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## **APPLICATION OF AUTOMATIC RECORDER AND SOUND ANALYSIS IN SURVEYING THE PRESENCE AND DISTRIBUTION OF BIRD SPECIES IN NGOC LINH NATURE RESERVE, QUANG NAM PROVINCE**

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### **SUMMARY**

It is necessary to have accurate information on a species' presence and distribution in order to monitor and protect an endangered species. While traditional survey methods have a several limitations, using automatic recorders in monitoring wildlife provides significant promise for detecting bird species. In this study we examined the application of automatic recorders and the associated sound analysis software (RAVEN software) to survey for the presence of 21 bird species. The survey was conducted at 11 study sites in three communes in Ngoc Linh Nature Reserve, Quang Nam province in June and July of 2016. The recordings and subsequent analysis detected the sounds of 9 bird species out of the total of 21 targeted bird species. The different species identified were detected with varying levels of frequency. While some species were detected many times in a recording and in various recordings, the others only appeared a few times in all recordings. Their active time during sampling period (3.00 - 9.00 AM) varied by species.

**Keywords:** Automatic recorders, biodiversity monitoring, bird monitoring, Ngoc Linh, RAVEN.

### **I. INTRODUCTION**

The management of endangered bird species requires detailed data on the presence and distribution of the species which is often hard to obtain. Traditional methods of surveying bird species may have a range of limitations and often do not give accurate information. Some birds are active very early in the morning, therefore, human surveyors will experience difficulty accessing field sites before or at dawn. Additionally, traditional methods require specialist surveyors who are usually not present in protected areas. One newly developed method is to use automatic sound recorders to gather information on the species for long periods of time with minimal human involvement. Autonomous recorders and software for data processing are now available and can provide a highly efficient method for biodiversity monitoring.

Ngoc Linh Nature Reserve (NLNR) is located in Nam Tra My district, Quang Nam province. The nature reserve is a part of a site that is considered an important Bird Area

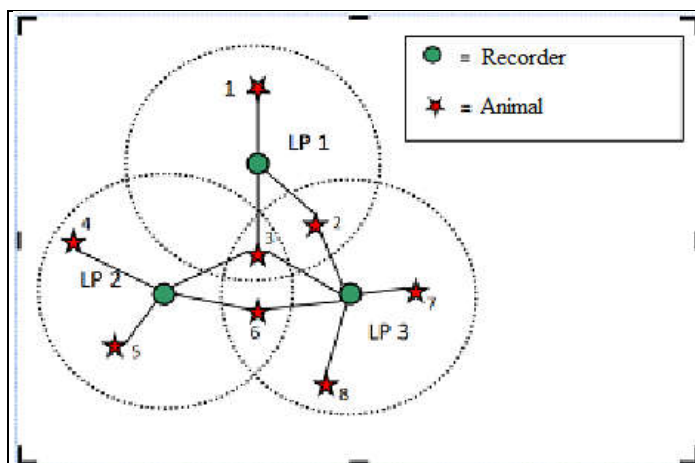
(Tordoff et al, 2002). So far, 194 bird species belonging to 33 families of 11 orders have been recorded in the nature reserve. NLNR is also home for many endangered birds species, including 10 species listed in Red Book of Vietnam, 8 species in IUCN threatened species list, and 09 species in Decree 32. Most importantly, the nature reserve supports one endemic bird species, the Golden-winged Laughingthrush (*Garrulax ngoclinhensis*), which is known to be restricted to the Central Annamites. Although, several studies on the avian community have been conducted (Tordoff et al, 2002; Tordoff et al, 2000; Le Trong Trai, 1999), most of the surveys were conducted more than a decade ago.

Ngoc Linh Nature Reserve is facing many difficulties in monitoring its diversity. It covers a large area and spans several high mountains. An experiment using automatic recorders for monitoring bird species in NLNR will be useful for management purposes. This is the first time that automated recorders were used for assessing biodiversity in Vietnam

**II. RESEARCH METHODOLOGY**

**Field survey:** A field survey was conducted in NLNR in June and July 2016. Each sampling site was sampled for at least 1 - 2 days. At each site two full spectrum recorders synchronized with satellite clock (SM3, Wildlife Acoustics Inc.) were set up 500 - 1 km apart (Fig. 1). The recorders were attached

to trees. The recorders were set to record from 03.00 to 9.00 on both channels with a gain of +48 dB and sampling rate of 2400 Hz. Recordings were saved to disk in a compressed (native.wac) format at one hour intervals. Batteries and memory disks were changed when the recorders were moved to other sites.

