An annotated checklist of molluscs recorded from Botswana

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Boikhutso Lerato Rapalai
University of Western Australia
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An annotated checklist of molluscs recorded from Botswana

Boikhutso Lerato Rapalai

Botswana National Museum, 331 Independence Avenue, Gaborone, Botswana
School of Biological Sciences, University of Western Australia, 35 Stirling Highway, Crawley, Perth, WA, Australia
E-mail: blmokotedi13@gmail.com, boikhutso.rapalai@research.uwa.edu.au
OCRID: https://orcid.org/0000-0002-3773-779X

ABSTRACT

Molluscs offer ecological services crucial for ecosystem functioning and integrity, yet they are often insufficiently studied and omitted in conservation planning and decision-making. In Botswana, information on malacofauna is scarce and exists in fragmented and mostly poorly accessible sources. The first comprehensive and annotated checklist of the mollusc fauna recorded from Botswana is presented, based on data of specimens collected and/or observed from 1854 to 2023. The information for compiling the checklist has been extracted and collated from published literature (scientific articles, technical reports and books), online databases and unpublished museum collections. The checklist comprises 63 native species (13 bivalves, 24 freshwater snails, 24 land snails and two slugs) in 43 genera and 21 families. The checklist highlights the occurrence of four introduced species in Botswana, *Cornu aspersum*, *Lissachatina fulica*, *Physella acuta* and *Radix auricularia*, which are potentially invasive and of economic concern. The article summarises updated information on the species taxonomy, distribution, habitats, conservation rank, and on the epidemiological status of species of the medical and veterinary importance. The checklist provides a solid baseline for the national species inventories, future research and biodiversity conservation in Botswana, and emphasizes the urgent need for broader field surveys across the country.

KEYWORDS: Biodiversity, Bivalvia, Gastropoda, Mollusca, Afrotropics, Botswana, Southern Africa, checklist, inventory.

INTRODUCTION

Mollusca, represented on continents by bivalves and gastropods, is the second most diverse invertebrate phylum in the Kingdom Animalia (Kershaw 1983). To date, the species diversity of molluscs is estimated to be 200,000 (Parkhaev 2017), with speculations that more species remain undiscovered to science.

Molluscs play critical roles in ecosystem functioning by providing ecological services such as water purification (Cummings *et al.* 2016), calcium cycling (Jordan & Black 2012) and facilitating microbial growth in the soil (Meyer *et al.* 2013). In addition to their ecological value, molluscs are economically important as food (Tanyitiku 2022), agricultural pests (Port & Ester 2002), in medicine (Benkendorff 2010; Ahmad *et al.* 2018), as well as disease vectors of medical and veterinary significance (Barker 2001). Having said that, comprehensive inventories of malacofaunas remain scant (Lopes-Lima *et al.* 2021; Miyahira *et al.* 2022), especially in developing countries (Koudenoukpo *et al.* 2020), where biodiversity research is impeded by lack of resources such as funding, research facilities and expertise (Barber *et al.* 2014; Miyahira *et al.* 2022). This knowledge gap hinders the understanding and maintenance of the overall biodiversity at both the species and ecosystem levels, as faunal inventories are crucial for monitoring species richness, population trends and for improving sustainable land management (Lo Brutto 2023).

The Republic of Botswana is a developing landlocked country situated in Southern Africa. It shares borders with Namibia on the west, Zambia on the north, Zimbabwe on the east, and South Africa on the south (Fig. 1), with an estimated surface area of 582,000 km^2 (Kampamba *et al.* 2019). The country's climate is semi-arid to arid, and the mean annual rainfall ranges from over 650 mm in the north-east, to less than 250 mm in the south-west (Zumer-Linder 1976). Botswana comprises seven internationally recognised sections of land known as terrestrial ecoregions (DEA 2015) defined as vast areas of land 'containing geographically distinct assemblages of natural communities and species' (Olson *et al.* 2001; Dinerstein *et al.* 2017; Ecoregions 2024). From north to south, these are: (1) Zambezian Baikiaea Woodlands, (2) Zambezi Flooded Grasslands, (3) Zambezian Mopane Woodlands, (4) Kalahari Acacia Woodlands, (5) Makgadikgadi Halophytics, (6) Central Bushveld, and (7) Kalahari Xeric Savanna.

Terrestrial ecoregions of Botswana feature diverse habitats and ecosystems. The Zambezian Flooded Grasslands in north-west Botswana boast the Okavango Delta, Africa's largest inland wetland system (Moliner Cachazo *et al.* 2023), the world's largest Ramsar site and the Botswana's second World Heritage Site (Mosepele & Mosepele 2021). Fed by the Okavango River from Angola (Steudel *et al.* 2013), the Okavango Delta supports a unique diversity of terrestrial and aquatic species (Mosepele & Mosepele 2021; Moliner Cachazo *et al.* 2023). The Zambezian

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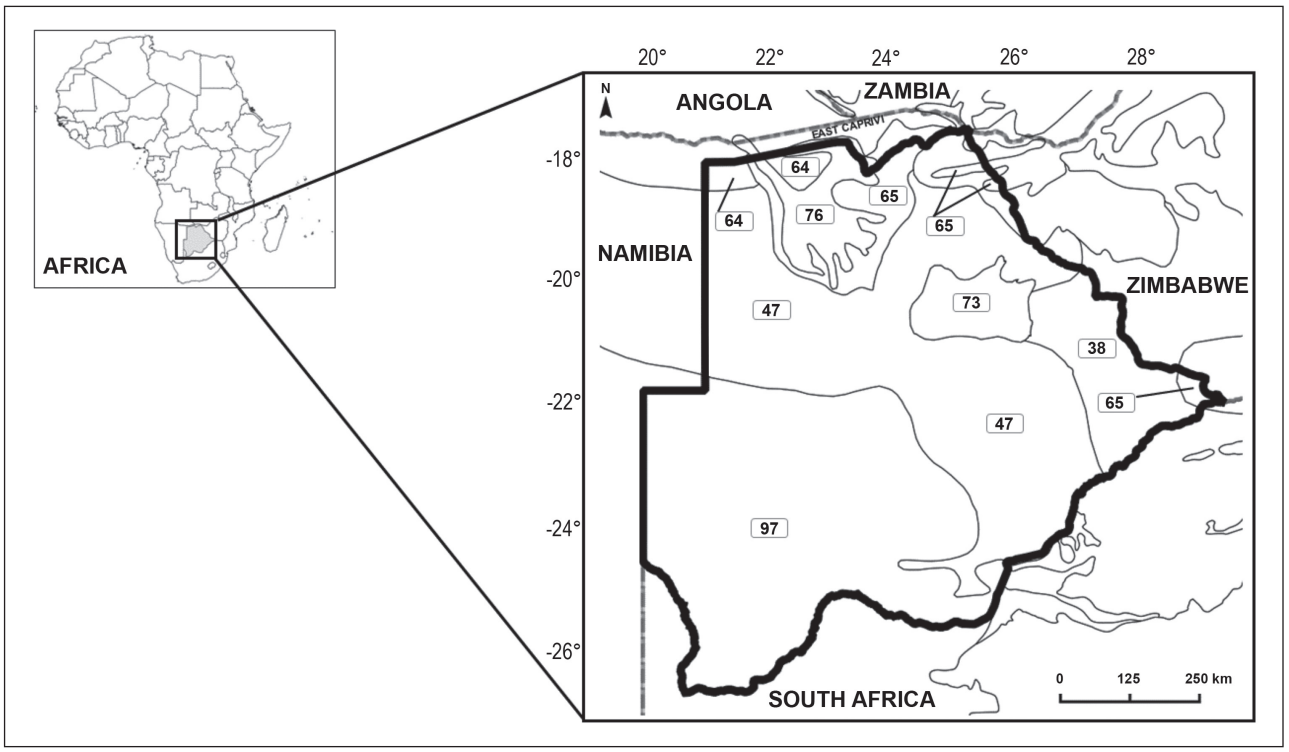

Figure 1: Seven ecoregions of Botswana, denoted by ecoregion codes (after Dinerstein *et al*. 2017; Ecoregions 2024): (38) Central Bushveld, (47) Kalahari Acacia Woodlands, (64) Zambezian Baikiaea Woodlands, (65) Zambezian Mopane Woodlands, (73) Makgadikgadi Halophytics, (76) Zambezian Flooded Grasslands, and (97) Kalahari Xeric Savanna.

Mopane Woodlands are dominated by mopane trees (*Colophospermum mopane* (J. Kirk ex Benth.) J. Léonard) and cover a small portion of eastern Botswana and Okavango Delta peripheries (Burgess *et al.* 2004). The Zambezian Baikiaea Woodlands in northern Botswana are deciduous forests characterised by Zambezi redwood (*Baikiaea plurijuga* Harms) (Burgess *et al.* 2004). This ecoregion harbours the Chobe–Linyanti–Kwando system, a complex of rivers along the Namibian East Caprivi featuring a hydrological connectivity between Namibia's Kwando River and Botswana's Linyanti Swamp and Chobe River (Schlettwein *et al.* 1991; Brown *et al.* 1992). As the name suggests, the Makgadikgadi Halophytics is located in the Makgadikgadi Pans, the dry saline remnants of what was once a massive ancient lake (Baillieul 1979), receiving seasonal inflow from the Boteti and Nata rivers (Burgess *et al.* 2004). The semi-arid Kalahari Acacia Woodlands span northwest to central Botswana around the Makgadikgadi Pans (Burgess *et al.* 2004), nestled in the Kalahari and featuring isolated granite hills such as Tsodilo, Koanaka and Aha (Isaacs & Stephens 2022). The Kalahari Xeric Savanna ecoregion is characterised by sand dunes and open savanna in the semi-arid south-western Botswana (Burgess *et al.* 2004). The Central Bushveld, in south-eastern Botswana, is characterized by mopane woodlands, grasslands, and seasonal rivers such as Lotsane and Motloutse, tributaries of the Limpopo River flowing along the Botswana–South Africa–Zimbabwe border (Zhu & Ringler 2012).

Botswana's unique habitats and ecosystems potentially harbour a wide diversity of molluscs. Yet, the true extent of this biodiversity remains largely unknown, and there are significant gaps in our understanding of Botswana molluscs (e.g. Seddon *et al.* 2011: fig. 4.2). For instance, the fifth Botswana National Report to the United Nations Convention on Biological Diversity notes a significant data deficiency in mollusc inventories, reporting only five species: four gastropods and one bivalve (DEA 2015). Such knowledge gaps hinder effective conservation efforts, as the available data are not comprehensive enough to be included in policy devising and decision-making.

Although there are evident knowledge gaps regarding Botswana molluscs, notable attempts have been made on documenting species inventories, with the earliest significant work conducted by Matthew Connolly in the early 20th century. Connolly reported a total of 26 species while reviewing the sub-Saharan African non-marine mollusc biodiversity south of the Kunene and Zambezi River systems (Connolly 1912; 1939). From the early 1960s, van Bruggen, then employed by the Natal Museum in South Africa, also contributed to Botswana malacological research by recording a total of 23 freshwater and 16 terrestrial species from Botswana (van Bruggen 1963; 1966*a*). Towards the end of the 20th century, a few more inventories of Botswana molluscs were compiled, such as bivalves of south-central Africa (Appleton 1979), freshwater snails of Southern Africa and/or

Africa (Brown & Kristensen 1989; Brown 1994) or a combination of both freshwater bivalves and gastropods of Southern Africa (Appleton 1996; 2002). Further research work took into account the neighbouring Namibia, for geographic relevance of species occurrences in a transboundary habitat along the East Caprivi and Okavango River basin (Brown *et al.* 1992; Curtis 1998; Appleton & Curtis 2007). However, there has not been a single study focused exclusively on Botswana, save for biodiversity surveys of the freshwater invertebrates of the Okavango Delta (Jansen van Rensburg 2001; Appleton *et al.* 2003; Dallas & Mosepele 2007).

Cataloguing the Botswana malacofauna faces a few challenges that occur in the available data. First, several publications containing mollusc inventories of Botswana deal with outdated nomenclature. Second, there is lack of information on the conservation status of the species, particularly in the International Union for Conservation of Nature (IUCN) Red Data Listing. Such information is crucial for advancing conservation actions and prioritising species of high conservation concern. Third, where the data exist, they are not easily and fully accessible to end-users being scattered across fragmented sources of information (e.g., published scientific articles, technical reports, book chapters, museum collections, online databases etc.). For instance, additional records and confirmation of mollusc species from Botswana are only available from publications focusing on molluscs of other countries, e.g., Angola (Graf & Cummings 2006), South Africa (van Bruggen 1966*b*; Brown 1967; van Bruggen & Appleton 1977; Govender 2007) and Namibia (van Bruggen 1980). Although data available on online platforms such as the Global Biodiversity Information Facility (GBIF) are prone to contain taxonomic misidentifications (Maldonado *et al.* 2015), such data may still be used with some caution and caveats for compiling species inventories.

Unquestionably, there is need for a comprehensive checklist, with updated nomenclature and the IUCN Red Listing statuses. Accordingly, this study intends to contribute to closing knowledge gaps surrounding Botswana mollusc biodiversity. The overall goal of this work is to present a checklist of molluscs of Botswana, compiled by collating species records and/or observations from the earliest possible date.

MATERIALS AND METHODS

Data from published literature

Searching was executed on Scopus and Google Scholar, using the key phrases like ‘molluscs AND checklist AND Botswana’, ‘molluscs AND Botswana’, ‘molluscs AND Bechuanaland’ ‘snails AND Botswana’, ‘snails AND Bechuanaland’, ‘Bivalves AND Bechuanaland’, ‘slugs AND Botswana’, ‘limpets AND Botswana’, to retrieve published literature on mollusc inventories of Botswana. Upon retrieving publications, a ‘snowballing’ technique (use of references in publications) was employed to obtain additional publications crucial for this research. The paper does not contain species data published after May 2023.

Data from online databases

Data were retrieved from the IUCN Red List of Threatened Species (IUCN 2023), the Mussels Project Online Database (Graf & Cummings 2023) and the GBIF (2023*a*). The IUCN Red List is a global inventory resource that provides information on the conservation status and extinction risk of species (IUCN 2023). The Mussels Project Online database shows records from preserved mussel specimens kept at natural history museums across the globe (Graf & Cummings 2023). The GBIF serves as a global network that facilitates free and open access to biodiversity data (e.g., species occurrence) from around the world (Chapman 2005). The GBIF Occurrence dataset (GBIF 2023*b*) on Botswana molluscs was downloaded and contained 371 occurrence records. These referred to specimen collections housed at natural history museums and research institutions, as well as observation records from the iNaturalist social network. For iNaturalist records, specimens were considered authoritatively identified if they showed a ‘Research-Grade’ status. For each species record, MolluscaBases database was employed to verify taxonomic information such as current name combination, synonyms, type locality, habitat type and any dubious records (MolluscaBase 2023).

Data from natural history institutions

To supplement information from published sources and online databases, data were also requested directly from natural history institutions keeping mollusc collections from Botswana: KwaZulu-Natal Museum, Pietermaritzburg, South Africa (NMSA 2023), Albany Museum, Makhanda, South Africa (AMGS), National Museum of Namibia, Windhoek, Namibia (SMWN 2024), Natural History Museum, London, UK (NHMUK) and Naturalis Biodiversity Center, Leiden, The Netherlands (RMNH.MOL). With regards to invertebrates, the Botswana National Museum specialises in insects and arachnids and does not host a mollusc collection.

It should be born in mind that species identity of unpublished records sourced from the above depositories could not be always verified due to the shortage of taxonomic expertise in Southern Africa.

Notes

Records of species from transboundary freshwater basins are meaningful for establishing species ranges. For the purpose of creating a biogeographically com-

prehensive list of taxa, the arbitrary political boundaries of Botswana are relaxed and species from transboundary freshwater basins are included even if they have not been recorded directly from Botswana. For instance, species recorded by Brown *et al.* (1992) from the Kwando River and Chobe River (near Ihaha and Ngoma) in the East Caprivi (Namibia) are included in the Botswana checklist.

Presentation of the species checklist

The class, order, family and species names are arranged in the alphabetical order. This list contains only mollusc taxa with the species-level identification. Each species account is presented in the following format:

Genus species **Author, year** [authors' names and years appear in parentheses when the species binomina are not the original combinations (ICZN 1999: Art. 53.1)].

Distribution and year: Information on the distribution and the year the species was recorded in Botswana. 'N/A' is used when the date is not available. Where applicable, voucher/catalogue numbers are provided in squared brackets.

Geographic range: An alphabetical list of African countries where the species occurs. For introduced species, 'Native range' and 'Extent of invasion' are used.

Habitat: Information on whether the species is found in a freshwater or a terrestrial habitat.

Notes: Remarks on the species (e.g., biology, ecology, endemism, economic importance etc.).

Type locality: The geographic location where the name-bearing type of a particular species was originally discovered, collected or observed (ICZN 1999: Art. 76). Where necessary, historical names are given in quotation marks in addition to current names.

Source(s): Publications specifically citing the distribution of the species in Botswana, with page numbers, where applicable.

Conservation status: Information on the IUCN Red Data Listing for indigenous species.

Institutional acronyms

AMGS – Albany Museum, Makhanda [Grahamstown], South Africa;
ANSP – The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA;
BMSM – Bailey–Matthews National Shell Museum, Sanibel, FL, USA;
DMNH – Delaware Museum of Nature and Science, Wilmington, DE, USA;
ETD – Experimental Taxonomy Division of the British Museum (Natural History) [Natural History Museum, London], London, UK;
FMNH – Field Museum of Natural History, Chicago, IL, USA;
LACM – Natural History Museum of Los Angeles County, Los Angeles, CA, USA;
MCZ – Museum of Comparative Zoology, Cambridge, MA, USA;
RMNH – Naturalis Biodiversity Center, Leiden, The Netherlands;
NCSM – North Carolina State Museum of Natural Sciences, Raleigh, NC, USA;
NHMUK – Natural History Museum, London, UK;
NHMR – Natural History Museum Rotterdam, The Netherlands;
SAMC – Iziko South African Museum, Cape Town, South Africa;
SMWN – National Museum of Namibia, Windhoek, Namibia;
TMSA – Transvaal Museum (currently Ditsong National Museum of Natural History), Pretoria, South Africa;
FSMC – Florida Museum of Natural History, University of Florida, FL, USA;
USNM – National Museum of Natural History, Washington, DC, USA.

RESULTS
Species accounts

The checklist provides information on 63 native and four introduced species.

Indigenous species

Class Bivalvia Linnaeus, 1758
Subclass Autobranchia Grobben, 1894
Order Sphaeriida Lemer, Bieler & Giribet, 2019
Family Sphaeriidae Deshayes, 1855
Common name: Orb mussels

1. *Euglesa viridaria* (Kuiper, 1956)

Distribution and year: Moremi Game Reserve, Okavango Delta 1984 (Appleton & Curtis 2007); Chief's Island, Okavango Delta 2000 (Appleton *et al.* 2003).

Geographic range: Botswana, Democratic Republic of the Congo, Ethiopia, Kenya, Lesotho, Madagascar, Rwanda, South Africa, Uganda, Zimbabwe.

Habitat: Freshwater.

Notes: The species is endemic to sub-Saharan Africa and more common in the Moremi region of the Okavango Delta (Appleton *et al.* 2003; Appleton & Curtis 2007).

Type locality: In Kenya (Kuiper 1956).

Sources: Appleton *et al.* (2003: 58–68, as *Pisidum* spp.); Appleton & Curtis (2007: 59, as *Pisidium viridarium*).

Conservation status: Least Concern.

2. *Eupera ferruginea* (Krauss, 1848)

Distribution and year: Okavango Delta panhandle at Shakawe [SMWN76994] 1996 (Appleton & Curtis 2007); Upper panhandle, Okavango Delta 2000 (Appleton *et al.* 2003).

