The Role of Museums in Safeguarding Biodiversity: A Happy End of the Century-Long Saga of Tritogenia Zuluensis (Beddard, 1907) (Oligochaeta: Tritogeniidae)

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The role of museums in safeguarding biodiversity: A happy end of the century-long saga of *Tritogenia zuluensis* (Beddard, 1907) (Oligochaeta: Tritogeniidae)

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ABSTRACT

Tritogenia zuluensis (Beddard, 1907) is re-described and the taxonomic position of this species is verified. Limited knowledge of South African earthworms at the time of the original species description and a misleading specimen illustration led to difficulty in the establishment of its true identity. Thanks to protection of the type material at the Natural History Museum, University of Oslo, Norway, this species can be re-described and illustrated, and its lectotype and paralectotype are designated. Types of *Microchaetus zulu* Michaelsen, 1907, a junior synonym of *Tritogenia zuluensis*, safely stored for more than a hundred years in the Göteborg Natural History Museum, Sweden, was most helpful in the process of re-description. The significant role played by museums and similar organizations in protecting past and present natural resource treasures for the future, is highlighted. The crucial function of natural history collections in supporting traditional taxonomy, the key to understanding biodiversity, is clearly demonstrated.

KEY WORDS: Microchaetidae, *Microchaetus*, South Africa, Hluhluwe-iMfolozi, earthworms, endemic, lectotype, paralectotype, natural history collections, taxonomy.

INTRODUCTION

The description of *Tritogenia zuluensis* (Beddard, 1907) in the genus *Microchaetus* Rapp, 1849, was published on 5 March 1907 on the basis of two fragments of specimens collected in the 'locality' indicated broadly as 'Zululand', which is a vast area in northern and north-eastern KwaZulu-Natal. Less than two months later (24 August 1907) Michaelsen described *Microchaetus zulu* from 'Zulu-Land, Umpolozi'. Two similar descriptions of two species collected in the area 'Zululand' suggested possible species synonymy, and motivated Michaelsen (1913) to re-examine specimens and to accept the species priority of Beddard's *zuluensis*. However, during Michaelsen's re-examination of the *zuluensis* and *zulu* type material, some of the '*immature and several mature specimens collected by E. Warren, June 1903 in Eastern Zululand, and by T.W. Jones, September 1911 in Mfongosi, Zululand*' (Michaelsen 1913: 436–437) were included, and a composite description of *Microchaetus zuluensis* Beddard, 1907 was set up. Similar data, enlarged with added information on calciferous glands, were restated by Michaelsen (1918). Subsequently, Plisko (1992) examined the material kept in the KwaZulu-Natal Museum collection, labelled as '*NMSA/Olig.00349, Zululand, Mfongosi, 19 March 1913, W.E. Jones leg.*', and found out that the initials 'T.W' for Jones, a collector of the material studied by Michaelsen (1913), was a printing error for W.E. Jones. She believed that the earlier material studied by Michaelsen for the *zuluensis* re-description and the specimens collected by the same person (W.E. Jones) in '*Mfongosi*, *Zululand*', may be accredited to the same species. After extended examination of the material, Plisko noted some of the characters used earlier by Michaelsen as being characteristic for *zuluensis* and accredited the new material to this species. Considering some of the exclusive features of the genus *Tritogenia* (location of gizzard in segment 6–7, septum 6/7 adherent to gizzard, meroic nephridial excretory system), *zuluensis* (as defined by Michaelsen (1913)) was

