Assessing the Conservation Status and Occurrence Records of Sub-Saharan African Freshwater Molluscs: Gaps and Patterns

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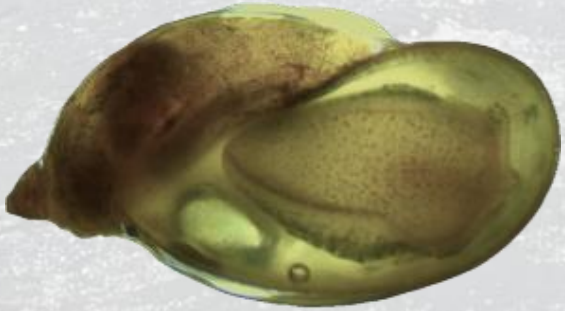
Freshwater Molluscs

- Unsegmented soft bodied animals found within a shell
- Bioindicators of ecosystem health
- Receives less attention in conservation efforts
- Most at-risk freshwater taxa globally due to:
  - Habitat loss
    - Climate change
    - Water pollution
  - Invasive species



IUCN Red List & Freshwater Molluscs

- Assesses extinction risk, identifies threatened species, and guides conservation
- Most powerful conservation tool
- Uneven taxonomic coverage:
  - Only 68% of vertebrates and <3% of invertebrates, plants, and fungi assessed
- 1 in 6 assessed species lacks sufficient data but face higher extinction risk
- DD species mainly due to taxonomic uncertainty and lack of distribution data
- Mollusca populations are in a general downward trend

Genetic Research for Biodiversity

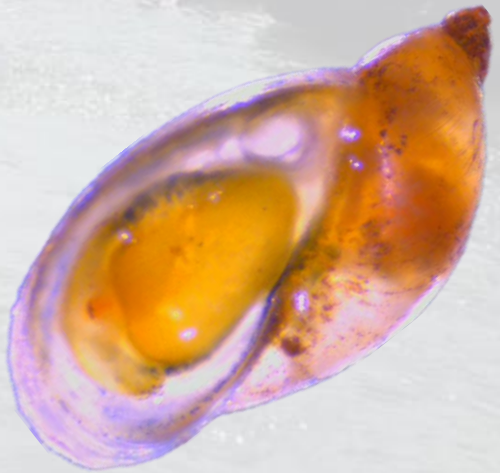
- COI mitochondrial gene enhances species identification and resolves taxonomic ambiguities
- DNA barcodes serve as unique genetic markers for species worldwide
- DNA barcoding in molluscs receives less attention than invertebrates
- Mollusc research is biased towards Europe & North America, leaving critical knowledge gaps in African ecosystems

Research Gap & Needs

The conservation status (red listing) of aquatic invertebrates, such as freshwater molluscs, in African countries face notable limitations:

- Distribution data
- Availability of molecular information
- Adequate taxonomic identification

- Red list data of African freshwater molluscs are outdated
- The effects of threats on African freshwater molluscs are not well researched



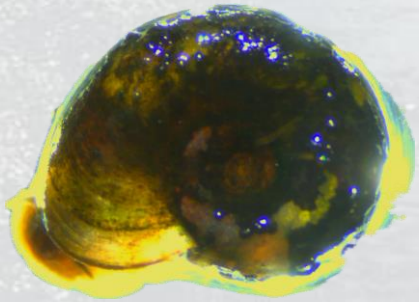
Project Scope & Goals

Scope

Undertake a comprehensive gap analysis on the availability of occurrence records, conservation status and genetic barcode COI for the freshwater mollusc species within Sub-Saharan Africa

Goals

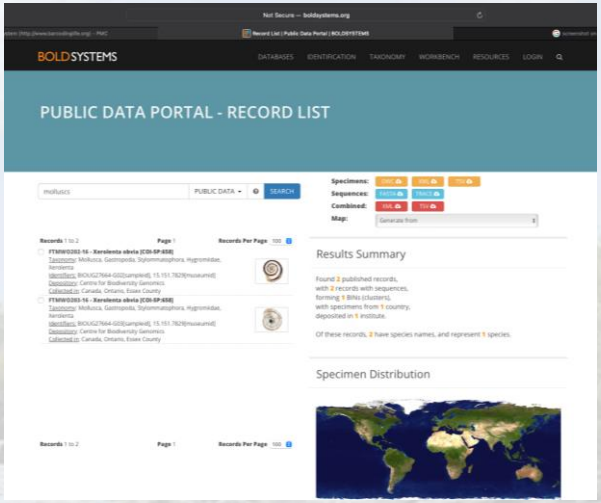
- Assess the availability and taxonomic status of occurrence records
- Examine the IUCN Red list status
- Analyse the availability of genetic barcodes
- Identify the main challenges of conservation assessments



Data Collection

Occurrence data

- Preserved specimens from Global Biodiversity Information Facility (GBIF)



Red List Status

- IUCN Red list data for all African molluscs

Molecular Availability

- Barcode of Life Data System (BOLD) version 4
- GENBANK
  - Cytochrome Oxidase I (COI)
  - Barcode Index Numbers (BINS)

Data Processing

Occurrence data

- 408,990 total records for mainland Africa
- Marine records excluded
- Records reduced to 36,927 for Sub-Saharan Africa
- Four classes used:
  - Freshwater / Brackish record
  - Incomplete records
  - Terrestrial inconclusive
  - Marine inconclusive
- Classification based on MolluscaBase descriptions
- Compiled species list of each country

