



Research

CAMPFIRE and Human-Wildlife Conflicts in Local Communities Bordering Northern Gonarezhou National Park, Zimbabwe

Edson Gandiwa^{1,2}, *Ignas M.A. Heitkönig*¹, *Anne M. Lokhorst*³, *Herbert H.T. Prins*^{1,4} and *Cees Leeuwis*⁵

ABSTRACT. Human-wildlife conflicts are a global problem, and are occurring in many countries where human and wildlife requirements overlap. Conflicts are particularly common near protected areas where societal unrest is large. To ease conflict, integrated conservation and development projects (ICDPs) have been implemented. The Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) is an example of an ICDP. We hypothesized that (i) a higher perceived effectiveness of CAMPFIRE would be associated with a decline in human-wildlife conflicts, and (ii) local communities with higher perceived effectiveness of CAMPFIRE programs would have more favorable attitudes towards problematic wild animals. Four focus group discussions and interviews with 236 respondents were conducted in four local communities adjacent to northern Gonarezhou National Park, Zimbabwe from December 2010 to August 2011. Moreover, we included data on recorded incidences of human-wildlife conflicts and CAMPFIRE financial returns to study communities between 2000 and 2010. Our results indicate that local communities showed considerable differences in how CAMPFIRE effectiveness was perceived. Local communities with higher ratings of CAMPFIRE effectiveness generally perceived a decline in human-wildlife conflicts, although some people had experienced problems with wild animals. Attitudes towards main problematic wild animals varied across the study communities and were partly associated with perceived CAMPFIRE effectiveness. Our findings partly support both of our study hypotheses. Contextual factors across the four local communities seemed to influence the perceived effectiveness of CAMPFIRE programs and attitudes towards problematic wildlife species. We recommend that decisions and actions regarding the control of problem animals be devolved to the community level in order to help reduce human-wildlife conflicts in community-based natural resources management programs.

Key Words: *attitudes; benefits; human-wildlife conflicts; integrated conservation and development projects; perception; protected areas*

INTRODUCTION

Human-wildlife conflicts are a global problem, and are occurring in many countries where human and wildlife requirements overlap (Deodatus 2000, Dickman 2010, Hoffman and O'Riain 2012). Conflicts between people and wildlife are encountered by a diverse group of communities, particularly those residing close to protected areas containing large to very large herbivores (buffalo, hippopotamus, rhino, and elephant) and large carnivores (Newmark et al. 1994, Hemson et al. 2009). Human-wildlife conflicts are contentious because the resources concerned have a considerable economic value for local residents, while wildlife species have both national and international value, and are legally protected (Mayaka 2002). Human-wildlife conflicts can take various forms, including carnivores attacking and killing livestock or humans, species raiding crops, competition for game and/or resources, disease exchange between livestock and wildlife, carcass poisoning, and retaliation killing (Thirgood et al. 2005, Madden 2008). The conflict involves a variety of mammals, birds, fish, insects, and reptiles (Manfredo and Dayer 2004).

Human-wildlife conflicts have escalated because of changes in land use, arable farming, and the sedentary lifestyle of pastoralists; inadequate wildlife control; and bans on hunting of some wild animals (Prins and Grootenhuys 2000). For instance, in Africa, a large proportion of the human population is dependent on the land for their (economic) well-being. Together with the presence of many species of large mammals, this leads to a high density of conflict between people and wildlife (De Boer and Baquete 1998). This, in turn, creates friction between managers of protected areas and local communities living in regions that border these protected areas. Consequently, the resulting human-wildlife conflicts often undermine local support for conservation (e.g., Gusset et al. 2009).

Crop raiding by large herbivores and livestock depredation by carnivores can reduce tolerance toward species that are already threatened, whereas potential dangers posed by conflicts with large-bodied wild animal species may also negatively influence local attitudes towards animals (Browne-Nuñez and Jonker 2008). Perceptions about problems and attitudes

¹Resource Ecology Group, Wageningen University, Wageningen, The Netherlands, ²Scientific Services, Gonarezhou National Park, Zimbabwe Parks and Wildlife Management Authority, Chiredzi, Zimbabwe, ³Knowledge, Technology and Innovation Group, Wageningen University, Wageningen, The Netherlands, ⁴School of Life Sciences, University of Kwazulu-Natal, Westville Campus, Durban, South Africa, ⁵Communication and Innovation Studies Group, Wageningen University, Wageningen, The Netherlands

towards conservation and/or animals are likely to be influenced by social interests and experienced costs and benefits (Leeuwis and van den Ban 2004). Studies of rural communities in developing countries have found that access to conservation-related benefits and involvement of local people in decision-making for resource management can positively influence local attitudes towards wildlife, protected areas, and conservation (Gillingham and Lee 1999, Treves et al. 2009).

Biodiversity conservation has been dominated by two paradigms, namely, the protectionist approach and community conservation approach. The protectionist approach, also known as fortress conservation, involves the creation of protected areas, uses of fences and fines, exclusion of people and domestic livestock, prevention of consumptive use, and minimization of other forms of human impact to ensure the retention of pristine environments or existence of wilderness areas (Oates 1999, Terborgh 1999, Hutton et al. 2005). Historically, most protected areas have been created using the protectionist approach. The major arguments of strict protection are that protected areas are important in maintaining ecological structure and function, and that many species, especially large mammals, need extensive, undisturbed tracts of habitat to ensure their survival (Wilshusen et al. 2002). The protectionist approach has been reported to have succeeded at several places but at a high social cost and conflict, especially in developing countries (Lele et al. 2010). Thus, by the 1980s and 1990s, the protectionist approach was progressively challenged by a new community conservation approach after wide discussions were held on the negative impacts of protected areas on local people (Brechtin et al. 2002, Brockington and Schmidt-Soltau 2004). It has been reported that strict protection in some cases has failed to consider other important factors, including social, cultural, and political issues, which has resulted in difficulties in enforcing conservation policies (Andrade and Rhodes 2012). One such challenge is human-wildlife conflicts. Hence, community conservation approaches stressed the need to ensure the involvement and participation of local people in biodiversity conservation in areas with protected areas (Hutton et al. 2005, Brockington et al. 2008).

Many conservation agencies have sought to gain local support by promoting community-based conservation programs (Prins et al. 2000). These community-based conservation interventions take a variety of forms, from community outreach to integrated conservation and development projects (ICDPs) in which development and conservation goals of people living in and around protected areas, particularly in developing countries, are equally prioritized (Barrett and Arcese 1995, Romero et al. 2012). ICDPs aim to achieve medium-term solutions to local conflicts between biological conservation and natural resource use in economically poor and remote areas (Johannesen 2006). Consequently,

improving the well-being of local communities as a means to alleviate the human pressures responsible for ecosystem degradation has been a central assumption of such approaches (Barrett and Arcese 1995). Available evidence, however, suggests that ICDPs are not fully effective in protecting biodiversity due to challenges in deriving meaningful local economic benefits from protected areas that lack tourism potential, and due to the mismatch between the location of costs and benefits of conservation, illegal resource exploitation, and limitations in designs, which fail to capture the highly complex and heterogeneous characteristics of local communities and geo-political realities (Brown 2002, Garnett et al. 2007).

Sustainable development practices of ICDPs include those that provide direct incentives for conservation of biodiversity through the harvest of animal or plant resources that are dependent upon natural habitats in and/or adjacent to protected areas (Hurt and Ravn 2000). The Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) launched in Zimbabwe, on communal areas adjacent to national parks, was considered to be one of the key initiatives adopted to ensure that there was no conflict between the economic survival of agricultural communities and the foraging needs of wildlife (Wolmer et al. 2004) while generating benefits, promoting conservation, and empowering local communities (Child 2000, Murphree 2009). The CAMPFIRE concept was instrumental in instilling pride and conservation on communally owned lands in Zimbabwe (Heitkönig and Prins 2009) while at the same time creating opportunities for employment and infrastructural development (Mutandwa and Gadzirayi 2007).

Previous studies have reported that successful or effective community-based natural resources management programs, such as CAMPFIRE, would be associated with reduced human-wildlife conflicts as a result of (i) the devolution of wildlife management to local people; (ii) a high response to incidences of human-wildlife conflicts, which would mitigate wildlife-induced damages in the community; and (iii) the high education and environmental awareness of local people on how to minimize risk or damage from wild animals (e.g., Woodroffe et al. 2005, Mapedza and Bond 2006). However, in certain cases where human-wildlife conflicts were on the rise due to increasing animal populations and unsatisfactory response by responsible authorities, human-wildlife conflicts have been reported as undermining what have been, to date, quite successful CAMPFIRE programs (Mutandwa and Gadzirayi 2007), given that the *Parks and Wildlife Act* of 1975, Zimbabwe, does not have provisions for direct compensation for losses from wildlife. Therefore, increases in wildlife populations, particularly large herbivores and carnivores, as a result of conservation programs have been reported to result in increased human-wildlife conflicts (Le Bel et al. 2011). Human population increases adjacent to protected areas and

the resultant encroachments into protected areas, and increasing livestock populations have also been reported to result in increases in human-wildlife conflicts (Lamarque et al. 2009). Furthermore, political instability and land reforms in some wildlife areas have been linked to increases in human-wildlife conflicts (Le Bel et al. 2011).

