# STRATIFIED ANALYSIS OF THREATS PATTERN OF HOODED VULTURE (*Necrosytes monachus*) AND PALM-NUT VULTURE (*Gypohierax angiogensis*) IN SOUTH-WEST NIGERIA

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## ABSTRACT

*Vulture species are gradually disappearing due to the numerous threats they encountered and the management of these threats has become a major research direction in the conservation and management of vulture species. Monitoring of vulture species is essential as it helps in identifying the threats leading to vulture extinction and also to establish conservation priorities. In managing of Necrosytes monachus and Gypohierax angiogensis that manifest them in the southwest Nigeria, understanding the factors leading to the threats and the effect on the vulture species must be established. Globally, ornithologists are working in determining threats to vulture communities as a way to mitigate the effects and proffer strategies to avert extinction. In southwest Nigeria research show that the most important threats to vulture population are the socioeconomic and demographic variables, the habitat fragmentation, destruction and degradation of habitats through various anthropogenic practices, poaching and illegal sale of vulture species. To analysis and prioritize the threats we are dealing with, it is essential to elaborate sustainable patterns of habitat management. To do this, it is essential that we take an inventory of the main threats that vultures face in southwest Nigeria following the method used by WWF in order to stratify the main threats and to establish actions that can be locally applicable to conserve vulture species logically and efficiently.*

**Keywords:** threat, threat ranking, anthropogenic, extinction, habitat management, ornithologists.

## INTRODUCTION

Monitoring and taking inventory of organism population is a critical step in the management of biological diversity. This is necessary as a result of the sharp decline in the population of biodiversity on a global scale owing to different threats. Ogada, *et al.* (2012) estimated that 15-25% of all species may become extinct in response to human activity (anthropogenic), by the turn of the century. Most of the recent species' loss is directly related to habitat loss, environmental degradation, intense poaching activities and continuous growth of the local population (Haslett *et al.* 2010). Birds are sensitive indicators of biological richness and environmental trends and fulfill many key ecological functions, according to Birdlife International (2016). Major serious threats to biodiversity areas are said to be from government policies responsible for their management (Haslett *et al.* 2010).

Vultures are scavengers and provide essential ecosystem services for humanity and the environment, yet they are among the most

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threatened groups of birds worldwide (Ogada, *et al.* 2012), with 69% of Vulture species listed as threatened, near-threatened, or classed as Endangered or Critically Endangered (BirdLife International 2013). These associated threats have resulted into a serious population decline crisis that is currently being witnessed globally most especially in Africa (Murn *et al.* 2016, Ogada *et al.* 2016 and Owolabi *et al.* 2020).

The Hooded vulture *(Necrosyrtes monachus)* and Palm-nut vulture (*Gypohierax angolensis*) are old-world vultures in the order accipitriformes. Hooded vulture, an important species of conservation target is categorized as critically endangered while Palm-nut vulture is categorized as least concern. Both species are with populations significantly declining particularly in Africa, where poisoning and habitat degradation has been reported as the major threats leading to population decline (Ogada *et al.* 2012, Ogada *et al.* 2016).

These threats include but not limited to habitat destruction and fragmentation, climate change, threats natural hazards, reduction in functionality of biological interactions, overexploitation for rituals and herbal medicine, habitat disturbance, poaching, pollution, invasive species. These listed threats are said to represent a fraction representing the global threats that affects vulture species (Primack *et al,* 2008; Ioja *et al*, 2010; Baldwin, 2010).

Documenting and understanding the causes, effects and status of threats in vulture communities and the management strategies to be used in ameliorating the effects of threats on vulture species population is important and a tool in its conservation management.

Therefore, the aim of our study is to identify in stratified order the threats facing *Necrosyrtes monachus* and *Gypohierax angolensis* in southwest Nigeria and to develop a method that could help the local authorities in the management and prioritization of the threats for the species using WWF method (Threat Ranking).

