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**Impact of human activities on the abundance and distribution of three
threatened primates in Jaibui Island, Sierra Leone: significance for
ecotourism and livelihood**

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DEDICATION

This work is dedicated to my dearest parents (Mr. Ambrose M. Kanneh and Mrs. Feima Kanneh) for bringing me up with the right mindset and investing their resources wholeheartedly in my education. Also, to my younger sister Amie Augusta Sheriff and my Spouse Hawa Vandi for their words of courage and frequent check on me while I was away for this study.

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LIST OF ABBREVIATIONS AND ACRONYMS

%CV	Percentage Coefficient of Variation
95%CI	95 Percentage Confidence Interval
AfDB	Africa Development Bank
CBD	Convention on Biological Diversity
CDS	Conventional Distance sampling engine
CI	Confidence Interval
CITES	Convention on International Trade in Endangered Species
CSOs	Civil Society Organizations
CSSL	Conservation Society of Sierra Leone
CV	Coefficient of Variation
EFA	Environmental Foundation for Africa
EPA	Environment Protection Agency
FAO	Food and Agriculture Organization
FD	Forestry Division
G1	Group one
G1N1	Group one, Nest one
GoSL	Government of Sierra Leone
GPS	Global Positioning System
GRNP	Gola Rainforest National Park
ID	Identification
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
KM	Kilometer

LMNP	Loma Mountain National Park
MAF	Ministry of Agriculture
MDAs	Ministry Department and Agencies
MEAs	Multilateral Environmental Agreements
MNC	Marked Nest Count
MoE	Ministry of Environment
MoLCP	Ministry of Lands and Country Planning
MoLGRD	Ministry of Local Government and Rural Development
MoTCA	Ministry of Tourism and Cultural Affairs
NPAA	National Protected Area Authority
NSRPA	Nuclear Safety and Radiation Protection Authority
OKNP	Outamba Kilimi National Park
RSPB	Royal Society for the Protection of Birds
SCNC	Standing Crop Nest Count
SDGs	Sustainable Development Goals
SLCWP	Sierra Leone Conservation and Wildlife Policy
SLFA	Sierra Leone Forestry Act
SLMA	Sierra Leone Meteorological Agency
SLWCA	Sierra Leone Wildlife Conservation Act
SSL	Statistics Sierra Leone
TCS	Tacugama Chimpanzee Sanctuary
UN	United Nation
UNDP	United Nation Development Program
UNWTO	United Nation World Tourism Organization
WWF	World Wildlife Fund

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ABSTRACT

Primate population studies and impending human impacts have been carried out at various sites. In many cases, site specific population estimates and threats were focused on conservation overlooking benefits for local communities living close to their habitats and policy options that can strongly influence their success. Within a community island (Jaibui Island) located close to seven human communities in southern Sierra Leone, the status of *Pan troglodytes verus* (western chimpanzee), *Cercopithecus diana* (Diana Monkey) and *Colobus polykomos* (Black and White Colobus), were investigated, while considering pathways for livelihood improvement of local communities through the long term conservation of the primates at the study site. We used a combination of systematic line transect survey, key informant interviews and stakeholder engagement. Our findings revealed that respondents are willing to promote the conservation of the three primates if there are opportunities to improve their livelihood. Majority (95.8%) of the respondents understood the importance of living close to primate habitats and believed that protecting primates and their habitats could improve their livelihood through direct income (72.1%), employment (60.3%), business (58.8%), education (35.3%) and infrastructure development (19.1%). Besides, 94.1% of the population considered wildlife tourism important to support their livelihoods and 97% showed willingness to promote this by selling handicraft items from their communities to tourists coming to see the primates in Jaibui Island. The western chimpanzee density was estimated at 0.25 individuals/km² (CI = 0.13 – 0.49), resulting in an estimate of 3 individuals (CI = 2 – 6). Black and White Colobus density estimated to be 57.75 no. /km² (CI = 27.86 - 119.69), supposing 722 individuals (CI = 348 – 1496). Due to fewer sightings, density and abundance estimate was not derived for Diana Monkey. A total transect walk of 21.30km resulted in 8 sightings and an encounter rate 0.37 (No. of sighting groups/km) for this species. Human activities were widespread and consisted of mining, hunting, logging, fishing, and fruit collection sites. Hunting using guns and snares accounted for the highest (signs 20-30) human activity that could severely impact the three primate populations compared to mining (signs 10-20) and logging (signs 1-10). Engagement with stakeholders confirmed that there are existing policies for the conservation of the primates (95%). However, the present state of policy implementation is unclear among stakeholders due to the differences in institutional mandates and interests; 15% were positive and 65% were negative about this. Policy implementation for wildlife conservation in the study country is challenged mainly with the lack of current species conservation acts for enforcement. Therefore, including livelihood opportunities in conservation planning coupled with legally binding species management act can enhance threatened species protection with local communities for positive conservation outcomes.

INTRODUCTION

The human impact on ecosystems have been recognized as a global environmental problem and a challenge for sustainable development since the first and second international environmental conferences - United Nations Conference on the Human Environment, held in Stockholm (5th - 16th June, 1972), and the United Nations Conference on Environment and Development which took place in Rio de Janeiro (3rd - 14th June, 1992) (**Handl *et al.*, 2012**). Following these conferences, the awareness on environmental protection and management has increased considerably. To date, several Multilateral Environmental Agreements (MEAs) have been adopted and ratified by nations to address various environmental issues that threatens human well-being, ecosystems, natural resources and associated biodiversity (**Churchill and Ulfstein, 2000; Handl *et al.*, 2012**). Amidst the ongoing environmental challenges and interventions from global to local level by various actors, to safeguard the environment and its biodiversity in order to attain sustainable development, the conservation of wildlife emerged as one of the sectors that underpins sustainable development– Sustainable Development Goals (SDGs) 14 and 15 (**Barrow, 2018**).

However, despite the increasing attention given to this sector, the current ever-increasing rate of human activities altering the ecosystems, coupled with the serious lack of data and the knowledge gap on many aspects for the conservation of species especially on the population status and distribution of rare and threatened species, makes wildlife conservation remain an immense challenge (**Tordoff *et al.*, 2012; Estrada *et al.*, 2017; Tran and Vu, 2020**). Humans' direct and indirect impacts on species habitats and ecosystems have caused many species to become extinct and more threatened with extinction (**IPBES, 2019**). A recent assessment done by Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) on biodiversity and ecosystem services, reported an alarming extinction risk of nearly one million species out of an estimated eight million animal and plant species. Additionally, the population of certain taxonomic groups (mammals, birds, fish, reptiles, and amphibians) has on average declined by 60 percent over the last four decades. This foreseen extinction crisis and decrease in wildlife population remains a global challenge in this *era* of Anthropocene, with suspected higher species extinction rate in the near future than in the past decades (**De Vos *et al.*, 2015**). These reflect largely on the impacts of human actions on the environment and suitable habitats for species survival.

Non-human primates (hereafter primates) are among the many wildlife species faced with the current threats of extinction and population reduction (**Estrada *et al.*, 2017**). The Western Chimpanzee - *Pan*

troglodytes verus (**Blumenbach, 1775**), Diana Monkey - *Cercopithecus diana* (**Linnaeus, 1758**) and Western Black-and-white Colobus - *Colobus polykomos* (**Zimmermann, 1780**), which are the focal species of this study, are among the many species of primates on the list of increasing human threats to their population, distribution and habitats. These primate species are increasingly threatened and their population and range have experienced dramatic decline in the last two to three decades (**Estrada et al., 2017; IUCN, 2020**). In 2016, the Western chimpanzee was categorized as critically endangered and ranked the most vulnerable among the four chimpanzee subspecies (**Humle et al., 2016**). The Diana Monkey and the Western Black-and-white Colobus are globally endangered and their populations are steadily decreasing (**Koné et al., 2019; Gonedelé Bi et al., 2020**). Attributed to this is the rapid increase in human population growth coupled with the need for more resources, and the lack of effective policy actions across sectors and other known threats (**Humel et al., 2016; Estrada et al., 2017**). This has left the species extremely vulnerable in this irreversible human generation characterized by rapid human development, population growth and ecosystem degradation.

Primates among other wildlife species provide a lot of ecological and social benefits to human populations. Ecologically, primates serve as prey, as predators and mutually beneficial species in food chains and food webs, seeds dispersal and greater contributors to forest growth and ecosystems health thereby influencing ecosystem structure, function and resilience (**Chapman et al., 2013; Estrada et al., 2017**). Studies have documented that many primate species are important pollinators due to their opportunistic non-destructive feeding on flowers and nectar (**Heymann et al., 2011; Chapman et al., 2013**). The importance of pollinators is immeasurable to the cost of protecting them. In addition, primates are good indicators and become umbrella species for the conservation of other less charismatic wildlife species and their habitats, enhancing the development of ecotourism activities. For example, on February 28, 2019, the government of Sierra Leone declared the Western Chimpanzee as the country's national animal and the new face for tourism. Tiwai Island Wildlife Sanctuary located in the Moa River in southern Sierra Leone harbors an abundant diversity of free-living primate species (**Whitesides, 1989**). It attracts eco-tourists from around the world, which is contributing greatly to local community livelihood support and long-term conservation of the wildlife on the island. Another example is Tacugama Chimpanzee Sanctuary (TCS) located in the Western Area Peninsular National Park, is the only chimpanzee rescue and rehabilitation center in Sierra Leone. TCS cares for over 100 chimpanzees and the sanctuary has expanded from its core work of law enforcement and rehabilitation of confiscated chimpanzees to include other important dimensions of chimpanzee conservation such as environmental

education, field surveys and assessments of wild chimpanzee populations, habitat conservation, and community-outreach activities for safeguarding the chimpanzee from a greater population crash.

Over the years, conservation practitioners have documented that it is necessary to have a detailed understanding of the population size, spatial distribution, habitat requirements and how these change over time in response to both natural and human-induced influences for the successful conservation and management of wildlife species (**Kouakou *et al.*, 2009; Plumpter *et al.*, 2010; Buckland and Plumptre, 2010**). Given that the three focal primates species for this study are increasingly threatened, an urgent research intervention is recommended to generate knowledge about their site-specific population size, distribution and trends, threats, climate change impact, human-primate interactions, detailed population recovery plans and strategic monitoring programs (**Estrada *et al.*, 2017; Koné *et al.*, 2019; Gonedelé Bi *et al.*, 2020**).

This study seeks to investigate some of the recommended research areas indicated above within a community Island and adjacent seven human communities in Pujehun District southern, Sierra Leone. The study aims to answer the following questions: (i) What are the effects of human activities on the habitat, population size and distribution of the study primate species within the study area?; (ii) Which policies exist and how effective are their implementation for the long-term conservation of these species?; (iii) How can the conservation of these species contribute to improve local livelihood in the study area?

Based on these research questions, the goal of this study is to determine the population status of three primate species, i.e. the Western Chimpanzee, the Diana monkey and the Western Black-and-white Colobus, in Jaibui Island, and examine the implications of their conservation strategy on the well-being of local human communities. The specific objectives to achieve this goal are: (i) To determine the abundance and distribution of the three primate species within the Island, and the impact level of human activities; (ii) To evaluate the effectiveness of the existing policies for the long-term conservation of the species, and (iii) To explore new opportunities for the promotion of ecotourism and its potential benefits for the local livelihood in the study area.

I. LITERATURE REVIEW

1.1 The order Primates: diversity, distribution, and threats

The class Mammalia comprises several species grouped into various orders according to their shared similarities and differences in biological classification. Among these orders, the order Primates have been recognized as one of the bio-diverse taxa which comprises about 504 living primate species belonging to 79 genera and 16 families (**Estrada *et al.*, 2017**). The order Primate is exceeded only by two other taxonomic groups of the class Mammalia - Chiroptera (bats, 1151 species), and Rodentia (rodents, 2256 species) in terms of species diversity (**Estrada *et al.*, 2017**; **Supriatna *et al.*, 2020**). Globally, primate species occur in three regions - the Neotropics (171 species), Africa (mainland countries 111 species and island country - Madagascar 103 species), and Asia (119 species), and are endemic to 90 countries, with Brazil, Madagascar, Indonesia, and the Democratic Republic of the Congo hosting 65% of the total primate species (439). According to the IUCN Red List, 60% of all primate species are categorized as threatened (**Estrada *et al.*, 2017**; **Supriatna *et al.*, 2020**).

The threats to primate's survival are not new in the science of primate conservation. This varies across ecosystems, countries, and regions based on the governance systems and management strategies at individual site level coupled with the actions put in place by both state and non-state actors which range from policy formulation to its implementation (**Estrada *et al.*, 2018**). Over the years, the effort placed on wild primate research have highlighted some of the threats faced by primates and the future implications on their population and distribution for their continuous survival (**Korstjens and Hillyer, 2016**; **Estrada *et al.*, 2017**; **Estrada *et al.*, 2018**). The generally known threats to primates are: habitat loss and fragmentation due to logging, mining, agriculture, local and global market demands for food and non-food commodities; hunting and poaching for domestic consumption and illegal commercial bushmeat trade; introduction and spread of invasive species; the pet trade; the climate change; diseases; and human growth and expansion (**Humel *et al.*, 2016**; **Korstjens and Hillyer, 2016**; **Estrada *et al.*, 2017**; **Koné *et al.*, 2019**; **Gonedelé Bi *et al.*, 2020**). However, it is important to accurately document the threats to primate's survival at any given site or ecosystem for a successful primate conservation and monitoring programs. This will require undertaking systematic studies which aim at identifying both the direct and indirect threats and its site-specific impacts and effects on the primate's population. Identifying the threats is one aspect, but the strategies to mitigate those threats is again another key area of concern mostly in places where people are living near primates communities and habitats (**Garriga *et al.*, 2019**), as primates among other wildlife species are involved in conflicts with humans due mostly to competition for food and to meet their habitat requirement (**Brncic *et al.*, 2010**).

To prevent the alarming extinction risk of primates in this perilous *era* of environmental degradation and deterioration, there is the need to adopt both short- and long-term action plans and management strategies. This encompasses: effective law enforcement to abate known threats on the survival of primate populations, increase the global public attention with campaigns on the ecological, social and economic importance of primates for the human well-being; active engagement with organizations and business operating at the global, national, and local levels to reduce unsustainable environmental demands; integration of sustainable land use planning and management initiatives in national economic development plans; and the overall monitoring and maintenance of biodiversity by ensuring a stable, intact and naturally functioning ecosystems (**Jacobson, 2010; Estrada *et al.*, 2018**).

1.2 Assessing the abundance of primate populations

There is an increasing recognition that species are the building blocks of an ecosystem, and abundance and diversity of species at both population and community levels are crucial for maintaining ecosystem health with subsequent provisioning of ecosystem goods and services for human wellbeing (**AfDB and WWF, 2012**). However, over the years, the abundance of species has been overlooked as a conservation value as most conservation initiatives and intervention focus on the loss, rarity, endangerment, minimum viable population sizes, and minimum viable conservation areas for species conservation, forgetting the fact that species which were once abundance are now rare or endangered due to unsustainable environmental practices, illegal human activities and several known threats on their populations for their survival (**Redford *et al.*, 2013**). Also, the United Nations (UN) and IPBES recently warned that humans are exploiting nature far more rapidly than it can renew itself. Treading on the current trajectory of nature destruction and disappearance, the world in future will be faced with a more severe situation of species disappearance where 30 to 50 percent of all species may be lost by the middle of the 21st century (**IPBES, 2019**).

The abundance of wildlife presents a unique sense of feeling for humans to connect with nature and several expedition bodies and organizations like zoos, sanctuaries and game reserves publicize the chance to experience or see wildlife in abundance such as primates, birds and other unique species of a particular area or region. Species abundance itself is an ecological feature that maintains other species, ecosystems and human well-being (**Gaston, 2011; Redford *et al.*, 2013**). Besides, it is easier in cost and in management effort, to maintain abundance in wildlife populations than to keep once abundant and now rare species from extinction (**Redford *et al.*, 2013**), thus the need for conservation effort to place priority on managing larger groups of species and reduce the likelihood of extinction on certain groups

of wildlife populations as in the case for majority of primate species. In addition, knowledge about species abundance is required to adequately interpret a wide variety of ecological processes affecting a given species population and the flow of ecosystem services to support human wellbeing (**Buckland *et al.*, 2015**).

For many primate studies, surveys and monitoring allow for the optimum investigation into the sources and impacts of threats on the population status (population size, density abundance, distribution and range) within and across ecosystems. Such information is significant when designing priority programs at local or global scale for primate's protection, establishing reserves and protected area networks, placement of corridors linking isolated primates' populations and in deciding where to invest resources during research planning and interventions geared towards the successful conservation of primates (**Plumptre *et al.*, 2013; Chi *et al.*, 2019; Heinicke *et al.*, 2019**). At the same time, this information will be used for status assessment of the targeted primate species by the IUCN (**Heinicke *et al.*, 2019**). Over the years, several survey methods and techniques have been adopted to estimate primate population size, abundance, occupancy and to provide potential information about their distribution and threats at specific sites while comparing results across sites (**Buckland *et al.*, 2001**). The most commonly used methods are: the total count of individuals (**Pruetz *et al.*, 2002**), genetic analysis (**Roy *et al.*, 2014**), line transect surveys (**Klop *et al.*, 2009**), indirect sign surveys – nest (**Kouakou *et al.*, 2009**), lure counts (**Mandl *et al.*, 2018**) for species that respond to playback calls, cue or point counts (**Hutschenreiter *et al.*, 2021**) for species that call and occupancy methods (**Keane *et al.*, 2012**) for rare species.

The Line transect method using distance sampling is one that is widely used for counting diurnal primates to derive estimates of their density or abundance. However, this method requires a minimum of 30 to 40 sightings of primate groups and to minimize error during analysis, it is preferably 60 to 80 independent group encounters (**Buckland *et al.*, 2001**). In cases when it's unlikely to obtain the minimum number of sightings to determine the absolute abundance or density estimates, we still can determine relative abundance (**Plumptre *et al.*, 2013**). It is important to note that encounter rates have been known to correlate positively with density estimate of primate population. In a study conducted in eight forests of the Albertine Rift forests of Western Uganda, the density obtained for chimpanzees was strongly correlated with nest encounter rates from reconnaissance walks in the same forest sites (**Plumptre and Cox, 2006**). Therefore, encounter rates from recce walks could be used to extrapolate density estimations of primate population in areas where resources are limited and there exist difficult situations to survey the primate species of interest (**Plumptre *et al.*, 2013**).

Population studies of great apes like chimpanzee within a forest ecosystem has been mostly done using nest counts along line transects (indirect survey), as they occur at low densities and the probability of direct sighting is often low due to their sensitivity to human presence and disturbances (**Kouakou et al., 2009**), making it impossible for direct counting as compared to other primate species. According to **Kouakou et al., (2009)**, two survey methods along line transects are commonly used to estimate chimpanzee population sizes - the Standing Crop Nest Counts (SCNC) and the Marked Nest Counts (MNC). The SCNC involves the count of all sleeping nests detected by the survey team on a visit along each line transect whereas the MNC method adopts the protocol of repeated counts of fresh nests on transects perceived over a short duration of specific interval visit. However, there are assumption related to the use of each method in estimating chimpanzee population size or densities, and therefore, care must be taken in the choice of method and during the analysis for a robust population estimation (**Devos et al., 2008; Kühl et al., 2008; Kouakou et al., 2009**)

1.3 Primate conservation and human well-being

Considering the current rate of human population growth, sustainable conservation programs and policies should integrate livelihood opportunities for local communities with the recognition that humans should not suffer from wildlife protection initiatives (**Sarkki et al., 2020**). Conservation programs should make a significant contribution to improving livelihood and securing new opportunities for communities living close to wildlife habitats (**Chesney et al., 2021**). Ethical considerations are that local communities have greater control over natural resources, and that conservation projects should contribute to their livelihood security (**Hill, 2002**). According to **Adams and Hulme (2001)** conservation must be participatory, must treat forest edge communities as partners and preferably must be organized so that protected areas and species within, yield an economic return for the local people and the wider economy, and contribute to sustainable livelihoods. These emphasize that local communities should be involved and considered as major actors in planning conservation programs and that benefit options for the population are key for a successful wildlife management and habitat protection intervention at any site (**Hill, 2002**).

