

# Buffer Zone Communities, Fishing Practices, and Biodiversity Conservation in Cross River National Park, Nigeria.

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## Abstract

Several rivers and streams in Cross River National Park are becoming empty of fish and other aquatic animals due to unsustainable commercial fishing practices in buffer zone communities. Conventional fishing methods with net or use of hook, line, and sinker are no longer popular in several buffer zone villages of Cross River National Park. The ubiquity of water poisoning (using different chemicals), across buffer zone villages, as fishing mechanism, is seriously undermining aquatic biodiversity in the park, and the rest of Cross River State of Nigeria.

Using a combination of qualitative (focus group discussions, observations, and interviews) and quantitative (livelihoods survey) research techniques, the study assesses fishing practices in the context of buffer zone rural livelihoods challenges in three villages of Cross River National Park. Findings reveal that unsustainable fishing practices are underpinned by poverty, common property regimes, wildlife management failure, and absence of buffer zone livelihoods programme in Cross River National Park. The paper discusses the biodiversity conservation implications of water poisoning in Cross River National Park, and concludes with recommendations for policy, and future research trajectories on aquatic biodiversity conservation in the park and anthropogenic challenges.

**Keywords:** Fishing, pesticides, water poisoning, livelihoods, buffer zone communities, aquatic biodiversity conservation, parks and protected areas.

## 1. Introduction

Cross River National Park is located in Cross River State of Nigeria, on longitudes 5°05'-6° 29'N and latitudes 8°15'-9° 30'E. It is a region of species endemism and one of the 25 biodiversity hotspots in the world (Oates, 1999). The park was formally established through decree 36 of 1991 with the primary objective of protecting the remaining pristine and verdant tropical rainforest in Nigeria (having lost well over 90% of her original rainforest ecosystem due to poor and unsustainable land use practices). The park stretches across two non-contiguous ecological divisions (Oban and Okwangwo divisions), occupying a total land area of about 4,424 km<sup>2</sup>. The Oban Division is in the south of Cross River State, covering an area of about 3,424 km<sup>2</sup> within the Cross River loop, and sharing a common boundary with the Korup National Park in Cameroon. The Okwangwo Division occupies about 1,000 km<sup>2</sup>, lies in the north of Cross River State, and shares a common boundary with the Takamanda Forest Reserve in Cameroon.

Both Cross River State of Nigeria and Cross River National Park derive their names from a famous river –the “Cross River”, which rises from the Cameroonian highlands (at Bamenda – Nkongsamba elevation towards Tinto) (Erukwa, 2010). Several tributary rivers (e.g. Okorn, Okpon, Lohai, Lokpoi, InyangIta, and Calabar river) and a network of streams in Cross River State / Cross River National Park all drain into the Cross River, which empties into the Atlantic Ocean. Cross River National Park is accordingly very rich in assorted fish species and other aquatic biodiversity (Ita, 1993). The Cross River alone is composed of over 166 fish species, from 15 orders, 42 families and 97 genera (Teugels et al. 1992). The Cross River has a length of over 600 km and an area of about 70,000 km<sup>2</sup> (Teugels et al. 1992). About two thirds of the Cross River basin (referred to as lower Cross River) lies within Nigeria, while one third of the basin (called Upper Cross River) lies within Cameroon. The Upper Cross River is characterized by several rapids and waterfalls (Reid 1989, Teugels et al. 1992). The paper maintains that assorted fish and other aquatic species in the rivers and streams of Cross River National Park are fast disappearing due to unsustainable fishing practices in buffer zone communities, hinging on the use of poisonous chemicals.

