HUMAN DEPREDATION AND THE WILD BIRD TRADE IN WEST AFRICA

ACKNOWLEDGEMENT

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ABSTRACT

Many authors have blamed the decline and threats to bird populations in the West African sub-region on habitat loss. This study revealed contrary to this main stream view that illegal hunting, capturing and trading in birds have contributed hugely to this phenomenon.

The study has also brought to light that most species are being subjected under enormous pressure from human depredation basically for livelihoods, opportunistic or economic reasons.

Results from demographic analysis suggest that some species can be harvested for population viability purposes whereas others can be harvested for both biological and economic viability

The study recommends the trade moratorium approach for the bird trade in the form of the certification system on timber and other forest products. This could help eliminate illegal laundering, poaching and overharvesting and would also open bird importation to internationally recognised trade groups and harvestings under scientifically approved models.

The magnitude of the illegal dimension of the bird trade requires appropriate management systems to sustain the trade and the framework for the management intervention to be piloted in the Wechiau and Kakum forest communities in Ghana and if possible replicated in two communities, one in each of Benin and Ivory Coast could help control inappropriate activities and initiate measures that would ensure regular monitoring of bird populations in the region.

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INTRODUCTION

The decline and extinctions of bird populations in many parts of the world have been attributed to habitat loss but hunting, capturing and trading in birds may have played a huge and recurrent part of the phenomenon.

Probably the extinction of the passenger pigeon *Ectopistes migratorius* is the most poignant example of mass slaughter in the history of wildlife conservation in the United States of America (Warren 1997).

In Europe, where hunting of birds is thought to be more of a recreational activity than for meat or eggs, hunting probably also did inflict some immeasurable impact on birds including on migratory wildfowl and on song-birds. Evidence from countries such as Germany, France, Russia (Siberia), Spain and England revealed a massive trade in millions of larks *Eremophila spp.*, thrushes *Turdus spp.*, moulting ducks *Aix spp.*, and thousands of eggs of lapwing *Vanellus spp.*, and moorhens *Gallinula spp.* between the nineteenth and twentieth centuries. In Yarmouth, England, a single dealer could offer for sale about 5,000 lapwing eggs in a season (Fisher and Peterson 1964).

In Asia, the only surviving hypothetical progenitor of the domestic fowl in the wild, the red jungle fowl, is also being hunted to threatening proportions. An account of unconstrained hunting and marketing in Sulawesi has now driven the population of the Red jungle fowl *Gallus gallus* to 50% decrease in its status, while the Maleo bird *Macrocephalon maleo* has suffered a 90% decline (O'Brien and Kinnaird, 200?).

In Latin America, the hunting of birds for meat and the export of birds for the wild trade is widespread and well documented. The monetary value of exports is enormous and the estimated total value of the exports of parrots alone is in the region of US$1.6 billion. Bird hunting for meat and other products involves many species including Pigeons *Zenaida spp* and doves *Columba fasciata*, Waterfowl *Dendrocygya spp.* and

Anas spp. In Venezuela alone, proceeds from waterfowl hunts could exceed US$2million per annum.

Africa is no exception to these trends. In West Africa, illegal hunting, capturing and trading in birds and its associated transformation of the populations of the avifauna of the region is enormous and threatening. There are relatively few documented cases to define the scale and magnitude of these threats on most bird species and or even mark an effective highlight of the scale of avian conservation needed in the region.

This study has two linked components. The first of part involves primary quantitative surveys to establish the extent of pressure on bird species targeted by human exploitation and also to explore the potential to involve all stakeholders through qualitative surveys of opinions and attitudes in order to highlight the issue of sustainability in communities where hunting, trapping and trading are prevalent.

The second component involves demographic analysis of pressurised species and to attempt to develop harvesting models that would explore whether or not harvesting would be acceptable and to what extent. For purposes of the geographical range of the study and resource constraints and preliminary results from the surveys, the African Grey parrot *Psittacus erithacus timneh* and the helmeted guinea fowl *Numida meleagris* were chosen for the harvesting model.

The overall aim is to be able to help communities where hunting, trapping and trading activities are prevalent to develop management intervention models.

METHODS AND DESIGN OF RESEARCH

The study applied a mixed methods approach (Creswell, 2003) and this refers to a combination of qualitative and quantitative research paradigms in the conduct of research (*ibid*). Combining both approaches capitalises on the strengths of both approaches and compensated for the weaknesses of each approach (Kish, 1987; Bryman, 1988).

Adolph (1999) and Ellis (2000) have used similar mixed methods to investigate stakeholders' participation in natural resource management in India and sustainable livelihood analysis in Eastern Africa.

The nature of this study necessitated the collection and collation of field data on either live birds or carcases of exploited species. A total of 32 bushmeat markets "fetish" markets, "chop-bars", various locations along bush or farm tracks and principal roads, and focal centres for trade in live birds including major border crossing points between Ghana, Ivory Coast and Togo, and from Togo to Benin were covered.

Qualitative data on all stakeholder groups, i.e. customs officials, Conservation authorities and NGOs, opinion leaders, hunters, trappers, bushmeat traders, farmers and other stakeholders in wildlife resource utilisation were accessed in the study areas to help address the research question investigated.

Snowball sampling was applied to determine the qualitative sample sizes for most of the high activity areas. Snowball sampling involves the practice of a researcher identifying and tracking suitable respondents and then asking for help from them to locate other suitable respondents (Oppenheim, 1992; Ellis, 1994; Denscombe; 1998). The likelihood is low that this sampling method would have produced representative samples (Ellis, 1994), but it has the advantage of building sample frames quickly where none exist (Black, 1999; Mason, 2002) and seems to be the most appropriate method where a researcher has to deal with decentralised activities, of which about 70% is illegal.

The search for information on hunted or traded bird carcases on various species proceeded from country to country and to regions/districts and then to the trading centres at community levels.

A modified random sampling technique was adopted to enable the sample selection process and the decision of which individual to be selected for the administration of the questionnaire or interview to be left to the questionnaire administrator. In each study area or community, target groups (hunters/trappers and traders) (referred to as *fong*) were randomly selected by field assistants bearing in mind gender balance, community membership and occupation.

On the basis of the above survey plan, a total of 35 stakeholders were interviewed in each community and 10 communities each at Wichau (latitude 09046' north and 02038' west) and Kakum (1^{o} 19' West 5^{o} 26' North) pilot study sites for implementation of the management intervention model. Structured, semi-structured and unstructured questions and Focus Group Interviews were applied.

The Statistical Package for Social Sciences (SPSS) was used in the analysis of the quantitative data. SPSS was designed specifically for the analysis of social survey data (Bryman and Cramer, 1999; Miller *et al.*, 2002).

After the coding of open-ended questions, data were entered onto the SPSS data file for analysis. It was recognised that as the bulk of the quantitative data was nominal or categorical data, descriptive statistics were appropriate for the analysis. A non-parametric Chi-square test was used in the analysis.

The perceptions of stakeholders on hunting/trading, bird population and livelihood issues were also given a different analysis using the Likert scale (Oppenheim, 1992; de Vaus, 1998). Based on a five-point scale, the attitude of a stakeholder to a statement or question was measured by assigning weights of 5 to "strongly agree", 4 to "agree", 3 to "uncertain", 2 to "disagree" and 1 to "strongly disagree". Thus a high score above the median score meant a favourable attitude to a given statement or question and conversely. It was therefore assumed that a stakeholder who was indifferent to the statements or questions would have a median score. On the scale of 1 to 5 above the median score was 2.5.

The Demographic analysis was computed here with the help of the software MATLAB. MATLAB is one of the high performance software packages designed for calculating projection matrices, modelling, simulation and prototyping.

