



**Thesis Topic: Foraging Activity Patterns of Critically Endangered White-bellied Heron
(*Ardea insignis*) in Punatshangchu and Mangdechu River Basins of Bhutan.**

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1. INTRODUCTION

1.1 Introduction

Foraging activities of the herons are essential daily activities of the birds for their survival and reproduction (Papakostas *et al.*, 2005). It's an instinctual habit for all birds to search for food for survival and raise their young (Renken *et al.*, 2016). Foraging habits of water birds bears significance in ecological studies as the ability to forage successfully determines the survival of the juveniles and adults (Frederick and Spalding, 1994), and reproductive success as well (Hafner *et al.*, 1993).

1.2 Rationale

Very little information is known about WBH and its foraging activity. Overall, numerous aspects in foraging ecology of the WBH are left unexplored (Maheswaran, 2007). Understanding of the factors which affects the foraging activity of WBH such as micro-habitat selection, breeding period and time of the day is scanty (Price and Goodman, 2015). Much less is known about the foraging activity of White-bellied Heron (*Ardea insignis*) compared to other species of same genus (Wangchuk, 2016). Thus knowing about its' foraging activity is imperative both from an ecological and conservation point of view.

Price and Goodman (2015) however proposed that studies carried out without testable hypotheses contributed little to overall conservation of the WBH. As a result, a wide research gap was identified as an ultimate call for urgent actions through empirical studies for the ultimate conservation of WHB.

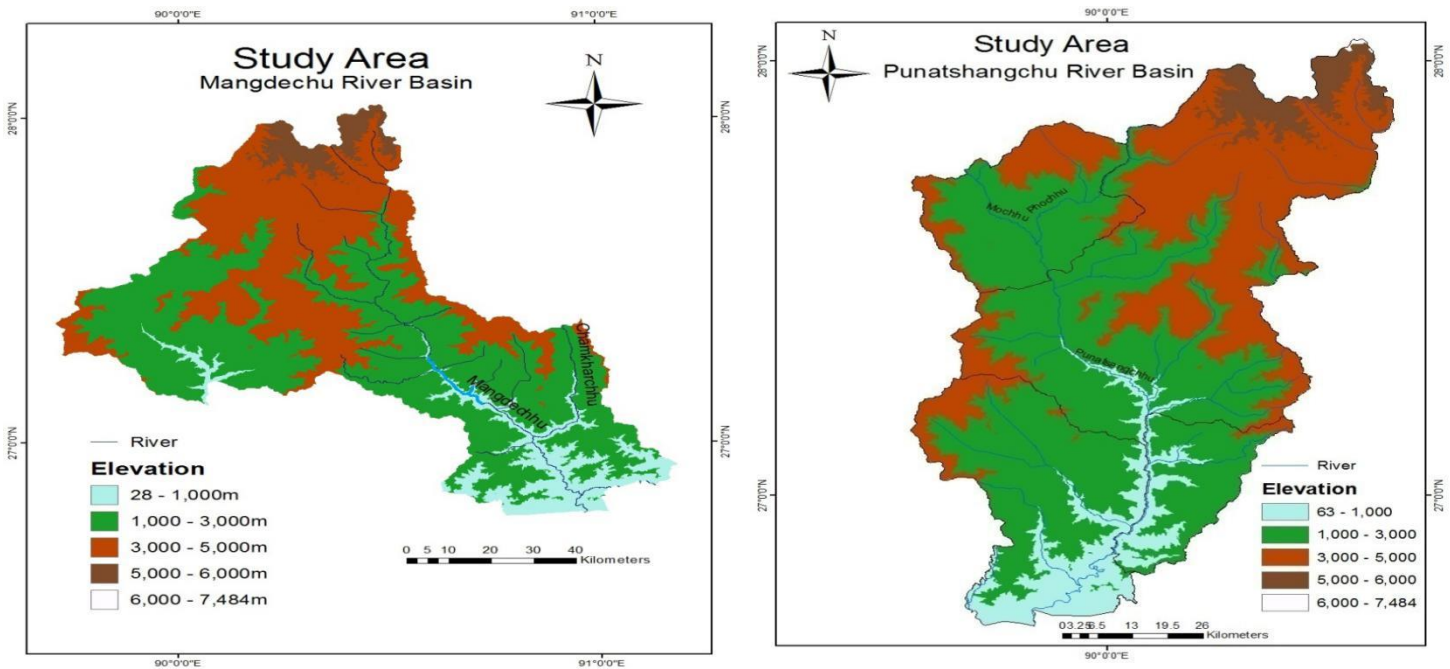
1.3 Research Questions

1. What are the factors affecting the foraging activity of WBH?
 - a) Does it show micro-habitat selection?
 - b) Does foraging activity differ during breeding periods?
 - c) Does it depict seasonal variations?
 - d) Does foraging activity differ between the times of the day?

