

Enriched School Environment for the Effective Bio-Activity of Barn Owls

Subhas Chandra Datta

Eco-Club Research Unit, Kanchannagar D. N. Das High School (HS), Kanchannagar, Purba, Bardhaman, West Bengal, India.

Abstract— Kanchannagar D.N.Das High School (HS), Kanchannagar, Purba Bardhaman-713102, West Bengal, India, is situated besides the Damodar river and is surrounded by ponds- and agriculture- fields. The school campus, prevails the main old- and tall- tree of banyan tree (*Ficus bengalensis*) with other trees, nutritional garden with midday meal, exhibited an enriched faunal diversity comprising small mammals, reptiles, toads, small birds and insects. Midday meal in a school depends on quality and supply of healthy foods which are depend on the habitants in the school environment. The rats were spoiling the foods for mid-day meal, rooms, important documents and materials in the school. Once the bats in the banyan tree began to make the school building dirty by their excreta. Different pests significantly reduce food production in the nutritious kitchen garden in school. The pesticides are the most effective means of control, but they are expensive and not environment friendly. To move forward, it will require **new and more efficient solutions, technologies, products and it has to fulfill all requirements**. Our best endeavor is to focus on the barn owl (*Tyto alba Scopoli*) which may have important economic implications for school environment as well as agriculture in future. Observations on the dietary habits and behaviors of the barn owl occupying a wooden nest were recorded in September 2018- February 2019 at school. During six months of observations, total consumed animals of barn owl, are analyzed from the regurgitated pellets; rats, mice and moles remained the highest as owls dietary proportions (58.13%), bats (13.57%), mongoose (10.41%), squirrels (8.89%), small birds like babblers etc (6.32%), insects (2.22%) and others animals like toads etc (0.47%). Due to mid day meal within the school campus and owl's clear vision during the night, it preferred to consume a variety of rodents inhabiting the kitchen stored as well as school campus. Food grains of mid day meal attracts rodents resulting a rapid increase of rats and mice but the presence of owl compel them to run away from the premises and they become guards for the cleanliness of the school. It can, therefore, serve as a useful "**Healthcare Bio-Controller**" i.e. **Biological Bird of Prey**. Their breeding helps to escalate the vegetation system of the school area and made the ponds clean; directly emphasized the ecosystem. Evidently, the barn owl would ensure a substantial management of ecosystem for better growth of economically important crops and their management in agriculture, horticulture as well as pisciculture also. And improves midday meal by supplying quality vegetables also and it would not only be easier way, easily available, cheap but also conserve our biodiversity and improves school environment which will contribute towards "**Sustainable Climate, School Health and Development with Joyful learning environment**". They are also opening a path of research for the students of our school who are observing them closely. We are amazed to find the coexistence of predator and prey on the same platform where owls and pigeons are found busy in incubation. It does not attacking the pigeons. Owls do not cause any harm to the other resident birds within the campus also and directly or indirectly they are helping us in various ways. They realize the meaning of relationship so they did not feel irritating when visitors, school students went to meet them.

Keywords— School health, Barn owls, Healthcare bio-controller, Midday meal, Regurgitated pellets.

I. INTRODUCTION

Number of birds are getting reduced gradually due to the rapid urbanization, poaching, superstation, use of insecticides and the fatal cord of kites¹. Having been

surrounded by green plantation, ponds, rivers and rivulets Kanchannagar D.N.Das High School location wise an ideal place for domestic and migratory birds. The diversity provides good habitat conditions for all animal groups¹⁻².

Barn owls belong to the top of the food chain and are attracted for the plenty of food availability³⁻⁶. Midday meal in a school depends on quality and supply of healthy foods which are depend on the habitants in the school environment⁵. The rats, moles and mice were spoiling the foods for midday meal, rooms, important documents and materials in the school¹⁻². Once the bats in the banyan tree (*Ficus bengalensis* L.) began to make the school building dirty by their stools and urinals making our white walls dirty¹⁻⁴. Different pests significantly reduce food production in the nutritious kitchen garden in school⁵. The pesticides are the most effective means of control, but they are expensive and not environment friendly⁶⁻¹¹. To move forward, it **will require new and more efficient solutions, technologies, products and it has to fulfill all requirements**. In 2015 it took the initiative to protect and preserve the birds those are the frequenters to the banyan tree within the school campus³. For safe nesting various types of boxes (including wooden box for the owl also), pitchers and swings are provided along with water for drinking and bathing, food particles and sand pits. Birds, squirrels, bats, monkeys, owls are the regular frequenters of this tree. They use these means to procreate³. In the last three years (2015-2018) number of barred owls increase noticeably³. In these three years, a pair of owls lay eggs twice and give birth to 24 owlets, on an average³. Eggs are generally laid in the months of May-June and October-November, in the same nest³.

