

***Varanus flavescens*: Status, Distribution and Potential Threats – A Case from Nepal**

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Abstract - *Varanus flavescens* is the least studied varanid lizard of Nepal, and scientific information about this species is very limited. This study explored the status, abundance and existing threats of *V. flavescens* around the Jagdishpur Reservoir of Nepal through field work and questionnaire surveys. A population estimate survey was conducted along transect lines and a distribution map was prepared based on both direct observations of the species and indirect evidence of its presence. The study found that grass cover within swampy areas and along stream beds are the preferred habitats of this species. The major cause of population decline for *V. flavescens* in the study area is illegal hunting.

Introduction

Varanus flavescens, the yellow or golden monitor lizard, is a carnivorous poikilothermic reptile (Shah & Tiwari, 2004; Ghimire & Shah, 2014) that occurs in Bangladesh, India, Nepal, and Pakistan (Auffenberg, 1989; World Conservation Monitoring Centre, 1996). In Nepal, it is known as “*Sun Gohoro*” in the Nepali language, and is most active during wetter months of the year.

Varanus flavescens is listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), but it is listed as a species of least concern by the IUCN Red List (World

Conservation Monitoring Centre, 1996). In Nepal, *V. flavescens* is found in 25 districts (Shah & Tiwari, 2004), and is protected by the National Parks and Wildlife Conservation Act of 1973 (GoN, 1973). The Department of National Parks and Wildlife Conservation (DNPWC) is the only government agency in Nepal which works for the conservation and management of wildlife. The DNPWC focuses its conservation programs in protected areas only. Human activities such as poaching and nuisance killing present challenges for the conservation of *V. flavescens* (Khatiwada & Ghimire, 2009). Although *V. flavescens* tend to have a large home ranges (Perry & Garland, 2002), their habitat is being encroached by humans for cultivation (Karki & Bista, 2008), and are

therefore limited to small patches of habitat in Nepal.

In an effort to help fill in information gaps for the species in Nepal, this study investigated the distribution, current status and threats of *V. flavescens* in Jagdishpur Reservoir - a Ramsar Site, and its surroundings. This information will be useful for the species' effective conservation and protection in Nepal.

Materials and methods

Study Area

The study was conducted around the Jagdishpur Reservoir, Niglihawa Village Development Committee (VDC), Kapilvastu District of Nepal which was declared a Ramsar Site in 2003 (CSUWN, 2013) and is situated in the tropical region of Central Nepal. Wetlands are surrounded by cultivated land and a few smaller lakes. This area experiences a tropical monsoon climate of hot, rainy summers and cool, dry winters (Baral, 2008). Twenty species of fishes and 42 species of birds including 13 species of waterfowl have been recorded in the Reservoir (CSUWN, 2013). Several reptile and amphibian species including *Varanus bengalensis*, *V. flavescens*, *Python molurus*, *Sphaerotheca maskeyi*, and *Microhyla ornata* were recorded in this area during this study.

Population Surveys

Transect survey - Transect surveys were conducted to determine the population status of *V. flavescens* in the study area. A total of 73 transects (100 x 15 m) were walked, maintaining a 100 m gap between each transect. For each observation the number of individuals, body size, and age class (juveniles < 1 m in total length [TL]; adults >1 m TL) (Heyer, 1994; Sung *et al.*, 2011) were recorded. Data from transect surveys were collected in two shifts: early morning (1000 to 1300 h) and late afternoon (1400 to 1800 h).

Distribution - Distribution patterns were identified on the basis of direct observations and indirect evidence such as burrows, scratchmarks and foot prints of *V. flavescens* during the transects survey. Local knowledge was used to identify the indirect signs of this species. Locations of observed individuals and indirect evidence were recorded with Global Positioning System (GPS) equipment and the data were used to create a spatial distribution map around Jagdishpur Reservoir by using ArcGIS 10.5 version (Panthi, 2011; Panthi *et al.*, 2012; Aryal *et al.*, 2015).

