STANDARD OPERATION PROCEDURES FOR POPULATION SURVEYS FOR SKYWALKER GIBBONS

THE MYANMAR SKYWALKER GIBBON CONSERVATION PROJECT

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UCDAVIS VETERINARY MEDICINE
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INTRODUCTION

Gibbons (Family: Hylobatidae) are a very difficult species to survey accurately. They are not only difficult to spot due to their preference for the upper canopy, but they often flee or hide when approached by humans. Whilst acoustic point-count sampling with fixed-radius listening areas is often considered the most accurate and effective way to survey gibbons, it is by no means an easy process. Surveying gibbons by listening to their morning song bouts requires a high degree of patience and training to accurately estimate distance and bearing (Supriatna et al. 2020). Whilst many gibbon species have yet to be surveyed thoroughly, there are several key published articles explaining the basics of acoustic point-count sampling, also known as triangulation or quadrangulation (Brockelman and Srikosamatra 1993, Buckley et al. 2006, Cheyne et al. 2008, Hamard et al. 2010; Brockelman et al. 2020). This SOP is not designed to replace these foundational documents. Please consult these articles for explanations of popular methods and the rationale behind them. We aim here to outline the minute details that are often omitted or not explained in full within these articles but are crucial for an accurate and successful survey.

PLANNING SURVEY TIMING

- Calling is density dependent, with groups calling less at lower densities and sometimes may not sing for days despite favourable weather conditions. Therefore, researchers must ensure that they census each area for a **minimum of 4 consecutive days** to ensure they hear all groups in the vicinity.
- Gibbons seldom sing when it is raining, although they may sing just before or after a rain shower. Bad-weather days should be objectively described, noted in data collection sheets, and not used in the final density estimations. Researchers should **record information about weather status** (i.e. rain, sun, cloud cover, wind) every 15 minutes during a listing period (Appendix I). If it is raining *before* the survey, researchers should wait for it to stop. If rain continues past 1000 h, the survey should be abandoned. If it starts to rain *during* a survey, researchers should also abandon the survey.
- The most dependable vocalisations are the morning duets which commonly carry up to 2 km. These occur on most mornings in majority of species and are sufficiently stereotyped within pairs to allow recognition of individuals. Therefore, researchers should **perform their listening census within the first three hours of daybreak** (this is species-specific, but usually between 0400-0700 h).

PLANNING LISTENING SITES

Essential materials: GPS (Garmin models are popular and reliable), map of forest and/or transect grid

Optional materials: Topographic map

- For best results, and to keep the survey process as simple as possible, it is beneficial to select an area carefully for acoustic monitoring, including the location of individual listening posts, before starting data collection.
- Each site should include a set of **at least three listening posts**, each 300-600m apart. Three hundred metres is considered the ideal distance between two posts as it results in more accurate triangulation. Each listening post should be manned by two researchers.
- **Each set of listening posts should be 1-2 km apart**. Some degree of overlap between the effective listening areas (ELA) can be beneficial as it can confirm locations of those groups that fall within overlapping areas. If using a topographic map, researchers should divide the sampling area into a 4 km^2 (2x2 km) grid system and randomly select sites to survey.
- To avoid sampling bias with regards to altitude, listening posts should be placed on hills/ridges and both sides of a mountain/valley. In mountainous terrain, listening posts are often in a linear formation as opposed to a triangle.
- Do not place listening posts at the edge of the forest (e.g. areas cleared for agriculture or forest fires) or where a large river is located. Using a topographical map or enlisting the help of someone who knows the forest's landscape will help in planning the location of your listening posts.
- Using a GPS unit, you can drop a 'waypoint' where you would like a listening post to be and then use the 'measure distance' tool to ensure the next two posts are the correct distance apart. The same method can be used to measure the distance between the two closest points from different sets to ensure that they are at least 1 km apart.

LISTENING POST SET-UP

Essential materials: GPS, flagging tape, compass

- You may need to mark trails with flagging tape to find your way to the listening posts. This should be done in the days preceding data collection.

- Ensure that markers are clearly visible and can be seen both in daylight and in the dark. It is best to flag trees on the way to a post as well as on your return, allowing researchers to find their way quickly in the early mornings, and is essential in preventing anyone from getting lost.
- It is important to ensure listening posts are also clearly marked and will not be confused for trail markers. This can be achieved by tying flagging tape between two trees across the pathway or tied in a large bow.

