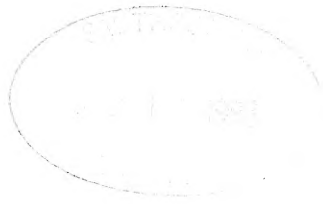


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# ANNALS

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2. LAYOUT should be as follows:

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Number of illustrations (figures, enumerated maps and tables, in this order)
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- (f) *Summary*, if paper is lengthy
- (g) *Acknowledgements*
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3. MANUSCRIPT, to be submitted in triplicate, should be typewritten and neat, double spaced with 3 cm margins all round. First lines of paragraphs should be indented. Tables and a list of captions for illustrations should be typed separately, their positions indicated in the text. All pages should be numbered consecutively.

Major headings of the paper are centred capitals; first subheadings are shouldered small capitals; second subheadings are shouldered italics; third subheadings are indented, shouldered italics. Further subdivisions should be avoided, as also enumeration (never roman numerals) of headings and abbreviations.

Footnotes should be avoided unless they are short and essential.

Only generic and specific names should be underlined to indicate italics; all other marking up should be left to editor and publisher.

4. ILLUSTRATIONS should be reducible to a size not exceeding 12 × 18 cm (19 cm including caption); the reduction or enlargement required should be indicated (and preferably uniform); originals larger than 35 × 47 cm should not be submitted; photographs should be rectangular in shape and final size. A metric scale should appear with all illustrations, otherwise magnification or reduction should be given in the caption; if the latter, then the final reduction or enlargement should be taken into consideration.

All illustrations, whether line drawings or photographs, should be termed figures (plates are not printed; half-tones will appear in their proper place in the text) and numbered in a single series. Items of composite figures should be designated by capital letters; lettering of figures is not set in type and should be in lower-case letters. If Letraset is used authors are requested to use Helvetica-style lettering, if possible.

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(b) Full references at the end of the paper, arranged alphabetically by names, chronologically within each name, with suffixes *a*, *b*, etc., to the year for more than one paper by the same author in that year, e.g. Smith (1969a, 1969b) and not Smith (1969, 1969a).

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- FISCHER, P. H., DUVAL, M. & RAFFY, A. 1933. Études sur les échanges respiratoires des littorines. *Archives de zoologie expérimentale et générale* **74** (33): 627-634.
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- THIELE, J. 1910. Mollusca. B. Polyplacophora, Gastropoda marina, Bivalvia. In: SCHULTZE, L. *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Süd-Afrika ausgeführt in den Jahren 1903-1905* **4** (15). *Denkschriften der medizinisch-naturwissenschaftlichen Gesellschaft zu Jena* **16**: 269-270.

(continued inside back cover)

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A NEW SPECIES OF *STREPTOCEPHALUS*  
(CRUSTACEA, BRANCHIOPODA,  
ANOSTRACA) FROM NAMIBIA

By  
MICHELLE HAMER  
&  
LUC BRENDONCK

Cape Town

Kaapstad

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A NEW SPECIES OF *STREPTOCEPHALUS*  
(CRUSTACEA, BRANCHIOPODA, ANOSTRACA)  
FROM NAMIBIA

By

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(With 2 figures)

[MS accepted 23 November 1992]

ABSTRACT

The adult male and egg morphology of a new anostracan species, *Streptocephalus namibiensis*, are described and illustrated. The new species resembles *S. proboscideus* and can be allocated to the same species group which also includes *S. trifidus*. *Streptocephalus namibiensis* has been collected from Bushmanland (northern Namibia), central Namibia, northern Botswana and the Transvaal Highveld (South Africa).

CONTENTS

	PAGE
Introduction .....	183
Materials and methods .....	184
Taxonomic description .....	184
Discussion .....	188
Acknowledgements .....	188
References .....	189

INTRODUCTION

The Namibian branchiopod fauna was first investigated by Barnard (1924). He reported seven *Streptocephalus* species after extensive collecting, mainly in the Kaokoveld and Ovamboland areas. An eighth, and the only endemic species of the genus, *S. kaokoensis*, was described by Barnard in his 1929 review of the southern African branchiopods. Curtis (1991) listed the same eight and one additional unidentified streptocephalid species in a checklist of the freshwater macro-invertebrates of Namibia. As part of a recent study of the African Streptocephalidae (to be published at a later date), material from the State Museum, Windhoek (SMN), the National Museum of Zimbabwe (NMZ), Bulawayo and from Barnard's collection (South African Museum (SAM), Cape Town) was examined. A number of specimens resembling *S. proboscideus* Frauenfeld (1873) were found to be slightly different from the

type description and from redescriptions and illustrations by Brauer (1877) and Brendonck (1990). Differences were most evident in male antennal and frontal appendage morphology. In addition, the two morphological types were collected sympatrically at two localities. This indicated that specimens of two distinct species, one undescribed, were involved. In this paper male antennal, frontal appendage and cercopod morphology of the new species are described. The external structure of the resting eggs and the distribution of the new species are also assessed. Finally, *S. namibiensis* sp. nov. will be allocated to a group consisting of species with similar antennal and frontal appendage morphologies.