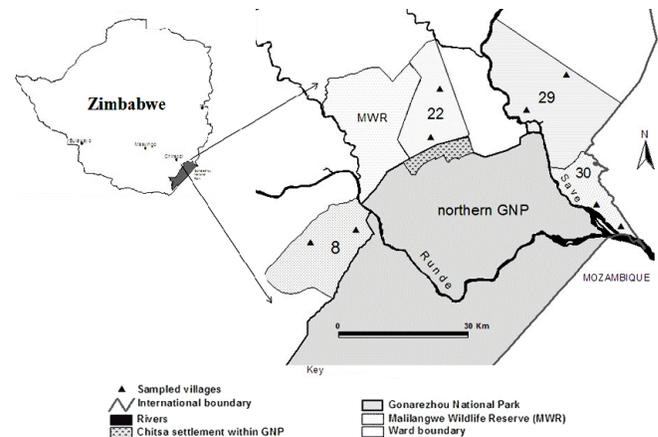
To date, there has been little research on human-wildlife conflicts that takes into consideration the effectiveness of CAMPFIRE programs (Mutandwa and Gadzirayi 2007). We focus on how effective the CAMPFIRE program is in the eyes of its participants, how this relates to perceived human-wildlife conflicts, and what are the resultant attitudes towards wild animals. The objectives of this study were to (i) describe the local people's views on the effectiveness of CAMPFIRE programs, (ii) explore the experienced conflicts with wildlife and perceived trends in human-wildlife conflicts, and (iii) determine attitudes of local people towards main problematic wild animals in communities with CAMPFIRE programs. We expected that perceptions of local people on the effectiveness of CAMPFIRE programs, human-wildlife conflicts, and attitude towards problematic wild animals would generally vary across the study communities due to the contextual differences among communities. More specifically, we hypothesized that (i) a higher perceived effectiveness of CAMPFIRE would be associated with a decline in human-wildlife conflicts, and (ii) local communities with higher perceived effectiveness of CAMPFIRE programs would have more favorable attitudes towards problematic wild animals.

METHODS

Study area

We focused on the northern Gonarezhou National Park (GNP) and four adjacent local communities that were implementing CAMPFIRE programs in southern Zimbabwe. The study area was selected based on (i) the existence of local communities with a diverse CAMPFIRE history that were adjacent to a large and unfenced state protected area (national park), and (ii) the existence of a protected area with a high diversity of large carnivores and herbivores. The GNP was established as a game reserve in the early 1930s but was upgraded to a national park in 1975 under the *Parks and Wild Life Act* of 1975. The GNP and surrounding areas have been part of the Great Limpopo Transfrontier Conservation Area since 2000. The GNP covers an area of ~5000 km², and is located between 21° 00'–22° 15' S and 30° 15'–32° 30' E. Four local communities adjacent to the northern GNP, namely Chibwedziva and Chizvirizvi in the Chiredzi district, and Mahenye and Mtandahwe in the Chipinge district, were selected (Fig. 1). Within the four selected communities, eight study villages out of 82 villages were randomly selected for data collection (Table 1). Within the eight villages, we controlled for the same culture, language, and economic development.

Fig. 1. Location of the four study communities adjacent to the northern Gonarezhou National Park (GNP), southeastern Zimbabwe. 8–Chibwedziva, 22–Chizvirizvi, 29–Mtandahwe, 30–Mahenye.



The study area lies in a semi-arid savanna ecosystem and supports a wide variety of large herbivore species, including elephant (*Loxodonta africana*), hippopotamus (*Hippopotamus amphibius*), buffalo (*Syncerus caffer*), giraffe (*Giraffa camelopardalis*), plains zebra (*Equus quagga*), waterbuck (*Kobus ellipsiprymnus*), and wildebeest (*Connochaetes taurinus*). The GNP also has a variety of large carnivores, including lion (*Panthera leo*), leopard (*Panthera pardus*), and spotted hyena (*Crocuta crocuta*). Local residents in communities adjacent to the GNP practice a combination of subsistence, cash crop farming, and livestock production (Hlambela and Kozanayi 2005). The main crops include sorghum (*Sorghum bicolor*) and maize (*Zea mays*), grown for both subsistence utilization and commercial sale, and cotton (*Gossypium* spp.), specifically grown for commercial sale. Livestock include cattle (*Bos taurus*), goats (*Capra hircus*), sheep (*Ovis aries*), donkeys (*Equus asinus*), and poultry. The dominant ethnic group in the study area is Shangaan.

Administrative structure of CAMPFIRE

CAMPFIRE is a government initiative that was designed specifically to stimulate long-term development, management, and sustainable use of natural resources in Zimbabwe's communal farming areas (Martin 1986). Communal areas in Zimbabwe are divided into administrative units of villages. Six or seven villages make a ward or community (Madzudzo 1997). The philosophy of CAMPFIRE initiatives is that local communities need to realize commercial benefits in order to sustainably manage local natural resources (Mapedza 2009). This philosophy attempts to link the costs of managing the resource with the benefits derived from the natural resource. CAMPFIRE has been operating in Zimbabwe since 1989, and

Table 1. General characteristics of the four study communities adjacent to the northern Gonarezhou National Park (GNP), Zimbabwe. Source: Hlambela and Kozanayi (2005), Mashinya (2007), Dunham et al. (2010).

Attributes	Community			
	Chibwedziva	Chizvirizvi	Mtandahwe	Mahenye
District	Chiredzi	Chiredzi	Chipinge	Chipinge
Ward number	8	22	29	30
Land status	Communal area	Resettlement area	Communal area	Communal area
Location	Northwest of the GNP	Northwest of the GNP	North of the GNP	North of the GNP
Area (km ²)	350	250	500	200
Human population	11,300	3,000	11,400	3,500
Chief	Chief Sengwe	Chief Tshovani	Chief Garahwa	Chief Mahenye
Elephant density (km ⁻²) in the area bordering GNP	2.4	2.2	2.2	2.2
Appropriate authority granted	1993	2003	1991	1991
CAMPFIRE tourism infrastructure	No hotel/lodges	No hotel/lodges	No hotel/lodges	Hotel/lodges
Study villages	Chihosi and Chipachani	Village 5 and Village 6	Maparadze and Matunga	Mudavanhu and Tongogara A

has largely been restricted to buffer zones adjacent to national parks (Logan and Moseley 2002). CAMPFIRE programs went through a period of intense development during the 1990s and have inevitably suffered from the recent crisis in the country; however, in that first decade, there were some important signs of success but also some considerable difficulties (Fischer et al. 2011). Between 1989 and 2003, the CAMPFIRE program was funded by numerous international donors, in particular, the United States Agency for International Development (Mapedza 2009). Funding for CAMPFIRE programs was withdrawn after 2002 following the fast track land reform processes, and this led to local communities relying on money raised from wildlife-based projects in their communities; hence, the decline in benefits accrued (Balint and Mashinya 2006).

In terms of the *Parks and Wild Life Act* of 1975 and amendment of 1982, appropriate authority for the management of wildlife resources in Zimbabwe is conferred to the landowner or occupier of land. Hence, for Chizvirizvi, the appropriate authority for the utilization and management of wildlife was conferred to the community or collective resettlement scheme plot holders in the same way that commercial farmers were granted appropriate authority for their properties. However, in the case of the other three communal areas, appropriate authority for the management of wildlife was conferred to the Rural District Councils (RDCs). The RDCs link with the national government through the provincial government. Most RDCs have entered into contractual arrangements with safari operators who bring hunting clients into CAMPFIRE areas. Revenue generated from wildlife, mainly from safari hunting, is generally distributed as follows: 15% to council as a levy, 35% to council for project management, and 50% to CAMPFIRE communities (Madzudzo 1997). Safari operators pay the hunting fees to the RDCs, and the RDCs then pass on the community proportion to producer communities through the local CAMPFIRE committees (Mapedza 2009, Taylor

2009). A local CAMPFIRE committee is chaired by an elected chairman, and the committee decides on how the revenues are used in consultation with the local people. However, in some communities, the revenues from wildlife are not large enough to be shared as household dividends (Madzudzo 1997).

Data collection

Effectiveness of CAMPFIRE programs

Data on the perceived success or performance of CAMPFIRE programs in four study communities were gathered through focus group discussions that followed standard procedures (Krueger and Casey 2000). Four semi-structured focus group sessions with residents of Chibwedziva, Chizvirizvi, Mahenye, and Mtandahwe communities were conducted between April and August 2011. Discussants for each focus group in the four study communities were selected from two randomly selected study villages per community (Table 1). In each of the four study communities, a simple random sample of 14 local residents was drawn from a large pool of 114 respondents who had participated in an earlier survey on perceptions of illegal hunting (Gandiwa 2011). The 114 respondents were randomly selected by picking numbers from a hat; the numbers corresponded to the households from each of the eight study village registers. Each focus group discussion involved 15 people, including one CAMPFIRE representative, per community, giving a total of 60 participants: 37 men and 23 women. CAMPFIRE secretaries of the four study communities were selected for the focus group discussions because they had good knowledge of CAMPFIRE projects. The CAMPFIRE secretaries contributed to the discussions in two ways: (i) by giving general inputs as the other discussants, and (ii) by answering any specific questions about CAMPFIRE. All participants were guaranteed confidentiality. A focus group discussion guide was developed for use by the focus group facilitator, the first author, and included questions designed to gather the ratings of indicators

of the CAMPFIRE programs' success or performance and responses to human-wildlife conflicts by responsible authorities in the four communities between 2000 and 2010, except for Chizvirizvi, which implemented the CAMPFIRE program only in 2004. Discussions were led by the focus group facilitator and supported by a local research assistant. The local research assistant's task was to translate Shangaan into English in cases where the participant(s) discussed in Shangaan.

