

Robin Rigby Trust

Final Report: *The Cabo Verde Elasmobranch Research and Conservation Project*

Background

The Cabo Verde archipelago might be one of the last refuges for elasmobranchs (sharks, skates, and rays) in West Africa and the North Atlantic Ocean (Edgar et al. 2014). The area hosts several species of international conservation concern, species occurring only in West Africa and, with the Cabo Verde skate (*Raja herwigi*), even an endemic species. However, the knowledge on elasmobranchs in Cabo Verde is highly limited, despite emerging national and international threats. In addition to the risk of local extinction, overexploitation of elasmobranchs may change the structure, function, and stability of the Cabo Verde marine ecosystem (Ferretti et al. 2010) which in turn threatens the livelihood of local fishermen.

In 2015 I initiated the Cabo Verde Elasmobranch Research and Conservation Project and have since then been collaborating with the local NGO Biosfera 1. Biosfera 1 is a local NGO on the island of São Vicente whose mission is to ensure the preservation of the natural heritage of Cabo Verde. One of their major goals is to promote the conservation of biodiversity in Cabo Verde and in the sub-region through an integrated strategy for the conservation of species and their habitats, especially focusing on the marine and coastal ecosystems. From 2015-2017 our work with Biosfera 1 has included the deployment of a temporary receiver line, with receivers deployed off the islands of São Vicente and the uninhabited island of Santa Luzia. During the time of receiver deployment our team tagged 20 Atlantic weasel sharks (*Paragaleus pectoralis*) with acoustic transmitters, to collect data on their movements at the island of Santa Luzia, to determine if the area could be of importance to this species. Atlantic weasel sharks are an endangered species endemic only to Cabo Verde and the western coasts of Africa (Jabado et al. 2021). Therefore, their habitat use within the Santa Luzia Marine Reserve, an increasingly exploited area even with the marine reserve designation (Vasconcelos et al. 2015, Freitas et al. 2019), is important to consider for future management.

In 2017, together with Biosfera 1 and researchers from the University of Cabo Verde (now the Atlantic Technical University), our team was also the first to scientifically validate the presence of the blackchin guitarfish (*Glaucostegus cemiculus*) in Cabo Verde (Freitas et al. 2018) (**Fig. 1**). Blackchin guitarfish belong to the family of giant guitarfishes, and together with wedgefishes these animals belong to the most at-risk group of marine fish globally (Dulvy et al. 2014, Moore 2017, Kyne et al. 2019). Given that guitarfishes have been locally extirpated in many areas of former occurrence (Moore 2017), Cabo Verde could be a stronghold of global importance for this species requiring urgent scientific monitoring and it was decided by our team to be the first focus of future research in Cabo Verde.



Figure 1: from Freitas et al. 2018, New and confirmed records of fishes from the Cabo Verde archipelago based on photographic and genetic data. Our team used morphological features to confirm the species as the blackchin guitarfish (*Glaucostegus cemiculus*). These features include a) rectangular-shaped nasal openings, b) sharply demarcated margins separating the cranial cartilages from the much paler snout, along with an elongated pointed snout and narrowly separated rostral ridges. Note, a black spot on the tip of the snout is usually only visible in younger individuals (Last et al. 2016, Freitas et al. 2018). (Photos: Manuel Dureuil).

Furthermore, Cabo Verde is the only region globally to find the elusive and aptly named Cabo Verde skate. This species is only known from ten published scientific records; three from Boavista and five from São Vicente (Krefft 1965, Stehmann 1971), and an additional two between the two islands from June of 2011 listed on the *Smithsonian National Museum of Natural History Fishes Collections* (<https://collections.nmnh.si.edu/search/fishes/>). The Cabo Verde skate has no known life history information such as age and size at maturity or growth rate, and the global status of this species – whether this species is endangered or not – is unknown. Therefore, our teams second focus of future research in accordance with the Cabo Verde Elasmobranch Research and Conservation Project is the Cabo Verde skate.

