

## Exploring environmental perceptions, behaviors and awareness: water and water pollution in South Africa

Barbara A. Anderson · John H. Romani ·  
Heston Phillips · Marie Wentzel · Kholadi Tlabela

Published online: 19 April 2007  
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**Abstract** Understanding the relationships among perceptions, behaviors and awareness of environmental initiatives is important for both policy makers and social scientists. There is, however, limited consensus among scholars as to the reasons for differences and similarities among ethnic and socio-economic groups in their environmentally related attitudes and behaviors. South Africa, which has established a constitutional right to a safe environment, together with the presence of parallel first and third world populations, offers an unusual setting in which to examine these issues. Using the 2004 South African General Household Survey, the similarities and differences between African and non-African households with respect to the perceptions, behaviors and awareness of programs related to water and water pollution are examined. Africans and those with lower socio-economic status are more likely to perceive water pollution as a community problem; educational attainment is unrelated to this perception. In combination with perception of water pollution as a problem, education is positively related to taking action to

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B. A. Anderson (✉)  
Population Studies Center, University of Michigan, 426 Thompson Street, Box 1248,  
Ann Arbor, MI 48106-1248, USA  
e-mail: barba@umich.edu

J. H. Romani  
School of Public Health, University of Michigan, Ann Arbor, MI, USA

H. Phillips  
Statistics South Africa, Pretoria, South Africa

M. Wentzel  
Human Sciences Research Council, Pretoria, South Africa

K. Tlabela  
Department of Correctional Services, Pretoria, South Africa

treat water for drinking and food preparation. Awareness of a highly touted program to clear waterways of alien vegetation is strongly positively related to socio-economic status, and is much more common among non-Africans than Africans.

**Keywords** Environmental perceptions · Africa · Racial differences · Water pollution

## Introduction

The late 20th and early 21st centuries have witnessed the emergence of the environment as a political and social issue. (Dunlap & Scarce, 1991; Dunlap, Gallup, & Gallup, 1993; Inglehart, 1995; Jacobs, 2002; Rohrschneider, 1988). This expanded interest in global warming and related environmental concerns has led governments and civil society alike to increase their efforts to raise public understanding of the underlying nature of water, air and ground pollution. Implicit, if not explicit, in these activities is the expectation that a heightened understanding of the causes and effects of environmental contamination will lead to improved environmental stewardship by both individuals and communities.

Although concerns about the environment are world-wide, South Africa offers a special setting in which to examine public perceptions, awareness and behaviors regarding issues of environmental quality. First is the historical context in which the reshaping of the South African political, economic and social systems is being carried out. South Africa, historically, as well as today, can be viewed as a country containing two parallel societies (Lumby, 2005). One, comprised mostly of the African population, continues to live under circumstances comparable to those found in the developing world. The other, which includes the white population and many from the other non-African groups (the Asian and Colored populations), enjoys economic and social amenities equal to those found in the developed world. Redressing these disparities that result from over 300 years of history requires substantial improvements not only in the economic status of those who are historically disadvantaged, but also in their social and political well-being. The addressing of these needs directly affects, among other things, the environment.

Second are the constitutional arrangements under which this reconstruction is taking place. The centerpiece of that constitutional framework is a comprehensive set of human rights, among which is the right of South African citizens:

“(a) to an environment that is not harmful to their health and well-being; and

- (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative acts and measures that
- (i) prevent pollution and ecological degradation;
  - (ii) promote conservation; and
  - (iii) to secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development” (Republic of South Africa, 1996; Constitution of South Africa, Chap. 2, Sec. 24).

A Department of Environmental Affairs and Tourism review of efforts undertaken in the first 10 years of the post-apartheid society underscored the significance of this provision in these terms:

“...the Environmental Right enshrined in the Bill of Rights has meant that environmental issues are now seen as an integral element to be addressed in the democratic transition” (DEAT, 2004: 57).

This is not to suggest that the South African government is obliged to provide each person with a safe and healthy environment. Indeed, the constitutional article cited above notes that government only has the responsibility to provide for these conditions through “reasonable legislative acts.” Further, there is detailed in this same chapter of the constitution the circumstances under which this, as well as other rights, may be circumscribed (Republic of South Africa, 1996; Constitution of South Africa, Chap. 2, Sec. 36).

These qualifications aside, the inclusion of this clause in the same constitutional category as other civil and socio-economic rights creates a context in which environmental concerns are given a greater prominence than might otherwise be the case. This not only creates a higher level of expectations about environmental matters but also establishes the potential that shortcomings in governmental performance in this arena would be viewed more critically. Thus, while the placement of a concern for the environment as part of the bill of rights can well lead to a greater public awareness of environmental matters, it also could result in a higher level of public interest in the environment than the South African authorities might wish (Heyns & Brand, 2004).

Third is the vision of the majority African population for the post-apartheid society. With the transition in 1994 this population acquired, for the first time in over 300 years, responsibility for setting the agenda by which its hopes for this new society could become a reality. Central to these expectations is the equal and equitable distribution of those services necessary for the well being of all citizens. Key among these are access to safe drinking water and sanitation, the provision of which directly affects environmental quality.

The actions of the African National Congress (ANC) government following its assumption of power in 1994 constitute an additional consideration

(African National Congress, 1992). Substantial efforts have been made since then to increase the availability of potable water supplies and basic sanitation services. By 2005, some 10 million households had access to safe water compared to less than 7.3 million with such access in 1996 (Mbeki, 2006; Statistics South Africa, 2004). In 2005 basic sanitation services were available to 67% of the population in contrast to less than 50% of the population that had such services in 1994 (DWAF, 2005). Governmental concern with water quality is also seen in the Working for Water Programme. Initiated by the Department of Water Affairs and Forestry in 1995 and carried out in conjunction with the Departments of Agriculture and Social Development, the program has employed over 33,000 people in more than 300 projects to clear alien vegetation from the South African waterways (DWAF, Working for Water, 2006). None of this is to argue that what is happening in South Africa is unique. Rather it is to observe that these aspects of the South African situation provide a special context in which to examine attitudes, awareness and behaviors regarding environmental issues.

## Issues

This paper explores factors related to perceptions, behaviors and public awareness regarding water pollution and treatment in South Africa. Such information is a critical element in the identification and development of programs to address environmental pollution. How perceptions concerning environmental issues are formed, the relationship of these perceptions to behaviors to alleviate environmental problems and the relative influence that specific circumstances, social status and other factors have in the development of these perceptions and resultant behaviors are also important for social science.

While these questions as they concern the field of environmental protection have been studied for more than 40 years, there is a limited consensus among scholars about the reasons for the differences and similarities among socio-economic and ethnic groups in perceptions and behaviors regarding environmental issues (Dunlap & Scarce, 1991; Jacobs, 2002; Rohrschneider, 1988; Van Liere & Dunlap, 1980). This paper addresses water pollution in South Africa. There has, however, been fairly little research explicitly about water pollution, especially outside the more developed world. Thus, we review the literature about perceptions and behaviors regarding environmental pollution generally from both more developed and less developed countries to formulate alternative hypotheses regarding determinants of perceptions and behaviors concerning water and water pollution.

One question is the influence of socio-economic and related factors in the formation of perceptions of the presence of environmental pollution and behaviors in response to these perceptions. Further is the impact of the specific circumstances in which people live on perceptions of environmental

problems. An additional issue is the extent to which differences among ethnic or racial groups concerning environmental matters are related to these factors.

Illustrative of a continuing lack of congruence in views concerning the role of these factors in the determination of perceptions regarding questions of environmental quality can be seen in the contrasting positions of Inglehart and those from a Gallup Institute survey of 24 countries. Inglehart argues that while objective conditions contribute to attitudes regarding environmental matters, he concludes, based on analysis of data from the World Values Survey, that the increased awareness of environmental contamination and the growth of interest in environmental issues is largely the product of a shift from materialist to post-materialist goals (Inglehart, 1995). Using Maslow's (1954) hierarchy of needs he suggests that the expanded recognition of environmental pollution as a problem as well as greater support for programs to address these conditions represents a shift at the societal level comparable to that which Maslow argued occurred at the individual level, i. e. when basic material needs of individuals are met, then people will focus their efforts on the satisfaction of higher order needs. For Inglehart environmental protection is an example of a higher order (post-materialist) need and reflects an inter-generational shift as a younger, better educated generation in advanced societies has come of political age. Implicit in this argument is that both the increase in awareness of environmental problems and the willingness to deal with them are the result of rising standards of living and levels of education.