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transferred from *Microchaetus* to *Tritogenia* Kinberg (1867) (see Plisko 1992: 373). The presented photograph of tubercula pubertatis and description of the material were based on individuals other than type material, and referred to 'composite *zuluensis*', as determined earlier by Michaelsen (1913). Later, however, Plisko (2008) become aware of this error and suggested a revision based on the type material in order to establish the real characters of this species. Closer evaluation of the earlier descriptions (Beddard 1907; Michaelsen 1907, 1913, 1918; Plisko 1992) confirmed the necessity of revision based on type material. The features used by authors since the original descriptions of *zuluensis*, comprising a complex species portrayal (Table 1), validated the decision. Furthermore, it was noted that *zuluensis* and *zulu* had been described in *Microchaetus*, as was commonly practised at that time for the majority of the other South African earthworm species, and continued to be kept in this genus, although *Tritogenia* generic characters were indicated by Kinberg in 1867, and also in the description of *Brachydrilus* Benham (1888). Supposedly, the erroneous assemblage of generic data for *Tritogenia* and *Brachydrilus* produced by Michaelsen (1900) were the basis for incorrect species placement. The exclusive *Tritogenia* generic characters recognized later by Michaelsen (1918) allowed him to synonymize *Brachydrilus* with *Tritogenia*, and to transfer all the species known at the time (*sulcata*, *howickiana*, *benhami*, *morosa* and *crassa*) from *Microchaetus* to *Tritogenia*, although the composite species *zuluensis* was still left in *Microchaetus*. Plisko & Zicsi (1991) emended Michaelsen's (1900, 1918, 1928*b*) generic characters given for *Tritogenia*, and added a few new species to this genus. Plisko (1992, 1997, 2003, 2005, 2006, 2008) included *zuluensis* in *Tritogenia*, described a number of new species, and provided more information concerning the taxonomic position of the genus. During the recent separation of the *Tritogenia* species from Microchaetidae (Plisko 2013) and their re-location to the family Tritogeniidae Plisko, 2013, a merged description of *Tritogenia zuluensis* was again noted, and it was discovered that no holotype or paratype was indicated amongst the original material or in the description. Therefore, a species revision was suggested. The aim of the present paper is to fulfil this necessity. The species re-description is founded upon examination of the type material and specimens that had been described by Michaelsen (1907) as the taxon *zulu*, and supplemented with data taken from the original species description. Designation of a lectotype and paralectotype of *Tritogenia zuluensis* (Beddard, 1907) is also included.

MATERIAL AND METHODS

The following acronyms and abbreviations are used in this paper: GNM – Natural History Museum, Göteborg, Sweden; NMSA – KwaZulu-Natal Museum, Pietermaritzburg, South Africa; NHMU – Natural History Museum & University, Oslo, Norway; NMSA/Olig. – NMSA Oligochaeta Collection, followed by accession numbers.

The type material of *Microchaetus zuluensis* Beddard, 1907, housed for more than a hundred years at the NHMU, containing two anterior parts of the body with small portions of posterior segments. A clitellate specimen illustrated by Beddard (1907: 279, text-fig. 85) (Fig. 1) and described as '*more fully mature than the other*', abscised behind the clitellum, with a total segment number reaching *ca* 86, presently designated as a lectotype of *Tritogenia zuluensis* (Beddard, 1907) (NHMU Oslo C5726, Figs 2, 3). The other specimen, abscised at *ca* the 109th segment, with slightly evident tubercula pubertatis and genital papillae, but with no clitellum, numbered, designated as the paralectotype

(NHMU Oslo C5727, Fig. 4). Material loaned by courtesy of the museum staff engineer Mrs Ann-Helén Rønning and Dr Philip D. Harris, helminth collection curator of the NHMU, who also provided kind advice regarding the accession numbers.

The type material of *Microchaetus zulu* Michaelsen, 1907, accepted by Michaelsen (1913) as a synonym of *zuluensis*, and declared by Reynolds and Cook (1976) as '*typus amissus*'. Thanks to its long-term protection at the GNM, it was rediscovered and loaned to me by courtesy of Prof. Kennet Lundin, senior curator of marine and limnic invertebrates. The dissected specimen, although slightly decomposed, is still in good condition but with no internal organs in segments 9–16, and is labelled 'GNM Oligochaeta 16' (Figs 5–7).

A sample of six clitellate earthworms and nine juveniles, numbered NMSA/Olig.00349 and kept at the NMSA, collected by '*W.E. Jones in Zululand, Mfongosi, 19 March 1913*' and mistakenly evaluated by Plisko (1992) as '*zuluensis*', is excluded from this study thus requiring separate treatment.

TAXONOMY

Genus *Tritogenia* Kinberg, 1867

Tritogenia zuluensis (Beddard, 1907)

Figs 1–4

Microchaetus zuluensis: Beddard 1907: 279.
Microchaetus zulu: Michaelsen 1907: 6.
Microchaetus zuluensis [*partim*]: Michaelsen 1913: 436; 1918: 331; 1928*a*: 6.
Tritogenia zululensis [*lapsus calami* for *zuluensis*] [*partim*]: Plisko 1992: 373.
Tritogenia zuluensis [*partim*]: Plisko 1997: 278; 2006: 34; 2008: 101; 2013: 69, 77.
Non *Microchaeta zuluensis*: Coles 1981: 299.
Non *Microchaetus zuluensis* Michaelsen, 1907 [*sic*] for *Microchaetus zuluensis* Beddard, 1907 *sensu* Reynolds & Cook 1976: 192.

