



WILD NATURE INSTITUTE

SUMMARY REPORT

Tuwatunze Twiga Song & Survey

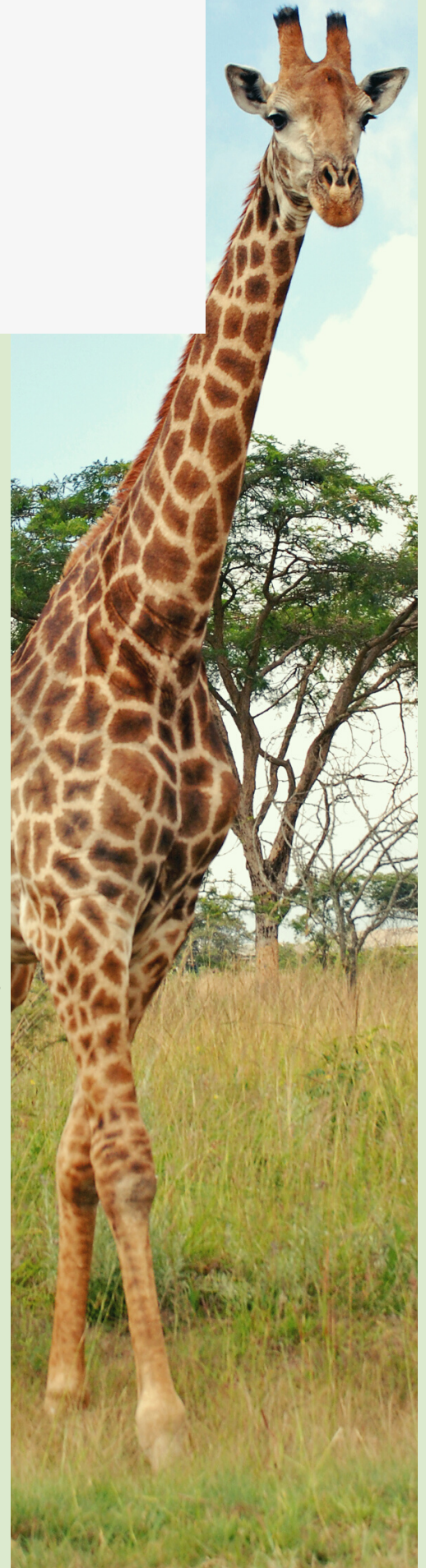
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Executive Summary

The giraffe (*Giraffa camelopardalis*), which exists across 21 countries in Africa, was listed as 'Vulnerable' after recognition that the population has declined 36-40% from 1985-2015 and continues to decrease (Muller et al. 2018). The Maasai giraffe (*Giraffa camelopardalis tippelskirchii*), a subspecies existing only in Tanzania, is classified as 'Endangered'.

In 2018 the Wild Nature Institute commissioned a gospel choir to record the song *Tuwatunze Twiga*, meaning 'let's conserve giraffes'. As part of an outreach strategy the song was broadcast across northern Tanzania urging listeners to recall the giraffe's beauty and protect it against poaching. Here, we assess how influential the song may have been in the three communities in which it was played.

A five-question survey was randomly administered to 240 community members before and another 240 members after broadcast of the song to capture baseline perceptions and changes that may have been induced by exposure to *Tuwatunze Twiga*.

We found that most respondents agreed that giraffe are beautiful, enjoyed having them live nearby, recognized they are threatened by poachers, and encouraged continued or improved efforts to protect the species and other natural resources. Respondents who heard the song are significantly more likely to agree more with the statement that God tells some people to protect giraffe. We suggest that broadcasting the song continue, along with other education and behavioral change efforts to help improve success.





Key Takeaways

- Nearly all respondents agreed that giraffe are beautiful with 89% agreement in the pre-song survey and 97% agreement in the post-song survey. (Pg. 9, 13)
- There was a significant increase in the percentage of respondents who agreed giraffe are beautiful between the pre-song survey and post-song survey. (Pg. 13)
- Roughly 70% of community respondents agreed that giraffe are threatened by poaching. (Pg. 11)
- Only 30% of post-song respondents heard the *Tuwatunze Twiga* song. Impacts of the song may have been easier to detect if a larger portion of the sample had been exposed. (Pg. 12)
- Paradoxically, in post-song surveys there was a 9% increase overall in the percentage of people who disagreed with the statement that they 'enjoy having giraffe living nearby'. (Pg. 13)
- People who have heard *Tuwatunze Twiga* were significantly more likely to agree that God tells some people that we should protect giraffe. (Pg. 14)



- Significantly more respondents from Makuyuni than the other two communities agreed that they enjoyed giraffe living nearby, they are beautiful, and that God tells some people they should be protected. (Pg. 8)
- In Mtowambu, there was a 19% increase in agreement that giraffe are threatened by poachers after *Tuwatunze Twiga* was released. The opposite was observed in Kigongoni and Makuyuni where 15-18% more people disagreed with this statement in the post-song surveys relative to the pre-song surveys. (Pg. 15)
- In Kigongoni, there was a 27% increase in agreement that giraffe are beautiful and a 13% increase in agreement that God tells some people we should protect giraffe after *Tuwatunze Twiga* was released. (Pg. 15)
- Of the three communities, Kigongoni had the smallest proportion of people who heard the song (24%), but the greatest changes in responses from pre- to post-song surveys, suggesting that results may stem from under-sampling. (Pg. 12, 15)
- In general, swings in agreement and disagreement from pre- to post-song surveys was highly variable and depended on the community surveyed. (Pg. 15)
- Respondents were mostly supportive of people working to protect natural resources like giraffe; they believe they are doing a good job and that protection efforts should be enhanced, specifically against poaching. Post-song surveys collected slightly more comments than pre-song surveys indicating that resource protection efforts were not sufficient and should be improved. (Pg. 16-17)





Introduction

In 2016 the giraffe (*Giraffa camelopardalis*), which exists across 21 countries in Africa, was listed as ‘Vulnerable’ after recognition that the population has declined 36-40% from 1985-2015 and continues to decrease (Muller et al. 2018). Within the giraffe are nine subspecies and only the Maasai giraffe, which accounts for a significant portion of the overall giraffe population, exists in Tanzania. In Swahili, the official language of Tanzania, ‘twiga’ means giraffe. Chosen for their grace, and long necks which can allow them to look far into the past and present, the giraffe is Tanzania’s national animal and protected under Wildlife Conservation Act No. 5 of 2009 (Wildlife Conservation Act 2009).

Despite their cultural, symbolic, and economic importance, the Maasai giraffe population continues to decline and the subspecies is classified as ‘Endangered’. Population monitoring across nine regions in Tanzania including large protected areas (national parks, game reserves, etc.) indicates that from 1986 to 2016 Maasai giraffe numbers in these areas have declined from approximately 38,000 to 23,000, or a 37-43% decline (Muller et al. 2018). While the various subspecies and populations

of giraffe face unique challenges, the Maasai giraffe are particularly endangered by land use change, habitat degradation and poaching for meat, hides, and tails. As the Maasai and other giraffe subspecies become increasingly endangered, efforts to protect and restore their habitats and populations grow, too.

To conserve the Maasai giraffe, and other giraffe subspecies, engaging nearby human communities to take the steps necessary to conserve the animals is essential. Interest in and capacity to engage in wildlife conservation will depend heavily on ecological factors as well as an array of political, social, economic conditions. Helping improve local peoples’ positive perceptions of giraffe will be integral to ensuring improved and further conservation efforts for the Maasai giraffe. One recently implemented outreach innovation has been the creation and broadcast of a gospel song across northern Tanzania urging listeners to recall the giraffe’s beauty and protect it against poaching. Here, we assess how influential the song may have been in the three communities in which it was played.