1.4 Research Objectives

1. To investigate the factors affecting the foraging activity of WBH.
 - a) To explore the micro-habitats types preferred by WBH.
 - b) To understand the trends during the breeding seasons.
 - c) To compare the seasonal variations in the foraging activity of WBH.
 - d) To differentiate foraging activity patterns between the time of the day.

2. DESCRIPTION OF THE PROPOSED RESEARCH AREA



The proposed study will try to cover the two major WBH's habitat range in Bhutan (coordinates: 27.5142° N, 90.4336° E) given its very small population. Dorji (2012), following a GIS model estimated a total suitable habitat for the WBH to about 347.95 km² which make up to 0.9 percent of the country's total geographic area.

The only two established habitat of WBH are Mangde-chu river basin covering Tingtibi/Berti region of Zhemgang district and Punatsang-chu river basin which falls within the jurisdiction of remaining 4 districts that also holds following important sites: Phochu, Mochu, Hara Rongchu, Nanzhina, Ada, Burichu, Wakleytar, Sunkosh, Dagachu, and Phibsoo Wildlife Sanctuary (Wangdi, Dhendup and Tsering, 2017).

3. METHODOLOGY

3.1 Pilot Study and Preliminary Field Visit

Prior to actual field study in WBH habitat ranges in Bhutan, pilot study was carried out in one of the fresh water lakes known as Thale Noi or Noi Lake at Pattalung in southern peninsular Thailand. It is also the first Ramsar site in Thailand falling within the coordinates 7°46'00"N 100°09'11"E. Pilot study will convene from 17-31 of December, 2017.

Initial visit to this site had already proven to be worthy to record the other species of Herons such as Grey Heron (*Ardea cinerea*), Purple Heron (*Ardea purpurea*), and Chinese Pond Heron (*Ardeola bacchus*). It is said to host about 180 species of waterfowl (Anon, 2017). The pilot study provided hands on experience in carrying out field works and mitigate possible challenges that may confront during the actual field study. Preliminary field study was undertaken to locate the foraging sites of WBH in the designated study area (Wangchuk, 2016). The expedition was made from 24-28 of February, 2018.

3.2 Factors Affecting the Foraging Activity

Factors effecting the foraging activity of WBH are grouped into following categories. The categories are; micro-habitat types, breeding period, and time of the day.

Micro-habitat types will be categorized into Islands, Banks, Pools, Riffles and Riparian. The breeding period would be grouped into following stages from the available data (RSPN, 2011); incubation (February-March), nestling (April-May) and fledgling (July-August). Time of the day would be grouped as early morning (06:00-09:00 h), midday (10:00-13:00 h), late evening (14:17 h).

The presence or absence of vegetation cover and disturbances (birds of prey, human activities and structures) within the 50m radius would also be recorded.

3.3 Estimating Prey Availability

Prey availability is the measure of prey abundance and vulnerability. Abundance will be determined by estimating the relative density (catch per unit area) of the prey and the prey vulnerability would be estimated through the degree of exposure of prey to the predator (Breed and Moore, 2016).

The sampling equipment for fish such as cast nets, gill nets of varying sizes (10-34mm), dip, and drag nets would be used according to different fish habitats (runs, pools, and riffles).

3.4 Observation of Foraging Activity: Focal Animal Sampling

I will carry out the visual survey of each station randomly for locating the presence of the focal species. After locating the focal species I will observe the focal species from a hideout within a distance of <100 m using 20-60x monocular spotting scope (Campos and Lekuona, 2001). Digital video camera would be used to record the foraging activity as it would be very useful for re-evaluation of foraging events.