In addition to focusing on research and conservation efforts for the blackchin guitarfish and Cabo Verde skate, our teams third focus is knowledge transfer. In particular a tagging initiative was established at the beginning of the Cabo Verde Elasmobranch Research and Conservation Project whereby knowledge transfer – including scientific data collection and training in safe handling methods of the animals –has allowed for the passive tagging of the blackchin guitarfish and other shark and ray species to continue year-round. Passive tags are each marked with a unique identification number, and recaptures of the same individual will allow for us to obtain crucial information such as rates of growth (Dureuil & Worm 2015) and an assessment of mortality (Hoenig et al. 1998). To date, this initiative has allowed us to tag and collect data on several coastal elasmobranch species, including spinner sharks (*Carcharhinus brevipinna*), blacktip sharks (*Carcharhinus limbatus*), nurse sharks (*Ginglymostoma cirratum*), blackchin guitarfish and Atlantic weasel sharks.

2021 Project Aims

Funding for the continuation of our work in Cabo Verde was provided generously to us from the Robin Rigby Trust in 2018, and since then we have maintained communication with Biosfera 1 to create a best plan of action for the future of the Cabo Verde Elasmobranch Research and Conservation Project. After three years of planning, and delays caused by the pandemic, in 2021 we were able to travel back to São Vicente Island for our planned field work. **Within our 10-day excursion we had three primary project aims:**

- i. **To gather species specific Fishers' Knowledge from locals in different fishing communities around the island.** It is my hope that Fishers' Knowledge can provide valuable information to enhance our understanding of local shark and ray species, and thus support future assessments. According to the *IUCN Guidelines for gathering of fishers' knowledge for policy development and applied use* (Cowie et al. 2020) Fishers' Knowledge is defined as: "The cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another, their environment and specifically fisheries resources. In the fishing context it includes contribution to societal living; the types of species caught and not caught - why and when; the methods of fishing; and knowledge of species and seasons. This knowledge may be manifested in myths and legends and in folk taxonomies". Specifically, we created a questionnaire to gather information on the blackchin guitarfish, and the Cabo Verde skate, in addition to determining the presence or absence of the smalltooth sawfish (*Pristis pectinate*) and the false shark ray (*Rhynchorhina mauritaniensis*), both of which are assessed as critically endangered on the IUCN Red List of Threatened Species and can be found off mainland west Africa. Our questionnaire (**Fig. 2**) consisted of 18 questions, all of which were translated to Portuguese as the official languages of Cabo Verde. We partnered with Biosfera 1 to arrange meetings with the Presidents of the fishing associations and interested fishers of the three respective communities we visited: Calhau, Salamansa, and São Pedro. Representatives from Biosfera 1 joined us to better establish rapport and assist with translating.



INFORMAÇÕES BÁSICAS A SEREM REGISTRADAS (data, nome da comunidade pesqueira, número de pescadores presentes, ...) | BASIC INFORMATION TO BE RECORDED (Date, Name of fishing community, Number of fishermen present, ...)