Results from a Gallup Institute survey in 24 countries, as well as a similar survey in Canada, present a different perspective. Here it was found that concerns about environmental quality were neither restricted to those living in the better-off nations nor associated with higher levels of income and education:

“...there is little difference in reported levels of environmental concern between people of poor, less developed nations and those of richer highly industrialized nations” (Dunlap, Gallup, & Gallup, 1993).

Further not only were environmental problems not seen as among the most important problems faced by respondents in either the developed or the less-developed countries, but there were also no significant differences between these countries when it came to choosing between economic development and environmental protection programs:

The authors of the Gallup study went on to state that:

“Even when it comes to environment-versus-economic tradeoffs, little difference exists between those living in wealthy, industrialized nations and those in the developing nations: Both give strong endorsement to environmental protection” (Dunlap, Gallup, & Gallup, 1993: 36).

This led them to conclude “...that environmental quality is no longer seen as a post-materialist value and that environmental degradation is increasingly

recognized as a direct threat to human health and welfare” (Dunlap, Gallup, & Gallup, 1993: 37). The Canadian study phrased the situation as follows:

“...concern about the environment cuts across key social divisions...there is no statistical association between income levels or education levels...The poorest and least-educated residents are just as likely as the richest and best-educated to care about environmental problems at home or in the world more generally” (Blake, Guppy, & Urmetzer, 1997: 469).

The question of the relationship between the context in which people find themselves and perceptions about environmental conditions was the focus of some early studies. One was a survey conducted in Durham, North Carolina in which public perception of environmental pollution as a problem was examined (Murch, 1971). One finding from that study was that while a large proportion of those surveyed saw pollution as a national issue, only a small proportion viewed pollution at the local level as important, despite the fact that environmental conditions in the community surveyed differed very little from conditions nationally. Moreover, homeowners and those who expressed a high level of satisfaction with their particular circumstances were less likely to state that pollution was a problem than those who were renters or were dissatisfied with their particular situations. However, among those who perceived pollution as a problem, there was some evidence that those who were better-educated were more willing to take action to combat pollution.

Similar conclusions were drawn from a study in Los Angeles in which satisfaction with one’s immediate condition was inversely related to the perception that air pollution was a problem (Hohm, 1976). This suggests that for people to admit that there are serious defects in their immediate neighborhood constitutes a challenge to their self image. Moreover, the recognition that one resides in a less than wholesome environment can lead to pressures to move and to alter one’s long standing relationships, which can be difficult. These results also suggest that individuals could become so habituated to a given set of circumstances that they are unable to perceive the shortcomings in their local setting.

On the other hand, Van Arsdol, Sabagh and Alexander (1964) in a study of Los Angeles found some evidence that the presence of an environmental hazard was positively related to perception of the presence of that hazard. Further, they found that those residents who were more satisfied with their neighborhood were also more likely to perceive that an environmental hazard was present.

More recent work done in developing societies presents a similar mixture of findings concerning the relative influence of socio-economic indicators and other factors on perceptions of environmental issues. One study from Costa Rica focused on the importance of environmental issues relative to other issues (Holl, Daily, & Ehrlich, 1995). Only 22% of respondents in this 1993 survey listed the environment in the top three problems faced by that society. However, the global nature of environmental problems was seen as more important than similar conditions at the national level (Holl, Daily, & Ehrlich,

1995: 1551). Further, interviewees from “upper class neighborhoods” saw global problems as not as important as respondents from lower class or rural neighborhoods. Respondents from “lower class neighborhoods,” however, ranked national problems as more important than did the other two groups (Holl, Daily, & Ehrlich, 1995: 1552).

Jacobs examined perceptions of environmental concerns and behaviors in a survey of three less well off areas of Rio de Janeiro and compared the results of that survey with those from the 1992 Euro-Barometer survey. She found that while the residents of the Rio de Janeiro communities were less likely than the Europeans to engage in recycling activities, their level of concern about the environment was higher than that reported in Europe (Jacobs, 2002: 69). Brazilian respondents also expressed a greater concern for matters “such as pollution of the ocean, biodiversity and global warming” than did the Europeans (Jacobs, 2002: 71). When asked about the relative importance of economic development and environmental protection, the interviewees in Brazil were also more likely than the Europeans to give priority to the latter. Moreover, Brazilians were more likely to have participated in a group endeavor designed to deal with particular environmental problems than the Europeans.

White and Hunter (2005) looked at environmental awareness and the relative importance of environmental issues in comparison to economic and social issues among residents of 6 coastal districts in the Central region of Ghana. Nearly all of the respondents indicated a general awareness of environmental quality; however, when reference was made either to the national or global environments, the level of awareness declined. Also found was a linkage between environmental concerns and local issues similar to what was reported in the earlier North Carolina and Los Angeles studies (Murch, 1971; Hohm, 1976).

When asked to rank the relative seriousness of a set of four social issues (hunger, crime and violence, poor health care, ethnic, and religious prejudice) and a set of 4 environmental issues (deforestation, fisheries depletion, water pollution, and drinking water availability/quality), residents rated two social issues (hunger, crime, and violence) as very serious, but gave only one of the environmental problems (fisheries depletion) the same rating (White & Hunter, 2005: Table 5) However, responses to a question concerning preferences between economic growth and environmental programs, showed that some “70.4% favored environmental protection while 29.6% favored economic growth” (White & Hunter, 2005: 23).

Perhaps of more interest were findings of the association between individual traits and responses to questions regarding the seriousness of environmental problems. White and Hunter (2005: 24) found, “Those who are literate, voted, male and of higher household SES are all more likely to express a priority for environmental preservation” (White & Hunter, 2005: 24). They also found linkages among attitudes regarding the seriousness of environmental conditions. They showed that those who viewed deforestation as a serious or very serious problem were also more likely to consider fisheries

depletion in the same light. Similar was the strong linkage reported between water pollution and the availability of drinking water and its quality (White & Hunter, 2005: Table 6).

This suggestion of a strong association between higher SES and positive attitudes regarding the environment contradicts findings from other work in this area. The Health of the Planet Survey and the Canadian study, cited earlier, reported that there are only marginal differences in environmental awareness and attitudes among those of different social status (Blake, Guppy, & Urmetzer, 1997; Dunlap, Gallup, & Gallup, 1993). White and Hunter argue, however, that individuals from:

“less-wealthy nations also express environmental concerns. Further, even when positioned to other social and economic concerns, many residents prioritize environmental issues” (White & Hunter, 2005: 30).

While this statement tends to confirm the presence of a limited consensus concerning relationships between socio-economic factors and perceptions regarding environmental questions, it also raises the possibility that the critical consideration is that these factors have differential influences depending upon the particular circumstances in which these issues are being explored. One possibility is that the connection between socio-economic status and a perception that pollution is a problem may differ depending on the environmental condition about which question is asked. Further, the strength of the relationship between any given factor or set of factors may also differ with reference to the specific situation of the respondents involved. It may also be the case that levels of education are more important explanatory factors with regard to behavior taken by individuals than perceptions concerning the presence or absence of a condition of environmental contamination.

This brief review of the literature suggests a set of alternative hypotheses about factors affecting perceptions of the presence of environmental problems such as water pollution and what leads to action to address such problems. The major alternative views involve the relation between objective or semi-objective indicators of the presence of an environmental problem and whether people perceive that the problem is present, with some studies suggesting a positive relation and others suggesting a negative relation. In addition socio-economic status and satisfaction with the neighborhood in which one lives are alternatively seen as inhibiting or promoting recognition of environmental problems. Education is also sometimes seen as promoting action in response to environmental problems and sometimes not. Examination of issues related to water and water pollution in South Africa will contribute toward resolution of these differences.

