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Enviro INSIGHT
environmental impact assessments

Methods employed for the surveying of vertebrate fauna in West Africa

Methods Statement 2012/3

by

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1 HERPETOFAUNA

1.1 Method Statement

1.1.1 Funnel traps

During wet season surveys several funnel trap drift fence arrays are deployed where herpetofauna diversity is expected to be greatest and where it was physically possible (soil conditions, rocks, slope etc.). Following the general pitfall trap design, which is very effective in trapping herpetofauna, particularly lizards, small snakes and amphibians (Corn & Bury 1990; Branch 1998; Crosswhite et. al. 1999; McDiarmid et. al. 2012), the trap efficacy is increased by replacing the 25 liter pitfall buckets with specialized end funnels (designed by L. Verburgt) and by the addition of funnel traps along the drift fences (e.g. Masterson et. al. 2009). The funnel-trap drift fence arrays (Figure 1-1) allows for the placement of traps where it is not possible to sink a 25 liter bucket (e.g. rocky or boggy ground) and provide greater trapping success (L. Verburgt, pers obs). Traps are inspected daily in the morning and all captured specimens are photographed and released away from the traps.

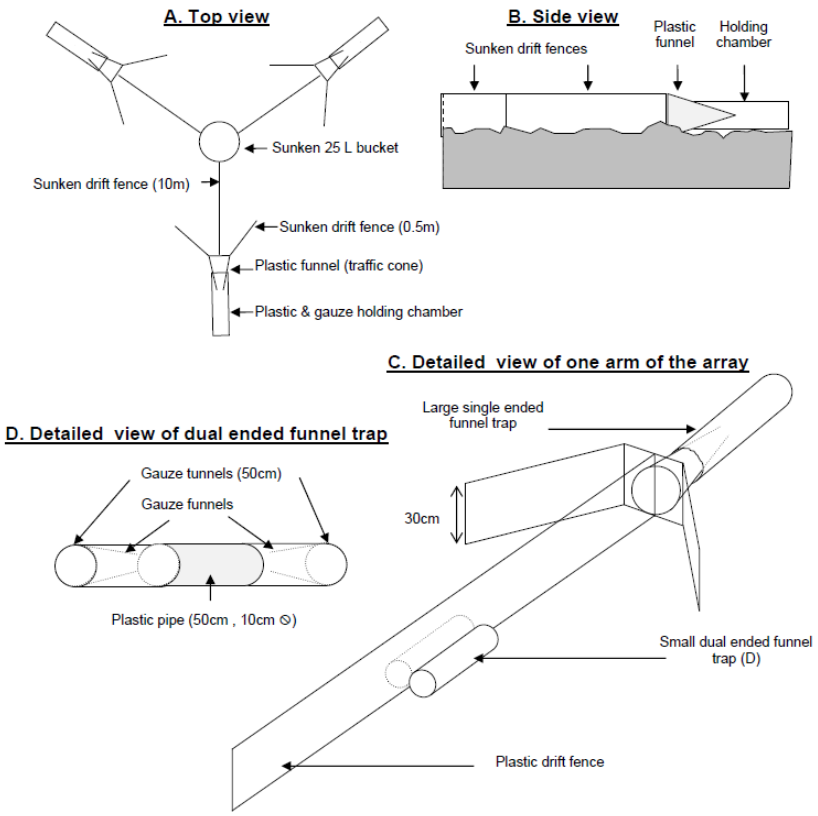

Figure 1-1: Funnel trap drift fence array used for the capture of herpetofauna. Funnel traps are constructed from metal gauze.

1.1.2 Climate monitoring

Because all herpetofauna are ectothermic and their behaviour is heavily influenced by the presence of rain it is necessary to present reptile survey data in the context of the prevailing climatic conditions. A DS1923 Hygrochron iButton ® is placed at each funnel trap drift fence array to log the temperature and the relative humidity at 30 min intervals. Each iButton is placed inside an inverted ventilated polystyrene cup to protect against the effects of rain and direct solar radiation and then fixed to a leafy tree in order to provide shade for the device over the whole day.

