

**BEHAVIOR OF CAPTIVE PAIRS OF VISAYAN WRITHED HORNBILL
(*Aceros waldeni*) DURING POST FLEDGING PERIOD IN REACTION TO
HUMAN PRESENCE**

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SCIENCE RESEARCH 2

by

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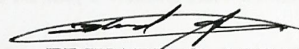
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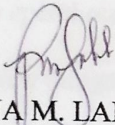
“Behavior of Captive Pairs of Visayan Writhed Hornbill (*Aceros waldeni*) during Post Fledging Period in Reaction to Human Presence”

Prepared and submitted by Almarie Joyce L. Divinagracia in partial fulfillment of the requirements in Science Research 2, has been approved and is recommended for acceptance and approval.

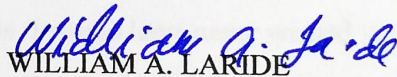


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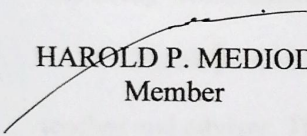
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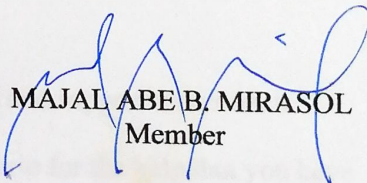
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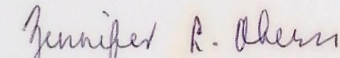
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ABSTRACT

The Visayan Writhed Hornbill *Aceros waldeni*, is the largest hornbill in the Visayas measuring for up to 79cm. It is at present critically endangered in its habitat in the forest of Panay and Negros islands. There is a prediction that nest defense among parent birds increases as nestling age increases (Trivers 1972, Barash 1975). Andersson (1980), Harvey and Greenwood (1978) hypothesized that nest defense intensity should increase with nestling age due to decreasing differences between expected future survival of parents and offspring and due to increases conspicuousness to predators of nestlings during the nestling period. The bird keeper and the stranger was exposed to the hornbills at 10, 5 and 0.5 meters from the enclosure while the researcher, who was situated in an observation post not visible to the birds, recorded the number of no active movements, hops and jumps from perch to perch for 3 minutes each distance. The results displayed that the sex of the Visayan Writhed Hornbill is dependent on the behavior it displays when exposed to either the bird keeper or the stranger. The type of behavior it displays is dependent on the distance of the keeper from the enclosure.

Background of the study

General description

The Visayan Writhed Hornbill

Previous studies on the Visayan Writhed Hornbill

Technical studies on other birds

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Chapter I

Introduction

A. Background of the study

Hornbills usually have large heads, thin necks, broad wings and long tail feathers. Their color is basically black or dark brown and most of them have markings of white and other colors. Because of its raucous call, striking features and jaunty disposition, hornbills are considered to be one of rainforest's most distinctive residences. They are critical to dispersal of seeds because they eat the entire fruit and fly long distances, dispersing the seeds widely (<http://animal.discovery.com> March 2007).

Hornbills are also known to eat other kinds of food like insects, lizards, small birds and small mammals (<http://animal.discovery.com> March 2007). They are omnivores but they eat mostly fruits. However, male hornbills prey on animals such as bats, reptiles, frogs, crabs and insects to brooding female and developing chicks (www.Oaklandzoo.org March 2007)

During mating season, male hornbills reportedly use their casqued bills for head-on collisions in mid-air. A month or more before mating, the male hornbill begins courting the female by bringing her food. When ready to lay her eggs, the female will enter a nest hole high in a hollow part of a tree. The pair will spend two or three days plastering up the hole with the female's clay-like droppings- she is on the inside, he is on the outside- using the sides of their bills as trowels. The female will remain enclosed for at least three months as the male delivers food to her and then to the chicks through a small finger hole. She will go through

a complete molt of her flight feathers while ensconced in the nest; once the nestlings have gotten their first feathers, she will break out of the chamber and join her mate in provisioning food for their young. Hornbills appear to pair for life, banding together to defend a territory against other members of their species. This helps to ensure adequate food supply as well as nesting sites (<http://animal.discovery.com> March 2007)

In order to successfully complete the steps in avian breeding cycle, parents may have to protect their nest from any predator or any approaching threat (Donnelly, 1998). Each parent has an over-all productive investment which involves not only gametes, but also raising, feeding and defending against threat (Trivers, 1972). At this point, the male is identified to be the one that would contribute more because the female is inside the nest box at this stage of the breeding cycle (<http://Oaklandzoo.org> March 2007). Most research to date focused on the intensity of nest defense to test the prediction that it should increase through the nesting cycle. (Montgomerie 1988). Experimental work such as that of Nice and Ter Pelkwyk (1941) emphasized the study of hand reared birds and their conditioned responses to both live and model creatures (Singlin and Weller 1963).

