Assessment of distribution and abundance of land snail species in Makurdi Metropolis, Benue State, Nigeria.

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Abstract
Snails are one of the most diverse groups of animals, also known to be a good delicacy. The study assessed the abundance and distribution of edible land snail species in Makurdi Metropolis, Nigeria. The study was conducted from April to October 2013. Five locations were selected (Achusa, Agbough, University of Agriculture Makurdi, NASME and Zoological garden). Descriptive statistics and ANOVA were used for data analysis. Three species of snails were identified (Achatina achatina, Achatina depreavata and Bulinus truncatus,) and a total of 2030 snails were collected. Their distribution in terms of location showed that the Makurdi Zoological Garden had the highest number of snails while NASME had the least number. The month of August had the highest distribution of snails while the least was recorded in the month of April. Analysis of Variance revealed significant difference (P<0.05) in location and months among the species sampled.

Keywords: Abundance, distribution, snail, species, Makurdi

Introduction
Snails belong to a group of invertebrate animals known as molluscs, which are the second largest phylum of the animal kingdom, forming a major part of the world fauna (Joseph, 2008). Most molluscs are shell bearing. Other members of this group include slugs, mussels, squid and cuttlefish. The Gastropoda is the only class of molluscs, which have successfully invaded land (Ramzy, 2009). Among gastropods, land snails (subclass: Pulmonata) are one of the most numerous with almost 35,000 described species of the world (Ramzy, 2009). Land snails are gastropod mollusks that have shells, (those without shells known as slugs).

In reality, some are more or less amphibious between land and freshwater, and others between land and saltwater (Pavlova, 2001). The most popular edible snails in West Africa are the giant land snail; Achatina achatina and Archachatina marginata. Most studies on snails in West Africa have concentrated on these two species and on the garden snail (Achatina fulica) (Joseph, 2008). In West Africa, snails dwell mostly in humid forest areas from where they are gathered by villagers for consumption and other uses (Ademosun & Omidiji, 1999). The African giant snails are pulmonate, hermaphroditic gastropods of the family Achatinidae. They are indigenous to Africa and are distributed in Sub-Saharan Africa ranging from the Gambia in the west to the Lake Chad region in the east. Their distribution extends southwards to the Orange River in South Africa (Hodasi, 1995).

Snails are sensitive to changes in atmospheric humidity and temperature (Omole & Tewe, 2000; Joseph, 2008). They thrive best in areas with moderate temperatures and high humidity especially Achatina fulica which are able to put up with a range of conditions, but when temperature and/or humidity are not their favour, they go into dormancy. They aestivate if the temperature is too high (above 30 °C), or if air humidity is too low (below 70-75%) relative humidity and hibernate if the temperature drops below 5 °C (Joseph, 2008). In the same vein, Jess and Marks (2011) report that soil moisture content of 80% capacity is favorable and in the hour of darkness air humidity of over 80% will promote good snail activity and growth. Edible land snail exhibits great adaptation to environmental changes brought about by human encroachment and modification of protected areas (Baba & Adeleke, 2006). They are however, nocturnal animals that are active in the night and live in cool environment, under leaves or stones in their natural habitat (Omole & Tewe, 2000). In Nigeria, snails are still gathered mainly from the forest, the wild snail and other species are on the decline due to frequent exploitation, deforestation, and other human activities (Adegbola, 1998).

Climate change and anthropogenic activities continue to modify distribution patterns of snails. Generally, the total area of suitable habitats is shrinking due to changes in land use and climate. There are no proper geological records of Africa, so re-surveys to monitor stability and change in land snail populations are difficult to interpret (Omole, 2000). Data on land snails especially edible ones is of critical importance since there is sharp decline in the snail's abundance in the markets over the years. Also, some evidences exist that the snails sold in the market can be sourced locally, and reared to multiply and meet local demands, thus reducing the cost of both transportation and other variables (Joseph, 2008). The study therefore investigates the distribution and relative abundance of snails' species that naturally exist within the urban vegetation and the reserve area of Makurdi Metropolis.