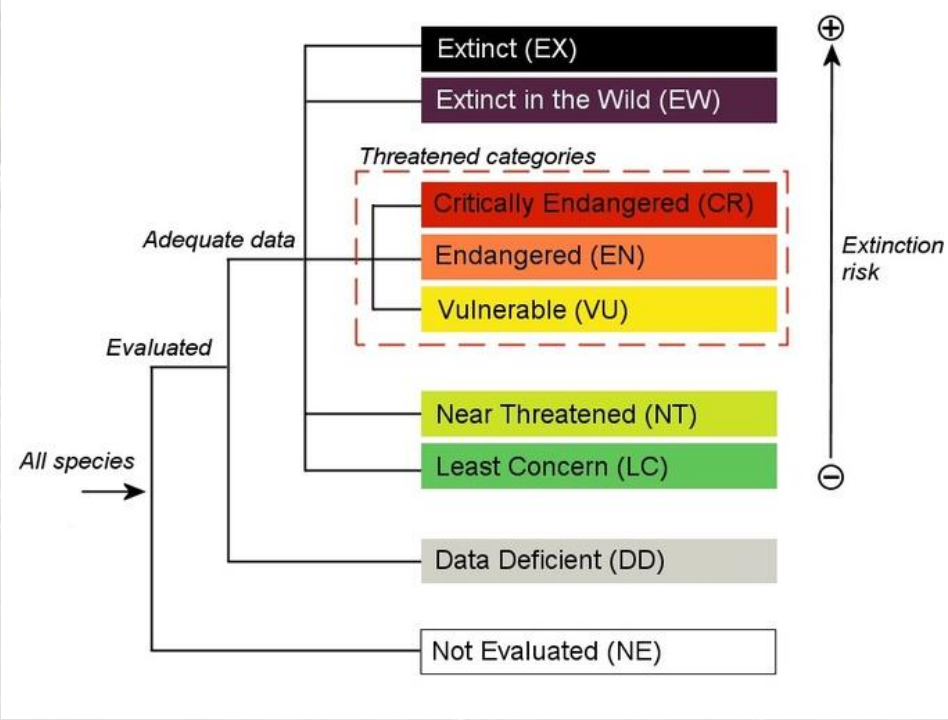
Data Processing

Molecular Availability

- Genus used for queries
- Results placed into three classes:
  - Available
  - Unavailable
  - Inconclusive

