Avian and wildlife diversity in the area of bauxite mining near lamba village, Dwarka in the state of Gujarat, India

Abstract
The bauxite is the primary ore of aluminum. Almost all of the aluminum that has ever been produced has been extracted from bauxite. The area in question is rich in bauxite and lime. The mining activity hinders the movement of wildlife especially birds. The area of bauxite mining is proximity to sea shore and major creek. In this study, 38 birds species (1 species protected under schedule –1 as per Indian Wildlife Protection Act 1972), 10 species of reptiles, 5 species of mammals, 13 species of marine fishes were observed.

Keywords: bauxite mining, core zone, buffer zone, mining, avian–biodiversity

Introduction
The avian and wildlife biodiversity of an area depends on several factors of biotic and abiotic components. The coastal areas are rich in avian biodiversity especially sea birds. The mining activity hinders the movement of avian fauna. The bauxite mining activity increasing as demand increased of bauxite for the industrial use. The unorganized and unscientific industrial activities lead to the deterioration of abiotic components which affect biotic components. Study area (Figure 1) comprises of 30% Sea, 29% cropping (dominant crop is ground nut), 9% Grassland, 7% fallow land, 5% stone (mainly bauxite), 2% Forest area, 1% human settlement and other area which is dry. The main activity in this area is mining of bauxite mineral as the area is rich in bauxite and lime.

Methodology
The detailed method and parameters covered for the said study has been highlighted in Table 1. The study area comprises of 8 villages viz. Lamba, Maleta, Navedra, Jodhpar, Gangdi, Satapar, Chachlana, Jamdevliya (Figure 1). Secondary sources and literature was reviewed to identify the representative variety of vulnerable species, inhabitants and ecological groups listed by IUCN, WCMC, ZSI, BSI and Indian Wild life Protection Act, 1972. The status of individual species was assessed using the revised IUCN/SSC category system (Table 1) (Figure 1).

Table 1 Mode of Data collection and Parameters considered during the Survey

<table>
<thead>
<tr>
<th>Data</th>
<th>Mode of Data Collection</th>
<th>Parameters Monitored</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary data</td>
<td>By Field Survey</td>
<td>–Reptiles, –Amphibians, –Birds, –Fresh water fishes, –Mammals, –Butterflies. Rare and Endangered fauna in the study area, Endemic fauna in the study area, Wild life and their conservation importance in the study area.</td>
<td>Random survey, opportunistic observations, diurnal bird observation, active search for reptiles, faunal habitat assessment, active search for microhabitat, scats, foot prints, animal call, pug marks, debarking sign, Nesting, Claws, Dung, etc. and information from local villagers.</td>
</tr>
<tr>
<td>Secondary data</td>
<td>Forest Division Data of Fisheries department, Literature like research papers, books published by research/ academic institutions.</td>
<td>Interpretation of secondary data for Ecological Sensitive Areas such as national forests, wild life sanctuaries, lakes, ravines, hills, hillocks and reserve forest, importance etc.</td>
<td>The status of individual species was assessed using the revised IUCN/SSC category system.</td>
</tr>
</tbody>
</table>

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Results and discussion

As per the map prepared by National Bureau of Soil Survey & Land Use Planning (NBSS&LUP), the study area fall under Central Malwa Highlands, Gujarat Plains and Kathiawar Peninsula which represents hot semi–arid eco–region with medium and deep black soils favorable for millets, wheat, pulses. In this area the agro–biodiversity should be promoted. As per the personal observation recorded (Figure 2), the area has scarcity of drinking water, the vegetation in the area is sparsely distributed, road side plantation and natural creek (mangrove) making the area green for avian wildlife.

Avian biodiversity

The 38 avian species were encountered during the survey. The most commonly spotted bird species of this area were Accipiter badius (Gmelin, 1788), Acridoidea gingeinaus (Latham 1790), Bubulcus ibis (Linnaeus, 1758), Dicrurus macrocercus (Vieillot, 1817), Merops leschenaulti (Vieillot, 1817), Phalacrocorax fuscicol (Stephens, 1826), Psittacula krameri (Scopoli, 1769), Fanelus indicus (Boddart, 1783), Muscicapa striata (Pallas, 1764). Water birds are very common as creek and sea shore line is the major part falls under study area. The Indian Peafowl was observed which is listed as schedule –I as per IWPA, 1972 and others listed as schedule IV as per IWPA, 1972. Total 38 avian species encountered during the study listed in Table 2.

