The Rufford Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Stephanny Arroyo-Arce
Project title	Jaguar Conservation on the North-eastern Caribbean Coast of Costa Rica
RSG reference	14049-2
Reporting period	17 January 2014-7 January 2014
Amount of grant	£5603
Your email address	sturnina@gmail.com
Date of this report	7 January 2014

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Objective 1: Assess jaguar population trends in the coastal habitat of Tortuguero National Park.			Yes	1. During 2014 we were able to identify 18 jaguars including nine adults (three males and six females), three sub-adults (two males and one female) and six new cubs (one female and five sex unidentified) (unpublished data). 2. Our data suggest that, as in previous years, jaguar population trends are strongly related to the high availability of prey (marine turtles) in Tortuguero beach. See Arroyo-Arce *et al*. (2014) for more information. 3. This data was collected in partnership with Global Vision International.
Objective 2 & 3: Describe the feeding and social behaviour of jaguars in relation to the predation on marine turtles in the coastal habitat of Tortuguero National Park.			Yes	**Jaguar predation on marine turtles:** 1. During 2014, and after 32 surveys, we recorded approximately 174 predated marine turtles (including 168 green turtles, three hawksbills, two leatherbacks and one loggerhead). This data was collected in partnership with Global Vision International (unpublished data). 2. During 2014 jaguars consumed an estimated of <1.5% and <5% of the green turtle and leatherback nesting population of Tortuguero beach, respectively. It is important to highlight that jaguar impact on hawksbills and loggerhead was not estimated because the clutch frequency for the studied rookery is unknown (unpublished data). 3. Based on our results we concluded that jaguars do not represent a threat to the population of green turtles that nest in Tortuguero beach, and it is not the main cause for population decline for leatherbacks and hawksbills (unpublished data). **Jaguar feeding and social behavior:** 1. During 2014 camera trapping survey were conducted on 43 predated turtles

				(including 40 green turtles, two hawksbills and one leatherback). This data was collected in partnership with Global Vision International (unpublished data). 2. Based on the data analysed so far (Period 2011-2013) we concluded that: a. Jaguars tended to return to the predated turtle throughout the year (Guilder *et al.* 2014). b. During 'Non-Peak Season' the number of jaguars per predated turtle increased, as well as the time they spend feeding from it. This increase ensures optimal foraging during periods of low prey availability (Guilder *et al.* 2014). c. There is a propensity for tolerated scavenging or sharing predated turtles (Guilder *et al.* 2014). d. There were no significant differences between males and females (Guilder *et al.* 2014). 3. Social behaviour in the coastal habitat was characterised by an evident home-range overlap between males and to a lesser extent between females (unpublished data).
Objective 4: Assess jaguar population and its prey species status in Barra del Colorado Wildlife Refuge.			Yes	1. We were able to extend the survey from 5 months (original proposed) to 11 months. 2. During 2014 we were able to: a. Conducted the first camera trap survey in the refuge. b. Identified one adult male jaguar that has not been reported in Tortuguero National Park (unpublished data). c. Recorded two other species of felids including ocelots and pumas (this represented the first photographic evidence of a puma in the Refuge) (unpublished data). d. Regarding prey species we identified 14 species distributed between seven orders and 11 families (unpublished data). e. The prey species more abundant was the common agouti (*Dasyprocta punctata*) (unpublished data).

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

In Barra del Colorado Wildlife Refuge several problems arose which included lack of access to proposed survey sites due to specific characteristics of the area (e.g. swampy area, floodplain). Also, some locations previously chosen were not monitored due to security concerns (e.g. as it is a border region in some cases we feared for the safety of the equipment and researchers). In both Barra del Colorado Wildlife Refuge and Tortuguero National Park we faced resistance from the hunters and poachers (e.g. three cameras were stolen). Finally, the weather conditions also had a negative effect on the camera traps leading to the malfunction of four of them.

3. Briefly describe the three most important outcomes of your project.

Firstly, we collected relevant information regarding the jaguar population and its prey species in both Tortuguero National Park and Barra del Colorado Wildlife Refuge. This information has been analysed and submitted in form of reports and workshops to the Tortuguero Conservation Area (ACTo) which forms part of the 'Sistema Nacional de Áreas de Conservación' (National System of Conservation Areas) in order to facilitate decision making regarding the conservation of the jaguar and other species in both protected areas.