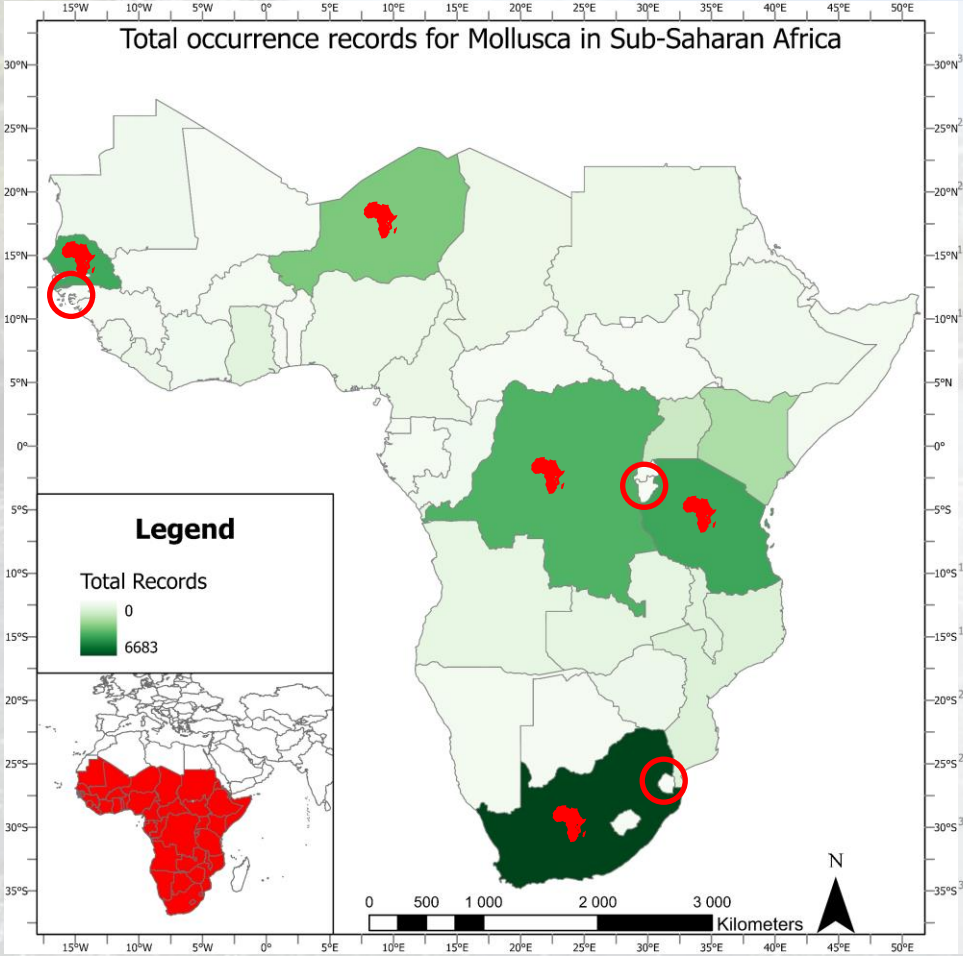
Red List Status

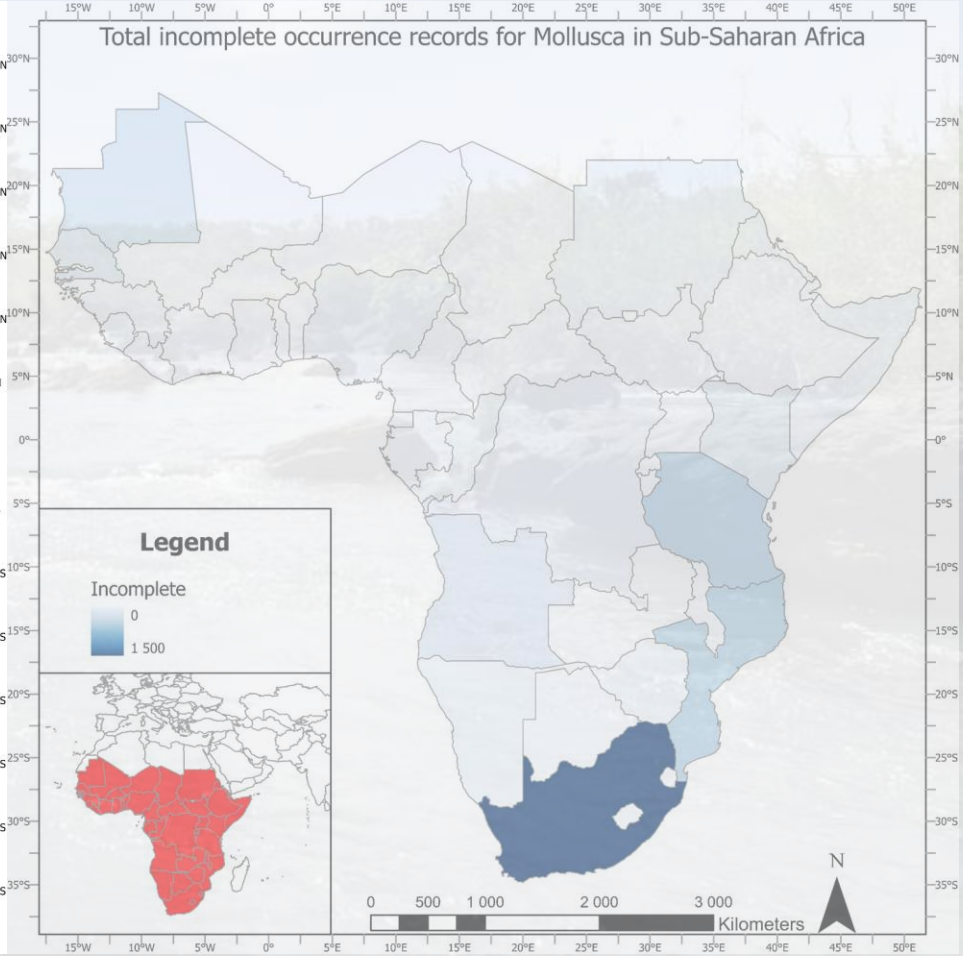
- 9 Classes used from red list status
- Standard colour codes used
- Status matched to species list



Total vs Incomplete Records

- No correlation between Total Records and Incomplete Records
- 11% of all records incomplete