The park has 105 buffer zone villages (39 in Oban Division and 66 in Okwangwo Division). Among other livelihood activities, villagers in the above buffer zone communities undertake fishing activities in the network of rivers and streams that straddle the Cross River National Park (Ita, 1993). The bone of contention here lies on the adoption of unsustainable fishing practices by local communities in Nigeria, hinging on the use of various chemicals (e.g. pesticides, herbicides, and fungicides) for commercial fishing purposes. Ita (1993) summarizes the pesticides used in Nigeria which have hazardous consequences on aquatic fish population and other organisms:

**Table 1: Trade names, active ingredients and properties of pesticides commonly used in Nigeria**

Pesticide Group	Trade name	Active ingredient	Chemical group of ingredient	W.H.O. classification of active ingredient	Hazard to fish	EPA criteria for protection of aquatic life in freshwater ( $\mu\text{g l}^{-1}$ )
Insecticides	Actellic	Pirimiphos-methyl	Organochlorine	Moderately hazardous	Extremely harmful	
	Alamon (also fungicide)	Heptachlor <sup>a</sup>	Organochlorine	Moderately hazardous	Extremely harmful	0.52
	Aldrex	Aldrine	Organochlorine	Highly hazardous	Harmful	2.5
	Aldrex (also fungicide)	Aldrine+Thriam <sup>T</sup>	Organochlorine+Dithiocarbamate	Highly hazardous+slightly hazardous	Harmful + extremely harmful	+
	Cymbush	Cypermethrine	Synthetic pyrethroid	Moderately hazardous	Extremely harmful/harmful	
	DDT (also rodenticide)	DDT <sup>a</sup>	Organochlorine	Moderately hazardous	Harmful	0.41
	Dimecron (also acaricide)	Phosphamidion <sup>an</sup>	Organophosphate	Highly hazardous	Slightly harmful	
	Fenthion (also acaricide)	Fenithrothion <sup>an</sup>	Organophosphate	Moderately hazardous	Extremely harmful	
	Gammalin (also rodenticide)	Lindane <sup>a</sup>	Organochlorine	Moderately hazardous	Extremely harmful	2.0
	Nogos (also acaricide)	Dichlorous <sup>an</sup>	Organophosphate	Highly hazardous	Extremely harmful/harmful	
	Nuvacron (also acaricide)	Monochrotophos <sup>an</sup>	Organophosphate	Highly hazardous	Slightly harmful	
	Perfekthion (also acaricide)	Dimethoate <sup>an</sup>	Organophosphate	Moderately hazardous	Harmful	
Primor	Primacarb	Carbamate	Moderately hazardous	Slightly harmful		
Insecticides	Queletox (also used as an acricide)	Fenthion	Organophosphate	Highly hazardous	Harmful	
	Ultracide (also an)	Methidathion <sup>an</sup>	Organophosphate	Highly hazardous	Extremely harmful	

acaricide)					
Herbicides	Atranex	Atrazine	Triazine derivative	Slightly hazardous	Harmful
	Basagran	Bentazone	Ditiocarbamate	Slightly hazardous	Slightly harmful
	Grammazon	Paraquat (dichloride)	Dipyridilium derivative	Moderately hazardous	Slightly harmful
	Igran	Terbacil	-	Slightly hazardous	Extremely harmful
	Primextra	Atrazine+ Metalochlor	Triazine derivative	Slightly hazardous	Harmful/slightly harmful
	Risane	Flurodifen+ Propanil	-	Slightly hazardous	Extremely harmful/harmful
	Ronster	Oxadiazone	-	Slightly hazardous	Slightly harmful
Stam	Propanil	-	Slightly hazardous	Harmful	
Fungicides	Fernasan	Thriam	Dithiocarbamate	Slightly hazardous	Extremely hazardous

Source: Ita (1993).

Gordon and Odei (1999) link the increasing use of pesticides in West Africa to the modernization of agricultural practices. Boateng et al. (2006: 1) report that “the use of pesticides has contributed significantly to improved national earnings from cocoa production in 2003 and 2004, as well as a reduction in the incidence of malaria in Accra”, Ghana. Gordon and Odei (1999) maintain that agricultural pesticides are known to be very toxic to non-target organisms. For instance gammalin 20, a pesticide meant for cocoa diseases like black pod (*phytophthorapalmivora*), is lethal to fish, and widely used for killing of fish across local communities in West Africa (Ezemonye and Ogbomida, 2010).