However, to simultaneously protect wildlife species and meet the needs of community members, there is the need to understand and account for the ultimate impact generated from the communities situated close to wildlife habitats on their population, habitats, and distribution for proper planning and management initiatives (**Oates, 1996; Hall et al., 1998**). This also requires understanding the needs and interests of the local communities while taking into consideration the various rewarding opportunities

that can benefit the community members for their cooperation and stewardship to the long-term conservation of wildlife species. In such a situation, the implementation of wildlife or forest-based tourism at a given wildlife habitat site where the local population relies on forest services and goods for their livelihood, can be considered as a good option for achieving a balance between wildlife management and community needs (Ngonidzashe *et al.*, 2015).

1.4 Wildlife tourism and the Sustainable Development Goals (SDGs)

In recent times, tourism has emerged as a major sector for achieving the SDGs, linking well-planned and sustainable tourism interventions to attaining one or more of the SDGs (Scheyvens, 2018). Supporting this, the United Nations World Tourism Organization (UNWTO) recognized tourism as an important sector for achieving rural development, and declared the year 2020 as the year of tourism and rural development. In 2014, the theme for the commemoration of the World Tourism Day (27 September) was - “Tourism and Community Development” (Mathew *et al.*, 2017). Besides, the UN 70th General Assembly designated 2017 as the International Year of Sustainable Tourism for Development. The year 2020 placed high priority on local participation in the tourism development sector with a focus on the potential of tourism to create jobs and opportunities for local communities and the role of tourism could play in preserving and promoting natural and cultural heritage as well as limiting the rural to urban migration. The UNWTO continues to promote tourism development that supports and creates a balance among the conservation of biodiversity, the social welfare of local populations and the economic security of the host countries and communities of which wildlife tourism is a perfect example. Notwithstanding, it is not advisable to set up any tourism development that damages the value and culture of local communities, contributes to biodiversity loss or lacks socio-economic benefits for the social living of the local population (<https://www.unwto.org/world-tourism-day-2020>).

1.5 Island Ecosystem

An island from an ecological perspective is an area of suitable habitat isolated by natural or artificial means from the surrounding land which limits the dispersal of individuals that occur within (Cartwright, 2019). In 1967, the biologists Robert H. MacArthur and Edward O. Wilson developed a general theory that explains the factors which drives the success of species within a delimited geographical area - Theory of Island Biogeography. According to this theory, an island is any ecosystem that is remarkably different from the surrounding area. This could refer to an actual island in the ocean or a land area bordered by river, or it may be an oasis that is surrounded by a desert. The theory of island biogeography further explains that a larger island will have a greater number of species than a smaller

island, with the notion that larger space can hold more species while smaller space will hold fewer species. The Island Biogeography Theory is built on the principles of population ecology and genetics to explain how distance and area combine to regulate the balance among immigration, emigration and extinction in island populations. Today, the Theory of Island Biogeography remains one of the pivotal themes when discussing about the geographic distribution of species (**MacArthur and Wilson, 2016**). Small islands are of special interest for sustainable development because of their unique ecological characteristics and vulnerabilities (**Kerr, 2005**). They are ecologically fragile and important, have limited resources, and are susceptible to natural disasters and climate change (**Balzan et al., 2018**). The independence and location of an island ecosystem contribute to its unique visual landscape, which provides an island with distinctive tourism resources (**Yang et al., 2016; Moon and Han, 2018**). Independence here refers to the limited area and isolated space, which generate special habitats for rare biological resources and thus makes an island a “biodiversity hotspot” (**Whittaker and Fernández-Palacios, 2007; Weigelt et al., 2013; Borges et al., 2018**). Island ecosystems are mostly located close to the sea, which also facilitates the development of the marine economy and attracts various human activities (**Agetsuma, 2007; Chi et al., 2020; Moghal and O'Connell, 2018**). However, human activities in an island ecosystem can damage the natural habitat beyond replacement because of its characteristic endemic species richness. Therefore, identifying, quantifying, and spatially exhibiting the damage generated by human activities on an island is of great significance to comprehensively providing references for its tourism development strategy and wildlife conservation (**Chi et al., 2020**).

1.6 Sierra Leone

Sierra Leone is located on the west coast of Africa with a land of 71,740 km². The country shares its geographical boundaries with Liberia to the southeast and Guinea to the northeast. It has a tropical climate which is transitional between two seasons – dry and wet season with diverse habitats ranging from savannah to rainforests. The most recent population and housing census conducted in 2015 reveals a total population of 7,075,641 people (**SSL, 2017; Lin et al., 2020**). The flora and fauna diversity within the country is rich ranging from large, medium to small size mammals, endemic birds, amphibians, butterflies and plant species that are of global conservation interest and importance (**RSPB, 2008**). The Chimpanzee, Diana Monkey and the Western Black-and-white Colobus are endemic primate species thriving in different types of terrestrial habitats in different sites across the country (**Whitesides, 1989**). In 2010, a nationwide census of chimpanzee population revealed an estimate of more than 5,500 individual (95%CI=3,052-10,446) chimpanzees living in the wild with 50% of the estimated population occurring outside protected areas (**Brncic et al., 2010**). However, since the last survey in 2010, there has

been no national census for monitoring the wild chimpanzees' population trend and the current population of chimpanzees in Sierra Leone is based on the 2010 national census report. Study on the population and other ecological requirements of the Diana Monkey and the Western Black-and-white Colobus is limited in Sierra Leone. Detailed study has only been done within the Gola Rainforest National Park (GRNP) and Tiwai Island Wildlife Sanctuary. According to the most recent IUCN status assessment for Diana Monkey - **Koné *et al.*, (2019)**, Diana Monkey has lost 30% of its primary habitat over the past three generations (~1990-2018) and are suspected to have undergone a population decline of 50% or more over this time period (~1990-2018). Extant populations were reported to be found in Tiwai Island Wildlife Sanctuary, Gola Forest National Park and Loma Mountains National Park in Sierra Leone without specific population estimated values provided for those sites. The most recent IUCN assessment on the status of the Western Black and-white Colobus reveals that there is insufficient data for Sierra Leone to provide a reliable assessment of their population (**Gonedelé Bi *et al.*, 2020**). However, the Sierra Leone national chimpanzee census conducted in 2010 reported that the species is very rare and its distribution is sparse within forest reserves and national parks in Sierra Leone (**Brncic *et al.*, 2010**). At present, viable populations of the Diana Monkey in Sierra Leone are found in Tiwai Island Wildlife Sanctuary, Gola Forest National Park and Loma Mountains National Park (**Koné *et al.*, 2019**).

1.7 Forestry and Wildlife Acts of Sierra Leone

In Sierra Leone, the governance and management of natural resources, forest, wildlife and the environment fall under the mandate of various government Ministries, Departments and Agencies (MDAs) such as: Ministry of Environment (MoE), Forestry Division (FD), Environment Protection Agency (EPA), Ministry of Lands and Country Planning (MoLCP), the National Protected Area Authority (NPAA), the Ministry of Tourism and Cultural Affairs (MoTCA) and the Ministry of Local Government and Rural Development (MoLGRD) among others. Additionally, other existing and well recognized national non-governmental organizations like the Conservation Society of Sierra Leone (CSSL), Tacugama Chimpanzee Sanctuary (TCS), Environmental Foundation for Africa (EFA), and the GRNP are working to complement government efforts across the country for the conservation and management of natural resources, forest, wildlife and the environment. International organizations like the Food and Agriculture Organization (FAO), Royal Society for the Protection of Birds (RSPB) and the United Nation Development Program (UNDP) are also supporting in that direction based on their work programs.

The Forestry Act of 1988, and the Wildlife Conservation Act of 1972 remain the principal documents governing the management and regulation of forestry and forest reserves and the management and regulation of wildlife and protected areas respectively. These two documents recognize six protected area categories within Sierra Leone namely: National Park, Strict Nature Reserve, Game Reserve, Game Sanctuary, Controlled Hunting Area and Non-hunting Forest reserves (**SLFA, 1998; SLWCA, 1972**). Besides, the Forestry Act made provision for the declaration of new protected areas for the purposes of conservation of soil, water, flora and fauna under the mandate of the minister heading the sector related to Agriculture, Natural Resources and Forestry in the country (**SLFA, 1998**).

Despite the establishment and operation of the various government and non-government institutions or organizations, coupled with the enactment of the Forestry and wildlife acts, since independence in 1961 to date, Sierra Leone is struggling to manage and protect its fauna and flora, due to the lack of a sustainable protection policy and management strategies across sectors (**Jackson, 2018**). According to **Wadsworth and Lebbie (2019)**, there has been no national forest inventory since 1975. As an outcome of the four decades long without updated nationwide forest inventory coupled with the rapid increase in human population growth, the current status of Sierra Leone forest is unclear with the present assumption that the forest cover is less than 5% of the original intact forest out of an approximate 70% of the country former forest cover (**Wadsworth and Lebbie, 2019**).

Also, there exist no recent comprehensive inventory on the current status of Sierra Leone's wildlife due to several factors such as conflict, land use change, uncontrolled exploitation of natural resources, agriculture, illegal logging and mining activities (**SLCWP, 2010**). Nevertheless, according to the 2010 SLCWP document, in terms of flora and fauna diversity, the country is home to several important endemic species. The native flora and fauna diversity includes more than 2000 species of vascular plants, 46 amphibians, 69 reptiles, 600 birds and nearly 200 species of mammals (including 15 primate species and 18 antelopes). Out of the estimated species' diversity, a minimum of 27 vertebrate species and 47 vascular plant species are recognized as threatened (**SLCWP, 2010**).

1.8 National Environment Policy 2020

The Government of Sierra Leone (GoSL) has made several commitments over the years to address sectorial policies that have been limited in scope and do not adequately provide the right measures to curtail cross-sectoral issues related to having a sustainable environment. The major backdrop to the success of this has been the disagreement among existing policies and legislation which do not reflect the current trend of international standards to meet national development needs for Sierra Leoneans. In

2020 the national environment policy was reviewed to address the challenges of the depleting forest cover, the declining and disappearing biodiversity, the worsening climate conditions and the increasing vulnerability to environmental disaster in Sierra Leone. The reviewed national environment policy of 2020 has incorporated new policies, programs and plans that are targeted at improving the economic and social standards of Sierra Leoneans with respect to maintaining environmental integrity and importance across multiple sectors and at all levels. The document acknowledges the newly established ministry of environment as the umbrella government arm responsible for supervising all departments and agencies of the government of Sierra Leone whose functions and work mandates deals with the environment such as: EPA-SL, FD, NPAA, Sierra Leone Meteorological Agency (SLMA) and Nuclear Safety and Radiation Protection Authority (NSRPA).

1.9 Policy Demand and Relevance

The present increase in environmental problems such as climate change, loss of biodiversity, degradation of ecosystems and the unsustainable use of ecosystem services among others, require urgent policy actions to lessen the negative impacts and adapt to any potential future change that can impede human wellbeing, biodiversity and the environment (**Sarkki *et al.*, 2020**), of which Sierra Leone is no exclusion. Systematic studies to provide in-depth understanding of the underlying causes of the problems are required in that direction. This can be achieved using different forms of policy supporting instruments, promotion of new learning outcomes, and by incorporating new actions in the development and planning of socially acceptable and environmentally friendly solutions across various state and non-state sectors to help abate the ongoing global environmental challenges (**Sharman and Mlambo, 2012**). In addition, there is the need to establish, improve and strengthen the relationships between researchers, policy and decision makers, markets and civil society groups and other relevant stakeholders at the local, regional and global level to enhance effectiveness in dealing with these environmental challenges.

1.10 Study area

The research was conducted in Jaibui Island, located in Pujehun District – Southern Sierra Leone (UTM 29, X: 238199; Y: 823787) and its closest seven human communities (Boma, Sahun, Kambama, Gbengama, Baoma Ngeya, Sembenhun and Taninahun) that use the island's resources. Over the time span, the island has been owned and managed by the community members for the harvesting of local resources to meet their livelihood demands, until 2017 when Tacugama Chimpanzee Sanctuary entered into an agreement for co-management of the Island. Jaibui Island has a total area of about 12.5 km², surrounded by the Moa River, and shares its land borders with the Gola Rainforest National Park (GRNP)

in the East and Tiwai Island in the North (Figure 1). The two adjacent forest blocks are extensions of the Upper Guinea Forest considered one of the 35 global most important biodiversity hotspots (Klop et al., 2009). GRNP is the largest national park in Sierra Leone and previous studies have documented 333 species of birds, 49 mammals, 363 butterflies and 25 species of amphibians occurring there (RSPB, 2008), and Tiwai Island is recognized for its primate diversity - nine primate species occurring there (Whitesides, 1989). The most recent camera trap study carried out in Jaibui Island recorded 35 mammals, 11 birds and one reptile (Tortoise) species (Garriga, 2019). The Jaibui Island has similar habitat and climate characteristics as the GRNP – the climate is tropical and transitional between two seasons - dry season (December – April) and wet season (May – November).

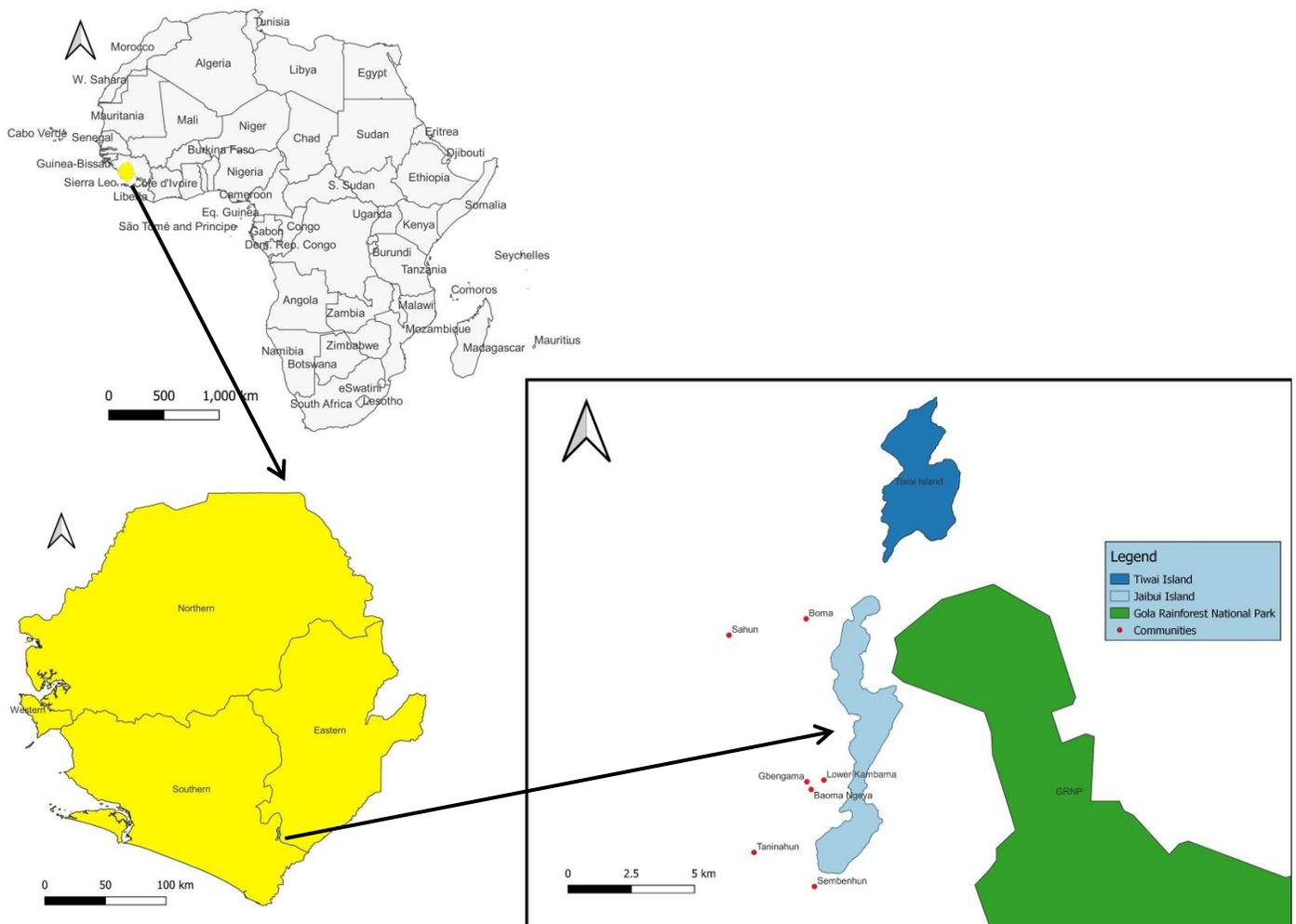


Figure 1: Map showing the study area – Jaibui Island, its surrounding villages and adjacent forest block

II. MATERIALS AND METHODS

2.1. Study species

2.1.1. Western Chimpanzee (*Pan troglodytes verus*)

The Species Survival Commission (SSC) of the International Union for Conservation of Nature (IUCN) recognizes four subspecies of the common chimpanzee (*Pan troglodytes*) (**Humle et al., 2016**): the Western Chimpanzee (*Pan troglodytes verus*); the Nigeria-Cameroon Chimpanzee (*P. t. ellioti*); the Central Chimpanzee (*P. t. troglodytes*); and the Eastern Chimpanzee (*P. t. schweinfurthii*). All of them are listed as endangered and their populations are declining. Recently the IUCN status for the western subspecies was upgraded to critically endangered (**Humle et al., 2016**) because it is predicted that over the next three generations, i.e. 75 years, its population is likely to decline by more than 80% as a result of poaching, habitat loss and fragmentation due to human activities (**Kühl et al., 2017**).

The Western Chimpanzee is endemic to West Africa, and its extinction has occurred in three of its former range countries (Benin, Burkina Faso and Togo) while the remaining population is still present in eight countries (Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Senegal and Sierra Leone) (**IUCN, 2020**). Among all wildlife species, chimpanzee are the closest living relatives to humans sharing 98.6% of our DNA, making them the largest brained and most intelligent of all non-human primates and as such, have senses very similar to humans including hearing, sight, smell, taste and touch (**Thomas and Laake, 2006**). They share evolutionary history, morphological and behavioral similarities with humans. They have long arms for gripping which allow them to pick objects and short legs and feet which enable them to stand up like humans (Figure 2). They live in complex social groups or communities and group size can range between 10 to 50 individuals. Before now, they were mostly found living in pristine habitats, but at present they have adapted to living in almost all terrestrial habitats due to habitat destruction, forest reduction and disappearance (**Brncic, 2010**). They are omnivores and feed on a wide variety of food items such as fruits, insects, leaves, seeds, nuts, tree bark, plant bulbs, tender plant shoots and flowers, small mammals, termites, honey and sometimes hunt other primates (**Boesch and Boesch, 1989**). Their reproduction is slow as compared to other primates, giving birth to a single baby once every four to five years (**Teleki, 1989**). They are good species indicator for monitoring ecosystem health and offer social, economic, traditional, tourism and religious benefits across most of their range countries (**Thompson et al., 2020**).

