

# 2011 SURVEY OF LION (*Panthera leo*) IN YANKARI GAME RESERVE AND KAINJI LAKE NATIONAL PARK, NIGERIA



*Male lion cub, Yankari 2011 © Philipp Henschel/Panthera*

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## **ABSTRACT**

The lion population of Yankari Game Reserve and Kainji Lake National Park was surveyed in January-February and May-June 2011 respectively using standard call-up methodology. The 2011 survey was a repeat of the original baseline national lion survey in 2009 (Saidu, 2010).

Formerly widespread in Nigeria, lions are now restricted to the core areas of only two protected areas: Kainji Lake National Park and Yankari Game Reserve. The decline of lions in Nigeria appears to be linked to two main factors: the depletion of the natural prey base as a result of poaching, and an increase in human-lion conflict resulting in direct persecution of lions. Human population growth and agricultural expansion is causing an unprecedented influx of nomadic livestock into protected areas, as alternative grazing reserves are largely absent. Human-lion conflict resulting from such incursions is considered to be the major factor responsible for the decline of the lion population in Nigeria. The marked decline of wild ungulate populations in all protected areas is also problematic and in areas where natural prey has been extirpated the remaining lions have little option but to prey on livestock. Retaliatory action taken by herdsmen against these lions is inevitable.

In 2009, Kainji Lake National Park and Yankari Game Reserve were estimated to contain a combined total of 44 individual lions (29 in Kainji Lake, and 15 in Yankari), at which time the current status of lions in Nigeria was described as critically endangered. In 2011 the combined lion population of these two sites had declined to an estimated 34 adult lions (32 in Kainji Lake, and 2 in Yankari). Although the estimate for Yankari is acknowledged to be tentative given the limitations of the call-up survey methodology, which lacks precision when applied to very small populations, the suggested dramatic decline of lions in Yankari since 2009 is corroborated by an analysis of CyberTracker data from ranger patrols.

Without concerted action the lion population will continue to decline and in time may completely disappear from Nigeria. The extremely small lion population now remaining at Yankari Game Reserve is in imminent danger of extinction, it is likely that lions will disappear from Yankari within a few years without rapid and decisive management interventions to permit the swift recovery of lion and prey populations. The long-term survival of lions in Nigeria demands urgent and focused conservation effort and improved financial and technical support for Yankari Game Reserve and Kainji Lake National Park.

## INTRODUCTION

The lion (*Panthera leo*) once roamed a large part of Africa, Europe, the Middle East and Asia. The species disappeared from Europe during the first century AD and from North Africa, the Middle East and Asia between 1800 and 1950, except one population in India, containing approximately 250 lions (Bauer et.al, 2003). The sub-species *Panthera l. leo*, the African lion, is now restricted to savanna habitat in Sub-Saharan Africa (Nowell & Jackson, 1996).

In the early 1990s, members of the IUCN SSC Cat Specialist Group assessed the size of the African lion population and made an educated guess of 30,000-100,000 individuals (Nowell and Jackson 1996). More recent estimates range from 29,000 to 47,000 lions (Chardonnet, 2002), and 16,500 to 30,000 lions (Bauer & van der Merwe, 2004), suggesting an alarming decline of the lion population on the continent. Consequently, the lion has been classified as Vulnerable on the IUCN Red List of threatened species since 1996 (Bauer et al., 2008). Lion populations in West Africa are particularly small and fragmented (Nowell & Jackson, 1996), and recent estimates for this region range from 450 to 1,300 individuals, with lions being virtually extinct outside protected areas (Bauer and Van Der Merwe, 2004). Consequently, the lion has recently been classified as Regionally Endangered in West Africa, while it remains classified as Vulnerable in the rest of Africa (Bauer & Nowell, 2004). In 2005, IUCN, the Wildlife Conservation Society and PANTHERA organized a regional lion conservation workshop in Douala, Cameroon, assembling lion specialists representing all lion range countries in this region (Nowell et al., 2006) in an unprecedented effort to define strategies for effective lion conservation in West and Central Africa. The workshop consisted of a technical session to map current lion range and status, followed by a strategic planning session to develop lion conservation strategies (Nowell et al. 2006). During the technical session specialists were guided to produce maps of current lion range and delimit critical areas harboring known populations called Lion Conservation Units or LCU's (Nowell et al., 2006).