Secondly, we were able to successfully disseminate the main results of the project to the scientific community. During 2014 a total of 4 papers were published by peer-review journals. These papers contribute to have a better understanding of the jaguar ecology. They also give new information about the distribution of the puma *Puma concolor* in Costa Rica.

Thirdly, we were able to extend our project to adjacent areas of Tortuguero National Park. During 2014 we successfully conduct the first camera-trap survey in Barra del Colorado Wildlife Refuge, located North of Tortuguero National Park. Based on this study we were able to record three species of wild cats (*Panthera onca*, *Puma concolor* and *Leopardus pardalis*) as well as 14 prey species. As a result of the project achievements during 2014 we were asked by Pacuare Reserve and Panthera Costa Rica to expand the project to Pacuare Reserve, located South of Tortuguero National Park. This will be the first camera-trap survey carry out in the area.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

We gave a workshop to the local communities of Barra del Colorado about 'Non-Invasive Techniques to Study Jaguars'. During the workshop the participants learn about camera traps set-up, identifying jaguars and prey species and use of databases. Thanks to this workshop we had four community representatives helping us during the fieldwork in Barra del Colorado Wildlife Refuge.

5. Are there any plans to continue this work?

During 2015 we will continue with our work focusing on:

1. Continue monitoring jaguar population trends in Tortuguero beach (*ongoing goal*).
1. Continue monitoring jaguar predation on marine turtles in Tortuguero beach (*ongoing goal*).

2. Continue monitoring the social and feeding behaviour of jaguars in relation to predation on marine turtles in Tortuguero beach (*ongoing goal*).
3. Assess cub behaviour, survival and development as well as mother-cub relationships (*new goal*).
4. Determine the diet of jaguars from scat content analysis in Tortuguero beach *(new goal)*.
5. Expand the camera trapping effort to Pacuare Reserve, located south of Tortuguero National Park (*new goal*).
6. Disseminate the information obtained to key stakeholder of the area, the general public and the scientific community (*ongoing goal*).

6. How do you plan to share the results of your work with others?

Throughout 2014 we were able to share the results of our work to the key stakeholders of the area, the general public and the scientific community. In this respect, we have been able to:

1. Published four scientific papers in peer-review journals. These papers focused on jaguar occupancy, feeding and social jaguar behaviour and records of other felids.

2. We participated in two conferences including "IV Congreso Mesoamericano de Áreas Protegidas" and "Simposio Internacional Conservación de Felinos en América" where we won first place in the poster presentation competition, and as a result of our lecture we were approached by the project leader of 'Panthera Puma Program' to collaborate with them in future publications.

3. Published one popular paper in 'La Nación', the main newspaper of Costa Rica.
Hambre lleva a jaguares a la playa de Tortuguero. 'La Nación' Newspaper, Costa Rica [http://www.nacion.com/vivir/ambiente/Jaguares-prefieren-playa-Tortuguero_0_1460453964.html] [December 31, 2014].

4. We created a Facebook page 'Conservación del Jaguar en el Noreste Caribeño de Costa Rica' in order to reach a wider audience.

In 2015 we will continue with our dissemination activities, and part of our work plan includes:

1. Present the main results to the Ministry of Environment and Energy and National System of Protected Areas (scientific committee, park rangers), local communities, local tourist guides and general public.
2. Participate in the conference 'Congreso de la Sociedad Mesoamericano para la Biología y la Conservación'.
3. Published at least one scientific paper and one popular paper regarding our study.

7. Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?

The initial project duration was one year and 5 months of fieldwork in Tortuguero National Park and Barra del Colorado Wildlife Refuge, respectively. However, we were able to extend the fieldwork in Barra del Colorado Wildlife Refuge for 11 months. Therefore, the RSG was used during a period of approximately one year (January 2014-December 2014).

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
1 local monitor @ 163£ monthly salary/6 months	326	326	0	
Lodging @ 6.5£ per day/100 days/2 people	910	910	0	
Gas cost for field vehicle @ 19.50£ per trip/2 monthly trips /12 months	156	156	0	This money was used to pay public transportation (buses, taxis) instead of gas for field vehicle.
Meals @ 4.55£/2 people/3 meals per day/100 day	1365	1365	0	
30 camera traps @ 163£ per unit	1630	1630	0	
31 security cable locks @ 6.50£ per unit	202	202	0	
30 camera memory cards @ 7.15£ per unit	215	215	0	
960 batteries AA @ 0.390£ per unit	374	374	0	
2 Dry bags (large) @ 29£ per unit	58	58	0	
2 plastic storage boxes (large) @ 19.50£ per unit	39	39	0	
2 plastic storage boxes (small) @ 6.50£ per unit	13	16	+3	Each box cost 8£
2 flagging tape @ 2.60£ per unit	5	5	0	
4 weatherproof notepad @ 6.50£ per unit	26	54	+28	Each notepad cost 18.31£
5 ziploc bag boxes @ 6.50£ per unit	33	33	0	
1 external hard drive @ 195£	195	195	0	
Printing paper @ 0.033£ per sheet/1000 sheets	33	33	0	
6 printing ink cartridges @ 3.90£ per unit	23	23	0	
Total	**5603**	**5634**	**31**	**We paid the difference using the other grants that were given to the project.**