2.1.2. Diana Monkey (*Cercopithecus diana*)

Diana Monkey is endemic to the Upper Guinean Forests in West Africa, ranging from the coastal southeastern Guinea to Sierra Leone, Liberia, and west of the Sassandra River in Côte d'Ivoire (**Koné et al., 2019**). According to the IUCN status assessment (**Koné et al., 2019**), Diana Monkeys are threatened mainly due to increased deforestation rates in range countries and the negative impact of hunting on their population. This species has lost nearly 30% of its primary habitat over the past three generations (~1990-2018) and are suspected to have undergone a population decline of 50% or more over this same time period. Presently in Sierra Leone, extant populations are found in Tiwai Island Wildlife Sanctuary, Gola Forest National Park and Loma Mountains National Park in Sierra Leone. The Diana Monkey is listed under appendix I of CITES and Class A of the African Convention on the Conservation of Nature and Natural Resources and as an endangered species on the IUCN red list of threatened species, with Sierra Leone hosting the highest remaining population (**Koné et al., 2019**). They feed on a wide variety of fruits and insects while spending much of their day time in the upper level of trees. The habitat requirement is mainly tall primary or old secondary forests ranging from 15 – 20 meters in height. They mostly avoid the forest floor for feeding thereby making detection rarely difficult in their forested habitats. They are usually found living in groups of about 20-30 individuals with one adult male and several adult females with their offspring (**Uster and Zuberbühler, 2001**). In most encounters, they are found in association with other primates' species like the Red Colobus, Western Black-and-white Colobus and Olive Colobus as predation protection mechanisms and for foraging advantages (**Bshary and Noë, 1997**). The major predators of this species in the wild are leopards, crowned-hawk eagle, chimpanzees and human poachers (**Zuberbühler et al., 1999; Boesch & Boesch, 1989**). During their inter and intra specific associations, the adult male usually makes loud alarm calls in response to disturbances, such as fleeing animals, falling trees or other threats like the presence of crowned-hawk eagles, leopards and humans, while the other group members regularly produce close-range calls at high rates which are audible at the distance of about 50m (**Uster and Zuberbühler, 2001**) (Figure 3).

2.1.3. Western Black-and-white Colobus (*Colobus polykomos*)

The Western Black-and-white Colobus is an endangered species on the IUCN red list of threatened species, facing threats for survival as any other primate species. They are mostly found living in primary and secondary forest but also sometimes prefer riverine forests, wooded grasslands and higher-density logged forests (**Gonedelé Bi et al., 2020**). This species is endemic to the rain forest region extending from Senegal, through Guinea-Bissau, Guinea, Sierra Leone and Liberia to Ivory Coast and they are possibly extinct in Senegal (**Gonedelé Bi et al., 2020; Groves, 2005**). *Colobus polykomos* is listed as

Class A species under the African Convention on the conservation of nature and Natural resources and under Appendix II of CITES. In Sierra Leone, data on their current population status is insufficient. According to the 2020 IUCN assessment for this species, systematic surveys should be conducted in Gola Rainforest National Park and Loma Mountains National Park which are known to host viable populations of this species (**Gonedelé Bi *et al.*, 2020**). Their diet consists mainly of leaves, fruit and flowers depending on the season and unlike Diana Monkeys, they can be found foraging on the ground and their main enemies in the wild are leopards, crowned-hawk eagle and humans (**Zuberbühler *et al.*, 1999; Groves, 2001**) (Figure 4).



Figure 2: Chimpanzee (*Pan troglodytes verus*)
Credit TCS

Figure 3: Diana Monkey (*Cercopithecus diana*)
Credit Animal Pictures Archive



Figure 4: Western Black-and-White Colobus (*Colobus polykomos*)

2.2. Sampling design

The survey was designed using the distance 7.3 software. The sampling design followed the standardized method as described in **Thomas *et al.*, (2010)**. The line transects were systematically placed with a random origin over the study area thereby satisfying the key design assumption – “Animals are distributed independently of the lines” (**Buckland *et al.* 2015**). A total of 21 transects were generated by the distance software. The distance between one transects and the other was 500m (Figure 5). For each line transects the coordinate of the start and end point were generated by the distance software including their lengths. The length of each transects vary according to the edge of the study area and the total lengths of all the line transects from the design was estimated to be 23,920m. The length of the line transects ranged between 440m and 2,280m and were oriented from west to east across the Island (Appendix A).

2.3. Sampling techniques along line transects

2.3.1. Transect survey

The methodology for the line transects surveys followed the survey techniques that are widely considered for estimating and monitoring wildlife population sizes in their forested habitats (**Plumptre, 2000; Thomas *et al.*, 2010**). Encounter-based survey was carried out along each of the line transects produced by the distance software. All 21 transects were walked once on a single visit within the duration of 13 days during the month of October 2021, from morning to evening depending on the transect lengths and the number of observations made. Owing to the high tides of the Moa river at certain location along the edge of the Island, that restricted the survey team from reaching the actual start or end points of some line transects, few transect lines were not fully surveyed. This resulted into a total transects length of 21,301m walked by the survey team (Mean transect length = 1,014.33 m (range 394 – 2190 m) at the end of the survey out of 23,920m from the initial design.

The data collection along the line transects were carried out by a team of three members - one transect cutter who was clearing the transect path at a minimal rate to allow the survey team to move and two other observers. Between the two observers, one experienced observer was focused on looking up for any monkey detection/movement and chimpanzee nests, and the other observer was looking down for other indirect signs. The team walked along the transects following a compass bearing in a straight line at an average speed of 0.62 km/h (range 0.39 - 0.83 km/h) to ensure detection of the target monkey species and chimpanzee nests. Data recording along all transects strictly adhered to the three key model

assumptions for distance surveys. The team ensured that: the monkeys, and all chimpanzee nest on the transects were detected, with the strong conviction that no monkey, and chimpanzee nest on the line transects were missed out from counting; perpendicular distances to detected monkey groups and chimpanzee nests were measured correctly at their exact detected spots; and the monkeys were detected at their initial location prior to any movement ensuring no responsive movement of the monkeys because of the team (**Buckland *et al.* 2015**).

2.3.2. Chimpanzee nest count along transects

The procedures for chimpanzee data collection were different from the two other monkey species but the same transects were used as observations were made accordingly. Based on the duration of the study, the SCNC method was adopted for the chimpanzee nest count along transects for subsequent estimation of chimpanzee population living within the Island. Walking slowly along the line transects, with the same team while maintaining the roles as explained above for the monkey survey, chimpanzee nests were searched for on the forest canopies. Nest detection was followed by recording of the following data sets on the same data sheet as the monkeys: nest-group size, perpendicular distances to transect, nesting tree species (local or scientific name if known by survey team), nest height, nest age class, time, distance from start and GPS coordinate of each nest. During the survey, nests which were of the same age class and found within 20m from each other were assigned to the same group, while nests that were of different age classes and separated from each other with more than 20m were considered as a different group (Kouakou *et al.*, 2009). Also, among the line transects, nest which were encountered on each of the transects were considered to belong to different group regardless of the age of the nest (Figure 6)

2.3.3. Monkey (Diana Monkey and Western Black-and-white Colobus) count along transects

Along the transects, once a monkey group was encountered, the team stopped for about 10 to 15 minutes to count and observe the monkey group and the following data were recorded on a data sheet: time of encounter, perpendicular distance from the transect to the first individual seen in the group, distance from starts of the transect, GPS location of the first individual seen in the group, monkey species, number of individuals in the group, group composition, group spread, group height, habitat type where the group was encountered, how the group was first detected, activity of the group when encountered, and fruit species (local name or scientific name) if found feeding (**Blom *et al.*, 2005; Alessandro *et al.*, 2014; Fragoso *et al.*, 2016**) (Figure 7), (Appendix B). The monkey groups were detected from their vocalization, direct sighting, and the shaking of tree branches during their movement, feeding and other activities. However, due to the dense vegetation and high canopy cover that is typical of tropical

rainforests and the occurrence of some primate species in large group spread, recording distance to group center can be difficult and prone to bias. Therefore, for this study, perpendicular distances were measured to the first monkey observed in the group and not to the center of the primate group, as distance to first individual seen can be used as a close proxy for group center when the size or spread of groups are small (**Whitesides *et al.*, 1988**). The primates groups were defined as whenever the targeted species were detected at a particular time along the line transects.

2.4. Description of the data collected

2.4.1. Wildlife signs

The wildlife signs collected were: tracks or trails, foot prints, feeding remains of eaten fruit, seeds and other plant parts, dung/feces, vocalization, nest in case of chimpanzee and direct sighting were possible (Appendix C). Based on the size of bite or eaten part of the fruits, feeding remains on fruits were referred to belong to either chimpanzee or monkey, as chimpanzee feeding remains were found to have larger bites or eaten parts than that of the monkeys. To decide whether particular feeding remains was for a specific monkey species, one of the team members had to see the monkey feeding on the fruit or plant part otherwise it was referred to as a general feeding remain of monkeys.

2.4.2. Human activities and disturbances

The signs of human activities and disturbances collected were: Logging, gun shells, snare trap, mining, mining camp, fish smoking site/camp, hunting trail and fruit collection sites.

All encountered signs/activities (both human and wildlife) were categorized as fresh, recent, old, and active depending on the sign type and the duration of the activity or disturbance (Appendix D).

2.4.3. Vegetation/habitat types

According to **Garriga (2019)**, the following are the habitat types found in the study area.

Mature/primary/high canopy forest: undisturbed forest with closed canopy and open undergrowth, no intervention and human disturbance known that would have modified the pristine nature of the area.

Degraded forest (selective logging): forest that is partly degraded through human activities, such as selective logging, showing signs of degradation like reduced number of big trees, partly open or missing canopy with thicker undergrowth.

Secondary forest: overgrown farm bush of more than 20 years of age – areas that have been cleared and then regrown having no really old large trees, homogenous forest structure, undergrowth not open.

Farm bush: this can be young (less than 10 years) or old (more than 10 years) – no large and old trees, open canopy, rather open tree stratum, thick bush stratum and undergrowth (how thick depends on age of farm bush – the younger the bushier).

Swamp: areas outside of forest habitat (without many trees) where water collects either throughout the year or during certain seasons of the year.

River – rocks: These are areas with exposed rock surfaces and an interspersed river in between the rocky surfaces at certain seasons of the year or all year round.

Bamboo forest: Forest areas with many bamboo stands and usually with very few or no trees at all around the area.

The same habitat types and classification scheme were observed during the transect survey for this study. Besides, the selection of these habitat types were also confirmed from the local guides who were members of the survey team as they know the history of the area and how it has been used in the past. For example, when a certain farm bush area was brushed and has been abandoned.

2.5. Chimpanzee nest age classification

Throughout the survey, nest ages were classified following **Tutin and Fernandez (1984)** as:

- **Fresh** (all leaves in the nest were green and feces or urine odors found underneath the nest);
- **Recent** (nest which has drying leaves of different colors, with dominant green coloration, and there was no smell of dung or urine underneath the nest location);
- **Old** (majority of the leaves were brown and the structure of the nest were still visible);
- **Decay/Rotten** (nest has holes showing few or no leaves, but was identified based on the bent twigs and branches).

2.6. Reconnaissance Walk

All through the survey period, nonlinear reconnaissance walks (recce walk) were carried out while moving from one transects start and end point to another. During the recce walk, opportunistic data were recorded on all observable features of human activities and disturbance and wildlife signs and sightings (both direct and indirect) encountered, with focus on the studied species to save time (**Refisch and Koné, 2005**). The categories of wildlife signs, human activities and disturbances, vegetation/habitat types and nest age class for chimpanzee indicated above were recorded during the recce walks.

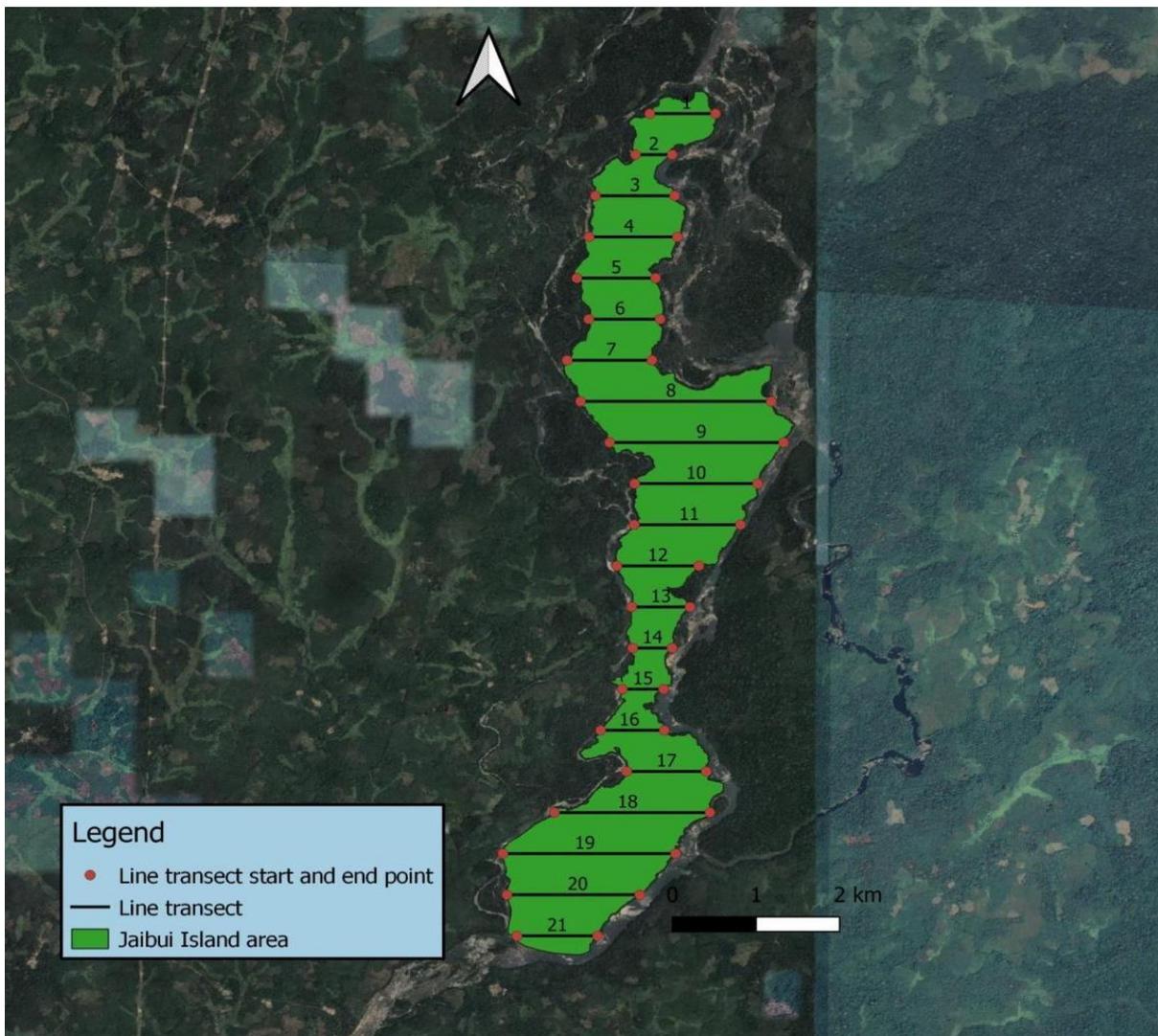


Figure 5: Line transects survey design for primate status assessment

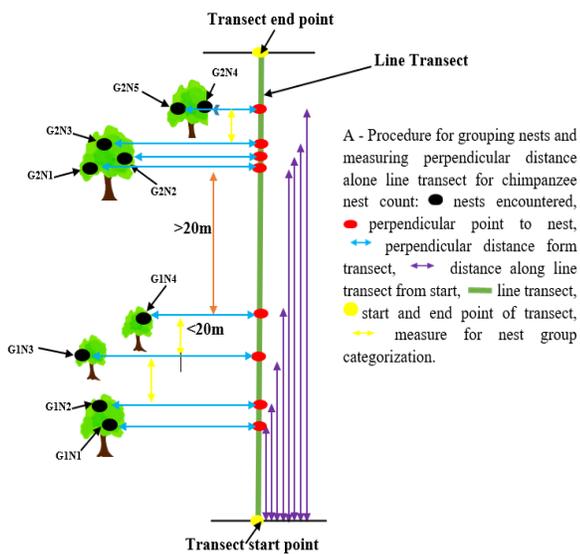


Figure 7: Chimpanzee data collection procedure

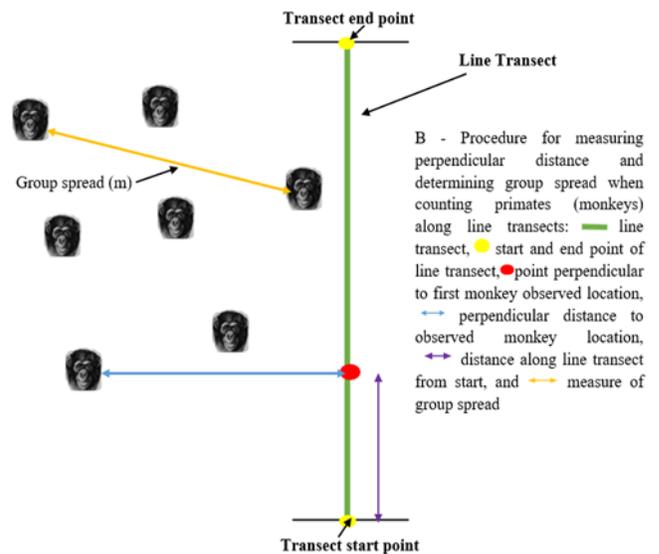


Figure 6: Monkey data collection procedure

2.7. Description of ecological survey equipment and materials

The following survey equipment were used as follows during the transect survey and recce walks (Appendix E).

Garmin GPSMAP 64s: This was used to record waypoints of all the observations made (direct or indirect). Navigation to the start and end points of all transects and to walk transect lines straight were made with the help of the GPS.

Compass: Together with the GPS, this was the main equipment used along transects for navigation in order to keep transect lines straight.

Binocular: this was used to aid in the proper identification of monkey species and correct categorization of nest age classes detected from far.

Range finder: this was used to determine the perpendicular distances to the location of the first individual of a monkey group, and that of encountered chimpanzee nests.

Measuring tape: this was used for measuring nest perpendicular distances in situations perceived by the team that the range finder could not provide accurate measure of distance due to very dense canopy cover around the area where the nest was detected.

Digital hand camera: was used for taking pictures of the different chimpanzee nest age classes and the monkeys encountered where possible coupled with other direct and indirect observations.

2.8. Social data collection

2.8.1. Surveys and questionnaires

A survey is a scheme for collecting information in such a way that it captures and represents the views of the surveyed group. A questionnaire is a tool for obtaining this information. This method was used to collect information among the community members about their knowledge, perceptions, existing and expected livelihoods options related to the conservation of the three primate species. Qualitative and quantitative semi-structured questionnaires were designed comprising open-ended, close-ended, multiple choice and Likert scale questions (Appendix F). This was administered in the general local language (Mende) to the community members of different status and working background within the seven communities on a face-to-face basis (**Krosnick and Presser, 2010**) (Appendix G). The administration of the questionnaires was aided by a primate guide to facilitate recognition of the target primate species by the various respondents (Appendix H). The number of years lived in the community and the age of

the respondents were used as the selection criteria of the various respondents. As such, the community members who had lived for a minimum of 10 years in the community and were above 18 years of age were interviewed throughout the seven communities. In six of the communities (Boma, Baoma Ngeya, Lower Kambama, Saahun, Gbengama, and Taninahun) a random selection of the respondents were done as follow: after meeting with the town chief and other key elders in the community with detail explanation of the purpose of the research and the selection criteria, the permission was granted to move around the community and talk to people who met the selection criteria. People who met the criteria were interviewed and some of the respondents at the end of their interview recommended people whom they know will give valid information based on the interview structure to respond to the questions. However, in one of the communities (Sembenhun) that was not the case; one of the town elders was assigned to select the respondents for the interview after the meeting for reasons best known to them. In total, 53 respondents from six communities were interviewed following random selections and 15 respondents from one community based on the choice of the community elders, totaling 68 completed questionnaires.