### **Socio-economic characteristics of racial groups in South Africa**

The analysis in this paper is conducted separately for African households and for non-African households, as well as for all households. The three



**Table 1** Characteristics of population groups in South Africa and of non-Africans as a whole: 2004

	% Urban	% With clean drinking water	% With household head 5+ years of education	% With a flush or chemical toilet
African	50	82	69	45
White	90	99	99	100
Colored	81	98	81	87
Asian	97	100	93	99
Weighted average of non-African groups	87	99	91	95

non-African groups, white, Colored and Asian, comprise 21% of the population as a whole. Of these three groups 45% are white, 41% are Colored (a mixed race category) and 14% are Asian, mainly of Indian background, but include Chinese and several other Asian groups. There were 2,886 Colored, 604 Asian and 2,950 White households in the survey.

The socio-economic characteristics of the three groups within the non-African category are much more similar to each other than to the majority African population (Table 1). One reason for the distinctiveness of Africans is that they were the only group that was not allowed to live in urban places under apartheid. The similarity of the three non-African groups to each other in contrast to the African group, as well as the small number of cases in the survey for some groups, is why the three non-African groups are combined into one group in the analyses.

## Data

Data for these analyses are from the 2004 General Household Survey conducted by Statistics South Africa. The 2004 survey was the third in a series of annual household surveys initiated in 2002 as a replacement for the October Household Survey which Statistics South Africa conducted from 1993 to 1999. The 2004 Survey was a stratified random sample which included 26,214 households, of which 19,950 (75.9%) were African households and 6,264 (23.9%) were non-African households.

The second survey in this series—the 2003 survey—contained a limited number of questions about household involvement in recycling activities and in the disposal of household waste. The 2004 instrument included most of the items used in the 2003 survey as well as a number of other questions regarding environmental issues. Only those questions which dealt with perceptions of water pollution as a community problem, actions taken by households in response to this problem and awareness of a program specifically created to deal with one aspect of water pollution are used in the analysis presented here (Table 2).

**Table 2** General Household Survey 2004 items relating to perceptions, behaviors and awareness in the area of water and water pollution

Perception of a community problem	Which of the following environmental problems do you experience in your community? Water pollution (Also asked about land degradation, outdoor/indoor air pollution and waste removal/littering)
Behaviors to address the problem	Do household members treat the water used for drinking? Do household members treat the water used for food preparation?
Awareness of initiatives related to the problem	Are you aware of the following initiative in South Africa? Work for water (clearing of alien vegetation from waterways)

Table 3 shows a summary of the proportions of all households, African households and non-African households which held particular perceptions, engaged in specific behaviors or were aware of a governmental initiative concerning water pollution. African households were much more likely than non-African households to perceive water pollution as a community problem. There were virtually no differences between African and non-African households in the percentage that treated water either for drinking or for food preparation. Non-African households were four times as likely as African households to be aware of the Work for Water Programme. Later multivariate analysis will show whether factors related to perceptions, behaviors and awareness differ between African and non-African households and whether African versus non-African household membership remains important once other household characteristics have been taken into account.

Table 4 provides a description of the explanatory or independent variables used in the analysis. It is necessary to note that the variables—the quality of drinking water, type of sanitation, and availability of refuse collection—are used in two different ways. First, these items, when taken together with additional items, constitute a package of indicators that can be used to define the level of living of a household. Each is also employed separately as an

**Table 3** Percentage of all households, African households and non-African households with water-related perceptions, behaviors and awareness

		All households (%)	African households (%)	Non-African households (%)
Perceived as a community problem	Water pollution	10.8	13.0	3.9
Behaviors	Treat drinking water sometimes or always	5.8	5.8	6.0
	Treat water for food sometimes or always	5.0	5.1	4.8
Awareness of initiative	Work for water	12.0	7.0	28.1

**Table 4** Description of explanatory variables used

Urban	Urban/non-urban classification based on 1996 South Africa Census 1 = Yes, is an urban place, 0 = No, is not an urban place
Flush/chemical toilet	Flush/chemical toilet includes flush toilet connected to a public sewage system, whether in dwelling, on site or off site, flush toilet connected to a septic tank whether in dwelling, on site or off site, or chemical toilet whether on site or off site 1 = Yes, uses a flush or chemical toilet, 0 = No, does not use a flush or chemical toilet
Clean water	The household's main source of water for drinking and food preparation. Clean water includes piped (tap) water in dwelling, piped (tap) water on site or in yard, neighbor's tap, public tap, or water from a water carrier/tanker 1 = Yes, has clean water, 0 = No, does not have clean water
Formal housing	Formal housing includes dwelling/house or brick structure on a separate stand or yard or on farm, flat or apartment in a block of flats, town/cluster/semi-detached, or unit in a retirement village 1 = Yes, lives in formal housing, 0 = No, does not live in formal housing
Household head 5+ years education	Education of household head 1 = Yes, household head has 5 or more years of education, 0 = No, household head does not have 5 or more years of education
African household	Population group of household head 1 = Yes, household head is African/Black, 0 = No, household head is not African/Black

independent variable related to the perception that a particular environmental condition is viewed as a community problem. The two ways in which these variables can be applied require that a clear distinction be made each time the variable is used in a given part of the analysis.

An additional matter is who answered the questions that we analyze. The 2004 General Household survey had a “person” section and a “household” section. For items in the person section, it is clear who the respondent was. The items that we analyzed were all in the “household” section. The 2004 Survey does not indicate which household member answered these questions. The interviewer instructions only specified that it was to be a “responsible adult.” The education of the household head is a relevant characteristic, but we do not know whether the actual respondent was male or female or his or her age.

The 2004 General Household Survey was not totally representative both because of differential response rates according to characteristics of households and because, despite the best efforts of Statistics South Africa, the survey sample was not perfectly representative of the South African population. In all of the tables with numerical results and in the figures, the data are weighted. The weights provided with the data inflate the numbers to that of South Africa as a whole. In the logistic regression results it would not be appropriate to pretend that the number of cases was that in South Africa as a whole, because then the statistical tests would give incorrect results.

When the results are shown for all households, the weights from the survey are scaled so that the weighted total number of households equals the total number of households in the survey. When results are shown for African households alone, the weights for African households are scaled to make the

**Table 5** Proportion of households with various characteristics, 2004

	All households	African households	Non-African households
Urban	.591	.504	.876
Flush/chemical toilet	.572	.455	.954
Clean water	.860	.822	.984
Formal housing	.668	.585	.938
Household head 5+ years education	.751	.695	.933
Rubbish collected at least weekly	.558	.459	.877
African household	.765	–	–

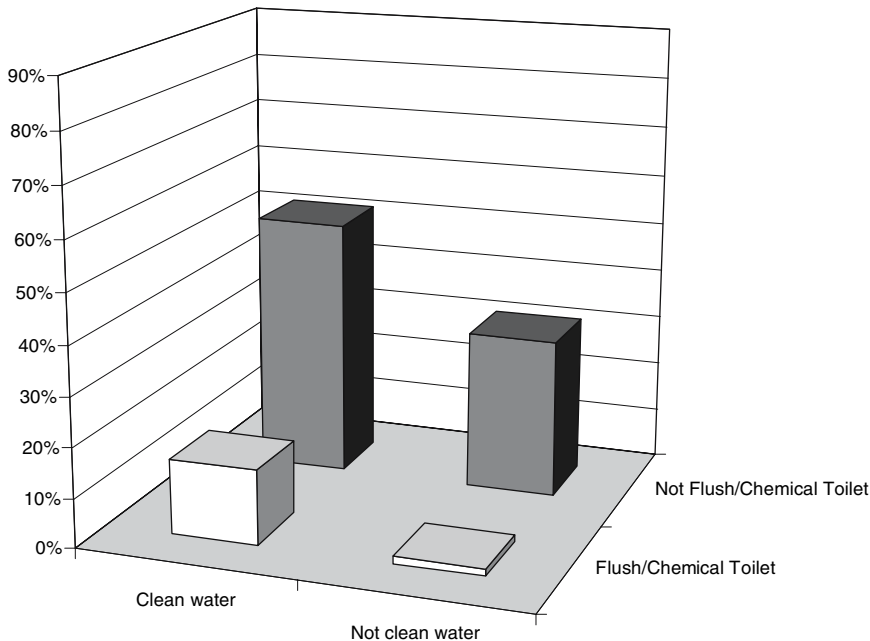
weighted number of African households equal to the number of African households in the survey. Similarly, when results are shown for non-African households alone, the weights for non-African households are scaled to make the weighted number of non-African households equal the number of non-African households in the survey. This is the weighting procedure employed for the results in all of the statistical tables.

