

Darwin Sparrows': measuring evolution in the schoolyard

Final Report

The project “Darwin Sparrows’: measuring evolution in the schoolyard” started in 2014 and ended in 2015. The project was inspired by and strictly coordinated with the research project “Darwin’s Sparrow’s – a new model for the study of speciation in nature?” funded by Fundação para a Ciência e a Tecnologia (FCT, Project EXPL/BIA-EVF/2372/2013). This project was an exploratory project that aimed to collect information about *Passer iagoensis*, a species first described from specimens collected by Darwin, to test the species potential as a model for studying evolution and adaptation. Very few information is available about the ecology of this species, which would be important to study this potential model species. Accordingly, to further extend the research project potential and simultaneously contribute to promote a deeper and long lasting understanding of evolutionary biology in Cape Verdean students we developed this “citizen science” project, with the collaboration of the University of Cape Verde (UnicV).

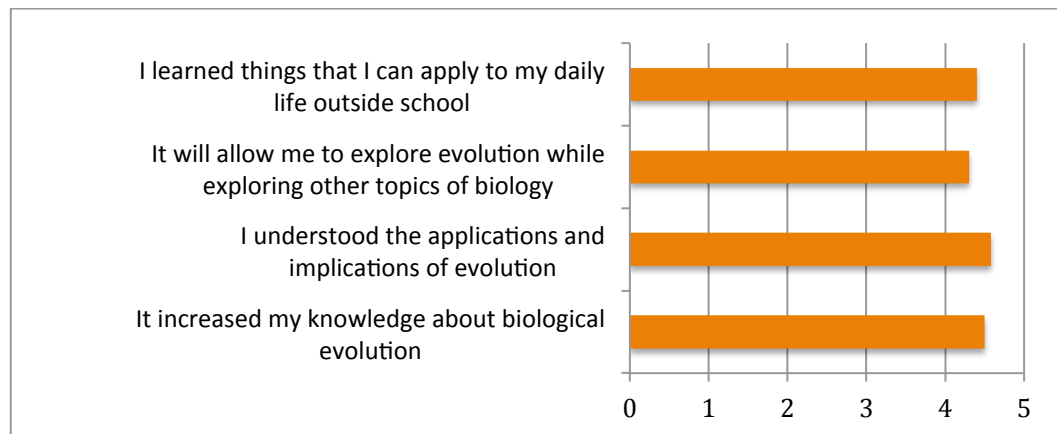
The project had two distinct goals. The first was to organize workshops for high school and university teachers to provide them scientific updating and didactic tools that could contribute to a deeper evolution understanding in Cape Verde. The first phase took place in 2014 while the research team was in Cape Verde to collect samples and gather information on the Cape Verdean sparrows. The workshops also aimed to divulge the on-going research project and to engage teachers and their respective classrooms. **Two workshops of 15 hours** were organized in 2014: one in Praia (in Santiago island) that took place from 14th to 18th October and was attended by **17 teachers** and one in Mindelo (in São Vicente island) that took place from 20th to 24th October and was attended by **14 teachers**. During the workshops we used situations and daily life examples that were familiar to Cape Verdean children and teachers to explore evolution and highlighted the pedagogic potential of the Cape Verdean sparrows. To further engage and inform teachers about the on-going research project we promoted **personal contact with the research team**. In Santiago this was promoted by organizing a field trip to the research ringing station that was set there during that period.



Figure 1- Field trip for teachers attending the workshop in Praia in 2014 and some of their students. Photo taken from National geographic article authored by Alexandre Vaz (available at <https://goo.gl/8AFMFc>).

In São Vicente we tried to achieve these goals through a videoconference between teachers attending the workshop and the research team that was collecting samples in another island.

A **third teachers' workshop** was organized in Praia in 2015, which was attended by **22 teachers**. Three of these teachers came only to one session, which they could not attend in the previous year and told us that they were applying the activities and information presented in the previous year in their classrooms. From the 49 teachers engaged in total, only 12 (24%) answered the evaluation questionnaire. All these participants stated they would use the resources provided in the workshop (both the activities and the presentations) in their own classrooms, agreeing that the workshop was useful for their practices and daily lives for several reasons (see **Graphic 1**).



Graphic 1: Results of the teacher workshop. Participants were asked to classify how much they agreed with each sentence from 1 (completely disagree) to 5 (completely agree).

During 2015 we also engaged students and teachers in the on-going research project, proposing and testing hypotheses to explain some of the obtained results. For this we have chosen **two classes from the 12th grade (one in Praia and one in Mindelo - around 28 students each)** and, in strict collaboration with their teachers, planned five lessons. In the first session we explored with the students natural selection and its impacts in their daily life and in insular habitats; the second session was dedicated to explore genetic drift and its impacts in insular habitats; in the third session we explored the process and outcomes of sexual selection; in the fourth session we have presented to the students the results of the on-going research project and discussed with them possible hypotheses to explain these results and planned distinct experiences to test these; in the fifth session we have done a

field trip to promote the contact of the students with all the species of sparrows present in these islands and provide information about their identification features (**figure 2**).