2.8.2. Stakeholders' engagement

Stakeholders for this study are individuals working for various organizations with an interest in these study outcomes that might influence future management decisions according to their specific office mandates. In that regard, individuals who hold valuable knowledge for the conservation of biodiversity and the environment working for several institutions/organizations within Sierra Leone were engaged. The stakeholders who were involved encompassed individuals working across various sectors such as: MDAs, International Non-Governmental Organizations (INGOs), National Non-Governmental Organizations (NNGOs), Civil Society Organizations (CSOs), and research institutions. The stakeholder's institutions/organizations were identified from policy documents like the Forestry Act, 1988, Sierra Leone Wildlife Conservation Act, 1972, Sierra Leone Conservation and Wildlife Policy 2010, Sierra Leone Forestry Policy 2010, The NPAA and Conservation Trust Fund Act, 2012, and research reports such as the "Biodiversity of Gola Forest, Sierra Leone 2008" which state some of the organizations and institutions working and are responsible for the conservation of biodiversity, environmental management and natural resources. An interview guide was designed consisting of open questions which guided the discussion individually with the various stakeholders (Appendix I). The same questions were asked to all the stakeholders and there was room for discussion on the questions to grasp their optimum insight on each of the questions (**Mark and Oughton, 2017**). Requests were made at each meeting to record the discussion for the use of research purposes and this was approved by all

the stakeholders. The discussion with each stakeholder lasted between 15 to 30 minutes according to their knowledge and willingness in responding to the various questions (Appendix J).

2.8.3. Stakeholders engagement workshop

At the end of the stakeholder's identification and analysis, ecological and social data collections, and preliminary analysis of all collected data, a community stakeholder workshop was held. The workshop served as a platform where the outcome of the study was presented to the stakeholders who had interest in the work, who held valuable knowledge in the topic, and whose decision could bring significance to the results. The workshop participants were mostly stakeholders who were identified earlier during the stakeholder engagement and analysis at the beginning and during the research. The event of the stakeholder's workshop allowed for contribution, suggestions and recommendations from the various actors (Appendix K). These were included in subsequent sections of this work according to the objectives which this study sets to achieve.

2.9. Data analysis

2.9.1. Survey and questionnaire

Data from the questionnaire survey was analyzed using Excel, SPSS and the Add-ons function in Google docs. The data was first entered into excel spreadsheet from the questionnaires, and pivot tables and charts of the variables were examined individually and as groups. Before coding the open responses, a word cloud was generated in Google docs using the Add-ons command that aided to analyze and presented the most common used words by the respondents. Coding of the open responses was then done based on the words which were generated in the word cloud combined with in-depth understanding and analysis of the context of the responses. The data was then imported into SPSS and summaries of the frequencies and percentages were calculated coupled with the required tables and charts. The relationships between key variables were examined using the scatter/Dot matrix in SPSS. Also, the Pearson correlation coefficient with a 2-tailed test of significance together with statistical tests for normality - Kolmogorov-Smirnov and Shapiro-Wilk test were carried out. This was to know whether there is a correlation between amounts of money to be charged as fees for people visiting to see the primates in Jaibu Island, and how much money should be paid as wages while working as a staff in the wildlife tourism sector.

2.9.2. Stakeholder discussion and analysis

Excel tables were used for the content analysis of the discussions and word clouds were generated using the Add-ons function in Google docs after the content analysis (Cornelia *et al.*, 2020). In addition, a profound description and reflection of the opinion and feedback from the various stakeholders was summarized based on the content analysis and presented in the form of charts and tables.

2.9.3. Transect survey and reconnaissance walks

Data from the transect survey was analyzed using QGIS 3.22.0, Excel, and the Distance 7.3 software. Data were entered into Excel tables and encounter rates and other findings were derived. QGIS was used to map the encounters of primate signs and human activities. The Conventional Distance Sampling engine (CDS) in the Distance 7.3 software was specifically used to derive an estimate of the population densities of the study primate species, their abundance and associated coefficients of variation and 95% confidence intervals. Using the distance software, model selection criterion was based on Akaike's Information Criterion and the selection method used was sequential. The Western Black-and-white Colobus final population density was calculated by multiplying the group density by mean group size. The mean of observed group size was used in the estimation of the cluster size.

Robust population estimate for indirect surveys – nest count required multipliers. Therefore, analysis of chimpanzee nest data was done while incorporating multiplier values from other studies conducted at various sites into the distance analysis engine as it was not possible to set up separate studies for that due to the short duration of this study. These include:

- An estimate of nest decay rate for forest nests from the 2010, Sierra Leone National Chimpanzee Census - 109 days (SE = 19.76, 95% CL = 76-154 days) (Brncic *et al.*, 2010);
- Nest production rate of 1.143 nests per day (SE = 0.04, % CV = 3.51) from a study in the Tai National Park (Kouakou *et al.*, 2009);
- Proportion 0.83 of non-nest builders, this is the same that was used in national chimpanzee census, and similar to what was reported for Ugandan data (Brncic *et al.*, 2010; Plumptre and Cox 1996).

In choosing the detection function, the model with the best fit to the data was a half-normal function with the simple polynomial adjustment term.

III. RESULTS

3.1. Summary of findings from surveys and questionnaire administration

A total of 68 questionnaires were administered to respondents of various occupations from the seven human communities. Based on population size of the communities, 5 questionnaires were administered in Baoma Ngeya, 6 in Boma, 7 in Gbengama, 7 in Kambama, 13 in Taninahun, 15 in Saahun, and 15 in Sembenhun. The mean time taken to complete one questionnaire was $18 \pm SD 5$ minutes (range 11 - 25). With slightly sex bias among the respondents, 64.7% were males while 35.3% were females. The mean year lived in the village by respondents was $13 \pm SD 2.17$ years (range 10 – 80). The mean age of the respondents was $42.5 \pm SD 13.7$ years (range 19 – 90). Considering the educational level of the respondents, 45.6% answered ‘yes’ to have formal education, among which 16.2% had primary studies, 19.1% secondary studies following the English learning and 10.3% had received Arabic education. The 68 respondents had 14 different titles in the communities, the majority were ordinary members (55.9%); elders (13.2%); youth leaders (5.9); town chiefs (4.4%), imam (4.4%); teachers (2.9%), community police (2.9%); deputy town chief, section chief, section youth leader, bio-monitoring technician, community nurse, community health worker, and tribal authority (1.5%) each. Out of eight different primary livelihoods activities, farming accounted for 80.9%, trading (7.4%), community health work (4.4%), and fishing, mining, teaching, carpentry, cooking each account for 1.5% of the primary livelihood of the people. Among these, 88.2% of the respondents answered ‘yes’ to preferring another work different from their primary livelihood (reasons described in Table 1) while 11.8% still want to maintain their present livelihood engagements. There were 16 different kinds of livelihood activities, and one or more of these were practiced across the seven communities ranging from farming, fishing, mining, logging, trading, teaching, hunting, Community health worker (CHW), carpentry, cooking, plantation cultivation (cacao, oil palm), swamp cultivation, giving birth, tailoring, ecotourism and coal burning.

The willingness to conserve Jaibui Island for the conservation of the primates and other wildlife species was expressed positively by 85.3% of the respondents, while 11.8% were not sure about this, and 2.9% proved to be unwilling. Interestingly 100% of the respondents indicated as happy (47.1%) and strongly happy (52.9%) that their village is situated close to the Jaibui Island, and they will continue to live there if the island is protected for wildlife conservation purposes. The initiative of practicing wildlife tourism in Jaibui Island was considered to be good by 92.6% of the respondents and 7.4% not sure about this. Notably, nobody rejected the initiative which is positive for the initiation of forest-based tourism in

Jaibui Island. All year round, good number of the community members cross to the Jaibui Island mostly in the dry season (30.9%) for various livelihood activities, and some rarely cross to the Island (23.5%), others cross once every month (16.2%), once every week (16.2%), and few of them don't cross to the Island at all (11.8%). Considering the importance of wildlife tourism for local community livelihoods, 94.1% of the respondents found that this was essential for their livelihoods, and to support the introduction of wildlife tourism in the area, 97% of the respondents were willing to sell handicraft items produced in their communities to tourists coming to see wildlife on Jaibui Island. In one of the communities, a respondent mentioned it as a reason for being proud for the community members, saying that ...

“...it is a pride for us to see visitors taking along the handicraft materials and items produced from this village to other places.”

When respondents were asked if they had ever thought about the idea to work in wildlife tourism because their communities are situated close to rich wildlife habitats, 51.5% said 'no', and 48.5% answered 'yes' The 'yes' responses were accompanied by several reasons such as: to stop the farming and mining activities; it is good for securing community livelihood; there is benefit in wildlife tourism for my livelihood; for long I have been practicing farming and fishing but no substantial benefit to fully support my family, I believe wildlife tourism will bring more economical benefits; for income and to protect the animals, it will bring community and personal development.

Overall, 69.1% answered 'yes' to having been receiving visitors who come to their communities and forests in quest for primates, and 93.8% agreed to receive people visiting their communities to watch any of the three primates species in Jaibui Island. All of the respondents thought it was important to protect the three primate species; 94.4% of the respondents do not buy forest products and majority (88.2%) of them does not cross on the island in the raining season, which means they get local material from other forest patches around their community that is good for the conservation of the primates in the Jaibui Island (Figure 8). The majority of the community members considered to be paid monthly (66.2%), followed by 23.5% (weekly) and 10.3% (daily) for their services if working as staff in the wildlife tourism sector. The average expected wage by respondents for working as staff in the wildlife tourism sector were: monthly – 1,100,000SLL (range 250,000 – 3,000,000 SLL), weekly – 443,750SLL (range 100,000 – 1,000,000 SLL), daily – 98,571.43SLL (range 40,000 – 300,000 SLL). The mean amount of money to be charged as fee for a single visit to see wildlife on the island by visitors was 228,750SLL (range 20,000 – 1,500,000 SLL).

Table 1: Reasons for preferring another livelihood related to wildlife tourism other than the primary ones

	Frequency	Percent
Earn money*	42	61.7
Support the family needs*	18	26.5
Contribute to community development*	1	1.5
Protect wildlife*	5	7.4
Acquire new skill and training*	5	7.4
Have sustainable employment*	8	11.8
Age**	3	4.4
Practice ecotourism*	1	1.5
No formal education**	2	2.9
Happy with present engagement**	7	10.3

Yes* - respondents who answered yes to a change of livelihood and the reasons, and **No**** - respondents who want to maintain their present occupations followed by the reasons.

3.1.2. Livelihood preferred by the respondents

The respondents expressed their wish to receive training in one or more profession options. 16 different kinds of livelihoods were identified as preferred by the respondents in the study area: 20.6% of the respondents desired to be engaged as community bio-monitors for their own forests in order to take active roles and responsibilities in managing their own natural resources; 17.6% of the respondents were not sure about which specific livelihood activity to engage in as they prefer anyone that can improve on their living standards. The rest of the community members choose to engage in business/trading, agriculture project activities, cooking, carpentry, cleaning, housing and construction work, adviser role, welding, catering, tailoring, chain-saw operator, driving, handicraft production and hair dressing within their respective communities (Figure 9).

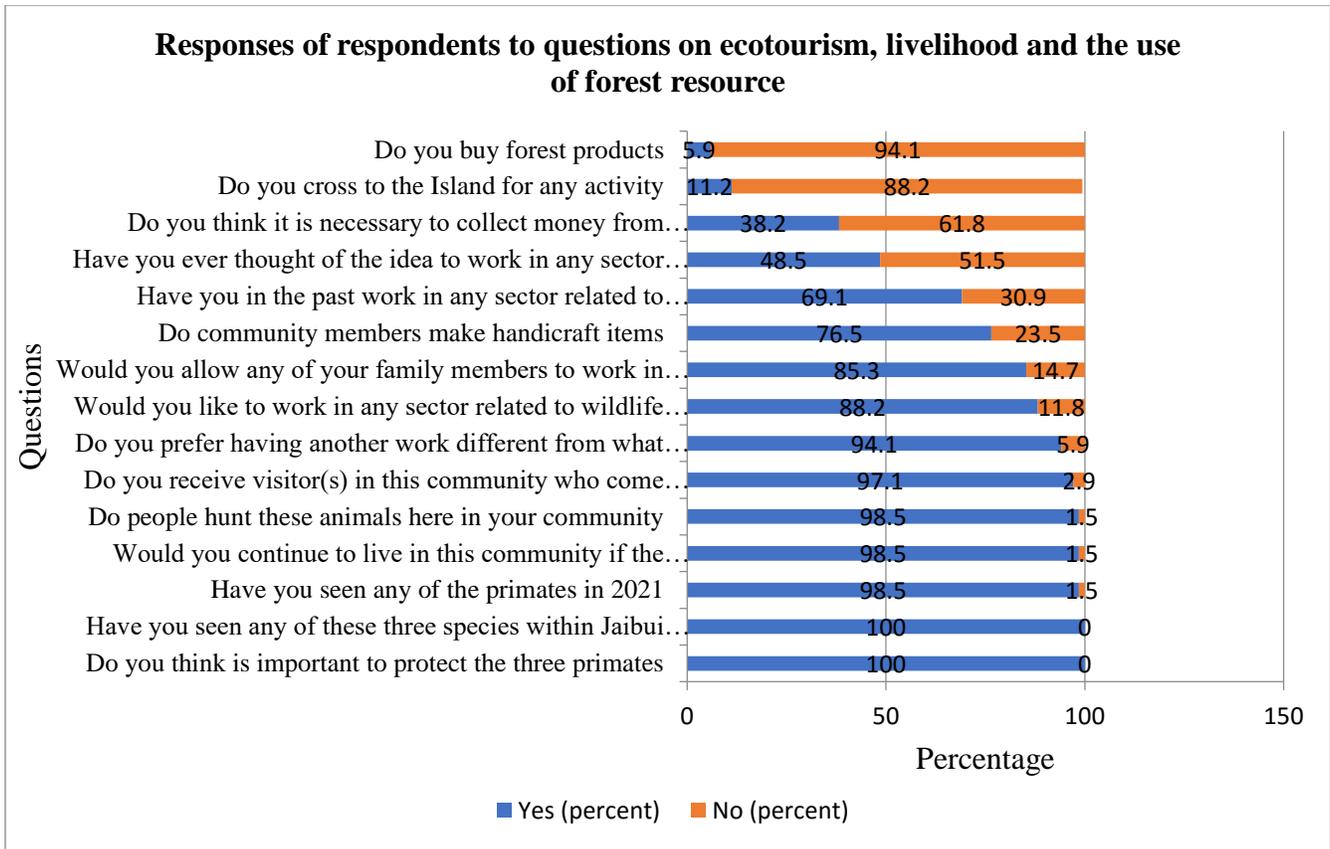


Figure 8: The opinion of respondents to questions directed about ecotourism, livelihood and utilization of forest resources.

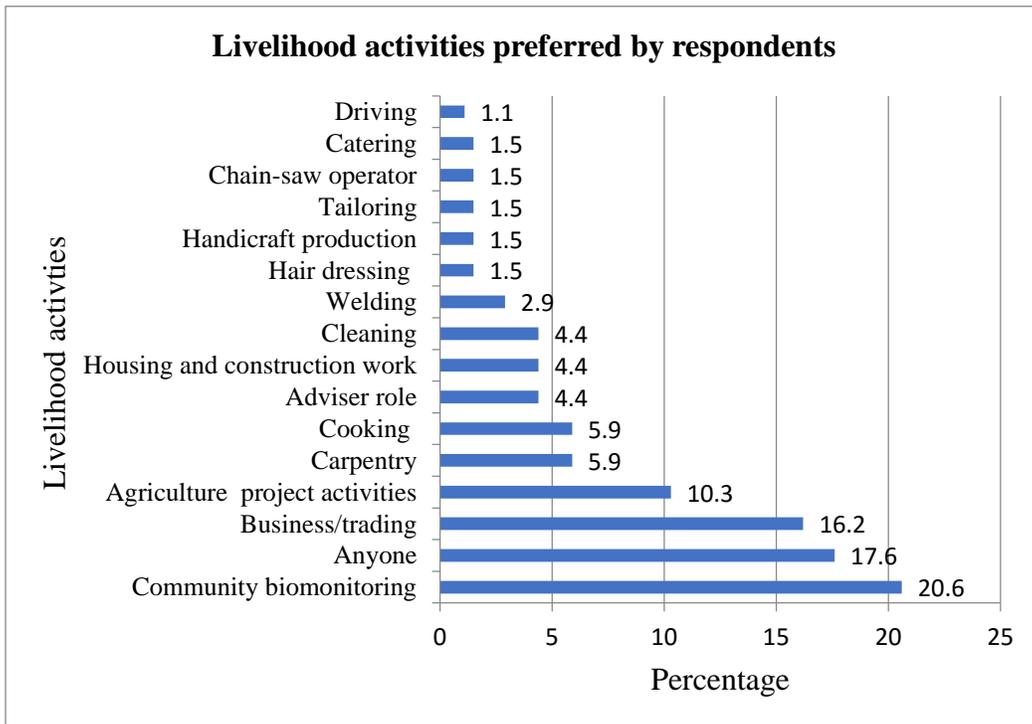


Figure 9: Various categories of livelihood skills and training preferred by respondents.

3.1.3. Existing skills within the communities

Both inherited and learned skills are major traits to the establishment of local communities at a particular locality, and these direct the interaction of the community members with their surroundings. A total of 19 different skills have been recognized within the communities for which community members are willing to offer in order to support and sustain wildlife tourism in the study area and build on it for their livelihood development. Expressing each skill frequency as a percentage, 27.9% make handicraft items from local resources occurring within the study area, 41.2% revealed having no specific skills, and several other skills were discovered with varying percentages (Figure 10).

3.1.4. Handicraft items produced within the community

As handicraft is the major skill identified within the community members that can support the initiative of wildlife tourism. The community members described to have skills in the production and making of 23 different kinds of local and modern handicraft items that will be of great attraction and interest to wildlife tourists in the study area. The majority of the respondents can produce raffia basket, fishing gears, and mats among several other handicraft items (Figure 11)

3.1.5. Perceptions of the respondents for conserving the three primate species

The respondents showed different perspectives and knowledge about the reasons for protecting the three primate species. Most importantly, 39.2% of the responses revealed that the three primates should be protected because of their intrinsic value as animals that deserve the right to live just as humans. Interestingly, 23.5% reported that the primates are destructive but above all they still need to be protected because of the fact that they are becoming rare and for the upcoming generation to see. On the contrary, 8.8% of the responses do not consider the primates to be destructive, but as helpful and beneficial animals to humans (Figure 12). One respondent stated that...

“... the chimpanzee in particular should be protected because I have seen it learning human skill in movies and being very helpful to humans - performing house jobs for humans.”

The perception of the above quotation could derive to the capture and keeping wild chimpanzees as pets. This is a huge challenge to conservation of the species, which requires sensitization and educational actions to change the perception of people having such a mindset.