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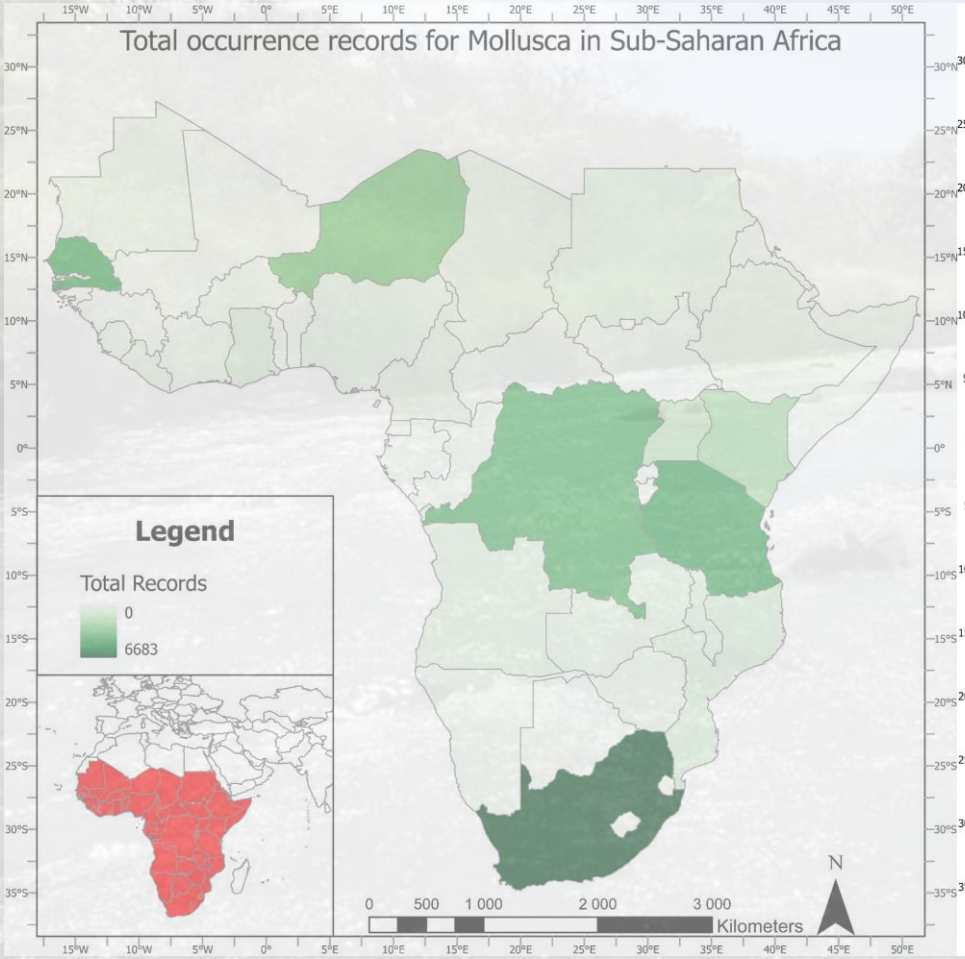
