Institution: University of Bath

Unit of Assessment: A5 Biological Sciences

Title of case study: Impact of evolutionary biology research on community-based conservation and public awareness in Cape Verde

Period when the underpinning research was undertaken: 2007 - 2020

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Professor Tamas Szekely	Professor, previously Reader	September 2000 - present

Period when the claimed impact occurred: August 2013 – July 2020

Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact

University of Bath research on bird species on Maio, an island of the Cape Verde, was essential to the establishment of the non-governmental organisation, Maio Biodiversity Foundation (FMB). FMB has successfully combined scientific research with community awareness-raising to develop a sustainable eco-tourism industry on Maio. Since 2015 there has been an increase in the number of loggerhead sea turtle nests from 1,000 to 15,000 and extended monitoring of Kentish plover shorebirds through community-based conservation. FMB plays a substantive role on the island of Maio, impacting on the economy via employment and tourism. Bath research has also influenced significant policy changes in the region, including the designation of key ecological sites on the island as protected under the Ramsar wetlands international treaty in August 2013 and its inclusion in UNESCO's Man and the Biosphere Programme in 2019.

2. Underpinning research

Islands are some of the powerhouses of evolution, since populations on islands can rapidly diversify and give rise to spectacular diversity such as the palm trees in Madagascar or Darwin's finches on the Galapagos islands. However, islands are also among the most threatened ecosystems in the world with humans driving thousands of animal and plant species to extinction, by introducing alien predators, converting habitats and overexploiting native plants and animals. The island of Maio lies within the Central Atlantic archipelago of Cape Verde and is one of the least developed parts of the country. In 2013, 80% of the 7,000 population depended heavily on the rich but over-exploited marine resources around the island [G].

Professor Szekely, University of Bath, went to Cape Verde in 2007 to study island birds, and quickly realised both the potential and the perils of researching on islands. His early studies produced three major insights. First, Szekely and his team surveyed the animal species on Maio Island, Cape Verde, for the first time, and identified the distribution of endemic and non-endemic species (1). Second, using molecular genetic analyses, he established that his main model organism, the Kentish plover *Charadrius alexandrinus*, has a unique breeding population in Cape Verde that is genetically distinct from all other plover populations (2). Third, his research has revealed that many animal populations are threatened by human development on Maio: habitat loss, overfishing and illegal poaching of breeding marine turtles (3).

To combat these threats and to protect the breeding sites of his model species, the Kentish plover, Szekely established a biodiversity conservation Non-Governmental Organisation Maio Biodiversity Foundation (FMB) in 2010, and served as FMB president until 2020.

The discovery of the unique breeding population of Kentish plovers in Cape Verde has facilitated the development of further unique research insights in the following areas:

- quantifying genetic variation and assessing its implication for conservation among plovers that breed in Cape Verde and elsewhere (4)
- understanding reproductive biology, mating systems and social behaviour of these plovers (5)
- quantifying sex ratio variation (6).

This research has had a direct impact on the ongoing conservation policies and activities of FMB, even as it has grown and expanded substantially beyond the original focus on Plover breeding sites (coastal wetlands and shores).

3. References to the research

1. Breitling, R, Coleing, A, Peixoto, T, Nagle, H, Hancock, EG, Kelsh, RN & Szekely, T 2012, 'An overview of the spider fauna of Maio (Cape Verde Islands), with some additional recent records (Arachnida, Araneae)', *Zoologia Caboverdiana*, vol. 2, no. 2, pp. 43-52. http://www.scvz.org/zoolcv/vol2no2/Breitling%20et%20al.%20Spiders%20Maio.pdf

2. Küpper, C, Edwards, SV, Kosztolányi, A, Alrashidi, M, Burke, T, Herrmann, P, Argüelles-tico, A, Amat, JA, Amezian, M, Rocha, A, Hötker, H, Ivanov, A, Chernicko, J & Székely, T 2012, 'High gene flow on a continental scale in the polyandrous Kentish plover *Charadrius alexandrinus*', *Molecular Ecology*, vol. 21, no. 23, pp. 5864-5879. https://doi.org/10.1111/mec.12064