Study Methods

In 2018 the Wild Nature Institute commissioned a gospel choir to write and record a 1-minute song, *Tuwatunze Twiga*, about the unique and beautiful characteristics of giraffe while urging people not to poach them (Appendix I). The song also emphasized that God created giraffe and we as humans are responsible for protecting them. *Tuwatunze Twiga* played on local radio stations over the course of several months. The primary objective was to engage local peoples' interest in giraffe protection by exposing them to the song and its messages. Short surveys of community members were conducted before and after broadcast of the song to document their baseline perceptions of giraffe and determine whether they were influenced by *Tuwatunze Twiga*. Such an assessment can help inform effective and inclusive solutions for addressing conservation challenges. Survey results also captured a rough idea of the percentage of people who heard the song. The song and accompanying survey were launched by Wild Nature Institute and developed with study design assistance from The Living Desert Zoo and Gardens.

The song was recorded by the Ngorongoro Hosea Kwaya Gospel Choir and is titled *Tuwatunze Twiga*, meaning 'let's conserve giraffe'. The song played on one radio station broadcasting from Mtowambu that reaches the three communities where surveys were

administered - Makuyuni, Kigongoni, and Mtowambu. The region in which these communities are located was selected because it incorporates two of the most popular national parks in Tanzania - Tarangire and Lake Manyara. These national parks, together with a large working ranch and conservancy Manyara Ranch and surrounding village lands, support one of the most important Maasai giraffe populations in the country. The Wild Nature Institute has been conducting long-term scientific research on giraffe survival, reproduction and movements that began in 2011.

The song played once during the daily morning news for the entire months of December (2018) and January (2019). The primary religions in Tanzania are Christianity (65%) and Islam (35%) (PRC 2010). Although the communities are nearby each other, the frequency of human-giraffe interaction and local attitudes or beliefs associated with giraffe may differ among them. Makuyuni, Kigongoni, and Mtowambu have populations of roughly 11,200, 11,000, and 11,400 people respectively (Sensa 2012; Mindat, 2016). The song played with the intention of influencing listeners' perceptions about giraffe and the poaching activities leading to their decline. Surveys were administered approximately one month before the song began playing and again a month after it ceased playing. Surveys were designed to assess how residents liked giraffe, perceived their poaching as





FIGURE 1. Approximate location of three communities surveyed. Communities are marked with yellow circles and include Mtowambu, Kigongoni, and Makuyuni (Image from Google Earth).

a threat, whether they thought protection of giraffe was necessary, and if any changes in perceptions from pre- to post-song sampling may have been influenced by the song.

In total, a pre-song and a post-song intercept survey was administered to 237 and 240 people respectively, with an average of 79.5 respondents per each of three towns (range 78-80) on each survey. A systematic probability sampling method was used to select respondents (Moring 2014). The surveyor, while standing in an active area of the focal community, approached every third passerby to request that they complete the two-minute survey. If multiple people were in a group, one person was randomly chosen to be asked. If that person said no, then the rest of the group was skipped. Surveys were administered orally with the surveyor recording quantitative answers and key phrases or notes from the qualitative responses on individual paper copies of the survey.

The pre-song survey (Appendix II) included five items. Four of the five Likert-type items were presented as statements with response options falling along a five-point scale ranging from ‘strongly disagree’ to ‘no opinion’ to ‘strongly agree’. One open-ended question asked respondents to explain their thoughts about people working together to protect the natural resources of Tanzania, including giraffe.

Post-song surveys (Appendix III) were administered after the song had been playing for approximately 8 weeks. Post-song surveys included the same five questions as the pre-song survey but added a sixth asking if the respondent had heard the *Tuwatunze Twiga*. Surveys were administered in the same method described above and responses were collected from approximately 80 people in each of the three towns. Pre-song surveys were completed in November of 2018 while post-song surveys were completed in February of 2019.



Data from all surveys were entered to Microsoft Excel and analyzed using basic descriptive statistics. Inferential statistical tests were performed using the statistical software R (R Core Team 2020). Likert-type responses were translated from text to numerical values where 'strongly disagree' = 1, 'no opinion' = 3, and 'strongly agree' = 5.

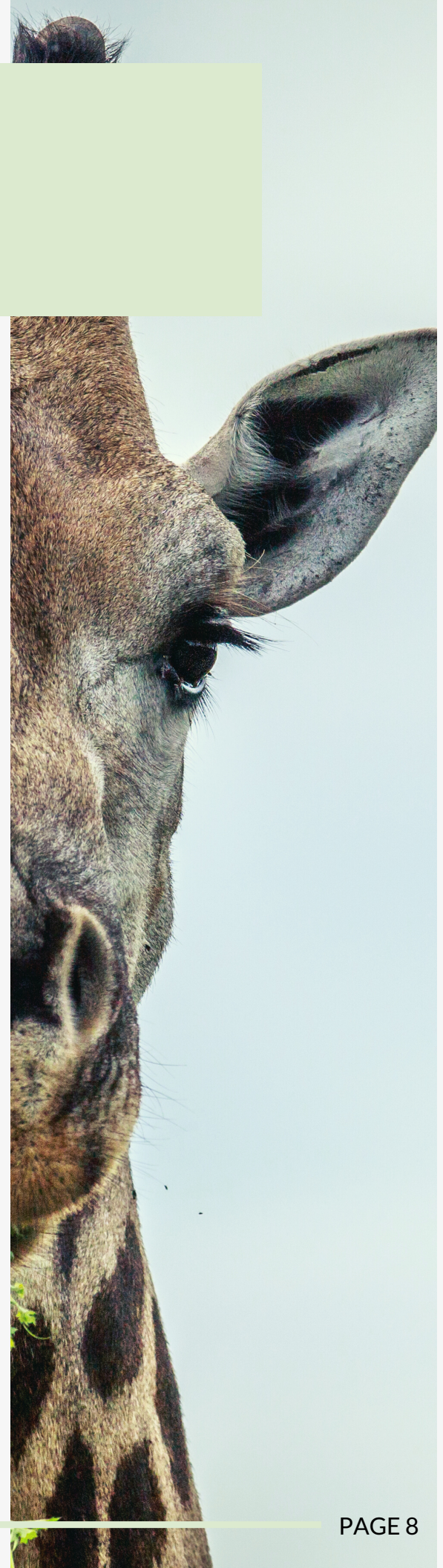
These numerical values were used to calculate means or other values for statistical analyses. See Appendix IV for details on statistical tests. Note that the sample is not representative of the population (town) and therefore results are not generalizable.



Results

Data indicate that *Tuwatunze Twiga* may have influenced the perceptions of residents, especially on whether they believe God tells people to protect giraffe. Residents sampled across pre- and post-song surveys mostly agree that giraffe are beautiful and enjoy that they live nearby. Overall, there is more dispersion of agreement among respondents about the threat posed to giraffe by poachers and whether God tells some people to protect giraffe, but there is still more agreement about these statements than disagreement. Most respondents to the pre-song survey said that they were supportive of people working to protect natural resources like giraffe, they believe they are doing a good job, wildlife should be protected, anti-poaching work is important, and that protection efforts should be enhanced. While most post-song survey responses also describe praise for the people protecting wildlife, noticeably more post-song respondents report that wildlife should be protected, rangers are not doing a good job, and they should enhance or improve efforts. Only 72 (30%) of 240 people surveyed overall had heard *Tuwatunze Twiga*.

In post-song surveys, there was significantly greater agreement with the statement that giraffe are beautiful, with some slightly greater disagreement with the statement 'I enjoy giraffe living nearby'. Secondly, people who had heard *Tuwatunze Twiga* reported significantly greater levels of agreement with the statement that 'God tells some people to protect giraffe'. Among the three communities sampled, significantly more residents from Makuyuni than the other two communities agree that giraffe are beautiful, they enjoy them living nearby, and that God tells some people to protect them.