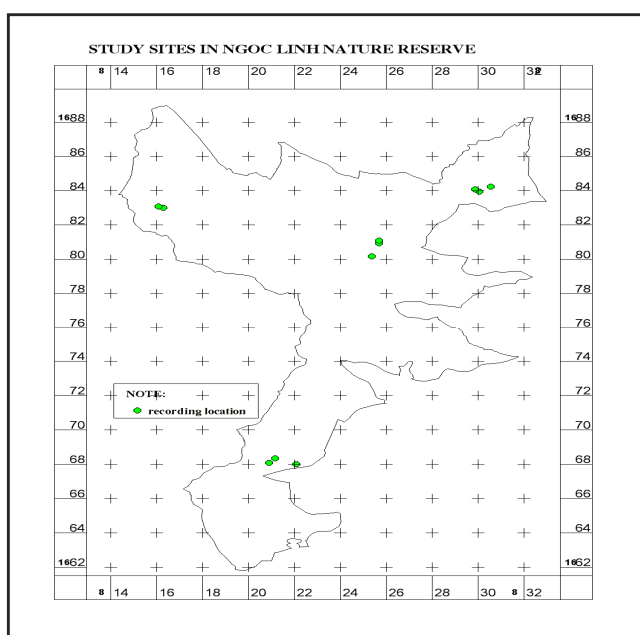


**Figure 1. Survey design**

**Data analysis:** Analyses found variation in birdsong signals, including frequency range, the speed of pitch modulation, vocabulary size, and song duration. Each song of a bird species has a different spectrogram that is a visual representation of the spectrum of frequencies

in a sound. Spectrograms can be used to detect the calls of selected bird species.

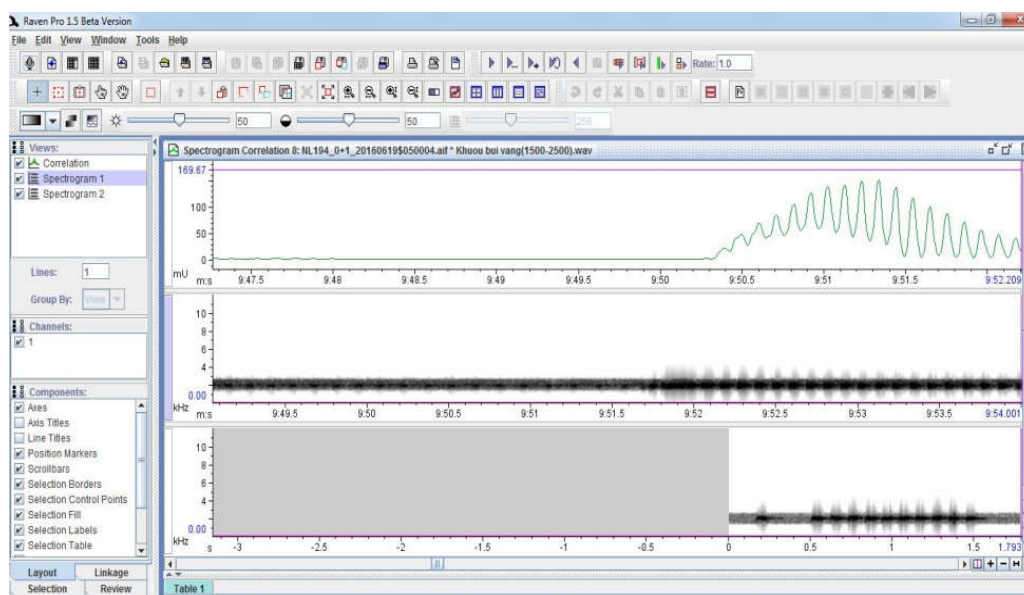
Recording data was analyzed in RAVEN software (Cornell Lab of Ornithology) to detect the spectrogram of bird species.



