Protocol for surveying understorey birds using mist nets in RAPELD standardised plots of PPBio modules and grids.

Protocol for surveying understorey birds using mist nets in RAPELD modules of PPBio / CENBAM

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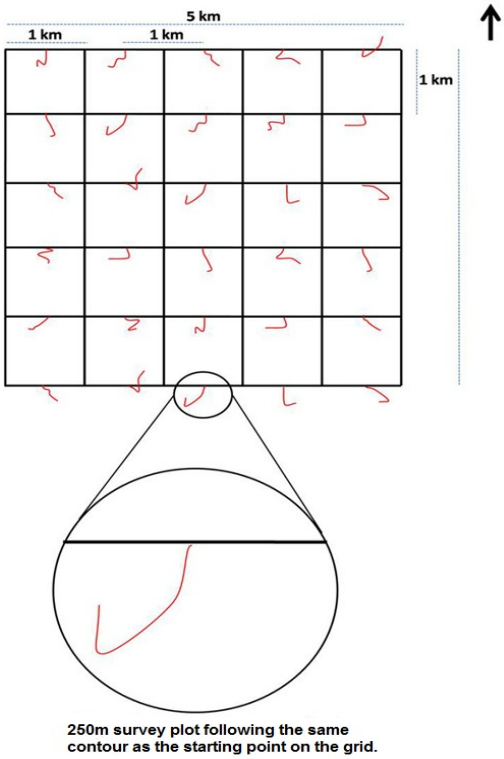
Note: Regulations concerning the banding of wild birds referred to here may be different if the survey is being carried out outside Amazonas. Although many of the general principles will be the same, you should follow the regulations for the area of your study. - Tim Vincent.

Why monitor birds?

Understory birds of are used in environmental monitoring because they have a significant effect on the the environment as pollinators, seed dispersers and for biological pest control, and are excellent indicators of environmental quality, especially for terrestrial environments.

There are a large number of species of birds and they occupy a wide variety of habitats. In Brazil alone, there are over 1,900 species (CBRO 2014). They have a lot of popular appeal and are kept as pets and used as conservation symbols. This is because of the diversity and beauty of their colours, their shapes and songs and because the majority of them are diurnal and easy to find. The bird group is well recognised and documented by extensive scientific literature, which helps to identify the species, making it easier to accurately monitor them.



How does the RAPELD system work?

The sampling units are distributed in the landscape through a system of trails that form modules and grids for the long-term monitoring of standardized studies. This system is usually formed by a set of trails 5 km long, 1 km apart from each other, and plots evenly distributed every 1 km. This type of arrangement may be modified (e.g. divided into modules or transects containing more or less plots) according to the purpose of the research or due to logistical conditions, as long as the standard distance between tracks and sample plots is maintained.

Figure 1. Schematic drawing of a RAPELD grid. The black lines indicate the trails (used for line transects) and red lines indicate evenly distributed plots. Design: PPBio.

The trails are marked every 50m by numbered pickets with aluminium tags displaying the track name and distance along the track (Figure 2).
Figure 2. On the left, an example of a trail marked with pickets.

On the right, detail of the tag with the trail name and distance in meters (3,000m in the example). Photos: Julio Valley.

In the RAPELD system, there are different types of permanent plots; evenly distributed plots and riparian plots are used to survey birds. The evenly distributed plots follow the ground contour (Figure 3), while the riparian plots follow the edge of watercourses (Figure 4). The centre-line of these plots is composed of 25 x 10m long straight segments, marked by numbered pickets.

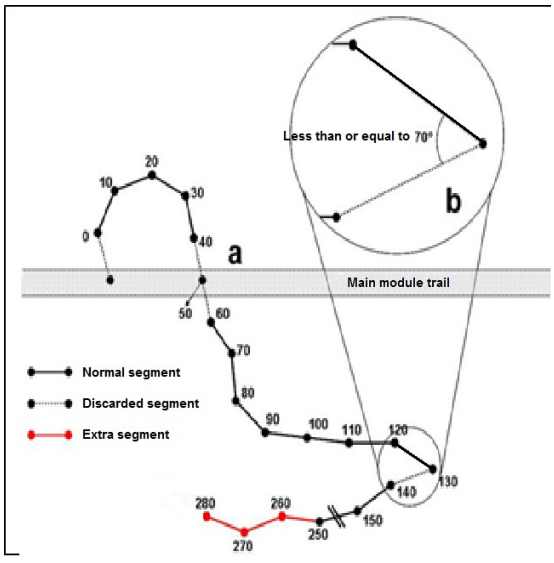


Figure 3. Schematic of a uniformly distributed plot following the contour of the land with straight segments of 10 meters. The dotted lines indicate segments that must be discarded and red lines indicate segments that should be added. Design: PPBio.