1. Já alguma vez apanhou ou viu o Raios de Cabo Verde (Página 1 e 2 do Guia de Identificação das Espécies)? | Did you ever catch or see the Cabo Verde Skate (Page 1 and 2 of the Species ID Guide)?
2. A que hora do dia e em que meses o viu ou o viu? | What time of day and which months did you catch or see it?
3. Onde você o pegou ou viu (área no mapa)? | Where did you catch or see it (area on the map)?
4. O fundo do mar nesta área é arenoso ou rochoso? | Is the seafloor in this area sandy or rocky?
5. É profundo ou raso nesta área? | Is it deep or shallow in this area?
6. Qual isca e método de pesca você usou? | Which bait and fishing method did you use?
7. Queres apanhar o Raios de Cabo Verde ou queres apanhar outra espécie de peixe? | Did you want to catch the Cabo Verde Skate or did you want to catch a different fish species?
8. Quando e onde apanhou ou viu o Raios de Cabo Verde pela última vez? | When and where did you catch or see the Cabo Verde Skate last?
9. Já viste ou viste o Raios de Cabo Verde mais antigamente ou vêes mais agora? | Did you catch or see the Cabo Verde Skate more in the past or do you see it more now?
10. Você pode comer o Raios de Cabo Verde? | Can you eat the Cabo Verde Skate?
11. Você já encontrou caixas de ovos de skate na praia (semelhantes às da página 4 do Guia de Identificação das Espécies)? | Did you ever find skate egg cases on the beach (similar to those on page 4 of the Species ID Guide)?
12. Quando e onde você viu as caixas de ovo? | When and where did you see the egg cases?
13. Você sempre pescou ou viu alguma das espécies na página 5 ou na página 6 do Guia de Identificação de Espécies em São Vicente ou em Cabo Verde? | Did you ever catch or see any of the species on page 5 or page 6 of the Species ID Guide around Sao Vicente or in Cabo Verde?
14. A que hora do dia e em que meses o viu ou o viu? | What time of day and which months did you catch or see it?
15. Onde você o pegou ou viu (área no mapa)? | Where did you catch or see it (area on the map)?
16. Você pode comer a espécie? | Can you eat the species?
17. Podemos usar essas informações que você nos deu para nosso trabalho e em uma publicação científica? | Can we use this information you gave us for our work and in a scientific publication?
18. Você gostaria de ser reconhecido pelo nome (indivíduo ou comunidade pesqueira) em uma publicação? | Would you like to be acknowledged by name (individual or fishing community) in a publication?

Thank you very much!

Figure 2: Questionnaire provided to local fishers from three fishing communities on the island of São Vicente, Cabo Verde: Calhau, Salamansa, and São Pedro.

- ii. **To establish more tagging sites for the blackchin guitarfish on São Vicente.** To date, primary efforts have been focused on tagging at Santa Luzia Island, where the species was first scientifically validated by our team. However, establishing additional tagging sites at São Vicente could allow us to better understand population connectivity between the two islands, and could help increase our knowledge on key areas for this species, information that can be combined with Fishers' Knowledge.
- iii. **To continue knowledge transfer.** New members have joined the Biosfera 1 team, and it is therefore important that best practises are continuing to be followed for tagging and handling the sharks and rays. Moreover, our data collection has increased to include tissue sampling of individuals for genetic analyses, and new best practices needed to be established accordingly.

Outcomes

The outcomes for the project aims were as follows:

- i. We spoke with a total of 17 fishers from the fishing communities of Calhau, Salamansa, and São Pedro. From our questionnaire it was determined that none of the fishers have seen the smalltooth sawfish or false shark ray in Cabo Verde. This was expected as this species are known from mainland West Africa. However, three fishers have caught or seen Cabo Verde skates, and all but one of the fishers have seen or caught blackchin guitarfish. Of the three fishers that have caught/seen Cabo Verde skates, two fishers agreed that they are most likely seen in Cabo Verde in the mornings of the late summer months and can be found in shallow waters with black sand. In Cabo Verde there is no commercial value for this species, but accidental capture might occur using fishing nets. These three fishers all stated that Cabo Verde skates were seen more in the past. Furthermore, no skate eggs have been seen by any of the interviewed fishers. Guitarfish were seen by the fishers at all points during the day which agrees to what we have found during our tagging expeditions. Some fishers told us that they saw more blackchin guitarfish in the past than they do now, exclaiming that the guitarfish would come right up to the beach, however some fishers stated that there are no more or no less guitarfish between the past and now. All fishing communities were able to provide us with locations of blackchin guitarfish sightings, which we used to focus our efforts during our second project aim. We also provided each community with a self-made species ID guide of the four focus species and fishers were shown the ID features. This ID guide was left with the members of each community in hopes that if they see any of the listed species, they can continue to inform Biosfera 1 and further enhance our understanding of these species.

