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Behavioural responses of *Chroicocephalus novaehollandiae* nesting in human dominated ecosystems during their breeding season

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Abstract

Bird tourism is increasingly becoming popular, which results in varying degree of pressure on the avian fauna. *Chroicocephalus novaehollandiae*, a ground-nesting endemic gull of Australia, which breeds in colonies have their nesting sites often becoming tourist attractions. This study looks into the altered behaviour of breeding birds induced by the presence of tourists in the vicinity of their nesting sites. Nest density showed positive correlation with the distance from the boardwalk. Gulls nesting <5 m from the boardwalk were more vigilant towards a stationary investigator than the birds stationed farther away. Gulls within 5m of the structure exhibited high level of investigator oriented behavior (39% of occasions). Visual observation of the investigator (28% of occasions), flight (8%) and intrusion into neighbor's territory (3%) were noticed. Investigator oriented behavior in birds tend to decrease with increasing distance from the boardwalk. The gulls apparently perceived larger groups of tourists as more threatening. Parents with mobile chicks showed increased intra-specific aggression. These groups were nested farther from the boardwalk, as early comers tend to occupy better nesting sites leaving less favorable sites for the latecomers. Presence of an investigator often resulted in the temporary neglect of nest in 12% of the birds stationed at a distance of <5 m from the boardwalk. Reduced focus on nesting activities among the Silver gulls, their increased energy expenditure and stress levels due to heavy tourist traffic may affect their reproductive success.

Keywords: Tourists, Silver gulls, nesting behavior, Reproductive success, Boardwalk

1. Introduction

Human dominated ecosystems which affect the biota are concepts that have of late become the focus of biologists [1, 2]. Increased human interventions influence the distribution and population of resident fauna. These ecological modifications or 'human footprints' may alter many ecosystem parameters like habitat, diet and intra specific behaviour. It has been well documented that urbanization leads to overall loss of biodiversity [2]. Biologists have also noticed species successfully adapting to urban environment. Although gulls have long been assumed to be strongly synanthropic, long-term researches have indicated that increasing urbanization and anthropogenic interferences affect their population [3, 4].

Australia have two endemic larids, the Pacific gull, *L. pacificus* and the Silver gull *C. novaehollandiae*, plus the now resident Kelp gull *L. dominicanus*, which have colonized naturally over the last 50 years. Larids are highly successful in urbanized environments because of their generalized feeding strategies which allow them to exploit human-derived food sources [5]. The ground-nesting Australasian Silver gull *Chroicocephalus novaehollandiae* which breed in colonies are abundant in Australia's coastal areas. They are viewed as pests in Australian urban environments [6], with the largest colonies occurring close to major human settlements and their refuse [7]. However, these birds can become highly vulnerable to human disturbances whilst breeding. Silver gulls are medium-sized at 38-42cm with a silky-white plumage over its head, neck, tail and under parts. Its wings are light grey with black and white tips. The bill, eye ring and legs are coloured bright red in adults. Young birds are mottled brown in appearance. The female Silver gull lays a clutch of between one and five eggs, with three being most common [8]. The eggs are laid at intervals of two to four days and are incubated by both sexes [9]. The incubation period is between 21 and 27 days, and the chicks remain within the colony for about 4 weeks [8]. Birds that breed in colonies form an eye-catching sight, often prone to human disturbances. Their aggregations frequently become popular tourist attractions.

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The susceptibility to human disturbances gets aggravated by the topographical factors and the physical accessibility of the colony [10]. Nesting near human recreation sites makes them highly vulnerable to human disturbances [10, 11]. Wild life tourism definitely provides opportunities for significant monetary benefit. At the same time it also raises the concern about the long lasting effects implicated on the flora and fauna [12]. In the long run, ecotourism and bird watching subject the birds to great pressure, especially during their breeding season. This study is an attempt to determine the responses of Silver gulls to human presence during their breeding season.

Materials and Methods

Study Site

The Nobbies, Phillip Island, Victoria, Australia

The Nobbies centre sits on the western tip of Phillip Island 140 km southeast of Melbourne, atop the cliff overlooking the wild waters of Bass Strait. The boardwalk winds around the cliff to give a spectacular view of the Bass Strait coastline. This area is the breeding and nesting site for thousands of Silver gulls. The mounds are occupied by the breeding pairs, their eggs and chicks from the month of August to January. Boardwalk provides a closer view of the bird life. The study was done during the months November-December 2013.



Fig 1: Breeding birds at Nobbies



Fig 2: Boardwalk overlooking the Bass Strait

Methodology

The response of the birds to an investigator on the boardwalk was studied before the influx of visitors. Birds at a distance of 5, 10, 15 and 20 meters were observed from three different stations on the board walk. Bird selection was done with the first breeding gull observed becoming the focal bird for study. Investigator-oriented behavior (IOB) was observed for one

minute from the boardwalk. Environment-oriented behavior (EOB) was also recorded without disturbing the birds. Focal groups of gulls at 3 different locations, each within a distance of 5, 10, 15 and 20 meters from the boardwalk were observed from a vantage point $\geq 20\text{m}$ away without being noticed by the gulls using 8x40 binoculars. Focal group size was restricted between 3 and 8 and was chosen randomly, provided that all focal gulls could be observed simultaneously. IOB involved visual fixation of the investigator detectable from the bird's head orientation, attacking or mobbing the investigator and also activity like sudden flight, intrusion into adjacent territory etc. EOB included visual scanning of the surrounding environment and aggressive posturing and attacks towards con-specifics. Behavioral responses to the presence of tourists based on their group size were also assessed. Response of birds to tourist group ≤ 3 and ≥ 8 were studied.