We specifically addressed seven topics: (i) cash dividends received by local people, (ii) employment opportunities under CAMPFIRE, (iii) infrastructure developments under CAMPFIRE, (iv) involvement of local residents in decision-making in CAMPFIRE projects, (v) anti-poaching activities by CAMPFIRE resource monitors, (vi) conservation awareness and education activities, and (vii) local peoples' satisfaction with responses to human-wildlife conflicts by responsible authorities. After a general group discussion on each of the seven topics on CAMPFIRE effectiveness indicators, each discussant was asked to give a rating, independent of other discussants, on a data sheet in the four communities using a five-point Likert scale (1: strongly unfavorable to 5: strongly favorable). Focus group discussions were conducted during weekdays at appropriate venues in the four communities. Focus group sessions took on average 2.2 hrs to complete (range: 1.4–2.5 hrs).

Experiences with human-wildlife conflicts and attitudes towards problematic animals

Surveys involving a sample of 236 households that were randomly drawn from each of the eight villages in northern GNP were conducted from December 2010 to May 2011 to gather data on local peoples' experiences with human-wildlife conflicts, perceived trends in human-wildlife conflicts, and attitudes towards problematic wild animals. Data were collected from respondents using semi-structured interviews. Current village registers of the eight study villages formed the sampling pool, and households were randomly selected by picking numbers from a hat; the numbers corresponded to the households from each study village register. The household heads were targeted as the respondents. In case of their absence, their wives or another permanent resident adult (≥ 18 years) in the households took part in the interview in his/her residence. The total sample of 236 local residents was comprised of 145 (61%) men and 91 (39%) women. Interviews were conducted conditionally upon the individual's willingness to fully participate.

Pre-testing was conducted in a village in the Chitsa community, outside of the study communities to ensure that all questions were clear, and a final version was prepared for sampling. Questions were constructed to seek information on respondents' perceptions of human-wildlife conflicts and their attitudes towards problematic wild animal species. Human-wildlife conflicts were measured in two ways: (i) actual

problems encountered, and (ii) whether respondents perceived that conflicts had increased, decreased, or remained the same between 2000 and 2010. Attitudes towards problematic animals were measured using sentences containing the following construct statement: "Do you 'dislike' the following animals...?" (Browne-Núñez and Jonker 2008). Both closed and open questions were included to allow for in-depth discussions of some of the issues raised (Table 2). The wording and ordering of the questions were also carefully thought out to avoid asking leading questions and/or directing the respondent towards particular responses to later questions.

Table 2. Selected survey questions and types of answers.

Questions	Options provided
Did you and your family have problems with wild animals in your village between 2000 and 2010?	Yes/no
In your opinion, have human-wildlife conflicts within the community increased, decreased, or remained the same between 2000 and 2010?	Increased/decreased/ remained the same
What explains this increase or decrease or no change in conflicts?	Open
What do you do when there are conflicts with wildlife in your village?	Report/no action/ personal action (e.g., poison, hunt, scare away)
What are the explanations for action you take in cases of conflicts?	Open
Do you dislike each of these five common problematic wild animal species? (elephant, hippopotamus, lion, leopard, and spotted hyena)	Yes/no
Why do you dislike these animals?	Open

Interview dates were communicated to each selected household one or two days in advance. Upon arrival in each village, a senior member of the village leadership was located, and permission to conduct interviews was sought. Before conducting the interviews, the general purpose of the study was explained. Interviews were conducted with the help of one local research assistant who was conversant in Shangaan language. The local research assistant had completed secondary school education. To ensure that the information asked was accurate, consistently phrased, and presented in the same way from one interviewee to another, a semi-structured interview guide was used to discuss each question with the local research assistant to ascertain the question's meaning and wording. Interviews took approximately 45–75 minutes to complete. Moreover, data on reported incidences of human-wildlife conflicts and revenue received from CAMPFIRE between 2000 and 2010 were collected from Chiredzi Rural District Council (Chibwedziva), CAMPFIRE committees (Mahenye and Mtandahwe), and Lowveld Hunters databases (Chizvirizvi).

Table 3. Indicators of success or performance of CAMPFIRE programs in four study communities adjacent to the northern Gonarezhou National Park, Zimbabwe, 2000–2010 (except for Chizvirizvi, which started in 2004 after being granted appropriate authority in 2003). Values are the mode, and range in parenthesis. Rating scale: 1 = strongly unfavorable, 2 = unfavorable; 3 = neutral; 4 = favorable; 5 = strongly favorable; *N*: sample size; *df*: degrees of freedom. Values with different superscript letters within rows differ significantly (Kruskal-Wallis test specific comparisons; $P < 0.05$).

Indicator variable	Community				<i>N</i>	<i>df</i>	Kruskal-Wallis χ^2	<i>P</i> value
	Chibwedziva	Chizvirizvi	Mtandahwe	Mahenye				
Involvement of local people in decision-making under CAMPFIRE	3 (2) ^a	2 (3) ^a	4 (2) ^b	5 (2) ^c	60	3	28.92	< 0.0001
Infrastructure (CAMPFIRE related)	3 (2) ^a	2 (1) ^b	3 (2) ^a	5 (1) ^c	60	3	39.59	< 0.0001
Anti-poaching patrols by resource monitors	4 (2) ^a	1 (1) ^b	3 (2) ^c	4 (1) ^a	60	3	42.19	< 0.0001
Conservation awareness and education	4 (2) ^a	2 (2) ^b	3 (2) ^a	5 (2) ^c	60	3	36.62	< 0.0001
Employment opportunities	3 (2) ^a	1 (1) ^b	3 (3) ^a	4 (1) ^c	60	3	38.75	< 0.0001
Cash dividends	3 (2) ^a	2 (2) ^a	2 (2) ^a	4 (2) ^b	60	3	29.86	< 0.0001
Response to conflicts by responsible authorities (e.g., shooting of problem animals)	2 (2) ^a	2 (2) ^a	2 (2) ^a	2 (2) ^a	60	3	3.39	0.642
Overall	3 (2)	2 (1)	3 (2)	4 (3)	–	–	–	–

Data analysis

Descriptive statistics were used to summarize the property of the focus group discussion and interview response data. The mode as a measure for central tendency and the range to represent the variability in response data were computed for each indicator of CAMPFIRE effectiveness for the four communities based on the discussants' ratings in the focus groups. The Kruskal-Wallis test was used to compare ratings of the CAMPFIRE programs' effectiveness across the four communities. We used Chi-square homogeneity tests to determine whether perceptions of experienced conflicts with wildlife, trends in human-wildlife conflicts, measures taken in cases of conflict with wildlife, and attitudes towards problematic animal species were different across the four study communities. Significant differences between community proportions were further tested by the normal deviate (*Z*) test. Furthermore, we used one-tailed Kendall's tau correlation tests to determine the relationship between the focus group discussants' ratings of indicators of CAMPFIRE effectiveness and perceived trends in human-wildlife conflicts and attitudes towards problematic animal species. Kendall's tau correlation tests are best suited for ordered categorical data (Kendall 1945). A *P* value < 0.05 was deemed significant. Data on human-wildlife conflicts were analyzed using two methods. First, the total number of reported incidences of human-wildlife conflicts for each year between 2000 and 2010 was regressed against the year to determine the trends in human-wildlife conflicts, i.e., increased, decreased, or remained the same. Second, data on the wild animals involved in the human-wildlife conflicts were compared across the four study communities. Moreover, data on revenue received from CAMPFIRE programs by the four communities were analyzed to show the patterns between 2000 and 2010. All analyses were conducted using the Statistical Package for Social Sciences (SPSS version 19, Chicago, USA).

RESULTS

Perceived effectiveness of CAMPFIRE programs

Mahenye had fairly high ratings (CAMPFIRE positive) for all indicators of CAMPFIRE effectiveness, followed by Mtandahwe and Chibwedziva, which could be labeled "CAMPFIRE neutral". In contrast, Chizvirizvi had the lowest ratings for indicators of CAMPFIRE effectiveness (CAMPFIRE negative) (Table 3). Ratings for involvement of local people in decision-making related to CAMPFIRE programs, CAMPFIRE-related infrastructural development, anti-poaching by CAMPFIRE resource monitors, conservation awareness and education, employment opportunities related to CAMPFIRE, and cash dividends received under CAMPFIRE differed significantly across the four communities (Table 3). Discussants from the four local communities indicated that cash dividends had declined by 75% to 85% since 2000, which was attributed to high inflation in Zimbabwe. In contrast, only ratings on response to conflicts by responsible authorities, for example, shooting of problem animals, did not differ significantly across the four communities (Table 3), which indicated that there was a need to improve the response mechanisms for dealing with incidences of human-wildlife conflicts.