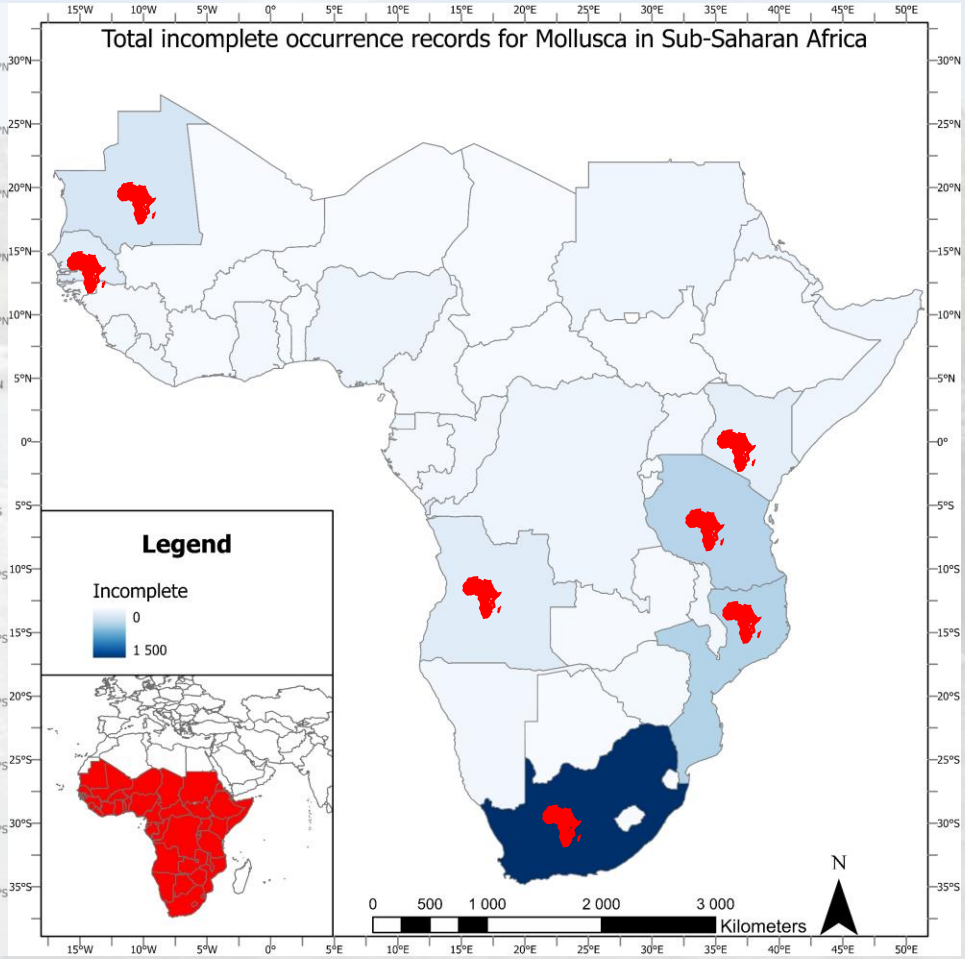
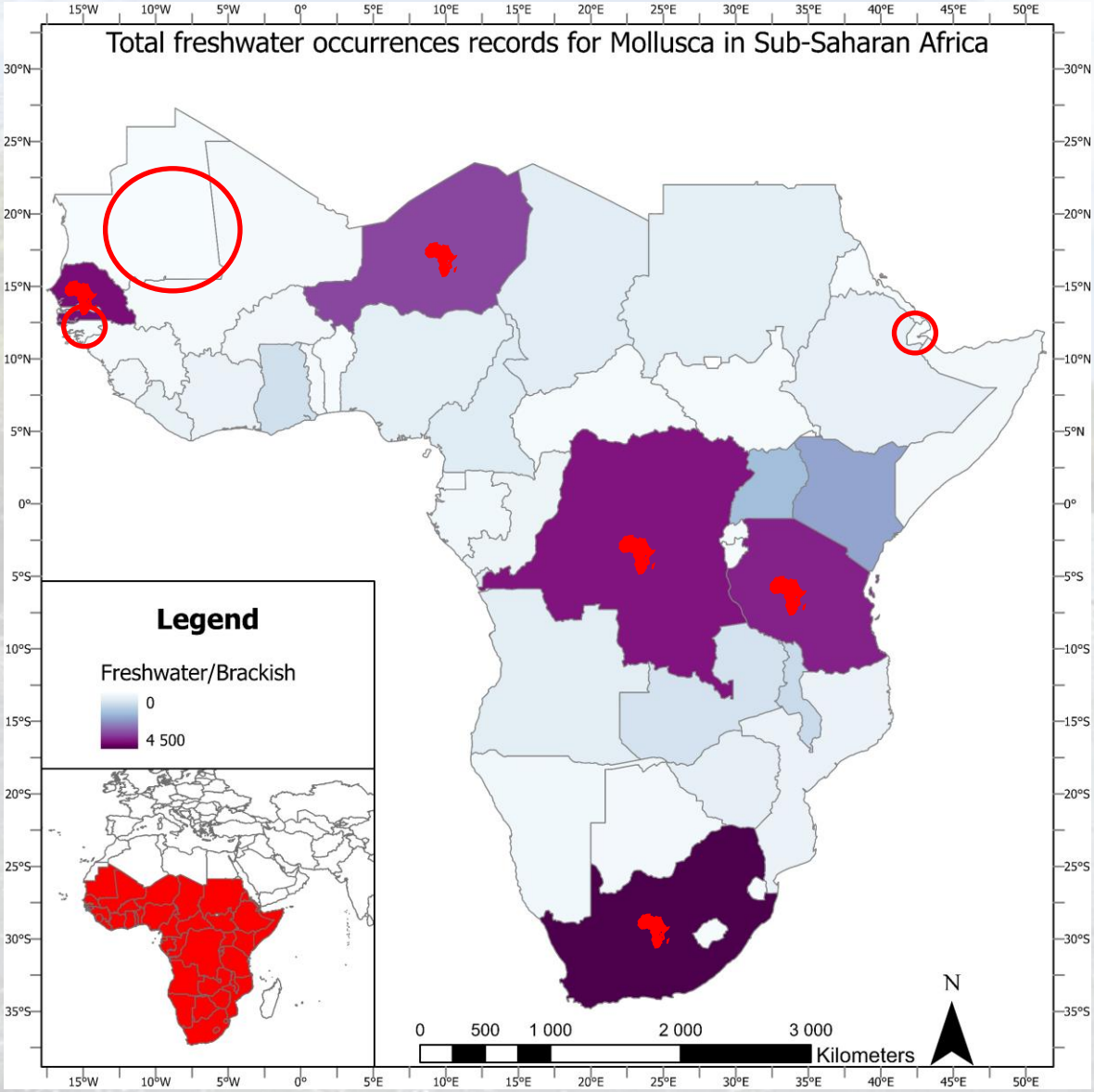