As the box was damaged by the rainy season (June 2018), the mother barn owl took shelter in the pigeons nest. Recently (from September 2018 to February 2019) in a tilted bench that has been hanged from the ceiling of the veranda, a pair of barn owl (*Tyto alba*) has nestled along with a pair of rock pigeon (*Columba livia*) just beside the three classrooms¹⁻². One fine morning we find both of them have laid eggs and engaged themselves in incubation. And there are about 1000 students attending the school and about 50 to 70 students / class are attending the three classrooms where the owl had laid eggs¹⁻².

For the present studies, our best endeavor is to focus on the observations on the dietary habits and behaviors of the barn owls (*Tyto alba*) which may have important, for improves the joyful school environment and economic implications for agriculture by better crop quality and production for midday meal in future. The results would be more realistic in terms of the potentiality of the barn owls, use as potential **bio-controller /-agents or environment friendly predator birds**, in controlling various pests. Our

main aim to investigate new and more efficient solutions, technologies, products and it has to improve joyful school environment and fulfill its food and nutrition requirement which indirectly influence the climate change and resource productive economies enriching quality of midday meal as well as joyful educational environment.

II. MATERIALS AND METHODS

Location and weather of the study area

The experiment was carried out at the Kanchannagar D.N.Das High School (HS), Kanchannagar, Purba Bardhaman-713102, West Bengal, India, where temperature was $17\pm 5^{\circ}\text{C}$, relative humidity was $67\pm 5\%$, was situated besides the Damodar river and is surrounded by ponds- and agriculture- fields. Bardhaman is extends from $22^{\circ}56'$ to $23^{\circ}53'$ North latitude and from $86^{\circ}48'$ to $88^{\circ}25'$ East longitudes⁵⁻⁶. And average rainfall was 150 millimeter⁵⁻⁶. The school campus, prevails the main old- and tall- tree of banyan tree (*Ficus bengalensis*) with other trees, nutritional garden with midday meal, exhibited an enriched faunal diversity comprising small mammals, small birds, reptiles, toads and insects¹⁻³.

Time of experiments and type of nest

The experiment was conducted from September 2018-February 2019 in the big wooden nest (dimensions: Length - 180.78cm; width - 50.5cm; depth - 15.0cm) which is a tilted bench that has been hanged from the ceiling of the veranda¹⁻³. The nest was observed every day thrice at 10 am, 1pm and 5pm^{1-4,12}. All the data were counted for statistical analysis by the analysis of variance (ANOVA).

Collection of pellets

The diet composition of the barn owls were studied by the analysis of the materials found in the pellets and the prey remains collected from the demarked floor-bade underneath the tilted bench nest of owls, nest box and its vicinity, in variable numbers throughout the studies (September 2018-February 2019), surveyed and analyzed^{4,12}. Solid pellets collection was done on daily basis in the morning (at 10 am), afternoon (at 1pm) and in the evening (at 5pm). All the pellets were not included in the samples^{4,12}. They were carefully numerically numbered and measured with the date and time, placed in polyethylene bags and brought to the laboratory for further analyses^{4,12}. All the data were counted for statistical analysis by the analysis of variance (ANOVA).

Analysis the pellets

For analysis the pellets were immersed in water in Petri boxes for 10 min^{4,12}. Bones and sclerosis fragments recovered from the pellets were separated by morphological categories. Each pellet before being dissected was photographed and length was measured^{4,12}. Pellets were cut loose with sharp forceps and contents were checked for small mammals, birds and insects. The dissected barn owl pellets were critically examined and materials identified were designated as small mammals, birds and insects, as predominant prey items. All the identified food items were compared and contrasted with available reference materials for various rodent species, mainly on the basis of their dentition and skull patterns etc^{4,12} and the other prey were identified using any recognizable remains^{4,12-13}. Analysis was done regularly for the six months¹⁻⁴. All the data were counted for statistical analysis by the analysis of variance (ANOVA).

Maintenance of records

Records were maintained for all the pellets sampling and all the data were counted for statistical analysis by the analysis of variance (ANOVA) to ascertain the monthly variations of barn owl pellets in the study site and their predilection for specific food items, as determined from their pellet analysis^{4,12}. Species richness estimation regarding the relative population abundance of prey items was calculated¹³⁻¹⁴ to explain the results meaningfully.

