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NICHE ALLOCATION & BEHAVIORAL NOTE OF BIRDS ON POND AND ITS SURROUNDINGS: A QUANTITATIVE STUDY FROM CLOSE POND AT RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE LOCALITY.

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Abstract:
This is a study of ethology & ethogram regarding fresh water birds across a water body named as 'College Pond' adjacent to our college locality. We generally noted behaviors in two sessions of a day (morning and evening sessions) for two seasons of a year (winter and spring season). Basically, we observed their niche specificity and their behaviors with counting time of each behavior and their frequency. For easier approach we used several short codes for each behavior and niche. By Focal animal sampling we proceeded our observations, mainly focused on bouting frequency of Intermediate Cormorant and their niche besides Pond Heron's and Kingfisher's behavior & niches preferred.
***Keywords*:** Ethology, Ethogram, Water birds, intermediate cormorant, pond heron, kingfisher, Bouting.

1. Introduction:

Assessing animal Behavior is essential to understand animal life. The initial process of studying Behavior is to make a catalogue of the discrete, species-typical Behavior patterns that form the basic Behavioral repertoire of the species, i.e., an ethogram. Making an ethogram from direct observations is fundamental to understanding animal Behavior (Martin and Bateson, 2001). Most ecological niche studies have described re-source utilization along the gradient of a single trophic niche component. For instance, the foraging niches of passerine birds have frequently been studied purely in terms of certain spatial dimensions (Hogstad, 1978; Alatalo & Alatalo, 1979a; Alatalo, 1982; Saether,1982; Rolando & Robotti, 1985). A few studies have described both foraging and feeding niches in birds (Rosenberg et al., 1982; Fasola 1986a) in fish (Glad-felter & Johnson, 1983; Hindar et al., 1988), in amphibians (Griffiths & Mylotte, 1987) and in mammals (Meserve, 1981; Harris, 1986). Water birds are the indicator species of stable biodiverse aquatic ecosystem (Brix 1997, Green et al. 2014). The role of water birds has long been considered of minor importance for functioning fresh water ecosystem. Though water birds may graze heavily on macrophytes under certain circumstances; many of them have an important indirect effect on fresh water fish abundance (Klassen et al. 2007). Diving patterns of different species like Indian Cormorant, Little Cormorant, Pond Herron were well studied by Lea et al. (1996). Thus, studying ethogram and analysis of behaviors of different water bird species& many shore side birds is important for any specific area around water body. Precise descriptions and definitions provided by an ethogram aid the quantitative study of Behavior (Lehner, 1996) and allow comparisons of Behavior between related species or within the species under different circumstances (Xiao and Wang, 2005). Besides acting as reference sources, ethograms are useful for drawing attention to Behavior with unknown species. Observation works primarily focused on: Focal Animal Sampling (Location specific) on wet

land and quantifying it& Specificity of sitting of birds on floating object or diving frequency and success rate of feeding calculation.

2. Methodology:

We have selected 54 behaviors& also designed behavioral codes for easy data calculation& analysis, which are provided in table. This quantitative approach of behavioral ethogram was done by field work and data was collected throughout two sessions of a day i.e. morning& evening covered within two seasons: Winter, Spring. We regularly visited the site of study: College Pond, Dighir Math, Mission para, Ward no.:11, Rahara, Khardaha Municipality Barrackpore subdivision, North 24 parganas, Kolkata, Pin- 700118, West Bengal, India. As this location is very close to our institution we have chosen this area for our data Collection& it is the visiting place for various aquatic birds for their foraging, nesting, feeding etc. For data collection observation was done on total 14,440.39 meter^3 area. The perimeter of the area: 490.96 meter with **Latitude** of 22°43'44"N **Longitude** of 88°22'54"E& **Elevation:** 28meter. During data collection we used various instruments like Mobile camera, Digital Camera, GPS camera, Binocular. Data collection sheet was also used.

Deciding observation area we have studied different methodology for **Ethogram** preparation& we finalized **Focal Animal Sampling** (Altman, 1974) method to full fill our objective.

3. Focal Sampling Method:

Focal animal sampling is a method commonly used in the study of animal Behavior, such as for the elaboration of ethograms (Altman, 1974). According to Altman (1974), observers using this method should sample the Behaviors of only one individual at a time, regardless of the number of individuals that could be sight during sampling. When using focal animal sampling, individuals are observed for a period of time each, recording their Behaviors in intervals of pre-established duration. This method allows a more detailed Behavioral sampling if compared to other sampling methods. Ideally, before beginning observations, the observers should define the recording rules. Three recording rules can be used for record Behavior in focal animal sampling: continuous recording, instantaneous sampling (occurrences in the beginning of the interval), and one-zero sampling (first occurrence in the interval) (Martin and Bateson 1986). Subsequently, it is important to determine the duration of the time interval in which the focal individual will be observed (Altmann 1974). Observation interval duration depends on multiple factors (Altmann 1974), including characteristics intrinsic of the focal species such as mobility and habit. For species that are very active or highly mobile, such as birds, a short observation interval can be efficient to quantify the Behavior of the focal individual using either recording rule. In these cases, longer observation intervals would prevent recovering accurate information regarding when the behaviors were observed. In order to determine the duration of the observation interval it is also necessary to consider the number of Behavioral categories that will be sampled. If the goal is to observe many categories (e.g., vocalizations, displays, agonistic interactions), short observation intervals might not be appropriate for accurately sampling all intended behaviors. Without appropriate planning, many Behavioral data might be in fact useless or obsolete.