Geographic range: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is widespread across Southern Africa (Appleton & Curtis 2007). *Eupera parasitica* and *E. ferruginea* are now considered synonyms (MolluscaBase 2023). Here, all specimen records for *E. parasitica* are classified as *E. ferruginea*.
Type locality: Knysna River, South Africa (Krauss 1848).
Sources: Appleton *et al.* (2003: 58–68, also recorded *E. parasitica* which is now considered a synonym of *E. ferruginea*); Appleton & Curtis (2007: 60); Appleton & Miranda (2015: 136); GBIF (2023*b*).
Conservation status: Least Concern.

3. *Pisidium reticulatum* Kuiper, 1966
Distribution and year: Moremi Game Reserve, Okavango Delta 2000 (Appleton *et al.* 2003).
Geographic range: Botswana, Madagascar, Malawi, Zimbabwe.
Habitat: Freshwater.
Notes: This is highly likely a variable species (Appleton *et al.* 2003) found in rivers and lakes (Van Damme 2018*b*).
Type locality: Nossi-Bé Island, Madagascar (Kuiper 1966*a*).
Sources: Appleton *et al.* (2003: 58–68); Appleton & Curtis (2007: 60).
Conservation status: Least Concern.

4. *Sphaerium capense* (Krauss, 1848)
Distribution and year: Guma Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Gadikwe Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Boro River [SMWN77001] 1996 (Appleton & Curtis 2007); Okavango Delta [SMWN76983] 1996 (Appleton & Curtis 2007).
Geographic range: Botswana, Eswatini, Madagascar, Mozambique, Namibia, South Africa, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The molluscs inhabit calm sandy substrates in lakes, rivers and streams (Van Damme *et al.* 2016). They mostly occur in large densities, usually with the congeneric *Sphaerium incomitatum* (see Appleton & Curtis 2007).
Type locality: In Knysna River, Western Cape Province, South Africa (Krauss 1848).
Sources: Appleton *et al.* (2003: 58–68); Appleton & Miranda (2015: 136); Appleton & Curtis (2007: 57); GBIF (2023*b*).
Conservation status: Least Concern.

5. *Sphaerium incomitatum* (Kuiper, 1966)
Distribution and year: Guma Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Gadikwe Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Boro River, Maun [SMWN77035] 1996 (Appleton & Curtis 2007).
Geographic range: Botswana, Democratic Republic of the Congo, Namibia, South Africa, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is ubiquitous in Southern Africa (Appleton & Curtis 2007). The molluscs are capable of tolerating oxygen deficient freshwater bodies (Van Damme 2011), and usually occur at high densities with the congeneric *Sphaerium capense* (see Appleton & Curtis 2007).
Type locality: McIlwaine Lake outside Harare, Zimbabwe (Kuiper 1966*b*).
Sources: Appleton *et al.* (2003: 58–68); Appleton & Curtis (2007: 58); GBIF (2023*b*).
Conservation status: Least Concern.

Order Unionida Gray, 1854
Family Iridinidae Swainson, 1840
Common name: Toothless River mussels

6. *Chambardia petersi* (E. von Martens, 1860)
Distribution and year: Limpopo River, Stevenford Game Reserve 1984 (Appleton & Curtis 2007).
Geographic range: Botswana, Eswatini, Malawi, Mozambique, South Africa, Tanzania, Zimbabwe.
Habitat: Freshwater.
Notes: The species is confined to the lower Zambezi, Limpopo and Incomati River catchments (Appleton & Curtis 2007). The molluscs occur in both large and small flowing waterbodies, and are capable of surviving in semi-arid regions (Van Damme *et al.* 2018*a*).
Type locality: In Mozambique (Martens 1860).
Source: Appleton & Curtis (2007: 51).
Conservation status: Least Concern.

7. *Chambardia wahlbergi* (Krauss, 1848)
Distribution and year: Thamalakane River, Maun [ANSP185374] N/A (Graf & Cummings 2023); Nata River, between Maitengwe and Nata police station [TMSA12237] N/A (Appleton 1979; Graf & Cummings 2006); Maitengwe River N/A (Graf & Cummings 2006); Lotsane River, Palapye N/A (Connolly 1939).
Geographic range: Benin, Botswana, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Egypt, Eswatini, Ethiopia, Ghana, Guinea, Kenya, Malawi, Mali, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Zambia, Zimbabwe.
Notes: This is the largest freshwater bivalve species in Africa, comprising six subspecies (Appleton &

Curtis 2007). The molluscs are capable of aestivating for up to two and a half years. Large specimens are used by fishermen as bait (Seddon & Van Damme 2018). There are speculations that this species has never been collected from the Okavango Delta (Appleton & Curtis 2007), but a voucher specimen record from Thamalakane River [ANSP185374] exists in the Mussel Online Project Database (Graf & Cummings 2023).
Type locality: Affen River, a tributary of the Limpopo River, South Africa (Krauss 1848).
Sources: Connolly (1939: 617); van Bruggen (1966*a*: 110, as *Aspatharia (Spathopsisi) wahlbergi*); Brown (1967: 487, as *Aspatharia wahlbergi*); Appleton (1979: 166, as *A. (S.) wahlbergi*); Mandahl-Barth (1988: 68); Graf & Cummings (2006: 180; 2023); Appleton & Curtis (2007: 51).
Conservation status: Least Concern.

8. *Mutela zambesiensis* Mandahl-Barth, 1988
Distribution and year: Boteti River, near Maun [FMNH293190] 1988 (GBIF 2023*b*); Thamalakane River at Maun, Okavango Delta [TMSA1075] 1973 (Appleton 1979); Chief's Island, Okavango Delta 2000 (Appleton *et al.* 2003); Nxaraga/Guma Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003), 2019 (GBIF 2023*b*); Gadikwe Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Savuti River, Chobe National Park 1984 (GBIF 2023*b*); Savuti Channel, 50 miles N Maun [FSMC539364] 1984 (GBIF 2023*b*); San Ta Wani Camp, Okavango Delta [FSMC40445] 1983 (Graf & Cummings 2023).
Geographic range: Angola, Botswana, Namibia, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: These molluscs are treated as a food source in Namibia (Kristensen & Stensgaard 2010). It appears that *M. zambeziensis* specimens were once erroneously identified as *M. dubia* and *M. rostrata* (see Appleton 1979; Connolly 1939). For the consistency sake, it is recommended that all Southern African specimens are assigned the name *M. zambesiensis* (Appleton 2002; Graf, pers. comm. 2023). Here, all Botswana records of *M. rostrata* and *M. dubia* are treated under *M. zambesiensis*.
Type locality: Zambezi River, between Kariba and Chirundu (Mandahl-Barth 1988).
Sources: Appleton (1979: 161, as *M. dubia*); Appleton *et al.* (2003: 58–68); Graf & Cummings (2006: 173; 2023); Appleton & Miranda (2015: 134); GBIF (2023*b*).
Conservation status: Least Concern.

9. *Aspatharia subreniformis* (G.B. Sowerby II, 1867)
Distribution and year: Thamalakane River, Maun [ANSP185375] 1984 (Graf & Cummings 2023); Boro River, Okavango Delta 1973 (Appleton 1979); Okavango Delta 2019 (GBIF 2023*b*); Okavango River, 3 km NW of Shakawe [NCSM35214] 2005 (GBIF 2023*b*); Savuti River in Chobe National Park 1984 (GBIF 2023*b*).
Geographic range: Angola, Botswana, Malawi, Mozambique, Namibia, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The molluscs prefer mud sediments in slow flowing waters in major river systems across Southern Africa (Van Damme 2018*a*). It appears that *Aspatharia* spp. specimens from the Cunene and Okavango regions have inaccurately been identified as *Aspatharia pfeifferiana* (Graf & Cummings 2006; Van Damme 2018*a*). Here, all specimen records for *A. pfeifferiana* from Botswana have been included under *A. subreniformis*.
Type locality: Lake Nyassa, East Africa (Sowerby II 1867).
Sources: Appleton (1979: 164, as *Aspatharia (Aspatharia) pfeifferiana*); Graf & Cummings (2006: 178; 2023); Appleton & Curtis (2007: 50, as *A. (A.) pfeifferiana*); GBIF (2023*b*).
Conservation status: Least Concern.

Family Unionidae Rafinesque, 1820
Common name: Freshwater mussels

10. *Coelatura kunenensis* (Mousson, 1888)
Distribution and year: Thamalakane River, Maun [TMSA5565] 1930 (Appleton 1979), 1973 (Appleton 1979), 1976 (Mandahl-Barth 1988), [BMSM44376] 1978 (GBIF 2023*b*), 1984 (Appleton & Curtis 2007); Gadikwe Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Moremi Game Reserve, Okavango Delta 2000 (Appleton *et al.* 2003); Boro River, Okavango Delta [SMWN77019, SMWN77027] 1996 (Appleton & Curtis 2007); Nxaraga Lagoon, Chief's Island, Okavango Delta 1984 (Appleton & Curtis 2007); Okavango and Boteti District, and in the salt pans of the Makgadikgadi brook N/A (Connolly 1912; 1939); Savuti Channel, Okavango Delta [NCSM28194] 2003 (GBIF 2023*b*); Okavango River, approx. 3 km NE of Shakawe [NCSM35215] 2005 (GBIF 2023*b*); Chobe River, a few kilometres upstream of where Chobe River meets the Zambezi 2014 (GBIF 2023*b*); Okavango Delta 2018, 2019, 2020 (GBIF 2023*b*)
Geographic range: Angola, Botswana, Namibia, Zambia.
Habitat: Freshwater.
Notes: This is the commonest mussel species in its native range (Appleton & Curtis 2007), occurring in fine sediments across rivers and lakes (Kristensen *et al.* 2010*b*).
Type locality: In Kunene River, Angola (Mousson 1888).
Sources: Connolly (1912: 274; 1939: 612, both as *Unio kunenensis*); van Bruggen (1966*a*: 110, as *U. kunenensis*); Appleton (1979: 154, as *Caelatura kunenensis*); Mandahl-Barth (1988: 29); Appleton *et al.* (2003: 58–68); Appleton & Curtis (2007: 48); Graf &

Cummings (2006: 186; 2023); GBIF (2023*b*).
Conservation status: Least Concern.

11. *Coelatura mossambicensis* (E. von Martens, 1860)
Distribution and year: Stevensford Game Reserve, Limpopo River 1984 (Appleton & Curtis 2007); Savuti Channel, Okavango Delta [NCSM28929] 2003 (GBIF 2023*b*).
Geographic range: Botswana, Malawi, Mozambique, South Africa, Tanzania, Zimbabwe.
Habitat: Freshwater.
Notes: The species is possibly facing threats from human-mediated activities such as pollution and overexploitation, and drought (Van Damme *et al.* 2018*b*). The species has a preference for floodplains in rivers and pools (Van Damme *et al.* 2018*b*).
Type locality: Mozambique (Martens 1860).
Sources: Appleton & Curtis (2007: 50); GBIF (2023*b*).
Conservation status: Least Concern.

12. *Unio caffer* Krauss, 1848
Distribution and year: "Nosob–Hygap watercourse" (Nossob River), Bokspits N/A (Connolly 1939); Limpopo River at Zanzibar Crossing, Tuli Block 1982 (GBIF 2023*b*).
Geographic range: Botswana, Malawi, Mozambique, Namibia, South Africa, Tanzania, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is endemic to Southern Africa (Brown 1967). Fish species parasitized by larvae of *U. caffer* are currently facing threats, hence qualifying *U. caffer* as an indicator of freshwater ecosystem health (Sonamzi *et al.* 2019).
Type locality: KwaZulu-Natal, South Africa (Krauss 1848).
Sources: Connolly (1939: 605); van Bruggen (1966*a*: 110); Graf & Cummings (2023); GBIF (2023*b*).
Conservation status: Least Concern.

Order Venerida Gray, 1854
Family Cyrenidae Gray, 1840
Common name: Porcelain Mussels

13. *Corbicula fluminalis* (O.F. Müller, 1774)
Distribution and year: Thamalakane River, near Maun 1984 (Appleton & Curtis 2007); Upper panhandle, Okavango Delta 2000 (Appleton *et al.* 2003); Maunachira Channel, Moremi Game Reserve, Okavango Delta 2000 (Appleton *et al.* 2003); Boteti River N/A (Connolly 1912; 1939); Limpopo River 2021 (GBIF 2023*b*).
Geographic range: Botswana, Malawi, Mozambique, Namibia, South Africa, Zimbabwe.
Habitat: Freshwater.
Notes: Mussels previously referred to as *Corbicula africana* are now regarded conspecific with *C. fluminalis* (see Appleton & Miranda 2015). The species is ubiquitous across Southern African river systems (Appleton & Curtis 2007).
Type locality: Euphrates River (Müller 1774).
Sources: Connolly (1912: 277; 1939: 619, both as *C. africana*); van Bruggen (1966*a*: 110, as *C. africana*); Appleton *et al.* (2003: 58–68); Appleton & Curtis (2007: 56); Appleton & Miranda (2015: 136); GBIF (2023*b*).
Conservation status: Least Concern.

Class Gastropoda Cuvier, 1795
Subclass Caenogastropoda Cox, 1960
Order Architaenioglossa Haller, 1892
Family Ampullariidae Gray, 1824
Common name: Tropical/Apple snails

14. *Lanistes ovum* Troschel, 1845
Distribution and year: Kwando River and flood plain [SMWN75897, 75928, 76378, 76380, 76390, 76525, 76542, 76565] 1986 (Brown *et al.* 1992); Chobe River area at Lake Liambezi [SMWN75902] and Ihaha [SMWN76348] 1986 (Brown *et al.* 1992); Boro River channel opposite Nxaraga Lagoon [ETD4284] 1984 (Brown *et al.* 1992); Thamalakane River opposite Okavango River Lodge [ETD4285] 1984 (Brown *et al.* 1992); Chief's Island, Okavango Delta 2000 (Jansen van Rensburg 2001; Appleton *et al.* 2003); Guma Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Mohembo floodplains, Okavango Delta 1999, 2000 (Jansen van Rensburg 2001); Lake Ngami [NHMUK:ecatalogue:2845503] 1910 (GBIF 2023*b*); "Ngami River" (Thamalakane River), Maun N/A (Connolly 1912; 1939); Okavango Delta 2018, 2019, 2020, 2021 (GBIF 2023*b*); Chobe National Park, 20 km west of Kasane [RMNH.MOL.104344] 2006 (NBC 2015*f*); San Ta Wani Camp, Okavango Delta [FSMC40447] 1983 (GBIF 2023*b*)
Geographic range: Angola, Botswana, Burundi, Cameroon, Chad, Congo, Democratic Republic of the Congo, Kenya, Malawi, Mozambique, Namibia, Niger, Nigeria, Senegal, Somalia, South Africa, South Sudan, Sudan, Tanzania, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is widely distributed across Africa (Brown & Kristensen 1989) and occurs in either flowing or standing waters, in sandy/muddy substrates, and can be used as animal feed (Albrecht *et al.* 2018*c*).
Type locality: In Mozambique (Troschel 1845).
Sources: Connolly (1912: 258; 1939: 555); van Bruggen (1966*a*: 109); Brown & Kristensen (1989: 11); Brown *et al.* (1992: 17); Jansen van Rensburg (2001: 29); Appleton *et al.* (2003: 58–68); Appleton & Miranda (2015: 126); GBIF (2023*b*).
Conservation status: Least Concern.

15. *Pila occidentalis* (Mousson, 1888)
Distribution and year: "Nausche or Nausib" (Nossob) River, Bokspits N/A (Connolly 1912; 1939); Kwando

River, Lizauli [SMWN75897] 1986 (Brown *et al.* 1992); western Chobe River at Linyanti channel [SMWN76304] 1986 (Brown *et al.* 1992); Boro River channel opposite Nxaraga Lagoon [ETD4280] 1984 (Brown *et al.* 1992); Thamalakane River opposite Okavango River Lodge near Maun [ETD4279] 1984 (Brown *et al.* 1992); Upper panhandle, Okavango Delta 2000 (Appleton *et al.* 2003); Guma Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Xugana, Okavango Delta [USNM755123, 755124] 1975 (GBIF 2023*b*); "Okavango Marshes" (Okavango Delta) (Connolly 1912; 1939); Okavango Delta 1999 (Jansen van Rensburg 2001), 2018, 2020, 2021, 2022 (GBIF 2023*b*); Lake Ngami 1970 (NMSA 2023); Boteti River channel opposite Nxaraga Lagoon; Moremi Game Reserve, approx. 65 km NW of Maun [NHMR993000187266] 2006 (GBIF 2023*b*); Thamalakane River, Maun 1930 (NMSA 2023); Shorobe 1930 (NMSA 2023).
Geographic range: Angola, Botswana, Namibia, Zambia.
Habitat: Freshwater.
Notes: This Southern African species is more common in the Okavango Delta and East Caprivi (Brown *et al.* 1992). The snails can aestivate for long periods (Kristensen *et al.* 2010*a*), their colourless egg clusters are laid on top of rocks above the water line (Appleton & Miranda 2015).
Type locality: Southern edge of the Kunene River, Angola (Mousson 1888).
Sources: Connolly (1912: 257, as *Ampullaria occidentalis*; 1939: 553); van Bruggen (1966*a*: 109); Brown & Kristensen (1989: 11); Brown *et al.* (1992: 16); Appleton (1996: 19); Brown (1994: 62); Jansen van Rensburg (2001: 29); Appleton (2002: 72); Appleton *et al.* (2003: 58–68); Appleton & Miranda (2015: 126); GBIF (2023*b*).
Conservation status: Least Concern.

16. *Pila wernei* (R.A. Philippi, 1851)
Distribution and year: Okavango "swamps" (Delta) [RMNH.MOL.5008820] 1973 (NBC 2015*g*; GBIF 2023*b*); Thamalakane River, Maun [DMNH129824] N/A (GBIF 2023*b*).
Geographic range: Botswana, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Ethiopia, Mali, Namibia, Nigeria, Somalia, South Sudan, Sudan, Togo.
Habitat: Freshwater.
Notes: The species is common in Central Africa (Koudenoukpo *et al.* 2020). In Southern Africa, it has only been recorded from north-eastern Namibia (Brown & Kristensen 1989) and Botswana.
Type locality: White Nile, Africa (Philippi 1851).
Sources: van Bruggen (1966*a*: 109); GBIF (2023*b*).
Conservation status: Least Concern.

Family Viviparidae Gray, 1847
Common name: River snails

17. *Bellamya capillata* (Frauenfeld, 1865)
Distribution and year: Chobe River, Kasane [SMWN 76342] 1986 (Brown *et al.* 1992), [LACM152404] 1997 (GBIF 2023*b*), [RMNH.MOL.104343] 2006 (NBC 2015*a*); Kwando River, Balelwa [SMWN 75938] 1986 (Brown *et al.* 1992); Upper panhandle, Okavango Delta 2000 (Jansen van Rensburg 2001; Appleton *et al.* 2003); Letter Tree, "Botletle" (Boteti) River N/A, and Kabulabula, 8 feet above floodplain of Linyanti River N/A (Connolly 1939); Thamalakane River opposite Okavango River Lodge near Maun 1984 [ETD4272] (Brown *et al.* 1992); Guma Lagoon, Okavango Delta 1999 (Jansen van Rensburg 2001); Okavango Delta 2018 (GBIF 2023*b*).
Geographic range: Botswana, Democratic Republic of the Congo, Kenya, Malawi, Mozambique, Namibia, South Africa, Tanzania, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is found in lakes, rivers and streams across a wide range of Southern Africa (Brown 1994), co-existing with the congeneric *B. monardi* (F. Haas, 1934) at the confluence of Omatako/Okavango River system (Brown *et al.* 1992).
Type locality: Lake Malawi, Malawi (Frauenfeld 1865).
Sources: Connolly (1912: 260, as *Vivipara passargei*, 1939: 559–560, as subfossil *V. passargei*); van Bruggen (1966*a*: 109, as *Bellamya passargei*); Brown *et al.* (1992: 12); Brown (1994: 156, as *B. passargei*); Jansen van Rensburg (2001: 29); Appleton *et al.* (2003: 58–68); Appleton & Miranda (2015: 124); GBIF (2023*b*).
Conservation status: Least Concern.