Pre-Song Survey Results

Although pre-song surveys were administered to 241 people, just 237 responded to more than half of the questions. Of these 237, 80 were from Kigongoni, 78 from Makuyuni, and 79 from Mtowambu. Demographic data were not collected in pre-song surveys. Responses to the four Likert-type items (Figure 2 and 3) serve as a baseline for comparison of post-song survey results to understand if the distribution of responses shifted significantly after residents were exposed to the *Tuwatunze Twiga* song.

Most respondents agreed with statements one and two (Figure 2), but residents sampled from Makuyuni expressed the greatest amount of agreement compared with other groups. Mtowambu expressed the most disagreement with the statement that giraffe are threatened by poachers. The greatest dispersion in responses to a question among the communities was in response to whether God tells people to protect giraffe (Figure 3). A series of Kruskal-Wallis rank sum tests verify that, overall, distribution of responses to each question is variable across the three communities (Table 1).



Statement	Median Response Value			Kruskall-Wallis Chi-Squared
	Kig.	Mak.	Mtwo.	
Enjoy giraffe nearby	4	5	4	$\chi^2 = 15.97, p > 0.001$
Giraffe are beautiful	4	5	5	$\chi^2 = 28.82, p > 0.001$
Threatened by poaching	4	4	4	$\chi^2 = 12.14, p = 0.002$
God tells people to protect	3	4	4	$\chi^2 = 10.02, p = 0.006$

TABLE 1. Differences among median response values for three communities to four survey statements. Response items occurred on a five-point scale where 1 = strongly disagree, 3 = no opinion, and 5 = strongly agree.



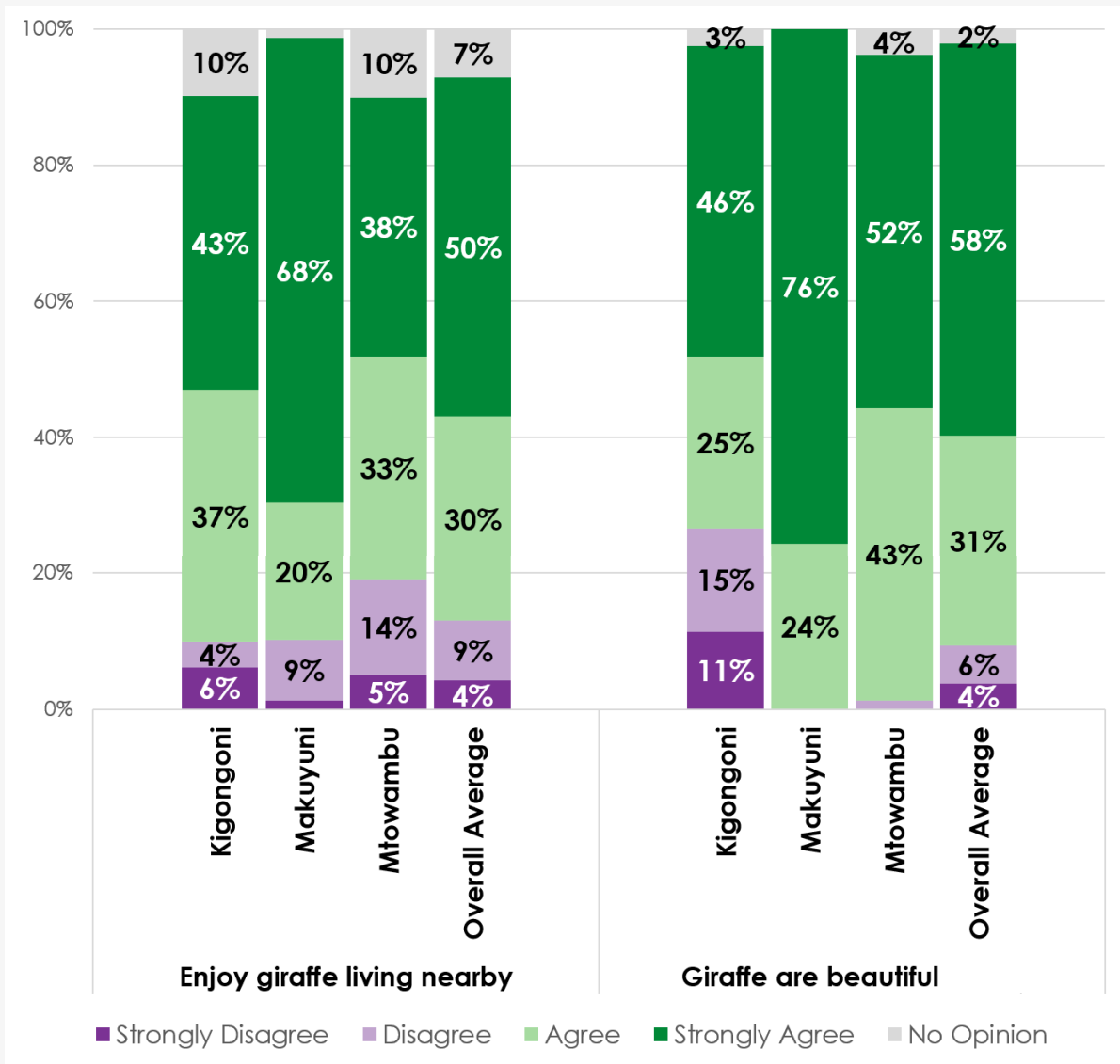


Figure 2. Perceptions of sampled residents I: Pre-song survey. Distribution of responses to Likert-items one and two. For item one (left) n = 239; n = 236 for item two.