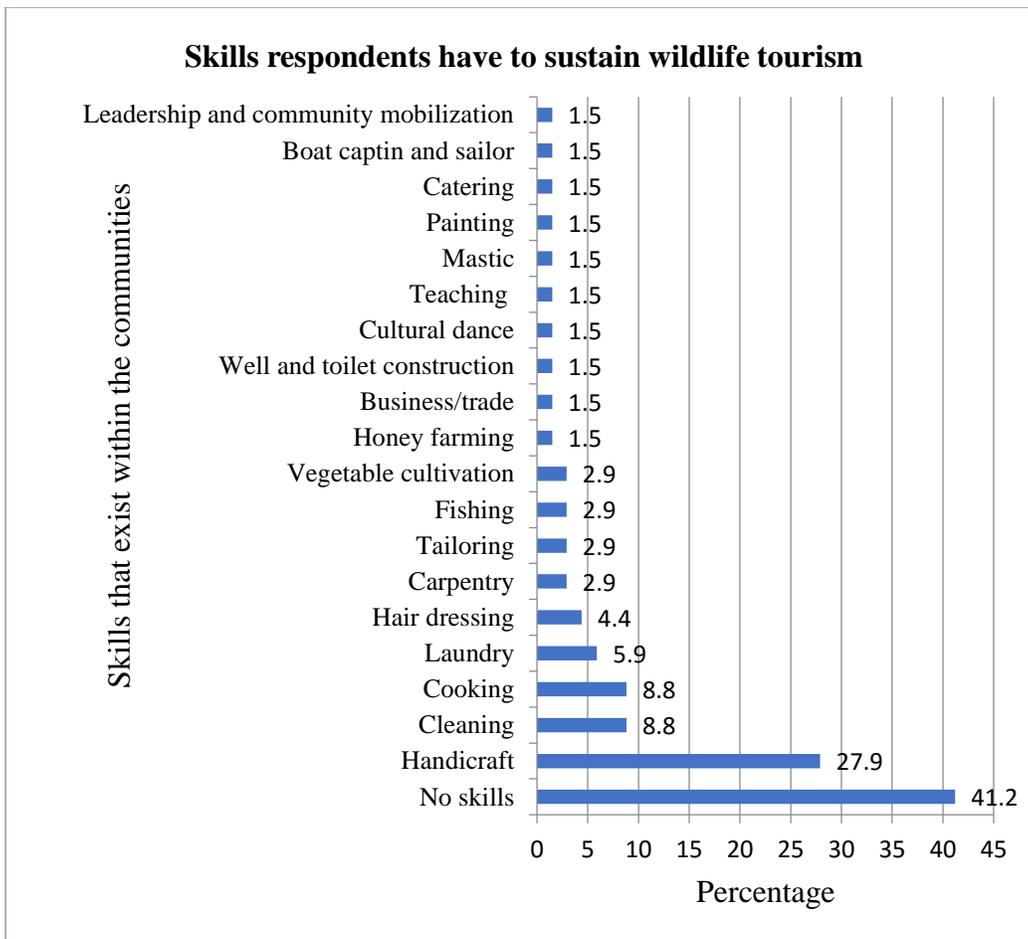


Figure 10: Skills identified within the communities to support the initiative of wildlife tourism

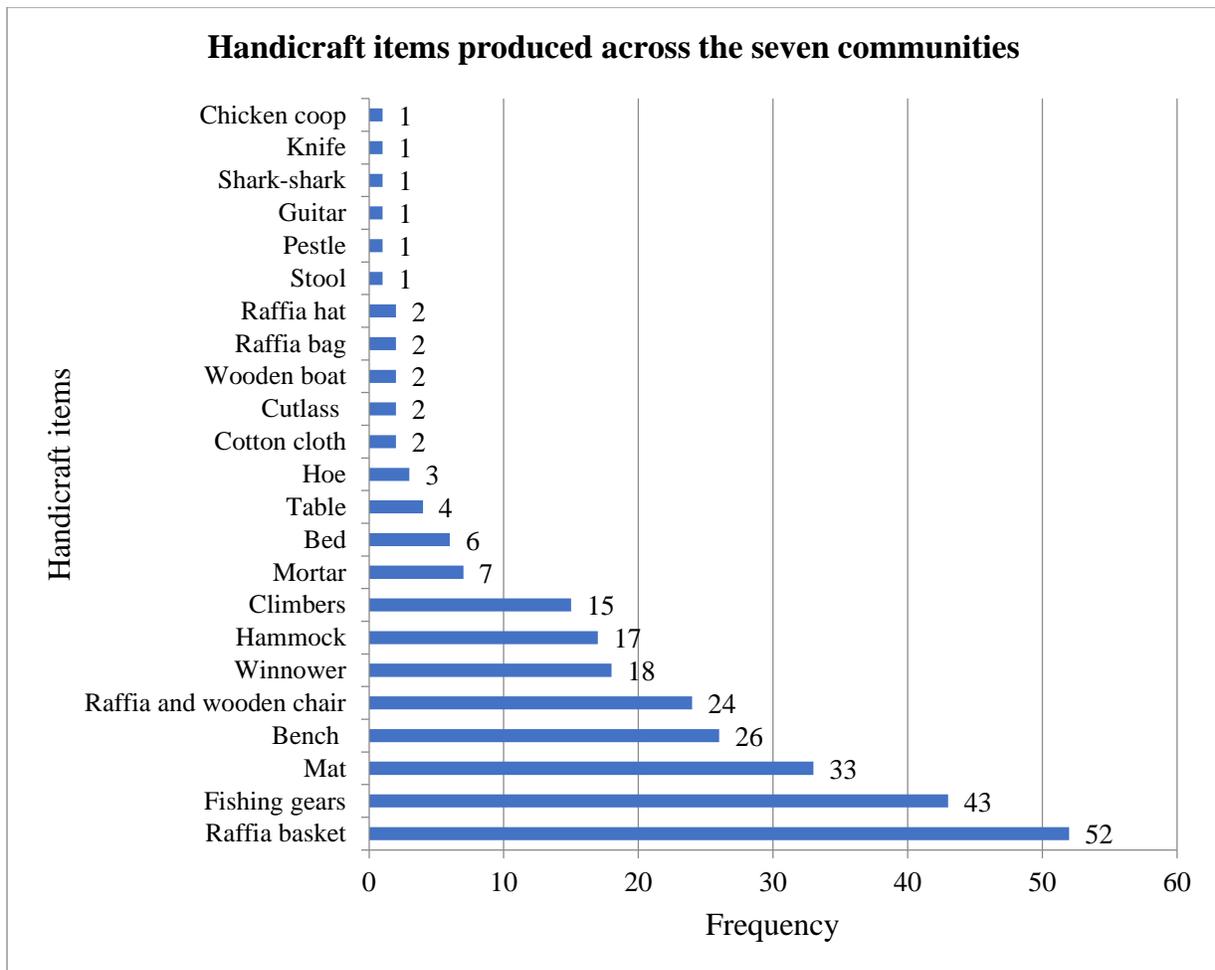


Figure 11: Handicraft items produced in the community

3.1.6. Contribution of wildlife tourism to improve community livelihoods

Figure 13 shows the frequencies and percentages of the various ways which community members think and feel that protecting wildlife for tourism development within the study area can improve their living conditions. Most respondents believe that wildlife tourism can improve their livelihood by direct income (72.1%) as well as in creating employment (60.3%).

3.1.7. Activities carried out on the island

Crossing the island to source for forest materials, goods and services for their livelihood is prevalent among the surrounding residents. This is more frequent in the dry season mainly because during the wet season the water of the river Moa is very height and dangerous to cross in the raining season (see summary 4.1.1). Community members cross to the Island for fishing, collecting wild fruits, collecting medicinal plants, mining, farming, harvesting wild honey, collecting raffia palms, walking to neighboring villages, hunting, logging, performing cultural ceremonies and to buy fish from migratory

fisher men who travelled from Guinea, fishing and camping along the Moa River during the dry season until they arrived to Jaibui Island (Figure 14).

3.1.8. Correlation between variables

To see the relationship between some of the variables, a scatter/Dot matrix was generated in SPSS for 10 of the variables. There exist linear relationships between the number of years lived in the village and the ages of the respondents. Also, the amount of money to charge as fees for a single visit to see the primate on the island increases as the age and the number of years lived in the village by the respondents increases, showing a slightly linear relationship (Figure 15).

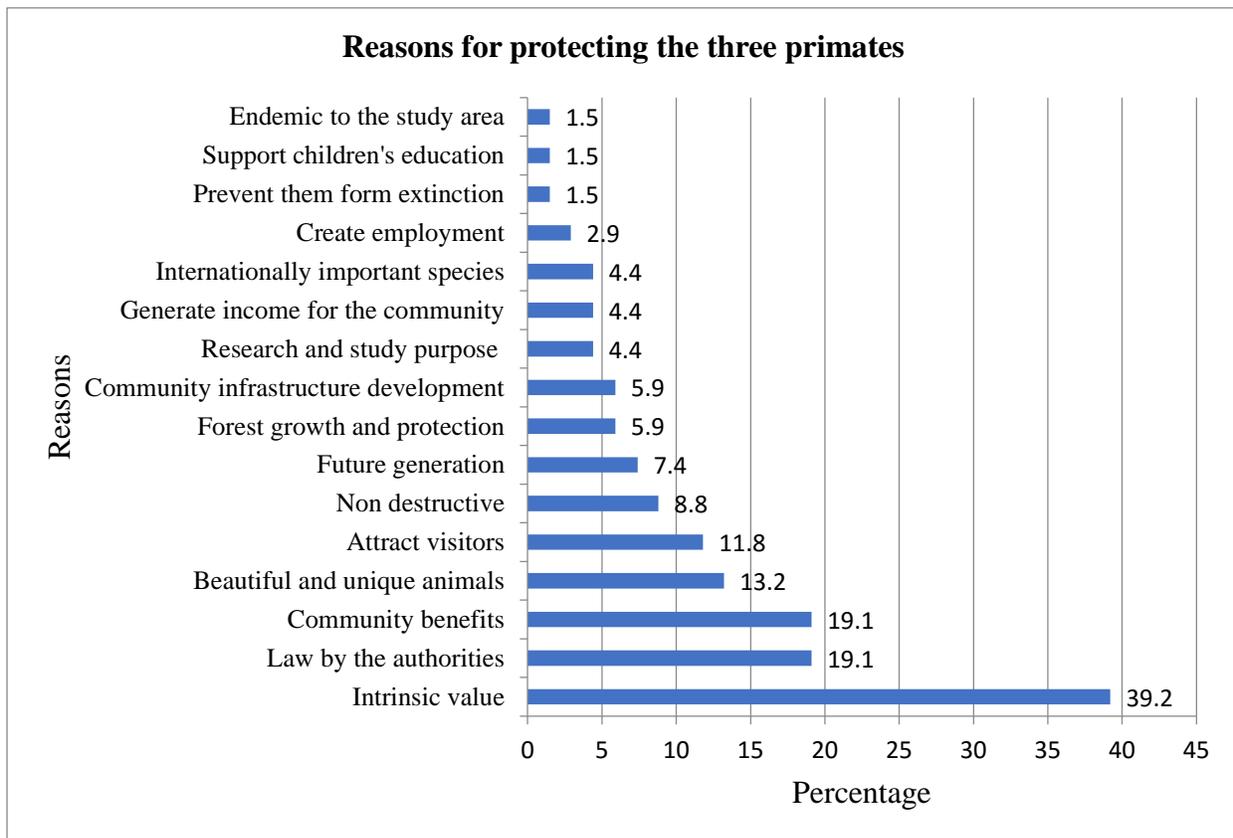


Figure 12: Perceptions of respondents in the study area about why the three primates should be protected

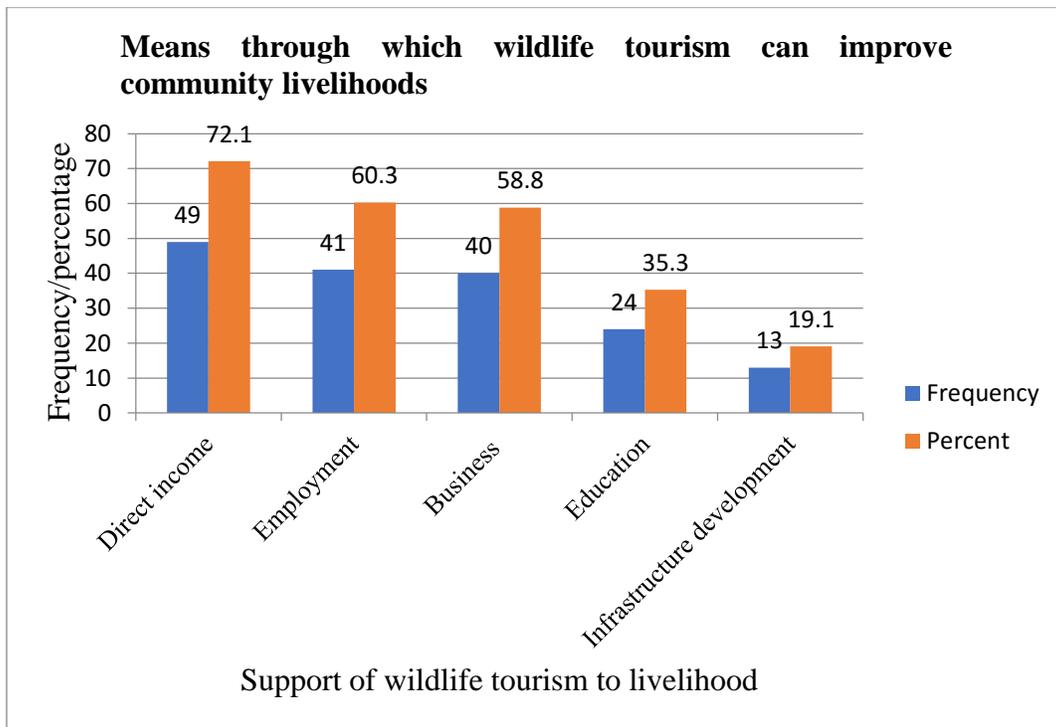


Figure 13: The various ways respondents feel that wildlife tourism contribute to improving on their livelihoods

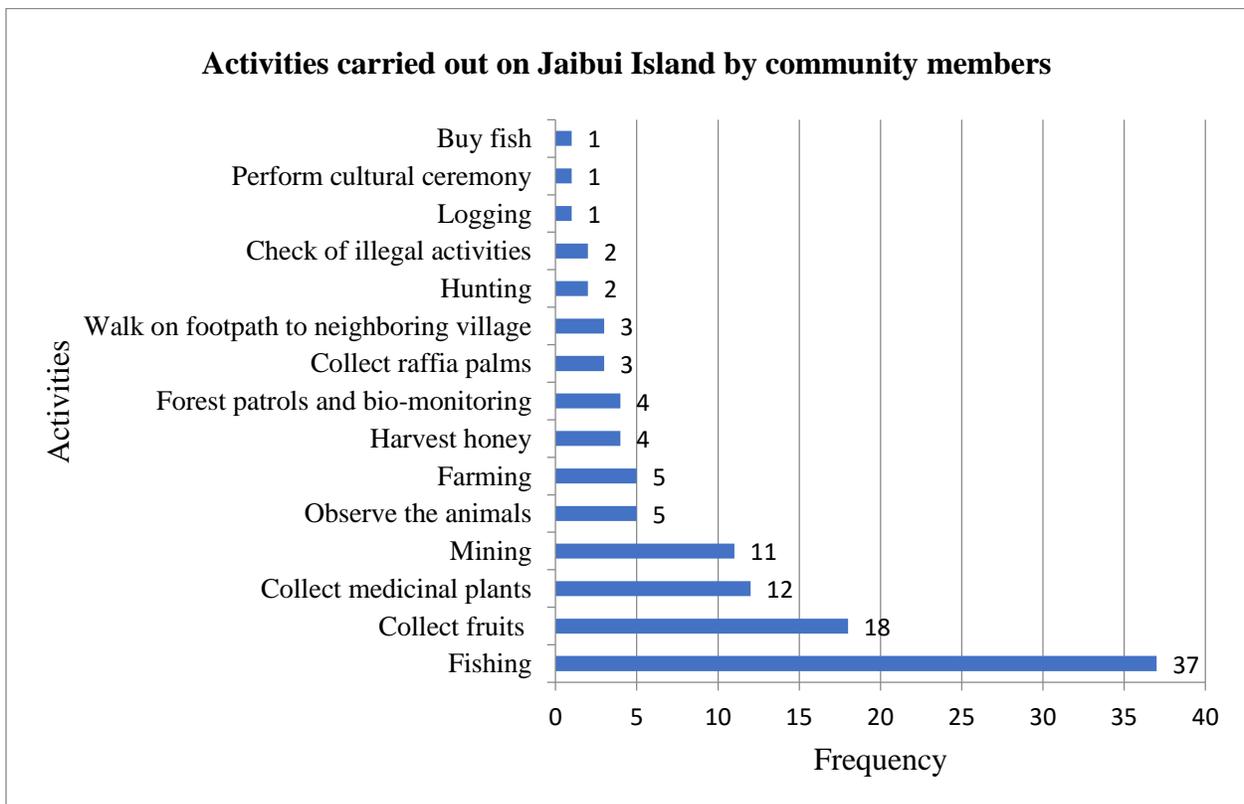


Figure 14: Reasons to cross to Jaibui island by the respondents

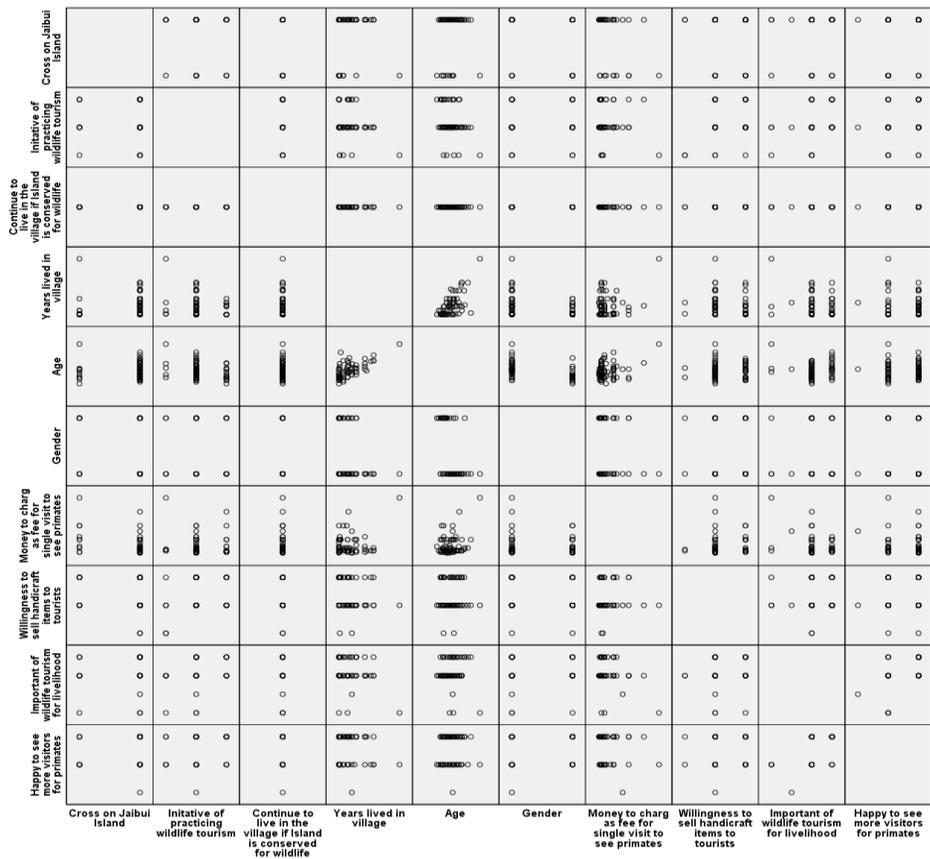


Figure 15: A scatter/Dot matrix showing the relationships that exist among 10 variables

3.1.9. Statistical test on two variables

Using the Pearson correlation coefficient with a 2-tailed test of significance in SPSS, there was a strong correlation between the responses on the amounts of money to be charged as fees for people visiting to see the primates in Jaibu Island, and how much money should be paid as wages while working as a staff in the wildlife tourism sector. The more money to charge as a fee for a single visit to see primates on the Island, the higher wages community members expect to earn for their service (Table 2).

Table 2: Correlation between two variables

		Money to charge as fee for single visit to see primates	How much money would you like to earn for your service
	Pearson Correlation	1	.595**
Money to charge as fee for single visit to see primates	Sig. (2-tailed)		.000
	N	68	68
	Pearson Correlation	.595**	1
How much money would you like to earn for your service	Sig. (2-tailed)	.000	
	N	68	68

** . Correlation is significant at the 0.01 level (2-tailed).

The test for normality (Kolmogorov-Smirnov and Shapiro-Wilk) was also done for the two categories and this also shows a significant correlation (Table 3).