Superfamily Cerithioidea Fleming, 1822
Family Paludomidae Stoliczka, 1868
Common name: Trumpet freshwater snails

18. *Cleopatra elata* Dautzenberg & Germain, 1914
Distribution and year: Chobe River near Ihaha [SMWN76352] 1986 (Brown *et al.* 1992); Okavango River downstream of Drotsky's Cabin [SMWN76989, 76993] 1996 (SMWN 2024); Nxamaseri airstrip drift, Okavango [SMWN76261] 1984 (Brown *et al.* 1992); Okavango Delta 1999, 2000 (Jansen van Rensburg 2001); Upper panhandle, Okavango Delta 2000 (Jansen van Rensburg 2001; Appleton *et al.* 2003), 2003 (Dallas & Mosepele 2007), 2018 (GBIF 2023*b*).
Geographic range: Botswana, Congo, Democratic Republic of the Congo, Namibia, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: This is a common species in the Okavango River system, East Caprivi, Zambezi River system,

as well as the Lualaba/Congo river system (Appleton *et al.* 2010*b*). Found in various habitats such as rivers, streams, water channels and lagoons (Appleton *et al.* 2003).
Type locality: Lualaba River at Bulongo, Democratic Republic of the Congo (Dautzenberg & Germain 1914).
Sources: Brown *et al.* (1992: 25); Jansen van Rensburg (2001: 29); Appleton (2002: 81); Appleton *et al.* (2003: 58–68); Dallas & Mosepele (2007: 4).
Conservation status: Least Concern.

19. *Cleopatra nsendweensis* Dupuis & Putzeys, 1901
Distribution and year: Chobe River, Kazungula N/A (Brown *et al.* 1992).
Geographic range: Angola, Botswana, Democratic Republic of the Congo, Kenya, Namibia, South Africa, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species occurs in lakes and rivers across Southern Africa (Appleton *et al.* 2010*a*).
Type locality: "Nyangwe, Nsendwe, Lokandu", Democratic Republic of the Congo (Dupuis & Putzeys 1901).
Sources: Brown & Kristensen (1989: 20); Brown *et al.* (1992: 24); Brown (1994: 134); Appleton (1996: 24); GBIF (2023*b*).
Conservation status: Least Concern.

20. *Melanoides tuberculata* (O.F. Müller, 1774)
Distribution and year: Lake Ngami [SAMC2617, SAMC1617] 1880 (Connolly 1912; 1939; GBIF 2023*b*); "Botletle" (Boteti) River N/A (Connolly 1912; 1939); "Makarrikarri" (Makgadikgadi) Pan N/A (Connolly 1912; 1939), 2016, 2017, 2019 (GBIF 2023*b*).
Geographic range: Algeria, Botswana, Benin, Burkina Faso, Burundi, Cameroon, Chad, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Djibouti, Egypt, Eritrea, Eswatini, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Malawi, Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The native range of this species is speculated to be subtropical and tropical Africa (excluding West Africa), Indo-Pacific region, south Asia as well as the Arabic region (Brown 1994). The species has a global distribution due to introductions into various parts of the world (Albrecht *et al.* 2018*f*). Common in waterbodies such as rivers, lakes and dams, and capable of surviving higher salinity levels (Appleton & Miranda 2015).
Type locality: Coromandel Coast, south-eastern India (Müller 1774).
Sources: Connolly (1912: 264, as *Melania tuberculata*, also as a [sub]fossil record; 1939: 566–567); van Bruggen (1966*a*: 109), Brown & Kristensen (1989: 19); Appleton & Miranda (2015: 128); GBIF (2023*b*).
Conservation status: Least Concern.

21. *Melanoides victoriae* (Dohrn, 1865)
Distribution and year: Xakanaxa (Moremi), Okavango Delta 2000 (Appleton *et al.* 2003), 2003 (Dallas & Mosepele 2007); Kwando River, pools near Sitwa [SMWN75934] 1986 (Brown *et al.* 1992).
Geographic range: Angola, Botswana, Namibia, South Africa, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is endemic to Southern Africa and occurs in sandy or muddy substrates of rivers and floodplains (Brown 1994).
Type locality: Rapids above the Victoria Falls of the Zambezi River (Dohrn 1865).
Sources: Brown *et al.* (1992: 19); Appleton *et al.* (2003: 58–68); Dallas & Mosepele (2007: 4); GBIF (2023*b*).
Conservation status: Least Concern.

Superorder Hygrophila Férussac, 1822
Family Bulinidae Fischer & Crosse, 1880
Common name: Ram's horn snails

22. *Bulinus africanus* (Krauss, 1848)
Distribution and year: Okavango Delta N/A (Appleton & Miranda 2015); Linyanti River, Kazungula [NHMUK:ecatalogue:2445293] 1956 (GBIF 2023*b*).
Geographic range: Botswana, Democratic Republic of the Congo, Eswatini, Ethiopia, Ghana, Kenya, Liberia, Mozambique, Namibia, South Africa, Sudan, Tanzania, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: This species is widely distributed from Southern to Eastern Africa and occurs mostly in permanent waterbodies such as rivers, streams and dams (Brown 1994); it is capable of aestivating for long periods (Appleton & Miranda 2015). This species is an intermediate host of parasites causing bilharzia in humans (Appleton & Miranda 2015) and schistosomiasis in both domesticated and wild bovines (Brown 1994).
Type locality: "Port Natal" (Durban), KwaZulu-Natal, South Africa (Krauss 1848).
Sources: Brown (1994: 329); Appleton & Miranda (2015: 130); GBIF (2023*b*).
Conservation status: Least Concern.

23. *Bulinus depressus* F. Haas, 1936
Distribution and year: Chobe River at Ngoma [SMWN 76313] 1986 (Brown *et al.* 1992); Okavango Delta, Nxamaseri airstrip drift [SMWN76263] 1984 (Brown *et al.* 1992); Thamalakane River at bridge [ETD4300]

1984 (Brown *et al.* 1992); Boro River, Nxaraga Lagoon, Chief's Island [ETD4299] 1984; Okavango Delta 2000 (Appleton *et al.* 2003), [SMWN77015, SMWN77028] 1996 (SMWN 2024).
Geographic range: Botswana, Democratic Republic of the Congo, Namibia, South Africa, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is common in Southern Africa (Appleton *et al.* 2003), occurring in rivers, pools, lakes and dams (Brown 1994). The mollusc is abundant in the Okavango Delta (Appleton *et al.* 2003).
Type locality: Lake Bangweulu, Zambia (Haas 1936).
Sources: Brown & Kristensen (1989: 47); Brown *et al.* (1992: 33); Appleton *et al.* (2003: 58–68); GBIF (2023*b*).
Conservation status: Least Concern.

24. *Bulinus globosus* (Morelet, 1866)
Distribution and year: Kwando River [SMWN76388] 1986 (Brown *et al.* 1992); Chobe River at Ngoma [SMWN76312] 1986 (Brown *et al.* 1992); Chobe River near Ihaha [SMWN76350] 1986 (Brown *et al.* 1992); Mochudi N/A (Brown 1994); Okavango Delta, Nxamaseri [SMWN76263] 1984 (Brown *et al.* 1992); Boro channel opposite Nxaraga Lagoon [ETD4301] 1984 (Brown *et al.* 1992); Upper panhandle, Okavango Delta 2000 (Appleton *et al.* 2003); Guma Lagoon, Okavango Delta 1999, 2000 (Jansen van Rensburg 2001; Appleton *et al.* 2003); Moremi Game Reserve, Okavango Delta 1999, 2000 (Jansen van Rensburg 2001; Appleton *et al.* 2003).
Geographic range: Angola, Benin, Botswana, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Equatorial Guinea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Malawi, Mali, Mozambique, Namibia, Senegal, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is distributed mainly in sub-Saharan Africa, occurring in freshwater systems such as rivers, lakes, earth dams, seasonal pools and irrigation systems (Brown 1994). The mollusc is an intermediate host for *Schistosoma* species causing human and cattle schistosomiasis (Appleton *et al.* 2003).
Type locality: Dande, Angola (Morelet 1866).
Sources: Brown & Kristensen (1989: 44); Brown *et al.* (1992: 31); Brown (1994: 273); Jansen van Rensburg (2001: 29); Appleton *et al.* (2003: 58–68); GBIF (2023*b*).
Conservation status: Least Concern.

25. *Bulinus scalaris* (Dunker, 1845)
Distribution and year: pools near Linyanti village in Linyanti Channel (near Chobe River) [SMWN76302, 76308, 76326] 1986 (Brown *et al.* 1992); between Maun and Nxaraga Lagoon, pool beside road [ETD 4302] 1984 (Brown *et al.* 1992); Okavango Delta 2000 (Appleton *et al.* 2003).
Geographic range: Angola, Botswana, Democratic Republic of the Congo, Ethiopia, Kenya, Namibia, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The native range of this species covers Eastern, Southern and Central Africa. The molluscs inhabit seasonal rain pools and irrigation channels (Brown 1994).
Type locality: Lake and swamps in the vicinity of Benguela, Angola (Dunker 1845).
Sources: Appleton *et al.* (2003: 58–68); GBIF (2023*b*).
Conservation status: Least Concern.

26. *Bulinus tropicus* (Krauss, 1848)
Distribution and year: remnant pools in flood-plain of Kwando River near Kongolo Bridge [SMWN76377] 1986 (Brown *et al.* 1992); "Gabarones" (Gaborone) (Brown 1994); Dobe 1965 (van Bruggen 1966*a*); Lake Ngami N/A (Connolly 1912; 1939); south of Hardekol Drift, "Botletle" (Boteti) River (Connolly 1912; 1939); Okavango Delta [SMWN77018] 1996 (SMWN 2024); 2000 (Jansen van Rensburg 2001).
Geographic range: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Egypt, Equatorial Guinea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Malawi, Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: *B. tropicus* belongs to the *tropicus/truncatus* species complex (Brown *et al.* 1991). The species distribution ranges from Eastern Africa southwards (Brown *et al.* 1992). It occurs in small earth dams, residual pools and lakes, surviving both extreme hot and cold conditions (Brown 1994). The mollusc is an intermediate host for *Schistosoma haematobium* (Bilharz, 1852), which causes human urinary schistosomiasis (Albrecht *et al.* 2018*d*).
Type locality: "Lepenula" (Olifants) River, "Transvaal" (Mpumalanga Province), South Africa (Krauss 1848).
Sources: Connolly (1912: 247, as *Isidora parietalis*; 1939: 504, as *Bulinus parietalis*, both also as fossils); van Bruggen (1966*a*: 104); Brown *et al.* (1992: 34); Brown (1994: 275); Jansen van Rensburg (2001: 29).
Conservation status: Least Concern.

Family Burnupiidae Albrecht, 2017
Common name: Pond snails

27. *Burnupia trapezoidea* (O. Boettger, 1910)
Distribution and year: Matopa Pan, Ngamiland N/A (Connolly 1939).
Geographic range: Botswana, Namibia, South Africa.
Habitat: Freshwater.
Notes: The species occurs in sufficiently oxygenated waterbodies (Kristensen & Appleton 2010). De Kock and Wolmarans (2017) further mention the potential of the molluscs as an indicator of the freshwater ecosystem health.
Type locality: "Witkop in British Bechuanaland near the German border", Limpopo Province, South Africa (Boettger 1910). The type locality of this species seems erroneously attributed to Botswana (see Discussion for suggested correction).
Sources: Connolly (1939: 517, as a subfossil); van Bruggen (1966*a*: 109); Brown (1994: 177); de Kock & Wolmarans (2017: 260).
Conservation status: Data Deficient. The species is possibly facing threat due to habitat loss and degradation (de Kock & Wolmarans 2017).

Family Lymnaeidae Rafinesque, 1815
Common name: Pond snails

28. *Radix natalensis* (Krauss, 1848)
Distribution and year: Chobe River at Ngoma [SMWN 76314] and Ihaha [SMWN 76351] 1986 (Brown *et al.* 1992); Thamalakane River near Maun [ETD4293] 1984 (Brown *et al.* 1992); Lake Ngami N/A (Connolly 1912; 1939); Boro River and Channel, and Nxaraga Lagoon, Chief's Island, Okavango Delta [ETD4293] 1984 (Brown *et al.* 1992), 2000 (Appleton *et al.* 2003); Guma Lagoon, Okavango Delta 2000 (Appleton *et al.* 2003); Upper panhandle, Okavango Delta 2000 (Jansen van Rensburg 2001; Appleton *et al.* 2003); Okavango Delta 1983, 2000, 2018, 2019 (GBIF 2023*b*); Limpopo River N/A (Appleton & Miranda 2015; Albrecht *et al.* 2018*e*).
Geographic range: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: *Radix natalensis* is a highly variable species across its wide range in Africa, suspected to contain cryptic species (Kristensen *et al.* 2009). The species is abundant in the Okavango River and East Caprivi (Brown *et al.* 1992). The mollusc is the main intermediate host of the liver flukes *Fasciola gigantica* Cobbold, 1855 and *Fasciola hepatica* (Linnaeus, 1758) in Africa (Appleton *et al.* 2003).
Type locality: KwaZulu-Natal, South Africa (Krauss 1848).
Sources: Connolly (1912: 233; 1939: 476); van Bruggen (1966*a*: 109); Brown & Kristensen (1989: 26); Brown *et al.* (1992: 26); Jansen van Rensburg (2001: 29); Appleton *et al.* (2003: 58–68); Appleton & Miranda (2015: 128) (all as *Lymnaea natalensis*); GBIF (2023*b*).
Conservation status: Least Concern.

Family Planorbidae Rafinesque, 1815
Common name: Ram's horn snails

29. *Hovorbis coretus* (Blainville, 1826)
Distribution and year: Kwando River, pool near Kongola Bridge [SMWN76374] 1986 (Brown *et al.* 1992); pool near Linyanti Channel [SMWN76309] 1986 (Brown *et al.* 1992); Thamalakane River, Okavango Delta [ETD4294] 1984 (Brown *et al.* 1992); Okavango Delta 2000 (Appleton *et al.* 2003).
Geographic range: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Egypt, Equatorial Guinea, Eswatini, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Libya, Malawi, Mauritania, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species inhabits rivers, springs and lakes across Africa (Albrecht *et al.* 2018*b*), including the tropical regions (Brown 2001).
Type locality: Podor, Senegal (Blainville 1826).
Sources: Brown *et al.* (1992: 28); Appleton (2002: 90); Appleton *et al.* (2003: 58–68) (all as *Afrogyrus coretus*); GBIF (2023*b*).
Conservation status: Least Concern. Possibly under threat due to habitat degradation resulting from clearing of vegetation (Albrecht *et al.* 2018*b*).

30. *Afrogyrorbis natalensis* (Krauss, 1848)
Distribution and year: Okwa River, Ghanzi District N/A (Connolly 1939); Okavango Delta 2000 (Appleton *et al.* 2003).
Geographic range: Botswana, Burundi, Chad, Congo, Democratic Republic of the Congo, Eritrea, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, South Africa, Tanzania, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is distributed across the southern and eastern parts of sub-Saharan Africa (Appleton 2002) and occurs in both permanent and ephemeral water bodies, usually in high densities (Brown 2001).
Type locality: Umgeni Valley, KwaZulu-Natal, South Africa (Krauss 1848).
Sources: Connolly (1939: 490, as *Planorbis natalensis*, a subfossil record); van Bruggen (1966*a*: 109,

as *Anisus natalensis*); Brown (2001: 62); Appleton (2002: 90, as *Ceratophallus natalensis*); Appleton *et al.* (2003: 58–68, as *Ceratophallus natalensis*); GBIF (2023*b*).
Conservation status: Least Concern.

31. *Biomphalaria pfeifferi* (Krauss, 1848)
Distribution and year: Kwando River between Lianzulu and Chobe River [SMWN76089, 76366, 76372, 76376, 76382, 76391, 76528, 76538, 76562] 1986 (Brown *et al.* 1992); Chobe River, Linyanti Channel [SMWN76306] 1986 (Brown *et al.* 1992); Chobe River at Ngoma [SMWN76315] and Ihaha [SMWN76353] 1986 (Brown *et al.* 1992); Boro River near Maun and Nxaraga Lagoon, Chief's Island [ETD4296] 1984 (Brown *et al.* 1992); Thamalakane River opposite Okavango River Lodge [ETD4297] 1984 (Brown *et al.* 1992); "Botletle" (Boteti) River at Chanoga [ETD 4297] 1984 (Brown *et al.* 1992); Okavango Delta 1999, 2000 (Jansen van Rensburg 2001; Appleton *et al.* 2003), 2003 (Dallas & Mosepele 2007).
Geographic range: Algeria, Angola, Botswana, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Libya, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is ubiquitous across Africa, including the tropical regions (Brown 1994). This is the commonest snail in the Okavango Delta (Brown *et al.* 1992; Appleton *et al.* 2003). The species seems to be tolerant to anthropogenic activities such as pollution and habitat disturbance (Brown 1994), but is not acclimatized to extremely hot or extremely cold conditions and does not favour sheltered habitats (Brown 1994). The mollusc is an intermediate host of *Schistosoma mansoni* Sambon, 1907, the parasite causing human schistosomiasis (Appleton *et al.* 2003).
Type locality: Umgeni Valley, KwaZulu-Natal, South Africa (Krauss 1848).
Sources: Connolly (1939: 484); van Bruggen (1966*a*: 109); Brown *et al.* (1992: 29); Jansen van Rensburg (2001: 29); Appleton *et al.* (2003: 58–68); Dallas & Mosepele (2007: 4); Appleton & Miranda (2015: 130).
Conservation status: Least Concern.

32. *Biomphalaria salinarum* (Morelet, 1867)
Distribution and year: Lake Ngami N/A (Connolly 1912; 1939).
Geographic range: Angola, Botswana, Cameroon, Democratic Republic of the Congo, Namibia, South Africa.
Habitat: Freshwater.
Notes: The species is an intermediate host of parasites *Schistosoma mansoni* and *Schistosoma edwardiense* Thurston, 1964, notorious for causing schistosomiasis (Brown 1994).
Type locality: In a stream connected to Dungo salt pans near Cuije River, Angola (Morelet 1866).
Sources: Connolly (1912: 238, as *Planorbis salinarum*, a subfossil record; 1939: 487); van Bruggen (1966*a*: 109).
Conservation status: Data Deficient.

33. *Gyraulus costulatus* (Krauss, 1848)
Distribution and year: Boro River, Nxaraga Lagoon, Chief's Island Maun [ETD4294] 1984 (Brown *et al.* 1992); Okavango Delta, Maun N/A (Brown & Van Eeden 1969).
Geographic range: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Egypt, Equatorial Guinea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Libya, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra Leone, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: The species is ubiquitous across Africa, including the tropical regions (Albrecht *et al.* 2018*a*). The molluscs dwell on vegetation and stones in rivers, lakes and dams (Brown 1994).
Type locality: Umgeni Valley, KwaZulu-Natal, South Africa (Krauss 1848).
Sources: Brown *et al.* (1992: 28); Appleton & Miranda (2015: 130).
Conservation status: Least Concern.