Experienced conflicts and perceived trends in human-wildlife conflicts

About 85% of the respondents reported that they had experienced conflicts with wildlife, whereas 15% reported that they had not experienced conflicts with wildlife between 2000 and 2010. The proportion of respondents who had experienced conflicts with wildlife was significantly different across the four communities (Table 4). Approximately 72% of the respondents perceived that conflicts with wildlife had increased, whereas 17% and 11% of the respondents perceived that conflicts with wildlife had decreased or remained the

Table 4. Differences and similarities in opinions regarding human-wildlife conflicts in communities adjacent to the northern Gonarezhou National Park, Zimbabwe. Values are number of respondents, and percentages in parentheses; *N*: sample size; *df*: degrees of freedom. Values with different superscript letters within rows differ significantly (*Z* tests, $P < 0.05$).

Attribute	Responses	Community				<i>N</i>	<i>df</i>	Chi-square (χ^2)	<i>P</i> value	Overall
		Chibwedziva	Chizvirizvi	Mtandahwe	Mahenye					
Experienced conflict with wildlife, 2000–2010	Yes	60 (100) ^a	47 (77) ^b	42 (74) ^b	51 (85) ^b	236	3	16.59	< 0.001	200 (85)
	No	0 (0) ^a	14 (23) ^b	13 (24) ^b	9 (15) ^b					
Perceived trend in human-wildlife conflicts, 2000–2010	Increased	58 (97) ^a	44 (72) ^b	32 (58) ^b	36 (60) ^b	236	6	29.87	< 0.0001	170 (72)
	Decreased	0 (0) ^a	9 (15) ^b	15 (27) ^b	17 (28) ^b					
	No change	2 (3) ^a	8 (13) ^b	8 (15) ^b	7 (12) ^b					
	Report	33 (55) ^a	40 (66) ^a	39 (71) ^a	35 (58) ^a					
Measures taken	No action	22 (37) ^a	15 (24) ^a	6 (11) ^a	17 (28) ^a	236	6	11.85	0.065	60 (26)
	Personal response	5 (8) ^a	6 (10) ^a	10 (18) ^a	8 (14) ^a					

same, respectively, between 2000 and 2010. The proportion of responses on perceptions of human-wildlife conflict trends between 2000 and 2010 differed significantly across the four communities (Table 4).

The overall increase in human-wildlife conflicts was largely associated with increases in crop damage and livestock depredation by large carnivores across the four communities. This was mentioned by many respondents across the communities, as follows: Chibwedziva ($n = 56$, 93%), Chizvirizvi ($n = 47$, 77%), Mtandahwe ($n = 36$, 65%), and Mahenye ($n = 41$, 68%) communities ($\chi^2 = 4.97$, $df = 3$, $P = 0.174$). Only a small proportion of respondents from Mtandahwe ($n = 5$, 9%) and Chizvirizvi ($n = 3$, 5%) indicated that increased protection of wildlife had led to an increase in wildlife numbers, hence, the increase in human-wildlife conflicts in adjacent areas. However, the perceived decline in human-wildlife conflicts that was indicated by some respondents from Mahenye ($n = 6$, 10%) was attributed to shooting of problem animals. Respondents from Mtandahwe ($n = 6$, 11%) attributed the perceived decline in human-wildlife conflicts to illegal killing of animals in the community.

Approximately 62% of the respondents indicated that they reported incidences of human-wildlife conflicts to responsible authorities, whereas 26% and 12% of the respondents reported that they took no action since they did not know what to do in cases of human-wildlife conflicts. The remaining 12% of the respondents reported that they took some personal actions, such as scaring away animals or poisoning or illegally hunting the animals when there were incidences of human-wildlife conflicts due to no responses or delayed action from the responsible authorities. The proportion of responses on actions taken in cases of human-wildlife conflicts was similar across the four communities (Table 4).

Relationship between indicators of CAMPFIRE effectiveness and perceived trends in human-wildlife conflicts

We found a trend of lower perceived increase in human-wildlife conflicts with higher and favorable rating of involvement of local people in decision-making related to CAMPFIRE programs (Kendall's tau-b = -0.33 , $P = 0.048$). In contrast, there were no significant correlations between trends in human-wildlife conflicts and ratings for (i) conservation awareness and education, (ii) anti-poaching activities, (iii) cash dividends, (iv) employment opportunities, (v) CAMPFIRE-related infrastructure, and (vi) response to human-wildlife conflicts by responsible authorities (all, Kendall's tau-b, $P > 0.05$). So, it appears that perceived declines in human-wildlife conflicts only partly go hand-in-hand with a higher perceived effectiveness of the CAMPFIRE program.

Attitudes towards common problematic wild animal species

The proportion of responses on lions and hippopotamus being disliked did not differ significantly across the four communities. In contrast, the proportion of responses for those who disliked spotted hyena, leopard, and elephant varied across the four communities (Table 5). The respondents from all four communities gave three reasons why they disliked the five problematic animals, namely livestock depredation by large carnivores ($n = 150$, 64%), crop damage mostly by elephants and hippopotamus ($n = 134$, 57%), and the five animal species were seen as dangerous to human life ($n = 95$, 40%). Reasons why respondents disliked the problematic animals did not differ significantly across the study communities. Compared to other communities, Chibwedziwa had the highest dislike of problematic wild animals, whereas Mtandahwe had the least dislike of problematic wild animals. The dislike of lion was negatively correlated with a high rating

Table 5. Differences and similarities among the four communities on the disliked animal species. Values are number of respondents, and percentages in parentheses; *N*: sample size; *df*: degrees of freedom. Total percentage exceeds 100 for each community because the respondents were allowed to give multiple answers. Values with different superscript letters within rows differ significantly (Z tests; $P < 0.05$).

Common name	Community				<i>N</i>	<i>df</i>	Chi-square (χ^2)	<i>P</i> value	Overall
	Chibwedziva	Chizvirizvi	Mtandahwe	Mahenye					
Lion	37 (62) ^a	48 (79) ^a	42 (76) ^a	37 (62) ^a	236	3	7.12	0.068	164 (70)
Spotted hyena	49 (82) ^a	43 (70) ^a	32 (58) ^b	34 (57) ^b	236	3	11.00	0.012	158 (67)
Elephant	45 (74) ^a	27 (45) ^b	15 (27) ^c	37 (62) ^a	236	3	28.48	< 0.0001	124 (52)
Leopard	36 (60) ^a	29 (48) ^a	14 (25) ^b	16 (27) ^b	236	3	20.69	< 0.0001	95 (40)
Hippopotamus	14 (22) ^a	11 (18) ^a	7 (13) ^a	8 (13) ^a	236	3	1.89	0.595	40 (17)

of conservation awareness and education (Kendall's tau-b = -0.91, $P = 0.035$). In contrast, elephant, hippopotamus, leopard, and spotted hyena were not significantly correlated with any of the measured ratings of CAMPFIRE effectiveness.

Trends in human-wildlife conflicts and CAMPFIRE revenues

Trends in recorded human-wildlife conflict incidences in the study communities between 2000 and 2010 are shown in Fig. 2. Overall, there was a nonsignificant increase in reported incidences of human-wildlife conflicts in Chibwedziva ($t = 1.26$, β (slope) = 0.39, 95% Confidence Limits (CL) of slope = -0.17 to 0.61, $P = 0.240$), Mtandahwe ($t = 0.90$, $\beta = 0.29$, 95% CL of slope = -0.31 to 0.71, $P = 0.393$), and Mahenye ($t = 1.26$, $\beta = 0.43$, 95% CL of slope = -0.12 to 0.40, $P = 0.249$). Further, a total of 10 animal species was recorded to have been involved in human-wildlife conflicts in the four communities (Table 6). Mahenye had the highest number of problem animal species, followed by Chibwedziva and Mtandahwe, whereas Chizvirizvi had the least number of recorded problem animal species. Five additional species, namely baboon, buffalo, bushpig, crocodile, and warthog, were recorded as having also been involved in human-wildlife conflicts, mostly in Mahenye, Chibwedziva, and Mtandahwe communities.

Moreover, there were variations in revenue received by the four study communities under CAMPFIRE between 2000 and 2010 (Table 7). Chibwedziva recorded an increase in revenue between 2000 and 2001, but revenue declined in 2002, 2003, 2005, 2007, and 2008. A peak of more than US\$109,000 was recorded in 2001, whereas the lowest figure of US\$2 was recorded in 2008 by Chibwedziva. Chizvirizvi recorded low revenues in 2004 and 2005, but a peak of US\$16,225 was recorded in 2009. Mtandahwe recorded an increase in revenue between 2000 and 2002, which was followed by a decline in revenue between 2003 and 2005. In contrast, revenue received by Mtandahwe increased between 2006 and 2010, and peaked at US\$16,000 in 2010. Mahenye had a peak of more than US\$109,000 in 2002, which was followed by a huge decline in revenue between 2004 and 2007. However, revenue received by Mahenye increased in 2009 and 2010.