The Visayan Writhed Hornbill (*Aceros waldeni*), is of the order *Bucerotiformes*, family *Bucerotidae*, genus *Aceros* and species *waldeni*. It is the biggest hornbill in the Visayas, measuring up to more or less than 79 centimeters (Fisher; Hicks). It is at present, critically endangered in its habitat in the forest of Panay and Negros Island. Captive- held birds are presently found at Mari-it

Conservation Park in Lambunao, Iloilo province; Pandan, Antique and NFEFI at Bacolod City, Negros Occidental, being reared for species recovery programs of the Department of Environment and Natural Resources (DENR) in partnership with various organizations both local and international.

Most studies about birds have focused on proximate factors underlying defensive behavior (Erwin 1979). The defense behavior of the Visayan Writhed Hornbill is rarely studied in the wild due to their small numbers. Accredited reports of hunters tended to show that this species vocalize most often during the nesting season and become cryptic and quiet following the fledging of the chick (Lastimoza personal comm. December 2007). This behavior could be a protective defense behavior for the newly fledged chick which is still dependent on its parents for food and could neither fly greater tree heights nor long distances in case of threats. Because post fledging defense behavior of this species is studied, this research had focused on the behavior exhibited by the bird in the presence of its keeper and complete stranger at certain distances (Andersen 1990).

B. Statement of the problem

What is the relationship between the types of behavior exhibited by the male and female Visayan Writhed Hornbill and the presence of the bird keeper and a complete stranger at different distances during the immediate post fledging period?

C. Objectives

General Objective

To determine the relationship between the types of behavior exhibited by the male and female Visayan Writhed Hornbill and the presence of the bird keeper and a complete stranger at different distances during the immediate post fledging period.

Specific Objectives

To determine the relationship between the sex and the types of behavior exhibited in response to human presence of the Visayan Writhed Hornbill

To determine the relationship between the sex and the type of behavior exhibited of the hornbills when exposed to a stranger

To determine the relationship between the sex and the type of behavior exhibited of the hornbills when exposed to the bird keeper

To determine the relationship between the type of behavior by hornbills exhibited and the different human stimuli

To determine the relationship between the type of behavior exhibited by hornbills when exposed to a stranger at distances of 10 meters, 5 meters and 0.5 meters from the aviary

To determine the relationship between the type of behavior exhibited by hornbills when exposed to the bird keeper at distances of 10 meters, 5 meters and 0.5 meters from the aviary

D. Hypothesis

H₀: There is no relationship between the sex and the type of behavior of the Visayan Writhed Hornbill.

H₀: There is no relationship between the sex and the type of behavior of the hornbills when exposed to a stranger.

H₀: There is no relationship between the sex and the type of behavior of the hornbills when exposed to the bird keeper.

H₀: There is no relationship between the type of behavior exhibited by hornbills and the different human stimuli.

H₀: There is no relationship between the type of behavior exhibited by hornbills and the distances of 10 meters, 5 meters and 0.5 meters of the stranger from the aviary.

H₀: There is no relationship between the type of behavior exhibited by hornbills and the distances of 10 meters, 5 meters and 0.5 meters of the bird keeper from the aviary.

E. Scope and Delimitation

The study was conducted at Mari-it Conservation Park in West Visayas State University College of Agriculture and Forestry, Barangay Jayubo, Inca, Lambunao, Iloilo. The experimental birds were two pairs of breeding Panay Writhed Hornbill. The existing pairs were in their respective aviary compartments with visual barriers and aviary compartment housing a different species (*Priniturus whiteheadi*) in order to minimize physical and visual contact among the birds. Preliminary observation started a day after the chick fledged and shall

last for 2 days from April 24 to 25, 2007, in order to record behavior patterns. Observation started from 4:00 in the morning until 6:00 in the afternoon. Actual observations shall immediately follow from April 26 to May 20, 2007 at 9:00A.M. for the morning observation and at 4:00P.M. for the afternoon observation.