Nest site dispersion was studied by surveying transects about 20m long which were at least 10m apart. Transects originated from both sides of the boardwalk and was arranged so as to avoid intersection. At 2m intervals along each transect, the number of nests that intersected or were located within 1m from transect were recorded. The number of nests at each interval from the boardwalk was summed from all transects. Birds seen in 5 square meter area at varying distances from the board walk were counted to assess the bird density. Juveniles and adults were counted separately.

Results

Nobbies form the nesting site for thousands of breeding Silver gulls. The grass covered mounds were occupied by parent birds with chicks in various stages of development. The eggs are laid in a shallow nest made of grass and seaweed.

IOB & EOB

IOB response of birds positioned at different distances from boardwalk showed marked variation, with the gulls nesting close to the boardwalk responding more strongly. Gulls within 5m of the structure exhibited high level of IOB (39% of occasions). The most frequent response was to remain near the nest and visually observe the investigator (28% of occasions) almost throughout the observation period. Birds were more alert which was displayed by their fixed gaze on the investigator. Gulls very close to the boardwalk often took to flight (8%) and some showed intrusion into neighbor's territory (3%) which often resulted in conspecific aggressive behaviour. These type of activities often resulted in the temporary neglect of nest, eggs and nestlings (12%). Larids at a distance of $>10\text{m}$ from the board walk were not much affected by the presence of the investigator. The usual activities like sleeping or preening went on unrelentingly. Birds at a distance between 5-10m showed IOB in 32% of the occasions, mainly by fixing gaze on the investigator. The results of EOB responses were found to be higher among the birds positioned $>10\text{m}$. 16% of the birds observed at a distance between 10-15m were seen to be occupied either in visual scanning of the surroundings or exhibiting pecking behavior, while 18% of the birds stationed farther than 15m showed the same EOB behavior. The focal groups studied had an average number of 5.2 ± 1.8 individuals. The group included both adults and chicks. The chicks could be identified by their mottled brown plumage and the absence of distinctive red eye-ring, bright red bill and legs.

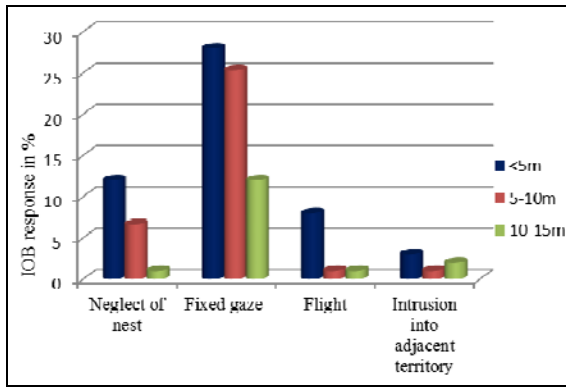


Fig 3: IOB responses of *C. novaehollandiae*

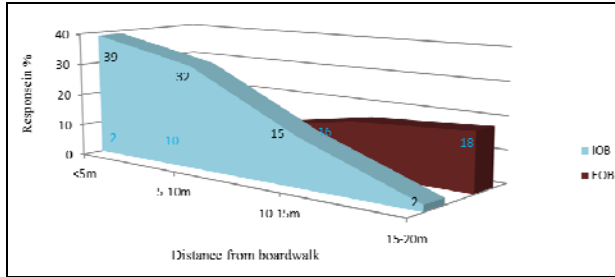


Fig 4: IOB & EOB of *C. novaehollandiae* in relation to the distance from boardwalk

Response to tourist

Nesting gulls responded at varying degrees to the stimulus provided by the presence of tourists. The size of the group determined the level of response in birds. Tourist group of eight or more definitely induced more response. Taking flight was commonly observed among the birds nesting very close to the boardwalk. Some of the resting birds slightly shifted their body position and a sort of alertness was observed in their behaviour. The most frequent response of birds within a distance of 5m from the boardwalk was to visually fixate the humans in 59% of the occasions, if the group size was ≥ 8 and 47% when the group size ≤ 3 .

Aggressive behaviour between the conspecifics were higher among the focal groups positioned $>10m$ from the boardwalk. The focal groups exhibited aggressive behavior like pecking and intrusion into the adjacent territory. Aggression frequencies were divided by the number of gulls in the focal group to make up for the disparities stemming from focal group size variation and presented as the number of aggressive events per focal gull per observation. This value was 12 ± 2.3 at a distance $>10m$, while it was only 4 ± 1.7 at a distance less than 5m.

