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Jungle cats-are they beneficial or harmful to the farmers of rural West Bengal?

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Abstract
Jungle cats have both positive and negative impacts on the lives of the farmers. They kill rodents and reduce the amount of crops destroyed by the rodents. In this study the Indian mole rat was observed to cause a loss of 238 kg/hectare of paddy and 5549.66 kg/hectare of potato. More paddy was collected by the rodents during the winter than in the summer. The rodents caused an economic loss of ₹ 5331.2 per hectare from rice and ₹ 106993.3 per hectare from potatoes. A total of ₹ 112324.5 was lost per hectare due to rodent activity. Studies have revealed that jungle cats consume 3-5 rodents per day, thereby reducing the rodent population and saving the farmers' money. Jungle cats also kill poultry birds in the agricultural villages. The study had revealed that only 23% of total poultry kept were lost due to jungle cat predation. Jungle cats killed 55.33± 28.3 chickens and 112.33± 27.42 ducks per year. Analysis of the data showed that more ducks were killed by the jungle cats than chickens. A total ₹ 47533.33 was lost from poultry bird deaths due to jungle cat predation. The economic loss caused by the rodents was more than twice the economic loss caused by the jungle cats. Comparing both impacts it seemed that the positive impact had far outweighed the negative impact of the jungle cats in the agricultural fields.

Keywords: jungle cat, Indian mole rat, poultry birds, economic loss

Introduction
Jungle cats (*Felis chaus*) are also known as reed cats or swamp cats. They inhabit mainly grasslands, scrublands and reedy banks of marshes [19]. They also adapt well to agricultural fields [39]. The head-body length is between 59-76 cm and the jungle cat stands at 36 cm at the shoulder. The weight ranges between 2-16 kg [8]. In the Indian subcontinent the average weight is 4 kg [19].The males are usually larger than the females. They are buff or greyish brown in colour. Melanistic individuals have also been recorded [9]. They have tufts of blackish hair at the tips of their ears. The eyes have yellow irises with elliptical pupils. They are usually solitary in nature. They mark their territory by urine spaying and scent marking. Their preferred prey are usually small mammals and birds [36].

History
Fossil records of *Felis chaus* have been found from the Holocene strata in Java [37]. Johann Anton Güldenstädt during his exploration near the Terek River at the southern frontier of the Russian empire caught the first specimen of jungle cat. J.A. Güldenstädt explored the region on the behalf of Catherine II of Russia. J.A. Güldenstädt described the specimen in 1776 under the name "Chaus" [13, 14, 31]. In 1778, Johann Christian Daniel von Schreber was considered the binomial authority of jungle cat as he was the first scientist to use 'chaus' as the species name for the jungle cat [32]. The first drawing of an Indian jungle cat named "allied cat" (Felis affinis) by John Edward Gray was discovered from Thomas Hardwicke's collection of illustrations of Indian wildlife [11]. In 1832, the Asiactic Society of Bengal was presented with a stuffed specimen of jungle cat from the jungles of Midnapore in West Bengal, India. J.T. Pearson proposed the name *Felis kutas* for the specimen as it differed in colouration from *Felis chaus* [26]. In 1852, the first jungle cat skin from Sri Lanka was described by Edward Frederick Kelaart [16]. In 1930, the jungle cat skulls and skins from British India and adjacent countries were reviewed by Pocock. Pocock subordinated the specimens from Turkestan to Balochistan to *Felis chaus affinis*, the ones from Bengal to Cutch under *Felis chaus kutas* and those from Burma under *Felis chaus fulvidina* based on differences in fur length and colour. Pocock described the six newly acquired larger skins from Sind as *Felis chaus prateri*. Pocock described skins with shorter coats from Sri Lanka and southern India as *Felis chaus kelaarti* [29].

Present Classification
In 2005, 10 subspecies of jungle cats were recognized as valid taxa by the authors of Mammal Species of the World [38]. From 2017, only three subspecies of jungle cats have been considered as valid by the Cat specialist Group [18]. They are listed below:-

- *Felis chaus chaus* Schreber, 1777
- *Felis chaus affinis* Gray, 1830
- *Felis chaus fulvidina* Thomas, 1929.