Table 5 shows the proportions of all households, African households and non-African households with particular characteristics. Readily evident from this table are the differences between the African and non-African households. For almost every one of these characteristics which can be used to define the level of living of a particular household, non-African households are better off than African households. Reflected here is the pattern of inequality that existed in the period prior to 1994 and which continues to be an important part of the context of this study.

The distribution of all rural households by sanitation and drinking water quality is shown in Fig. 1 and the distribution of all urban households with respect to sanitation and drinking water quality is seen in Fig. 2. In each figure, the four categories sum to 100%. The difference between rural and urban households in 2004 with reference to water quality and type of sanitation is clear. Only 15% of all rural households had access to both clean water and a flush or chemical toilet compared to slightly less than 32% of rural households which lacked both clean water and a flush or chemical toilet. A completely different picture is found for urban households. Eighty-five percent of urban households had both clean water and a flush or chemical toilet, while less than .5% lacked clean water and did not have a flush or chemical toilet.

### Perception of water pollution as a community problem

The extent to which water pollution is seen as a community problem is the first question addressed. As seen in Table 3, slightly less than 11% of all households viewed water pollution as a community problem. This is a substantially lower proportion of households reporting perception of pollution in their communities than has been cited in other studies where up to 90% of respondents expressed awareness of such conditions. (White & Hunter, 2005).



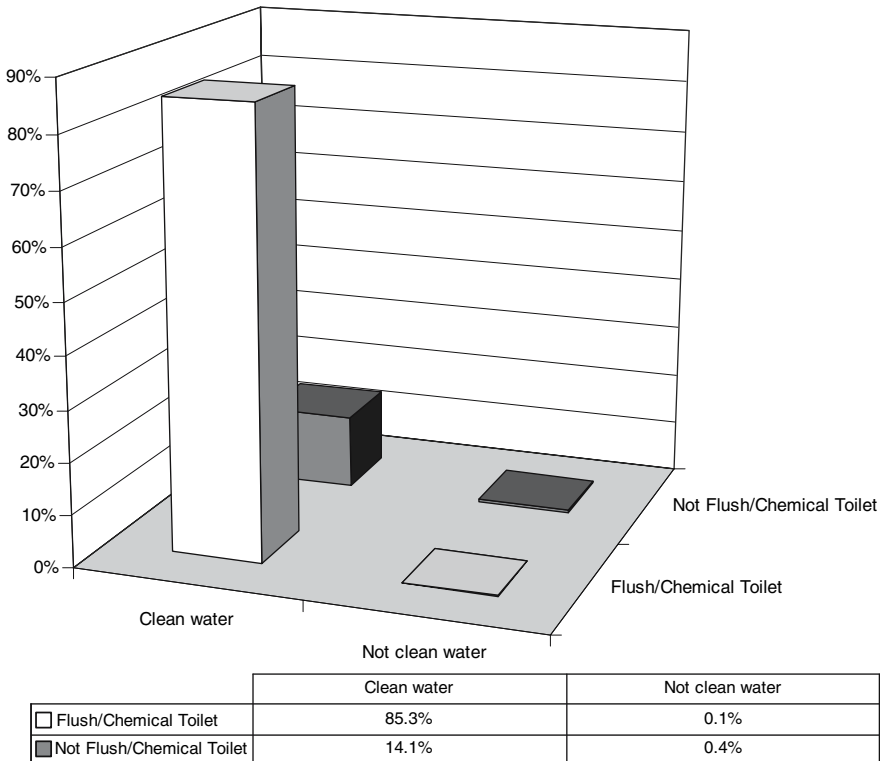
	Clean water	Not clean water
□ Flush/Chemical Toilet	15.0%	1.4%
■ Not Flush/Chemical Toilet	51.7%	31.9%

**Fig. 1** Rural distribution of all households by sanitation and water quality 2004

However, perhaps more important for this analysis are the differences between the African and non-African households. African households are three times more likely to see water pollution as a community problem than non-African households (13% vs. 4%). Given the historic situations in which the African and non-African households have lived in South African society, this is perhaps not surprising. It also suggests that those who live in a worse environmental situation are more likely to perceive environmental problems.

Table 6 presents the results of a logistic regression analysis. It shows that for all households there was the strong likelihood that water pollution will be considered a problem when that household is urban, lacks a flush or chemical toilet, lacks clean water, and resides in non-formal housing. African households are also significantly more likely than non-African households to perceive water pollution as a community problem, even after the other independent variables have been taken into account. In bivariate analyses (not shown), the education of the head of household was significantly negatively related to perception that water pollution was a community problem. Note that in the multivariate analysis the educational level of the head of household is not statistically significant for all households or for African households.

There are two important factors related to perception of water pollution as a problem in non-African households. The education of the head of household



**Fig. 2** Urban distribution of all households by sanitation and water quality 2004

and the type of housing are both statistically significant. For these households water pollution was more likely to be seen as a problem if the head had less than 5 years of education and if the household lived in informal housing.

Given the very different characteristics of African and non-African households as shown in Table 5, it is difficult to find a set of independent variables that is equally appropriate for analysis of both groups. The independent variables selected work well for the analysis of all households and of African households. If, however, the main purpose of the analysis were the examination of non-African households, a somewhat different set of independent variables might have been used.

Not dealt with directly in these analyses of the data is whether urban and rural Africans differ regarding the perception of water pollution as an issue. The substantial differences in the position of the urban and rural populations in South Africa with reference to water supplies and type of sanitation available was mentioned earlier (Figs. 1, 2). Also noted was that nearly 90% of non-African households are classified as urban. This observation might lead to the conclusion that differences in perceptions of water pollution as a problem between urban and rural households simply reflect an African versus non-African distinction.

**Table 6** Logistic regression results related to water and water pollution, 2004

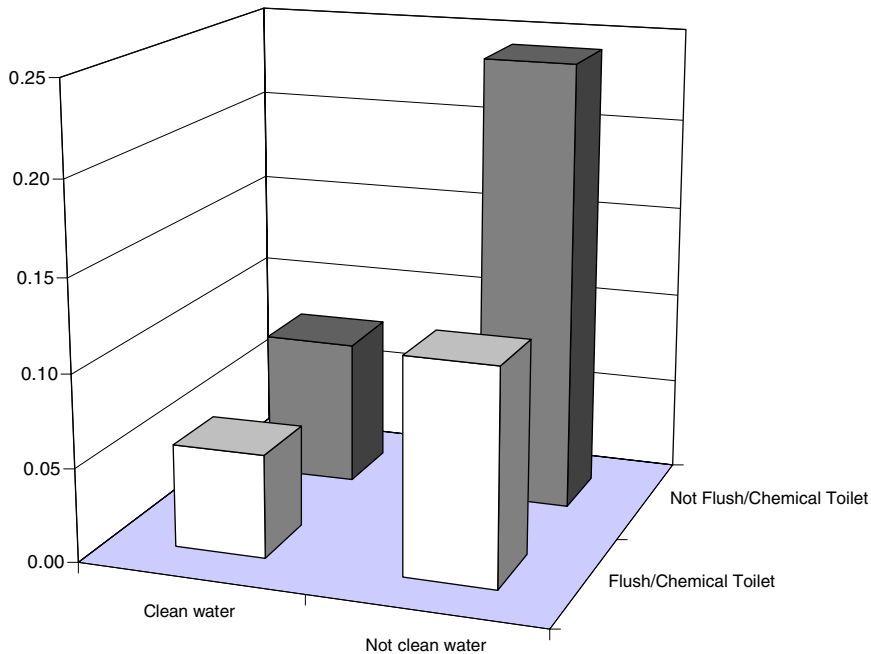
	All households						African households						Non-African households												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
	Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Aware of work preparation for food (0 = No, 1 = Yes)	Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Treat water for food preparation (0 = No, 1 = Yes)	Aware of work preparation for food (0 = No, 1 = Yes)	Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Treat water for food preparation (0 = No, 1 = Yes)	Aware of work preparation for food (0 = No, 1 = Yes)	Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Treat water for food preparation (0 = No, 1 = Yes)	Aware of work preparation for food (0 = No, 1 = Yes)	Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Treat water for food preparation (0 = No, 1 = Yes)	Aware of work preparation for food (0 = No, 1 = Yes)	Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Treat water for food preparation (0 = No, 1 = Yes)	Aware of work preparation for food (0 = No, 1 = Yes)	
Urban (0 = No, 1 = Yes)	.639 (.000)	-.114 (.191)	-.001 (.989)	-.112 (.069)	.653 (.000)	-.095 (.341)	.026 (.805)	-.048 (.553)	.429 (.077)	-.090 (.619)	.001 (.996)	-.164 (.084)	Clean Water (0 = No, 1 = Yes)	-1.087 (.000)	-1.311 (.000)	-1.269 (.000)	.325 (.001)	-1.111 (.000)	-1.279 (.000)	-1.221 (.000)	.453 (.000)	-.117 (.821)	-2.017 (.000)	-2.025 (.000)	-.505 (.049)
Flush/Chemical Toilet	-.333 (.000)	-.270 (.003)	-.236 (.013)	.342 (.000)	-.333 (.000)	-.348 (.000)	-.306 (.003)	.204 (.011)	-.400 (.184)	.447 (.162)	.404 (.216)	1.314 (.000)	Formal Housing (0 = No, 1 = Yes)	-.565 (.000)	.122 (.052)	.157 (.019)	.680 (.000)	-.560 (.000)	.101 (.121)	.120 (.081)	.714 (.000)	-.635 (.003)	.201 (.417)	.671 (.042)	.477 (.001)
HH Head 5+ Yrs Education (0 = No, 1 = Yes)	.057 (.371)	.299 (.000)	.262 (.000)	.466 (.000)	.079 (.108)	.255 (.000)	.244 (.001)	.353 (.000)	-.469 (.045)	.915 (.002)	.456 (.113)	.875 (.000)	Water Pollution a Problem (0 = No, 1 = Yes)	-	.858 (.000)	.667 (.000)	-	-	.691 (.000)	.604 (.000)	-	1.922 (.000)	1.202 (.000)	-	-
African Household (0 = No, 1 = Yes)	.945 (.000)	-.597 (.000)	-.384 (.000)	-1.206 (.000)	-	-	-	-	-	-	-	-													