Figure 2- Students of Mindelo at the field trip watching *Passer iagoensis*.

According to the preliminary results of the research project, beak size and shape significantly differed between São Vicente (the island where Mindelo is located) and Santiago (Praia's island) and a significant, but island-dependent, sexual dimorphism was found in this feature. These results were presented to students.

In Mindelo, students hypothesized that differences in beak size between islands were due to differences in the amount of food available in each island. They hypothesized that in islands with scarce resources birds with largest beaks would survive longer because they would be able to obtain more food. Another possible hypothesis that was put forward by them was that beak size dimorphism could be due to selective pressures acting on body size (a significant correlation was found by the researchers between beak and body size). Students proposed that bigger males could find and provide more food to the females while they were incubating. Finally, students also proposed that sexual dimorphism could be explained by a female preference for bigger males. Students decided they would test this last hypothesis. For that, they proposed to catch males and females of *Passer iagoensis*, to build a suitable place to keep birds in captivity and test female preferences in terms of male body size. They proposed presenting females with two males with distinct body sizes and record their preferences. The project provided students with binoculars and calipers and some

materials to build the cages. Students and the teacher were meant to construct the cages, find the information about permissions required to catch and keep birds in captivity and perform the experiments.

In Praia, students were surprised with the fact that *Passer iagoensis* beak size differed from island to island. They hypothesized that these differences in beak size were dependent on the type of available seeds. They decided to test if birds from different islands would prefer seeds from distinct sizes. For that, they proposed to make pitfalls with three distinct types of seed and test which type of seed would attract more birds. They also decided to measure beak sizes of the caught individuals. The location of pitfalls/feeders would change during the experiment to avoid the impact of cage location in the observed results (see figure 3). The project provided students with binoculars and calipers and money to buy seeds and other required material. Students and the teacher were meant to construct the bird feeders and perform the experiments.



Figure 3- Student in Praia building a pitfall to collect *Passer iagoensis*

In both cases, additional collaboration with the research team was required to carefully plan experiments before making the tests. Several skype meetings and e-mail exchanges were planned so that the experiments could be successfully conducted. Unfortunately, despite many attempts, problems with Internet access and speed and with the computers precluded

all the meetings to take place and strongly delayed communication between the students and researchers. In the end, this made it impossible to carry out the planned experimental work. With hindsight, this last phase of the project should have received direct support in the field and, hence, additional trips should have been budgeted in the project proposal.

Despite this, we think this project resulted in important outcomes, which included: *i*) three workshops that engaged 49 teachers and that, according to the participants that filled the questionnaire, was useful to improve their teaching practices and knowledge on evolution; *ii*) a week of lessons on each classroom and discussions about evolution that allowed students to learn, think and plan experiments to test evolutionary scenarios using a model system that is close to them; *iii*) an article in National Geographic reporting both the ongoing research project and the outreach project (**available at <https://goo.gl/8AFMFc>**); *iv*) the departments of UniCV at Mindelo and Praia were offered a kit with material to perform activities to teach natural and sexual selection, genetic drift, phylogenetic reconstruction and the effects of mutations; *v*) all schools with teachers attending the workshop (including both UniCV departments, N=19) received the Portuguese translation of the book *Why Evolution is True* authored by Jerry Coyne and offered by CIBIO.UP (**figure 4**); *vi*) networking between Europe and Cape Verde: the contact list of the Portuguese Evolutionary Biology Association (APBE) was opened up to teachers in Cape Verde. The importance of this last outcome is illustrated by the fact that Cape Verde was the fourth country with the highest number of visits to ESEB2015 blog (average of 15 visits per month, during the publication of the Portuguese version of the *Question of the day*).

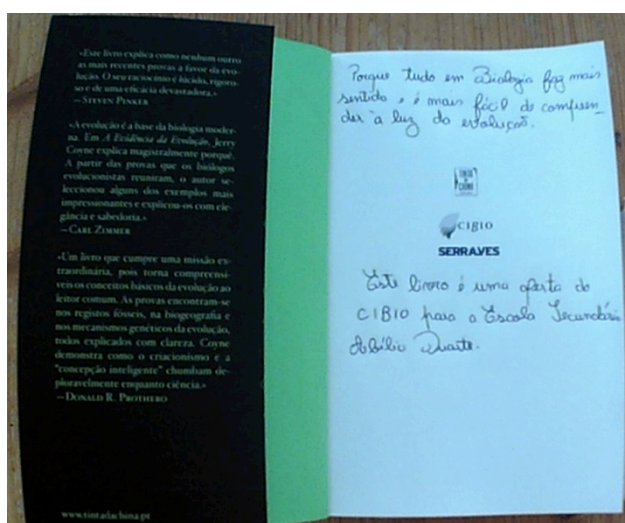


Figure 4 – exemplar of Jerry Coyne book, offered by CIBIO to one of the Cape Verdean high schools engaged in the project. For additional photos from the project go to <https://goo.gl/m0Zy13>.