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MUTUAL BENEFITS FROM MANGROVE RESERVES IN GUYANA: COASTAL PROTECTION AND AVIFAUNAL HABITATS

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Abstract: Rehabilitation of mangrove ecosystems in Guyana has been accompanied with the establishment of mangrove reserves. This has further served to recognize the value of mangroves in preserving biodiversity, maintaining and sequestering carbon stocks while at the same time offering protection to people and infrastructure from natural disasters. However, not much primary work was done locally to investigate the specific role of mangrove reserves in delivering these benefits. This initial study examines the potential role of two mangrove reserves in Guyana as avifaunal habitats and for protection of the coast. The results have shown that these mangrove reserves are important avifaunal habitats for local avian biodiversity. The study has also revealed although the potential exists there is a need for additional research before further conclusions and management recommendations can be made regarding coastal protection. In addition the study has re-emphasized the need for authorities to pay attention to aspects of mangrove forest management, driving forces of deforestation as well as specific buffer zone specifications for effective coastal zone protection. However, it is anticipated that the designation of other areas as mangrove reserves, once they are properly managed they will contribute to the conservation of mangroves locally and continue to be significant habitats for avian species in Guyana.
Keywords: Mangrove reserves, coastal protection, avifaunal species, avifaunal habitats.

INTRODUCTION

Approximately 90% of Guyana's population lives along the coast, thus making this area one of economic as well as ecological importance for the country. Close to 60% of the coast of Guyana is protected by mangroves thereby affording this vegetation type a significant role in offering protection to human life, infrastructure and livelihood. However, despite this, mangroves have been and are still being destroyed. The global phenomenon of climate change has steadily impacted this important zone and has resulted in more frequent instances of overtopping, inundation and coastal flooding in the country.

In an effort to alleviate and reduce the impacts of the loss of mangroves, climate change and coastal flooding the Government of Guyana annually expends significant amounts of money on artificial man-made sea defences. Hence, external funding support was sought and obtained from the European Union Global Climate Change Alliance (GCCA) to strengthen

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local policies and actions on sea defence, climate change and mangrove conservation and management through the Guyana Mangrove Restoration Project (GMRP).

MANGROVE RESERVES IN GUYANA

Since May 2010 the GMRP has been involved in the planting of mangrove seedlings and other protective strategies at ten different locations along the Guyanese coastline. An important aspect of the GMRP is promotion of the sustainable management and conservation of Guyana's mangrove forests through the establishment of Village Mangrove Action Committees (VMACs). This paved the way for the creation of mangrove reserves in the country and to date two such reserves have been identified; the Golden Grove Belfield Mangrove Reserve (GGBMR) in Region 4 and the Wellington Park Mangrove Reserve (WPMR) in Region 6. These mangrove reserves, although not yet fully legally established, are being developed primarily to promote coastal protection. To ensure their efficient functioning management plans are also being developed based on consultation with local communities and key stakeholders. In the process, the biodiversity values of these reserves as well as current levels of community use of the resources have been recognized as two of the key drivers behind the success of the selected areas.

GOAL, OBJECTIVES AND METHODOLOGY OF STUDY

The present study was undertaken to assess the value of two recently identified mangrove reserves in Guyana to offer coastal protection while serving as important avifaunal habitats and so further justify the designation of other areas as mangrove reserves. The main objectives were therefore to: (i) compare the avifaunal composition observed at the GGBMR and the WPMR; (ii) provide information that could be useful when considering future areas for designation as mangrove reserves and (iii) examine the role mangrove reserves play in coastal protection.

For this study the documented results of previous research was examined and by comparing these known records the output of the current study was achieved. The methodology of the studies compared were similar and included field work at the two identified mangrove reserves, desktop investigations and literature reviews of previously conducted field studies; one at the GGBMR and another at the WPMR. Additional fieldwork was conducted at the two sites to determine the extent of community knowledge of the resources and identify knowledge gaps. This approach allowed for emphasis to be placed on understanding the avian species diversity and their connections to local livelihoods. "Key informants" in each of the villages surrounding the GGBMR and the WPMR were interviewed and the information was

recorded. The objective of the interviews was to capture their knowledge of avian biodiversity in the reserves, the community use of floral and avifaunal species and perspectives on changes in avian biodiversity at the two sites over time.

COASTAL PROTECTION AND MANGROVES IN GUYANA

Coastal protection in Guyana depends on a combination of natural and manmade interventions. Natural protection is afforded by the extensive mudflats and mangrove vegetation while manmade interventions include earthen dams and embankments and concrete se defences. It has long been recognized that there is a close relationship between the dynamics of the mangrove vegetation and the geomorphology of the coast of Guyana (van Marren, 2004). Therefore any attempt to explain the development of coastal mangrove communities through time will ultimately require an evaluation of changes in magnitude and frequency of coastal geomorphic processes. The main reason for this is most likely because the processes create variable environmental conditions, which ultimately determine colonisation and regeneration patterns by mangroves, their growth and reproduction. Further, the succession of the mangrove vegetation along Guyana's coast is known to be related to the cyclic alternation of accretion and erosion processes along the coast (van Marren, 2004).