Threats to lion conservation identified by workshop participants included habitat loss, fragmentation and degradation; reduction of wild prey; lion-human conflict; and increased extinction vulnerability due to low population size (Nowell et al. 2006). Marked decreases in wild ungulate populations have recently been recorded in protected areas across the Sahelian region (East, 1999; Fischer & Linsenmair, 2001; de Iongh et al, 2001; Omondi et al, 2006; Caro & Scholte, 2007; Scholte et al 2007), while numbers of livestock have shown a steep increase during the same period (Binot et al. 2006; de Iongh & Bauer, 2008). The outcome is predictable and has been particularly well documented in Waza NP in northern Cameroon. Lions in Waza are forced to leave the park due to the scarcity of wild prey, and individuals follow nomadic livestock herds (Tumenta et al., 2009). Retaliatory killing of lions for livestock losses is regularly recorded and the lion population in Waza NP decreased from 40-60 individuals in 2002 (Bauer et al., 2003) to 14-21 in 2009 (Tumenta et al. 2009). In Nigeria, human population growth and agricultural expansion is currently causing an unprecedented influx of nomadic livestock into protected areas, as alternative grazing reserves are largely absent. During aerial

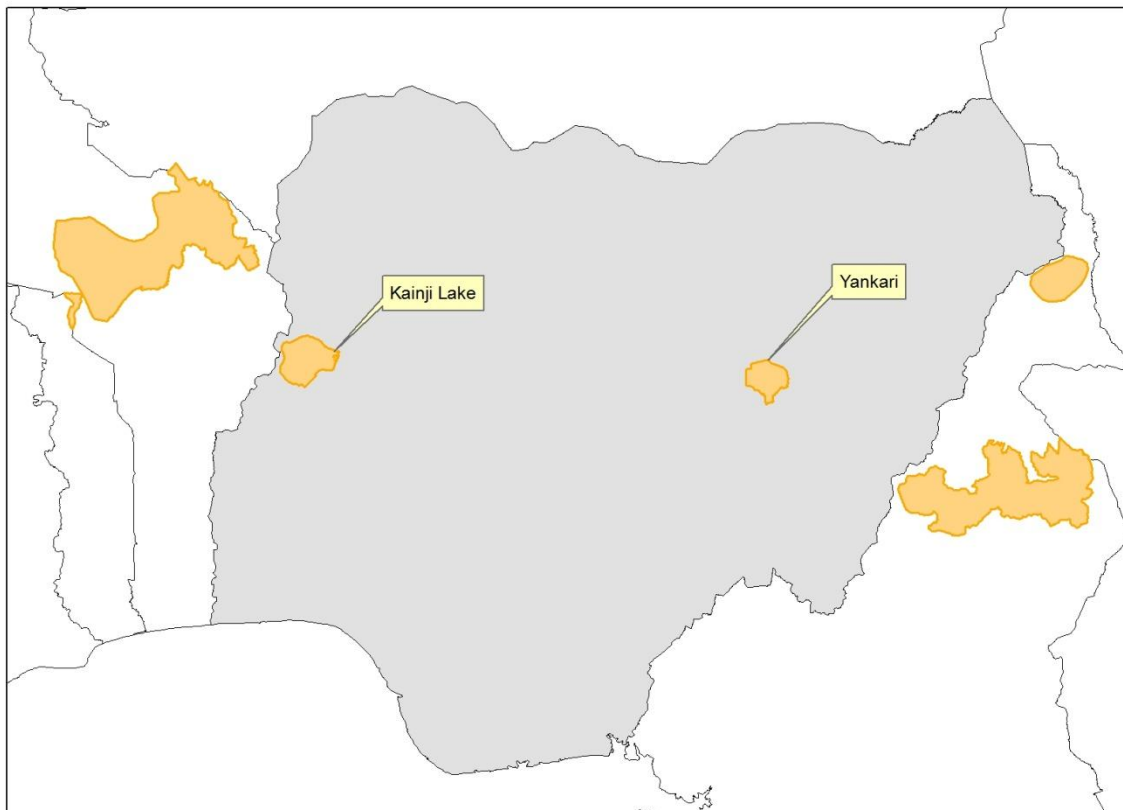
counts of the Yankari ecosystem in 2006 and 2011, cattle were by far the most abundant species recorded (Omondi et al, 2006; Bergl et al, 2011). Furthermore, a questionnaire based survey examining the use of lion parts in traditional medicine in the communities surrounding Yankari, indicated a wide use of such derivatives, and lion body parts were available in two of the markets surveyed near Yankari Game Reserve (Born Free Foundation, 2008).