Figure 1-2: A climate data logger (Hygrochron iButtons) is deployed under a leafy tree at each drift fence funnel trap array in an inverted ventilated polystyrene cup.

1.1.3 Active searching during point sampling

Reptiles are searched for on foot within the study area during the day. Specific habitat types are selected where active sampling is focused intently (point samples). The habitat of these point samples is described and photographs are taken. Active searching for reptiles occurs for approximately 2 hours per point sample and involves:

- Photographing active reptiles from a distance with a telephoto lens
- Lifting up and searching under debris or rocks (rocks are always returned to their original positions)
- Excavation of suitable animal burrows that appeared to be in use by herpetofauna
- Scanning for any signs of reptiles such as shed skins, the positive identification of which is taken as an observation of that species

- Catching any observed reptile by hand. All captured reptiles are photographed and released unharmed

Nocturnal reptiles are searched for on foot and by driving very slowly on the roads at night. Amphibians (frogs and toads) are nocturnal and are searched for by torchlight at night along dam/pond/river edges and in wetland areas. Positive identification of amphibian acoustic signals (males call to attract females) is also used as a means of identifying amphibians. Where necessary acoustic signals are recorded with high-precision recording equipment and identification confirmed with existing recordings.

1.1.4 Passive audio sampling

Automated sound recording equipment is stationed at various sites and programmed to record up to 4 hours of sound per night (). Importantly, the timing of the sound recording is pre-set so that different choruses are capture throughout the night in order to maximise the probability of sampling all calling species present. Recordings are then analyzed *post hoc* with the help of freeware software (Audacity 2.0).

