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SYSTEMATIC REVIEW OF ECOLOGICAL AND ETHOLOGICAL STUDIES ON WATER BIRDS

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ABSTRACT:
Wetlands are particularly complicated ecosystems because of the numerous interactions between the different parts, with water birds being the most obvious ecological change. Wetland-dependent flocking species of water birds are the most active component of wetland ecosystems. By observing changes in community composition and diversity that directly reflect changes in wetland ecosystems, they serve as an objective biological indicator of changes in the wetland environment. Seasonal patterns of migration are distinct for water birds. In this article, systematic review of ecological and ethological studies on water birds has been discussed.

Keywords: Ecological, Ethological, Water Birds

INTRODUCTION:

Birds can serve as bio-indicators of occupied regions and provide information about the general habitat quality. Bird population trends can reveal information about the health of the ecosystem when birds depend on the habitat's functioning in particular ways. West Bengal is fortunate to have several wetlands because it is located in the Ganga-Brahmaputra floodplain. The South Bengal deltaic plains and the high-altitude Darjeeling Hills both have wetlands. According to Chowdhury (2009), West Bengal's wetlands comprise primarily lakes, floodplains, oxbow lakes, and marshes, bogs, and Sunderbans estuaries.

An ecological study is a project that aims to understand how biotic and abiotic elements interact in a natural setting. Ecologic research evaluates the general prevalence of disease in a number of groups and searches for a relationship with the populations' average exposure. These studies stand out since the analysis is not based on information about specific people.

The study of animal behavior in their natural habitats is known as ethology. In particular, ethological investigations make an effort to apply two different causal hypotheses to pinpoint the origins of specific animal behavior patterns. Research on proximal explanations, often known as the causes and effects that inspire or direct animal behavior, is done by ethologists. Ethologists also research the "ultimate explanations," or phylogenetic factors, that have an impact on the evolution of animal behavior. Ethological theory or ethological perspective holds that animal behavior can be connected to biological structures, such as the connection between bipedal locomotion and a particular skeletal structure.

Birds that dwell near or in water are known as "water birds." While semi-aquatic birds may spend little to no time in the water yet still rely on it for resources like food, true aquatic birds spend the majority of their time in the water. Numerous birds spend the majority of their lives near water. There are no birds that live their entire lives in the water, though. Even those who are well adapted occasionally land and spend a lot of their time in the air, as do those who spend the most of their lives over the ocean. A kind of bird known as a "water bird" frequents bodies of water and frequently spends most of its time there. There are numerous varieties of water birds that exhibit a gradient of different morphologies, habitats, and diets. Some birds, like the great egret, have long limbs that enable them to wade over water and long, slender beaks that enable them to catch fish with amazing skill.

RELATED REVIEW OF LITERATURE:

Swaroop Patankar et al. (2021) claim that urbanization poses a severe threat to biodiversity worldwide. We focused on birds as an interesting taxon of interest that has been thoroughly studied in order to review

the literature on characteristics that influence reactions to urbanization. Data on five major categories of factors that have been thoroughly examined are compiled after reviewing 226 papers spanning the years 1979 to 2020. These categories are ecological attributes, life history, physiology, behavior, and genetic features. Regarding trait changes in both individual species and bird populations, some sound conclusions can be drawn. Due to a shortage of resources for specialized food and shelter, generalist species predominate in the urban bird community, whereas specialized species are in decline. Urbanized bird populations display bolder behavior, higher song frequency, and higher song amplitude when compared to rural populations of the same species. Different food sources and predator pressure result in changes in life cycle traits, such as lengthened breeding periods and increases in clutch and brood size, to make up for lower survival rates. In rural communities, hormonal status, physical condition, and genetic variances are additional species-specific alterations. We draw attention to the limitations of the study, such as the scarcity of studies in tropical cities and the need for additional research into the traits that influence persistence and success in native vs. introduced populations. [1]

According to Vallino C. et al. (2021), methods and equipment designed specifically for distant wildlife surveys and monitoring are becoming more widely used and effective. But in contemporary culture, remote controllers are also often used for a number of non-scientific applications. For instance, ski resorts in the European Alps advertise themselves and offer panoramic views on their websites by using webcams. We assessed a built-in webcam's value as a remote tool for eco-ethological research. Our target species was the friendly and opportunistic corvid Pyrrhocorax graculus, which is a native of high mountain settings. It visits ski resorts frequently to consume food leftovers from high-altitude pubs and restaurants. We studied the impact of weather and winter visitors on ski resort flocking behavior. We assessed the correlation between flock size and the number of guests, the number of hours spent at the ski resort, and the weather as response factors. A total of 13,500 photographs from French, Italian, and Swiss ski resorts in the European Alps were examined. Ten-minute intervals were used for the shooting. The bird populations at the three research locations are remarkably diverse. The flock size and time spent were related to the same environmental factors, but with different impact sizes in the three regions. The daily maximum flock size and the amount of time spent at ski areas increased with visitor numbers and decreased with temperatures at two out of three sites. Furthermore, we found that maximum flock numbers fell with fresh snow cover at all ski resorts. The presence of people and the weather caused Alpine choughs to change their presence at ski resorts, but these responses differed depending on the circumstance. Thus, despite some restrictions, preinstalled webcams can be employed in eco-ethological studies. Worldwide, there are an increasing number of webcams, making them a valuable potential resource. If camera companies could be persuaded to make a few modest adjustments without compromising their goals, this would offer a novel way to collect eco-ethological data. [2]