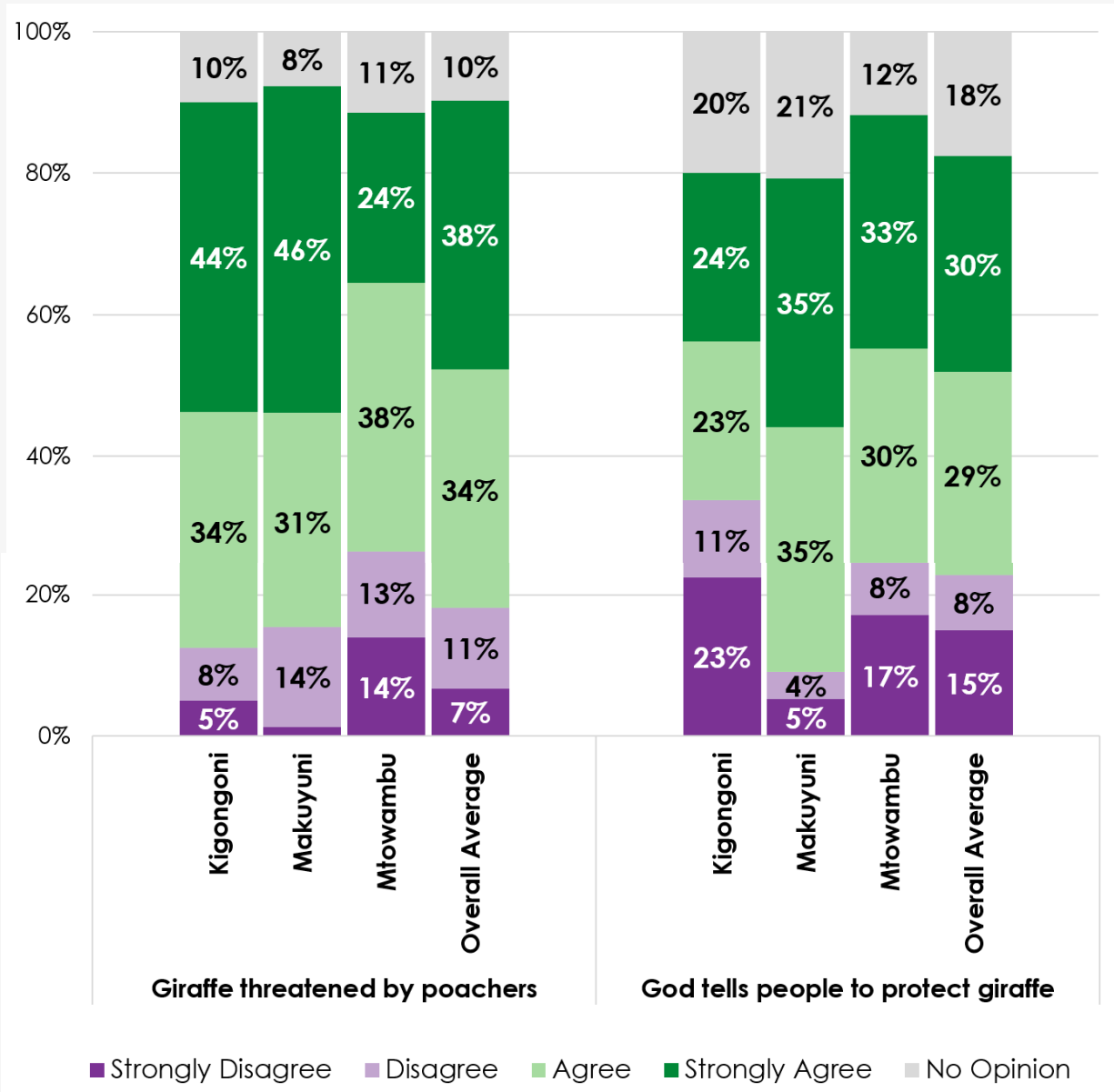
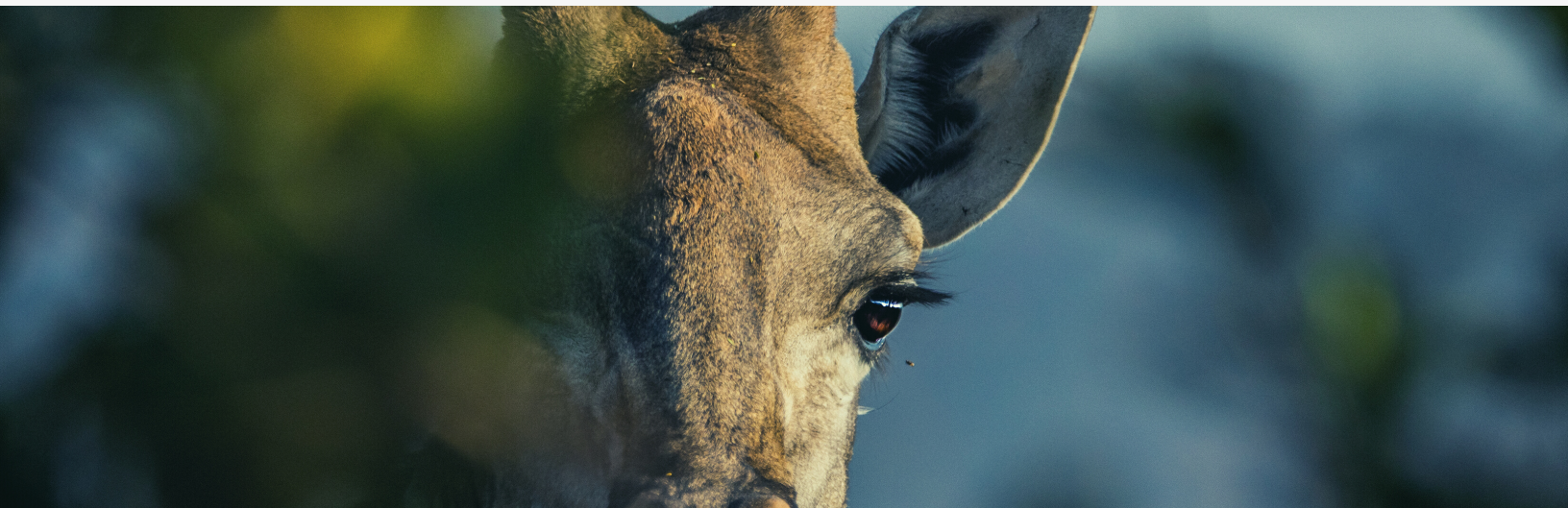


Figure 3. Perceptions of survey respondents II: Pre-song survey. Distribution of responses to Likert-items three and four. For item three (left) n = 237; n = 233 for item four.



Post-Song Survey Results

Post-song surveys were administered to 240 residents from the three communities, with only 30% reporting to have heard *Tuwatunze Twiga* (Table 2). Respondent age (Figure 4) varied widely from 16 to 67, with a modal age of 27 and mean of 32. The respondent pool was male biased, with 73 females and 128

males participating in the post-song survey. The average age of those who had heard the song is 30.5, which is negligibly less than that of those who had not – 32 years old.

Location	Heard Song	Did Not Hear Song	Total
Makuyuni	27 (34%)	53 (66%)	80
Kigongoni	19 (24%)	61 (76%)	80
Mtowambu	26 (33%)	54 (67%)	80
Total	72 (30%)	168 (70%)	240

Table 2. Proportion of respondents from each community who heard *Tuwatunze Twiga*.

When post-song survey data are compared with pre-song survey data, there is minimal change in degree of agreement with each of the four statements (Figure 4). However, there was a significant increase in agreement with the statement that giraffe are beautiful, with more respondents in the post-song survey agreeing with the statement (Kruskal-Wallis chi-squared = 13.838, $p = 0.0001$) than those who responded to the pre-song survey. In pre-song surveys, 89% of all respondents

agreed that giraffe are beautiful while 97% agreed in post-song surveys. However, there was no significant difference in perception between respondents who heard the song and those who did not. Respondents who heard the song expressed a slightly lower mean level of agreement with the statement than those who did not (among respondents who heard the song agreement was 4.58 (SD = 0.86), versus 4.67 (SD = 0.59) among those who did not).



Finally, while not statistically significant, there is an observed 9% increase in the proportion of respondents who do not enjoy giraffe living nearby (Figure 4). If the song influenced public opinion as was intended, the agreement bars for each of the four questions should all be positive and the disagreement bars should all be negative in Figure 5. This was only the case for the statement that giraffe are beautiful.