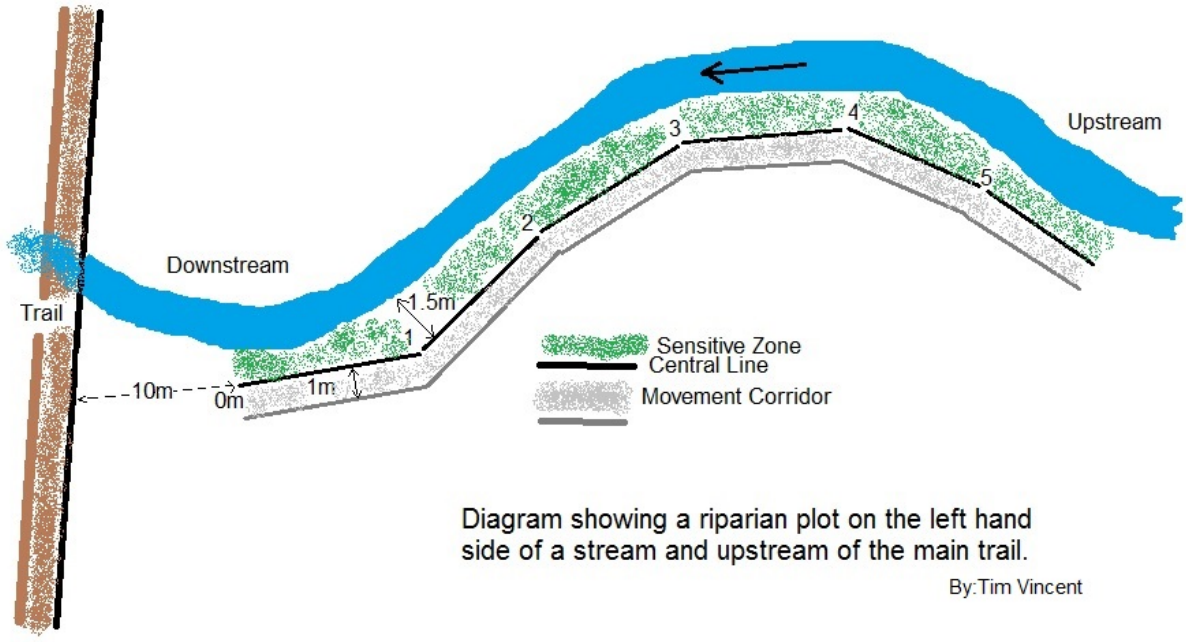


Figure 4. Diagram of a riparian plot following the bank of a watercourse with straight segments of 10 meters.

All position measurements are made with respect to the centre line of the plot. The other auxiliary lines are used to stake out the central movement corridor and the sensitive zone in which small delicate organisms which respond quickly to environmental change are monitored. Don't trample on, or step into, this area.

When should you monitor birds?

Because of the migratory behaviour of some species of birds, it is recommended that surveys are spread out through the year, so that all the local bird species are represented. In tropical regions, it is best to carry out surveys in the dry and rainy seasons and if possible in the periods of transition between these seasons. In biodiversity studies, choose the same times of the year when studies were previously conducted. In the subtropics, you should sample over the four seasons: spring, summer, autumn and winter. It may be that the research question will define when the surveys are to be carried out.

When the surveys can not be carried out throughout the year, they must take place in the dry season in tropical regions (e. g., in the Amazon) and in the spring and summer seasons in the subtropics (e. g., in the Pampas), because these are the times of year when the birds sing more, they are more active and conspicuous and display brighter colours.

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Know your subjects.