**Table 6** continued

All households			African households				Non-African households				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water always (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Aware of water initiative (0 = No, 1 = Yes)	Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Treat water for food preparation sometimes or always (0 = No, 1 = Yes)	Aware of water initiative (0 = No, 1 = Yes)	Water pollution a problem (0 = No, 1 = Yes)	Treat drinking water sometimes or always (0 = No, 1 = Yes)	Treat water for food preparation sometimes or always (0 = No, 1 = Yes)	Aware of water initiative (0 = No, 1 = Yes)
Constant	-1,940 (.000)	-1,944 (.000)	-2,572 (.000)	-1,001 (.000)	-2,081 (.000)	-2,297 (.000)	-3,788 (.000)	-2,088 (.000)	-2,363 (.000)	-2,552 (.000)	-2,852 (.000)
X <sup>2</sup>	1119.480 (.000)	506.985 (.000)	2048.289 (.000)	697.953 (.000)	654.754 (.000)	452.841 (.000)	273.827 (.000)	19,292 (.002)	160.063 (.000)	72.273 (.000)	126.284 (.000)
d.f.	6	7	8	5	6	6	5	5	6	6	5
N	26,214	26,185	26,214	19,950	19,932	19,950	19,920	6,264	6,264	6,264	6,264

*p* values in parentheses. Coefficients underlined if *p* < .05



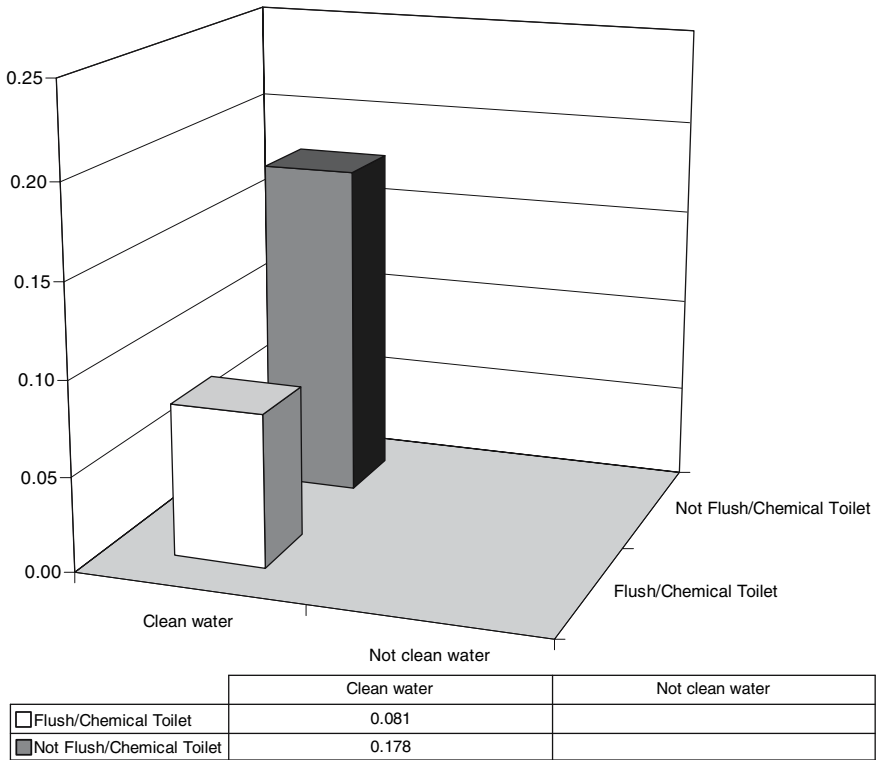


	Clean water	Not clean water
□ Flush/Chemical Toilet	0.055	0.116
■ Not Flush/Chemical Toilet	0.079	0.243

**Fig. 3** Proportion of rural African households viewing water pollution as a community problem, by sanitation and water quality 2004

This does not appear to be the case. First, as seen in Fig. 3, for rural African households the quality of the water source is strongly related to whether water pollution is identified as a problem. A substantially higher proportion of rural African households dependent on unclean water supplies viewed water pollution as a community problem than those rural African households who have access to clean water. Urban African households, largely by virtue of an urban location, almost all have clean water. Only .7% do not have access to clean water. However, the type of sanitation available to these units is more varied and plays a significant role in the perception of water pollution as a problem (Fig. 4).

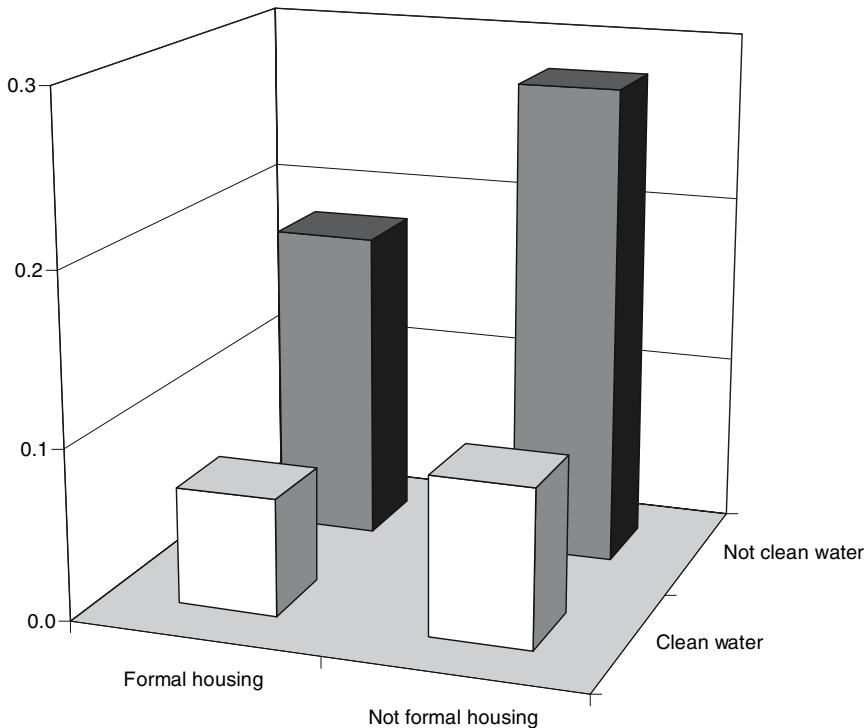
Although urban residence was positively related to perceiving water pollution as a problem in the multivariate analyses shown in Table 6, in bivariate analyses (not shown), urban residence was significantly related to being *less* likely to perceive water pollution as a problem both for all households and for African households. Figures 3 and 4 also help explain this change in the sign of urban residence in relation to perception of water pollution as a problem. A higher percentage of urban African households with clean water and a flush or chemical toilet perceived water pollution as a problem than rural African households with clean water and a flush or chemical toilet (11% vs. 7%).