As posited by van Marren (2004), accretion of the coast will involve both an increase in height and increase in area. While the increase in area of the tidal swamp is the main land-reclaiming process a change in the height of the swamp bottom will eventually influence the frequency of tidal inundation and thus the rate of accretion. With an increase in the height of the tidal swamp, there will be an initial acceleration of the rate of accretion. This will be followed by increasing plant cover and then the succession of smaller species characterized by more bushy vegetation. However, this process will decrease as inundation by the tides becomes less frequent. It may be inferred that as the height of the marsh increases there will be a change in plant species composition. When tidal influence is affected other changes may become evident. These could range from hypersaline conditions leading to death of mangrove vegetation and growth of halophytic species such as saltwort (*Batis maritima*) and sea purslane (*Sesuvium portulacastrum*). However, if tidal flushing is restored there could be the regrowth of *Avicennia germinans* and *Languncularia racemosa* to replace the halophytic species.

MANGROVES AS AVIFAUNAL HABITATS

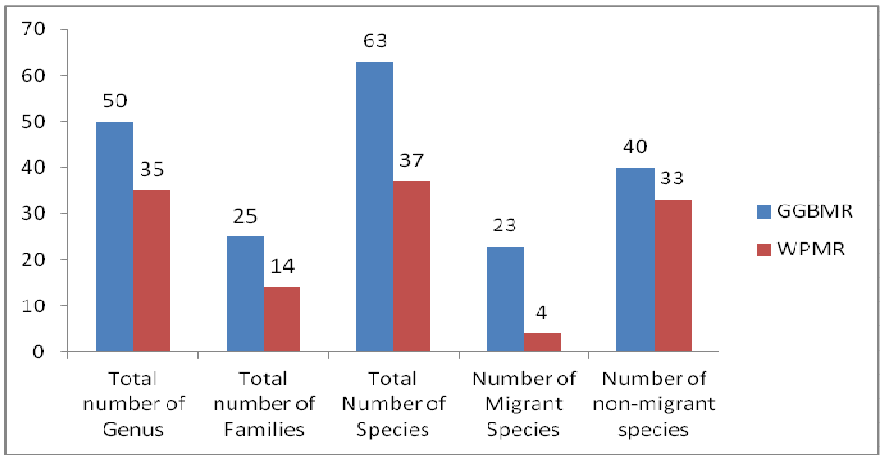
Mangrove ecosystems support important wetland communities of plants and animals (Mann, 1982; Mestre, Krul & Moraes 2007) and inspite of their sometimes low floristic diversity

(Pool, Snedaker & Lugo, 1977; Barrantes, 1998) they are known to posses a relatively rich diversity of avifauna (Lefebvre, Poulin & Mc Neil, 1994). This ecosystem type provides good habitats for birds because they are usually teeming with prey and they provide relatively safe nesting and roosting sites (Nisbet, 1968; van Balen, 1989). Although the above is true not many studies have been conducted and published from Guyana on the diversity of avifauna in mangrove ecosystems and their specific role in the lives of these avi-fauna (Da Silva, 2014).

Much of the available information, about avifaunal species in mangroves in Guyana, comes from existing works such as Snyder, 1966; Pastakia, 1991; Prince & Bernard, 1997; Singh & Fernandes, 2004; Bayney & Da Silva, 2005; Braun, Finch, Robbins & Schmidt, 2007. One of the more historical and comprehensive pieces of work by Snyder (1966) listed 720 avian species for Guyana (Braun, et. al. 2007). Braun, et al 2000 and Braun, et al 2007 built on that of Snyder (1966 and produced a first edition checklist with 786 species and a second edition checklist with included 814 avian species. Despite this evident lack of research, previous studies have noted that nine (9) of the twenty (20) bird orders documented in Guyana are shorebirds (Prince & Bernard, 1997; Bayney & Da Silva, 2005). Another unpublished study of the Waini-Shell Beach area conducted by Mendonca (2006) documented ninety (90) species of birds; sixty (60) species were landbirds while the remaining thirty (30) were waterbirds. Migrant species were found to be twenty-nine percent (29%) of the total list of birds observed. More specifically, thirteen (13) landbirds and thirteen (13) waterbirds, a total of twenty-six (26) of the identified species, were listed as either Austral, Nearctic or Caribbean Migrants (Braun et al, 2000 and Hilty, 2003). Considering the two identified mangrove reserves, a WWF (2012) study at the GGBMR site documented forty six (46) species of birds. Among the species were the Black Skimmer (*Rynchops niger*), the Yellow-crown Night-Heron, (*Nyctanassa violacea*), the Snowy Egret, (*Egretta thula*) and the Magnificent frigatebird (*Fregata magnificens*). A study by Da Silva (2014) at the WPMR recorded a total of 1184 birds comprising thirty-seven (37) species representing seven (7) Orders, fourteen (14) Families and thirty seven (37) Genera. Given the forgoing it may be safe to surmise that although some work was undertaken to address mangroves and avifauna in Guyana there are still significant gaps in the information and a need for continued efforts to improve the assessment of this ecosystem type as an avifaunal habitat.

