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Research article

Community perspectives on the prospect of lion (*Panthera leo*) reintroduction to Comoé National Park, Côte d'Ivoire (West Africa)

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The civil war in Côte d'Ivoire led to a hike in human disturbances and the extirpation of African lion *Panthera leo* from the Comoé National Park (CNP). After the war, many efforts have been made to restore this ecosystem and management is considering the reintroduction of lions. In a participatory management with people at the center of conservation, there is a need to discuss with communities the initiatives affecting their livelihoods. We assessed the acceptance of lion reintroduction by the local communities; through semi-structured questionnaires to 307 volunteer participants in surrounding 23 villages. Most respondents had knowledge of lions from CNP (93%, n = 286). A generalized linear model (GLM) revealed that sex, profession, perceived benefits and risks, and an appreciation of the current management system are the main significant determinants for the acceptance of lion reintroduction in CNP. A large majority (73%, n = 223) were in favor of the lion reintroduction with significant variance among socio-professional categories. The majority of respondents (81%, n = 250) acknowledged having coexisted with lions, with previous lion conflicts reported by 20% (n = 61), and a willingness to coexist in future by 74% (n = 227). More than 84% (n = 260) believed that there would be benefits associated with lion reintroduction to CNP and 53% (n = 162) believed that the potential benefits would be greater than the possible risks associated with lions. Most respondents (88%; n = 270) confirmed the possibility of taking precautions to prevent future lion attacks. While only 42% (n = 129) of respondents felt that current management was participatory, most of them felt that it was acceptable (83%; n = 254). Our data shows a large degree of lion support, positive perceptions and willingness to coexist with lion in future. These results form part of a fundamental step in the direction for ethical reintroduction, as described by the IUCN reintroduction specialist group. We recommend the improvement of the involvement of indigenous communities in potential reintroduction of lions, especially the pastoralists, and the sharing of any associated benefits.

Keywords: acceptance of reintroduction, anthropogenic disturbances, Comoé National Park, local perceptions, socio-political crisis

Introduction

Despite decades of conservation effort, biodiversity is rapidly being degraded across West and Central Africa (Sarrazin and Barbault 1996, Mallon et al. 2015). Wildlife is mostly confined to protected areas but even there, conservation is not always effective (Brashares et al. 2001, Brugière et al. 2015). The situation is of great concern in West Africa where there are increasing population declines of many species due to hunting, habitat loss and degradation. Several carnivore species including the lion *Panthera leo* (Linnaeus 1758), are threatened (Henschel et al. 2010, Bauer et al. 2015, IUCN SSC Cat Specialist Group 2018). The subspecies *P. leo leo* is classified as 'Vulnerable' due to the loss of at least 75% of its original habitat (Barnett et al. 2009, IUCN SSC Cat Specialist Group 2018). The situation is more critical in West Africa, where lions are classified as 'Critically Endangered' at the regional level with fewer than 500 survivors and fewer than 250 mature lions (Henschel et al. 2014).

Comoé National Park (CNP), located in northeastern Côte d'Ivoire, is one of the former habitats in West Africa where lions lived until the late 1990s. In CNP, during the civil war in Côte d'Ivoire from 2002 and 2010, an influx of refugees led to severe degradation of CNP and the park listed on World Heritage Danger listin 2003 (Badman et al. 2009). The disappearance of the lion from CNP occurred in the same period. With the current socio-political stability and the efforts made by the Ivorian government through the Office Ivoirien des Parcs et Réserves OIPR, a positive trend in the state of its biodiversity has been noted and the park has been removed from the 'World Heritage in Danger List' since 2017 (www.iucn.org/km/node/28689). Clearly, the ecological and environmental conditions in CNP became favorable and the management authority is considering the reintroduction of lions (Djafarou and Kalpers 2013, OIPR 2015). To reduce the extinction risk and improve the conservation status, reintroduction into former natural habitats should be based on the Guidelines for reintroductions of the International Union for Conservation of Nature (Mechin 2012, Seddon and Heezik 2013, IUCN SSC Cat Specialist Group 2018, Paquette-Boisclair 2019).

Aside from the requirements for the availability of suitable prey and preferred habitats that are crucial to ensure the existence of large carnivores such as lions (Karanth et al. 2004, Seddon and Heezik 2013), their return to historic habitats dominated by human populations necessitates an understanding of community attitudes (Cheyne 2006, Zajac et al. 2012, IUCN/SSC 2013, Soka et al. 2021). Human–wildlife conflict, a major source of mortality for large carnivores and particularly lions in protected areas, illustrates the consequences of classic conservation that does not greatly engage local people (Woodroffe and Ginsberg 1998, Balme et al. 2010, Redpath et al. 2017, Torres et al. 2018). People engage in activities that affect the survival of large carnivores such as direct killing (Hunter et al. 2007, Watson et al. 2013, Rosenblatt et al. 2014, Hazzah et al. 2017, Soka et al. 2021), reduction in habitat quality and prey availability (Ripple et al. 2015), and limitation of usable space and activity patterns (Kolowski et al. 2007, Kolowski and Holekamp 2009, Schuette et al. 2013). As CNP is an open ecosystem and the likelihood of lions interacting with humans is high, it is essential to involve local communities to reduce post-reintroduction issues (Hunter et al. 2007, Redpath et al. 2017). Considering the potential reintroduction of lions to CNP, we aim to: 1) assess the degree of acceptance of lion reintroduction by local communities; 2) assess levels of knowledge, past coexistence and past conflicts with lions; 3) analyze benefits and risks perceptions toward the reintroduction of lions by the local populations; and 4) identify socio-demographic determinant factors for the acceptance of lion reintroduction. This study will guide authorities in making appropriate decisions to limit post-reintroduction problems (Hunter et al. 2007, IUCN/SSC 2013).