## MATERIALS AND METHODS

Specimens were drawn and prepared for scanning electron microscopy following the procedures in Hamer & Appleton (1993) and the terminology used is from Brendonck (1990). Measurements were made using a graticule and are presented as total body length (mean  $\pm$  standard deviation if  $n > 10$ ) from the front of the head (excluding the antennae) to the tips of the cercopods (excluding the setae).

## TAXONOMIC DESCRIPTION

Family **Streptocephalidae** Daday, 1910

*Streptocephalus namibiensis* sp. nov.

### *Type material*

*Holotype*. SMN 51312, 1 male (16 mm); collected by B. A. Curtis, 12 March 1988; Namibia, Bushmanland, Nyae-Nyae Pan (19°46'S 20°30'E).

*Paratypes*. SMN 51294, 46 males (13  $\pm$  1,0 mm) and 18 females (13  $>$  1,0 mm); collected by B. A. Curtis, 12 March 1988, from grassy pool adjoining Nyae-Nyae Pan, Bushmanland (19°46'S 20°30'E).

### *Other material*

SMN 51056, 1 male (17 mm), 1 female (15 mm); collected by B. A. Curtis, 14 May 1986, from Namibia, Bushmanland, Etosha National Park, Onangombati (18°45'S 14°50'E).

SMN 51318, 2 males (one with cercopods damaged, other 16 mm); collected by B. A. Curtis, 13 March 1988, from Namibia, Bushmanland, Tsumkwe (19°34'S 20°31'E).

SAM-5986, 4 males, 6 females, all in poor condition; collected by Miss Wilman, date unknown, from Namibia, Gobabis (22°33'S 18°56'E).

SAM-A7299, 1 male (19 mm), 3 females (19, 19, 18 mm); collected by G. Hutchinson, 1928, from Transvaal, Benoni, Avenue Pan (26°11'S 27°15'E).

SAM-7305, 3 males (20, 19, 17 mm); collected by Miss Schuurman, January 1929, from Transvaal, Heidelberg (26°30'S 28°22'E).

NMZ/Cr 9, many specimens, 14 males measured (20  $\pm$  1,0 mm), 17 females measured (19  $\pm$  1,0 mm); collected by J. Peacock, 26 April 1972, from Botswana, northern fringe of Makarikari Pan (20°S 25°E).

*Description of male*

*Antenna.* Lateral process (lp) slender, ventrally curved and apically acute (Fig. 1A). Median antennal process (mp) long (ratio to total body length 0,56:1).