- ii. We were able to successfully catch and tag two large, mature female blackchin guitarfish at one of the sites suggested to us by the local fishers on São Vicente Island. This is a particularly important finding because large females are of highest conservation concern. Therefore, we will explore this site further in future expeditions.
- iii. We were able to bring additional tagging equipment with us to Cabo Verde, which can otherwise be difficult to order or purchase on the islands. Furthermore, we were able to observe the current tagging, sampling, and data collection procedures by the Biosfera 1 team and provide expert knowledge advice on the best areas to improve and confirm all areas of the procedure. Working together with Biosfera 1, we are now establishing a best-practises tagging protocol. This included knowledge on where to collect the tissue sample (trailing edge of the pectoral fin, where the fin meets the body), how large of a sample to collect (~5 mm), and proper storage of the samples (should be cooled in a cell preserving solvent such as 96% alcohol or DMSO and kept cool). During the 2021 expedition to Cabo Verde, I also taught members of Biosfera 1 team how to offload receiver data, so that we can begin our analyses of the acoustic tagging data from our 2015-2017 project work. In addition, we are beginning to work on our first collaborative publications based on the six years of tagging data we have to-date. It is my hope that, if desired, the project can now help support a local Biosfera 1 member to pursue a Master's in Science degree.



Left: Research assistant Kirsti Burnett taking a tissue sample for genetic analysis with the help of the Biosfera 1 tagging team. *Photo credit Manuel Dureuil* **Right:** I am demonstrating the proper insertion of the passive external marker tag into the dorsal musculature of the blackchin guitarfish for the Biosfera 1 team. *Photo credit Biosfera 1*

Discussion

The following discussion will focus on the five points laid out by the Robin Rigby Trust Guidelines.

Point 1 - Time: Was the time in the field sufficient to accomplish your project objectives? Was the time spent on site optimum for the work or would another season be more appropriate?

All aims of our 2021 expedition were successful during our time spent in the field. Overall, these aims have provided us with information needed to further progress the Cabo Verde Elasmobranch Research and Conservation Project. In particular, with the information learned from the Fishers' Knowledge we were able to establish another promising tagging site for the blackchin guitarfish in Cabo Verde, this time on São Vicente Island. Moving forward it will be important to continue our tagging and genetic sampling efforts at this location, while further explore other sites, so that we can analyse the population connectivity of blackchin guitarfish from São Vicente and Santa Luzia Islands. Moreover, continuing our tagging efforts at this new location will help us determine if the area could be of particular importance for the species. For example, mature females like the ones we caught and tagged, are critical for contributing to future generations of the population, and regions where they are found to frequent would therefore be of importance to the species survival. Continued and consistent mark-recapture tagging efforts of all coastal shark and ray species are also needed to gather sufficient growth data, to determine population trends and to assess population status. Overall, it is therefore fair to say that while the time in the field was sufficient to accomplish this year's project aims, continued seasons of field work are needed for progress and continuation.

Replication: Would you consider it reasonable to repeat/replicate this project? If so what changes would you recommend in the planning or implementation? If not, why?

It is our intention to replicate all aims of the 2021 project. We intend to expand our Fishers' Knowledge questionnaires to include additional fishing communities on other islands within the Cabo Verde archipelago, such as Boavista, currently the only other island with the scientific records of the Cabo Verde skate (Krefft 1965, Stehmann 1971). We will also continue all tagging and genetic sampling efforts to look at growth and population trends of coastal shark and ray species over time, results of which could aid in establishing appropriate management strategies to best conserve these threatened species.

Cooperation: Cooperation may well have been integral to the project implementation. Are you aware of any cooperative skills you or any of those working with you acquired while in the Field? If so, please discuss and note how this skill will enhance your future working relations.

While working in the field a key aim of the 2021 project was to pass on expert knowledge gained through over a decade of research experience to the team, while continuously learning about how to improve methods from what we experience on the ground. I also discussed with the team how the data gathered from this project can be used to shed light on growth and population trends of the coastal elasmobranch species found in Cabo Verde. This allows for the continuation of data collection year-round. Future working relations will then involve using this data and collaborating with Biosfera 1 to publish study results together, with the overall aim of improving shark and ray conservation in Cabo Verde.