Diagnosis: Holandric. Two pairs of seminal vesicles, with posterior pair slightly smaller than anterior pair. Excretory system meroic; small number of nephridia, very difficult to find. One oesophageal gizzard in 6–7, with septum 6/7 attached at ⅓ part of gizzard. Dorsal blood vessel double in segments 4–10 and when crossing septa, in 12 and the following segments broader, simple. Spermathecae difficult to locate, multiple in segments 11–15. Septa much thickened in 4/5 and 5/6–8/9. Setae small, at anterior part of the body difficult to discern, eight posteriorly, paired in four rows.

Description:

External characters (preserved material slightly decomposed): Grey with minor brownish colouration. Body in life probably plump, at present softened and extended. *Dimensions*: Abscised part of clitellate lectotype >70 mm long, 10 mm wide at 10, 14 mm in region of tubercula pubertatis. Anterior fragment of semi-mature paralectotype >130 mm long. Complete specimens probably *ca* 120–180 mm long, as is observed in synonymic material. *Segment number*: Anterior body fragments: lectotype >86, paralectotype >109 (complete segment number unknown, possibly around 130 segments; other material *ca* 138). *Prostomium*: Small, zygolobous. *Segmentation*: Secondary annulation present; 1–3 simple, first and second with irregular annulation, longitudinally grooved; third smooth; 4–10 with 2 simple ringlets, similar in size (Figs 2, 4, 5); 11 and those that follow simple, ventrally irregularly annulated; postclitellar segments simple, randomly annulated. *Nephridial pores*: Not observed. *Female pores*: Not detected externally.

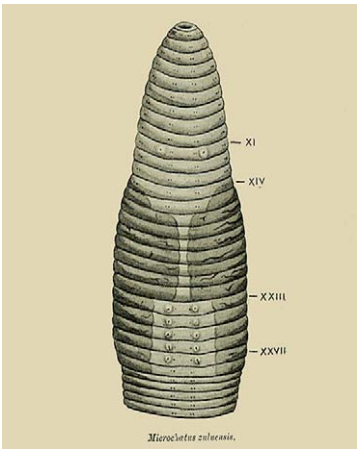
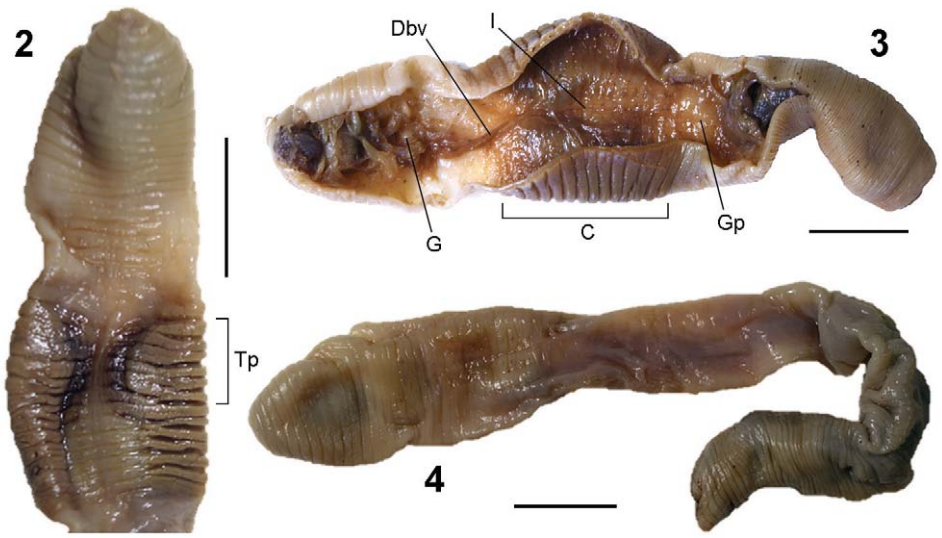


Fig. 1. Reproduction of the historical drawing of *Microchaetus zuluensis* Beddard, 1907 (text-fig. 85), the anterior part of the body, with misleading indication of the simple segmentation.