Freshwater Records



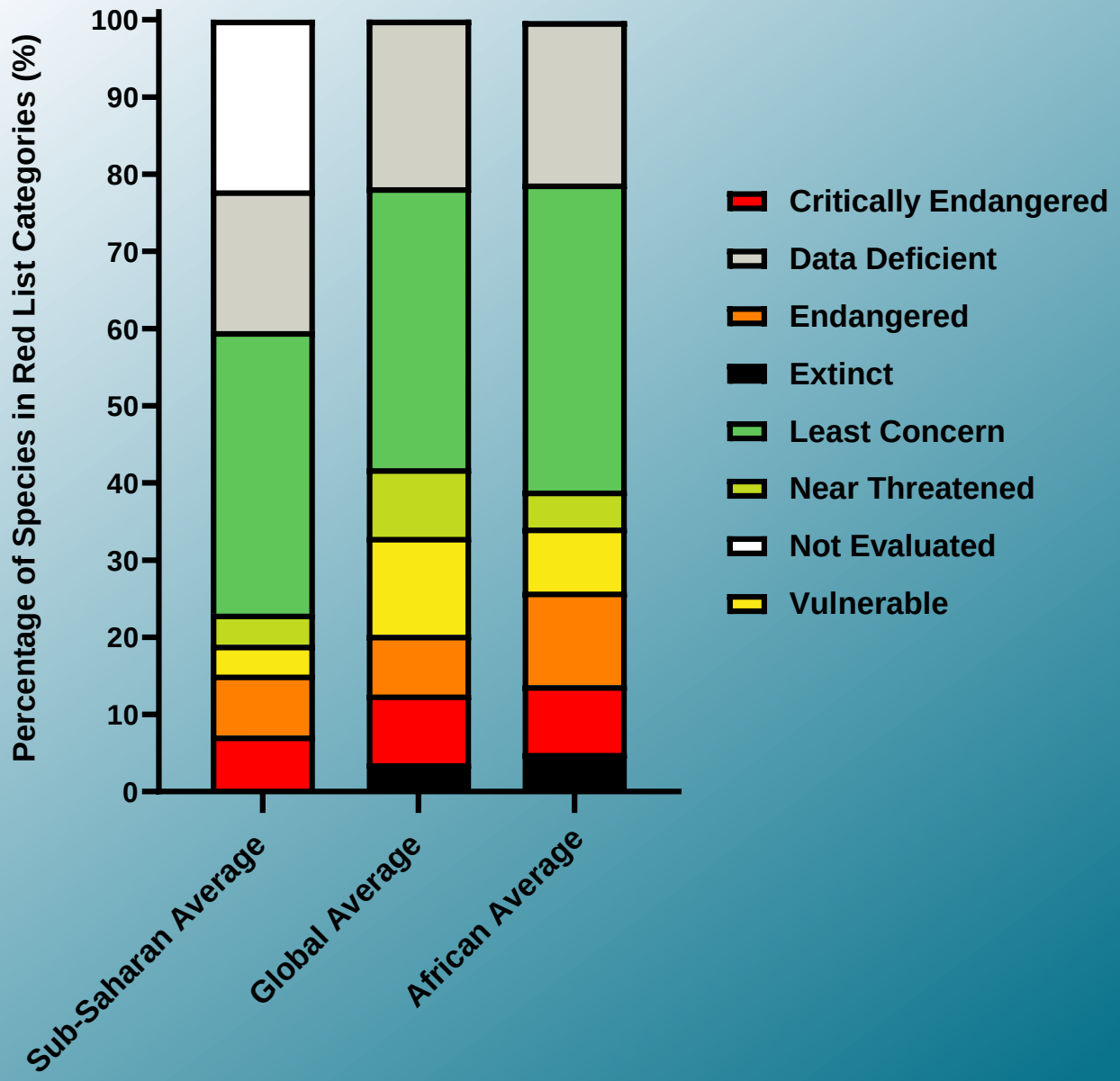
Most records

- South Africa
- Senegal
- DRC
- Tanzania
- Niger

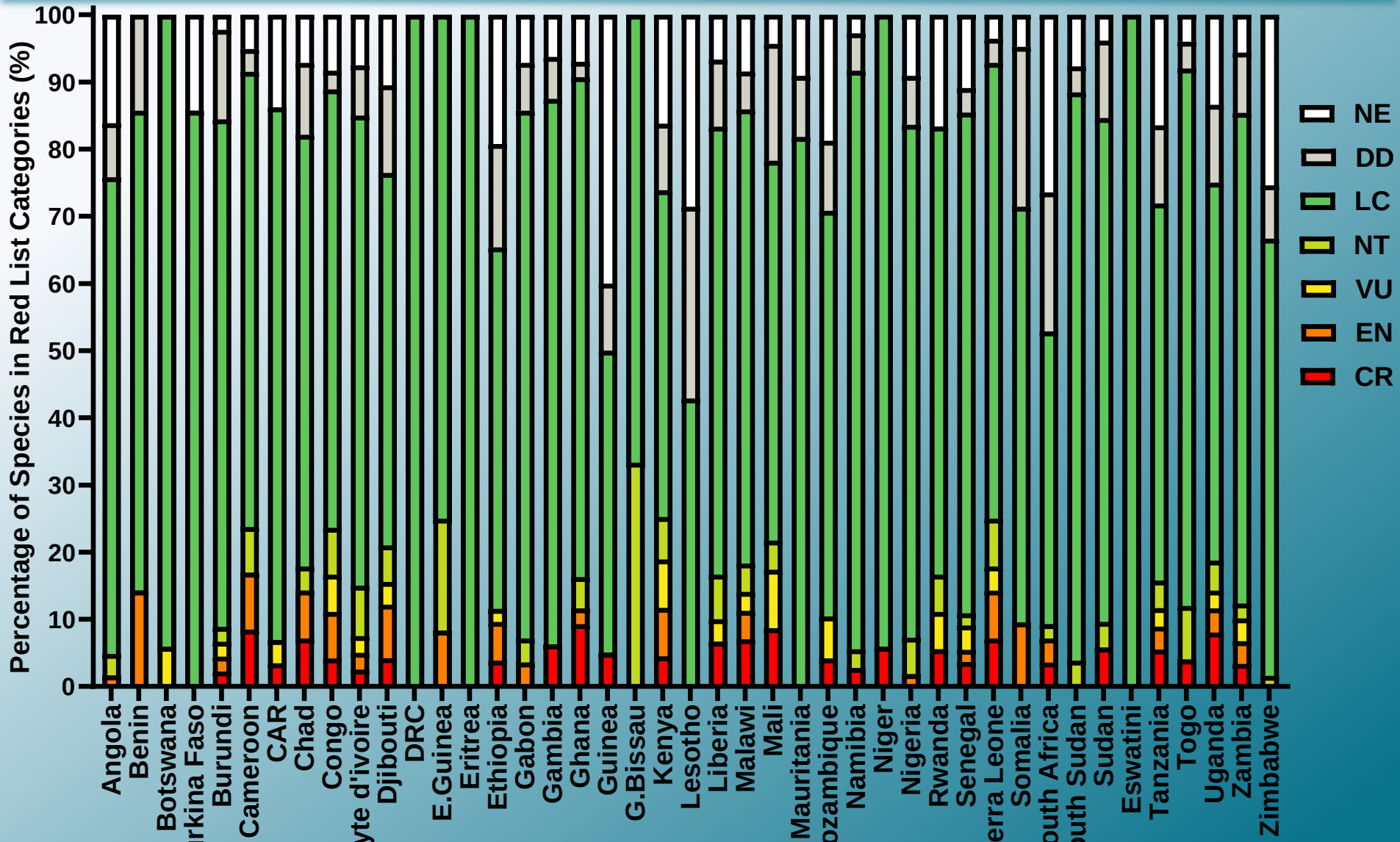
Least records

- Guinea Bissau
- Mauritania
- Djibouti

Global vs African Classification

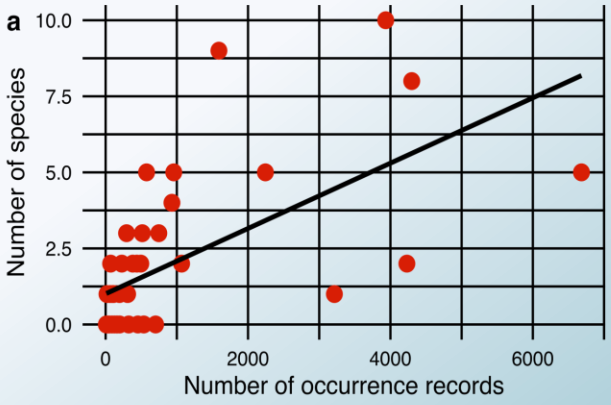


Red list Status

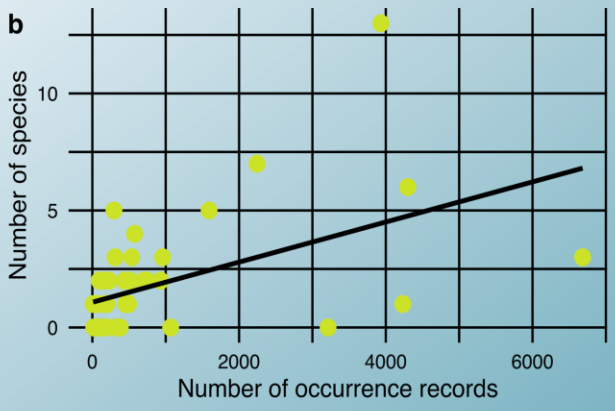