We started data collection from 23-01-2024 Up to 31-03-2024. Between this time-period we have collected all the Behavioral data, Duration, Behavior frequency. We have preferred morning shift (From 7.00-9.00 am or 10.30 am to 12.00 pm) and afternoon shift (From 4.00-5.30 pm). Within this time-period we observed some bird species regularly such as Pond Herron, Intermediate Cormorant and other species occasionally like Rufous Treepie, Greater Coucal.

Focal animal sampling as used to record the overall activities of birds. During data collection we recorded each set of data with every 15 minutes time interval& through daily activities of birds datasheet prepared. Photographs were taken by digital camera (Nikon D3400). Android mobile device was used for keeping time, measuring distances and to use stop

watch. Species identification was done by field guide book (Ali 2002, Grimmett 2016). Satellite image of the study area is given. (Fig 01)

Observation of Feeding (FD) behavior was most difficult during our study. We subdivided Feeding into three sub-behavioral components: Floating (FL), Flew to pond (FOP)& Bouting numbers (BT).

Arithmetic mean& standard deviation of Feeding component were calculated by standard methods (Zar, 2010). Standard Deviation (SD)& Standard Error (SE) calculated. Graphical Representation and basic statistical works were completed using MS-EXCEL 2007.

Observed behavioral activities of birds and their codes& location of birds and their codes are listed in Table 01&02 respectively.

Fig 01: Satellite image of study area (College pond, Dighir math, Rahara, North 24 parganas)

4. Behavior of the Birds& their Code:

TABLE 01:

SL NO	BEHAVIOR	CODE
1	Bouting	BT
2	Prey handleing	PHN
3	Waving wing	WW
4	Prey searching	PSC
5	Scanning locality while resting	SL
6	Flew outside	FO
7	Observing	OBS
8	Flew away	FLW
9	Gliding over the pond	GLD
10	Sitting	SIT
11	Gular flattering	GFL
12	Feeding	FD
13	Looking around	LA
14	Pecking	PC
15	Nibbling	NB
16	Moving head	MH
17	Tail shaking	TSH
18	Wing flapping	WF
19	Preening with beak in wet body	PWB
20	Sieving with beak	SB
21	Roosting	RS
22	Scanning locality during flight	SLF
23	Perching	PE

24	Moving	MO
25	Searching for food	SE
26	Flying over the pond	FOP
27	Flew to a fishing net	FN
28	Sitting on Fish Net	SF
29	Swimming	SG
30	Facing Towards	FT
31	Jumping	JU
32	Floating	FL
33	Scanning pond	SP
34	Touch soreline	TS
35	Upward movement during floating	UDF
36	Downward movement during floating	DDF
37	Sat for a long time	SLT
38	Flew back to the tree	FBT
39	Flew (from shoreline to net)	FSN
40	Roaming	RM
41	Flew (from fig tree to the net)	FF
42	searching for twig	ST
43	Chirping	CP
44	Head Shaking	HSH
45	Flew (from shoreline to tree)	FS
46	Nesting	NE
47	Crossing the pond	CRP
48	Carrying Twigs in beak	TW
49	Stand still	SS
50	Dipping Head into water	DHW
51	Flew from outside to tree	FOT
52	Flying from one to another tree	FAT
53	Changing their place	CTP
54	Flew to a pond	FP

5. Location of the Birds and their Code:

TABLE 02:

SL NO	LOCATION	CODE
1	shoreline of the pond	SOP
2	Pond	PD
3	Coconut tree beside the pond	CBP
4	Wall beside the pond	WBP
5	Floating sac(pond)	FS
6	Electric Wire (adjacent to pond)	EW
7	Dighir math - pond (fresh water)	DMP
8	Over dighir math (fresh water)	ODM
9	Fig tree	FT
10	Over dighir math pond	ODP
11	Jackfruit tree (adjacent to pond)	JT
12	Papaya tree (beside pond)	PT
13	Under growth beside sore line of pond	USP
14	Dead mango tree beside pond (on twig)	MTP
15	Dead mango tree	DMT
16	Wall beside college pond	WCP

17	Coconut tree	CT
18	Neem tree	NT
19	Sore line of the pond	SLP
20	College pond	CP
21	Unknown tree	UT
22	undergrowth beside tree	UBT
23	Undergrowth beside the pond	UBP
24	college pond (coconut leave sheath petiole)	CPP
25	Field adjacent to pond	FAP
26	Over the pond	OP
27	Mahogany tree	MHT
28	Net hanging on pond	NHP
29	Cannonball tree	CBT
30	Eucalyptus tree	ET
31	Mango tree	MT
32	Net hanging over the pond	NOP
33	Field besides the pond	FBP
34	Eucalyptus tree	ET
35	Burflower tree	BT
36	Archer cherry	AC
37	Cannonball tree besides the pond	CTP
38	over college pond	OCP

6. Results:

After regular observation& data collection throughout two months, it has been observed that location college pond contain more number of bird species followed by Net hanging on the pond (Graph 2). We observed that *Ardeola grayii* (W. H. Sykes,1832) visited more number of location in study area (21 locations) followed by *Phalacrocorax fuscicollis* (Francis Stephens, 1826), which visited 8 locations. Similarly when comparing species wise behaviors; P*halacrocorax fuscicollis* (Intermediate cormorant) have shown 31 number of behaviors followed by *Ardeola grayii* (Pond Herron) with 24 behaviors& *Acridotheres tristis* with 7 behaviors.