Male pores: Not detected externally and internally. *Spermathecal pores*: Not observed, although Michaelsen (1907) noted them in the 5 intersegmental furrows 11/12–15/16. *Clitellum* (Figs 2, 3): Brownish grey; saddle-shaped, clearly segmented, on ⅓14–28); ventral borders terminate parallel to dorsal edges of tubercula pubertatis. *Tubercula pubertatis* (Fig. 2): Glandular, elongated flat tubercles; on lectotype at 16–22 below clitellar edges, extending to middle of the body, separated by narrow segmented field; on paralectotype less developed, on 17–21. *Papillae* (Figs 2, 4, 5): Variable in size, shape and location, paired or single swellings in *ab* setal lines; on lectotype large, paired on 10, smaller on 11–14, on 22–26 prominent, some with genital setae. On paralectotype single on 11, paired on 12, prominent and paired on 23–26, some with genital setae. On other specimens on 11, 12 and sometimes 21–26.

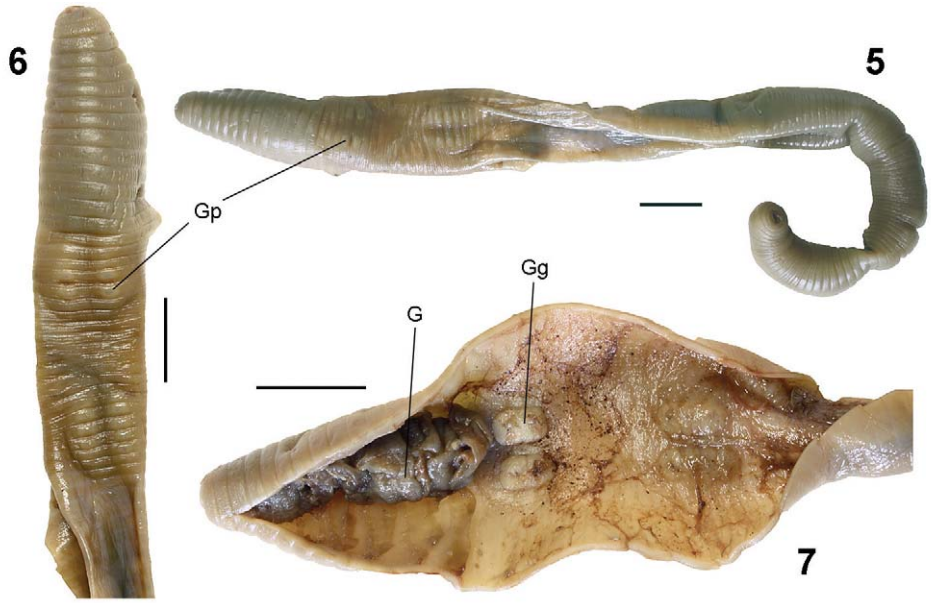
Internal characters: *Septa* (Figs 3, 6): 4/5 slightly thickened, 5/6–8/9 markedly so, similar in appearance; 9/10 very thin, partly aborted; other septa in preclitellar segments thin; in posterior segments somewhat thicker. *Gizzard* (Fig. 6): Oesophageal, large, muscular, commencing in 6, extends and occupies whole of 7, terminating abruptly at septum 7/8. *Calciferous glands* (difficult to see in type material; not present in comparative material, having been removed by Michaelsen (1918: 331–332) for a study with its particular description): Half-globular in 9–10; closely connected to oesophagus; dorsally and ventrally separated. *Intestine* (Fig. 3): Commences in 12 in lectotype (it is difficult to see where the origin of the intestine is due to desiccation). *Typhlosole*: Commencement not detected. *Dorsal blood vessel*: Double in 5–10 and also when crossing septa 4/5–10/11; in 12 and the segments that follow, broader and simple. *Paired dorso-ventral commissural vessels*: In 4–8, slender tubes; in 9–11, thick moniliform 'hearts'. *Excretory system*: Meroic; minute mero-nephridia difficult to detect between fragile, decomposing internal tissues, so their exact number and position were not established; two tiny pairs possibly occur in each segment, as was found in a few postclitellar segments of type material. (Obvious meroic pairs observed in anterior segments in material described by Michaelsen (1907) were mistakenly interpreted: '*Nephridialsystem meganephridisch*'



Figs 2–4. *Tritogenia zuluensis* (Beddard, 1907): (2, 3) lectotype, anterior part of the body, ventrally (2) and specimen dissected dorsally (3); (4) paralectotype, specimen dissected dorsally. Abbreviations: C – clitellum, Dbv – dorsal blood vessel, G – gizzard, Gp – genital papillae, I – intestine, Tp – tubercula pubertatis. Scale bars = 1 cm.