Observation on different behaviors

Nesting and hunting behavior, egg laying, incubation and hatching behaviors, breeding behavior, sound producing behaviors, cleanliness behavior and social behaviors has been observed^{1-3,12-14}. Relationship or interaction or attitude among the parents owls, among the hatchlings of owls, pigeons, others birds, students, teachers, closely related staffs, photographers, visitors and media personnel, has also been studied for six months. The position of nest boxes provide direct physical access to observe all¹⁻³.

III. RESULTS AND DISCUSSIONS

Diet spectrum and frequency of ingested barn owl preys

Table 1 shows that during six months of observations from September 2018 to February 2019, 855 - total consumed prey animals of barn owl, are analyzed from the 767- regurgitated pellets; rats, mice and moles remained the highest as owls dietary proportions (58.13%), bats (13.57%), mongoose (10.41%), squirrels (8.89%), small birds specially babbler (6.32%), coleopteran insects (2.22%) and others animals like toads (0.47%) (P<0.1 by ANOVA).

Regarding the rodent composition in its diet, rats and mice, were found to be most comprehensively depredated food item, while moles and squirrels were the next consumed food item. Of the others, nocturnal mammals bat and mongoose were moderately preferred in the diet but the amphibians toads and coleopteran insects were the least preferred in the school and surrounding environment. These observations suggest that the barn owl is an opportunistic predator taking whatever prey is available³⁻⁴. It is interesting that barn owls are capable of switching to alternative prey when mammals become rare, but that they return to preferred prey as soon as it becomes available^{3-4,12-14}.

Highest numbers of pellets and consumed prey animals are found in the month of January due to presence of 6 young owlets and parents (P<0.1 by ANOVA). Highest numbers of dade animals are found in the month of February due to the owlets grow and learn to eat and hunt from their parents (P<0.1 by ANOVA). But highest numbers of owls / owlets are found in the month of December for the quick demand food supply to the 6 growing nestlings owlets (P<0.1 by ANOVA). Highest numbers are consumed by; rat / mice in November, moles and bats and squirrels in January, small babbler birds in February, insects in November, others animals like toads in December and mongoose in November- December (P<0.1 by ANOVA)^{3-4,12-14}.

Significantly, the size and color of the barn owl pellets were also variable (average length 5 to 8 cm, diameter 12 to 16 cm and color blackish to deep brown), but sufficiently large to include the scats of variable small mammals, insects and small sized birds^{3-4,12-14}. Pellet analysis also indicated a relatively high richness of the dietary habit in each sample for the barn owl, therefore, rendering it to be the cosmopolitan bird of prey^{4,12-15}.

Nevertheless, the percentage composition of small mammals was largest which showed its affinity for them throughout the present studies, lasting from fall through winter, relatively cold and dry weather, which had no impacts from rainfall, as there are incidences of the rain to affect the barn owl populations, and during the rainy days, resource availability certainly increases to affect the barn owl populations¹⁶. Perhaps, the species richness for barn owl (rodents) would be considerably higher during the November to February, with more availability of food to them, than in the fall and winter seasons^{4,12-16}. As majority of the rodents have proved to be destructive to important cash crops causing substantial economic losses, efficiency

of barn owls among the woodlands might trigger the reverse trend to control their populations through an efficient control, an augmented global trend for management of pests using non chemical methods to protect the already dwindled agricultural systems, as well manifested in oil-palm plantations in Malaysia using the barn owl populations against rodent pests¹⁷.

Of the toads and insects present in the barn owl pellets, can also be regarded as an alternative diet of the owl due to the diminishing of their preferential foods, the rodents, in any habitat^{4,12-18}, and finally the incidence of avian fauna was found in small proportions in the barn owl pellets, with babbler in relative abundance, whereas, some traces were also found for other birds. Impacts of rodent pests have been unparalleled on sustainable agro-ecosystems in the school, causing considerable depredations to mid day meal stored grains and the materials^{5-11,19}. The requirements of the modern day agriculture in wake of alarming increase in population, demand better crop quality and yield⁵⁻¹¹. Cropping systems throughout India are plagued with various vertebrate pests, mainly the rodents, insects and mammals, disrupting the stability and sustainability of the rich diversity of food crops⁵⁻¹¹. It, therefore, augments that, propagation of the barn owl in the cultivations would be beneficial to do away with the rodent menace largely, inhibit the damage and economic losses, without putting any serious implications of the sustainability of agro-ecosystems of school and surroundings^{1-3,5-11}.