RESULTS OF FIELD SURVEY

In an earlier research survey Kassim (2003) revealed about 240 bird species to be involved in trading out of which 8 were classified as either vulnerable or critically endangered. This study has adopted techniques to extend the scope of the survey beyond bushmeat markets to cover roadsides, chop bars, farm and fishing tracks, and nodal points along hunting and trapping routes and across borders into some countries in the sub-region neighbouring Ghana.

During the course of the study it became apparent that some experienced hunters have been able to classify birds into two categories: the palatable and the unpalatable species. They recorded birds such as herons, ducks, geese, and nearly all members of the game bird families, as palatable, as were many rails, bustards, cranes and waders, some parrots, pigeons and nightjars, all larks, most weavers, some buntings, finches and flycatchers, most thrushes and even owls.

In contrast, most conspicuously coloured birds such as the plovers, turacos, cuckoos, hoopoes, kingfishers, hornbills, crows, starlings, tits, shrikes, swallows, drongos and certain coursers were regarded unpalatable.

Though preference and taste may play an important role in influencing the choice of prey, many species as small as bulbuls and sparrows up to larger birds such as hornbills and crows have been considered edible and recorded as being hunted and killed for meat.

This is a clear indication that the activity of most hunters is highly opportunistic or economic.

An analysis of the scale preference of some the most preferred species in 20 hunting communities in Ghana revealed that the Guineafowl is the most preferred for meat over Francolin and other species. A Chi-Square test indicates a statistically significant difference to attest the preference (79.035(a) @df 12> P=0.001, Figure 1).

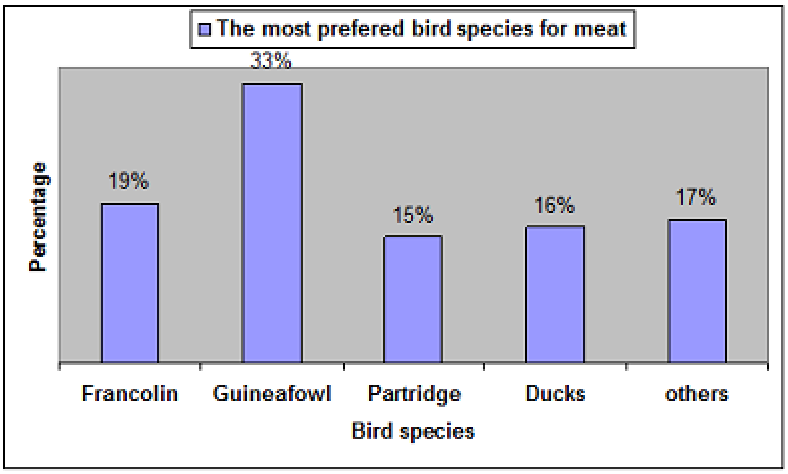


Figure 1. A display of birds preferred for meat.

A similar analysis also showed the African Grey Parrot and allied species score of 86%, as the most preferred for live trade over finches and other species. Please refer figure 2 for details.

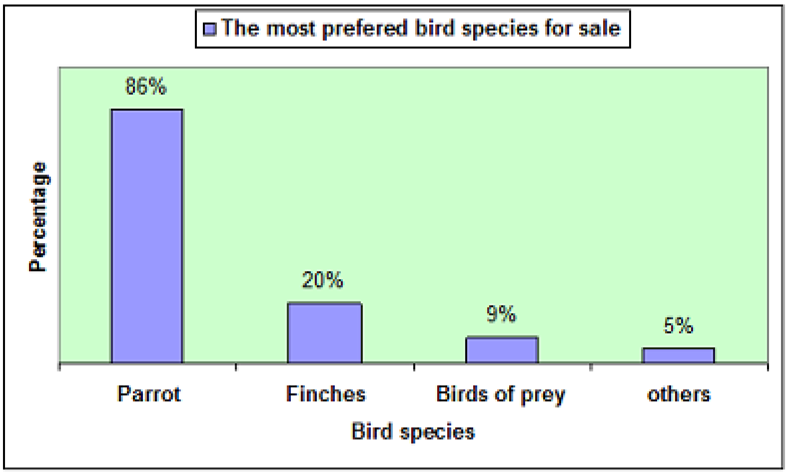


Figure 2. A graphical display of the most preferred species for the pet trade.

Again parrots and owls registered the highest among species preferred for magico-religious purposes. The test also indicates a statistically significant preference (Chi-Square 76.469(a) df 12.> 99%) for the above species for magico-religious purposes over any other form of use.

Given that spirituality and religiosity play a significant role in key decisions of individuals or groups with regards to limitations as to what is permissible to eat or what is an acceptable practice, birds could be eaten as meat, sold for money, kept as pets or used for magico-religious purposes by the different religious groups.

The African traditionalist groups, followers of traditional religious beliefs with metaphysical perceptions, scored 85% for their use of birds for magico-religious purposes more than for meat 15%. Whereas most Christians hailed the kill of birds for meat and for pet keeping, a majority in the Islamic faith (70%) regard consumption of bird carcases as unholy and unwholesome and place high preference on the use of birds for pet keeping and magico-religious purposes.

Stakeholder perceptions

The likert scale results in Table 1 show the stakeholder perceptions of the three main issues: hunting as a secure profession, sustainability of the bird trade and the forces driving the hunting, capturing and trade in birds.

Table 1.

		Hunting/capturing and trading engages over 300,000 in Ghana. Does this mean the occupation provides adequate livelihood security?	Poverty and increasing human population threatens sustainable utilisation of wild birds	Hunting, capturing and trading in birds is more driven by economic incentive than cultural/traditional affirmation
N	Valid	105	105	105
	Missing	0	0	0
Mean		2.5143	3.6476	3.5429

The likert mean score of the views of stakeholders was 2.5 for whether or not hunting and trading provides adequate livelihood security. The score suggested a balance of opinion as to the sustainability of hunting and trading in birds as a profession in the long term.

The mean scores of the perceptions of stakeholders on the sustainability of bird utilisation and the economic force driving the hunting and trading in birds were 3.6 and 3.5 respectively and indicate a more positive acceptance of the issues of unsustainably and economic incentives.

The results of the likert scale measure is consistent with the results of the species survey, highlighting the pressure of human predation on bird species and the long term sustainability of livelihoods completely dependent on hunting and trading.

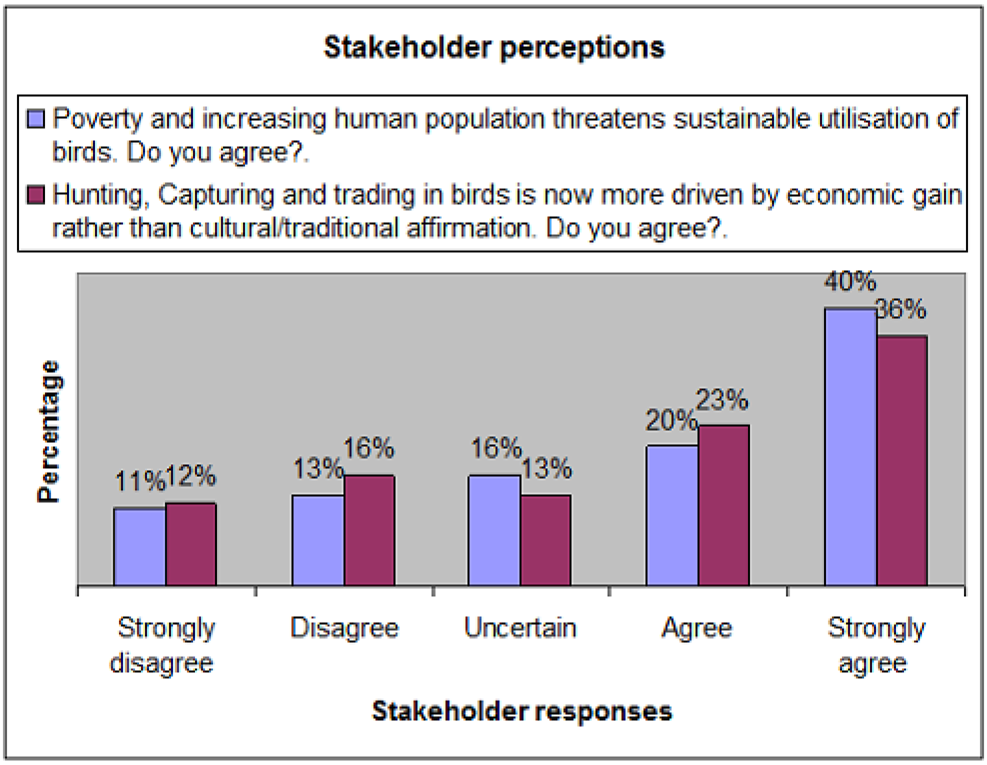


Figure 3. Graph representing the percentage response of stakeholders to issues of threats and the main cause of activities.