Behaviors that were recorded will only be limited to the number of hops in one place, number of jumps from perch to perch and no activity.

F. Significance

The study will benefit: conservationists- they will have more understanding of this species' behavior- how mobile it becomes when exposed to its keeper or a stranger at different distances. Such observations shall be beneficial in the enhancement of breeding management of the Visayan Writhed Hornbill in captivity and protection management in the wild; keeper- to inform them how active the birds are in terms of moving around the enclosure so that they can make necessary precautions in their close interactions with the birds during the breeding season; researchers- this study will serve as basis of the behavioral studies of *Aceros waldeni* as they conduct further research about it; other people- to make them realize the difference in the behavior in terms of its behavior in terms of its mobility when exposed to its keeper or a stranger and the significant effects of the variation in distances, so that they can behave appropriately when visiting ecotourism sites and zoos or captive breeding centers.

G. Definition of Terms

- Casque- a projection on top of the bill of a hornbill
 - Fledge- to become capable of flight and leave the nest for the first time
(refers to the offspring)
 - Perch- (noun) pole, branch or wire used as a roost by birds
 - Hop- jumping on only one perch(noun)
 - Stranger- in this study, it is referred to as the person whom the birds have never seen before
- Breeding season- the period of time when the male and female mates and produces young
- Courtship-feeding behavior- the breeding behavior exhibited by the male to attract the female
 - Emergence and post fledging period- the last stage of the breeding season where the female breaks out of the nest and the chick soon follows but still remains dependent upon its parents for food
 - Immediate post fledging period- this is the 35-day period following the fledging or emerging of the female and the chick from the nest box.
During this period, the chick is still dependent on its parents for food; additional flight feathers are developing and molting and growing of new feathers for sexual dichotomy
 - No active movement – no movement is exhibited during the 3 minute observation

CHAPTER II

Review of Related Literature

I. Background of the study

A. General description

Hornbills are of the order *Bucerotiformes*, and genus *Bucerotidae*. They are big birds with a massive “double-story” bill consisting of a long, deep beak with a projection on top (known as casque). Most of the members of this family have large heads, thin necks, broad wings and long tail feathers. All of them are basically blackish or dark brown in color, and most have markings of white and other colors. With its raucous call (the casque on its beak amplifies its voice), striking features and jaunty disposition, the hornbill is one of the rainforest’s most distinctive residents. They are critical to the dispersal of figs because they eat the entire fruit, including the seed, and then fly long distances, dispersing the seed widely (<http://animal.discovery.com> March 2007)

Although they are partial to figs, hornbills are known to eat other kinds of fruit as well as insects, lizards, small birds and even small mammals (<http://animal.discovery.com> March 2007). They are omnivorous but eats mostly fruits. However, male feeds animal prey such as bats, reptiles, frogs, crabs, and insects to brooding female and developing chicks and browses from tree tops to the forest floor and even in water ([www. Oaklandzoo.org](http://www.Oaklandzoo.org) March 2007).

During mating season, male hornbills reportedly used their casqued bills for spectacular head- on collisions in mid- air. A month or more before mating, the male begins to court the female by bringing her food. When ready to lay eggs, the female will enter a nest hole high in a hollow tree, the pair will then spend two or three days

plastering up the hole with the female's clay- like droppings as she is on the inside while the male is on the outside while using their bills as trowels. The female will remain enclosed for about three months as the male delivers her food and then to the chicks through a small (finger- sized) hole. The female will go through a complete molt of her flight feathers while ensconced in the nest; once the nestlings have gotten their first feathers, the female will break out of the chamber and join her mate in provisioning food for their young. Hornbills don't change their mates until they die, banding together to defend a territory against other members of their own species. This helps to ensure adequate food supply and as well as nesting sites (<http://animal.discovery.com> March 2007).

During the emergence and post fledging period, the female breaks out of the nest first and the chick soon follows, although the female appears to be a little stiff and the chick is never as agile as its parents. The chick now appears almost as large as its parents, but its bill is noticeably smaller, it lacks any form of casque and the wing and tail feathers are shorter since their growth is not quite complete. The chick remains in the vicinity of the nest for a few days after emergence, secreting itself amongst dense cover but neither it nor the female re-enters the nest- cavity until the following breeding season. The chick continues to be fed by its parents and to develop its flying skills. Juveniles may remain with their parents for months or even years (Kemp 1995).