Material and methods

Study area

CNP is located in the northeast of the Republic of Côte d'Ivoire, between latitudes 8°30′–9°36′ North and longitudes 3°6′–4°25′ West, and covers an approximate area of 11 500 km^2 (Fig. 1). The major watercourse is the Comoé River, which crosses the park in its western part from north to south and gives the park its name. The climate is tropical sub-humid with two seasons, a long rainy season and a long dry season. The dry season can last up to eight months and covers the period from October to May. This is the period for development and management activities in CNP. The rainy season runs from June to September and the park is mostly inaccessible during this period. March is the hottest month with temperatures around 37°C while January is the coolest with an average temperature of around 15°C. Annual precipitation ranges from 900 to 1200 mm with an average of 1084 mm per year (Fisher et al. 2002). The average annual temperature ranges from 26 to 27°C (OIPR 2015). There are four main vegetation types in CNP namely gallery forests, forest patches, tree savannas and shrub savannas; savanna formations occupy more than 80% of the total area of the park (Poilecot 1990, Schweter 2016). In CNP, wildlife is diverse with forest and savannah species, including the chimpanzee *Pan troglodytes* and forest elephant *Loxodonta cyclotis*, and a variety of antelope species. Although the secondary streams and most of the pools dry up during several months of the year, the Comoé River, Iringou River, Kongo River and some other tributaries provide wildlife with ample access to water. Several saltpans allow the animals to fulfill their requirements for mineral salts. Recent works in CNP including the last aerial census identified nineteen prey species, with the western hartebeest *Acelaphus buselaphus major*, the African buffalo *Syncerus caffer*, the kob *Kobus kob* and the roan antelope *Hippotragus equinus* being the most common species (Bouché 2016, Viljoen 2019, Atta et al. 2020, Linchant et al. 2022).