Distribution
Jungle cats are distributed from Africa to South East Asia [1]. They are found in Egypt, Jordan, Israel, northern Saudi Arabia, Iraq, Syria, Iran, Uzbekistan, Tadzhikistan, Turkmenistan, Kazakhstan, western Xingjian, Pakistan,

Afghanistan, Nepal, Sri Lanka, India, Myanmar, Laos, Cambodia, Thailand, Vietnam and China [36]. In Nepal, in the Annapura Conservation Area jungle cats have been reported at high elevations of 3000-3300m [5]. In Pakistan, camera traps have recorded footage of jungle cats in the unprotected areas of Haripur district [4]. According to Menon (2014) four subspecies of jungle cats are present in India- *Felis chaus affinis* in northern India, *Felis chaus prateri* in western India, *Felis chaus kutas* in peninsular India and *Felis chaus kelaarti* in south India.

Reproduction

Mating generally takes place in December and June. In the Middle East mating takes place in January-February [3]. Mating season is marked by the shrieks and fights of male jungle cats. Mating behaviour is similar to that of domestic cats. Males follow the females and frequent vocalization can be heard from both sexes. The females can breed twice in a year. The gestation period is between 63-66 days. The females use tree roots, hollow trees, thorny hedges, paddy fields and dense reed beds as den sites. The males do not take part in parental care in the wild. In captivity males have been observed to be protective towards their young. The usual litter size is 2-3 kittens but as many as 6 kittens can also be born in a single litter. The young ones are 43-55 g in weight at around the two day period. The kittens open their eyes around 10-13 days old. The kittens can take solid foods at 49 days old period. The kittens continue to suckle till they are 90 days old. In some case complete weaning takes place at 102 days old period. The kittens can kill prey at around 6 months old. The kittens leave their mother at 8-9 months old stage. In some cases females become sexually mature at 11 months old [28, 27, 36].

Objective

To determine the overall impact of jungle cats on the lives of the farmers in the unprotected areas of rural Purba Bardhaman district, West Bengal, India (Fig 1)

Fig 1: Jungle cat at Ketugram

Materials and Methods

The study was conducted in the Nabagram (23^0 41'32.31"N, 88^0 4'25.35"E) Panchayat of Ketugram II community developmental block in Katwa subdivision of Purba Bardhaman district of West Bengal, India. The study was conducted in the year March 2019 to May 2021. Paddy was cultivated twice per year and potatoes were cultivated only during the winter in Ketugram. The rodent burrows were dug to determine the total paddy hoarded by the rodents. The collected data were subjected to t test to determine if there was any significant difference in the amount of paddy collected by the rodents during the summer vs during the winter. The potatoes damaged by the rodents were collected and weighted to estimate the total loss caused by the rodents. A survey was conducted to determine the total number of poultry birds lost due to the jungle cats. Two types of poultry birds – chickens and ducks were kept by the villagers. The data were analysed to determine if one type of poultry bird was killed more by the jungle cats than the other. All statistical analysis were performed by Graphpad Prism 2019 at West Bengal State University (WBSU).

Results

The study revealed that 160.4±0.44 kg of paddy was lost per hectare during the summer and 316.3±2.8kg of paddy was lost during the winter due to rodent activities. Analysis of the data showed that more paddy was lost due to rodent activities during the winter than the summer (t test: t=3.475, df=4, p=0.0255). A total of 238 kg of paddy was lost per hectare per year due to rodent activities. Only 64% of collected paddy is converted into rice in the Indian paddy mills (Singha, 2013). Total rice lost per hectare per year was 152.32 kg. The price of rice was ₹ 35 per kg. A total of ₹ 5331.2 was lost due to the activity of the rodents.

52.71 rodent burrows per hectare were recorded during the time of the study. 64% of the burrows contained the rodent. So, total number of rodents per hectare was 33.92 (34 approx). Only the Indian mole rat was recorded from the burrows (Fig 2)

Fig 2: Indian mole rat

The study revealed that 5349.66±804.79 kg of potato was lost due to rodent activities per hectare. The price of potato was ₹ 20 per kg. A total of ₹106993.3±16095.93 was lost due to potatoes eaten by the rodents per hectare per year (Table 1). A total of ₹ 112324.5 was lost per hectare per year due to the rodents.

Table 1: Economic loss caused by rodents from 2019-2021

Year	Potato Loss (kg/hectare)	Economic Loss (₹)
2019	5521	110420
2020	6055	121100
2021	4473	89460

The survey revealed that 55.33±28.3 chickens and 112.33±27.42 ducks were lost per year due to the jungle cat predation. Only 23.06% of the overall poultry kept was lost due to jungle cat predation. The price of chicken was ₹250 and that of duck was ₹300. A total of ₹ 47533.33±8064.9 was lost from poultry deaths due to jungle cat predation per year (Table 2).