Lions were formerly widespread in Nigeria, however, a national lion survey conducted in 2009 established that the species is now restricted to the core areas of only two protected areas: Kainji Lake National Park and Yankari Game Reserve (Figure 1; Saidu, 2010). The decline of the lion in Nigeria appears to be linked to two main factors: the depletion of the natural prey base as a result of poaching, and an increase in human-lion conflict resulting in direct persecution of lions.

### 1.1 OBJECTIVES

The objectives of the study are to:

- i. Determine the lion population size in Kainji Lake National Park and Yankari Game Reserve.
- ii. Compare these results against the 2009 national lion survey baseline (Saidu, 2010).



**Figure 1:** Map showing remaining lion populations in Nigeria and neighboring countries.

## **2 STUDY AREAS AND METHODS**

### **2.1 STUDY AREAS**

The national lion survey of 2009 identified the presence of only two Lion Conservation Units (LCUs) left in the entire country; these were Kainji Lake National Park and Yankari Game Reserve (Saidu, 2010). The present call-up survey of Kainji Lake National Park and Yankari Game Reserve was conducted in a collaborative effort between the Nigeria National Park Service, Bauchi State Government, PANTHERA and WCS.

#### **2.1.1 Kainji Lake National Park**

Kainji Lake National Park covers an area of 5,340 km<sup>2</sup> and consists of two non-contiguous sectors, the Borgu and Zugurma sectors. The Borgu sector, in which the call-up survey was carried out, covers an area of 3,970 km<sup>2</sup>. It is bordered to the east by Kainji Lake, and to the west with the Republic of Benin. The mean annual rainfall within the Borgu sector varies from 1,100mm to 1,150mm (Milligan 1979). The western and southern part of the Borgu sector is drained by the perennial Oli River which is the largest river in the Park, while Rivers Doro, Timo, Menai and Sadoro drain the eastern part, all flowing into Kainji Lake. There are no lions present in the Zugurma sector (Saidu, 2010).

#### **2.1.2 Yankari Game Reserve**

Yankari Game Reserve covers an area of 2,244 km<sup>2</sup> and is located on latitude 9°50'N and Longitude 10°30'E. Much of the reserve consists of gently rolling hills between 200 to 400m above sea level (Green, 1996). The reserve is situated on sedimentary rocks with many rocky outcrops. The largest river in the reserve is the perennial Gaji River, which is joined in the north by Yashi River and in the south by Yuli River where it runs into the River Benue. The reserve has a high ground water level with five springs (Wikki, Dimil, Mawulgo, Gwana and Tungan Maliki), which drain into the Gaji River (Geerling, 1973; Green and Amanche 1987). The mean annual rainfall of Yankari is about 395mm (Geerling 1973). The vegetation of the reserve is Sudan Savanna, but the numerous springs and the high ground water level of the Gaji River Valley are responsible for more luxuriant vegetation than normally found in the Sudan Zone. The vegetation is made up of savanna trees and shrubs with an open canopy and a continuous layer of annual perennial grasses (Geerling 1973).