The views expressed (Figure 3) provide a clear manifestation of the extent of the dimension of the importance of poverty and livelihoods in the hunting trade activity and why outlawing the trade completely could impact severely on livelihoods.

RESULTS OF DEMOGRAPHIC ANALYSIS

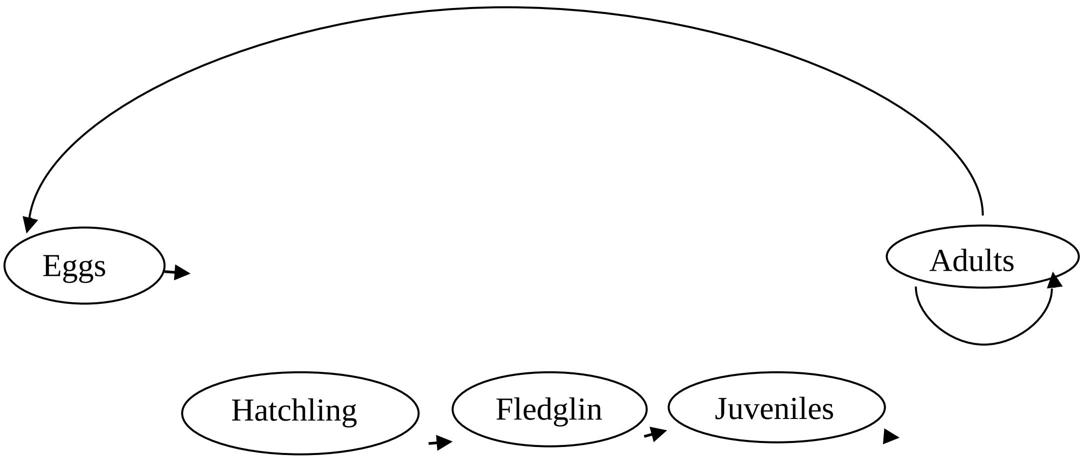
This section presents the population dynamics of the African Grey parrot (*Psittacus erithacus timneh*) and the Helmeted Guinea fowl (*Numida meleagris*) by examining likelihoods of their long-term survival under the present conditions of enormous human pressure for the pet trade, aviculture, medicinal purposes and food. A stage-class matrix model has been constructed to derive potential growth rates of the two populations to predict the tendency of the populations to increase or decrease over time. In addition, sensitivity and elasticity analyses have been carried out in order to identify which changes in the life cycles of these species would have the highest impact on the population growth rate and which stage classes would contribute most to this impact (de Kroon *et al*., 1986; Silvertown *et al*., 1993, 1996).

The demographic characteristics of the two species have been critically examined to determine whether or not the two populations could tolerate any harvesting and, if so, to what extent. Different harvesting regimes were simulated by alternating the removal of each stage class from the selected stage classes. The optimal harvesting strategy was also calculated by maximising the total yield among all sustainable harvesting policies analysed.

A 3 stage class model was constructed based on the life cycle of the bird. Since Birds lay eggs that may hatch into hatchlings, grow into fledglings, then develop into juveniles and finally grow to adulthood, but the hatchling and fledgling stages were merged due to the lack of data for the transition between these two stages.

The Life Cycle of a Bird

The nodes on the life cycle graph represent the stage classes:,Eggs; Hatchlings; Fledglings; Juveniles; and Adults. The arrows indicate the transition between stage classes: the straight arrows pointing to the right represent growth, whereas the long arrow pointing to the left stands for reproduction; the bottom loop stands for stasis.



Stage Class Matrix per year

African Grey Parrot

			1	2	3
			Eggs	Juvenile	Adult♀
	[1	Eggs	0	0	3
A=	2	Juvenile	0.6	0.75	0
	3	Adults	0	0.25	0.3]

Helmeted Guinea Fowl

			1	2	3
			Eggs	Juvenile	Adult♀
	[1	Eggs	0	0	12
A=	2	Juvenile	0.55	0.7	0
	3	Adult	0	0.3	0.5]

The stasis loop represents the probability that an individual of stage class (Adult) survives from one breeding season to the next and remains in the same stage class (adult); the short rightward arrows represents growth or development, i.e. the probability that an individual of a juvenile stage class survives and grows into the next stage class or adulthood. The projection matrix as a whole summarises the per-capita contributions of all classes from one breeding season to all classes at the next season (Caswell, 2001). The probabilities were assigned on the basis of data on Grey Parrots and Helmeted Guineafowl taken from (Urban et al, 1986).

Estimates of transition probabilities in matrices of the two populations were expressed as percentages and used as measure of potential rates of increase:

The construction of the matrix population model, proceeded with a projection interval of a breeding season and attributed to the state of the population at time t as described by the population vector n(t) of stage class abundance whose entries n,(t), i =1..3, were represented by the number of individuals in each stage class and where 1 represents eggs, 2 for juveniles and 3 for adults. The intrinsic rates of increase (r) for the populations assumed to have a stable age distribution were estimated by $n(t + 1) = An(t)$, where n(t) is a column vector of stage classes at time t and A is a population projection matrix with fertility elements in the rows where newly laid eggs hatches and develops into juveniles and juveniles to adults during the time interval from one breeding season to the next regardless of the number of survivors and the survival probabilities in the subdigonials given by the probability that an individual of a current breading season survives and makes a transition to the next stage class. (Leslie, 1945).

To obtain more realistic estimates, the matrix models were designed to include mortalities. Using estimates discussed above and assuming synchronous development matrices for the two species.

There have been few detail studies on the parrot in the wild to conduce adequate biological knowledge, status and the ecology of the species. Most of the researches on parrots have focused on the Neotropic species.

African Grey Parrot *Psittacus erithacus timmeh* occur in the West parts of the moist Upper Guinea forest and bordering savannas of West Africa. The grey parrot is a long-lived bird with life span of 50+ years, with a clutch size of 2-4 eggs and raises only one brood a per year. The sexual maturity is also delayed to about 4-7 years. These demographic parameters render the parrot most sensitive to over harvesting (Bucher 1991). The African grey parrot is monogamous, nesting in loose colonies or several pairs but in most places solitarily in tree cavities (*e.g. Terminalia, ceiba or Distemonathus)* 10-30 m above ground with a hole for their eggs. It is yet to be proven as to whether or not the African grey parrot is capable of adapting to different forms nesting other than tree cavities.

Few studies have been done on helmeted guinea fowl in South Africa, Nigeria and Cameroon. The Helmeted Guineafowl *Numida meleagris* inhabits both woodland and grassland biomes. Occur in edge habitats and associated with optimally fragmented habitat mosaic (Ratcliffe C.S and Crowe T.M.2001). The helmeted guinea fowl has a life span of about 15years and capable of producing large numbers of eggs with a clutch size of 7-20 eggs and breed twice over several conservative seasons.

The Helmeted Guineafowl has a remarkable ability to exploit landscapes transformed by humans and successfully copes and adapts well with edge habitat effect (Crowe 2000a).

