belief;

Mc = the motivation to comply with the normative belief;

w₀; w₁ = empirically determined weights

Fishbein and Ajzen (1975) expanded on this equation to predict specific intentions and human behaviour with their Theory of Reasoned Action (Figure 1). The departure point of the Theory of Reasoned Action is that any behaviour is precursed by an intention to perform the specific behaviour. According to this Theory of Reasoned Action, a person will only execute certain behaviour if he/she had the intention to do so. In turn, this intention to act depends on two factors: firstly, the person's attitude towards the behaviour, and secondly, the person's perception of social pressures, e.g. what other people expect of the person. This perception of social pressures is called the subjective norm.

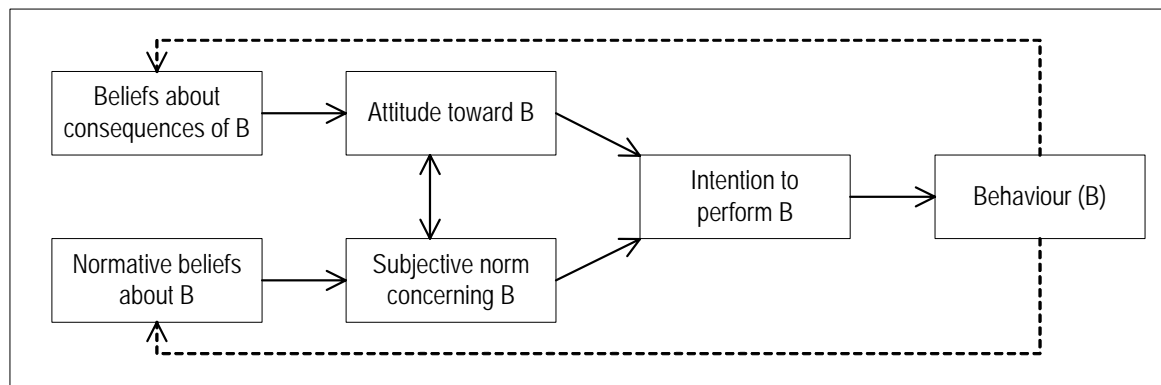


Fig 2.1 A schematic presentation of the conceptual framework for the prediction of intentions and behaviours, also called the Theory of Reasoned Action, adapted from Fishbein and Ajzen (1975).

From Figure 2.1 it is clear that attitudes and intentions of individuals, as well as the social pressures that surround them, play important roles in the ultimate behaviour that could result in either a positive or a negative action (B). However, as Eagly and Chaiken (1993, p169) pointed out several years later, this theory did not make provision for behaviour that is not voluntary due to the lack of skills and resources.

Ajzen and Fishbein (1980) also acknowledged the role of personality factors, demographic variables and social variables in certain behaviour. They motivated that these factors influence the beliefs of a

person rather than have a direct influence on behaviour, and referred to these factors as external variables. These external variables are shown on the left in Figure 2.2.

The Theory of Planned Behaviour (Ajzen 1985) as depicted in Figure 2.3, improved the aforementioned theories of behaviour by including a perceived behavioural control component. Perceived behavioural control is “the person’s belief as to how easy or difficult performance of the behavior is likely to be” and helps to predict the intention of a person to act in a certain way (Ajzen & Madden 1986). Although it is the person’s decision to act or not to act, this variable is influenced by the availability of resources which could influence how easy or difficult it is to perform a certain behaviour or act (Ajzen & Madden 1986). Several studies that followed supported and referred to this Theory of Planned Behaviour (Ajzen 1991; Nilsson & Küller 2000; Winter 2003).

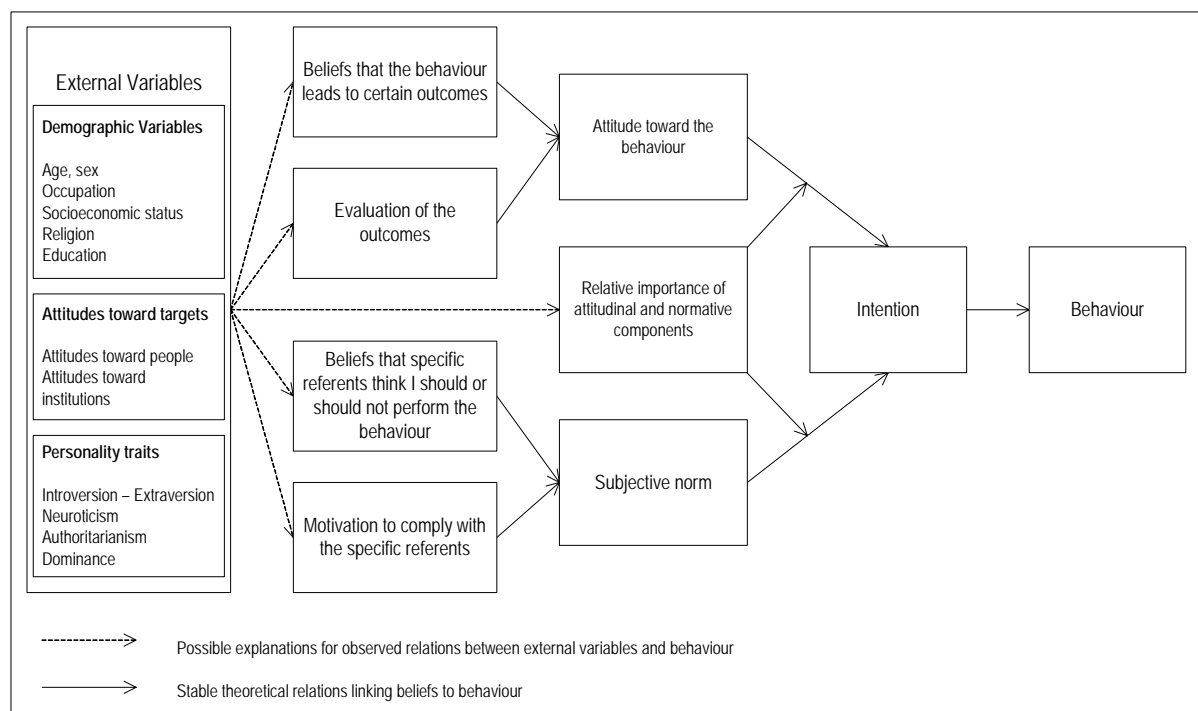


Fig 2.2 Diagram based on Ajzen and Fishbein’s (1980) model for determining a person’s behaviour. The external variables on the left side of the diagram show the indirect effects these variables have on behaviour.

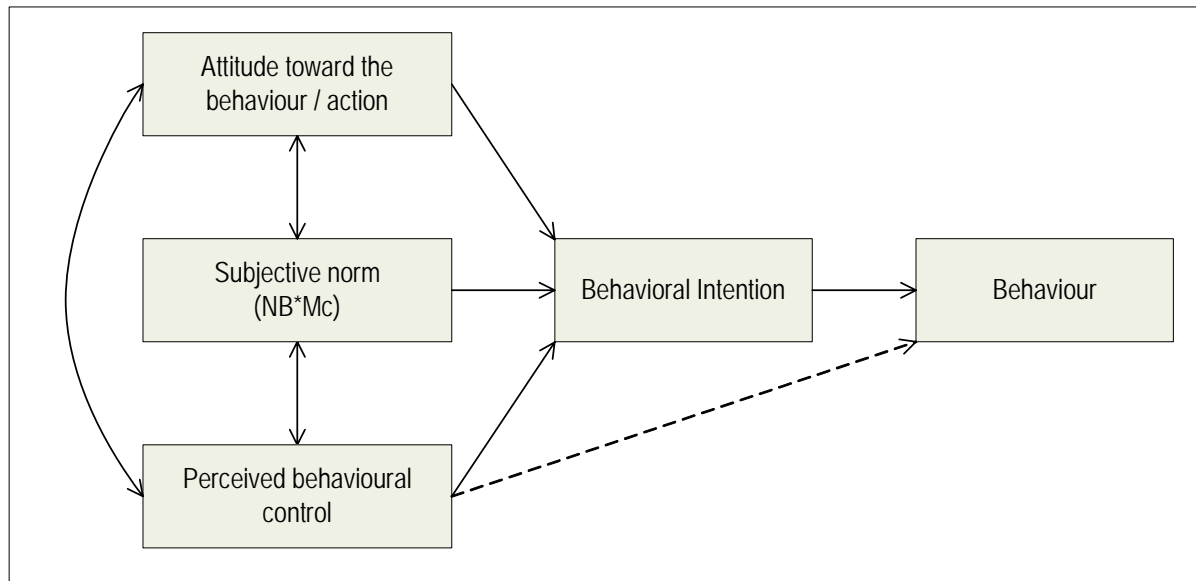


Fig 2.3 Schematic depiction of the Theory of Planned Behaviour, adapted from Azjen and Madden (1986). According to the Theory of Planned Behaviour, perceived behavioural control not only correlates with both the subjective norm and the attitude towards the behaviour, but also affects the intention to behave independently and the behaviour itself directly.

A few years later, in 1991, Grob developed a model (Fig. 2.4) that explains the influence of emotions and environmental awareness on behaviour (Grob 1995). The emotions component captures the emotional value that people place on aspects of the environment and the perceived discrepancies between the ideal and actual environmental conditions. The environmental awareness component acknowledges the role of factual knowledge about the environment, and recognition of environmental problems, on environmental behaviour.

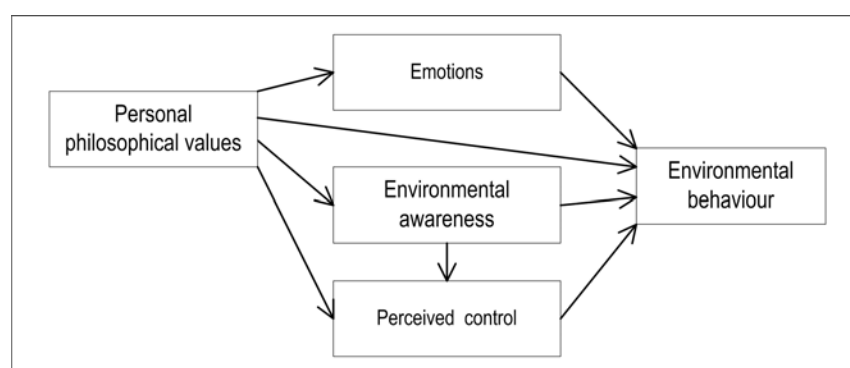


Fig 2.4 The model of environmental behaviour as proposed by Grob (1995) includes an emotional component.

Geller (1995) adds another dimension to the behavioural change models by recognising two lines of thought: the first being that behaviour is a function of activators (information, advice, education) and

attitudinal change is the mediating variable; the second being that human behaviour is a function of its consequences and change cannot be expected from activators alone – especially when information is about the distant future. Geller subsequently developed the flow of behavioural change – a model, depicted in Figure 2.5 (Geller 2002). Geller argues that excessive use of environmental resources is often maintained by natural reinforcing consequences. Monetary rebates, commendations or condemnations and recognition (e.g. by listing someone on the honour energy efficient roll and allowing the attendance of special learning events) are examples of possible consequences (Geller 1995). In order to support behaviour that is beneficial to the environment, all behavioural change strategies that currently support behaviour that is detrimental to the environment should be removed (Geller 2002).

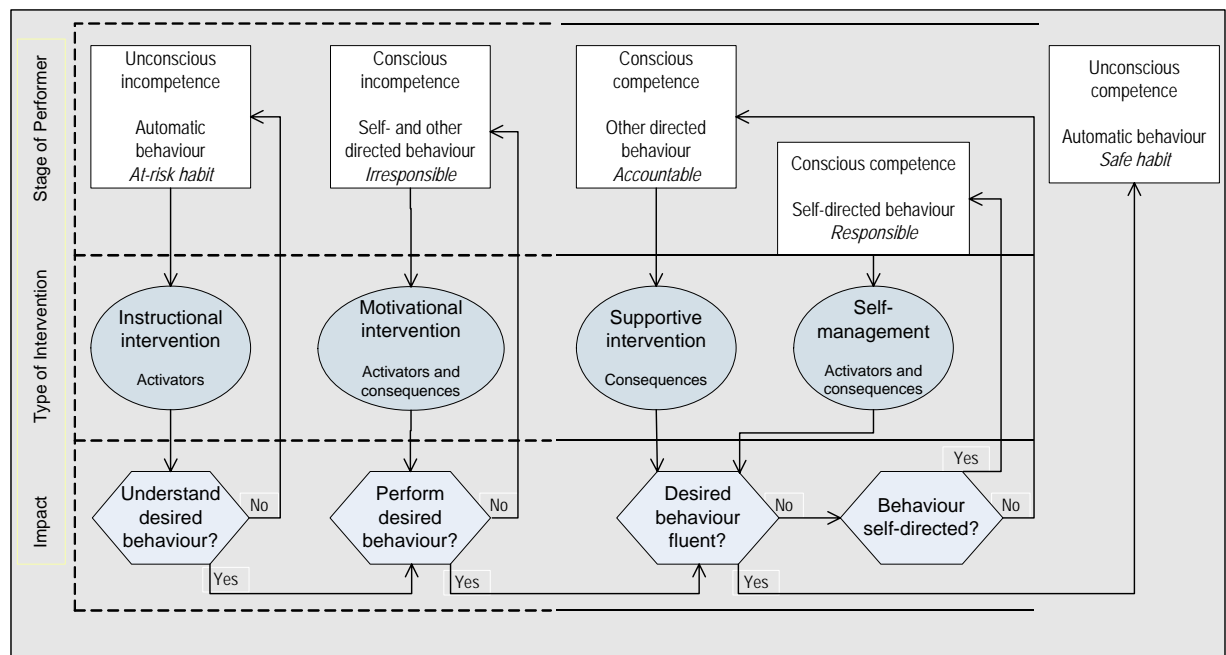


Fig 2.5 The flow of behavioural change model, adapted from Geller (2002).

2.3.1.1 Motivation to act

From the above theories it is clear that predicting human behaviour is not easy. When human behaviour towards the environment is added to the equation it becomes even more complex. Explaining this complexity, Geller (2002) pointed out that the well-studied direct persuasion techniques used in social marketing (advertising) to change market-related behaviour are neither applicable nor relevant to changing environmental behaviour for several reasons:

- Time scales differ – the effect of responses may lag well beyond the lifetime of the respondents; environmental consequences are not immediate (Denisov & Christoffersen 2001; Geller 2002)
- Lack of certainty – inherent variability in the environment; environmental consequences are not certain

- Behavioural adjustments and effort – change in environmental behaviour often requires significant adjustments or changes in lifestyle that are inconvenient and difficult, requiring a person to move away from behaviour that uses excessive environmental resources (Geller 2002)
- Responsibility – for environmental behavioural change to be upheld persistently, self-directed responsibility which is not acquired through direct persuasion of somebody else's idea, is needed
- Accountability – people should hold themselves accountable for what is happening in the environment
- Lack of sustainability of contingencies – when the person's resultant behaviour is not a contingency and external contingencies does not encourage the development of internal justifications for the sustenance of the desired behaviour (Geller 2002)
- Continuity in actions required (in some instances) – to have an impact, persistent behaviour that favours the environment is required from most of, if not all, the individuals affected
- Social pressures – default modern lifestyles do not favour environmentally friendly behaviour.

2.4 Variables

Several attributes potentially influence people's attitudes and behaviour. These can be grouped into dependent and independent variables. The independent variable (typically graphically portrayed on the x-axis) causes the observed variation in the dependent variable (y-axis). The dependent variable is thus the outcome or result of the influence of the independent variable (the dependent variable depends on the independent variable) (Creswell 2003). Considering this explanation of variables, and depending on the type of variable, some variables could thus be considered either as dependent or independent variables. For the purpose of the current study, demographics (age, socio-economic status, years of formal schooling, ownership of house), knowledge, awareness, and social influences are considered as independent variables. Attitude and behaviour are discussed as dependent variables.

2.4.1 Independent variables

2.4.1.1 *Demographics*

Studies that ascertain the correlation between demographics and the dependent variables, attitude and behaviour, include those within the general environmental field, as well as specialized fields such as pesticide use and waste recycling. Most studies either found no relationship or were inconclusive regarding the effect of demographics such as age, gender and place of residence on pro-environmental type attitudes and behaviour (Krause 1993; Van Liere & Dunlap 1980). Interviews as well as a mail survey to establish the factors that influence household recycling behaviour found that

most demographic variables did not predict behaviour (Oskamp *et al.* 1991; Gamba & Oskamp 1994). A dilemma with the recycling projects was that those that do not participate in the surveys are also observed to be those that do not recycle (Gamba & Oskamp 1994).

Neiman & Loveridge (1981) found no relationship between social class and environmental protection. Similarly, Baldassare & Katz (1992) found that income, education levels and political convictions were unrelated to environmental conservation practices. However, Van Liere & Dunlap (1990) found that education is positively correlated with environmental concern, but the broad construct of social class, which encompasses income, occupation and education, shows only weak association with environmental concern.

A study conducted by Grieshop and Stiles (1989) about the use of pesticides for domestic purposes found that women were more risk-averse than men. Women and older people are noted to be more likely to participate in environmental conservation practices (Baldassare & Katz 1992). Women, also, to a greater degree than men, have positive protective attitudes toward the environment (Steger & Witt 1988). Concern about toxic waste contamination was highest among younger respondents, women and those respondents with children younger than 18 years of age (Hamilton 1985). Education and occupation showed no significant relationship with concern over toxic wastes.

2.4.1.2 Knowledge, awareness and social influences

Oskamp and co-workers (1991) found that general knowledge about conservation issues was higher amongst those families that recycle their household waste. They also found that having friends and family who recycle correlates positively with recycling behaviour (Oskamp *et al.* 1991). A strong positive relationship was found between a respondent's self-reported behaviour and what they expect from other households and from government sectors (Staats *et al.* 1996).

Diverging from the above, findings from a questionnaire survey that was conducted to test Grob's model (n = 722) concluded that factual knowledge had no significant effect on environmental behaviour, and that personal-philosophical values and emotions had the strongest effect (Grob 1995). Similarly, knowledge had a smaller effect on travel behaviour in Sweden than environmental attitudes (Nilsson & Küller 2000). Finger (1994) also reported that environmental knowledge played no significant role in behaviour toward the environment.

2.4.2 Dependent variables

Attitude is defined as a psychological construct, composed of affective, cognitive and behavioural components, which may be used to describe human evaluative responses (Eagly & Chaiken 1993). Both Weigel and Weigel (1978) and Ajzen and Fishbein (1973) warned that the way in which attitudes and behaviours are measured could have an effect on the outcomes of studies and that they should be measured at a comparable level of specificity. Another distinction that should be made when attempting to understand human behaviour is between environmental issues and human safety issues. For example, if toxic waste has the potential to pollute individual households, it becomes a

safety issue and those individuals that are affected will react differently to the potential environmental hazard than those that are not affected (Hamilton 1985).

Although the behaviour of individuals, and the resulting impact on the environment, is relatively small, when similar individual behaviours are combined, they collectively have the potential for significant impact (Stern 2000). Some individuals also have the potential, for example, through their occupations or circle of friends, to influence and guide policies, decision-making within national and local government, industry and other organisations.

2.4.2.1 Attitude

According to the Theory of Reasoned Action, the attitude that an individual holds towards a certain behaviour is an important predictor of whether the actual behaviour will be executed (Fishbein & Ajzen 1975). Attitude is thus an important variable in the prediction of behaviour. Most of the work carried out on attitude tends to be conducted within the framework of psychological theory. For the purpose of this study, only those with a more environmental application are discussed.

Gagnon-Thompson and Barton (1994) found that ecocentric individuals (individuals that value the environment for the sake of the environment itself) were more likely to engage in conservation activities than anthropocentric individuals (individuals that value the environment for what value they can get from the environment). Ecocentric attitudes also predicted self-reported and observed behaviour. Kallgren & Wood (1986) found that attitudes can be important predictors of behaviour.

2.4.2.2 Behaviour

A change in behaviour is more difficult to achieve than either the acquisition of knowledge or a change in attitude (Hersey *et al.* 1996). Results from a survey conducted in The Netherlands following a mass media campaign to communicate the greenhouse effect to the public, concluded that it “is hard to change current cognitions and behaviour” (Staats *et al.* 1996). The Netherlands study showed that knowledge and problem-awareness played a smaller role in promoting behavioural change than was assumed before the campaign started (Staats *et al.* 1996). Other studies have also confirmed that knowledge has a relatively small effect on the opinions, attitudes and behaviour of the general public (Priest 2004). Researchers have noted that it is very difficult to induce “environmentally relevant behaviour, even when people are made aware of the negative collective consequences of their own acts” (Staats *et al.* 1996). A South African study has also shown that it is equally difficult to determine the impact of projects that distribute information such as State of Environment Reports (Pretorius 2000).

In contrast to the results reported above for The Netherlands and South Africa, but also acknowledging that behavioural changes are still poorly defined (Krumiech *et al.* 2001; Onyango-Ouma 2003), a study conducted by Onyango-Ouma *et al.* (2005) amongst school children in Western Kenya obtained different findings. This study concluded that health messages not only changed the behaviour of study groups, but also improved the knowledge levels and behaviour of their fellow school mates and parents, whom they in turn had to guide and teach. This could be due to the direct

benefit obtained from the changed behaviour. Behavioural studies indicate that where desired behaviour is immediately rewarded, there is a greater possibility that good behaviour will continue even when it is no longer rewarded (Hersey *et al.* 1996). Unfortunately, the relatively slow response times of ecosystem components mean that the environment will often only reward the impacts of desirable behaviour years after the human actions have changed.

The level to which the state of the environment is perceived to be a threat to personal health and well-being should also be taken in account. Baldassare & Katz (1992) found personal environmental threat to be the most significant predictor of overall environmental behaviour. Finger (1994) distinguished between environmental behaviour and protest behaviour/environmental activism, with information and knowledge playing a role in the social environmental behaviour change as far as protest behaviour is concerned, and to a lesser extent environmental activism.

2.5 Discussion

During the 1970s, a general awareness of the link between human behaviour and ecological problems took effect. Psychologists and social scientists increasingly examined the relationships between humans and nature with emphasis on ecological attitudes (Gooch 1995). During this time it was highlighted that ecologically responsible human behaviour is needed to rectify the increasing detrimental effects humans have on the environment (Stern & Oskamp 1987).

What will motivate people to take environmentally beneficial action? Understanding of the adverse impact of human activities on the environment could motivate individuals and decision-makers to take preventative action or to remediate problem areas (Gamba & Oskamp 1994; Moser 1999). Although the knowledge to ensure sustainable use of the environment is available, it is questionable whether the will to do so exists (Repetto 1986). In turn, Gardner and Stern (1996) postulate that two types of knowledge are needed: the knowledge of ecosystems, and the knowledge of human activities that alter the natural environment. The latter encompasses the human activities that change the environment, the cause of these actions and how to change the behaviour (Gardner & Stern 1996). Findings from several studies, however, show a weak link between factual knowledge and pro-environmental behaviour. Despite this, and from a theoretical perspective, it can be argued that knowledge is an important factor required to establish environmental concern and ecologically sound behaviour, and that knowledge creation and awareness cannot be neglected (Staats *et al.* 1996; Nilsson & Küller 2000). Denisov & Christoffersen (2001) reason that economic considerations, traditions, culture and social issues interact with both old and new knowledge and can either strengthen or weaken the effect of environmental information.

Although people are aware of the negative collective consequences of behaviour that are detrimental to the environment, they are often reluctant to change their own behaviour. Similarly, many individuals feel that they have no power to make a positive impact (Denisov *et al.* 2005) and therefore fail to act. Scientists feel that most elected officials are often uninformed and highly driven by short-term political agendas, and that they therefore find it difficult to formulate sound science policy (Mathews 2005). Ideally, policy-makers should make more use of available information resources

(Ballantyne 1995), while scientists, through their societies, should more actively volunteer to help politicians formulate science policy (Bielak 2008). This can be done by carefully and effectively informing elected officials, decision-makers and the public, to ensure that decisions are based on credible information and not dominated purely by political agendas (Moser 1999; Mathews 2005). One of the reasons for the above conflict can be found in the social dilemma paradigm (Dawe 1980), where individuals do not trust that their own individual contributions will be followed by others to form a significant combined effect (Staats *et al.* 1996). People are therefore in favour of rather changing and enforcing policies than changing their own behaviour.

To date, findings from attitudinal and behavioural studies related to human behaviour and the environment are mixed. This is evident from several studies that proposed the following possible explanations:

- Van Liere and Dunlap (1990) suggest that environmental concern is too broad a general concept and that issues such as air and water pollution and wildlife protection should be considered separately.
- Rural communities that are dependent on the quality of the environment for their survival could be expected to show higher levels of environmental concern and pro-environmental behaviour than communities that are indirectly dependent on the environment. However, many rural inhabitants are often also 'poor' when measured with the standards of city dwellers. The poor often cannot afford the luxury of considering environmental issues, as their priorities are with the primary necessities of life – food and shelter, with jobs and education also higher on the priority list than environmental protection (O'Riordan 1976). Considering Maslow's ranking of basic human needs, the factors that can be singled out because of the harmonious link they may form between nature and humans are all very high up on the hierarchy of basic human needs (Maslow 1970). These include improvement in values; more holistic ways of looking at things; and changes in morality, ethics and values.
- People differ in the way they experience and value the environment (Gagnon Thompson & Barton 1994; Gooch 1995). There is a relationship between society and nature and each individual sees and values this relationship differently. Some humans are in harmony with nature, making use of what is on offer, without abusing nature. Others perceive their interaction with nature as an improvement, where "man conquers nature through its own ingenuity and for his own benefit" (Douglas, 1982).

2.6 Conclusion

Three key issues emerged from this literature overview. They are:

- Researchers attempting to assess the impact of environmental information on public behaviour and decision-making find that impact is very difficult to measure and thus to draw clear conclusions.

- In the context of the variety of South African cultures, and although not the subject of this study, it is important to explore the influence of socio-cultural aspects on human attitudes and behaviour.
- After several decades of studying human psychology, attitudes and behaviour towards the environment, no clear guideline exists on how to change behaviour to ensure conservation of our natural resources.

Scientists publish their findings in scientific journals that are accessible mainly to their peers. Those that are interested and involved in large-scale dissemination and application of information to change human environmental behaviour are not from the same disciplines as those investigating psychological and sociological behaviour and do not readily have access to the latter subject material, books and journals (Geller 2002). Geller (2002) noted that it is thus understandable that very little progress has been made with the understanding of the impact of environmental information on behavioural change.

Without fully understanding the drivers of human attitudinal and behavioural change, the scientist's potential role in changing attitudes and behaviour becomes very challenging. Scientists not only have a role to play in the interface with society, but also in the interface with government, that is responsible for evidence-based policy-making. Although no direct positive correlation between knowledge/education and behaviour has been found, the possibility of an indirect influence cannot be excluded. This is confirmed by several studies: experiences of nature during childhood play a role in attitudes and behaviour in later life (Palmer 1993, Wells & Lekies 2006); the environmental knowledge and attitudes of educators influence the perceptions and attitudes of learners (Palmer 1998, Gil-Perez *et al.* 2003, Barraza 1996), Ballantyne & Packer (2005) found that informal learning about the environment changes attitudes and behaviour.

The complexity of understanding people's attitudes and behaviour has far-reaching consequences. Natural scientists cannot ignore the relationship between this human component and the resulting consequences on conservation, sustainable development of natural resources and water resource management. Having well-informed solutions to environmental problems will not have any positive outcome if the people do not accept these solutions and adapt their attitudes and behaviour accordingly.

2.7 Reference List

- Ajzen, I. (1985) From intentions to actions: A theory of planned behaviour. *Action-control: From cognition to behavior* (eds J. Kuhl & J. Beckman), pp.11-39. Springer, Heidelberg.
- Ajzen, I. (1988) *Attitudes, Personality and Behavior*. Open University Press, Milton Keynes.
- Ajzen, I. (1991) The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, **50**, 179-211.
- Ajzen, I. & Fishbein, M. (1973) Attitudinal and normative variables as predictors of specific behaviors. *Journal of Personality and Social Psychology*, **27**(1), 41-57.
- Ajzen, I. & Fishbein, M. (1980) *Understanding Attitudes and Predicting Social Behavior*. Prentice-Hall, New Jersey.
- Ajzen, I. & Madden, T.J. (1986) Prediction of goal-directed behaviour: attitudes, intentions, and perceived behavioural control. *Journal of Experimental Social Psychology* **22**, 453-474.
- Baldassare, M. & Katz, C. (1992) The personal threat of environmental problems as predictor of environmental practices. *Environment and Behavior*, **24**(5), 602-616.
- Ballantyne, P. (1995) *Information, Capacity Development and Environmental Policy-making*. Report from a Consultation on Information Capacities and the Management of National Environmental Policy Agendas, Maastricht, 22-24 May 1995. ECDPM Working Paper No. 7, October 1995.
- Ballantyne, R. & Packer, J. (2005) Promoting environmentally sustainable attitudes and behaviour through free-choice learning experiences: what is the state of the game? *Environmental Education Research*, **11**(3), 281-295.
- Barraza, L. (1996) *Environmental knowledge and attitudes of English and Mexican school children*. PhD thesis University of Cambridge, United Kingdom.
- Barraza, L. (2001) Perception of Social and Environmental Problems by English and Mexican School Children. *Canadian Journal of Environmental Education*, **6**, 139-157.
- Bielak, A.T., Campbell, A., Pope, S., Schaefer, K. & Shaxson, L. 2008. From Science Communication to Knowledge Brokering: the Shift from Science 'Push' to 'Policy Pull'. (eds D. Cheng, M. Claessens, T. Gascoigne, J. Metcalfe, B. Schiele & S. Shi) *Communicating Science in Social Contexts: New models, new practices*. Springer, pp 320.
- Boulter, D. (1998) Public perception of science and associated general issues for the scientist. *Phytochemistry*, **50**(1999), 1-7.
- Brown, C.P., Propst, S.M. & Woolley, M. (2004) Report: Helping researchers make the case for science. *Science Communication*, **25**(3), 294-303.
- Burns, T.W., O'Connor, D.J. & Stocklmayer, S.M. (2003) Science communication: a contemporary definition. *Public Understanding of Science*, **12**(2003), 183-202.