**Figure 2. Map of study sites in Ngoc Linh Nature Reserve**

We focused on 21 bird species including: Oriental Bay Owl (*Phodilus badius*), Mountain Scops Owl (*Otus spilocephalus*), Indian Scops-owl (*Otus bakkamoena*), Brown Wood Owl (*Strix leptogrammica*), Collared owl (*Glaucidium brodiei*), Great Eared-nightjar (*Eurostopodus macrotis*), Large Scimitar Babbler (*Pomatorhinus hypoleucos*), Golden babbler (*Stachyris chrysaea*), Grey-throated babbler (*Stachyris nigriceps*), Pin-striped tit-babbler (*Macronous gularis*), Golden-breasted fulvetta (*Alcippe chrysotis*), Grey-hooded fulvetta (*Alcippe cinereiceps*), Grey-hooded fulvetta (*Alcippe cinereiceps*), Rufous-winged fulvetta (*Alcippe castaneiceps*), Rufous-

throated fulvetta (*Alcippe rufogularis*), Mountain Fulvetta (*Alcippe peracensis*), Buff-breasted Babbler (*Trichastoma tickelli*), Stripe-throated Yuhina (*Yuhina gularis*), Crested Argus (*Rheinardia ocellata*), Rufous-throated Partridge (*Arborophila rufogularis*), Bar-backed partridge (*Arborophila brunneopectus*) and Red-headed trogon (*Harpactes erythrocephalus*). Available sample songs of these species were adopted from Scharringa (2005). If sampling frequency of the recording and the sample file were not the same, we used Audacity software (The Audacity Team) to convert the frequency of the recordings into the same sampling frequency.



**Figure 3. Spectrogram correlation process**

We used the "correlator" tool in RAVEN to find the most similar spectrogram; regions with a correlator index higher than 40 % were then checked carefully and visually (Fig. 3). Suitable minimum and maximum frequency were applied for each species. We chose the

30-minute interval recordings in study sites from 3 AM to 9 AM because most of targeted birds are active at that time.

### **III. RESULTS AND DISCUSSION**

#### *Presence of targeted bird species*

Of 21 bird species examined, 9 species were

identified to be present in the study area. families (Table 1).  
These 9 bird species belong to 4 orders and 5

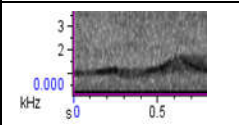
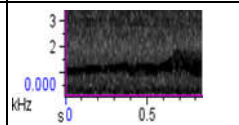
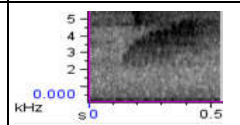
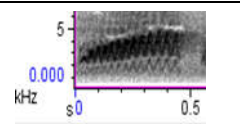
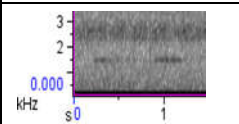
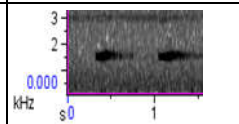
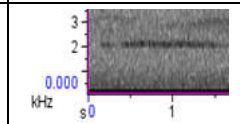
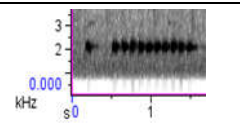
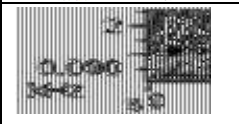
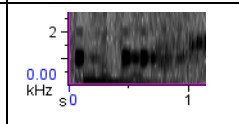
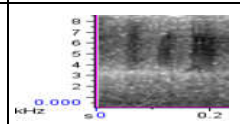
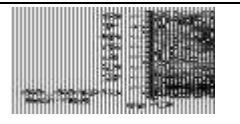
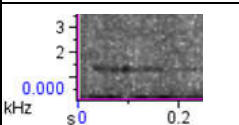

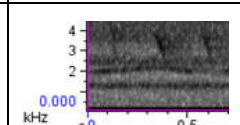
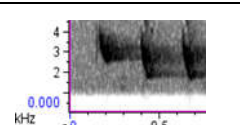
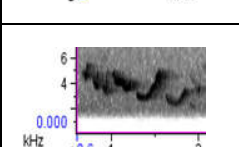
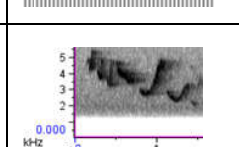
**Table 1. List of detected bird species in Ngoc Linh Nature Reserve**