Wildlife: In amphibian group, the toads were sighted during the study period. In the reptile group, Calotes versicolor (Cuvier, 1817), Hemidactylus flaviviridis (Ruppell, 1835), Stanaponticeria(Cuvier, 1817), Bungurus caeruleus (Schneider, 1801) etc. were observed in the region is given in the Table 3. In the mammals; Funambulus pennantii (Wroughton, 1905), Pteropus giganteus (Brünnich, 1782), Lepus nigricolis (F. Cuvier, 1823), Boelaphus tragocameus (Pallas, 1766) and Herpestes javanicus (Geoffroy Saint–Hilaire, 1818) were observed in the study area are listed in the Table 4. The marine fishes Pampus chinensis (Bonaparte, 1834), Penaeus indicus (Milne–Edwards, 1837), Mugil cephalus (Linnaeus, 1758), Mugil dussumieri (Linnaeus, 1758), Harpodon neherius (Hamilton, 1822), Polyenemus indicus (Linnaeus, 1758), Tenaulosa illusia (Hamilton, 1822) etc. are encountered in the coastal area (Figure 3) listed in Table 5.

Domestic animals: Camel, Bull, Buffalo, Sheep, Cow, Goat, etc.

Insects: like Wasps, Honeybees and Signature spider was also recorded (Figure 2) (Figure 3).

RET species: The IUCN Red List is the world’s most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. Among the birds in the study area, Pea fowl (Pavo cristatus) is included in schedule I of Wild life protection Act (1972), while many other birds are included in schedule IV. Among the reptiles Xenochrophis piscator (Schneider, 1799), Naja naja (Linnaeus, 1758), Bungarus caeruleus (Schneider, 1801) and Daboia russelli (Shaw & Nodder, 1797) provided protection as per Schedule–II of Indian Wild life Protection Act, (1972). In the mammal group, Herpestes javanicus (Geoffroy Saint–Hilaire, 1818) is protected under schedule–II while others are not covered under schedule–I or II as per Indian Wild life Protection Act, (1972).

Status of the forest

The forest areas of Gujarat are unevenly distributed. The major concentration of forests is found all along the eastern border of the state and the hilly portion of Saurashtra. The wide variations in Geophysical and Eco–climatic conditions ranging from hot saline deserts to humid hilly tracts and from coast to high hills have resulted in to formation of various types of forest. No forest land is involved within the mine lease area; however it is present in the study area. On the basis of forest classification by Champion and Seth 1968, tropical dry deciduous forest exists in the study area. In this type of forest vegetation developed due to they have long dry seasons which last several months and vary with geographic location. The common trees are the teak and a variety of acacia. However, vegetation in core are of mine is very sparsely distributed. As per revenue record and toposheet (SOI), there is a reserved forest (open scrub) for stony waste area. This can be classified under open scrub. This is open and having no vegetation currently, reserved for bauxite mineral.
Table 2 Avian Biodiversity in the area