Exchange rate: 1 Costa Rican colon = 0.0012 pound sterling

9. Looking ahead, what do you feel are the important next steps?

We are planning to apply for a 'Booster Grant', and we are also looking for additional funding, in order to secure the continuity of the project. In this respect, we believe the most important next steps are: a) to disseminate the information obtained to key stakeholders in order to facilitate decision-making regarding the proper management of the species, b) to continue the project in

Tortuguero National Park, c) to expand the jaguar conservation efforts to Pacuare Reserve, located South of Tortuguero National Park, to allow a comprehensive study of the jaguar population in the Caribbean coast of Costa Rica, and d) to share the main results to the general public and the scientific community.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

RSGF was mentioned in every material or activity related to this project, including the following:
Scientific articles

1. **Arroyo-Arce, S.**, J. Guilder & R. Salom-Pérez. 2014. Habitat features influencing jaguar *Panthera onca* (Carnivora: Felidae) occupancy in Tortuguero National Park, Costa Rica. Revista de Biología Tropical 62(4): 1449-1458.
2. **Arroyo-Arce, S.** & R. Salom-Pérez. 2014. First record of *Puma concolor* in Tortuguero National Park, Costa Rica. Brenesia 81-82: 115-118.
3. Thomson, I., **S. Arroyo-Arce**, & F. Spooner. 2014. Record of two jaguar cubs suckling from their mother in the wild. Cat News 61: 8
4. Guilder, J., B. Barca. **S. Arroyo-Arce**, R. Gramajo & R. Salom-Pérez. 2014. Jaguars (*Panthera onca*) increase kill utilization rates and share prey in response to seasonal fluctuations in nesting green turtle (*Chelonia mydas mydas*) abundance in Tortuguero National Park, Costa Rica. Mammalian Biology (*in press*). doi:10.1016/j.mambio.2014.11.005

Grey literature

1. **Arroyo-Arce, S.** & I. Thomson. 2014. Jaguar Project Manual: Tortuguero National Park, Costa Rica. Heredia, Costa Rica.
2. **Arroyo-Arce, S.** & I. Thomson. 2014. Informe Final: Proyecto Conservación del Jaguar en el Noreste Caribeño de Costa Rica. Heredia, Costa Rica.

Articles online

1. Reserva Biológica Cerro Coronel. Monitoreo de Jaguares [http://www.cerrocoronel.org/#!jaguar/c2q4] [October 13, 2014].

Conferences

1. We presented a poster and a lecture in 'IV Congreso Mesoamericano de Áreas Protegidas' in San José, Costa Rica [18-21 March 2014].
2. We presented a poster and a lecture in 'Simposio Internacional Conservación de Felinos en Améric' in Sarapiquí, Costa Rica [23-26 May 2014].

Workshop

1. Workshop for rangers and local communities of Barra del Colorado Wildlife Refuge on the 'Use of Non-Invasive Techniques to Study Jaguars' [February 2014].

11. Any other comments?

I would like to thank The Rufford Small Grants Foundation, Liz Claiborne Art Ortenberg Jaguar Research Grant Program at Panthera and Idea Wild for the financial support provided to this project. I gratefully acknowledge all the staff and volunteers of Global Vision International (GVI) for their support throughout the execution of this investigation, especially Ian Thomson, Katherine Cutler, Jizel Miles, Michele Chiacchio, Frank Spooner, Mariliana Leotta, Anna Johncock and Blaine Clarke. We also thank the Ministry of Environment and Energy and National System of Protected Areas for giving us permission to work in Tortuguero National Park and for their logistical support. Special thanks to Estación Biológica El Zota, Reserva Biológica Cerro Coronel and local farmers of Barra del Colorado for their support during the execution of this investigation.