Pelagodroma marina: Testing raven-proof artificial nests in Laje Branca islet, Maio Island, Cabo Verde

FMB's Report 2020

Fundação Maio Biodiversidade

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INTRODUCTION

Background

Cabo Verde is globally recognized as both a terrestrial and marine biodiversity hotspot, in which the whole archipelago consists of an Important Bird Area (IBA) (MAHOT, 2014), by providing nesting and feeding areas for several seabird species including the white-faced storm petrel (*Pelogodroma marina*) (INIDA, 2007; MAHOT, 2014). In Maio Island there is only one known place where this species nests which is Laje Branca. A small (~0.3ha) and uninhabited islet situated in the north of Maio Island, and it is located within the Natural Park "Parque Natural do Norte da Ilha do Maio – PNNM", 400 m from the coast (Figure 1). Laje Branca is also a Restricted Protected Zone due to its conservation importance to the reproduction of this species.

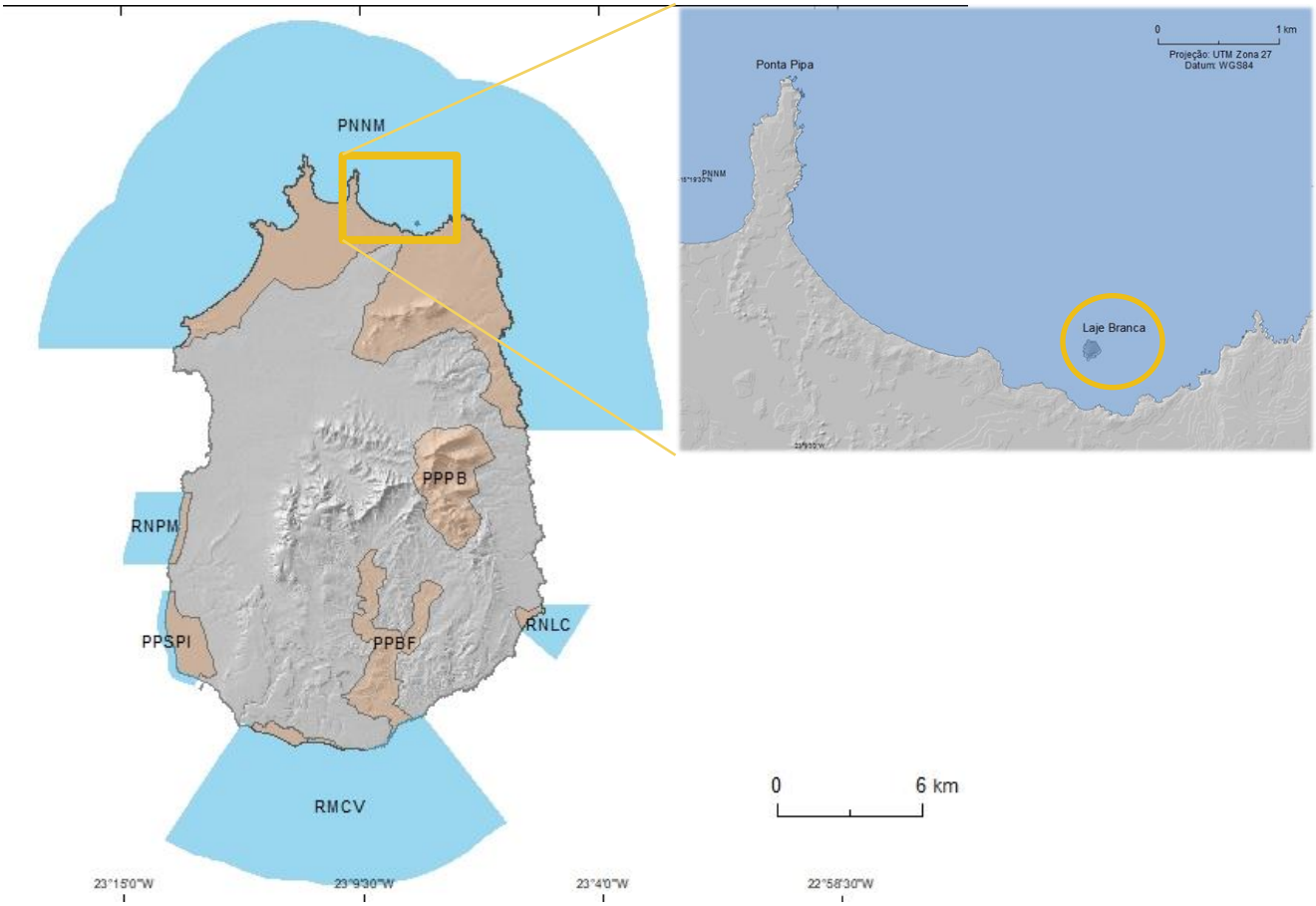

Figure 1. Maio island with the 7 Protected Areas highlighted (blue= marine component, brown= terrestrial component). PPSPI= Protected Lanscape of Salinas Porto Inglês, RNPM= Nature Reserve of Morro's beach, PNNM= Natural Park of the North of Maio, PPPB= Protected Landscape of Mounts Penoso and Branco, RNLC= Nature Reserve of Cimidor lagoon, PPBF= Protected Landscape of Barreiro and Figueira, RMCV= Nature Reserve/Marine Reserve of Casas Velhas. Laje Branca islet showed in detail within the Natural Park.

Previous projects

In 2016, the first monitoring of the white-faced storm petrel was done in the islet with the support of the Seabird Group, co-funded with the DARWIN INITIATIVE. This was first a one-year project which was extended to 2 years. This project was extremely important as it provided the baseline information on this population, including estimates of the population size and some clues of possible threats. It enabled FMB, a local NGO, to monitor these trends over the course of those 2 years. In 2018, the studies carried out at Laje Branca were funded by two main different funders (MAVA Foundation and Arcadia. In 2019 and 2020, funded by the Seabird Group and MAVA Foundation, FMB continued carried on learning about this unknown population using artificial nests.

OBJECTIVES

This year several hypotheses were tested in order to better understand the breeding ecology of this species. The idea was to also compare this year's data with that of previous years to obtain better results and more precise conclusions. The aims of this year's work were:

- Determine whether breeding pairs remain the same
- Determine whether breeding pairs return to the same nests
- Continue building up the baseline database with further captures (ringing, collection of morphometrics data, collection of blood and feather samples) and refining data, particularly on population size and chick surviving rate
- Determine whether the direction of nest opening, wind direction, type of floor and vegetation cover influence nest choice
- Continue monitoring the predators (particularly ravens that have access to the islet, and mice to check there is no invasion to the islet)
- Test new artificial nest designs against raven predation
- Carry on community work: talks on the breeding ecology of the *P. marina* in Laje Branca on communities as well as on schools

EDUCATIONAL ACTIVITIES

This year FMB had to cancel most of predicted activities due to the COVID-19 virus to avoid agglomerations and follow the Governments prevention measures (Table 1).

Table 1. Summary of educational activities in 2020.

DATE	ACTIVITY	ATENDEES	DESCRIPTION
Jan – Jun 2020	10 Awareness talks on *P. marina* in local schools	N/A	We were not able to do this because of the COVID-19 situation. We thought of doing it as a webinar/live session however all school classes were then cancelled. We will carry on this activity next year, if the COVID-19 situation allows it.
31/01/2020	World Wetlands Day	N/A	The activity was not done because we were too busy at the time. We changed the date to be done together with the next activity "World sparrow day" however that was not possible as we were told by the school Director that the Government had decided to close all schools that week because of the COVID-19.
20/03/2020	World Sparrow Day	N/A	The activity was scheduled to take place that Friday simultaneously with the activity "World Wetlands Day" but it was cancelled due to the closing of the schools because of the COVID-19.
09/05/2020	World Migratory Bird Day	N/A	Because of the COVID-19 we made an infographic to post in our Facebook and Instagram pages.

22/05/2010	World Biodiversity Day	N/A	Because of the COVID-19 we made an infographic and posted in our Facebook and Instagram pages.

Figures 2 and 3. Infographics posted on FMB's Facebook and Instagram pages of the "World Migratory Bird Day" and "World Biodiversity Day".

METHODOLOGY

Different methodologies were used to collect most data possible on the breeding ecology, population estimates, ringing and morphometric data. These methodologies are described below.