3. Lopes, K, Passos, L, Rodrigues, JG, Koenen, F, Stiebens, V, Székely, T & Dutra, A 2016, 'Sea Turtle, Shark, and Dolphin Bycatch Rates by Artisanal and Semi-Industrial Fishers in Maio Island, Cape Verde', *Chelonian Conservation and Biology*, vol. 15, no. 2, pp. 279-288. https://doi.org/10.2744/CB-1213.1

4. Almalki, M, Kupán, K, Carmona-Isunza, MC, López, P, Veiga, A, Kosztolányi, A, Székely, T & Küpper, C 2017, 'Morphological and genetic differentiation among Kentish plover *Charadrius alexandrinus* populations in Macaronesia', *Ardeola*, vol. 64, no. 1, pp. 3-16. https://doi.org/10.13157/arla.64.1.2017.ra1

5. Székely, T 2019, 'Why study plovers? The significance of non-model organisms in avian ecology, behaviour and evolution', *Journal of Ornithology*, vol. 160, no. 3, pp. 923-933. https://doi.org/10.1007/s10336-019-01669-4

6. Eberhart-Phillips, LJ, Küpper, C, Carmona-Isunza, MC, Vincze, O, Zefania, S, Cruz-López, M, Kosztolányi, A, Miller, TEX, Barta, Z, Cuthill, IC, Burke, T, Székely, T, Hoffman, JI & Krüger, O 2018, 'Demographic causes of adult sex ratio variation and their consequences for parental cooperation', *Nature Communications*, vol. 9, no. 1, 1651, pp. 1-8. https://doi.org/10.1038/s41467-018-03833-5

4. Details of the impact

Driving conservation efforts through establishing Maio Biodiversity Foundation (FMB)
The Non-Governmental Organisation, Maio Biodiversity Foundation (FMB), plays a significant role in conservation efforts to protect Maio island's unique eco-system. "*Szekely's research into native and visiting animal species on Maio and the dangers of the loss of habitat was critical in the establishment of Maio Biodiversity Foundation and shaping its strategic direction focusing on conservation and research*" [E, President of the Zoological

Society of Cape Verde]. Using his research insights to galvanise the support of local officials, Szekely established the FMB in 2010 [C] and was its president until 2020: "*Szekely's research underpinned the development of the Foundation's key conservation and community programmes between 2013 and 2020*" [E].

Combining a remit of scientific investigation and public education and awareness-raising as a way to make the environmental work sustainable [A, B, C], the FMB has had a positive impact on the island. The former Director of FMB stated that: "*Szekely's research and his commitment and energy as President…has enabled [FMB] to carry out these functions extremely successfully*" [A]. FMB's projects include research into Kentish plovers, white-faced storm petrels and endangered loggerhead turtles alongside community-based conservation programmes and local partnerships designed to achieve "better management and law enforcement of the protected areas" [B].

i). Protecting Kentish plovers and loggerhead turtles through community-based conservation measures

FMB has worked with a team of volunteers to successfully monitor the largest breeding population of Kentish plovers in Cape Verde (834 nests), which in recent years has been expanded to all protected and key areas of Maio [B]: "*The monitoring of and protection for a rich variety of bird species and their habitats, including Kentish plovers was…enhanced on the island of Maio through the Foundation's programmes*" [A, Former FMB Director].

Maio's beaches host the second-largest nesting population of the endangered north-east Atlantic population of loggerhead sea turtles. As a result of the Foundation's participatory community projects to protect loggerhead sea turtles the number of loggerhead sea turtle nests on the island increased from "under 1,000 to over 15,000 between 2015 and 2020" [A] with the percentage of killed females per year reducing from 43% to 5% and number of poached nests from 18% to 2% between 2012 and 2017 [D]. In 2015 FMB was awarded a Grassroots Conservation Award by the International Sea Turtle Society for its sea turtle conservation programme [F].

ii). Promoting eco-tourism and creating employment for local residents in Maio

FMB has enabled Maio to diversify its economy, moving from sole dependence on fishing to embracing eco-tourism through its Home Stay programme. This supports local women with finance, training and marketing and enables them to establish businesses providing accommodation for tourists and visiting scientists. "*By 2017 74 households had hosted pilot visitors in eight* [8] *coastal villages and the project had empowered more than 25 local women from rural areas to acquire new skills and increase their ability to support their families by generating additional income from new revenue sources*" [A, Former FMB Director, G]. Through the Foundation's innovative homestay programme, "*the focus on opportunities for women was especially important, as unemployment for women [headed households] was 52% higher than for men on the island*" [A, B].