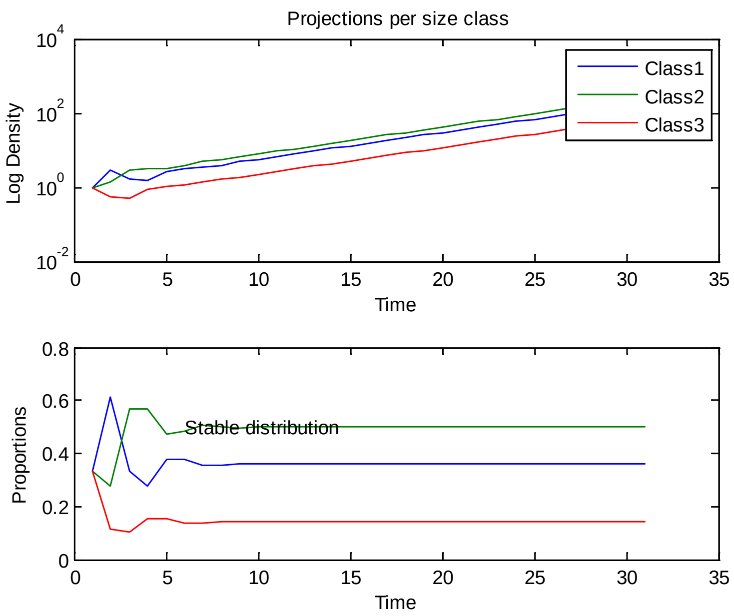


Figure 4. Projection Matrix

Using the matrix population model it is possible to observe the long-term behaviour of the populations over time as shown in the projections per stage class of populations of the two birds. After a few iterations the growth rate tends towards a constant value, traditionally denoted by λ_1, and the stage class distribution, i.e. the relative number of individuals in each stage class, becomes constant. This asymptotic behaviour of convergence to a stable distribution independently of the initial conditions is known as ergodicity and is an attribute of a stochastic population in a constant environment (Ulian 2005).

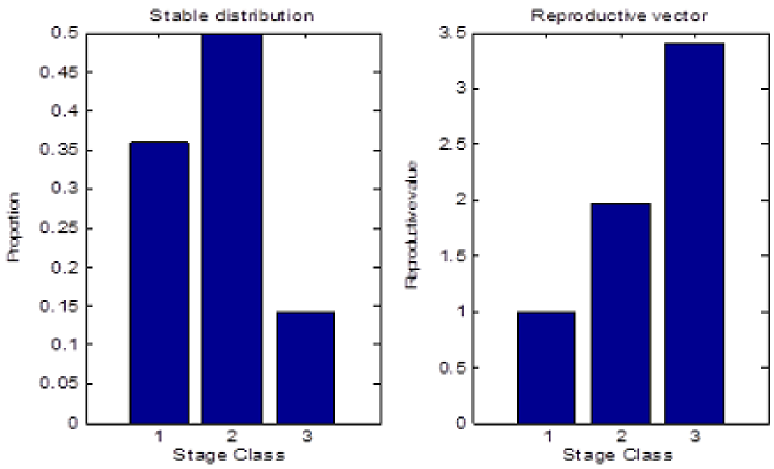
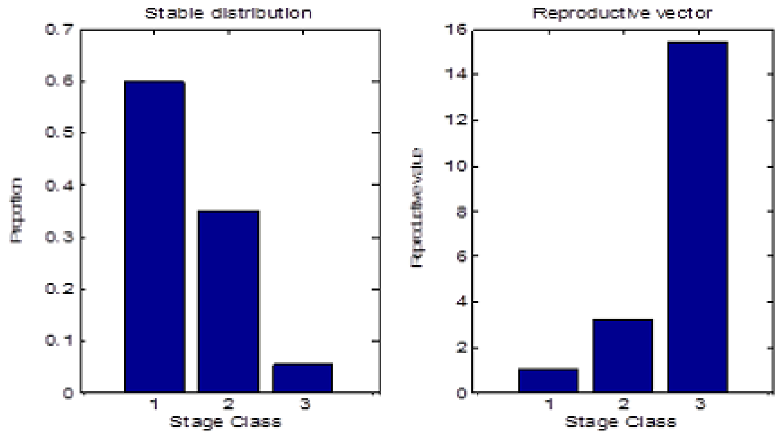


Figure 5. a & b (a) Normalised stage class distribution (w) and reproductive value distribution normalised for stage class 3 (v) for the population of the African Grey Parrot *P. e. timneh*.



(b) Normalised stage class distribution (w) and reproductive value distribution normalised for stage class 3 (v) for the population of Helmeted Guinea Fowl (*Numida meleagris*).

This means that survival of the adult stage class seems to contribute highly to reproduction in both populations.

Sensitivity and Elasticity

The demographic analysis also attempted to measure how sensitive the population growth rate λ_1 is to changes in a particular matrix element, while keeping all other entries of the matrix fixed at their present values. It can be shown that the sensitivity can be expressed in terms of the stable stage distribution and the reproductive value vectors for a matrix with 3 stages classes (Caswell, 2001). For both species, the population growth rate λ_1 tends to be more sensitive to small changes in the progression coefficients represented by the stage class juveniles (93% for parrot and 95% for the helmeted guinea fowl) than in the stage classes' eggs and Adults of the population.

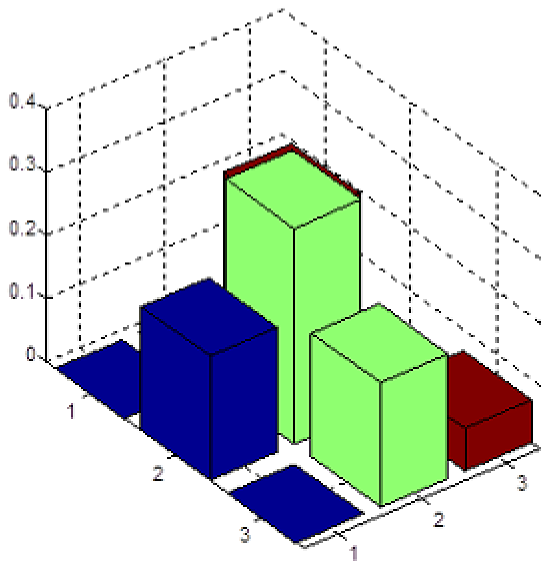
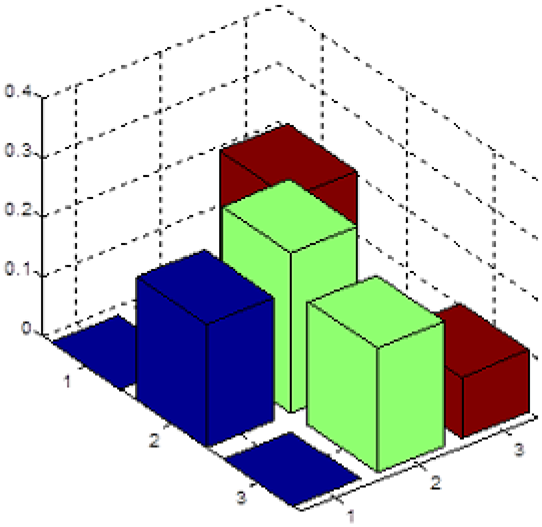


Figure 6 a & b. Sensitivity matrices of the two species. (a) Sensitivity to matrix displayed as a three dimensional graph for the population of Grey parrot.



(b) Sensitivity to matrix displayed as a three dimensional graph for the population of the helmeted guinea fowl.

Elasticities in both populations are very similar. The Elasticity of juveniles to contribute to growth rate 34% of the value of λ_1 in population of parrots than the survival of adults that would contribute only 6.7%. The contribution of juveniles (44%) and 3.2% of adults of the population of the helmeted guinea fowl is really similar.