Table 3: Tests of normality between two variables

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
How much money would you like to earn for your service	.433	68	.000	.165	68	.000
Money to charge as fee for single visit to see primates	.252	68	.000	.686	68	.000

a. Lilliefors Significance Correction

3.2.1. Summary from the stakeholder identification and analysis

A discussion with 20 stakeholders occupying 20 different positions and working for 11 different institutions/organizations was completed. The stakeholders were individuals whose work program and office mandated are within the scope of biodiversity conservation, environmental management and associated natural resources within Sierra Leone (Table 4). They were met with because of their knowledge and understanding about past and present conservation status of the three primate species within Sierra Leone, ranging from the threats, conservation practices and interventions to abate threats – policies/law formulation and implementation, and the benefit options for the local population for the long term conservation of the three primate species. The average years each stakeholder has worked for the institution/organization is 9.25 years (range 1 – 26 years). 95% of the stakeholders acknowledged that they knew about the three primate species, and that they knew they were endangered and protected by Sierra Leone laws as well as knowing about the existing policies for their conservation. Only one individual person (5%) considered that these species were not endangered and not protected by Sierra Leone laws stating that ...

“...people who are killing them are not arrested; if they are protected and there is a law guiding their protection the people who kill them should be prosecuted and arrested”

Table 4: Number of stakeholders discussed with and their respective working organizations/institutions

Organization/institutions	Status	Number of stakeholders interviewed
Eastern Polytechnic	Academic	2
GRNP (Now: Gola Rainforest Conservation Limited by Guarantee)	NNGO	2
National Tourist Board of Sierra Leone	Government	2
Tacugama Chimpanzee Sanctuary	Government	2
Food and Agriculture Organization of the United Nation	INGO	2
Forestry Division, Ministry of Environment	Government	1
Ministry of Agriculture and Forestry, Wildlife Unit	Government	1
Conservation Society of Sierra Leone (CSSL)	CSO	2
Environment Protection Agency Sierra Leone	Government	2
Ministry of Environment	Government	2
National Protected Area Authority (NPAA)	Government	2

3.2.2. Stakeholders' perception about primate population trend

Discussion with the 20 stakeholders about population trend of the targeted primates reflecting 10 years back, resulted that, the populations of the three primate species are on the increase in protected national parks like GRNP, Loma Mountain National Park (LMNP) and OKNP (60%) supported with evidence from reports coming from conservation organizations. The primate population was perceived stable (5%) in places with evidence of conservation intervention which are not national parks. However, the primate population was said to have experienced a decrease and become rare than it was 10 years ago mostly in community forests (CFs) that have no protection committed to it. Besides, 10% of the stakeholders indicated that the populations are highly threatened and close to extinction if management strategies are not put in place to reduce the ongoing human threats on their habitats. Eventually 10 % of the stakeholders were unsure about describing the population trend of the species. Figure 16 shows a graphical representation of the stakeholder's opinion to the question - What do you think are the threats to the conservation of the three primate species in Sierra Leone?

According to the stakeholders, the three primate species have experienced a population decrease in the last 10 years owing to several factors across multiple sectors such as: bush meat trade; pet trade; hunting; zoonotic diseases; encroachment, urbanization, human population growth; market forces; lack of awareness; wildlife trafficking across borders presenting a trans-boundary challenge; poaching; introduction of exotic or invasive species; natural disasters; competition for habitat requirements within and among primates population and communities; climate change which has affected their distribution; reduced food availability; deforestation leading to habitat fragmentation, habitat destruction and reduction resulted from both subsistence and commercial agriculture, mining and logging. This has forced primate species to live in smaller forest fragments where hunters can easily access and kill them. Bush fire in savannah habitats or woodland savannah, the lack of compliance and monitoring from government ministries accountable for conserving wildlife, weak capacities of institutions and organizations responsible for conserving wildlife, weak policies and laws; fraudulence practices among local authorities – “the local authorities are not honest, because they know the policies, they were part of forming the policies with the government and the government entrust them with the responsibility to enforce the policies but they are not enforcing it at all” as reported by one of the stakeholders are all ranging factors responsible to population decrease of the primates in Sierra Leone.

3.2.3. Policies for conservation of the primate species

Most of the stakeholders (95%) confirmed that there are existing policies that are right but needs amendments in certain areas for appropriate conservation of the three primate species in Sierra Leone and only 1 individual believed that with the newly established ministry – Ministry of Environment, the right policies will be formulated as update to existing policies that no longer meet the global demand for protection of the primates and other wildlife in Sierra Leone. The existing policies are embedded within policy documents such as: wildlife act of 1972, wildlife policy of 2010, forestry act of 1988, forestry policy of 2010, forestry regulation of 1989, NPAA act of 2012, National Environment Policy of 1994 that has been revised in 2020, National Environment Policy of 2020, EPA act of 2008, SL-NBSAP, and SL-NDC to Paris agreement. Also, there are several international obligations, conventions and treaties that Sierra Leone is a signatory. For example, CITES, IUCN and CBD which all encompasses policy statements at national and international scale for the conservation of primates. Interestingly, the fact that the three species are internationally endangered and protected, automatically designate them as protected species of Sierra Leone. Embedded in these policy documents for the conservation of the primates are policy statements that put ban on keeping the primates as pet, hunting and killing them, trade in them (buy and sell), eat them, restrict entering their habitats (PAs) to undertake illegal activities like mining,

logging, hunting and farming. Introduction of exotic animal or plant species within their protected habitats as well as export of their products outside Sierra Leone is strongly prohibited. The wildlife conservation act clearly stated that the species are protected species of Sierra Leone based on their categories as CITES species. There are also fines attached to the policy statements for both foreigners and citizens living in Sierra Leone who may go contrary to the laws.

3.2.4. State of policy implementation for conserving the primates and other wildlife

Fifteen percent of the stakeholders had positive opinions with regard to the implementation of existing policies for the conservation of the three primates and other wildlife species occurring in Sierra Leone. However, 65% have negative opinions about this, indicating that the implementations of the existing policies are not being done to achieve the mandates for which those policies were formulated. Besides, 20% were unsure about this by being neutral in their responses to the present state of policy implementation for managing wildlife and their habitats in Sierra Leone. At present, the state of policy implementation for the management and conservation of wildlife within Sierra Leone is unclear among stakeholders owing to the individual interest of the various government MDAs for which they are working

3.2.5. Challenges related to policy implementation for the conservation of the three primates

The challenges related to policy implementation vary among stakeholders based on their institutional mandates. The various arms of the government and other working organizations have challenges that overlap to successfully conserve wildlife and the environment. These challenges presented here cut across sectors at varying levels of management within Sierra Leone. The weak support to the implementation and enforcement of the existing laws resulted to be the major challenge for the conservation of the primates and other wildlife species. Figure 17 presents a chart in the increasing order of frequencies to the individual challenges stated by the 20 stakeholders that is currently impeding the success of policy implementation for species conservation within Sierra Leone.



Figure 16: Word cloud showing the terms used by the stakeholders' opinions about the threats to primate conservation in Sierra Leone

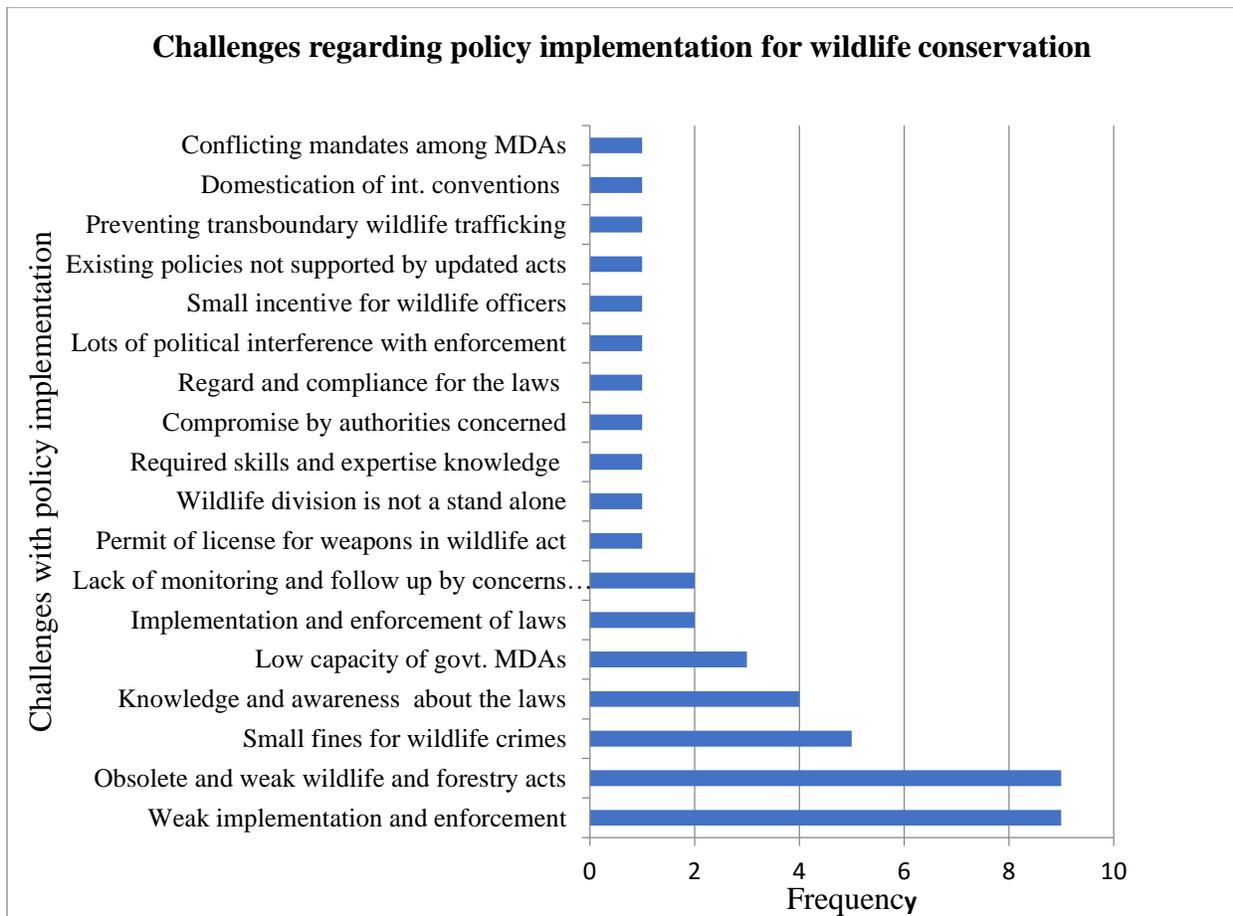


Figure 17: Key challenges faced across sectors for threatened species management

3.2.6. Pathways for the long term conservation of the three primate species

Based on the opinions of the 20 stakeholders, the adoption of strategies across multiple sectors should incorporate actions that cut across from policy formulation to its enforcement as pathways for the long-term conservation of the primates and other wildlife within Sierra Leone. The actions mostly emphasized during the discussions were: environmental education, sensitization and awareness raising among the national population; review and update of the existing wildlife and forestry acts which were reported to be obsolete when considering the current trend of biodiversity loss and environmental degradation; and the collaborative management of PAs with forest edge communities among others (Figure 18)

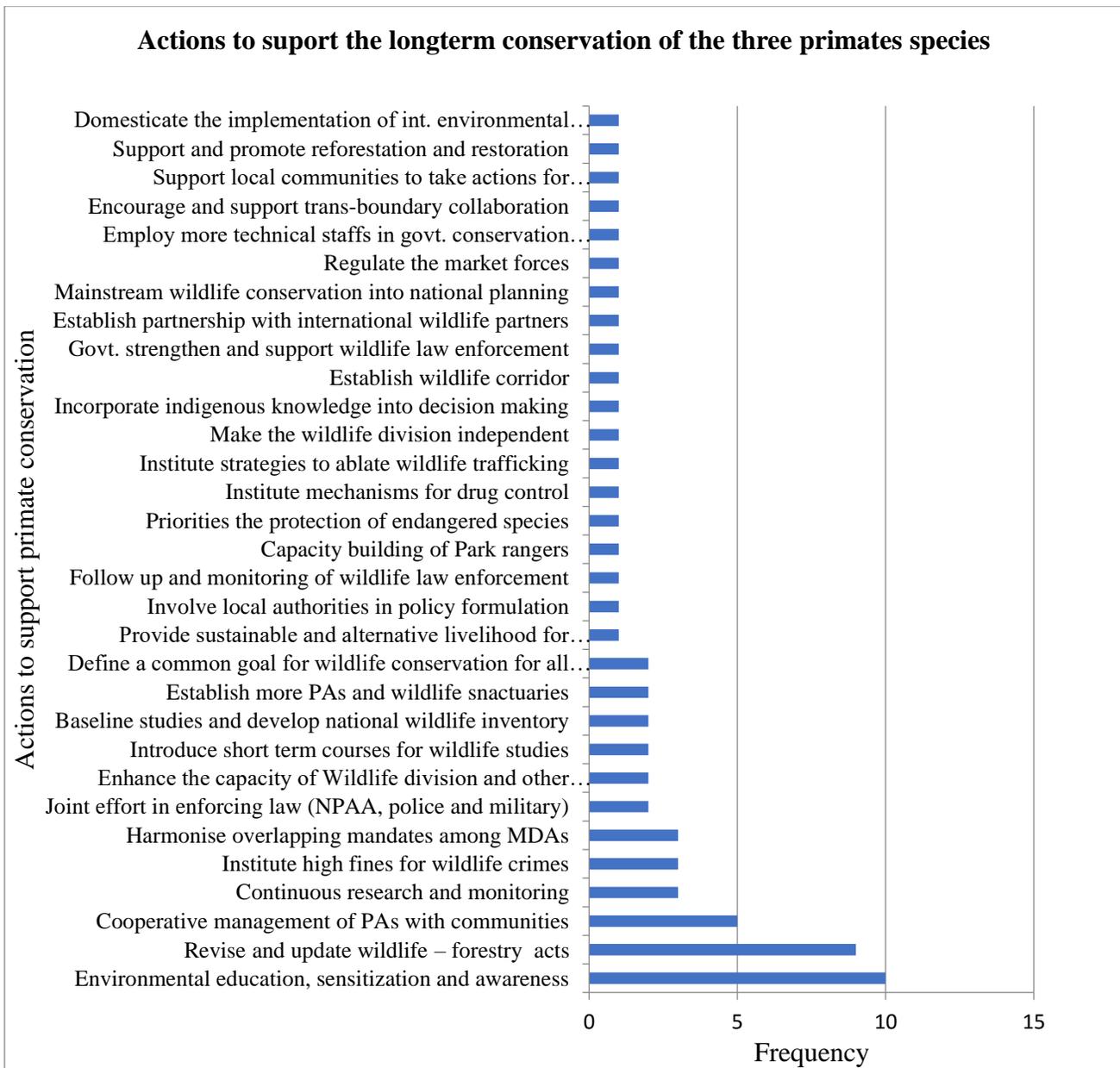


Figure 18: Some strategies to support the conservation of threatened species at national level

3.3.1. Chimpanzee nest survey

A total of 40 chimpanzee nests were detected on 12 transects (57.1% of total transects walked) -10 fresh, 22 old, and 8 decayed nests, with an encounter rate of 1.87 (No. seen/21.301km walked). A total of 15 nest groups were encountered following the nest grouping procedure defined earlier. However, repeated groups were observed by the survey team as there were similar group sizes occurring along the same transect and on different transects. The average nest group size is 2.66 nests (range 1-5 nests). Including all detected nests, dung, and feeding remains, 48 chimpanzee signs were encountered along the line

transects. This included 1 chimpanzee nest which was encountered during the recce walks that was not counted for chimpanzee density and abundance estimate (Table 5).

Table 5: Summary of nest data from transect survey

Number of transects	21
Total transect length (km)	21.301
Study area (km ²)	12.5
Number of transect with chimpanzee nests	12
Total chimpanzee nests	40
Total chimpanzee nest groups	15
Average nest group size	2.66
Nest encounter rate (nests/km)	1.87
Number of transects with chimpanzee signs	15
Number of all chimpanzee signs (nests, dung and feeding remains) recorded	48
Encounter rate including all chimpanzee signs (nests, dung and feeding remains) (signs/km)	2.25
Total number of all chimpanzee signs recorded on transects and on route (recce walks)	50

3.3.2. Chimpanzee density and abundance

The estimate density of chimpanzee in Jaibui Island was 0.25 chimpanzee/km² (SE = 0.88, %CV = 34.63, 95% CI = 0.13 – 0.49), resulting to an estimate of 3 individuals (SE = 1.03, %CV = 34.63, 95% CI = 2 – 6) (Table 6).

Table 6: Chimpanzee density and abundance estimate

Study area (km ²)	12.5
Chimpanzee density (ind/km ²) [95% CI]	0.25 [0.13-0.49]
Number of chimpanzee [95% CI]	3 [2-6]
%CV	34.63
Effective strip width (meter)	33

3.3.3. Primate Diana Monkey and Western Black and White Colobus detail form survey

We recorded the presence of Diana monkey groups in 6 transects through vocalization (5), direct observation (2) and shaking of branches (1), totaling of 8 sightings, with an encounter rate of 0.37 (No.

seen/21.301km walked). The average group size was 5.75 (range 4 - 8 individuals). If we include all direct sightings of Diana Monkey groups, vocalizations, feeding remains, we recorded 23 signs along the line transects providing an encounter rate of 1.07 (signs/km).

Eleven groups of the Western Black-and-white Colobus were spotted on 8 transects (38.1% of total transects) with an encounter rate of 0.51 (No. seen/21.301km walked). The total number of signs encountered, including direct sighting was 19 given an encounter rate of 0.89 (signs/km) (Table 7).

Table 7: Summary of Diana Monkey and Western Black and White Colobus survey data

Parameters	Diana Monkey	Black and White Colobus
Number of transects	21	21
Total transect length (km)	21.301	21.301
Study area (km ²)	12.5	12.5
Number of transects primate groups where encountered	6	8
Total primate encounter groups	8	11
Average group size (individuals) [range]	5.75 [4 – 8]	7.36 [5 – 10]
Primate group encounter rate (No. of group/km)	0.37	0.51
Number of transects with primate signs	10	12
Number of primate signs including direct sightings on transect	23	19
Primate signs encounter rate on transects (signs/km)	1.07	0.89
Total number of primate signs on transects and on route (recce walks)	25	25

3.3.4. Western Black and White Colobus density and abundance estimate

The density estimate of Western Black-and-white Colobus within Jaibui Island was found to be 57.75 number/km² (%CV = 36.85, 95% CI = 27.86 - 119.69), resulting to an estimate of 722 individuals (%CV = 34.63, 95%CI = 348 – 1496) (Table 8). However a minimum of 60-80 sightings are ideally recommended for fitting a perfect diction function to avoid overestimation of animal density (Buckland *et al.*, 205). Notwithstanding, numerous authors suggest a lower number of sightings groups to be used for density estimation if the distribution of the data is highly favorable (Peres, 1999; Kolowski and Alonso, 2012).

Table 8: Western Black and White Colobus density and abundance estimate

Study area (km ²)	12.5
Black and White Colobus density (ind./km ²) [95% CI]	57.75 [27.86 - 119.69]
Estimate number of individuals [95% CI]	722 [348 – 1496]
%CV	36.85
Effective strip width (meter)	33
Average cluster size	7.36

3.3.5. Diana monkey encounter rate and distribution

Density and abundance estimate for Diana Monkey was not calculated due to the very low number of sighting group's encountered (8 sightings). Instead, we calculated the encounter rate for Diana Monkey. Other relevant parameters are shown in table 7 about their present status within the Island (Table 7), and the distribution of encountered groups during the survey (Figure 19).

3.3.6. Human activities within the Island

A total of 19 human signs were recorded on 12 transects (57.1% of total transect walked). The encounter rate of human activities along transects was 0.89 (No. signs/km walked). However combining human activities recorded from both the transect survey and recce walks, resulted in 39 signs across the island. These include gun shells (GS), mining pits, fruit collection sites, mining camps, snare traps (ST), fishing camps, logging, and hunting trail (HT) (Figure 20).