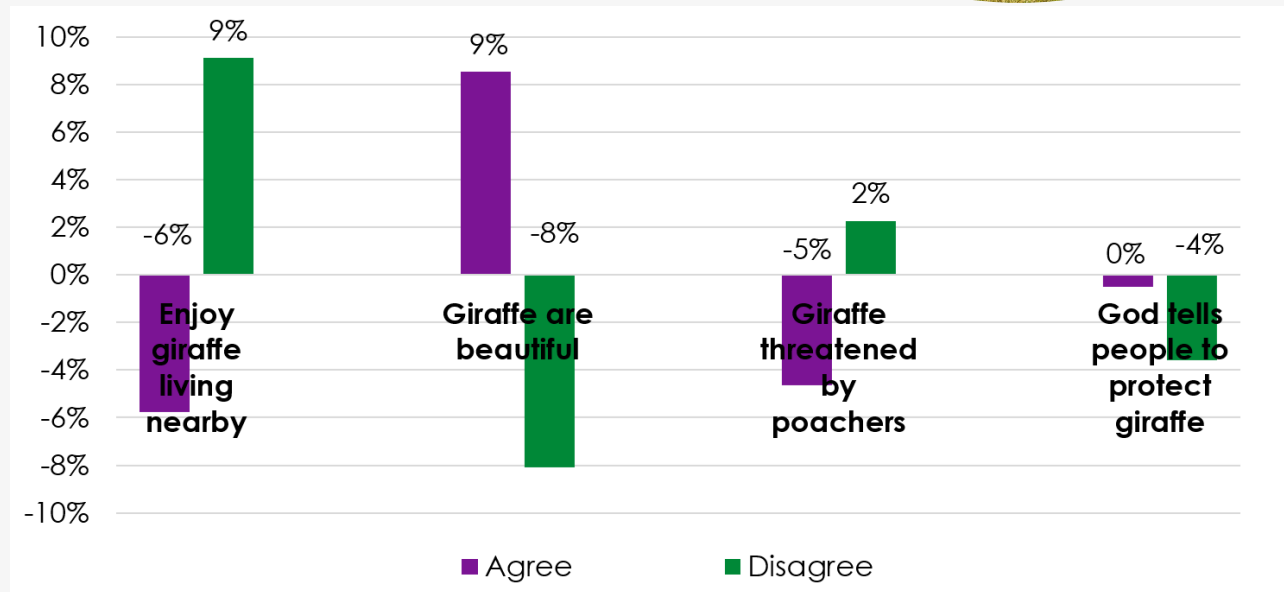


Figure 4. Changes in agreement with four statements from pre- to post-song surveys. Net change in total agree and disagree responses from pre- to post-song surveys. We combined 'strongly agree' and 'agree' values and combined 'strongly disagree' and 'disagree' value for composite 'agree' and 'disagree' values. A negative number indicates a decline in responses in either agreement or disagreement with that question from pre- to post-song surveys, whereas a positive number indicates an increase. Note that some change was in the 'no opinion' response which is not shown here.



Although overall disagreement with the statement that ‘God tells at least some people to protect giraffe’ increased across post-song respondents, the 72 respondents who heard *Tuwatunze Twiga* expressed significantly more agreement with the statement than those who had not heard the song (Kruskal-Wallis chi-squared = 5.693, df = 1, p = 0.017) (Figure 5). The mean response value to this statement among

respondents who heard the song was 3.75 (SD = 1.49), versus 3.24 (SD = 1.59) for those who did not hear the song. Similarly, among those who heard the song, there was a non-significant trend towards more agreement with the statement that giraffe are threatened by poachers. The mean response value for those who heard the song was 4.01 (SD = 1.28) and 3.67 (SD = 1.42) for those who did not.

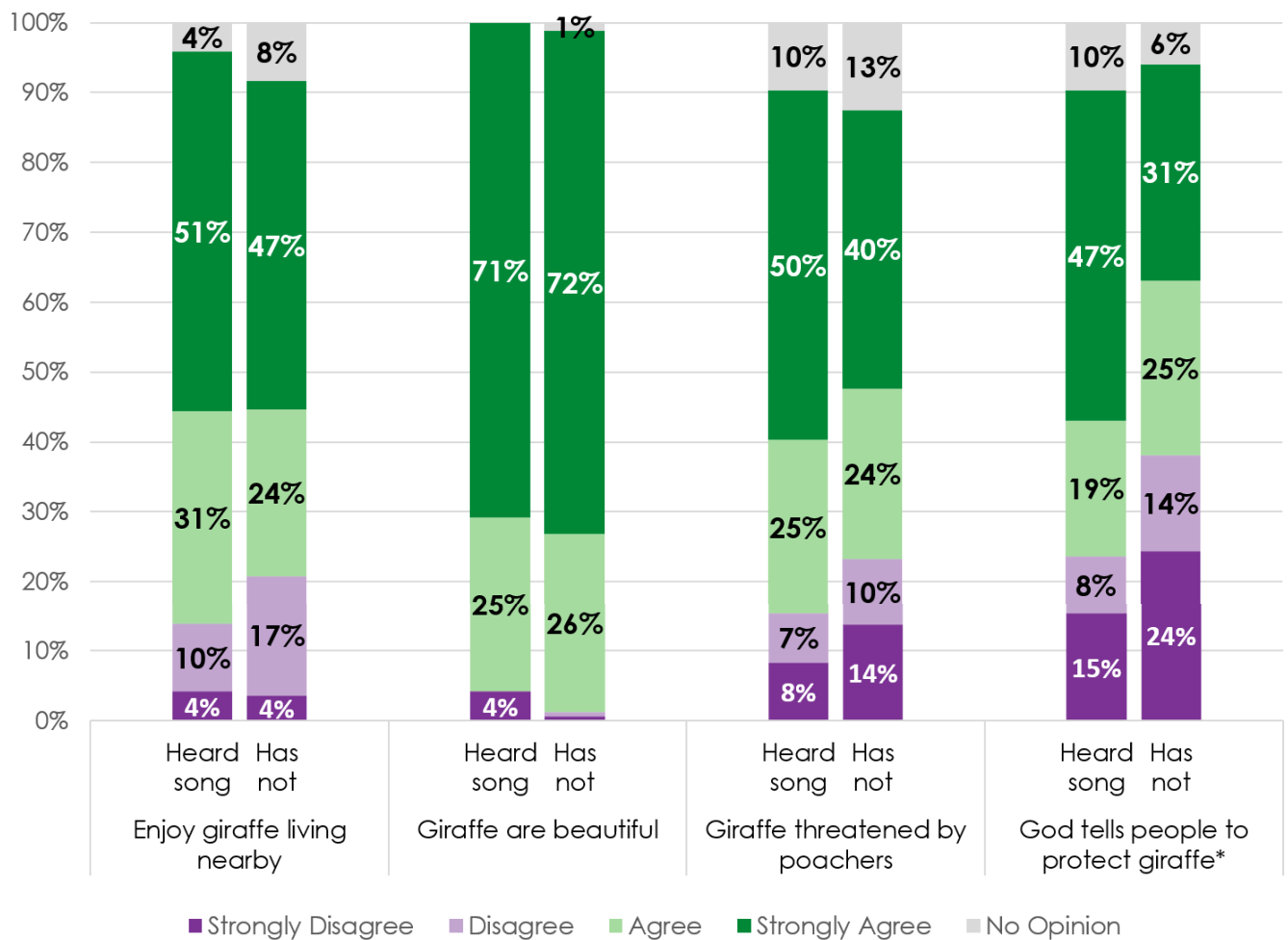


Figure 5. Perceptions of giraffe: people who have heard the song vs. those who have not. Distribution of responses to four survey statements from people who have heard *Tuwatunze Twiga* and those who have not. * p < 0.05.



Comparing pre- to post-song survey results at the community level revealed differences in perceptions (Table 3). Results from Kigongoni indicate a 26% increase in the percentage of respondents who strongly agreed that giraffe are beautiful and a coupled 26% decrease in the frequency of 'strongly/disagree' responses. In Mtowambu there was also a 27% increase in 'strongly agree' responses, or a 19% net increase in overall agreement, with the statement that 'giraffe are threatened by poachers' and a coupled 12% decrease in 'strongly/disagree' responses. However, since only 24-34% of

respondents from each community heard *Tuwatunze Twiga*, it is difficult to confirm that these changes can be attributed to the song and were not instead merely sampling effects. Interestingly, Kigongoni had the greatest swings in degree of agreement to each statement from pre- to post-survey, but this community had the smallest percentage of respondents (24%) who heard the song. As above, if the song influenced public opinion as was intended, the Agree values in Table 3 for each of the four questions should all be positive and the Disagree values should all be negative in Figure 5 in each of the four communities.

	Kigongoni		Makuyuni		Mtowambu		Overall Avg.	
	Agree	Disagree	Agree	Disagree	Agree	Disagree	Agree	Disagree
I enjoy having giraffe living nearby	-13%	18%	-5%	5%	0%	5%	-6%	9%
I think giraffe are beautiful animals	27%	-27%	-4%	1%	3%	1%	9%	-8%
I think giraffe are threatened by poachers and other illegal hunters	-15%	11%	-18%	7%	19%	-12%	-5%	2%
I think God tells at least some people we should protect giraffe	13%	-16%	-6%	5%	-8%	1%	0%	-4%

Table 3. Percent change in dis/agreement between pre- and post-song surveys. We combined 'strongly agree' and 'agree' response values and combined 'strongly disagree' and 'disagree' response values for composite 'agree' and 'disagree' values. Figures in 'Agree' and 'Disagree' columns are a summation of total change on either side of the agreement spectrum.





