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Study on Habitat and Feeding Ecology of Asian openbill stork (*Anastomus oscitans*) in Pokkali wetlands of Ernakulam District, Kerala, India

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Abstract
The Pokkali wetlands of Ernakulam district, Kerala comes under the Central Asian Flyway and part of Vembanad Ramsar site in India. They are highly nutritive, biodegradable, rich in biodiversity providing lot of services. Asian Openbill stork (*Anastomus oscitans*) is a migratory bird belonging to Stork family Ciconiidae under the order Ciconiiformes. They are good ecosystem health indicator. The paper deals with the study on Habitat and Feeding Ecology of Asian Openbill Stork (*Anastomus oscitans*) in Pokkali wetlands of Ernakulam district, Kerala, carried out from 1 January 2016 to 30 November 2018**.** Collection of basic data on habitat use, food availability and foraging techniques are necessary for the effective implementation of conservation strategy. Due to their continuous presence in the study area, the area can be treated as a favourable habitat for Asian Openbill stork and their presence in the study area indicates the healthy nature of the ecosystem.

Keywords: Pokkali wetlands, Habitat ecology, Feeding ecology, *Anastomus oscitans*

1. Introduction
Wetlands referred as the 'Kidneys of earth' is an environment at the interface between truly terrestrial ecosystems and aquatic ecosystems making them different from each yet highly dependent on both [10]. Wetlands alone support 20% of the known range of biodiversity in India [4]. Kerala stands first in having largest area under wetlands [11]. Rice fields are important habitat of water birds in different regions of the world [6].

Pokkali is a unique, traditional, sustainable, organic cultivation in the water - logged coastal areas of Ernakulam, Alappuzha and Thrissur Districts of Kerala, India. The Pokkali cultivation is carried out during the low saline phase (May to October / mid November), followed by shrimp cultivation in the high saline phase (mid November to April) [13]. This natural system of cultivation relies on the symbiotic association of prawn and rice, monsoons and sea tides. Pokkali wetlands which comes under the Central Asian Flyway and part of Vembanad Ramsar sites in India. They are highly nutritive, biodegradable, rich in biodiversity providing lot of services [14].

Ecologically, birds are of tremendous importance. They are often used as a biological model and excellent ecological indicator of environmental health as they are easily observable [3]. Asian Openbill stork (*Anastomus oscitans*) is a migratory bird belonging to Stork family Ciconiidae under the order Ciconiiformes. They are colonial resident breeders. They are good ecosystem health indicator. They are large wading bird with grayish or white body, glossy black wings, long legs and a unique bill, which meets together only at the tip. They are widely distributed across the Indian subcontinent and the mainland of Southeast Asia [12]. Collection of basic data on habitat use, food availability and foraging techniques are necessary for the effective implementation of conservation strategy.

2. Study Area and Methodology
A study on the Habitat and Feeding ecology of Asian Openbill stork (*Anastomus oscitans*) was carried out from 1 January 2016 to 30 November 2018 in Pokkali wetlands of Ernakulam district, Kerala. Five different Pokkali wetlands were selected for the study: 1. Kandakkadavu (9° 51' 34.182"N)(76° 16 '6.4668"E) 2. Kadamakudy (10° 01' 53"-10° 4' 21"N)(76° 14 '25.7"-76° 16 ' 46"E) 3. Kumbalangi (9° 51' 01"- 9° 54' 02"N)(76° 16 '11"-76° 11 ' 49"E) 4. Kuzhupilly (10° 05' 01"- 10° 06' 18"N)(76° 11 '23"-76° 13 ' 08" E) 5. Palliyakkal (10° 6' 0" N)(76° 13 ' 0" E). Fortnightly visits were carried out in a month. Observations on Habitat ecology and feeding behaviour were made with the help of spotting scope (10-45×), binocular (7×50). Direct observation method was used for the study [1]. The observation was carried out from 06.00 a.m. to 6.30 p.m. The list of food items consumed, size of the prey, feeding techniques and interaction with other birds were recorded. Most of the observations were taken from a distance of 50-200 m. The water depth was measured. Fishes collected using Cast net and Chinese fishing net were identified and recorded [9]. Studies were also carried out for identification of aquatic plants [15].