Before starting to work in the field, it is important to familiarize yourself with the local bird populations. Have a list of the birds you expect to find so that it is easier to identify them. Do a search in the literature for bird surveys previously carried out in your area. If there aren't any, look for surveys that have been carried out in the surrounding region. In the Amazon, it is important to ascertain whether or not surveys were carried out in the same watershed so that endemic species can be identified. When you have obtained a list of the local birds, highlight them in your field guide.

View photos and listen to the bird songs in databases available on the Internet. For example, WikiAves (www.wikiaves.com.br) and xeno-canto (www.xeno-canto.org). For some regions of Brazil, there are books with photographs and bird song CDs. If possible, go to the study area to preview the birds that are commonly found there.

Sampling Methods

Birds can be sampled by direct observation, listening to their vocalizations and by catching them. These different methods record species with different levels of efficiency. Catching birds with a mist net is a widely used method for monitoring because it allows for the standardization of sampling methods and for long-term studies, which may be carried out by different people. Thus, the results do not depend on the person conducting the sampling. It also enables the birds to be ringed which is a marking technique using numbered rings enabling access to information such as the lifespan of individuals, loyalty to their territories and their migration routes.

Preparation for field work.

Before going to the field, one must organise the materials needed to conduct a survey of understory birds.

A map of the site, showing the grid and/or the plots to be studied. The map is important because the centrelines may not always be continuous and you need to know which segments should be sampled and which should be disregarded. Check out the maps on the PPBio website (https://ppbio.inpa.gov.br) or your project site. If you do not find one, look for the manager of your research site.

Metadata form (Appendix 1);
Data Worksheet, where the collected data will be recorded (Annex 2);
Clipboard;
Pencils, rubber and sharpener;

Wristwatch, to monitor when to check the nets and record the time the birds were captured;
Leather gloves to remove bats that may be caught in the nets;
Mist nets to capture the birds, preferably with the following specifications:

- 10 meters long;
- 2.5 meters in height;
- 32mm mesh, which means half the perimeter of the hole, or 16x16 mm squares;
- 5 bags;
- Black colour.

3m aluminium poles for supporting the nets;
Plastic tape or thin plastic string to tie to the surroundings and make the nets taut;
Dissecting forceps with a round, serrated edge to assist in removing birds from nets;
Cotton bags for storing the captured birds;
Masking tape for labelling the bags and recording the time that the bird was found in the net, the net number and the panel where the bird was found, the ring number in the event of a recapture, and the bird processing priority (first hummingbirds then manakins, passerines weighing less than 15 grams, then recaptured birds and then the remaing captures;
Permanent markers, for writing on the masking tape;
A kit for processing the captured birds which can be stored in a tool box, together with other materials, as follows:

- metal rings (CEMAVE standard) and coloured (optional), to ring the birds;
- pliers, for opening, closing and adjusting rings – suitable for hummingbirds;

Figure 5. CEMAVE standard bird ring.

Figure 6. pliers used to band birds. From left to direct, they are exemplified pliers used to open, close and adjust washers and washers shape of hummingbirds. Photo: Anderson Saldanha Bueno.

- Spring balances: 50, 100 and 300 grams, to weigh the birds (Figure 7);

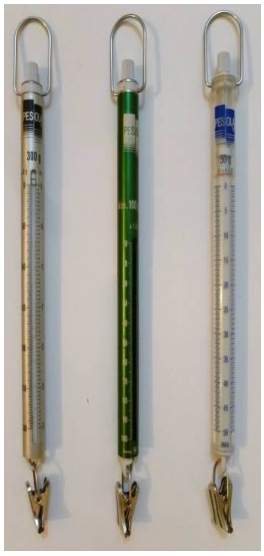

Figure 7. Spring balances. From left to right, here with scales up to 300, 100 and 50 grams. Photo: Anderson Saldanha Bueno.

- Callipers to take morphometric data;
- Small tape measure (3-5 m) for birds larger than 15 centimetres;
- small pointed scissors, for cutting the net in the event that a bird cannot be safely extracted. This should only be done when the bird is weak, somewhat tangled up and you feel unable to remove the bird without harming it further.

