

Final Evaluation Report

Your Details	
Full Name	Dominique Kelsi Paynee
Project Title	Conservation genetics of the inshore Bryde's whale (<i>Balaenoptera edeni brydei</i>) population off South Africa
Application ID	35677-1
Date of this Report	22 June 2023

1. 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
Collection of biopsy samples of free-ranging Bryde's whales from various locations on the South African coastline				Biopsy samples of Bryde's whales in different locations were successfully collected throughout the duration of the project.
Generation of multi-locus genotypes for each individual				Once optimisation procedures were completed for microsatellite loci, genotypes for all available samples were successfully generated. In total, 85 multi-locus genotypes were generated.
Generation of mitochondrial control region sequences for newly collected samples				Primers were newly designed for amplification of the mitochondrial control region and newly collected samples were sequenced successfully
Estimation of population parameters such as relatedness and sex-ratios				This was partially achieved as most of the population parameters were estimated from genotype data. However, molecular sexing was not optimised within the timeline thus sex ratios could not be calculated
Assessment of genetic diversity on nuclear and mitochondrial genome levels				Assessment of genetic diversity was achieved using microsatellite genotypes and mitochondrial control region sequences
Estimation of population structure by detection of distinct gene pools within the inshore population				Detection of structure within the South African inshore population was successfully completed using the tested microsatellite loci, however small sample size from other locations (Namibia and Madagascar) limited the conclusions that could be drawn about distinct populations within the southern African region
Phylogenetic analyses using mitochondrial sequence data				This objective was partially achieved as there were some limitations on the available data.

				Genbank data of global Bryde's whale control region sequences proved to be biased in terms of sampling from certain regions. This would have skewed results and thus a smaller subset of sequences were used instead of all available sequences
Outreach				Presentations on this research was given at various festivals in order to engage with the public and bring about awareness for South Africa's resident baleen whale species.

2. Describe the three most important outcomes of your project.

- a) On a local scale: South Africa's inshore Bryde's whales form a single population along the coastline with evidence of high nuclear and low mitochondrial genetic diversity. The observed high neutral nuclear diversity may be the first, crude indicator of population viability. However, the results are preliminary and must be confirmed by other more informative parameters such as effective population size and levels of adaptive genetic variation. In addition, high neutral nuclear diversity also suggests a larger population size than was originally expected ($N < 1,000$).
- b) Within the broader southern African region: Results suggest the occurrence of three genetically distinct populations, which may indicate South Africa's inshore population is genetically isolated. This needs to be confirmed with larger sample sizes from populations within the region.
- c) On a global scale: Preliminary analyses comparing the available data from global Bryde's whale populations provided important insight into the possible colonisation history of the South African inshore population. Results showed shared haplotypes (from mitochondrial DNA) between South Africa and an individual from the Eastern Indian Ocean (Java). This could suggest ancient gene flow between these areas and further investigation is required with larger sample sizes from other Bryde's whale populations.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

Difficulties associated with this project related mostly to sample sizes and laboratory work in generating genetic data. Although a large enough sample size was available for South Africa's inshore population there was an extremely small sample size of individuals from the broader southern African region (namely from Namibia and Madagascar). Comparing populations within the broader region was not a primary aim but was explored as it would provide important insight into the potential genetic isolation of South Africa's inshore population. This challenge was overcome by generating data for the available samples and completing preliminary analyses

which indicated genetic distinction between the tested populations. Other challenges included the generation of genetic data as molecular sexing (which would have provided information on sex-ratios) could not be optimised by the project deadline. However, the information on relatedness was captured for each individual and once the molecular sexing is optimised the additional information can be added and reanalyses can be completed.

4. Describe the involvement of local communities and how they have benefited from the project.

Local communities were involved in this project through public presentations as well as social media and printed media. The results of this research were presented at both the "Welcome the whales" and "Whale festival" in Hermanus, South Africa. Here, local communities were engaged, and presentations brought about awareness of the ongoing research of this project. This was beneficial as, although a resident South African marine mammal, not many people know of the Bryde's whale population. Thus, this engagement increased awareness for the species and its conservation which is important as it forms a unique part of South Africa's marine ecosystem.