Habitat Preferences - Habitat types used by *V. flavescens* such as swamp land and agricultural areas were maintained using transect surveys and intensive field surveys around Jagdishpur Reservoir. Different habitat parameters such as trees, shrubs and grasses, canopy cover, ground cover, agricultural land, land features, and swampy areas were recorded on each transect. Microsoft Excel was used to analyze the data and determine habitat preferences of this species.

Threats - Local residents of Jagdishpur Reservoir were interviewed to elicit information on the threats faced by *V. flavescens* around the reservoir. A total of 60 randomly selected respondents from different areas of Jagdishpur Reservoir within the study area were interviewed using a semi-structured questionnaire. Questions such as “Why is the population of *V. flavescens* decreasing?” and “For what purposes are people killing this animal?” were asked during the questionnaire survey. Issues were also assessed based on direct observations in the field. Habitat disturbances such as signs of grazing and feral animals, and the stumps of felled trees were used to visually assess habitat disturbance.

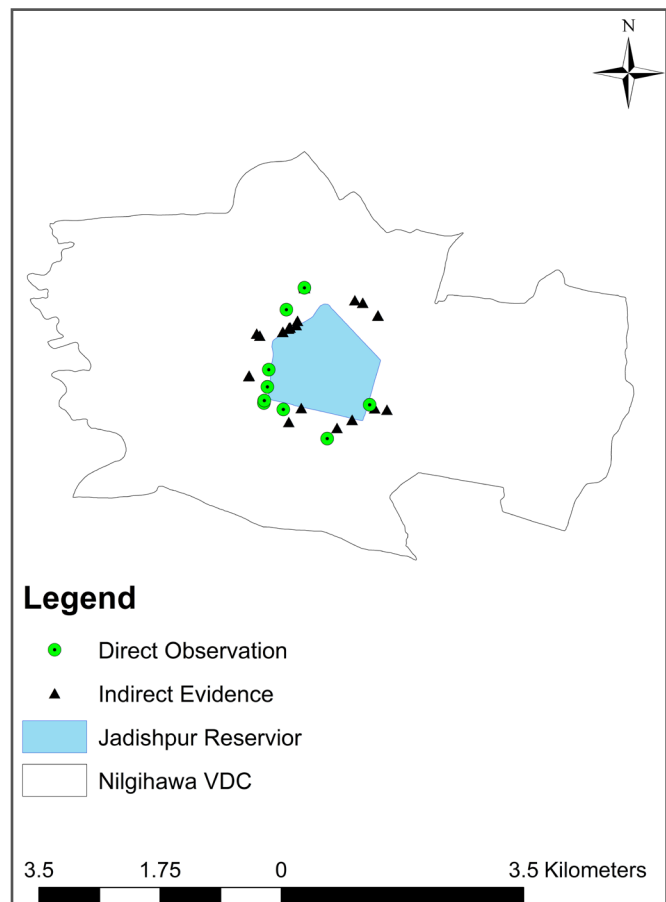


Fig. 1. Distribution of *Varanus flavescens* in the study area.

Results

Status of Varanus flavescens

Varanus flavescens was observed along 9 of 73 transects. As shown in Table 1, we observed 10 live individuals during transect surveys; six of which were adults and four were juveniles. Six of these observations were made in the swampy area around Jagdishpur Reservoir, whereas four individuals were sighted on agricultural land (Table 1).

Habitat Preferences

Habitat structure - Seventy percent of the potential habitat of *V. flavescens* at the study site was comprised of grasses, shrubs, trees and swampy areas, and 30% was comprised strictly of grasses.

Approximately 40% of *V. flavescens* were present in areas with dense ground cover (51-75% coverage) followed by 30% in areas with complete ground cover (76-100% coverage), 20% in areas with medium ground cover (26-50% coverage), and the remaining 10% were on open ground. Most of the potential habitats of this species were covered by the grasses *Impereta cylindrica* and *Saccaram spontanium*, and the shrubs *Ipomea carnea* and *Typha angustifolia*.