Nesting and hunting behaviors

In 2015 it took the initiative to protect and preserve the birds those are the frequenters to the banyan tree within the school campus¹⁻³. For safe nesting various types of boxes, pitchers and swings are provided along with water for drinking and bathing, food particles and sand pits¹⁻³. Birds, squirrels, bats, monkeys, owls are the regular frequenters of this tree¹⁻³. They use these means to procreate. In the last three years number of barred owls increase noticeably in the wooden owl-box of the banyan tree¹⁻³. In three years, a pair of owls lay eggs twice and give birth to 24 owlets, on an average. Eggs are generally laid in the months of May-June and October-November, in the same nest³.

As the owl-box was damaged by the rainy season in the banyan tree, the mother owl recently took shelter in the pigeons nest, which is a tilted bench that has been hanged from the ceiling of the veranda, a pair of barn owl (*T. alba* L.) has nestled along with a pair of rock pigeon

(*Columba livia* L.) just beside the three classrooms, without hesitation the pigeon family welcomed her and this resulted in a good relationship between them^{1-3,20}. The female owl hunted rat, frog, bat, squirrel in order to attract the male one and the effort results in a relationship between them and began to stay together. When hunting they are very swift and will catch their prey unawares with their long and slim feet^{1-3,20}.

Egg laying, incubation and hatching behaviors

One fine morning we find both of them (owls and pigeons) have laid eggs and engaged themselves in incubation. The owl has laid six white colored eggs within 12-days. The average measurements of egg were: length 4.8cm, width 3.2cm, weight 20.7g. We got dumb founded to find this amicable juxtaposition of predator and prey without hesitation the pigeon family welcomed her and this resulted in a good relationship between them^{1-4,14-20}.

After one month of incubation the six nestling (two male and four females) comes to the earth. It is observed that 1st hatchling is female owl, 2nd one is also female owl, 3rd one is male owl, 4th one is female, 5th one female and last one is again male owl³⁻⁴. Sex determination has done by morphological characters. Nesting barn owls store prey items at the nest site while they are incubating to feed the young once they hatch. The adult male counterpart has taken responsibility of supplying food. The length of the adult female is 33 cm and 93 cm when it spans its wings. And the parent owls always feed and care for the newborns. Within 10-12 days from hatching, the owlets grow and learn to eat and hunt from their parents^{1-4,14-20}.

Food supply behaviors

The female tears up the food brought by the male and distributes it to the chicks. Initially these make a "chittering" sound but this soon changes into a food-demanding "snore". The bird was conscious about the surrounding environment. On some disturbance, parents flew away from the nest giving an alert call and perched on a palm tree nearer the building. Sometimes two owlets were observed sitting on the nest. The male is the main provider of food until all the chicks are at least four weeks old at which time the female begins to leave the nest and starts to roost in the palm tree. By the sixth week the chicks are as big as the adults but have slimmed down somewhat by the ninth week when they are fully fledged and start leaving the nest briefly themselves. They are still dependent on the parent birds until about thirteen weeks and receive training from the female in finding, and eventually catching prey^{1-4,14-20}.

Sitting behaviors

The young 6-owlets always sit side by side in 180° angle and two male owlet posses in the middle surrounded by female owlets due to maintaining body temperature as well as defense mechanism. About 70 days after hatching, they leave the nest for their first flight. However, they return to the nest to roost. About 3-5 weeks after they began flying, they then become independent. Eventually, after 90-116 days of full maturity, they are looking for their new nest. In the month of March, all the owls flew away and take safe-shelter behind the dry leaves of a palm tree where difficult to see or find out the owls due to same background color of owl and dry leaves¹⁴⁻²¹.

Cleanliness behavior

Parents owls and 6 nestling owlets always clean the nest and never make dirty by their excreta. We do not get any decomposed materials from the nest excepts some little bones after all the adult owls flew away from the nest. It is noted that owls forms a thin ash colored solid layer in the platform of the wooden nest by cementing substance^{1-3,4,12-21}.

Sound produce during breeding behaviors

During incubation, the male will feed the female and both parents take care of the nestlings. When disturbed at its roosting site, an angry barn owl lowers its head and sways it from side to side, or the head may be lowered and stretched forward and the wings drooped while the bird emits hisses and makes snapping noises with its beak. A defensive attitude involves lying flat on the ground or crouching with wings spread out. They also 'twitter' when quarrelling with nest mates. Nest boxes provide direct physical access to the breeding location^{1-3,4,12-22}.