The necessity for high-quality overwintering habitats among migrating water birds focused on freshwater ecosystems in mosaic environments was examined by M.A. Rasool et al. (2021). In the West Dongting Lake National Nature Reserve (WDLNNR), China, key wintering habitats for migrating water birds have been damaged by land-use change and hydrological alternation. The availability of natural wintering habitats has currently changed due to changes in the hydrology and terrain, even though the impact of hydrological management on the habitat selection of wintering water birds is mostly uncertain. In this study, we identified differentially managed habitats and computed their area using the normalized difference vegetation index (NDVI) in order to analyze the availability of suitable habitat across the study period (winter seasons of 2016–2017 and 2017–2018). Then, using species-species social interactions and species habitat correlations, we used the social behavioral association network (SBAN) model to compare habitat quality in lakes with different hydrological management practices. The results show that social interactions between and within species created wintering waterbird groups, which may be dominated by one or more species, with dominant species having control over other coexisting species' behaviors. Analysis of variance (ANOVA) testing revealed significant differences in SBAN measurements between lake ($p = 0.0237$) and habitat (p 0.0001) levels. More species, in particular, favored lakes with controlled

hydrology. The managed lakes had greater habitat quality, with significantly more habitat areas (p 0.0001) and fewer habitat transitions (p = 0.0113). Our entire body of research suggests that effective hydrological management can continually provide a stable SBAN with high-quality habitats, notably mudflats and shallow rivers, in order to maintain a population of wintering water birds with more sympatric species in a changing environment. [3]

Understanding how waterbird communities respond to changes in both can have a big impact on conservation and management, according to İbrahim Kaan Özgencil et al. (2020). Ecosystems in shallow lakes are reliant on the water's level and submerged macrophytes to survive. Here, we evaluated the effects of changes in water level and the condition of submerged macrophytes on the size of the wintering waterbird community, functional group abundances, functional diversity (FD), and community assembly using a dataset acquired over 50 years. We developed generalized linear models to evaluate the effects of water level and submerged macrophyte status on the aforementioned characteristics of the waterbird communities using midwinter waterbird censuses, water level measurements, submerged macrophyte surveys, and submerged macrophyte macrofossil records from two shallow lakes in Turkey. For the purpose of evaluating assembly rules, we identified functional groups, computed four FD measures, and simulated null distributions of the FD measures using an appropriate set of functional attributes. We found that years with a macrophyte preponderance had significantly higher waterbird abundances in one of the study lakes. In both lakes, these years also saw an increase in the number of diving omnivores and herbivores but a decrease in the number of diving and scooping fish-eating water birds. Interestingly, despite community size demonstrating a negative association with water level, neither functional group abundances nor FD indices were significantly connected with water level in Lake Beyşehir. The fact that the functional richness and functional dispersion standardized impact sizes were often lower in the research communities than in randomly generated communities, two indices that are highly sensitive to community assembly processes, suggests functional clustering. Increases in these two indices were associated with transitions to a sparse macrophyte state, which may be the result of sampling transitional communities or adjusting the relative strengths of environmental filtering and limiting community formation similarities. Undoubtedly, more study covering a wider spectrum of trophic and macrophyte states is needed. The results of this study reveal that variations in the abundances of plentiful and scarce macrophytes can have a major impact on changes in the abundances of wintering water birds, FD, and community assembly. The results suggest that shallow lakes in states with a macrophyte preponderance can support more aquatic birds that migrate south for the winter, especially diving omnivores, some of which are threatened globally. [4]

