Automatic Identification of Animal Species in Miyagi Prefecture, and Its Use in Environmental Education

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雑誌名	宮城教育大学環境教育研究紀要
巻	14
ページ	41-44
発行年	2012-03
URL	http://id.nii.ac.jp/1138/00000963/

Automatic Identification of Animal Species in Miyagi Prefecture, and Its Use in Environmental Education

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要旨：テクノロジーやデジタル情報処理の発展に伴い，科学者がデータを処理・解析する手法には革新的変化もたらされた．音響生物学の分野では，その場にいなくても遠隔操作で動物の音声を長時間録音することができるようになってきている．得られたデジタル録音には，研究者にとって役立つだけではなく，特定の動物の音声や，学校の周囲を含む特定のハビタットにおけるサウンドスケープを教材にしたいと考える教師にとっても有用な情報が含まれている．そうした目的に適したデータが宮城県内で蓄積され，地域の環境教育に貢献するものとして活用できるようになってきた．

Abstract : Advances in technology and digital information processing have brought about a revolution in in the way scientist process and analyze their data. In the field of bioacoustics, this advance has meant the capacity for unattended, remote recording of animal vocalization for extended periods of time. These digital recordings contain information not only useful for researchers and conservationists, but also, for teachers and educators interested in letting children know how particulars species vocalize, or teaching them about soundscape differences along the year in a particular habitat, or around the school. In Miyagi Prefecture, extensive remote recordings exercises have produced data that can be purportedly use for this end, contributing to the ongoing environmental education efforts in the region.

Keywords : animal sounds, automatic identification, Miyagi, environmental education

1. Introduction

Ever since 1925, when Ivan Regen's experiments recording insects marked the beginnings of bioacoustics as a scientific discipline (Wikipedia, 2012), scientists have been battling the available technologies of their times to record and reproduce animal sounds. However, it wasn't until the second half of the XX century that portable devices allowed researchers to travel deep into the wilderness with the capacity for recording animal and nature sounds more accurately. More recently, in the first decade of the XXI century, technological advances in digital signal processing and storage capacity, have also allowed researchers to deploy their devices for long periods in remote areas (days, weeks or months), widening the impact of biocoustics in fields such as conservation biology.

More often than ever, bioacoustic approaches are impacting the conservation of vocalizing species that live in remote, isolated areas. However, gathering acoustic data for long periods with unattended devices deployed in these areas, imply the use of analytical tools that could substitute the trained ear of researchers. This is

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due to the fact that listening to days, weeks or months of recordings in order to identify vocalizing species can be very tedious, time consuming, and is not an efficient mode of investigation. Fortunately, in recent years, sophisticated digital signal processing applications capable of automatically identifying animal species have been available to wildlife researchers and conservationists. These applications allow them to analyze long field recordings in a few hours, and provide the capacity to both, identify species and study the dynamics of sounds in space and time, to other professionals that are not necessarily trained in the identification of species by the sounds they produce. Among these professionals we found teachers and educators.

Talking about conspicuous animals such as rhinoceros beetles is always attractive to children, many of whom may grow to become insect collectionists as adults. However, even though we use our hearing sense to keep track of what is going on around us since early childhood, most adults living in urban areas may not be able to identify forest species by their sounds. Among the obvious reason are the fact that we are not actively taught to listen to nature, and the reality of urban areas, where not as many animal species live compared to forested places. In this report, we provide 2 examples of automatically identified animal species, one easily recognizable by its song, and other that call above the hearing range of humans, but that is very common in places where human live. We discuss how this knowledge could be used by teachers and educators to teach children about animal sounds as an approach to environmental education.

2. Materials and Methods

For the 2 examples provided in this report, we used the SM2-Bat recorder from Wildlife Acoustics (http://www.wildlifeacoustics.com/ , Fig. 1). The device was deployed in different habitats such as inside the forest (74 recording hours, Fig. 2), along a river (65 recording hours, Fig. 3), at the age of a paddy rice field (87 recording hours, Fig. 4).