## **2.2 METHODOLOGY**

Some large carnivore species respond positively to the distress call of preferred prey species, and this behavioral trait can be exploited for censusing large carnivores using sound playbacks (Ogotu and Dublin, 1998). Such broadcasts are audible for lions for up to 3km, and individuals within the radius will generally approach the sound as it promises an easy meal (Ogotu and Dublin, 1998). Since the surface area within the audible range of the broadcast can easily be estimated, this method permits the estimation of lion population density, by dividing the total number of lions counted by the total area covered by the broadcast. We employed the distress call of young buffalo (*Syncerus caffer*) broadcast over a commercially available FOXPRO (FOXPRO INC; Lewistown, PA USA) Snow-Crow Pro 5 game call system with a built-in 50W amplifier and two high-performance conical speakers, positioned on top of a 4x4 WD vehicle. Call-ups started after nightfall and lasted for one hour in total at each station consisting of three consecutive cycles of 10-minute broadcasts followed by 10 minutes of silence during which the speakers were rotated by 90°. Calling stations were located along park jeep tracks and were spaced 6km apart to avoid any overlap of individual call-ups and reduce the risk of double-counting any lions. Call-ups were conducted in the Borgu sector of Kainji Lake National Park and in Yankari Game Reserve.

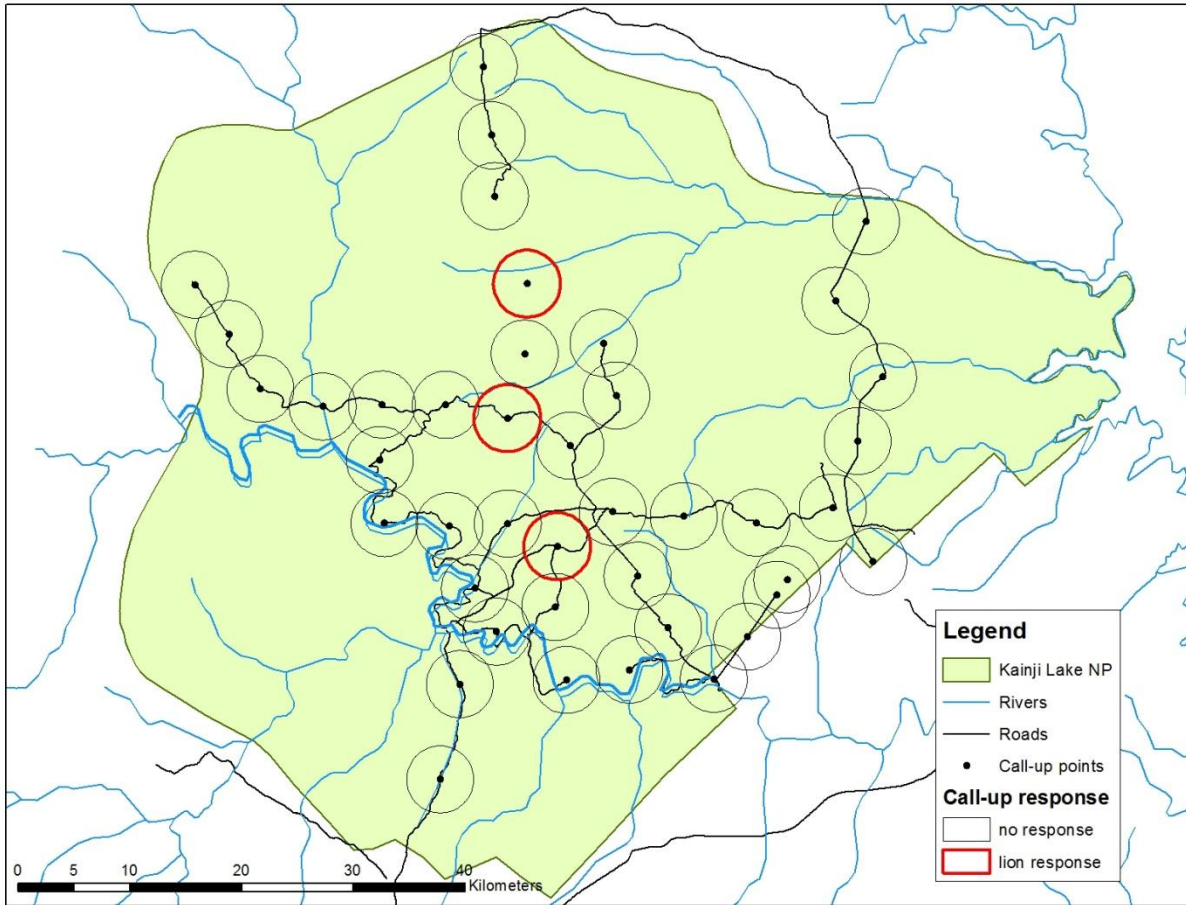
## **3 RESULTS**

### **3.1 Kainji Lake National Park**

The call-up survey in Kainji Lake National Park was carried out from May 25 – June 7, 2011, and was carried out in the Borgu sector. The presence of lions in the Borgu sector was confirmed by the previous national lion survey of 2009 (Saidu, 2010) and the sightings of park staff, whereas most large mammal species were considered to be absent in the isolated Zurguma sector. The use of the call-up survey method was made possible because of the good network of jeep tracks in the park. Forty call-up stations were distributed across the Borgu sector (Figure 2), which covered an area of 19.6 km<sup>2</sup> per station, resulting in a total of 785.2 km<sup>2</sup> covered in the survey (Table 1).

Table 1 Call-up effort and lion population density at Kainji Lake National Park, Nigeria, 2011.

# Call-up stations	Area covered per station (km <sup>2</sup> )*	Total area covered (km <sup>2</sup> )	Response rate	# lions responding	Population density (lions/100km <sup>2</sup> )
40	19.6	785.2	0.264	5	2.41