## MATERIALS AND METHODS
### Study Area
The study was conducted in the south-western region of Nigeria. The region is the home to the Yoruba speaking tribe of Nigeria and it consists of six (6) states namely: Lagos, Ogun, Oyo, Osun, Ondo and Ekiti states. It is also known as the south west geographical zone of Nigeria. The area lies between longitude $2^{\circ}31^{'}$ and $6^{\circ}00^{'}$ East and Latitude $6^{\circ}21^{'}$ and $8^{\circ}37^{'}$ North with a total land area of 77,818 $km^2$ and a projected population of 28,767,752 in 2002 (NPC, 1991). The study area is bounded in the East by Edo and Delta states, in the North by Kwara and Kogi states, in the West by the Republic of Benin and in the south by the Gulf of Guinea (Figure 1). The climate of southwestern Nigeria is tropical in nature and it is characterized by wet and dry seasons, (May-September) and (October-April) respectively.

### Human Population of the Study Area.
According to Owolabi, *et al* (2020), the National Population Census of 2006 put the approximate population of southwest Nigeria at 27.7 million (Lagos has the highest population record of 9.2 million; followed by Oyo with 5.6 million; Ogun state recorded 4 million; Ondo state and Osun State had an estimated of 3.5 million while Ekiti had the lowest with approximate population staked at 2.4 million).
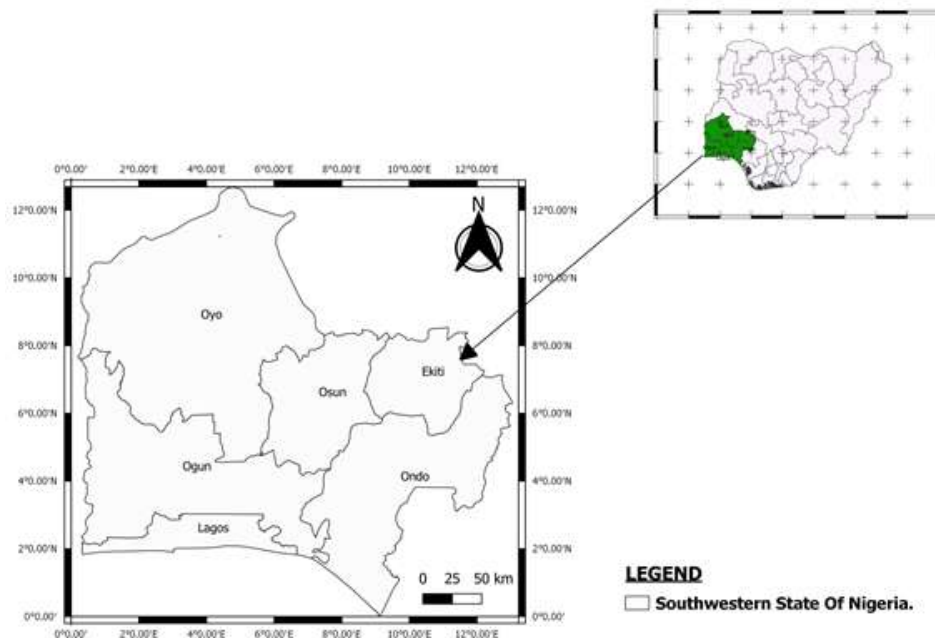
**Figure 1: Map of the study area, showing the Southwestern States of Nigeria.**
*Source:* Field work 2020.

**Method of data collection.**
The threat factors affecting the population of Hooded Vulture and Palm-nut Vulture in southwest Nigeria were identified using Oral interviews, focus group discussion (FGD) as described by Stafford *et al.* (2016) and direct field observation as described by Odewumi *et al.* (2016).

Oral interview and Focus group discussion: Identified and known threats that were mentioned when conducting oral interview and focus group discussion during the abundance and distribution survey were collated ranked in order of severity. A total of 200 (Two hundred) interviews and 64 focus group discussions were granted across southwest Nigeria on the various threat factors affecting Vulture species such as: human activities (which may include farming, hunting, trapping, egg collection, logging, charcoal making and hunters' camp) and attitude/behaviour (hostile or not hostile)

within the study areas. A conservation awareness poster featuring a colour picture of the Hooded Vulture and Palm-nut Vulture were shown to the respondents to ensure that interviewees could correctly identify the birds.