Figure 1. The SM2-Bat recorder.

Figure 2. Surveyed area inside the forest.

Figure 3. Surveyed area along a river.

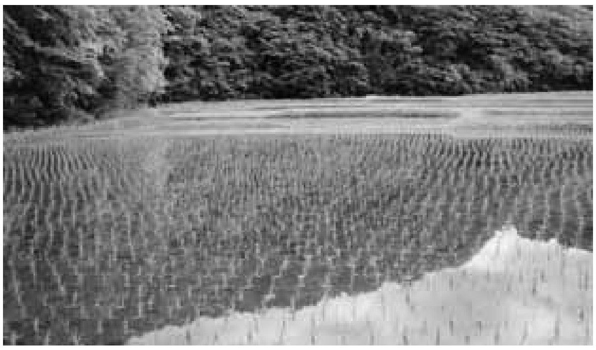

Figure 4. Surveyed area at the age of a paddy rice field.

Recordings were stored in 8 GB flash cards, class 6 (Transcend Inc.), and later transferred to a desktop Apple computer. Before analyzing our data, we had compiled a database with the sounds of several species that we had previously recorded. We used 2 species calls from the database to build "recognizers" , a reference against which vocalizing species could be automatically recognized in SM2-Bat recordings. These reference calls, and the automatic recognition of species was done with Song Scope 4.0.3, a software designed to be easy to use, and does not require the user to be an expert in digital signal processing (http://www.wildlifeacoustics.com/).

Recognizers were builded for the following species:

Cettia diphone（ウグイス）. Fig. 5.

Known as the "spring bird" , it is distributed throughout Japan and adjacent regions. It is very easily recognizable by their songs, but given their habits of hiding in tree foliages, is also difficult to spot.

Pipistrellus abramus（アブラコウモリ）. Fig. 6.

A very common bat species in urban and suburban areas, and probably the most noticeable bat species in Japan. This bat feeds on small insects, including mosquitoes, and is known to roost only in human-made structures such as houses, temples, and schools. It is not uncommon to hear stories of school children excited at