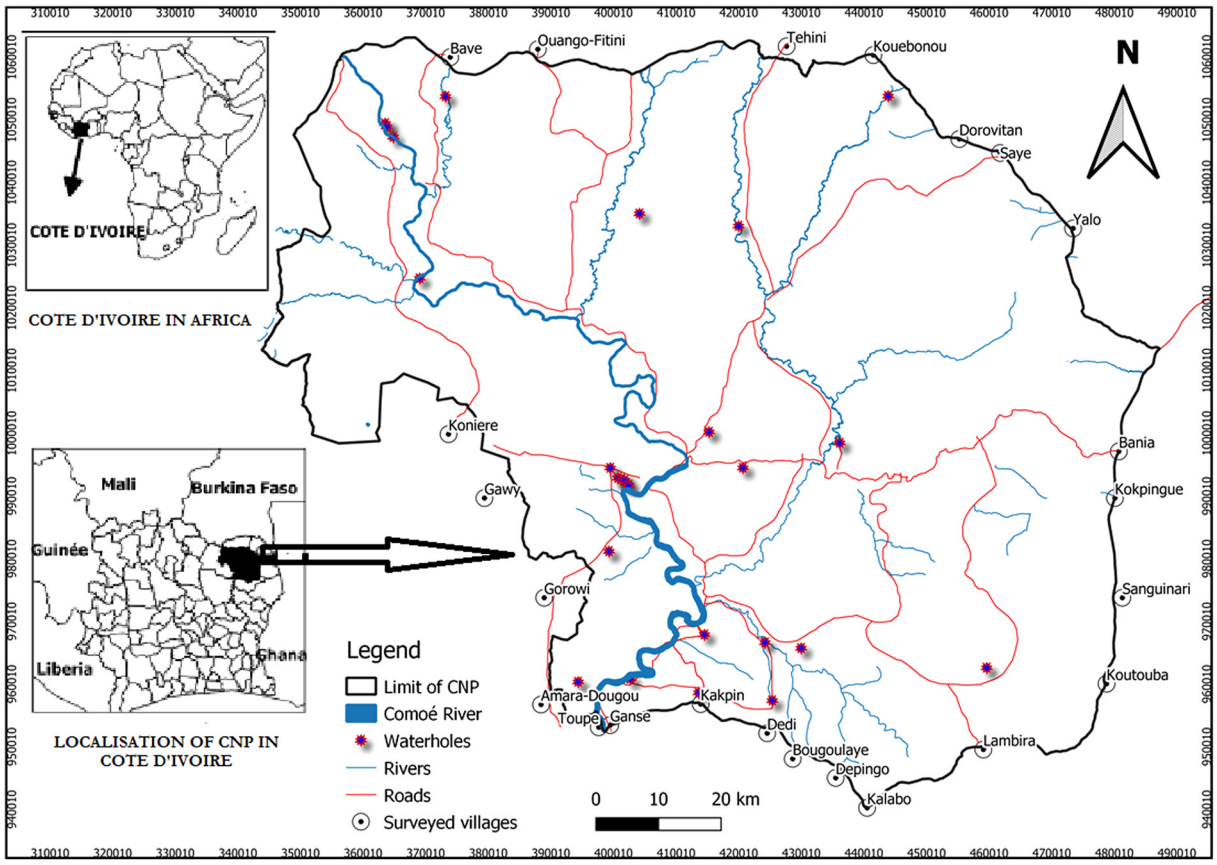

Figure 1. Geographic location of CNP and distribution of surveyed villages.

The main ethnic groups around CNP are Koulango, Lobi, and Malinké called Dioula, Djimini and Lohron (OIPR 2015) (Supporting information). Their settlement occurred in successive waves in the 16th and 19th centuries. In addition to these fivemain communities, there are Fulfulde (Peulh nomads). While Fulfulde already had a long-standing presence, they increased following the droughts of 1971–1973 and 1982–1984 in the Sahelian regions. Fulfulde represent a specific ethnic group we included in the sample because of their specific activity of livestock breeding, which has key importance in managing human–lion conflicts. Finally, there are a few groups from three neighboring countries (Lobi from Burkina Faso, Bozo from Mali, Awlan from Ghana). Around CNP, there are currently five provinces (Tehini, Bouna, Nassian, Dabakal and Kong). The main activities carried out around CNP are agriculture, livestock raising, most often with transhumant movements, agro-food processing and artisanal gold panning. People are not allowed to reside in CNP or to harvest resources from the park. As a result, the high rate of population growth combined with difficulties in accessing alternative sources of income for the populations, causes pressure on arable land, animal resources and forest products around and within CNP (UNEP-GEF Volta Project 2011, OIPR 2015).

Methods of data collection

Sampling and survey techniques

We carried out our survey among local populations from September to November 2021. The socio-professional groups within local villages were farmers, agro-pastoralists, housewives, former hunters, traditional healers, influential people, livestock breeders, and others (drivers, students and traders). Since hunting is illegal, the use of 'former hunters' is a locally conventional way to allow for uncontroversial dialogue with people that may, in fact, still hunt. The difference between farmers and agro-pastoralists comes from the fact that some farmers confirmed that they breed livestock in addition to farming. Therefore, we wanted to get their perceptions separately from those who simply farm. We selected twenty-three main villages among the fifty bordering CNP (Fig. 1). We based the choice of surveyed villages on the criteria of accessibility, proximity to CNP (villages less than or equal to 1 km from CNP), size, characteristics of socio-cultural groups and security of the area (Atta et al. 2021). In each of the given villages, with the agreement and presence of the village chief and the youth president, we organized meetings as focus group discussions for a brief presentation of the project. After these explanation sessions, the volunteers registered on a list

and we proceeded to individual interviews (Koue Bi et al. 2017). The Lohron ethnic group was not represented at the meetings and no volunteers were found among this group so we had to proceed with interviews without them. We employed participatory rural appraisals (PRA) techniques, including semi-structured interviews, focus group interviews and questionnaires (Borrini-Feyerabend and Buchan 1997). We then combined quantitative and qualitative approaches given the nature of the information sought, photo support sheets designed on the lion and its competitors (Dickman 2008), and the service of an interpreter for translations into the main local languages. We interviewed 307 respondents from the five main ethnic groups: Lobi, Koulango, Malinke (Dioula), Djimini, and Fulfulde (Peulh nomads) (Supporting information Questionnaires aimed to gather important basic information on the respondents (province, village, ethnic group, religion, age and profession) and then aimed to gather information on the acceptance of lion reintroduction (perceived benefits, perceived risks, personal control management system) (Supporting information).