Singing Behavior

It is observed that barn owls do have various types of calls. There are five main categories of calls: screams, snores, hisses, chirrups and twitters, and other calls. The scream category consists of the advertising call (a drawn-out gargling scream), the distress call (a series of drawn-out harsh screams), the warning call (high-pitched scream), and the purring call (quiet scream used by male to attract female to a nest site). Snores are self-advertising calls given mostly by females and nestlings. Hisses are long and loud; they are given repeatedly to intimidate predators. Chirrups and twitters are given by males when delivering food and by females when feeding young. Nestlings will often twitter when uncomfortable or quarreling with a nest mate. Other

calls include the mobbing call (an explosive yell), copulation call (staccato squeal), and greeting call (used during courtship and food deliveries)^{1-3,4,20-22}.

Barn owl Anti-predator behaviors

In the ecological food web the barn owls are predated by large carnivorous mammals, red kites, hawks, eagles, some snakes, humans and their pets, particularly house cats and feral cats. Barn owls are also predated by other owls, for example, the great horned owl^{1-3,4,20-22}. One day, at the age of 65 days, a female owlet is theft by man for pet in the house but the owl produces large alarming sound when they tide in a big bag. Students hear the owlet voice and inform the headmaster. Then, it is rescue by day-guard and frighten owlet don't come out from the bag when open the mouth of the bag by the headmaster. But, when headmaster enter and hold the owlet by the hand with repeated calling "Barn", the owlet comes out and produces pleasure sound with the movement of head^{1-3,20-25}.

Barn owl Social behavior

Owls always give positive responses for the relationship or interaction or attitude among the parents owls, among the hatchlings of owls, pigeons, students, teachers and closely related staffs specially headmaster and two guards. Owls give negative responses to others birds, photographers, visitors and media personnel. But they behave good positive responses when very close related staffs like headmaster or guards accompany with them. Nest boxes provide direct physical access to observe all. Other sounds produced include a purring chirrup denoting pleasure^{1-3,12-25}.

Barn owl Communication behavior

Barn owls are mainly acoustic, that is, they communicate using sounds^{1-3,12-25}. The advertising call is the drawn-out gargling scream which is used often. A series of drawn-out gargling scream indicates that the owl is distressed. Some other vocalizations are a twitter when feeding and during courtship, an explosive yell in response to a mammalian predator and a defensive hissing sound. When they are not breeding they are less vocal^{1-3,20-25}. The young one also uses several distinct vocalizations which include a twitter during discomfort, attention seeking and a snoring food call. The barn owl also shows visual communication to its predator. When attacked it squints its eyes, spread its wings, jerks its head back and forth, falls on its back and strikes at the intruder with its feet^{1-3,12-25}.

Special Responses

The parents owls flew away from nest when visitors come to the spot without closely acquainted staffs

for photography. It took shelter behind the leaves of a palm tree. The headmaster stated that no problem and he shall call the bird back. And started shouting...Barnol.. Barnol...come come..Barnol (later he stated that he found the name Barnol to be appropriate for the Barn Owl). Barnol came out and perched on a beautiful perch of a neem tree.

"What a beautiful relationship!" ... when headmaster calls, "Barn, Barn... Look your brothers from Kolkata for photography here". The young owlets also get delighted with thousands of students, teaching and non teaching staffs. All the Barn Brothers are now students forming joyful school environment. It is noted that male owl is more responsive than female owl^{1-3,4,12-25}.

Observation on biodiversity

Therefore, it is observed that the biodiversity of the campus of Kanchannagar D. N. Das High School^{1-3,5-11}, it is seen that the procreation of the barn owls are taking place in the same environment where students, staffs, visitors and birds and animals like mynah, dove, magpie, drongo, oriole, bulbul, crow, cuckoo, babbler, kingfisher, woodpecker, migratory birds, squirrel, bats, tailor birds, snake, mongoose, mice, frogs, stray dogs, different types of insects, monkeys etc. are amicably co-existing. Three years ago, the droppings of the bats in the banyan tree use to make our white walls dirty, but surprisingly, it does not occur anymore due to the presence of the owls. Food grains of mid day meal attracts rodents resulting a rapid increase of rats and mice but the presence of owl compel them to run away from the premises^{1-3,4,12-25}.