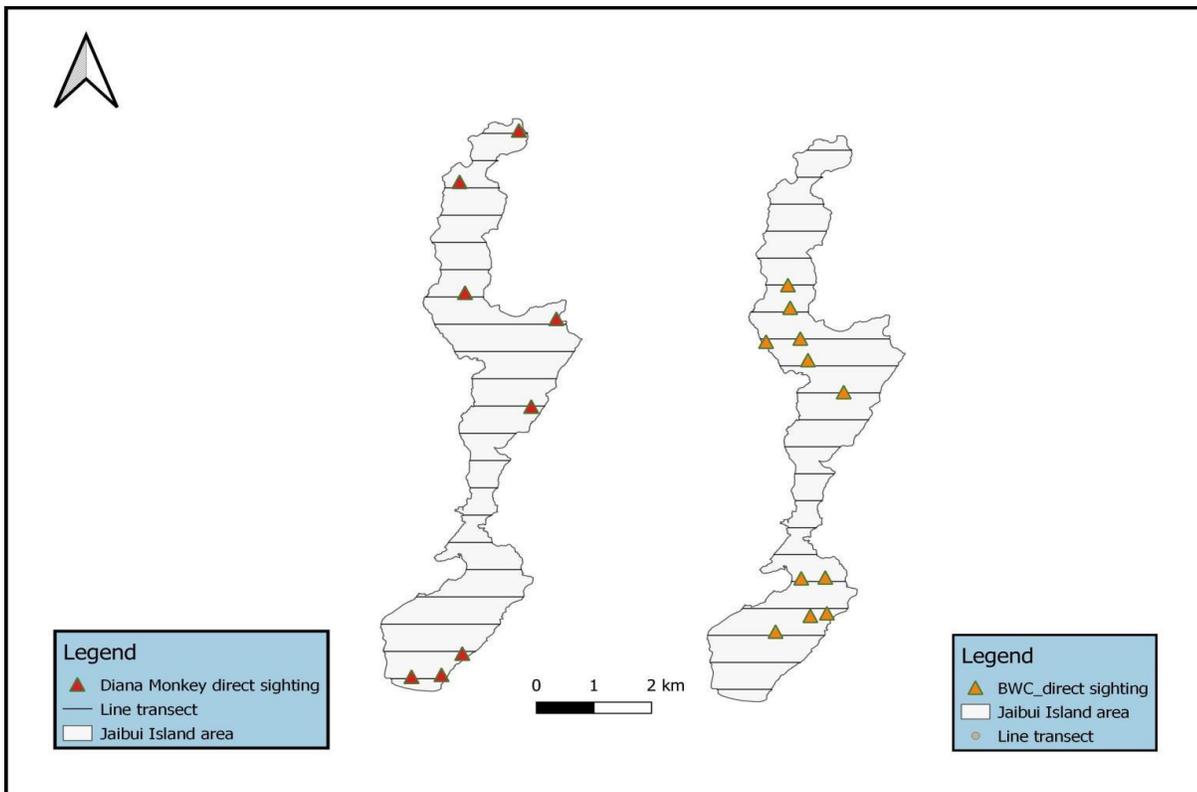


Figure 19: Distribution of sighting locations of Diana monkey and the Western Balck and White Colobus during the line transects survey.

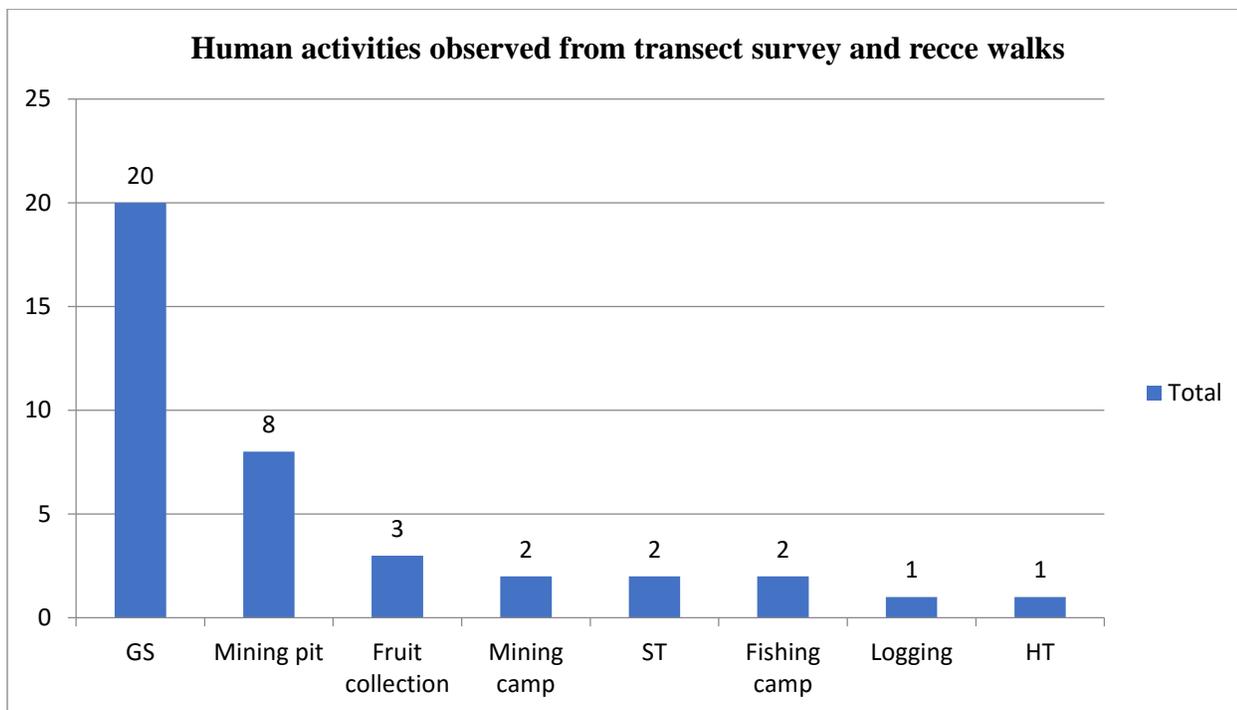


Figure 20: Human activities recorded during the transect survey and the recce walks combined. GS – Gun-shell, ST – Snare Trap and HT – Hunting Trail

3.3.7 Distribution of human activities and primate sightings on transects within the Island

Human activities and wildlife signs were randomly distributed within the Jaibui Island. Figure 21 shows a map of how encountered human activities vary with wildlife signs during the transect survey. There were more wildlife direct sightings and signs in areas where less human activities and disturbances were recorded. For example, there was less human activity in the southern tip of the Island (on transect 20 and 21) and therefore more direct sightings of Diana monkey groups were possible. Among the different kinds of human activities, hunting using snare traps and gun shells were more widely distributed on the island. Overall, few human activities and disturbances were observed as compared to activities and direct sighting of the target primate species from the transect survey.

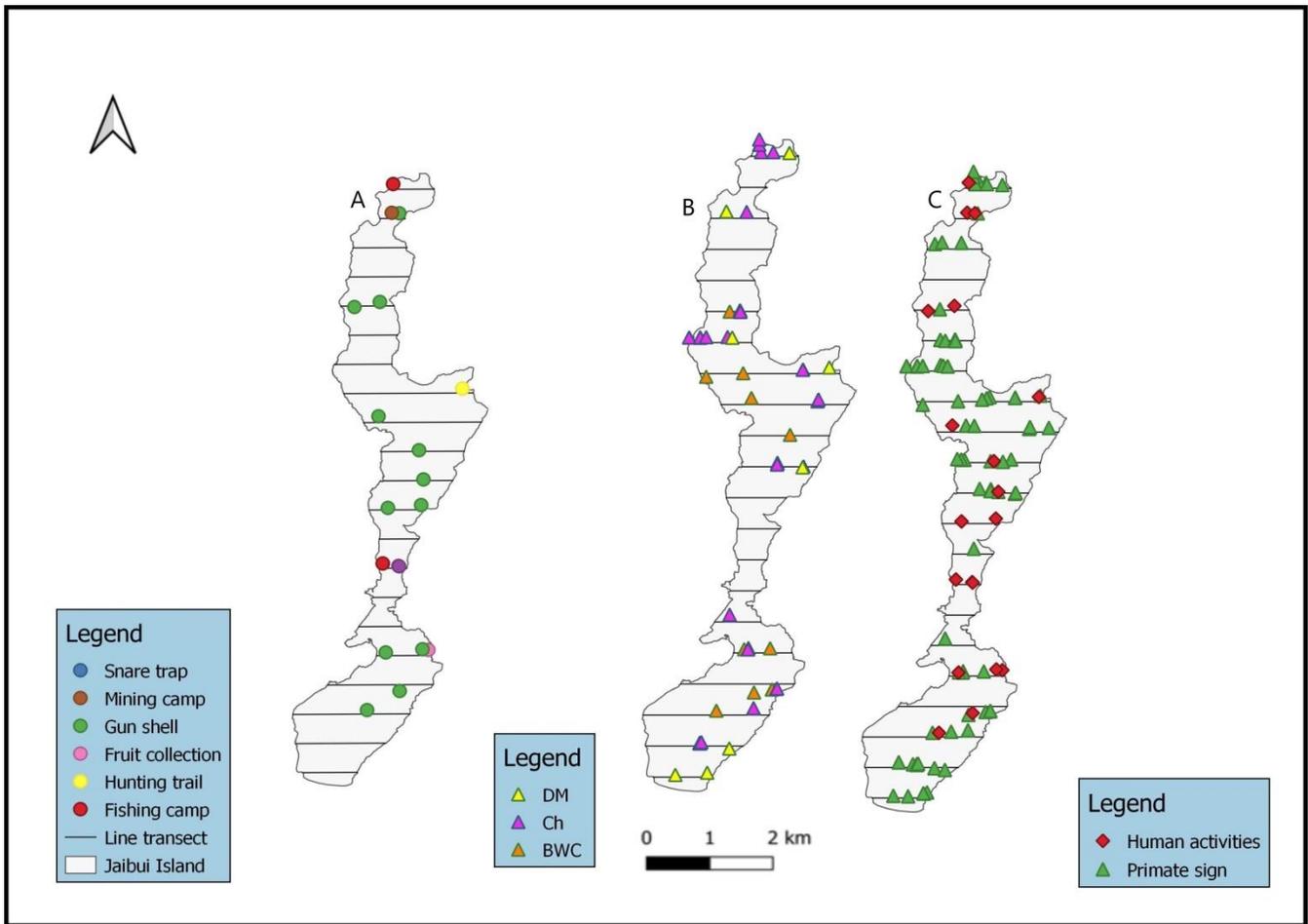


Figure 21: Map A - different human activities, B - direct sighting locations of the three primates (DM-Diana Monkey, Ch-Chimpanzee (nests) and BWC-Black and White Colobus) and C - primate signs encountered including direct sightings and all human activities during line transect survey.

3.3.8. Impact of human activities on the primate status in the Island

Human activities and disturbance were distributed across the Jaibui Island. These included: mining pits, mining camps, gun shells, snare traps, hunting trails, fishing camps, fruit collection sites, and logging. Categorizing the different kinds of human activities as: mining (mining pits and camps), hunting (gun shell, snare trap, and hunting trail), logging, fishing, and fruit collecting, resulted in 5 categories that could directly impact the conservation of the three primate species. Rating the impact of the encountered human activities and disturbances we considered as high impact 20-30 signs encountered, moderate impact 10-20 signs encountered, and low impact 1-10 signs encountered. Hunting using shotguns and snares accounted for 23 signs considering it as a high impact to the primate population status, followed by mining (10 signs) which was found to have moderate impact, and logging, fishing and fruit collections each found to have low impact on the primate population within the Jaibui Island (Table 9)

Table 9: Human activities and their impact within the Island

	High (20-30 signs)	Moderate (10-20 signs)	Low (1-10 signs)
Hunting	23		
Mining		10	
Logging			1
Fishing			2
Fruit collection			3

IV. DISCUSSION

This study presents the analysis and results of the research data gathered using a combination of methods to determine the population status of three threatened primates – *Pan troglodytes verus*, *Cercopithecus diana*, and *Colobus polykomos* inhabiting a small community Island, Jaibui Island, located in the river Moa, and close to seven human communities in the district of Pujehun in Southern Sierra Leone. The collected data also provided knowledge about the potential livelihood opportunities that could benefit the local human communities through the long-term conservation of these primate species. We also inform on the stakeholders’ perspectives about the current and future conservation strategies in order to ensure the long term conservation of these threatened wildlife in Sierra Leone.

This study has clearly demonstrated the willingness and supportive capacities of the communities to promote conservation of threatened species if they can obtain opportunities to improve their livelihood. This has been expressed through the willingness from 85.3% of respondents to preserve the wildlife and its habitat - Jaibui Island and 100% of the respondents answered that they were happy to be living close to the habitat of these primates. Positive attitudes from community members towards conservation of threatened species and their habitats can emerge if they perceive benefits and other life supporting opportunities for meeting their livelihood (**Mutanga et al., 2020**). Community members believe that protecting threatened wildlife and their habitat through forest based tourism with high participation from them can improve their livelihood through direct income (72.1%), employment (60.3%), Business (58.8%), education (35,3%), and infrastructure (19.1%).

Evidence from this study confirmed that 41.2% of the respondents have no skills to support wildlife tourism in the study area and 17.6% of the responses show that the respondents are willing to learn any skills to support wildlife tourism in the study area. Existing skills within communities can serve as a major driver to the success of conservation programs. Well planned conservation programs can foster communities to use their skills positively for conservation gains (**Thompson et al., 2020**). This presents reasonable settings for conservation practitioners or organizations working with local communities in developing conservation strategies that encompasses capacity building in new skills and teachings that can substitute negative human practices on wildlife populations. This can have a long term positive impact to the success of threatened species while the community members meet their livelihood demand by learning new skills – a situation where a win –win state for both wildlife and human needs are met simultaneously.

The age and numbers of year's community members have lived more closely with wildlife and their habitats are relevant parameters deduced from this study to take into consideration when making plans to design wildlife tourism intervention aimed at developing local livelihoods. Findings from this study have shown a correlation between the age of community members and the amount of money to charge as fees to see primates within their habitats. Older people who have lived for a long time in the study area demand more money for seeing the animals within their natural habitats than younger people. Corresponding to that also was the significant correlation between the amount of money to charge as fee for a single visit to see primates within the Island and the expected money to earn while working in any sector of wildlife tourism. These reflect the importance given by people with long-time experience living with wildlife as well as the greatest value given by older people. Older people tend to appreciate nature more than younger people as they see nature disappear while growing older and missing the valuable services nature has offered in the past for their survival. The findings reported here are in many aspects similar to a study carried out in Zimbabwe to understand the perceptions about wildlife conservation linked to tourism of community members living close to four protected areas. This was found to be neutral with community members showing positive perception and the willingness to work in the tourism sector related to species and natural habitat conservation. Further investigation into the age, numbers of year's community members living in the study area, gender, and education level related to wildlife conservation through tourism shows strong correlation and positive outcome for tourism intervention through livelihood development (**Mutanga *et al.*, 2020**).

Farming happens to be the major livelihood activity practiced by the community members (80.9 %) in the study area. Despite farming being the main livelihood activity in the study area, 88.2% of the respondents preferred another work different from their primary livelihood. The impact of farming either for subsistence or commercial purposes is known to have devastating long term effects on wildlife habitats and their population (**Sokos *et al.*, 2013**). With the majority of the community members showing interest to move from farming practices to other forms of livelihood shows there is hope for the conservation of threatened species if proper intervention is planned with the cooperation from community members at the study site. Therefore, creating opportunities for other forms of sustainable environmental livelihoods and improving the farming practices to have less impact on the environment within local communities living in close association with wildlife habitats can serve as a positive strategy to attain conservation gains at community level. It is noteworthy that the 20.6% of the respondents expressed the desire to engage in community bio-monitoring activities (to actively participate in the management of their own resources. This is where conservation programs can set in to

offset these challenges through well planned community conservation packages which can foster both species conservation and human livelihood development.

Human activities have been documented to impact wild species population and distribution to varying degrees across several different sites (**Refisch and Koné, 2005; Korstjens and Hillyer, 2016; Estrada *et al.*, 2018**). Large terrestrial mammals mostly tend to avoid areas that are frequently accessible to human use (**Blom *et al.*, 2005**). Primates in general tend to favor certain areas within their habitat that are free from human disturbance and activities providing favorable ecological conditions for their survival (**Moraes *et al.*, 2020**). This might be the case for these primates of Jaibui Island. The distribution of human signs compared to that of primate signs clearly showed primate avoidance of human disturbance within the Island. The direct sightings locations of Diana Monkey groups in the south of the island shows the primate avoidance of human activities, similarly towards the north of the island where less human activity were encountered, more signs of the three primates were detected (Figure 22). The potential human derived threats recorded during the survey that could impact the survival of the primates on the Island, i.e.: mining (mining pits and camps), hunting (gun shell, snare trap, and hunting trail), logging, fishing, and fruit collecting have been identified among globally drivers acting in synergy to exacerbate the population decline and disappearance of primates in the present era (**Estrada *et al.*, 2017**). Hunting had the highest impact on the primates population status within the Island (signs 20-30). However, the clear purpose for hunting whether for household consumption or for commercial purpose within this area is unknown as it is beyond the scope of this study. Hunting pressure has been confirmed to be high on large primate species like the Western Black-and-white Colobus (**Refisch and Koné, 2005**). However, with the presence of several primate species of the lower IUCN categories living within the Island that are not the focus of this study, the pressure from hunting may not be species-specific severe on any of the focal primates in this study. Notwithstanding, threats such as mining and logging also have been known to impact negatively the primate population in other studies (**Brodie *et al.*, 2015; Estrada *et al.*, 2017**).

Density and abundance estimates of primates within a known home range have been reported by several studies using different methods. Line transects methods are more widely used to estimate diurnal primate population across their ranges (**Klop *et al.*, 2008; Kouakou *et al.*, 2009; Brncic *et al.*, 2010**). Chimpanzee density and abundance estimates from line transect surveys have been reported from various sites across West Africa, and compared to this study as well previous study conducted in Jaibui Island in Table 11. These density estimates outside Jaibui Island in comparison to this study reflect

mainly the differences in the extent of the study area and the management status attached to the various sites. Previous study in Jaibui Island and this study show similar population densities (0.22 and .0.25 chimpanzee/km² respectively). However, the chimpanzee density estimated from this study is slightly lower than the result obtained in GRNP which was 0.27 chimpanzee/km² (Ganas, 2009). Nevertheless, the %CV presented here is higher due to the low number of nests counts and therefore there are uncertainties associated with this population estimate. Most chimpanzee population studies done using indirect survey methods, nest production and decay rates are taken from studies conducted at other sites due to factors like short study duration and resources constrains. However, it has been advised to conduct site specific estimate of multipliers (Nest production and decay rates) at the study site prior or during the time of the study for analysis of indirect survey of chimpanzee aiming to derive density and abundance estimates to enhance robustness and reduce bias in the final result (**Buckland *et al.*, 2015**). The management status of a particular species habitat has influence on the population of species that occur within. NPs are legally binding restricted areas for entry and any activity except with approval from the authorities. Within a national park that has proper species monitoring strategies and effective ranger patrols, there is a possibility of high species density and abundance because of the conservation effort which is unlike community forests like the Jaibui Island where access is free and right based thereby creating a significant impact on species population occurring within. Chimpanzee nest encounter rate from this study was found to be 1.87 (No. seen/21.301km walked). Previous study conducted in 2019 within the Jaibui Island reported chimpanzee nest encounter rate as 1.7 per km which is similar to this study (**Garriga, 2019**). A study conducted within the GRNP following similar methods and protocols on transect reported chimpanzee nest encounter rate at 0.102 per km. This encounter rate is much lower than the findings here. This can be attributed to differences in survey effort during data collection because GRNP is large and possibly chimpanzees within tend to nest far apart which may not be the case in Jaibui Island due to the small size of the Island.