The MRI Whale Unit has a substantial social media following which assist substantially in public outreach:

- Facebook MRIWhaleunit: Page followers = 5,012 / Reach (2022) = 276,881 / max post share = 638
- Instagram: 793 followers / Reach = 3,235
- Twitter: Page followers: 432
- LinkedIn: Page followers = 497 / Post reach = 1,200

5. Are there any plans to continue this work?

Yes, this work will be continued in my PhD project which recently started. More importantly, the results from this study directed the research questions for my PhD work. This PhD will focus on three major areas, which will bring clarity to the viability and the potential genetic isolation of the inshore Bryde's whale population. The three focus areas are: (1) estimation of population abundance and effective population size, (2) assessment of adaptive genetic diversity and (3) investigation into population connectivity and phylogenetics between South Africa's inshore population and members of the Bryde's whale complex. These aspects of the population will be assessed using a combination of population genetics and genomics.

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

The results of this project were presented and shared at three main events (two conferences and one departmental presentation day). An oral presentation was completed at the South African Marine Science Symposium (SAMSS) and an e-poster presentation was completed for the Society of Marine Mammalogy Biennial conference both in 2022, both presentations used preliminary results. In addition to

this, the final results of this project were presented at the Annual General Meeting (AGM) for the Department of Zoology and Entomology, University of Pretoria. These results will also be shared through publication in an academic journal which is currently in preparation.

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

The results of this project increased our understanding of the demography and ecology of South Africa's inshore Bryde's whale population. But it also highlighted areas that require further investigation. So, the next steps for this will be to provide an estimate of census and effective population size using genetic methods. An up-to-date population abundance estimate is one of the critical outstanding parameters for South Africa's inshore Bryde's whales inhibiting accurate conservation status assessments and population monitoring. In addition to an overall population abundance estimate, an effective population size estimate will provide insight into the viability of the population and its ability to persist in the future under various environmental scenarios. Other important steps relate to the assessment of adaptive genetic diversity of the population and the investigation of the level of connectivity between South Africa's inshore population and other populations of the species. Altogether these next steps will provide important information which will direct more effective conservation practices for the species and for this population in particular.

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

The Rufford Foundation logo was used in all presentations and materials related to this project.

9. Provide a full list of all the members of your team and their role in the project.

Professor Paulette Bloomer: Supervisor for the duration of this project. Prof Bloomer provided guidance and suggestions in all genetic data generation and analyses. Since Prof Bloomer is the research group leader of the Molecular Ecology and Evolution Programme (MEEP) at the University of Pretoria, her knowledge and guidance were vital throughout the duration of this project.

Dr Els Vermeulen: Co-supervisor for the duration of this project. Dr Vermeulen organized all fieldwork activities as well as provided guidance on the interpretation of genetic information in an ecological context. Dr Vermeulen also completed the biopsy sampling of free-ranging animals which, with her expertise, resulted in successful field trips throughout the project. Dr Vermeulen's experience (over 20 years) with cetacean biology was also a vital contribution to the success of this project.

Dr Gwenith Penry: External co-supervisor for the duration of this project. Dr Penry completed all the pilot genetic studies (Penry, 2010 and Penry *et al.* (2018)) on the inshore Bryde's whale population which this project expanded on. Thus, some of her previously generated data was used in this project as well. In addition to this, Dr

Penry's is the only Bryde's whale specialist in South Africa, which made her knowledge and contributions to this project invaluable.

Mr Chris Wilkinson: Technician for the Mammal Research Institute Whale Unit (MRIWU), University of Pretoria. Mr Wilkinson skippered the boat during all fieldwork of this study. His expertise in working with and around cetacean species ensured the safety of all members on fieldwork trips as well as the animals under study. In addition to this, his knowledge together with Dr Vermeulen's experience ensured successful biopsy sampling trips throughout the duration of this project.

10. Any other comments?



Photo-identification picture of Bryde's whale using the dorsal fin with a small base notch. © MRI Whale Unit.



Photo-identification picture of Bryde's whale using the dorsal fin with a unique shape. © MRI Whale Unit.