Barn owl social responsibility

We are amazed to find the coexistence of predator and prey on the same platform where owls and pigeons are found busy in incubation. It does not attacking the pigeons. Owls do not cause any harm to the other resident birds and others within the campus. When the nestlings owlets are able to fly and their food habit resulted them as the "Guard" for the cleanliness of the school¹⁻³. Their breeding helps to escalate the vegetation system of the school area and made the ponds clean; directly emphasized the ecosystem. Directly or indirectly they are helping us in various ways. They are influencing the ecosystem as well as joyful school environment and also working as "Bio-controller" and huge support to agriculture, horticulture and pisciculture¹⁻⁴. They are also opening a path of research for the students of our school who are observing them closely.

IV. CONCLUSIONS

These observations suggest that the dietary habits and behaviors of the barn owl, total consumed animals of barn owl, are analyzed from the regurgitated pellets; rats, mice and moles remained the highest as owls dietary proportions (58.13%), bats (13.57%), mongoose (10.41%), squirrels (8.89%), small birds like babblers etc (6.32%), insects (2.22%) and others animals like toads etc (0.47%). Due to mid day meal within the school campus and owl's clear vision during the night, it preferred to consume a variety of rodents inhabiting the kitchen stored as well as school campus. Food grains of mid day meal attracts rodents resulting a rapid increase of rats and mice but the presence of owl compel them to run away from the premises and they become guards for the cleanliness of the school. It can, therefore, serve as a useful "Bio-Controller" i.e. Biological Bird of Prey. Their breeding helps to escalate the vegetation system of the school area and made the ponds clean; directly emphasized the ecosystem. Evidently, the barn owl would ensure a substantial management of ecosystem for better growth of economically important crops and their management in agriculture, horticulture as well as pisciculture also. And improves midday meal by supplying quality vegetables also and it would not only be easier way, easily available, cheap but also conserve our biodiversity and improves school environment which will contribute towards "Sustainable Climate, School Health and Development with Joyful learning environment". They are also opening a path of research for the students of our school who are observing them closely. We are amazed to find the coexistence of predator and prey on the same platform where owls and pigeons are found busy in incubation. It does not attacking the pigeons. Owls do not cause any harm to the other resident birds within the campus also and directly or indirectly they are helping us in various ways. They realize the meaning of relationship so they did not feel irritating when visitors, school students went to meet them.

ACKNOWLEDGEMENTS

The work described here has been supported by all staffs, students and guardian as well as whole community. I like to thanks Sri Subrata Mukherjee, Senior District Judge for photography and Sri Basudev Mondal, Assistant English-Teacher of Kanchannagar D.N.Das High School, Kanchannagar, Burdwan, who help for preparation of the manuscripts.