Read the CEMAVE Biosafety Protocol for fieldwork activities www.icmbio.gov.br/cemave/downloads/finish/3-protocols/ 8-protocol-of-biosafety-to-activity-of-campo.html)

Additional materials as described below:
A compass or GPS to record your position;
Digital camera to record the birds that were captured and also assist with their subsequent identification;
Binoculars;
Head or hand torches to walk to and from the site in the in the dark;
Machete – to cut branches that are impeding the nets. Plants that have metal tags cannot be cut.

Two tarpaulins for constructing a temporary camp where birds will be processed.

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Licenses to capture and ring birds

To be able to legally capture and band birds in Brazil, you must obtain a capture licence from ICMBio/SISBIO (www.ibama.gov.br/sisbio/sistema) and a banding permit must be requested from CEMAVE/SNA (www.ibama.gov.br/sna).

It is also recommended that you request an ICMBio license for collecting and transporting dead birds. All licenses must be printed out and carried by the lead researcher.

Banding permits, require you to be a senior bander registered with the SNA. The senior bander title is given to junior category banders who have had a year's experience and a letter of recommendation from 2 senior banders. All banders start as juniors and are overseen by a senior bander and qualify as a senior bander only after they have the necessary experience.

In order to legally comply with the requirements for banding or ringing wild birds, it is necessary to read the instructions: No. 27/2012 of the Brazilian Institute of Environment and Natural Resources Renewable (IBAMA) and the Manual for the Banding of Wild Birds (2004). These should be printed and taken with you to answer any questions related to bird banding. www.icmbio.gov.br/cemave/downloads/finish/7-sna/10-in27-2002-sna.html) www.icmbio.gov.br/cemave/downloads/finish/7-sna/13-manual-de-anilhamento-de-aves-silvestres.html).

Field sampling.

The mist nets are installed between the centre line of the plot and the narrow ribbon (plastic tape), which defines the boundary of the central corridor of the plot. Movement up and down the plot must be along the corridor. It is important to install the line of nets to avoid the sensitive zone which is usually located to the left of the centre line of the plot. If you need to move out of the corridor, use the opposite side to the sensitive zone. Check previous metadata for the plot to determine which side of the plot is the sensitive zone.

The RAPELD protocol recommends using mist nets 10 meters in length because this is the same as the length of the segments. The thickness of the edge of the net should be greater in forested areas and less in open areas to hamper detection of the net by birds. Nets should be distributed over the 250 meters of the plot, alternating a segment with a net and a segment without. The first net must be installed in the first segment of 10 meters, the second network third segment, and so on, totalling 13 mist nets by the end of the 250 meter plot.

Figure 8. The securing clips.

The mist nets are supported by aluminium rods, which have rubber clips every 50 cm to attach to the net's handles. Use tape to tie the rods to a branch or tree and stretch the net. Nets are open from the ground up to 2.5 meters in height. To open the mist nets, one person should hold the handles on one end and release the net while the other walks with the net to the next picket.

Usually, the best time to sample birds is from dawn until four hours later. In the Amazon, the recommended time for surveying is from 6am to midday. However, in open areas, you must avoid the hottest times of the day because the captured birds may die in the net due to heatstroke. Nets should be checked every 30 minutes or less when the survey is being carried out in open areas on a sunny day. To process the captured birds, work on a tarpaulin away from the survey area. A second tarpaulin might be required to provide shelter from the sun or rain.

The field sheet (Annex 2) must contain the following information: site parcel, date, team, start time (time when all nets are opened) and end of the sampling time (When all the nets are closed).

For each captured bird, you should record the following information on the data sheet:

Status, according to the following categories:
- C (capture), when the bird is captured for the first time;
- RMD (recaptured the same day): when the bird is caught again in the same day sampling. Birds with this status are not included in analysis and therefore can be released at the site of capture, without having done their record in the field of sheet;
- R (recapture): When a banded bird is captured at a time or location other than the first capture but during the same set of surveys;
- ROP (recovery): when the bird was ringed by someone from another project;
- COL (collection): when the captured bird is collected;
- NA (not banded): when the captured bird is not banded If it escaped or if the bander wasn't certain about the bird's identification. Note: when in doubt about the identification of the species, the bird should not be banded. In this situation, make a small cut with scissors in one of the wing feathers to indicate that the bird should not be recorded if recaptured on the same day.