**Fig. 4** Proportion of urban African households viewing water pollution as a community problem by sanitation and water quality 2004

Similarly, a greater proportion of urban African households with clean water and without a flush or chemical toilet perceived that water pollution was a problem than rural African households with the same conditions, clean water and without a flush or chemical toilet (18% vs. 8%).

Similar is the influence of the type of housing—formal or informal—on the perception that water pollution is a community problem. The logistic regression analysis indicated that the type of housing for African households had a statistically significance influence on whether water pollution was perceived as a community issue. This is shown in Figs. 5 and 6 in which for both rural and urban African households the lack of formal housing is related to the perception that water pollution is a problem. It is important to note that when the type of housing is looked at together with the quality of the water supply and sanitation available to each of these populations, the observation from the earlier analyses of this question in which the strong influence of the two latter factors in the perception of water pollution as a community problem is reinforced (Figs. 3, 4). For rural Africans the quality of the water supply is critical, while for urban Africans the type of sanitation is the most important household characteristic.

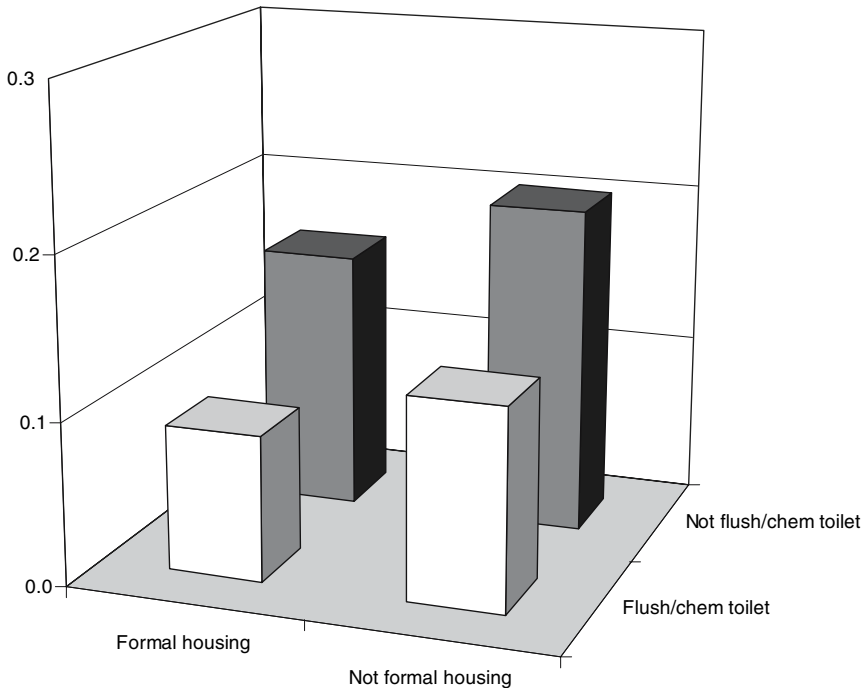


	Formal housing	Not formal housing
□ Clean water	0.069	0.093
■ Not clean water	0.182	0.281

**Fig. 5** Proportion of rural African households viewing water pollution as a community problem by housing type and water quality 2004

Other studies have suggested that the educational background of the respondent was an important factor in forming perceptions of the presence or absence of environmental contamination, with those having a higher level of educational attainment more likely to be aware of environmental problems (White & Hunter, 2005). Our analysis, however, indicates that educational level of the head of the household on the perception of water pollution as a problem has, at best, an inconsistent influence. As noted above, education had a negative, statistically significant relationship with the perception of water pollution as a community problem in the bivariate analysis (not shown). Households with less educated heads were more likely to perceive water pollution as a community problem. This relationship held true for all households as well as for African and non-African households looked at separately.

The results of the logistic regression analysis, however, show that the educational level of the head household is not statistically significant in explaining the perception of water pollution as a problem either for all households or for African households (Table 6). For non-African households, the educational level of the household has a moderately strong negative



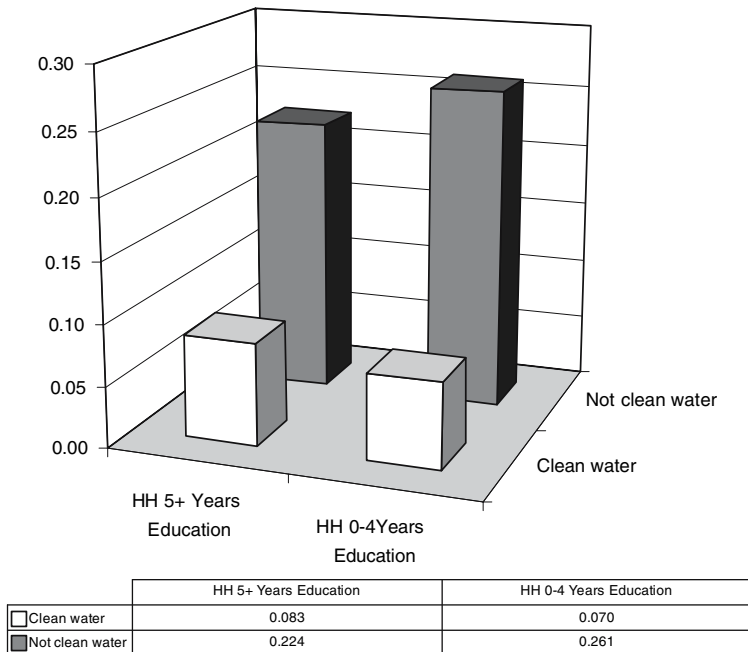
**Fig. 6** Proportion of urban African households viewing water pollution as a community problem by housing type and sanitation 2004

relationship. In these households there is a greater likelihood that water pollution was seen as an issue when the education of the household head was less than 5 years (Table 6).

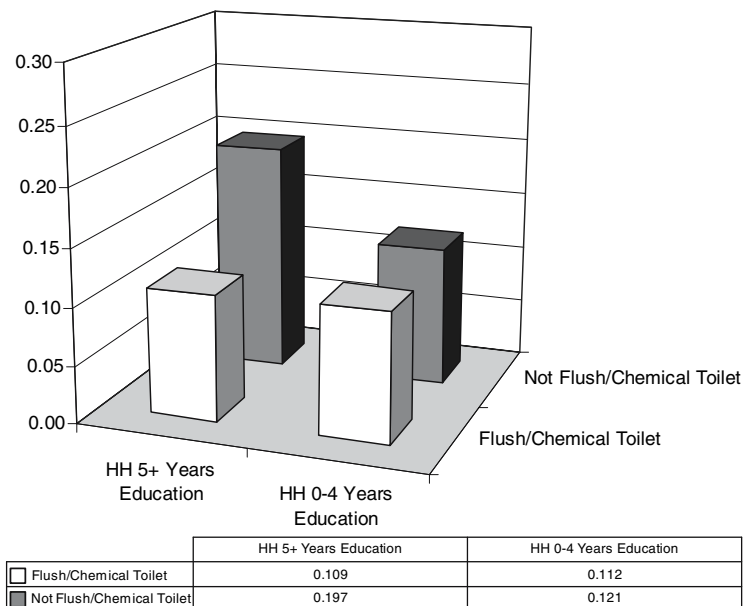
Figures 7 and 8 look at the role that the education of household head plays when associated with source of water for rural African households and type of sanitation for urban African households. Again it can be seen that this variable is of less importance in explaining the view of water pollution as a problem than is the quality of the water supply for rural African households and less important than the type of sanitation for urban African households.