REFERENCES

- [1] **Staff reporter. 2019a.** Increased owls safely in the Kanchannagar D.N.Das High School. 23rd February 2019 in *Eisamay State News Paper, Bardhaman Page.*
- [2] **Staff reporter. 2019b.** Environment friendly owls. 1st March 2019 in *Kalam State News Paper.*
- [3] **Datta S C. 2018a.** Increased owl populations in the artificial nest of Kanchannagar D.N.Das High School act as a bio-controller. *Khaskatha*, **13:50-51.**
- [4] **Hammad AK, Muhammad J, Muhammad S, Muhammad A. 2014.** Dietary Habits of the Barn Owl (*Tyto alba*) in an Agricultural Farmland of Faisalabad Pakistan. *Int.J.Curr.Microbiol.App.Sci*, **3(8) 211-218.**
- [5] **Datta S C, Datta B. 2018b.** Improved midday meal by using cowpea as eco-friendly crop controlling root-knot forming global green, growth and green economy. *J.Recent Sci.* (In Press). ISBN: 978-93-86675-21-7 and ISSN: 2277-2502.
- [6] **Datta S C, Das R, Chatterjee K, Mondal B, Das R. 2016a.** Amaranth Plant: Protects Climate, Health and Development by Controlling Root-Knot Disease. *J.Environ.& Analytical Toxicol.*, **6: 341. doi:10.4172/2161-0525.1000341.**
- [7] **Datta S C, Datta R. 2016b.** Prevention and control of root-knot disease of mulberry plants using bioagents amaranth plants: improving sericulture by protecting climate health, health and development. *J. Environ. & Sociobiol.* : **13(2):191-200.**
- [8] **Datta S C, Datta R. 2017.** Acaciasides use as Potential Bio-Agents against Various Plant Pathogens. *Book: New Innovations in Environmental Biotechnology. Publisher: Lenin Media Pvt. Ltd., New Delhi, 2017.* Hardcover. Condition: New. 472pp. [Chapter 14, 2016; Pages-20], Editors: Dr.M.M. Abid Ali Khan (India), Murtaza Abid (India), Dr. Abdeen Mustafa Omer (United Kingdom), Dr. Binna Rani (India). BN 10: [9385995154](https://doi.org/10.9385995154) ISBN 13: [9789385995156](https://doi.org/10.9789385995156).
- [9] **Datta S C, Datta R. 2007.** Intercropping amaranth with mulberry for managing root-knot nematodes and improving sericulture. *Sericol.*, **47(3) : 297-302.**
- [10] **Datta S C. 2006.** Effects of *Cina* on root-knot disease of mulberry. *Homeopath.*, **95 (2):98-102.**
- [11] **Datta S.C. 2019.** Enriched Sericulture from Effective Treatment of Mulberry Diseases by *Homeopath. Med. Adv. Biochem. Biotechnol.*, **7: 084.** DOI: 10.29011/2574-7258.000084
- [12] **Torre I, Arrizabalaga A, Flaquer C.2004.** Three methods for assessing richness and composition of small mammal communities. *J. Mammal.*, **85:524-530.**
- [13] **Le LH, Que´re´ JP. 2003.** Les Rongeurs de France: Faunistique et Biologie. *Institut National de la Recherche Agronomique Editions, Paris.*
- [14] **Clark DR, Bunck CM. 1991.** Trends in North American small mammals found in common barn-owl (*Tyto alba*) dietary studies. *Can. J. Zool.*, **69: 3993-4002.**
- [15] **Taylor I. 1994.** Barn owls. Predator-Prey relationships. *Cambridge university press, Cambridge, England.*
- [16] **Leirs H, Stenseth NC, Nicols JD, Hines JE, Verhagen P, Verheyen W. 1997.** Stochastic seasonality and non-linear density dependent factors regulate population size in an African rodent. *Nature*, **389: 176-180.**
- [17] **Wood BJ, Chung GF. 2003.** A critical review of the development of rat control in Malaysian agriculture since 1960s. *Crop Prot.*, **22: 445-461.**
- [18] **Pavez E. 2004.** Descripcio´n de las aves rapaces chilenas. In: Mun oz-Pedrerros A, Rau J, Ya´nez J, editors. *Aves rapaces de Chile. Valdivia: CEA Ediciones.* p 29 106.
- [19] **Lathiya SB, Ahmed SM, Pervez A, Rizvi SWA. 2008.** Food habits of rodents in grain go downs of Karachi. *J.stored Prod. Res.*, **44: 41-46.**
- [20] **Julius O, Christian B, Friederike R, Yair A, Hermann W, Ohad BS.2015.** Visual pop-out in barn owls: Human-like behavior in the avian brain. *J. Vision.*, **15: 4.** doi:10.1167/15.14.4
- [21] **Dreiss AN, Ruppli CA, Oberli F. 2013.** Barn owls do not interrupt their siblings. *Ani. Behav.*, **86:119-126.**
- [22] **Moffat CB. 1940.** The notes of the barn owl. *The Irish Naturalists’ J.*, **7: 289-292.**
- [23] **Carl D. Marti.2010.** Dietary Trends of Barn Owls in an Agricultural Ecosystem in Northern Utah. *The Wilson J.Ornithol.*, **122(1):60-67.** DOI: 10.1676/09-025.
- [24] **Ineich GP, Fontaine B , Gargominy O. 2012.** Banded geckos, *Gekko vittatus* (Reptilia, Gekkonidae), as the main prey of barn owls (*Tyto alba*) on the Torres Islands (northern Vanuatu), *New Zealand J. Zool.*, DOI: 10.1080/03014223.2011.627565.
- [25] **Wolf MH, Katrin G, Hermann W.2007.** Vernier acuity in barn owls. *Sci.Dir., Vision Res.*, **47:1020–1026.**

Table.1 Month wise distribution of animals in the owls pallets collected from study area of Kanchannagar D.N.Das High School.