No.	Species name	Scientific name	Family	Order	Site
1	Crested Argus	<i>Rheinardia ocellata</i>	Phasianidae	Galliformes	Tra Tap, Tra Leng
2	Mountain Scops Owl	<i>Otus spilocephalus</i>	Strigidae	Strigiformes	Tra Tap, Tra Leng, Tra Linh
3	Collared owlet	<i>Glaucidium brodiei</i>	Strigidae	Strigiformes	Tra Tap
4	Red-headed trogon	<i>Harpactes erythrocephalus</i>	Trogonidae	Trogoniformes	Tra Tap
5	Mountain Fulvetta	<i>Alcippe peracensis</i>	Pellorneidae	Passeriformes	Tra Tap
6	Buff-breasted Babbler	<i>Trichastoma tickelli</i>	Pellorneidae	Passeriformes	Tra Tap
7	Golden babbler	<i>Stachyris chrysaea</i>	Timaliidae	Passeriformes	Tra Tap, Tra Linh, Tra Leng
8	Golden-breasted fullvetta	<i>Alcippe chrysotis</i>	Timaliidae	Passeriformes	Tra Tap
9	Pin-striped tit-babbler	<i>Macronous gularis</i>	Timaliidae	Passeriformes	Tra Linh

One of the possible reasons for high frequency of detection of 9 species could be that these bird species have loud vocalizations which can be heard from a long distance, such as Crested Argus, Mountain Scops Owl, Collared owlet, Red-headed trogon. in particular, the sounds of the of Mountain Scops Owl, Collared owlet, Red-headed trogon, Crested argus, and Golden babbler are in low frequency range, usually smaller than 2.5 KHz. Especially, the frequency of sounds of Crested

Argus and Collared owlet is close to 1KHz (Table 2). Sounds of other species such as Mountain fulvetta, Buff-breasted, Babbler Golden-breasted fulvetta, and Pin-striped tit-babbler has much higher frequency, approaching 6KHz or higher. This explains why the sounds of bird species that emit low-frequency sound can be heard at very long distance and the chance to detect those species is higher.

**Table 2. The comparison between the sonogram of detected birds and the sample sonogram of targeted birds**

Species name	The sonogram in the recording	The sample sonogram	Species name	The sonogram in the recording	The sample sonogram
Crested Argus			Buff-breasted Babbler		
Mountain Scops Owl			Golden babbler		
Collared owlet			Golden-breasted fullvetta		
Red-headed trogon			Striped Tit-Babbler		
Mountain Fulvetta					

We found that some bird species usually sang or called at dawn such as Mountain Scops Owl, Collared owlet, Crested Argus.

Meanwhile, others including Golden babbler and Crested Argus often started vocalizing at later time of the day (Table 3).

**Table 3. The active time during the day of each species**

No.	Species name	Singing peak during the day
1	Crested Argus	5:00 – 9:00 AM
2	Mountain Scops Owl	3:00 – 7:30 AM
3	Collared owlet	4:30 – 7:00 AM
4	Red-headed trogon	5:30 – 7:30 AM
5	Mountain Fulvetta	6:00 – 6:30 AM
6	Buff-breasted Babbler	6:30 – 7:30 AM
7	Golden babbler	5:00 – 8:30 AM
8	Golden-breasted fullvetta	6:00 – 6:30 AM
9	Pin-striped tit-babbler	6:30 – 7:00 AM

Using automatic recorders can be considered an effective survey method for a wide range of reasons. The primary reason is that it is suitable for surveying bird species that do not vocalize regularly. Another reason is that surveying with automatic recorders causes less human disturbance than traditional

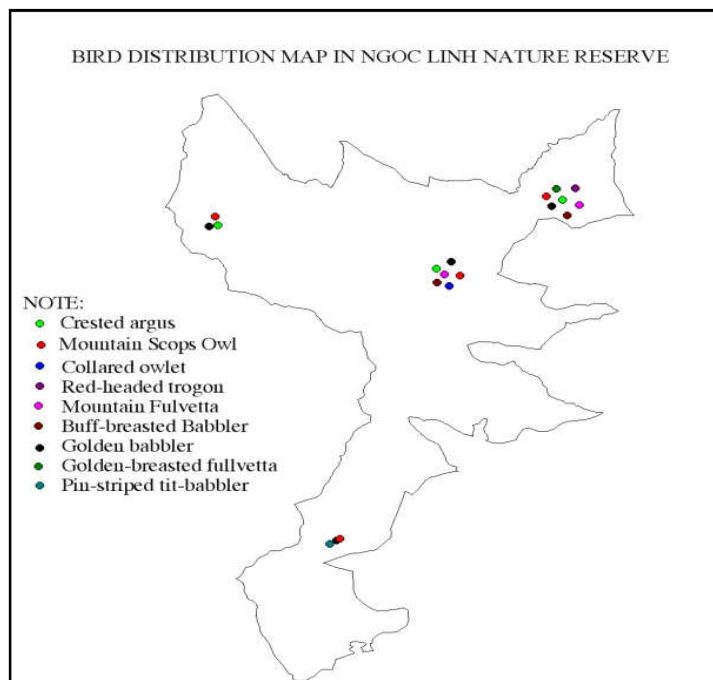
surveys. In addition, they can be beneficial when surveys are carried out in the areas which are difficult to access. The tasks of field surveyors are only deploying them to other places or replacing the batteries. Besides, monitoring program does not need specialist surveyors for the field survey. People with