B. The Visayan Writhed Hornbill (*Aceros waldeni*)

The Visayan Writhed Hornbill is of the order *Bucerotiformes*, family *Bucerotidae*, genus *Aceros* and species *waldeni*. It is the biggest hornbill in the Visayas, measuring up to more or less 79 centimeters (Fisher; Hicks). It is at present, critically endangered and could be found at Mari-it Conservation Park in Lambunao, Iloilo; Pandan, Antique NFEFI in Bacolod City, Negros Occidental.

C. Previous studies on *Aceros waldeni*

The maturation of multiple sexual ornaments of the Panay Writhed Hornbill and the Visayan Tarictic Hornbill (*Penelopides panini panini*), except for the hood on the hind neck, from nestling stage through five years for the Panay Writhed Hornbill and from fledgling stage through 3+ years for the Visayan Tarictic Hornbill. Only the Panay Writhed Hornbill passes through a male-like plumage in the nestling/fledging stage, the Visayan Tarictic Hornbill juveniles attain their sexually dimorphic appearance right away. The Panay Writhed Hornbill chick exhibit color dimorphism of the eye (iris) color irrespective of sex, in which the two phases pass through two stages, but in reverse order. At least a part of the ornaments can be interpreted as honest indicators of condition (Curio 2004).

II. Behavioral studies on other birds

There is a prediction that nest defense among parent birds increases as nestling age increases (Trivers 1972, Barash 1975). Andersson (1980), Harvey and Greenwood (1978) hypothesized that nest defense intensity should increase with nestling age due to decreasing differences between expected future survival of parents and offspring and due to increases conspicuousness to predators of nestlings during the nestling period. Andersen observed the behavior of the birds for ten (10) minutes and estimated the closest distance that each adult approached. He approached at least 500 meters away and then recorded the distance from which each adult had approached. After he recorded the behavior of the adults while he was at the base of the tree, he climbed to the nest and recorded the number of calls and dives at the closest distance for five (5) minutes. To minimize the influence of weather, he only conducted the observations when the wind speeds were < 20 kph (kilometers per hour) and there were no precipitation. Red-tailed hawks aggressively defended their nests in response to a human at the base of the nest tree and at the nest (Andersen 1990)

An experimental work emphasized the study of hand-reared birds and their innate and "conditioned" responses to both live and model animals (Nice, Terpelkwyk 1941). Considerable work also has been directed to the elements of models which serve as releasers (Tinbergen 1948). This study reported was an attempt to compare the nest defense behavior of the four species of marsh birds namely: Redwinged Blackbird (*Agelaius phoeniceus*), which nested in shoreline emergent and terrestrial plants; Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), which used emergents near open water; Black Tern (*Chlidonias niger*), which is nested on low,

unused muskrathouses or built low nests of floating debris at or near the water level; Forster Tern (*Sterna forsteri*), which nested on higher muskrat houses. Their experiments were conducted during the summer of 1961 in Iowa at Goose and Little Wall lakes near Jewel in Hamilton County and at Dan Green Slough, and Rush Lake in Clay and Palo Alto counties near Ruthven. Nest defense behavior was induced by the two- dimensional models and mounted specimens like: fox snake (*Elaphe vulpina*), snapping turtle (*Chelydra serpentina*), Muskrat (*Ondatra zibethicus*), Mink (*Mustela vison*), crow (*Corvus brachyrhynchos*), Red- tailed Hawk (*Buteo jamaicensis*), barred owl (*Strix varia*), Great- horned owl (*bubo virginianus*). The nest reactions of four species of marsh birds to models and mounts of potential predators at the nest suggest that behavior is related to both nest site and social habits. Redwinged Blackbirds, which nest close to shore or on shore, used pecking and mobbing to deter terrestrial predators. Yellow-headed Blackbirds, which nest over water, were much less disturbed by terrestrial forms but reacted conspicuously to aerial predators. Less difference in nest site and behavior occurs between Black and Forester terns, which both nest over water. Both showed highly social behavior and responded aggressively to any mounted animals near the nest. (R.Singlin, M.Weller 1963).