The behavior of many animals in a novel habitat has a major impact on their fitness, according to Mónika Jablonszky et al. (2020). It is extensively studied using the so-called open-field or novel environment test, which entails putting people in an unfamiliar experimental context. By making a comparison to characteristics that actually reflect wild exploration, one can determine whether traits assessed under such sterile conditions have biological applicability. In this field study, we sought to characterize behaviors seen in an artificial, novel environment (an aviary) and assess their biological significance in collared flycatchers (*Ficedula albicollis*). In order to determine the consistency, correlations, and linkages between a range of behavioral traits and breeding dispersal (which denotes natural exploration), we evaluated these features. There was evidence of non-zero repeatability in the frequency of crosses between the quarters, the number of hops, and the delay in perching in the aviary; these repeatabilities were high when assessed over shorter time periods. It's possible that short perching latency is related to dispersal in the wild because birds with short perching latency were also more likely to have bred close to their breeding nest box and to have been residents the year before. Our findings indicate that, at the very least on shorter time scales, behaviors measured in a lab setting are individual-specific and that at least one aspect of these behaviors is associated with an ecologically significant trait. [5]

The persistent decline in the abundance of various waterbird species in wetland habitats has drawn attention from Y. Zhang (2019), who examined the need for explanations to enable effective management

actions. Using survey data gathered over a six-year period in Shengjin Lake National Nature Reserve in the Yangtze River Floodplain, China, we examined the role of natural and anthropogenic factors as predictors of waterbird species abundance. Our results showed that effects varied by guild but that overall bird numbers were most negatively impacted by proximity to nearby populated areas. The Yangtze River Wetlands would probably benefit most from a reduction in pressure from the surrounding human population, these data revealed, even though habitat conditions and buffalo grazing activities can have an impact on the number of waterbird species. We suggest that screening and/or limiting public access at some key locations may be the most cost-effective way to curtail or reduce human activity in these wetlands and enhance the conservation status and wintering habitats for these water birds. [6]

According to Faid Rahman and Ahmad Ismail (2018), water birds are frequently employed around the world as an essential bio-indicator of ecological changes. This is due to the fact that they display noticeable and significant responses to changes in their surroundings. They also highlight other characteristics that make them useful bio indicators. For this reason, knowledge of their biology and ecology is crucial for making wise decisions. This is essential for better protecting both them and their surroundings. They are currently dealing with fresh difficulties brought on by global development that never stops. In addition, if they are not protected and conserved, many endangered species will continue to deteriorate and may go extinct. An alternative would be to create artificial habitats like wetlands to make up for the loss of natural habitat. To do this, though, requires thorough knowledge of the water birds' relationships with their new surroundings. The fact that there haven't been many studies focusing on water birds, especially in Malaysia, is also addressed. We thus encourage more local young scientists to take on this task, equip themselves with the appropriate knowledge and abilities, and continue to be relevant with respect to the norms of worldwide research. To maximize the effect of the nation's conservation effort, the government and local authorities should also take proper planning, finance, and emphasis into consideration. [7]

According to Hale Robin et al. (2016), ecological traps have important conservation and management repercussions when animals unintentionally choose locations where their fitness is lower than in other available habitats as a result of rapid environmental change. The majority of empirical study has focused on analyzing the behavioral effects of a few closely spaced habitat patches in order to assess the behavioral effects of traps. Although this scale is more relevant for management, traps have also been discussed in terms of their effects on populations (i.e., favoring habitats of poor enough quality to cause population declines). We perform a systematic review of the literature on ecological traps to describe the geographic and taxonomic distribution of trap research efforts, analyze how different traps differ in the strength of their effects on fitness and preference, evaluate the validity of methods used to identify traps, and determine whether the data required to evaluate the population-level effects of traps has been taken into account. Our research fills up significant knowledge gaps, offers improved trap analysis techniques, and identifies intriguing research avenues for the future. [8]

Andy J. Green and Johan Elmberg (2014) define ecosystem services as environmental activities that directly or indirectly enhance human well-being. Numerous recent studies have discovered the communities and species that perform distinct activities. This is an important first step in the administration and maintenance of different services. Because they are generally overlooked, water birds play crucial ecological roles in many aquatic ecosystems as predators, herbivores, and carriers of seeds, invertebrates, and nutrients, thus we have chosen to concentrate on them in this analysis. Waterbirds can act as excellent bio indicators of ecological conditions, manage pests, maintain the diversity of other organisms, and act as sentinels for potential disease outbreaks. They serve cultural functions as well as essential provisioning (meat, feathers, eggs, etc.) for both indigenous and westernized people. We identify the most significant research gaps in our understanding of the ecosystem services provided by water birds in order to highlight their functional significance in ecosystems and the services they provide. We provide some examples while outlining some techniques for figuring out the monetary value of these services. This appraisal will offer compelling arguments for waterbird conservation. [9]