basic skills in operating the recorder can participate in the field data collection. Data could be analyzed more easily if the sound sample is available.

**The distribution of detected bird species**

The number of bird species in Tra Tap commune made up the largest percentage (8

species) in total number of detected bird species in Ngoc Linh Nature Reserve (Figure 4). Meanwhile, those in Tra Linh and Tra Leng communes contributed a small proportion with three species detected in each commune. This can be explained by the fact that the numbers of recorders used varied by commune.



**Figure 4. Spatial distribution map of detected birds in Ngoc Linh Nature Reserve**

**IV. CONCLUSION**

Of 21 bird species targeted by the study, we detected the sounds of 9 species including Mountain Scops Owl, Collared owl, Crested Argus, Red-headed trogon, Golden babbler, Mountain Fulvetta, Buff-breasted Babbler, Golden-breasted fulvetta and Striped Tit-Babbler.

The frequency of detection varied among species. Some birds were detected many times in the recordings, such as Mountain Scops Owl, Collared owl, Crested Argus, Red-headed trogon and Golden babbler. The sounds of other species were detected a few times in all recordings.

The active time during surveying period (3.00-9.00 AM) of detected bird species varies

by species. Some species including Mountain Scops Owl, Collared Owllet, Crested Argus usually called or sang in the very early morning while other species start calling in later time.

The number of bird species in Tra Tap commune made up the largest percentage (8 species) in total number of detected bird species, the number of bird species detected in Tra Linh and Tra Leng commune contributed a small proportion.

**Acknowledgement**

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## SỬ DỤNG MÁY GHI ÂM TỰ ĐỘNG VÀ KỸ THUẬT PHÂN TÍCH ÂM THANH TRONG ĐIỀU TRA SỰ CÓ MẶT VÀ PHÂN BỐ CỦA MỘT SỐ LOÀI CHIM TẠI KHU BẢO TỒN THIÊN NHIÊN NGỌC LINH, TỈNH QUẢNG NAM

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### TÓM TẮT

Đề phục vụ cho công tác quản lý và bảo vệ các loài động vật hoang dã, các thông tin về sự có mặt và phân bố của chúng là hết sức cần thiết. Trong khi các phương pháp truyền thống có những hạn chế nhất định, việc sử dụng máy ghi âm tự động và kỹ thuật phân tích âm thanh mang đến những điểm mạnh trong việc phát hiện các loài chim hoang dã. Trong nghiên cứu này, chúng tôi sử dụng máy ghi âm tự động và phần mềm RAVEN để điều tra 21 loài chim thuộc 3 xã tại Khu Bảo tồn thiên nhiên Ngọc Linh, tỉnh Quảng Nam trong khoảng thời gian từ tháng 6 đến tháng 7 năm 2016. Sau khi phân tích dữ liệu, có 9 loài chim đã được phát hiện. Tuy nhiên, tần số xuất hiện của chúng rất khác nhau. Trong khi một số loài chim xuất hiện rất nhiều lần trong một bản ghi âm và nhiều bản ghi âm khác nhau, một số loài khác chỉ xuất hiện rất ít lần trong tất cả các bản ghi âm. Thời gian mà các tiếng kêu được ghi nhận trong khoảng thời gian chúng tôi đặt máy (3:00 - 9:00) cũng rất khác nhau giữa các loài.

**Từ khóa:** Giám sát chim, giám sát đa dạng sinh học, máy ghi âm tự động, Ngọc Linh, RAVEN.

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