

Attitudes to illegal behaviour and conservation in western Tanzania

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TABLE S1 Unmatched count technique questions used in a survey of local people living in the vicinity of Ugalla Game Reserve, Tanzania (Fig. 1), with sensitive items in italics.

Practice card:

How many of these crops have members of your household cultivated in the last 12 months? (Maize, *tobacco*, onion, cassava, sisal)

Treatment card:

How many of these places have members of your household obtained honey from in the last 12 months? (Own beehives, *honey that members of your household have gathered from tree trunks*, friends & neighbours, sellers in the village, supermarket)

How many of these activities have members of your household generated income from in the last 12 months? (Farming, remittances from relatives in town, *logging*, small businesses, formal employment)

How many of these places have members of your household obtained meat from in the last 12 months? (Own livestock, *meat that household members have hunted*, meat from friends or neighbours' livestock, local butcher, supermarket)

How many types of meat have you and your household eaten in the last 12 months? (Chicken, beef, *bushmeat*, sheep, goat)

TABLE S2 Basic necessity survey scores, with the number, percentage and proportion of people (n = 533) who said each item was a basic necessity, and the number, percentage and proportion (weighting) of people who possessed or could gain access to the item.

Item	No. of people who perceived each item as a basic necessity (%)	Weighting	No. of people who possessed or could access necessity (%)	Weighting
Motorbike	501 (94.00)	0.94	64 (12.01)	0.12
Tobacco barn	436 (81.80)	0.82	182 (34.15)	0.34
Public transport	528 (99.06)	0.99	438 (82.18)	0.82
Primary education	533 (100.00)	1.00	513 (96.25)	0.96
Electricity	524 (98.31)	0.98	14 (2.63)	0.03
Hoe	533 (100.00)	1.00	522 (97.94)	0.98
Chicken	528 (99.06)	0.99	418 (78.42)	0.78
Bicycle	532 (99.81)	1.00	434 (81.43)	0.81
Radio	526 (98.69)	0.99	338 (63.41)	0.63
Water containers	533 (100.00)	1.00	506 (94.93)	0.95
Mobile phone	532 (99.81)	1.00	422 (79.17)	0.79
House	528 (99.06)	0.99	210 (39.40)	0.39
Farm land	531 (99.62)	1.00	479 (89.87)	0.90
Cart	512 (96.06)	0.96	90 (16.89)	0.17
Manure	533 (100.00)	1.00	316 (59.29)	0.59
Solar energy	526 (98.69)	0.99	231 (43.34)	0.43
Water pond nearby	533 (100.00)	1.00	424 (79.55)	0.80
Cereal milling machine	533 (100.00)	1.00	471 (88.37)	0.88
Dispensary	533 (100.00)	1.00	269 (50.47)	0.50
At least TZS 50 per month	525 (98.50)	0.98	237 (44.47)	0.44
Plough	514 (96.44)	0.96	97 (18.20)	0.18
3 meals per day	528 (99.06)	0.99	245 (45.97)	0.46
Fuelwood	532 (99.81)	1.00	514 (96.44)	0.96
Mattress	531 (99.62)	1.00	431 (80.86)	0.81
Medicinal plants	351 (65.85)	0.66	247 (46.34)	0.46
Toilet	533 (100.00)	1.00	524 (98.31)	0.98
			Total respondents	533
			Maximum possible score of people who say the item is a basic necessity	25.23
			Mean score (percentage) of people who say the item is a basic necessity	0.97 (97%)
			Maximum possible score of people who possess the basic necessity	16.20
			Mean score (percentage) of people who possess the basic necessity	0.62 (62%)