Months	No. of Pallets	No. of Owl / Owlets found in the Nest	No. of Dade Animals found in the Nest	Rats / Mice	Moles	Bats	Squirrels	Small Birds (Babbler)	Insects	Other Animals (Toads etc.)	Mongoose (whole Cranium with Skeleton)	No. of Total Prey Animals Consume
Sept.-2018	88a±0.12	56a±0.01	42a±0.02	37b±0.03	20a±0.04	14a±0.03	9a±0.01	05a±0.01	01a±0.01	0.3a±0.01	02a±0.02	88.3a±1.80
Oct.-2018	107b±0.15	58a±0.04	53b±0.09	48c±0.02	22a±0.08	17b±0.05	10a±0.02	8b±0.02	01a±0.01	0.2a±0.01	05b±0.01	111.2b±3.10
Nov.-2018	122c±0.12	228d±0.10	65c±0.13	55e±0.01	24b±0.06	18b±0.03	12b±0.02	9c±0.03	12c±0.06	0.4b±0.02	28e±0.06	158.4d±4.60
Dec.-2018	139d±0.13	232d±0.26	79d±0.11	37b±0.03	52d±0.04	21c±0.07	14c±0.04	9c±0.03	03b±0.05	2.1d±0.07	29e±0.03	167.1e±4.70
Jan.-2019	165f±0.17	203c±0.17	92e±0.22	32a±0.04	75e±0.13	24d±0.09	17d±0.05	12d±0.04	01a±0.03	0.8c±0.02	17d±0.07	178.8f±6.70
Feb.-2019	146e±0.14	197c±0.36	98f±0.08	53d±0.09	42c±0.09	22c±0.11	14c±0.08	11d±0.07	01a±0.07	0.2a±0.02	08c±0.02	151.2c±6.10
Total	767	974	429 (50.18%)	262 (30.64%)	235 (27.49%)	116 (13.57%)	76 (8.89%)	54 (6.32%)	19 (2.22%)	4 (0.47%)	89 (10.41%)	855

a,b- different small letters in a column show significant difference by 'ANOVA' (P<0.01).

Environmental enrichment is the stimulation of the brain by its physical and social surroundings. Brains in richer, more stimulating environments have higher rates of synaptogenesis and more complex dendrite arbors, leading to increased brain activity. This effect takes place primarily during neurodevelopment, but also during adulthood to a lesser degree. With extra synapses there is also increased synapse activity, leading to an increased size and number of glial energy-support cells. Environmental The discovery of many dead barn owls lying around the highway peaked this young naturalist's curiosity. See what he learned when from his investigation. This made me wonder if this could also create problems for the owls on the highway because semis can create wind tunnels with their size and speed. In fact, while we were stopped on the side of the highway so I could take pictures of the dead owls, I could feel the wind as the big semis passed. They even shook our parked car. Small pebbles on the road would some times get kicked up and would hit me. I could imagine that these factors affected the barn owls' chances of survival on the highway. Dissection of barn owl pellet. The Great Britain Barn Owl Trust also says that a weak barn owl wi Barn Owls (*Tyto alba*) are one of the most widespread owls in the Indian Subcontinent. The word *Tyto* has been derived from the Greek word *tyto*, meaning night This explains its nocturnal nature, and the word *alba*, which corresponds to its white or dull white colour. These owls are medium-sized with long legs and wings and have a relatively shorter tail when compared to other similar sized owls. Owls have one of the most fascinatingly coloured eyes in birds but the Barn Owl exhibits dark eyes, and a distinct heart-shaped facial disc. This owl doesn't have the characteristic "woo-woo-woo" hoot of Enriched School Environment for the Effective Bio-Activity of Barn Owls. Article. Jan 2019. Evidently, the barn owl would ensure a substantial management of ecosystem for better growth of economically important crops and their management in agriculture, horticulture as well as pisciculture also. And improves midday meal by supplying quality vegetables also and it would not only be easier way, easily available, cheap but also conserve our biodiversity and improves school environment which will contribute towards "Sustainable Climate, School Health and Development with Joyful learning environment". Review Article (ISSN: 2637-6679). Enriched School Health for the Effective Healthcare Bio-Activity of Barn Owls Volume 3 - Issue 3. Subhas Chandra Datta*. Eco-Club Research Unit, Kanchannagar D.N.Das High School (HS), West Bengal, India. Kanchannagar D.N.Das High School (HS), Kanchannagar, Purba Bardhaman-713102, West Bengal, India, is situated besides the Damodar river and is surrounded by ponds- and agriculture- fields. The school campus, prevails the main old- and tall- tree of banyan tree (*Ficus bengalensis*) with other trees, nutritional garden with midday meal, exhibited an enriched faunal diversity comprising small mammals, reptiles, toads, small birds and insects.