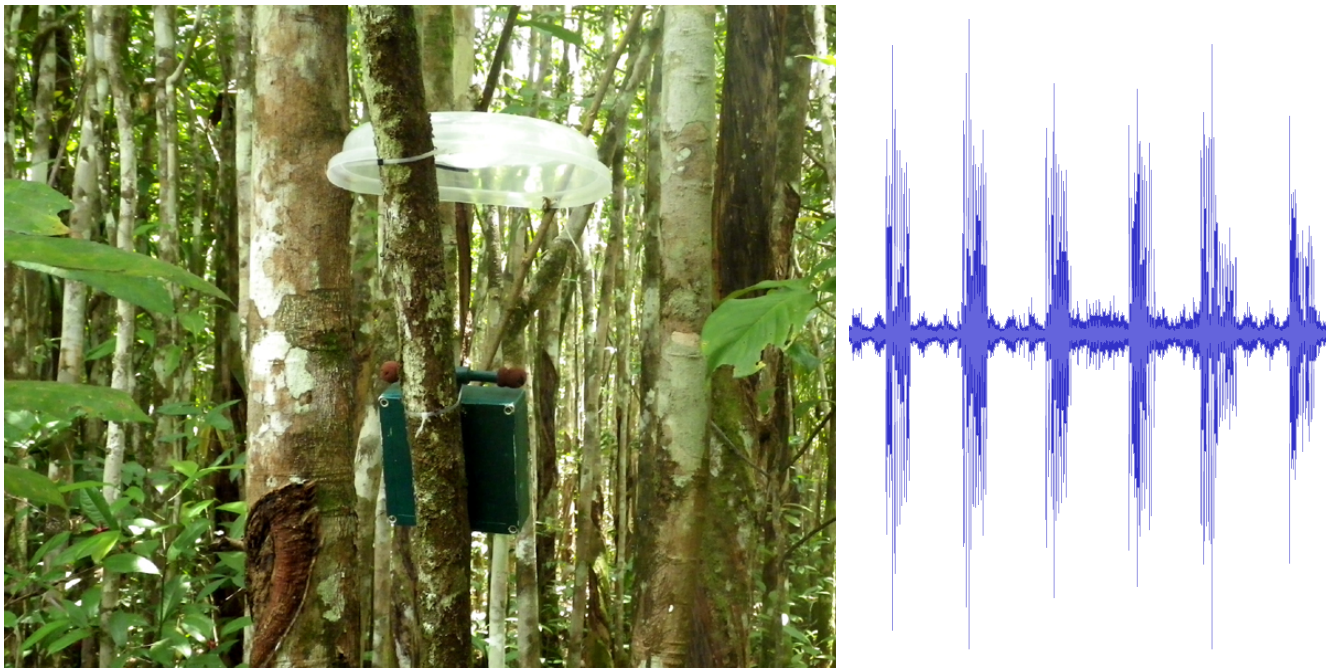

Figure 1-3: An automated sound recorder is deployed (with a rain shelter) to record all sound at several different intervals per night. Software is used to filter the sound and enhance the animal calls for identification. Here the processed oscillogram of a reed frog is shown.

1.1.5 Opportunistic sampling

Reptiles, especially snakes are incredibly illusive and difficult to observe. Consequently, all possible opportunities to observe reptiles are taken in order to augment the standard sampling procedures described above. These are:

- During driving between the different study sites the road and road verge is constantly scanned for active and killed (road collisions) reptiles. Driving speed is slower than normal to increase the likelihood of a successful observation. Once a reptile is observed the vehicle was rapidly (but safely) brought to a halt and the observed reptiles would be photographed.
- The other biodiversity specialists sometimes took photographs of reptiles and amphibians observed on the study site. These images were copied for proper identification and added to the list of random observations.

1.1.6 Local knowledge

During a survey it is important to acquire any local knowledge of herpetofauna species, especially if evidence can be provided (e.g. photographs). Local residents were interviewed where possible using community liaisons and with the consent of the local administrators and community leaders.

1.1.7 Desktop study

All available books providing information on distribution ranges and/or conservation status of African herpetofauna are utilized to make predictions of occurrence in the area (see extensive reference list). Three main peer-reviewed websites exist that provide information on herpetofauna at a national level. For reptiles, www.reptile-database.org is used and for amphibians, www.amphibiaweb.org and http://research.amnh.org/vz/herpetology/amphibia/ is used. The IUCN website (www.iucnredlist.org) is utilized to provide the most current account of the global conservation status of reptiles and amphibians while all relevant local literature is consulted for the national conservation and protection status of herpetofauna. Internationally recognized protected areas are taken into consideration according to IUCN & UNEP (2012). All impacts are assessed and analyzed within the framework of the International Finance Corporation's (IFC) Performance Standard 6.

1.1.8 Limitations and assumptions

To perform an exhaustive herpetofauna survey of a study area would take years of time due to the very secretive and unpredictable movements of most reptile species. The results of any herpetological field survey are compromised by time and funding availability as well as the movement/activity patterns of the herpetofauna community during the survey period. Therefore, a typical herpetofauna survey provides only a snapshot of the herpetofauna community and can only be used as a guideline to understand the composition of this community and its interaction with the different available habitat types.

There is a lack of reliable information on herpetofauna for most African countries. In particular, there is a lack of known geographic distributions of herpetofauna from which a predictive species list may be generated. Consequently, any list of expected species will have some degree of error associated with it. It is prudent to apply the precautionary principle in these cases and to rather include a species into the expected list.

2 AVIFAUNA

2.1 Method Statement

2.1.1 Literature review and desktop study

A literature review of the study area is undertaken to collate as much information as possible. The following literature represents key references:

- General information on the life history attributes of relevant bird species present in the study area is sourced from del Hoyo et al. (1992-2011) and Gatter (1997);
- Distributional data (apart from those obtained during the surveys) is sourced from del Hoyo et al. (1992-2011), Sinclair & Ryan (2010), Borrow & Demey (2007) and Gatter (1997);
- The scientific nomenclature, taxonomy and common names are used according to the International Ornithological Committee (the IOC World Bird Names), unless otherwise specified (see www.worldbirdnames.org; Gill & Donsker, 2012). The nomenclatural sequence of Sibley & Ahlquist (1990) is adopted with slight modifications to the inferred phylogenies of the passerines due to the lack of robust taxonomic structure (Hockey et al., 2005);
- The conservation status of bird species is categorised according to the IUCN Red List of Threatened Species (IUCN, 2012), while their biogeographic affinities (e.g. biome and range-restricted species) are obtained from Robertson (2001);
- Information regarding the Important Bird Areas (IBAs) is sourced from Robertson (2001); and
- All impacts are assessed according to the International Finance Corporation's (IFC) Performance Standard 6.