Perceptions of Natural Resource Protection in Tanzania

Respondents were asked what they thought about people working together to protect the natural resources of Tanzania, including giraffe. See Appendix IV for analysis methods. Respondents typically provided a one or two sentence response. It is important to note that most people clearly gave their thoughts on efforts to protect the giraffe specifically, however others may have answered a broader question about efforts to protect the collective natural resources in Tanzania. Most respondents believed that rangers, and others working to protect giraffe/natural resources, are doing well and/or should continue working toward these ends (Figure 7). However from pre- to post-

song surveys the ideas that (1) rangers are doing a good job and that (2) wildlife should be protected were both less frequent. Alternatively, statements relating to larger themes of (1) rangers/resource conservationists not doing a good job and that (2) they should enhance their efforts both became more frequent. Based on whether respondents heard the song, only one theme had a clear difference. Of the 72 people who heard *Tuwatunze Twiga*, 38% said that rangers/resource conservationists are doing a good job while just 28% of the 168 who did not hear the song included this sentiment in their response. However, this difference may be related to sampling effects.



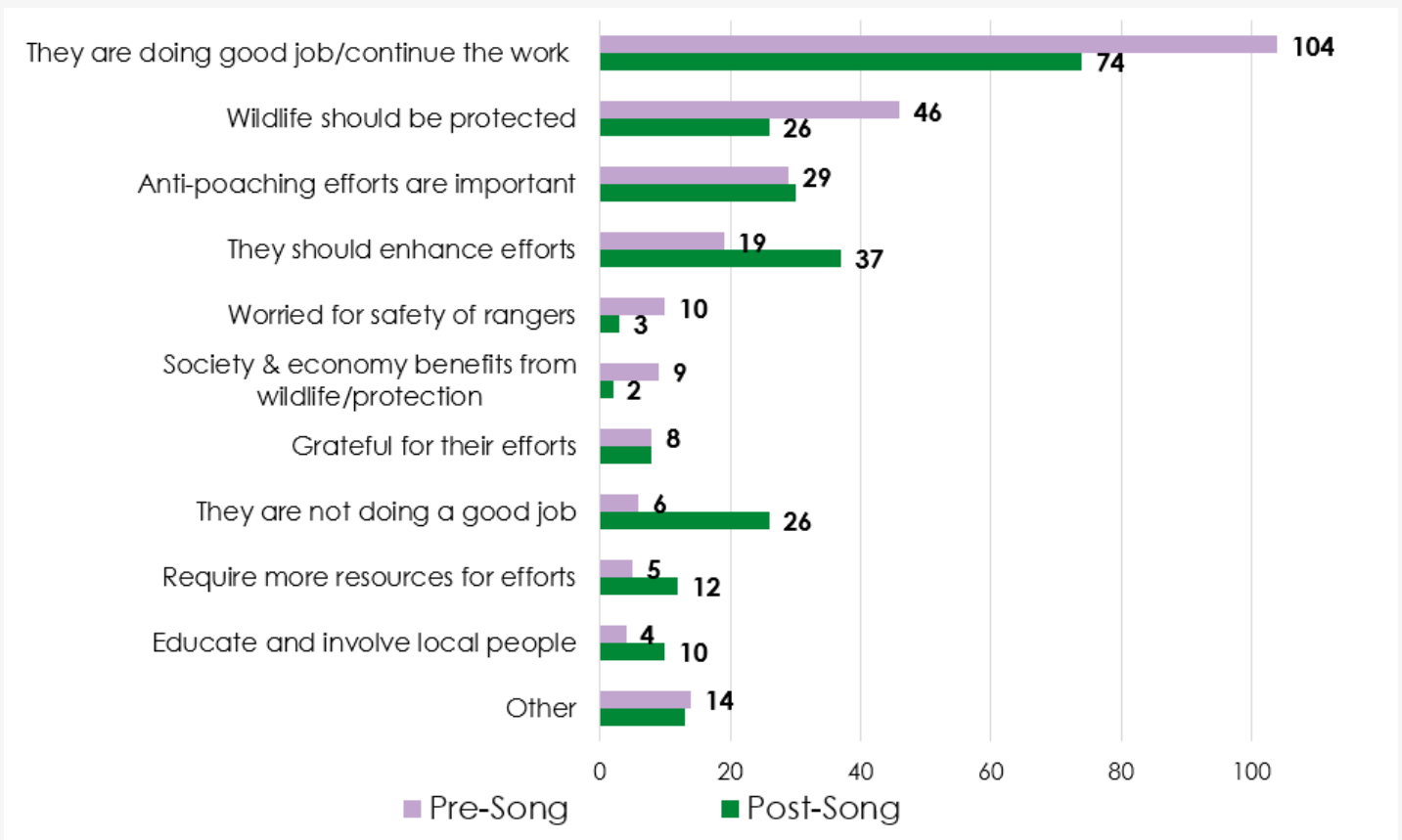


Figure 7. Perceptions of people working to protect wildlife & natural resources in Tanzania. Frequency of commonly mentioned perceptions collected in pre- and post-song surveys. Twenty-eight people in the pre-song survey and 50 in the post-survey provided 'no comment'.

As a supplement to survey data, the surveyor recorded basic observations about each of the communities. In Makuyuni, there had been several cases of human-wildlife interactions resulting in conflict, and many people complained that elephants had destroyed their crops. However, most seemed to like giraffe since they posed no threat to their farms. Just before pre-song survey administration, there were two giraffe roadkill incidents. Local police mentioned they gather villagers and other stakeholders to discuss such roadkill incidents. Thus it is possible that residents' responses to the survey may have been influenced by the recent event.

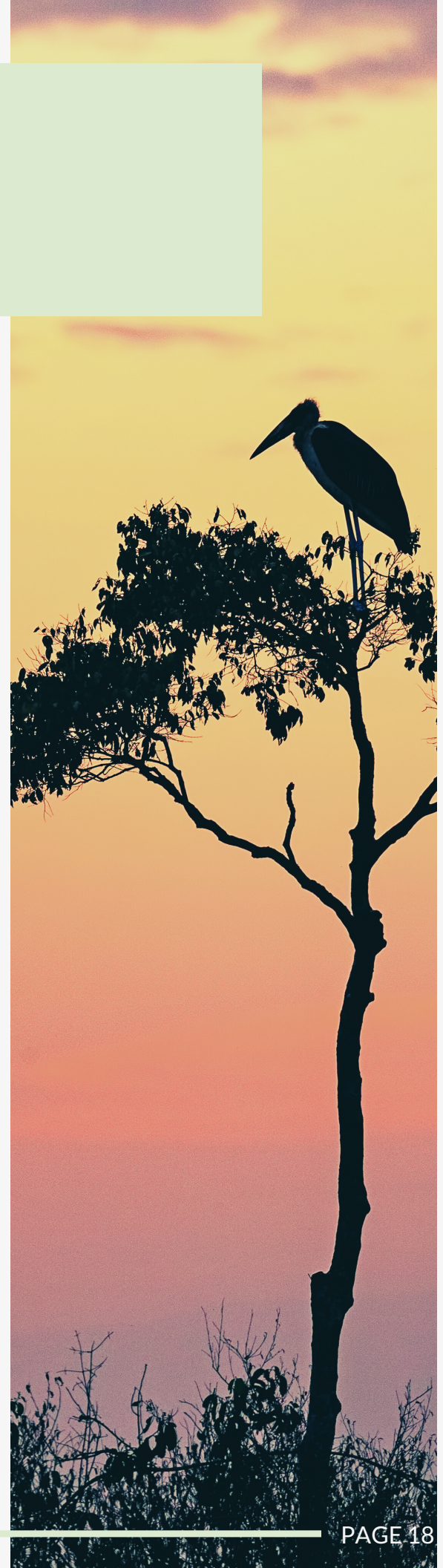
In Kigongoni several people complained about mistreatment by the Tanzanian Wildlife Authority's anti-poaching unit. According to some people, when the unit is informed of illegal hunters among villagers, they persecute whomever they suspect rather than conducting a proper investigation. Finally, since Mtwambu is near Lake Manyara National Park, and the residents likely interact more with park staff and rangers, the proximity and subsequent interactions may influence their perceptions of giraffe and protection efforts. Note that these observations were taken via informal methods and are not complete but can add some context to data.