EAZA guidelines for captive hornbill has standard measurements of the aviaries. The enclosures must be 4 times the wingspan of the Panay Writhe Hornbill enabling it to pass each other. A minimal height of 3.0 meters is recommended to perch above the public and the keepers. The enclosure must have a wooden boarding which can serve as a boundary from the adjacent aviaries. It must be surrounded by wire mesh which is small enough not to allow the hornbills to stick their beaks out nor allow smaller

birds to be caught inside the enclosure (EAZA guidelines p.29). The enclosure must contain plants of various heights and perches should optimize hornbill use of vertical and horizontal enclosure space. Perches must not serve as obstruction for flight and must be placed at different heights to provide more perching options. Some of the natural perches should have small, forked side-branches that the birds could use to clean the inside of their bills. Nests should be placed in a quiet corner with a visual barrier between the nest and the adjacent enclosure to prevent disturbance. A roof or screen above the nest is recommended for protection. The distance of the enclosure floor and nest bottom should preferably be more than 1.5 meters. Regular hand-feeding of hornbills may have a negative effect on pair-bonding, as a hand-fed bird could eventually become more interested to the keeper than its partner up to the extent that they are observably displaying towards their keeper instead of their partners. It is preferable that during breeding season, the keeper must access the food from outside of the enclosure because the hornbills tend to become extremely aggressive (EAZA guidelines pp.32-34). Hornbills, particularly males in breeding condition can become extremely aggressive to people (EAZA guidelines p.60).

Chapter III

Methodology

A. Study site

The study was conducted at Mari-it Conservation Park West Visayas State University- College of Agriculture and Forestry in Barangay Jayubo, Lambunao, Iloilo.

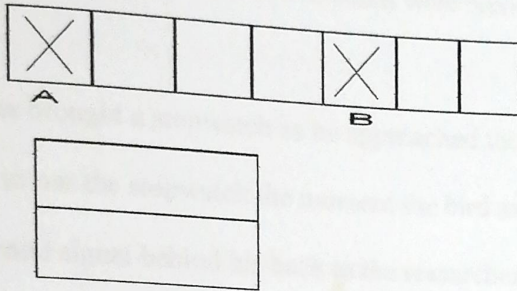
B. Materials

- Enclosure
- Meter stick
- Markers (for the distances)
- Binoculars
- Timer
- Pen and Paper
- Observation Post (Blinds)

C. Set-up

The aviary compartments of the experimental pairs measured 3.0 meters wide, 6.0 meters long and 6.0 meters high, made of steel and 2.5- centimeter wire mesh. The aviary compartments were provided with branches as perches in addition to trees and other under story plants that were purposely planted to make the aviary as naturalistic as possible.

C.1 Lay-out of Study site



The 'X' marks the breeding pairs used in this study in which pair A has the same length of pairing with pair B. They were paired in the year 2001. Both pairs have chicks that have already fledged last April 23, 2007.

The researcher was situated in the observation post which was situated 10 meters from the enclosure. Observation posts were made out of green cloth which imitates the colors of the leaves and grass around it. It was built among the thick shrubs to further conceal it from the birds' sight.

The 10, 5 and 0.5 meter distances were marked with stakes to ascertain the area where the keeper and stranger must pause.

D. Data Gathering

The actual study was conducted 5 days after fledging. All 12 observations lasted for 25 days due to precipitation and more than 2 degrees Celsius increase/decrease in the temperature from 30 degrees Celsius. Both male and female hornbills were used in observation. The keeper and three strangers were made to wear plain, sky- blue T-shirt so as not to give the experimental birds impressions such as food.

The data included the distance of the bird keeper and or stranger from the aviary of the experimental birds at 10 meters, 5 meters and 0.5 meters. At these different

distances the frequency counts of the different behaviors such as no active movement, hopping in place and jumping from perch to perch were recorded in each of the male and female birds.

The keeper brought a stopwatch as he approached the enclosure at the 10 meter mark. He started to use the stopwatch the moment the bird saw him at the 10- meter mark while he gave a hand signal behind his back to the researcher as she started her own timer and recorded the number of hops and the number of perches. When 3 minutes have elapsed, the keeper walked to the five- meter mark for approximately 30 seconds and stayed there for 3 minutes while the researcher recorded the bird's behavior. After another 3 minutes have elapsed (6 minutes and 30 seconds was shown on the LCD of the stopwatch), the keeper walked towards the 0.5 mark while the researcher recorded the bird's behavior. After the remaining 3 minutes have elapsed, observation for the day was over.