2.1.2 Point count surveys

Data are collected by means of point counts (Buckland et al. 1993; Ralph et al. 1995; Sutherland et al. 2004) to determine indicator species and to delineate the different bird communities present. The use of point counts is the preferred method for detecting shy or elusive species. It is also preferred over line transect counts where access is problematic, or where terrain is complex, for example in dense forest habitat. It is an appropriate method to use, and is very efficient for gathering a large amount of data in a short time period (Sutherland, 2006).

Point counts are located at least 200 m apart to improve the independence of observations. Each point count was surveyed for a period of 20 minutes. The following data are collected at each survey point:

- the species (identification) of each bird seen; and
- the number of individuals of each species seen during each observation (group size).

2.1.3 Random surveys

To obtain a more complete inventory of bird species present (apart from those observed during the point counts), all

bird species observed while moving between point counts are identified and listed. Particular attention is paid to suitable roosting, foraging and nesting habitat for threatened or near-threatened species. Besides visual observations, bird species are also identified by means of their calls and other signs such as nests, discarded egg shells and feathers.

Nocturnal bird species are searched for on foot and by driving very slowly on the roads at night. Attention is paid to calling bird species such as owls and nightjars.

2.1.4 Playback of bird calls/vocalisations

The probability of detecting skulking or elusive species (e.g. forest interior species of the genera *Illadopsis, Alethe, Pseudalethe, Bleda, Criniger* and *Bathmocercus*) is verified by playback of their respective calls/songs wherever suitable habitat is observed. Special care is taken to keep disturbance to a minimum and not to affect the bird's natural behaviour (e.g. to prevent unnecessary habituation). Bird songs/calls are sourced from Chappuis (2001) and the online Xeno-Canto library at www.xeno-cantho.org.

2.1.5 Local knowledge

Additional information regarding threatened and near-threatened bird species is sourced from interviews with local people. Local residents are interviewed where possible using community liaisons and with the consent of the local administrators and community leaders.

2.1.6 Detecting patterns in community composition and diversity

The data generated from the point counts are analysed according to Clarke & Warwick (1994). A comparison of the different bird communities relative to the different habitat types/floristic units is performed using multivariate community analyses of calculated Bray-Curtis similarity coefficients. The similarity matrix is exposed to a cluster analysis based on ordination techniques (using hierarchical agglomerative clustering). Sampling entities (or point counts) that group together (being more similar) are believed to have similar bird compositions.

The contribution (%) of each species to each habitat type/floristic unit is determined (Clarke & Warwick, 1994). Species with high contributions represent typical/dominant species for a given community. In addition, the dissimilarity between the different communities are measured. A species with a high contribution to the dissimilarity between two sites are good indicator species of the particular community or habitat.

Species diversity is analysed by means of rarefaction, while richness measures (such as the total number of species recorded (S) and Shannon-Weaver diversity index) will aim to compare communities with each other. The advantage of rarefaction is that it adjusts the number of species expected from each sample if all are reduced to a standard size.

2.1.7 Construction of guild profiles

Bird guilds are a better alternative to species lists or species inventories. The different habitat types support different bird communities, each representing a "guild profile" of different feeding and nesting guilds that consists of one or more species (Feinsinger, 2001). For example, a forest patch may have several species that are insectivorous, although they may use it in different ways (e.g. gleaning, probing, hawking) at different strata (vertical levels) to obtain their prey. Hence, a forest patch with a high diversity of guilds is therefore often highly functional. Since species richness and composition alone are not good ecological indicators, the "guild profile" may be more sensitive to the effects of human activities. The "guild profile" of each bird community is analysed and interpreted (e.g. dominant guilds vs. "missing" guilds).