<table>
<thead>
<tr>
<th>SNO</th>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Schedule/UCN</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Accipitridae</td>
<td>Shikra</td>
<td>Accipiter badius (Gmelin, 1788)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>2</td>
<td>Alaudidae</td>
<td>Oriental Sky Lark</td>
<td>Alauda gulgula (Franklin, 1831)</td>
<td>Schedule IV</td>
<td>M</td>
</tr>
<tr>
<td>3</td>
<td>Alcedinidae</td>
<td>White–throated Kingfisher</td>
<td>Halcyon smyrnensis (Linnaeus, 1758)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>4</td>
<td>Ardeidae</td>
<td>Little Egret</td>
<td>Egretta garzetta (Linnaeus, 1766)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>5</td>
<td>Charadriidae</td>
<td>Lapwing</td>
<td>Vanellus indicus (Boddart, 1783)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>6</td>
<td>Ciconiidae</td>
<td>Painted Stork</td>
<td>Mycteria leucocephala (Pennant, 1769)</td>
<td>Schedule IV</td>
<td>RM</td>
</tr>
<tr>
<td>7</td>
<td>Columbidae</td>
<td>Eurasian Collared–Dove</td>
<td>Streptopelia decocto (Frivaldszky, 1838)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>8</td>
<td>Coraciidae</td>
<td>Indian Roller</td>
<td>Coracias benghalensis (Linnaeus, 1758)</td>
<td>LC</td>
<td>R</td>
</tr>
<tr>
<td>9</td>
<td>Cuculidae</td>
<td>Crow–Pheasant</td>
<td>Centropus sinensis (Stephens, 1815)</td>
<td>LC</td>
<td>R</td>
</tr>
<tr>
<td>10</td>
<td>Dicruridae</td>
<td>Black drongo</td>
<td>Dicrurus macrocerus (Vieillot, 1817)</td>
<td>LC</td>
<td>R</td>
</tr>
<tr>
<td>11</td>
<td>Laniidae</td>
<td>Great Grey Shrike</td>
<td>Lanius excubitor (Linnaeus, 1758)</td>
<td>Schedule IV</td>
<td>RM</td>
</tr>
<tr>
<td>12</td>
<td>Laridae</td>
<td>Little Tern</td>
<td>Sterna albifrons (Pallas, 1764)</td>
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<td>R</td>
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<tr>
<td>13</td>
<td>Leiotrichidae</td>
<td>Common Babbler</td>
<td>Turdoides caudatus (Dumont, 1823)</td>
<td>Schedule IV</td>
<td>R</td>
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<tr>
<td>14</td>
<td>Meropidae</td>
<td>Chestnut–headed Bee–eater</td>
<td>Merops leschenaulti (Vieillot, 1817)</td>
<td>LC</td>
<td>R</td>
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<tr>
<td>15</td>
<td>Motacillidae</td>
<td>Yellow Wagtail</td>
<td>Motacilla flava (Linnaeus, 1758)</td>
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<td>RM</td>
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<tr>
<td>16</td>
<td>Muscicapidae</td>
<td>Spotted Flycatcher</td>
<td>Muscicapa striata (Pallas, 1764)</td>
<td>Schedule IV</td>
<td>R</td>
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<tr>
<td>17</td>
<td>Nectarinidae</td>
<td>Purple Sunbird</td>
<td>Nectarinia asiatica (Latham, 1790)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>18</td>
<td>Passeridae</td>
<td>House sparrow</td>
<td>Passer domesticus (Linnaeus, 1758)</td>
<td>LC</td>
<td>R</td>
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<tr>
<td>19</td>
<td>Phalacrocoracida</td>
<td>Cormorant</td>
<td>Phalacrocorax fuscicollis (Stephens, 1826)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>20</td>
<td>Phasianidae</td>
<td>Little Cormorant</td>
<td>Phalacrocorax niger (Vieillot, 1817)</td>
<td>Schedule IV</td>
<td>RM</td>
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<tr>
<td>21</td>
<td>Phoenicopterida</td>
<td>Lesser Flamingo</td>
<td>Phoenicopterus minor (Geoffroy Saint–</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>22</td>
<td>Ploceidae</td>
<td>Baya weaver</td>
<td>Ploceus philippinus (Linnaeus, 1766)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>23</td>
<td>Podicipedidae</td>
<td>Little Grebe</td>
<td>Tachybaptus ruficollis (Pallas, 1764)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>24</td>
<td>Pitiaccidae</td>
<td>Rose–ringed Parakeet</td>
<td>Pitaicaula krameri (Scopoli, 1769)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
<tr>
<td>25</td>
<td>Rallidae</td>
<td>White–breasted Water hen</td>
<td>Amaurornis phoenicus (Pennant, 1769)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
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<td>26</td>
<td>Scolopacidae</td>
<td>Ruff</td>
<td>Philomachus pugnax (Linnaeus, 1758)</td>
<td>LC</td>
<td>R</td>
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<tr>
<td>27</td>
<td>Sturnidae</td>
<td>Bank Myna</td>
<td>Acridotheres ginnianus (Latham 1790)</td>
<td>Schedule IV</td>
<td>R</td>
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<tr>
<td>28</td>
<td>Threskiornithida</td>
<td>Red–naped ibis</td>
<td>Pseudibis papillosa (Temminck, 1824)</td>
<td>Schedule IV</td>
<td>R</td>
</tr>
</tbody>
</table>

Citation: Rathoure Ak. Avian and wildlife diversity in the area of bauxite mining near lamba village, Dwarka in the state of Gujarat, India. Int J Avian & Wildlife Biol. 2018;3(3):225–229. DOI: 10.15406/ijawb.2018.03.00090
Table 3 List of Reptiles in the Study Area