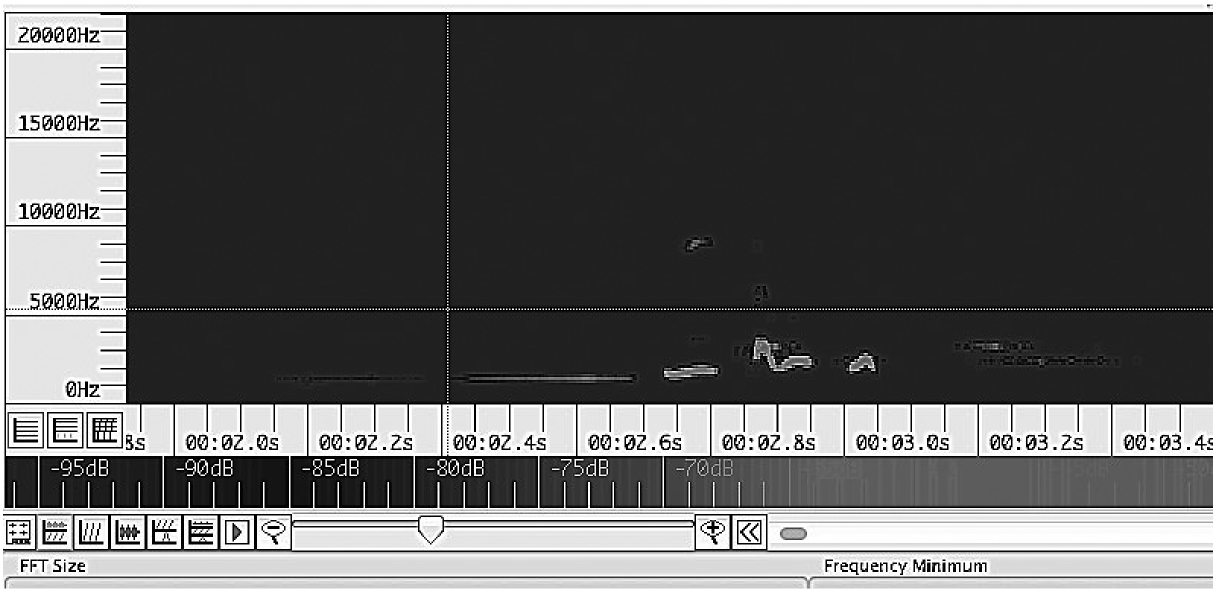

Figure 5. The sonogram of *Cettia diphone* as displayed by Song Scope 4.0.3. Note that in this particular recording there was no other birds songs that could mask the call of *C. diphone*.

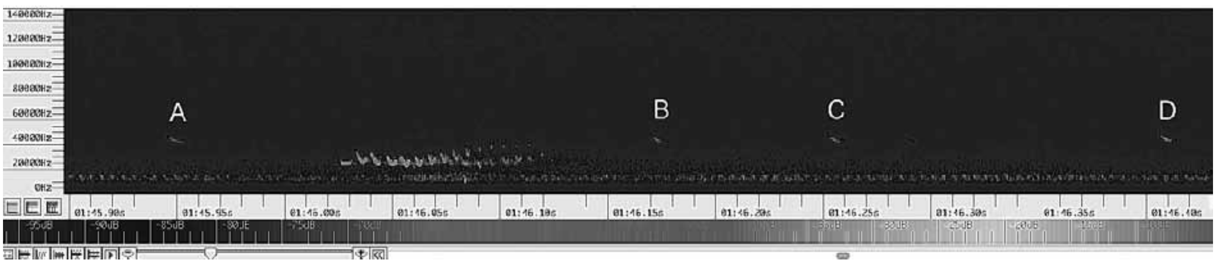

Figure 6. The sonogram of *P. abramus*. The species was easily recognized by Song Scope 4.0.3. Note that only pulses A, B, C, and D were recognized as being from this species. The pulses between A and B were not automatically recognized, but they are known to represent a change in behavior of the species (feeding approach and buzz).

the presence of this species flying inside the classroom, probably as a result of the school building being used as a roost by the bat.

3. Results and Discussion

The bat *P. abramus* was recognized in recordings obtained at the edge of the paddy rice field (as expected), while *C. diphone* was recognized in all other habitats. The recognition process was rather easy, given the existence of reference calls and the software especially designed for this task, and confirmed that it can be easily carried out by researchers and non-experts alike.

The software used in this exercise (Sound Scope 4.0.3) is mainly known to field biologist interested in the study of population density, migration patterns and behavior of specific animal species, especially those considered threatened or endangered (Wildlife Acoustics, 2012). However, teachers that wish to involve children in the study of nature and animal sounds by means of this method, can easily master the procedures needed for this end. The critical point is to gather the sounds of different species, which can be easily done from many internet sources (Echenique-Diaz and Saito, 2009), and build “recognizers” in Sound Scope 4.0.3. Once this has been done, recordings obtained at the school yard or other sites of interest can be scanned to see if species for which recognizers has been built are present.

This process provides meaningful data of the day and time the species of interest has been around the recorders, and can also give an idea of their behavior, as observed in fig. 6 for *P. abramus*, where a series of search and approach pulses, and then a buzz indicate that the animal was feeding. Similarly, from these calls we can know whether the animal is vocalizing for their territories, to attract a female, etc. By actively involving children in reading this data, they can develop an appreciation of the value of animal and nature sounds in their surroundings, because it teaches them that animal sounds do have a message they can easily read. At the same time, because sonograms in these recordings show the dynamics of sounds along days and weeks, teachers can show children how sound levels and properties are structured through time, highlighting the differences between “noisy” and “quiet” . This are important concepts that may have not been properly addressed in environmental education programs where visual materials are dominant.

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