Statistical analysis

After tabulation, the data collected from the respondents were cleaned, processed, and compiled in a spreadsheet. Descriptive statistics were determined for variables we measured (Mouzoun 2018) and significant differences were evaluated with the chi-square test to determine biases in the samples. After coding data, we performed statistical analysis using R ver. 4.2.2 software (www.r-project.org). Our dependent variable is the 'Acceptance of lion reintroduction' whereby we coded Yes as 1 and No as 0. To identify variables that have important effects on the response (Acceptance of lion reintroduction), we used the generalized linear model (GLM) with binomial family (link = logit) under the 'nnet' package (Chambers 1992, Venables and Ripley 1997, Moral 2022, www.r-project.org). The explanatory variables for the response (Acceptance of lion reintroduction) in the initial model were province, village, age, sex, ethnic group (EG), religion, profession, personal control (PC), perceived benefits (PB), perceived risks (PR) and management system (MS). We used the following equation for the model: GLM(Acceptance ~ Province + Village + Sex + EG + Religion + Profession + Age + PC + PB + PR + MS, Data, family = binomial(link = logit)). For model selection, we used the package 'step' of *stats* function to exclude the variables without effects based on the AIC values by stepwise selection with backward direction (Cavanaugh and Neath 2019). The null model was built with β0 as the mean of dependent variable (acceptance of lion reintroduction). We used function *aictab* of 'AICcmodavg' package to generate the number of parameters (k), AICc, delta AICc, model likelihood and AICc weight of all models (Mazerolle 2023). With *Anova of stats* function, we performed the Analysis of Deviance (type II tests) to determine the odds ratio (OR) for coefficients derived from the parsimonious model for checking the weight of the determining variables in relation to the reference level, and identifying where differences lay in the levels within the variables (Fiske and Chandler 2011). After identifying the significant variables, we determined percentages for additional parameters behind the responses provided by respondents. For all statistical analyses, the results were validated based on the threshold of significance for the value of p-value ≤ 0.05.

Results

Sociodemographic characteristics of the respondents

We surveyed 307 respondents consisting of 69% (n = 212) men and 31% (n = 95) women, aged 33–94. Our sample was composed of 61% (n = 188) muslims, 21% (n = 65) christians and 18% (n = 54) animists. Given that traditional cultural practices are widely practiced in this region, each person is necessarily rooted in tradition irrespective of their religious affiliations. The ethnic groups and socio-professional distributions of the sample are summarized in Supporting information. Our sample had significantly more respondents from the regionally dominant ethnic group, the Koulango ($\chi^2 = 30.16$; df = 5 and p-value < 0.05), and significantly more respondents from the main profession, farmers ($\chi^2 = 36.71$; df = 7 and p-value < 0.05).

Determinant factors for the acceptance of the reintroduction of the lion to CNP

More than two thirds of the respondents were generally in favor of lion reintroduction to CNP (Supporting information).

We found that sex, profession of the respondents; perceived benefits and risks by the respondents, and the appreciation of current management system are main significant determinants for the acceptance of lion reintroduction in CNP (Table 1). The AICc weight of the parsimonious model revealed that this model predicted 58.62% of respondents' responses regarding acceptance of lion reintroduction to CNP. The perceived risks by respondents and the profession of interviewees were the factors that had greatest contributions to the model fitness, followed by the appreciation of the current management system, perceived benefits of lion reintroduction and finally the sex of respondents (Table 2). According to coefficients, odds ratio and p-values showed by the model, significant negative effects on the acceptance of lion reintroduction came from respondents who perceived risks of lion reintroduction and those who estimated that the current management system was poor (Table 3). Conversely, major positive perceptions were from people of male sex, farmers, housewives, influential people and those who perceived benefits linked to lion reintroduction. Most professions thus had positive correlations on the acceptance of lions. According to our results, all professions are largely in favor of lion reintroduction to CNP except livestock breeders, with a lower score of 36% favorable responses (Fig. 2). Influential people and traditional healers were totally in favor

Table 1. Model selection with number of parameters (k), AICc values, Delta_AICc, model likelihood and AICc weight.

Model names	K	AICc	Delta_AICc	Model likelihood	AICc weight
Model 1*	12	193.34	0	1	58.62
Model 2	14	194.78	1.438	0.4872	28.56
Model 3	15	196.96	3.616	0.1639	9.61
Model 4	16	199.17	5.833	0.0541	3.17
Model 5	20	207.79	14.46	0.0007	0.04
Model 6	42	237.67	44.33	2.3599×10^{-10}	0
Null model	1	343.38	150.05	2.6160×10^{-33}	0

*The parsimonious model with the lowest AICc value.
Model 1 = Acceptance ~ Sex + Profession + PB + PR + MS.
Model 2 = Acceptance ~ Sex + Religion + Profession + PB + PR + MS.
Model 3 = Acceptance ~ Sex + Religion + Profession + PC + PB + PR + MS.
Model 4 = Acceptance ~ Age + Sex + Religion + Profession + PC + PB + PR + MS.
Model 5 = Acceptance ~ Age + Sex + EG + Religion + Profession + PC + PB + PR + MS.
Model 6 = Acceptance ~ Village + Age + Sex + EG + Religion + Profession + PC + PB + PR + MS.
Null model = Acceptance ~ β0.

of lion reintroduction. Among socio-professional categories, the acceptance of lion reintroduction varied significantly ($\chi^2 = 19.34$, df = 7 and p-value < 0.05). Most ethnic groups were in favor of lion return to CNP (Fig. 3). The Koulango were the most favorable ethnic group to lion return with 84% of favorable responses from their respondents, followed by Dioula/Malinké (p = 73%), Djimini (p = 65%), and Lobi (p = 63%), while Fulfulde were mostly against any potential reintroduction with only 36% favorable responses (Fig. 3). Overall, the degree of acceptance varied significantly among the ethnic groups ($\chi^2 = 39.95$, df = 4 and p-value < 0.05). In most villages surrounding the CNP, the rate of respondents in favor of lion reintroduction was greater than or equal to the overall percentage of favorable opinions (73%; n = 223). The village as co-variate was not significant factor influencing the acceptance of lion reintroduction in CNP; however, respondents showed considerable opposition frequencies between 38 and 50% in villages of Kokpingué, Dépingo, Bougoulaye, Gorowi, Téhini and Kouébonou (Supporting information).