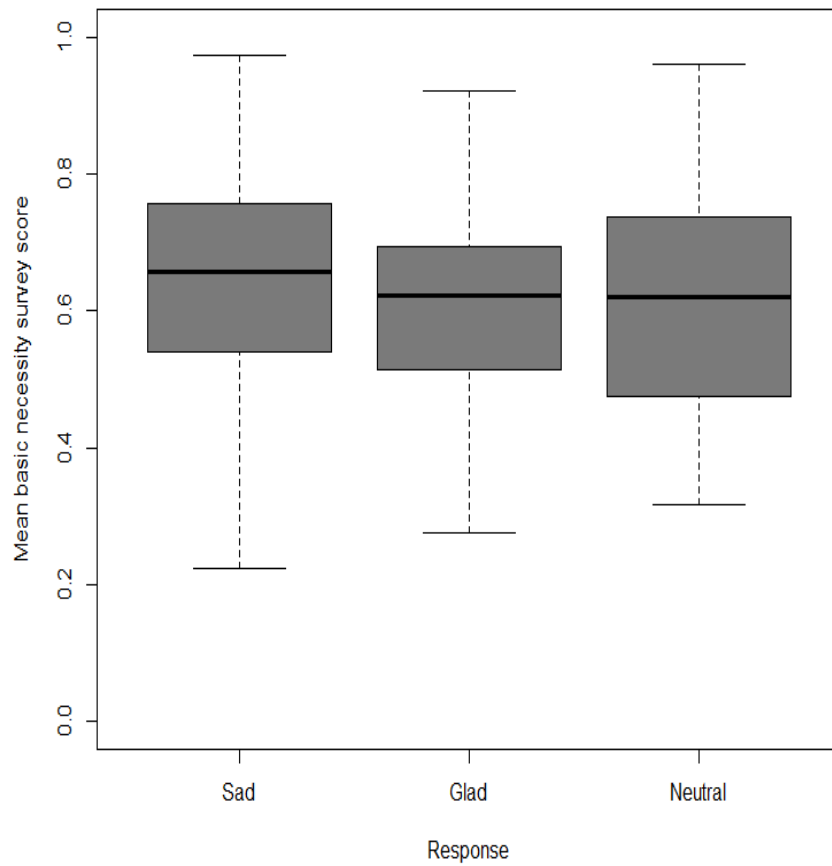


FIG. S1 Proportion of study participants who expressed views on whether they would be glad if Ugalla Game Reserve (Fig. 1) were abolished, compared against basic necessity survey scores.

TABLE S3 Summary results table for the linear mixed effects model of unmatched count technique results for bushmeat consumption, of the form response ~ treatment + (1 | village).

	Estimate	SE	t value
Intercept	2.225	0.094	24.841
Treatment	0.225	0.071	3.146

TABLE S4 Summary results table for the linear mixed effects model of unmatched count technique results for honey collection, of the form: response ~ treatment + (1 | village).

	Estimate	SE	t value
Intercept	1.113	0.143	7.781
Treatment	0.189	0.058	3.248

TABLE S5 Summary results table for the linear mixed effects model of unmatched count technique results for hunting, of the form: response ~ treatment + (1 | village).

	Estimate	SE	t value
Intercept	1.758	0.076	23.186
Treatment	0.276	0.063	4.407

TABLE S6 Summary results table for the linear mixed effects model of unmatched count technique results for logging, of the form: response ~ treatment + (1 | village).

	Estimate	SE	t value
Intercept	1.446	0.091	15.938
Treatment	0.197	0.055	3.595

TABLE S7 Responses to attitudinal questions, and commonly mentioned reasons for attitudes towards Ugalla Game Reserve (Fig. 1), based on household interviews (n = 533) and 12 focus groups. Similar reasons have been combined in a single statement.