<table>
<thead>
<tr>
<th>SNO</th>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Schedule as per 1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agamidae</td>
<td>Common Garden Lizard</td>
<td>Calotes versicolor (Cuvier, 1817)</td>
<td>Not listed</td>
</tr>
<tr>
<td>2</td>
<td>Agamidae</td>
<td>Fan-Throated Lizard</td>
<td>Sitana ponticeriana (Cuvier, 1817)</td>
<td>Not listed</td>
</tr>
<tr>
<td>3</td>
<td>Chamaeleonidae</td>
<td>Indian Chameleon</td>
<td>Chameleo zeylanicus (Rafinesque, 1815)</td>
<td>Not listed</td>
</tr>
<tr>
<td>4</td>
<td>Colubridae</td>
<td>Checker Keelback</td>
<td>Xenochrophis pascator (Schneider, 1799)</td>
<td>Schedule II</td>
</tr>
<tr>
<td>5</td>
<td>Elapidae</td>
<td>Indian Cobra</td>
<td>Naja naja (Linnaeus, 1758)</td>
<td>Schedule II</td>
</tr>
<tr>
<td>6</td>
<td>Gekkonidae</td>
<td>House Gecko</td>
<td>Hemidactylus flaviviridis (Rupell, 1835)</td>
<td>Not listed</td>
</tr>
<tr>
<td>7</td>
<td>Viperidae</td>
<td>Indian Saw Scaled Viper</td>
<td>Echis carinatus (Schneider, 1801)</td>
<td>Schedule II</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Russell’s Viper</td>
<td>Daboia russell (Shaw &amp; Nodder, 1797)</td>
<td>Schedule II</td>
</tr>
</tbody>
</table>

Table 4 Mammals in Study Area

<table>
<thead>
<tr>
<th>SNO</th>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Status as per IWPA 1972/IUCN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Antilopinae</td>
<td>Blue Bull</td>
<td>Boselaphus tragocamelus (Pallas, 1766)</td>
<td>Schedule III</td>
</tr>
<tr>
<td>2</td>
<td>Herpestidae</td>
<td>Small Asian mongoose</td>
<td>Herpestes javanicus (Geoffroy Saint-Hilaire, 1818)</td>
<td>Schedule II</td>
</tr>
<tr>
<td>3</td>
<td>Leporidae</td>
<td>Indian Hare</td>
<td>Lepus nigricollis (F. Cuvier, 1823)</td>
<td>Schedule IV</td>
</tr>
<tr>
<td>4</td>
<td>Pteropodidae</td>
<td>Indian flying fox/Fruit bat</td>
<td>Pteropus giganteus (Brünnich, 1782)</td>
<td>LC</td>
</tr>
<tr>
<td>5</td>
<td>Sciuridae</td>
<td>Five striped Palm Squirrel</td>
<td>Funambulus pennantii (Wroughton, 1905)</td>
<td>Schedule IV</td>
</tr>
</tbody>
</table>

Table 5 List of Marine Fish

<table>
<thead>
<tr>
<th>SNO</th>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clupeidae</td>
<td>Hilsa shad</td>
<td>Tenualosa ilisha (Hamilton, 1822)</td>
</tr>
<tr>
<td>2</td>
<td>Mugilidae</td>
<td>Grey Mullet</td>
<td>Mugil cephalus (Linnaeus, 1758)</td>
</tr>
<tr>
<td>3</td>
<td>Mullet</td>
<td>Mullet</td>
<td>Mugil dussumieri (Linnaeus, 1758)</td>
</tr>
<tr>
<td>4</td>
<td>Penaeidae</td>
<td>Indian Prawn</td>
<td>Penaeus indicus (Milne-Edwards, 1837)</td>
</tr>
<tr>
<td>5</td>
<td>Polynemidae</td>
<td>Thread Fin</td>
<td>Polynemus indicus (Linnaeus, 1758)</td>
</tr>
<tr>
<td>6</td>
<td>Stromateidae</td>
<td>Pomfret</td>
<td>Pampus chinensis (Bonaparte, 1834)</td>
</tr>
<tr>
<td>7</td>
<td>Synodontidae</td>
<td>Bombay Duck (Bumla)</td>
<td>Harpodon heuerius (Hamilton, 1822)</td>
</tr>
<tr>
<td>8</td>
<td>Sciaenidae</td>
<td>Jewfish</td>
<td>Argyrosomus japonicus (Temminck &amp; Schlegel, 1844)</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>Pseudosciensa amblepus (Bleeker, 1863)</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>Protonibea diacanthus (Lacepede, 1802)</td>
</tr>
</tbody>
</table>

*not seen directly

Conclusion

Study area has 30% sea shore and 70% terrestrial. No any major forest observed in the study area, the wild life distribution is meager. The wildlife can sustain when human influence will be minimized and agro–forestry will be encouraged. An urgent need to protect agro–biodiversity of the area by using good practice in bauxite mining such as controlled wet blasting, 5m high boundary on periphery of mining area; regular water sprinkling and manual mining instead of mechanized mining, plantation over benches, grooves development, rainwater harvesting and its use in irrigation and restoration of mine pits. The effective plantation should be done in 3 tier green belt development to protect the avian biodiversity of the area.

Acknowledgements

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Conflict of interest

Author declared that he has no conflict of interest.

References