- Christoffersen, L. *et al.* (2000) *Impact of Information on Decision-making Processes*. GRID-Arendal Issues Paper. May 11, 2000. GRID-Arendal, Norway. Available from: www.grida.no/impact (accessed April 2006).
- Creswell, J.W. (2003) *Research design: Qualitative, Quantitative and Mixed Methods Approaches*. Sage Publications, Thousand Oaks, California.
- Dawson, R. (2000) *Developing Knowledge-based Client Relationships – The Future of Professional Services*. Butterworth Heinemann, Boston.
- Denisov, N. & Christoffersen, L. (2001) *Impact of Environmental Information on Decision-making Processes and the Environment*. UNEP/GRIDArendal Occasional Paper 01 2001. Available from <http://www.grida.no/impact> (accessed April 2006).
- Denisov, N, Folgen, K., Rucevska, I. & Simonett, O. (2005) *Impact II Telling Good Stories. We have the message but how to communicate it using the right messengers*. A collection of practices and lessons. GRID-Arendal occasional paper 01 2005. Available from <http://www.grida.no/impact> (accessed April 2006).
- Douglas, M. (1982) *Essays in the Sociology of Perception*. Routledge & Kegan Paul, London.
- Eagly, A.H. & Chaiken, S. (1993) *The Psychology of Attitudes*. Pp 794. Harcourt Brace and Company, Orlando.
- Finger, M. (1994) From knowledge to action? Exploring the relationships between environmental experiences, learning, and behavior. *Journal of Social Issues*, **50**(3), 141-160.
- Fishbein, M. & Ajzen, I. (1975) *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Addison-Wesley, California, London.
- Gagnon-Thompson, S.C. & Barton, M.A. (1994) Ecocentric and antropocentric attitudes toward the environment. *Journal of Environmental Psychology*, **14**(2), 149-157.
- Gamba, R.J. & Oskamp, S. (1994) Factors influencing community residents' participation in commingled curbside recycling programs. *Environment and Behaviour*, **26**(5), 587-612.
- Gardner, G.T., Stern, P.C. (1996) *Environmental Problems and Human Behavior*. Allyn and Bacon, Boston.
- Geller, E.S. (1995) Actively caring for the environment: An integration of behaviorism and humanism. *Environment and Behaviour*, **27**(2), 184-195.
- Geller, E.S. (2002) The challenge of Increasing proenvironmental behaviour. *Handbook of Environmental Psychology*. (eds. R.B. Bechtel & A. Churchman) John Wiley & Sons.
- Gilbert, J.K., Stocklmayer, S. & Garnett, R. (1999) Mental modelling in science and technology centres: what are visitors really doing? *Paper presented at the International Conference on Learning Science in Informal Contexts, Canberra, 1999*, pp16-32.

- Gil-Perez, D., Vilches, A., Edwards, M., Praia, J. & Marques, L. (2003) A proposal to enrich teachers' perception of the State of the World: first results. *Environmental Education Research*, **9**(1), 67-90.
- Gooch, G.D. (1995) Environmental beliefs and attitudes in Sweden and the Baltic States. *Environment and Behavior*, **27** (4), 513-539.
- Gregory, J. & Miller, S. (1998) *Science in Public, Communication, Culture, and Credibility*. Basic Books, Cambridge.
- Grieshop, J.I. & Stiles, M.C. (1989) Risk and Home-Pesticide Users. *Environment and Behavior*, **21**(6): 699-716.
- Grob, A. (1995) A structural model of environmental attitudes and behaviour. *Journal of Environmental Psychology*, **15**(3), 209-220.
- Hamilton, L.C. (1985) Concern about toxic wastes: Three demographic predictors. *Social Perspectives*, **28**, 463-486
- Hersey, P., Blanchard, K.H. & Johnson, D.E. (1996) *Management of Organizational Behavior*. Utilizing Human Resources. International Edition. Seventh Edition. Prentice Hall, New Jersey.
- Jasanoff, S., Colwell, R., Dresselhaus, M.S., Golden, W.T., Goldman, R.D., Greenwood, M.R.C., Huang, A.S., Lester, W., Levin, S.A., Linn, M.C., Lubchenco, J., Nicholson, R.S., Novacek, M.J., Roosevelt, A.C., Taylor, J.E. & Wexler, N. (1997) Conversations with the Community: AAAS at the Millennium. *Science*, **278**(5346), 2066-2067.
- Kallgren, C.A. & Wood, W. (1986) Access to attitude-relevant information in memory as a determinant of attitude-behavior consistency. *Journal of Experimental Social Psychology*, **22**, 328-338.
- Krause, D. (1993) Environmental consciousness: an empirical study. *Environment and Behaviour*, **25**(1), 126-142.
- Krumiech, A., Weijts, W., Reddy, P. & Meijer-Weitz, A. (2001) The benefits of anthropological approaches for health promotion research and practice. *Health Education Research*, **16**(2), 121-130.
- LaFollette, M.C. (1992) Beginning with the Audience. *When Science Meets the Public* (ed B.V. Lewenstein). Proceedings of a Workshop Organized by the American Association for the Advancement of Science Committee on Public Understanding of Science and Technology pp 33-39. February 17, 1991, pp164. Washington, DC.
- Lewenstein, B.V. (1992) *When Science Meets the Public*. Proceedings of a Workshop Organized by the American Association for the Advancement of Science Committee on Public Understanding of Science and Technology. February 17, 1991, pp164. Washington, DC.
- Lewin, K. (1952) *Field Theory in Social Science. Selected Theoretical Papers*. Lowe & Brydone (Printers) Ltd., London pp346

- Lubchenco, J. (1998) Entering the century of the environment: a new social contract for science. *Science*, **279**, 491- 497.
- Lubchenco, J., Olson, A.M., Brubaker, L.B., Carpenter, S.R., Holland, M.M., Hubbell, S.P., Levin, S.A., MacMahon, J.A., Matson, P.A., Melillo, J.M., Mooney, H.A., Peterson, C.H., Pulliam, H.R., Real, L.A., Regal, P.J. & Risser, P.G. (1991) The Sustainable Biosphere Initiative: An Ecological Research Agenda: A Report from the Ecological Society of America. *Ecology*, **72**(2), 371-412.
- Mathews, D.J.H., Kalfoglou, A. & Hudson, K. (2005) Geneticists' views on science policy formation and public outreach. *American Journal of Medical Genetics Part A*, **137A**(2), 161-169.
- Maslow, A.H. (1970) *Motivation and Personality*. Harper & Row, New York pp369.
- Moser, S. (1999) *Impact Assessments and Decision-making: How can we connect the two?* White paper prepared for the SLR impact assessment workshop in Charleston, SC, January 31 – February 3, 1999.
- Neiman, M. & Loveridge, R.O. (1981) Environmentalism and Local Growth Control: A Probe into the Class Bias Thesis. *Environment and Behavior*, **13** (6), 759- 772.
- Nilsson, M. & Küller, R. (2000) Travel behaviour and environmental concern. *Transportation Research*, Part D 5, 211- 234.
- Onyango-Ouma, W. (2003) Children as partners in health communication in a Kenyan community. *Anthropology in Action*, **10**(1), 25-33.
- Onyango-Ouma, W., Aagaard-Hansen, J. & Jensen, B.B. (2005) The potential of schoolchildren as health change agents in rural western Kenya. *Social Science & Medicine*, **61**(2005), 1711-1722.
- O'Riordan, T. (1976) Attitudes, Behavior, and Environmental Policy Issues. *Human Behavior and Environment. Advances in Theory and Research. Volume 1*. (eds I. Altman & J.F. Wohlwill) pp 301. Plenum Press, New York.
- Oskamp, S Harrington, M.J., Edwards, T.C., Sherwood, D.L., Okuda, S.M., & Swanson, D.C. (1991) Factors influencing household recycling behavior. *Environment and Behavior*, **23**(4): 494-519
- Palmer, J.A. (1993) Influences and experiences affecting the pro-environmental behaviour of educators. *Environmental Education Research*, **24**(3), 26-30.
- Palmer, J.A., Suggate, J., Bajd, B., Hart, P., Ho, R.K.P., Ofwono-Orecho, J.K.W., Peries, M., Robottom, I., Tsaliki, E. & Van Staden, C. (1998) An overview of significant influences and formative experiences on the development of adults' environmental awareness in nine countries. *Environmental Education Research*, **4**(4), 445-464.
- Pretorius, R. (2000) Impact of Information on Decision-Making Processes in South Africa. *Impact of Information on Decision-making Processes: Case studies* (eds E. Leif, L. E. Christoffersen, K. Folgen & N. Denisov) UNEP/GRID-Arendal, May 2000. pp23. Available online: <http://www.grida.no/impact/papers/casestudies.doc> (accessed April 2006).

- Priest, S. (2004) Biotechnology, media and public opinion across national boundaries. *Ecquid Novi*, **25**(1), 80-93.
- Repetto, R. (1986) *World enough and time: successful strategies for resource management*. Yale University Press, New Haven, Connecticut.
- Robinson, J.G. (2006) Conservation Biology and Real-World Conservation. *Conservation Biology*, **20**(3):658-669.
- Santi, E. & Grenna, L. (2003) Environmental Communications Assessment – A framework of analysis for the environmental governance. *Paper presented at the 7th Biennial Conference on Communication and the Environment (COCE 2003)*. Available online: <http://siteresources.worldbank.org/EXTDEVCOMMENG/Resources/cocefinaldraft.pdf> (Accessed March 2006)
- Saunders, C.D., Brook, A.T. & Myers, O.E. Jr. (2006) Using Psychology to Save Biodiversity and Human Well-Being. *Conservation Biology* **20**:702-705.
- Staats, H.J., Wit, A.P. & Midden C.Y.H. (1996) Communicating the greenhouse effect to the public: evaluation of a mass media campaign from a social dilemma perspective. *Journal of Environmental Management*, **45**, 189-203.
- Steger, M.A.E. & Witt, S.L. (1989) Gender differences in environmental orientations: A comparison of publics and activists in Canada and the U.S. *Western Political Quarterly*, **42**, 627-649
- Stern, P.C. (2000) Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, **56**, 407-424.
- Stern, P.C., Dietz, T., Guagnano, G.A., Kalof, L. (1999) A value-belief-norm theory of support for social movements: the case of environmentalism. *Human Ecology Review*, **6**(2), 81-97.
- Stern, P.C. & Oskamp, S. (1987) *Managing scarce environmental resources*. Handbook of Environmental Psychology, vol. 2. (eds D. Stokols & I. Altman), pp. 1043-1088. Wiley, New York.
- Trudgill, S.T. (1990) *Barriers to a Better Environment. What Stops us Solving Environmental Problems?* Belhaven Press, London.
- Turton, A.R., Hattingh, J., Maree, G.A., Roux, D.J., Claassen, M. & Strydom, W.F. (2007) *Governance as a Trialogue: Government-Society-Science in Transition*, Water Resources Development and Management Series, Springer-Verlag, Berlin.
- Van Liere, K.D. & Dunlap, R.E. (1980) The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *Public Opinion Quarterly*, **44**:181-197.
- Weigel, R. & Weigel, J. (1978) Environmental concern. The development of a measure. *Environment and Behavior*, **10**, 3-15.

- Wells, N.M. & Lekies, K.S. (2006) Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism. *Children, Youth and Environments*, **16**(1). Available online: www.colorado.edu/journals/cye (accessed: 28 March 2008).
- Winter, S.J. (2003) *Attitudes and behaviour of landholders towards the conservation of Overberg Coastal Renosterveld, a threatened vegetation type in the Cape Floral Kingdom*. Thesis presented in partial fulfillment of the requirements for the degree of Master of Science at the University of Stellenbosch. University of Stellenbosch, South Africa.
- Winter, S.J., Esler, K.J. & Kidd, M. (2005) Index to measure the conservation attitudes of landowners towards Overberg Coastal Renosterveld, a critically endangered vegetation type in the Cape Floral Kingdom, South Africa. *Biological Conservation*, **126**, 383-394.
- Worchel, S., Cooper, J. & Goethals, G.R. (1991) *Understanding Social Psychology*. Brooks/Cole Publishing Company, Pacific Grove, California.
- Wynne, B. (1992) Sheep Farming After Chernobyl: A Case Study in Communicating Scientific Information. *When Science Meets the Public* (ed B.V. Lewenstein) Proceedings of a Workshop Organized by the American Association for the Advancement of Science Committee on Public Understanding of Science and Technology, pp 43-67. February 17, 1991, pp164. Washington, DC.

Chapter 3

Peoples' awareness of and attitude towards river conservation in the Buffalo and Hartenbos & Klein Brak catchments

3.1 Abstract

For the past two decades there has been a growing emphasis on the need for scientifically credible environmental information to support water resource management and to inform the public about the importance of river conservation. There is still insufficient evidence available that environmental information is efficiently used in decision-making. Political and economical considerations, as well as human development needs still overshadow environmental evidence and biodiversity conservation needs.

This study reported on respondents' awareness of general water issues in South Africa, their attitudes towards river conservation and additionally it tests the relationship between specific attitudes and demographic attributes, such as geographic locality, social issues, gender and age. It also ascertained the respondents' understanding of the benefits that healthy rivers provide, of the negative impacts people have on rivers in general, and the availability of river health information that was easy to comprehend.

With a sample size of 1144 respondents and Cronbach alpha values between 0.61 and 0.84, the results were considered reliable. There was a positive correlation between respondents' attitude and awareness and education levels as well as their understanding of the benefits that can be gained from healthy rivers. Simultaneously, there was a negative correlation between attitudes and awareness and an understanding of negative human impact on rivers. The correlation between attitude and age, and awareness and age was insignificant. As expected there was a strong relationship between respondents' attitudes and their willingness to participate in a follow-up survey. Those respondents with the highest awareness scores indicated that they neither wished to receive more information nor to participate in a follow-up survey. In general, respondents expressed a need for more information about river health.

In line with evidence-based conservation, 'outputs' and 'outcomes' of conservation-related projects should be continuously monitored and evaluated, and the impact thereof assessed: strategies on how to reach the audience should be researched and regularly updated; the effectiveness of communication materials should be evaluated; and their impact on awareness, attitudes and behavioural changes assessed. Recommended areas for future research include language barriers, socio-economic circumstances, and cultural differences as drivers of human attitudes and behaviour.

3.2 Introduction

The vast majority of environmental problems stem from human actions (Geller 1995, Gardner & Stern 2002, Millennium Ecosystem Assessment 2005, Nuyen 2008). Perceptions that earth and all its life exists for human comfort alone (Krause 1993) contribute to the over-exploitation of natural resources. Fortunately, changes in human behaviour have the potential to contribute towards environmental conservation (Geller 1995). Since technological changes alone will not solve our planet's ecological problems, people's attitudes and behaviour towards the environment also need to change (Weigel & Weigel 1978, Saunders 2003, Reid 2005, Robinson 2006).

The recent call for evidence-based conservation asks for a rigorous, well-documented, scientific process, both in the way conservation decisions are taken and in the measuring of conservation outcomes (Sutherland *et al.* 2004). Ferraro *et al.* (2006) support programme evaluations with a shift in focus from 'inputs' and 'outputs' to 'outcomes'. However, in decision-making processes, environmental evidence is most often overshadowed by political and economical considerations, with peoples' water needs taking priority over biodiversity conservation needs (Roux *et al.* 2008). Given this conflict of interest, it is even more important to acknowledge the human factor in the design of conservation projects (Saunders *et al.* 2006, Cowling & Wilhelm-Rechmann 2007). Unfortunately, this "human choice" factor, which is critical to successful implementation of conservation goals, is often ignored (Knight *et al.* 2006).

During the latter half of the 1900s, psychologists and socio-psychologists started investigating the human-environment interaction – i.e. relationships between behaviour and various variables, such as demographics, personal values, and how these link with attitudes, intentions and awareness (Lewin 1952, Ajzen & Fishbein 1973, Ajzen & Fishbein 1980, Ajzen and Madden 1986, Geller 1995, Grob 1995, Stern 2000, Geller 2002). Kollmuss and Agyeman (2002) provide a summary of various environmental behaviour models and barriers between environmental concern and pro-environmental behaviour.

Several studies interrogated the relationship between attitudes, behaviour, knowledge and demographic attributes. While some found positive correlations between knowledge and behaviour (Curtis and Robertson 2003), others did not (Krause 1993, Grob 1995). While women are generally more concerned about the environment than men, relationships between urbanism, age and environmental concern are insignificant (Van Liere & Dunlap 1980), and often complex (Milfont & Duckitt 2004, Winter 2007). Although socio-economic circumstances and awareness-creation play a role, attitude is the most important factor influencing conservation behaviour (Kallgren & Wood 1986, Battershill & Gilg 1995). Other studies indicate that attitude alone is not enough to ensure positive conservation behaviour (Gamba & Oskamp 1994, Curtis & Robertson 2003). If people do not 'see'/are unaware of the state of the environment, they will neither be able to 'see'/observe/notice any changes or degradation (Rogan *et al.* 2005), nor foster the desire to take action.

In 1992, delegates to the Earth Summit held in Rio de Janeiro emphasised the need for scientifically credible environmental information to support decision-making and to inform the public (UNCED

1992). Since then, efforts have been made to improve decision-making through better understanding (Tveitdal 2001). In line with the earliest models of pro-environmental behaviour, many Non-Governmental Organisations (NGOs) and Governments still rely solely on knowledge to influence and change behaviour (Kollmuss & Agyeman, 2002). For the impact of information to become meaningful, scientists should realize that knowledge, and communications to their peers in scientific journals, are not enough to ensure successful conservation of natural resources. Within the scientific community, attitudes are changing with regards to if and how information should be communicated to society and decision-makers (Bielak *et al* 2008, Riise 2008).

Lessons from the fields of psychology and human behaviour should also be incorporated into conservation communication and information dissemination strategies (Robinson 2006, Saunders *et al.* 2006). The focus of environmental education should not be on forcing messages onto the recipient, but rather, through a learning experience, guiding the receiver of information to make sense of the information they are provided with (Hooper-Greenhill 2004, Ballantyne & Packer 2005). Simultaneously, information should be available and useful to decision-makers (Alsop & Watts 1997, Bielak *et al.* 2008) to assist in restoring the belief that it is possible to make a positive impact on environmental problems (Ballantyne & Packer 2005). Since the public and communities hold the key to conservation successes, communications and research should be focused on their awareness, attitudes and behaviour.

In South Africa, the National State of Environment and several sectoral reports (DEAT 1999), such as State of Rivers reports (SoR) (Strydom *et al.* 2006), were made freely available and accessible to a wider audience, ranging from politicians and resource managers, to communities who live next to rivers, and to the general public (Strydom 2003). The 40 page glossy SoR reports summarise the ecological state of rivers in such a way that can be understood by the non-scientific community. Although the style and content of SoR reports were previously tested (Strydom *et al.* 2002), the success of dissemination and impact of SoR reporting on peoples' attitudes were not previously measured. Although this study initially set out to measure the impact of SoR reporting on people's attitudes towards river conservation, this was not achieved due to the SoR reports not being disseminated widely enough (as indicated by the pre-study). This chapter reports on a 2007 study in two South African river catchments where the attitudes of people towards river conservation, as well as their water-use behaviour was studied. The survey set out to determine whether any relationships were apparent between people's attitudes towards river conservation and demographic attributes such as geographic locality, social and economic issues, gender and age. The study also aims to gain insight into people's awareness of general water issues in South Africa and their knowledge about the benefits that can be derived from healthy rivers, as well as the negative impacts of human activities on rivers.

3.3 Methods

3.3.1 Approach

A pre-survey (Appendix A) preceded the main study to determine the extent to which the SoR reporting material has been distributed and whether formal dissemination strategies were followed. Several national and provincial government departments and organisations received SoR reporting materials for distribution. Although it was assumed that the SoR reporting material was distributed widely enough in the respective catchments at the time of production of these materials¹³, this could not be taken for granted. The pre-survey questionnaires were followed-up by telephone calls when there was a lack of response. Target organisations and government departments that were included in this study were Department of Water Affairs and Forestry: Western Cape Region, Department of Water Affairs and Forestry: Eastern Cape Region, Provincial Departments of Environmental Affairs and Tourism, and Cape Nature.

3.3.2 Research design

For the primary study, a quantitative research approach was followed to allow statistical analysis of the data, and testing of relationships between independent variables and the behaviour, attitude, awareness and knowledge of people living in the study area. Questions measuring theoretical groupings, or constructs, were selected to interrogate relationships between these variables. A fixed form survey (Kempton *et al.* 1996), with questions posed in the same way and in the same order, was used to standardise the interview process and to ensure the reliability of the data by reducing non-sampling errors (Babbie & Mouton 2001). Respondents indicated their degree of agreement or disagreement with each of the statements posed. Open-ended questions, which allow respondents to speak for themselves, were added to the structured interviews to allow less constrained responses. Due to the geographical remoteness of some of the study sites, it was not possible to revisit the respondents that were interviewed at the beginning of the study, when the data collected at a later stage indicated that additional questions should be asked. Open-ended questions were used to complement the closed-ended questions where more detail was needed to understand specific issues.

The questionnaire was either self-administered or completed with the assistance of an interviewer in instances where respondents were illiterate. In the cases where respondents were illiterate, the interviewer read the questions and then recorded the responses. While facilitating the completion of the questionnaires, care was taken not to bias the outcomes. Although self-administered questionnaires allow for a faster response rate, a drawback is that they do not capture the first responses, which are usually the most accurate in ascertaining attitudes (Brace 2004).

¹³ For example, the Buffalo report, poster and activity book was launched during an event at Maden Dam which, apart from government officials, also involved the schools and communities in the direct vicinity of the dam.

One of this study's major challenges was the translation of the English questionnaire (Appendix B) into Afrikaans and isiXhosa. Since isiXhosa is not a scientific language, many of the terms used were either not easily translatable or not clearly understood by the respondents. The isiXhosa questionnaire therefore also contained the English version for cross reference. Even though it doubled the perceived length of the questionnaire, misunderstandings due to language were minimised.

3.3.2.1 Questionnaire design

The questionnaire (Appendix B) consisted of two sections. The first section measured respondents' behaviour, attitudes, awareness and knowledge. The second section collected data on the demographics and the perceptions of respondents of their socio-economic circumstance. Since it is easier to respond to questions about behaviour, which are factual and can be recalled (Brace 2004), and to avoid contradictory responses and potentially wrong accounts of behaviour that the respondent may try to align with their indicated attitudes (Brace 2004), the questionnaire started with the behavioural items. As recommended by Brace (2004), classification questions that could possibly be experienced as intrusive and thus jeopardize co-operation, were asked at the end of the questionnaire.

The questionnaire contained seven sets of items, measuring constructs (Babbie and Mouton 2001), and posed as closed-ended questions to ascertain from each participant their:

- Behaviour with regard to current water use (2 items – personal and household water use – choosing from 4 options each);
- Attitude towards river management and conservation, including items testing potential behaviour or 'willingness' and items 'admitting that something needs to be done' (26 items on a five-point Likert scale anchored at either end of the scale with "strongly agree" and "strongly disagree") (Page & Meyer 2003);
- Awareness of river and water issues in South Africa (7 items on a three-point scale: agree, neutral, disagree, and a "do not know" option);
- Level of understanding or knowledge of the concept that rivers provide benefits (goods and services) and that appropriate river management is necessary (10 items on a three-point scale: agree, neutral, disagree, and a "do not know" option);
- Knowledge of adverse impacts on river systems (13 items to choose between large, medium, little or no impact);
- Perceptions of the availability of information on rivers (2 items on a five-point Likert scale anchored at either end of the scale with "strongly agree" and "strongly disagree" and a "do not know" option);

- Perceptions of the difficulty level of information on rivers (2 items on a five-point Likert scale anchored at either end of the scale with 'strongly agree' and 'strongly disagree' and a do not know option); and
- Previous interaction with SoR information (1 item, choosing from 4 options).

Amongst others, questions tested respondents' previous interaction with SoR information; their perspectives about water conservation; and their willingness to participate in a future survey.

Since the dependent variable was the outcome or result of the influence of the independent variable (Creswell 2003), some of the variables listed above could be considered either as dependent or independent. For this study, demographics (age, socio-economic status, years of formal schooling, ownership of house), social influences, the level of understanding of the concept that rivers provide benefits, and knowledge of adverse impacts on river systems, were considered as independent variables. Attitudes and behaviour were discussed as dependent variables, while awareness was taken as an independent variable in relation to attitude and behaviour, but also as a dependent variable in relation to the independent variables.

3.3.2.2 *Study area and population profile*

The study area comprised two river catchments situated within two of South Africa's nine provinces. For both these catchments SoR reporting materials (RHP 2008) were produced¹⁴. Situated in the Western Cape province, the total population of the Hartenbos and Klein Brak River catchment is approximately 70 000 (Stats-SA, 2001), with some migration taking place mainly from the rural to the coastal areas. The residents of this area speak Afrikaans, isiXhosa and English. With about 700 000 inhabitants (Stats-SA, 2001), the Buffalo River catchment has one of the highest population densities of all the Eastern Cape catchments. The population density is highest in the middle and lower reaches, with up to 1000 people per square kilometre. More than a third of the population lives in low-density rural areas where isiXhosa is the dominant language. In both catchments, but more so in the Buffalo catchment, many people have no access to clean piped water, either supplied in the house or via a standpipe in the street.

3.3.2.3 *Sampling selection and sampling method*

After discussions with community members, it was decided to use school children as an entry point to their parents, and, in rural areas where literacy levels are low, to include communities through their community representatives or through school meetings¹⁵ (also see footnote 16). Lists of all schools, together with contact information and Global Positioning System (GPS) co-ordinates, in the Eastern and Western Cape were obtained from the South African Department of Education. For each

¹⁴ See *Achievements of the River Health Programme 1994-2004: A national perspective on the ecological health of selected South African rivers* (Strydom *et al.* 2006) pages 34 and 35 for a summary of all State-of-Rivers reports produced during the given period.

¹⁵ See Table 5.1. All sampling methods contain a degree of bias. Some options contain also safety concerns which were pointed out by the local people. School headmasters, teachers, government officials, a hospital matron and traditional leaders were consulted while deciding on the best manner in which to distribute the questionnaires.

catchment, the GPS co-ordinates were overlain with an area map and schools within the catchment boundaries were identified. In the Hartenbos and Klein Brak catchment, a sample of 8 of the 18 primary schools and 3 of the 4 secondary schools was selected based on location and learner representation, namely, socio-economic background, race and language. One of the selected secondary schools declined to participate in the survey. Due to the large number (approximately 300) of government schools in the Buffalo catchment, a random selection process¹⁶ was followed to select 7 primary and 7 secondary schools in the catchment. Since all schools represented either rural or very poor communities, another school from a more affluent suburb was included in the study to replace one of the schools that pulled out of the study. The majority of the schools in the Hartenbos and Klein Brak catchment are concentrated around the town of Mossel Bay. Due to this irregular distribution and the impracticality of phoning all 300 schools in the Buffalo catchment to obtain learner representation, the same sampling method was not used in both catchments.

3.3.2.4 Measuring attitude and behaviour

Preliminary analysis of the pilot study data indicated that some of the behavioural questions actually measured attitude and not behaviour. Although behaviour can be predicted by attitude (Kallgren & Wood 1986), it could lead to wrong deductions. The dubious questions were identified and either removed from the final questionnaire or excluded from the final analysis. It also proved impossible to measure actual behavioural changes within a short period. As a result, this study, measured respondents' attitudes towards conservation as well as their reported water use behaviour.

It proved easier for respondents to answer factual questions about their behaviour that could be recalled (Brace 2004). Thus, posing questions related to behaviour first, helped to avoid contradictory responses and the risk of respondents trying to align wrong accounts of behavior with their indicated attitudes (Brace 2004). Brace (2004) also recommends that classification questions are asked at the end of the questionnaire to avoid them being perceived as intrusive and undermining co-operation. Brace (2004) further recommends that behavioural questions be stated in a "face-saving way", for example, "Have you had time to read the latest edition".

An attitude scale was developed by weighing responses according to each item's wording (Shaw & Wright 1967). The Likert scaling method (Likert 1932), where the weights of all items were summed, was employed to analyse the relationships between the variables (Walizer & Wienir 1978; Dunn-Rankin 1983).

¹⁶ The Buffalo catchment was divided into seven blocks and each school was given a random number. The schools were then sorted according to block and thereafter according to the random number. The first primary and first secondary school from each block was thus randomly selected.

3.3.2.5 Data analysis

Microsoft Excel was used for data capture and STATISTICA 2008 for data analysis, including calculating Cronbach alpha scores, Spearman correlations, p-values and analysis of variance (ANOVA). Mean scores for the respondents from the two study areas were calculated for the individual constructs, namely behaviour, attitude, knowledge, understanding benefits, understanding impacts and perceived availability of and difficulty levels of river information. Cronbach alpha calculations were used to test the reliability of the data (Cronbach 1951). Relationships between dependent and independent variables were investigated through Spearman correlations and analysis of variance (ANOVA).

3.4 Results

3.4.1 Representation

A total of 1144 parents responded to the questionnaires. Although it varied, response rates of greater than 50 % were obtained in some areas. Residents in the Hartenbos and Klein Brak catchment represented 53 % of the total number of respondents and residents in the Buffalo catchment the remaining 47 %. Language representation in the sample group was fairly equal with 29 %, 41 % and 30 % of the responses in English, isiXhosa and Afrikaans, respectively. The majority of respondents were 31 – 40 years of age (38 %) and 41 – 50 years (18 %), with 20 % being 30 years and younger, and 11 % being 61 years of age and older. The remaining 13 % did not indicate their ages. Female respondents dominated (64 %) over males (21 %)¹⁷, while 15 % of the respondents did not indicate their gender. Male representation was higher in the urban areas. While 27 % of respondents had grade 12 level education, 19 % had grade 10 and 12 % grade 7. Nineteen percent of the respondents indicated that they had acquired a higher education.

3.4.2 Information dissemination

The primary method of dissemination of the SoR reports was during the respective launches¹⁸ of the reports in the catchments, which typically included one school and the surrounding community. Thereafter, the materials were mainly distributed during science conferences and seminars and a few upon request.

Sixty six percent of the respondents either had not heard about the RHP and SoR reporting (43 %), or had no knowledge of what it was about (23 %) (Figure 3.1). Another 18 % selected no option. The remaining 16 % of respondents indicated that they were either familiar with or involved in SoR reporting. While only 31 % of the total respondents resided in the Buffalo River catchment rural

¹⁷ It is a South African reality that females run households, especially in rural areas, while the men are working elsewhere.

areas, 63 % and 48 % of the total number of responses indicating involvement in and being familiar with SoR reporting, respectively, were from this area.

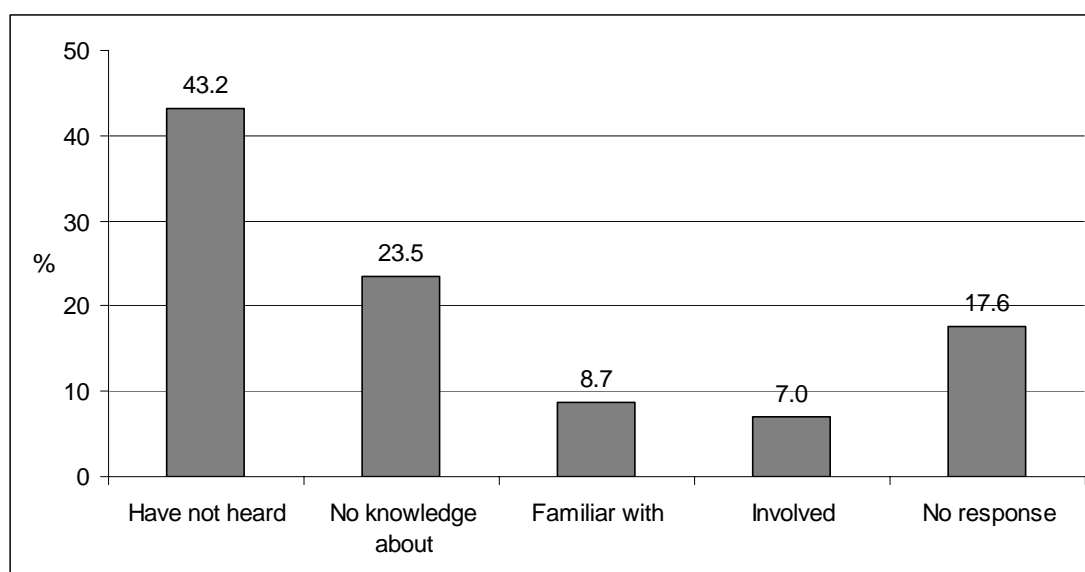


Fig 3.1 Responses indicating the level of awareness of and knowledge of the River Health Programme and State-of-Rivers reporting

3.4.3 Constructs and reliability of data (Cronbach alpha)

Table 3.1 presents the reliability of the five constructs, as derived from the Cronbach alpha scores. Normally, Cronbach alpha values above 0.70 are considered reliable for basic research and values above 0.60 reliable for applied research. Data from five of the constructs were reliable.