34. *Pettancylus victoriensis* (B. Walker, 1912)
Distribution and year: Okavango Delta 2000 (Appleton *et al.* 2003).
Geographic range: Botswana, Namibia, Zimbabwe.
Habitat: Freshwater.
Notes: The molluscs are common in a variety of waterbodies such as rivers, streams and lakes (Kristensen *et al.* 2010*a*). In the Okavango Delta, the species was collected underneath leaves in deeper parts of the lagoon (Appleton *et al.* 2003).
Type locality: Victoria Falls, Zambezi River, Zambia (Walker 1912).
Sources: Curtis (1998: 3, as *Ferrissia victoriensis*); Appleton *et al.* (2003: 58–68, as *Ferrissia victoriensis*); GBIF (2023*b*).
Conservation status: Data Deficient.

35. *Segmentorbis angustus* (Jickeli, 1874)
Distribution and year: Pools in Kwando flood plain near Sitwa [SWMN76522] 1986 (Brown *et al.* 1992); "Botletle" (Boteti) River at "Chinoko" (Chanoga) [ETD4295] 1984 (Brown *et al.* 1992); Boro River, Nxaraga Lagoon, Chief's Island [ETD4295] 1984 (Brown *et al.* 1992); Okavango Delta 2000 (Appleton *et al.* 2003).

Geographic range: Algeria, Angola, Botswana, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Namibia, Niger, Nigeria, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.
Habitat: Freshwater.
Notes: This species is widespread, mainly in permanent waterbodies, across Africa (Brown 1994).
Type locality: "Mekerka [Mek'erka] in Toquor, Hamaszen province", Eritrea, "White Nile", South Sudan, "and the Gazelle River", Kenia (Jickeli 1874).
Sources: Brown *et al.* (1992: 29); Appleton *et al.* (2003: 58–68); GBIF (2023*b*).
Conservation status: Least Concern.

Order Littorinimorpha Golikov & Starobogatov, 1975
Family Bithyniidae Gray, 1857
Common name: Mud freshwater snails

36. *Gabbiella kisalensis* (Pilsbry & Bequaert, 1927)
Distribution and year: Linyanti Channel [SMWN 76303] 1986 (Brown *et al.* 1992); floodplain of Kwando River at Sitwa [SMWN76526] 1986 (Brown *et al.* 1992); Okavango Delta 2000 (Appleton *et al.* 2003).
Geographic range: Angola, Botswana, Democratic Republic of the Congo, Gabon, Mozambique, Namibia, Zambia.
Habitat: Freshwater.
Notes: The species occurs in rivers, lakes and pools (Appleton *et al.* 2010*c*) across Southern and Central Africa, and is abundant in the Okavango River and East Caprivi (Brown *et al.* 1992).
Type locality: Lake Kisale, near the source of Kimilolo River, Democratic Republic of the Congo (Pilsbry & Bequaert 1927).
Sources: Brown & Kristensen (1989: 14); Brown *et al.* (1992: 18); Brown (1994: 91); Appleton (2002: 78); Appleton *et al.* (2003: 58–68).
Conservation status: Least Concern.

Family Cochliopidae Tryon, 1866
Common name: Small freshwater snails

37. *Lobogenes michaelis* Pilsbry & Bequaert, 1927
Distribution and year: Kwando River floodplain at Singalamwe [ETD4350] 1986 (Brown *et al.* 1992); Okavango Delta 2000 (Jansen van Rensburg 2001).
Geographic range: Botswana, Democratic Republic of the Congo, Namibia, Zambia.
Habitat: Freshwater.
Notes: The species has a limited and patchy distribution in Southern Africa, and is facing threats due to unsustainable water extraction from the Kafue River, Zambia (Kristensen *et al.* 2009).
Type locality: At the source of Kimililo River near Élisabethville (Lubumbashi), Democratic Republic of the Congo (Pilsbry & Bequaert 1927).
Sources: Jansen van Rensburg (2001: 29); Kristensen *et al.* (2009: 40).
Conservation status: Varies from IUCN Near Threatened (Jørgensen 2010) to regionally endangered (Kristensen *et al.* 2009). More data are needed for its proper assessment.

Order Stylommatophora Schmidt, 1855
Family Achatinidae Swainson, 1840
Common name: Tropical land snails, including Giant African land snails.

38. *Achatina ampullacea* O. Boettger, 1910
Distribution and year: Dobe, near Aha hills 1965 (van Bruggen 1966*a*); banks of Epukiro-Omuramba, approx. 22°S, 15 km from Komeduve, south of Lake Ngami 1965 (Connolly 1939; NMSA 2023).
Geographic range: Botswana, Namibia.
Habitat: Terrestrial.
Notes: The species is possibly better acclimatized to the semi-arid regions of south-western Africa (van Bruggen 1969).
Type locality: The edge of the Epukiro-Omuramba, 15 km from Komeduve in the southern part of Lake Ngami in the Kalahari, Namibia (Boettger 1910).
Sources: Connolly (1912: 191; 1939: 317); van Bruggen (1966*a*: 107).
Conservation status: Not Evaluated.

39. *Achatina dammarensis* L. Pfeiffer, 1870
Distribution and year: Dekar, 30 miles north-west of Ghanzi 1961 (van Bruggen 1963; NMSA 2023); Tshane Pan 1961 (van Bruggen 1963); Tuwhe Pan, 80 miles west of Tshane Pan 1961 (van Bruggen 1963); Koanaka Hills 1965 (van Bruggen 1966*a*); Aha Hills 1965 (van Bruggen 1966*a*); Tsodilo Hills 1965 (van Bruggen 1966*a*); Nyatsane Pan, halfway between Molepolole and Tshane Pan 1965 (van Bruggen 1966*a*); banks of Epukiro-Omuramba, approx. 20°S, 10 km east of Komeduve, south of Lake Ngami N/A (Connolly 1912; 1939); Ngamiland, 30 miles west of Lake Ngami [ANSP166778] N/A (GBIF 2023*b*)
Geographic range: Botswana, Namibia.
Habitat: Terrestrial.
Notes: The species is endemic to Southern Africa, with its range restricted to the south and south-western semi-arid regions (Fontanilla 2010).
Type locality: "Dammara province, West Africa", former Damaraland, Namibia (Pfeiffer 1870).
Sources: Connolly (1912: 192; 1939: 320); van Bruggen (1963: 266; 1966*a*: 107); GBIF (2023*b*).
Conservation status: Not Evaluated.

40. *Achatina passargei* E. von Martens, 1900
Distribution and year: "Kwebe" (Kgwebe) Hills 1965 (van Bruggen 1966*a*).
Geographic range: Botswana, Namibia.
Habitat: Terrestrial.
Notes: Endemic to Southern Africa.

Type locality: "At Sodanna" (in present-day Kavango East Region), Namibia (Martens 1900).
Source: van Bruggen (1966*a*: 108).
Conservation status: Not Evaluated.

41. *Achatina schinziana* Mousson, 1888
Distribution and year: Paradise Pan, between Nata and Maun 1963 (NMSA 2023); Gweta 2019, 2020 (GBIF 2023*b*); "Kakir" (Khakhea) N/A (Connolly 1912); Gumare, 25 miles South of Sepopa 1965 (van Bruggen 1966*b*); Mesilume Pan, 133 km from Tshane Pan, Ghanzi District N/A (NMSA 2023); Maun, Ngamiland [NHMUK:ecatalogue:2671805] 1931 (Connolly 1939; GBIF 2023*b*); 50 miles SW by W of Victoria Falls, on border of Kalahari, (Kazungula), Bechuanaland (Botswana) [MCZ:Mala:166258] N/A (Harvard University M. & Morris 2024*a*).
Geographic range: Angola, Botswana, Namibia.
Habitat: Terrestrial.
Notes: The species' distribution range is restricted to Southern Africa (van Bruggen 1980).
Type locality: "Ondonga, in the country Ovamba", Namibia (Mousson 1888).
Sources: Connolly (1912: 200, as *Achatina schinziana* var. *degenerata*; 1939: 316); van Bruggen (1966*a*: 108; 1980: 82); GBIF (2023*b*).
Conservation status: Not Evaluated.

42. *Achatina smithii* Craven, 1881
Distribution and year: Sepopa, on Okavango River, Ngamiland 1965 (van Bruggen 1966*a*).
Geographic range: Botswana, Namibia, South Africa.
Habitat: Terrestrial.
Notes: This medium-sized species is endemic to Southern Africa (van Bruggen 1966*a*).
Type locality: Lydenburg, Mpumalanga, South Africa (Craven 1881).
Source: van Bruggen (1966*a*: 107).
Conservation status: Not Evaluated.

43. *Burtoa nilotica* (L. Pfeiffer, 1861)
Distribution and year: Tshesebe, near Francistown N/A (Govender 2007; NMSA 2023).
Geographic range: Botswana, Congo, Democratic Republic of the Congo, Kenya, Malawi, Mozambique, South Africa, South Sudan, Sudan, Tanzania, Uganda, Zambia, Zimbabwe.
Habitat: Terrestrial.
Notes: This is one of the largest land snail species with a ubiquitous distribution across tropical Africa (Tothill 1948).
Type locality: At the sources of the White Nile (probably South Sudan) (Pfeiffer 1861).
Source: Govender (2007: 114).
Conservation status: Not Evaluated.

44. *Lissachatina immaculata* (Lamarck, 1822)
Distribution and year: Mosu 1975 (NMSA 2023); Francistown 1915 (van Bruggen 1966*a*), 2018, 2019, 2020 (GBIF 2023*b*); Gaborone 2021 (GBIF 2023*b*); Serowe 2021 (GBIF 2023*b*); east side of Makgadikgadi Salt Pan [MCZ:Mala:184606] 1854 (Harvard University M. & Morris 2024*b*); Mmopane 2013 (GBIF 2023*b*); farm 'Gesond', Tuli Block, at confluence of "Macloutsi" (Motloutse) and Limpopo rivers 1964 (van Bruggen 1966*a*); Maun 2022 (GBIF 2023*b*)
Geographic range: Botswana, Eswatini, Malawi, Mozambique, Namibia, South Africa, Zimbabwe.
Habitat: Terrestrial.
Notes: The species thrives in the Southern African savannas (Fontanilla 2010) and occurs in leaf debris in dune forests, thickets, woodlands and also in novel habitats such as urban gardens (Herbert & Kilburn 2004). *Lissachatina immaculata* has spread and become invasive in other parts of the world, where it acts as an intermediate host for *Angiostrongylus cantonensis* (Chen, 1935), a nematode causing meningitis in humans (Wang *et al.* 2023).
Type locality: Maputo, Mozambique (van Bruggen 1966*b*).
Sources: van Bruggen (1966*a*: 109; 1966*b*: 374); Govender (2007: 110) (all as *Achatina immaculata*); GBIF (2023*b*).
Conservation status: Not Evaluated.

45. *Lubricetta subteres* (O. Boettger, 1910)
Distribution and year: Aha Hills 1961 (van Bruggen 1963), 1965 (van Bruggen 1966*a*).
Geographic range: Botswana, Namibia, South Africa.
Habitat: Terrestrial.
Notes: The species is quite common around hills and mountainous ranges (van Bruggen 1970).
Type locality: "140 km inland from Swakopmund", Namibia (Boettger 1910).
Sources: van Bruggen (1963: 266; 1966*a*: 105, both as *Xerocerastus (Lubricetta) subteres*).
Conservation status: Not Evaluated.

46. *Opeas lineare* (Krauss, 1848)
Distribution and year: Francistown 1937 (Connolly 1939; GBIF 2023*b*).
Geographic range: Botswana, Malawi, Mozambique, South Africa, Zimbabwe.
Habitat: Terrestrial.
Notes: The species is widely distributed across its native range in Southern Africa and mainly prefers habitats that are sheltered, such as under rocks and logs (van Bruggen 1966*b*).
Type locality: "on the mountain of Mohapaani by the river Limpopo", Witfonteinrand, near Thabazimbi, Limpopo Province, South Africa (Krauss 1848).
Sources: Connolly (1939: 348); van Bruggen (1966*a*: 109; 1966*b*: 366); GBIF (2023*b*).
Conservation status: Not Evaluated.

47. *Subulina vitrea* (Mousson, 1888)
Distribution and year: Aha Hills 1961 (van Bruggen 1963), 1965 (van Bruggen 1966*a*).

Geographic range: Botswana, Namibia, South Africa.
Habitat: Terrestrial.
Notes: The species is endemic to the arid regions of Southern Africa (van Bruggen 1964).
Type locality: "in Ku-Ganab, south-east of Ondonga", Namibia (Mousson 1888).
Sources: van Bruggen (1963: 264; 1966*a*: 104).
Conservation status: Not Evaluated.

48. *Xerocerastus burchelli* (J.E. Gray, 1834)
Distribution and year: Kalahari N/A (Connolly 1912); Dekar, Ghanzi 1961 (van Bruggen 1963); Tshane Pan 1961 (van Bruggen 1963).
Geographic range: Botswana, Mozambique, Namibia, South Africa.
Habitat: Terrestrial.
Notes: The molluscs tend to be variable in terms of their size and proportions; the shell length increases while the shell width decreases along the south-north gradient (van Bruggen 1966*b*). The species is endemic to Southern Africa, occurring in drier arid regions west of the Limpopo River, and also in the tropical regions east of the Limpopo River (van Bruggen 1966*b*).
Type locality: near "Lattakoo" (Dithakong), east of Kuruman, Northern Cape, South Africa (Gray 1834).
Sources: Connolly (1912: 166, as *Ena (Xerocerastus) burchelli*); van Bruggen (1963: 264; 1966*a*: 109; 1966*b*: 367); Govender (2007: 189).
Conservation status: Not Evaluated.

49. *Xerocerastus damarensis* (H. Adams, 1870)
Distribution and year: Dobe 1965 (van Bruggen 1966*a*); Meno-a-kwena (about 24°E and 20°S), Ngamiland N/A (Connolly 1912); Boritse–Tsetseng 1963 (NMSA 2023).
Geographic range: Botswana; Namibia; South Africa.
Habitat: Terrestrial.
Notes: The species' range is restricted to drier regions of Southern Africa (van Bruggen 1966*a*).
Type locality: "Damara Land", Namibia (Adams 1870).
Sources: Connolly (1912: 167, as *Ena (Xerocerastus) damarensis*); van Bruggen (1966*a*: 105).
Conservation status: Not Evaluated.

50. *Xerocerastus schultzei* (O. Boettger, 1910)
Distribution and year: "Sekuma" (Sekoma) 1904 (Boettger 1910); Kang 1904 (Boettger 1910); Kang-Kakir 1904 (Boettger 1910); "Kakir–Lekututu" (Khakhea–Lehututu) 1904 to 1905 (Boettger 1910).
Geographic range: Botswana, Namibia, South Africa.
Habitat: Terrestrial.
Notes: The species is endemic to the semi-desert regions of Southern Africa. Fossilised shells were mostly found in pans of the Kalahari Desert (Lancaster 1974).
Type locality: "in the British region of the Kalahari", Botswana (Boettger 1910).
Sources: Boettger (1910: 442); Connolly (1912: 174); van Bruggen (1966*a*: 109); GBIF (2023*b*).
Conservation status: Not Evaluated.

Family Ferussaciidae Bourguignat, 1883
Common name: Blind awl snails or pin snails

51. *Cecilioides gokweana* (O. Böttger, 1870)
Distribution and year: Gokwe River 1869 (Böttger 1870).
Geographic range: Botswana, Kenya, Mozambique, Namibia, South Africa.
Habitat: Terrestrial.
Notes: The species is ubiquitous in Southern Africa, especially in semi-arid regions (van Bruggen & Appleton 1977) and common in various habitats such as forests, bush thickets and coastal woodland (Herbert & Kilburn 2004).
Type locality: Gokwe River (22°S 28°E, tributary of Motloutse River), Botswana (Böttger 1870).
Sources: Böttger (1870: 47, as *Cionella gokweana*); Connolly (1912: 207; 1939: 370, both as *Cecilioides gokweanus*); van Bruggen (1966*a*: 109; 1966*b*: 351, both as *Cecilioides gokweanus*); van Bruggen & Appleton (1977: 23, as *Cecilioides gokweanus*); Herbert & Kilburn (2004: 127, as *Cecilioides gokweanus*).
Conservation status: Not Evaluated.

Family Gastrocoptidae Pilsbry, 1918
Common name: Minute land snails

52. *Gastrocopta damarica* (Ancey, 1888)
Distribution and year: Koanaka Hills 1965 (van Bruggen 1966*a*); Aha Hills 1965 (van Bruggen 1966*a*); Tsodilo Hills, along Rhino trail, Ngamiland 2006 (NBC 2015*c*); Savuti Safari Lodge, 150 km SW of Kasane, Chobe National Park [RMNH.MOL.104345] 2006 (NBC 2015*b*).
Geographic range: Botswana, Mozambique, Namibia, South Africa, Zimbabwe.
Habitat: Terrestrial.
Notes: The species is broadly distributed across Southern Africa, inhabiting the arid dunes, forests and savanna woodlands (Herbert & Kilburn 2004). The molluscs mostly occur in plant debris under twigs and leaves (van Bruggen & Appleton 1977).
Type locality: "Damara", Namibia (Ancey 1888).
Sources: van Bruggen (1966*a*: 104); van Bruggen & Appleton (1977: 19); Herbert & Kilburn (2004: 107); GBIF (2023*b*).
Conservation status: Not Evaluated.

53. *Gastrocopta klunzingeri* (Jickeli, 1873)
Distribution and year: Savuti Safari Lodge, 150 km SW of Kasane, Chobe District [RMNH.MOL.104346] 2006 (NBC 2015*d*).
Geographic range: Botswana, Democratic Republic of the Congo, Eritrea, Ethiopia, Mozambique, Senegal, Tanzania.

Habitat: Terrestrial.
Notes: The species range extends from Eritrea southwards to Southern Africa (Muratov 2010; Gittenberger & van Bruggen 2013).
Type locality: "province of Hamaszen", Eritrea, Ethiopia (Jickeli 1873).
Source: GBIF (2023*b*).
Conservation status: Not Evaluated.

Family Pupillidae Turton, 1831
Common name: Minute land snails

54. *Pupilla tetrodus* (O. Böttger, 1870)
Distribution and year: Gokwe River 1869 (Böttger 1870).
Geographic range: Botswana, Lesotho, Namibia, South Africa, Zambia.
Habitat: Terrestrial.
Notes: The species is ubiquitous across Southern Africa, occurring from semi-arid regions of the Kalahari Desert to the coastal regions of the Eastern Cape (Herbert & Kilburn 2004).
Type locality: Gokwe River (22°S 28°E, tributary of Motloutse River), Botswana (Böttger 1870).
Sources: Böttger (1870: 46, as *Pupa tetrodus*); Connolly (1912: 185, as *Jaminia tetrodus*; 1939: 393); van Bruggen (1966*a*: 109); Herbert & Kilburn (2004: 105).
Conservation status: Not Evaluated.

55. *Pupoides calaharicus* (O. Boettger, 1886)
Distribution and year: Dekar 1961 (van Bruggen 1963); Koanaka Hills 1965 (van Bruggen 1966*a*); Aha Hills 1965 (van Bruggen 1966*a*), Dobe 1965 (van Bruggen 1966*a*); Francistown 2016 (GBIF 2023*b*).
Geographic range: Angola, Botswana, Mozambique, Namibia, South Africa, Zimbabwe.
Habitat: Terrestrial.
Notes: The species occurs in the arid regions of the Kalahari towards the subtropical regions of Mozambique and to the Eastern Cape in South Africa (Herbert & Kilburn 2004). The molluscs prefer sheltered habitats under logs and rocks. Some authors treated *P. minusculus* and *P. calaharicus* as different species (Connolly 1912; van Bruggen 1966*a*).
Type locality: "Ghous in the Southern Kalahari", South Africa (Boettger 1886).
Sources: Connolly (1912: 177, as *Leucochiloides minusculus*, a fossil record; 1939: 395); van Bruggen (1963: 262, as *Pupoides minusculus*; 1966*a*: 104); Herbert & Kilburn (2004: 105); Govender (2007: 150); GBIF (2023*b*).
Conservation status: Not Evaluated.