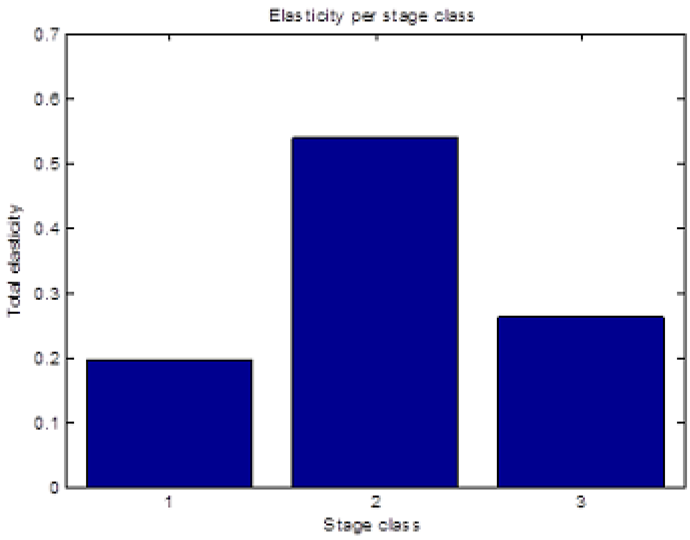
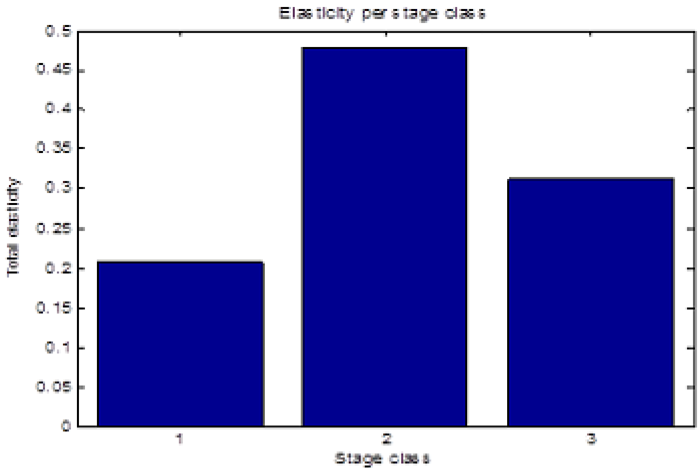


Figure 7. a & b. (a) Elasticities representing the per stage classes of the population of the grey parrot.



(b) Elasticities representing the per stage classes of the population of the helmeted guinea fowl.

Harvesting

When $\lambda_1 > 1$ can be suggested that some percentage of the two populations can be harvested without adverse affects on the populations' maintenance up to a harvest level at which the population reaches the equilibrium ($\lambda_1 = 1$) (Lefkovitch, 1967; Usher, 1969a,b, Caswell, 2001). In order to calculate how much harvesting each population can withstand, harvesting is simulated using mortality, by changing different proportions of the matrices and predicting both pessimistic and optimistic scenarios (Cheke 1992).

However, it is important that before any harvest is effected, the harvesting analysis should be able to specify exactly when harvesting occurs within the projection interval, i.e. with respect to the processes of survival, transition and reproduction. The approach adopted here corresponds to harvesting *after* reproduction, an efficient option that produces high yield.

Applying the post-reproduction harvesting model for the removal of an entire stage class alternately was simulated to study the different impacts on the population growth rate of each stage class. The results showed that two populations behaved differently when the above harvesting regimes were applied.

In order to observe to what extent each stage class can be harvested without affecting the populations' maintenance, an increasing percentage of harvesting was applied to each stage class and its effects on the population's growth rate was determined. The population growth rate λ_1 in response to different harvesting regimes for each stage class in the populations of grey parrot and the helmeted guinea fowl indicated that the rate of decline along the harvest gradient was faster for stage class Juveniles in both populations, attaining a maximum sustainable rate of harvest of 20% (Juveniles) for the population of parrots and 30% (Adults) for the population helmeted guinea fowl.
These sorts of harvesting strategies determine harvest levels that do not affect the equilibrium of the population.

Optimal Harvest

The optimal harvest presents a harvesting strategy from a commercial point of view and the one that produces the *maximum sustainable yield*. It is therefore the harvesting strategy that provides sustainability as well as maximises some measure of yield.
The *yield of the harvest* at each time is estimated as

$$\mathrm{Y} = \mathbf{y}^{\mathrm{T}}\mathbf{HAn}(t)$$

where $\mathbf{y}^{\mathrm{T}}$ is the transpose of a vector whose entries give the *yield* or economic value or revenue (either in money or biomass unit) of a harvested individual in each stage class. The yield Y of the harvest represents the value assigned to the entire harvest. An optimal harvesting policy is one that maximises the yield of the harvest.

The condition of sustainability of the harvest requires that the previous stage structure and population size be restored at the end of the cycle of reproduction and harvesting. This condition imposes a constraint on the total number of adult reproductive individuals in the equilibrium population.

The maximum sustainable yield problem has therefore been solved using an optimization routine of the computer software MATLAB. Once an optimal vector $\mathbf{w}$ is found, the entries of $\mathbf{H}$ were calculated by:

$$h_i = 1 - \frac{w_i}{\langle \mathbf{A}(i,:), \mathbf{w} \rangle}$$

where $\mathbf{A}(i,:)$ is the ith row of $\mathbf{A}$ and $\langle \cdot,\cdot \rangle$ denotes the inner product between two vectors.

To solve the maximum sustainable yield problem for populations of the grey parrot and helmeted guinea fowl, different economic values were given to the stage classes through the yield vector, different sustainable harvesting policies were found for both populations. Since the harvests of the juveniles of the grey parrot are preferable and adults of the helmeted guinea fowl considered being valuable by hunters, these were assumed to be of great value to the yield vector. Different optimal admissible harvesting policies were found for both populations, first by giving the same economic value to the Juvenile stage class with the yield vector ($\mathbf{y} = 0\ 2\ 1$) for the parrot , and then assigning different values to the egg and adult stage classes. The same was done for the Guinea fowl and the results obtained from the optimization give the largest fraction of the total population being harvested that maximise the yield while still maintaining sustainability. For Grey parrot, the more likely harvesting policy is the one considering higher economic values to juveniles, with the yield vector ($\mathbf{y} = 0\ 2\ 1$) expressing the economic value of Juveniles as double the adults. According to this policy, 38% of juveniles of the grey parrot should be harvested in order to produce the most valuable sustainable harvest, while in a population of the helmeted guinea fowl 65% of adults should be harvested to maximise the yield.

DISCUSSION

Hunting/capturing pressures are clearly associated with poverty a phenomenon that has posted challenges with regard to the usage of words such as hardship, misery and 'destitution poverty' conditions peculiar to people compelled to live in high cost environments in which livelihood options are nonexistent or of marginal utility .

In West Africa, the bird trade is incomparable to the overall bushmeat trade where gender dimension is highly pronounced. In the case of the bird trade, women participate only in marketing of bird carcases whereas men are involved in hunting, trapping and trafficking of live birds. The bulk of the live bird trade involves transporting large numbers of captured birds to centres where they fetch higher prices.

The markets or trading centres are highly decentralised with various structures and networks and offer important benefits in areas of few alternative livelihood options.
This section presents a brief discussion of the various categories of the trade and its impact on species pressurised by human activity.

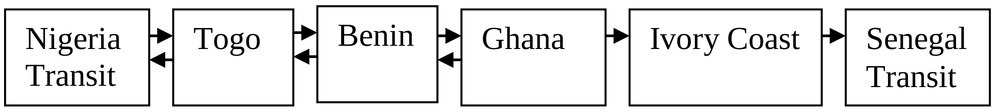
Trade in Cage Birds

The trade in cage birds was at its peak in the 1870s and continuing to date. The trade is now mostly illegal and involving almost every species that is marketable. Most finches *Lagonosticta spp*., the Yellow-fronted canary; *Serinus mozambicus*, the Rose ringed parakeet; *Psittacula krameri,* species of Doves *Streptopelia* spp, and *Turtur spp* , the African green pigeon *Treron calvus*, and Green turaco; *Tauraco persa* , are involved in the trade.