Night Captures

Given the pressure to a small colony, FMB decided to carry out 1-night capture per month during the breeding season. Night captures occurred around new moon when it seems to be higher abundance of animals. The methodology used was the one used by the Natural Park of Fogo and the University of Barcelona that have been using for other seabird studies in Cabo Verde. Metal rings provided by University of Barcelona were used for ringing the birds. Data collected included population, locality, date, species, time, sampler name, whether it was a new bird or recapture, whether it had a wind bars, their number and on which feather they occurred; stage of the brood patch, number of ring; the length of tarsus, total bill depth, bill depth at nostril, total head length, wing, culmen (all in millimetres), using rulers to the nearest 1 millimetre for the wing length and Vernier calipers to the nearest 0.1 millimetre for all the other lengths), identification number of feathers collected, weight (grams, using a spring balance) and blood sample (milliliters).

The feathers collected were S8 (secondary) and R6 (retrace) from the right wing, P1 (primary) and S1 (secondary) from the left wing and ~10 breast feathers were additionally collected. Blood samples were taken from the brachial vein using insulin syringes (0.25 ml) and were then transferred to a vial containing ethanol.

If a bird was highly stressed from being captured, no further data collection was done with it and it was promptly released back to the colony. Pregnant females were only ringed, and a picture of the brood patch taken – these birds would have priority amongst all others and would be released straight after being ringed.

Monitoring of Nests

The monitoring of the nests was done to get a better idea of the breeding and chick rearing phases of this species. To compare it, both artificial and natural nests were used. Monitoring of both artificial and natural nests occurred once a week, in which all artificial nests were checked and if a natural nest was found to be occupied it would also be marked and checked from that moment onwards.

Artificial Nests

51 artificial nests were set up in the islet: the majority was split into 2 transects that run from the periphery of the island towards the center, and the remain in 4 short transects were set up in the periphery of the islet.

Artificial nests were built similar to those in previous years: made of wood (20 x 20 x 10 cm) with a hole done in one of the walls where a metal thin exhaust tube (~70 cm long and 9 cm diameter) was attached (see Figure 4). The main difference between previous nests and 2020 nests was that in 2020 nests FMB added an extra thin wood board to the top of the lid that run along most of the tube so that it would protected from the ravens. In addition, these thin wooden boards were fixed with a screw-in hook to the nest so they would not be moved around as easily by the ravens (Figures 5 and 6). The nests were set up in places where there were already nests from the previous year during the non-breeding season (beginning of November 2019) to avoid the risk of destroying potential occupied nests.

Occupied nests were classified as such if they had an adult, an adult and egg, egg or chick,

Figure 4. Setting up of previous artificial nests in Laje Branca, November 2018, in preparation of 2019's season.

Figures 5 e 6. Similar artificial nests for 2020 season however a thin wood board was added to be placed on top of the tube and fixed with a screw-in hook to check whether it could work against ravens.

Natural Nests

Natural nests within all 6 transects would be marked with a flat stone with the correspondent alphabetic letter if found to be occupied (adult, adult and egg, egg or chick), and be checked from that moment onward.

Population Estimates

Population estimates was done by using a set of different techniques: 1) checking the proportion of occupancy and density of active burrows vs all burrows found per transect (Figure 7); 2) using the artificial and natural nests; and 3) capture/recapture data from night captures.

Once a week, all burrows were counted within the 6 transects to check occupancy and density. A burrow/artificial nest was determined as explored if it contained a new vegetation, sand accumulated outside the burrow, or feathers inside the burrow/artificial nest. Whereas an occupied burrow/artificial nest would be defined as such if it had a chick, an egg or an adult with an egg. The natural burrows in the transects were checked with an endoscope that allowed to confirm whether the explored burrow became a nest.