There are serious ecological effects associated with the use of pesticides for fishing purposes. Jamu and Ayinla (2003) maintain that fish yields of most Nigerian inland waters are generally declining due to unsustainable fishing practices anchored on the use of poisonous chemicals. Tijani (2006) enumerates different consequences of the use of pesticides which comprise pollution of drinking water, depletion of the populations of various species of fish and aquatic biodiversity in general, destruction of natural vegetation, and human diseases such as diarrhoea, cancer, leukaemia, brain and liver tumours. Unsustainable fishing practices in CRNP have been linked to rural livelihoods challenges in buffer zone communities. A peep into the livelihoods challenges of buffer zone communities is therefore necessary.

## 2. Rural Livelihoods and Biodiversity Conservation

Forest communities rely on natural resources and biodiversity for food, medicines, wild meat, livestock fodder, income generation, socio-cultural values and soil and water management (CIFOR, 2005). The conversion of vast and biologically rich forest lands into parks and protected areas (hitherto serving the livelihood needs of people) has direct livelihood impacts on the buffer zone communities of such parks and protected areas (Kothari et al, 1998). Marrie (2004: 106) upholds that over 50% of existing protected areas have been established on the ancestral lands of indigenous people and local communities. As a result, “conflict, rather than collaboration often characterise relations among rural communities, policy makers, forest managers, and development agents. This is further exacerbated by differing interests and interpretations of land-use policies and laws” (Barrow et al., 2002).

Tropical forest and their neighbouring villages in sub-saharan Africa are seriously threatened ecologically and economically (Plumptre et al. 2003; PRIME 2005). The commercialization and utilization of bush meat (including fish) in many developing nations remains a frontline issue at the intersection between biodiversity conservation, livelihoods and food security (Mainka et al., 2002). Elaborate research has highlighted the ever increasing utilization of bush meat in different parts of Africa (Friedman, 2003; Chardonnet et al., 2002; Barnett,

2000; and Bakarr et al., 2001). Bush meat plays a leading role in local food security, engages more people than any other wildlife activity, and significantly contributes towards rural revenue generation (Brown et al., 2007).

Wild animal products constitute important items for consumption or display and have rich medicinal and spiritual values in several human cultures (Scoones et al, 1992). Across nations in the tropical world, “many people benefit from wild meat: from those who eat it as part of a forest-dependent life-style, to those who trade and transport it at all points along different supply chains, to those who consume it in restaurants and homes, often far from the forest” (Brown et al, 2008: 13).

Survival has continued to be a major reason why villagers in the buffer zones of parks and protected areas trespass into such territories for bush meat hunting purposes. The feasibility study document on Cross River National Park, prepared by ODNRI/WWF (1989:12) aptly observed that “beyond farming, hunting and gathering, few opportunities exist for regular employment.” A number of international organizations working on bush meat issues such as ODI<sup>1</sup>, UK Tropical Forest Forum<sup>2</sup>, TRAFFIC<sup>3</sup>, and BMCTF<sup>4</sup> (Bush meat crisis taskforce) all agree that livelihood challenges are at the core of reasons accounting for villagers’ frequent trespass into the territories of parks and protected areas in the tropics.

Though the commercialization and utilization of bush meat is an illegal activity, Baldus (2002) maintains that it has continued to thrive and expand due to a number of reasons:

- (i) Difficulty of wildlife law enforcement inside protected areas, coupled with the challenging task of securing wildlife living outside protected areas;
- (ii) Low level of awareness amongst rural villagers on the illegality, wrongfulness, and conservation effects of commercial bush meat hunting and utilization;
- (iii) Population increase and corresponding increase in the demand for bush meat;
- (iv) Lack of a sense of ownership of wildlife and protected areas on the part of villagers, culminating in indiscriminate hunting of bush meat; and
- (v) Low cost of bush meat (cheaper than beef) and the fact that it<sup>1</sup> is the protein source that is easily available.