Table 3.1 Reliability of the results was tested by calculating the Cronbach alpha values of five constructs.

Construct	Attitude	Awareness of general water issues in SA	Understanding the benefits rivers provide (Knowledge 1)	Understanding what impacts on rivers (Knowledge 2)	Behaviour (water use)
Cronbach alpha	0.84	0.61	0.64	0.84	0.75
No of items	26	7	10	13	2

¹⁸ Exact dates for the respective launches of the reports were not available. The *State-of-Rivers Report: Hartenbos and Klein Brak River Systems* was produced in 2003 and the *State-of-Rivers Report: Buffalo River System* in 2004.

3.4.4 Behaviour related to water use

Very few respondents indicated that water was wasted, with the majority indicating that they only used the water that they needed. Figure 3.2 presents personal water use as reflected by the respondents living in the Hartenbos & Klein Brak and Buffalo catchments, respectively. While reported water use in the Hartenbos & Klein Brak area peaked at 'only use the water needed', respondents from the Buffalo area reported a more equal distribution ranging from the possibility to use water more sparingly to using water very sparingly. Results for household water use were similar to the results for personal water use.

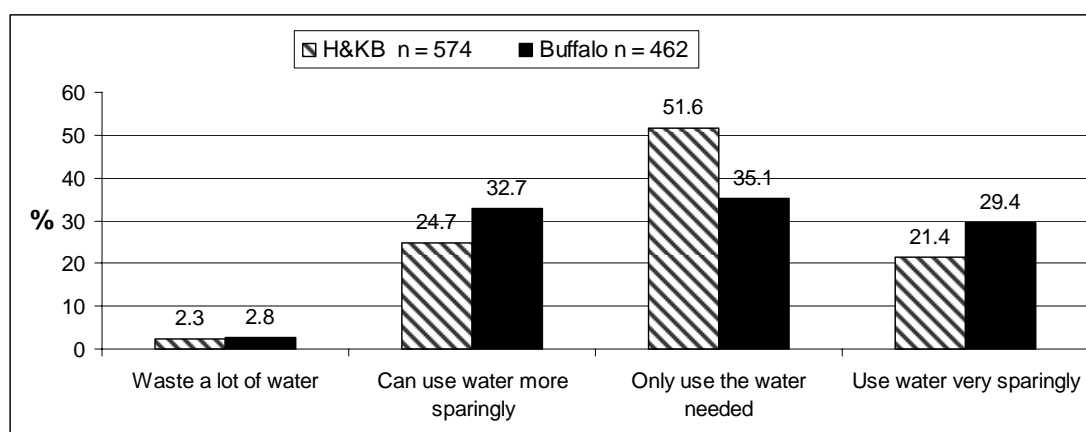


Fig 3.2 Reported personal water use of respondents in both the Hartenbos & Klein Brak (n=574) and Buffalo (n=462) catchments.

Using domestic water supply as a parameter, an ANOVA indicated that those having access to municipal tap water in their homes were more prone to wasting water than those who do not have direct access ($p < 0.01$) (Table 3.2). Simultaneously, those respondents who have access to municipal water in their homes showed better attitudes towards ($p = 0.02$) and more awareness of river conservation issues ($p = 0.03$) than those who do not have access.

Table 3.2 The relationship between attitude, awareness and behaviour and the method of domestic water supply.

Domestic water supply:		Attitude		Awareness		Behaviour (water use)	
		Mean Score ANOVA (n)	p-value	Mean Score ANOVA (n)	p-value	Mean Score ANOVA (n)	p-value
Municipal tap in house	yes	1.22 (488)	$p = 0.02$	0.64 (256)	$p = 0.03$	2.82 (610)	$p < 0.01$
	no	1.16 (286)		0.55 (155)		3.01 (405)	

3.4.5 Attitude, awareness, behaviour and knowledge

A relatively small but significant correlation ($r=0.25$, $p<0.01$) was found between respondents' attitude and their awareness of general water issues in South Africa (not shown). A small but significant correlation ($r=0.17$, $p<0.01$) was found between attitude and respondents' understanding of the benefits that healthy rivers provide (the knowledge 1 construct) (Table 3.3). Spearman correlations showed that there was a relatively large and significant ($r=0.49$, $p<0.01$) relationship between the knowledge 1 construct and respondents' awareness of general water issues. Significant but negative correlations of medium effect were found between both attitude ($r=-0.30$, $p<0.01$) and awareness ($r=-0.39$, $p<0.01$) and respondents' understanding of the negative human impacts on rivers (knowledge 2 construct). Although the effect size was small, behaviour was positively correlated to the knowledge 2 construct ($r = 0.13$, $p < 0.01$).

Table 3.3 The relationship between respondents' attitudes towards river conservation, awareness of general water issues, and behaviour towards water use, and the knowledge constructs. Unreliable results are shaded in grey. (ns = not significant)

Variable	Attitude towards river conservation		Awareness of general water issues in South Africa		Behaviour related to water use	
	Spearman r (n)	p-value	Spearman r (n)	p-value	Spearman r (n)	p-value
Understanding benefits that healthy rivers provide (Knowledge 1)	0.17 (421)	$p<0.01$	0.49 (314)	$p<0.01$	-0.01 (492)	$p=0.88$ (ns)
Understanding negative human impacts on rivers (Knowledge 2)	-0.30 (551)	$p<0.01$	-0.39 (302)	$p<0.01$	0.13 (637)	$p<0.01$

3.4.6 The relationship between the dependent variables, attitude, awareness and behaviour, and the independent demographic and socio-economic variables

Respondents from urban areas scored higher in their attitudes towards river conservation than those from rural areas ($p=0.02$). Urban residents were more aware of water issues in South Africa than their rural counterparts ($p<0.01$). Both the attitudinal and awareness scores did not align with water use behaviour, with the ANOVA indicating that rural respondents use water more sparingly ($p<0.01$). Both attitude and awareness towards river conservation improved slightly with increased education levels (Spearman $r = 0.20$ and 0.19 , respectively; $p<0.01$). However, a relatively small negative but significant correlation (Spearman $r = -0.16$, $p<0.01$) was found between education and behaviour.

No correlation was found between economic status of the communities and attitude. There was a small but significant ($r=0.16$; $p<0.01$) positive correlation between awareness and economic status of the community in which the respondents lived. Again, a relatively small but significant correlation

(Spearman $r = -0.21$, $p < 0.01$) was found between economic status and behaviour. Results from ownership of residence (whether owned, rented or communal), as well as duration of stay at their present homes, were inconclusive. Similarly, correlations with age were non-significant. Although insignificant, male respondents scored higher than females in both attitude and awareness, but females showed better water use behaviour than males.

3.4.7 Comparing equity, ecological and financial orientation

Three options representing social equity, ecological and financial perspectives were presented to respondents who were asked to choose which option best described their attitudes towards water use. While 44 and 42 % selected social equity and ecology, respectively, 14 % of the respondents indicated the financial option (Table 3.4). Respondents with the social equity and ecological inclinations scored high in their attitudes (Figure 3.3). Respondents inclined to pay more for water in order to maintain the current supply, had the lowest score for attitude towards river conservation ($p = 0.03$).

Table 3.4 The perspectives of respondents towards water use and water conservation.

Statement	Perspective	n (Total n = 1011)	% of Respondents
I will use less water if it will ensure that there is enough for all in South Africa	Social equity	441	44
I will use less water if it will prevent the over-exploitation of our water resources	Ecological	428	42
I will rather pay more so that I can keep on using the same amount of water that I do at this time	Financial	142	14

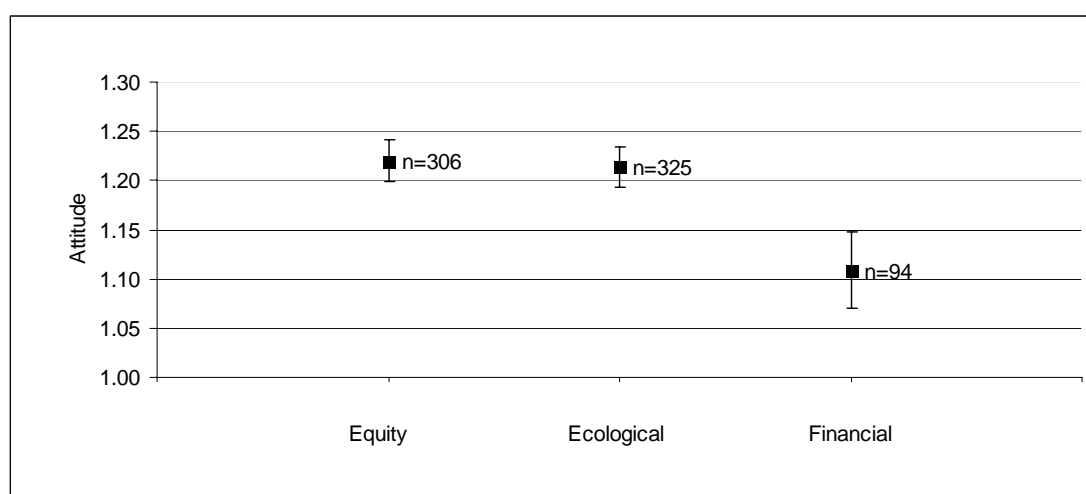


Fig 3.3 The relationship between attitude and respondents' inclination towards using less water (n=725).

3.4.8 Information needs and future participation

There was large consensus amongst respondents (82 % of respondents) that there was a need for more information about rivers. Only 4 % of the respondents disagreed that more information was needed, while 7 % were neutral and 6 % did not know.

A high number of respondents (60 %) indicated that they wish to receive information as well as participate in a follow-up survey (IP). Another 30 % of the respondents wished to receive information only (I), and 10 % specified that they wish to neither receive information nor participate in a follow-up survey (N). Figure 3.4 shows that the group of respondents that indicated the IP option also had the highest mean attitudinal score, and the N group the lowest ($p < 0.01$). Correlations with awareness indicated that those with high awareness scores selected N ($p < 0.01$). Although less significant ($p = 0.05$), respondents with the best water use behaviour also chose to receive more information and participate (IP) in a follow-up survey.

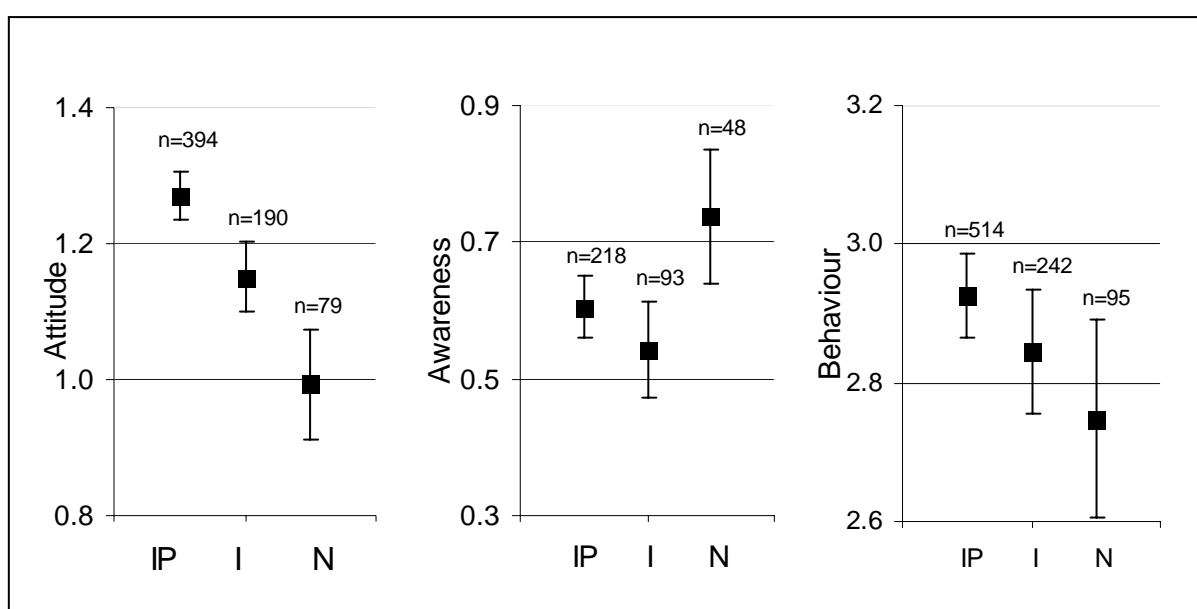


Fig 3.4 The attitude (n=663), awareness (n=359) and behaviour (n=851) scores of respondents wishing to receive river information¹⁹.

3.5 Discussion

This study differed from other studies measuring environmental attitudes (Milfont & Duckitt 2004) as it focused on attitudes related to water use and river conservation. Due to insufficient and lack of dissemination strategies and/or ineffective execution thereof, the SoR reports did not reach the intended target audience. Since the majority of respondents had not seen or read the SoR reports,

¹⁹ The abbreviation IP indicates that respondents wish to receive information and are willing to participate in a follow-up survey, the I indicates that respondents wish to receive information but not to participate in a follow-up, and N that respondents wish to neither receive information nor participate in a follow-up survey.

the measured knowledge, awareness, attitudes and behaviour cannot be ascribed to the impact of SoR reporting.

The majority of respondents indicated that there was a need for more information on rivers. This was confirmed by the number of respondents that indicated that they wish to receive information on rivers. As expected, respondents with the lowest attitudinal and behavioural scores did not wish to receive information about rivers. Those with the highest awareness scores also indicated that they do not want to receive information; probably because they feel that their access to information is adequate e.g. having internet access.

A higher than expected number of respondents residing in the rural areas indicated that they were involved in the RHP. Since the RHP is not aware of such participation in the programme a social desirability bias is suggested. Social desirability bias refers to the tendency of people to gain the approval of others through the way they respond to research items (Edwards 1957, Milfont & Duckitt 2004, Bogner & Wiseman 2006). It is possible that people using river water not only want to gain the approval of others by indicating that they are contributing, but also want to improve the source and quality of their domestic water supply. There is a possibility that the low number of respondents (less than 3 %) that indicated that they waste water, both personally and in their households, could be ascribed to the same phenomenon. However, this is difficult to verify since actual water use figures were not available.

A higher percentage of respondents from the Buffalo River catchment used water very sparingly. Many more people in this catchment still lack basic water supply in their homes and have to either make use of the stand pipes in the streets where these are available, or have to fetch their water from boreholes, rainwater tanks or rivers and streams, sometimes several kilometers away. The relationship between water-use behaviour and type of domestic water supply shows that people who experience the most difficulty to obtain water, use less water. The reality is that as people become more affluent and have more access to natural resources, they need and use more (Blignaut 2008). Several studies have shown how wealth and economic development and the economic markets of the 'rich and powerful' actually cause environmental degradation through their use of a disproportionate share of the world's natural resources (Duraiappah 1998, Blignaut & De Wit 2004, Gray & Moseley 2005).

The South African government's drive to improve the quality of life of all citizens through the supply of potable tap water and sanitation services will have far-reaching consequences if the supply of water is not accompanied by the necessary creation of awareness and changes in attitude and behaviour. It is acknowledged that domestic water use is not one of the major water use sectors in the country, but if people cannot be responsible domestic water users that value natural resources, they will also not be responsible water users that understand the importance of natural resources and conservation in the agricultural, forestry, mining and industrial sectors.

Human behavioural models were not tested in this study, but provided an overall impression of the attitudes, awareness and knowledge of respondents in two selected catchments in South Africa. However, the results of this study confirms Ajzen and Fishbein's (1980) model for determining a

person's behaviour as presented in Figure 2.2, where the external variables such as age, gender and economic status do not have direct effects on attitudes and behaviour (Van Liere & Dunlap 1980). The urban respondents' higher awareness levels could be due to the accessibility of information in urban areas in relation to rural areas. The actual availability of general information was not tested during this study. Since male respondents dominated in the urban areas, the higher scores for males could be due to the urban factor rather than gender. Cultural influences on awareness levels were not examined.

Education proved to be the dominant demographic variable that showed a small but significant correlation with awareness, attitude (positive) and behaviour (negative). Acknowledging the various other factors contributing a bias factor to this finding, the implication of how and what learners learn in the current education system, and the implication for river conservation and the conservation of natural resources in general, cannot be ignored.

While respondents from urban areas and those with higher education levels scored higher in their attitudes and awareness (Bandara & Tisdell 2003), the opposite was found for water-use behaviour. In comparison, respondents from rural areas and those with less formal education scored higher in their water-use behaviour. There is a strong indication that people do not understand negative impacts to rivers, nor their extent and severity thereof. Having a greater awareness of water issues does not imply that people know and understand what is affecting rivers negatively, and knowing about adverse impacts does not necessarily contribute to people's attitudes towards river conservation. The non-effect of attitude on behaviour can be ascribed to the fact that this study did not measure attitudinal items related to water-use behaviour only, but a broad range of attitudinal items including those related to river protection, pollution and legislation enforcement (also see Gamba & Oskamp 1994, Milfont & Duckitt 2004). There is only a link between behaviour and attitude if the same parameter, e.g. water use, is measured. For this study, attitude measured a broad selection of items, which explains the inconclusive results.

Similarly, it can be argued that general education levels were measured and not education about nature, the environment, sustainable development and the importance of conservation. Although urban residents and those with higher education grades are more aware of general water issues in South Africa, it does not imply that this will drive their behaviour towards using water more sparingly. The correlation between awareness and the type of domestic water supply could be a function of education and socio-economic factors rather than the type of water supply. With many respondents from the rural areas lacking the same basic water supply infrastructure as their urban counterparts, it could be suggested that the socio-economic circumstance of respondents, e.g. not having clean water conveniently supplied, rather than their attitude drive particular behaviours.

3.6 Conclusions and recommendations

Since the SoR information disseminating efforts of the RHP did not adequately reach its target audience, this study could not ascertain if there has been an attitude change and an associated change in human behaviour that can be ascribed to SoR reporting in the catchments. Distribution of

the SoR reports and posters in the two catchments was primarily through the launch events and did not necessarily reach representative groups in the catchments. The RHP should pay more attention to the actual dissemination of information to ensure that the information reaches the intended target audiences. It is recommended that dissemination strategies are formulated, implemented, and adapted to suit the special needs of the diverse target audiences. Such strategies and the execution thereof should be regularly revised and evaluated. Similarly, all types of SoR communications should be evaluated to see whether it is suitable for the different levels of society. The effectiveness of communication materials should be evaluated and adjusted where necessary; and the impact on awareness, attitudinal and behavioural changes assessed. It is equally important to apply this learning and knowledge to follow up or new studies.

There is a general need for more information on rivers. Given that education has an effect on awareness, attitudes and behaviour, albeit indirectly through people's belief systems (Ajzen & Fishbein 1980), and is negative in some instances, the current formal education system (the syllabus as well as the way knowledge is gained) and the implication for conservation of natural resources cannot be ignored and should be investigated further. Recommended areas for future research include language barriers, socio-economic circumstances, cultural differences as drivers of human attitude and behaviour. Childhood experiences (Finger 1994, Palmer *et al.* 1998, Wells & Lekies 2006, Louv 2007) and the formal education system (schools) as a vehicle for environmental education (Barraza 2001, Loughland *et al.* 2003, Owens 2004, Chawla & Flanders Cushing 2007, Littledyke 2008), should not be neglected. Difficulties related to culture when using children as a means to educate their parents (Onyango-Ouma 2003), as well as the lack of understanding adverse impacts on rivers and the general water use culture should be investigated within the South African context.

Creating awareness of river conservation issues to change people's attitudes and behaviour in such a way as to ensure adequate protection of South Africa's natural water resources is challenging. Whether this can be achieved if all efforts are concentrated on adults is debatable and intervention is most probably needed at a very early age and throughout children's formative years (see Chapter 4).

South Africa's natural water resources are facing detrimental consequences under the current status quo. It is the responsibility of every citizen to ensure that these resources are used in a responsible and sustainable manner, and every citizen should carry that responsibility to his/her workplace, whether it is in the agriculture, mining, industrial or policy-making arena.

3.7 References

- Ajzen, I. & Fishbein, M. (1973) Attitudinal and normative variables as predictors of specific behaviors. *Journal of Personality and Social Psychology* **27**, 41-57.
- Ajzen, I. & Fishbein, M. (1980) *Understanding Attitudes and Predicting Social Behavior*. Prentice-Hall, New Jersey.
- Ajzen, I. & Madden, T.J. (1986) Prediction of goal-directed behaviour: attitudes, intentions, and perceived behavioural control. *Journal of Experimental Social Psychology* **22**, 453-474.
- Alsop, S. & Watts, M. (1997) Sources from a Somerset Village: A Model for Informal Learning about Radiation and Radioactivity. *Science Education*, **81**, 633-650.
- Babbie, E. & Mouton, J. (2001) *The Practice of Social Research*. Oxford University Press, Oxford. pp674.
- Ballantyne, R. & Packer, J. (2005) Promoting environmentally sustainable attitudes and behaviour through free-choice learning experiences: what is the state of the game? *Environmental Education Research*, **11**, 281-295.
- Bandara, R. & Tisdell, C. (2003) Comparison of rural and urban attitudes to the conservation of Asian elephants in Sri Lanka: empirical evidence. *Biological Conservation*, **110**, 327-342.
- Barraza, L. (2001) Environmental education in Mexican schools: The primary level. *Journal of Environmental Education*, **32**, 31-36.
- Battershill, M.R.J. & Gilg, A.W. (1995) New Approaches to Creative Conservation on Farms in South-west England. *Journal of Environmental Management* **48**, 321-340.
- Bielak, A.T., Campbell, A., Pope, S., Schaefer, K. & Shaxson, L. (2008) From Science Communication to Knowledge Brokering: the Shift from Science 'Push' to 'Policy Pull'. (eds D. Cheng, M. Claessens, T. Gascoigne, J. Metcalfe, B. Schiele & S. Shi) *Communicating Science in Social Contexts: New models, new practices*. Springer.
- Blignaut, J. (2008) Economic development in South Africa: Facing the reality of resource constraints. *Proceedings of Interfaces 2008 Conference held 3 – 7 August 2008 in Oudtshoorn, South Africa*.
- Blignaut, J. & De Wit, M. (2004) *Sustainable options: Economic development lessons from applied environmental resource economics in South Africa*. UCT Press, Cape Town, South Africa.
- Bogner, F.X. & Wiseman, M. (2006) Adolescents' attitudes towards nature and environment: Quantifying the 2-MEV model. *Environmentalist*, **26**, 247-254.
- Brace, I. (2004) *Questionnaire Design*. Kogan Page, London.
- Chawla, L. & Flanders Cushing, D. (2007) Education for strategic environmental behaviour. *Environmental Education Research*, **13**, 437-452.

- Cowling, R.M. & Wilhelm-Rechmann, A. (2007) Four perspectives on conservation in Africa: Social assessment as a key to conservation success. *Oryx*, **41**, 135.
- Creswell, J.W. (2003) *Research Design: Qualitative, quantitative, and mixed method approaches, Second Edition*. Sage Publications, Thousand Oaks, California.
- Cronbach, L.J. (1951) Coefficient alpha and the internal structure of tests. *Psychometrika*, **16**, 297-334.
- Curtis, A. & Robertson, A. (2003) Understanding landholder management of river frontages: The Goulburn Broken. *Ecological Management & Restoration*. **4**, 45-54.
- DEAT (1999) National State of the Environment Report. Department of Environmental Affairs and Tourism, South Africa. Available online: <http://www.environment.gov.za/soer/nsoer/index.htm> (accessed April 2006).
- Denisov, N. & Christoffersen, L. (2001) *Impact of Environmental Information on Decision-making Processes and the Environment*. UNEP/GRIDArendal Occasional Paper 01 2001. Available from <http://www.grida.no/impact> (accessed April 2006).
- Dunn-Rankin, P. (1983) *Scaling Methods*. Lawrence Erlbaum Associates, Hillsdale.
- Duraiappah, A.K. (1998) Poverty and Environmental Degradation: A Review and Analysis of the Nexus. *World Development*, **26**, 2169-2179.
- Edwards, A. L. (1957) *The social desirability variable in personality assessment and research*. New York: Dryden Press.
- Ferraro, P.J. & Pattanayak, S.K. (2006) Money for Nothing? A Call for Empirical Evaluation of Biodiversity Conservation Investments. *PLoS Biology*, **4**(4):e105. Available from <http://www.plosbiology.org>.
- Finger, M. (1994) From knowledge to action? Exploring the relationships between environmental experiences, learning, and behavior. *Journal of Social Issues*, **50**, 141-160.
- Gamba, R.J. & Oskamp, S. (1994). Factors influencing community residents' participation in commingled curbside recycling programs. *Environment and Behavior*, **26**, 587-612.
- Gardner, G.T. & Stern, P.C. (2002) *Environmental Problems and Human Behaviour. Second Edition*. Pearson Custom Publishing, Boston.
- Geller, E.S. (1995) Actively caring for the environment: An integration of behaviorism and humanism. *Environment and Behaviour*, **27**, 184-195.
- Geller, E.S. (2002) The challenge of Increasing pro-environmental behaviour. *Handbook of Environmental Psychology*. (eds. R.B. Bechtel & A. Churchman) John Wiley & Sons.
- Gray, L.C. & Moseley, W.G. (2005) A geographical perspective on poverty-environment interactions. *The Geographical Journal*, **171**, 9-23.

- Grob, A. (1995) A structural model of environmental attitudes and behaviour. *Journal of Environmental Psychology*, **15**, 209-220.
- Hooper-Greenhill, E. (2004) Measuring Learning Outcomes in Museums, Archives and Libraries: The Learning Impact Research Project (LIRP). *International Journal of Heritage Studies*, **10**, 151-174.
- Kallgren, C.A. & Wood, W. (1986). Access to attitude-relevant information in memory as a determinant of attitude behavior consistency. *Journal of Experimental Social Psychology* **22**, 328-338.
- Kempton, W., Boster, J.S. & Hartley, J.A. (1996) *Environmental Values in American Culture*, The MIT Press, The Massachusetts Institute of Technology, Cambridge.
- Knight, A.T., Cowling, R.M. & Campbell, B.M. (2006) An operational model for implementing conservation action. *Conservation Biology*, **20**, 408-419.
- Kollmuss, A. & Agyeman, J. (2002) Mind the Gap: why do people act environmentally and what are the barriers to pro-environmental behaviour? *Environmental Education Research*, **8**, 239-260.
- Krause, D. (1993) Environmental Consciousness: An Empirical Study. *Environment and Behaviour*, **25**, 126-142.
- Lewin, K. (1952) *Field Theory in Social Science. Selected Theoretical Papers*. Lowe & Brydone Printers Ltd., London.
- Likert, R. (1932) A technique for the measurement of attitudes. *Archives of Psychology*. No. 140.
- Littledyke, M. (2008) Science education for environmental awareness: approaches to integrating cognitive and affective domains. *Environmental Education Research*, **14**, 1-17.
- Loughland, T., Reid, A., Walker, K. & Petocz, P. (2003). Factors influencing young people's conceptions of environment. *Environmental Education Research* **9**, 3-19.
- Louv, R. (2007) Leave no child inside. *Orion Magazine*, March/April. Available from <http://www.orionmagazine.org/index.php/articles/article/240> (accessed March 2008).
- Millennium Ecosystem Assessment (2005) *Ecosystems and Human Wellbeing: Synthesis*. Island Press, Washington, DC.
- Milfont, T.L. & Duckitt, J. (2004) The structure of environmental attitudes: A first- and second-order confirmatory factor analysis. *Journal of Environmental Psychology* **24**, 289-303.
- Nuyen, A.T. (2008) Ecological education: what resources are there in Confucian ethics? *Environmental Education Research*, **14**, 187-197.
- Onyango-Ouma, W. (2003) Children as partners in health communication in a Kenyan community. *Anthropology in Action*, **10**, 25-33.
- Owens, P. (2004) Researching the development of children's environmental values in the early school years. Paper presented at the Charney Manor Conference, Developing Primary Geography, Oxfordshire, UK 2003. *Researching Primary Geography*. (eds S. Catling and F.

Martin) Special Publication No 1, Aug 2004. London Register of Research. ISBN 0-9538154-3-9. Blackheath, London.

Page, C. & Meyer, D. (2003) *Applied Research Design for Business and Management*. McGraw-Hill, Sydney.

Palmer, J.A., Suggate, J., Bajd, B., Hart, P., Ho, R.K.P., Ofwono-Orecho, J.K.W., Peries, M., Robottom, I., Tsaliki, E. & Van Staden, C. (1998) An Overview of Significant Influences and Formative Experiences on the Development of Adults' Environmental Awareness in Nine Countries. *Environmental Education Research*, **4**, 445-464.

Pretorius, R. (2000) Impact of information on decision-making processes in South Africa. *Impact of Information on Decision-making Processes: Case Studies*. (eds Christoffersen, L.E., Folgen, K. and Denisov, N.) GRID-Arendal, Arendal.

Reid, W.V. (2005) Science: Who Needs It? *Conservation Biology*, **19**, 1341-1343.

Riise, J. (2008) Bringing science to the Public. *Communicating Science in Social Contexts: New models, new practices*. (eds D. Cheng, M. Claessens, T. Gascoigne, J. Metcalfe, B. Schiele & S. Shi) Springer.

Robinson, J.G. (2006) Conservation Biology and Real-World Conservation. *Conservation Biology*, **20**, 658-669.

Rogan, R., O'Connor, M. & Horwitz, P. (2005) Nowhere to hide: Awareness and perceptions of environmental change, and their influence on relationships with place. *Journal of Environmental Psychology* **25**, 147-158.

Roux, D.J., Nel, J.L., Ashton, P.J., Deacon, A.R., de Moor, F.C., Hardwick, D., Hill, L., Kleynhans, C.J., Maree, G.A., Moolman, J. & Scholes, R.J. (2008) Designing protected areas to conserve riverine biodiversity: Lessons from a hypothetical redesign of the Kruger National Park. *Biological Conservation* **141**, 100-117.

Saunders, C.D. (2003) The Emerging Field of Conservation Psychology. *Human Ecology Review*, **10**, 137-149.

Saunders, C.D., Brook, A.T. & Myers, O.E. Jr. (2006) Using Psychology to Save Biodiversity and Human Well-Being. *Conservation Biology* **20**, 702-705.

Shaw, M.E. & Wright, J.M. (1967) *Scales for the Measurement of Attitudes*. McGraw-Hill, New York.

STATISTICA (2008) Statistica version 8. Statsoft.

Statistics South Africa (Stats-SA) (2001). South African Population Statistics: Census 2001. Available from: <http://www.statssa.gov.za/census01/html>. (Accessed August 2007).

Stern, P.C. (2000) Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, **56**, 407-424.