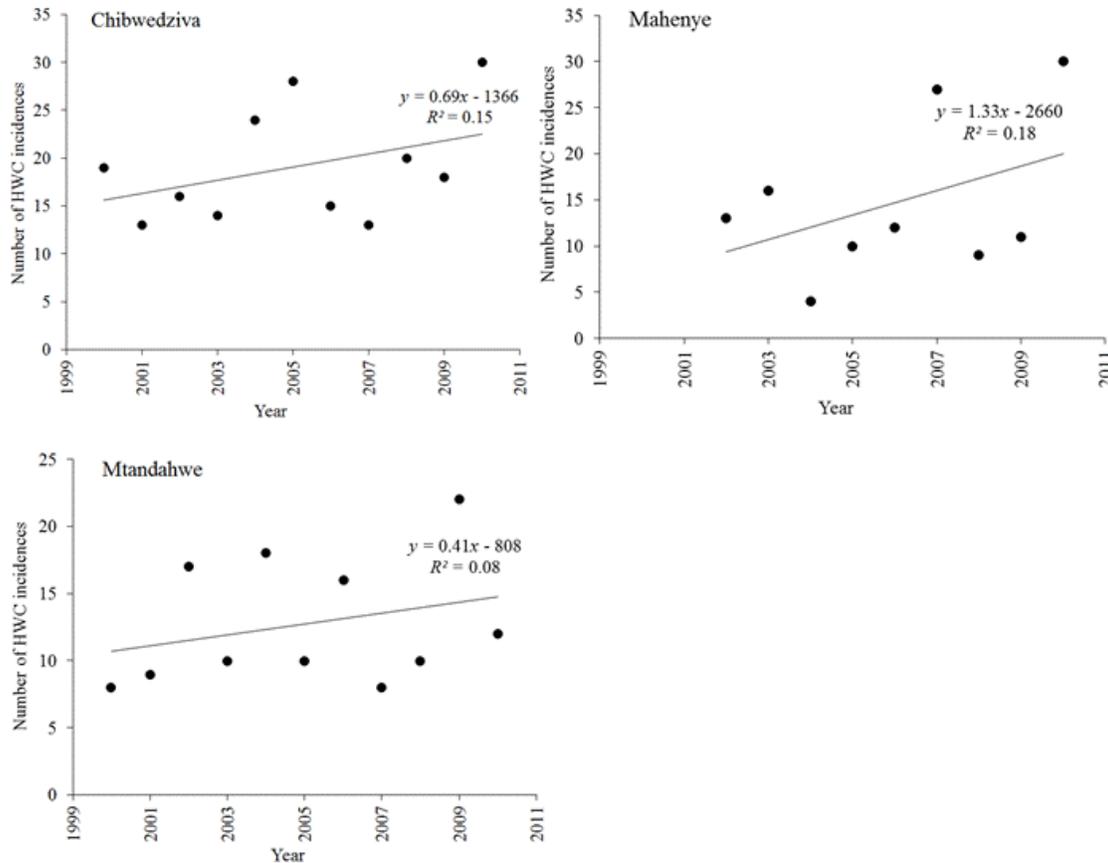
Table 6. Animal species that were recorded as being involved in human-wildlife conflicts in the four study communities adjacent to the northern Gonarezhou National Park, Zimbabwe between 2000 and 2010. X = recorded to have been involved in conflict with local communities.

Common name	Scientific name	Chibwedziva	Chizvirizvi	Mtandahwe	Mahenye
Baboon	<i>Papio ursinus</i>			X	X
Buffalo	<i>Syncerus caffer</i>	X			X
Bushpig	<i>Potamochoerus larvatus</i>				X
Crocodile	<i>Crocodylus niloticus</i>	X		X	X
Elephant	<i>Loxodonta africana</i>	X	X	X	X
Hippopotamus	<i>Hippopotamus amphibius</i>	X		X	X
Leopard	<i>Panthera pardus</i>	X	X	X	X
Lion	<i>Panthera leo</i>	X	X	X	X
Spotted hyena	<i>Crocuta crocuta</i>	X	X	X	X
Warthog	<i>Phacochoerus africanus</i>				X

DISCUSSION

Living in close proximity to protected areas imposes costs such as damage to or loss of crops and livestock, and occasionally injury or death of local people (Deodatus 2000, Woodroffe et al. 2005). These costs increase as conservation efforts lead to the recovery of animal populations, and as human population growth leads to an increase in the proportion of land outside the parks that is used for agriculture (Richardson et al. 2012). Our results show that human-wildlife conflicts were perceived to be prevalent in the study area between 2000 and 2010. Conflicts with wildlife over crops, livestock, and human safety issues were reported in all four local communities, irrespective of the perceived level of CAMPFIRE effectiveness. In concert with scientific studies conducted in the GNP (Dunham et al. 2010, Gandiwa 2012, Gandiwa et al. 2013), local residents asserted that some populations of large herbivores and carnivores, particularly

Fig. 2. Trends in recorded human-wildlife conflict (HWC) incidences in communities adjacent to the northern Gonarezhou National Park, Zimbabwe between 2000 and 2010. Human-wildlife conflict incidences data for Chizvirizvi were unavailable.



elephants, spotted hyena, and lions, had increased. These assertions were based largely on recorded increases in crop damage and livestock depredation by large carnivores between 2000 and 2010. However, we recorded a nonsignificant increase in the number of human-wildlife conflict incidences in the study communities. This nonsignificant trend could be a result of some local people not reporting incidences of conflict with wildlife. Our results show that most indicators of CAMPFIRE effectiveness were not associated with a decline in experienced human-wildlife conflicts. However, involvement of local people in decision-making was indeed positively correlated with a lower perceived increase in human-wildlife conflict, even though a higher proportion of residents had experienced problems with animals. Elsewhere, in Masoka, northern Zimbabwe (Matzke and Nabane 1996) and Tsholotsho District near Hwange National Park, western Zimbabwe (Vorlaufer 2002), fences had to be erected between wildlife areas and villages as a way of minimizing human-wildlife conflicts. Human-wildlife conflicts have been reported to be prevalent in several community-based natural

resources management programs, for example, in Botswana (Mbaiwa 2005) and Zambia (Richardson et al. 2012).

Our study findings show that there are differences and similarities in effectiveness of CAMPFIRE programs across the four study communities. Contextual factors across the four communities seem to influence the perceived effectiveness of CAMPFIRE programs. Further investigation revealed that Mahenye, which had the highest ratings for indicators of CAMPFIRE effectiveness despite the decline in Zimbabwe's economy since 2000, was among the first communities in Zimbabwe to implement community-based natural resources management projects before the official launch of the CAMPFIRE program in 1989. Conservation projects in Mahenye started in 1982, and this resulted in the community developing several income-generating projects, including a high-end tourism lodge, which created more employment opportunities, a well-structured anti-poaching team, and awareness and education programs (Chigwenya and Chifamba 2010).

Table 7. Revenue received by Chibwedziva, Chizvirizvi, Mahenye, and Mtandahwe CAMPFIRE communities from the Rural District Councils and safari operator between 2000 and 2010. Source: Chiredzi Rural District Council, Mahenye and Mtandahwe CAMPFIRE committees, and Lowveld Hunters databases. Z\$: Zimbabwean dollar; US\$: United States dollar; n/a: not applicable; -: unavailable. Revenue (US\$) is based on the official exchange rates from Wikipedia (http://en.wikipedia.org/wiki/Zimbabwean_dollar). The Zimbabwean dollar was abandoned as an official currency in 2009.

Year	Chibwedziva		Chizvirizvi		Mtandahwe		Mahenye	
	Z\$	US\$	Z\$	US\$	Z\$	US\$	Z\$	US\$
2000	1,274,308	23,169	n/a	n/a	180,000	3,273	-	-
2001	6,004,392	109,171	n/a	n/a	230,000	4,182	-	-
2002	689,587	12,538	n/a	n/a	270,000	4,909	5,995,918	109,017
2003	7,600,720	1,326	n/a	n/a	350,000	61	20,770,766	3,625
2004	59,568,000	10,396	5,000,000	873	375,000	65	126,397,780	22,059
2005	78,004,500	922	64,900,000	767	460,000	5	199,874,814	2,363
2006	1,724,506,500	17,041	870,000,000	8,597	95,000,000	939	769,260,502	7,602
2007	9,781,200	31	-	-	650,000,000	2,055	1,221,094,925	3,861
2008	156,205,117	2	-	-	850,000,000,000	8,500	-	-
2009	-	28,405	-	16,225	-	8,000	-	68,127
2010	-	24,650	-	7,000	-	16,000	-	37,797

Moreover, the success of the Mahenye community in CAMPFIRE has been attributed to the commitment of socially dedicated individuals in positions of influence or leadership, the balancing of sources of traditional and popular legitimacy, the presence of an enlightened private sector, the existence of a rich natural resource base, the capacity for flexibility and acceptance of innovation and risk, the existence of intra-communal cohesiveness, and the presence of economic incentives in the form of the regular annual distribution of household dividends in an equitable and transparent manner (Murphree 2001). However, it has been reported that since 2000, the Mahenye community has experienced challenges with CAMPFIRE because local people have been receiving few benefits and there has been less involvement of local people in decision-making processes related to CAMPFIRE. These challenges have reportedly been related to changes in chieftainship, involvement of the new chief in determining the composition of the CAMPFIRE committee in 2001, election of a new ward councilor, and lack of transparency in tendering the hunting concession (Rihoy and Mugaranyanga 2007). Despite these challenges, the people of Mahenye have reportedly continued to demonstrate a remarkable level of intra-communal cohesiveness (Murphree 2001).

Only Mahenye, Chibwedziva, and to some extent Mtandahwe recorded an increase in natural resources monitoring and law enforcement due to the availability of financial resources from the accrued CAMPFIRE benefits. In contrast, monitoring and law enforcement of natural resources was nonexistent in Chizvirizvi. Further, the involvement of local people in decision-making in the CAMPFIRE program was very low in Chizvirizvi. The failure of the CAMPFIRE program in Chizvirizvi has been attributed to the coercive and often violent activities of war veterans within the community, which have eroded the power and influence of both the

developmental resettlement committee and traditional leadership; the lack of democratic elections for CAMPFIRE committee; the lack of involvement of local people in management activities or decisions regarding wildlife management; and the lack of benefits to local households from wildlife management (Rihoy and Mugaranyanga 2007).