Family Streptaxidae Gray, 1860
Common name: Carnivorous land snails

56. *Gulella miniata* (Krauss, 1848)
Distribution and year: Tsodilo Hills, along Rhino Trail, Ngamiland [RMNH.MOL.104350] 2006 (NBC 2015*e*).
Geographic range: Botswana, South Africa.
Habitat: Terrestrial.
Notes: Hunter snails of the genus *Gulella* dwell in a variety of habitats, mostly occurring underneath logs, rocks and leaf litter (Herbert & Kilburn 2004).
Type locality: Mt Mohapaani, Witfonteinrand, near Thabazimbi, Limpopo, South Africa (Krauss 1848).
Sources: van Bruggen (1966*a*: 110); Govender (2007: 169); GBIF (2023*b*).
Conservation status: Not Evaluated.

57. *Tayloria gwandaensis* (Preston, 1912)
Distribution and year: Aha Hills 1961 (van Bruggen 1963), Dobe 1961 (van Bruggen 1963), 1965 (van Bruggen 1966*a*).
Geographic range: Botswana, Malawi, Mozambique, South Africa, Zimbabwe.
Habitat: Terrestrial.
Notes: The species is widely distributed in arid regions of Southern Africa (Herbert & Kilburn 2004).
Type locality: Near the Geelong Mine, Gwanda District, Zimbabwe (Preston 1912).
Sources: van Bruggen (1963: 268; 1966*a*: 109, both as *Gonaxis gwandaensis*; 1980: 82); Herbert & Kilburn (2004: 153, as *G. gwandaensis*); Govender (2007: 154, as *G. gwandaensis*).
Conservation status: Not Evaluated.

Family Succineidae Beck, 1837
Common name: Amber snails

58. *Oxyloma patentissimum* (L. Pfeiffer, 1853)
Distribution and year: Upper panhandle, Okavango Delta 2000 (Appleton *et al.* 2003).
Geographic range: Angola, Botswana, Democratic Republic of the Congo, Lake Chad (at the conjunction of Chad, Cameroon, Nigeria and Niger), Mozambique, South Africa, Zimbabwe.
Habitat: Terrestrial.
Notes: The molluscs are mostly common in emergent and overhanging vegetation in streams and lagoons (Herbert & Kilburn 2004; Appleton & Miranda 2015).
Type locality: "Port Natal" (Durban), South Africa (Pfeiffer 1853).
Sources: Appleton (2002: 84); Appleton *et al.* (2003: 58–68); Appleton & Miranda (2015: 132) (all as *Oxyloma patentissima*); GBIF (2023*b*).
Conservation status: Not Evaluated.

59. *Succinea arboricola* Connolly, 1912
Distribution and year: Ghanzi N/A (GBIF 2023*b*); Lake Ngami N/A (Connolly 1912; 1939); Okavango "marshes" (Delta) N/A (Connolly 1912; 1939); "Botletle" (Boteti) River N/A (Connolly 1912; 1939).
Geographic range: Botswana, Namibia, South Africa.
Habitat: Terrestrial.
Notes: The species seems to be restricted to the arid

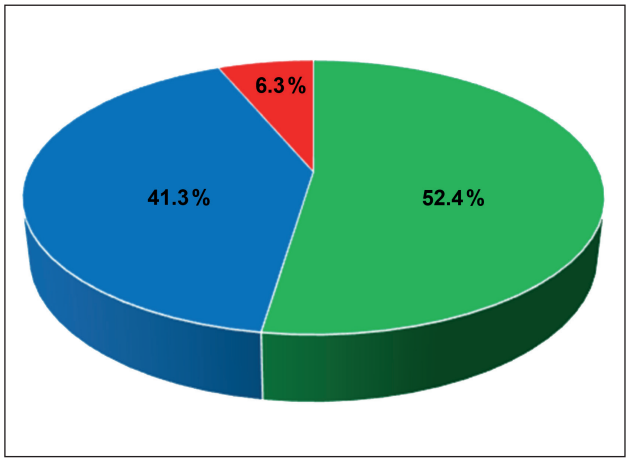

Figure 2: The percentage of the IUCN Red Listings for mollusc species recorded in Botswana from 1854–2023: green – Least Concern, blue – Not Evaluated, red – Data Deficient.

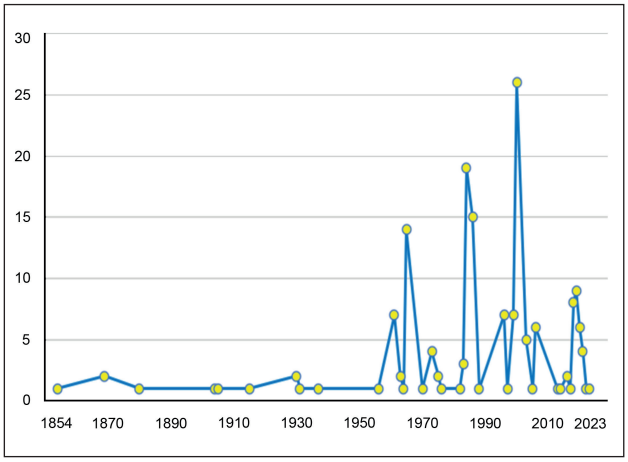

Figure 3: The number of mollusc species recorded from Botswana between 1854–2023.

regions of Southern Africa (van Bruggen 1967).
Type locality: Kalahari, Botswana (Connolly 1912).
Sources: Connolly (1912: 220; 1939: 446); van Bruggen (1966*a*: 109); GBIF (2023*b*).
Conservation status: Not Evaluated.

60. *Succinea badia* Morelet, 1867
Distribution and year: "Botletle" (Boteti) River N/A (Connolly 1912; 1939); Aha Hills 1961 (van Bruggen 1963), 1965 (van Bruggen 1966*a*); Dekar 1961 (van Bruggen 1963).
Geographic range: Angola, Botswana, Namibia, South Africa.
Habitat: Terrestrial.
Notes: The distribution range is restricted to the drier parts of south-western Africa, where the species is well adapted to the savanna conditions (van Bruggen 1978).
Type locality: Calemba, Angola (Morelet 1867).
Sources: Connolly (1912: 221, as *Succinea moussoni*; 1939: 443); van Bruggen (1963: 263; 1966*a*: 104); Govender (2007: 190).
Conservation status: Not Evaluated.

61. *Succinea striata* Krauss, 1848
Distribution and year: Ngamiland [NHMUK:ecatalogue:2666824] 1925 (GBIF 2023*b*).
Geographic range: Botswana, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Zimbabwe.
Habitat: Terrestrial.
Notes: The species is ubiquitous across Southern Africa, occurring in various habitats such as pool edges, under logs, on trees and grasses (Herbert & Kilburn 2004). This is an ecologically tolerant species (van Bruggen & Appleton 1977).
Type locality: "On the river Limpopo", South Africa (Krauss 1848).
Sources: van Bruggen & Appleton (1977: 21); Herbert & Kilburn (2004: 269); GBIF (2023*b*).
Conservation status: Not Evaluated.

Order Systellommatophora Pilsbry, 1948
Family Veronicellidae Gray, 1840
Common name: Leather-back land slugs

62. *Laevicaulis alte* (A. Férussac, 1822)
Distribution and year: Francistown 2018, 2019 (GBIF 2023*b*).
Geographic range: Botswana, Democratic Republic of the Congo, Malawi, South Africa, Tanzania, Zambia, Zimbabwe.
Habitat: Terrestrial.
Notes: The species is widely distributed across Southern Africa, occurring in several types of habitats such as the savanna and the equatorial forest (van Bruggen & Appleton 1977), unknown to occur at very high altitudes, and has been introduced in several parts of the world (Herbert & Kilburn 2004). The species is known as an intermediate host of larval nematode parasites affecting vertebrates (Mahajan *et al.* 1992).
Type locality: Pondicherry, India (Férussac 1822).
Source: GBIF (2023*b*).
Conservation status: Not Evaluated.

63. *Laevicaulis natalensis* (Krauss, 1848)
Distribution and year: Francistown 2020 (GBIF 2023*b*); Ngwaketse North 2023 (GBIF 2023*b*).
Geographic range: Botswana, Mozambique, South Africa, Zimbabwe.
Habitat: Terrestrial.
Notes: This is a common species in Southern Africa, found in a variety of habitats such as the forest, bushveld and woodland (Herbert & Kilburn 2004).
Type locality: KwaZulu-Natal, South Africa (Krauss 1848).
Source: GBIF (2023*b*).
Conservation status: Not Evaluated.

IUCN Red Data Listing
Out of the species recorded from Botswana, 52.4 % are listed as 'Least Concern', 41.3 % as 'Not Evaluated',

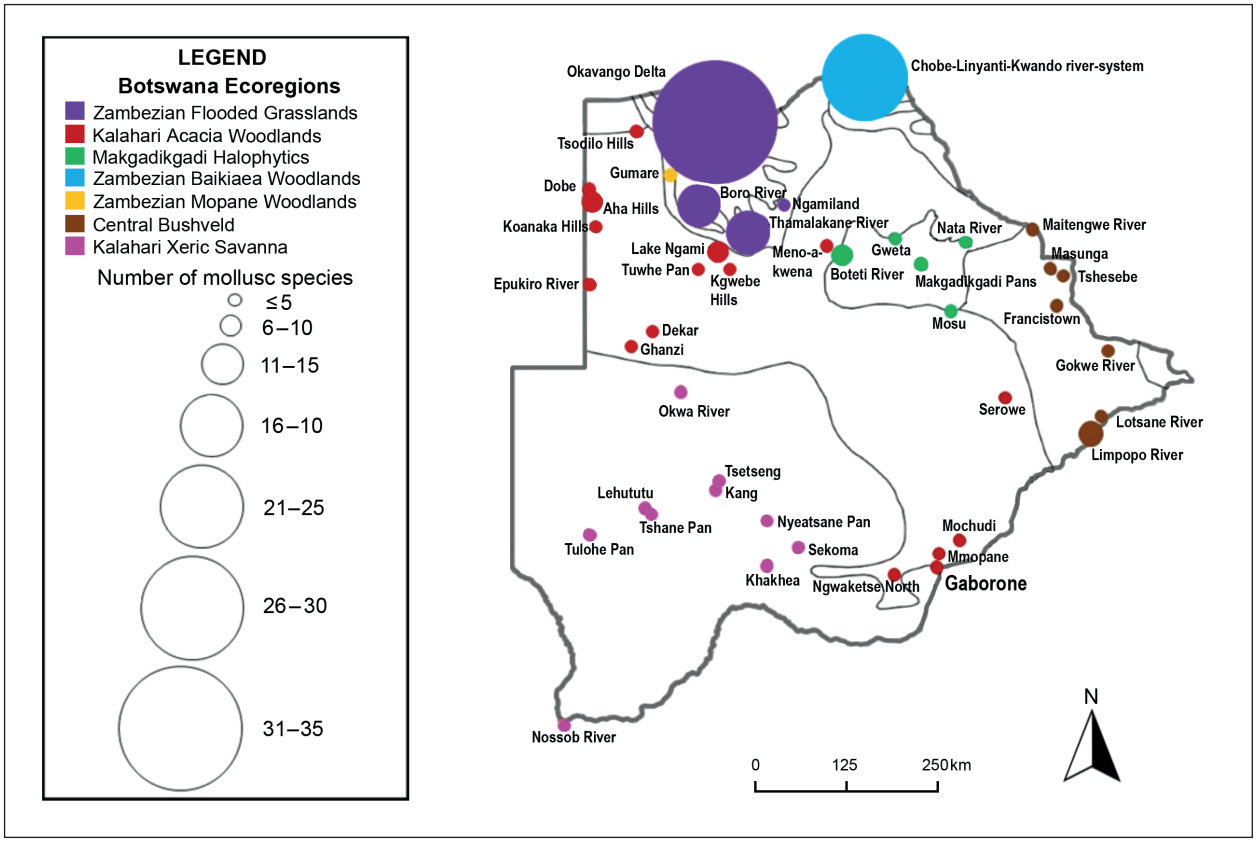

Figure 4: Botswana localities where mollusc species were collected and/or observed. The size of each circle is proportional to the number of species collected and/or observed in that locality. The colours correspond to the seven ecoregions of Botswana (Fig. 1).

while 6.3% are considered 'Data Deficient' in the IUCN Red Data Listing (Fig. 2).

Sampling effort over the years

Species comprising this checklist were collected and/or observed from 1854 to 2023. Less than five species were recorded from 1854 to the early 1960s (Fig. 3). Following the Harvard-Smithsonian-Transvaal Museum Kalahari expedition in 1961 and publications by van Bruggen (1963; 1966*a*), there was a slight increase to seven species around the early 1960s, with further growth to 14 species in the mid-1960s. The number of recorded species abruptly declined in the late 1960s and remained low during the 1970s until dedicated collecting of freshwater molluscs by C.C. Appleton, S. Bethune and B.A. Curtis in 1983–1986 contributed to 19 species in 1984 and 15 species in 1986. The 1990s saw a decline of documented molluscs to less than ten species. A multilateral AquaRAP expedition to the Okavango Delta in 2000 (Ashton *et al*. 2003) prompted the instantaneous addition of 26 species (Appleton *et al*. 2003). The beginning of the 21st century witnessed a record of less than ten (often less than five) species annually.

Species richness per locality and ecoregion

The Okavango Delta harbours 31 species, the highest figure per locality, followed by the Chobe–Linyanti–Kwando river-system with 25 species (Fig. 4). The Thamalakane and Boro rivers host 13 species each. Lake Ngami, Boteti River, Aha Hills, and Limpopo River yield between 6–10 species. All the other localities produce less than five species (Fig. 4). In terms of the ecoregions, the Zambezi Flooded Grasslands record the highest number of freshwater mollusc species, while the Kalahari Xeric Savanna biome has the lowest number of them (Fig. 5). For terrestrial molluscs, the Kalahari Acacia Woodlands record the richest diversity, whereas the Zambezian Mopane Woodlands host the lowest number of species (Fig. 5).

Introduced species

Order Stylommatophora Schmidt, 1855
Family Helicidae Rafinesque, 1815
Common name: Typical snails or helix garden snails

1. *Cornu aspersum* (O.F. Müller, 1774)

Distribution and year: Francistown 2019 (GBIF 2023*b*).
Habitat: Terrestrial.
Native range: Mediterranean region (Sherpa *et al.* 2018), from north-west Africa, western Europe and eastwards towards Asia.
Extent of invasion: The species is cosmopolitan, being introduced either accidentally or deliberately as a source of animal feed (Guiller *et al.* 2012). It

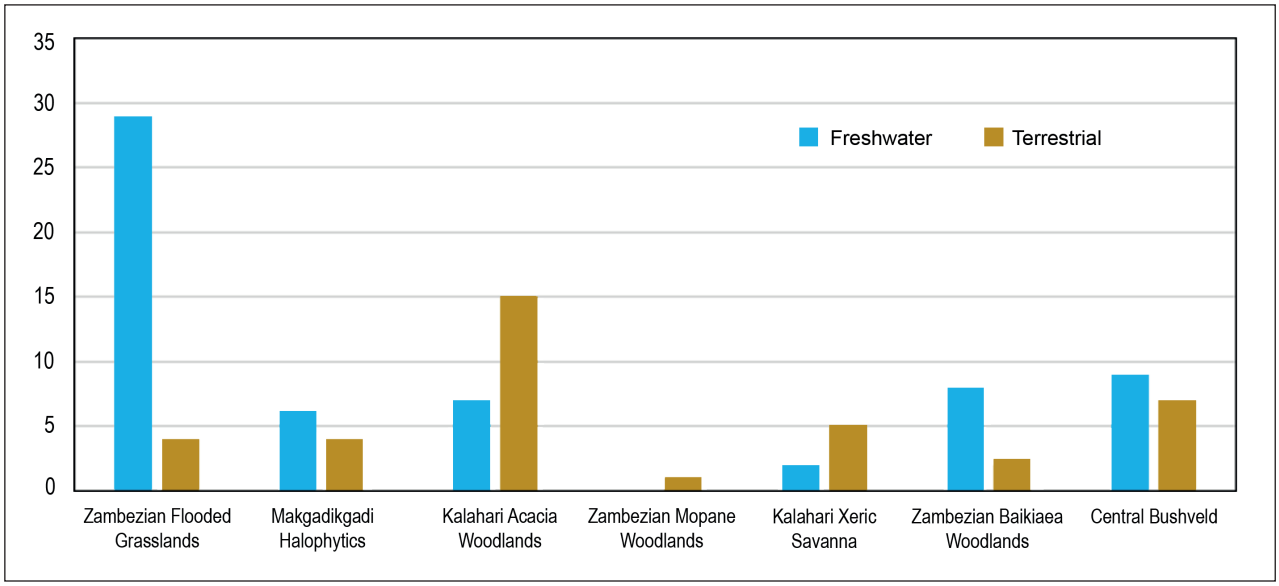

Figure 5: The number of mollusc species recorded per each ecoregion of Botswana.

is now found in regions such as Australia, eastern and southern regions of Africa, New Zealand, North America and southern South America (Gaitán-Espitia *et al.* 2013).
Notes: The molluscs were imported deliberately to Southern Africa around the 1850s as a food resource (Herbert & Kilburn 2004). The species is now considered a notorious agricultural pest, constantly devouring citrus orchards and vineyards (Barker & Watts 2002). The molluscs are eaten in some parts of the world and often utilised as a main ingredient in pharmaceuticals and cosmetics (Jørgensen & Sørensen 2008).
Type locality: In Italy (Müller 1774).
Source: GBIF (2023*b*).

Superorder Hygrophila Férussac, 1822
Family Lymnaeidae Rafinesque, 1815
Common name: Pond snails

2. *Radix auricularia* (Linnaeus, 1758)
Distribution and year: Okavango Delta 2018/2019 (Malatji *et al.* 2019).
Native range: Europe and Asia (Larson 2018).
Extent of invasion: The species has a wide invasion expansion range in North America (Larson 2018) and New Zealand (Winterbourn 2023), and has recently been discovered in the Okavango Delta, Botswana, and KwaZulu-Natal, South Africa (Malatji *et al.* 2019).
Habitat: Freshwater.
Notes: The species occurs in slow flowing rivers, lakes, as well as in man-made waterbodies such as ponds, irrigation canals and reservoirs (Winterbourn 2023). The molluscs serve as an intermediate host of *Fasciola gigantica* Cobbold, 1855 (Malatji *et al.* 2019); they are used for feeding fowl and fish in some regions in Asia (Winterbourn 2023).
Type locality: In Europe (Linnaeus 1758).
Source: Malatji *et al.* (2019).

Family Physidae Fitzinger, 1833

3. *Physella acuta* (Draparnaud, 1805)
Distribution and year: Chobe River, Kasane 1987 (GBIF 2023*b*) (as *Physa* spp., see Notes).
Habitat: Freshwater.
Native range: Not entirely resolved, but highly speculated to be North America (Brown 1994; De Kock & Wolmarans 2007).
Extent of invasion: The species is recorded from Africa, Europe and Asia (Van Damme *et al.* 2017).
Notes: It is highly likely the *Physa* spp. recorded from the Chobe River by the AMGS in the GBIF. The species occurrence in Botswana is further supported by one scientific publication (Paraense & Pointier 2003) and an IUCN Red Listing assessment report (Van Damme *et al.* 2017). As Appleton *et al.* (2003) have recommended, it is crucial to note the possibility of the species occurrence in the Okavango Delta, especially because of the delta's close proximity to the neighbouring Lake Kariba where the species was discovered. The species is common in both flowing and standing waters and thrives exceptionally well in polluted waters (Brown 1994); its invasive success is attributed to a high fecundity rate and the capacity to travel swiftly upstream (De Kock & Wolmarans 2007). The species serves as an intermediary host for food-borne trematode diseases such as echinostomiasis and fascioliasis (Lawton *et al.* 2018).
Type locality: Garonne River, France (Draparnaud 1805).
Sources: Paraense & Pointier (2003); Van Damme *et al.* (2017); GBIF (2023*b*).