**Figure 2:** Map of Kainji Lake National Park, showing locations of call-up stations and lion responses.

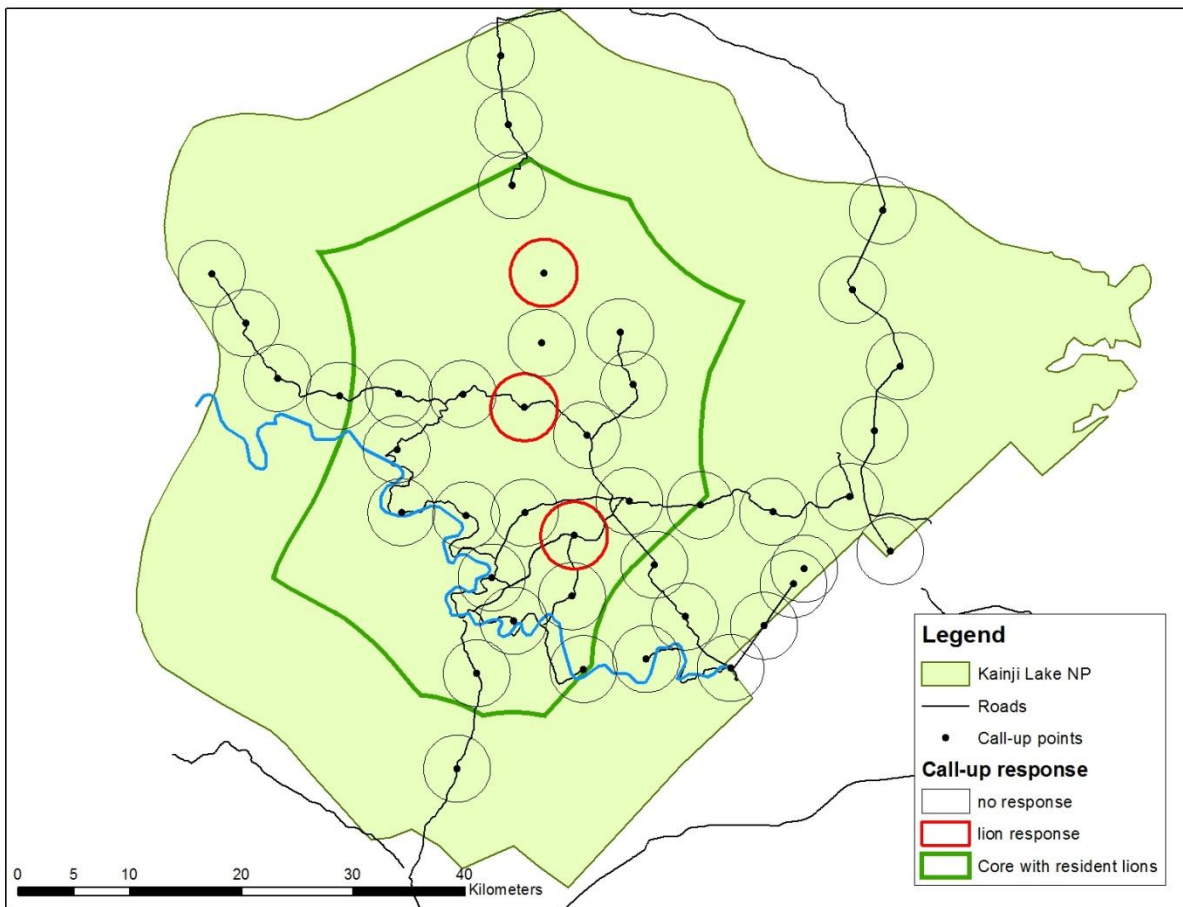
In total, three lion responses of a one single individual (male) and two responses of two lions each (male and female) were recorded. As explained above, an effective range of 3km was adopted based on the effective range applied by Ogutu and Dublin (1998) and Mills et al. (2001).

This results in a conservative density estimate of 2.41 per 100 km<sup>2</sup> in the Borgu sector of Kainji Lake National Park (Table 2).

Table 2 Lion population density and corresponding population size at Kainji Lake National Park, Nigeria, 2011.

Population density (lions/100km <sup>2</sup> )	Size of PA core area (km <sup>2</sup> )	Size of total PA (km <sup>2</sup> )	Lion pop size for core area	Lion pop size for total area (theoretical)
2.41	1,325	4,200	32	101

Lions were found to be restricted to a core area of the Borgu sector, >10km from the park boundary and the Wawa-Luma highway bisecting the eastern part of the sector, and with an approximate size of 1,325 km<sup>2</sup> (Table 2, Figure 3). Applying our density estimate to this core area, results in a population size estimate of 32 lions for the Borgu sector of Kainji Lake National Park (Table 2). If lions were to occupy the entire Borgu sector, it could potentially harbor >100 lions (Table 2).



**Figure 3:** Map of Kainji Lake National Park showing the core area of the park expected to support resident lions (inner green polygon).

### 3.2 Yankari Game Reserve

The call-up survey was carried out from January 30<sup>th</sup> to February 4<sup>th</sup> 2011. The presence of a good network of jeep tracks in Yankari Game Reserve enabled the application of the call-up survey method. Twenty-three call-up stations were distributed across the reserve, equally covering an area of 19.6 km per station, and a total area of 450.8 km<sup>2</sup>.

There were no lion responses during the entire call-up survey. Spotted hyenas responded at seven call-up stations through vocalizations, and poachers approached at three call-up sites. A group of three lions (two adults and one cub) were sighted in Yankari at the time of the survey in January 2011, and another group of four lions (two adults and 2 sub-adults) was sighted in the same general area in October 2011. Therefore we know that a minimum of two lions still survive in Yankari (cubs and sub-adults are not normally included in any population estimate).

