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ABSTRACT

Data collection is one of the first steps to unveil natural history traits in living organisms. Many projects around the world are engaging enthusiast individuals - most of whom not trained as scientists - in collecting, categorizing, transcribing, and analyzing scientific data, making this a new and perfectible tool for the scientific community. Thanks to a joint collaboration between the Italian Gekko Association, the Fonoteca Zoológica at the Museo Nacional de Ciencias Naturales CSIC (Madrid), and the Museo Regionale di Scienze Naturali (Turin), it was possible to record vocalizations of captive bred geckoes using smartphones and upload them on the websites of GeCall and FonoZoo.com. In addition to being a new collection, this represents a source of useful bioacustic material.

***Key Words*:** Geckoes, Database, Vocalizations, Citizen-Science.

RIASSUNTO

Progetto "GeCall": gechi allevati da erpetocoltori come utile risorsa di scienza partecipata per la raccolta di vocalizzazioni specie-specifiche

La raccolta di dati rappresenta uno dei primi passi per svelare i tratti di storia naturale degli organismi viventi. Diversi progetti in tutto il mondo stanno coinvolgendo appassionati, molti dei quali non sono formati come scienziati, nella raccolta, classificazione, trascrizione o analisi di dati scientifici, rendendoli un nuovo e perfezionabile strumento per la comunità scientifica. Grazie a una collaborazione tra Italian Gekko Association, Fonoteca Zoológica, Museo Nacional de Ciencias Naturales-CSIC (Madrid) e Museo Regionale di Scienze Naturali (Torino) è stato possibile registrare le vocalizzazioni dei gechi riprodotti in cattività utilizzando uno smartphone, e caricarle sui portali di GeCall e di FonoZoo.com. Oltre ad essere una nuova collezione di vocalizzazioni, rappresenta un'utile fonte di materiale bioacustico.

***Parole Chiave*:** Gechi, Banca dati, Vocalizzazioni, Scienza partecipata.

INTRODUCTION

The study of acoustic patterns emitted by living organisms can play an important role in species identification and their behavioural features, everything leading a better understanding of ecological dynamics and surveys. The ability to vocalize is well-known in geckoes (BAUER *et al.*, 1991). Indeed, vocalizations are important intraspecific interaction signals and may reflect sexual and territorial patterns. As a relevant example, males of *Ptenopus* sp. from Namibia call to attract females from the entrance of their borrow. Males head size, throat yellow colouration, intensity of the calling, type of the burrow, suggest relevant roles in sexual selection (POLAKOW, 1997), and are crucial for partner selection. Furthermore, gecko calls play important functions for female attraction by males and as territorial signals against rivals (BRUMM & ZOLLINGER, 2017). Furthermore, geckoes also emit vocalizations in presence of predators (LANDOVÁ *et al.* 2013) or other threats: As an example, *Mniarogekko chahoua* exhibits a remarkable protection of the eggs and does not hesitate to "shout" against a possible aggressor or eggs-predator (A. Vaccari, pers. obs.). More often, vocal signaling is associated with evident body displays: head and/or tail waving, opened mouth showing colourful mucosae. In many animal groups, including geckoes, vocalizations are species-specific traits, and this may help researchers to detect the presence of new species or delimiting the distribution for the already known ones. However, collecting in-situ vocalizations is not always easy due to various reasons, such as habitat disturbance, where simple phone applications may be not perfect as in captive-controlled situations. Specific designed tools are also needed for a better field calls-collection. Collaboration between scientists with amateur herpetocolturists, especially gecko enthusiasts / keepers, may be crucial. Citizen-science projects achieve participant gains in knowledge about science knowledge and process, increase public awareness of the diversity of scientific research, and provide deeper rationale to participants' hobbies (BONNEY *et al.*, 2015). Here we report the first data obtained through the "GeCall Project", a collaborative program between a private association and public natural history museums (Italian Gekko Association, Museo Nacional de Ciencias Naturales-CSIC in Madrid, and Museo Regionale di Scienze Naturali in Turin) to record vocalizations obtained from species kept in captivity.