Direct Field Observation: A total of 96 trips were made across the 6 southwest Nigeria states between January 2017 - April 2020 (Fig 2). Direct filed observations were carried out both at the roosting and nesting sites of Hooded Vulture and Palm-nut Vulture by visiting the study area to document the various threats to: the habitat (farming, logging, hunters' camp, bush paths, bush fire and charcoal making regarded as indirect threat) and the bird (hunting- indirectly measured by presence of spent cartridges, trapping and egg collection) within a 50m radius of each breeding and roosting site. The threat factors were ranked in the order of their severity using the absolute ranking method by World Wildlife Fund (2007).
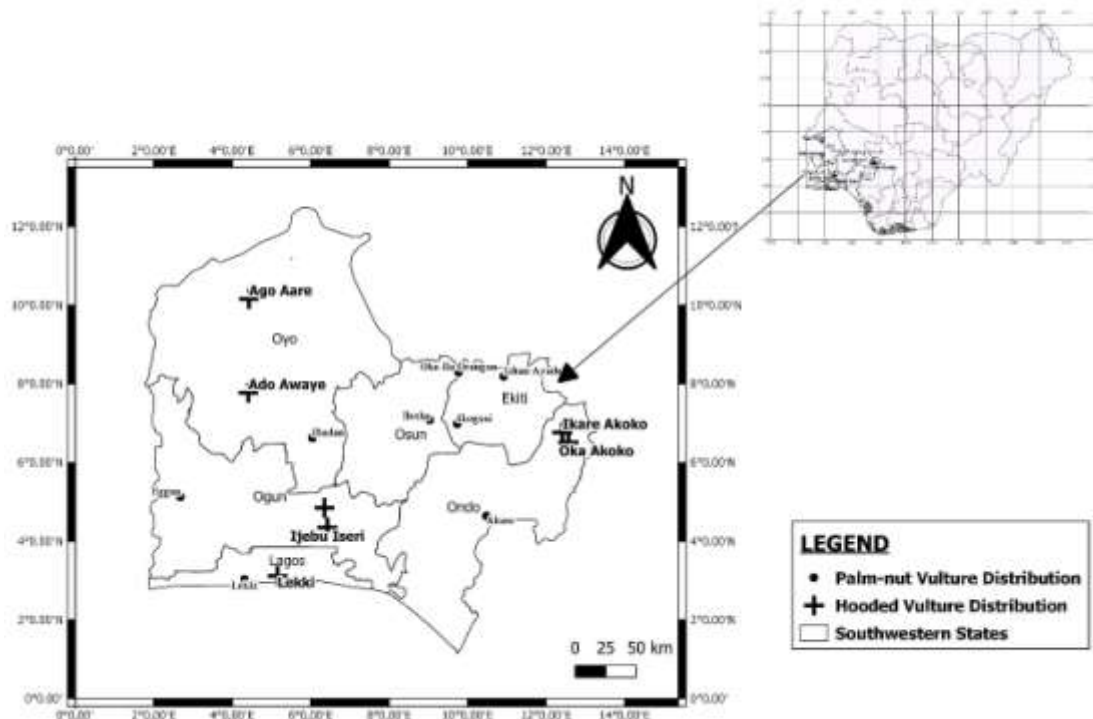
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**Figure 2:** Spatial Distribution and locations of both Hooded Vulture and Palm-nut Vulture in Southwest Nigeria.
Source: field work 2019.

**Threat ranking**

The method used for standards of project and programme management by WWF was adopted for this study to identify the degree to which each threat affects vulture's species in Southwest Nigeria. The methods adopted to do this evaluation are the absolute and relative method. The first step is to determine the criteria against which the threats at the site will be ranked taking the criteria of scope, severity, urgency and irreversibility. The criteria of scope and severity are used in both methods while urgency is used in the relative threat ranking and irreversibility in the absolute threat ranking WWF Project and Programme Standards (2007).