Respondents based their responses on the past relationship with lions and the current outcomes from the management of CNP. A majority of respondents recognized the lion (93%, n = 286), and 81% (n = 250) reported having coexisted, with few specific cases of conflicts with lions in CNP (20%; n = 61) (Table 4). Most respondents (74%; n = 227) confirmed the willingness to coexist with lions in the event of a potential reintroduction in CNP. In addition, respondents reported they were involved in the management system (42%; n = 129), and 88% (n = 270) confirmed having the ability to protect themselves from future attacks of lion by own precautions.

The most important benefits of lion reintroduction perceived by most respondents are human well-being around CNP (84%; n = 258), the potential for ecotourism, recreation and education, and CNP health and ecosystem services improvement. These are not direct monetary benefits, but respondents believed that futures lions would generate tangible outcomes. The main risks perceived by respondents were lion attacks on communities (32%, n = 98), pets and livestock, and an increase in human–wildlife conflicts due to lions. Finally, more than half of the respondents (53%; n = 163) thought that benefits would be higher than risks of lions reintroduction (Table 4). In the villages surrounding CNP, most respondents (83%; n = 255) deemed the current state of management as acceptable. The majority of respondents expressed their confidence and believed that OIPR is able to effectively manage future lions and the related conflicts as well as taking into account the concerns from local populations (Table 4).

Table 2. Analysis of Deviance showing the contribution of determinant parameters (sex, profession, perceived benefits (PB), perceived risks (PR) and management system (MS) to the fitness of the parsimonious model. Likelihood ratio (LR Chisq), degree of freedom (df) and probability value (p (> Chisq). Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

Response: Acceptance			
Source of variation	LR Chisq	df	Pr(>Chisq)
Sex	4.196536	1	4.050665×10^{-2}*
Profession	29.343751	7	1.252225×10^{-4}***
Perceived benefits (PB)	7.522269	1	6.094087×10^{-3}**
Perceived risks (PR)	51.687836	1	6.506460×10^{-13}***
Management system (MS)	14.404358	1	1.474607×10^{-4}***

Discussion

This study is an important contribution to understanding community perceptions on the potential reintroduction of lions into CNP. Given that the main socioeconomic activities of the local populations are agriculture and livestock (UNEP-GEF Volta Project 2011, OIPR 2015), this category of stakeholders is particularly important to consider for this study because it demonstrates their influence on the proposed lion reintroduction project at CNP. However, the perceptions of all occupational categories and ethnic groups are important to this study.

The reappearance and re-establishment of large carnivore populations in human-dominated landscapes create the need to understand how people react to the new presence of

Table 3. Determinant variables for the acceptance of lion reintroduction from the parsimonious model with coefficients estimate, standard error, odds ratio (OR) and p-value. Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. * These categorical covariates for which parameter estimates are presented in the table, the reference (baseline) levels are: the gender "Female" for the sex of respondents, the negative response "No" for perceived benefits (PB) by respondents, the negative response "No" for perceived risks (PR) by respondents, and the response "Acceptable" for the appreciation of the current management system (MS) by respondents.

		Estimate	SE	OR	z-value	Pr(>|z|)
	(Intercept)	−2.137930	1.3603945	0.12	−1.57155133	1.160546×10^{-1}
	Sex (Male)*	2.327896	1.0854227	10.26	2.14469078	3.197758×10^{-2}*
Profession	Farmer	1.360844	0.6064582	3.90	2.24392019	2.483754×10^{-2}*
	Former hunter	1.763271	1.2410040	5.83	1.42084260	1.553625×10^{-1}
	Housewives	4.008753	1.3153376	55.08	3.04769906	2.306007×10^{-3}**
	Influential people	4.198963	1.3735894	66.62	3.05692750	2.236184×10^{-3}**
	Livestock breeder	1.202811	0.9242118	3.33	1.30144526	1.931061×10^{-1}
	Other	1.267613	1.2570142	3.55	1.00843199	3.132471×10^{-1}
	Traditional healer	18.744062	1253.0045079	138179263.98	0.01495929	9.880647×10^{-1}
PB (YES)*		1.693054	0.6451324	5.44	2.62435096	8.681428×10^{-3}**
PR (YES)*		−3.343691	0.5297321	0.04	−6.31204140	2.753785×10^{-10}***
MS (BAD)*		−1.932097	0.5113618	−0.14	3.77833722	1.578790 × 10−4***

these animals (Cheyne 2006, Zajac et al. 2012, IUCN/SSC 2013). Understanding the attitudes and behaviors of local communities toward the return of large carnivores in protected areas is critical to the success of reintroduction projects (Breitenmoser et al. 2001). Our study contributes to determining the feasibility of the potential reintroduction of lions to CNP. It focuses on the current thoughts and perceptions of local people and places local communities at the center of the management strategies and mechanisms of the potential lion reintroduction project. The lion is an emblematic species with very important ecological, economic and social roles currently absent from Côte d'Ivoire (Simberloff 1998, Maddox 2002, Sergio et al. 2008, Sogbohossou et al. 2017).