3.5 Non-invasive genetic sampling

Faeces were collected opportunistically from night roosting sites during the early hours, preserved in 100% ethanol on collection and stored at room temperature. Feather samples were collected (dropped by some birds) to provide samples of their DNA and stored in dry Eppendorf tubes at room temperature.

4. Results

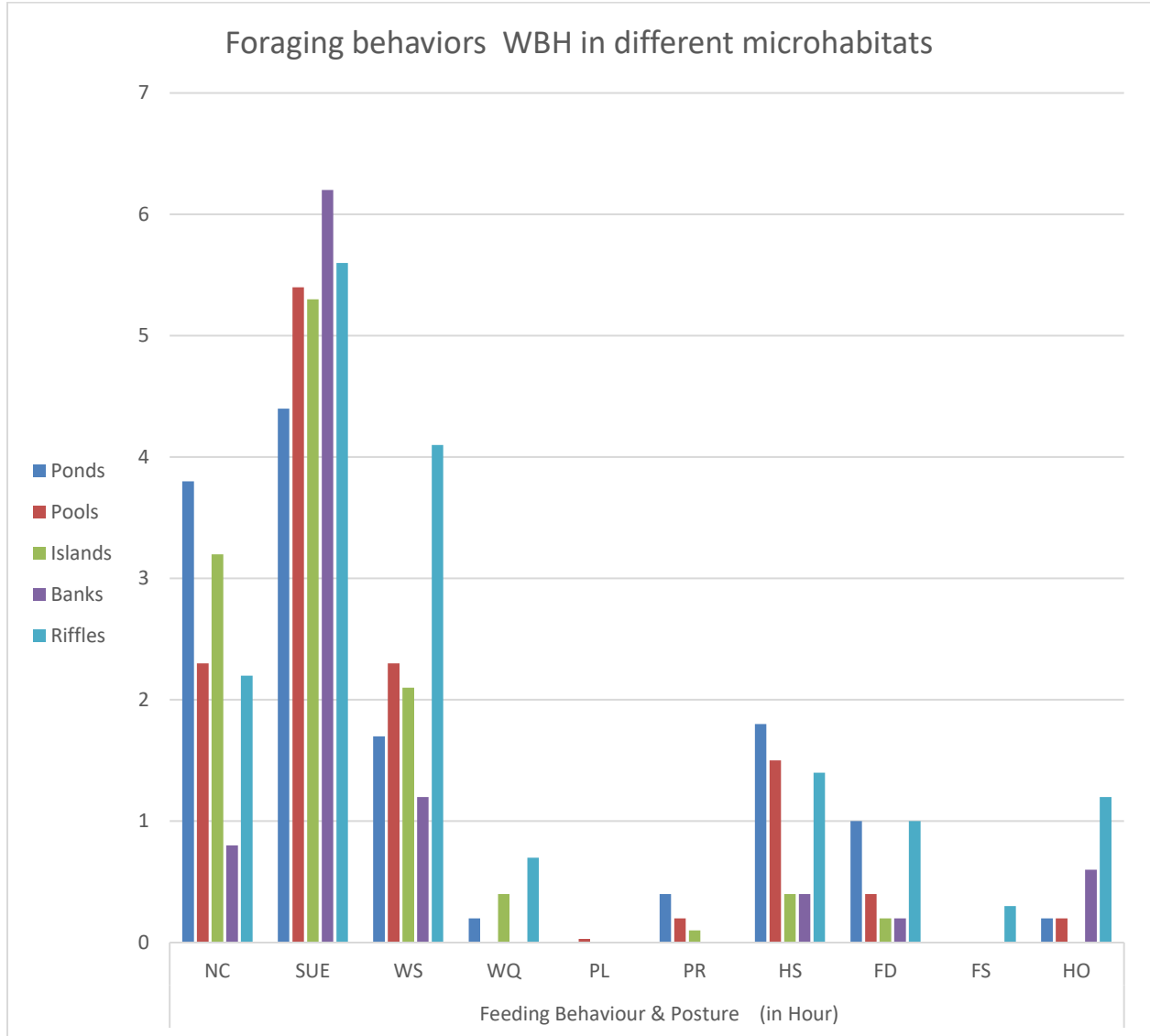


Figure 1: Feeding Repertoire Show by WBH in Various Micro-habitat Types: NC (Neck Craning), SUE (Stand Upright and Erect), WS (Walk Slowly), WQ (Walk Quickly), PL (Plunge), PR (Probing), HS (Head Swaying), FD (Face Down), FS (Foot Stirring), HO (Hopping)