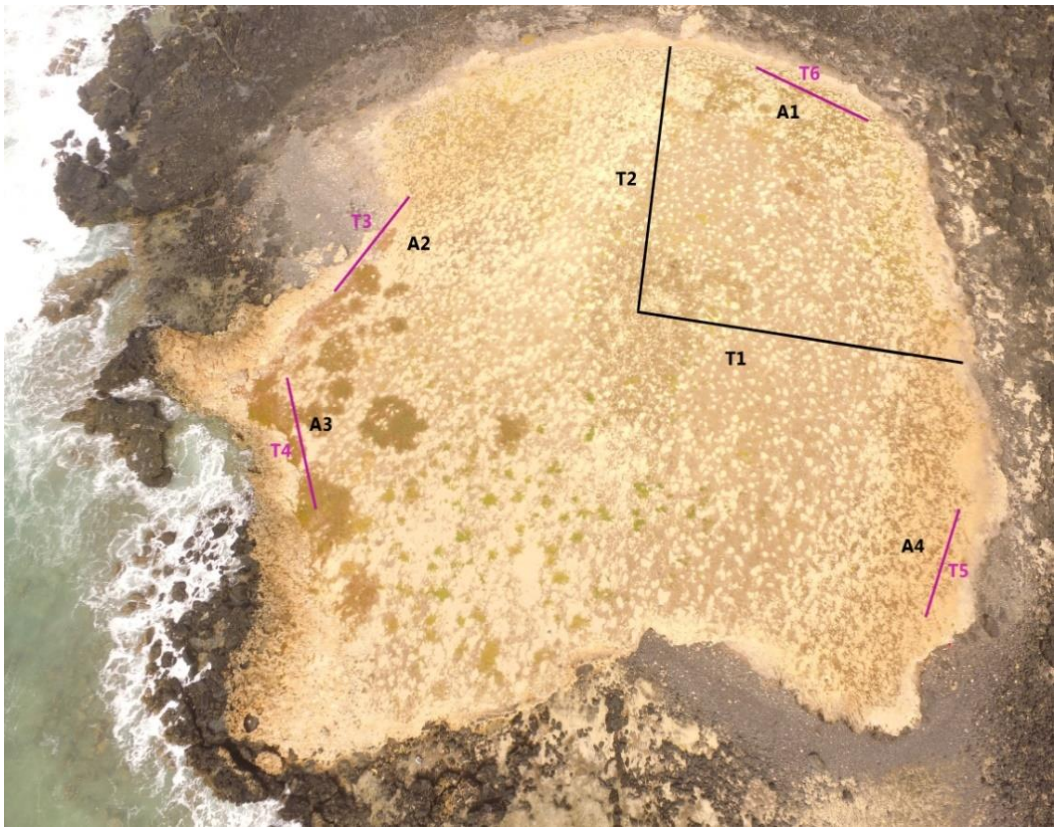

Figure 7. Aerial picture of Laje Branca islet showing the estimated positions of transects 1-6 (T1-T6). A1-4 were still used but only as a reference of activity throughout the season, in which pictures were taken every visit to the islet.

Predation

Predation was studied by looking at how many birds were killed per week. Every week the team went to the islet, it would note and collect all dead birds. The team also tried to take pictures of possible predators. In addition, more detection tunnels were used occasionally to check for invasive species (mice) in the islet. Rings from dead ringed birds were also removed and sent to Barcelona University.

RESULTS

Night captures of the white-faced storm petrel (*P. marina*) in Laje Branca continued in 2020 which resulted in a total of 291 captured birds, from which 197 were new captures. These numbers are higher than in 2019 (147) because of the higher number of capture events (3 in 2019 to 4 in 2020). In addition, FMB used 51 artificial nests to monitor the breeding success of the species. 30/51 artificial nests were occupied, in which one was occupied by a new species, the Cape Verde storm-petrel *Hydrobates jabejabe*. 21 chicks hatched of the 30 occupied artificial nests, including the Cape Verde storm-petrel.

18 natural nests were occupied within the 6 transects of which 16 had laid eggs: 8 hatched and 5 chicks successfully left the nest. The remaining eggs and hatchlings were either predated, buried with collapse of the natural nests or of unknown destiny.

Night Captures

A total of 4-night captures were done in 2020, resulting in a total of 186 birds captured, from which 145 were new captures. See table below for summary of the night captures (21/01, 03/03, 18/5 and 26/05/2020) and of the birds ringed from the artificial nests. Recaptures of artificial nests include all birds seen every time we visited the nests over the days.

Table 2. Summary table of ringed animals (new captures and recaptures) for Laje Branca in 2020.

	21/01/2020	03/03/2020	18/05/2020	26/05/2020	Animals ringed from artificial nests	TOTAL
New captures	27	51	37	30	52	**197**
Recaptures	9*	8[*1]	11[*2]	13[*3]	53[*4]	**94**
Total	**36**	**59**	**48**	**43**	**105**	**291**

Figure 8. Taking morphometric data of captured adults of *P. marina* during a night capture in which mist nets had been set up, in Laje Branca islet, 18th May 2020.