The strangers repeated the whole process.

There was only 1 observation of 10 minutes duration conducted per day for 12 days in order to prevent stress for the birds which may significantly affect the data.

Time of observation for the day and person used for the observation were determined randomly.

E. Statistical analysis

Data on type of behavior the male and female Visayan Writhed Hornbills exhibited at distances of 10 meters, 5 meters and 0.5 meters and the type of human stimuli (stranger and bird keeper) were formulated into 3 x 2 contingency tables and analyzed using Chi-square (χ^2) test of independence between:

1. the sex and the type of movement or behavior of the Visayan Writhed Hornbill
2. the sex and the type of behavior of the hornbills when exposed to a stranger
3. the sex and the type of behavior of the hornbills when exposed to the bird keeper
4. the type of behavior exhibited by the Visayan Writhed Hornbills and different human stimuli
5. the type of behavior exhibited by hornbills when exposed to a stranger at distances of 10 meters, 5 meters and 0.5 meters from the aviary
6. the type of behavior exhibited by hornbills when exposed to the bird keeper at distances of 10 meters, 5 meters and 0.5 meters from the aviary

CHAPTER IV

This study aims to determine the relationship between the types of behavior exhibited by the male and female Visayan Writhed Hornbill and the presence of the bird keeper and a complete stranger at different distances during the immediate post fledging period.

It will determine the relationship between: the type of behavior exhibited in response to human presence and the sex of the Visayan Writhed Hornbill; the type of behavior exhibited and the sex of the hornbills when exposed to a stranger; the type of behavior exhibited and the sex of the hornbills when exposed to the bird keeper; the type of behavior by hornbills exhibited and the different human stimuli; the type of behavior exhibited by hornbills when exposed to a stranger at distances of 10 meters, 5 meters and 0.5 meters from the aviary; the type of behavior exhibited by hornbills when exposed to the bird keeper at distances of 10 meters, 5 meters and 0.5 meters from the aviary.

It was hypothesized that: there is no relationship between the type of behavior and the sex of the Visayan Writhed Hornbill; there is no relationship between the type of behavior and the sex of the hornbills when exposed to a stranger; there is no relationship between the type of behavior and the sex of the hornbills when exposed to the bird keeper; there is no relationship between the type of behavior exhibited by hornbills and the different human stimuli; there is no relationship between the type of behavior exhibited by hornbills and the distances of 10 meters, 5 meters and 0.5 meters of the stranger from the aviary; there is no relationship between the type of behavior exhibited by hornbills and the distances of 10 meters, 5 meters and 0.5 meters of the bird keeper from the aviary.

Chi-square (χ^2) test of independence determines the relationship between the parameters and is used to investigate whether distributions of categorical variables differ from one another (<http://math.hws.edu> January 2008).

Results

Table 1.0 shows the computed Chi-square (χ^2) value of $\chi^2=26.0081$ which is significant and shows a dependent relationship between the sex of the Visayan Writhe Hornbill and type of movement or behavior.

Table 1.0 Independence of the type of movement to the male and female Visayan Writhe Hornbills

Chi-square (χ^2) value	Significance	relationship
$\chi^2=26.0081$	Significant	dependent

Table 2.0 shows the computed Chi-square (χ^2) value of $\chi^2=27.4775$ which is significant and shows a dependent relationship between the sex of the Visayan Writhe Hornbill and type of movement or behavior when exposed to the stranger.

Table 2.0 Independence of the type of movement to the male and female Visayan Writhe Hornbills when exposed to a stranger

Chi-square (χ^2) value	Significance	Relationship
$\chi^2=27.4775$	Significant	Dependent

Table 3.0 shows the computed Chi-square (χ^2) value of $\chi^2=9.624$ which is significant and shows a dependent relationship between the sex of the Visayan Writhe Hornbill and type of movement or behavior when exposed to the bird keeper.