2.1.8 Limitations and assumptions

In order to obtain a comprehensive understanding of the dynamics of terrestrial communities, as well as the status of endemic, rare or threatened species in any area, bird assessments should consider investigations at different time scales (across seasons/years) and through replication. However, due to time and available funding, such long-term studies are not possible to achieve. Therefore, the bird survey provides an indication of the bird diversity in the area during an instantaneous sampling session. It is by no means exhaustive and should be used as a reference to understand the community composition, distribution and its interaction with the different available habitat types.

3 MAMMALS

3.1 Method Statement

3.1.1 Sherman traps

Site selection for trapping focuses on the representative habitats within the study area. Sites are selected on the basis of GIS mapping and Google Earth (Google Corporation) imagery and then final selection is confirmed through ground truthing. Habitat types sampled should include disturbed and semi-disturbed zones (rice fields and secondary growth areas along with the Bong mine camp), primary rainforest, drainage lines and wetlands.

For the sample period, the trap lines are deployed in pre selected areas. Each trap line consists of 15 large Sherman traps baited with a combination of peanut butter, oats, sardines and oil. Figure 3-1 shows an example of the traps used. Traps are baited and checked every day for 5 consecutive days. Captured animals are moved from the traps into clear plastic bags, identified, photographed and then released unharmed. The small mammal data collected is limited to species trap successes and diversity in order to get a basic understanding of the small mammal assemblages in the area.

Figure 3-1: Sherman Trap used for the capture of small mammals.

3.1.2 Camera trapping

The use of camera trapping has long been considered as a valuable ecological census tool, especially in forest systems. An initial reconnaissance is carried out in the area before camera deployment in order to determine the suitability of possible bait station locations. Bait stations are chosen based on available cover around the area, the location of the site on the properties and the presence of any promising mammalian signs (e.g. tracks, scats, tree scrapings) as well as the likelihood of possible habitat for important species. Once suitable sites have been located, the cameras are mounted and baits deployed. The baits used are a fish remains acquired from the local communities. All bait used will be acquired locally. Eight cameras will be deployed in order to adequately cover the study area.

Cameras are set to record 1 image and 30 seconds of video footage, with a 1 minute delay between events. The cameras are placed at each of the monitoring points (in association with Sherman trapping and spoor tracking points). Additional cameras may be placed at other locations throughout the study site depending on changes in conditions (human presence, mine expansion, access and migration of species).

Figure 3-2: A typical camera trap set up where the camera is deployed under a leafy tree (to limit accidental image captures) with bait and

an associated i-button in an inverted ventilated polystyrene cup.

3.1.3 Spoor tracking

Spoor tracking is considered to be the world's oldest science (Liebenberg 2005), enabling detailed sampling of mammalian species without the need for trapping or direct observation. All spoors, including footprints, scats, den sites, burrows, hairs, scrapings and diggings are documented through geo-referenced photography. The spoor tracking itself is focused on optimal tracking substrates, especially roads (in the early morning), drainage lines and wetland banks (where animal movements are focused). Liebenberg (2005) and Stuart and Stuart (1998) were the primary reference guides used for spoor tracking. However, much extrapolation of spoor was required as no spoor guide currently exists for the region. Finally, local hunters were recruited to help with spoor identification and confirmation of species.

3.1.4 Opportunistic and deliberate mammal sampling

The mammal population, both regionally and locally are characterised by extreme shyness and cryptic behaviour. This can be attributed to both the inherent cryptic nature of forest mammals and the extreme hunting pressure on the local mammal population. It is for this reason that mammals within the study area are seldom seen. Therefore, opportunistic and deliberate sampling provided valuable data for the sample period.

The opportunistic sampling data acquisition is divided into two sections.

1. Planned night drives/walks: Due to severely reduced access in the region (impassable roads/poor weather conditions), walking is the primary method of opportunistic sampling data acquisition. However, major arteries throughout the mining area also serve as excellent sources of data acquisition, especially at night. All observations of mammals (sightings/vocalisations/fresh tracks) are recorded during each pre planned night survey. Night surveys last for a minimum of 4 hours each.