MATERIAL AND METHODS

The collection of bioacustical data was obtained using smartphones and installing Auphonic, a specific application that records sounds in WAV format (https://auphonic.com/). Vocalizations were recorded by gecko-owners in a quiet environment, doing the best improving the quality of the recording and thus, making it easier to analyze. Records were subsequently uploaded on the Italian Gekko (IGA) website, on GeCall webpage (https://italiangekko.net/ig/italiangekko/progetti/gecall, and audible on http://www.fonozoo.com/index.php). Indication of the species, sex, and the recording context helps understanding each acoustic repertoire. Recording parameters were as follows: 44.1 KHz (or more) and 16 bits (or more). Recording level was set manually in order not to reach the maximum (12dB). The distance was important to get good quality sounds. For example, not less than one meter from a loud gecko call, while 30 centimeters were enough for a small gecko chirping. We consulted the list of geckoes' species kept and bred by IGA members and partners (BARALE, 2018) to provide an accurate evaluation of legitimate husbandry according to Italian and international laws. Recordings were done on animals kept in captivity for generations. At this purpose, it is also crucial to highlight that for species from New Caledonia, Seychelles and Australia (such as *Ailuronyx seychellensis*, *Correlophus ciliatus, Nephrurus wheeleri*, *Oedura castelnaui, Phyllurus platurus, Rhacodactylus auriculatus*, and *R. leachianus*) legal imports were banned since several years and all these species come from old-multi-captive-bred lineages (in 1990 were possible for zoos, private researchers and specialists provided of permits from the New Caledonian government). All the individuals belonging to CITES listed species (no samples recorded yet at this time of the project) and owned by IGA members were regularly accompanied by permits which were requested and verified, before the uploading.

DISCLAIMER

All the acoustic records in the present study belong to exclusive captive bred geckoes which are not included in CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) appendices. Therefore, according to international and Italian trade legislation, we asked the GeCall collaborators to show the legal certification for species in their possess. Through the expansion of the database, it will be IGA's concern to verify, and possibly reject, the validity of the accompanying documentation necessary for the species included in CITES before vocalization uploading.

RESULTS

So far, we collected reliable records from the following geckoes (species, provenance/distribution, number and sex of the recorded individuals, type of vocalization): (1) *Ailuronyx seychellensis* (Seychelles: one female, defensive call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22525;
(2) *Correlophus ciliatus* (New Caledonia: one male, mating call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22519 ;
(3) *Eublepharis macularius* (Pakistan: one unsexed, defensive call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22516 ;
(4) *Gehyra marginata* (Halmahera Island: two males, mating call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22520 ;
(5) *Mniarogekko chahoua* (New Caledonia: one male, defensive call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22526;
(6) *Nephrurus cinctus* (Australia: one female, defensive call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22518 ;
(7) *Oedura castelnaui* (Australia: one female, defensive call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22522 ;
(8) *Phyllurus platurus* (Australia: one female, defensive call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22524;
(9) *Rhacodactylus leachianus* (New Caledonia: three females, defensive call) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22517;
(10) *Rhacodactylus auriculatus* (New Caledonia: one female, defensive call against male courting) http://www.fonozoo.com/fnz_detalles_registro.php?tipo_registro=2&id=22523 .
Participants to the project were requested to upload only good quality records as requested from the instructions page on https://italiangekko.net/ig/italiangekko/progetti/gecall. No need of record removal for now because of bad quality records. Most of these vocalizations refers to defensive calls, while only three species were recorded during mating courtship. This means, as mentioned, that it is not easy to obtain acoustic data from actual undisturbed individuals. Various recording samples are needed for each species, in order to study their complete vocal repertoire and understand how vocalizations are used in different situations (BRUMM & ZOLLINGER, 2017).

DISCUSSION

The collection of vocal records in captive species is not an easy task, since geckoes tend to be shy and elusive even in captive conditions. So far, it is not so rare to hear a gecko vocalizing, but it soon stops and hides if approached. We tried to set up a standardized process, fast and shared by many people, in order to get as much records as possible with proper indication about the type of vocalization. Social media, meetings and other events were used to expand the pool of users and get a response, even outside IGA members and partners. We hope that this database will be filled up with interesting records from known legally kept captive bred species and maybe from undescribed ones collected in the wild from scientific expeditions. Following the simple collection, different studies on bioacustic patterns can be conducted from non-academics, using dedicated programs to analyze sonograms. This can become a useful tool in behaviour characterization, expanding the simple knowledge of the taxon or offering one more method in comparing subspecies or lower taxonomical entities. Thanks to the collaboration between IGA, natural history museums, universities and other scientific partners, we plan to implement this project, finalized to the expansion of gecko biology knowledge and awareness, i.e., interactive panels reproducing vocalizations and sonograms for school science activities or museums and nature reserves. Gaining more curiosity in visitors, tourists, locals and children, is our goal, hoping for more interest of the large public about geckoes and habitats conservation.

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