Table 3.0 Independence of the type of movement to the male and female Visayan Writhe Hornbills when exposed to the bird keeper

Chi-square (χ^2) value	Significance	relationship
$\chi^2=9.624$	Significant	dependent

Table 4.0 shows the computed Chi-square (χ^2) value of $\chi^2=1.4911$ which is not significant and shows independence in the relationship between the type of movement or behavior of hornbills and different human stimuli

Table 4.0 Independence in the relationship between the type of movement or behavior of hornbills and different human stimuli

Chi-square (χ^2) value	Significance	relationship
$\chi^2=1.4911$	Insignificant	independent

Table 5.0 shows the computed Chi-square (χ^2) value of $\chi^2=4.8074$ which is not significant and shows independence in the relationship between the type of movement or behavior of hornbills when exposed to a stranger at distances of 10 meters, 5 meters and 0.5 meters from the aviary.

Table 5.0 Independence in the relationship between the type of movement or behavior of hornbills when exposed to a stranger at distances of 10 meters, 5 meters and 0.5 meters from the aviary

Chi-square (χ^2) value	Significance	relationship
$\chi^2=4.8074$	Insignificant	independent

Table 6.0 shows the computed Chi-square (χ^2) value of $\chi^2=22.2939$ which is significant and shows a dependent relationship between the type of movement or behavior of hornbills when exposed to the bird keeper at distances of 10 meters, 5 meters and 0.5 meters from the aviary.

Table 6.0 Independence in the relationship between the type of movement or behavior of hornbills when exposed to the bird keeper at distances of 10 meters, 5 meters and 0.5 meters from the aviary

Chi-square (χ^2) value	Significance	relationship
$\chi^2=22.2939$	Significant	dependent

Discussion

There is a relationship between the type of behavior and sex of the Visayan Writhed Hornbill. Results show that the type of behavior exhibited by the Visayan Writhed Hornbill when exposed to human presence during the immediate post fledging period is dependent on its sex.

In other studies, the sex-dependent behavior is shown towards their offspring while in this study, the sex-dependent behavior is shown towards the human stimuli (EAZA p.64).

There is no relationship between the type of behavior exhibited and the different human stimuli and between the types of behaviors exhibited and the distance of the stranger at 10, 5 and 0.5 meters away from the aviary.

The type of behavior exhibited is dependent to the distance of the bird keeper from the aviary. These birds develop a sense of familiarity to their keepers or handlers because of their frequent encounters with them. The hornbills may associate the keeper as a source of food. There are cases where the male displays towards the keeper instead of their mates (EAZA p. 57).

Chapter V

A. Summary

This study determined the relationship between human presence and the behavior exhibited by captive pairs of Visayan Writhed Hornbills (*Aceros waldeni*) during the breeding season.

It specifically aimed to:

1. To determine the relationship between the sex of the Visayan Writhed Hornbill and the type of movement or behavior exhibited in response to the presence of humans
2. To determine the relationship between the sex and the type of movement or behavior of the hornbills when exposed to a stranger
3. To determine the relationship between the sex and the type of movement or behavior of the hornbills when exposed to the bird keeper
4. To determine the relationship between the type of movement or behavior of hornbills and the different human stimuli
5. To determine the relationship between the type of movement or the behavior of hornbills when exposed to a stranger at distances of 10 meters, 5 meters and 0.5 meters from the aviary
6. To determine the relationship between the type of movement or behavior of hornbills when exposed to the bird keeper at distances of 10 meters, 5 meters and 0.5 meters from the aviary

It was hypothesized that there will be no relationship between the behavior exhibited by the hornbills and their sex; behavior exhibited by the hornbills and

their sex when exposed to a stranger; behavior exhibited by the hornbills and their sex when exposed to the bird keeper; behavior exhibited by the hornbill and different human stimuli; behavior exhibited by the hornbills and distance of the stranger; behavior exhibited by the hornbills and distance of the bird keeper.

Summary of Results

With the computed Chi-square (χ^2) value significant at $\chi^2=26.0081$, the type of behavior is dependent with the sex of the Visayan Writhed Hornbill. The computed Chi-square (χ^2) value of $\chi^2=27.4775$ is significant therefore, the type of behavior is dependent to the sex of the Visayan Writhed Hornbill when exposed to a stranger. The computed Chi-square (χ^2) value of $\chi^2=9.624$ is significant therefore, the type of behavior is dependent to the sex of the Visayan Writhed Hornbill when exposed to the bird keeper. The Chi-square (χ^2) value of $\chi^2=1.4911$ shows no significance therefore, the type of behavior is independent to the human stimuli. The Chi-square (χ^2) value of $\chi^2=4.8074$ shows no significance therefore, the type of behavior is independent to the distances of the stranger from the aviary. With the computed Chi-square (χ^2) value significant at $\chi^2=22.2939$, the type of behavior is dependent to the distances of the bird keeper from the aviary.