[excretory system meganephridial], which means a holoic system.) *Male funnels*: Two pairs of funnels, indicating holandric nature of this species, and not proandric as is stated by Beddard (1907: 281) and Michaelsen (1907: 8); the first pair much larger than second, both closely connected with seminal vesicle. *Vasa deferentia*: Not detected due to internal dryness and slight decomposition of specimens. *Seminal vesicles*: Two pairs, second being much smaller than the anterior pair, in 10 and 11 respectively, both linked with testis sacs. *Spermathecae*: Spermathecal ampullae were not observed in type material by Beddard (1907), possibly because of their small size, and perhaps emptiness; being uninseminated, these structures were difficult to trace amongst the thick, slightly decomposed body tissues. Some tiny remnants of the ampullae that were seen at 350× magnification in segment 13, suggest their possible presence in other segments as well. In a specimen collected by I. Trägårdh in Umfolozi, close to the type locality, two to eleven spermathecal ampullae are present, near intersegmental furrows 11/12–15/16. *Ovaries*: In 13; one funnel-like, near septa 13/14. *Genital glands*: Variable in size and shape, associated with genital papillae. *Genital setae*: Noted once in genital gland of 22nd segment.

Type material and locality: Lectotype (NHMU Oslo C5726) and paralectotype (NHMU Oslo C5727) originated from 'Zulu-Land', the area north of the Thukela River in north-eastern KwaZulu-Natal, South Africa. Unfortunately, no additional data concerning the collection site were given. It was probably in the vicinity of where *Proandricus colletti* (Beddard, 1907) (Plisko 2000) was collected by Knut Dahl during his hunting expedition to Zululand in 1893–1894 (Dickison 1951; Pethon 2009), and likely the same as what was known at that time as Umfolozi Game Reserve, which was visited by various hunters and researchers.



Figs 5–7. *Tritogenia zuluensis* (Beddard, 1907), re-examined specimen 'GNM Oligochaeta 16' described by Michaelsen (1907) as *Microchaetus zulu*, accepted as a synonym of *zuluensis* by Michaelsen (1913): (5) whole specimen, ventrally; (6) anterior part of specimen; (7) anterior part dissected. Abbreviations: G – gizzard, Gg – genital glands, Gp – genital papillae. Scale bars = 1 cm.

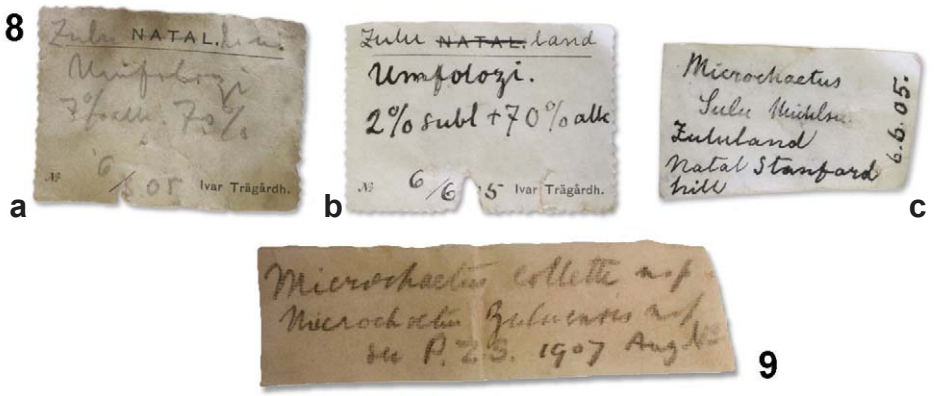
Other material was collected by Swedish researcher Ivor Trägårdh on 6 June 1905, in 'Zulu-Land, Umpolozi' (Michaelsen 1907), probably close to the type locality of *zuluensis* but described by Michaelsen as '*Microchaetus zulu*', which he later accepted as a synonym of *Microchaetus zuluensis*. The present study indicates that this type specimen (GNM Oligochaeta 16), should now be known as *Tritogenia zuluensis* (Beddard, 1907).

Distribution: The species is so far known from the Hluhluwe-iMfolozi Nature Reserve in the KwaZulu-Natal Province of South Africa.