Monitoring of Nests

A total of 51 artificial nests were monitored throughout the season of which 30 were occupied. No artificial nests were found to be occupied.

Artificial Nests

30 out of the 51 artificial nests were occupied (observed with an adult, adult and egg, egg or chick) by white-faced storm petrels (Figure 9) and 1 was occupied by Cape Verde storm petrel *Hydrobates jabejabe* (Figures 10-12), which makes 59% of occupancy for 2020, a decrease from the 74% of the 2019 occupation of artificial nests (revised data). From the occupied artificial nests, 5 animals returned to the artificial nests but occupied different nests that in 2019. In addition, 21 eggs have hatched, including the Cape Verde storm petrel *Hydrobates jabejabe* chick.

From the 42 adults of the artificial nests, 35 new animals were ringed in 2020. The remaining 7, 3 were first ringed in 2019, 3 was ringed in 2018, 1 ringed in 2017. These recaptures make up ~17% of the total ringed adults in the artificial nests 2020.

Figure 9. FMB's team member carrying on morphometric measurements on an adult *P. marina* that was in one of the artificial nests, February 2020.

Figure 10. First time adult Cape Verde storm petrel (*H. jabejabe*) nesting in the artificial nests in Laje Branca, 5th May 2020.

Figures 11 and 12. First time Cape Verde strom petrel (*H. jabejabe*) chick in artificial nests in Laje Branca. Pictures taken on 26th May 2020.

The brown-necked ravens (*Corvus ruficollis*) that observed in or around the islet destroyed 13 out of the 51 artificial nests (11 partly destroyed tubes and 2 nests with completely destroyed tubes, Figure 13).

Figure 13. One of the two heavily destroyed artificial nest by the ravens during 2020 reproductive season. However, there were still a few more partly destroyed tubes of artificial nests.

Natural Nests

This year, FMB found 18 natural nests occupied within the 6 monitored transects, of which 16 had eggs: 8 hatched and 5 chicks successfully left the nest. The remaining eggs and hatchlings were either predated, buried with the fall of the nest or of unknown destiny.

Population Estimates

Population has been previously estimated at 648 breeding pairs, 1296 white-faced storm petrels (Gemma Charles, MSc Thesis 2017). The latest data revision reveals that FMB has ringed a total of 851 (53 (2017) + 453 (2018) + 149 (2019) + 196 (2020 – not counting with the Cape Verde storm petrel)) from both night captures and monitoring of artificial nests. If the estimate done by Charles was correct, that means that we have currently ringed ~66% of the population in the last 4 breeding seasons.

Predation

This year, this population continued suffered predation by brown-necked ravens (*Corvus ruficollis*) that were observed in or around the islet several times. It resulted in at least 189 white-faced storm petrels/ petrel eggs predated by the ravens, in which 146 were adult birds, 35 were chicks and 8 eggs (Table 3, Figures 14 and 15). It is likely that there were more dead birds that FMB was unaware of.

This was the second time that the team was able to identify the cause of the deaths of *P. marina* after several FMB members directly observed ravens killing or attempting to pull petrels out of their nests during daytime.

Table 3. Resume of adults, chicks and *P. marina* eggs predated by brown-necked raven (*Corvus ruficollis)* in 2020.

	Adults	Chicks	Eggs	TOTAL
Predation by ravens	146	35	8	**189**

From the 181 dead birds that FMB managed to collect this year, 18 birds were ringed: 13 had been ringed in 2018, 3 were ringed in 2019 and 2 were ringed this year (2020).

Figure 14. A predated egg by the brown-necked ravens in Laje Branca islet, May 2020.

Figure 15. Dead *P. marina* circled in yellow, found in Laje Branca islet in 2020.

In summary, in relation to the aims, FMB accomplished the following:

- **Determine whether breeding pairs remain the same** – FMB observed only 3 birds that nested in different nests than those of the previous year, and they had different partners.
- **Determine whether breeding pairs return to the same nests** – Differently to what happened between 2018 and 2019, in which ~41% of the birds returned to the same nests, in 2020 FMB did not find any bird in the same nest as in 2019.
- **Continue building up the baseline database with further captures (ringing, collection of morphometric data, collection of blood and feather samples)** – data continued to be collected throughout the season, counting now with a total of 851 ringed birds (adults and chicks)
- **Determine whether the direction of nest opening, wind direction, type of floor and vegetation cover influence nest choice** – data analysis related to this will be carried out later when FMB starts preparing a paper on this topic
- **Continue monitoring predators** – predators were still confirmed as brown-necked ravens. FMB suspect that some eggs might be predated by larger Maio's wall geckos (*Tarentola maioensis*) however this is yet to be confirmed.
- **Test new artificial nest designs against raven predation** – New nest designs seemed to work slightly better against ravens than older designs, however we would stronger recommend the addition of yet another piece to the new nests against ravens: 1-2 u-shaped thin iron that would fit at the beginning of the wood board, close to the end of the tube and one closer to the nest entrance so it would keep the wood board better in place, instead of just using 1 screw-in hook
- **Carry on community work: talks on the breeding ecology of the *P. marina* in Laje Branca on all 13 communities as well as on schools** – FMB was particularly busy at the beginning of the year which did not allowed FMB members to have time to carry on the first awareness activities. However, when having the time to do it and was organized, all schools were closed due to the COVID-19 and have been closed since. FMB has also followed the Government's measures to avoid agglomerations in closed places and thus all activities were cancelled. FMB tried to replace some with infographics so we could keep passing information regardless.

DISCUSSION

Overall fieldwork went well in 2020. However, given the COVID-19 situation which had the whole country on quarantine for 1 month in April, closed schools and implemented several prevention measures after quarantine, most educational activities were cancelled. FMB was still able to collect further data on the breeding ecology of this species, monitor families, chicks and also ring another sample of the population and collect further morphometric data, feathers and blood samples for future analysis.

The still very high level of predation by ravens that resulted in at least 30% of the petrel population killed in two seasons. This is of great conservation concern because if it continues over the years, it could mean that the population could become extinct in the next 5 to 7 years, having in mind that 205 birds were killed by only 2 ravens in 2019, and this year we had a total of 189 killed birds/eggs by ravens.

Ravens have also become a problem for other bird species such as the Kentish plover (*Charadrius alexandrinus*) and the cream-coloured courser (*Cursorius cursor exsul*) in Maio. They are also an issue for other bird breeding species in other islands, such as Boavista. Studies suggest that under favourable conditions such as a rich food source and availability of suitable night roots, non-breeding ravens may settle in very small areas for a long time (Loretto *et al*. 2015). Given the situation in Laje Branca, FMB is continuing to test short term solutions using raven traps (catch and relocate them, Butchko & Small, 1992; Kövér *et al*. 2018) and deterrents (Barker *et al*. 1977; Nicolaus *et al.* 1989; Avery *et al.* 1995). In some places lethal methods are used to control corvid populations (Kövér *et al*., 2015; Kövér *et al*. 2018), outside their breeding season, however there is controversy in the use of these methods and this is thought to be a short term solution only, as they can quickly recolonize. A long-term solution suggested by Kövér *et al*. 2018 is to improve waste management by working alongside the local Council. FMB will soon be asking for a permit to control ravens under extreme circumstances during breeding season of certain bird species, as part of an activity within the Management Plan of the Protected Areas of Maio island. FMB is also contacting several partners and funders to start a possible collaboration to carry on a study on raven population and sustainable control measures.

NEXT STEPS

- The marine program will undergo a structural change which might mean that the team will no longer monitor nests. However, we plan to keep carrying on night captures to continue ringing and sampling the adults and carry on minimal monitoring of the population.
- Develop a raven population control. FMB's bird team is currently trying raven traps in areas nearby other bird populations (waders) that are being predated too, and contacting partners and funders for collaborations to develop the raven population control plan
- Monitor the raven population in the island (e.g.: identify potential nesting sites)
- Continue to work together with the local Council on the waste situation in the island (e.g.: in the creation of better places to hold the rubbish bins so that they are not thrown to the floor and be opened for animals)
- Carry on more awareness activities so fishermen do not climb on the islet that is also a fully protected zone within that Natural Park.

FINANCIAL STATEMENTS

The funding from the Seabird Group helped contributing towards the whole Laje Branca monitoring project. All the money received was spent and there was additional co-funding of other projects. Note: the co-funded does not include the price of previous bought field material still currently being used.

DESCRIPTION	BUDGET (GBP)	BUDGET (CVE)	SPENT (CVE)	Co-funded by other projects (CVE)
Laje Branca Project	444	65 069	65 069	~30 000

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