AVIFAUNA FROM TWO MANGROVE RESERVES IN GYANA

The data on the total number of families, genera and species garnered from this study is summarized and is shown in Figure 1 for the GGBMR and the WPMR.



The family with the greatest number of species was the Scolopacidae with nine (9) genera and seventeen (17) species, followed by Tyrannidae with seven (7) genera and eight (8) species, Ardeidae with four (4) genera and six (6) species, Thraupidae with four (4) genera and four (4) species), Accipitridae with three genera and three (3) species, Columbidae, Icteridae and Laridae each with two (2) genera and two (2) species, Cuculidae and Trochilidae with one (1) genus and two (2) species each. All other families represented had one genus and one species. The species with the greatest abundance were *Egretta caerulea, Calidris minutilla, Eudocimus ruber, Egretta thula,* while the species with the lowest abundance was *Haematopus palliatus.* Nesting sites were observed at the GGBMR for the *Eudocimus ruber*, *Egretta thula, Egretta caerulea* and *Hydranasse tricolor*. The presence of these nesting sites may have contributed to the high abundance but lower diversity of these species. This kind of nesting pattern was typical for these species and was associated with stands of *Avicennia germinans.*

At the Wellington Park Mangrove Reserve (WPMR) thirty-seven (37) species of birds were recorded from fourteen (14) families and thirty five (35) genera. The family with the greatest number of species was the Ardeidae with six (6) genera and seven (7) species, followed by Tyrannidae and Accipitridae with five (5) genera and five (5) species each. The Icteridae and Scolopacidae had three (3) genera and three (3) species each and the Cuculidae had two (2) genera with three (3) species. The Alcedinidae, Parulidae and Thraupidae each had two (2) genera with two (2) species. All other families had one (1) genus with one (1) family. Nesting sites were observed at the WPMR for the *Eudocimus ruber*. The most abundant species recorded were the Rufous Crab-hawk (*Buteogallus aequinoctialis*), Great egret (*Ardea alba*), Greater Kiskadee (*Pitangus sulphuratus*), Scarlet Ibis (*Eudocimus ruber*) and the washer woman or Pied Water Tyrant (*Fluvicola pica*).

The WPMR had fewer mature trees since this area was more inhabited by young replanted mangroves from the replanting exercise of the GMRP. This site also had a greater rate of survival of replanted trees. The area also has lesser expanse of exposed mudflats thus reducing the possible areas for feeding by species that utilize these mudflats for feeding purposes. It could only be surmised that the number of species could increase as the trees mature and so provide more cover, nesting and roosting habitats for the species of birds. In addition there were fewer understory birds at the WPMR since there were fewer mature trees to provide such understory habitats.

There was a greater mature plant/tree density at the GGBMR site as compared to WPMR site. This may have contributed to a greater occurrence of understorey birds at the GGBMR. Additionally there was also a greater expanse of exposed mudflat at the GGBMR location and this may have offered more optimal feeding grounds for many of the herons, egrets, ibises, and plovers.

A notable observation was the high number of migrant bird species at the GGBMR (23 species out of the total of 62 species found at the location). This will also have implications for management, because of the continuous threat to those species as a result of uncontrolled harvesting of these migrant species, especially during the months of April to August. Key informants noted that many of the birds were often unable to fly because of their being injured by the harvesting techniques used to catch them.

There should be continuous monitoring of the nesting sites of all of the species especially the scarlet ibis (*Eudocnemis ruber*). There is at the moment at the two reserves an especially large population of *Eudocnemis ruber,* as reported by many community residents and as observed by the researcher. Monitoring of the newly planted areas at the Wellington Park Mangrove Reserve is needed since this area has shown a considerable increase in the avifauna from the time that the area was replanted. This area could become an important habitat for many of the species recorded as well as others that may subsequently utilize the area as the trees mature and provide more robust feeding, roosting and nesting areas. It should be noted that there are no contiguous inland forest areas neither are there any inland forests in close proximity to the two mangrove reserves. Hence there is little chance of these reserves sharing species with inland forested areas that could lead to higher numbers of species and greater species diversity and density.