Response (No. of respondents)	Reason Survey (% of respondents)	Focus groups (No. of focus groups)
If Ugalla were abolished, how would you feel?		
Sad (248)	Our livelihoods will be ruined, as we all depend on the Reserve. (14) There will be no natural resources in the area. (13) The Reserve is the only area with animals these days. (7) The area will soon be turned into a desert. (6) The wellbeing of our future generations will be in jeopardy. (5) Ugalla is the main source of our everyday needs. (2)	Everything in Ugalla will be wiped out. (5) Our future generations will suffer the consequences. (3) All the animals will leave this area. (2) Ugalla will be converted into farms & grazing areas. (2) Allowing free boundaries will escalate unsustainable use of resources. (2) This area is the only source of fish, honey, charcoal & timber. (1) Our only source of water will be destroyed. (1) Building materials (timber & poles) will be scarce. (1)
Glad (136)	There will be free access to the Reserve for hunting & logging. (7) We will have freedom to harvest timber & other construction materials from the Reserve. (5) There will be adequate land for agricultural activities. (4) We need land for settlements & grazing. (3) No benefits are realized by local communities. (2) The Reserve is poorly managed. (2) There is no local participation in Ugalla conservation. (1) There is a lot of corruption among game rangers. (1)	We desperately need land for farming & settlements because our population is growing. (2) The Reserve has been the main source of discomfort in our area, as game rangers harass villagers a lot. (2) Elephants & bushpigs raid our crops. (1) The Reserve harbours dangerous animals, such as lions & crocodiles. (1) We are not interested as we don't know what is going on in the Reserve; all we know is that strangers are the ones who are allowed to go there & hunt animals. (1)
Neutral (116)		
Thinking about the management of the Reserve, how would you describe its effectiveness?		
Ineffective (193)	There is deliberate use of excessive force & beatings. (10) Game rangers make false allegations. (8)	There is a tense relationship between villagers & game rangers. (4) Villagers caught in the Reserve are brutally beaten & tortured. (3)

We receive no tangible benefits from the Reserve. (5)
Villagers are not involved in Ugalla activities. (4)
Game rangers are frequently bribed by illegal loggers. (3)
Game rangers are often outsmarted by poachers. (3)
Lots of bushmeat hunters perform their activities inside the Reserve. (2)
The Reserve is the main source of timber. (1)
The Reserve is over exploited by trophy hunters. (1)

Villagers don't realize benefits from the management of the Reserve. (3)
Ugalla is the only source of animals hunted under a legal subsistence hunting scheme in partially protected areas. However, pastoralists & farmers are left to destroy the partially protected areas, & animals are disappearing; consequently the whole concept of licensed subsistence hunting is warped. In addition, villagers can hardly meet the criteria for legal subsistence hunting in partially protected areas. (2)
There are no neighbourhood meetings with Ugalla owners, which could promote villagers' involvement in the conservation of Ugalla. (1)
Wild animals are raiding our crops every year, yet when we report to authorities absolutely nothing is done to compensate for the damage or at least to control the animals. (1)
There are fewer patrols in the partially protected areas surrounding Ugalla (especially Luganzo Game Controlled Area to the north of the Reserve). (1)
There are lots of poaching activities within the Reserve. (1)
There is unfair confiscation of villagers' cattle grazed in the areas adjacent to the Reserve boundary. (1)

Neutral (157)

Effective (114) There are frequent patrols by game rangers. (9)
There is a lot of fear, as game rangers arrest people even in the villages. (5)
At least the Reserve still exists. (3)
Some villagers are given fishing & beekeeping permits. (2)
Game rangers are doing their job effectively. (1)

TABLE S8 Costs and benefits of Ugalla Game Reserve (Fig. 1) as perceived by study participants (n = 533).

Variable	Response	% of respondents	
Benefit	Logging (Ugalla is the main source of timber)	16.3	
	Availability of honey	15.2	
	Fishing (Ugalla is the source of fish)	10.5	
	Hunting (Ugalla is the source of bushmeat)	10.1	
	Rain & water (Ugalla brings rain)	9.0	
	Building materials (building poles, timber, etc.)	7.7	
	Development projects (NGOs and/or tourist companies support development projects such as schools & dispensaries because of the Reserve)	7.1	
	Future generation (Ugalla is important for future generations)	5.0	
	Charcoal (Reserve is the source of charcoal)	2.6	
	No tangible benefits (we don't think there are benefits)	0.6	
	Cost	We are not free to use our natural resources.	19.3
		Ugalla is the main source of conflicts between game rangers & villagers.	12.2
		The Reserve takes too much land.	11.2
We live in constant fear of being arrested, beaten & jailed.		9.2	
Wild animals are raiding our crops, threatening our lives & killing our livestock.		9.0	
Wild animals are valued more than our lives and livelihoods.		5.6	
People are unsettled by fear of being displaced to allow expansion of the Reserve.		2.4	
We don't experience any costs.		1.7	
The village gets so little from the tourist hunting companies.		0.6	
It is a complicated process to obtain permits for fishing & beekeeping in the Reserve.		0.2	