The Brown-necked *Poicephalus robustus*, Senegal *poicephalus senegalus*, and the Red tailed or grey Psittacus erithacus timneh, parrots are the most targeted in this part of the region.

The most recent assessment of the parrot trade (Clemmons, 2002, Dandliker 1992a,b; Fotos 1998a,b,; McGowan 2001) recommend annual export limits of 4,500 to Ghana and Ivory Coast, yet over 15,000 of red tailed or grey parrot (2003-2005) have been traded illegally across the borders of Nigeria, Ghana, Benin, Togo and Ivory Coast, up to Senegal. Nigeria and Senegal are now the principal export transits for the grey parrot to the USA and Europe due to the total trade ban on this species in Ghana and domestic demand and illegal export pressure on the species in Nigeria.

Illegal trade route of the bird trade (Parrots).



A total ban on the harvest and commercial export of *P. e. timneh* in Ghana was in force since 1986 and the main purpose of this ban was the intent to contain the illegal trade before the ban could be lifted. At present the ban is still in place but illegal trade continues with enormity across the middle and coastal belt, ranging from Ashanti, Western, Eastern and central regions of the country and evidence suggests the population is on the decline and habitat destruction has occurred at an unprecedented rate during the past two decades due to massive deforestation and with particular destruction of nest cavities needed by the species for breeding.

Land tenure has also played a major role in exposing and facilitated the exploitation of wild birds as free resource.

The high international demand for birds for aviculture and for pet husbanding is motivating the illegal harvesting and smuggling of parrots. Bans are unlikely to stop the rate of habitat destruction or stop the internal trade of some bird species (James 1991).

The magnitude of illegal smuggling indicates that the number of birds harvested or killed in the wild has more than tripled the estimated value of the bird trade (Inigo-Ellias and Ramos 1991, James 1991).

Senegal parrots *P. senegallus* being smuggled from Elubo (a border town in Ghana across to Ivory Coast.

The domestic capturing and trading in Ghana is now more prevalent in the Anomabu and Kakum areas close to Cape Coast. The main illegal trade market /centre is at the Achimota Forest. Over 40% mortality occurs along the trade chain from the collector to the importer owing to excessive stress as a result of transport weariness and appalling holding boxes, cages, unhygienic and inadequate feeding and confinement practices.

Bird Meat

In Africa, birds used to be killed and eaten as snacks in farms and around village communities by children using catapults, slings, nets and snares. Today, birds are hunted and killed by more sophisticated weapons including bolt action shot guns. The trade now forms a significant proportion of the wild animal trade in West Africa deriving substantial cash income and supporting the livelihoods of over a million people in the sub-region. Though bushmeat harvested in Ghana only amounts to 300,000 tones (Ntiamoah 1998), there is sufficient evidence to suggest a large protein gap in west Africa (Fa and Seymour 2005) and wild birds are not spared of their role in fulfilling the protein deficiency in the region. Birds' target of meat is indiscriminate of any species and ranging from small bodied birds to large birds such as herons and even vultures. As indicated in the results, the most preferred are Guinea fowl, Francolins, partridges etc. However, the contribution of birds is woefully under estimated and undetermined.


Carcases of the helmeted Guinea Fowl displayed for sale at a kebab restaurant in Bolgatanga, Ghana.

The analysis and representation of biomass as main indicator of prey density and weighted measure of the impact of exploitation on wildlife species is one factor that crucially undermined the magnitude of bird exploitation as bird carcasses are often calculated at equal proportions with the heavy and large bodied mammals and primates. For example, the weight of the Guineafowl is about 1.8kg (4lbs). Whereas the weight of an antelope as small as the grey duiker *Sylvicapra grimmia* is about 20 kg. A measure of 1,365 whole carcasses of identified birds, involving 37 bird species, weighed only 35,200kg. Despite the disproportionately high number of birds killed, the measure provided only one hundredth of the total biomass of species traded as bushmeat (Kassim 2003).

Magico-Religious Uses

Traditional medicine is by far the most significant socio-cultural form of use of birds and their products. Given that close to about 60% of the population in the West African region, have access to conventional heath services (FAO, 2004). The vast realm of orthodox medicine in West Africa provides some examples of the products of birds used in the treatment of critical conditions to various ailments in the region.

Several religions practiced in Africa today still retain the respect for other forms of life as basic tenets with the ideology of animism that all creatures and objects possess souls (Cocker, 2000). This trade alone engages close to 70,000 traditional religious and medicinal practitioners in the region and over 3,000 birds involving 44 species have been counted from 2003-2005.

Dried birds (owls, vultures, parrots, eagles and products from African pied hornbill, Green turaco and Palm-nut vultures) displayed in Bohicon fetish market in Benin.

Uses of Bird Products

Products of some birds believed to be highly intelligent are most used to improve the thinking, learning, and memory abilities of those seeking to enhance their learning educational prospects. In Nigeria, Togo and Benin for example, the *P.e. timneh* and the Yellow fronted Canary *Serinus mozambicus* popularly nicked named the 'brain birds' have their brains regularly extracted and commonly added to the colourful flowers, fruits and some concoctions to boost memory and enhance cognitive performance.

Products from Vultures are believed to have potent antioxidant properties. Free radicals occur naturally in the body, but environmental toxins (including food and drink poisons, cigarette smoking, and air pollution) can also increase the number of these damaging particles. Free radicals are believed to contribute to a number of health problems including heart disease and cancer as well as Alzheimer's disease and other forms of dementia. Antioxidants such as those found in the vulture's tongue and liver can neutralize free radicals and may reduce or even help to prevent some of the damage they cause.

Eyes of nocturnal bird species such as the owl may help halt degenerative eye disease and River blindness that tends to affect a wider age group including older adults.

The traditional practitioners believe eye balls from some nocturnal bird species such as the owl may help preserve vision in those affect by these diseases.

Demographic Analysis

Demographic analysis of age-structured populations typically rely on life history data for individuals, or when individual animals are not identified, on the information about the numbers of individuals in each stage or age class through time. While it is often difficult to determine the age class of a randomly encountered individual, it is often the case that the individual can be readily and reliable assigned to one of a set of age classes. For instance, it is often possible to distinguish juveniles from adults. For example, many birds and animals can be identified as juveniles based on physical characteristics such as plumage, coloration etc. (Link *et al*., 2003). Also, accessing demographic data of many animal species especially those of birds can prove difficult and in some cases unfeasible. In light of the above, the population's stage classes can be considered as sufficient for structured population models.

Model

Age-structured population models form the basis of many studies of animal populations, and are employed as a tool to facilitate the conservation and management of number of animal species of special interest, such as waterfowl (Johnson *et al*., 1997), and sea turtles (Crouse *et al*., 1987). These models are used to assess population growth rate, minimum viable population size, and the effects of harvest or human-induced impacts (Caswell, 2000).

In the light of development and competition for land use, conservationists are confronted with exploring ways to justify the conservation of resources by allowing some form of utilisation.

The use of the projection matrix models allows the characterization of the present life history of a species, and the possibility of examining eventual consequences should the conditions present at the time of the study remain unchanged (Caswell, 1986; de Kroon *et al.*, 1986). Thus, the populations of the grey parrot and the helmeted guinea fowl are bound to increase if the conditions at the present remain constant but in reality, temporal variability is an intrinsic property of natural environments, and significant annual variability may affect demographic parameters, and for some species even differences between matrices of different seasons may be significant (Nault and Gagnon, 1993).

Secondly, the model is assumed to be linear, which implies that there are no effects of density on population growth (Werner and Caswell, 1977). And solving the dependency on density of the growth rate may require a large amount of data (Ginzburg *et al*., 1990).