The number of avifaunal species observed in the replanted area at the WPMR, increased from October through to December. During the period of study the birds frequenting the beach

mudflats with newly planted mangroves were also observed to fluctuate in numbers depending on the level of the tide. It is assumed that changes in the tidal cycles may have exposed some advantageous foraging sites for the birds to feed. It is generally known that shorebirds feed on a variety of small invertebrates and insects present in mudflat areas (Robert et al, 1989). There was no temporal separation observed since many different bird species were seen foraging together on the exposed mudflats. This may be an indication of either of two situations: either the food available was adequate to supply the needs of the varied bird populations, or, there was some amount of trophic separation between species. Given this fact, this is an area that needs further study. Raghukumar & Anil (2003) notes that biodiversity and community structure are important determinants of ecosystem functioning. Thus it is important for continuous monitoring of the mangrove reserves so that changes in species could be detected. It has been noted by researchers (Ripley, 1978; Morrison, 1986; Diamond & Filion, 1987; Pawar, 2011) that avifauna is not only sensitive to changes in the habitat but is also very good and useful bio-indicators of environmental and ecological health (Ripley, 1978; Morrison, 1986; Diamond & Filion, 1987; Pawar, 2011).

Herons and egrets were present in greater numbers over the entire study area at WPMR. This is in keeping with findings reported by Kumar & Kumara (2011) who stated that "Herons, egrets and ibises are the most conspicuous group of birds that are found in mangroves". This is probably linked to the fact that there may have been abundant food sources in a relatively safe habitat. Most of these species of Ardeidae feed on fishes and crabs which were very abundant in the study area in all of the subhabitats, the beach mudflat and the area dominated by *Batis maritima*. Of the Ardeidae the Great Egret (*Ardea alba*) was the most abundant and the Little Blue Heron, *Egretta caerulea*, was the most common in this family. The scarlet ibis (*Eudocimus ruber*) was the only member of the family Threskiornithidae that was recorded and based on the numbers of this species observed over the study period this species was determined as being abundant. The Rufous Crab Hawk (*Buteogallus aequinoctialis*) was the most abundant of the Accipitridae with the snail kite (*Rostrhamus sociabilis*) and the roadside hawk (*Buteo magnirostris*) being the most common. This is not too surprising given the prevalence of food for the Rufous Crab-hawk and the proximity to freshwater habitats where snails abound and serve as food for the snail kite. The numbers of birds that were observed varied depending on the tidal levels. This was most likely linked to the exposure of the mudflats during the low tide when there is the occurrence of optimal foraging sites on

mudflats for shorebirds, which feed on a variety of small invertebrates including snails, larvae and insects present in mudflat areas (Robert, McNeil & Leduc, 1989).

These survey findings represent an additional entry to the baseline data for the two rehabilitated mangrove ecosystems in Guyana. However, given the limited data sets, trends in avifaunal population of the various taxonomic groups cannot be made at this time. However, successful management of the areas as habitats for the species would require continual monitoring of the identified groups of avifauna and the general health of the mangrove vegetation.

CONCLUSIONS AND RECOMMENDATIONS

Given the results and observations made during this study it may be concluded that the mangrove environment at the GGBMR and the WPMR are important to local and migrant avifauna. The ecological conditions at the two mangrove reserves appear to be good for supporting a fair diversity of avifauna. The information gathered during this study can be used to inform further studies and to learn more about the status of avifaunal species at the two mangrove reserves and in mangrove ecosystems in Guyana. Such studies will be beneficial since a number of residents make use of coastal areas for agriculture and livestock rearing (Da Silva, 2015). These are activities which can pose direct and indirect threats for the mangroves as well as the avifauna since many of the migrant species are targeted for their meat. Such studies of avifaunal populations in other mangrove areas will help Guyanese to better understand and appreciate the roles mangroves play in maintaining healthy ecosystems and associated biodiversity populations. Further research should be conducted to record changes over time of the listed species to determine any change in the bird populations, population counts of keystone and bio-indicator species for the two areas. The mangrove vegetation formations of the coast of Guyana are of considerable value not only as an avifaunal habitat but also for their function as a natural sea defence. Therefore, they should be protected at all costs.

It is recommended that more mangrove reserves be established and legally designated in Guyana since they (i) appear to have a diversity of flora that support foraging and nesting requirements of many avifaunal species, (ii) serve as good habitats for local and migrant species of birds, (iii) have the potential for being used as breeding habitats by a number of bird species (iv) they represent an ecosystem that faces many threats and (vi) provide coastal and riverine protection for the country thus helping to reduce the overall cost of protecting the coast associated infrastructure from flooding and the impacts of climate change.

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