B. Conclusion

The type of behavior is dependent to the sex of the Visayan Writhe Hornbill.

The type of behavior is dependent to the sex of the Visayan Writhe Hornbill when exposed to a stranger.

The type of behavior is dependent to the sex of the Visayan Writhe Hornbill when exposed to the bird keeper.

The type of behavior is independent to the different human stimuli.

The type of behavior is independent to the distances of the stranger from the aviary.

The type of behavior is independent to the distances of the bird keeper from the aviary.

C. Recommendation

Further studies will be conducted using the same methods but with non-breeding pairs during the breeding season.

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APPENDIX A

RAW DATA

A. Male

Table 1.0 Frequency count on the type of behavior exhibited by the male Visayan Writhed Hornbill when exposed to the birdkeeper

HOP			PERCH		
10 m.	5 m.	0.5 m.	10 m.	5 m.	0.5 m.
14	11	3	15	12	3
6	8	14	11	8	7
0	0	4	2	1	4
4	7	1	6	12	10
2	19	7	5	9	13
2	2	5	7	1	3

Table 2.0 Frequency count on the type of behavior exhibited by the male Visayan Writhed Hornbill when exposed to the stranger

HOP			PERCH		
10 m.	5 m.	0.5 m.	10 m.	5 m.	0.5 m.
3	12	0	9	8	4
16	4	0	9	3	3
10	3	11	14	10	11
15	4	10	10	6	7
2	1	1	8	13	10
3	5	8	13	8	6

B. Female

Table 3.0 Frequency count on the type of behavior exhibited by the female Visayan Writhed Hornbill when exposed to the birdkeeper

HOP			PERCH		
10 m.	5 m.	0.5 m.	10 m.	5 m.	0.5 m.
1	1	4	2	1	1
13	9	4	6	5	6
0	5	1	0	2	3
0	6	1	4	7	6
0	3	0	0	3	4
0	2	1	0	2	22

Table 4.0 Frequency count on the type of behavior exhibited by the female Visayan Writhe Hornbill when exposed to the stranger

10 m.	HOP		PERCH		
	5 m.	0.5 m.	10 m.	5 m.	0.5 m.
0	4	0	0	2	3
8	0	0	2	0	0
0	2	3	1	1	2
6	4	2	0	1	4
3	8	14	12	5	0
14	5	8	2	11	3

APPENDIX B

CHI-SQUARE COMPUTATIONS

Table 1.0 Type of behavior between male and female Visayan Writhed Hornbills

Type of behavior	Male	Female	Total
No movement	4	18	22
Hop in place	217	132	349
Jumping from perch to perch	281	123	404
Total	502	273	775

Table 2.0 Type of behavior between male and female Visayan Writhed Hornbills when exposed to the stranger

Type of behavior	Male	Female	Total
No movement	2	10	12
Hop in place	108	81	189
Jumping from perch to perch	152	49	201
Total	262	140	402

Table 3.0 Type of behavior between male and female Visayan Writhed Hornbills when exposed to the birdkeeper

Type of behavior	Male	Female	Total
No movement	2	8	10
Hop in place	109	51	160
Jumping from perch to perch	129	74	203
Total	240	133	373

Table 4.0 Type of behavior exhibited by the male and female Visayan Writhed Hornbills when exposed to the stranger and the birdkeeper

Type of behavior	Birdkeeper	Stranger	Total
No movement	10	12	22
Hop in place	160	189	349
Jumping from perch to perch	203	201	404
Total	373	402	775

Table 5.0 Type of movement exhibited by the Male and Female Visayan Writhed Hornbills when exposed to different stranger distances

Type of behavior	10 m.	5 m.	0.5 m.	Total
No movement	2	3	4	9
Hop in place	82	56	59	197
Jumping from perch to perch	62	54	52	168
Total	146	113	115	374

Table 6.0 Type of movement exhibited by the Male and Female Visayan Writhed Hornbills when exposed to different birdkeeper distances

Type of behavior	10 m.	5 m.	0.5 m.	Total
No movement	3	2	2	7
Hop in place	79	66	40	185
Jumping from perch to perch	78	65	31	174
Total	160	133	73	366