Conclusions

The *Tuwatunze Twiga* song was launched with the intentions of increasing positive perceptions of the giraffe and awareness of the threat caused by poachers while encouraging people to engage in the collective responsibility of appreciating and protecting this beautiful species. The design of a gospel song, with references to God's creation of the giraffe and His plea that humans protect it, was especially intended to appeal to values and beliefs of the predominantly religious audience. The goal of this and other outreach campaigns is to increase awareness, tolerance, and appreciation of wildlife to create greater support for and perhaps engagement in wildlife conservation efforts. Given that the Maasai giraffe is increasingly endangered, public support for the conservation of the species is critical.

Tuwatunze Twiga may have significantly influenced public perceptions of giraffe across all three test communities, specifically by increasing the degree to which respondents believe God tells people we should protect giraffe. It is possible that the messaging in the song appealed to listeners' existing belief systems and also promoted the protection of the giraffe as a social or moral norm (Stern et al. 1985; Stern et al. 1999). Other non-significant differences observed in the post-song survey group, such as the decrease in support for giraffe living nearby, may be related to exposure to the song but seems unlikely. The significant differences in how the three communities responded between surveys can be explained by the relative scarcity of respondents who heard the song, strong and idiosyncratic socio-ecological conditions influencing each, or simply by sampling effects.

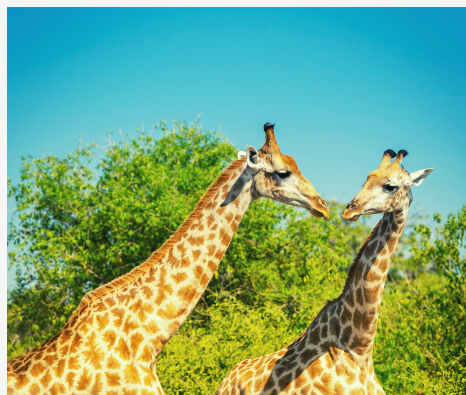


Interestingly, all three communities expressed 5-18% more disagreement with the statement 'I enjoy having giraffe living nearby' in the post-song surveys than in pre-song survey. To no other statement in the post-song survey did all community responses change similarly. From pre- to post-song surveys, Makuyuni residents expressed 18% less agreement with the idea that giraffe are threatened by poachers while Mtowambu expressed 19% more agreement with the statement. The responses to 'I enjoy giraffe living nearby' from the 72 respondents who heard *Tuwatunze Twiga* is essentially the same between the pre- and post song surveys. As such, the increasing disagreement with 'I enjoy having giraffe living nearby' between surveys was due to changes among those who had not heard the song. Therefore, it is likely that this difference is due to sampling effects rather than a change inspired by the song.

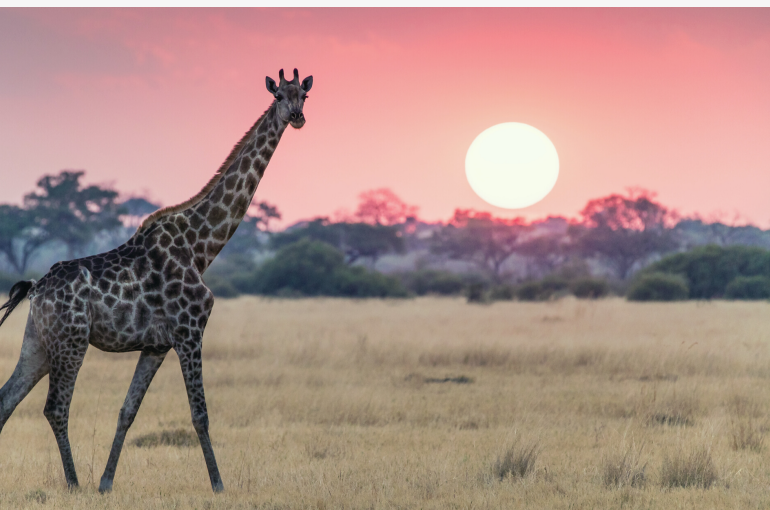
In the post-song survey there was a significant increase among all three communities in agreement that giraffe are beautiful. However, there was no difference in response between those who heard the song and those who did not, likely indicating that the change was not caused by exposure to the song. On the contrary, slightly more people who

have not heard *Tuwatunze Twiga* strongly agree that giraffe are beautiful than those who did hear it. While Mtowambu and Makuyuni had negligible changes in agreement with this statement, 27% more of Kigongoni respondents agreed with the statement in the post-song survey than in the pre-survey. The statistically significant difference observed between surveys among all three communities was likely driven by the large percentage increase recorded in Kigongoni alone. However, it is difficult to confirm that the change observed in Kigongoni is related to the gospel song and not to a sampling effect, especially when just 19 people in the sample of 80 heard the song, compared with 26 and 27 in other towns.

One challenge in deciphering meaningful changes from pre- to post-song surveys could be related to our question design. While Likert-type scales are helpful for measuring opinions and attitudes toward an object (Likert 1932), analysis and interpretation of the data encounters challenges related directly to the structural nature of the question. In this case, we analyzed Likert-type items which can be less reliable than a full Likert-scale (Carifio and Perla 2007). In any case though, statistical analysis and interpretation of individual Likert



questions are especially challenging as they can produce misleading results (Clason and Dormody 1994; Jamieson 2004; Carifio and Perla 2008; Scherpenzeel and Saris 1997). The 36 km separating Mtowambu and Kigongoni



from Makuyuni is quite small. Local events or socio-cultural factors may have fed the differences we observed at the community level, including several cases of human-wildlife crop raiding conflict in Makuyuni, mistreatment by the Tanzanian Wildlife Authority's anti-poaching unit in Kigongoni, and that the residents of Mtowambu likely interact more with park staff and rangers because it is near Lake Manyara National Park. These events and interactions may influence community-level perceptions of giraffe and protection efforts.

What is clear is that people who have heard the song are significantly more likely to agree that God tells some people that we should protect giraffe. Given that the majority of the Tanzanian population identifies as very religious, it is likely the song appealed to their worldview, and thus reinforced the idea (Kahan et al. 2017; Oreg and Katz-Gerro 2006) that giraffe are God's creatures and should be protected. Some studies

have exemplified a negative relationship between Judeo-Christian beliefs and environmental values and concern (Guth, Green, Kellstedt, & Smidt, 1995; Hartwig, 1999; Shultz et al. 2000). However, there are many Biblical citations in the three Abrahamic religions that purport the natural world is a gift from God and to be worthy of protection (Wardekker et al. 2009). How pro-environmentalist beliefs and action are framed may influence whether those receiving the message are receptive (Wolsko et al. 2016). For example, Schuldt et al. (2016) found that awareness of Pope Francis' beliefs on climate change significantly influence public opinions by enhancing moral beliefs about climate change action. The Pope, a highly respected global leader, has famously framed climate change action as a moral imperative, engendering belief in and concern for the issue among followers who previously thought differently.