Remarks: The type material of *T. zuluensis* was probably collected in the southern part of the Hluhluwe-iMfolozi Park which, before its proclamation in 1895 as a National Park, was a hunting area named Umfolozi. The area covers over 50,000 ha of magnificent foothills of the first escarpment rising from the coastal plain, with the two main rivers, the Black and White Mfolozi, joined by a number of streams. Erosion over millions of years have resulted in a variety of soils with many endemic plant and animal species, and some earthworm material was sporadically collected in the region.

Michaelsen's *zulu* (Figs 5–7) was from this area, with the name incorrectly printed as 'Umpolozi'. The original label in the tube (Fig. 8a) reads: 'Zulu-land, Umfolozi, 6. 6. 05, Ivar Trägårdh, 2% subl. 70% alcohol, 16'. The other (re-written) label (Fig. 8b) repeats data. The third label (Fig. 8c) has: '*Microchaetus zulu* Michaelsen, 6. 6. 05, Zululand'.

It should be noted that in the tube received from the NHMU, there were three earthworms and two hand-written labels, one of which reads: '*Microchaetus colletti* sp. n.,



Figs 8, 9. Labels: (8) a, b – original by I. Trägårdh, referring to collection locality and preservation method; c – species name, collection area and date ('Natal Stanford Hill' refers to another specimen, possibly to *M. papillatus*); (9) label referring to *Microchaetus colletti* and *Microchaetus zululensis*, the species identified by Beddard, with the added comment: 'see P.Z.S. 1907 August'.

Zululand, leg. Dahl, det. Beddard, kopi av kartotekkort, Lumbrici, Zululand 1893, Dahl'. The following appears on the other label (Fig. 9): '*Microchaetus colletti* sp. n., *Microchaetus zuluensis* sp. n., see P.Z.S. 1907 August'. After the *colletti* type had been examined, it was sent back to the NHMU, and the species was re-described by Plisko (2000). The two abscised specimens of *Microchaetus zuluensis* are described in the present paper. The label claiming two species names and the note 'see P.Z.S. 1907 August' was probably written by Beddard at the time of the original description of both species, as the note refers to *Proceedings of the Zoological Society of London*, where Beddard described *colletti* and *zuluensis* (1907: 277–281). As the specimens of both species and the labels were inserted into the same tube, it is likely that both *colletti* and *zuluensis* were collected by Knut Dahl during his excursion to Zululand in 1893–1894.

Other earthworm material included in the re-description of *zuluensis* by Michaelsen (1913) was collected further south-west of the *zuluensis* type locality. The site indicated as Mfongosi is located to the south, at the Mfongosi River, a tributary of the Thukela River, and differs from the iMfolozi area as regards soil types, flora and fauna. W.E. Jones was a 'keen amateur naturalist' (to quote from Herbert and Kilburn (2004: 53)) who collected numerous litter and soil invertebrates, many of which are located at the NMSA. This non-type material, once included with *zululensis*, is now found to differ from the type material and should be separately revised.

It is anticipated that new material of *zuluensis* may provide more data confirming the present species evaluation, and modern research methods might contribute information that sheds further light on relationships between *zuluensis* and other native South African *Tritogenia* species.

DISCUSSION

At the time of its initial description, *Tritogenia zuluensis* (Beddard, 1907) was insufficiently described and illustrated. The drawing of the anterior part of the body (Beddard 1907: text-fig. 85) (Fig. 1) did not show secondary annulation characteristics for

the studied specimen, thereby conflicting with the actual characters. This inaccuracy was later, during species re-description, partly corrected by Michaelsen (1913). However, inclusion of specimens other than type material, which had been collected at distant sites, made his re-description erroneous. The need for revision based on the type material was therefore a necessity. Thanks to more than a hundred years of high-care protection of the earthworm specimens at the NHMU and GNM, this new revision in terms of assessment of taxonomic status and species re-description, was made possible.