### Water-related behaviors: treatment of drinking water and water for food preparation

A second question is: What is related to whether households take any action to treat their water before using it for either drinking or cooking? It is also important to determine how important perception of water pollution as a problem is in influencing whether households treat their water.



**Fig. 7** Proportion of rural African households viewing water pollution as a community problem by water quality and education of household head 2004



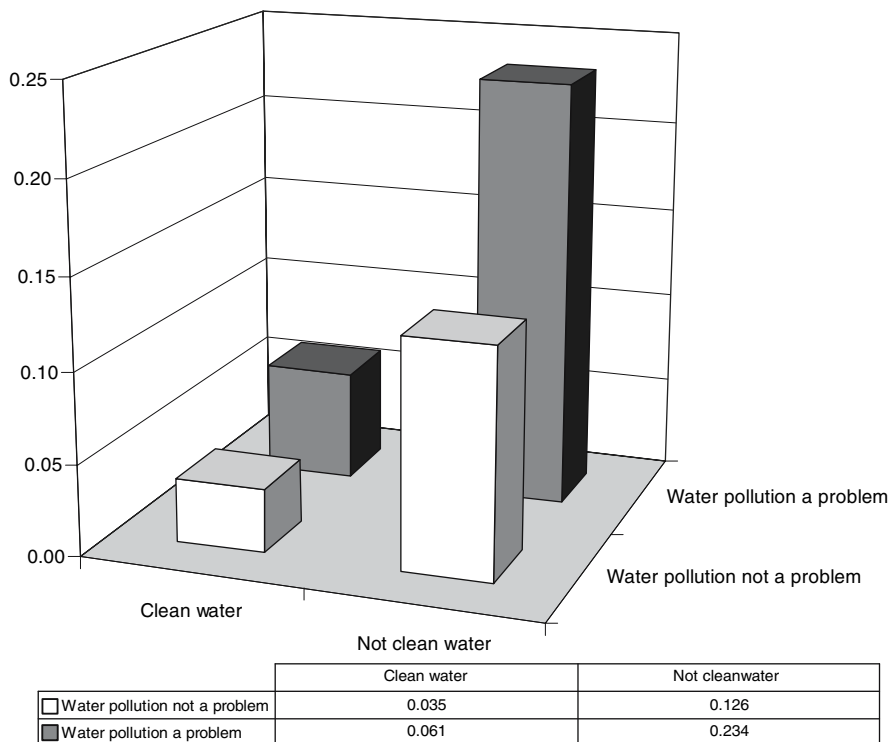
**Fig. 8** Proportion of urban African households viewing water pollution as a community problem by sanitation and education of household head

Table 6 presents analysis of these relationships using logistic regression. Perception of water pollution as a problem has a strong significant relation to treatment of water for both drinking and food preparation for all three groups considered. For all households it is more likely that water for drinking and cooking will be treated if such households lack access to clean water and do not have a flush or chemical toilet and if the head has 5 or more years of education (Table 6, Columns 2, 3). Households which exhibit these characteristics plus those who live in formal housing are also more likely to treat water for cooking, but not for drinking. While the relationship between formal housing and treatment of water for drinking is positive, it is not statistically significant. When other factors are taken into account in the logistic regression analysis, African households are significantly less likely than non-African households to treat water either for drinking or for food preparation. This is a major change from the results in the bivariate analysis (not shown) and the overall percentages treating water shown in Table 3, for which it was not significant whether a household was African or not.

The influence of these several factors on the decision to treat water by African households yields results almost identical to those for all households (Table 6, Columns 6, 7). Water is more likely to be treated for both drinking and cooking if these households lack a flush toilet, lack a clean supply of water, and whose head has 5 or more years of education. Neither urban/rural residence nor whether the housing is formal or informal are related significantly to this behavior. These findings are different from those in the bivariate analysis (not shown). In that analysis both the rural/urban factor and housing type had some influence, but that the education of head of household was not significant.

Water will be treated by non-African households (Table 6, Columns 10, 11) for both drinking and food preparation if the household lacks clean water. Also these households are more likely to treat drinking water if the head of household has 5 or more years of education. While treatment of cooking water is more likely if the non-African household is also in formal housing, treatment of cooking water is not significantly related to the educational level of the head of household. None of the other factors are statistically significant in explaining the treatment of water by the non-African households.

Figures 9 and 10 present another way of looking at the behavior of African households concerning the treatment of water. Figure 9 indicates that drinking water is more likely to be treated by African households in which water pollution is viewed as a problem and whose water supply is not clean. Another perspective is shown in Fig. 10. While a slightly larger proportion of African households whose head has 5 or more years of education are likely to treat drinking water than is the case in other households, the critical difference is whether the household has access to clean water.



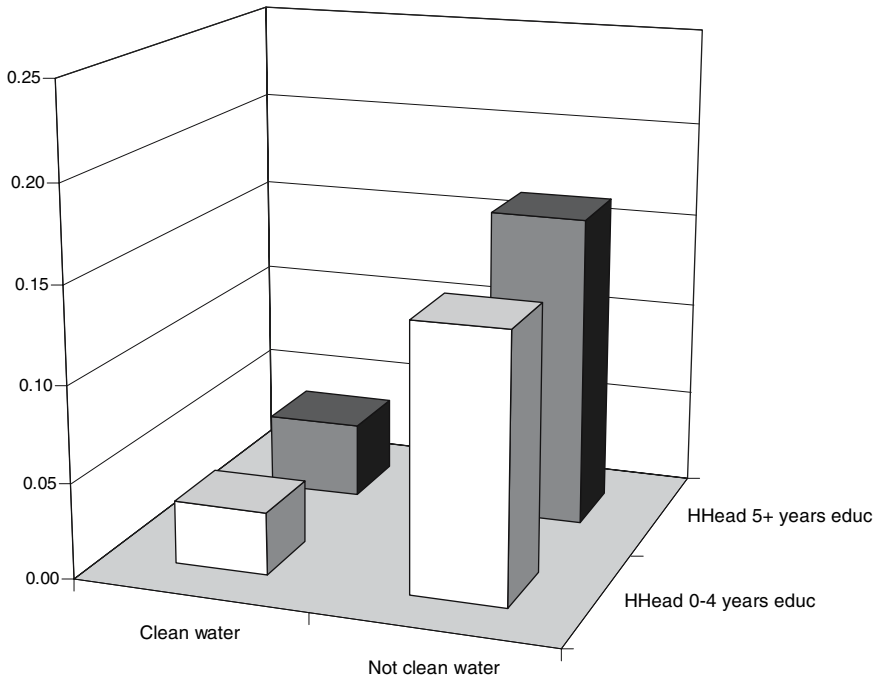
**Fig. 9** Proportion of African households who sometimes or always treat drinking water by water quality and perception of water pollution as a problem

**Awareness of the working for water programme**

Whether the household was aware of the Working for Water Programme of the Department of Water Affairs and Forestry was a specific question in the 2004 General Household Survey. Responses to that item yielded somewhat disappointing results if this endeavor is viewed as an important environmental undertaking. While 28% of non-African households had heard of the program, knowledge of the program was reported by only 7% of African households and barely 10% of all households (Table 3).

Awareness of this program for all households was significantly related to the household having access to clean water, with a flush or chemical toilet, in formal housing, and having a head with five or more years of education. Also, African households were significantly less likely to be aware of the program than non-African households, even when other household characteristics have been taken into account. There was an identical pattern of significant variables among African households. For non-African households, those with a flush or chemical toilet, without clean water, in formal housing, and whose head had 5 or more years of education were more likely to be aware of the program.

Except for the significant negative relation of clean water to awareness of the Work for Water Programme among non-Africans, the rest of the



	Clean water	Not clean water
□ HHead 0-4 years educ	0.033	0.139
■ HHead 5+ years educ	0.039	0.164

**Fig. 10** Proportion of African households who sometimes or always treat drinking water by water quality and education of household head

significant results portray awareness of this program as strongly associated to living in a relatively good environmental situation (clean water and good sanitation) and having relatively high social status (more educated household head and formal housing). Also, it is notable that even after other characteristics are taken into account, African households are significantly less likely to be aware of the program. This clearly suggests that whatever efforts have been taken to publicize the program, they have not produced any substantial level of awareness of this endeavor among Africans or among relatively disadvantaged households.