The code on the ring consists of words and numbers (Figure 9). Note the number before putting the ring on, just in case the bird escapes.
Species: the scientific name adopted by the Brazilian Ornithological Records Committee (www.cbro.org.br);

Gender: Male (M) Female (F), indeterminate (I);
Age: Adult (A), young (J), nestling (N), indeterminate (I);
Time: When bird was found in the net;
Net: The number of the net where the bird was captured. Net 1is installed on first segment of 10 meters (closest to the trail) and net 13, is located at the last segment;
Panel: Number 1 is closest to the ground, number 5 the highest;
Weight: weight of bird plus bag;
Bag: the weight of the bag; the weight of the bird does not need to be recorded at this stage.
CT: the total length of the bird, measured from the tip of the beak to the tip of the tail;
Wing; the length of the closed wing;
Tail: the length of the tail;
Beak; the length of the beak;
Tarsus, the diameter of the tarsus;
(Plus any other measurement that may be required by the study)

Figure 9. Bird ring. Anyone finding this ring should report it to CEMAVE. www.ibama.gov.br/sna/recuperacao.php. Photo: Anderson Saldanha Bueno.

When there is no information to record in a field, put a dash, rather than leave it blank, so that you know it's not data that you have forgotten to include.

Note that this protocol differs slightly from the video here.

Additional information on how to collect the information described above can be obtained in Roos (2010) or the Manual for Banding Wild Birds (1994) www.icmbio.gov.br/cemave/downloads/finish/7-sna/13-manual-de-anilhamento-de-aves-silvestres.html.

Before checking the nets, make sure you have:
cotton cloth bags, they should be new or clean. Use them inside out so that birds don't entangle their nails in the stitching along the seams;
Masking tape;
marker pen;
Tweezers;
Scissors (avoid using);

Personal protective equipment: gloves, mask and goggles
(see the protocol Biosecurity for Field Activities, available at
www.icmbio.gov.br/cemave/downloads/finish/3-protocolos/8-protocolo-de-biosseguranca-paraatividade-de-campo.html).

Bird extraction from nets and processing priority.

To remove the birds from mist nets, first identify which side and the panel where the bird was captured. Then release the toes and legs, untangle the wings and finally the head. Place the bird in a bag and tie-up the mouth of the bag to prevent the bird from escaping; stick a strip of masking tape onto the bag and record when and where the bird was found in the net and the location on net where it was captured. Note also whether it's a delicate species like a hummingbird or manikin. If it has a ring, record the ring number.

Figure 10. Weighing the birds.

Before processing the birds, hang the bags in the shade.

Process the birds starting with the delicate species and finish with the more robust ones. That is; start with hummingbirds and manakins then passerines less than15 grams and recaptured birds.

Weigh the bird in the bag, carefully remove the bird from the bag and pass the bag to the assistant, so that she/he can write down information on the tape and weigh the empty bag.

Check the condition of the animal: if it is too debilitated release it immediately after identifying the species; if it is just a little weakened, you can ring it after it has been identified; if the animal is in good condition, you can ring it and collect all the information required for the data sheet.

If there are many birds to process, stop taking morphometric data (total length, wing, tail, beak) in order to expedite the processing.

To remove the bird from the bag, hold it by putting the index finger and middle finger around its neck; with hand hold the bird's body (see Manual Banding Wild Birds, 2004).

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Identify the bird using a field guide. Only ring birds if you are certain of their identity. If you have any doubts, collect your data and photograph it, then use scissors to make a small nick on one of the wing feathers, so that you do not process it again on the same day. Try to determine the birds' age and sex. If you cannot determine the gender of age with certainty record that is wasn't possible on the datasheet.

Banding, collecting morphometric data and photography.

To band the bird with the proper ring size, we must first measure the width of the tarsus, with the aid of a calliper. The appropriate ring for the species can be found in the Manual Banding of Wild Birds (2004) and the list of species of Brazilian birds with ring sizes Recommended, published by CEMAVE (available www.icmbio.gov.br/cemave/downloads/finish/7-sna / 11-size-list-of-anilhas.html).