Despite the limiting assumptions on the model, the difficulty in attaining demographic information on bird species and financial limitations, the results obtained provided an insight into the demographic structure of the two species of birds (Grey parrot and helmeted Guinea fowl) under the most intense human exploitation.

Several useful demographic interpretations could be made directly from the study of the individual matrices. Like most animal species, the populations of two bird species seemed to have clearly shown the size dependent mortality attribute.

The large number of egg and the double broods (dual production) of the Guinea fowl may be a strategy for this species to cope with exploitation, habitat destruction and extreme conditions and narrow dimensions.

Since $\lambda_1 > 1$ in both populations, some percentage of the birds could be harvested in each population without adversely affecting their maintenance, as explained below.

Once the maximum sustainable levels of harvests were identified with the use of the model, an economic analysis of the range of harvest intensities between zero and the maximum sustainable yield was conducted, with the goal of identifying the range of possible harvest intensities that are both sustainable and economically viable (Boot and Gullison, 1995).

The harvesting policy has suggested the higher economic values for juveniles of the parrot and adults of the guinea fowl leaving eggs unharvested. According to this policy, 20% juvenile stage class of parrots could be harvested in population to ensure population viability and further up to 38% (at a price range of $7,000-$12,000 per bird) to optimise yield and for the trade in parrots to be economically viable. The guinea fowl could be harvested at 30% of adults), for biological sustainability of the species but a further up to 65% of the adults (at price range $50-$80 per bird) would be required in order to attain economic viability in the trade of the meat of the helmeted guinea fowl. It is unlikely that the helmeted guinea fowl could survive the 65% optimal harvest and should be harvested only for population viability.

A better insight on the impact of harvesting on the two species populations may be obtained by implementing a more complex model which considers the effect of a variable environment and density dependency on the populations. However, this model would require some years of experimental harvesting to obtain the necessary data.

BRIEF BIOLOGICAL HISTORY AND GEOGRAPHICAL RANGE OF *P.E.TIMNEH* AND THE *NUMIDA MELEAGRIS*.

THE AFRICAN GREY PARROT (*Psittacus erithacus timneh*)

COMMON NAME: African grey parrot

KINGDOM: Animalia

PHYLUM: Chordata

CLASS: Aves

ORDER: Psittaciformes

FAMILY: Psittacidae

GENUS SPECIES SUBSPECIES: Psittacus erithacus timneh

SIZE: Approximately 33 cm (13.2 in.)

WEIGHT: Approximately 400 g (14 oz.)

DIET: Includes fruit, seeds, buds, nectar, and pollen; occasionally insects or other meat will be eaten

INCUBATION: 28 days

CLUTCH SIZE: 2-4 eggs

FLEDGING DURATION: 12 weeks

SEXUAL MATURITY: 4-7 years

LIFE SPAN: To 50+ years

RANGE: West parts of the moist Upper Guinea forest and bordering savannas of West Africa from Guinea-Bissau, Sierra Leone and South of Mali to Cote d'Ivoire east to at least 70km east of the Bandama River.

IBA RANKING A3

HABITAT: Inhabits primary and secondary rain-forest, forest edges and clearings, gallery forest and mangroves; wooded savanna, cultivated land and even gardens are also frequented.

BREEDING REGIME: Records suggest as a rule it is a dry season breeder. Young fledglings reported for sale from March onwards in Ghana. Nest in tree-cavity *(e.g. Terminalia, Ceiba* or *Distemonathus).*

POPULATION: GLOBAL; Uncertain

STATUS: IUCN*;* least Common

BirdLife International: Least Common

CITES; Appendix II

USFWS; Not listed

Regional population: 100-259,000.

The red tailed grey parrot, the common name for the West African subspecies *P. e. timneh* is thought to be the most intelligent and the more preferred subspecies for keeping as pets of the two recognised subspecies of the African Grey Parrot.

There are two main races of the Grey Parrot *Psittacus erithacus,* separated by geographical range.

Psittacus erithacus timneh occurs in the West parts of the moist Upper Guinea forest and bordering savannas of West Africa from Guinea-Bissau, Sierra Leone and South of Mali to C'ote d'Ivoire east to at least 70km east of the Bandama River.

Map showing the geographical extent of *P. e. timneh*. The range of timneh extents from Ghana across Ivory Coast to Guinea Bissau.

Psittacus erithacus erithacus on the other hand occurs in Equatorial Africa from south-eastern Cote d'Ivoire to Western Kenya, North West of Tanzania, South Zaire and the North of Angola.

However, a third race *Psittacus erithacus princeps* is restricted to the islands of Principe and Bioko and doubtfully thought to be larger and darker than *Psittacus erithacus erithacus.* This race is no longer deemed valid (Jupiter and Parr 2003).

THE HELMETED GUINEAFOWL

COMMON NAME: Helmeted guinea fowl

KINGDOM: Animalia

PHYLUM: Chordata

CLASS: Aves

ORDER: Galliformes

FAMILY: Phasianidae

GENUS SPECIES: *Numida* (old Roman name for northwest Africa) *meleagris* (guinea-fowl)

SIZE: Approximately 42.5-47.5 cm (17-19 in) long

WEIGHT: Up to 1.8 kg (4 lbs)

DIET: Includes seeds, roots, tubers, grubs, rodents, small reptiles, and crawling insects; occasionally feeds on vegetation and fruits

INCUBATION: 26-28 days

CLUTCH SIZE: 7-20 eggs

FLEDGING DURATION: 10 weeks

SEXUAL MATURITY: Approximately 2 years

LIFE SPAN: Approximately 15 years

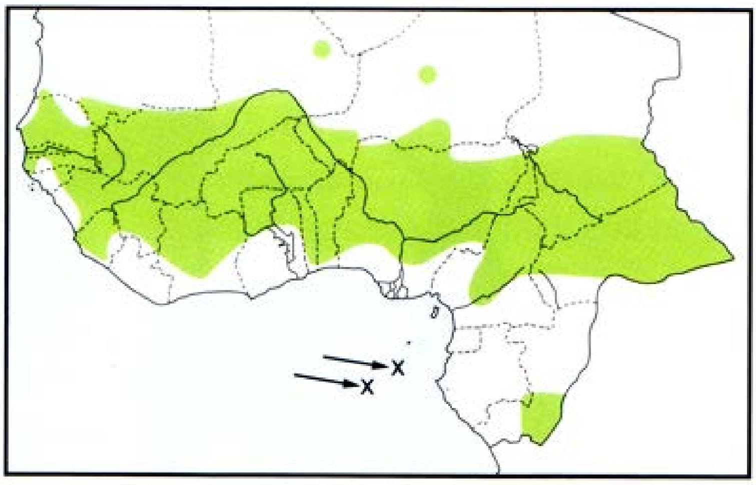
RANGE: South Mauritania –Cameroon South East Gabon-Congo. Introduced in Cape Verde, Sao Tome and Annobon.

HABITAT: Inhabits forest, brush, and grassland

POPULATION: GLOBAL; Unknown

STATUS: IUCN; Not listed
CITES; Not listed
USFWS; Not listed

There appear to be several races of the Helmented guineafowl in Africa; the West African subspecies *Numida meleagris galeatus*, (South Mauritania –Cameroon) *Numida meleagris meleagris* (South East Gabon-Congo) *Numida meleagris juv* (Cape Verde, Sao Tome and Annobon) and the South African *Numida meleagris coronata*.



Map of the geographical range of the helmeted guinea fowl.

The head and neck of the helmeted guinea fowl are bare, but there may be a wattle. The bill is short and stout; the body is stocky and black and dotted uniformly with white spots; and the wings are medium sized and rounded. The wattle on the male is much larger than on the female.

The helmeted guinea fowl is one of the most 'sluggard' birds capable of strong flight, but often chooses to run rather than fly. It typically roosts in trees. Pairs remain monogamous. This bird makes diurnal calls with a rasping, stuttering, grating "keerrrr". It lives in flocks of up to hundreds of birds, and forages on open ground.