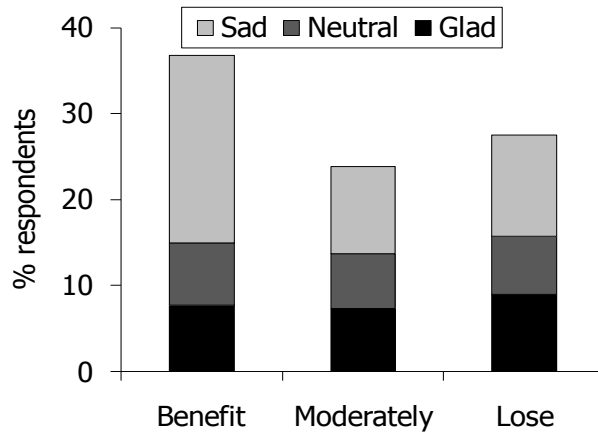


FIG. S2 Percentage of respondents (n = 533) who perceived villages close to Ugalla Game Reserve (Fig. 1) benefited, benefited moderately, or lost out from the Reserve, in each of three categories (sad, neutral or glad if the Reserve were abolished).

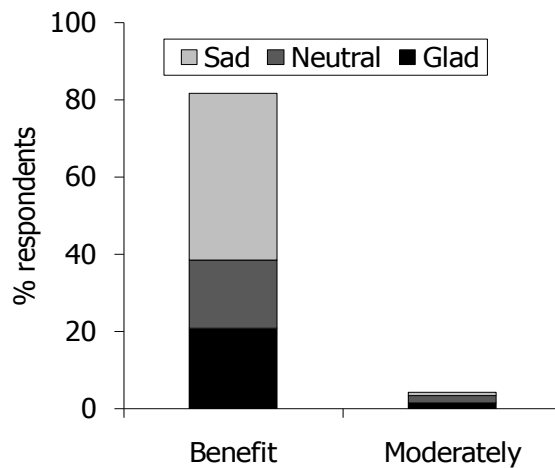


FIG. S3 Percentage of respondents (n = 533) who perceived foreign nationals benefited or benefited moderately from Ugalla Game Reserve (Fig. 1), in each of three categories (sad, neutral or glad if the Reserve were abolished).

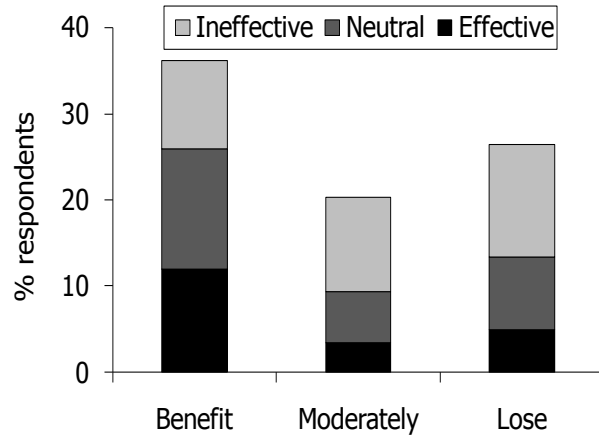


FIG. S4 Percentage of respondents (n = 533) who perceived people living close to Ugalla Game Reserve (Fig. 1) benefited, benefited moderately, or lost out from the Reserve, in each of three categories of perception regarding whether the Reserve was managed effectively.