Materials and Methods
The study was carried out in Makurdi metropolis, Benue State, Nigeria. Makurdi lies within the Southern Guinea Savannah Zone; between latitude 7°38’ to 7°52’N and longitude 8°20’ to 8°38’E (Figure 1). The Makurdi metropolis shares boundaries with Tarkaa and Guma Local Government Area of Benue State in the

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North, Gwer East and Gwer-West in the West. The vegetation type is that of Guinea savanna. The soils are moderately deep to very deep, ranging in depth from 55cm on the crest and upper-slope to 200cm in the lower-slope. The soil textures consist of sandy loam surface and sandy clay to clay in the subsurface (Idoga, Adegoye, & Agbede, 1998; Idoga, Abagyeh, & Agber, 2005). The terrain is basically an undulating plain. Its relief ranges between 83m to 167m above sea level. The drainage system comprises of tributaries of river Benue which in include Bar and Demekpe. The rainy season is from April to October while the dry season is from November to March and the average annual rainfall was between 150 and 180 mm, relative humidity is between 60% to 80% but decrease in the early month of dry season (Jimoh, Debisi, & Ikyagba, 2009) The vegetation of the area is characterized by pattern of secondary forests regrowth interspersed by extensive savanna with very tall grasses and was primarily dominant by tree species like Daniella olivera, Prosopis africana and Parkia biglobosa while predominant grasses include Andropogon gayanus, Hyparrhenia involucrate and Imperata cylindrica. Chromolaena odoratum is a common herb in the area especially close to river banks (Idoga et al., 2005).

Data Collection and Analysis

Eleven (11) council wards namely: Mbalagh, Agan, North Bank I, North Bank II, Fiidi, Bar, Modern Market, Walomayo, Akpan Wadata, Central South mission and Clerk market ward were mapped. Five (5) council wards which had evidence of snails' presence were:purposely selected. In each of the council ward, a location was selected namely: Zoological Garden (Fiidi), Achusa (Bar), University of Agriculture (Agan), Agbough (Modern market) and Nigerian Army School of Military Engineering (NASME) (Mbalagh) respectively. In each of the locations, a 30m x 30m plot was laid and in each of the 30m x 30m plot, six 5m x 30m sub-plots were demarcated for sample collection. The plots were marked with flagging tapes. A total of thirty (30) sub-plots were searched for snail for 30 minutes. This was done four times per month from April to October 2013. The time quantitative searches method by various investigators (Emberton, Pearce, & Randalana, 1996; Bishop, 1977; Cameron & Pokryszko, 2005) was adopted. The searching covers both day and night time and commenced at 6.30am to 9.30am and 6 to 7pm when snails were still very active (Ajayi, 1978). Snails were handpicked with gloved hands from trees, bushes and ground surface and placed in plastic container and taken to the Fisheries laboratory in the University of Agriculture Makurdi for identification. Data obtained were subjected to descriptive analysis while analysis of variance (ANOVA) was used to test for significant difference between location and months.

Results

Two edible land species and one non-edible were identified. Two thousand and thirty (2,030) snails were collected during the study (Table 1). In terms of location, Zoological garden area had the highest number (505) snails collected, followed by the Achusa location (409) and the least was NASME (329). The mean distribution of snails collected from the selected locations was significantly different (p<0.05). Further analysis showed that the number of snails collected in all the months were significantly different (P<0.05). In terms of period of collection among the study sites,
Achusa had the highest number in the months of April and May respectively. More snails were collected at zoological garden study site in the months of June, August, September and October than other months. The three species of land snails identified and the composition were *Achatina achatina*, *Achatina depravata* and *Bulinus truncatus* (Table 2 and Figure 4). Sampled specimens are shown in plates 1, 2 and 3 respectively. In terms of month, the month of August recorded the highest number of snails (359) followed by the month of July (357), while the least number of snails (159) was recorded in the month of April. *Achatina achatina* was the most abundant species (1,386) throughout the period, follow by *Achatina depravata* (517), while *Bulinus truncatus* (127) had the least number.

### Table 1. Distribution and abundance of snails collected for seven months in the study area.

<table>
<thead>
<tr>
<th>Locations</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achusa</td>
<td>45</td>
<td>64</td>
<td>56</td>
<td>64</td>
<td>75</td>
<td>54</td>
<td>51</td>
<td>409</td>
</tr>
<tr>
<td>Agbough</td>
<td>21</td>
<td>42</td>
<td>49</td>
<td>98</td>
<td>71</td>
<td>66</td>
<td>44</td>
<td>391</td>
</tr>
<tr>
<td>Nasme</td>
<td>34</td>
<td>45</td>
<td>57</td>
<td>66</td>
<td>62</td>
<td>35</td>
<td>30</td>
<td>329</td>
</tr>
<tr>
<td>Uam</td>
<td>30</td>
<td>45</td>
<td>61</td>
<td>65</td>
<td>72</td>
<td>69</td>
<td>43</td>
<td>396</td>
</tr>
<tr>
<td>Zoo</td>
<td>29</td>
<td>63</td>
<td>86</td>
<td>64</td>
<td>79</td>
<td>106</td>
<td>78</td>
<td>505</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>159</strong></td>
<td><strong>270</strong></td>
<td><strong>309</strong></td>
<td><strong>357</strong></td>
<td><strong>359</strong></td>
<td><strong>330</strong></td>
<td><strong>246</strong></td>
<td><strong>2030</strong></td>
</tr>
</tbody>
</table>