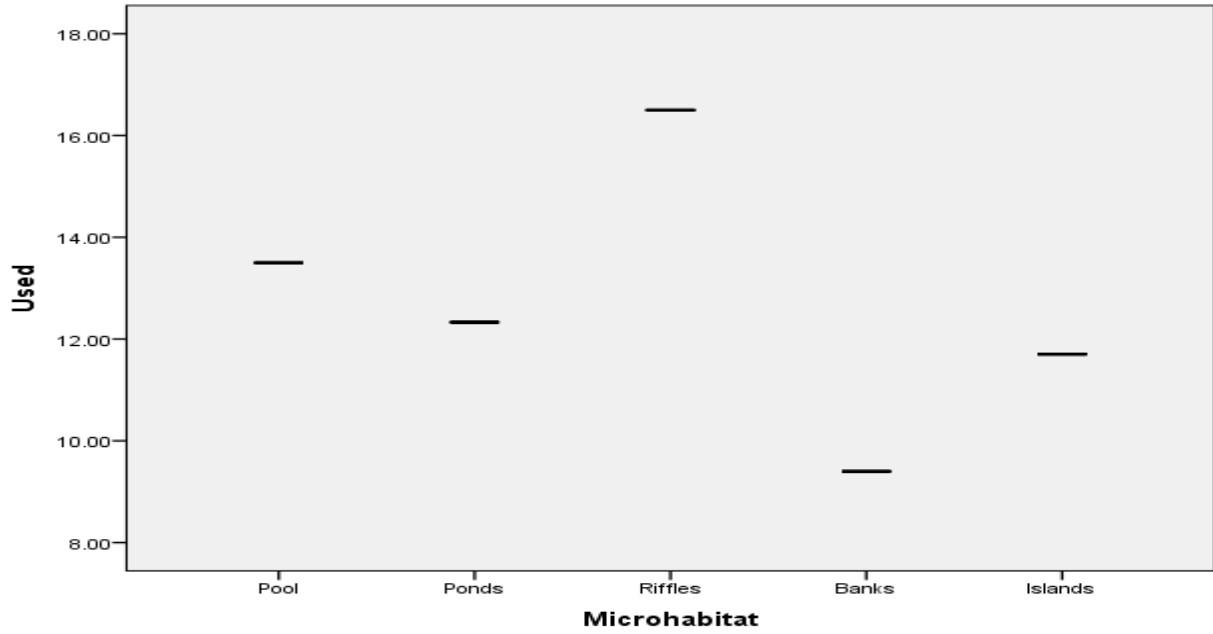


Figure 2: Comparison of Microhabitat Use by the WBH.

Prey Size Preference

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Small	4	13.3	13.3	13.3
	Medium	6	20.0	20.0	33.3
	Large	15	50.0	50.0	83.3
	Very large	5	16.7	16.7	100.0
	Total	30	100.0	100.0	

Table 1: Prey size preference shown by WBH.

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6. APPENDIX

6.2 Summary of Expenditure Incurred

Item No	Item Details	Quantity	Rate (Nu.)	Amount
1	#Research materials and field equipments			
	• Spotting scope	1	36500	36500
	• Spotting scope adapter	1	1590	1590
	• Tripod	2	4207	8414
	• Garmin GPS (etrex 20)	1	12349	12349
	• Binocular	1 pair	18600	18600
	• Water Parameters Measuring Meter	1	5364	5364
	• Range Finder	1	5800	5800
	• Thermohygrometer	2	1800	3600
	• Cast nets	3	2450	7350
	• Hideout	2	3800	7600
	• Camouflage tent	1	4200	4200
	• LED Head lamp	2	1476	2952
	• Search Torch lamp	2	870	1740
	• Nikon Zoom lens 150-600mm	1	68999	68999
	• Digital Video Camera	1	25600	25600
	• Snowbee PVC chest waders	3	1800	5400
2	#Transportation Cost			
	• Gasoline for the car	12 Months	4000	48000
	#Research assistant employment	12 Months	6000	72000
3	#Books and papers			8000
4	#Thesis report			5000
5	#Wages for Assistant			40000

Total Fund = Nu 389058/-