Despite the fact that the bush meat crisis in certain parts of Africa is more of a livelihood issue than a development issue (Bennett, et al., 2006), some researchers are critical of programmes that link biodiversity conservation with poverty or people oriented initiatives (Agrawal and Redford, 2006). On the strength of the foregoing, this study concludes that successful strategies or options for effective tropical biodiversity conservation will be those that significantly or effectively address sustainable rural livelihoods. This implies revisiting the conservation drawing board to accord sustainable rural livelihoods priority or first class attention in resource allocation, and in frameworks that guarantee effective local participation in project planning and implementation.

The curiosity here is whether park authorities in the tropics have been investing adequately on livelihood activities (compared to social amenities or development projects) in buffer zone communities over the years. In their evaluation of conservation and livelihoods at Korup National Park, Cameroon, Mbile et al (2005: 13) stress that “successful park management depends on support for livelihood activities and the involvement of local communities.”

### 3. Methods

This study commenced in January 2010 and lasted for 6 months, cutting across three forest communities of Cross River State of Nigeria. Two of the communities are in the buffer zone of Cross River National Park, while one is a non-buffer zone forest community rich in water resources. The three villages were purposively sampled, vis-à-vis the intensity of the use of pesticides for fishing purposes. A combination of quantitative (livelihoods survey), and qualitative (focus group discussions, interviews, and non-participant observation) research methods were used. For purposes of generating a representative sample of households, a community listing exercise was undertaken, and household rosters prepared for each village. The household rosters were crosschecked with community health workers who carry out immunization exercises (measles, yellow fever, small pox, etc) in each village.

A total of 360, 308 and 400 households were compiled in Old Ekuri, Abo Mkpang and AkwaIbami villages respectively. Due to time and resource constraints, it was not possible to sample every household per village.

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<sup>1</sup> <http://www.odi.org.uk/projects/03-05-bushmeat/>; <sup>2</sup> <http://www.forestforum.org.uk/tradee.htm>; <sup>3</sup> <http://www.traffic.org/>; <sup>4</sup> Bush meat crisis taskforce: <http://www.bushmeat.org/portal/server.pt> as at 15/03/09.

Proportional to the above number of households per village, a formula of one-in-four households was used to generate a sample population of 90 (Old Ekuri), 77 (Abo Mkpang), and 100 (Akwalbami), resulting in a total sample size of 267. To guide questionnaire distribution, households were stratified on the basis of their major livelihood activities as shown in table 2.

**Table 2: Proportional stratified random distribution of questionnaire**

S/No	Village name	No. of hhs*	S/Size	Proportional distribution of questionnaire across livelihoods groups				
				Hunters / fishing	Farmers	Traders	Palm wine tappers	NTFPs gathering *
1	Old Ekuri	360	90	18	18	18	18	18
2	Abo Mkpang	308	77	17	15	15	15	15
3	Akwalbami	400	100	20	20	20	20	20
	Total	1,068	267	55	53	53	53	53

\*hhs = households \*NTFPs = Non-timber forest products.