Fossil evidence suggests that one member of the Ethiopian family of the Guineafowl (the Helmeted Guineafowl) was extinct outside Africa as early as the late Pleistocene and may have been reintroduced to Greece and Italy between the 4^{th} and 5^{th} centuries B.C. The ancient Romans domesticated guineafowl for food. These birds are still kept domestically and also hunted today (Fisher and Peterson, 1964). The hunting of the helmeted guineafowl with sophisticated weaponry such as the shot gun dates back to the 19^{th} century (Crowe 1978).

FRAMEWORK FOR MANAGEMENT INTERVENTION

The management model is intended to be piloted at two sties in Ghana:

1, Wechiau sanctuary area in the Guinea savanna woodland area of the north part of Ghana where the hunting and trading of birds including the helmeted guinea fowl is prevalent.

2. The Kakum forest community area, a tropical forest area where trapping of birds particularly the African Grey parrot is under intense pressure.

The framework is intended to provide communities in areas of high prevalence of hunting and trading activities a clear approach to managing bird populations, habitats and the trade as a whole.

The educational component would provide programmes not only awareness creation but basic understanding of the impact of human activities on bird populations and their habitats.

It has an overall intent to assist stakeholders and the youth in developing positive attitudes to wards the need to manage natural resources and the environment.

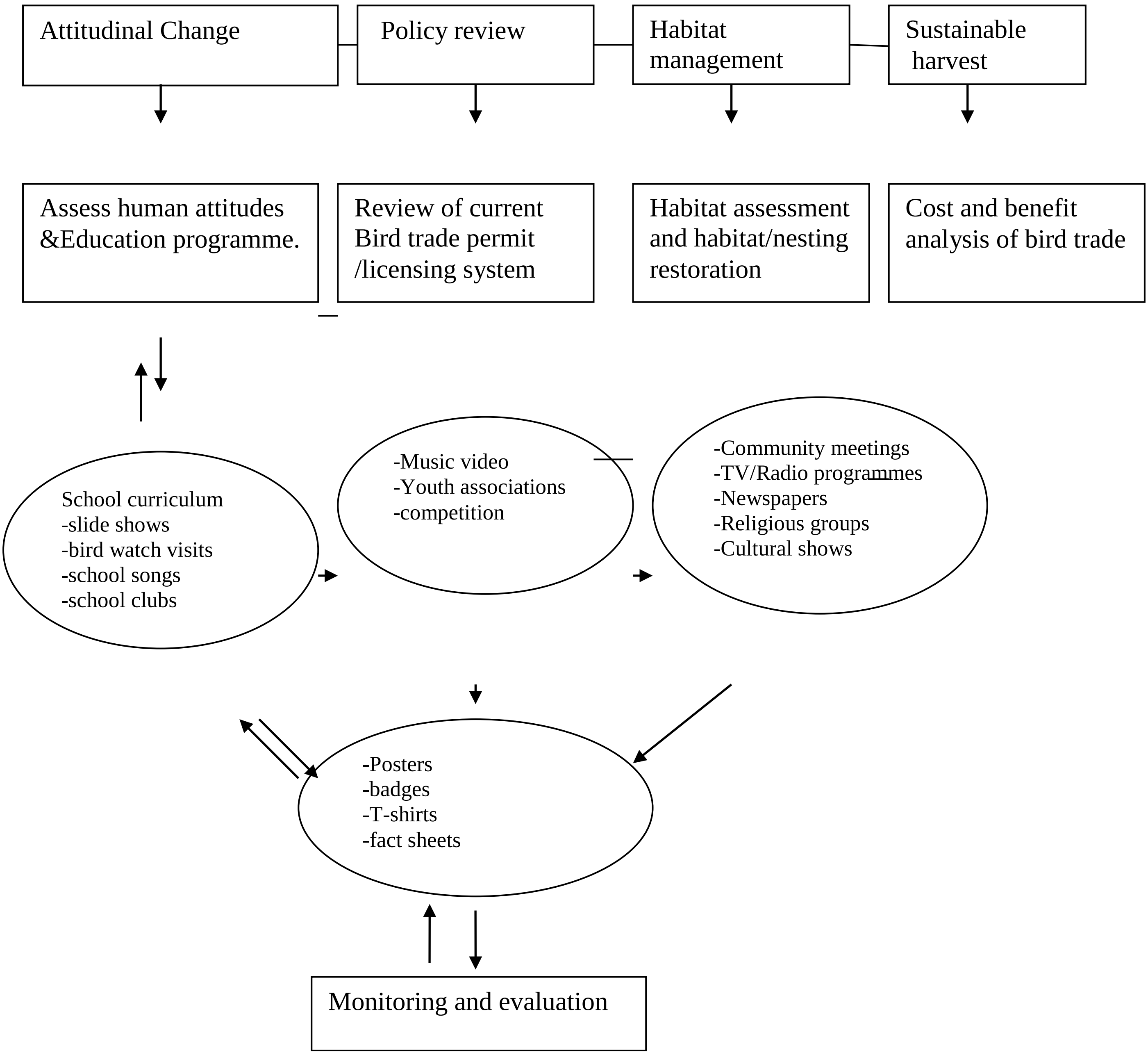


Figure 8. The dual square boxes present a schema of approaches to the management of birds in West Africa. The circles represent an education programme of activities tailored towards all age groups in the region

- Approaches to continually assess changes in stakeholder and public opinions and attitudes would always assist in adopting conservation strategies that would promote sustainable conservation.

- The importance of education in pivoting participation and changes sustainable conservation can only be demonstrated by an innovative campaign targeted at all age groups, organisations and through various media.

- Review of permit, licensing, quotas and bans on trade in bird species in the region and advocates for the consumer countries such as the USA, Asia and EU member states to introduce certification measures as a means to controlling illegal trade in birds.

- Habitat destruction is widespread in the region and harvesting strategies that aim at destroying entire bird nests and its support systems need a direct management approach. Continuous habitat assessment, habitat and nest restoration are essential in managing and maintaining the productive potential and regimes of birds.

- Harvesting models essential to guide harvesters of the appropriate harvesting levels and also help to highlight waste and ensure the cost and benefits of exploiting the various bird species. The model also requires that trappers, hunters, and traders invest to support the cost habitat of management, monitoring and educational programmes.

- Monitoring should incorporate assessments of recruitment rates to ensure that harvesting is directed at the appropriate age cohorts of the population, crude harvesting methods such as felling nest trees and with measures to manage trade of species if population declines are detected.

CONCLUSION:

This study has brought into focus the pressures that some bird species are being subjected to from both livelihoods, opportunistic or economic reasons. The study also highlights the magnitude of the illegal dimension of the bird trade and the apparent lack of appropriate management systems to sustain the trade and bird populations.

This study concluded based on demographic analysis that some species can be harvested for population viability purposes whereas others can be harvested for both biological and economic viability. It is hoped that the findings of this study will assist decision makers and all stakeholders in the bird utilisation and management activity to eradicate illegal practices and instate appropriate management interventions to ensure the sustainability of all bird species.

The following recommendations are made in the light of the findings of this research:

1. Permit and licensing systems in the sub-region require urgent review. It is important that licence and permit fees are cost effective and reflect the pricing of birds traded in both national and international markets.

2. This study also recommends a trade moratorium on the importation of birds like the certification system on timber and other forest products. This could help eliminate illegal laundering, poaching and overharvesting and would also open bird importation to internationally recognised trade groups and harvestings under scientifically approved models.

3. All stakeholders including hunters, trappers, traders and exporters be made to invest to support the cost of habitat/nesting management, population monitoring and education campaign programmes.

4. Framework for the management intervention should be piloted in the Wechiau and Kakum forest communities in Ghana and if possible replicated in two communities, one in each of Benin and Ivory Coast.

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