We found that the majority of the local population support and would like to see lions return to see lions return to CNP, while opposition comes from some stakeholders (e.g. the Fulfulde out of concern for their livestock). Our findings concur with those of Kansky et al. (2021a,b) who found that Namibian and Zambian people have a high tolerance for species including lion and spotted hyena through the Wildlife Tolerance Model (WTM) in the Mudumu Complex in Zambezi Region in Namibia, and in the Kwando Wildlife Dispersal Area of KAZA in Zambia around Sioma-Ngwezi National Park. Gebresenbet et al. (2018) also found that most local interviewees around Kafa Biosphere Reserve, Ethiopia, also wanted to see lions in the wild and did not want them to disappear. Our results are also similar to other works such as on indigenous Taiwanese attitudes toward the reintroduction of the clouded leopard into Tawushan Nature Reserve (Greenspan et al. 2020a,b), and about the preference for increasing tiger population size in Chitwan National Park, Nepal (Carter et al. 2012). We found that only twenty percent of respondents had pointed out past specific-conflicts with lions in CNP. This overall low prevalence of human–wildlife conflict specifically related to lions supports their reintroduction to CNP. Another key factor is the familiarity of local communities with the species as knowledge of lions allows local people to weigh the relative risks and benefits, thereby promoting coexistence and community contribution to conservation. Unfortunately, very few pioneer initiatives of reintroduction undertaken in Africa have carried out feasibility studies and included the perceptions of local communities before project implementation (Hunter 1998, Bantlin 2017, Goeminne 2020, Sievert and Sievert 2020, Bouley et al. 2021). Nevertheless, our findings were similar to those of Auster et al. (2020) who have found a correlation between the

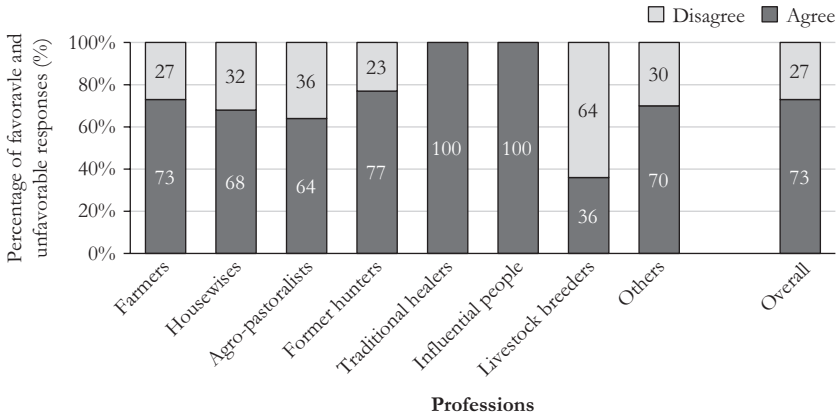

Figure 2. Acceptance of lion reintroduction in CNP by socio-professional categories.

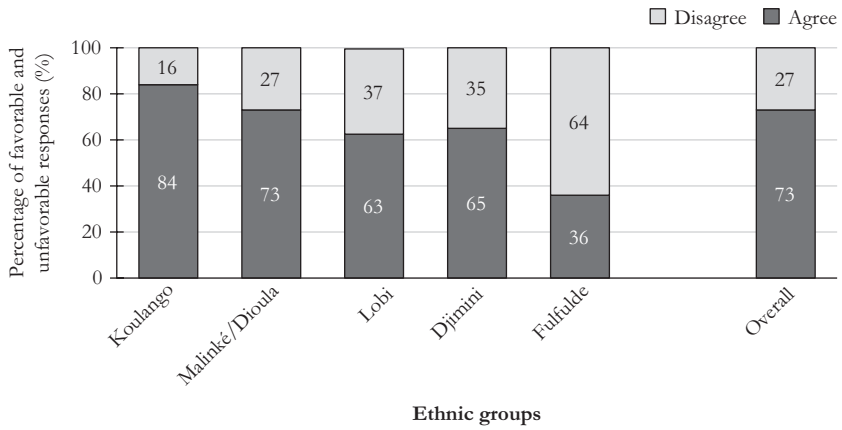

Figure 3. Acceptance of lion reintroduction in CNP by ethnic groups.

high knowledge of the clouded leopard and positive attitudes of rural communities towards the reintroduction of animals. In addition, the majority of respondents felt that the return of lions would have benefits related to ecotourism, recreation and public education, among others. Ecotourism could arguably have monetary benefits, a driver that could have positive effects on tolerance to wildlife (Kansky et al. 2021b). In addition, as showed by Zajac et al. (2012), this perception of benefits represents an asset to animal reintroduction initiatives that increases community acceptance and support (Greenspan et al. 2020a,b). Community acceptance and support could be justified by business opportunities related to tourism (Auster et al. 2020, Greenspan et al. 2020a,b, Kansky et al. 2021a).