Tell your assistant the ring number to record on the data sheet. If the ring is closed, use pliers to open it and put it on the bird's tarsus. Close the ring using the correct size of banding pliers. (Figure 7). After banding, you can collect the remaining information.

Measure the total length of the bird using a tape measure or callipers. Align the bird's neck and measure from the tip of the beak to the tip of the tail. Avoid stretching the bird's neck when you are doing this. The wing length is measured from the fold of the closed wing to the tip of the longest feather. To measure the length of the tail, find the point of the rump and measure to the tip of the longest tail feather. The beak length is often measured from the tip of the beak to the side of the bird's mouth, but sometimes the measurement is taken differently (Roos 2010). The method should be noted in the metadata of the study. Additional measurements are found in the Banding Manual of Wild Birds (1994) and Roos (2010), which also provide explanations and illustrations of how to collect data.

It is important to photograph the birds so that they can be identified at a later stage and also to simply record the captured birds. These pictures may be used for the preparation of a digital or printed field guide. Take pictures of the birds' profile - as they normally appear in field guides - and important details that will help with identifying the species. When releasing the bird you do not should throw it; just open the hand close to the ground and wait for it to fly away.

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Photography

Sampling Day

After finishing the survey, close the mist nets and install them in the next plot. Although the number of days in which nets are open on the same plot may vary depending on the study, it is recommended that they remain open for only one day. Before returning to that plot, every other plot on the module or grid should be surveyed first. During a season this procedure should be repeated 3 or 5 times. This procedure maximizes the number of individuals and species caught and allows species occupancy analyses to be calculated.

When planning your study, remember to allocate extra days to make up for the days when you can not open the nets. That is, days with strong wind, rain or extreme temperatures. If you open the network on these days, there will be a decrease in the capture rate and increased mortalities.

Accidental mortality of birds

The ideal in studies with mist nets is that there is a zero mortality rate, but this is not always possible. Mortality rates of up to 1% are considered to be acceptable, even for experienced banders (Spotswood et al. 2013). In cases where the mortality rate is over 1%, the procedures carried out should be reviewed. Dead birds should be collected and deposited in a scientific collection recognized by ICMBio.

After the survey

When you complete the sample, you must send the banding report to CEMAVE/SNA by SNA. Also, you must deposit your data and metadata in a public data repository so that your study can be used by others.

The sampling protocol presented in the understory bird video monitoring was produced in 2012. As PPBio protocols are constantly evolving, you should consult the metadata to determine the protocols previously used in your site survey.

References:
Brazilian Ornithological Records Committee (CBRO). 2014. Lists of birds of Brazil. 11th ed. Available in:<Www.cbro.org.br>.
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Biosafety Protocol to CEMAVE field activities. Available in: <www.icmbio.gov.br/cemave/downloads/finish/3-protocolos/8-protocolo-de-biosseguranca-para-atividadede-campo.html>
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Annex 1. Sheet for metadata, available for download at https://ppbio.inpa.gov.br).

Project title:

Team: (name and role)

Geographic coverage:

Temporal coverage:

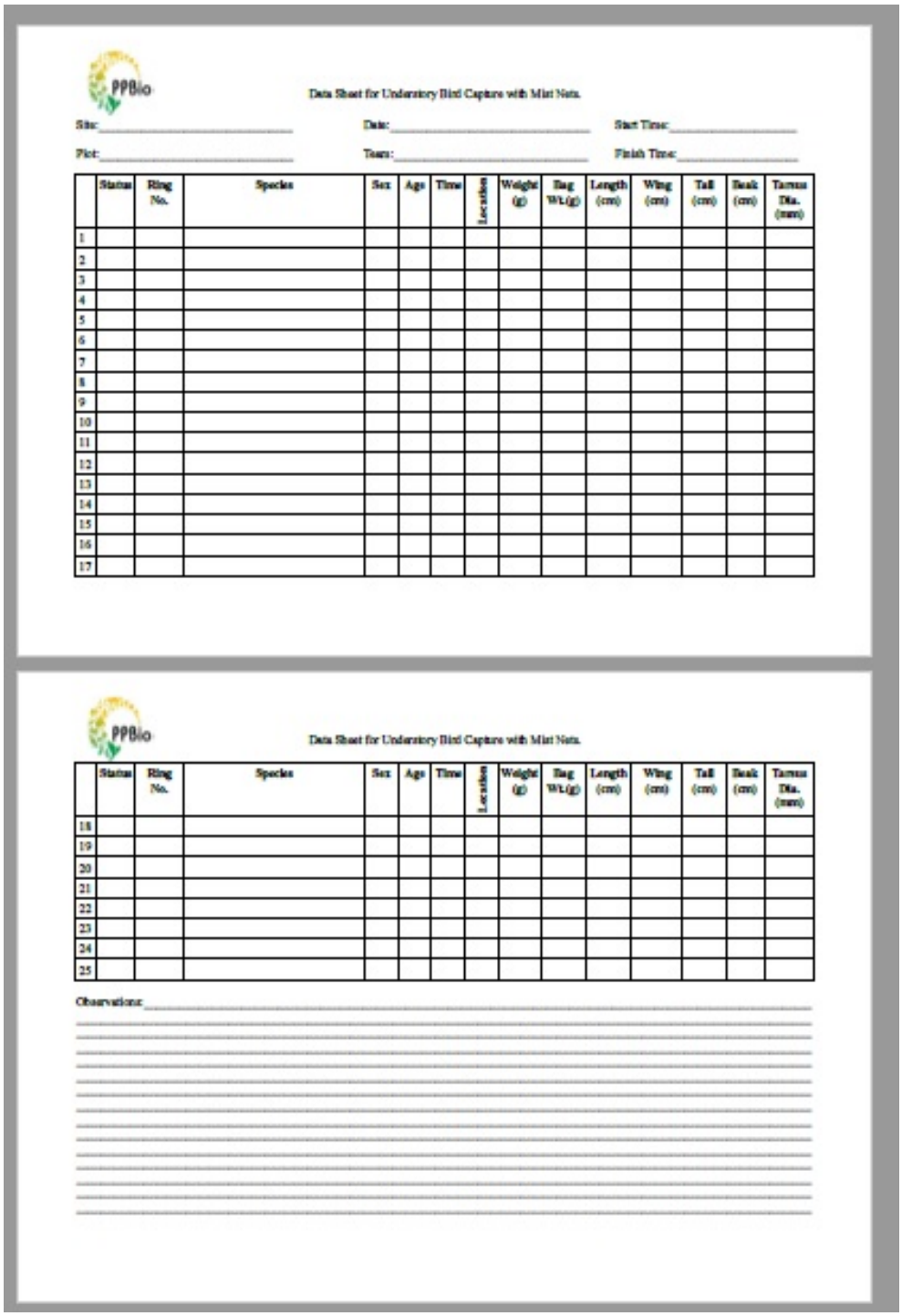
Collection methods:

Data File name:

Information about the attributes:

Attribute	Definition

Annex 2. Sample Data Sheet for understory birds. Available for download at https://ppbio.inpa.gov.br/sites/default/files/Understory_Birds_DataSheet.pdf



Data Sheet for Understory Bird Capture with Mist Nets

Site:_____ Date:_____ Start Time:_____

Plot:_____ Team:_____ Finish Time:_____

	Status	Ring No.	Species	Sex	Age	Time	Location	Weight (g)	Bag Wt.(g)	Length (cm)	Wing (cm)	Tail (cm)	Beak (cm)	Tarsus Dia. (mm)
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														

Data Sheet for Understory Bird Capture with Mist Nets

	Status	Ring No.	Species	Sex	Age	Time	Location	Weight (g)	Bag Wt.(g)	Length (cm)	Wing (cm)	Tail (cm)	Beak (cm)	Tarsus Dia. (mm)
18														
19														
20														
21														
22														
23														
24														
25														

Observations:_____

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Note: Understorey or understory?

Understory (or understorey, underbrush) in forestry and ecology comprises plant life growing beneath the forest canopy without penetrating it to any great extent, but above the forest floor. Only a small percentage of light penetrates the canopy so understory vegetation is generally shade tolerant. The understory typically consists of trees stunted through lack of light, other small trees with low light requirements, saplings, shrubs, vines and undergrowth. https://en.wikipedia.org/wiki/Understory