- Strydom, W.F., Van Wyk, E., Maree, G. & Maluleke, T.P. (2002) The evolution of state-of-rivers reporting in South Africa. Proceedings of the 7th International Conference on Public Communication of Science and Technology, Cape Town, 5-7 December 2002. Available from <http://www.saasta.ac.za/scicom/pcst7/strydom.pdf> (accessed December 2008).
- Strydom, W.F. (2003) Compiling State-of-Rivers Reports and Posters: A Manual. River Health Programme Report Series No 17. Available from: <http://www.csir.co.za/rhp/reports/reportseries17.pdf>
<http://www.dwaf.gov.za/iwqs/rhp/reports/reportseries17.pdf>
- Strydom, W.F., Hill, L. & Eloff, E. (2006) *Achievements of the River Health Programme 1994 – 2004: A national perspective on the ecological health of selected South African rivers*. Department of Water Affairs and Forestry, Government of South Africa. Also available from: www.csir.co.za/rhp/ (accessed March 2008). http://www.dwaf.gov.za/iwqs/rhp/state_of_rivers/RHP_10years_e_20060621.pdf (accessed December 2008).
- Sutherland, W.J., Pullin, A.S., Dolman, P.M. & Knight, T.M. (2004) The need for evidence-based conservation. *TRENDS in Ecology and Evolution*, **19**, 305-308.
- Tveitdal, S. (2001) Foreword. *Impact of Environmental Information on Decision-making Processes and the Environment* (eds N. Denisov. & L. Christoffersen) UNEP/GRIDArendal Occasional Paper 01 2001. Available from: www.grida.no/impact (accessed April 2006).
- UNCED (1992) Earth Summit Agenda 21. *The United Nations Programme of Actions from Rio*. United Nations Conference on environment and development (UNCED), Rio de Janeiro, Brazil, 3 to 14 June 1992. Geneva: United Nations, Department of Public Information.
- Van Liere, K.D. & Dunlap, R.E. (1980) The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *Public Opinion Quarterly* **44**, 181-197.
- Walizer, M.H. & Wienir, P.L. (1978) *Research Methods and Analysis. Searching for Relationships*. Harper & Row, New York.
- Weigel, R. & Weigel, J. (1978) Environmental concern: The development of a measure. *Environment and Behavior*, **10**, 3-15.
- Wells, N.M. & Lekies, K.S. (2006) Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism. *Children, Youth and Environments*, **16**(1). Available from: www.colorado.edu/journals/cye (accessed March 2008).
- Winter, S.J., Prozesky, H. & Esler, K.J. (2007) A case study of landholder attitudes and behaviour towards the conservation of Renosterveld, a critical endangered vegetation type in the Cape Floral Kingdom, South Africa. *Environmental Management*, **40**, 46-61.

Chapter 4

River conservation - effectiveness of State-of-Rivers communication material in education

4.1 Abstract

Changing attitudes and behaviour towards conservation is an intricate process and contrary to general perceptions, is seldom achieved by exposure to education materials. This statement is however seldom tested nor supported by evidence-based conservation activities. Recent studies highlight the importance of childhood learning and experiences and the effect these have on future attitudes and behaviour.

During 2007, a study was conducted in randomly selected schools in the Buffalo (B) and Hartenbos and Klein Brak (H) catchments in South Africa to determine how effectively the State-of-Rivers communication materials had been used in the education system. The study focused on learners in grades 1 to 3, and used questionnaires and participatory evaluation techniques to determine the level of understanding of potential human impact on rivers. The learners were evaluated before and after they had viewed the materials, allowing sufficient time between the data collection periods to allow facilitators to use the materials during classroom activities.

Results from this study indicated that, with the exception of a few schools, the materials were used primarily to keep the learners busy. The learners in the Hartenbos and Klein Brak catchments displayed a slight increase in their understanding of river ecology concepts over time. In rural areas within the Buffalo catchment, 50 % of the schools showed a slight decrease in understanding, while the other 50 % gained significant understanding, resulting in an overall increase in understanding in the catchment. One school was responsible for the significant decrease in understanding amongst learners in the Buffalo urban area.

Optimum intervention in learners' understanding requires that communication materials are aligned closer with the school curriculum. Closer work with the Department of Education should be encouraged to ensure the introduction of fundamental ecosystem learning. Through better understanding of ecosystems, facilitators can be empowered to add maximum value in the classroom.

4.2 Introduction

Information gathered on the state or health of South Africa's river systems will not add any value to ensure sustainable water use unless it is communicated to, and then understood and applied by water resource managers, relevant organisations and affected communities. Goodrum *et al.* (2000) reason that improved scientific literacy helps people to understand the world around them and enables them to engage in discourses about science. Improved scientific literacy also helps

individuals to question the basis of scientific claims and empowers them to investigate and make informed decisions – not only about the environment, but also about their own health and well-being. The value of public support in “advancing” environmental movements should not be underestimated (Stern *et al.* 1999). Brown *et al.* (2004) noted that public opinion drives public policy, an issue that is underestimated by the scientific community. Similarly, it can be reasoned that if members of the public were well-informed about river health issues, they would be more inclined to confidently enter debates on water resource management.

State-of-Rivers (SoR) reports, one of the key communication tools of the South African River Health Programme (RHP) (Strydom *et al.* 2006; RHP 2008), have the potential to supply the public with the information they need to display interest in river management issues and to participate in the activities of river forums and other conservation initiatives. The RHP is a national biomonitoring programme that was designed to support informed river ecosystem management through improved understanding of river ecosystems (Roux 1997). The SoR reports, published since 1998 (Strydom *et al.* 2006; RHP 2008), are designed in a user-friendly and easy to understand format to complement the more formal technical reporting on river ecosystems. Similarly, other SoR-related products, such as the SoR posters and other “soft” communications, are designed for easy comprehension by a non-technical reader. The product series aims to make the information available and accessible to a wide audience, ranging from politicians and water resource managers to communities who live adjacent to the river, and to the general public (Strydom 2003).

SoR reporting materials can potentially be used for environmental education in schools. Agenda 21 (UNCED 1992) called on educators from all subjects to contribute to the understanding of global issues. However, an evaluation of environmental education practice in New Zealand schools during 2002 – 2003 indicated that the understanding of environmental concepts, such as sustainability, was inconsequential – meaning different things to different people – and was often inadequate (Eames *et al.* 2008). Littledyke (2008) accentuates the challenge of environmental education: “...to encourage and develop in children a sense of relationship with the environment, which may translate into pro-environmental behaviour that follows through to adulthood”. Despite shortcomings in research, such as the measured inconsistencies between attitudes and behaviour, the questions used, the categorization of the sample groups, and the way in which the data are analyzed (Chawla 1998), indications are that positive experiences of nature in early childhood encourage the development of pro-environmental attitudes and behaviours (Tanner 1980, Finger 1994; Palmer 1993; Palmer & Suggate 1996, Chawla 1998; Palmer *et al.* 1998a; Palmer *et al.* 1998b; Chawla 1999; Wells & Lekies 2006). The way children understand the environment, their perceptions of and how they experience the environment, differs from that of adults (Barratt Hacking *et al.* 2007). Unfortunately, in our changing world²⁰, children are often denied the right to experience nature (Louv 2007; Wells & Lekies 2006). Access difficulties and lack of suitable safe places close to schools, make it increasingly

²⁰ “Specifically, childhood participation in ‘wild’ nature such as hiking or playing in the woods, camping ... is ... positively associated with environmental behaviours”. “‘Domesticated nature’ experiences [such as picking flowers or produce and planting seeds] are marginally related to environmental behaviors” (Wells & Lekies 2006). Many children are denied ‘wild experiences’ because of urban life styles and ‘wild’ places are often considered unsafe.

difficult for school groups to experience nature first-hand (Owens 2004). However, because educators can compensate for the decline in nature experiences of children, the relevance and role of schools and educators in environmental education cannot be ignored (Barraza 2001a,b; Loughland *et al.* 2003; Chawla & Flanders Cushing 2007).

Due to the receptive minds of young learners, the early school years create opportunities to imprint values and perceptions that would last into adulthood (Wells & Lekies 2006; Owens 2004; Cullingford 1995; Piaget 1978; Vygotsky 1962). For this reason, and to complete the SoR reporting series, it was decided to develop materials for younger children (future decision makers) within South Africa's outcomes based education (OBE) system. It is acknowledged that written learning materials can never be a substitute for direct experiences in nature (Littledyke 2008). However, if these materials are used within the curriculum's water theme, they could add value to the learning possibilities. Accordingly, in collaboration with the South African Department of Education, Activity Books and accompanying non-verbal posters were developed as part of the suite of SoR reporting materials.

The purpose of this study was to determine how widely the SoR reporting materials were distributed in schools; whether the recipients gained any new knowledge on the benefits of healthy rivers and factors that impact negatively on rivers; and if they gained a better understanding of the importance of river conservation. This study also attempted to ascertain if attitudes could change amongst the learners after working through the activity books and posters.

4.3 Methods

4.3.1 Aim/objectives

An experiment was designed to address the following research question using pre- and post-testing as well as an experimental and control group:

Do State-of-Rivers reporting materials contain sufficient information in the appropriate format and language to improve people's understanding of the goods and services that rivers provide, increase their awareness of adverse impacts on river systems, and change their attitudes towards river management and conservation?

4.3.2 Approach

To facilitate the planning of this study, the first phase of the study was preceded by both a pre-study and a pilot study. The study was designed in this way since the pre-study as well as the pilot study suggested that the SoR reporting material was not distributed widely enough in the respective catchments.

4.3.2.1 Pre-study

The pre-study was conducted to determine the extent to which SoR reporting materials had been distributed within the two study catchments. Enquiries were made about dissemination strategies, the number of copies of the activity books and non-verbal posters that had been distributed, and to which schools the materials had been distributed. For this purpose, and to assist verbal enquiry, a questionnaire (Appendix A) was distributed to all organisations and government departments known to have received SoR reporting material for distribution within the two catchments.

4.3.2.2 Pilot study

The pilot study was carried out amongst grade 1 to 3 learners in one school, chosen for its representation of socio-economic backgrounds, cultures and the home language of learners. The purpose of the pilot study was to determine if the proposed method would work in the school situation, if sufficient teacher cooperation could be obtained through the proposed process, and whether or not the questions were clearly stated (Brace 2004; Babbie & Mouton 2001). The pilot study also sought to determine whether data obtained through the questionnaire and participatory evaluation combination were adequate, in a workable format, and appropriate to address the research question.

Determining the cause-effect of the Activity books (Grades 1 – 3) included marking what is “good” and “bad” on the SoR fun posters. Although working in groups of 3 to 4 learners per poster sped up the process, quarrelling and differing opinions occurred with the strongest personality (and sometimes the physically strongest) opinion being captured. A quick experiment during the final day of the pilot study showed that the collective result of a group of three girls did not equal the sum of the individual results. Thus, poster evaluations were conducted of individuals who participated in both stages of the study to improve the accuracy of the results.

Capturing the reasoning behind markings on the poster ensured that conclusions were made within the correct context. For example, during the pilot study, catching fish in the dam was indicated as being bad and upon questioning it turned out that it was considered “impossible to catch fish while they are jumping like that”. Since safety and security comments could suppress ecological comments if not captured in context, secondary questions were asked to determine in what context answers were given, for example: “Only one house? It is not safe to live all alone in the forest...” could have resulted in a ‘bad’ mark on the indigenous forest which is actually considered ‘good’. A monitoring team was marked “bad” because “Their feet are dirty and other people want to drink the water!” Recording the conversations during the poster sessions could have added value, but the number of recorders available would have limited the number of simultaneous group activities at any given time and transcribing of such recordings would have been time-consuming. The idea of recording conversations was thus discarded.

4.3.3 Research design

This study used an experimental research design to establish whether or not there was a cause–effect relationship between the exposure of Grade 1 to 3 learners to the different SoR reporting materials (activity book and non-verbal poster) and their resulting knowledge and possible change in attitude. A causal effect was measured because prior to the onset of the study there was no evidence that learners had seen the SoR materials, to allow valid statistical deductions to be made.

This study, involving school children grades 1 to 3²¹, consisted of two phases. The first phase of the study set out to determine specific variables (the learners' understanding, knowledge and attitudes) prior to contact with SoR reporting material. Four months later, the second phase was initiated, repeating the same assessments, after facilitators had been provided with sufficient opportunity to use the materials in class.

4.3.3.1 Study area and sample selection

The study was conducted amongst grade 1 to 3 learners in two pre-selected catchments, the Buffalo River catchment and the Hartenbos and Klein Brak River catchment, referred to as areas B and H, respectively. SoR reporting materials had previously been developed for both these areas. The grade 1 to 3 learners in area H speak and receive tuition in either Afrikaans (mainly), isiXhosa or English. IsiXhosa and English are the most widely spoken languages in area B, with isiXhosa dominating in the rural areas.

A list of all the junior primary schools in each study area, together with contact information and Global Positioning System (GPS) co-ordinates, was obtained from the Department of Education. For each catchment, the GPS co-ordinates were overlain with an area map and schools within the catchment's boundaries were identified. Due to the large number (170) of government junior primary schools in area B, a random selection process was followed to select 7 schools in the catchment, representing both the urban (subgroup B Urban) and the rural areas (subgroup B Rural). In area H a sample of 8 out of 18 primary schools were selected based on location and learner representation, namely, socio-economic background, race and language. Subgroup H Urban represented the learners from the urban schools and subgroup H Rural the learners from the rural schools in the Hartenbos and Klein Brak catchments (see footnote 16, page 44).

4.3.3.2 Facilitation

Several cross checking methods of enquiry were used to attempt to determine the level of use of the activity books. These included: a teacher/facilitator questionnaire (Appendix F and G) where they

²¹ Challenges of working with foundation phase learners were mainly overcome by getting them excited about the study. At the onset of the study the researcher explained to the learners why she was there, why their school was picked, how the process would work and that each learner would receive an activity book and the classroom, a poster. It was also emphasised that filling of the questionnaire was not a test, but a fun activity in which they could express their ideas. With a few exceptions, most learners cooperated well and they particularly enjoyed the participatory evaluations. While some learners were initially either scared or shy, the majority participated after being reassured that it was not a test, that there were no right or wrong answers, and that it was about what they think.

indicated whether the materials were useful and for which learning outcomes they were used; asking the teachers how the books could be improved; asking the learners whether they enjoyed working in the books; asking the learners whether their teachers/facilitators helped them with completing the questionnaires or used the books to keep them busy; asking learners to show what they have done in the books and to indicate their favourite page. The timing of the study, and its alignment with curriculum requirements around water-related issues, was crucial to ensure maximum use of the materials.

4.3.3.3 Data collection methods

Two types of data collection methods were used to determine the awareness, knowledge and attitudes of learners towards river conservation. A questionnaire, consisting of both open-ended and closed-ended questions, was supplemented by participatory evaluations. Both data collection methods were informed by a facilitator questionnaire (Appendix F and G) that gave clarity on the degree to which the distributed communication materials were used between phases 1 and 2 of this study.

A control group verified whether or not a change in knowledge and attitudes was due to normal development during the study period, or due to contact with the SoR reporting materials.

4.3.3.4 Grade 1 to 3 questionnaire

A questionnaire (Appendix C), consisting of 19 closed-ended and four open-ended questions, was designed to determine the social background of learners as well of their current awareness, knowledge and attitudes towards river health. The questionnaires were designed in English and translated into both Afrikaans and isiXhosa. Of the 23 questions, one determined the previous contact with materials, four the social background of the learner and one the perception of future availability of water. The social background questions dealt with the availability of books about rivers, dependence on rivers, ways of providing drinking water, and whether sufficient water was available. The remaining part of the questionnaire consisted of 4 open-ended and 13 closed-ended questions. Of the closed-ended questions, 11 were grouped into 3 sets of items (constructs) measuring 3 variables: the knowledge of learners (Table 4.1); their understanding of the benefits that healthy rivers provide (Table 4.2); and their understanding of human impacts on rivers (Table 4.3). Of the open-ended questions, two measured learners' understanding of human impacts on rivers and two the attitude of learners towards river pollution (Table 4.4). Respondents had to suggest from their own thinking and experiences what they possibly thought could make rivers either "healthy/happy" or "unhealthy/sad". In the activity books the terms happy and sad were used to indicate healthy and unhealthy rivers, respectively. For each "correct" item, a score of 1 was allocated. "Incorrect" and "no responses" were calculated separately. For example, in the case of an unhealthy/sad river, a "correct" item could be a word, phrase or sentence to indicate the respondent understands what would have a detrimental effect on a river. The remaining two closed-ended questions: "Do you want to learn more about sad and happy rivers?" and "Should we conserve our rivers? (Conserve means to protect, look after and care for)", measured the attitude of learners.

Table 4.1 The *knowledge of learners* construct was measured by two items.

Item no	Question	Response
K1	Are rivers the home of many kinds of insects?	“yes” or “no”
K2	Are there plants that can only grow in or near rivers?	

Table 4.2 The *understanding benefits that healthy rivers provide* construct was measured by four items.

Item no	Question	Response
B1	Where is it best to swim and play?	“water from a clean river” or “water from a dirty river” or “I do not know”
B2	Which water is best for cooking?	
B3	Where would you find happy or healthy fish?	
B4	Where would you find happy or healthy plants and trees?	

Table 4.3 The *understanding human impact* construct was measured by four items.

Item no	Question: What happens if we...	Response
I1	...throw rubbish in the river?	“we make the river happy” or “we make the river sad” or “I do not know”
I2	...chop down the trees next to a river?	
I3	...take all the water from the river?	
I4	...build our house very close to the river?	
I5	... chop down the alien trees next to a river? *	

- Although designed to form part of the *understanding of human impact on rivers* construct, misunderstanding of this question in the isiXhosa questionnaire as well as in general, resulted in this question being omitted from further analysis.

Table 4.4 The open-ended questions that measured learners’ understanding of human impacts on rivers and their attitudes.

Parameter	Question
understanding of human impacts on rivers	What do you think makes a river happy?
	What do you think makes a river sad?
attitude	What can you do to make sad rivers happy and healthy rivers?
	Why should we conserve our rivers?

Facilitators were requested to assist with response capturing where a learner's writing skills were inadequate. Upon completion of the questionnaires in phase 1, each facilitator was issued with posters for use in the classroom as well as an activity book per learner, also for use in the classroom. The possible use of the materials during the water theme of the curriculum was discussed with facilitators, emphasising that the use of the material was not restricted and that they could use their imagination on how to best enrich the learning experience.

At an agreed date, after approximately four months, a second questionnaire, identical to the first one, was completed by all the participating learners. The difference in the responses between phases 1 and 2 was recorded for each individual.

4.3.3.5 Participatory evaluations

Laminated posters, identical to those issued to the facilitators at the end of phase 1, were used to capture the learners' perceptions of what the good and bad practices portrayed. Learners had to mark the good practices with a tick and the bad practices with a cross and give reasons why they thought a particular action was either good or bad. The corresponding ticks and crosses were transferred to datasheets, while the reason given for each choice was captured. Without creating bias, probing questions were allowed to facilitate the thinking process of slow starters. Scoring was based on 1 point per correct item and another point if it was accompanied by the correct reason.

Determining the cause-effect of the Activity books (Grades 1 – 3) included marking what is “good” and “bad” on the SoR fun posters. Although working in groups of 3 to 4 learners per poster sped up the process, quarrelling and differing opinions occurred with the strongest personality (and sometimes the physically strongest) opinion being captured. A quick experiment during the final day of the pilot study showed that the collective result of a group of three girls did not equal the sum of the individual results. Thus, poster evaluations were conducted of individuals who participated in both stages of the study to improve the accuracy of the results.

Capturing the reasoning behind markings on the poster ensured that conclusions were made within the correct context. For example, during the pilot study, catching fish in the dam was indicated as being bad and upon questioning it turned out that it was considered “impossible to catch fish while they are jumping like that”. Since safety and security comments could suppress ecological comments if not captured in context, secondary questions were asked to determine in what context answers were given, for example: “Only one house? It is not safe to live all alone in the forest...” could have resulted in a ‘bad’ mark on the indigenous forest which is actually considered ‘good’. A monitoring team was marked “bad” because “Their feet are dirty and other people want to drink the water!” Recording the conversations during the poster sessions could have added value, but the number of recorders available would have limited the number of simultaneous group activities at any given time and transcribing of such recordings would have been time-consuming. The idea of recording conversations was thus discarded.

4.4 Data Analysis and Results

4.4.1 Pre-study

Due to staff turnover in the organisations responsible for the distribution of the reporting materials, only one pre-study questionnaire was returned. From verbal enquiry it was evident that the SoR materials were used mainly to showcase the River Health Programme during conferences, meetings and workshops. Although the activity books and non-verbal posters were distributed to the participating schools during the launch events, the percentage of learners reached were insignificantly low. The materials were also distributed to a few individuals upon request.

The information obtained through the pre-study added considerable insights to the expected outcomes of the study – very few, if any learners in the study area had seen the SoR materials. It could not be established whether the SoR reporting material was distributed to any of the sampled schools. Knowing the latter influenced the design of the final study. Both the pilot and primary studies were thus adapted to be executed in two phases: phase 1 provided a baseline for learners' attitudes and knowledge before they have seen the materials, and phase 2 after learners have seen and worked with the materials.

4.4.2 Pilot study

Experience from implementing the pilot study influenced the design of the main study, namely the sample size and the design of the final questionnaire. Several questions were either omitted or changed to prevent confusing the learners. Instead of dividing the whole sample of learners into groups of three for the participatory evaluations, a smaller random sample group was selected for individual evaluations. This eliminated the likelihood that where opinions differed, the physically strongest learner's opinion was reported as that of the group. Although indicated correctly on the poster, learners often had very different reasons for their indicated choice, for example, marking a house in the forest wrong because "it is not safe to live alone in the forest". Therefore, instead of capturing the ticks and crosses on the laminated poster with photographs to be evaluated at a later stage, all marks were immediately transferred to a datasheet and learners' reasons for a specific response captured.

Overall, the pilot study provided valuable information and lessons. Apart from influencing the main study and the questionnaire design, the pilot study also provided a time duration reality check. The final sample size was adjusted accordingly to allow finalization of the study with the available resources, within the available time.

4.4.3 Sample size

A total of 1178 learners – 770 from area H and 408 from area B – participated in the study in both phases 1 and 2. Although smaller than hoped for, the sample size was large enough for meaningful

statistical analysis (Babbie & Mouton 2001). Reasons for the smaller than expected sample size are discussed in Appendix D. For the participatory evaluations a smaller sub-group was randomly selected from each participating area. In total, 261 learners (147 from area H and 114 from area B) participated in both phases of the participatory evaluation.

4.4.4 Reliability analysis

Questions measuring three constructs, designed to capture change in the thinking of respondents, were tested for their reliability (Table 4.5). The items that measured the level of understanding of human impact on rivers construct, proved to be reliable, giving a Cronbach alpha score of 0.79 and 0.81 for phases 1 and 2, respectively. A second set of items was designed to measure learners' level of understanding of the benefits that healthy rivers provide construct. Reliability for both phases 1 and 2 were similar, with Cronbach alpha scores of 0.41 (n=894) and 0.38 (n=967) for phases 1 and 2, respectively. The knowledge construct proved to be unreliable with Cronbach alpha scores of 0.29 and 0.32 for phases 1 and 2, respectively. Since the confidence level ($p=0.083$) for the time, group and location correlation was also low, this construct was omitted from further analysis.

Table 4.5 The reliability of the constructs as set out in the quantitative section of the grade 1 to 3 questionnaire was tested and presented with Cronbach alpha scores.

Construct	Cronbach α (Phase 1)	Cronbach α (Phase 2)
Understanding human impact on rivers	0.79 (n=805)	0.81 (n=927)
Understanding the benefits that healthy rivers provide	0.41 (n=894)	0.38 (n=967)
Knowledge of river ecosystems	0.29 (n=1129)	0.32 (n=1111)

4.4.5 Understanding the benefits that healthy rivers provide

The *understanding the benefits that healthy rivers provide* construct was measured by four items (listed in Table 4.2). The results were subjected to the low Cronbach alpha scores and should be interpreted as such. Repeated Measures Analysis of Variance (RANOVA) results indicated that Grade 1 to 3 learners from group B had a better *understanding of the benefits that healthy rivers provide* than learners from group H (Figure 4.1). In both study areas the rural subgroups showed a higher level of understanding than the urban subgroups (Figure 4.1), with subgroup B Rural showing the highest level of understanding.

Over time, for group H and B combined (n=674), the change in understanding was insignificant. However, this varied according to location with subgroup B Rural showing a significant increase in the understanding of the benefits that healthy rivers provide (Figure 4.2) over time ($p<0.01$).

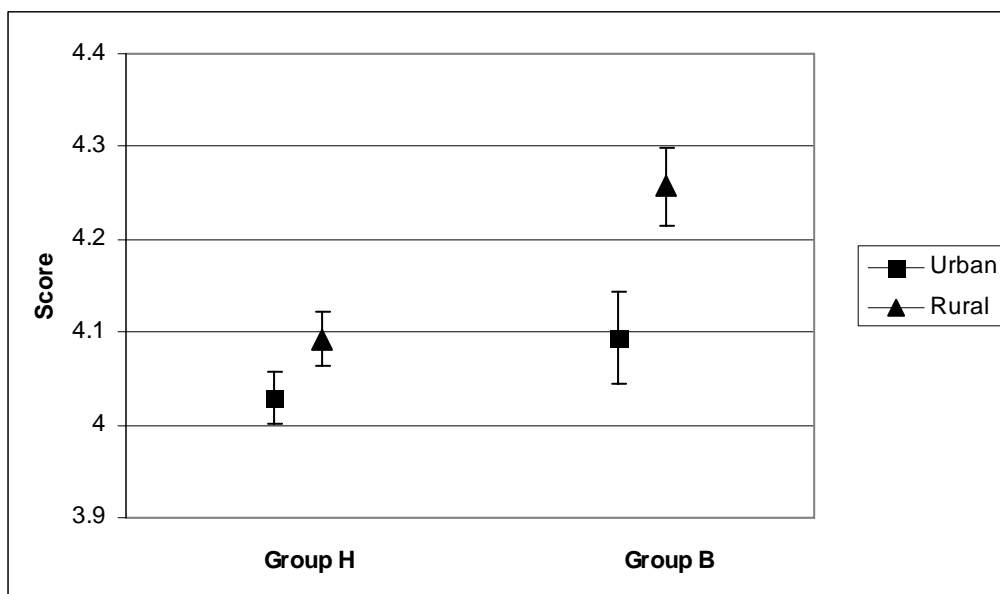


Fig 4.1 RANOVA results indicating the difference in *understanding of the benefits that healthy rivers provide* amongst the groups and locations. Subgroups B Urban n=96; B Rural n=136; M Urban n=283; M Rural n=248. $p=0.01$. Vertical bars denote 95 % confidence intervals.

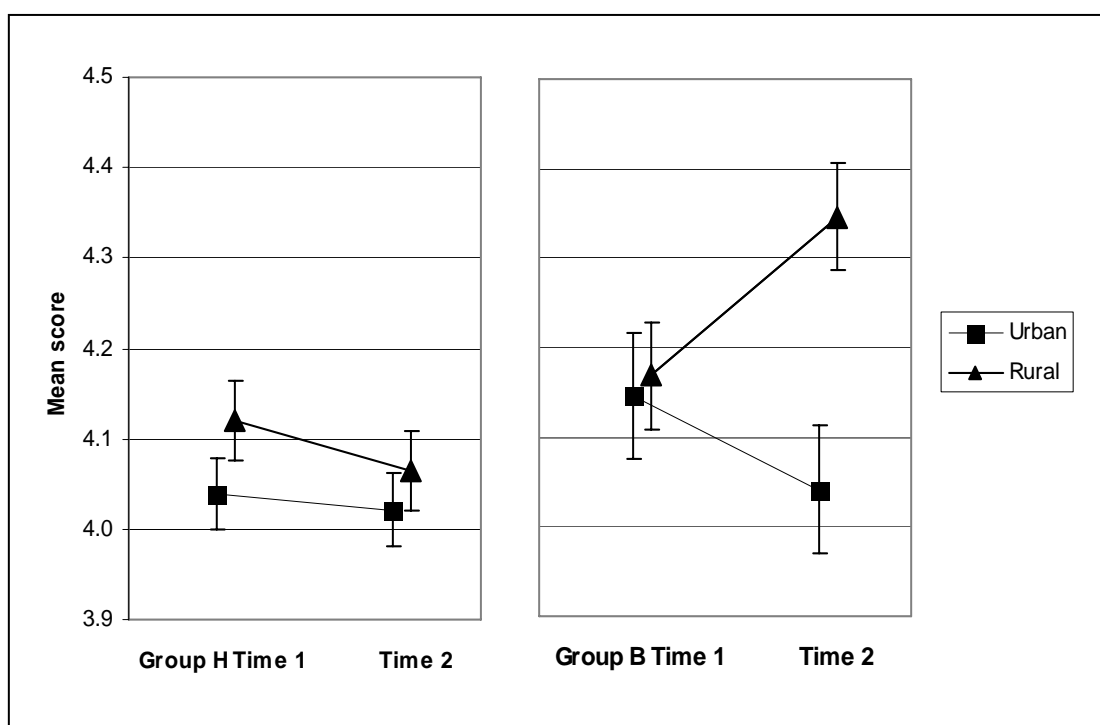


Fig 4.2 RANOVA results indicating the differences in *understanding of the benefits that healthy rivers provide* amongst the groups and locations over time (phase 1 and phase 2). For the subgroups B Urban n=96; B Rural n=136; H Urban n=283; H Rural n=248. $p<0.01$. Vertical bars denote 95 % confidence intervals.

4.4.6 Understanding human impact on rivers

The level of *understanding of human impact on rivers* amongst grade 1 to 3 learners and their change in related knowledge through interaction with SoR communication materials was determined in two ways, namely: through a survey consisting of both quantitative and qualitative items, and through participatory evaluations.

Results from the quantitative items were inconclusive. Although results from the quantitative items did not show an overall increase in understanding, three of the four subgroups showed a tendency that the understanding of human impacts on rivers increased over time, with sub-group B rural showing the most increase. The decline in understanding in subgroup B urban, however, dominated the analysis. The results from the qualitative items showed the opposite, with learners improving on the numbers of correct items they chose, representing what they think makes a river happy/healthy or sad/unhealthy. Results from the qualitative data gathering method indicated that learners' perceptions of both the negative impact on rivers and possible mitigation actions improved during the study period. More learners were able to mention one or more items after some time. There was a significant overlap in the items that learners thought made a river either healthy or unhealthy, with littering-related responses dominating. From the participatory evaluations it was concluded that there was an overall increase in learners' understanding of good practices and the negative impact of human activities on rivers. The average respondents' score showed a statistically significant increase over time. The results are discussed in detail below.

4.4.6.1 Quantitative items

Analysis of Variance (ANOVA) results from subgroups H Urban (n=217), H Rural (n=218) and B Rural (n=157) showed an upward trend over time (Figure 4.3), indicating that there was an increase in understanding due to contact with the SoR reporting materials. However, the decrease in understanding in subgroup B urban (n=69) showed the largest relative change and, when included, cancels out the increases in the other subgroups ($p < 0.01$) (combined study group n=661).