DATA COLLECTION

Essential materials: Clipboard, data sheets (Appendix I and II), pencil, compass with 2° gradations, digital watch, head torch.

Optional materials: Audio recorder, camera

- Before leaving camp, all **digital watches should be synchronised** to ensure accurate readings.
- **Arrive at the listening post before sunrise** (depending on the species and location, this is usually between 0400 and 0700 h).
- The aim of the survey is to **estimate the compass bearing and distance to every group** heard at 3-min intervals (Appendix II). When a new group is heard, the start and end time, as well as the compass bearing to the group or individual is recorded. Additional notes on solo (one individual singing), duet (male and female singing in unison), and the number of great calls (female vocalisation) will help to identify groups when conferring with other teams later.
- Weather data should be recorded and updated every 15 minutes (Appendix I).
- Data collection can stop when there has been a period of no calling which exceeds 30 minutes.

POST-DATA COLLECTION MAPPING

Essential materials: paper, ruler, compass, calculator, pencil, eraser, data sheets

- To ensure that there is agreement between the different listening post teams, it is important to **plot the locations of each estimated group after each daily survey**. This allows you to determine not only where a group's home range is, but also to ensure that bearing and distance are being estimated with accuracy.

- Take an average of the distance and bearing for each group heard by each listening post team. If there is a discrepancy in the distance estimation and two potential groups fall within 500 metres of each other, they are normally considered to be part of the same group.
- Use the average distances and bearings from one listening post to another to place them on a hand drawn map. Once all data points are plotted, use the intersections of estimates to determine the approximate location of each group.
- To ensure a group was quadrangulated correctly, look at the time each person heard the group in question. Comparing when female great calls were heard is especially useful.

ESTIMATING GROUP DENSITY

Crude gibbon density estimates can be estimated using the following formula, as developed by Brockelman and Ali (1987):

$$D = n / [p(m) \times E]$$

where, n is the number of groups heard in an area as determined by the post-data collection mapping, p(m) is the estimated proportion of groups expected to sing during a sample period of m days, and E is the effective listening area (ELA).

After which, a correction factor is often applied at each site using the following formula:

$$p(m) = 1 - [1 - p(1)]\, m$$

where, p (1) is the singing probability for any given day, and m being the number of survey days. The effective listening area (ELA) for each site is the fixed radius around each listening post (usually *ca.* 1 km). Forest edges, as well as cleared areas and rivers can be deducted from the ELA using GPS and satellite imagery.

Surveys which use **better statistical methods, however, have been found to yield more accurate results and higher population estimates** (Brockelman et al. 2020). New tools for determining gibbon density are now available, such as the Acoustic Spatial Capture-Recapture (ASCR) package. This package was developed specifically for the IUCN Primate Specialist Group Section on Small Apes (IUCN SSA). More details about the package can be found here: https://gibbons.asia/tag/ascr/

REFERENCES

This guide is intended as a quick reference for field teams. For more detailed descriptions of survey methodology and background information please reference:

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Male and Female pair of Hoolock tianxing. Photo: Professor Fan Peng-Fei

APPENDIX I

WEATHER DATA SHEET

Date:		**Observers:**		**GPS/Location:**	
Time	**Cloud cover**	**Sun**	**Rain**	**Wind**	**Notes**
04:30					
04:45					
05:00					
05:15					
05:30					
05:45					
06:00					
06:15					
06:30					
06:45					
07:00					
07:15					
07:30					
07:45					
Etc.					

Cloud cover = Clear/< 50%/> 50%
Sun = Yes/No
Rain = None/Light/Heavy
Wind = Calm/Breeze/Storm

APPENDIX II

GIBBON SINGING DATA SHEET

Date:			**Observers:**				**GPS/Location:**			
Listening Post ID:										
	GROUP 1		**GROUP 2**		**GROUP3**		**GROUP 4**		**GROUP 5**	
Time	Bearing	Distance	Bearing	Distance	Bearing	Distance	Bearing	Distance	Bearing	Distance
04:30										
04:33										
04:36										
04:39										
04:42										
04:45										
04:48										
04:51										
04:54										
04:57										
05:00										
Etc.										
Number of great calls										

N.B. This is an example only. Add more group columns, as necessary.