Land features - The majority of indirect signs of *V. flavescens* (indirect evidence such as burrows, signs of scratching, or foot prints) were recorded in the stream bed of Jagdishpur Reservoir. Ninety percent of indirect signs of this species were found in the streambed, whereas 10% were found in flat open terrain.

Threats to Varanus flavescens

During fieldwork, we identified anthropogenic activities such as recreational hunting and alleged safety concerns as major threats to *V. flavescens*. We also found that people hunt this species to protect fish farms, and for their skin (Fig. 2).

During the interviews, 52% of respondents stated that illegal hunting by local people around the reservoir area was the main cause for decreases in the *V. flavescens* population. Residents used various local materials such as sticks, stones, and agricultural tools for killing individuals of this species. They killed *V. flavescens* for recreation as well as for their skin and meat. Ten percent of respondents reported that the use of pesticides and insecticides was the main cause of its declination, whereas 15% of respondents said habitat destruction was the responsible factor for the decreasing population. Twenty three percent of respondents did not know the cause for declines.

Fifty five percent of respondents said that they killed this species for recreation; 17% of which claimed that *V. flavescens* was highly poisonous. Alleged poisonous substances excreted from the mouth of this species are believed to be physically dangerous to humans, so some people also appear to be killing this species for safety. Fifteen percent of respondents said that people killed the species because it predares fish; 8% said that people hunted this species for the skin to be used for making drums, and another 5% noted that *V. flavescens* was killed for its meat.

During the survey, it was reported that only men are involved in the killing of *V. flavescens*, and that women are not involved in such activities. It is mostly

Table 1. Observations of *Varanus flavescens* made at Jagdishpur Reservoir.

Time (h)	Populaton			Weather	Site
	Adult	Juvenile	Total		
0615	1	-	1	Sunny	Swampy area
0725	-	1	1	Sunny	Swampy area
0820	-	2	2	Sunny	Swampy area
1000	1	-	1	Sunny	Swampy area
1555	-	1	1	Sunny	Agricultural area
0915	1	-	1	Cloudy	Swampy area
1830	1	-	1	Sunny	Agricultural area
1725	1	-	1	Sunny	Agricultural area
0820	1	-	1	Sunny	Agricultural area
Total	6	4	10		



Fig. 2. *Varanus flavescens* killed by local residents.

local residents that are involved in killing activities, and represent the main conservation threat for *V. flavescens* in this area.

Discussion

The greatest number of *V. flavescens* encountered in this study were seen in swampy areas, which is consistent with other field studies on the species by Shah & Tiwari (2004) and Khatiwada & Ghimire (2009). Ghimire & Shah (2014) found that this species prefers wetland areas with few large trees. Our study found that this species occurred alongside streambeds and gently-sloped or flat terrain. It preferred dense ground cover (51-75%) over other habitat types and was more often found in areas with grasses and other ground cover than in strictly grassy areas.

Das (1988) reported that recreational killing of *V. flavescens* was a major threat to these lizards in eastern India. Anderson & Marcus (1992) identified improper land use, hunting, commercial use, inappropriate wetland management, harmful fishing practices, poisoning and overgrazing as major long-term threats to these lizards. Ghimire & Shah (2014) found that indiscriminate killing was a major threat to *V. flavescens* in Nepal. Similar to Khatiwada & Ghimire (2009) and Ghimire & Shah (2014), we have also found that poaching, particularly as recreation was the major conservation threat to this species in our study area. Children may be more responsible for killing this species in the country due to the lack of awareness about its importance (Ghimire *et al.*, 2014), and while some people in Nepal believe that eating the meat of monitor lizards can improve their health and act as a deterrent or possible cure for tuberculosis, leprosy, asthma, and piles (Shah & Tiwari, 2004), we found a lower number of respondents in our study area that claimed that this species is hunted for its

meat.

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