Across the globe, high levels of perceived risk (such as perceived conflict) can lead to negative attitudes among local residents regarding carnivore reintroduction (Fort et al. 2018, Ramesh et al. 2019). In general, even when there are positive feelings, negative public attitudes toward reintroduction projects may still exist. The opposition among some local residents may stem from both past conflicts with lions and concerns about the impacts of future carnivore reintroduction e.g. domestic animal predation and attacks on local populations (Greenspan et al. 2020a). In our case, the perception of risks and a lack of appreciation for the current management system negatively affect the acceptance of lion reintroduction to CNP, and some stakeholders were opposed to lion reintroduction because of their experience and potential future risks (e.g. attacks on people and livestock depredation). As found by Gebresenbet et al. (2018) around Gambella National Park, Ethiopia, the livestock loss due to depredation was

Table 4. Number of respondents (n = 307) and response percentages (%) for parameters related to acceptance of lion reintroduction, personal control, perceived benefits, perceived risks and current management system of the CNP.

Terms	Rates of response (%)	
	Yes	No
Acceptance of lion reintroduction		
Agreement of lion return	73	27
Knowledge of lion	93	07
Past coexistence with lions	81	19
Past conflicts with lions	20	80
Acceptance for future cohabitation with lions	74	26
Personal control (PC)		
Implication of local communities in the management system	42	58
Ability to protect against lions attacks by taking own precautions	88	12
Perceived benefits related to the lion return in CNP (PB)		
Improvement of well-being conditions for riparian people	86	14
Ecotourism, recreational and educational potentialities	86	14
CNP health and ecosystem services improvement	84	16
Benefits would be higher than related risks to lion return	53	47
Perceived risks related to the lion return in CNP (PR)		
Attacks by lions on communities	32	68
Attacks by lions on pets and livestock	30	70
Contribution to the human-wildlife conflicts increasing	33	67
Management system (MS)		
Acceptable vs Bad management system	83	17
OIPR can effectively manage future lions	80	20
OIPR can effectively manage conflicts related to future lions	80	20

among strong predictors of locals' attitude towards lion population growth and conservation. This is also the case in Ohio (USA) where risk perception strongly influences people's level of acceptance to coexist with black bears *Ursus americanus* (Zajac et al. 2012). Sometimes, local people may overestimate their risks from wildlife. For example, in Tanzania, Kushnir and Packer (2019) found that people overestimated their real risks from lions. In any case, if lion reintroduction become effective in CNP, the design and implementation of projects to raise awareness among groups of antagonistic stakeholders could improve the project success rate. For example, 'Lion Guard' projects involving local stakeholders in lion conservation have proved successful in several protected areas in Africa (Kamgang et al. 2019, Kiki et al. 2021). The risk mitigation measures and compensation for damage would be also effective solutions in the event of conflicts with reintroduced lions (Dickman 2008, Dickman et al. 2011).

Here even though livestock breeders constitute a minority group, they can determine most consequences, as pointed out by the Pareto principle (Pareto 1967). The low proportion of respondents opposing reintroduction could potentially lead to project failure, as a small population of lions is relatively easy to eradicate with poison. This has been observed in northern KwaZulu-Natal (South Africa) where anthropogenic factors accounted for all post-release deaths of founders of reintroduced lions (Hunter et al. 2007). In addition, other anthropogenic factors (e.g. general attitudes toward lions, engagement in traditional customs, lion killing intentions to defend property, and socio-cultural killing intentions) could also influence lion killing (Hazzah et al. 2017). The project can only be effective if livestock depredation is very well mitigated, and that is only possible through improved animal husbandry practices (Bauer and Kari 2001, Tumenta et al. 2013).

When local people and carnivores share the same living landscape, personal and direct interactions can occur (Carter et al. 2012). CNP is a historic habitat where lions lived until 2005 before disappearing (Bodendorfer et al. 2006). As a result, local populations around CNP have a high level of knowledge about lions, good past coexistence and reported a low level of past lion-related conflicts. These important parameters are determinants for respondents' acceptance of lion reintroduction. Respondents with low knowledge who had experienced previous conflicts with lions perceived unbearable levels of risk. The knowledge and prior experience of lions are assets for reintroduction because they allow local people to weigh the relative risks and benefits, and improves future coexistence. Attitudes of local communities represent a key factor for reintroduction as they influence the survival of lions. As showed in the Maasai Steppe ecosystem of northern Tanzania, lion conservation was negatively influenced by the negative attitudes of local communities (Soka et al. 2021).