The museums, herbariums, and other institutions mandated with safeguarding of collected specimens are sanctuaries of the past and present that enhance our knowledge of life on Earth. A significant role of such collections in the recognition, understanding, and preservation of natural resource treasures has been emphasised in many publications (e.g. Suarez & Tsutsui 2004; Pyke & Ehrlich 2010; Williams 2010; and references therein). Biological diversity refers to the variety of life on Earth, and needs constant awareness and documentation. However, the concept of biodiversity can only be properly understood if viewed in the context of an ecosystem in which all forms of life on the planet require our continual protection. Special concerns about the conservation of global biodiversity emerged in Rio de Janeiro during the 1992 United Nations Conference on Environment and Development as the Convention on Biological Diversity. Over the past few decades, the protection of biodiversity has often come to be understood as guarding of natural ecosystems, with parallel disregarding of traditional taxonomy (Mace 2004). However, it should be remembered that taxonomy is a discipline that provides a basis for understanding biodiversity (Ebach & Holdrege 2005). Only through descriptive recognition of species richness, the global protection of Nature may be understood and implemented. As was stated by Boero (2010), '*The study of biodiversity cannot proceed further without the contribution of integrative taxonomy*' and this is clearly demonstrated in recent research such as that by Blakemore (2013). Taxonomy requires the dedicated attention of the researchers who create faunal and floral collections, identify and name taxa, so the latter can be duly recognized and used in future studies. Natural history collections are the major foundation for traditional taxonomy; they should receive greater attention in the academy and must get a higher level of support from the government (e.g. Hamer 2012). It should be remembered that *taxonomy* is a basis for understanding *biodiversity* and the whole complexity of *life* on our planet Earth.

I cannot resist including a quotation (after Herbert & Kilburn 2004) taken from a letter written in 1919 by of the first Director of the Natal Museum, Dr Ernest Warren, to the Hon. Jan Smuts, who was then the Prime Minister of South Africa. The conception is still profoundly true at the present time:

> '*In many respects the African fauna is one of the most wonderful in the world, and should be a cause of national pride, but at the present time on one pretext or another it is being rapidly and ruthlessly destroyed in many areas, and once destroyed it can never be restored ...*
>
> *It is slowly being realized throughout the world that the indigenous fauna of the country is a heritage that should be passed on, unimpaired as far as possible, to the next generation, and it is not something that the present generation has the right to destroy for the sake of temporary convenience*.'

TABLE 1

Summary of characters and their states used by authors for the *Microchaetus zuluensis* Beddard, 1907 and *M. zulu* Michaelsen, 1907 descriptions, compared with the present observations. Abbreviations: L – lectotype, P – paralectotype.

Species	*M. zuluensis*	*M. zulu*	Re-description of *M. zuluensis* by Michaelsen (1913)	Re-description of *M. zuluensis* in Michaelsen (1918)	*Tritogenia zuluensis* (Beddard, 1907) (present study)
Specimens and their maturity	One clitellate; one with developing tubercula pubertatis	Only one, with clitellum not fully developed	Revised *zuluensis* + *zulu*; plus 'one immature and several mature specimens'	Not given	L clitellate; P with no clitellum, but with developing tubercula pubertatis
Characters					
Length	Large, abscised	185 mm	90–145 mm	90–145 mm	L: >70 mm; P: >130 mm
Diameter	12 mm	9–11 mm	8–16 mm	Not given	L & P: 10 mm at 10, 14 mm at clitellum
Prostomium	Not observed	Epilobous, short, broad	Prolobous to zygolobous	Not given	Zygolobous
Number of segments	Abscised, not observed	135	102–135; new material 131–135	102–133	L: >86 P: >109
Setae	Minute, difficult to detect	Minute, only on some segments, closely paired	*aa* = 1.5–1.8 *bc*; *dd* = 2/3 U; first pair on 6; lateral pairs irregular	*aa*>*bc*, *dd* = *ca* 2/3 U	Single *ab* pair seen on 7 under 250× magnification, other pairs separated posteriorly
Annulation of anterior segments	Not described; figure misleading, showing no secondary annulation	4(?)–10 ringleted and annulated	1–3 simple; 4–10 with 2 ringlets	4–10 two-ringletted	L & P: 1–3 simple; 4–10 ringleted, annulated, with wider anterior annuli
Male pores	14/15	Not observed	Not detected; Beddard's observation not accepted	Not given	Not noted
Shape of clitellum	Saddle-shaped	Not developed	Saddle-shaped	Not given	L: saddle-shaped; P: not developed

TABLE 1 (*continued*)

Summary of characters and their states used by authors for the *Microchaetus zuluensis* Beddard, 1907 and *M. zulu* Michaelsen, 1907 descriptions, compared with the present observations. Abbreviations: L – lectotype, P – paralectotype.