Among 11 birds observed throughout our study species not only varies in number of locations but also varies in total durations& frequency of behaviors. In *Ardeola grayii* Sitting (Sit) most timely performed behavior with 5100 seconds with highest Frequency:18 followed by gliding (Gld) duration with 2460 seconds (Graph 06).

In *Alcedo atthis* (Linnaeus, 1758) Sitting (Sit) behavior most duration followed by Flew away(FLW), Flew back to tree(FBT) accordingly 5100 seconds, 2160,600 seconds.(Graph 07).

Phalacrocorax fuscicollis (Intermediate cormorant) also shown Sitting (SIT) followed by Gliding (GLD), flew away (FLW), scanning pond (SP). We also calculated behaviors according to frequency. Intermediate Cormorant Bouting(BT) frequency:21, Gliding(GLD) with frequency: 8.

(Graph:08).

The above mentioned objective related data was taken and observed for a total 20 hours, showing 54 Behaviors in total as a foraging Ethogram study.

Fig 02: ***Ardeola grayii***

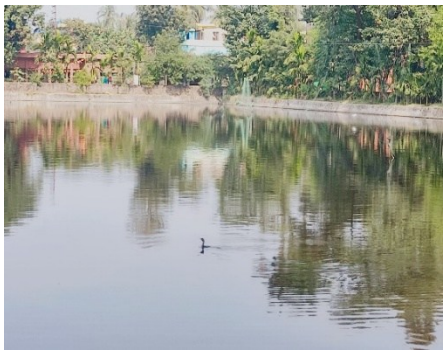
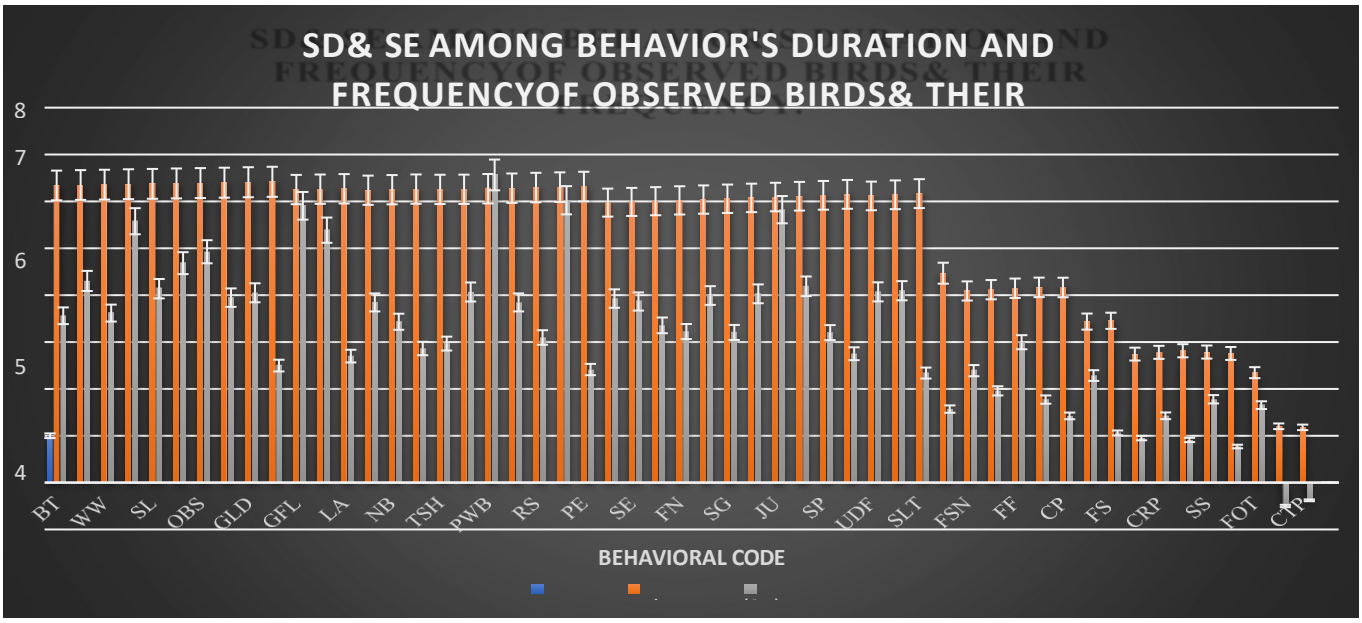


Fig 03*: Phalacrocorax fuscicollis*

Analytical Graphs:

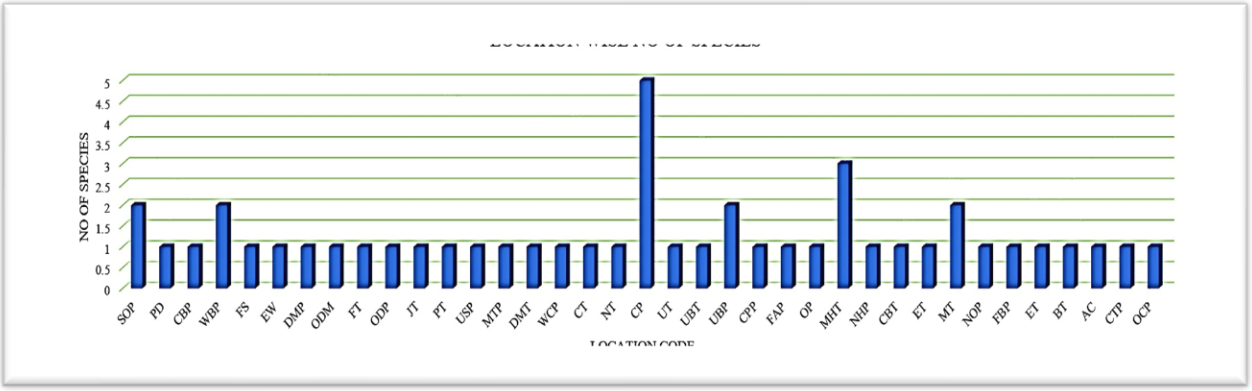
01. <u>SD& SE among behavior's duration and frequency of observed birds& their frequency:</u>

Graph 01: Here the Chart represented with Error Bar reflected the range of deviation



Graph 01: Here the Chart represented with Error Bar reflected the range of deviation and error regarding Mean of each behavior with respect to their duration and frequency.

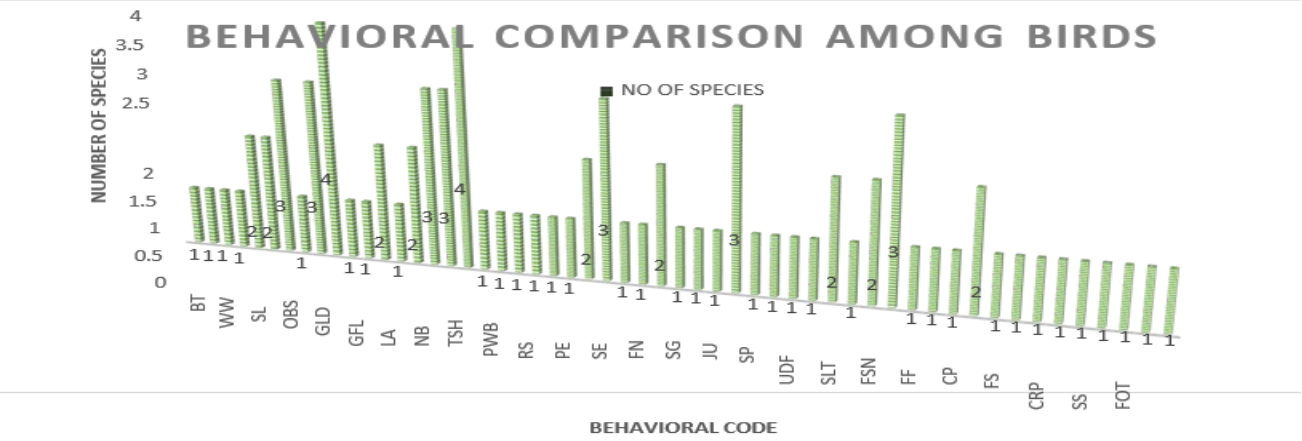
02. Location wise Species Number:



Graph 02: Observation site (college pond) contains 38 locations. This graph represents location wise species number of species i.e. Which species preferred maximum locations. Location Cp

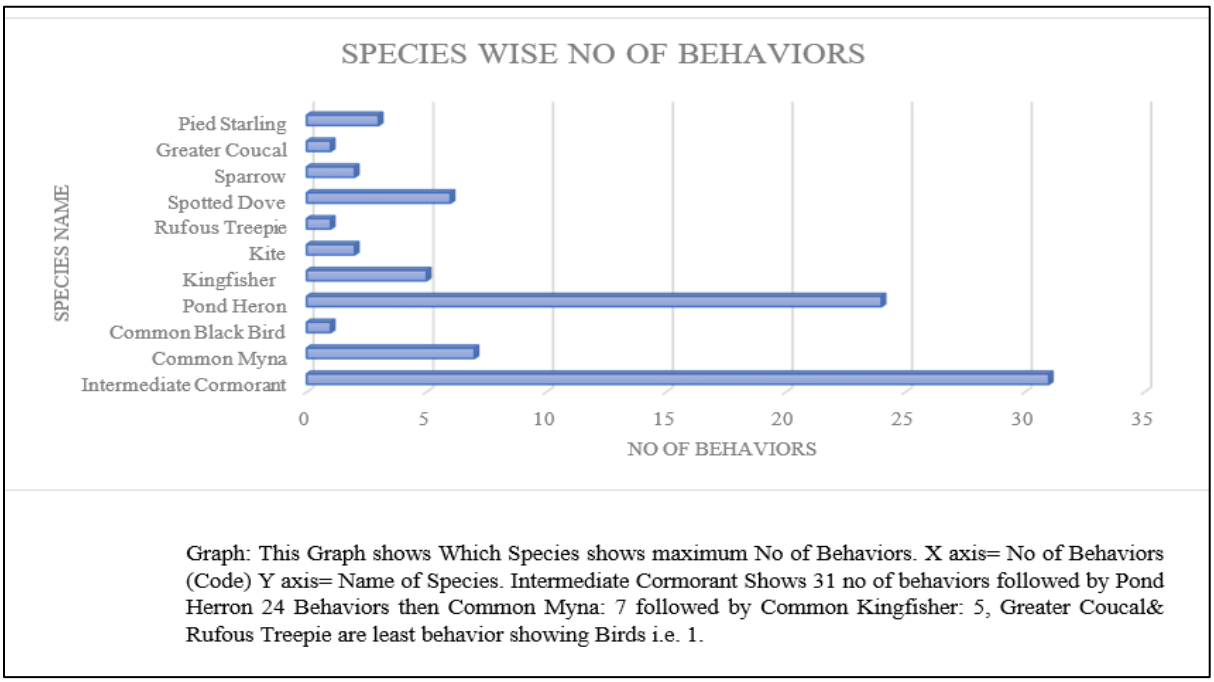
(college pond) contain more number of species followed by NHP (Net hanging on the pond), 3 species & AC, CT with almost same species number (2)