Further investigation of this decline revealed that relatively few learners (n=69; 45 %) from subgroup B urban (n=154) fully completed this part of the questionnaire. One school in subgroup B Urban was primarily responsible for the decline in the understanding of human impact. Omitting this school's results from the data analysis resulted in a non-significant difference in understanding for subgroup B Urban as presented by Urban(2) in Figure 4.3.

4.4.6.2 Qualitative items

The qualitative study showed a 35 % and 40 % increase in the number of correctly listed items as either making a river happy (healthy) or sad (unhealthy) after exposure to SoR materials (Table 4.6). *No littering* was the most popular reason why rivers are healthy (happy). It was the most often mentioned item in both phases, and showed a 28 % increase (calculated as a percentage of phase 1) over time. Referencing what made rivers sad, *littering* again received the most referrals in both

phases and showed a 46 % increase over time. Overall, it was concluded that learners' perceptions of possible negative impact on rivers, as well as possible mitigation actions, broadened during the study. There was an increase in the number of respondents that offered one or more correct answer and a decrease in the number of learners that did not respond to the questions or had a "don't know" response. Although, the overall number of items per respondent increased, responses of items that impact on, e.g. water quantity, fauna and flora, were less frequently mentioned and even decreased over time. Differentiation between the rural and urban subgroups revealed a higher percentage of rural respondents moving from an incorrect or no response to one with one or more items listed. These qualitative results are discussed in more detail in Appendix E.

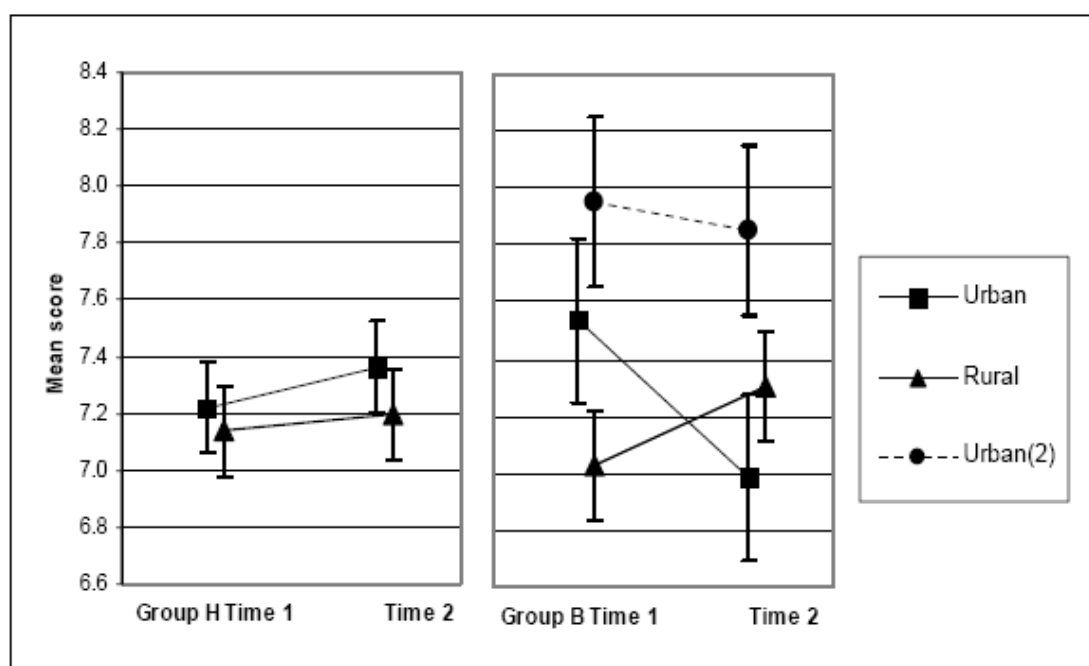


Fig 4.3 Group, location and time RANOVA correlations, showing the results of a quantitative analysis to determine learners' *understanding of human impacts on rivers* ($p < 0.01$). Vertical bars represent 95 % confidence intervals.

Table 4.6 Percentage change in the number of correct items listed between phase 1 and phase 2, measuring learners change in understanding of human impact on rivers. ($n = 471$)

Questions addressed	Number of correct items listed		% increase
	Phase 1	Phase 2	
What do you think makes a river happy?	398	537	35 %
What do you think makes a river sad?	420	590	40 %

4.4.6.3 Participatory evaluations

Respondents taking part in the participatory evaluations displayed an overall increase in their understanding of good practices as well as the negative impact of human activities on rivers. Over time, both groups H and B showed an overall increase in their understanding: the group H score increased by 9.58 points, from 18.57 to 28.06, and group B by 5.23 points, from 14.82 to 20.05 (Table 4.7).

Differentiating between locations, the rural subgroups showed higher increases in their scores over time, than the respective urban subgroups. Both rural subgroups showed significantly lower scores at time 1 than the urban subgroups ($p=0.01$). However, after contact with the SoR reporting materials, at time 2, the rural scores increased to the same level as the urban scores ($p=1.00$) (Table 4.7). Overall, subgroup H Rural showed the best improvement over time.

Table 4.7 Means and distributions of participatory evaluation results before and after contact with State-of-Rivers activity books designed for grades 1 to 3.

Group/ subgroup	Phase 1 (pre contact)			Phase 2 (post contact)			n	P
	<i>m</i>	SD	<i>Std Err</i>	<i>m</i>	SD	<i>Std Err</i>		
H	18.57	11.35	0.936	28.06	13.20	1.089	147	<0.01
B	14.82	8.66	0.811	20.05	7.71	0.722	114	<0.01
H Rural	13.91	9.68	1.283	25.04	12.72	1.685	57	0.14
H Urban	21.52	11.39	1.200	29.98	13.21	1.392	90	
B Rural	12.88	8.55	1.029	19.86	7.28	0.877	69	<0.01
B Urban	17.80	8.04	1.199	20.36	8.39	1.251	45	

Further analysis of the results of those respondents with the lowest scores (≤ 5) at time 1 compared with those with the highest scores (≥ 20) revealed that those respondents that scored low at time 1 showed the most improvement over time (Table 4.8). In group H, the scores lower than or equal to 5 improved from a mean of 1.64 by 11.81 points to a mean of 13.45 over time. Similarly, in group B the scores ≤ 5 improved significantly with 13.0 points from a mean of 3.25 to a mean of 16.25 ($p<0.01$). While group H respondents with scores ≥ 20 at time 1 showed a significant increase of 7.22 points from a mean of 28.03 at time 1 to a mean of 35.25 at time 2 ($p<0.01$), there was no change in the B group with initial scores of ≥ 20 ($p=0.57$) (Figure 4.4). It can be concluded that those learners who knew the least at the start of the study, gained the most understanding of human impacts on rivers over time.

Table 4.8 Means and distributions of participatory evaluation results of learners scoring very low and very high during phase 1, showing change over time.

Group	Parameter	Phase 1 (pre contact)			Phase 2 (post contact)			n	p
		Mean	SD	Std Err	Mean	SD	Std Err		
H	≤ 5	1.64	1.71	0.36	13.45	9.55	2.04	22	<0.01
H	≥ 20	28.03	7.32	0.87	35.25	11.99	1.42	71	<0.01
B	≤ 5	3.25	1.55	0.347	16.25	7.01	1.569	20	<0.01
B	≥ 20	25.83	5.62	1.011	23.77	7.87	1.414	31	0.57

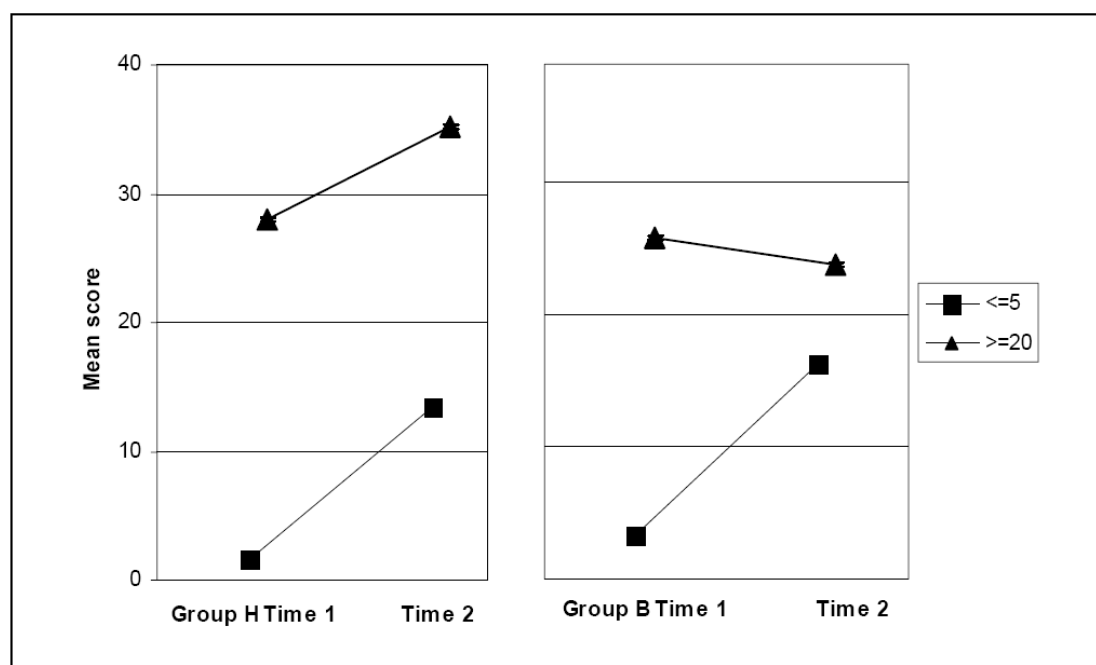


Fig 4.4 The relationship between time and initial score (≤ 5 and ≥ 20) as reflected by the participatory evaluations of groups H and B.

Further analysis, differentiating between schools, indicated that all schools in group H, with the exception of one, showed a slight increase in understanding of human impacts on rivers over time (Figure 4.5). Results from group B were more variable.

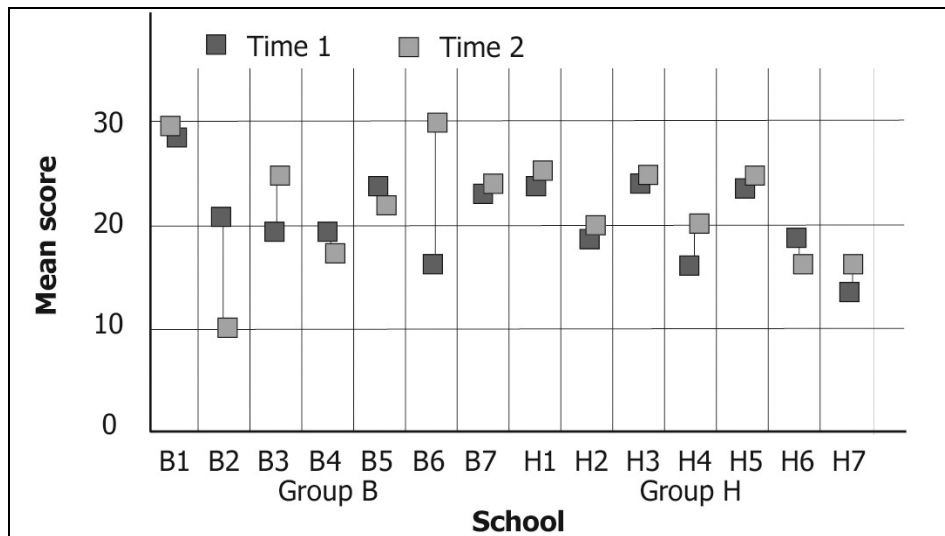


Fig 4.5 The change in learners' understanding of human impacts on rivers over time, expressed as a mean score per school.

4.4.7 Knowledge

More learners (77 %) knew at the onset of the study (phase 1) that there were plants that can only grow in rivers, compared to the 69 % that acknowledged that rivers are the home of many kinds of insects. Change in knowledge of the combined group over time was insignificant. Since the knowledge construct, measured by two items, were not reliable (Cronbach α =0.29; n =1129 and Cronbach α =0.32; n =1111 for phases 1 and 2 respectively), it was assumed that the questions to determine knowledge were not sufficiently well formulated.

4.4.8 Changing attitudes of grade 1 to 3 learners

Two closed-ended and two open-ended questions were aimed at gathering evidence of changed attitudes due to the use of SoR reporting materials in the classrooms. Analysis of both closed-ended questions did not indicate a significant change over time (p =0.05). Learners scored high in both phase 1 and 2; 95 % and 89 % respectively. The 5 % of responses that indicated that rivers should not be conserved were equally split between the two study areas.

4.4.8.1 Conserve our rivers

Learners were given the opportunity to explain their choices to an open-ended question as to whether rivers should be conserved or not. The responses were analyzed and grouped according to three categories: benefits from clean rivers, ecosystem and human impacts. Over time, the relative frequencies of all three categories increased and the number of respondents that gave either an irrelevant or no answer decreased accordingly (Figure 4.6) – the relative frequency dropped from 41.9 % to 28.5 % (Table 4.9). The relative frequency of the *human impact on rivers* category increased from 15.1 % to 26.1 %, indicating that learners acquired a better understanding that rivers

should be conserved, because of the negative impacts that humans are responsible for. The relative frequency of the *benefit of healthy rivers* category also increased from 29.6 % to 38.0 %. There was only a small change over time in the number of respondents that referred to ecosystem-related items, such as fish, animals, trees, plants and water quantity, with relative frequencies of 13.6 % and 14.1 % for time 1 and 2, respectively.

When comparing locations, the urban group showed a higher frequency than the rural group at time 1 in all three categories (Table 4.9). This indicated that urban learners had a better initial understanding as to why rivers should be conserved than learners from rural areas. Although the rural group's relative frequencies at the second phase still did not match those of the urban group, the rural group gained significantly greater understanding over time.

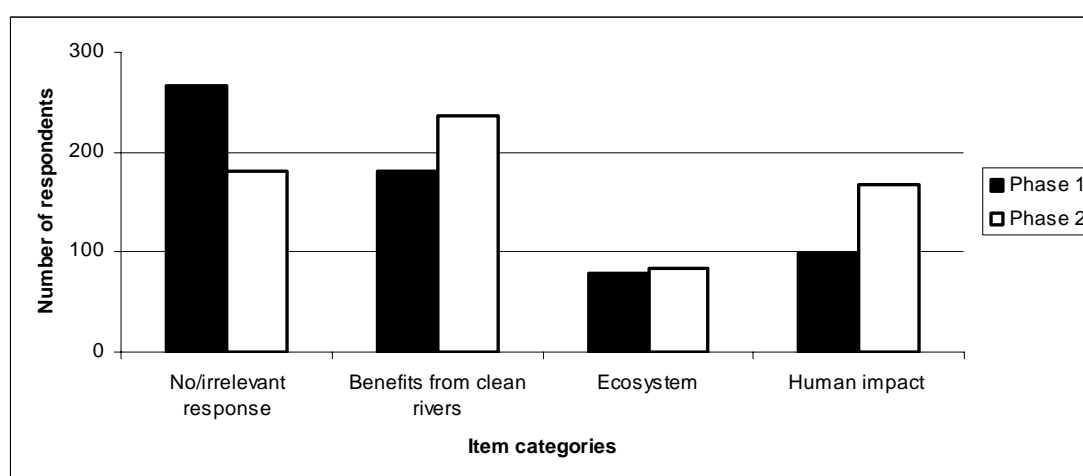


Fig 4.6 Comparison of four categories of responses to questions why rivers should be conserved. Data from the two phases of the study. (n=582)

Table 4.9 Relative frequency (%) with which items were selected by learners at each location during the two phases of the study. (n = 582)

Location	Benefits from river		Ecosystem		Human impact		No/irrelevant response	
Phase	1	2	1	2	1	2	1	2
Urban	33.5	37.2	14.9	13.3	17.9	24.9	33.7	24.5
Rural	19.0	31.9	7.7	10.5	11.3	24.8	62.1	32.9
Total	29.6	38.0	13.6	14.1	15.1	26.1	41.9	28.5

4.4.8.2 Take responsibility

An open-ended question: "What can you do to make sad rivers happy, healthy rivers again?" was posed to the grade 1 to 3 participating learners and they were allowed to mention more than one

action. Some respondents allocated responsibility to their suggestions by phrasing their answers in one of the following ways: I can...; we can ...; you can...; people can...; others can...; etc. The majority of the respondents did not mention who should execute the proposed action. This could be due to the following: to prevent bias, learners were not prompted to mention who should take responsibility - their spontaneous responses were captured; and, some of the exact meanings were lost during the data capturing and translation process.

A comparison between phases 1 and 2 showed an increase over time in the responses that allocated responsibility (I can...; we can ...; etc.) and a decrease in responses that did not allocate responsibility for the action (Figure 4.7). The number of those that did not respond to the question (no response) also declined over time.

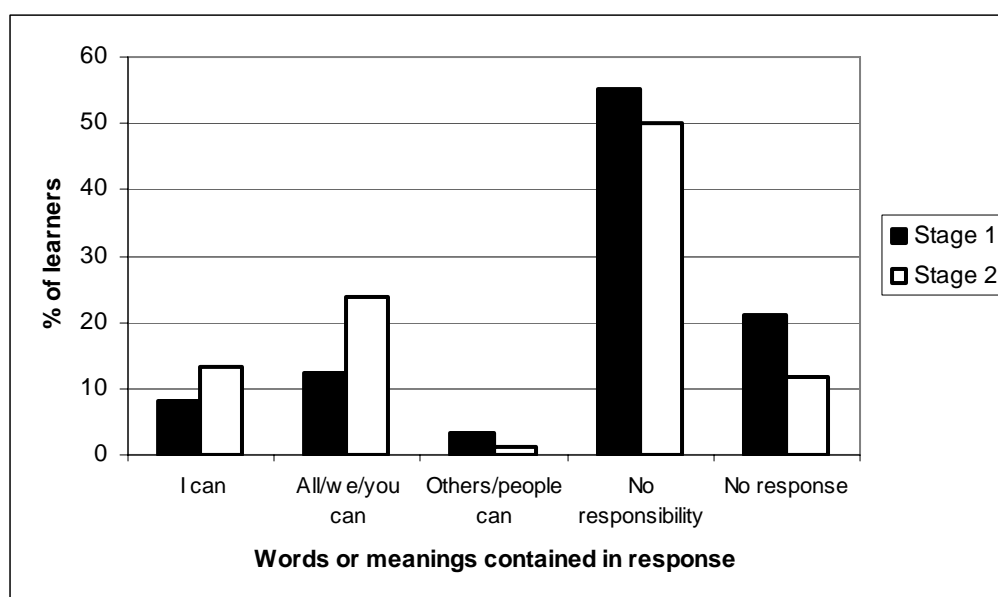


Fig 4.7 Relative frequency of responses to the question: 'What can you do to make sad rivers happy, healthy rivers again?' allocating responsibility to the proposed actions. (n=582)

Litter removal, no littering, protection of rivers, remediation (cleaning up), and the protection of plants and trees were areas where respondents felt they could best contribute to river health improvement. The actions mentioned by most of the respondents, and their relative frequencies for stages 1 and 2, are listed in Table 4.10.

Other less frequently mentioned actions related to: pollution (water quality), water quantity, alien species, and domestic activities (washing and building of houses too close to the river). Far more learners mentioned remediation types of actions than protection or preventative actions. The changes in frequency over time were also more significant for the remediation type of actions.

Table 4.10 Items frequently listed by grade 1 to 3 learners as actions to be done to change unhealthy rivers to healthy rivers, in descending order of greatest change. (n=582)

Action	Phase 1		Phase 2	
	Frequency	Relative frequency	Frequency	Relative frequency
Litter removal	91	15.6	196	33.7
Remediation (clean up the rivers)	79	13.6	108	18.6
No littering	71	12.2	83	14.3
Protection of rivers	68	11.7	73	12.5
Protection of trees/plants and fish/animals	81	13.9	79	13.6

4.5 Discussion

Adequate materials to support environmental learning are lacking in many schools in South Africa and there is a need amongst facilitators to improve their understanding and knowledge of environmental education (Maila 2003). Results indicated that the SoR activity books and posters added value to the learning and understanding of learners in grades 1 to 3. Since the control group, who had not seen the materials, showed no increase in all three measurements during the same period, it can be concluded that the increased understanding in the sample group was due to the activity book and poster and not due to normal development or other influences during the study period. However, there is clearly still ample room for improvement. Verbal inquiry²² indicated that activity books were most often used for self study – to keep the learners busy. Where the activity books and posters were used as source materials, few facilitators went beyond the first couple of pages, which cover the uses of water and the water cycle. Facilitators and learners, who exploited the materials in full, were complimentary about the materials: how they improved the learning experience and broadened the facilitators' options of what could be done within the water theme. However, several options were identified to improve the activity books and posters. Additionally, the role that the educators/facilitators can play should be highlighted (Maila 2003). Acknowledging that a facilitator's understanding or knowledge of his/her subject does not necessarily ensure that students learn more, Woolfolk (1980) accentuates the role of the facilitator in the classroom. Facilitators who have the necessary knowledge will, apart from being able to present work more clearly, be able to recognize areas in which learners have difficulty, give direction and explain the work clearly (Woolfolk 1980). The attitude of facilitators towards learning also has an influence on learners' attitudes and their levels of interest, curiosity, enjoyment and creativity (Littledyke 2008). Although teachers need to be equipped with the necessary support that would enable them to transfer the know-how of sustainable lifestyles to learners (Maila 2003), the enthusiasm of the teachers also plays a major role

²² Informal questioning of both learners and facilitators about how the activity books were used.

in the viability of environmental education in schools (Eames *et al.* 2008). Unfortunately, the knowledge, attitudes and motivation levels of teachers/facilitators is a variable that was not foreseen and thus not planned for investigation as part of this study. It would have added additional insight to the overall results if the facilitators' knowledge, attitudes and motivation levels were measured before and after the study.

The increased understanding of both *benefits that healthy rivers provide* and *human impact* amongst learners from rural areas in the Buffalo catchment can be ascribed to the fact that many residents in the Buffalo rural area do not have access to potable tap water. Those that have access to standpipes in the streets also supplement the tap water with other available sources of water. Between 67 and 100 % of the learners from this subgroup indicated that they do not have access to municipal water in their homes, either during phase 1 or phase 2 of the study. Due to the sensitivity regarding having access to tap water, if learners indicated at any stage that they do not have tap water in their homes, it was counted as not having tap water. Children from these areas are thus very conscious of the importance of other water sources and the benefits they derive from rivers.

The small changes in *understanding human impact* recorded during the quantitative study when compared to the qualitative and participatory evaluations, which showed more substantial changes, could be due to several reasons. Although the questions were read by the facilitator, the quantitative section relied primarily on the reading skills of the learners and thus the ability to select the correct options. Other possible reasons include the way the study was facilitated, the manner in which the questions were phrased and the lack of scientific terms in the isiXhosa language; all of these could have led to misinterpretation of the questions. The resultant sample size for the qualitative analysis (n=471) was smaller than the total sample size (n=1178). This was because not all learners answered the qualitative questions and not all schools were included in this analysis. Schools were included only if it could be established beyond doubt that the difference between phases 1 and 2 was not due to learners' lack of expected mastery of the written language and the facilitators' efforts to compensate for this. Although this problem was foreseen and facilitators were used to read the questions to the learners and write down the learners' responses, schools were excluded where the same answers were repeated over and over, e.g. where the facilitator gave the learners options to choose from, as well as where the answers were given in illegible learners' handwritings.

Results from the participatory evaluations showed increases in the mean scores for all four subgroups. It can be concluded that those learners that knew the least at the start of the study, gained the most in terms of their understanding of human impact on rivers over time. The results indicated that, irrespective as to whether facilitators added value or not, the below average group learned either through self-study while working in the activity books, or from their peers while discussing the non-verbal posters and the activities in the activity books. This resulted in their understanding reaching the same level as that of the above-average learners. It can be argued that the above-average learners would also gain knowledge through discussions with other learners, both below and above average that have different life experiences. Where input from facilitators guided

the learning process, it can be assumed that the understanding of above-average learners would also improve significantly.

Although challenging and time-consuming, the participatory evaluations proved to be a successful way to test Foundation Phase learners, especially those who had not yet acquired the expected verbal and writing skills as well as confidence levels to trust their individual thoughts and opinions. Acknowledging the advantages, the emphasis on group work in the current curriculum unfortunately has its disadvantages, especially in those schools where it is not correctly implemented. An example is facilitators that encourage copying between co-learners as opposed to fostering a working together, co-learning and joint responsibility culture.

This study distinguished between human impact on the environment (littering or no littering, cutting of trees, etc.) and the environment as a functioning ecosystem (presence of trees and fish and enough water in a river, etc.). This differs from, and complicates a comparison with other studies that addressed children's concerns about the environment, where items such as 'no littering' forms part of the environment component (Hicks & Holden 2007). Results indicated that the number of learners that were willing to take responsibility for their actions, as well as learners' attitudes towards river conservation, improved over time. Both the benefits from rivers and human impact items increased when learners were asked why rivers should be conserved, but the reasons that could be related to ecosystem type responses showed almost no increase. Similar to the findings reported by Barraza (2001b), themes related to littering dominated learners' perceptions.

Experiences of nature during childhood play an important role in knowledge, attitudes and behaviour in later life (Palmer 1993; Wells & Lekies 2006). The role of educators (their environmental knowledge and concern for the environment) in shaping the perceptions and attitudes those learners will form and display cannot be overemphasized (Palmer 1993; Palmer *et al.* 1998a; Palmer 1998b; Gil-Perez *et al.* 2003). Schools play an important role in learners' perceptions of and understanding of environmental problems: environmental policies, availability of environmental information, activities where the learners are actively involved and attitudes of educators who facilitate the learning process, all influence learners and shape their future attitudes (Barraza 2001a; Barraza 2001b; Barraza 1996). Littledyke (2008) proposed that knowledge would be more likely to translate into actions if affective domain learning is used in science education that encourages an understanding of environmental relationships. In contrast to cognitive domain learning (acquiring knowledge and developing intellectual skills), affective domain learning deals with emotions such as feelings, values, appreciation, enthusiasm, motivation and attitude (Bloom 1956). Attitudes and behaviour can be influenced by informal learning about the environment (Ballantyne and Packer 2005). Although this study did not allow for any outdoor activities, there was no evidence that facilitators made any use of personal environmental experiences to enhance the learning from the activity books and posters. Providing exciting and sensory stimulatory surroundings such as outdoor areas could contribute to the willingness of learners to take responsibility for their environment (Mercer 2000, Owens 2004).

An investigation into 25 years of environmental education in the United Kingdom found that education focused on local problems and that the global issues do not receive the necessary attention (Hicks &

Holden 1995). In South Africa, the foundation phase school curriculum, grades R-3, currently focuses on water uses and water as a benefit to humans: human's need for food, water and air, similar to the needs of plants and animals (DoE 2002a). The role of water in ecosystems, sustaining both plant and animal life, as well as sources of pollution and the impact of industries, agriculture and domestic activities on the quality and quantity of available water, is covered in the Natural Sciences component of the Intermediate Phase (DoE 2002b). The small initiative of the RHP to develop activity books and posters for use in schools partly addresses the curriculum's water theme, but also includes water resource and general attitude activities. However, in South Africa, the foundation phase schools' curriculum currently focuses on how people use water and not on the value of water within a functioning ecosystem. Ways in which people can contribute to conserving valuable natural resources and looking after our environment in general, should be included and given the necessary substance in the curriculum. Facilitators' understanding of ecosystems and the importance of functioning ecosystems should be expanded. Supportive materials for use in the classrooms should be supplied by the Department of Education as well as continuous guidance and support on how to use them.

4.6 Conclusion

This paper describes the findings from an empirical study in two catchment areas in South Africa, which determined whether or not State-of-River materials developed for foundation phase learners improved their understanding of and influenced their attitudes towards river conservation. A rigorous sampling method ensured that learners from different cultures and socio-economic backgrounds were included in the study. The learners' knowledge, perceptions and attitudes were measured in several areas.

The understanding of the learners from rural areas within group B (the Buffalo River catchment) improved the most during the course of the study. This is likely due to the large number of households in this group that use rivers as a main source of domestic water. The degree to which the lack of piped water and sanitation and socio-economic circumstances in general influenced both the initial scores and the improvement in understanding, needs to be further investigated. Those learners who knew the least at the start of the study, gained the most understanding of human impact on rivers over time during this study.

The motivation and attitudes of teachers - as an influencing factor - is an important variable that was not foreseen and planned for in this study. Future studies should take into account and plan for this variable. Environmental learning in schools, and the creativity with which it is carried out, also needs greater attention. The impact of environmental education on learners' environmental awareness, and the possibility of creating an environmentally responsible society, need to be further investigated.

While the importance of functioning ecosystems and how humans can contribute to saving valuable natural resources, and looking after the environment in general, should be expanded and given the necessary substance in the curriculum, the activity books should also be developed to accommodate learning in the Intermediate Phase. Facilitators' understanding of ecosystems and the importance of

functioning ecosystems should be expanded. Supportive materials for use in the classrooms should be supplied by the Department of Education. In addition, the department should provide continuous guidance and support on how to use them.

Currently, the SoR materials target the foundation phase learners. Learners are most receptive to education that addresses moral issues and behaviour when they are aged between 10 and 13 (Sprinthall & Mosher 1978, Mercer 2000) and when the learning experience includes practical life experiences (Mercer 2000). In future, SoR materials should be expanded beyond the foundation phase to encourage the forming of attitudes and behaviours that support sustainable development and a better future for all South Africans.

