A Guide to the effective species and of the Atlantic Ocean. Molecular of and using priority marine ecosystems

Summary of taxa on of the project. DST/NRF/SANBI Foundational Biodiversity Knowledge

Dr Kerry Sink Castle PHJ, 1

is barcoding SANBI to sustainable Research Centre, Cape Town, South Africa

Unlocking foundational marine biodiversity

Foundational Knowledge

The information on the biodiversity of most southern African marine ecosystems is limited. The development of comprehensive databases is therefore critical to support the effective monitoring of marine ecosystems and species for the implementation of evidence-based policy and conservation management for sustainable use. The SEAKEYS project funded by the DST/NRF/SANBI Foundational Biodiversity Knowledge and Information research funding Programme (FBIP) therefore aims to unlock fundamental biodiversity information using DNA barcoding to generate species records and distribution databases for priority ecosystems and groups.

To describe and undertake associated generic (DNA barcoding), systematic and ecological research for:

- **Priority taxa:** harvested, habitat forming, indicator, threatened and potentially invasive species.
- **Priority ecosystems:** with key ecosystem services and those that are particularly sensitive to fishing, mining and other impacts.

The research aims to support biodiversity assessments and evidence-based decision making and effective marine biodiversity.

DNA barcodes of 573 specimens of coastal marine fishes and invertebrates from 128 nominal species

Collected from the cool-temperate, warm-temperate and sub-tropical bioregions and offshore (Agulhas Bank) in South Africa, mascarene plateau and Inhaca Island in southern Mozambique.

These species included invasive, commercially important, rare, threatened and endangered species. Average COI sequence divergences within species, genera and families were moderate to high at 1.76%, 20.0% and 23.5% respectively.

The barcode-gap analysis indicated that 14 species were indistinct, while 23 had high intraspecific distances (>2%) due to either deep divergences or cryptic speciation.

An additional 12 species had very low interspecific variation suggesting misidentifications or a need for taxonomic evaluation.

The 138 Barcode Index Numbers (BIN) identified included 93 concordant assignments.

17 singleton specimens that will require more sampling for species verification.

High levels of genetic variation

Taxonomically discordant BINS (28) with good sample sizes (5-65 samples) were re-analysed and corrected using the DNA barcode.

**Example:** Genetic variation of Gymnothorax undulatus (Anguilliformes: Muraenidae) in the WIO

G. undulatus is an Indo-Pacific species defined by presence of irregular brown rectangular spots with reticulated pattern.

Taxonomic status is unclear and the species is highly misidentified and confused with other Indo-Pacific species.

This was observed in both DNA barcode data and morphological analysis.

**RESULTS**

- **DNA barcoding of 573 specimens of coastal marine fishes and invertebrates from 128 nominal species**
- **Collected from the cool-temperate, warm-temperate and sub-tropical bioregions and offshore (Agulhas Bank) in South Africa, mascarene plateau and Inhaca Island in southern Mozambique.**
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- **The 138 Barcode Index Numbers (BIN) identified included 93 concordant assignments.**
- **17 singleton specimens that will require more sampling for species verification.**

**SIGNIFICANCE**

- **Southern African marine taxa are very diverse, with more species to be discovered.**
- **BINs are higher than the number of identified species.**
- **The voucher specimens from this study will be critical in linking all new and unclear BIN clusters to species and new descriptions.**
- **Thus more holotype and type locality barcodes will become vital.**
- **Barcodes consistent with good morphological identifications for species.**
- **Therefore, this project will contribute towards the estimation of marine biodiversity in South Africa.**

**Funding Sources/Acknowledgements**

1. DST/NRF/SANBI Foundational Biodiversity Knowledge
2. Dr Kerry Sink – SANBI
3. Yonela Sithole (MSc)
4. BOLD team
5. DNA Zoo

**References**


**Figure 1:** Summary of taxa analysed from SeaKeys project. Graph show diversity among fishes (e.g. endemic species of Carolforgiobius).

**Figure 2:** DNA barcoding (COI) ML tree and WIO colour morphs of G. undulatus in the WIO (Top: South Africa, Middle: Seychelles, Bottom: FISHBASE distribution map.

**SEAKEYS:** unlocking foundational marine biodiversity knowledge in South Africa using DNA barcoding

1. Monica Mwale, 2Geoff Gouws, 3J Landschoff, 4UA Toms, 5CL Griffiths and 6K. Sink

1National Zoological Gardens of South Africa, PO BOX 754, Pretoria 0001, South Africa
2South African Institute for Aquatic Biodiversity, P/Bag 105, Grahamstown, South Africa
3South African National Biodiversity Institute, Kirstenbosch Research Centre, Cape Town, South Africa

**ABSTRACT**

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