03. Behavioral Comparison among Birds:



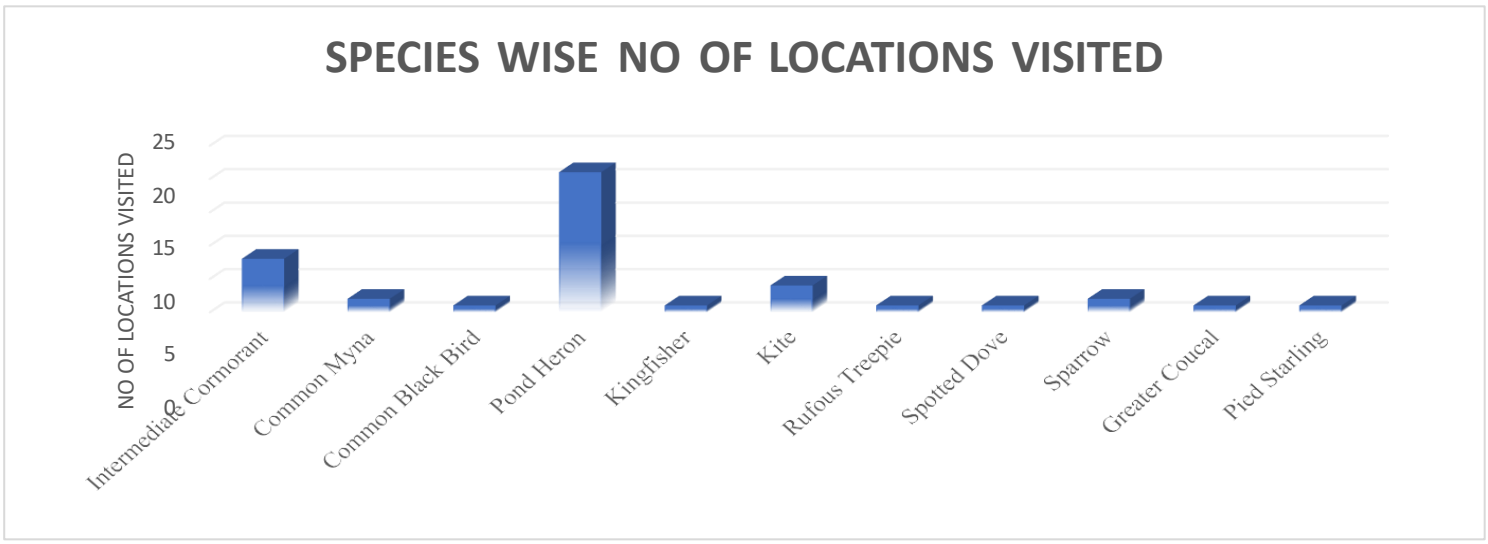
Graph: This graph represents comparisons according to behaviors of different Bird species. X axis contains Behavioral code while Y axis contains Number of species. Sitting behavior performed by 4 Bird species followed by Flying over the pond (3 Bird Species), FF (3 Bird Species), SP (3 Bird Species). RM, FBT these behaviors performed by 2 no of bird species. RS, PE shown by least no of Bird Species. [SIT= Sitting, FOP= Flying over pond, SP= Scanning the pond, PE= Perching, RS= Roosting]