We also analysed CyberTracker data collected by rangers on patrol (foot and vehicle-based patrols) throughout the reserve since August 2009 to date. Lion abundance, expressed as an encounter rate of lion sign recorded per 100 km of patrol, declined from 1.51 in 2009 to 0.63 in 2010 to 0.58 in 2011 (see Table 3).

Table 3: CyberTracker encounter rates of lion sign from 2009-2011

	Total no of observations	Km (foot and vehicle patrols)	No of months	Encounter rate per 100km
2009	27	1,785	5	1.51
2010	115	18,279	12	0.63
2011	56	9,576	12	0.58

## **4 DISCUSSION**

### **4.1 Kainji Lake National Park (Borgu Sector)**

Based on our survey results, it appears that the lion population in Kainji Lake has remained stable since the last call-up survey conducted in 2009; an estimated 32 lions in 2011, compared to 29 in 2009 (Saidu, 2010). However, in July 2010 at least one lion was killed in Kainji Lake National Park by hunters – presumably to supply body parts for use in traditional medicinal practices. Human encroachment and expanded agricultural practices along the shoreline of Lake Kainji, together with increasingly heavy vehicle traffic along the Wawa-Luma highway that bisects the Park, have further contributed to the confinement of lions to the core area of the park. As has been observed in 2009 (Saidu, 2010), activities such as poaching, illegal livestock grazing and human encroachment, appear to have caused a decline of large ungulates at the periphery of Kainji Lake NP, restricting lions to the central core area of the park around Oli Camp (Figure 3). As natural prey species decline, this exacerbates human-lion conflict with the resultant persecution and retaliatory killing of lions by herdsman. The Borgu sector of the Park is known to be a transit route for cattle movement from the north-west to the south-west of the country during the dry season and during this period there is persistent disturbance and harassment of lions and other wildlife by livestock herders.

### **4.2 Yankari Game Reserve**

There was no response by lions to the twenty three call-ups conducted in Yankari Game Reserve in 2011. Our direct observation of three lions (two adults and one cub) during the call-up period, and another group of four lions (two adults and 2 sub-adults) in the same general area in October 2011 confirms that the species is still present in the park. There has clearly been a significant population decline since 2009 when 15 lions were estimated to occur in Yankari (Saidu, 2010). We conclude that the current minimum population size could be as low as two adult individuals. It is acknowledged that the call-up method lacks precision when applied to very small populations, as on average only about a quarter of the lion population responds to the call-up (Ogutu and Dublin, 1998). This is accommodated by the applied response rate of 0.264 used in the density estimation (see Table 1 above), but leads to skewed results through stochastic process if only a few lions remain that can either respond or not respond.

Nonetheless, our results strongly suggest that lion numbers have substantially decreased since the 2009 survey. These findings are corroborated by an analysis of CyberTracker data from August 2009 to date which demonstrate a similar decline from 1.51 lion sign/100km in 2009 to 0.63 lion sign/100km in 2010 to 0.58 lion sign/100km in 2011. The decline appears to have been caused by a combination of direct persecution and high levels of poaching of lion prey. In 2004, two poachers were arrested for killing a lioness inside the reserve, and just prior to the 2011 survey, a young male lion cub died from injuries most likely sustained after being hit by a

vehicle. Whilst this death was probably accidental, the ensuing theft of the lion carcass by reserve staff serves as an important indicator of the value of a dead lion to local people. These observations agree with a report by the Born Free Foundation, which uncovered a large illegal trade in lion body parts in the villages surrounding Yankari Game Reserve (Born Free, 2008). Levels of illegal livestock grazing within the reserve have also remained high in recent years - during the aerial census of Yankari in April-May 2011 over 3,000 cattle and 900 sheep/goats were sighted within the reserve boundaries compared to fewer than 1,000 wildlife sightings recorded during the same census (Bergl et al, 2011). High levels of poaching were also observed in Yankari during the call-up survey in January-February 2011. On three separate occasions poachers responded positively to the distress call of the buffalo played to attract lions – approaching the vehicle at night using their headlamps. The very small population of lions in Yankari will most likely disappear within a few years if no management interventions are implemented that would permit swift recovery of lion and prey populations.