**ANOVA**

Location ($F_{4,24} = 3.198$, $P=0.03$)

Month ($F_{6,24} = 5.884$, $P=0.001$)

### Table 2: Number of snails' species collected during the study period.

<table>
<thead>
<tr>
<th>Species</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Achatina achatina</em></td>
<td>118</td>
<td>154</td>
<td>246</td>
<td>209</td>
<td>269</td>
<td>218</td>
<td>172</td>
<td>1386</td>
</tr>
<tr>
<td><em>Achatina depravata</em></td>
<td>36</td>
<td>97</td>
<td>34</td>
<td>107</td>
<td>73</td>
<td>99</td>
<td>71</td>
<td>517</td>
</tr>
<tr>
<td><em>Bulinus truncatus</em></td>
<td>5</td>
<td>19</td>
<td>29</td>
<td>41</td>
<td>17</td>
<td>13</td>
<td>3</td>
<td>127</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>159</strong></td>
<td><strong>270</strong></td>
<td><strong>309</strong></td>
<td><strong>357</strong></td>
<td><strong>359</strong></td>
<td><strong>330</strong></td>
<td><strong>246</strong></td>
<td><strong>2030</strong></td>
</tr>
</tbody>
</table>

Figure 3: Distribution and abundance of snails collected for seven months.
Assessment of distribution and abundance of land snail Species

Discussion

The high number of snails recorded is typical of West African taxa as reported by Joseph (2008) that snails are mostly found in reserve area and protected urban vegetation. This result indicated that both locations had a considerable diversity and abundant number of snails. It also indicates that snails were available in the study area throughout the study period. The distribution and abundance of land snails in study area may be attributed to the availability of suitable food, shelter and oviposition sites. The abundance of snails varied considerably from location to location during the survey, the highest abundance observed at Zoological garden could be attributed to the fact that the environment is well conserved and is located along the shores of river Benue, thus retained moisture. This agrees with Ikpa, Amounum, and Orshi (2006) who reported that conserved natural environment is suitable for snails’ survival and abundance. Amongst the snail species identified, *Achatina achatina* had the highest number (1,386). There was a general fluctuation in the number of snails collected from April to October. The
African giant land snails population between months of May to October was highly influenced by the rainfall pattern. This finding was consistent with what was reported by Akufongwe, Dondji, Okwuosa, Dakul, and Ntonifor (1995). One of the three snail species encountered (Bulinus truncatus) is recognized intermediate host for schistosomiasis in Nigeria and therefore not normally consumed (Obureke, Arene, & Ufodike, 1987; Emejulu, Okafor, & Ezigbo, 1992; Agi & Okwuosa, 2001). Most snails attributed the marked increase of its population at the onset of rain to the resumption of normal metabolic activities by snails that have successfully gone through period of adverse conditions (Cooper, Richards, & Lewis, 1992). Lassau, Hochuli, Cassis, and Reid (2005) reported that snail distribution could be influenced by season, while Cameron (2005) inferred that time of day could also affect the distribution of snails. Hodasi, (1979) reported that Achatina achatina is more prolific and attains sexual maturity earlier in the wild environment than Bulinus truncates.

**Conclusion**

Snails population within Makurdi was low, although Achatina achatina was more abundant and well distributed. Several factors may have inter-playing roles in accounting for the situation. Among these are the issues of increased human population in the area and the attendant over exploitation of the snails, clearance of forests (the snail's habitats) for agriculture, using cultural practices that result in the degradation of the Makurdi ecosystem. As no previous database exists against which the current figures of snail distribution and abundance could be tested to establish trends over the years. Snails are vulnerable to changes in environmental conditions and many species of land snails are living close to their thermal and desiccation tolerance due to the removal of the shade trees in their habitat because of deforestation and habitat loss. Various microhabitats may be used for the rearing of snails, depending on the suitability and availability of such-microhabitats to ensure sustainability and productivity. It is hereby recommended that people should be educated on the effect of snails' overexploitation and preservation of urban vegetation should be encouraged to enhance snails' survival and populations. Domestication of land snails especially the edible ones should be encouraged to reduce over dependence of the wild ones, thus increasing their abundance.

**References**


Assessment of distribution and abundance of land snail species