Order Stylommatophora Schmidt, 1855
Family Achatinidae Swainson, 1840
Common name: Tropical land snails

4. *Lissachatina fulica* (Bowdich, 1822)
Distribution and year: 90 miles south of Nata, near Thalia village 1969 (GBIF 2023*b*).
Native range: The coastal regions of East Africa (Fontanilla 2010), southern limit possibly being the Zambezi River (Herbert 2010).
Extent of invasion: The species became widely spread across the Indian ocean islands such as Madagascar and Mauritius during the 1800s (Fontanilla 2010). It later spread to India, Sri Lanka, Asia and into several Pacific islands, and gained ground in Europe and North America (Raut & Barker 2002).
Habitat: Terrestrial.
Notes: Introduction of the species to other regions of the world is presumed to be more deliberate than accidental (Raut & Barker 2002). This rapidly invading species, which covers a wide range expansion within a short period of time (Herbert 2010), acts as an intermediate host of the rat lungworm *Angiostrongylus cantonensis* that causes human eosinophilic meningitis (Fontanilla 2010), and is also infamously known as a crop pest in regions such as Ghana and mainland Kenya (Raut & Barker 2002). *Lissachatina fulica* can easily be mistaken for the indigenous *L. immaculata* (see Herbert 2010).
Type locality: Unknown (Bowdich 1822).
Source: GBIF (2023).

DISCUSSION

Enabling access to species inventories is a paramount component of biodiversity conservation, whereby conservation biologists and managers develop meaningful action plans and make informed decisions based on the spatial and temporal occurrence of particular species (Reyserhove *et al.* 2020). The present study reports 63 native molluscs recorded (collected or observed) from Botswana from 1854 to 2023, belonging to 43 genera and 21 families. Among them, the Achatinidae (land snails) and Planorbidae (freshwater snails) are the most diverse families with 13 and seven species respectively, while others have less than six species representatives. The species list comprises 13 freshwater bivalves, 24 freshwater snails, 24 land snails and two slugs. Three species — two slugs (*Laevicaulis natalensis* and *Laevicaulis alte*) and one land snail (*Gastrocopta klunzingeri*) — have been noted exclusively on the iNaturalist and NBC platforms, respectively; thus, these are the first formally published records for Botswana. The four introduced species — *Cornu aspersum*, *Lissachatina fulica*, *Physella acuta* and *Radix auricularia* — are potentially invasive and of economic concern.

The rigorous approach to compilation of this checklist resulted in the exclusion of several records. Two taxa from the published literature, *Elisolimax* sp. (Appleton *et al.* 2003) and *Curvella* spp. (van Bruggen 1966*a*) were omitted as they were only identified to the genus level. Filtering the Botswana mollusc GBIF Occurrence dataset (GBIF 2023*b*) led to exclusion of nine species. *Bullastra lessoni* (Deshayes, 1831) was omitted on the basis that the GBIF records it from a locality in the Finke River, Northern Territory, Australia. *Lissachatina layardi* (Pfeiffer, 1858) and *Zonitoides africanus* Boettger, 1910 were omitted due to unresolved taxonomy, being labelled 'uncertain > taxon inquirendum' in MolluscaBase (2021; 2024). Three species — *Afroconulus diaphanus* (Connolly, 1922), *Oreohomorus zebra* (Connolly, 1923) and *Primigulella pilula pilula* (Preston, 1911) — were removed based on occurrence uncertainty, with the 'locality' being recorded as Mount Kenya, while 'higher geography' was recorded as Machaneng (a village in Botswana). Another three species — *Melliteryx mactroides* (Hanley, 1857), *Microcardium gilchristi* (G.B. Sowerby III, 1904) and *Styloptygma jaculum* (Melvill & Standen, 1896) — were excluded from the list as these marine species had been erroneously documented to occur in the land-locked Botswana.

During preparation of the checklist, it became evident that nomenclature of some species changed over time. Ten species (*Afrogyrorbis natalensis*, *Cecilioides gokweana*, *Euglesa viridaria*, *Hovorbis coretus*, *Lissachatina immaculata*, *Lubricetta subteres*, *Oxyloma patentissimum*, *Pettancylus victoriensis*, *Radix natalensis* and *Tayloria gwandaensis*) are listed in this publication under their updated (current) scientific names.

With regards to the conservation status of the species, the checklist does not contain threatened taxa, i.e., those species classified as 'Endangered', 'Critically Endangered' or 'Vulnerable' according to the IUCN Red Data Listing guidelines (Mace *et al.* 2008). A majority (33) species are listed as 'Least Concern', 26 species are listed as 'Not Evaluated', and four species are treated as 'Data Deficient'. Kristensen *et al.* (2009) argue that most of the species assessed as 'Data Deficient' are usually smaller and often overlooked during field work. Indeed, two species listed as 'Data Deficient', *Burnupia trapezoidea* and *Lobogenes michaelis*, are relatively small and may potentially go unnoticed during surveys in freshwater habitats (Brown *et al.* 1992; de Kock & Wolmarans 2017). Further dedicated research is needed to acquire more data for assessment of the conservation status of the 'Data Deficient' species and those that are not yet evaluated.

In terms of the species richness, the Okavango Delta harbours the highest number of species (31), followed

by the Chobe–Linyanti–Kwando River system, Thamalakane River, Boro River, Boteti River, Lake Ngami, Aha Hills and the Limpopo River with 25, 13, 13, 9, 7, 7 and 6 species, respectively. All the other localities have five or less species recorded. This reflects the sampling bias towards the freshwater habitats in the Zambezi Flooded Grasslands and the Zambezi Mopane Woodlands ecoregions, particularly the Okavango Delta (and associated Thamalakane and Boro rivers) and the Chobe–Linyanti–Kwando river-system (Ashton *et al*. 2003). This bias also results from the significance of these rivers as Botswana's major sources of perennial surface water located in an ecologically and economically important wetland ecosystem (Cronberg *et al.* 1995). Moreover, the Okavango Delta's importance is highlighted by its status as a renowned Ramsar site and Botswana's second listed World Heritage Site (Mosepele & Mosepele 2021), harbouring unique biodiversity (Moliner Cachazo *et al.* 2023) and attracting a significant number of researchers from all over the world. Hence, more effort for freshwater mollusc surveys should be geared towards the Limpopo River and its left-hand ephemeral tributaries such as Lotsane and Motloutse rivers. Based on the findings from the present endeavour, only one bivalve species *Chambardia petersi* is recorded exclusively from the Limpopo River in south-eastern Botswana. Indeed, the species' geographic range is confined to the Limpopo, Icnomati, lower Zambezi and Shiré river-systems in eastern Southern Africa (Appleton & Curtis 2007; Van Damme *et al.* 2018*a*). Further investigation of the population dynamics and key threats specific to the Limpopo River is needed to advance proper conservation actions for *C. petersi* across its native range in Botswana.

There is also dire need for intense sampling of terrestrial mollusc species in other ecoregions of the country. It is evident from results of the 1961 Harvard–Smithsonian–Transvaal Museum Kalahari Expedition (van Bruggen 1963) and the Transvaal Museum's Mr W.D. Haacke's expedition in 1965 (van Bruggen 1966*a*) that the richest diversity of terrestrial molluscs comes from the Aha Hills in the Kalahari Acacia Woodlands ecoregion. Clearly undersampled are the Zambezian Mopane Woodlands and Zambezian Baikiaea Woodlands, with currently recorded one and three species respectively.

The present study also highlights the occurrence of several introduced species in Botswana – two freshwater and two terrestrial snails. Both terrestrial snails *Lissachatina fulica* and *Cornu aspersum* are infamously known as notorious agricultural pests (Barker & Watts 2002; Raut & Barker 2002), devouring crops and ultimately causing losses in the agricultural sector. The freshwater snails *Physella acuta* and *Radix auricularia* are species of public health concern as they are intermediate hosts of trematodes that cause fascioliasis (Lawton *et al.* 2018; Malatji *et al.* 2019).

It is crucial to take note of several errors that have been observed in some older publications used for this study. The first concern addresses some locality names, which do not appear and/or are not recorded as landmarks in Botswana. The second concern deals with a recurrent confusion between British Bechuanaland and Bechuanaland. The following observations have been made:

(1) Gokwe River, known as the type locality for two land snail species, *Cecilioides gokweana* and *Pupilla tetrodus*, does not appear and/or is not recorded as a landmark in Botswana. To shed light on resolving the location of the river, Böttger (1870) described the species and noted that Gokwe River (approx. 22°S 28°E) was one of the three streams that fed into the Motloutse River as a left tributary of the Limpopo River in the present-day south-eastern Botswana.

(2) The type locality for the freshwater snail *Burnupia trapezoidea* is accepted to be in Botswana. Nonetheless, Boettger (1910) stated that the locality for the species was Witkop in British Bechuanaland, which he further described as being 'adjacent to the German Border'. Historically, Bechuanaland was administratively divided into two political segments (Smith *et al.* 1993). The first one, British Bechuanaland was demarcated as the region south of the Molopo River (covering much of the now North West Province (part of the former Transvaal Province) of South Africa). The other section was Bechuanaland Protectorate, which was the region north of the Molopo River (now Republic of Botswana). It appears that subsequent publications maintained the incorrect assigning of the type locality to be Botswana (Brown 1994; de Kock & Wolmarans 2017). Boetgger (1910) was referring to Witkop (Limpopo Province) in South Africa.

(3) In his 1939 monograph, Connolly made inaccurate records for Bechuanaland and British Bechuanaland, whereby there was interchange and confusion between the two. For instance, for the species *Pupoides calaharicus*, Maun, a locality known from Botswana is written under British Bechuanaland, while the Harts River (Taung), a locality known from South Africa, is written under Bechuanaland (Connolly 1939).

(4) Mt Mohapaani was described as a locality southwest of Palapye (halfway between Francistown and Gaborone in Botswana) in Connolly's 1939 publication. However, this is an error. Mt Mohapaani is a

locality in Witfoneirand, near Thabazimbi, Limpopo Province, South Africa (Krauss 1848; van Bruggen 1969; Herbert & Warén 1999).

LIMITATIONS OF THE STUDY

Obtaining sufficient data from 'grey' literature and natural history museums other than AMGS, NHMUK, NMSA, RMNH and SMWN was beyond the scope of this study. Consequently, the author diligently accepts that this work may not offer an exhaustive list of mollusc species recorded from Botswana. Despite this limitation, the compilation provides a significant baseline for mollusc species inventories, guiding future research and advancing policy- and decision-making on mollusc conservation in Botswana.

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REFERENCES

Adams, H. 1870. Descriptions of a new genus, and of eighteen new species of Mollusks. *Proceedings of the Scientific Meetings of the Zoological Society of London* **1870**: 5–9. https://www.biodiversitylibrary.org/page/28554801

Ahmad, T.B., Liu, L., Kotiw, M. & Benkendorff, K. 2018. Review of anti-inflammatory, immune-modulatory and wound healing properties of molluscs. *Journal of Ethnopharmacology* **210**: 156–178. https://doi.org/10.1016/j.jep.2017.08.008

Albrecht, C., Clewing, C., Appleton, C., Ghamizi, M., Jørgensen, A., Kristensen, T.K., Lange, C. & Stensgaard, A.-S. 2018*a*. *Gyraulus costulatus*. *The IUCN Red List of Threatened Species* **2018**: e.T165767A120115499. https://www.iucnredlist.org/species/165767/120115499

Albrecht, C., Clewing, C., Appleton, C.C., Curtis, B., Ghamizi, M., Jørgensen, A., Kristensen, T.K., Lange, C. & Stensgaard, A.-S. 2018*b*. *Africanogyrus coretus*. *The IUCN Red List of Threatened Species* **2018**: e.T165775A120113348. https://www.iucnredlist.org/species/165775/120113348

Albrecht, C., Clewing, C., Jørgensen, A., Kristensen, T.K., Lange, C. & Stensgaard, A.-S. 2018*c*. *Lanistes ovum*. *The IUCN Red List of Threatened Species* **2018**: e.T165799A120111809. https://www.iucnredlist.org/species/165799/120111809

Albrecht, C., Clewing, C. & Lange, C. 2018*d*. *Bulinus truncatus*. *The IUCN Red List of Threatened Species* **2018**: e.T99507883A120114540. https://www.iucnredlist.org/species/99507883/120114540

Albrecht, C., Clewing, C. & Lange, C. 2018*e*. *Radix natalensis*. *The IUCN Red List of Threatened Species* **2018**: e.T165761A120112796. https://www.iucnredlist.org/species/165761/120112796

Albrecht, C., Clewing, C., Van Damme, D. & Lange, C. 2018*f*. *Melanoides tuberculata*. *The IUCN Red List of Threatened Species* **2018**: e.T155675A120117210. https://www.iucnredlist.org/species/155675/120117210

Ancey, C.-F. 1888. Descriptions de mollusques terrestres. *Le Naturaliste* **35**: 188–190. https://www.biodiversitylibrary.org/page/10453024

Appleton, C.C. 1979. The Unionacea (Mollusca, Lamellibranchiata) of south-central Africa. *Annals of the South African Museum* **77**: 151–174. https://biostor.org/reference/116855

Appleton, C.C. 1996. *Freshwater molluscs of Southern Africa: With a chapter on* Bilharzia *and its snail hosts*. Pietermaritzburg: University of Natal Press. https://www.researchgate.net/publication/316609957

Appleton, C.C. 2002. Mollusca. **In:** Day, J.A. & de Moor, I.J. (Eds), *Guides to the freshwater invertebrates of Southern Africa.* Vol. 6: Arachnida and Mollusca. Pretoria: Water Research Commission, pp. 42–125. https://www.wrc.org.za/wp-content/uploads/mdocs/TT-182-02.pdf

Appleton, C.C. & Curtis, B.A. 2007. An annotated checklist of the freshwater bivalves (Mollusca: Bivalvia) of Botswana and Namibia. *Annals of the Eastern Cape Museum* **6**: 45–71. https://www.biodiversitylibrary.org/item/212554#page/47

Appleton, C.C., Curtis, B.A., Alonso, L.E. & Kipping, J. 2003. Freshwater invertebrates of the Okavango Delta, Botswana. **In:** Alonso, L.E. & Nordin, L.A. (Eds), *A rapid biological assessment of the aquatic ecosystems of the Okavango Delta*, *Botswana: High Water Survey. RAP Bulletin of Biological Assessment*. Vol. 27. Washington, DC:

Conservation International, pp. 58–69.
http://biocart.de/naturschutz/pdf/RAP-Botswana.pdf

Appleton, C., Curtis, B., Jørgensen, A. & Kristensen, T.K. 2010*a*. *Cleopatra nsendweensis*. *The IUCN Red List of Threatened Species* **2010**: e.T165774A6115710.
https://www.iucnredlist.org/species/165774/6115710

Appleton, C., Jørgensen, A., Kristensen, T.K. & Stensgaard, A.-S. 2010*b*. *Cleopatra elata*. *The IUCN Red List of Threatened Species* **2010**: e.T165814A6139870.
https://www.iucnredlist.org/species/165814/6139870

Appleton, C., Jørgensen, A., Kristensen, T.K. & Stensgaard, A.-S. 2010*c*. *Gabbiella kisalensis*. *The IUCN Red List of Threatened Species* **2010**: e.T165797A6132461.
https://www.iucnredlist.org/species/165797/6132461

Appleton, C.C. & Miranda, N. 2015. Molluscs. **In:** Griffiths, C., Day, J.A. & Picker, M. (Eds), *Freshwater life: A field guide to the plants and animals of Southern Africa.* Cape Town: Struik Nature, pp. 124–137.

Ashton, P.J., Nordin, L.-A. & Alonso, L.E. 2003. Introduction to the Okavango Delta and the AquaRAP Expedition. **In:** Alonso, L.E. & Nordin, L.A. (Eds), *A rapid biological assessment of the aquatic ecosystems of the Okavango Delta, Botswana: High Water Survey. RAP Bulletin of Biological Assessment*. Vol. 27. Washington, DC: Conservation International, pp. 29–37.
http://biocart.de/naturschutz/pdf/RAP-Botswana.pdf

Baillieul, T.A. 1979. Makgadikgadi Pans Complex of Central Botswana. *GSA Bulletin* **90**(2): 289–312.
https://doi.org/10.1130/GSAB-P2-90-289

Barber, P.H., Ablan-Lagman, M.C.A., Ambariyanto, Berlinck, R.G.S., Cahyani, D., Crandall, E.D., Ravago-Gotanco, R., Juinio-Meñez, M.A., Mahardika, I.G.N., Shanker, K., Starger, C.J., Toha, A.H.A., Anggoro, A.W. & Willette, D.A. 2014. Advancing biodiversity research in developing countries: the need for changing paradigms. *Bulletin of Marine Science* **90**(1): 187–210.
https://doi.org/10.5343/bms.2012.1108

Barker, G.M. (Ed.) 2001. *The biology of terrestrial molluscs*. Wallingford, UK: CABI.
https://doi.org/10.1079/9780851993188.0000

Barker, G.M. & Watts, C. 2002. Management of the invasive alien snail *Cantareus aspersus* on conservation land. *DOC Science Internal Series 31.* Wellington: Department of Conservation. 30 pp.
https://api.semanticscholar.org/CorpusID:81255344

Benkendorff, K. 2010. Molluscan biological and chemical diversity: secondary metabolites and medicinal resources produced by marine molluscs. *Biological Reviews* **85**(4): 757–775. https://doi.org/10.1111/j.1469-185X.2010.00124.x

Blainville, H.M.D. 1826. Planorbe, *Planorbis*. (Malacoz.). **In:** Cuvier, F. (Ed.), *Dictionnaire des sciences naturelles….* Vol. 41. Paris: Le Normant, pp. 222–230.
https://www.biodiversitylibrary.org/item/81578#page/232

Böttger, O. 1870. Ueber den Mergel vom Gokwe in Süd-afrika und seine Fossilien. *Bericht über die Tätigkeit des Offenbacher Vereins für Naturkunde* **11**: 45–50.
https://www.biodiversitylibrary.org/page/35404140

Boettger, O. 1886. Beiträge zur Herpetologie und Malakozoologie Südwest-Afrikas. *Berichte der Senckenbergischen Naturforschenden Gesellschaft* **1886**: 3–29.
https://www.biodiversitylibrary.org/page/8783751

Boettger, O. 1910. Die Binnenkonchylien von Deutsch–Südwestafrika und ihre Beziehungen zur Molluskenfauna des Kaplandes. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* **32**: 431–456.
https://www.biodiversitylibrary.org/page/58353782

Bowdich, T.E. 1822. *Elements of conchology, including the fossil genera and the animals. Part 1. Univalves.* Paris: J. Smith. http://www.biodiversitylibrary.org/item/45861

Brown, D.S. 1967. A review of the freshwater Mollusca of Natal and their distribution. *Annals of the Natal Museum* **18**(3): 477–494. https://hdl.handle.net/10520/AJA03040798_732

Brown, D.S. 1994. *Freshwater snails of Africa and their medical importance*. London, Taylor and Francis.