Trends

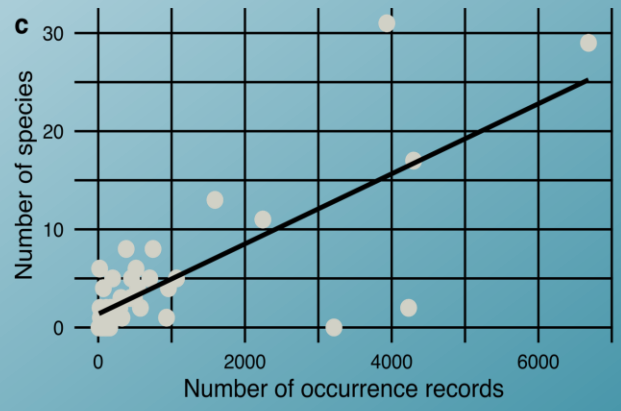
Number of species in IUCN classes versus total number of occurrence Records



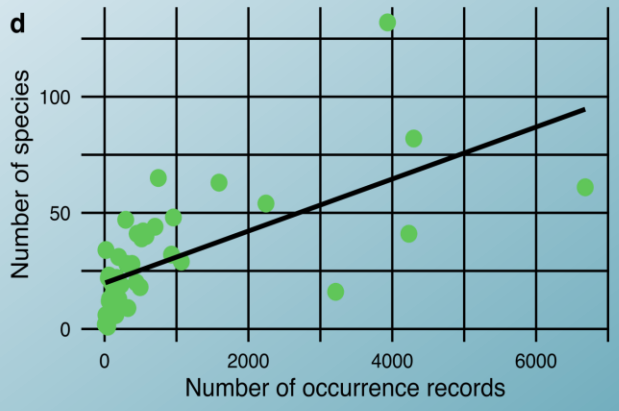
Classification	R^2	P-value
Critically Endangered species	0.387	<0.0001



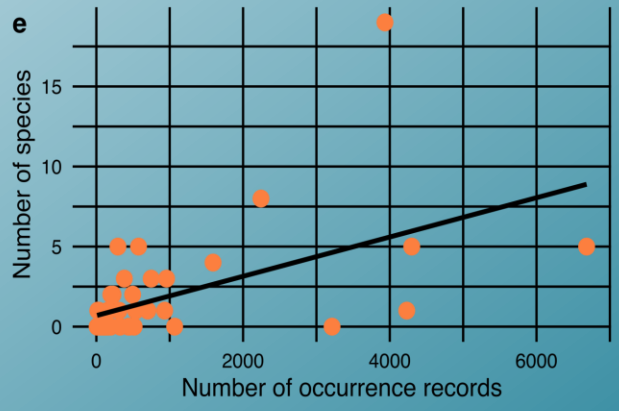
Classification	R^2	P-value
Near Threatened species	0.255	0.0006