*Yohanna Saidu in action during the call-up survey of Kainji Lake National Park*

## 5 CONCLUSION

With population size estimates of 32 lions for Kanji Lake and potentially as few as 2 adult lions for Yankari, it is likely that fewer than 40 adult lions now remain in Nigeria. Lions have dramatically declined at Yankari since 2009 and this noble iconic species is in imminent danger of extinction at Yankari unless urgent and focused conservation effort occurs at this site immediately. The rapid collapse of the lion population in Yankari should serve as a warning sign to the managers of Kainji Lake National Park – what may now be Nigeria’s last viable lion population.

Current population size of lions at both sites could be rapidly increased if protection measures in Kainji Lake and Yankari could be extended to cover the entire protected area, and not only their core zones. Kainji Lake’s lion population could potentially be linked to populations in neighboring Benin through concerted efforts between both governments. Some of the factors responsible for the vanishing population of lions in Nigeria include the declining natural lion prey population as a result of widespread poaching in both protected areas, rapid human population growth both within and around protected areas, and habitat destruction and displacement by livestock and resultant human-lion conflict. Inadequate funding of protected area management and poor incentives for guards are some of the major factors responsible for the decline in the lion population in Nigeria. The survival of lion in Nigeria demands an urgent and realistic conservation strategy, based on focused protection efforts and effective mitigation of human-lion conflict.



*Gilbert Nyanganji in action during the call-up survey of Kainji Lake National Park*

## 6 RECOMMENDATIONS

- Lions in Yankari are in imminent danger of extinction. As a matter of urgency levels of protection for lions and their prey species must be improved in the entire reserve, not just the central core area. In particular, illegal livestock grazing currently seen throughout the reserve and most pronounced along its edges must be reduced. Strengthening levels of protection in Yankari will require much greater levels of financial and political support from Bauchi State Government: additional rangers and vehicles are urgently needed together with adequate and regular funds for fuel, field rations, camping allowances, arrest bonuses and the maintenance of an informant network. Improved supervision and training of rangers is also necessary, together with field equipment, uniforms, boots and firearms. Regular maintenance of the existing network of tracks and bridges is required to facilitate access by rangers to all areas of the reserve. Finally, there must be greater emphasis on tackling the perennial problem of ranger corruption at Yankari.
- Investigate the feasibility of fencing Yankari to keep livestock out and elephants in.
- Although the lion population at Kainji appears to be relatively stable there is no room for complacency here either since it is known that hunting of lions occurs at this site and at least one lion was killed by poachers in 2011. There have been recent improvements in protection at Kainji but these improvements must be extended to all areas of the national park, not just the central core area, and this protection must target both lions and their prey species. The issue of human encroachment along the shores of Lake Kainji needs to be addressed. Regular maintenance of the existing network of tracks and bridges is required to facilitate access by rangers to all areas of the reserve. Illegal livestock grazing within the reserve must be tackled to allow an extension of the current lion range in Kainji (presently restricted to the central core area).
- The new National Environmental (Protection of Endangered Species in International Trade) Regulations of 2011 provide stiff penalties prohibiting the use and trade of lion body parts as well as the poisoning of large carnivores by herdsmen. Unfortunately these laws are still poorly known and have not been widely distributed within the country. NESREA is urged to improve levels of awareness and understanding of these new regulations among all stakeholders, particularly the judiciary.
- Oblige managers of all protected areas to conduct a campaign to raise awareness and sensitize people through all forms of media on the present endangered status of lion and the need to save them from extinction.
- Encourage trans-boundary conservation efforts between Kainji Lake NP and adjacent protected areas in neighboring Benin.

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