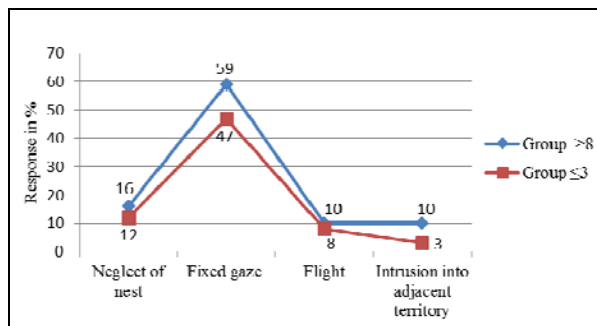


Fig 5: Response of birds stationed up to 5m from boardwalk to varying group size of tourists

Bird density

Bird count at varying distances from the board walk revealed the highest density of birds at 15-20m from the board walk. Juveniles and adults showed this difference in their density. The young birds were identified by their mottled appearance.

Nest site dispersion

At the greatest distance from the boardwalk (20m), the mean number of nests was 14.2 ± 3.1 . The smallest mean of 1.8 ± 0.58 occurred at a distance of 2m. The increase in the nest density was noticed with increase in distance from the boardwalk. Another observation noted was that the nests positioned at a distance beyond 10m from the board walk had more grown up chicks. Nests positioned between 10-15m had 11% incubating mothers while those at a distance of less than 5m had 26% incubating birds.

Table 1: Bird density at varying distance from the boardwalk

Distance from board walk	Number of adult birds	Number of young birds
<5m	2 ± 0.27	2 ± 1.70
5-10m	4 ± 1.52	8 ± 2.61
10-15m	6 ± 1.93	14 ± 2.23
15-20m	9 ± 2.43	16 ± 1.32

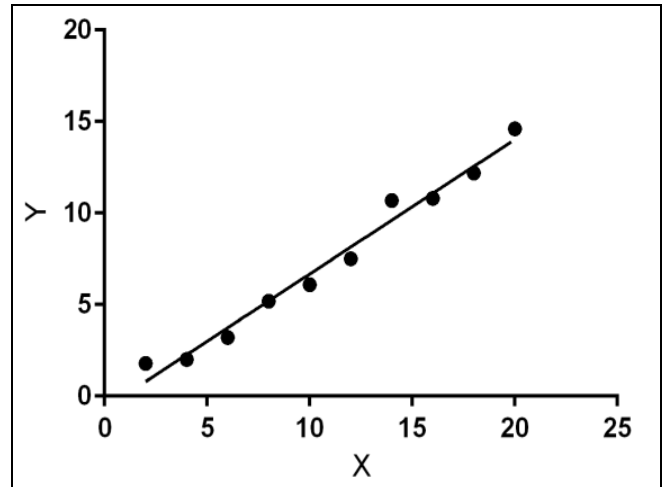


Fig 6: Regression analysis for nest dispersion X represents independent variable and Y represents dependent variable

Discussion

Silver gulls although pugnacious and daring when feeding are cautious and wary while roosting and nesting. They roost in areas that are surrounded by water so that they are safe from land predators. The present study site revealed this geographic peculiarity with free access to Bass Strait. Breeding adults tend to show high colony tenacity^[13]. The roosts demonstrated strongly-focused visual monitoring for intruders. Results of this study also showed EOB to be higher among gulls with older chicks, which are positioned farther from the boardwalk than those with incubating eggs or brooding hatchlings. The proportional increase in nest density with the distance from the boardwalk may also be a reason for increased EOB along with the fact that the older chicks with higher activity needed greater care and attention. The gulls apparently perceived larger group of tourists as more threatening and were thus more likely to flee, consequently invading neighboring territories and stimulating more aggressive defense from their owners.

Gulls nesting close to the boardwalk spent more time visually

monitoring an investigator than the birds nesting farther away. Monitoring of people moving around in their vicinity significantly reduced their focus on breeding and nesting activities, particularly as there was heavy tourist flow during the breeding season. Less experienced younger birds and latecomers may be forced to nest in locations with high human disturbance level. Ottaway *et al* ^[14] have reported that the older gulls occupy the best breeding sites, whose vegetation and topography minimized intra-specific aggression and exposure to extreme weather.

Alterations in normal breeding activity of birds may result in constant stress ^[15, 16, 17], which may cause the transference of high levels of corticosterone from the maternal circulation to the egg yolk ^[18, 19]. When approached by the tourists, gulls nesting close to the boardwalk frequently abandoned their nests temporarily leaving the eggs or hatchlings exposed ^[19]. Even frequent, short interruptions of incubation can impair hatching success ^[20]. It has been reported that the success of nests varied greatly, from 100% fledging success for Pacific gulls nesting solitarily to only 12% for those nesting in colonies ^[21]. Solitary breeders presumably experience reduced levels of disturbance from mankind.

People worldwide are increasingly becoming interested in travel and nature, resulting in augmented tourism related impacts on wild life. Bird population aggregating during their reproductive and chick rearing season often becomes the target of tourist attraction. Uncontrolled recreational activities in these sites can often affect the nesting activities of gulls. Over a period of time some level of habituation may occur, but the birds may still respond sufficiently to impair their breeding success.

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