**Criteria used in evaluation**

There are some factors to consider in ranking threats. This includes:

i. the scope (Table 1) that refers to the area affected by the threat within 10 years under current circumstances,

ii. the severity (Table 2) dealing with the impact of the threats,

iii. the irreversibility (Table 3), which targets the recovery that may happen if possible, meaning that a given threat can be undone and the targets affected by the threat restored, if the threat is stopped and the urgency that shows the importance of taking immediate action to deal with a threat.

The most important criteria for rankings are scope and severity that together will give us the magnitude of the threat. For this reason, the recommendation given by WWF is to double weight the threats. The threats with the highest number will be considered the biggest threats in the site for the analyzed targets. We will have different scales depending on the model we use according to WWF 2007, (eg. 1-

11 for the Relative Threat Ranking System; 1-    4 for the Absolute Threat Ranking System).

**IUCN Threat Classification Scheme**

**Table 1: Scale classification for scope criteria**

| Scale | Classification | Definition |
|---|---|---|
| 4 | Very High | Threat is likely to affect the target across all or most (71-100%) of the population |
| 3 | High | Threat is likely to affect the target across much (31-70%) of the population |
| 2 | Medium | Threat is likely to affect the target across some (11-30%) of the population |
| 1 | Low | Threat is likely to affect the target across a small proportion (1-10%) of the population |

Source: Resources for Implementing the WWF Project & Programme Standards 2007

**Table 2: Scale classification for severity criteria**

| Scale | Classification | Definition |
|---|---|---|
| 4 | Very High | within the scope, the threat is likely to destroy, eliminate or reduce the population by 71-100% in the next 10 years |
| 3 | High | within the scope, the threat is likely to seriously reduce the population by 31-70% in the next 10 years |
| 2 | Medium | within the scope, the threat is likely to moderately reduce the population by 11-30% in the next 10 years |
| 1 | Low | within the scope, the threat is likely to slightly reduce the population by 1 10% in the next 10 years |

Source: Resources for Implementing the WWF Project & Programme Standards

**Table 3: Scale classification for irreversibility criteria**

| Scale | Classification | Definition |
|---|---|---|
| 4 | Very High | the effects of the threat cannot be reversed, it's unlikely the target can be restored and will take more than 100 years to do it |
| 3 | High | the effects of the threat can be reversed and the target restored within 21-100 years |
| 2 | Medium | the effects of the threat can be reversed and the target restored within 6-100 years |
| 1 | Low | the effects of the threat are easily reversible and the target restored within 0-5 years |

Source: Resources for Implementing the WWF Project and Programme Standards

**RESULT**
**Absolute Threat Ranking System**
The ATRS system of ranking threats compares all the direct threats target-by-target as proposed by WWF Project and Programme Standards (2007) and it considers the criteria of scope, severity and irreversibility.

**Relative Threat Ranking System**
Under RTRS, threats were splits into 4 categories considering all types of threat given by IUCN 2012 and their aggressiveness, from very high to low threats.

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**Table 4: Vulture's threat using the absolute threat ranking method with three criteria (scope, severity, and irreversibility) in evaluating threats across two vulture species with a 4-point scale in south-west, Nigeria**

| Threat factors | Target: Hooded Vulture (*Necrosytes monachus*) | | | | | Target: Palm-nut Vulture (*Gypohierax angiogensis*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Scope | Severity | Irreversibility | Total | Classification | Scope | Severity | Irreversibility | Total | Classification |
| Intentional poisoning | 3 | 4 | 1 | 15 | Very High | 2 | 2 | 1 | 9 | High |
| Unintentional poisoning | 3 | 3 | 1 | 13 | High | - | - | - | - | - |
| Traditional Medicine | 3 | 3 | 1 | 13 | High | 1 | 1 | 1 | 5 | Low |
| Source of income | 3 | 2 | 1 | 11 | Medium | 1 | 1 | 2 | 6 | Medium |
| Egg Collection | 4 | 2 | 1 | 13 | High | - | - | - | - | - |
| Source of protein | 1 | 3 | 1 | 9 | Low | 2 | 2 | 1 | 9 | High |
| Cultural Believes | 3 | 3 | 2 | 14 | High | - | - | - | - | - |
| Deforestation in roosting site | 3 | 4 | 3 | 17 | Very High | 3 | 2 | 2 | 12 | Very High |
| Lack of carrions as food | 1 | 2 | 1 | 7 | Low | 1 | 1 | 1 | 5 | Low |
| Climate Change | 3 | 3 | 3 | 15 | Very High | 2 | 2 | 1 | 9 | High |
| Modern way of Disposing Carcass | 2 | 3 | 1 | 11 | Medium | - | - | - | - | - |