Differences in CAMPFIRE effectiveness and human-wildlife conflicts reported in this study could also have been influenced by several other factors. For instance, Chizvirizvi had the shortest length of community-based wildlife management because appropriate authority was granted only in 2003, whereas in the other three communities, CAMPFIRE has been running since the early 1990s. This difference in length of involvement with CAMPFIRE among the study communities may have influenced the cohesiveness and involvement of local people in the community, since Chizvirizvi is a resettlement area. In addition, of the four communities, only Mahenye had tourism infrastructure (lodges); hence, the community had diversified forms of revenue generation, which increased the community benefits, even during the period of economic decline in Zimbabwe between 2000 and 2008. Chibwedziva is adjacent to an area of the GNP that has a slightly higher density of wild animals, e.g., elephants, compared to the other three communities, which corresponds to the perceived high conflicts. Moreover, differences in human population densities across the four communities could also have influenced variations in benefits accrued by local people, as shown by perceptions of effectiveness of CAMPFIRE indicators recorded in this study. Chibwedziva had the highest density (32 people km⁻²), followed by Mtandahwe (23 people km⁻²), Mahenye (18 people km⁻²), and Chizvirizvi (12 people km⁻²). Besides Chizvirizvi, where CAMPFIRE was not functioning well, Mahenye, with a relatively low human density, had higher ratings for benefits

and other indicators of CAMPFIRE effectiveness accrued compared to Mtandahwe and Chibwedziva. Perceptions of human-wildlife conflict trends could also have been influenced by the distance of the village from the park boundary and other adjacent wildlife areas. Local people living close to protected areas are likely to experience more conflicts than those living further away (Mackenzie 2012). For instance, Chizvirizvi borders the GNP and a fenced boundary with Malilangwe. Only Mahenye had both villages close to the GNP boundary, whereas the other three communities had one village close to the park boundary and the other further away.

Our results show that across the four study communities there was a widespread dislike of and negative attitudes towards most of the common problematic wild animals, although only a lower dislike of lion was associated with communities with a higher rating for conservation awareness and education. Chibwedziva had the overall highest dislike of the problematic wild animals, probably due to the area's proximity to the GNP, which resulted in these species frequently moving into the community. Mtandahwe had the lowest dislike of problematic wild animals because most of residents wanted to have more animals on a sport hunting quota that is specific to the area. Mtandahwe and Mahenye have a single quota, but most animals are hunted in Mahenye and most profits go to Mahenye. Livestock depredation by large carnivores and crop raiding mostly by elephants were the main reasons why the animals were disliked. Human-wildlife conflicts in Zimbabwe are compounded by the fact that proceeds from the killing of problem animals, such as elephants, in terms of meat, and/or safari hunting are given to the entire CAMPFIRE community and not specifically the individual household affected (Madzudzo 1997). This procedure unfortunately neglects those particular groups who bear the costs of living close to wildlife. It has been suggested that residents who feel they are benefiting from wildlife have more positive attitudes towards wildlife species compared to those who do not receive any benefits (Kideghesho et al. 2007).

Quite striking was the overall dissatisfaction in the four local communities with the response to human-wildlife conflicts, for example, shooting of problem animals, by the responsible authorities. Local resource management capacity in terms of responses to incidences of human-wildlife conflicts could have been negatively affected by resource constraints due to the economic decline in Zimbabwe between 2000 and 2008. Financial difficulties led to challenges in purchasing ammunition for controlling problem animals and obtaining resources for responding to problem animals, and resulted in RDCs reducing the proportion of revenue they gave back to the CAMPFIRE communities (Mapedza 2009). The economic collapse in Zimbabwe, high inflation, and the withdrawal of the donor community following the land reforms since 2000 have been reported to have eroded the benefits that most

conservation programs derive from the communal areas, given that payments of household cash dividends from CAMPFIRE revenue activities take place six months to a year after the activities have occurred (Mapedza and Bond 2006, Rihoy and Mugaranyanga 2007, Fischer et al. 2011). For instance, in 1999, each household in the Mahenye community received an average earning of US\$59 (Vorlauffer 2002). However, in 2008, discussants from Mahenye revealed that they received an average earning of US\$10. With the exception of Chizvirizvi, our results similarly show that revenue received under CAMPFIRE markedly declined in Chibwedziva, Mahenye, and Mtandahwe between 2003 and 2008, likely due to the high inflationary environment in Zimbabwe following the political unrest and economic decline since the land reforms in 2000. A key constraint to the success of community-based natural resource management in many countries is the high tax on wildlife, as reflected in the retention by central and local governments of a high proportion of the revenues generated by wildlife-based tourism. In Namibian communal lands, the establishment of community conservancies where the full benefits of wildlife-based tourism are retained at local levels has led to a dramatic increase in both wildlife populations and revenues to communities in the past 20 years (Weaver et al. 2011). However, in the case of Chizvirizvi, where the money does not pass through the local government, there were indications that the money was not being directly channeled to the community.

CONCLUSION

Human-wildlife conflicts in the study area have implications for local livelihoods since communities in the southeast lowveld of Zimbabwe and those in the Great Limpopo Transfrontier Conservation Area rely mainly on crop production and livestock rearing (Cumming 2005). Moreover, the removal of fences in some wildlife areas under the transboundary management of resources through the Great Limpopo Transfrontier Conservation Area and issues of wildlife health, domestic animal health, and human health and livelihoods (Osofsky et al. 2005) should take cognizance of the current levels and future dynamics of human-wildlife conflicts.

Our findings partly support our first hypothesis that a higher perceived effectiveness of CAMPFIRE would be associated with a decline in human-wildlife conflicts, even though many people had experienced problems with wild animals. Of the various indicators of CAMPFIRE effectiveness, only involvement of local people in decision-making correlated with a lower perceived increase in human-wildlife conflicts. This suggests that having influence in, and ownership of, wildlife management programs may be more important in influencing perceived conflicts with wildlife than is direct economic benefit. We also recorded mixed attitudes towards problematic wild animals, with little association with perceived CAMPFIRE effectiveness. Only for one of the

problem animals (lions) was there a relation with one dimension of CAMPFIRE effectiveness (conservation awareness and education). Our results, therefore, only minimally support our second hypothesis that local communities with high perceived effectiveness of CAMPFIRE programs would have more favorable attitudes towards problematic wild animals. The perceived effectiveness of CAMPFIRE programs and attitudes towards problematic animal species varied among local communities primarily due to contextual differences.

Despite the recorded differences in perceived CAMPFIRE effectiveness and human-wildlife conflicts among the four study communities, our results show that even if it is difficult to provide material benefits, it still seems beneficial to involve local people in decision-making (Weaver et al. 2011) in CAMPFIRE programs. Similarly, it has been suggested that CAMPFIRE's most important principle is involving the rural population in decisions about the implementation of CAMPFIRE and the use of the revenue gained (Vorlaufer 2002). Our study provides an important lesson for ICDPs, since the situation in Zimbabwe is not unique. On the basis of data from this study, we recommend the following: (i) decisions and actions regarding the control of problem animals need to be devolved to the community level, and (ii) conservation awareness and education need to be enhanced to improve attitudes towards problematic animal species and to minimize the negative impacts of human-wildlife conflicts in community-based natural resource management initiatives.

Responses to this article can be read online at:
<http://www.ecologyandsociety.org/issues/responses.php/5817>

Acknowledgments:

This study was undertaken under the Competing Claims on Natural Resources programme and was funded by the International Research and Education Fund (INREF) of Wageningen University, The Netherlands. We thank the Districts' Authorities and Director-General of the Zimbabwe Parks and Wildlife Management Authority for permission to carry out this study in villages adjacent to northern Gonarezhou National Park. We are greatly indebted to the village authorities for their cooperation and kind support during this study. We are grateful to the following who contributed in the fieldwork: the local people who generously gave their time; Gift Pikela, Titus Mutombeni, Josiah Dhluma, and Nonkutula Mahohoma for assistance in data collection. We thank Patience Gandiwa, Cheryl Mabika, and Ruvimbo Nyabawa for assistance with data capturing; Chiredzi Rural District Council, Mahenye and Mtandahwe CAMPFIRE

committees, and Lowveld Hunters for assistance with data on recorded human-wildlife conflicts and CAMPFIRE revenue. We are also grateful to three anonymous reviewers for their constructive comments and suggestions, which helped improve the manuscript.