Table: 10. A comparison of western chimpanzee densities ($d = \text{individuals/km}^2$) across West Africa. FR=Forest reserve, CF=Classified forest (French system)/Community forest, NP=National park

STUDY SITE	COUNTRY	D	SOURCE
Koulako	Guinea	1.09	Ham,1998
Djakoli	Mali	0.39	Granier andMartinez, 2004
Gola FR (now GRNP)	Sierra Leone	0.27	Ghanas, 2009
Jaibui Island (CF)	Sierra Leone	0.25	This study
Jaibui Island (CF)	Sierra Leone	0.22	Garriga, 2019 (previous study)
Nation wide	Liberia	0.047	Tweh <i>et al.</i>,2014
NiokoloKoba NP	Senegal	0.13	Preutz <i>et al.</i> 2002
Tai NP	Ivory Coast	0.10	N’Goran <i>et al.</i> 2007
Tia NP	Ivory Coast	0.08	Kouakou <i>et al.</i> 2009
Goualongo Triangle	Republic of Congo	1.53	Morgan <i>et al.</i> 2006

Encounter rate of a species within a defined geographical boundary is known to provide valid information about their population and can serve as a proxy to inform planning for management purposes (**Plumptre et al., 2013**). From north to south, Dina monkey groups were evenly distributed in the Island unlike the Western Black-and-White Colobus where no groups were encountered in the north of the Island. Encounter rate reported for diurnal primates from line transect surveys vary across sites. The encounter rate for Diana Monkey and the Westren Black-and-white Colobus from this study shows significant differences when compared to a study conducted in GRNP. With a total transect length of 21.301km surveyed in Jaibui Island resulted in an encounter rate of 0.37 (No. of groups/km) for Diana Monkey and 0.51(No. of groups/km) for Black-and-White Colobus. Whereas in GRNP, a total transect length of 245.28 km resulted in an encounter rate of 1.048 (No./km) and 0.282 (No./km) respectively for the two primate species. Variation in the encounter across the two sites can again be attributed to the size of the sampled area. GRNP covers a land area of 710 km² given the possibility of placing more transects at longer lengths than what was done in the Jaibui Island with only 12.5km².

Conservation policies are crucial to drive the success of species management. Policy implementation for the conservation of threatened species is challenging with the existing policies. The fact that existing policies are not supported by an updated wildlife and forestry act presents a drawback to the success of wild species conservation in Sierra Leone. Also, existing policies have been described as obsolete, missing the laws that meet the current trend of global species conservation. An urgent call to review the policy document is an utmost request from the findings of this study. However, the individual institutional mandates and interest is again another factor challenging for conservation interventions and the success of species protection. Various government MDAs have their own interest and focus which in

most cases does not favor species conservation. . However, there is the existence of the NPAA that is responsible for protected area management. The NPAA and wildlife division of the ministry of forestry have conservation units that ensure patrol, surveillance and sensitization of local communities about the importance of wildlife conservation and the dangers for hunting them. The establishment of NPAA has also led to the recruitment of forest rangers across districts in Sierra Leone to enforce existing policies. Nevertheless, the increasing information about the rate of deforestation leading to forest cover loss within the country are alarming indicators that need urgent actions to enact enforcement and compliance of the existing laws. Therefore, to succeed in effectively conserving wild species and their habitats, a concerted effort is required from all sectors of the government concerned with the management of the environment and its associated natural resources. Efforts should be directed towards establishing a common goal that can create an empowering setting for all arms of the government to support the goal of wild species conservation.

CONCLUSION

The Jaibui Island is a small area (12.5 km²) for the persistence of primate's species that are sensitive to human disturbance and known to have large home ranges such as chimpanzees. Considering the location of the seven communities (situated close to the island) and the known effect of human on wildlife population at other sites, as well as the sympatric associations which exists between and among groups of species to successfully survive, it was indeed timely that this study was set up to investigate the findings presented here. This study aims to create approaches for the long-term conservation of threatened species through linking wildlife conservation with sustainable community based tourism in order to meet local livelihood demands for communities situated close to wildlife habitats. The findings of this study can inform policy makers and other developmental partners in planning conservation programs that will foster community participation and boost local community livelihoods development through a shift to positive and sustainable conservation practices. The study clearly revealed the importance of community forest management as areas hosting species of higher conservation value that are of global focus and ecological significance. Thereby, informing conservation practitioners to not just concentrate conservation efforts within protected areas, but incorporate community forest management into their conservation planning. The results show the challenges and backdrops to primate conservation with respect to the existing national policies in the study country. Across multiple sectors, adopting the actions and pathways of this study might bridge the gaps in national policy implementation for the long term conservation of the primate species. Human activities have extensive influence on many aspects of

species' survival. Within Jaibui Island, this study revealed low level of human activity, an indicator of hope for the survival of primates on the Island, if the hunting pressure is addressed, community livelihood demands are met and the right policies are instituted. The concern for species conservation is presently a global topic of discussion on the agenda of world leaders. Policy formulation and implementation that involves the arms of world leaders determines the success of the target set for species protection at both global and national level. Devising the right policies that cater for human wellbeing and species conservation goes a long way in attaining this global goal. At the national level, based on the findings from this study, recommendations in this direction are the following ones:

1. Establishment of new protected areas and wildlife sanctuaries as habitat degradation is one of the threats impeding the survival of wildlife species;
2. The national government and NGOs should work with local communities to protect community forests as they host a good number of ecologically important species;
3. Public education and sensitization on the importance of conserving wildlife and their habitats for human wellbeing and national development should be emphasized at all levels and across sectors;
4. More effort should be done to reach the forest edge communities in remote places with the basic life requirements as support for their stewardship in protecting wild species to encourage their participation in conservation programs as conservation goals cannot be achieved without the participation of the local people.

FUTURE PERSPECTIVES

This study has both long and short term perspectives that cannot just be limited to Jaibui Island and its seven human communities but with possibilities to extend at other sites in the study area. Some areas of concern for future interventions related to this work are the following ones:

1. Investigate into the hunting pressure to include the source and purpose of hunting on the primate population within the Island in order to devise strategies to mitigate it;
2. Extend the population study of the three primate species to the two adjacent islands harboring similar forest habitat;
3. Engage with multiple stakeholders to formulate the right policies supported with recent wildlife and forestry acts that meet the global trend of species conservation within the country;

4. Establish a continuous and effective community bio monitoring program on the island to provide updated knowledge about the primate status and create jobs for community youth as livelihood support.
5. Build capacities of the community members in sustainable environmental skills to manage their own natural resources in a profitable way while also promoting eco-tourism in the area.

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APPENDIX A

Line transects and their respective start and end point coordinates

Sampler	Transect start		Transect end		Transect length from design (m)	Transect length surveyed (m)	UTM
	X coordinate	Y coordinate	X coordinate	Y coordinate			
Sampler 1	238457	829803	239244	829803	788	793	29
Sampler 2	238286	829281	238726	829281	440	440	29
Sampler 3	237807	828759	238756	828759	949	931	29
Sampler 4	237733	828237	238788	828237	1055	1070	29
Sampler 5	237585	827714	238526	827714	942	1130	29
Sampler 6	237727	827192	238582	827192	856	826	29
Sampler 7	237469	826670	238483	826670	996	1010	29
Sampler 8	237629	826147	239910	826147	2280	2190	29
Sampler 9	237977	825625	240058	825625	2081	2040	29
Sampler 10	238277	825103	239747	825103	1470	1480	29
Sampler 11	238273	824581	239543	824581	1230	1150	29
Sampler 12	238064	824058	239045	824058	981	941	29
Sampler 13	238242	823536	238939	823536	697	545	29
Sampler 14	238253	823014	238724	823014	471	427	29
Sampler 15	238130	822492	238623	822492	494	394	29
Sampler 16	237870	821969	238631	821969	760	762	29
Sampler 17	238181	821447	239134	821447	953	850	29
Sampler 18	237317	820925	239177	820925	1860	1320	29
Sampler 19	236701	820403	238766	820403	2065	1360	29
Sampler 20	236750	819880	238338	819880	1588	835	29
Sampler 21	236869	819358	237833	819358	964	807	29
Total transects length					23920	21301	

APPENDIX B

Data sheet for the recording of ecological data during the transect survey and recce walks

Data Collection Sheet

Date: _____ Transect ID: _____ Start time: _____ End time: _____ Total transect length: _____

Data recorder: _____ Team members: _____ Weather _____

Time	Dist. from start	WPt	GPS Coordinates		Spp	Obs. or sign type	Num	Det. type for monkeys	Perp. dist. (m)	Approx Height (m)	Age	Group ID, Nest ID	Tree/fruit species	Group spread (monkeys) (m)	Mixed group (yes/no)	Hab type	Pho. No.	Comment
			X	Y														

Weather: Sunny (SU), Very sunny (VS), Light clouds (LC), Cloudy (C), Rain (R), Others (specify)

Species: Chimpanzee (CH), Diana Monkey (DM), Black and White Colobus (BWC), Human (H), Others (specify)

Detection type: Seen (S) or Vocalisation (V), Branches (B)

Observation/sign: Non-Human Primates: Nest (N), Dung (D), Feeding remains (FR), Feeding site (FS), Nut cracking site (NS), Call (C), Direct sighting (DS), Trail – for chimp (TR) Others (please specify),

Nest Age Class: Fresh Nest (FN), Recent Nest (RN), Old Nest (ON), Decayed Nest (DN)

Another observation/sign age: Fresh (F), Recent (R) and Old (O)

Nest Group ID: Group one, Nest one (G1N1), Group one, Nest two (G1N2),

Group two, Nest one (G2N1), Group two, Nest two (G2N2),

Human: Footpath (FP), Hunting trail (HT), Snare trap (ST), Snare fence (SF), Cartridge shell (CS), Gunshot (GS), Logging (L), Farming (F), Mining (M), Fishing (F), Brushing (B), Fruit collection (FC),

Habitat type: Mature/pristine forest (MF), Degraded Forest (selective logging) (DF), Secondary Forest (SF), Farmbush of less than - < 10 years (YFb), Farmbush of greater than - >10 years age (OFb), Swamp (Sw), River – rocks (RR), Bamboo Forest (BF), Raphia palm forest (RPF), Another habitat type (specify).

APPENDIX C

Wildlife signs and sightings encountered during the ecological survey



Old chimpanzee dung



Fresh feeding remain of monkeys on *Parinari excelsa*



Fresh chimpanzee nest

APPENDIX D

Human activities and disturbances encountered during the survey



Old gun shell



Old timber logging site



Active snare trap



Old artisanal mining pit

APPENDIX E

Survey equipment and materials used



APPENDIX F

Questionnaire for the collection of social data (interviews) among community members

SEMI-STRUCTURED QUESTIONNAIRE

1. Questionnaire ID

Interviewer: _____ Questionnaire No.: _____ Name of village _____
Date: _____ Interview start time: _____ Interview end time: _____

2. General information about respondent

2.0	Name of respondent	
2.1	Gender: ___ Male, ___ Female	Age: _____ Religion: _____
2.2	What is your marital status? (Circle one)	a) single, b) married, c) divorced, d) widow, e) widower
2.3	How long have you lived here? (In years) _____	
2.4	What is your role in this village? (Circle one)	a) Town chief, b) deputy town chief, c) elder, d) youth leader, e) women leader, f) member, others.....
2.5	Did you go to school	___ Yes, ___ No
2.6	If yes, what is your highest level of education?	___ Primary, ___ Secondary, ___ Tertiary

3. Community knowledge of the three primate species

3.0	Have you seen any of these three primates within Jaibui Island in the last 10 years? ___ Yes, ___ No If yes, which of the species? ___ Chimpanzee, ___ Diana Monkey, ___ Western Black and White Colobus In 2021? ___ Yes, ___ No
3.1	How can you describe the population of these primates in Jaibui Island in the last 10 years? ___ Chimpanzee, ___ Diana Monkey, ___ Western Black and White Colobus a) increase, b) decrease, c) stable, d) rear, e) many, f) not sure

3.2	<p>Do you think is important to protect them? ___Yes, ___No</p> <p>If yes, why do you think these primates should be protected?</p> <p>.....</p> <p>.....</p>
3.3	<p>Do people hunt these primates here in your community? ___Yes, ___No</p> <p>If yes, for which reason(s) are they hunted? (Write the correct letter of all that applies against each animal)</p> <p>_____Chimpanzee, _____Diana Monkey, _____Western Black and White Colobus</p> <p>a) eating, b) selling, c) pet, d) cultural purpose, e) spiritual purpose, f) others.....</p>
3.4	<p>How willing are you to conserve the Jaibui Island where these primates live?</p> <p>1 = strongly unwilling, 2 = unwilling, 3 = not sure, 4 = willing, 5 = strongly willing</p>
3.5	<p>Are you happy that your village is situated close to Jaibui Island where the primates live?</p> <p>1 = very unhappy, 2 = unhappy, 3 = not sure, 4 = happy, 5 = very happy</p>
3.6	<p>Would you continue to live in this community if the Island is conserved for the protection of these species?</p> <p>___Yes, ___No</p>

4. Community perception of wildlife tourism

4.0	<p>Do you receive visitor(s) in this community who come purposely for wildlife? ___Yes, ___No</p> <p>If yes, who are those visitor(s)? (Circle all that applies)</p> <p>a) students, b) researchers, c) poachers, d) tourists, e) don't know, f) others.....</p> <p>For which reason(s) do you think these people visit your community? (Select all that applies)</p> <p>a) experience our culture</p> <p>b) support our children's education</p> <p>c) prevent us from accessing our resources</p> <p>d) bring development for the community</p> <p>e) mock us because we are poor</p> <p>f) help us to protect our natural resources</p> <p>g) others</p>
4.1	<p>How do you consider the initiative of practicing wildlife tourism in Jaibui Island?</p>

	<p>1 = very bad, 2 = bad, 3 = not sure, 4 = good, 5 = very good</p> <p>Why.....</p> <p>.....</p>
4.2	<p>Would you agree to have people coming to your community to see these primates in Jaibui Island?</p> <p>1 = Strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree</p>
4.3	<p>How do you consider people who come to your community for these primates? (Select all that applies)</p> <p>a) good, b) bad, c) helpful, d) respectful, e) not respectful, f) value our culture and tradition, g) rude, h) others.....</p>
4.4	<p>How happy would you be to see people visiting your community to see these primates?</p> <p>1 = very unhappy, 2 = unhappy, 3 = not sure, 4 = happy, 5 = very happy</p>

5. Community livelihood and Wildlife tourism

5.0	<p>Which work do you do for your livelihood? (Select all that applies)</p> <p>a) farming, b) fishing, c) mining, d) logging, e) trading, f) teaching, g) hunting, i) other.....</p> <p>Which is the one you do most?</p>
5.1	<p>Do you prefer having another work different from what you are doing for your livelihood? ___Yes, ___No</p> <p>Why?</p> <p>.....</p> <p>.....</p>
5.2	<p>Would you like to work in any sector related to wildlife tourism? ___Yes, ___No</p>
5.3	<p>Would you allow any of your family members to work in the wildlife tourism sector? ___Yes, ___No</p>
5.4	<p>What skills do you have that you can contribute to sustain wildlife tourism in your community? (Specify)</p> <p>.....</p> <p>.....</p>
5.5	<p>How sure you are that protecting wildlife for tourism within the Jaibui Island can improve your livelihood? (Please circle one)</p> <p>1 = 0-20%, 2 = 20-40%, 3 = 40-60%, 4 = 60-80%, 5 = 80-100%</p>

5.6	<p>How important do you consider wildlife tourism for your livelihood? 1= not important, 2= less important, 3= not applicable, 4= important, 5= very important</p>	
5.7	<p>In which ways do you think wildlife tourism can contribute to improving your livelihood in this community? (Circle all that applies)</p> <p>a) direct income, b) employment, c) business d) education, d) infrastructure development, e) Others.....</p>	
5.9	<p>Do community members make handicraft items? ____ Yes, ____ No If yes, which handicraft items do people make in this community? (Please list them)</p> <p>.....</p> <p>.....</p> <p>Where do you know where people collect the local materials from to make those items? a) Jaibui Island, b) farm, c) plantation, d) swamp, f) nearby forest patches, g) others.....</p> <p>How could you describe your willingness to sell handicraft items to tourists who come to see this primate? 1 = strongly unwilling, 2 = unwilling, 3 = not sure, 4 = willing, 5 = strongly willing</p>	
6.0	<p>Do you cross to the Island for any activity? ____ Yes, ____ No</p> <p>If yes, how often do you cross to the Island? a) every day, b) once every week, c) once every month, d) rarely, e) others.....</p>	
6.1	<p>Which activities do you cross to do on the Island? (Select all that applies)</p>	<p>a) mining, b) logging, c) fishing, d) collect firewood, e) collect fruit, f) harvest honey, g) hunting, i) collect medicinal plants, j) others.....</p>

7. Community member's experiences and expectation about wildlife tourism

7.0	<p>Have you in the past worked in any sector related to wildlife tourism? ____ Yes, ____ No</p>	
7.1	<p>Have you ever thought of working in a wildlife tourism sector? ____ Yes, ____ No Why.....</p> <p>.....</p>	

7.2	If you are employed to work in any sector of wildlife tourism, how do you consider being paid for your service? a) hour, b) week c) month, d) year, f) day, g) others.....
7.3	How much money are you willing to be paid for your service if employed in any sector for wildlife tourism? SLL.....
7.4	Do you think it is necessary to collect money from people who come to see these primates? __Yes, __No If yes, which amount of money do you think will be charged as a fee for a single visit within a day to see these primates in Jaibui Island? SLL.....
7.5	How will you act to people visiting your community to see wildlife on the Island? (select all that applies) 1 = very bad, 2 = bad, 3 = not sure, 4 = good, 5 = very good, 6 = caring, 7 = rude
7.6	Which behavior (s) do you expect from people who visit your community to see wildlife on the Island?

APPENDIX G

Key informant interview with community members



Interview in Gbengama community



Interview with a community member in Sahun



Interview with an elder from Boma community

APPENDIX H

PRIMATE GUIDE FOR COMMUNITY INTERVIEW

1



Western Chimpanzee (*Pan troglodytes verus*)

Local Name (Mende): **Ngolei**

2



Diana Monkey (*Cercopithecus diana*)

Local Name (Mende): **Kelli**

3



Western Black and White Colobus (*Colobus polykomos*)

Local Name (Mende): **Tuwei**

APPENDIX I

Interview guide for individual stakeholder meeting/discussion

INTERVIEW GUIDE

Organization/Institution name:

Respondent name:

Role or position:

How long have you served in the position (months/years)?

1. Do you know these three primate species?
2. Are you aware that these species are endangered and protected by law?
3. What do you think are the threats to the conservation of these three primate's species – Chimpanzee, Diana Monkey and Western Black and White Colobus in Sierra Leone?
4. How can you describe the population trend of these three species in the last 10 years in Sierra Leone (1 decade)?
 - Chimpanzee
 - Diana Monkey
 - Western Black and White Colobus
5. Are there any existing policies for the conservation of these species in the country (yes..... / no.....)?

If yes, please tell me more about the policies (state the policies based on general knowledge)

6. How can you describe the present state of policy implementation for the conservation of these species?
7. What can you propose as measures/policies for the long-term conservation of these species?
8. What benefit(s) do you think the conservation of these species can provide for the local population?
9. What can you propose that will help to achieve those benefit(s)?

APPENDIX J

Individual stakeholders meeting



A stakeholder discussion with Mr. Bala Amarasekaran, Tacugama Chimpanzee Sanctuary



Stakeholder discussion with Mr. Edward Pieh Bendu, Ministry of Environment

APPENDIX K

Stakeholder engagement workshop at the FAO/UN office, Freetown on 8th December, 2021