04. Species wise no of behaviors:



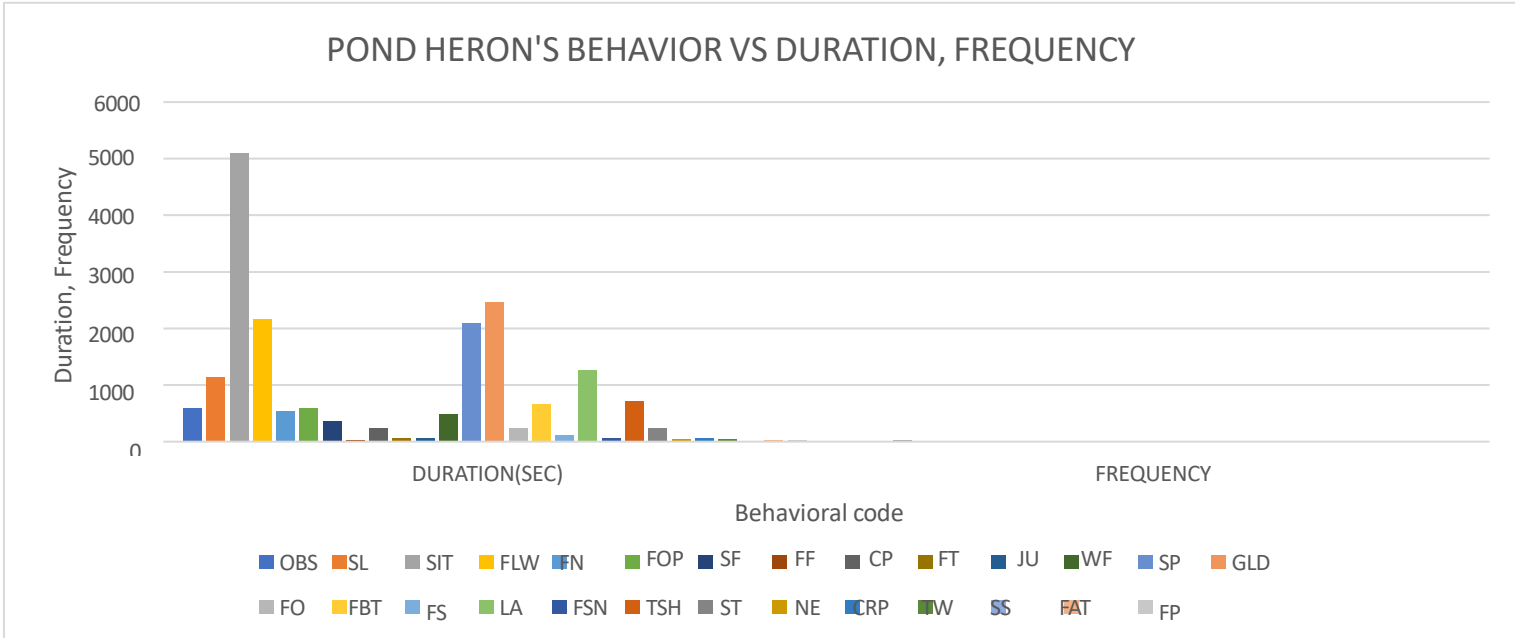
Graph: This Graph shows Which Species shows maximum No of Behaviors. X axis= No of Behaviors (Code) Y axis= Name of Species. Intermediate Cormorant Shows 31 no of behaviors followed by Pond Herron 24 Behaviors then Common Myna: 7 followed by Common Kingfisher: 5, Greater Coucal& Rufous Treepie are least behavior showing Birds i.e. 1.

05. Locations in Study area visited by Different Species:



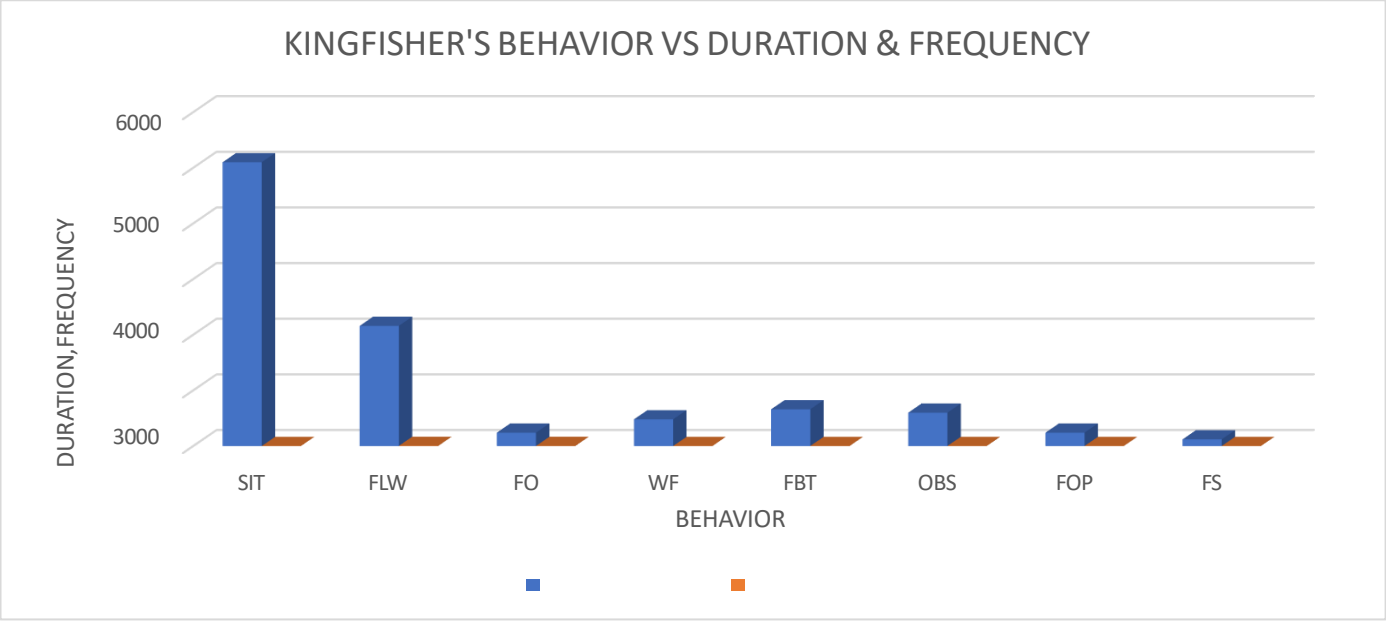
Graph 05: 11 Bird Species also varies in no of locations they have visited throughout observation area. Since we have coded 38 locations (Table 2), but all species not preferred all the locations in similar manner. Pond Heron visited 21 locations followed by Intermediate Cormorant: 8. The Kite preferred 4 locations while least no of locations visited by Pied Starling, Common King Fisher, Rufous Treepie,1.

