Status, distribution and ecology of the Grey-headed Bulbul *Pycnonotus priocephalus* in the Western Ghats, India

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Executive summary

Background

The Western Ghats of peninsular India is one of the globally important ecoregions harbouring some of the finest rain forests of the world. Western Ghats host more than 507 species of birds including 41 endemics and more than 40 'disjuncts'. Of the 16 restricted-range species recorded from this Endemic Bird Area (BirdLife international, 2001) one is Threatened, three are Vulnerable and 12 are Near Threatened. Habitat loss and fragmentation due to human activities are the major threats to the restricted-range birds of Western Ghats. Their narrow habitat requirements, particularly during the breeding season, are yet another possible important factor causing their decline. Hence, evaluation of their basic ecological requirements, particularly their selectivity to microhabitats during breeding is of significant value while formulating conservation programme for these species.

Grey-headed Bulbul *Pycnonotus priocephalus* is a poorly known endemic to the Western Ghats. This Near Threatened species has a very limited distribution in the heavy rainfall areas in the hills along the south-western side of India from Belgaum and Goa to Kanyakumari. Observations, including both sightings and collections of the Grey-headed Bulbul are very few from 1869 to 2002. The qualitative comment given on the status of the species by Ali and Ripley (1987) is "fairly common but rather local". However the recent surveys do not show them 'common' in any of the areas covered. This indicates a decline in population probably due to habitat loss and fragmentation. The possibilities of environmental toxicity and hunting pressures are quite low.

Objectives

In the above background a project on the Grey-headed Bulbul was initiated with the following specific objectives:

- Assess the status and distribution of the Grey-headed Bulbul in the Western Ghats with respect to altitude and habitat.

- Determine the foraging ecology and breeding biology of the species to identify key factors affecting its long- term conservation.

Study areas

Intensive field surveys were carried out at 24 sites across the four south Indian states between February 2002 and January 2004 to assess the status of the target species. The ecology of the species was studied at two sites:

1. Silent Valley National Park (11^0 00' and 11^0 15' N, 76^0 15' and 76^0 35' E) is a tropical evergreen forest of Western Ghats extending over 8952 hectares at the south western corner of the Nilgiri Biosphere Reserve. Ecologists describe this area as the sole surviving largest, contiguous stretch of evergreen forests in the Western Ghats. The elevation ranges from 700 m to 2283 m. The mean annual rainfall is 4,400 mm and temperature 20.2 ^{0}C. The landscape is highly undulating with high and continuous ridges along its north-eastern boundary.
2. Muthikkulam Reserve Forests (10^0 56' and 10^0 59' N, 76^0 41' and 76^0 45' E) is an isolated generally undulating hills and valleys well clothed with rainforest except for large grassy areas in the southeast and a mass of high hills in the south. The reserve comprises an area of 6386 hectares with elevation varying from 610 metres at the exit of Siruvani river to 2,065 metres, the highest peak north west of Elival hill. The climate is tropical wet with mean annual rainfall above 4000 mm and mean annual temperature below 27 ^{0}C. The vegetation in both the study sites consists mainly of tropical wet evergreen, montane sholas and grasslands in the higher altitudes.

Methods

Status and distribution

Unlimited line transect method (Bibby et al., 1992, 1998) was used to assess the status and distribution of the species. The habitat was classified based on Champion and Seth (1968). At every 0.5 km of transect, various habitat attributes were recorded.

Foraging ecology and behaviour

Sampling was based on the methods of Remsen and Robinson (1990) and a single foraging event was recorded for each bird sighted while walking slowly (kmh^{-1}) through the existing trek paths or animal trails. The foraging maneuvre, substrate, height of the foraging location, height of the foraging tree, horizontal position of the bird in the canopy, percentage of the foliage density at the foraging site and food handling technique were recorded for each foraging observation. The fruit morphology and phenology of the food plants were recorded using standard methods (Chapman et al., 1994). The invertebrates were sampled by following the methods of Southwood (1971), and Cooper and Whitmore (1990).

Breeding biology and behaviour

Nest searches were conducted throughout the breeding seasons of 2003 to 2005. Nests were located and monitored by following the standard methods (Martin and Geupel, 1993; Martin et al., 1996). Various attributes of nest placement and morphometry of the nests were recorded after the completion of the breeding cycle. Vegetation structure around the nest sites was measured using a circular plot of 0.04 ha (James, 1971; Sedgwick and Knopf, 1992; Martin et al., 1996).