LITERATURE CITED

- Andrade, G. S. M., and J. R. Rhodes. 2012. Protected areas and local communities: an inevitable partnership toward successful conservation strategies? *Ecology and Society* 17:14. <http://dx.doi.org/10.5751/ES-05216-170414>
- <
>/> Balint, P., and J. Mashinya. 2006. The decline of a model community-based conservation project: governance, capacity, and devolution in Mahenye, Zimbabwe. *Geoforum* 37:805–815. [online] URL: <http://dx.doi.org/10.1016/j.geoforum.2005.01.011>
- Barrett, C. B., and P. Arcese. 1995. Are integrated conservation-development projects (ICDPs) sustainable? On the conservation of large mammals in Sub-Saharan Africa. *World Development* 23:1073–1084. [online] URL: [http://dx.doi.org/10.1016/0305-750X\(95\)00031-7](http://dx.doi.org/10.1016/0305-750X(95)00031-7)
- Brechin, S. R., P. R. Wilshusen, C. L. Fortwangler, and P. C. West. 2002. Beyond the square wheel: toward a more comprehensive understanding of biodiversity conservation as social and political process. *Society & Natural Resources* 15:41–64. [online] URL: <http://dx.doi.org/10.1080/0894192-02317174011>
- Brockington, D., R. Duffy, and J. Igoe. 2008. *Nature unbound*. Earthscan, London, UK.
- Brockington, D., and K. Schmidt-Soltau. 2004. The social and environmental impacts of wilderness and development. *Oryx* 38:140–142. [online] URL: <http://dx.doi.org/10.1017/S0030605304000250>
- Brown, K. 2002. Innovations for conservation and development. *Geographical Journal* 168:6–17. [online] URL: <http://dx.doi.org/10.1111/1475-4959.00034>
- Browne-Nuñez, C., and S. A. Jonker. 2008. Attitudes toward wildlife and conservation across Africa: a review of survey research. *Human Dimensions of Wildlife* 13:47–70. [online] URL: <http://dx.doi.org/10.1080/10871200701812936>
- Chigwenya, A., and E. Chifamba. 2010. The decentralization-recentralization confusion: an analysis of the decentralized management of common pool resources in Mahenye CAMPFIRE projects in Chipinge Zimbabwe. *Journal of Sustainable Development in Africa* 12:359–368.
- Child, B. 2000. Making wildlife pay: converting wildlife's comparative advantage into real incentives for having wildlife in African savannas, case studies from Zimbabwe and Zambia. Pages 335–387 in H. H. T. Prins, J. G. Grootenhuys, and T. T.

- Dolan, editors. *Wildlife conservation by sustainable use*. Kluwer Academic Publishers, Boston, Massachusetts, USA. http://dx.doi.org/10.1007/978-94-011-4012-6_17
- Cumming, D. H. M. 2005. Wildlife, livestock and food security in the south-east lowveld of Zimbabwe. Pages 41–46 in S. A. Osofsky, S. Cleaveland, W. B. Karesh, M. D. Kock, P. J. Nyhus, and A. Yang, editors. *Conservation and development interventions at the wildlife/livestock interface: implications for wildlife, livestock and human health*. IUCN, Gland, Switzerland and Cambridge, UK.
- De Boer, W. F., and D. S. Baquete. 1998. Natural resource use, crop damage and attitudes of rural people in the vicinity of Maputo Elephant Reserve, Mozambique. *Environmental Conservation* 25:208–218. <http://dx.doi.org/10.1017/S0376892998000265>
- Deodatus, F. 2000. Wildlife damage in rural areas with emphasis on Malawi. Pages 115–140 in H. H. T. Prins, J. G. Grootenhuis, and T. T. Dolan, editors. *Wildlife conservation by sustainable use*. Kluwer Academic Publishers, Boston, Massachusetts, USA. http://dx.doi.org/10.1007/978-94-011-4012-6_7
- Dickman, A. J. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. *Animal Conservation* 13:458–466. [online] URL: <http://dx.doi.org/10.1111/j.1469-1795.2010.00368.x>
- Dunham, K. M., E. Van Der Westhuizen, H. F. Van Der Westhuizen, and E. Gandiwa. 2010. *Aerial survey of elephants and other large herbivores in Gonarezhou National Park (Zimbabwe), Zinave National Park (Mozambique) and surrounds: 2009*. Zimbabwe Parks and Wildlife Management Authority, Harare, Zimbabwe.
- Fischer, C., E. Muchapondwa, and T. Sterner. 2011. A bio-economic model of community incentives for wildlife management under CAMPFIRE. *Environmental and Resource Economics* 48:303–319. [online] URL: <http://dx.doi.org/10.1007/s10640-010-9409-y>
- Gandiwa, E. 2011. Preliminary assessment of illegal hunting by communities adjacent to the northern Gonarezhou National Park, Zimbabwe. *Tropical Conservation Science* 4:445–467.
- Gandiwa, E. 2012. Local knowledge and perceptions of animal population abundances by communities adjacent to the northern Gonarezhou National Park, Zimbabwe. *Tropical Conservation Science* 5:255–269.
- Gandiwa, E., I. M. A. Heitkönig, A. M. Lokhorst, H. H. T. Prins, and C. Leeuwis. 2013. Illegal hunting and law enforcement during a period of economic decline in Zimbabwe: a case study of northern Gonarezhou National Park and adjacent areas. *Journal for Nature Conservation* 21:133–142. [online] URL: <http://dx.doi.org/10.1016/j.jnc.2012.11.009>
- Garnett, S. T., J. Sayer, and J. Du Toit. 2007. Improving the effectiveness of interventions to balance conservation and development: a conceptual framework. *Ecology and Society* 12:2. [online] URL: <http://www.ecologyandsociety.org/vol12/iss11/art12/>
- Gillingham, S., and P. C. Lee. 1999. The impact of wildlife-related benefits on the conservation attitudes of local people around the Selous Game Reserve, Tanzania. *Environmental Conservation* 26:218–228. <http://dx.doi.org/10.1017/S0376892999000302>
- Gusset, M., M. J. Swarner, L. Mponwane, K. Keletile, and J. W. McNutt. 2009. Human–wildlife conflict in northern Botswana: livestock predation by endangered African wild dog *Lycaon pictus* and other carnivores. *Oryx* 43:67–72. [online] URL: <http://dx.doi.org/10.1017/S0030605308990475>
- Heitkönig, I. M. A., and H. H. T. Prins. 2009. Land use in Zimbabwe and neighbouring southern African countries. Pages 445–457 in J. J. Boersema and L. Reijnders, editors. *Principles of environmental sciences*. Springer, The Netherlands. http://dx.doi.org/10.1007/978-1-4020-9158-2_22
- Hemson, G., S. MacLennan, G. Mills, P. Johnson, and D. Macdonald. 2009. Community, lions, livestock and money: a spatial and social analysis of attitudes to wildlife and the conservation value of tourism in a human–carnivore conflict in Botswana. *Biological Conservation* 142:2718–2725. [online] URL: <http://dx.doi.org/10.1016/j.biocon.2009.06.024>
- Hlambela, S., and W. Kozanayi. 2005. Decentralized natural resources management in the Chiredzi district of Zimbabwe: voices from the ground. Pages 255–268 in C. J. P. Colfer and D. Capistrano, editors. *The politics of decentralisation: forests, power and people*. Earthscan, London, UK.
- Hoffman, T. S., and M. J. O'Riain. 2012. Monkey management: using spatial ecology to understand the extent and severity of human–baboon conflict in the Cape Peninsula, South Africa. *Ecology and Society* 17:13. <http://dx.doi.org/10.5751/ES-04882-170313>
- Hurt, R., and P. Ravn. 2000. Hunting and its benefits: an overview of hunting in Africa with special reference to Tanzania. Pages 295–314 in H. H. T. Prins, J. G. Grootenhuis, and T. T. Dolan, editors. *Wildlife conservation by sustainable use*. Kluwer Academic Publishers, Boston, Massachusetts, USA. http://dx.doi.org/10.1007/978-94-011-4012-6_15
- Hutton, J., W. M. Adams, and J. C. Murombedzi. 2005. Back to the barriers? Changing narratives in biodiversity conservation. *Forum for Development Studies* 32:341–370. [online] URL: <http://dx.doi.org/10.1080/08039410.2005.9666319>
- Johannesen, A. B. 2006. Designing integrated conservation and development projects (ICDPs): illegal hunting, wildlife conservation, and the welfare of the local people. *Environment*