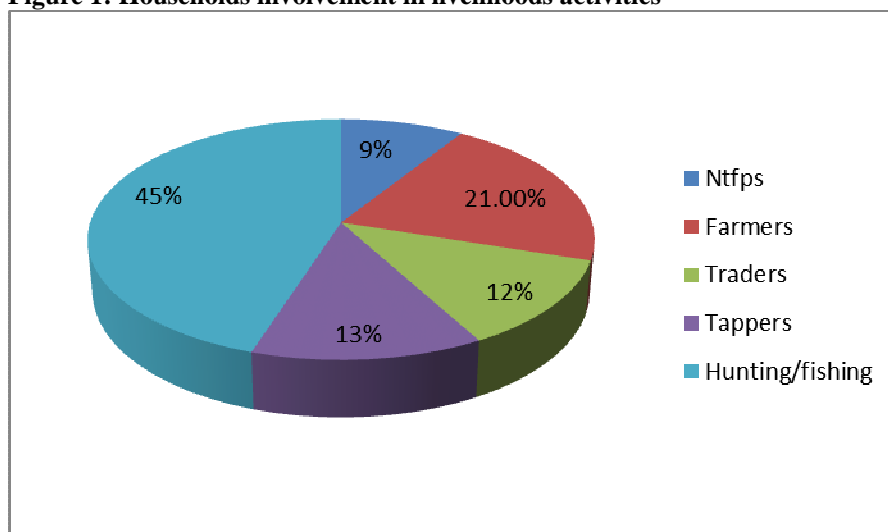
The above guided questionnaire distribution only. Respondents were advised in the questionnaire to fill in their major and minor livelihood activities. This was intended to establish the nature of local livelihood combinations amongst respondents (as people do not depend on a single livelihood activity for survival), and to have a fair idea of the total number of those who hunt or fish (whether as major or minor occupation). The focus group discussions were 9 in total, while household interviews were 60 (twenty per village). Non-participant observations comprise field visits to some selected rivers and streams to explore fish availability, using food or bait dropping method. Boateng et al. (2006:1) stress that “in freshwater, the presence or absence of fish has been widely used as a biological indicator of the degree of pollution.”

#### 4. Results

From the livelihoods survey, buffer zone livelihood activities are categorized into (i) farming (tree crop and food crop production), (ii) hunting/fishing, (iii) trading, (iv) palm wine tapping and local gin production, and (v) gathering of non-timber forest products (NTFPs). Generally, it was discovered that buffer zone villagers do not specialize in a specific livelihood activity, but practice a combination of different activities, depending on what fetches revenue at different times of the year. Analysis of household heads' monthly net income (earned from different activities) reveal that the 267 household heads (sample size), fall under different range of income. 127 household heads (47.6%) generate less than ten thousand Nigerian naira (N10,000.00) or forty British pounds (£40.00) per month. 31.5% (84 household heads) generate within N11,000 – N20,000 (£80); 12.4% (33 household heads) generate within N21,000 – N30,000 (£120); 8.6% (23 household heads) generate within N31,000 – N40,000 (£160); while no number was recorded in the last income range in the questionnaire - N41,000 – N50,000 (£200) per month. Poverty amongst buffer zone villages of Cross River National Park is thus glaring.

From the above sample size, household involvement in different livelihood activities indicate that more households are into hunting and fishing activities (figure 1).

**Figure 1: Households involvement in livelihoods activities**



Source: Livelihoods survey, 2010.

In comparison with other livelihood activities, hunting/fishing is more lucrative and fetches more household income (table 3). For instance, whereas the highest income earned by respondents per month (in food crop and cash crop farming) is within N25,000 – N30,000 (£120), hunting/fishing activities fetch up to N50,000 (£200) as shown in table. The highest revenue earned by household heads involved trading and palm wine tapping falls between ten and fifteen thousand naira (N10,001 – N15,000) (or £40 - £60). The highest income earners in the sample population belong to the hunting/fishing group. This makes hunting/fishing activities very attractive to buffer zone villagers in Cross River National Park.

**Table 3: Household income from hunting, trading, palm wine tapping and NTFPs**

Amount/month (Naira)	Hunting/fishing		Trading		Palm Wine Tapping		NTFPs	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
≤ 5000 (£20)	-		10	29.4	29	60.4	30	20.5
5001 – 10,000 (£40)	42	34.7	14	41.2	18	37.5	33	22.6
10,001 – 15,000 (£60)	-		10	29.4	1	2.1	32	21.9
15,001 – 20,000 (£80)	29	24.0	-		-		29	19.9
20,001 – 25,000 (£100)	1	0.8	-		-		17	11.7
25,001 – 30,000 (£120)	26	21.5	-		-		5	3.4
30,001 – 35,000 (£140)	-		-		-		-	
35,001 – 40,000 (£160)	13	10.7	-		-		-	
40,001 – 45,000 (£180)	-		-		-		-	
45,001 – 50,000 (£200)	10	8.3	-		-		-	
Total	121	100.0	34	100.0	48	100.0	146	100.0

Source: Survey data, n=267, 2010.