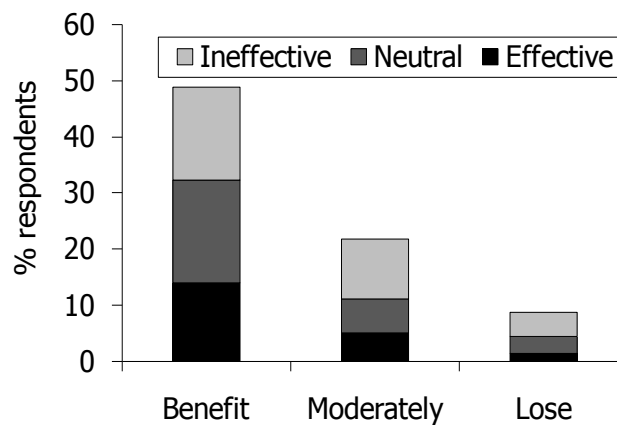


FIG. S5 Percentage of respondents (n = 533) who perceived Tanzanian people in general benefited, benefited moderately or lost out from Ugalla Game Reserve (Fig. 1), in each of three categories of perception regarding whether the Reserve was managed effectively.

TABLE S9 Reasons for benefiting, moderately benefiting and losing from Ugalla Game Reserve (Fig. 1) for various user groups (in bold), as reported by survey respondents (n = 533).

Response	Reason	% of respondents
Near villages		
Benefit	Reserve supports their livelihoods	6.0
	Development projects are directed to them	4.3
	They are near the Reserve	3.6
	Benefit through illegal use of resources	3.0
	The government is too much concerned about their livelihoods	2.4
	Beekeeping activities	2.1
	Have plenty of land because they are living near forests	1.7
	Grazing areas near Reserve	0.9
	Medicinal plants	0.8
Benefit moderately	Can easily access the resources	4.1
	Development projects by hunting companies	4.0
	Villagers benefit very little, as the Reserve is owned by the government	3.6
	Meat for food	3.4
	Lose too much of their food crops to wild animals	2.0
Lose	Only foreign hunters benefit	10.5
	Reserve is owned by the government	5.8
	Poverty is a problem	5.1
	No benefit because villagers are not allowed to use the resources within the Reserve	4.5
	They are constantly harassed by game rangers	4.5
	Crop raiding animals	2.3
	Dangerous animals (lions, elephants, crocodiles, etc.)	2.3
	Living with displacement worries	1.1
Far villages		
Benefit	Poachers come from the town centres & far communities	7.0
	Villages are far from the Reserve	5.6
	Not allowed to enter the Reserve	5.0
	Reserve is the source of water & fish	4.5
	They are the main loggers	3.6
	Reserve supports their livelihoods	3.2
	Benefit from development projects by NGOs	1.5
	Benefit moderately	Poachers come mostly from near villages
Benefit from money paid to the government by tourist hunting companies		2.6
Benefit from fishing & beekeeping scheme		2.4
Poachers come from further villages		2.3
Depend on Reserve for their livelihoods		2.3
Not allowed to enter the Reserve		1.7
Lose	Reserve belongs to the government	6.8
	Tanzanians from far regions exploit resources in Reserve	5.8
	Hunting companies are the ones allowed to use resources	5.4
	Ugalla benefits Tanzania community more than locals	5.1

	Poverty is a problem	4.7
	Only few (elite) Tanzanians benefit from the Reserve	4.7
	Not allowed to enter the Reserve	4.5
	Villages are far from the Reserve	4.0
	Harassed by game rangers during special anti-poaching operations	1.5
	Development projects are not directed to them	1.1
Tanzanians		
Benefit	Tanzanians benefit through money paid to the government by tourists	4.1
	This area caters for timber needs in other regions	3.6
	Honey from Ugalla is popular in other Tanzania regions	3.4
	Only people from other places are employed to work for hunting companies	2.8
	Tanzania benefits moderately	2.3
	Future generations	2.2
Benefit moderately	Only few Tanzanians benefit from the Reserve	3.4
	Tanzania benefits moderately	2.3
	Too few animals	2.3
	Benefit only through trophy hunting	2.1
	Future generations	1.5
	This is a small wildlife area	1.1
	No transparency regarding how much resource is used	0.8
Lose	Reserve is used only by foreigners	5.4
	Reserve is being overexploited	3.4
	Foreign hunters are finishing the animals	3.2
	All good timber tree species are cut	2.0
	No resource use plan	0.9
Foreigners		
Benefit	Foreigners benefit a lot	21.8
	Only foreigners have hunting rights in Reserve	16.0
	Reserve is foreigners' property	8.6
	Reserve authorities are corrupt	6.2
	Foreigners have capacity & resources to exploit Reserve	5.4
	Reserve authorities are biased towards foreigners	4.7
	We frequently see vehicles taking tourists to the Reserve	4.3
	Foreigners own all our protected areas	3.0
	We hear that the Reserve is for foreigners	2.6
	The Reserve is sold to foreigners	0.4
Benefit moderately	Few tourists visit Reserve nowadays	4.1
	The reserve has fewer animals	2.0
	Foreigners benefit moderately	1.5