Findings

Status and distribution

- The Grey-headed Bulbul is a rare species; the average encounter rate being 0.19 birds/km in a 728.5 km surveyed in 24 areas across the four south Indian states.
- Large stretch of evergreen forests with in 700 – 1000 metre was the preferred habitat. The encounter rate (0.33 birds/ km) in the evergreen forests below 1000 metre was significantly higher than that in any other habitat type and elevation.

- Most sightings of the Grey-headed Bulbul came from areas dominated by *Strobilanthus* (39.13%, 27 detections) and reeds (30.43%, 21 detections) followed by *Lantana camara* (16%, 11 detections).
- Although many congeneric and other restricted-range species are adapted to the plantations and agricultural landscapes, absence of the Grey-headed Bulbul in the above habitats (all are modified rainforests) indicates that this species is a 'habitat specialist' and highly susceptible to habitat modification.

Foraging ecology

- Grey-headed bulbuls forage in pairs or in groups on a wide variety of fruits and arthropods.
- The food comprises mainly fruits during both breeding (66%) and non-breeding seasons (64%).
- Gleaning was the most preferred foraging maneuver (70.17%) followed by reach (14.01%), hang (9.30%) and sally (5.58%).
- Of the different tactics used to catch the insects, gleaning was the most used maneuver (χ^2 (df =4, N =626) =482.227, p< 0.001).
- Foraging activities are confined more on the edges, where the fruits of sub-canopy trees and shrubs are abundant.
- The optimal foraging zone is between three to five meters on trees with an average height of four to eight metres. The Grey-headed Bulbul foraged more in the upper (36.20%) and middle edges (23.44%) of the canopy. Foraging in the edges is significantly higher than in the inner areas of the canopy (χ^2 (df =5, N =1826) =1162.46, p< 0.01).
- There is significant difference in the mean height of trees used for foraging (6.41 $\pm$ 3.39 and 3.81 $\pm$ 1.98, Z = -16.36; p<0.001) and the mean foraging height (5.01 $\pm$ 2.60 and 2.88 $\pm$ 1.29, Z = -18.01; p<0.001) during the breeding and non-breeding seasons.
- The Grey-headed Bulbul forages more in the upper canopy of taller trees during the breeding season, while it does so in under storey shrubs during non-breeding season. However the relative foraging height was consistent during both the seasons.

- Grey-headed Bulbul devoured the fruits of 36 species of plants. Of this 12 species were used frequently and accounted for more than 80% of the total observations.
- *Symplocos cochinchinensis, Antidesma menasu, Litsea floribunda, Syzygium cumini, Viburnum corriatum, Maesa indica, Clerodendrum viscosum, Callicarpa tomentosa,* and *Lantana camara* are the major fruits devoured by Grey-headed bulbul.
- The highest number of food species with fruits was observed between March and May in 2003 and between February and May in 2004.
- The flowering phenology of food plants was inversely correlated with rainfall ((r_s= -0.440, n=24, p<0.05) and positively associated with the maximum temperature (r_s= 0.509, n=24, p<0.05).
- Clear-cut seasonality of phenological patterns of 25 food species was observed at Silent Valley National Park, and the seasonal movement of Grey-headed Bulbul was highly correlated with the availability and abundance of the fruits.
- Grey-headed bulbuls appear to have colour preference; they fed more on black fruits (37.04%) followed by red (29.63%) and purple fruits (25.93%).
- The selection of the fruits was not based on the shape of seeds (χ^2 (df =1, N =24) =0.167, p> 0.05) and growth forms (χ^2 (df =1, N =27) =6.889, p> 0.05), whereas the major portion of the fruits consumed were single seeded (χ^2 (df =1, N =24) =18.083, p< 0.01).
- Invertebrates form more than 30% of the food of Grey-headed Bulbul during both breeding and non-breeding seasons.
- The invertebrates sampled by the sweeping method were predominantly Diptera (34%) followed by Hymenoptera (23%), spiders (16%) and Coleoptera (15%), while those sampled by beating were predominantly Hymenoptera (30%), followed by spiders (24%) and Coleoptera (12%).