**Discussion and conclusions**

In the logistic regression analyses presented in Table 6 it can be seen that having a low SES is generally related to perceiving water pollution as a problem. Not having a flush or chemical toilet, not having clean water, and not living in formal housing are related to seeing water pollution as a problem for all three groups of households, even though the sanitation and water variables



were not statistically significant for non-African households. The education of the household head either was not significantly related or was negatively related to perception of water pollution as a problem. Thus, living in poor environmental circumstances was generally associated with the perception of an environmental problem, and it was not necessary for the household head to have a high education. These findings counter the view that perception of environmental problems is a post-materialist perspective. Rather, those most likely to be directly affected by water pollution are also most likely to see it as a problem.

Second, not having clean water was significantly related to treatment of water for all groups, and not having a flush or chemical toilet was significant for all households and for African households. The type of housing was either statistically insignificant or positively related to treating water, with those in formal housing more likely to treat water. Education of household head was positively related to treating water for all groups and was statistically significant except for treatment of water for food preparation for non-Africans. Perception of water pollution as a problem was significant for all groups. While living in poor environmental conditions overall is somewhat less important for the treatment of water than it was for perception of water pollution as a problem, it still is related to this behavior. We also see that in the presence of poor environmental conditions, especially not having clean water, the education of the household head is important in determining whether the household takes the action of treating water. Although education is not important for perception of water pollution as a problem, having a relatively well educated household head seems to empower households to take action to alleviate the problem.

For awareness of the Working for Water Programme, living in favorable environmental conditions is significantly related to awareness for all groups and, again, education of the household head is significantly related to awareness. These results are consistent with Inglehart's views of environmental awareness being a post-materialist concern. These findings are also consistent with the finding by White and Hunter (2005) that there is likely to be more awareness of environmental issues among higher SES groups.

Across perceptions, behavior and awareness, we see a changing configuration of the importance of living in poor environmental conditions and of the influence of education. It seems that the transition from perception to behavior to awareness is not automatic.

It was suggested at the beginning of this paper that given the particular situation in South Africa one might expect a higher level of awareness of environmental matters among South Africans than in populations in other parts of the world. That only slightly more than 10% of all households identified water pollution as a community problem (Table 3) challenges this assertion. Not only is the proportion of households indicating a awareness of water pollution as an issue much lower than that reported in other studies, it is also lower than that reported in Costa Rica where only 22% of the population saw environmental problems as a major concern (Holl, Daily, &

Ehrlich, 1995). Further, as reported in other studies that environmental concerns are generally not seen as among the most important issues facing a particular nation, the situation in South Africa appears to be more consistent with that elsewhere than originally anticipated (Bloom, 1995; Dunlap & Scarce, 1991; Dunlap, Gallup, & Gallup, 1993; Van Liere & Dunlap, 1980). However, it is not possible from the data available to determine if the South African population, like other populations, attaches a higher level of importance to social and political issues than to environmental concerns.

Closely related is the small proportion of households indicating knowledge of the Working for Water Programme. Only 12% of all households indicated awareness of this endeavor. A possible alternative explanation for the low level of awareness of this particular program may lie in the program's purpose and focus. While the need to clear alien vegetation from the waterways is important, what may not be clear is how this activity directly contributes to meeting the critical need for access to safe water. A recent poll by a private polling organization reported that 30% of respondents were more satisfied with the supply of clean water than some two years earlier (Markinor, 2006). While this is not a completely comparable measure of awareness, it indicates, at least in this case, where the activities are seen as contributing directly to the amelioration of a specific environmental condition of importance to the people, there is a higher level of awareness of what is going on. This suggests the need to examine further the degree to which awareness of particular environmental concerns is a function of the extent to which the issue or activity involved is seen as being of immediate concern to those whose awareness of the matter is being explored.

Although there are some similarities in perceptions and behaviors between the African and non-African households, important differences between these households in these matters exist. One explanation is to attribute these differences to race. Another explanation is that the differences are a function of the historic positions of these population groups in South Africa. The standard of living among African households is still, on the whole, significantly lower than that for non-African households. It is not clear whether, as African households acquire higher SES characteristics, their perceptions and awareness concerning environmental matters will also change. If such a shift occurs, it would mean that the proportion of African households that perceived water pollution as a problem would substantially decline. However, if as more African households enjoy a better standard of living their awareness of environmental initiatives became more like that of non-African households, then awareness of initiatives such as the Working for Water Programme should substantially increase.

An analysis of African and non-African households which simultaneously had clean water, a flush or chemical toilet, lived in formal housing and a head with 5 or more years of education showed that these households, African and non-African, were much more likely to be aware of this program than all African or non-African households shown in Table 3. Table 7 shows the percentage of all African and all non-African households with these

**Table 7** Percentage of African households and non-African households aware of the work for water initiative among those households which simultaneously have clean water, a flush or chemical toilet, a household head with 5 or more years of education and who live in formal housing

African households	11%
non-African households	30%

characteristics which were aware of the program. Shown in that table is the considerable increase in the awareness for African households (7% vs. 11%). That table also indicates that there is still a large gap in the proportions of African and non-African households with knowledge of the program. Moreover, the presence of clean water, a flush or chemical toilet, formal housing and a head with 5 or more years of education are descriptive of the conditions for 84% of all non-African households, but only for 26% of all African households.

It is not possible to make the comparison shown in Table 7 for households which lack all of the characteristics considered in that table - no clean water, no flush or chemical toilet, not living in formal housing, head of household with less than 5 years of education. Although 6% of African households live in these conditions, only .1% (8 households in the survey) of non-African households live in these conditions. In the African households with all of the advantages shown in Table 7, 11% were aware of the Work for Water Programme.

However, it needs to be noted that even when one controls for the simultaneous presence of particular conditions in a household, as done here, the percentage of non-African households with an awareness of this program is still nearly 3 times the proportion of African households with knowledge of the program (30%–11%). Perhaps even more important is the consideration that non-African households are also over 3 times (84%–26%) more likely than African households to have clean water, a flush toilet, formal housing and a head of household with 5 or more years of education. This suggests that the likelihood of a large shift in awareness of environmental initiatives resulting from changes in living standards does not appear to be immediate.

Emerging from this analysis of the relationship among perceptions, behaviors and awareness of water pollution in South Africa is a set of observations that deserve additional attention. One especially striking finding is the importance of the specific conditions in which a household finds itself in explaining particular perceptions and behaviors of that household. This is perhaps most pronounced in the existence of a strong linkage between the lack of clean water and the view of water pollution as a community issue. Where this condition exists, there is the strong probability not only that water pollution will be seen as an important question, but also that action will be taken by the household to treat water use for both drinking and cooking. This holds for all households and African households. For non-African households the same relationship is present, but not at a statistically significant level.

The importance of basic living conditions is reflected in the fact of a household being African. If a household is African, that household will not only be far more likely to identify water pollution as a community problem, but also will have little awareness of the Working for Water Programme. The factors associated with these perceptions and levels of awareness are those used to describe higher levels of living and education. More importantly this finding reflects the continuing presence for African households of conditions under which the African population lived during the apartheid regime. It suggests, as noted above, that a shift in these perceptions and awareness concerning these two environmental matters may not be as immediate as one might hope.

Thirdly there does not appear to be a high level of awareness about environmental concerns among South Africans, despite the attention given to environmental concerns in the constitution and by the current government. In this respect, the South African population does not differ significantly from those in other parts of the world. While the perceptions concerning the specifics of water pollution appear to have some consistency with that which White and Hunter (2005) found with reference to socio-economic status in Ghana, it is not clear whether similar patterns exist among South Africans when it comes to other environmental issues. An examination of these questions constitutes a next area to be explored.

**Acknowledgments** Helpful comments were provided by Pieter Kok, Louis van Tonder and Paul Mohai. The research upon which this paper was based was supported by a National Institutes of Child Health and Human Development Infrastructure Grant HD41028 to the Population Studies Center, University of Michigan, by the Human Sciences Research Council, Pretoria, South Africa, and by Statistics South Africa. Anderson and Romani were Visiting Researchers in the Urban and Rural Economic Development Research Programme at Human Sciences Research Council, and Anderson was a Visiting Analyst at Statistics South Africa when this paper was prepared.

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