4.7 Reference List

- Babbie, E. & Mouton, J. (2001) *The Practice of Social Research*, 674 pages. Oxford University Press, Oxford.
- Ballantyne, R. & Packer, J. (2005) Promoting environmentally sustainable attitudes and behaviour through free-choice learning experiences: what is the state of the game? *Environmental Education Research*, **11**(3), 281-295.
- Barratt Hacking, E., Barratt, R. & Scott, W. (2007) Engaging children: research issues around participation and environmental learning. *Environmental Education Research*, **13**(4), 529-544.
- Barraza, L. (2001a) Environmental education in Mexican schools: The primary level. *Journal of Environmental Education*, **32**(3), 31-36.
- Barraza, L. (2001b) Perception of Social and Environmental Problems by English and Mexican School Children. *Canadian Journal of Environmental Education*, **6**, 139-157.
- Bloom B. S. (1956). *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain*. New York: David McKay Co Inc.
- Brace, I. (2004) *Questionnaire Design. How to Plan, Structure and Write Survey Material for Effective Market Research*, 289 pages. Kogan Page, London.
- Brown, C.P., Propst, S.M. & Woolley, M. (2004) Report: Helping researchers make the case for science. *Science Communication*, **25**(3), 294-303.
- Chawla, L. (1998) Research Methods to Investigate Significant Life Experiences: review and recommendations. *Environmental Education Research*, **4**(4), 383-397.
- Chawla, L. (1999) Life paths into effective environmental action. *Journal of Environmental Education*, **31**(1), 15-26.
- Chawla, L. & Flanders Cushing, D. (2007) Education for strategic environmental behaviour. *Environmental Education Research*, **13**(4), 437-452.
- Cullingford, C. (1995) Children's attitudes to their local environment. *Monitoring change in education* Vol 2: Environmental issues in education (G. Harris & C. Blackwell, Eds.) Aldershot, Ashgate

- Department of Education (2002a) *Revised National Curriculum Statement Grades R-9 (Schools): Life Orientation*. Gazette No.: 23406, 443, May 2000. Department of Education, Pretoria, South Africa. Available online: <http://www.education.gov.za/Curriculum/GET/GETstatements.asp> (Accessed: December 2008).
- Department of Education (2002b) *Revised National Curriculum Statement Grades R-9 (Schools): Natural Sciences*. Gazette No.: 23406, 443, May 2000. Department of Education, Pretoria, South Africa. Available online: <http://www.education.gov.za/Curriculum/GET/GETstatements.asp> (Accessed: December 2008).
- Eames, C., Cowrie, B & Bolstad, R. (2008) An evaluation of environmental education practice in New Zealand schools. *Environmental Education Research*, **14**(1), 35-51.
- Finger, M. (1994) From knowledge to action? Exploring the relationships between environmental experiences, learning, and behavior. *Journal of Social Issues*, **50**(3), 141-160.
- Gil-Perez, D., Vilches, A., Edwards, M., Praia, J. & Marques, L. (2003) A proposal to enrich teachers' perception of the State of the World: first results. *Environmental Education Research*, **9**(1), 67-90.
- Goodrum, D., Hackling, M. & Rennie, L. (2000). DETYA Report: The Status and Quality of Teaching and Learning of Science in Australian Schools: A Research Report prepared for the Department of Education, Training and Youth Affairs. Department of Employment, Training and Youth Affairs, Australia.
- Hicks, D. & Holden, C. (1995). *Visions of the future. Why we need to teach for tomorrow*. Trentham books, London.
- Hicks, D. & Holden, C. (2007) Remembering the future: what do children think? *Environmental Education Research*, **13**(4), 501-512.
- Littledyke, M. 2008. Science education for environmental awareness: approaches to integrating cognitive and affective domains. *Environmental Education Research*, **14**(1), 1-17.
- Loughland, T., Reid, A., Walker, K. & Petocz, P. (2003) Factors influencing young people's conceptions of environment. *Environmental Education Research*, **9**(1), 3-19
- Louv, R. (2007) Leave no child inside. *Orion Magazine*, March/April. Available online at: www.orionmagazine.org/index.php/articles/article/240 (Accessed 28 March 2008).
- Maila, M. W. (2003) *Issues and challenges regarding the implementation of environmental education policy in formal education in South Africa*. Submitted in accordance with the requirements for the degree of Doctor of Education in the subject Didactics at the University of South Africa.
- Mercer, A.J. (2000) *The importance of affective curriculum in educating children to live responsible, creative and fulfilling lives*. Submitted in partial fulfillment of the requirements for the Masters of Science Degree. The Graduate College, University of Wisconsin-Stout.
- Owens, P. (2004) Researching the development of children's environmental values in the early school years. Paper presented at the Charney Manor Conference, Developing Primary

- Geography, Oxfordshire, UK 2003. In: *Researching Primary Geography*. S. Catling and F. Martin (Eds) Special Publication No 1, Aug 2004. London Register of Research. ISBN 0-9538154-3-9. Blackheath, London.
- Page, C. & Meyer, D. (2003) *Applied Research Design for Business and Management*, pp331. McGraw-Hill, Sydney.
- Palmer, J.A. (1993) Influences and experiences affecting the pro-environmental behaviour of educators. *Environmental Education Research*, **24**(3), 26-30.
- Palmer, J.A. & Suggate, J. (1996) Influences and experiences affecting the pro-environmental behaviour of educators. *Environmental Education Research*, **2**(1), 109-121.
- Palmer, J.A., Suggate, J., Bajd, B. & Tsaliki, E. (1998) Significant Influences on the Development of Adults' Environmental Awareness in the UK, Slovenia and Greece. *Environmental Education Research*, **4**(4), 429-444.
- Palmer, J.A., Suggate, J., Barbara, B., Hart, P., Ho, R.K.P., Ofwono-Orecho, J.K.W., Peries, M., Robottom, I., Tsaliki, E., Van Staden, C. (1998) An overview of significant influences and formative experiences on the development of adults' environmental awareness in nine countries. *Environmental Education Research*, **4**(4), 445-464.
- Piaget, J. (1978) *The development of thought: Equilibration of cognitive structures*. Blackwell, Oxford.
- RHP (2008) The River Health Programme. Available online: <http://www.csir.co.za/rhp/> (Accessed March 2008).
- Roux, D.J. (1997) Overview of the design process and guidelines for implementation. Health Programme Report Series No 6. Available online: <http://www.csir.co.za/rhp/reports/reportseries6.html>
- Stern, P.C., Dietz, T., Guagnano, G.A., Kalof, L. (1999) A value-belief-norm theory of support for social movements: the case of environmentalism. *Human Ecology Review*, **6**(2), 81-97.
- Strydom, W.F. (2003) *Compiling State-of-Rivers Reports and Posters: A Manual*. River Health Programme Report Series No 17. Available online: <http://www.csir.co.za/rhp/reports/reportseries17.pdf> (accessed March 2008).
- Strydom, W.F., Hill, L. & Eloff, E. (Eds) (2006) *Achievements of the River Health Programme 1994 – 2004: A national perspective on the ecological health of selected South African rivers*. Department of Water Affairs and Forestry, Government of South Africa. 69 pages. (Also available online: www.csir.co.za/rhp/ accessed March 2008).
- Sprinthall, N.A. & Mosher, R.L. (EDS.). (1978). *Value Development as the Aim of Education*. Character Research Press, New York.
- Tanner, T. (1980) Significant life experiences. *Journal of Environmental Education*, **11**(4), 20-24.

- UNCED (1992) Earth Summit Agenda 21. The United Nations Programme of Actions from Rio. United Nations Conference on environment and development (UNCED), Rio de Janeiro, Brazil, 3 to 14 June 1992. Geneva: United Nations, Department of Public Information.
- Vygotsky, L.S. (1962) Thought and language. The MIT Press, Massachusetts.
- Wells, N.M. & Lekies, K.S. (2006) Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism. *Children, Youth and Environments*, **16**(1). Available online: www.colorado.edu/journals/cye (accessed: 28 March 2008).
- Woolfolk, A. (1980) *Educational Psychology*. 6th Edition ISBN 0-205-155542-1. Allyn & Bacon, Needham Heights, MA pp647.

Chapter 5

Conclusion and Recommendations

5.1 Key findings and key messages

To the author's knowledge, no other studies to measure the success of dissemination and impact of SoR reporting on children's and adult's attitudes towards river conservation have previously been undertaken. Pretorius (2000) acknowledges the challenge of measuring the impact of information distribution projects. This study drew ideas from various studies: Tanner (1980) identified a lack of research in the field of environmental education; and Palmer and co-workers (1993 and 1998) studied the acquisition of environmental knowledge in learners as well as adults in many countries. However, the main driver for this study was the urge to know whether SoR reporting added any value towards awareness and knowledge creation in the South African society.

This 2007 study collected valuable information regarding people's general awareness of water issues, their understanding of adverse impacts on rivers and the benefits derived from rivers. A significant need was expressed for more river information. Since the SoR reports were not adequately distributed, the change in people's attitudes and behaviour due to the influence of SoR reporting could not be determined. Thus, although unanswered, the question stays relevant as to whether SoR reports contribute towards this need.

Until recently, researchers almost solely focused their communications on peer-reviewed journals and scientific conferences (Bielak 2008). Although it does not allow sufficient communication to diverse audiences (Saywell & Cotton 1999), scientists are well-trained to communicate this way (Roux 2004). The River Health Programme, and more particularly State-of-Rivers reporting is an example where scientists crossed this divide and through relatively short, easy to read and well-illustrated booklets attempted to bridge the gap between science and policy, as well as science and society. However, results from the pre-study, pilot study and the main study indicated that the communication materials did not reach the respective target audiences. Information dissemination strategies and policies in the organisations and departments responsible for the dissemination were either not in place, or were not adhered to. This institutional malfunctioning has detrimental effects on both the science-society and the science-policy interfaces (see also Roux 2004 and Turton *et al.* 2007).

For successful communication between scientists and society, as well as between scientists and policy-makers, the mechanisms for both scientific evidence push and pull²³ should be in place and operating well (Bielak 2008). Organisations and Departments should realize and give effect to the fact that the end-user is the one for which the communication was intended and subsequently developed. The value in showcasing communication materials at conferences and seminars is limited

²³ "Push and pull" is a term used in the science communication literature. Scientists "push" the scientific information to the users and the users "pull" from the scientists the information that they need for, for example, decision-making.

to showcasing the possibilities of what could be achieved and encouraging others to start or continue similar work. If the communication does not eventually reach the target audience, bragging about achievements of part of the communication chain will not help to achieve the desired change in attitudes and behaviour, and the necessary conservation goals will not be reached.

Similarly, the activity books and posters were not distributed in the schools as planned. Despite this, the school setup allowed a controlled environment to test a cause-effect relationship between the exposure of Grade 1 to 3 learners to the different SoR reporting materials (activity book and non-verbal poster) and their resulting knowledge and possible change in attitude.

Questionnaires, combined with participatory evaluations, were valuable ways to collect data on the learners' change in understanding. In general, learners were eager to participate and cooperated in the participatory evaluations with enthusiasm.

Two measurements were used to determine learners' understanding of human impact on rivers over time: a survey consisting of quantitative and qualitative items, as well as participatory evaluations. There was an overall increase in learner's understanding of good practices and the negative impact of human activities on rivers. Although the rural subgroups achieved lower scores during phase 1 than the urban subgroups, the rural scores increased to the same level as the urban scores in phase 2. With the exception of one, all schools in the Hartenbos and Klein Brak catchment showed a slight increase in understanding. Results from the sampled schools in the Buffalo catchment varied more.

A quantitative method was used to measure learners' understanding of the benefits of healthy rivers. While learners in the rural areas of the Buffalo catchment better understood the benefits that rivers provide than the learners in the Hartenbos and Klein Brak catchment during phase 1 of the study, they also acquired a significantly better understanding that can be ascribed to the use of the activity books and posters. Results from the quantitative investigation indicated that learners in the Hartenbos area and Buffalo urban area acquired no additional knowledge.

Qualitative items measured learners' perceptions as to why rivers should be conserved. Comparing categories of possible responses over time, learners indicated that rivers should be conserved because humans have an impact and because people benefit from healthy rivers. There was only a slight increase in responses related to ecosystems, indicating that more needs to be done to convince learners of the importance of ecosystems. Compared to phase 1, the phase 2 study also indicated that more learners were willing to take responsibility for their actions related to river health.

The activity books and posters were not used to their full potential. The activity books (Buffalo and Hartenbos and Klein Brak catchments) and the poster (Buffalo catchment) contain a detailed facilitator's guide on how materials could be used in the respective OBE learning areas. There is evidence that, in the majority of the sampled schools, the facilitators only used the activity books to keep the learners busy. However, the general response from both learners and facilitators was that it has the potential to influence the mindset of the learner. Although it was not formally analysed, several facilitators indicated that the study materials encouraged them to use the materials across many learning areas and to expand the learner's experiences beyond what is expected by the current

school curriculum. During the second phase of the study, the learners from those classes that used the activity books were proud to show the progress they had made in the activity books and to share what they had learned. While facilitators used the activity books to complement other materials on the water theme, it could not be established without doubt that the facilitators in all schools had access to other materials apart from the supplied activity books and posters. Sufficient and content specific study materials would encourage environmental learning, but the learning process also depends on the environmental knowledge of the facilitators. Although a facilitator's knowledge of his/her subject does not guarantee that students learn more, it helps the facilitator to recognise areas where learners experience difficulty and to give clear direction and explanations (Woolfolk 1980). Maila (2003) established that there was a need amongst facilitators to improve their environmental knowledge for educational purposes.

Contrary to general perceptions, the exposure to education material does not change people's attitudes and behaviour to conservation (Ajzen & Fishbein 1980, Finger 1994). However, education does have an indirect effect on attitudes through people's belief systems (Ajzen & Fishbein 1980). Even when human attitudes favour conservation efforts, they might still not behave accordingly if they do not have the right knowledge or do not receive accurate information on how to change their behaviour. With South Africa's challenged education system (O'Connell 2008), disadvantaged communities and dysfunctional societies, this could be a bigger problem than anticipated by conservation ecologists and resource managers who are trying to find a balance between the use of natural resources and conservation. Although the conflict between conservation and basic human need is obvious, the overexploitation of resources through greed cannot be ignored (Shiva 1988).

This study showed that respondents having access to municipal tap water in their homes were more prone to wasting water than those who do not have direct access. The South African government's drive to supply all people with potable drinking water will have detrimental consequences on natural water resources if all citizens do not learn and demonstrate pro-conservation behaviour. It might well be possible that many South Africans simply do not know and cannot distinguish between good and bad environmental conservation behaviour. If the example is not set for children to co-exist with nature rather than to master and over-exploit it, how will they be able to treasure the natural resources that are necessary for continued life on earth?

5.2 Sources of error

Sampling and non-sampling errors (Babbie & Mouton 2001; Brace 2004) commonly arise from a questionnaire survey. Non-sampling errors include questionnaire errors, coding and data entry mistakes, as well as errors committed by interviewers and translators (Brace 2004). A fixed form survey was used to ensure that the interview process was standardized, with the same questions posed in the same way and in the same order. Although the questionnaire was compiled to ensure that the most accurate data possible were obtained to address the objectives of the study possible non-sampling (data collection) errors were:

- The inability of learners to accurately communicate due to a lack of reading and writing skills;

- Biased facilitators that overruled a learner's responses to the questions;
- Classroom setups that were conducive to teamwork (sitting together in groups facing each other) unfortunately also allowed copying from fellow learners. In some schools this was allowed and encouraged by facilitators; and
- Learners filling questionnaires on behalf of their parents (study 1).

Learners in grade 1 to 3 often do not yet have the vocabulary or writing skills to express their views on paper. In addition, the spelling of some of the concepts was foreign to them and once a learner asks out loud how to spell a certain word, the rest of the group tends to also use the word in their responses.

Interference with learners' responses by classroom facilitators was identified in several cases in the second study, which determined the effectiveness of use of SoR reporting materials in schools. While such known cases were excluded from the analyses, there is a possibility that more subtle interferences were not detected.

Sampling errors originate during the selection of the respondents and can be reduced by increasing sample size (Babbie & Mouton 2001; Page & Meyer 2003; Brace 2004). The population in the Buffalo catchment was 10 times larger than the population in the Hartenbos and Klein Brak catchment, although the size of the Hartenbos and Klein Brak catchment is approximately 60 % of the Buffalo catchment. If, for example, a choice was made to sample 2 % of the total population for this study, this would result in a sample size of almost 14 000 in the Buffalo catchment and 1 400 in the Hartenbos and Klein Brak catchment.

According to Brace (2004) it is difficult to obtain accurate attitudinal and behavioural data from surveys. It was thus foreseen that it could be a challenge to measure the attitudes and behaviour of people.

The first study, measuring people's awareness of and attitudes towards river conservation, was focused on parents and caretakers of learners at school. This study thus represents only a portion of the population. Findings from other studies indicate that parents with children normally have better attitudes towards the environment than those who do not have children (Hamilton 1985). It can thus be assumed that the results of a more representative sample group would be equal or worse than was found in this study.

The primary languages of both study areas are English, isiXhosa and Afrikaans (isiXhosa to a lesser extent in the Hartenbos and Klein Brak area and Afrikaans to a lesser extent in the Buffalo area). Drawing up questionnaires in isiXhosa posed a problem because isiXhosa is not a language of science and many of the terms used were either not easily translatable or not clearly understood by the respondents. The isiXhosa questionnaire therefore also contained English translations for cross reference. Even though it doubled the perceived length of the questionnaire, misunderstandings due to language were effectively ruled out.

An important aspect that was considered was the fact that although many people had a 'home' in a rural area, they lived in informal settlements in town during the week (Matanzima 2006). The questionnaire therefore provided for those that have more than one place of residence so as to avoid the mixing of rural and urban perspectives.

The suggested social desirability bias amongst responses to participation in the RHP and SoR reporting could also have an influence on the rest of the results.

As depicted in Table 1.2, approximately 50 000 (11.6 %) residents in the Buffalo River catchment had no formal schooling. Many could not read or write and needed facilitators to complete the questionnaires. Due to the language barrier, data gathering amongst community members took place with the help of a trusted interpreter. Care was taken to ensure that the view of the facilitator did not bias the findings. Depending on the method of distribution, it was not always possible to have the questionnaire completed under controlled circumstances. To capture any bias based on the influence of other facilitators, two questions were added to ascertain who completed the questionnaire and whose views were expressed. The timing of data collected on weekdays amongst community members was initially a concern, because it would have excluded those working elsewhere. However, many people in the sampled rural areas were unemployed and lived off government grants.

Several questionnaire distribution methods, listing the advantages and shortcomings of each, are presented in Table 5.1. Including communities through their traditional leaders²⁴ proved successful in the remote rural areas where literacy levels were low and where controlled facilitation was possible. The elected methods also avoided negative associations with possible ulterior purposes of the questionnaire (as explained in the disadvantages column in Table 5.1) as well as provided above average response rates.

Since English proficiency and the safety of the researcher was a concern, a trusted interpreter, who also doubled as a facilitator, sometimes accompanied the researcher to certain areas. Initially there were uncertainties with regards to cultural issues, also amongst subgroups, and a suitable escort for each of the areas was used. Where possible, the community and cultural leaders within communities were consulted/informed upon arrival in an area.

5.2.1 Dissemination and availability of SoR reporting material

At the time of writing, only one pre-survey questionnaire had been returned. This could indicate a lack of formal dissemination strategies or an acknowledgement of distribution not adequately undertaken; it may not have been a priority for the official tasked with completing the questionnaire; due to the loss of dissemination memory due to resignations in the organisations; or the distribution might simply not have been documented properly. The questionnaires were followed by telephone calls

²⁴ Numerous phone calls in an effort to locate and set up appointments with community leaders were unsuccessful. However, it was found that it is fairly easy to locate community leaders and representatives in rural areas by asking pedestrians passing by. They were helpful in pointing out where community leaders could be found. Community leaders were accommodating in distributing the questionnaires. In one case a community representative suggested that the questionnaires be filled during their monthly community meeting.

which provided some insight into the dissemination that took place. The limited number of copies of the various materials that was sourced, and the printing costs involved in producing more, did not allow the evaluation of a causal effect in study 1. For study 2, sufficient SoR reporting material was available to determine the causal effect in 15 schools.

Table 5.1 Sampling possibilities: the advantages and disadvantages of the different methods.

Sampling mode	Advantage	Disadvantage
With water and electricity bills	A quick way of reaching many potential respondents	1. Response rate normally low 2. Reach only registered water and electricity users; may exclude many rural residents 3. The questionnaire might be associated with the payment for services – there are questions such as ‘are you willing to pay more...?’
Through school children to parents and neighbours	The ‘personal touch’ especially if the child writes letter to request a response, increases response rates	The sample might be biased in favour of respondents with children of school-going age or those knowing parents with school children
Through established groups, e.g. organisations, forums, church groups	Safe way of getting groups of people together	The group in itself may be biased in favour of a particular viewpoint.
At taxi ranks, bus stops, hospitals, clinics, libraries, pension payout points, municipalities, community halls, house visits	Collectively all age groups, both employed, self-employed and unemployed	1. Interpreter/spokesperson to be present at all times 2. Accessibility of some areas, especially during periods of high rainfall 3. Safety and security cannot be guaranteed 4. To be completed in the presence of the facilitator to ensure return of questionnaires

5.2.2 Learner facilitation

The outcome of Study 2 depended heavily on facilitators using the SoR reporting materials and facilitating learning during the study period. There was, however, no way to measure the extent of use and dedication to this. Although activity in the Activity books could be monitored, it was impossible to determine whether the children worked through the books during quiet time or whether

the teachers/facilitators used it to facilitate a learning experience during class activities. The variation in the knowledge, attitudes and motivation of the facilitators was not foreseen and planned for.

5.3 Recommendations

All research projects with an applied focus should have well-planned, and well-executed science communication, information dissemination and impact/outcomes assessment components. Appropriate budgets and human resources should be allocated to all these components. Science organisations and research and development funding organisations in South Africa should apply the successes of science councils in other countries as well as, for example, the pharmaceutical industry. In some instances project plans for the communication of science amounting to 10 % of total budgets of projects are a prerequisite (Lawton 2007).

Organisations responsible for the dissemination of SoR reporting materials should develop detailed dissemination strategies and action plans, and supply the necessary human resources and budget accordingly to execute these plans. The possibilities of partnerships between government departments, organisations, NGOs and consultants in executing disseminating action plans should be investigated.

The importance of science and environmental education in the DoE needs to be revisited. Facilitators' understanding of the various science fields, their willingness to learn more, and the implication this could have for learners to meet the requirements to enroll in higher education institutions and acquire degrees in natural sciences and engineering, needs to be investigated.

In South Africa, the foundation phase schools' curriculum currently focuses on water uses and water as a benefit to humans. The importance of functioning ecosystems and how humans can contribute to saving valuable natural resources and looking after the environment, in general, should be included and given the necessary emphasis in the curriculum. Facilitators' understanding of ecosystems and the importance of functioning ecosystems should be expanded. Environmental learning in schools, and the creativity with which it is portrayed, also need to be improved. Supportive materials for use in the classrooms should be supplied by the Department of Education along with continuous guidance and support on how to use them.

Currently the SoR materials target the foundation phase learners. Learners are most receptive to education that addresses moral issues and behaviour when they are aged between 10 and 13 (Sprinthall & Mosher 1978, Mercer 2000). In future, SoR materials should be expanded beyond the foundation phase to encourage the forming of attitudes and behaviours that support sustainable development and a better future for all South Africans.

5.4 Future studies and burning issues

Similar to the phased study amongst the learners (see Chapter 4), the study involving the parents of learners (see Chapter 3) should be continued into the second phase. Such a study should entail that participants in the first study will take part in the second survey after they have received the SoR

reports. Respondents' perceptions of the comprehensibility and appropriateness of the type of information should be measured as well as possible changes in attitude and behaviour.

Adults' attitudes towards river conservation should be studied comprehensively to determine why they hold particular attitudes. All possible attributes that may have possible influences on attitudes should be included. The impact of general upbringing, cultural influences and childhood experiences and the impact thereof on conservation attitudes later in life should be included. Although not addressing attitudes towards river conservation, valuable lessons can be drawn from related research (see Palmer 1993, Palmer *et al.* 1998, Wells & Lekies 2006)

The degree to which the lack of piped water and sanitation and socio-economic circumstances in general had an influence on both the initial scores and the improvement in understanding, needs to be further investigated. The learners' attitudes should also be correlated with those of their parents as well as those of their teachers.

The impact of environmental education on learner's environmental awareness, and the possibility of creating an environmentally responsible society, needs to be investigated further. The motivation and attitudes of facilitators is an important influencing factor. Future studies should take into account and plan for this variable. The potential role that the motivation and attitudes of facilitators, in collaboration with social services, play as an influencing factor to compensate for the dysfunctional societies of today should be investigated. These proposed studies should be conducted amongst diverse study groups including the remote poverty stricken rural areas.

Environmental learning in schools, with the focus on, for example, water uses and water as a benefit to humans vs how humans can support ecosystems to ensure continued benefits to humans needs to be investigated further. Simultaneously, the creativity with which environmental education is carried out needs to improve, and ways to achieve this need to be explored. Ways in which facilitators' knowledge of and interest in functioning of natural ecosystems can be generated and expanded need greater attention. Learner facilitators should receive the necessary support, guidance and materials from the Department of Education to adequately support sufficient learning in schools. Supplying schools with the latest technology (personal computers, television, internet access) without guidance on how to use the internet to source credible information, the supply of suitable and appropriate education material to watch on television, and control on what is watched on television during school time, will not yield the desired results.

The impact of environmental education on learner's environmental awareness, and the possibility of creating an environmentally responsible society, needs to be further investigated.

5.5 References

- Ajzen, I. & Fishbein, M. (1980) *Understanding Attitudes and Predicting Social Behavior*. Prentice-Hall, New Jersey.
- Babbie, E. & Mouton, J. (2001) *The Practice of Social Research*. Oxford University Press Southern Africa, Cape Town.
- Brace, I. (2004) *Questionnaire Design. How to Plan, Structure and Write Survey Material for Effective Market Research*. Kogan Page, London.
- Bielak, A.T., Campbell, A., Pope, S., Schaefer, K. & Shaxson, L. (2008) From Science Communication to Knowledge Brokering: the Shift from Science 'Push' to 'Policy Pull'. In: D. Cheng, M. Claessens, T. Gascoigne, J. Metcalfe, B. Schiele & S. Shi (eds) *Communicating Science in Social Contexts: New models, new practices*. Springer, pp 320.
- Finger, M. (1994) From knowledge to action? Exploring the relationships between environmental experiences, learning, and behavior. *Journal of Social Issues*, **50**(3), 141-160.
- Hamilton, L.C. (1985) Concern about toxic wastes: Three demographic predictors. *Social Perspectives*, **28**, 463-486.
- Lawton, A. (2007) Verbal communication with Professor Allen Lawton from NERC during his visit to CSIR in January 2007, Pretoria.
- Maila, M. W. (2003) *Issues and challenges regarding the implementation of environmental education policy in formal education in South Africa*. Submitted in accordance with the requirements for the degree of Doctor of Education in the subject Didactics at the University of South Africa.
- Matanzima, I.N. (2006) Verbal communication with Chief Matanzima during Katoomba Group meeting on 8 November 2006, Cape Town.
- Mercer, A.J. (2000) *The importance of affective curriculum in educating children to live responsible, creative and fulfilling lives*. Submitted in partial fulfilment of the requirements for the Masters of Science Degree. The Graduate College, University of Wisconsin-Stout.
- O'Connell, B. (2008) South Africa and the challenge of development. Keynote address at the Water Research Commission event: Celebrating Knowledge for Growth and Development, held on 2 December 2008 at the Auditorium, ABSA Conference Centre, Montana Park, Pretoria.
- Page, C. & Meyer, D. (2003) *Applied Research Design for Business and Management*. McGraw-Hill, Sydney.
- Palmer, J.A. (1993) Influences and experiences affecting the pro-environmental behaviour of educators. *Environmental Education Research*, **24**(3), 26-30.
- Palmer, J.A., Suggate, J., Bajd, B., Hart, P., Ho, R.K.P., Ofwono-Orecho, J.K.W., Peries, M., Robottom, I., Tsaliki, E. & Van Staden, C. (1998) An overview of significant influences and

- formative experiences on the development of adults' environmental awareness in nine countries. *Environmental Education Research*, 4(4), 445-464.
- Pretorius, R. (2000) Impact of Information on Decision-Making Processes in South Africa. *Impact of Information on Decision-making Processes: Case studies* (eds E. Leif, L. E. Christoffersen, K. Folgen & N. Denisov) UNEP/GRID-Arendal, May 2000. pp23. Available from: <http://www.grida.no/impact/papers/casestudies.doc> (accessed April 2006).
- Roux, D.J. (2004) From Monitoring Design to Operational Program: Facilitating the Transition under Resource-Limited Conditions. *Environmental Monitoring*. (ed G.B. Wiersma). CRC Press, Boca Raton.
- Saywell, D. L. & Cotton, A. P. (1999) *Spreading the Word – Practical Guidelines for Research Dissemination Strategies (Interim Findings)*, Water, Engineering and Development Centre, Loughborough University, Leicestershire.
- Shiva, V. (1988) *Staying Alive: Woman, Ecology and Development*. Zed Books Ltd., London, pp 224.
- Sprinthall, N.A. & Mosher, R.L. (1978). *Value Development as the Aim of Education*. Character Research Press, New York.
- Tanner, T. (1980) Significant life experiences. *Journal of Environmental Education*, 11(4), 20-24.
- Turton, A.R., Hattingh, J., Maree, G.A., Roux, D.J., Claassen, M. & Strydom, W.F. (2006) *Governance as a Trialogue: Government-Society-Science in Transition*, Water Resources Development and Management Series, Springer-Verlag, Berlin.
- Wells, N.M. & Lekies, K.S. (2006) Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism. *Children, Youth and Environments*, 16(1). Available online: www.colorado.edu/journals/cye (accessed: 28 March 2008).
- Woolfolk, A. (1980) *Educational Psychology*. 6th Edition ISBN 0-205-155542-1. Allyn & Bacon, Needham Heights, MA pp647.

Appendices

Appendix A

The pre-survey questionnaire to determine the extent to which the SoR reporting material has been distributed and whether formal dissemination strategies were followed.

Please help us to determine the impact of State-of-Rivers reporting



This questionnaire is sent to the organisations and government departments who received the Hartenbos and Klein Brak State-of-Rivers (SoR) and/or the Buffalo SoR reporting material for distribution. The reporting material includes the SoR reports, the SoR posters and the Activity books.

The information that you will provide through filling in this questionnaire will be used towards a Masters study to determine the impact of SoR reporting in the two mentioned catchments. The questionnaire will take about 30 minutes of your time to complete, depending on the availability of the information requested. Your cooperation is appreciated.

This questionnaire is filled in by _____(your name) on behalf of _____(your organisation/department name)

Telephone number: _____

Address: _____

My organisation/department received SoR reporting material of:

The Hartenbos & Klein Brak River Systems? ☐ yes ☐ no

The Buffalo River System? ☐ yes ☐ no

How did your organisation/department distribute the SoR reporting material? Tick the box(es) that resembles your organisation/department's distribution method the closest.

We give SoR reporting material to individuals and community groups that ask, irrespective of who they are	
We give SoR reporting material to individuals and community groups that we think can use it wisely	
We use SoR reporting material to showcase our work at functions, workshops and conferences.	
We distribute SoR reporting material in schools	
We distribute SoR reporting material to libraries	
We distribute SoR reporting material during Water Week	
Other (please specify)	

If your organisation/department followed a specific dissemination strategy, in short, what does the strategy entail?

How many copies of SoR reporting material have your organisation/department received? Please tick the box that resembles most closely the number of copies of each of the types of SoR reporting material received. If you remember the exact numbers please note these in the space provided. If you have not received any Hartenbos & Klein Brak SoR reporting material, please go to the middle of this page where the questions relating to the Buffalo River SoR reporting material start.

Hartenbos & Klein Brak SoR reporting material

How many Hartenbos and Klein Brak SoR **Reports** have you received for distribution?

☐ none ☐ less than 20 ☐ 20 – 100 ☐ 100 - 500 ☐ more than 500

We have received _____ number of Hartenbos & Klein Brak SoR reports.

How many Hartenbos and Klein Brak SoR **four-page booklets** have you received for distribution?

☐ none ☐ less than 20 ☐ 20 – 100 ☐ 100 - 500 ☐ more than 500

We have received _____ number of Hartenbos & Klein Brak SoR posters.

How many Hartenbos and Klein Brak SoR **Activity Books** have you received for distribution?

☐ none ☐ less than 20 ☐ 20 – 100 ☐ 100 - 500 ☐ more than 500

We have received _____ number of Hartenbos & Klein Brak SoR activity books.

Buffalo River SoR reporting material

How many Buffalo River SoR **Reports** have you received for distribution?

☐ none ☐ less than 20 ☐ 20 – 100 ☐ 100 - 500 ☐ more than 500

We have received _____ number of Buffalo River SoR reports.

How many Buffalo River SoR **Non-verbal Posters** have you received for distribution?