From a list of fishing techniques in the questionnaire, comprising (i) hook, line and sinker, (ii) fishing nets, (iii) local fishing snares, and (iv) use of chemicals, 78% of respondents admitted using different chemicals (especially gammalin 20) for fishing purposes. In an interview, a key informant explained that all communal attempts to ban the use of chemicals has failed, and that different strategies are being used by offenders to circumvent the law. He cited instances where several offenders undertake water pollution activities in the night, which makes it difficult for local chiefs to apprehend them. The informant further mentioned that some villagers usually go very far to rivers and streams in the core area of Cross River National Park, and undertake pollution activities, killing not just fish, but other aquatic animals or organisms.

Findings also reveal that 66% of those using chemicals or pesticides to fish are unemployed secondary school leavers. They go in groups to far distances and pollute rivers and streams, inside the national park territory. In a focus group discussion with park rangers on wildlife management challenges and the menace of water pollution in Cross River National Park, the following comments were obtained (box 1).

**Box 1: Comments from park rangers**

**Researcher:** *Why is the use of gammalin 20 for fishing activities common in buffer zone communities of the park?*

**Ranger 1:** *The park is bigger than the number of rangers employed to do the job. The park is over 4,000 km<sup>2</sup>, and we have less than 200 park rangers. There are 105 buffer zone communities with several rivers and streams. We need more hands and more ranger stations to effectively police the park.*

**Ranger 2:** *I feel that the founding fathers of this park are yet to do justice to what was proposed in the management plan of the park.*

**Researcher:** *Who are the founding fathers and what did they propose in the management plan that has not been done?*

**Ranger 2:** *WWF, EU, and the Federal Government of Nigeria are the founding fathers of this park. The management plan was prepared by both WWF and ODNRI in 1989. The plan has provision for the resettlement of enclave communities (villages found inside the park: Mkpot 1, Abung, Iku, Butatong, Okwa 1 and Okwa II), and a support zone development programme, both of which have not been implemented till today. The support zone development programme has a livelihoods package for buffer zone communities, which is yet to be implemented. That is why hunting and fishing activities are common in the park.*

*Source: Fieldwork, 12<sup>th</sup> May 2010: FGD 02.*

A retired teacher and chief in one of the villages of the study however maintains that hunting/fishing threats to biodiversity conservation in Cross River National Park can only be halted if government is prepared to recognise their rights as landlords and pay annual land rents or sustainable compensation (as coined by him) over nationalized forestlands hosting the park (box 2).

**Box 2: Demand for payment of annual land rents on nationalised forest lands**

*There is government Oil Palm plantation at Borum, here in Boki Local Government Area of Cross River State, about 15 kilometres from Abo Mkpang. The community has been receiving land rents annually over the years. That is why the people of Borum and their sister communities are able to establish a Community Secondary School in the area. There is government cocoa plantation at Bendeghe, about 25 kilometres from Abo Mkpang. That is where the people of Bendeghe draw their financial strength in building and running the Community Secondary School at Bendeghe. These communities now have more man power than us. When these communities had no government agricultural plantations (and not receiving land rents), they were all at the same level with us.*

*We have national park on our land, and instead of conservation improving our lot, it is making us poorer and poorer every day. That is why Abo Mkpang is the way it is. Other villages are developing, while we are stagnating. Concrete buildings are all over Bendeghe village, while thatch houses are all you see in Abo Mkpang. Tell me how we can be happy with Cross River National Park? CRNP or government has to compensate us for the land that has been taken as national park. If they pay annual land rent, or compensation that is yearly, or sustainable, conservation will be acceptable to us. In this world, we need money to survive. There is no welfare or social security in this country. That is why people are hunting and killing fish to generate revenue.*