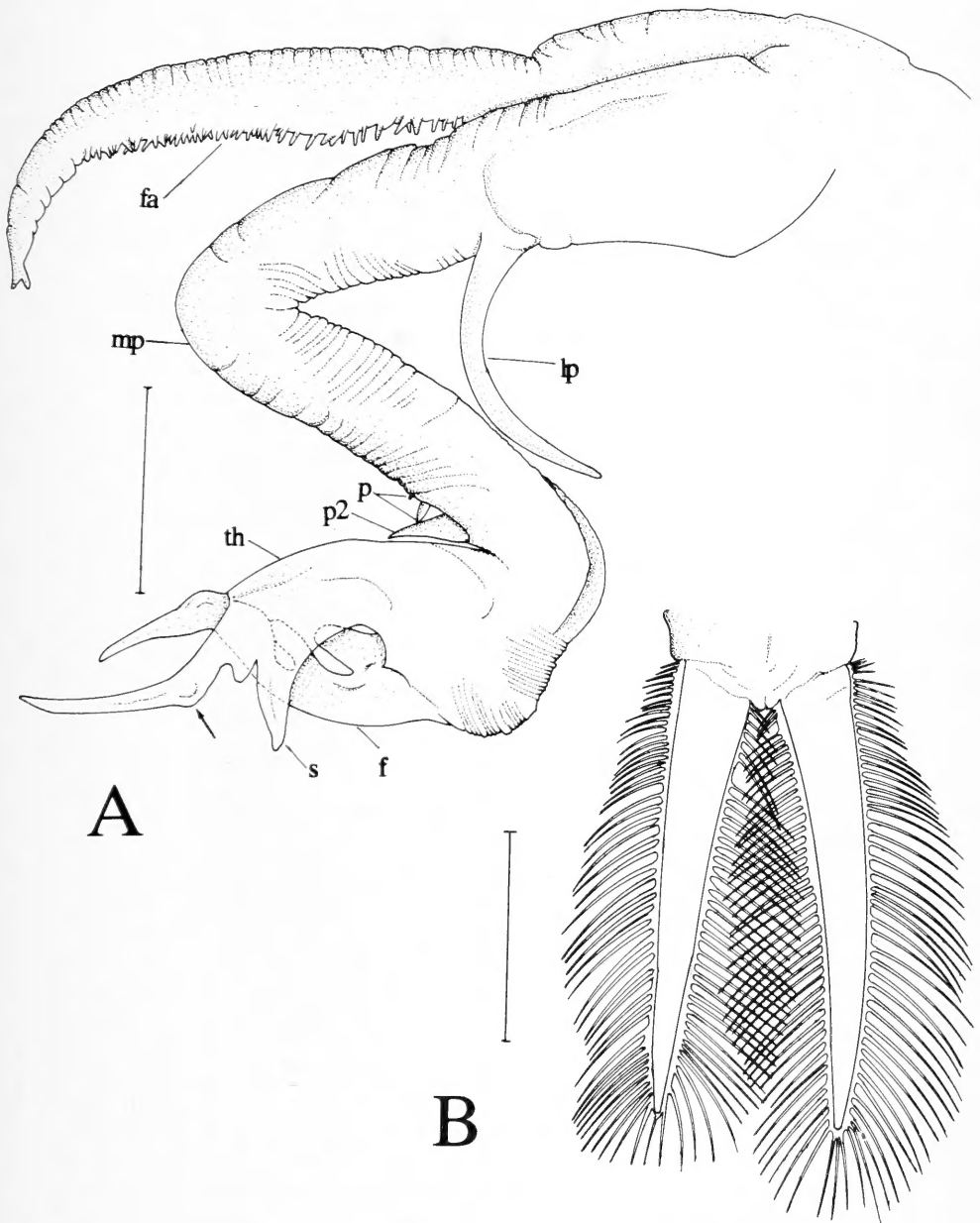


Fig. 1. *Streptocephalus namibiensis* sp. nov. A. Lateral view of left antenna and frontal appendage of male. B. Dorsal view of cercopods. Bar scale = 1 mm. Abbreviations: f = finger, fa = frontal appendage, lp = lateral process, mp = median antennal process, p = processes, p2 = process 2, s = spur, th = thumb.

Antero-medial surface proximal to hand with three slender triangular processes (p) of unequal length (Fig. 1A). A large leaf-shaped process (p1) just proximal to hand on medial surface (Fig. 2A) followed by a similar smaller process distally and another (p2) on the lateral surface (Fig. 1A). Thumb (th) slender, folded proximally. Anterior region of thumb with bend (Fig. 1A) and apically acute. Angle between proximal and distal region of anterior part of thumb about  $135^\circ$ . Thumb spur (s) broad, apically