- and *Development Economics* 11:247–267. [online] URL: <http://dx.doi.org/10.1017/S1355770X05002792>
- Kendall, M. G. 1945. The treatment of ties in ranking problems. *Biometrika* 33:239–251.
- Kideghesho, J. R., E. Røskaft, and B. P. Kaltenborn. 2007. Factors influencing conservation attitudes of local people in Western Serengeti, Tanzania. *Biodiversity and Conservation* 16:2213–2230. [online] URL: <http://dx.doi.org/10.1007/s10531-006-9132-8>
- Krueger, R., and M. Casey. 2000. *Focus groups: a practical guide for applied research*. Sage, London, UK.
- Lamarque, F., J. Anderson, R. Fergusson, M. Lagrange, Y. Osei-Owusu, and L. Bakker. 2009. *Human-wildlife conflict in Africa*. Food and Agricultural Organization of the United Nations (FAO), Rome, Italy.
- Le Bel, S., A. Murwira, B. Mukamuri, R. Czudek, R. Taylor, and M. La Grange. 2011. Human wildlife conflicts in southern Africa: riding the whirl wind in Mozambique and in Zimbabwe. Pages 283–322 in J. López-Pujol, editor. *The importance of biological interactions in the study of biodiversity*. InTech, Croatia.
- Leeuwis, C., and A. van den Ban. 2004. *Communication for rural innovation: rethinking agricultural extension*. Third edition. Blackwell Publishing, Oxford, UK. <http://dx.doi.org/http://dx.doi.org/10.1002/9780470995235>
- Lele, S., P. Wilshusen, D. Brockington, R. Seidler, and K. Bawa. 2010. Beyond exclusion: alternative approaches to biodiversity conservation in the developing tropics. *Current Opinion in Environmental Sustainability* 2:94–100. [online] URL: <http://dx.doi.org/10.1016/j.cosust.2010.03.006>
- Logan, B. I., and W. G. Moseley. 2002. The political ecology of poverty alleviation in Zimbabwe's Communal Areas Management Programme for Indigenous Resources (CAMPFIRE). *Geoforum* 33:1–14. [online] URL: [http://dx.doi.org/10.1016/S0016-7185\(01\)00027-6](http://dx.doi.org/10.1016/S0016-7185(01)00027-6)
- Mackenzie, C. A. 2012. Accruing benefit or loss from a protected area: location matters. *Ecological Economics* 76:119–129. [online] URL: <http://dx.doi.org/10.1016/j.ecolecon.2012.02.013>
- Madden, F. M. 2008. The growing conflict between humans and wildlife: law and policy as contributing and mitigating factors. *Journal of International Wildlife Law & Policy* 11:189–206. [online] URL: <http://dx.doi.org/10.1080/13880-290802470281>
- Madzudzo, E. 1997. Communal tenure, motivational dynamics and sustainable wildlife management in Zimbabwe. *Zambezia* 24:147–158.
- Manfredo, M. J., and A. A. Dayer. 2004. Concepts for exploring the social aspects of human-wildlife conflict in a global context. *Human Dimensions of Wildlife* 9:1–20. [online] URL: <http://dx.doi.org/10.1080/10871200490505765>
- Mapedza, E. 2009. Decentralisation outcomes in the context of political uncertainty in Zimbabwe: a comparative assessment from comanagement and CAMPFIRE and implications for policy. Pages 215–233 in L. A. German, A. Karsenty, and A. M. Tiani, editors. *Governing Africa's forests in a globalized world*. Earthscan, London.
- Mapedza, E., and I. Bond. 2006. Political deadlock and devolved wildlife management in Zimbabwe: the case of Nenyunga ward. *Journal of Environment & Development* 15:407–427. [online] URL: <http://dx.doi.org/10.1177/10704-96506294635>
- Martin, R. B. 1986. *Communal Areas Management Programme for Indigenous Resources (CAMPFIRE)*. Revised version. CAMPFIRE Working Document No. 1/86. Branch of Terrestrial Ecology, Department of National Parks and Wild Life Management, Harare, Zimbabwe.
- Mashinya, J. 2007. *Participation and devolution in Zimbabwe's CAMPFIRE program: findings from local projects in Mahenye and Nyaminyami*. Dissertation. University of Maryland, College Park, Maryland, USA.
- Matzke, G. E., and N. Nabane. 1996. Outcomes of a community controlled wildlife utilization program in a Zambezi Valley community. *Human Ecology* 24:65–85. [online] URL: <http://dx.doi.org/10.1007/BF02167961>
- Mayaka, T. B. 2002. *Value wildlife! An ecological and economic assessment of wildlife use in northern Cameroon*. Dissertation. Wageningen University, Wageningen, The Netherlands.
- Mbaiwa, J. E. 2005. Wildlife resource utilisation at Moremi Game Reserve and Khwai community area in the Okavango Delta, Botswana. *Journal of Environmental Management* 77:144–156. [online] URL: <http://dx.doi.org/10.1016/j.jenvman.2005.03.007>
- Murphree, M. W. 2001. Community, council and client: a case study in ecotourism development from Mahenye, Zimbabwe. Pages 177–194 in D. Hume and M. W. Murphree, editors. *African wildlife and livelihoods. The promise and performance of community conservation*. James Currey, London, UK.
- Murphree, M. W. 2009. The strategic pillars of communal natural resource management: benefit, empowerment and conservation. *Biodiversity and Conservation* 18:2551–2562. [online] URL: <http://dx.doi.org/10.1007/s10531-009-9644-0>

- Mutandwa, E., and C. T. Gadzirayi. 2007. Impact of community-based approaches to wildlife management: case study of the CAMPFIRE programme in Zimbabwe. *International Journal of Sustainable Development & World Ecology* 14:336–344. [online] URL: <http://dx.doi.org/10.1080/13504500709469734>
- Newmark, W. D., D. N. Manyaza, D. G. M. Gamassa, and H. I. Sariko. 1994. The conflict between wildlife and local people living adjacent to protected areas in Tanzania: human density as a predictor. *Conservation Biology* 8:249–255. [online] URL: <http://dx.doi.org/10.1046/j.1523-1739.1994.08010249.x>
- Oates, J. F. 1999. *Myth and reality in the rainforest: how conservation strategies are failing in West Africa*. University of California Press, Berkeley, California, USA.
- Osofsky, S. A., S. Cleaveland, W. B. Karesh, P. J. Nyhus, L. Starr, and A. Yang, editors. 2005. *Conservation and development interventions at the wildlife/livestock interface: implications for wildlife, livestock and human health*. International Union for Conservation of Nature (IUCN), Gland, Switzerland and Cambridge, UK. <http://dx.doi.org/10.2305/IUCN.CH.2005.SSC-OP.30.en>
- Prins, H. H. T., and J. G. Grootenhuis. 2000. Introduction: the value of priceless wildlife. Pages 1–12 in H. H. T. Prins, J. G. Grootenhuis, and T. T. Dolan, editors. *Wildlife conservation by sustainable use*. Kluwer Academic, Boston, Massachusetts, USA. http://dx.doi.org/10.1007/978-94-011-4012-6_1
- Prins, H. H. T., J. G. Grootenhuis, and T. T. Dolan, editors. 2000. *Wildlife conservation by sustainable use*. Kluwer Academic Publishers, Boston, Massachusetts, USA. <http://dx.doi.org/10.1007/978-94-011-4012-6>
- Richardson, R. B., A. Fernandez, D. Tschirley, and G. Tembo. 2012. Wildlife conservation in Zambia: impacts on rural household welfare. *World Development* 40:1068–1081. [online] URL: <http://dx.doi.org/10.1016/j.worlddev.2011.09.019>
- Rihoy, E., and B. Mugaranyanga. 2007. *Devolution and democratisation of natural resource management in southern Africa: a comparative analysis of CBNRM policy processes in Botswana and Zimbabwe*. Commons Southern Africa, Paper No. 18. CASS/PLAAS Occasional Paper Series. [online] URL: www.uwc.ac.za/plaas
- Romero, C., S. Athayde, J. G. E. Collomb, M. DiGiano, M. Schmink, S. Schramski, and L. Seales. 2012. Conservation and development in Latin America and southern Africa: setting the stage. *Ecology and Society* 17:17. <http://dx.doi.org/10.5751/ES-04863-170217>
- Taylor, R. 2009. Community based natural resource management in Zimbabwe: the experience of CAMPFIRE. *Biodiversity and Conservation* 18:2563–2583. [online] URL: <http://dx.doi.org/10.1007/s10531-009-9612-8>
- Terborgh, J. 1999. *Requiem for nature*. Island Press/Shearwater Books, Washington, D.C., USA.
- Thirgood, S., R. Woodroffe, and A. Rabinowitz. 2005. The impact of human-wildlife conflict on human lives and livelihoods. Pages 86–106 in R. Woodroffe, S. Thirgood, and A. Rabinowitz, editors. *People and wildlife: conflict or coexistence?* Cambridge University Press, Cambridge, UK.
- Treves, A., R. B. Wallace, and S. White. 2009. Participatory planning of interventions to mitigate human-wildlife conflicts. *Conservation Biology* 23:1577–1587. [online] URL: <http://dx.doi.org/10.1111/j.1523-1739.2009.01242.x>
- Vorlaufer, K. 2002. CAMPFIRE—the political ecology of poverty alleviation, wildlife utilisation and biodiversity conservation in Zimbabwe. *Erdkunde* 56:184–206. <http://dx.doi.org/10.3112/erdkunde.2002.02.06>
- Weaver, L. C., E. Hamulnyela, R. Diggle, G. Matonga, and T. Pietersen. 2011. The catalytic role and contributions of sustainable wildlife use to the Namibia community-based natural resources management program. Pages 59–70 in M. Abensperg-Traun, D. Roe, and C. O’Criodain, editors. *CITES and CBNRM. Proceedings of an international symposium on “The relevance of CBNRM to the conservation and sustainable use of CITES-listed species in exporting countries”*. IUCN-SSC Occasional Papers Series No. 46. IUCN, Gland, Switzerland and London, UK; IIED., Vienna, Austria.
- Wilshusen, P. R., S. R. Brechin, C. L. Fortwangler, and P. C. West. 2002. Reinventing a square wheel: critique of a resurgent “protection paradigm” in international biodiversity conservation. *Society & Natural Resources* 15:17–40. [online] URL: <http://dx.doi.org/10.1080/089419202317174002>
- Wolmer, W., J. Chaumba, and I. Scoones. 2004. Wildlife management and land reform in southeastern Zimbabwe: a compatible pairing or a contradiction in terms? *Geoforum* 35:87–98. [online] URL: [http://dx.doi.org/10.1016/S0016-7185\(03\)00031-9](http://dx.doi.org/10.1016/S0016-7185(03)00031-9)
- Woodroffe, R., S. Thirgood, and A. Rabinowitz, editors. 2005. *People and wildlife: conflict or coexistence?* Cambridge University Press, Cambridge, UK. <http://dx.doi.org/http://dx.doi.org/10.1017/CBO9780511614774>