☐ none ☐ less than 20 ☐ 20 – 100 ☐ 100 - 500 ☐ more than 500

We have received _____ number of Buffalo River posters.

How many Buffalo River **Activity Books** have you received for distribution?

☐ none ☐ less than 20 ☐ 20 – 100 ☐ 100 - 500 ☐ more than 500

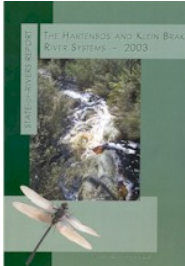
We have received _____ number of Buffalo River activity books.

We are trying to determine the type of audience and the size of the audience of the specified SoR reporting products. Please fill in all tables relating to the specific reporting material that you have received. If you've received both Hartenbos & Klein Brak AND Buffalo SoR reporting material please fill in both sections. If you have only received Buffalo River SoR reporting material, you can turn to the Buffalo River Section on p8.

HARTENBOS & KLEIN BRAK RIVER SECTION

HARTENBOS & KLEIN BRAK RIVER SOR REPORT

How many and to whom did you distribute the **Hartenbos and Klein Brak SoR REPORTS**? On the right hand side please tick the boxes that most closely resemble the number of reports that your organisation or department has distributed to each of the corresponding groups. If you know the exact number of copies distributed to each group, please write the number of copies in the corresponding box.



Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Specific individuals within National Government Departments If possible please specify:							
To national government departments in general If possible please specify:							
Specific individuals within Provincial Government Departments If possible please specify:							
To provincial government departments in general If possible please specify:							
Specific individuals within Local Government Departments If possible please specify:							
To local government departments in general If possible please specify:							
Interest groups within the Hartenbos and Klein Brak Catchments If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Interest groups NOT within the Hartenbos and Klein Brak Catchments If possible please specify:							
Commercial farmers within the catchment If possible please specify:							
Subsistence farmers within the Hartenbos and Klein Brak Catchments If possible please specify:							
High School teachers If possible please specify:							
High School learners If possible please specify:							
Primary School teachers If possible please specify:							
Primary School learners If possible please specify:							
The community within the catchment If possible please specify:							
Other Please specify							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Number of copies still available for distribution?							
Number of copies distributed during 2003 ?							
Number of copies distributed during 2004 ?							
Number of copies distributed during 2005 ?							
Number of copies distributed during 2006 ?							

HARTENBOS & KLEIN BRAK RIVER SOR POSTER

Note: An A1 poster was not produced for the Hartenbos & Klein Brak river systems. A 4-page booklet opened up serves as an A3 poster printed on both sides. How many and to whom did you distribute these **Hartenbos and Klein Brak SoR POSTERS/BOOKLETS**? On the right hand side please tick the boxes that most closely resemble the number of posters that your organisation or department has distributed to each of the corresponding groups. If you know the exact number of copies distributed to each group, please write the number in the corresponding box.



Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500+
Specific individuals within National Government Departments If possible please specify:							
To national government departments in general If possible please specify:							
Specific individuals within Provincial Government Departments If possible please specify:							
To provincial government departments in general If possible please specify:							
Specific individuals within Local Government Departments If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
To local government departments in general If possible please specify:							
Interest groups within the Hartenbos and Klein Brak Catchments If possible please specify:							
Interest groups NOT within the Hartenbos and Klein Brak Catchments If possible please specify:							
Commercial farmers within the catchment If possible please specify:							
Subsistence farmers within the Hartenbos and Klein Brak Catchments If possible please specify:							
High School teachers If possible please specify:							
High School learners If possible please specify:							
Primary School teachers If possible please specify:							
Primary School learners If possible please specify:							
The community within the catchment If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Other Please specify							
Number of copies still available for distribution?							
Number of copies distributed during 2003 ?							
Number of copies distributed during 2004 ?							
Number of copies distributed during 2005 ?							
Number of copies distributed during 2006 ?							

ACTIVITY BOOKS

Note: Activity Books were not produced for the Hartenbos and Klein Brak area specifically. If you have received and distributed other related RHP or SoR Activity books please indicate the distribution of those books within the Hartenbos and Klein Brak area below.

Name/describe the Activity Books distributed in the Hartenbos & Klein Brak area.

How many of the **Activity Books** described above did you distribute and to whom? On the right hand side please tick the boxes that most closely resemble the number of activity books that your organisation or department has distributed to each of the corresponding groups. If you know the exact number of copies distributed to each group, please write the number in the corresponding box.

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500+
Specific individuals within National Government Departments If possible please specify:							
To national government departments in general If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Specific individuals within Provincial Government Departments If possible please specify:							
To provincial government departments in general If possible please specify:							
Specific individuals within Local Government Departments If possible please specify:							
To local government departments in general If possible please specify:							
Interest groups within the Hartenbos and Klein Brak Catchments If possible please specify:							
Interest groups NOT within the Hartenbos and Klein Brak Catchments If possible please specify:							
Commercial farmers within the catchment If possible please specify:							
Subsistence farmers within the Hartenbos and Klein Brak Catchments If possible please specify:							
High School teachers If possible please specify:							
High School learners If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Primary School teachers If possible please specify:							
Primary School learners If possible please specify:							
The community within the catchment If possible please specify:							
Other Please specify							
Number of copies still available for distribution?							
Number of copies distributed during 2003 ?							
Number of copies distributed during 2004 ?							
Number of copies distributed during 2005 ?							
Number of copies distributed during 2006 ?							

Buffalo river section follow on next page

BUFFALO RIVER SECTION

BUFFALO RIVER SOR REPORT

How many and to whom did you distribute the **Buffalo River SoR REPORTS**? On the right hand side please tick the boxes that most closely resemble the number of reports that your organisation or department has distributed to each of the corresponding groups. If you know the exact number of copies distributed to each group, please write the number of copies in the corresponding box.



Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500+
Specific individuals within National Government Departments If possible please specify:							
To national government departments in general If possible please specify:							
Specific individuals within Provincial Government Departments If possible please specify:							
To provincial government departments in general If possible please specify:							
Specific individuals within Local Government Departments If possible please specify:							
To local government departments in general If possible please specify:							
Interest groups within the Buffalo catchment If possible please specify:							
Interest groups NOT within the Buffalo catchment If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Commercial farmers within the Buffalo catchment If possible please specify:							
Subsistence farmers within the Buffalo catchment If possible please specify:							
High School teachers If possible please specify:							
High School learners If possible please specify:							
Primary School teachers If possible please specify:							
Primary School learners If possible please specify:							
The community within the Buffalo catchment If possible please specify:							
Other Please specify							
Number of copies still available for distribution?							
Number of copies distributed during 2004 ?							
Number of copies distributed during 2005 ?							
Number of copies distributed during 2006 ?							

BUFFALO SOR NON-VERBAL POSTER

How many of and to whom did you distribute the **Buffalo River non-verbal POSTERS**? On the right hand side please tick the boxes that most closely resemble the number of posters that your organisation or department has distributed to each of the corresponding groups. If you know the exact number of copies distributed to each group, please write the number in the corresponding box.



Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500+
Specific individuals within National Government Departments If possible please specify:							
To national government departments in general If possible please specify:							
Specific individuals within Provincial Government Departments If possible please specify:							
To provincial government departments in general If possible please specify:							
Specific individuals within Local Government Departments If possible please specify:							
To local government departments in general If possible please specify:							
Interest groups within the Buffalo catchment If possible please specify:							
Interest groups NOT within the Buffalo catchment If possible please specify:							
Commercial farmers within the Buffalo catchment If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Subsistence farmers within the Buffalo catchment If possible please specify:							
High School teachers If possible please specify:							
High School learners If possible please specify:							
Primary School teachers If possible please specify:							
Primary School learners If possible please specify:							
The community within the Buffalo catchment If possible please specify:							
Other Please specify							
Number of copies still available for distribution?							
Number of copies distributed during 2004 ?							
Number of copies distributed during 2005 ?							
Number of copies distributed during 2006 ?							

BUFFALO SOR ENGLISH/XHOSA POSTER

How many of and to whom did you distribute the **Buffalo River non-verbal POSTERS**? On the right hand side please tick the boxes that most closely resemble the number of posters that your organisation or department has distributed to each of the corresponding groups. If you know the exact number of copies distributed to each group, please write the number in the corresponding box.



Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500+
Specific individuals within National Government Departments If possible please specify:							
To national government departments in general If possible please specify:							
Specific individuals within Provincial Government Departments If possible please specify:							
To provincial government departments in general If possible please specify:							
Specific individuals within Local Government Departments If possible please specify:							
To local government departments in general If possible please specify:							
Interest groups within the Buffalo catchment If possible please specify:							
Interest groups NOT within the Buffalo catchment If possible please specify:							
Commercial farmers within the Buffalo catchment If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Subsistence farmers within the Buffalo catchment If possible please specify:							
High School teachers If possible please specify:							
High School learners If possible please specify:							
Primary School teachers If possible please specify:							
Primary School learners If possible please specify:							
The community within the Buffalo catchment If possible please specify:							
Other Please specify							
Number of copies still available for distribution?							
Number of copies distributed during 2004 ?							
Number of copies distributed during 2005 ?							
Number of copies distributed during 2006 ?							

ACTIVITY BOOKS

How many of and to whom did you distribute the Buffalo River **Activity Books**? On the right hand side please tick the boxes that most closely resemble the number of activity books that your organisation or department has distributed to each of the corresponding groups. If you know the exact number of copies distributed to each group, please write the number in the corresponding box.



Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500+
Specific individuals within National Government Departments If possible please specify:							
To national government departments in general If possible please specify:							
Specific individuals within Provincial Government Departments If possible please specify:							
To provincial government departments in general If possible please specify:							
Specific individuals within Local Government Departments If possible please specify:							
To local government departments in general If possible please specify:							
Interest groups within the Buffalo catchment If possible please specify:							
Interest groups NOT within the Buffalo catchment If possible please specify:							
Commercial farmers within the Buffalo catchment If possible please specify:							

Number of copies distributed to:	None	1 – 5	6 – 20	21 – 100	101 – 200	201 – 500	500 +
Subsistence farmers within the Buffalo Catchment If possible please specify:							
High School teachers If possible please specify:							
High School learners If possible please specify:							
Primary School teachers If possible please specify:							
Primary School learners If possible please specify:							
The community within the catchment If possible please specify:							
Other Please specify							
Number of copies still available for distribution?							
Number of copies distributed during 2004 ?							
Number of copies distributed during 2005 ?							
Number of copies distributed during 2006 ?							

Please list other organisations/departments that distributed the SoR reporting material in the Hartenbos and Klein Brak and/or Buffalo Catchments that you are aware of.

Please use the lines below if there are any other information relating to the distribution of SoR reporting material that you wish to share?

Thank you very much for your cooperation in providing this valuable information.

Regards

Wilma Strydom

CSIR
Natural Resources and the Environment
wstrydom@csir.co.za
Tel: 012 841 2284
Fax: 012 841 2506

Please return filled in forms to:
Ms Wilma Strydom
POBox 395
Pretoria
0001

Appendix B

The combined English and isiXhosa questionnaire used for measuring relationships/correlations between independent variables and the behaviour, attitude, awareness and knowledge of people living in the study area

Injongo yeli phepha lemibuzo kukuqondisisa ngendlela yokuqhagamshelana nempumelelo yezixhobo zoqhagamshelwano ezimalunga nemeko yemilambo yethu.

Questionnaire to determine the success of state-of-rivers information

Injongo yeli phepha lemibuzo kukuqondisisa ngendlela yokuqhagamshelana nempumelelo yezixhobo zoqhagamshelwano ezimalunga nemeko yemilambo yethu. Ukuthatha kwakho inxaxheba kolu phando kuza kusinceda sazi ukuba sizisebenzisa ngempumelelo na iindlela zangoku zokusasaza iinkcukacha zemilambo yethu yaye singaziphucula njani na. Iimpendulo zakho zakusinika ulwazi oluncedayo. Kungathatha imizuzu ephakathi kwe-15 nengama 30 ukufaka zonke iinkcukacha kweli phepha lemibuzo. Ukuba le mibuzo ayilwanelisi uluvo lwakho, uvumelekile ukuba ezinye iinkcukacha ungazibhala kwisithuba osilungiselelweyo. Kubalulekile ukuba eli phepha lemibuzo liyinqakula imeko njengoko injalo kanye ngoku. Nceda ungathathi izifundo ezimalunga nemilambo, Linda ude ugqibe ukuphendula le mibuzo ukuze ulibuyise neli phepha. Khumbula ukuba akukho zimpendulo zichanekileyo, zingekho neempendulo ezingalunganga, zonke iinkcukacha ozibhalileyo zakuthathwa njengemfihlelo.

The purpose of this questionnaire is to determine the availability and success of communication material about the state of our rivers. Your participation in this survey will help us to understand whether current communications of river information are successful and how the process could be improved. Your response will provide valuable information. It will take between 20 and 40 minutes to complete this questionnaire. If the questions do not address your opinion adequately, you are welcome to provide more information in the provided space. It is important that this questionnaire captures the situation as you see it now. Please do not read up on rivers until you have completed all the questions and returned this questionnaire. Remember, there are no right or wrong answers and all the information that you provide will be treated as strictly confidential.

Ngeli ixesha ezi zivakalisi zilandelayo zimalunga nendlela owasebenzisa ngayo wena amanzi. Kwezi zivakalisi zilandelayo sesiphi esinokuyibeka ngokucacileyo imeko yakho? / **The following statements deal with your personal water use at this time. Which one of the following statements would describe your situation the best? Mark only one.**

- ☐ Ndiwasebenzisa gwenxa amanzi amaninzi / I waste a lot of water
- ☐ Amanzi ndingawasebenzisa ngoqoqosho / I can use water more sparingly
- ☐ Ndisebenzisa kuphela amanzi endiwafunayo / I only use the water that I need
- ☐ Ndiyawonga amanzi xa ndiwasebenzisa / I use water very sparingly

Ezi zivakalisi zilandelayo zimalunga nendlela asetyenziswa ngayo amanzi ngabantu bakowenu. Kwezi zivakalisi zilandelayo sesiphi esinokuyibeka ngokucacileyo imeko yakho? / **The following statements deal with your household's water use at this time. Which one of the following statements would describe your situation the best? Mark only one.**

- ☐ Siwasebenzisa gwenxa amanzi amaninzi / We waste a lot of water
- ☐ Amanzi singawasebenzisa ngoqoqosho / We can use water more sparingly
- ☐ Sisebenzisa kuphela amanzi esiwafunayo / We only use the water that we need
- ☐ Siyawonga amanzi xa siwasebenzisa / We use water very sparingly

Ezi zivakalisi zilandelayo zimalunga nokulondolozwa kwemilambo. Kwezi zivakalisi zilandelayo sesiphi esinokuyibeka ngokucacileyo imeko yakho? The following statements deal with river conservation. Which one of the following statements would describe your situation the best? Mark only one.

- ☐ Ndithatha inxaxheba ngokudlamkileyo kwiinkqubo zasekuhlaleni okanye kwezommandla ezinxulumene nolawulo kunye nokulondolozwa kwemilambo / I actively participate in the local or regional programmes related to river management and river conservation in my catchment
- ☐ Ngamanye amaxesha ndithatha inxaxheba ngokudlamkileyo kwiinkqubo zasekuhlaleni okanye kwezommandla ezinxulumene nolawulo kunye nokulondolozwa kwemilambo / I sometimes participate in the local or regional programmes related to river management and river conservation in my catchment
- ☐ Inxaxheba andiyithathi ngokudlamkileyo kwiinkqubo zasekuhlaleni okanye kwezommandla ezinxulumene nolawulo kunye nokulondolozwa kwemilambo / I do not actively participate in the local or regional programmes related to river management and river conservation, but I will try my best to find out more and support them wherever I can
- ☐ Anndinamdlala kwiinkqubo zasekuhlaleni okanye kwezommandla ezinxulumene nolawulo kunye nokulondolozwa kwemilambo I am not interested in the local or regional programmes related to river management and river conservation

Zithini ezakho iimbono ngokuphathwa kwemilambo nangokulondolozwa kwayo? Kwingongoa okanye kwisivakalisi ngasinye esikwesi sicwangciso singezantsi, faka uphawu kwingcamango echazisiwa kakuhle uvakalelo lwakho. Ibhokisi yokuqala engasekhohlo yeyengcamango 'evuma ngokupheleleyo'. Ukuba ufaka kuyo uphawu, loo nto ithetha ukuba uyavumelana neso sivakalisi. Ibhokisi esekugqibeleni ngasekunene yeyngcamango 'engavumiyo kwaphela', into ethetha ukuba akuhambisani nengxelo elapho. Zikwakho neengcamango zobuba sesithubeni 'zokuvuma' kunye 'nokungavumelani'. Kukwakho nengcamango 'yobudikidiki' onokufaka kuyo uphawu xa uvumelana okanye ungavumelani, kodwa zama ukuba ungayisebenzisi. Cingisisa ngesivakalisi ngasinye phambi kokuba uphendule. / How do you feel about river management and river conservation? For each of the statements in the table below, tick the option that would describe your response the best. The first box to the left is the 'strongly agree' option. If you tick this option, it means that you absolutely agree with the given statement. The last box to the right is the 'strongly disagree' option which means that you definitely do not agree with the statement. There are in-between options of 'agree' and 'disagree'. There is also a 'neutral' option that you can tick if you do not agree or disagree but please try to avoid this option. Think carefully about each statement before you answer.

INGXELO OKANYE ISIVAKALISI STATEMENT	Ndivuma ngokuph eleleyo Strongly agree	Ndiya- vuma Agree	Ndidiki diki Neutral	Andivu melani Disagree	Andivumi kwaphela Strongly disagree
Ndizimisele ukuwasebenzisa ngoqoqosho amanzi nangaphezu kokuba ndisenza ngoku I am willing to use water more sparingly than I do at this time					
Ndiyavuma ukuthatha amanyathelo ndithintele ukungcoliseka kwemilambo I am willing to take action to prevent river pollution					
Imilambo yethu kufuneka ikhuselwe ize ilondolozwe Our rivers should be protected and conserved					
Umzi wam uwodwa nje ungenza umahluko ekukhuseleni ukusetyenziswa kakubi kobutyebi bemilambo / My household on its own can make a difference in preventing the over-exploitation of water resources					
Uuba kwindawo endihlala kuyo wonke umntu					

INGXELO OKANYE ISIVAKALISI STATEMENT	Ndivuma ngokuph eleleyo Strongly agree	Ndiya- vuma Agree	Ndidiki diki Neutral	Andivu melani Disagree	Andivumi kwaphela Strongly disagree
akavumelani nokongiwa kwamanzi, imizamo yam yokukhusela ukusetyenziswa kwawo kakubi iya kufadalala If everybody in my community does not agree to save water my efforts to prevent the over-exploitation of water resources will be wasted.					
Uwiso-mthetho kufuneka lunyanzeliswe kuqinisekiswa ukuba imilambo yethu ayisetyenziswa gwenxa Legislation should be enforced to ensure that our rivers are not over-exploited					
Abantu mabawasebenzise ngobulumko amanzi kuqinisekiswa ukuba imithombo yawo ayisetyenziswa gwenxa People should use water wisely to ensure that our water resources are not over-exploited					
Makuthathwe amanye amanyathelo kuqinisekiswa ukuba ubomi bezidalwa ezisemilanjani yethu bulondolozwe More should be done to ensure that our river systems are conserved					
Makuthathwe amanyathelo okuthintela nokulawula ungcoliseko lwemilambo Action should be taken to prevent and control river pollution					
UmThetho waManzi kuZwelonke nomThetho woLawulo lweNdalo esiNgqongileyo kuZwelonke imele ukunyanzeliswa yaye abo bangcolisayo bamele ukuhlawula / The National Water Act and National Environmental Management Act should be enforced and the polluters should pay					
Abantwana kufuneka bafunde lukhulu ngemilambo yethu Children should learn more about our rivers					

INGXELO OKANYE ISIVAKALISI STATEMENT	Ndivuma ngokuph eleleyo Strongly agree	Ndiya- vuma Agree	Ndidiki diki Neutral	Andivu melani Disagree	Andivumi kwaphela Strongly disagree
Wonke umntu anganento ayenzayo ngokuba negalelo lokuwukhusela umlambo Every person can do something to contribute to river protection					
Kubalulekile ukuba kubekho inguquko kwiimbono zolawulo nolondolozo lwemilambo ukuze siyikhusele ngokwaneleyo imilambo yethu It is important that people's attitudes regarding river management and river conservation need to change in order to sufficiently protect our rivers					
Ubungakanani bamanzi afunekayo okuzigcina zisempilweni izinto eziphilayo zomlambo (izityalo, izilo nezinye eziphila apho) kufuneka bukhuselwe The quantity (amount) of water that is needed for keeping river ecosystems (river plants, animals and their habitat) healthy should be protected					
Iqondo lococeko lamanzi afunekayo okugcina zisempilweni izinto eziphilayo zomlambo (izityalo, izilo nezinye eziphila apho)kufuneka likhuselwe. The quality of water (how clean the water is) that is needed for keeping river ecosystems (river plants, animals and their habitat) healthy should be protected					
Ndingathanda ukufunda kakhulu ngezinto eziyilungeleyo nezingayilungelanga imilambo yethu / I would like to learn more about what is good and what is bad for our rivers					
Nam ndinganegalelo ekukhuseleni umlambo wengingqi yam I can contribute to river protection in my area					
Ndiyavuma ukuwalondolozwa amanzi ekhaya ukuze impilo yezidalwa nezityalo ezihlala emilanjani ingalondolozwa iphuculwe / I am willing to save water in my household so that the health of river ecosystems can be maintained and improved					

INGXELO OKANYE ISIVAKALISI STATEMENT	Ndivuma ngokuph eleleyo Strongly agree	Ndiya- vuma Agree	Ndidiki diki Neutral	Andivu melani Disagree	Andivumi kwaphela Strongly disagree
Sonke simele ukuwalondoloza amanzi emakhaya ukuze impilo yezityalo nezidalwa ezisemilanjani ingalondolozwa iphuculwe All of us should save water in our households so that the health of river ecosystems can be maintained and improved					
Ndiyavuma ukuluthwala uxanduva lwemeko yomlambo endiwusebenzisayo nendihlala kufutshane nawo / I am willing to take responsibility for the state (condition or health) of the river that I use and live close to					
Thina njengabahlali simele ukuluthwala uxanduva ngemeko (okanye ngempilo) yomlambo esiwusebenzisayo nesihlala kufutshane nawo We, as a community, should take responsibility for the state (condition or health) of the river that we use and live close to					
Ndiza kuvuma ukuthatha inxaxheba ndibe sequmrhwini lomlambo wengingqi ukuze sibe negalelo kwimpatho yomlambo wengingqi endikuyo eqokelela amanzi emvula I will be willing to participate in a local river forum to contribute towards river management in my catchment					
Inkulu kakhulu ingxaki yamanxi omlambo wethu, kodwa imizamo yam ndindedwa iyakuba negalelo elibonakalayo / The magnitude (size) of our river problem is overwhelming (very big), but my individual efforts will have a positive effect (it will help) to reduce the problem					
Nangona inkulu ingxaki enxulumene nemeko yemilambo yethu, singayilungisa le meko ukuba singazama sonke / Although the magnitude of our river problem is very big, if we all make an effort we can rectify the situation					
Asimelanga kuzikhathaza ngezinto ezilahlwayo					

INGXELO OKANYE ISIVAKALISI STATEMENT	Ndivuma ngokuph eleleyo Strongly agree	Ndiya- vuma Agree	Ndidiki diki Neutral	Andivu melani Disagree	Andivumi kwaphela Strongly disagree
nangokungcoliswa kwemilambo yethu ngoba leyo yingxaki yesizukulwana sexesha elizayo We do not need to worry about dumping waste and polluting our rivers, because it is the next generation's problem					
Sesizinikezeke kwinqanaba elithile longcoliseko, kaloku iindleko zokuluthintela okanye ezokucoca ziphezulu kakhulu We have to put up with a certain level of pollution, since the cost of preventing it or cleaning it up is very high					

Ingaba unazo ezinye iingcamango onqwenela ukwabelana nathi ngazo?
Do you have any other thoughts or concerns that you wish to share?

Sesiphi kanye kwezi zivakalisi zilandelayo esinokuyichaza indlela ovakalelwa kamnandi ngayo? Faka uphawu kwisivakalisi esinye kuphela. Which one of the following statements would describe how you feel the best? Mark only one.

- ☐ Ndakusebenzisa amanzi amancinci xa loo nto inokundiqinisekisa ukuba akubakho ngokwaneleyo awoMzantsi-Afrika.
I will use less water if it will ensure that there is enough for all in South Africa
- ☐ Ndakusebenzisa amanzi amancinci ukuba eso senzo siya kuthintela ukusetyenziswa kwendyebo yamanzi.
I will use less water if it will prevent the over-exploitation of our water resources
- ☐ Ndixolelele ukuhlawula ngokuthe chatha ukuze ndisoloko ndisebenzisa umlinganiselo wamanzi olingana nala ndiwasebenzisayo ngeli ixesha.
I will rather pay more so that I can keep on using the same amount of water that I do at this time

Luthini olwakho uluvo ngemeko yamanzi eMzantsi-Afrika? Khawisancedise siyazi loo nto. Kumbuzo ngamnye faka uphawu kwenye yeengcamango ezingasekunene. Uyavuma ngokupheleleyo, uyavuma, akuvumi okanye akuvumi tu kwaphela? Ukuba ngokwenene akukwazi kukhetha kwezi ngcamango, ungafaka uphawu kuleyo idikidiki, kodwa uze uncede ungayisebenzisi le ngcamango xa kunokwenzeka. / What is your opinion about the water situation in South Africa? Please help us to find out. For each question, tick one of the options on the right. Do you agree or disagree? If you really cannot choose between the options you may tick the neutral option, but please avoid this option where possible.

INGXELO OKANYE ISIVAKALISI / STATEMENT	Ndiyavu ma Agree	Ndidikidi ki Neutral	Andivum elani Disagree	Andazi Do not know
UMzantsi-Afrika ulilizwe lomileyo yaye unemithombo yamanzi enqongopheleyo South Africa is a dry country and has limited water resources				
Kufuneka sonwabisane nendalo ukuba sifuna ukuphila We have to live in harmony with nature if we want to survive				
Indlela afuneka ngayo amanzi ingaphezulu kokufumaneka kwawo kuMzantsi-Afrika uphela The demand for water exceeds the availability of water in South Africa in general				
Indlela afuneka ngayo amanzi ingaphezulu kwendlela afumaneka ngayo kwingingqi yethu eqokelela amanzi emvula The demand for water exceeds the availability of water in our catchment				
Imeko yomlambo idlala indima ebalulekileyo kumgangatho wobomi babantu abahlala emaphandleni The state of the river plays a key role in the quality of life of people living in rural areas				
Imeko yomlambo idlala indima ebalulekileyo kumgangatho wobomi babantu abahlala ezidolophini The state of the river plays a key role in the quality of life of people living in the city				
Umlambo okufutshane ekhaya ukwimeko entle The river closest to my home is in a good state				

INGXELO OKANYE ISIVAKALISI / STATEMENT	Ndiyavuma Agree	Ndidikiki Neutral	Andivumelani Disagree	Andazi Do not know
Imeko yechibi lechweba inxulumene kakhulu nemeko yomlambo walo The state of an estuary (lagoon) is very closely linked to the state of its river				
Isuke yaphucuka imeko yomlambo kule minyaka ili-10 igqithileyo The state of our river has improved over the past 10 years				
Abantu abadala nabanobulumko bathi umlambo ngoku ukwimeko embi kakhulu xa uyithelekisa nemeko yawo eminyakeni engama-50 egqithileyo The wise, older people say that the river is now in a worse state than 50 years ago				
Ungcoliseko lwemilambo luyingxaki exhomisa amehlo kwingingqi yethu River pollution is a significant (big) problem in our area				
Imithombo yamanzi oMzantsi-Afrika ingaxhasa kuphela abantu abambalwa South Africa's water resources can only support a limited number of people				
EMzantsi-Afrika sibongoza elona nani liphezulu labantu linokuxhaswa yimithombo yamanzi ethu In South Africa, we are approaching the maximum number of people that our water resources can support				
AboMzantsi-Afrika bayisebenzisa gwenxa imithombo yamanzi ethu South Africans in general are over-exploiting water resources				
Bukhona ubuchule obufunekayo bokusombulula iingxaki zongcoliseko lwemilambo The necessary technologies are available to solve the river pollution problems				

Unazo ezinye iingcinga ngemeko yomlambo okufutshane kuwe? Imeko yawo iya iphucuka okanye iya isiba mbi / Do you have any other concerns about the state of the river closest to you? Is the situation improving or deteriorating?

Le mibuzo ilandelayo iveza umgangatho wengqiqo yakho ngeenkonzo nokunye okulungileyo okuza nemilambo. Khumbula ukuba azikho iimpendulo ezichanekileyo, zingekho nezingalunganga.

The following questions determine your current level of understanding of the benefits (also called *goods and services*) that rivers provide.

Remember that there are no right or wrong answers.

INGXELO OKANYE ISIVAKALISI / STATEMENT	Ndiyavuma Agree	Ndidikidiki Neutral	Andivumelani Disagree	Andazi Do not know
Imilambo ixhasa uninzi lwemisebenzi yethu Rivers support many of our activities				
Imithi nezityalo ezikwiindonga zemilambo iminxanisa umhlaba nezinto ezingafunekiyo phambi kokuba zingene emlanjeni / The trees and plants on the riverbank trap soil and waste material before it enters the river				
Izihluma eziphaya kwiindonga zemilambo zinqanda amanzi omlambo ukuba angaphuphumeli ngaphandle xa kusina kakhulu / Natural vegetation on the riverbanks help to prevent flooding during periods of heavy rain				
Iintlanzi, amasele, oononkalanezinye izilwanyana ezihlala emanzini zifuna imilambo enika impilo ukuze zihlale ziqhame zande / Fish, frogs, crabs and other animals that live in the river require healthy rivers to live in and to reproduce (lay eggs and have babies)				
Amandla okuba umlambo mawujongane nezinto eziwungcolisayo ukuze uzicocwe ngokwawo axhomekeka kwimeko yomlambo lowo The ability of a river to deal with pollutants (the way that a river cleans itself) depend on the state (health) of the river				
Ixabiso lokucocwa komlambo namanzi asemadameni ukuze asetyenziswe ezindlwini lixhomekeka kwimeko yemithombo yamanzi / The cost of purifying (cleaning) river and dam water for domestic use depends on the state of these water resources				

INGXELO OKANYE ISIVAKALISI / STATEMENT	Ndiyavuma Agree	Ndidikidiki Neutral	Andivumelani Disagree	Andazi Do not know
Xa singcolisa umlambo kwindawo enye, sichaphazela imeko yawo kuba olo ngcoliseko luza kutyhutyha luhle ngomlambo lowo luhambe umgama omde If we pollute the river in one place, we affect the state of the river for a long distance downstream				
Uncedo oluvela emilanjini lunamandla okuphucula ubomi babantu / Benefits derived from rivers have the potential to improve the livelihoods of people				
Inexabiso imbonakalo yomlambo nendalo ewungqongileyo / The visual appearance of a river and its surroundings has value				
Imilambo ekwimeko entle (engangcoliswanga) iyakuba noncedo lwezoqoqosho ixesha elide Rivers that are in a good state (not polluted) will have a long term economic benefit				

Unazo ezinye iingcinga okanye amava onokwabelana nathi ngawo?