*Conservation is pushing us to fight, or to struggle and recover our forestlands and convert it to other purposes. If conservation continues to push us this way, our young men are ready, we will do it one day.*

*Source: Fieldwork, 13 July 2010. Hh Interview 08*

Field visits to some rivers (e.g. Okorn river at Abo Mkpang village, and InyangIta river at Akwa Ibami village), and streams (e.g. Ibija and lohai at Old Ekuri village) and testing for fish presence (by throwing in dead grasshoppers, pieces of yam and banana into the water), reveal no fish rushing to catch or eat the food. A number of community leaders interviewed across the three villages of the study (Abo Mkpang, Old Ekuri and AkwaIbami) all lamented over the growing number of streams and rivers that are becoming empty of fish, due to the use of pesticides for fishing activities. Several fishermen (interviewees) equally lamented that they no longer have where to practice traditional fishing (using hook, line, and sinker) because their major water bodies (rivers

and streams) have no enough fish as before.

## 5. Discussion

The discovery in this study that some rivers and streams in Cross River National Park are becoming empty of fish and other aquatic organisms due to the use of pesticides (e.g. gammalin 20) for fishing purposes, is consistent with several studies on the ecological effects of pesticides. Rahman et al. (2002) point out the danger of biodiversity loss in aquatic ecosystems due to indiscriminate human use of pesticides. Meletev et al. (1971) comment that the introduction of toxicants into aquatic systems decrease dissolved oxygen concentration, impair fish respiratory processes, and culminate in asphyxiation. Ezemonye and Ogbomida (2010:4) report on the effects of gammalin 20 on African catfish (*clariasgariepius*) and conclude that “dysfunction of fish behaviour and respiration can serve as an index of gammalin20 toxicity.” Similarly, Omoniyi and Sodunke (2002) maintain that pesticides trigger abnormal behaviours in fish such as incessant jumping and gulping of air, restlessness, loss of equilibrium, increased opercular activities, water surface to bottom movement, sudden quick movement, and resting (death) at the bottom.

This study shows that livelihood challenges (income generation) is the reason why buffer zone communities in Cross River National Park are using pesticides for fishing activities. Survival has continued to be a major reason why villagers in the buffer zones of parks and protected areas trespass into such territories for hunting and fishing purposes (Timko and Satterfield, 2008). The feasibility study document on Cross River National Park, prepared by ODNRI/WWF (1989:12) aptly observe that “beyond farming, hunting and gathering, few opportunities exist for regular employment.” This study reveals that both the resettlement of enclave villages, and livelihoods programme that was proposed in the above feasibility study document (now over 23 years) is yet to be implemented. In their evaluation of conservation and livelihoods at Korup National Park, Cameroon, Mbile et al (2005: 13) stress that “successful park management depends on support for livelihood activities and the involvement of local communities.”

The call by buffer zone communities that parks should recognize them as landlords and pay annual land rents (or sustainable compensation), as panacea for hunting/fishing activities is supported by a number of organizations and researchers. The World Bank’s (2010:126) call for greater flexibility and sensitivity to the concerns and perspectives of communities already affected by conservation initiatives:

“So far, the principal actors in creating protected areas have been nongovernmental organizations and central governments. To ensure the flexibility needed to maintain biodiversity, a wide range of managers, owners, and stakeholders of these matrix lands and waters will need to be engaged in management partnerships. Incentives and compensation for these actors may be required to maintain a matrix that provides refugia and corridors for species. Some of the options include extending payments for environmental services, ‘habitat banking’, and further exploration of ‘rights-based approaches to resource access’, as used in some fisheries.”

Ferraro and Simpson (2001:20) stress that “the simplest explanation for why local peoples do not maintain biodiversity is that they find destructive options are more attractive.” James et al. 2001 maintain that developing countries have 3.62 million square kilometres of forests under protection, and that

“the total land value of all reserves (parks and protected areas) is estimated to be \$49.5 billion. Assuming a discount rate of 10%, annual compensation for these existing reserves should thus be approximately \$4.9 billion. The compensation payment averages \$1,365 per square kilometre per year – a significant amount, considering that most parks in developing countries are run on only a few hundred dollars per square kilometre per year. For example, the communities surrounding Mikumi National Park in Tanzania, a reserve of 3,230 square kilometres, would collectively receive \$2.6 million a year in compensation.”