The Foundation also makes a direct economic contribution to the island. Between 2013 and 2017 the Foundation increased its annual turnover from under EUR100,000 to more than EUR300,000 and increased employment from 6 to 12 full time employees; more than 100 volunteers and temporary personnel also carry out regular beach monitoring [A]. Between 2014 and 2017, 328 FMB training days were attended by 1,806 people; 91 people who received training were subsequently involved in protected area management, 68 people were employed as permanent or temporary staff [A]. In 2017 Maio's Association in Portugal gave an Honourable Mention for FMB's work "supporting and giving opportunities to Maio's youth and developing sustainable tourism strategies" [F]. In 2018 the Cape Verdean Institute for Children and Teenagers gave an Honourable Mention to FMB for their work "supporting the protection of vulnerable youth" [F].

Providing environmental protection through protected designation

Szekely's research was key to the designation of the Salinas de Porto Ingles area of Maio as a protected area for Ramsar listing in August 2013. The Ramsar Convention on Wetlands is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The President of the Zoological Society of Cape Verde states that: "*Ramsar designation has been important in protecting the wide range of rare birds and animals found in this area of Maio from inappropriate development for tourism purposes. Professor Szekely's research is cited in the application documents giving essential background information*" [E]. The announcement of the formal designation on the Ramsar website (13 August 2013) emphasises the importance of bird species in the area in maintaining the biological diversity of the Macaronesia ecoregion, and emphasises the need for regulatory actions to protect the site" [H].

In 2019 the islands of Maio and Fogo were classified by UNESCO as World Biosphere Reserve and designated as having reserve status under their Intergovernmental Man and the Biosphere Programme [E, I]. The Cape Verdean government's application for the status emphasises that the saline ecosystems and coastal lagoons are of "*great importance for shorebirds*"; specific mention is made of Szekely's research findings on Kentish plovers in Maio [I]. FMB's community-based conservation work played a key part in the success of the application [E]; its work is cited 25 times within the application [I].

5. Sources to corroborate the impact

[A] Testimonial letter from Former Director (2015-2017), Maio Biodiversity Foundation, 7 December 2020.

[B] Maio Biodiversity Foundation. *What we do: Community-based conservation*. http://fmb-maio.org/whatwedo/ accessed 9 November 2020.

[C] Judicial and other notices, Ministry of Justice, Cape Verde Government, 17 February 2010.

[D] Presentation by the Project Coordinator of the FMB Delta Sea Turtle Programme Maio Biodiversity Foundation (FMB): 8 years of community-based conservation in Maio island, Cape Verde. (University of Bath, 26 November 2018).

[E] Testimonial letter from President, Zoological Society of Cape Verde, and Lecturer and Researcher in Marine and Environmental Science, Atlantic Technical University, 25 November 2020.

[F] Details of awards on screenshot of FMB Facebook page, accessed November 2020: Grassroots Conservation Award by the International Sea Turtle Society (ISTSS), 2015 Honourable Mention by Cape-Verdean Institute for Children and Teenagers (ICCA), 2018 Honourable Mention by Maio's Association in Portugal (AMP), 2017.

[G] Enhancement of wellbeing and conservation in Cape Verde's biodiversity hotspots (Ref: 2324), Darwin Initiative Final Report, Department for Environment Food & Rural Affairs, 2017.

[H] The Ramsar Convention Secretariat. 2014. Cape Verde designates salt flats for Ramsar List. Available at: https://www.ramsar.org/news/cape-verde-designates-salt-flats-for-ramsar-list Information Sheet on Ramsar Wetlands (RIS) – 2009-2014 version.

[I] Application submitted by the Cape Verdean government to UNESCO's Man and the Biosphere Programme, August 2019.