2. Random observations: Throughout the fieldwork, all incidental mammalian sightings are recorded (and subsequently georeferenced). Finally, sightings and photographs from the other biodiversity specialists are collated and added to the list of random observations.

3.1.5 Local knowledge

In the West African system Mammalogy is inextricably linked to the local communities and their traditional hunting techniques. This is because of the strong link between humans and the bushmeat trade that is axiomatic to the region. A lack of alternative protein sources have created a situation where mammals are heavily targeted by the local human population, who do not distinguish between common mammal species and species of conservation concern. Due to this strong connection between humans and mammals throughout Liberia, the acquisition of local knowledge has proved to be a highly useful method for obtaining data.

Information is gathered in three distinct ways.

Firstly, questionnaires are compiled and interviews conducted with communities and local hunters. The information gathered from the questionnaire is used to provide focus on the following issues concerning the mammalian fauna within both the study area, as well as surrounding communities. The processed data provides information as to the following aspects:

- The extent of the current impacts on the mammalian fauna within the study area (including poaching, human/wildlife conflict and utilisation).
- The attitudes of the local communities towards the mammalian fauna.
- The mammalian assemblages, including density, diversity, preferred habitats and seasonality of various mammals.
- Occurrence of red-data species on the site (including the community awareness towards legislative protection of the protected species).

Secondly, local markets are observed on a daily basis in order to create a species list of mammals acquired in the area. Species that appear in the markets are recorded and their locations (of acquisition) confirmed in order to provide a context for the study area. At no point did any specilaist solicit bushmeat or pay communities to hunt species.

Finally, local hunters are employed on a strictly guiding capacity in order to provide relevant data concerning the mammal assemblages on site. Hunters accompany the specialists into the study site and show their methods of mammal acquisition, areas of high mammal density and diversity and major hunting routes.

3.1.6 Desktop study

All desktop resources available are used in the desktop component of the study.

Identification of mammal species as well as cross referencing of mammal distributions is facilitated through the use of the following field resources:

- Stuart and Stuart (1998) and Kingdon (1997) were consulted in regards to identification of larger mammals.
- Kingdon (1997), Booth (1970) and Skinner and Chimimba (2007) were consulted in order to aid with the identification of small mammals.
- Liebenberg (2005) and Stuart and Stuart (1998) were consulted to aid with identification of tracks and signs. It must be stated that not all tracks were applicable for the area and some extrapolation was required.

Red-data species

Confusion still persists regarding which is the most appropriate information source to utilize when discussing species of conservation concern. The most common method is to examine lists generated by the Liberian conservation authorities (the FDA) as well as the list of IUCN globally threatened and regionally (Liberia specific) threatened species. In addition, the Convention for the Trade in Endangered Species (CITES) can be consulted regarding the utilization and exploitation of faunal species. The primary source of red-data species information can be obtained from the International Union for Conservation of Nature. The IUCN red data list website www.iucnredlist.org.

Finally, information in regards to the bushmeat trade is facilitated through the use of the following resources:

- Anstey (1991)
- Davies (2002)

3.1.7 Limitations and assumptions

There are a number of limitations associated with a mammalian survey of this nature which need to be addressed.

- Due to both the migratory habits of many of the local mammalian species, the inherent time frames allocated to the study period are wholly insufficient in order to fully understand the mammal assemblages on site. The size and complexity of the area as well as the relative inaccessibility of the sites severely hampers full coverage.
- The primary forest systems that characterize much of the study area often show very poor trap success in regards to small mammals. This is because many of the rodent/small mammal species are arboreal, living high in the canopies where most of the food resources are found. This dilutes the effectiveness of the method, the results of which may not be truly representative of the actual scenario. This hypothesis has been validated by Monadjem (2012 *pers.comm).*
- The high rainfall in the area severely limited the effectiveness of tracking within the study area. Afternoon and nightly rains all but washed away much of the evidence of mammals moving through the areas at night, when human activity had reduced.
- Due to the extreme hunting pressure that is axiomatic to the region, many of the mammal species have become extremely shy and elusive. This limits the amount of information that could be otherwise ascertained in regards to behaviour, migratory patterns and other observational data.

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