Linkages: The prime rationale of the Trust is to assist early-career researchers to have overseas coastal research experiences, and to improve existing or develop additional or new linkages with organizations and individuals focused on coastal resource assessment, development, and sustainable management. In Trust projects, people from different geographical areas and cultural backgrounds have on site opportunities to observe and assess both the natural and human resources. Did you forge linkages which will provide opportunities for further identification or resource development in the same or another coastal area?

Since initiation of the Cabo Verde Elasmobranch Research and Conservation Project in 2015 I have built and maintained relationships not only with local NGO Biosfera 1, but also with other local NGO Maio Biodiversity Foundation (FMB), local researchers at the Atlantic Technical University, local government officials, and researchers from the National Institute of Fisheries Development (INDP) and Ocean Science Centre Mindelo (OSCM). During our 2021 field expedition in particular our team was able to continue building on these relationships, especially with Biosfera 1, and establish new ones with the genetics lab at the University, and with three fishing communities on São Vicente Island. These relationships will help further the development of the project, providing us with local resources and support. It is most important to me that the relationships built are mutually beneficial, and therefore a key component of the project is providing the opportunity for *all* individuals involved to be a part of all published works that come out of the project, with future goals of supporting local Cabo Verdean students.



Here our team is speaking with the fishers from Calhau, São Vicente, where we went through our questionnaire and self-made species ID guide. Their shared knowledge of local species and seasons gained from generations of experience has provided us with additional information on critically endangered species such as the blackchin guitarfish, and elusive species like the Cabo Verde Skate, which we can use to supplement our research and focus our efforts. One of the fishers was kind enough to let us meet in their house.

(Photo credit: Odair Lopes)

Sustainability: Did your study/work in itself provide insight into sustainable resource management? If yes, please note how you or others you worked with might use this awareness to further develop and/or maintain sustainable human (particularly at the personnel level) and natural resources in the focus area.

Continued research and data collection through mark-recapture studies will be needed to provide useable insights for establishing best management practices for coastal shark and ray species in Cabo Verde. It is clear, however, that a species belonging to the most at-risk group of marine fish globally – the blackchin guitarfish – can be found in Cabo Verde, and therefore the island nation is likely of global importance for the species. In the meantime, it is discussed that awareness campaigns will be established with and by local partners to inform the local communities about these species.

Summary of Finances

| Item | CAD |
|--------------------------|---------|
| Travel expenses | 3100.09 |
| Research/Field assistant | 946.8 |
| Tagging equipment | 1490.06 |
| Field costs | 463.05 |
| TOTAL | 6000 |

Collaborators

- Biosfera 1, in particular Stiven Pires as the local project coordinator for the Cabo Verde Elasmobranch Research and Conservation Project, and Blandine Mélis as the Executive Director of Biosfera 1
- Dalhousie University
- The Ocean Tracking Network
- Shark and Ray Research and Conservation Centre (ShARCC), formerly Sharks of the Atlantic Research and Conservation Centre
- Deutsche Elasmobranchier-Gesellschaft e.V.