Breeding biology

- The breeding activities in all the three years started in the first half of January and ended in May, by the onset of monsoon.
- Fifty four nests were recorded from four sites; 16, 18 and 20 during 2003, 2004 and 2005 respectively.
- Peak breeding was observed in April during 2004 and 2005, while it was in March during 2003.
- The breeding seasonality of Grey-headed Bulbul was positively correlated with the temperature (r_s= 0.660, n=29, p<0.01) and inversely correlated with monthly rainfall ((r_s= -0.373, n=29, p<0.05).
- The nests were 1.50 $\pm$ 0.78 m (range: 0.52 - 4.8 m) above the ground and at a mean relative height of 0.61 $\pm$ 0.20 m range: 0.18 – 1.00 m).
- They prefer live plants for nesting; only two nests (out of 54) were on dead branches of *Ochlandra travancorica* and sapling of *Syzygium sp.*
- Twelve species of plants were used by Grey-headed Bulbul for nesting. *Ochlandra travancorica*. (39%) and *saplings* of *Syzygium sp* (33%) were the most used plant species. Other species commonly used were *Calamus pseudo-tenuis, Tottea siliquosa, Saprosma glomerata,* and *Laseanthus jackianus*.
- The clutch size varied from one to two. The average incubation period was 13 days and the fledgling period 12 days.
- Nest architecture varied, apparently, based on the microhabitat. The dominant (66.04%, N=35) typical bulbul nest was made mainly of vines and grasses and seen mainly in *Strobilanthes* patches.
- Those nests constructed mainly with *Ochlandra* leaves (33.96%, N=18) were located mostly in reed patches. These nests had inner layers of small fibres and outer decorative layers of moss.
- The nests on reed patches had a high nesting success.
- The nest sites of Grey-headed bulbuls are associated with the reed and *Strobilanthus* patches in the mid-elevation evergreen forests.
- There is a considerable variation in the vegetation structure and other habitat attributes in the nest sites located in the reed and *strobilanthus* patches. Of

the 19 habitat variables measured, 10 differed between the two nest types ($p<0.05$).

- Of the 19 habitat variables, only four differed between the successful and failed nest sites. The nest height, nesting plant's height and nest plant GBH (girth at breast height) were higher in the successful nests ($p<0.05$).
- The overall breeding success for three years was 20.83% (15 chicks were fledged from 72 eggs). One of the major reasons for nest failures was predation.
- Smaller clutch size, nest site limitations, and higher predation pressure appear to be the main factors lead to low productivity and annual recruitment of Grey-headed Bulbul.

Conservation and research implications

Patchy distribution and the local migratory behaviour of Grey-headed Bulbul have significant conservation implications. The breeding of the species is entirely restricted to the undisturbed medium and low elevation rainforests, while it occupies the lower elevation forests including the scrublands during the non breeding season. Thus, the species requires two distinct habitats for its survival.

Hence, one of the major threats to the species is the loss of lower and mid elevation evergreen forests due to various human activities including conversion to plantations. Most of the existing Protected Areas in the southern Western Ghats lies in the mid or higher elevations, and the habitats on the lower elevations are excluded. Therefore, the non-breeding habitats are not protected. Lower areas adjoining the existing National Parks and Wildlife Sanctuaries need to be protected for the effective conservation of altitudinal migrant bird species and other fauna of the low elevations.

The specificity of food plants by the Grey-headed Bulbul plays a vital role in determining its breeding seasonality and the local migration, as these two annual phenomena are correlated to the seasonality of fruit plants. Microhabitat specificity within the evergreen forests namely *Strobilanthus* and *Ochlandra* patches for nesting

is yet another factor appeared to be limiting the population of the Grey-headed Bulbul. About half of the nests of Grey-headed Bulbul were located from the reed patches. Fragmentation of rainforests and extraction of reeds, therefore assume greater significance in the conservation of not only the Grey-headed Bulbul, but many other specialists.

The restricted range, patchiness in occurrence, low population density, low breeding productivity and annual recruitment; and the threats to the habitat of Grey-headed Bulbul make it a right candidate for considering under the “vulnerable” category of the IUCN.

Although the present project brings out the basic ecology of the species and several vital clues for its conservation, several questions remain unanswered. These include the status of the species in areas that could not be surveyed during this study, breeding status in the lower elevation evergreen forests, phenological patterns of food species, its dependence on insect food and competition with the co-generic species in the non-breeding habitat and behavioural plasticity to cope with the changing habitat.