If biodiversity conservation yields revenue to buffer zone villages (conservation payments), and such revenue source is tied to biodiversity conservation objectives, villagers will support biodiversity conservation (Ferraro and Kiss, 2002). Currently, tropical biodiversity conservation is anchored on gratis; does not recognise property rights; does not yield revenue to villagers; and exacerbates poverty through persistent wildlife raiding of agricultural crops. That is why local people are resorting to unsustainable commercial fishing practices for income generation purposes.

## 6. Conclusion and recommendation

Biodiversity in national parks and protected areas comprise both terrestrial and aquatic resources. In the case of Cross River National Park, Nigeria, there are several rivers and streams which not only provide fresh water for



human use, but contain assorted fish species, and uncountable diversity of aquatic organisms. As global biodiversity hotspot and region of species endemism, the aquatic resources of Cross River National Park are globally important. Unfortunately, the use of different pesticides for fishing purposes is ubiquitous amongst buffer zone communities of the park. Several rivers and streams are becoming empty of fish and other aquatic organisms due to the above practices.

Findings in this study reveal that unsustainable fishing practices are underpinned by poverty, common property regimes, wildlife management failure, absence of buffer zone livelihoods programme, and non-resettlement of enclave communities in Cross River National Park. Though the problem appears hydra-headed, buffer zone community leaders and chiefs maintain that once the park recognises their rights as landlords, and pays annual land rents (or sustainable compensation), anthropogenic challenges in the park (including unsustainable fishing practices) will be halted. There is need for conservationists to look into this proposition, in order to chart a successful course for not just Cross River National Park, but tropical parks in general. The paper also highlights the views of some international organisations and researchers on the need for conservation to take the issue of compensation of local people (who bear the costs of tropical biodiversity conservation) seriously.

Parks should not continue to serve global sustainable development objectives whose costs are borne by the world's poorest and marginalised people only. One option could be to introduce a global sustainable development tax on businesses (who all derive their raw materials from biological resources), and such funds used to annually finance the payment of land rents (or sustainable compensation) to buffer zone communities of parks across the world. The sustainable compensation scheme should be tied to biodiversity conservation objectives, strict community compliance, and strict park protection. Current strict park protection efforts are insensitive to property rights contestations, and are therefore not yielding positive conservation results. Communities are now overtly and covertly engaging in unsustainable hunting/fishing activities due to property rights arguments, and other ignored social impacts that attended the creation of Cross River National Park.

There is need for further studies to quantitatively establish how biodiversity conservation is influencing hunting/fishing practices, and how hunting/fishing practices are influencing biodiversity conservation in Cross River National Park. There is need to ascertain why the resettlement of enclave communities and livelihoods programme contained in the management plan of Cross River National Park (prepared by WWF/ODNRI in 1989) have not been implemented till the present day. Furthermore, no studies have been carried out to ascertain the level of food insecurity and poverty effects of wildlife raiding of agricultural crops amongst buffer zone villages of Cross River National Park. Such studies could help in strengthening local people's contestations on the social impacts of parks, property rights advocacy, and call for the payment of annual land rents (or sustainable compensation) to buffer zone communities.

#### **Acknowledgements**

*This paper is an off-shoot of my doctoral research programme: Buffer Zone Communities, Commercial Bushmeat Hunting, and Biodiversity Conservation in Cross River National Park, Nigeria. The programme ended in December 2012 at the University of Reading, UK, and its sponsorship by the Commonwealth Scholarship Commission, UK, is hereby acknowledged and highly appreciated. The cooperation of both management and staff of Cross River National Park, during field research, which made the study successful, is also hereby acknowledged and highly appreciated.*

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