When compared with pre-song survey results, there was a notable but non-significant increase in percent of total post-song respondents who heard the song who agreed that giraffe are threatened by poachers. Why Mtowambu might have experienced a 19% boost in agreement with this statement (giraffe are threatened by poachers), compared to -15 and -18% decreases in agreement in the other two communities, warrants further investigation. Additionally, a deeper understanding of the unique socio-ecological conditions in each location – e.g. interactions with poaching units, proximity of giraffe or protected areas, frequency of human-wildlife interaction, roadkill incidents, prevalence of wildlife tourism, etc. – would in turn inform a deeper understanding of the data collected from each community.



Future Directions



Although detecting changes caused by exposure to *Tuwatunze Twiga* is challenging, results do reveal other insights that can be used to design and inform future interventions. First, it is obvious that residents sampled believed giraffe are beautiful. This does not necessarily correlate to support for conservation of the species, but it would likely not facilitate conservation efforts if residents did not believe the species was beautiful (Knight 2008). Second, because only 59-78% of respondents agreed with the statement that giraffe (and other wildlife) are threatened by poachers, there may be a great opportunity to increase public knowledge of these threats. Third, because 47-70% of respondents agreed that God tells people we should protect giraffe, leveraging this belief in other settings and communicues can benefit from preexisting belief systems. Last, the qualitative responses indicate that most respondents seemed supportive of natural resource and giraffe protection efforts. Many respondents recognized the importance of protection efforts and some even suggested that they should be better funded or improved. Therefore, community members would likely be supportive of future endeavors to increase protection of wildlife and other natural resources.

Although *Tuwatunze Twiga* did not lead to many large changes in pro-environmental beliefs, we nonetheless recommend that local radio stations continue to play *Tuwatunze Twiga*. Members of the public are more responsive to musical messages, and continued popularization of the song could become self-perpetuating if it becomes more prominently part of the culture. In the future, it may be additionally



helpful to include a brief spoken, one to two sentence campaign message at the end of the song to make the message even more explicit. The song may be more impactful if it is partnered with other outreach efforts to create a larger, more encompassing and coordinated outreach campaign and ongoing educational efforts as a core thematic element. The song also has potential to be used in other creative performance ways (e.g. live choirs or dances) which may amplify the message it carries.

One shortcoming of this study is that post-song samples were not representative of the population as indicated in the male bias in respondents, and that demographic data were not collected for the pre-song survey group. The male bias may be caused by lower proportion of women willing to speak with the unfamiliar men conducting the survey. Future surveys can quantify the proportion of available males and females. Secondly, sampling effects have likely confused reliability of some results. The current questionnaire asks about general knowledge and perception of giraffe but is methodologically limited in its ability to answer how listeners were impacted specifically by *Tuwatunze Twiga*. Contextual information about the socio-ecological conditions in each community may have helped explain the community-level

changes observed in pre- to post-surveys across locations.

During future comparable research and interventions with *Tuwatunze Twiga*, researchers can consider targeting specific audiences (e.g. youth, taxi drivers, homemakers, business workers, church- or mosque-goers, farmers, etc.). In this way, specific but open-ended questions could be tailored to each group about how they perceive the song, how it affects their perceptions of giraffe and threats to them, if they find it an effective tool for communication, if they would like to hear other conservation messages through song, and how the song could have been more influential. For example, it would be interesting to specifically ask respondents what most prominent message they received from the song. Future surveys may include a question relating to respondents' behavioral intentions related to conservation such as sharing the message with others or wanting to learn more about giraffe and poaching.

Finally, given that the song appears to have had a significant effect on respondents' beliefs that God tells people to protect giraffe, future research can examine which religious beliefs the song is appealing to and how these beliefs may be leveraged to create meaningful conservation or educational action.



Appendix I. Swahili Lyrics & English Translation of Tuwatunze Twiga

Title *Tuwatunze twiga*

Title *let's conserve giraffe*

Acha kuwauwa twiga

Stop killing giraffe

Twiga twiga ni mnyama mwenye sifa za pekee

Giraffe is an animal with unique characteristics/features

Twiga twiga ni mpole mwenye Shingo nrefu

Giraffe is calm with a long neck

Na rangi nzuri zenye kupendeza

And beautiful colors (spots)

Pamoja na uzuri alionao twiga, watu wasio waaminifu, wawindaji haramu, huingia katika hifadhi za wanyama kinyume cha sheria.

Despite the beauty that the giraffe have, corrupt people and poachers enter the protected areas against the laws

Na Kuwauwa twiga ni kosa la jinai

Killing giraffe is a criminal offense

Wanachi tupambane na wanao wanaowaua wanyama wetu.

Citizens let's fight against those who kill our animals

Mungu alikuwa na makusudi yake kuwaumba wanyama hawa kwa faida yetu na vizazi vijavyo.

God had his purpose in creating these animals for us and for the next generation

Hata maneno ya mungu yanasema... ni jukumu letu kuwalinda twigaa

Even God's words say... It's our responsibility to conserve giraffe



Appendix II. Pre-Song Survey

Please say how much you would agree with these statements, from strongly agree down to strongly disagree.

1. I enjoy having giraffe living nearby.

Strongly Disagree / Disagree / No opinion / Agree Strongly / Agree

2. I think that giraffe are beautiful animals.

Strongly Disagree / Disagree / No opinion / Agree Strongly / Agree

3. I think that giraffe are threatened by poachers and other illegal hunters.

Strongly Disagree / Disagree / No opinion / Agree Strongly / Agree

4. I think that God tells at least some people that we should protect giraffe.

Strongly Disagree / Disagree / No opinion / Agree Strongly / Agree

5. What do you think about people working together to protect the natural resources of Tanzania, such as giraffe? (open ended question)



Appendix III. Post-Song Survey

Please say how much you would agree with these statements, from strongly agree down to strongly disagree.

1. I enjoy having giraffe living nearby.

Strongly Disagree / Disagree / No opinion / Agree Strongly / Agree

2. I think that giraffe are beautiful animals.

Strongly Disagree / Disagree / No opinion / Agree Strongly / Agree

3. I think that giraffe are threatened by poachers and other illegal hunters.

Strongly Disagree / Disagree / No opinion / Agree Strongly / Agree

4. I think that God tells at least some people that we should protect giraffe.

Strongly Disagree / Disagree / No opinion / Agree Strongly / Agree

5. What do you think about people working together to protect the natural resources of Tanzania, such as giraffe? (open ended question)

6. Have you heard the gospel song “Tuwatunze twiga”?

Yes / No

7. What is your age?

8. What is your gender?



Appendix IV. Analysis Methods

Statistical Analysis

Data from all surveys were entered to Microsoft Excel and analyzed using basic descriptive statistics. Inferential statistical tests were performed using the statistical software R (R Core Team 2020). Likert-type responses were translated from text to numerical values where 'strongly disagree' = 1, 'no opinion' = 3, and 'strongly agree' = 5. These numerical values were used to calculate means or other values for statistical analyses. Responses to each of the four Likert-type responses were not normally distributed, which required non-parametric statistical tests.

We executed Kruskal-Wallis chi-squared tests to determine if there were differences between respondent groups. where the null hypothesis states that groups are from identical populations. This rank-based test determines whether the medians of two or more groups are different. The following pairs of groups were assessed:

- All pre-song respondents x all post-song respondents
- Post-song respondents who heard the song x post-song respondents who did not

Qualitative Analysis

All pre-song and post-song responses to the open-ended questions were entered to Microsoft Excel sheets to facilitate the coding process. Coding is the labeling and organization of data to identify themes and relationships among them (Babbie 2013). After an initial review of the data, the first stage of labeling identified common ideas or sentiments within each response and assigned a code (e.g. wildlife should be protected) or placed each statement within a category. Codes were further refined in a second review of the data. Finally, to ensure intercoder reliability, or reliability of the organization of codes and subsequent interpretation, the codes were assessed by the non-primary researcher (Hesse-Biber & Leavy 2004). Some statements received more than one code. Figure 7 shows the frequency of statements representative of each code.



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