06. Pond Heron's Behavior, Duration& It's Frequency



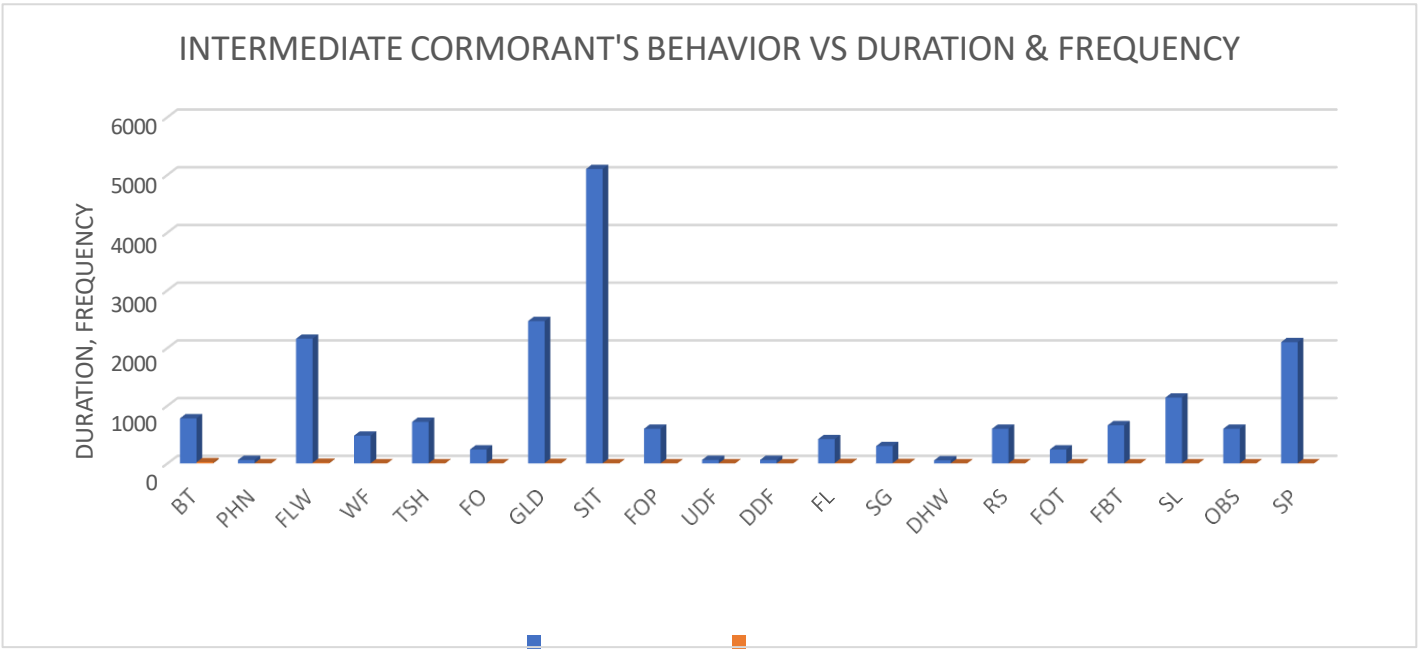
Graph 06: Among Three Frequently observed Birds **Pond Heron**'s Behaviors, total duration and frequency is represented. Here the graph is showing SIT most timely performed behavior: 5100 seconds with highest Frequency: 18 followed by GLD: duration: 2460 seconds, Flw: 2160 Second, but it's frequency: 16. SF, CP, JU are least frequent behaviors accordingly 360,60,240 seconds.