3. Results and Discussion
Asian openbill storks exhibits diurnal feeding pattern. Hence it was easy to observe the feeding behaviour. In response to habitat conditions they displayed local movements. They usually prefer places with abundant water. During the study it was observed that, they forage solitary or in groups as well as with mixed flock consisting of painted storks (*Mycteria leucocephala*), grey heron (*Ardea cinerea*), black - headed ibis (*Threskiornis melanocephalus*), purple heron (*Ardea purpurea*), great egret (*Ardea alba*), Indian pond heron (*Ardeola grayii*),

little egret (*Egretta garzetta*) and intermediate egret (*Mesophoyx intermedia*). It was found that they shared their foraging habitat with other birds without showing any aggression. The foraging groups consists of five to ten individuals. It was found that they always keep a distance and get scattered away to choose different feeding areas within the same habitat. They are also seen feeding in a tightly packed group when they are foraging in areas with a water depth of 20 - 25 cm. Feeding activity was highest during morning (06.30 a.m. - 09.30 a.m.) and evening (4.00 p.m. - 6.00 p.m.). In between these hours, less activity was recorded. These hours were utilized for roosting, preening, basking and soaring in the nearby trees like *Acacia nilotica* or mangroves like *Rhizophora mucronata*, *Rhizophora apiculata***.** It was observed that after morning feeding they change their feeding ground. The selection of feeding ground mainly depends on food availability and less disturbances. It was recorded that pokkali wetlands after dewatering and harvesting are favourite foraging grounds for these storks. Dewatering process begins with the advent of post - monsoon and large flocks comprising of 65 - 125 individuals are seen during this period. Least number were noticed during monsoon season. September - January was the most active season for these storks. They are found during Pokkali cultivation period and prawn cultivation period.

The Asian Openbill Storks were found to prefer prey of medium or larger sized ones. The maximum sizes of these prey are constrained by the ability of the birds to catch, handle and swallow their prey [16]. Large prey may be avoided due to an unprofitable increase in handling time [8]. It was recorded that very large prey was not selected by the Asian Openbill Storks. Predators are commonly observed to feed upon a variety of prey types and to actively select their prey [5]. Asian openbills are carnivores. Their diet primarily consists of molluscs, crabs, toads, worms in the study area. It was found that they occasionally feeds on small fishes. in the study area. Feeding on fishes by Asian openbill stork as described by Anam *et al.* [3] was supported during the study. Asian openbills wade in the water and locate their prey using touch and sight. Sometimes, they are seen stalking their prey in an effort to capture them. In most cases, these storks swallow their prey whole. Sometimes they may use their sharp, pointed lower mandibles to crush the hard shelled prey and extract their flesh. Usually they feed from the same spot where they captured their prey, but sometimes in order to avoid snatching, they kept the prey inside the bill and flew to a distant area from other storks and then will feeds on them. The fine brush like structure at the cutting edges of the mandible gives them better grip while holding the snails [7]. They usually avoid human interaction. They generally walk forward in a linear fashion and thoroughly wades in the substrate. The movement pattern and quick movements in mudflats and shallow water help to cover the whole food patch. While openbill storks walk, they probe only once in a spot, and when they felt the presence of food item, they stopped walking and undergo multiple probing. It was observed that openbill storks spent more time in vegetated areas and floating vegetation.

The people in these areas have much conservative feeling towards these birds. The area is free from much disturbances. Hence large number of Asian open bill storks were found in the study area. These birds are excellent tool in monitoring the ecosystem health. Hence their presence indicates the healthy nature of the ecosystem and environment.

Fig 1: Asian openbill stork (*Anastomous oscitans*)

Fig 2: Asian openbill stork (*Anastomous oscitans*)

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