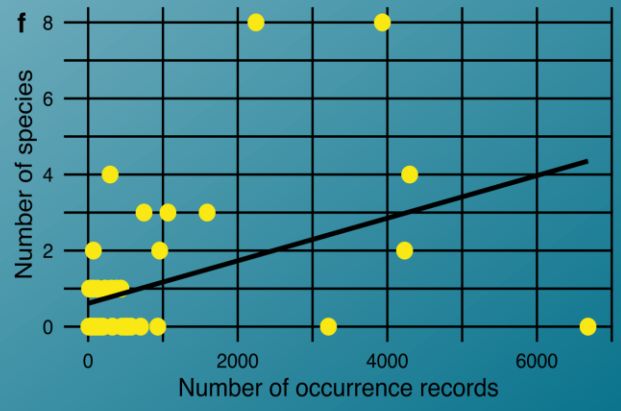
Classification	R^2	P-value
Data Deficient species	0.583	<0.0001



Classification	R^2	P-value
Least Concern species	0.419	<0.0001

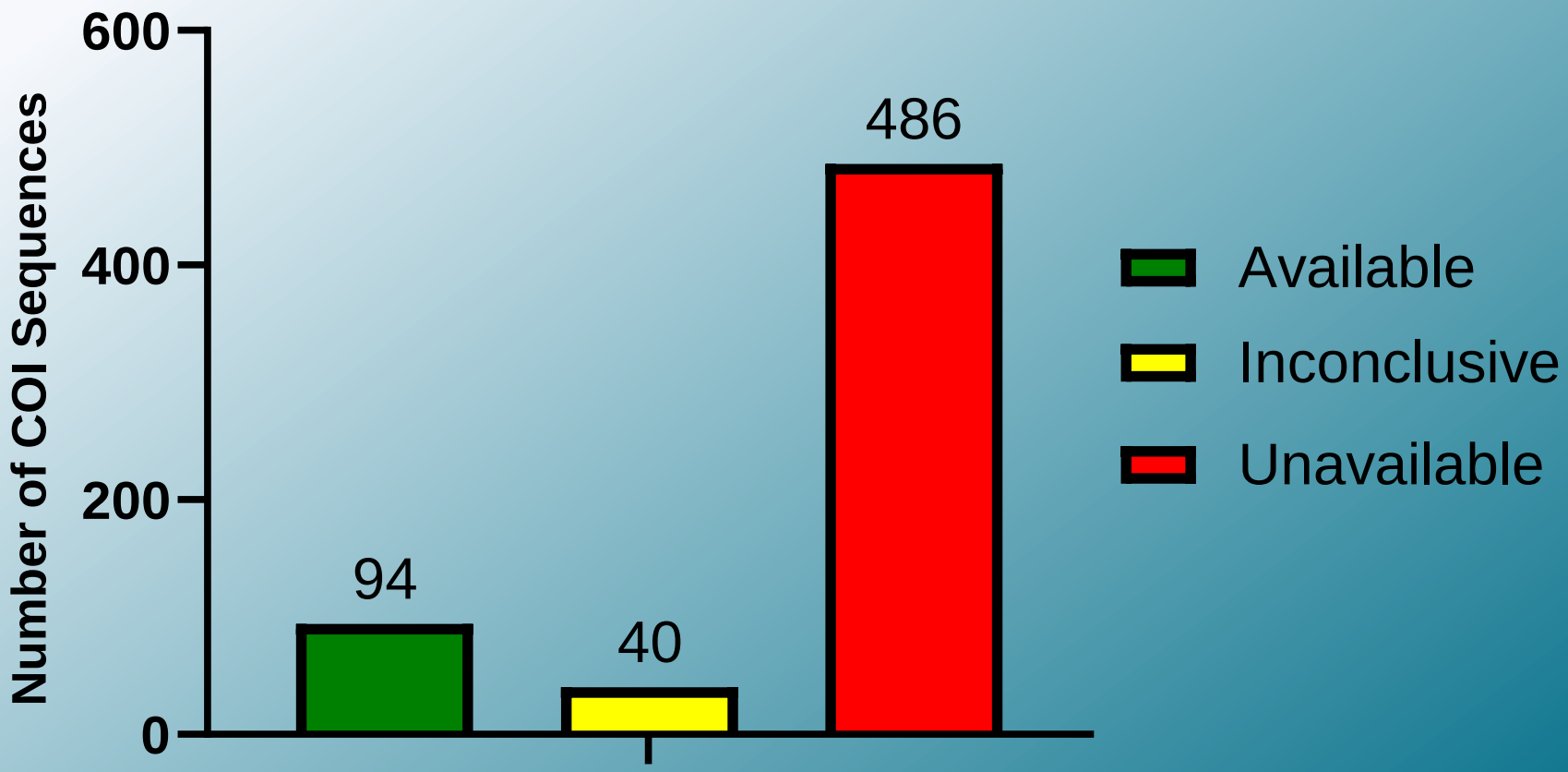


Classification	R^2	P-value
Endangered species	0.292	0.0002



Classification	R^2	P-value
Vulnerable species	0.179	0.0047

Molecular Availability



What does this mean?

Conservation Status & Knowledge Gaps

- Significant knowledge gap exists on the conservation status and occurrences of Sub-Saharan African freshwater molluscs
- Gaps due to historical reliance on shell morphology for taxonomy
- Many regions in Africa remain unexplored; potential for new species discoveries

Need for Genetic Data & COI Barcoding

- High biodiversity but limited genetic data hampers conclusive species identification
- Filling COI barcode gaps would improve species monitoring and conservation efforts

Thank you