Note: Total = 2 X (scope + severity) + Irreversibility
Source: Processed after the IUCN Red List of Threatened Species 2012.

**Table 5: Vulture's threat using the relative threat ranking method with three criteria (scope, severity, and Urgency) in evaluating threats across the study area with a scale of 1-11 in southwest, Nigeria**

| Direct threats | Scope | Severity | Urgency | Total | % | Classification |
|---|---|---|---|---|---|---|
| Residential & commercial development | 5 | 8 | 7 | 20 | 10 | High |
| Agriculture & aquaculture | 7 | 4 | 6 | 17 | 9 | High |
| Industrial activities | 8 | 7 | 3 | 18 | 9 | High |
| Transport & service corridors | 2 | 3 | 5 | 10 | 5 | Medium |
| Biological resource use | 9 | 11 | 11 | 31 | 16 | Very High |
| Human intrusion & disturbance | 11 | 9 | 10 | 30 | 15 | Very High |
| Natural system modifications | 10 | 10 | 9 | 29 | 15 | Very High |
| Invasive species | 1 | 2 | 2 | 5 | 2 | Low |
| Pollution | 6 | 6 | 8 | 20 | 10 | High |
| Geological events | 3 | 1 | 4 | 8 | 4 | Low |
| Low Climate change & severe weather | 4 | 5 | 1 | 10 | 5 | Medium |
| **Total** | 66 | 66 | 66 | | | |

## DISCUSSION
### Absolute Threat Ranking System
For this study, seven direct threats were chosen to represent the small scale of analysis and the local applicable threats. A 4-pointer scale is used in rating each threat with a more detailed and focused analysis on the two species of vulture (*Necrosytes monachus* and *Gypohierax angiogensis*) in southwest Nigeria. This will give us a clear view of the measures we will have to take in conserving the habitat and vulture species in the study area.

For *Necrosytes monachus,* the main threats are deforestation in roosting site, climate change and intentional poisoning. The threat through poisoning, habitat destruction through deforestation in southwestern Nigeria is similar to the global persecution reported by Bird- Life International (2014) and Ogada *et al.* (2012a).

### Relative Threat Ranking System
The most aggressive threats for the whole southwest Nigeria are the biological resource use, human intrusion and disturbance and natural system modifications. Biological resource use here are represented by exploitation of various living organism that is associated with the population explosion of vulture species such as vegetations, body of water, predators that will kill and make carrions for vultures to feeds. Human intrusion, disturbance and natural system modifications, also are important serious threats that requires urgency and attention.

Considering the ecological zone of the study area being a rain forest zone, where farming and poaching are prevailing. Natural resources such as vegetation and wetland used as habitats are being converted for residential and commercial development, agriculture and aquaculture and industrial activities agricultural land and other construction works such as built-up areas. This to a large extent has adversely affected vulture species population in the study area, and if not controlled, vulture species may become extinct in southwest Nigeria.

The medium classification includes: transportation and service corridors and low climate change and severe weather. They do not represent an urgent problem at the level of the entire southwest Nigeria except in some communities. Without a long-term

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management strategy, they could easily pass into a higher threat category. Invasive species and geological events can be considered one of the main causes of biodiversity loss due to their role in competition and hybridization (Goudie, 2006).

## Hooded vulture severity ranking

Hooded Vulture population is the most affected out of the two studied species in Southwestern Nigeria. Eleven (11) threat factors were recorded during the study, they are: deforestation in roosting site, intentional poisoning, climate change, cultural believes, unintentional poisoning, traditional medicine, egg collection, source of income, modern way of disposing carcass, source of protein (as confirmed during the study), lack of carrions as food.