PLATE S1 Sample focus group discussion activity: seasonal calendar.

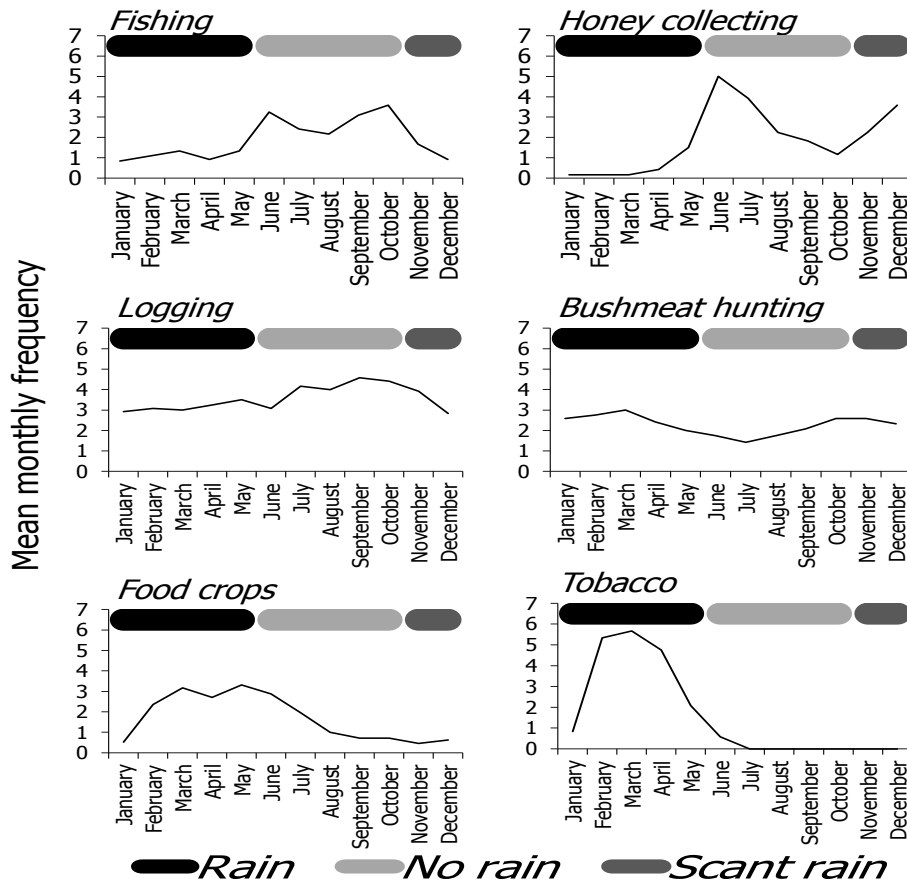


FIG. S6 Monthly frequency of livelihood activities in various seasons, as stated by participants of focus group discussions. Common food crops comprise maize, cassava, groundnut and rice. Tobacco is the most common commercial crop in the study area.

SUPPLEMENTARY MATERIAL 1 Attitudinal questions asked in a survey about illegal behaviour in and around Ugalla Game Reserve, Tanzania (Fig. 1), and the effectiveness of management practices in the Reserve.