In an effort to evaluate the role of adaptive foraging behavior in the spatial and temporal heterogeneity as a factor determining the success of the colony, Y.G. Matsinos et al. (2012) investigated whether we used single-colony individual-based spatial models for a visual foraging bird, the Great Blue Heron, and a tactile foraging bird, the Wood Stork. Throughout a nesting season, the model monitored an individual's daily routines, spatial movements, foraging efficiency, bioenergetics, and nestling growth. The first scenario, which simulated a typical nesting season, demonstrated that both species effectively reproduced as a result of the number and location of the feeding spots in each colony. For each colony, we used two scenarios. In the second, we simulated different precipitation regimes that led to a change in the water's depth (i.e., depth rises during the dry season when water levels should typically be dropping). The results indicate that wood storks were significantly more negatively influenced than great blue herons by the prey dilution brought on by the changes in water depth. In the second scenario, where resources were few, there was a decrease in resource predictability. The diminished foraging success of the group-foraging birds led to poor reproductive performance. The impact was more pronounced when storks foraged in groups than when herons did. In conclusion, greater variability in precipitation regimes is more likely to have an effect on tactile foraging bird species than on visual foraging bird species. Furthermore, wading birds discovered that when the weather was bad (rainfall and water levels were rising), foraging alone was more profitable than foraging in groups. [10]

Many studies have been conducted on the relationships between bird ecology, conservation, and the cultivation of rice (Oryza sativa), according to Chris S. Elphick et al. (2010). A grain that is farmed all over the world, rice affects waterfowl in a number of different ways. Rice fields are not a substitute for true wetlands, despite the fact that many species use them and that they can help lessen the loss of natural habitats in regions where agriculture is the main business. The majority of birds forage on rice fields, but some, particularly rare species, also construct their nests there. A few of the consequences of field management on birds have been thoroughly studied, but the majority have not. Through improved collaboration between academics, farmers, and agronomists, it is feasible to better understand how field management may be altered to raise the conservation value of fields without harming the economic viability of farming. A solid foundation would be established for the promotion of "wildlife-friendly" rice products thanks to such research, which would also make it simpler to develop intelligent agri-environment programs. Future studies are also necessary to examine the success of nesting and post-fledging, the availability and value of foods other than rice found in fields, the significance of field edges and water delivery infrastructure, the impact of landscape features, the effects of rice farming on population dynamics, experimental studies of management activities, particularly at large spatial scales, in tropical regions, and during the breeding season, as well as an improved under sampling technique. [11]

Tamisier, A. et al. (2003), hunting water birds is a common human activity in the marshes of the Eurasian continent. Mortality and disturbance are two of the elements that can affect the dynamics of migratory species' populations. A rising number of thorough studies that combine experimental and theoretical methods centre on disturbance. They are created in this article. When induced alterations affect a species' individual fitness (reduction in survival or breeding success), the disturbance is regarded as relevant. According to studies, disturbances nearly invariably cause changes in the geographic distribution of birds, which results in underuse of the food resources present in hunting regions. Disturbance may also encourage a rise in the population turnover rate during a migratory stop. Despite being precisely assessed at the local level, it is unknown if these variations in bird distribution have an impact on the number of individuals of the targeted species. Because many of these species are widely distributed over several continents, it is difficult to measure their impact precisely. Disturbance alters behaviour by either reducing the amount of time spent gaining energy or by increasing the amount of time spent on activities that are more expensive than those done without disturbance. A calculation or estimate of these losses might amount to 25% of daily energy costs. Birds that experience disturbance may acquire a variety of physiological adjustments, such as higher food intake, improved energy assimilation, or increased corticosterone production that stimulates foraging. It can be claimed that these adaptations allow birds to

maintain energy gains equivalent to those gained in the absence of disturbance, even though a direct evaluation of their energy balance has not yet been done. The long-term cost of this compensation is substantial. Anser caerulescens atlantica during their spring molt in Canada. Hunting disturbance causes geese to use lower-quality habitats, reduces their body condition (fat and protein), and lowers their breeding success compared to individuals who have not experienced hunting. Although there are still some unanswered questions, such as those at the species level (waders have received little research), all of the authors who highlighted them also agreed that protective measures must be implemented to balance off the effects of hunting disturbance. They suggest expanding protected areas (hunt-free regions), creating a network of reserves, and building non-hunted zones around existing reserves in order to minimize the negative effects of disturbance on birds that use these reserves. The implementation of these management strategies must promote the spatial diversification of these populations and facilitate their local and regional expansion. These conservation efforts have successfully addressed the directives of the European Union on birds and habitats. [12]

CONCLUSION:

The foundation for guaranteeing the success of waterbird migration is a variety of accessible wetland stopping places throughout the migration route. These resting places are crucial for water birds to replenish their energy during migration and offer distinct populations food and shelter. Wetland is an ecotone that separates the wet aquatic habitat from the dry terrestrial ecosystem. Where shallow waters typically encircle the land. These rich, shallow environments are home to a wide range of submerging and merging flora and animals. Studies of this kind are very important for migratory avifauna as well as for wetland management.

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