Brown, D.S. 2001. Taxonomy, biogeography and phylogeny of the non-lacustrine African freshwater snails belonging to the genera *Ceratophallus* and *Afrogyrus* (Mollusca: Planorbidae). *Journal of Zoology* **255**(1): 55–82.
https://doi.org/10.1017/S095283690100111X

Brown, D.S., Curtis, B.A., Bethune, S. & Appleton, C.C. 1992. Freshwater snails of East Caprivi and the lower Okavango River basin in Namibia and Botswana. *Hydrobiologia* **246**: 9–40. https://doi.org/10.1007/BF00005620

Brown, D.S. & Kristensen, T.K. 1989. *A field guide to African freshwater snails. 8. Southern African species*. Charlottenlund, Denmark: Danish Bilharziasis Laboratory.
https://www.eliminateschisto.org/sites/gsa/files/content/attachments/2022-08-05/fg_sa_1989.pdf

Brown, D.S., Shaw, K.M. & Rollinson, D. 1991. Freshwater snails of the *Bulinus trancatus/tropicus* complex (Basommatophora: Planorbidae) in Kenya: diploid populations. *Journal of Molluscan Studies* **57**(2): 143–166.
https://doi.org/10.1093/mollus/57.2.143

Brown, D.S. & Van Eeden, J.A. 1969. The molluscan genus *Gyraulus* (Gastropoda: Planorbidae) in Southern Africa. *Zoological Journal of the Linnean Society* **48**(3): 305–331.
https://doi.org/10.1111/j.1096-3642.1969.tb00715.x

Burgess, N., Hales, J., Underwood, E., Dinerstein, E., Olson, D., Itoua, I., Schipper, J., Rickketts, T. & Newman, K. 2004. *Terrestrial ecoregions of Africa and Madagascar: A conservation assessment*. Washington, DC: World Wildlife Fund. https://www.researchgate.net/publication/292588815

Chapman, A.D. 2005. *Principles of data quality*. Global Biodiversity Information Facility.
https://doi.org/10.15468/doc.jrgg-a190

Connolly, M.W.K. 1912. A revised reference list of South African non-marine Mollusca; with descriptions of new species in the South African Museum. *Annals of the South African Museum* **11**(3): 59–306.
https://www.biodiversitylibrary.org/item/43652#page/7

Connolly, M.W.K. 1939. A monographic survey of South African non-marine Mollusca. *Annals of the South African Museum* **33**: 1–660.
https://www.biodiversitylibrary.org/page/40865351#page/21

Craven, A.E. 1881. On a collection of land and freshwater shells from the Transvaal and Orange Free State in South Africa, with descriptions of nine new species. *Proceedings of the Scientific Meetings of the Zoological Society of London* **1880**: 614–618.
https://www.biodiversitylibrary.org/page/28522818

Cronberg, G., Gieske, A., Martins, E., Prince Nengu, J. & Stenström, I.-M. 1995. Hydrobiological studies of the Okavango Delta and Kwando/Linyanti/Chobe River, Botswana. I surface water quality analysis. *Botswana Notes & Records* **27**(1): 151–226.
https://hdl.handle.net/10520/AJA052550590_383

Cummings, K.S., Jones, H.A. & Lopes-Lima, M. 2016. Rapid bioassessment methods for freshwater molluscs. **In:** Larsen, T.H. (Ed.), *Core standardized methods for rapid biological field assessment.* Arlington, VA, USA: Conservation International, pp. 186–207.
https://www.researchgate.net/publication/303988906

Curtis, B. 1998. *Aquatic invertebrates (Namibian Sector) and water-borne diseases of the Okavango River Basin*. Luanda, Gaborone, Windhoek: Permanent Okavango River Basin Commission.
http://the-eis.com/elibrary/search/2227

Dallas, H.F. & Mosepele, B. 2007. A preliminary survey and analysis of the spatial distribution of aquatic invertebrates in the Okavango Delta, Botswana. *African Journal of Aquatic Science* **32**(1): 1–11.
https://doi.org/10.2989/AJAS.2007.32.1.1.138

Dautzenberg, P. & Germain, L. 1914. Récoltes malacologiques du Dr J. Bequaert dans le Congo Belge. *Revue Zoologique Africaine* **4**: 1–74.
https://www.biodiversitylibrary.org/page/11472300

De Kock, K.N. & Wolmarans, C.T. 2007. Distribution and habitats of the alien invader freshwater snail *Physa acuta* in South Africa. *Water SA* **33**(5): 717–722.
https://doi.org/10.4314/wsa.v33i5.184093

de Kock, K.N. & Wolmarans, C.T. 2017. Distribution and habitats of *Burnupia trapezoidea* (Boettger, 1910) (Gastropoda: Ancylidae) in South Africa. *Water SA* **43**(2): 258–263.
https://doi.org/10.4314/wsa.v43i2.09

DEA [Department of Environmental Affairs]. 2015. *Republic of Botswana fifth national report to the Convention on Biological Diversity*. Gaborone: Department of Environmental Affairs.
https://www.cbd.int/doc/world/bw/bw-nr-05-en.pdf

Dinerstein, E., Olson, D., Joshi, A., Vynne, C., Burgess, N.D., Wikramanayake, E., Hahn, N., Palminteri, S., Hedao, P., Noss, R., Hansen, M., Locke, H., Ellis, E.C., Jones, B., Barber, C.V., Hayes, R., Kormos, C., Martin, V., Crist, E., Sechrest, W., Price, L., Baillie, J.E.M., Weeden, D., Suckling, K., Davis, C., Sizer, N., Moore, R., Thau, D., Birch, T., Potapov, P., Turubanova, S., Tyukavina, A., de Souza, N., Pintea, L., Brito, J.C., Llewellyn, O.A., Miller, A.G., Patzelt, A., Ghazanfar, S.A., Timberlake, J., Klöser, H., Shennan-Farpón, Y., Kindt, R., Lillesø, J.-P.B., van Breugel, P., Graudal, L., Voge, M., Al-Shammari, K.F. & Saleem, M. 2017. An ecoregion-based approach to protecting half the terrestrial realm. *BioScience* **67**(6): 534–545.
https://doi.org/10.1093/biosci/bix014

Dohrn, H. 1865. List of the land and freshwater shells of the Zambesi and Lake Nyasa, eastern tropical Africa, collected by John Kirk. *Proceedings of the Scientific Meetings of the Zoological Society of London* **1865**: 231–234.
https://www.biodiversitylibrary.org/page/28497164

Draparnaud, J.P.R. 1805. *Histoire naturelle des mollusques terrestres et fluviatiles de la France*. Paris: Colas et Gabon.
https://www.biodiversitylibrary.org/page/52682088

Dunker, W. 1845. Diagnoses molluscorum quorundam novorum, quae ex itinere ad oras Africae occidentalis reportavit cl. G. Tams, Med. Dr. *Zeitschrift für Malakozoologie* **1845**(11): 163–168. http://biodiversitylibrary.org/page/16291751

Dupuis, P. & Putzeys, S. 1901. Diagnoses de quelques espèces de coquilles nouveaux et d'un genre nouveau provenant de l'État indépendant du Congo, suivies de quelques observations relatives à des espèces déjà connues. *Annales de la Société royale malacologique de Belgique*, *Bulletins des Séances* **36**: LI–LXI.
https://www.biodiversitylibrary.org/page/5604458

Ecoregions [Ecoregions 2017© Resolve]. 2024. *RESOLVE* Ecoregions Dataset and Interactive Map.
https://ecoregions.appspot.com (accessed 10.06.2024)

Férussac, A.E.J.P.F., d'Audebard, de. 1822. *Tableaux systématiques des animaux mollusques classés en familles naturelles*, *dans lesquels on a établi la concordance de tous les systèmes; suivis d'un Prodrome général pour tous les mollusques ou fluviatiles*, *vivantes ou fossiles*. Paris: A. Bertrand. https://biodiversitylibrary.org/page/11057234

Fontanilla, I.K.C. 2010. Achatina (Lissachatina) fulica *Bowdich: its molecular phylogeny*, *genetic variation in global populations*, *and its possible role in the spread of the rat lungworm* Angiostrongylus cantonensis *(Chen).* PhD Thesis. Nottingham, UK: University of Nottingham. https://eprints.nottingham.ac.uk/id/eprint/11069

Frauenfeld, G.R. von. 1865. Zoologische Miscellen. V. *Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien* **15**: 525–536. https://www.biodiversitylibrary.org/page/16400966

Gaitán-Espitia, J.D., Scheihing, R., Poulin, E., Artacho, P. & Nespolo, R.F. 2013. Mitochondrial phylogeography of the land snail *Cornu aspersum*: tracing population history and the impact of human-mediated invasion in austral South America. *Evolutionary Ecology Research* **15**(1): 61–78. https://www.researchgate.net/publication/236044425

GBIF. 2023*a*. *GBIF: Global Biodiversity Information Facility. Free and open access to biodiversity data*. https://www.gbif.org (accessed 23.05.2023)

GBIF. 2023*b*. *Occurrence download. The Global Biodiversity Information Facility*. https://www.gbif.org/occurrence/download/0257952-230224095556074 (accessed 23.05.2023)

Gittenberger, E. & van Bruggen, D. 2013. Land snails of the islet of Misali, off Pemba Island, Zanzibar, Tanzania. *Zoologische Mededelingen* **87**(3): 235–273. https://repository.naturalis.nl/pub/613718

Govender, V. 2007. *Patterns of distribution*, *diversity and endemism of terrestrial molluscs in South Africa.* MSc Thesis. Durban: University of KwaZulu-Natal. http://hdl.handle.net/10413/366

Graf, D.L. & Cummings, K.S. 2006. Freshwater mussels (Mollusca: Bivalvia: Unionoida) of Angola, with description of a new species, *Mutela wistarmorrisi*. *Proceedings of the Academy of Natural Sciences of Philadelphia* **155**(1): 163–194. https://doi.org/10.1635/i0097-3157-155-1-163.1

Graf, D.L. & Cummings, K.S. 2023. *The freshwater mussels (Unionoida*) *of the world (and other less consequential bivalves*). MUSSEL Project. http://www.mussel-project.net (accessed 20.09.2023)

Gray, J.E. 1834. Characters of new species of shells. *Proceedings of the Zoological Society of London* **2**(19): 63–68. https://biodiversitylibrary.org/page/12859659

Guiller, A., Martin, M.C., Hiraux, C. & Madec, L. 2012. Tracing the invasion of the Mediterranean land snail *Cornu aspersum aspersum* becoming an agricultural and garden pest in areas recently introduced. *PLOS ONE* **7**(12): Art. e49674. https://doi.org/10.1371/journal.pone.0049674

Haas, F. 1936. Binnen-Mollusken aus Inner-Afrika, hauptsächlich gesammelt von Dr. F. Haas während der Schomburgk-Expedition in den Jahren 1931/32. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* **431**: 1–156. https://molluscabase.org/aphia.php?p=sourcedetails&id=294295

Harvard University M. & Morris, P.J. 2024*a*. *Achatina schinziana* Mousson, 1888 collected in Zimbabwe. *Occurrence dataset. The Global Biodiversity Information Facility*. https://www.gbif.org/occurrence/477097831

Harvard University M. & Morris, P.J. 2024*b*. *Achatina immaculata* Lamarck, 1822 collected in Botswana. *Occurrence dataset. The Global Biodiversity Information Facility*. https://www.gbif.org/occurrence/477045165

Herbert, D.G. 2010. The introduced terrestrial mollusca of South Africa. *SANBI Biodiversity Series* **15**: 1–108.

Herbert, D. & Kilburn, D. 2004. *Field guide to the land snails and slugs of eastern South Africa*. Pietermaritzburg: Natal Museum.

Herbert, D.G. & Warén, A. 1999. South African Mollusca described by Ferdinand Krauss: their current status and notes on type material housed in the Naturhistoriska Riksmuseet, Stockholm. *Annals of the Natal Museum* **40**: 205–243. https://hdl.handle.net/10520/AJA03040798_101

ICZN. 1999. *International Code of Zoological Nomenclature*. 4th ed. London, UK: The International Trust for Zoological Nomenclature. https://www.iczn.org/the-code/the-code-online

Isaacs, S.M. & Stephens, M. 2022. Geoconservation in Botswana. **In:** Eckardt, F.D. (Ed.), *Landscapes and landforms of Botswana.* Cham: Springer, pp. 361–375. https://doi.org/10.1007/978-3-030-86102-5_21

IUCN. 2023. *The IUCN Red List of Threatened Species*. Ver. 2023-1. https://www.iucnredlist.org (accessed 21.09.2023)

Jansen van Rensburg, C. 2001. *Snail borne larval trematodes of the Okavango Delta*, *Botswana.* MSc Thesis. Bloemfontein: University of the Free State. http://hdl.handle.net/11660/7458

Jickeli, C.F. 1873. Diagnosen neuer Mollusken aus meiner Reiseausbeute. *Malakozoologische Blätter* **20**: 99–108. https://www.biodiversitylibrary.org/page/15648237

Jickeli, C.F. 1874. Fauna der Land- und Süsswasser-Mollusken Nord-Ost-Afrika's. *Verhandlungen der Kaiserlich Leopoldinisch-Carolinisch Deutschen Akademie der Naturforscher* **37**(1): 1–352.
https://www.biodiversitylibrary.org/page/12577303

Jordan, S.F. & Black, S.H. 2012. *Effects of forest land management on terrestrial mollusks: A literature review*. Portland, OR, USA: The Xerces Society for Invertebrate Conservation.
https://xerces.org/sites/default/files/publications/12-054.pdf

Jørgensen, A. 2010. *Lobogenes michaelis* (Central Africa assessment). *The IUCN Red List of Threatened Species* **2010**: e.T165764A6109034.
https://www.iucnredlist.org/species/165764/6109034

Jørgensen, P.S. & Sørensen, N. 2008. *The invasive potential of the brown garden snail (*Cantareus aspersus*): A future invasive species in Denmark?* BSc Thesis. Copenhagen, Denmark: University of Copenhagen.
https://www.researchgate.net/publication/242680566

Kampamba, J., Kachepa, S., Sungirirai, L., Nyendwa, C., Mpolokang, P. & Majingo, M. 2019. Land governance in Botswana. **In:** *2019 Land Governance in Southern Africa Conference, July, 2018*. Windhoek, Namibia: The NUST-NELGA Hub, pp. 1–38.
https://www.researchgate.net/publication/336086064

Kershaw, D.R. 1983. Phylum Mollusca. **In:** Kershaw, D.R., *Animal diversity.* Dordrecht: Springer, pp. 169–191.
https://doi.org/10.1007/978-94-011-6035-3_10

Koudenoukpo, Z.C., Odountan, O.H., Van Bocxlaer, B., Sablon, R., Chikou, A. & Backeljau, T. 2020. Checklist of the fresh and brackish water snails (Mollusca, Gastropoda) of Bénin and adjacent West African ecoregions. *ZooKeys* **942**: 21–21. https://doi.org/10.3897/zookeys.942.52722

Krauss, F. 1848. *Die südafrikanischen Mollusken. Ein Beitrag zur Kenntniss der Mollusken des Kap- und Natallandes und zur geographischen Verbreitung derselben, mit Beschreibung und Abbildung der neuen Arten*. Stuttgart: Ebner & Seubert.
https://www.biodiversitylibrary.org/page/13801704

Kristensen, T.K. & Appleton, C. 2010. *Burnupia trapezoidea*. *The IUCN Red List of Threatened Species* **2010**: e.T63421A12669956.
https://www.iucnredlist.org/species/63421/12669956

Kristensen, T.K. & Stensgaard, A.S. 2010. *Mutela zambesiensis*. *The IUCN Red List of Threatened Species* **2010**: e.T63455A12679680.
https://www.iucnredlist.org/species/63455/12679680

Kristensen, T.K., Appleton, C.C., Curtis, B. & Stensgaard, A-S. 2009. The status and distribution of freshwater molluscs. **In:** Darwall, W.R.T., Smith, K.G., Tweddle, D. & Skelton, P. (Eds), *The status and distribution of freshwater biodiversity in Southern Africa*. Gland, Switzerland: IUCN and Grahamstown, South Africa: SAIAB, pp. 38–47.
https://portals.iucn.org/library/node/9325

Kristensen, T.K., Stensgaard, A.-S. & Curtis, B. 2010*a*. *Pila occidentalis*. *The IUCN Red List of Threatened Species* **2010**: e.T17278A6916407.
https://www.iucnredlist.org/species/17278/6916407

Kristensen, T.K., Stensgaard, A.S. & Appleton, C.C. 2010*b*. *Coelatura kunenensis*. *The IUCN Red List of Threatened Species* **2010**: e.T63456A12679964.
https://www.iucnredlist.org/species/63456/12679964

Kuiper, J.G.J. 1956. *Pisidium viridarium*, eine neue Art aus Ost-Afrika. *Archiv für Molluskenkunde* **85**(1/3): 61–63.
https://www.zobodat.at/pdf/Archiv-fuer-Molluskenkunde_85_0061-0063.pdf

Kuiper, J.G.J. 1966*a*. *Pisidium* (*Parapisidium* n. subg.) *reticulatum* n. sp. von der Insel Nossi-Bé bei Madagascar und aus Rhodesien. *Archiv für Molluskenkunde* **95**(1/2): 15–18.
https://www.zobodat.at/pdf/Archiv-fuer-Molluskenkunde_95_0015-0018.pdf

Kuiper, J.G.J. 1966*b*. Les espèces africaines du genre *Pisidium*, leur synonymie et leur distribution (Mollusca, Lamellibranchiata, Sphaeriidae). *Annales du Musée Royal de l'Afrique Centrale*, *Tervuren. Sciences zoologiques* **151**: 1–77.
https://molluscabase.org/aphia.php?p=sourcedetails&id=345245

Lamarck, J.-B.P.A. 1822. *Histoire naturelle des animaux sans vertèbres.* Vol. 6. Paris.
https://www.biodiversitylibrary.org/page/13181853

Lancaster, I.N. 1974. Pans of Southern Kalahari. *Botswana Notes and Records* **6**: 157–169.
https://www.jstor.org/stable/40959216

Larson, M.D. 2018. Range expansion and parasitism in the nonnative snail *Radix auricularia*. *Western North American Naturalist* **78**(1): 112–116.
https://doi.org/10.3398/064.078.0112

Lawton, S.P., Allan, F., Hayes, P.M. & Smit, N.J. 2018. DNA barcoding of the medically important freshwater snail *Physa acuta* reveals multiple invasion events into Africa. *Acta tropica* **188**: 86–92.
https://doi.org/10.1016/j.actatropica.2018.08.027

Linnaeus, C. 1758. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Vol. 1. 10th revised edition. Holmiae: Laurentius Salvius.
https://biodiversitylibrary.org/page/726886

Lo Brutto, S. 2023. Zoological checklists: From natural history museums to ecosystems. *Diversity* **15**(6): Art. 741. https://doi.org/10.3390/d15060741

Lopes-Lima, M., Riccardi, N., Urbanska, M., Köhler, F., Vinarski, M., Bogan, A.E. & Sousa, R. 2021. Major shortfalls impairing knowledge and conservation of freshwater molluscs. *Hydrobiologia* **848**(12): 2831–2867. https://doi.org/10.1007/s10750-021-04622-w

Mace, G.M., Collar, N.J., Gaston, K.J., Hilton-Taylor, C., Akçakaya, H.R., Leader-Williams, N., Milner-Gulland, E.J. & Stuart, S.N. 2008. Quantification of extinction risk: IUCN's System for classifying threatened species. *Conservation Biology* **22**(6): 1424–1442. https://doi.org/10.1111/j.1523-1739.2008.01044.x

Mahajan, R.K., Almeida, A.J., Sengupta, S.R. & Renapurkar, D.M. 1992. Seasonal intensity of *Angiostrongylus cantonensis* in the intermediate host, *Laevicaulis alte*. *International Journal of Parasitology* **22**(5): 669–671. https://doi.org/10.1016/0020-7519(92)90017-F