Table 2: Condition of poultry from year 2019-2021

Year	Chicken Kept	Chicken Lost	Economic Loss (₹)	Duck Kept	Duck Lost	Economic Loss (₹)	Total Economic loss (₹)
2019	455	88	22000	565	97	29100	51100
2020	212	38	9500	332	96	28800	38300
2021	121	40	10000	496	144	43200	53200

Analysis of the data showed that more ducks were killed by jungle cats than chickens (Fisher's exact test: p=0.0042).
The economic loss caused by rodents per year was more than double the economic loss caused by jungle cats.

Discussion

Positive Impact on Farmers

Studies have revealed that rodents cause a mean yield loss of 12.4% of the total yield [6]. 5-10% of total cultivated paddy are lost due to rodent activity in Asian countries. Rodents destroy enough crops to feed 200 million people on a yearly basis in Asia [34]. In South Asia, the Indian mole rat (*Bandicota bengalensis*) is the most common type of rodent infesting the paddy fields. In West Bengal of India, the Indian mole rat was estimated to cause a yield loss of 261kg of rice per hectare [24]. Hoarding of paddy in the burrows was the main way of damage by the Indian mole rats in West Bengal. The Indian mole rat has been reported to store 1.7 kg of paddy in their burrow system [7]. $45 million is lost annually due to rodent activity in Tanzania [35]. Analysis of scats of jungle cat in suburban West Bengal had revealed that rodents contributed to 87.9% of the total diet of jungle cats [2]. Studies on jungle cats in the Sariska Tiger Reserve had revealed that 73% of their total diet consists of rodents. This study had concluded that each jungle cat potentially consumed 3-5 rodents per day or 1825-2190 rodents per year [20]. So, jungle cats could serve as biological pest controls for rodents in agricultural fields.

Negative Impact on Farmers

Family poultry rearing is a small scale industry in Asia, Africa, Latin America and South Pacific. In Bangladesh, family poultry rearing contributes to 90% of the total poultry produced. Family poultry rearing is a source of money for low income families. Rural poultry farming is generally considered as the responsibility of the women [15]. In India, rural poultry farming is a good source of protein for the poor farmers with little to no investment in feed cost [25]. In India, rural poultry farming is also used as a source of subsidiary income [30]. Jungle cats have been reported to kill poultry birds in the agricultural fields [29, 17]. In Turkey, the jungle cats have been known to kill aquatic birds in winter [23]. So, by killing the poultry birds the jungle cats potentially deprive the farmers of a source of protein and subsidiary income.

Conservation Status

Jungle cats are listed Least Concern (LC) in the IUCN Red List Category but their population is steadily declining [12]. Jungle cats are listed in the Schedule II Part I of the Wildlife (Protection) Act, 1972 of India [10]. Jungle cats have been listed under CITES Appendix II. Hunting of jungle cats is prohibited in India, China, Bangladesh, Turkey, Israel, Myanmar, Pakistan, Tajikistan and Thailand. In countries like Bhutan, Georgia, Nepal, Laos, Sri Lanka, Lebanon and Vietnam, jungle cats do not receive any protection outside of the protected areas [22]. Habitat destruction and hunting by humans are the main threats towards jungle cats. The ever growing human population has converted the natural habitat of the jungle cats into farmlands. Although the jungle cats have adapted well to farmlands, the hunting of poultry birds by the jungle cats in these farmlands has brought the jungle cats in direct conflict with the poultry owning farmers. The farmers often hunt or poison the jungle cats to protect their poultry birds. The jungle cats are also often poached for their fur. Although hunting of jungle cats is illegal in many countries, the illegal trade in jungle cat fur still persists to this day. Over the last decade more than 3000 skins of jungle cats have been seized across the World [36, 21, 23].

Conclusion

The jungle cats play an important role in the lives of farmers by controlling the rodent population. They help to reduce the crop damage done by the rodents. Although they also kill poultry birds, the study revealed that each household only lost a small portion of the poultry they kept per year due to the jungle cat predation. So, overall the jungle cats haves mainly a positive impact on the lives of the farmers in West Bengal's unprotected areas. The knowledge of this beneficial aspect of the jungle cats could help to get the local farmers involved in their conservation efforts in these unprotected areas.

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