Do you have any other thoughts or experiences that you wish to share?

Kwezakho iibono yintoni kanye enoxinzelelo olukhulu emilanjeni? Faka uphawu kwingcamango ethi “uxinzelelo olukhulu ” engasekhohlo xa ucinga ukuba le yingxaki enkulu. Kwakhona faka uphawu kwingcamango ethi “uxinzelelo oluncinci” ngasekunene ukuba okwenziwayo akonakalisi kakhulu. Kwakhona kukho “uxinzelelo oluphakathi ” ukuze uthi “alukho uxinzelelo” kwenye ingcamango. Kukhumbule ukufaka uphawu kwingcamango esondele kuluvo lwakho ngengxelo leyo.

In your opinion what has an impact on rivers in general? Tick the option “large impact” on the left if you think this is a serious problem. And tick the option “little impact” on the right if the specific activity does not do much harm. There is also a “medium impact” and “no impact” option. Remember to tick the option that best resembles your reaction to the statement.

INGXELO OKANYE ISIVAKALISI / STATEMENT	Uxinzelelo olukhulu Large Impact	Uxinzelelo oluphakathi Medium Impact	Uxinzelelo oluncinci Little Impact	Alukho uxinzelelo No Impact
Amahlathi atyaliweyo / Forestry plantations				
Amahlatho atyaliweyo angaphathekanga ngendlela yolondolozo lwamahlathi oluhle Forestry plantations that are not managed according to good forestry practices				
Imigodi yesanti ethe nca emilanjeni nepsemilanjeni kanye Sand mining close to and within rivers				
Ukutshintshwa kwentslele yomlambo neendonga zawo / Changing the river bed and river banks				
Ukuvulwa kwamadama emilanjeni Damming of rivers				
Ukuguqula icala obalekela kulo umlambo (umzekelo; amadama, iindonga ezinqamleza umlambo zokulawula amanzi, ukwenziwa kwemijelo emanzini nokujika iindlela zemisinga) Changing river flow (e.g. dams, weirs, channeling and diverting streams)				
Imisebenzi yasezifama ngokubanzi Farming practices in general				
Ukulima kwiindonga zomlambo Farming on river banks				

INGXELO OKANYE ISIVAKALISI / STATEMENT	Uxinzelelo olukhulu Large Impact	Uxinzelelo oluphakathi Medium Impact	Uxinzelelo oluncinci Little Impact	Alukho uxinzelelo No Impact
Ukufunxwa kwamanzi emilanjeni Water abstraction (taking water from rivers)				
Umsebenzi wemichiza efana neyokubulala izinambuzane The use of chemicals such as pesticides				
Ukubhuqwa kwamadlelo yimfuyo Overgrazing				
Ukuvumela imfuyo itye phezu okanye ecaleni komlambo / Grazing on river banks				
Imithi nezityalo ezingaqhelekanga okanye zamanye amazwe Alien trees and other alien plants				
Ulwakhiwo lwezindlu ngasemilanjeni Housing development close to rivers				
Ukususwa kotyani Removal of natural vegetation				

Yintoni esiyishiyileyo? Loluphi uxinzelelo lwempilo yomlambo okufutshane nawe ekungathethwanga ngalo apha ngasentla?

What have we left out? What impacts on the health of the river closest to you have not been addressed above?

Le mibuzo ilandelayo ijongene nobukho beenkcukacha ezingomlambo.
The following questions deal with the availability of river information.

INGXELO OKANYE ISIVAKALISI STATEMENT	Ndivuma ngokuph eleleyo Strongly agree	Ndiya- vuma Agree	Ndidikidi ki Neutral	Andivu melani Disagree	Andivumi kwaphela Strongly disagree	Andazi Do not know
linkcukacha ezingemilambo zifumaneka lula / Information about rivers is readily available (easy to find)						
linkcukacha ezingemilambo kunzima ukuzifumana Information about rivers is difficult to find						
linkcukacha ezingemilambo zezenzululwazi, kunzima kakhulu ukuzilandela ngoba zintsonkothile The river information that is available is too scientific (difficult to follow, understand or identify with)						
linkcukacha ezingemilambo zilandeleka lula The river information that is available is easy to follow (can understand or grasp it)						
Kukho imfuneko yolwazi olunzulu malunga nemilambo / There is a need for more information about rivers						

Unayo ingcamango ngobukho beenkcukacha ezingemilambo ongathanda
 ukwabelana nathi ngazo? Do you have any opinion about the availability of river
 information that you would like to share?

**Kwezi ngongoma zilandelayo yeyiphi ocinga ukuba iyinyaniso? (Faka
 uphawu kwenye yezi bhokisi). Which one of the following statements are
 true (tick one of the boxes)**

- ☐ Khangenive ngeNkqubo yeMpilo yomLambo nangokunikwa kweNgxelo
 ngeMeko yemiLambo / I have not heard about the River Health Programme
 and State-of-Rivers Reporting
- ☐ Ndikhe ndeva ngeNkqubo yeMpilo yomLambo nangokunikwa kweNgxelo
 yeMeko yemiLambo, kodwa andazi ukuba oko kumalunga nantoni na / I
 have heard about the River Health Programme and State-of-Rivers reporting
 but have no knowledge of what it is about
- ☐ Ndiyiqhelile iNkqubo yeMpilo yomLambo nangokunikwa kweNgxelo yeMeko
 yemiLambo / I am familiar with the River Health Programme and State-
 of-Rivers Reporting
- ☐ Ndiyabandakanyeka kwiNkqubo yeMpilo yomLambo nangokunikwa
 kweNgxelo yeMeko yemiLambo / I am involved in the River Health
 Programme and State-of-Rivers reporting

**Ungasichazela njani ngemeko yezemali yabantu bendawo ohlala kuyo?
Faka uphawu kwibhokisi ocinga ukuba iyichaza kakuhle imeko.**

How would you describe the financial situation of the people living in your community? Tick the box that you feel describes the situation best.

- ☐ Inkoliso yezi ntsapho inemali eyaneleyo; bangazithengela nantoni na abayifunayo abantu
Most of the families have enough money; they can buy whatever they want
- ☐ Inkoliso yeentsapho inazo ngokwaneleyo iimfuno zoluntu, kodwa kufuneka lwenziwe ngobunono uhlahlo lwabiwo-mali lwezinto zokuzonwabisa
Most of the families have enough for the basics but have to budget carefully for luxury items
- ☐ Inkoliso yeentsapho iihlala ngolonwabo; ingeniso yabo yanele zonke iimfuno zabo eziphambili
Most families live comfortably; their income is sufficient to supply the basics
- ☐ Inkoliso yeentsapho yamkela imali eyanele iimfuno eziphambili zokuphila.
Most families earn enough money to supply the bare basic needs
- ☐ Inkoliso yeentsapho ayamkeli mali yanele ukuba banganeemfuno eziphambili, kodwa ke ngandlela ithile bayakwazi ukuziphilela
Most families do not earn enough money to supply in basic needs but somehow they find a way to manage
- ☐ Inkoliso yezi ntsapho ayamkeli mali yanele iimfuno zabo eziphambili, abakwazi nokuziphilela ngaphandle olunye uncedo
Most families do not earn enough money to supply in basic needs and they do not manage without other help
- ☐ Inkoliso yeentsapho ayinamali tu kwaphela yaye xa bengenakuncedwa ngabanye bangatywa yindlala
Most families have hardly any income at all and if others do not provide they will go hungry

Imeko yezemali yabantu bakowenu ungayichaza njani xa uyithelekisa neyabantu bendawo ohlala kuyo? Faka uphawu kwenye yezi bhokisi zilandelayo, leyo inemeko esondele kakhulu kweyabantu bakowenu.

How would you rate the economic status of your family compared to the rest of your community? Tick one of the following boxes that resemble your family closest.

- ☐ Kwindawo esihlala kuyo silusapho olungezozityebi kodwa asihluphekanga – siyafana nabanye abantu / **Our household is above average – we find it much easier to get by than most of the other households in our community**
- ☐ Abantu basekhaya batsala nzima, abakwazi kuzifumana iimfuno eziphambili xa ndibathelekisa nezinye iintsapho zendahlala kuyo / **Our household is slightly above average – we find it somewhat easier to get by and supply in basic needs than the average household in our community**
- ☐ Abantu basekhaya bakumgangatho othe kratya – noko siphila kamnandi, sinezinto ezifunekayo ngaphezu kwabantu bendawo esihlala kuyo
We are an average household in our community – very much like the others
- ☐ Abantu basekhaya bakowona mgangatho uphezulu – siphila ubomi obumnandi ngaphezu kwabantu bendawo esihlala kuyo
Our household finds it more difficult to supply in basic needs than the average household in our community
- ☐ Abakowethu bakubona kunzima kakhulu ukuzuza iimfuno zabo nangaphezu kweminye imizi esinayo ekuhlaleni
Our household finds it much more difficult to supply in basic needs than the average household in our community

Ikhona enye into onokusixelela yona malunga nemeko yezemali kwindawo enihlala kuyo?

Is there anything else to tell about the financial situation in your community?

Ngezi ngongoma zilandelayo sithanda ukwazi indlela eniwafumana ngayo amanzi asetyenziswayo emakhaya ukwenzela (ukusela nokupheka). Faka uphawu kwiingongoma ezilungele ikhaya lakho. Ukuba indlu okanye ikhaya lakho lingaphezulu kwesinye, nceda ubonise ngokufaka uphawu kuloo ndlu apha emephini, ekhasini elilandelayo faka uphawu kwindlu yesibini.

With the following statements we would like to find out how you obtain your water for household (drinking and cooking) use. Tick those statements that are applicable to your family. If you have more than one house or home, below please indicate for the house that you've marked on the map, and for the second house on the next page.

**Indlu okanye ikhaya lokuqala (libonise emephini)
First house or home (indicated on map)**

- ☐ Indlu enikezelwe ngumasipala enompompi wamanzi phakathi
Water supplied by municipality with tap in house
- ☐ Indlu enikezelwe ngumasipala enompompi wamanzi kufutshane kakhulu kuyo
Water supplied by municipality with tap close to house
- ☐ Indlu enikezelwe ngumasipala enompompi wamanzi okude kuyo
Water supplied by municipality with tap far from house
- ☐ Amanzi epitsi
Borehole water
- ☐ Amanzi emvula
Rainwater
- ☐ Amanzi mawakhiwe edameni labucala elisefama
Fetch water from a private farm dam
- ☐ Amanzi mawakhiwe edameni likarhulumente
Fetch water from a government dam
- ☐ Amanzi mawakhiwe e,lanjeni okanye emfuleni okufutshane
Fetch water from a river or stream close by
- ☐ Amanzi mawakhiwe emlanjeni okanje emfuleni okude endlwini yakho
Fetch water from a river or stream that is far from your house

Le ndlu okanye eli khaya lisedolophini okanye emaphandleni?
Is this house or home in an urban (town) or rural (farm) area? Please mark the correct one below:

- ☐ Edolophini / Urban
- ☐ Emaphandleni / Rural
- ☐ Kwenye indawo / Other
- ☐ Andazi / Do not know

Kule ndlu zeziphi ezinye iindlela owafumana ngazo amanzi okupheka nawokusela? / At this house, in which other ways do you provide for your cooking and drinking water?

Ukuba amanzi okuphela nawokusela uwafumana kwindawo ekude kwindlu yakho, xela ukuba ungawakha njani amanzi, kungathatha ixesha elingakanani ukuwakha kwakho ngemini.
If you have to fetch your water for drinking and cooking from a place that is far away from your house, describe how you fetch the water and how long it takes you to fetch the water each day.

Le ndlu uyayirenta okanye yeyakho? Nceda ufake uphawu kwenye yezi ndlela zilandelayo:
Do you own or rent this property or house? Please indicate one of the following:

- ☐ Indlu yeyakho / Own the property
- ☐ Indlu uyayirenta / Rent the property
- ☐ Indlu le yeyoluntu / It is communal property
- ☐ Kwenye indawo? / Other?

(Nceda usixelele ezinye izinto) (please tell us more) _____

Mingaphi iminyaka uhlala kule ndlu? _____
For how many years have you been staying at this house?

Bangaphi abantu abahlala kule adresi? _____
How many people live at this address?

Bangabantu bomzi omnye? Ukuba akunjalo, ngabaphi abona basondeleyo (umama, utata, Utatomkhulu, umakhulu, abantwana)? _____
Are they all family members? If not, how many are close family members (mother, father, grandparents, children)?

Indlu okanye ikhaya lesibini Second house or home

Xa unendlu okanye ikhaya lesibini, nceda uphendule imibuzo kweli phepha. Xa ungenakhaya lesibini, yiya ekhasini elilandelayo kwiphepha 26.
If you do have a second home please answer the questions on the rest of this page. If you do not have a second home, please go to the next page, page 26.

- ☐ Indlu enikezelwe ngumasipala enompompi wamanzi phakathi
Water supplied by municipality with tap in house
- ☐ Indlu enikezelwe ngumasipala enompompi wamanzi kufutshane kakhulu kuyo
Water supplied by municipality with tap close to house
- ☐ Indlu enikezelwe ngumasipala enompompi wamanzi okude kuyo
Water supplied by municipality with tap far from house
- ☐ Amanzi epitsi
Borehole water
- ☐ Amanzi emvula
Rainwater
- ☐ Amanzi mawakhiwe edameni labucala elisefama
Fetch water from a private farm dam
- ☐ Amanzi mawakhiwe edameni likarhulumente
Fetch water from a government dam
- ☐ Amanzi mawakhiwe e,lanjeni okanye emfuleni okufutshane
Fetch water from a river or stream close by
- ☐ Amanzi mawakhiwe emlanjeni okanje emfuleni okude endlwini yakho
Fetch water from a river or stream that is far from your house

Le ndlu okanye eli khaya lisedolophini okanye emaphandleni?
Is this house or home in an urban (town) or rural (farm) area? Please mark the correct one below:

- ☐ Edolophini / Urban
- ☐ Emaphandleni / Rural
- ☐ Kwenye indawo / Other
- ☐ Andazi / Do not know

Kule ndlu zeziphi ezinye iindlela owafumana ngazo amanzi okupheka nawokusela? / At this house, in which other ways do you provide for your cooking and drinking water?

Ukuba amanzi okuphela nawokusela uwafumana kwindawo ekude kwindlu yakho, xela ukuba ungawakha njani amanzi, kungathatha ixesha elingakanani ukuwakha kwakho ngemini.
If you have to fetch your water for drinking and cooking from a place that is far away from your house, describe how you fetch the water and how long it takes you to fetch the water each day.

Le ndlu uyayirenta okanye yeyakho? Nceda ufake uphawu kwenye yezi ndlela zilandelayo:
Do you own or rent this property or house? Please indicate one of the following:

- ☐ Indlu yeyakho / Own the property
- ☐ Indlu uyayirenta / Rent the property
- ☐ Indlu le yeyoluntu / It is communal property
- ☐ Kwenye indawo? / Other?

(Nceda usixelele ezinye izinto) (please tell us more) _____

Mingaphi iminyaka uhlala kule ndlu? _____
For how many years have you been staying at this house?

Bangaphi abantu abahlala kule adresi? _____
How many people live at this address?

Bangabantu bomzi omnye? Ukuba akunjalo, ngabaphi abona basondeleyo (umama, utata, Utatomkhulu, umakhulu, abantwana)? _____
Are they all family members? If not, how many are close family members (mother, father, grandparents, children)?

Uya kangaphi emlanjeni?

How often do you go to the river?

Zidwelise apha ngezantsi izizathu zokuya kwakho emlanjeni. Ngesizathu ngasinye faka uphawu oluxela ukuba uya kangaphi na ngenxa yesi sizathu, (umzekelo: yonke imihla, kanye ngeveki, kanye ngenyanga, kanye ngonyaka)

List the reasons why you visit the river below. For each reason tick how often you visit the river for this specific purpose (e.g daily, weekly, monthly, annually)

linjongo zokuya emlanjeni Purpose for which river is visited	yonke imihla Daily	kanye ngeveki Once each week	kanye ngenyanga Once each month	kanye ngonyaka Once each year	akuyi kwaphela Not applicable
Ukuwakha amanzi Fetching water					
Kukuhlamba impahla / Washing					
Kukuqumba / Swimming					
Kukuloba / Fishing					
Uyela amasiko nezithethe / Cultural purpose					
Uyela eminye imicimbi / Other (make a list of the other purposes below and tick how often you use the river for each of these purposes)					

Ngubani obhale iinkcukacha zeli phepha lemibuzo? Faka uphawu kofanelekileyo kwabo bangezantsi.

Who filled in this questionnaire? Please tick one of the options below.

- ☐ Ngumzali womntwana / Parent of a child in school
- ☐ Ngumakhulu okanye ngutatomkhulu womntwana
Grandparent of a child in school
- ☐ Ngumntwana egameni lomzali / Child on behalf of the parent
- ☐ Ngumntwana egameni likamakhulu okanye likatatomkhulu
Child on behalf of the grandparent
- ☐ Ngomnye umntu egameni lomzali
Somebody else on behalf of the parent
- ☐ Ngomnye umntu egameni likatatomkhulu okanye likamakhulu
Somebody else on behalf of the grandparent
- ☐ Ngomnye umntu / Other

Kubhalwe iingcamango zikabani xa bekuzaliswa eli phepha lemibuzo? Nceda ufake uphawu apho kufanelekileyo ukhethe apha ngezantsi.

Whose views were expressed when filling in the questionnaire? Please tick one of the options below.

- ☐ Ziingcamango zomzali / The views of the parent
- ☐ Ziingcamango zikamakhulu okanye ezikatatomkhulu
The views of the grandparent
- ☐ Ziingcamango zomgcini okanye zomkhuseli (lowo uthwele uxanduva lomntwana) / The views of the custodian or guardian (the one who takes responsibility for the child)
- ☐ Ziingcamango zomntu obhale ephepheni lemibuzo egameni lomzali okanye egameni likamakhulu nelikatatomkhulu. / The views of the person who filled in the questionnaire on behalf of the parent or grandparent
- ☐ Ngomnye umntu / Other

Ikhona enye into enokuthethwa ngokuzaliswa kwephepha lemibuzo, ziingcamango zikabani ezibhalwe kulo?
Is there anything else to tell about the filling in of the questionnaire and whose views are reflected in this questionnaire?

Faka uphawu kwiibhokisi ezineenkukacha ezichanekileyo:
Tick the correct boxes
(Please give the information of **the person whose views are reflected** in this questionnaire):

Iminyaka yobudala / Age:

☐ 20 nabangaphantsi koko / 20 and younger

☐ 21-30

☐ 31-40

☐ 41-50

☐ 51-60

☐ abanama-61 nabadala kunoko / 61 and older

Isini / Gender:

☐ Abangamadoda / Male

☐ Ababhinqileyo / Female

☐ nezinye izini / Other

Eyona mfundo iphakamileyo onayo / Highest school grade obtained:

☐ iGreyidi 3 / Grade 3

☐ iGreyidi 7 / Grade 7

☐ iGreyidi 10 / Grade 10

☐ iGreyidi 12 / Grade 12

☐ iDiploma / Diploma

☐ iMfundo enesiDanga okanye ePhakamileyo / Degree or higher

Enkosi ngexesha nangenyameko yakho yokufaka zonke iinkcukacha kweli phepha lemibuzo. Ukuze ugqibezele nceda ufake uphawu kwenye yezi ngcamango zilandelayo:

Thank you very much for your time and patience in completing this questionnaire. To finalise, please tick one of the following options:

- ☐ Ndingwenela ukuzuza iinkcukacha ezingemilabo yethu yaye ndiyavuma ukuthatha inxaxheba kuphando olulandelayo / I wish to receive information on our rivers and I am willing to participate in a follow up survey
- ☐ Ndingwenela ukuzuza iinkcukacha ezingemilabo yethu kodwa andizokuthatha nxaxheba kuphando olulandelayo / I wish to receive information on our rivers, but will not participate in a follow-up survey
- ☐ Andinamdla wokufumana iinkcukacha ezimalunga nemilambo yethu / I am not interested to receive any information on our rivers

Iphepha elmibuzo elilandelayo ungathanda ukuba libhalwe ngoluphi ulwimi (xa ikho indlela)? / In which language would you prefer to receive a follow up questionnaire (if applicable)?

- ☐ ngesiNgesi / English Afrikaans
- ☐ ngesiXhosa / isiXhosa
- ☐ ngesiBhulu /

Nceda uqaphele ukuba igama ne-adresi yakho uzibhala ngokuthanda kwakho apha ngezantsi. Ezi nkcukacha zakususwa kwezi zilapha kweli phepha lemibuzo. Zakusetyenziselwa kuphela ukuthumela kuwe iinkcukacha ezimalunga nemilambo nephepha lemibuzo elilandelayo.

Please note that providing your name and address below is optional. These details will be detached from the rest of the questionnaire and will be used for mailing of the river information and follow-up questionnaire, only.

Igama / Name: _____

I-adresi / Address: _____

THANK YOU

Appendix C

Grade 1 to 3 questionnaire

School	Phase	Code
City	Town	Rural

Name: _____

Grade: _____

English / IsiXhosa

Questionnaire for Grades 1, 2 & 3

The teacher or facilitator needs to ensure that the learners mark the boxes which contain statements with which each individual learner agrees.

This can be done in a group but care has to be taken that it is not the groups' answers that are portrayed but each learner's individually.

1. Has anybody told you about sad and happy rivers? / **Ukhona umntu okhe wanixelela ngamanzi?**

☐ Yes / **Ewe**

☐ No / **Hayi**

2. Where do you find books about rivers? / **lincwadi ezithetha ngemilambo zifumaneka phi?**

☐ at a library / **kwithala leencwadi**

☐ at school / **esikolweni**

☐ at home / **ekhaya**

3. Does your family depend on (or use) the river for drinking water? / **Abantu bakowenu baxhomekeke emlanjeni ukuze basele amanzi?**

☐ Yes / **Ewe**

☐ No / **Hayi**

4. Does your family have enough water to use? /
Abantu bakowenu banamanzi aneleyo
abanokuwasebenzisa?

☐ Yes / Ewe

☐ No / Hayi

5. Will there always be enough water for everybody
to use? / Akusoloko ekhona amanzi awaneleyo
ukuze asetyenziswe ngumntu wonke?

☐ Yes / Ewe

☐ No / Hayi

6. Where do you get your drinking water at home? /
Ekhaya uwafumana phi amanzi okusela?

☐ from a tap in house / kumpompi okanye etephini
ephakathi endlwini

☐ from a tap outside house /
kumpompi ongaphandle kwendlu

☐ a borehole / epitsini

☐ from a rain water tank / etankini anamanzi amvul

☐ fetch it from a river or dam /
siwakha emlanjeni kanye edamini

7. Where is it best to swim and play? / Yeyiphi
indawo apho niqubhayo nidlale kamnandi kuyo?

☐ in a clean river / emlanjeni ococekileyo

☐ in a dirty river / emlanjeni omdaka

☐ I do not know / andazi

8. Which water is best for cooking? / **Ngawaphi awona manzi sifanele ukupheka ngawo?**

- ☐ water from a clean river / **ngawomlambo ococekileyo**
- ☐ water from a dirty river / **ngawomlambo omdaka**
- ☐ I do not know / **andazi**

9. Where would you find happy or healthy fish? / **Ningazifumana phi iintlanzi ezonwabileyo nezisempilweni?**

- ☐ in a clean river / **emlanjeni ococekileyo**
- ☐ in a dirty river / **emlanjeni omdaka**
- ☐ I do not know / **andazi**

10. Where would you find healthy or happy plants and trees? / **Ningazifumana phi izityalo nemithi esempilweni entle neyonwabileyo?**

- ☐ at a clean river / **emlanjeni ococekileyo**
- ☐ at a dirty river / **emlanjeni omdaka**
- ☐ I do not know / **andazi**

11. What happens if we throw rubbish in the river? / **Kwenzeka ntoni xa sigalela inkunkuma emlanjeni?**

- ☐ we make the river happy / **siyawonwabisa umlambo**
- ☐ we make the river sad / **siwenza lusizi umlambo**
- ☐ I do not know / **andazi**

12. What happens if we chop down the trees next to a river? / Kwenzeka ntoni xa siyigawulayo imithi engasemlanjeni?

☐ we make the river happy / siyawonwabisa umlambo

☐ we make the river sad / siwenza lusizi umlambo

☐ I do not know / andazi

13. What happens if we take all the water from the river? Kwenzeka ntoni xa siwathathayo onke amanzi omlambo?

☐ we make the river happy / siyawonwabisa umlambo

☐ we make the river sad / siwenza lusizi umlambo

☐ I do not know / andazi

14. What happens if we build our house very close to the river? / Kwenzeka ntoni xa indlu yethu siyakha kufutshane kakhulu nomlambo?

☐ we make the river happy / siyawonwabisa umlambo

☐ we make the river sad / siwenza lusizi umlambo

☐ I do not know / andazi

15. What happens if we chop down the alien trees next to a river? Kwenzeka ntoni xa siyigawulayo siyiwise imithi?

☐ we make the river happy / siyawonwabisa umlambo

☐ we make the river sad / siwenza lusizi umlambo

☐ I do not know / andazi

16. Are rivers the home of many kinds of insects? /
Ingaba imilambo ingamakhaya ezinambuzane ezininzi?

☐ Yes / Ewe

☐ No / Hayi

17. Are there plants that can only grow in or near rivers? / Zikhona izityalo ezinakho ukukhula kuphela phakathi emlanjeni okanye ngasemlanjeni?

☐ Yes / Ewe

☐ No / Hayi

18. Do you want to learn more about sad and happy rivers? / Ningathanda ukufunda nazi ngokubanzi ngemilambo elusizi naleyo yonwabileyo?

☐ Yes / Ewe

☐ No / Hayi

19. What do you think makes a river happy?
Ucinga ukuba umlambo wonwatyiswa yintoni?

20. What do you think makes a river sad? / Ucinga ukuba yintoni ewenza lusizi umlambo?

21. What can you do to make sad rivers happy and healthy rivers? / Ucinga ukuba ungenza ntoni ukuze imilambo elusizi yonwabe inike impilo?

22. Should we conserve our rivers? (Conserve means to protect, look after and care for) / Imilambo yethu kuyafuneka na ukuba siyilondoloze? (Ukulondoloza kuthetha ukukhusela, ukunonelela nokukhathalela)

☐ Yes / Ewe

☐ No / Hayi

23. Why do you say so? / Kutheni usitsho nje?

Appendix D

Reasons for smaller sample size than planned

Study 2 sample size smaller than anticipated

The expected sample size of 1155 learners from the Buffalo River catchment, and 1402 learners from the Hartenbos and Klein Brak River catchment could not be achieved for several reasons. Some headmasters allowed only one class per grade to participate. Although to a lesser degree, conflicting timeslots with learners participating in other activities such as athletics, music and choir practice during either of the two phases also contributed to the smaller sample size. Due to abnormally high rainfall and extreme cold temperatures in area B during phase 1, up to 50 % of the learners from the rural areas (some of whom had to cross rivers to get to school), were absent. Unfortunately, the study period also coincided with a teachers' strike. Although the study did not overlap with the exact strike dates, some teachers were unproductive/not helpful during the pre- and post-strike periods, which resulted in learners being sent home before fully completing questionnaires. One school was found deserted during the time for which the phase 2 appointment was made despite the fact that the appointment was confirmed twice in advance of the visit.

Appendix E

Results from the qualitative study indicating what grade 1 to 3 learners think make rivers happy/healthy and sad/unhealthy

What makes rivers happy and sad - perceptions of grade 1 to 3 learners

There was a significant overlap in the type of items listed that either make a river healthy or unhealthy, e.g. no littering vs. littering; plants and trees vs. no plants and trees; do not chop trees vs. chopping trees. Table E.1 captures in descending order of combined scores for phases 1 and 2, those items that respondents most often listed.

Table. E.1 Frequency and percentage change over time of correct responses to what is having an impact on rivers, making rivers either healthy (happy) or unhealthy (sad). Items are ranked in descending order, according to the combined scores for phases 1 and 2. (n = 471)

What makes a river ...	Happy / Healthy			Sad / Unhealthy			
Item	Frequency		% change	Item	Frequency		% change
	Phase 1	Phase 2			Phase 1	Phase 2	
No littering	83	106	28	Littering	187	274	47
Plants/ trees	76	69	-9	Chopping trees	66	95	44
Remove rubbish/ clean up	22	89	305	Dirty water	66	71	8
No pollution/ keep clean	46	51	11	Lack of water (quantity)	34	22	-35
Fish	41	30	-27	No plants/ trees	17	19	12
Do not chop trees	24	44	83	Houses close to river	14	16	14
Clean water	32	32	0	No fish/ catch all fish	11	17	54
Water (quantity)	21	10	-52	Alien trees	5	22	340
Chop alien trees/no aliens	10	20	100	No cleaning up	3	11	267
Other	43	86	100	Other	17	43	152
Total number of correct items listed	398	537	35	Total number of correct items listed	420	590	40

No littering was the most popular reason why rivers are healthy (happy). It was the most mentioned item in both phases, and showed a 28 % increase (calculated as a percentage of phase 1) over time. The *removal of rubbish/clean up of the river* and the *chop of alien trees* showed the highest increase over time. Concerning what makes rivers sad, *littering* again received the most referrals in both time 1 and 2. The presence of *alien trees* and *no cleaning up of the river* received the highest increase over time.

The *remove rubbish/clean up* and *no pollution/keep clean* items ranked amongst the top four in the healthy river section. Although the *presence of plants/trees* scored second highest, the

change over time decreased. The *remove rubbish/clean up* score increased significantly (305 %) over time. *Littering* was the most frequently mentioned item that respondents considered as the cause of unhealthy (sad) rivers. This was followed by the *chopping of trees*, *dirty water* and *lack of water*. While having an insignificant initial score, the *alien trees* item showed the biggest increase in score over time, followed by the *no cleaning up* item.

Appendix F

Facilitator questionnaire: phase 1

Questions to the grades 1, 2 and 3 teachers/facilitators

Date: _____

Grade: _____

School: ☐ Rural

☐ Urban

Have the learners had previous contact with River Health Programme activities?

☐

Yes

☐

No

☐

Not sure

Were any of the learners involved in the launch of the State-of-Rivers report?

☐

Yes

☐

No

☐

Not sure

Do you have sufficient material on water and rivers to implement the OBE curriculum successfully?

☐

Yes

☐

No

☐

Not sure

What are your main sources of material on water and rivers?

Do you have any other comment on the availability of suitable material relating to water and rivers to implement the OBE curriculum successfully?

Would it be possible to indicate whether learners stay in a rural area, a town or a city?

☐

Yes

☐

No

Please discuss with researcher how best to provide this information.

The following is optional

Name: _____

School: _____

Appendix G

Facilitator questionnaire: phase 2

Questions to the grades 1, 2 and 3 teachers/facilitators

Date: _____

Grade: _____

Did you find the Activity Book suitable for use in the OBE curriculum?

☐

Yes

☐

No

☐

Not sure

Did you find the State-of-Rivers poster suitable for use in the OBE curriculum?

☐

Yes

☐

No

☐

Not sure

For which outcomes were the Activity Book and Poster used?

Do you have any comments on how the Activity Book and Poster can be improved?

The following is optional

Name: _____

School: _____