Deforestation was ranked highest threat facing Hooded Vulture with 17 threat evaluation points, having a scale of 3,4 and 3 in Scope, Severity, and Irreversibility. Followed by Intentional poisoning and Climate change with 15 point each ranking the second highest threat. Intentional poisoning having a scale of Scope 3, Severity 4, and Irreversibility 1 while Climate change had 3 for Scope, Severity and Irreversibility.

Cultural Believe ranked third with 14 points, Scope had a scale of 3, Severity had 3, and Irreversibility 2. Unintentional poisoning, Egg collection and Traditional Medicine had 13 points each ranking fourth. Unintentional poisoning and Egg collection had a scale of 3 for Scope and Severity while Irreversibility had 1 each while, Egg collection had a scale of 4, 2 and 1 for Scope, Severity, and Irreversibility. Fifth in the threat ranking is Source of income and Modern way of Disposing Carcass with 11 points having a scale of 3,2, 1 and 2,3,1 respectively for Scope, Severity and Irreversibility. Source of Protein clicked sixth with 9 points in the threat ranking with a scale of 1,3,1 for Scope, Severity and Irreversibility. Lack of carrions as food was the least ranked threat of Hooded

Vulture with 7 points having a recorded scale of 2 for Scope, Severity 3 and Irreversibility 1(Table 4).

## Palm-nut vulture severity ranking.

Palm-nut vulture has less threat unlike what was recorded for Hooded Vulture. Palm-nut Vulture had 7 (seven) identified threats during the study. They are, deforestation in roosting site, climate change, source of protein, intentional poisoning, source of income traditional medicine and lack of carrions as food.

Deforestation in roosting site was the highest ranked threats facing Palm-nut Vulture in the study area with 12 points having a scope, severity and irreversibility scales of 3, 2, 2 respectively. Climate Change, Source of protein and Intentional poisoning, all clicked number 2 (Two) on the threat list with scope, severity and irreversibility scales of 2,2,1 respectively. Source of income was the third ranked threat with 6 points having a scale of 1,1 and 2 for scope, severity and irreversibility. Lack of carrions as food and Traditional Medicine, had a scale of 1 for scope, 1 for severity and 1 for irreversibility respectively as the least ranked threats in the study area with 5 points (Table 4).

## CONCLUSION AND RECOMMENDATIONS

Management measures for the conservation of vulture species without ranking of threat is an effort in futility as threat ranking is considered an important tool in the conservation and management of biodiversity. Threat ranking in vulture species communities helps the management in prioritizing conservation actions in areas in need of urgent attention to prevent extinction of vulture species. From the threat ranking values obtained from the study through the relative threats ranking system (RTRS) and absolute threat ranking system (ATRS) using the IUCN categories of threats, it was discovered that:

i.    Vulture species threats across the entire southwest Nigeria resulted from the Relative Threat Ranking System are:

Residential & commercial development, agriculture & aquaculture, industrial activities, biological resource use, human intrusion & disturbance, natural system modifications and pollution;

ii. The local threats resulted from the Absolute Threat Ranking System for *Necrosytes monachus* in southwest Nigeria are: Intentional and unintentional poisoning, traditional medicine, deforestation in roosting site and source of income, egg collection, climate change, source of protein for human and cultural believes;

iii. The local threats resulted from the Absolute Threat Ranking System for *Gypohierax angiogenesis* in southwest Nigeria are: Intentional and unintentional poisoning, deforestation in roosting site and climate change;

iv. The main activities that require immediate actions to reduce the effects on vulture species and their habitats in southwest Nigeria are: Residential & commercial development, biological resource use, human intrusion & disturbance, natural system modifications and pollution.

Comparatively, Absolute Threat Ranking System (ATRS) is more realistic than the Relative Threats Ranking System (RTRS), the opportunity for direct field observation gives room for the establishment of logical and effective actions that can be applied locally. The only limitation is that different people might use different criteria or apply them differently so in the end we can obtain different results. In order to use the right method for a particular site, we must be aware of the benefits and limitations of each method.

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