References

- Cowie W, Al Dhaheer S, Al Hashmi A, Solis-Rivera V, Baigun C, Chang K, Cooney R, Kamaka'ala S, Lindeman K, Louwa C, Roe D, Walker-Painemilla K, Al Baharna R, Al Ameri M, Al Hameli S, Al Jaber K, Alzahawi N, Binkulaib R, Al Kharusi Y (2020) IUCN Guidelines for gathering of fishers' knowledge for policy development and applied use.
- Dulvy NK, Fowler SL, Musick JA, Cavanagh RD, Kyne PM, Harrison LR, Carlson JK, Davidson LNK, Fordham S V., Francis MP, Pollock CM, Simpfendorfer CA, Burgess GH, Carpenter KE, Compagno LJV, Ebert DA, Gibson C, Heupel MR, Livingstone SR, Sanciangco JC, Stevens JD, Valenti S, White W (2014) Extinction risk and conservation of the world's sharks and rays. *Elife* 3:e00590:34p.
- Dureuil M, Worm B (2015) Estimating growth from tagging data: an application to north-east Atlantic tope shark *Galeorhinus galeus*. *J Fish Biol* 87:1389–1410.
- Edgar GJ, Stuart-Smith RD, Willis TJ, Kininmonth S, Baker SC, Banks S, Barrett NS, Becerro MA, Bernard ATF, Berkhout J, Buxton CD, Campbell SJ, Cooper AT, Davey M, Edgar SC, Försterra G, Galván DE, Irigoyen AJ, Kushner DJ, Moura R, Parnell PE, Shears NT, Soler G, Strain, Elisabeth. M. A. Thomson RJ (2014) Global conservation outcomes depend on marine protected areas with five key features. *Nature* 506:216–220.
- Ferretti F, Worm B, Britten GL, Heithaus MR, Lotze HK (2010) Patterns and ecosystem consequences of shark declines in the ocean. *Ecol Lett*.
- Freitas R, Falcon J, Gonzalez J, Burnett K, Dureuil M, Caruso J, Hoving H-J, Brito A (2018) New and confirmed records of fishes from the Cabo Verde archipelago based on photographic and genetic data. *Arquipelago Life earth Sci* 35:67–83.
- Freitas R, Mendes TC, Almeida C, Melo T, Villaça RC, Noguchi R, Floeter SR, Rangel CA, Ferreira CEL (2019) Reef fish and benthic community structures of the Santa Luzia Marine Reserve in the Cabo Verde islands, eastern central Atlantic Ocean. *African J Mar Sci* 41:177–190.
- Hoenig JM, Barrowman NJ, Hearn WS, Pollock KH (1998) Multiyear tagging studies incorporating fishing effort data. *Can J Fish Aquat Sci* 55:1466–1476.
- Jabado RW, Chartrain E, De Bruyne G, Derrick D, Dia M, Diop M, Doherty P, Ducrocq M, G.H.L. L, Metcalfe K, Pires JD, Ratão S, Seidu I, Soares A-L, Tamo A, VanderWright, W.J. Williams AB (2021) *Paragaleus pectoralis*, Atlantic Weasel Shark. 8235.
- Kreff G (1965) Die ichthyologische Ausbeute der ersten Westafrika-Fahrt des fischereitechnischen Forschungsschiffes 'Walter Herwig' I. *Raja herwigii* spec. nov., eine neue Rochenart aus dem Seegebiet der Kapverden. *Arch Fischereiwiss*:209–216.
- Kyne PM, Jabado RW, Rigby CL, Dharmadi, Gore MA, Pollock CM, Herman KB, Cheok J, Ebert DA, Simpfendorfer CA, Dulvy NK (2019) The thin edge of the wedge: extremely high extinction risk in wedgefishes and giant guitarfishes. [bioRxiv:595462](https://doi.org/10.1101/2019.05.20.259546).
- Last P, Naylor G, Séret B, White W, de Carvalho M, Stehmann M (2016) *Rays of the World*. Last P, Naylor G, Séret B, White W, de Carvalho M, Stehmann M (eds) CSIRO.
- Moore ABM (2017) Are guitarfishes the next sawfishes? Extinction risk and an urgent call for conservation action. *Endanger Species Res* 34:75–88.
- Stehmann (1971) Ergebnisse der Forschungsreisen des FFS 'Walter Herwig' nach Südamerika XVII. *Raja (Raja) herwigii* Krefft, 1965; ergänzende Untersuchungen zum subgenerischen Status der Art. *Arch Fischereiwiss*:85–97.
- Vasconcelos R, Freitas R, Hazevoet CJ (2015) Cabo Verde: história natural das Ilhas Desertas. *Soc caboverdiana Zool*.