Malatji, M.P., Lamb, J. & Mukaratirwa, S. 2019. Molecular characterization of liver fluke intermediate host lymnaeids (Gastropoda: Pulmonata) snails from selected regions of Okavango Delta of Botswana, KwaZulu-Natal and Mpumalanga provinces of South Africa. *Veterinary Parasitology*: *Regional Studies and Reports* **17**: Art. 100318. https://doi.org/10.1016/j.vprsr.2019.100318

Maldonado, C., Molina, C.I., Zizka, A., Persson, C., Taylor, C.M., Albán, J., Chilquillo, E., Rønsted, N. & Antonelli, A. 2015. Estimating species diversity and distribution in the era of Big Data: to what extent can we trust public databases? *Global Ecology and Biogeography* **24**(8): 973–984. https://doi.org/10.1111/geb.12326

Mandahl-Barth, G. 1988. *Studies on African freshwater bivalves*. Charlottenlund, Denmark: Danish Bilharziasis Laboratory. https://ivh.ku.dk/research-files/pap-gamle-pdf-filer/docs/fg_1988_bivalvia.pdf

Martens, E., von. 1860. Verzeichniss der von Prof. Peters in Mossambique gesammelten Land- und Süsswasser-Mollusken. *Malakozoologische Blätter* **6**: 211–221. https://www.biodiversitylibrary.org/page/16014305#page/483

Martens, E., von. 1900. Einige neue Arten südafrikanischer Landschnecken. *Sitzungs-Berichte der Gesellschaft naturforschender Freunde zu Berlin* **1900**: 117–119. https://www.biodiversitylibrary.org/page/8797123

Meyer, W.M.III, Ostertag, R. & Cowie, R.H. 2013. Influence of terrestrial molluscs on litter decomposition and nutrient release in a Hawaiian rain forest. *Biotropica* **45**(6): 719–727. https://doi.org/10.1111/btp.12057

Miyahira, I.C., Clavijo, C., Callil, C.T., Cuezzo, M.G., Darrigran, G., Gomes, S.R., Lasso, C.A., Mansur, M.C.D., Pena, M.S., Ramírez, R., dos Santos, R.C.L., dos Santos, S.B., Scarabino, F., Torres, S.H., Vogler, R.E. & Cowie, R.H. 2022. The conservation of non-marine molluscs in South America: where we are and how to move forward. *Biodiversity and Conservation* **31**(11): 2543–2574. https://doi.org/10.1007/s10531-022-02446-1

Moliner Cachazo, L., Makati, K., Chadwick, M.A., Catford, J.A., Price, B.W., Mackay, A.W., Guiry, M.D., Murray-Hudson, M. & Murray-Hudson, F. 2023. A review of the freshwater diversity in the Okavango Delta and Lake Ngami (Botswana): taxonomic composition, ecology, comparison with similar systems and conservation status. *Aquatic Sciences* **85**(4): Art. 115. https://doi.org/10.1007/s00027-023-01008-z

MolluscaBase. 2021. *MolluscaBase*. *Zonitoides africanus* O. Boettger, 1910. https://www.molluscabase.org/aphia.php?p=taxdetails&id= 1264077 (accessed 26.09.2023)

MolluscaBase. 2023. *MolluscaBase*. https://www.molluscabase.org/aphia.php?p=search&adv=1 (accessed 20.09.2023)

MolluscaBase. 2024. *MolluscaBase*. *Lissachatina layardi* (L. Pfeiffer, 1858). https://www.molluscabase.org/aphia.php?p=taxdetails&id= 1609655 (accessed 24.05.2024)

Morelet, A. 1866. Coquilles nouvelles recueillies par le Dr Fr. Welwitsch dans l'Afrique équatoriale, et particulièrement dans les provinces portugaises d'Angola et de Benguella. *Journal de conchyliologie* **14**(2): 153–163. https://www.biodiversitylibrary.org/page/15667391

Morelet, A. 1867. Mollusques terrestres et fluviatiles. **In:** *Voyage du Dr Friederich Welwitsch exécuté par ordre du Gouvernement Portugais dans les royaumes d'Angola et de Benguella (Afrique équinoxiale)*. Paris, London, New York: J.-B. Baillière et fils. https://www.biodiversitylibrary.org/page/12983668

Mosepele, B.Q. & Mosepele, K. 2021. Ch. 11. Review of aquatic biodiversity dynamics in the Okavango Delta: Resilience in a highly fluctuating environment. **In:** Adam, D., Jiayi, P. & Shah, M.M. (Eds), *Inland waters - Dynamics and Ecology.* Rijeka: IntechOpen. https://doi.org/10.5772/intechopen.93259

Mousson, A. 1888. Coquilles recueillies dans le Sud-Ouest de l'Afrique par M. le Dr. H. Schinz, déterminée par Alb. Mousson. *Journal de Conchyliologie* **35**(4): 291–301. https://www.biodiversitylibrary.org/page/15921538

Müller, O.F. 1774. *Vermium terrestrium et fluviatilium*, *seu animalium infusorium*, *helminthicorum*, *et testaceorum*, *non marinorum*, *succincta historia*. Havniæ et Lipsiæ: Heinek et Faber. https://www.biodiversitylibrary.org/page/12893715

Muratov, I.V. 2010. Terrestrial molluscs of Cabo Delgado and adjacent inland areas of north-eastern Mozambique. *African Invertebrates* **51**(2): 255–288. https://doi.org/10.5733/afin.051.0203

NBC [Naturalis Biodiversity Center]. 2015*a*. *Bellamya capillata* (Von Frauenfeld, 1865), Specimen RMNH.MOL.104343. *Naturalis–Zoology and Geology Catalogues*. https://bioportal.naturalis.nl/en/specimen/RMNH.MOL.104343 (accessed 22.09.2023)

NBC [Naturalis Biodiversity Center]. 2015*b*. *Gastrocopta damarica* (Ancey, 1888), Specimen RMNH.MOL.104345. *Naturalis–Zoology and Geology Catalogues*. https://data.biodiversitydata.nl/naturalis/specimen/RMNH.MOL.104345 (accessed 22.09.2023)

NBC [Naturalis Biodiversity Center]. 2015*c*. *Gastrocopta damarica* (Ancey, 1888), Specimen RMNH.MOL.104354. *Naturalis–Zoology and Geology Catalogues*. https://data.biodiversitydata.nl/naturalis/specimen/RMNH.MOL.104354 (accessed 22.09.2023)

NBC [Naturalis Biodiversity Center]. 2015*d*. *Gastrocopta klunzingeri* Jickeli, 1873, Specimen RMNH.MOL.104346. *Naturalis–Zoology and Geology Catalogues*. https://data.biodiversitydata.nl/naturalis/specimen/RMNH.MOL.104346 (accessed 22.09.2023)

NBC [Naturalis Biodiversity Center]. 2015*e*. *Gulella miniata* (Krauss, 1848), Specimen RMNH.MOL.104350. *Naturalis–Zoology and Geology Catalogues*. https://data.biodiversitydata.nl/naturalis/specimen/RMNH.MOL.104350 (accessed 22.09.2023)

NBC [Naturalis Biodiversity Center]. 2015*f*. *Lanistes ovum* Peters, 1845, Specimen RMNH.MOL.104344. *Naturalis–Zoology and Geology Catalogues*. https://bioportal.naturalis.nl/nl/specimen/RMNH.MOL.104344 (accessed 22.09.2023)

NBC [Naturalis Biodiversity Center]. 2015*g*. *Pila wernei* (Philippi, 1851), RMNH.MOL.5008820. *Naturalis–Zoology and Geology Catalogues*. https://bioportal.naturalis.nl/en/specimen/RMNH.MOL.5008820 (accessed 22.09.2023)

Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P. & Kassem, K.R. 2001. Terrestrial ecoregions of the world: A new map of life on earth: A new global map of terrestrial ecoregions provides an innovative tool for conserving biodiversity. *BioScience* **51**(11): 933–938. https://doi.org/10.1641/0006-3568(2001)051[0933:TEOTWA]2.0.CO;2

Paraense, W.L. & Pointier, J.-P. 2003. *Physa acuta* Draparnaud, 1805 (Gastropoda: Physidae): a study of topotypic specimens. *Memórias do Instituto Oswaldo Cruz* **98**(4): 513–517. https://doi.org/10.1590/S0074-02762003000400016

Parkhaev, P.Y. 2017. Origin and the early evolution of the phylum Mollusca. *Paleontological Journal* **51**(6): 663–686. https://doi.org/10.1134/S003103011706003X

Pfeiffer, L. 1853. Diagnosen neuer Heliceen. *Zeitschrift für Malakozoologie* **10**(4): 51–58. https://www.biodiversitylibrary.org/page/16300951

Pfeiffer, L. 1861. Descriptions of forty-seven new species of land-shells, from the collection of H. Cuming, Esq. *Proceedings of the Scientific Meetings of the Zoological Society of London* **29**(2): 20–29. https://biodiversitylibrary.org/page/28672456

Pfeiffer, L. 1870. Zwei neue Achatinen. *Malakozoologische Blätter* **17**: 29–31. https://www.biodiversitylibrary.org/page/35535538

Philippi, R.A. 1851. Die Gattung *Ampullaria*. In Abbildungen nach der Natur mit Beschreibungen. **In:** von Schuberth, G.H. & Wagner, J.A. (Eds), *Systematisches Conchylien-Cabinet von Martini und Chemnitz.* Vol. 1. Nürnberg: Bauer & Raspe, pp. 1–74. https://www.biodiversitylibrary.org/page/34225424

Pilsbry, H.A. & Bequaert, J.C. 1927. The aquatic mollusks of the Belgian Congo: with a geographical and ecological account of Congo malacology. *Bulletin of the American Museum of Natural History* **53**(2): 69–602. http://hdl.handle.net/2246/975

Port, G. & Ester, A. 2002. Gastropods as pests in vegetable and ornamental crops in Western Europe. **In:** Barker, G.M. (Ed.), *Molluscs as crop pests.* CABI, pp. 337–351. https://doi.org/10.1079/9780851993201.0337

Preston, H.B. 1912. Additions to the land-molluscan fauna of Rhodesia. *The Annals and Magazine of Natural History, including Zoology, Botany, and Geology*. *Series 8* **9**(49): 69–72. https://www.biodiversitylibrary.org/page/18638826

Raut, S.K. & Barker, G.M. 2002. *Achatina fulica* Bodwich and other Achatinidae as pests in tropical agriculture. **In:** Barker, G.M. (Ed.), *Molluscs as crop pests.* CABI, pp. 55–114. https://doi.org/10.1079/9780851993201.0055

Reyserhove, L., Desmet, P., Oldoni, D., Adriaens, T., Strubbe, D., Davis, A.J.S., Vanderhoeven, S., Verloove, F. & Groom, Q. 2020. A checklist recipe: making species data open and FAIR. *Database* **2020**: Art. baaa084. https://doi.org/10.1093/database/baaa084

Schlettwein, C.H.G., Simmons, R.E., Macdonald, A. & Grobler, H.J.W. 1991. Flora, fauna and conservation of

East Caprivi wetlands. *Madoqua* **17**(2): 67–76. https://hdl.handle.net/10520/AJA10115498_510

Seddon, M., Appleton, C., Van Damme, D. & Graf, D. 2011. Freshwater molluscs of Africa: diversity, distribution, and conservation. **In:** Darwall, W., Smith, K., Allen, D., Holland, R., Harrison, I. & Brooks, E. (Eds), *The diversity of life in African freshwaters : under water, under threat : an analysis of the status and distribution of freshwater species throughout mainland Africa*. Gland, Switzerland & Cambridge, UK: IUCN, pp. 92–119, 322–324. https://www.researchgate.net/publication/265684401

Seddon, M.B. & Van Damme, D. 2018. *Chambardia wahlbergi*. *The IUCN Red List of Threatened Species* **2018**: e.T98324221A120110242. https://www.iucnredlist.org/fr/species/98324221/ 120110242

Sherpa, S., Ansart, A., Madec, L., Martin, M.-C., Dréano, S. & Guiller, A. 2018. Refining the biogeographical scenario of the land snail *Cornu aspersum aspersum*: Natural spatial expansion and human-mediated dispersal in the Mediterranean basin. *Molecular Phylogenetics and Evolution* **120**: 218–232. https://doi.org/10.1016/j.ympev.2017.12.018

Smith, G.F., Cole, D.T. & van Wyk, B.E. 1993. Bechuanaland: A misunderstood geographical name; and the type locality of *Haworthia tenuifolia* (Asphodelaceae: Alooideae). *Taxon* **42**(2): 369–371. http://www.jstor.org/stable/1223146

Sonamzi, B., Mlambo, M.C., Appleton, C.C. & Barber-James, H.M. 2019. The importance of museum collections in determining biodiversity patterns, using a freshwater mussel *Unio caffer* (Krauss 1848) as an example. *Bothalia* **49**(1): Art. a2400. https://doi.org/10.4102/abc.v49i1.2400

Sowerby, G.B., II. 1867. Monograph of the genus *Anodon*. **In:** Reeve, L.A. (Ed.), *Conchologia iconica: or, Illustrations of the shells of molluscous animals.* Vol. 17. London: L. Reeve & Co., pp. 1–37. http://biodiversitylibrary.org/page/10974774

Steudel, T., Göhmann, H., Mosimanyana, E., Quintino, M., Flügel, W.-A. & Helmschrot, J. 2013. Okavango Basin – Hydrology. **In:** Oldeland, J., Erb, C., Finckh, M. & Jürgens, N. (Eds), *Environmental assessments in the Okavango Region – Biodiversity and ecology*. Vol. 5. Hamburg: University of Hamburg, pp. 19–22. https://doi.org/10.7809/b-e.00238

Tanyitiku, M.N. 2022. Nutritious food and health risks: a review on the edible land snails of Africa. *Journal of Food Safety and Hygiene* **8**(2): 64–77. https://doi.org/10.18502/jfsh.v8i2.10669

Tothill, J.D. 1948. A collector's notes on the large land snails of the Anglo-Egyptian Sudan. *Sudan Notes and Records* **29**(2): 189–205. https://www.jstor.org/stable/41716561

Troschel, F.H. 1845. Anatomie von *Ampullaria urceus* und über die Gattung *Lanistes* Montf. *Archiv für Naturgeschichte* **11**(1): 197–216. https://www.zobodat.at/pdf/Archiv-Naturgeschichte_11-1_0197-0216.pdf

van Bruggen, A.C. 1963. Report on the mollusca of the 1961 Harvard-Smithsonian-Transvaal Museum Kalahari expedition. *Annals of the Transvaal Museum* **24**(4): 261–270. https://hdl.handle.net/10520/AJA00411752_334

van Bruggen, A.C. 1964. On the distribution of the genus *Xerocerastus* Kobelt & Von Möllendorff, 1902 (Mollusca, Gastropoda Pulmonata, Subulinidae). *Zoologische Mededelingen* **39**(24): 224–234. https://repository.naturalis.nl/pub/318551

van Bruggen, A.C. 1966*a*. Notes on non-marine molluscs from Mozambique and Bechuanaland, with a checklist of Bechuanaland species. *Annals of the Transvaal Museum* **25**(6): 99–111, pl. 10. https://hdl.handle.net/10520/AJA00411752_297

van Bruggen, A.C. 1966*b*. The terrestrial Mollusca of the Kruger National Park: a contribution to the malacology of the Eastern Transvaal. *Annals of the Natal Museum* **18**(2): 315–399. https://hdl.handle.net/10520/AJA03040798_740

van Bruggen, A.C. 1967. Miscellaneous notes on Southern African Gastropoda Euthyneura (Mollusca). *Zoologische Verhandelingen* **91**(1): 1–34. https://repository.naturalis.nl/pub/317698

van Bruggen, A.C. 1969. Studies on the land molluscs of Zululand. *Zoologische Verhandelingen* **103**(1): 1–116. https://repository.naturalis.nl/pub/317774

van Bruggen, A.C. 1970. A contribution to the knowledge of non-marine Mollusca of South West Africa. *Zoologische Mededelingen* **45**(4): 43–73. https://repository.naturalis.nl/pub/318771

van Bruggen, A.C. 1978. A new land snail, *Curvella transvaalensis*, from Southern Africa (Gastropoda, Pulmonata: Subulinidae). *Annals of the Transvaal Museum* **31**(2): 17–20. https://hdl.handle.net/10520/AJA00411752_198

van Bruggen, A.C. 1980. A note on some molluscs from the Caprivi Strip, South West Africa (Namibia). *Basteria* **44**(5/6): 81–84. https://natuurtijdschriften.nl/pub/596728

van Bruggen, A.C. & Appleton, C.C. 1977. Studies on the ecology and systematics of the terrestrial molluscs of the Lake Sibaya area of Zululand, South Africa. *Zoologische Verhandelingen* **154**(1): 1–44. https://repository.naturalis.nl/pub/317725

Van Damme, D. 2011. *Musculium incomitatum*. The IUCN Red List of Threatened Species 2011: e.T188882A8657203. https://www.iucnredlist.org/species/188882/8657203

Van Damme, D. 2018*a*. *Aspatharia subreniformis*. The IUCN Red List of Threatened Species 2018: e.T44266A120109809. https://www.iucnredlist.org/species/44266/120109809

Van Damme, D. 2018*b*. *Pisidium reticulatum*. The IUCN Red List of Threatened Species 2018: e.T165762A123935643. https://www.iucnredlist.org/species/165762/123935643

Van Damme, D., Appleton, C., Kristensen, T.K. & Stensgaard, A.-S. 2018*a*. *Chambardia petersi*. *The IUCN Red List of Threatened Species* **2018**: e.T184527A120110068. https://www.iucnredlist.org/species/184527/120110068

Van Damme, D., Ghamizi, M., Seddon, M.B., Budha, P.B., Dutta, J. & Cordeiro, J. 2017. *Haitia acuta*. *The IUCN Red List of Threatened Species* **2017**: e.T155538A91354457. https://www.iucnredlist.org/species/155538/91354457

Van Damme, D., Kristensen, T.K., Stensgaard, A.-S. & Appleton, C.C. 2016. *Sphaerium capense*. *The IUCN Red List of Threatened Species* **2016**: e.T165807A91293585. https://www.iucnredlist.org/species/165807/91293585

Van Damme, D., Stensgaard, A.-S., Kristensen, T.K. & Ngereza, C. 2018*b*. *Coelatura mossambicensis*. *The IUCN Red List of Threatened Species* **2018**: e.T165768A120111249. https://www.iucnredlist.org/species/165768/120111249

Walker, B. 1912. A revision of Ancylini of South Africa. *The Nautilus* **25**(12): 139–144. https://www.biodiversitylibrary.org/item/17978#page/173

Wang, X., Tang, Y., Li, Z., Wu, Q., Qiao, X., Wan, F., Qian, W. & Liu, C. 2023. Investigation of immune responses in Giant African Snail, *Achatina immaculata*, against a two-round lipopolysaccharide challenge. *International Journal of Molecular Sciences* **24**(15): Art. 12191. https://doi.org/10.3390/ijms241512191

Winterbourn, M. 2023. *Guide to the freshwater Mollusca of New Zealand (Fully revised 2021).* https://www.researchgate.net/publication/369793730

Zhu, T. & Ringler, C. 2012. Climate change impacts on water availability and use in the Limpopo River Basin. *Water (Basel)* **4**(1): 63–84. https://www.mdpi.com/2073-4441/4/1/63

Zumer-Linder, M. 1976. Botswana. **In:** Rapp, A., Le Houérou, H.N. & Lundholm, B. (Eds), *Can desert encroachment be stopped? Ecological Bulletins* **24**: 171–187. http://www.jstor.org/stable/20112551