07. Common Kingfisher's Behavior, Duration& it's Frequency.



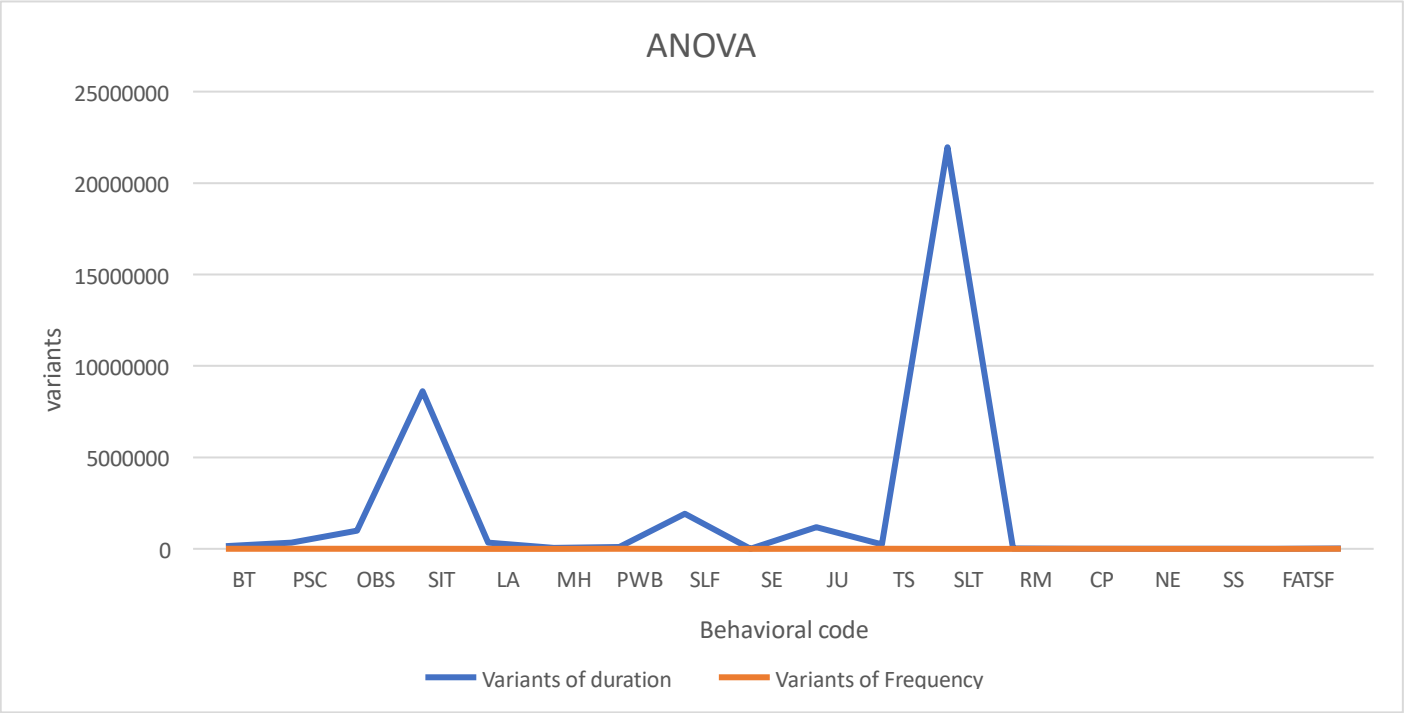
Graph 07: **Common Kingfisher**'s total duration and frequency is represented. We are seeing SIT most duration followed by FLW, FBT accordingly 5100 seconds, 2160,600 seconds. Flw frequency:3, FO:2 and least frequent behaviors: FS, FOP.

08. Intermediate cormorant's behavior vs duration & frequency :



Graph 08: Intermediate Cormorant's Behavior wise, Duration, Frequency represented. SIT most timely performed behavior followed by GLD, FLW, SP. Least timely performed behaviors: PHN, DDF, UDF. According to frequency behaviors are: BT (21), FLW (10), GLD (7). This Behaviors, Duration varying with previous two birds. Thus, college pond is highly assemblage with most common aquatic birds their different behaviors.

ANOVA:



ANOVA: Total Variants of Duration, Frequency are calculated and Graph designed with respect to Behavioral code.

Conclusion:

An animal's behavior consists of a stream of movements and events (Martin & Bateson, 2007). Before we can measure these movements, an animal's behaviors must be organized into specific categories. Throughout our observation we have tried to differentiate reasons behind different behaviors by different bird species. We also tried to calculate frequency of each behavior coded during data collection and changes in duration of such behaviors within changing weather, Observation of rare bird species& their behavior and if there are any similarities in behaviors with common bird species on observation area. We performed Graphical representation, Anova. We have also learned preference of Specific location by different bird species, similarities in their behaviors. Feeding behavior& Bouting frequency calculation was most difficult task. We have divided behaviors into three sub-behavioral components (as previously mentioned). From Graphical representations& data calculation we found: *Ardeola grayii*, *Phalacrocorax fuscicollis*, were mostly observed species to shown behavior. In Analysis of Variants (ANOVA) [Sir Ronald Fisher, 1918] we have represented Variants of duration (blue line) & Variants of frequency (Orange line) by plotting behavioral code on X-axis and variants on Y-axis.

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Declaration To Be Submitted:
"This is to declare that this work developed by us based on our primary published data and that we have duly acknowledged the use of all previously published related data in preparation of this report in a conventional manner. Further we declare that this report has not previously been submitted for publication in any other journal." _____ Akash Dutta.

Authors Contribution:
Akash Dutta and Nirban Pramanik both worked simultaneously in this article/ work where the former one provided the idea about the topic, later one executed the study.

Consent Of Authors:
Consent of each author towards publication of the article is to be submitted separately along with the manuscript with the following format-

Declaration Of Consent:
"This is to declare that I have full consent in publishing the article 'NICHE ALLOCATION & BEHAVIORAL NOTE OF BIRDS ON POND AND ITS SURROUNDINGS: A QUANTITATIVE STUDY FROM CLOSE POND AT RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE LOCALITY' along with Nirban Pramanik as co-author. I do not have any conflict of interest in publication of this article"- Akash Dutta.
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Conflict Of Interest:
There is no conflict of interest during publication of this work.