Name of enumerator:

Date:

Study village:

GENERAL INSTRUCTIONS FOR ENUMERATOR

- Before starting the interview, greet everyone you encounter at the household in a friendly manner. Then introduce yourself and carefully ask for their consent to carry out a brief interview with the head of the household in private for academic purposes. Thereafter, say these words to the respondent: ‘I am conducting a small survey on behalf of Paulo Wilfred, who is a tutor at the Open University of Tanzania, as part of his short-term training in England. The survey is about your livelihoods and how you interact with Ugalla Game Reserve. However, we are neutral, in the sense that we are not connected with the Reserve in any way, and the interview will be totally confidential and anonymous. Besides, you are free to withdraw at any time and you can choose not to answer any question.’
- If the respondent withdraws or chooses not to answer the questions, end the interview and write gender and approximate age in the table below.

Gender (<i>Tick √ one</i>)	
Male	
Female	
Approximate age (<i>Tick √ one</i>)	
20–30	
31–40	
41–50	
51–60	
>60	

HOUSEHOLD HEAD OR HIS REPRESENTATIVE







1. Gender: Male/Female
2. Age:
3. Education (*Tick √ one*):
 - Primary education
 - Secondary education
 - Higher education (College/University)
 - No formal education
4. Household composition by age, including members of the household during all or part of the past 12 months

Age	Number
0–10	
11–20	
21–30	
31–40	
41–50	

51-60	
>60	

Instructions for questions 5 & 6:

- For questions 5 & 6, please show the smiley face card provided and let the respondent point to a face that best describes their feelings about the question, then tick ✓ one correct answer among the options provided accordingly. Use the guide below to determine the correct answer.

					
-2	-1	0	1	2	N/A

- In the past 12 months, how has life for you and your household been? (Show the smiley face card and tick ✓ one accordingly)
 - Very good (2)
 - Quite good (1)
 - Okay (0)
 - Quite bad (-1)
 - Very bad (-2)
 - Don't know/prefer not to answer (N/A)
- In comparison to the rest of the village, do you think your household is (show the smiley face card and tick ✓ one accordingly):
 - Amongst the poorest in the village (-2)
 - Poorer than others (-1)
 - About the same as others (0)
 - Better off than others (1)
 - Amongst the most well off in the village (2)
 - Don't know/prefer not to answer (N/A)







CONSERVATION

- I am now going to ask you about Ugalla Game Reserve

- Firstly, I would like you to list three benefits that you and your household obtain from the Reserve, and then three costs that you and your household feel from the Reserve.

Benefits	Costs

- For questions 2, 3 & 4, please show the smiley face card provided and let the respondent point to a face that best describes their feelings about the question, then follow the instructions in each question to record the correct answer. Use the guide below to determine the correct answer.

					
-2	-1	0	1	2	N/A

2. Thinking about all the people who benefit or lose from the Reserve, how does each group benefit or lose from the Reserve, and why?

Readout each option in the table below. For each option show the smiley face card and let the respondent point to a face that best describes their feelings about the option, then write the number corresponding to the chosen face, and the reasons (if any) in the space provided.

Beneficiaries/Losers	Benefit? (-2, -1, 0, 1, 2, N/A)	Reasons, if any
Villagers living close to the Reserve		
Villagers living further from the Reserve		
Tanzanian people in general		
Foreign nationals		

3. If Ugalla Game Reserve were abolished, would you be (show the smiley face card and tick \surd one accordingly):

- Very glad (2)
- Quite glad (1)
- Neutral (0)
- Quite sad (-1)
- Very sad (-2)
- Don't know/prefer not to answer (N/A)

3.1 Why?

4. Thinking about the management of the Reserve, can you tell me whether the Reserve is (show the smiley face card and tick \surd one accordingly):

- Very effectively managed (2)
- Quite effectively managed (1)
- Neutral (0)
- Quite ineffectively managed (-1)
- Very ineffectively managed (-2)
- Don't know/prefer not to answer (N/A)

4.1 Why?

5. What do you think are the main threats to Ugalla Game Reserve and its wildlife?
6. If you were manager of Ugalla Game Reserve, what would you do differently in order to make the management more effective?