Species	*M. zuluensis*	*M. zulu*	Re-description of *M. zuluensis* by Michaelsen (1913)	Re-description of *M. zuluensis* in Michaelsen (1918)	*Tritogenia zuluensis* (Beddard, 1907) (present study)
Location of clitellum	14–28	Not developed	14–28 on type material; not distinct on material from Mfongosi	14, 15–28	L: ⅓14, 15–28; P: not developed
Tubercula pubertatis	16–22, longitudinal	16, 17–22, oval-convex	16–22, rounded, thick	16, 17–22	L: 1/n 16–23, elongated; P: 17–21, elongated
Genital papillae	11, 12, 23–27	11, 12, 23–25, 26 with genital setae	Variably sized and located, paired or simple; on 11–13; 23–27 or 23–24; 'always six papillae taken together'	11–13 or on some of them, 23–24, 23–27 in *ab*	L: paired, 11 large, 12–14 smaller, 24–28, prominent; some with genital setae; P: single at 11 & 12, paired, 23–26 with genital setae
Genital glands	Not observed	Present, large	Circular or hemispherical, extending from genital papillae	Not given	L: connected to genital papillae, all with genital setae; P: not fully developed, in 24, 25
Genital setae	Not observed	2 mm long	Present in some papillae/ glands	Ornamented, 3.4 mm long, 85 μm wide	Present, but not studied
Spermathecal pores	Not observed	1–6 in 11/12 or 12/13–15/16	*zulu*: 1–10 in 11/12 or 12/13–15/16; not in *zuluensis*	1–10 on 11/12 or 12/13–15/16; often absent	L & P: not noted
Location of gizzard	6–7	6–7	6–7 with septum 6/7 attached to middle of gizzard	Not given	L & P: 6–7 with septum 6/7 attached to part of gizzard
Septa	6–9 thickened	4/5 quite thick, 5/6–8/9 markedly thickened; 9/10, or aborted; others thin	4/5 slightly thickened; 5/6–8/9 very prominent	4/5 slightly thickened, 5/6–8/9 markedly thickened	L & P: 4/5 slightly thickened, 5/6–8/9 markedly so

TABLE 1 (*continued*)

Summary of characters and their states used by authors for the *Microchaetus zuluensis* Beddard, 1907 and *M. zulu* Michaelsen, 1907 descriptions, compared with the present observations. Abbreviations: L – lectotype, P – paralectotype.

Species	*M. zuluensis*	*M. zulu*	Re-description of *M. zuluensis* by Michaelsen (1913)	Re-description of *M. zuluensis* in Michaelsen (1918)	*Tritogenia zuluensis* (Beddard, 1907) (present study)
Calciferous glands	9	9–10, with attached septum in 9/10	9 or 9–10	Separated, paired; histological description added	L & P: 9–10 globular, separated ventrally and dorsally
Intestine begins in	11	12, with typhlosole	12, with typhlosole	Not given	L & P: 12
Dorsal blood vessel	Dilated in 9	5–10 double, crossing septa double	5–10 double; 'confluent intersegmentally'	Not given	L & P: double, including septa in 5–10
Excretory system (nephridia)	Not observed	Meganephridial	Not given	Not given	L & P: meroic, difficult to discern; 2 pairs in segments 30 and 31
Testis funnels	'one set' in 9/10[?] = proandric	Proandric	'one pair of funnels in 10, enclosed' = proandric	Proandric	L & P: holandric, with second pair in 11 much smaller, enclosed in second pair of seminal vesicles
Seminal vesicles	9/10 and 10?	One pair: 10/11, extending to 11	Project from 10/11 to 11	Not given	L & P: two pairs in 10/11 and 11, second pair much smaller than anterior pair
Spermathecal shape	Looked for but not noted	Globular, close to each other, with neck	Very small and globular with fragile, short duct concealed in body wall	Not given	L & P: not noted, possibly due to internal maceration
Spermathecal position and number	Looked for but not noted	Multiple	Not found in *zuluensis*; in *zulu* and new material, noted in some segments	Not given	L & P: not noted; in *zulu*, 12–15, multiple
Type locality and other material studied	'Zululand'	'Umpolozi' = Umfolozi; present name Hluhluwe-iMfolozi Park	'Zululand' Beddard (1907); 'Umpolozi' Michaelsen (1907); eastern Zululand, juvenile. New mature material: Zululand, Mfongosi	'Zulu-Land, Umfolozi, Mfongosi' after Michaelsen (1913)	Hluhluwe-iMfolozi Nature Reserve

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