A criterion for reintroduction is that the factor leading to the initial disappearance must have changed. During the civil war, people invaded CNP but this is not anymore the case. IUCN guidelines recommend that species reintroduction projects should affect and be impacted by the interests of local people (IUCN/SSC 2013). Socioeconomic and political factors must therefore be integrated into reintroduction projects. Like Hazzah et al. (2017) in the Amboseli-Tsavo ecosystem (southern Kenya), and Soka et al. (2021) in the Maasai Steppe (northern Tanzania), we found that a large proportion of respondents believed that there will be potential post-reintroduction benefits such as ecotourism, recreation and public education, etc., compared to potential risks, which will allow help to mitigate frustration and disappointment by creating business opportunities for positively influencing local community attitudes. In addition to these non-monetary benefits, potential lion reintroduction could provide monetary benefits and compensation to people who will experience lion-incurred damage (e.g. livestock losses due to depredation, injury to people). When local communities are involved in the species reintroduction project and confident in receiving benefits, they are able to contribute to the success of the project (Blackburn et al. 2016, Kansky et al. 2021a).

According to Kansky et al. (2021b), human–wildlife conflict should be defined as consisting of impacts that deal with direct interactions between humans and wildlife species (Young et al. 2010), and conflicts between humans over how to manage wildlife impacts (Redpath et al. 2017). The willingness of communities to share the landscape and tolerate possible costs from wildlife while ensuring sustainable wildlife populations are critical for the success of human–wildlife coexistence (Redpath et al. 2017, Crespin and Simonetti 2019). Tolerance is therefore defined as the willingness of an individual to absorb the extra potential or actual costs of living with wildlife (Kansky et al. 2016). Wildlife reintroduction acceptance or tolerance is not just about balancing costs and benefits but include historical, political and religious dimensions (Bauer et al. 2022). For example perceptions might change as reintroduced lions shift from 'God's species to government's species', and rapid widespread changes in public perceptions and behaviors have the potential to influence conservation outcomes (Niemiec et al. 2022).

Initiatives to reintroduce large carnivores into human-dominated environments require prior understanding of the attitudes and behaviors of local communities (Zajac et al. 2012). Our results suggest that the various stakeholders and their activities around CNP will have impacts on the reintroduction project. In general, anthropogenic factors and particularly human–wildlife conflicts with lions are most often the cause of reintroduction problems (Hunter et al. 2007, Hazzah et al. 2017). Our observations are consistent with previous studies that demonstrate the negative effects of socioeconomic activities of local populations on large carnivores in protected areas. These include direct killing, reduction in habitat quality and prey availability, limitation of usable space, and activity patterns (Hunter et al. 2007, Kolowski et al. 2007, Kolowski and Holekamp 2009, Schuette et al. 2013, Watson et al. 2013, Rosenblatt et al. 2014, Ripple et al. 2015, Hazzah et al. 2017). Community awareness and greater involvement of local communities are important to limit human–wildlife conflicts that are a major source of post-reintroduction failures (Hunter et al. 2007,

Hazzah et al. 2017). The majority of positive attitudes does not guarantee full protection of reintroduced species, and any reintroduction project of large predators would never get full support from all local communities (Agan et al. 2021). However, the reintroduction of lions to CNP crucially depends on the support of local populations and our results show a favorable starting point but it is important to consider and monitor perceptions according to different socio-economic groups. As recommended by the IUCN Guidelines for Reintroductions and Other Conservation Translocations (IUCN/SSC 2013), we contributed to the social requirements by informing local communities, and paved the way for potential reintroduction of lion in CNP if the management system can effectively control the earlier causes of lion extirpation, and current ecological conditions are favorable. In case of effective lion reintroduction in CNP, we recommend management to improve the involvement of indigenous communities in lion conservation strategies, set up committees to monitor and manage complaints in surrounding villages, and promote the sharing of the associated benefits among local communities.

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Author contributions

Aglissi Janvier: Conceptualization (lead); Data curation (lead); Formal analysis (lead); Investigation (lead); Methodology (lead); Writing – original draft (lead); Writing – review and editing (lead). **Sogbohossou Etotépé Aïkpémi**: Conceptualization (supporting); Data curation (supporting); Formal analysis (supporting); Investigation (supporting); Methodology (supporting); Project administration (lead); Supervision (lead); Validation (lead); Visualization (supporting); Writing – original draft (supporting); Writing – review and editing (supporting). **Bauer Hans**: Data curation (supporting); Formal analysis (supporting); Investigation (supporting); Methodology (supporting); Supervision (lead); Validation (equal); Visualization (equal); Writing – original draft (supporting); Writing – review and editing (equal).

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Data are available from the Dryad Digital Repository: https://doi.org/10.5061/dryad.9w0vt4bnd (Aglissi et al. 2023).

Supporting information

The Supporting information associated with this article is available with the online version.

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