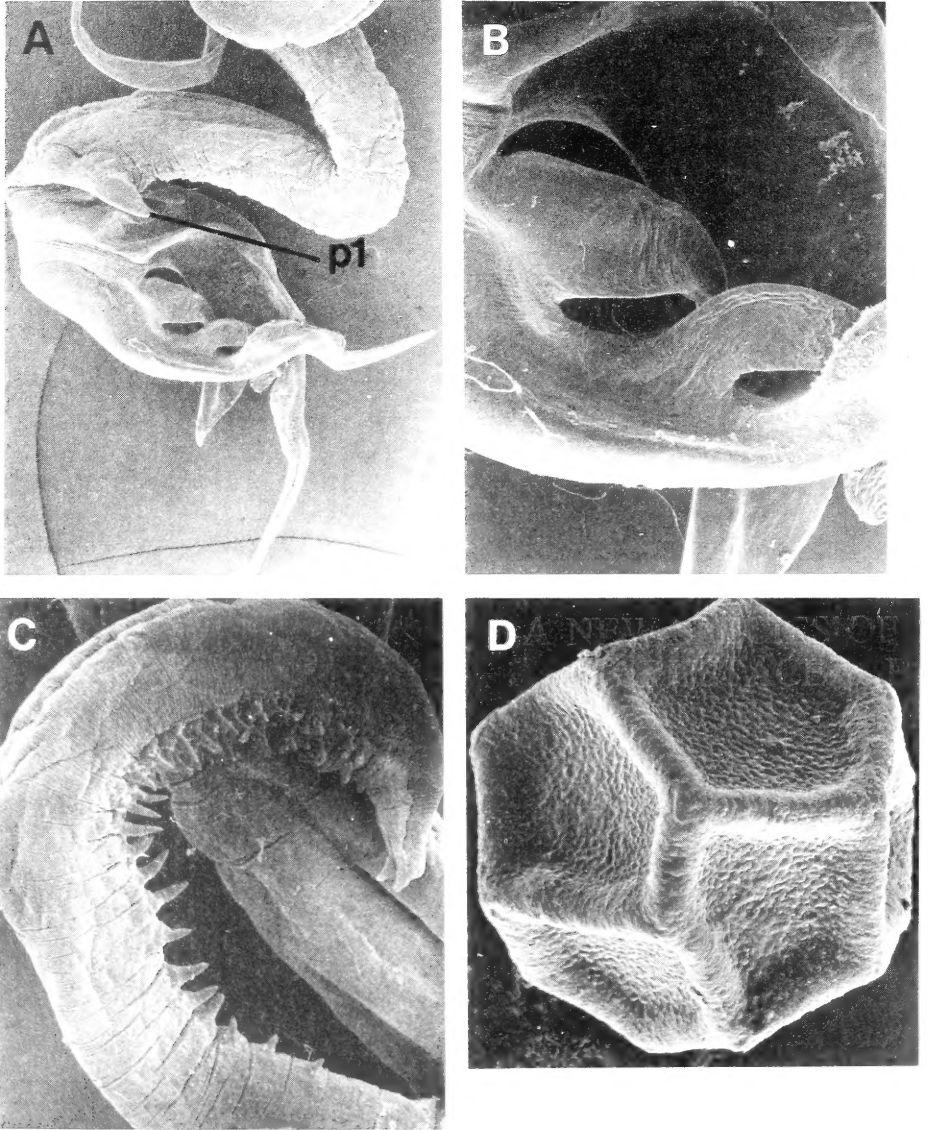


Fig. 2. *Streptocephalus namibiensis* sp. nov. A. Medial view of right antenna of male.  $\times 33$ . B. Detail of teeth on dorsal margin of finger (medial view).  $\times 117$ . C. Frontal appendage.  $\times 66$ . D. Egg morphology.  $\times 248$ . Abbreviation: P1 = process.



tapered and separated from anterior part of thumb by prominent rounded triangular tooth (Fig. 1A). Finger (f) approximately three-quarters length of thumb, recurved and with pointed apex (Fig. 2A). Two teeth of equal height on dorsal margin of finger, with distal tooth narrower (Fig. 2B). Finger with prominent inflation distal to teeth (Fig. 2A).

*Frontal appendage.* Long (half length of antenna), slightly coiled, distally tapered and apically bifid. Single row of short spiniform processes at base of frontal appendage, splitting into two rows about one-third along length. Distal half with four rows of irregularly arranged processes decreasing in size along length (Figs 1A, 2C).

*Cercopods.* Moderate length (in relation to total body length 0,16:1). Outer margin not strongly curved, both margins with long, plumose setae along entire length (Fig. 1B).

#### *Egg morphology*

Eggs angular, with large, regular pentagonal fields separated by broad, rounded ribs (Fig. 2D). Diameter = 420  $\mu\text{m}$ .

#### *Differential diagnosis*

Although very similar in general appearance, *S. namibiensis* and *S. proboscideus* have a number of characters that are clearly different. *Streptocephalus proboscideus* has long digitiform processes on the anterior margin of the median antennal process and a shorter second tooth on the dorsal margin of the finger. *Streptocephalus namibiensis* only has three, shorter slender processes just proximal to the hand and has two teeth of equal length on the finger. In addition, in *S. proboscideus*, the frontal appendage is more tapered and strongly coiled with less regularly arranged spiniform processes and the distal thumb region is longer (ratio to total thumb length 0,43; in *S. namibiensis* this is only 0,34). The egg shell of *S. proboscideus* is characterized by a large number of complex polygons (Brendonck 1990) rather than the large, regular and simple pentagons of the *S. namibiensis* egg.

#### *Distribution*

*Streptocephalus namibiensis* has, to date, been collected from four areas: the Transvaal Highveld (South Africa), central Namibia (Gobabis), northern Namibia (Bushmanland), and the Makarikari Pan area in northern Botswana.

#### *Etymology*

*Streptocephalus namibiensis* is named after the country from which the type specimens were collected.

#### *Habitat*

The only data regarding the habitat of *S. namibiensis* are provided by Hutchinson *et al.* (1932) for the SAM-A7299 specimens. These were collected from an open pan, about one-third of a mile (approx. 0,5 km) in diameter, south-west of Avenue Station, Benoni, which filled up after heavy rains in January 1928. On 5 May (presumably when the fauna was sampled), the pan contained about 2 ft (approx. 0,6 m) of turbid water and was largely unvegetated apart from four species of *Lemna* and some weeds

and grasses in the shallow part of the east side. The fauna of the pan included *Arcella* (Protozoa), five cladoceran species, one species of Ostracoda, and four copepod species.

### DISCUSSION

Due to the similarity between the antenna and frontal appendage of *S. namibiensis* and *S. proboscideus*, the Benoni (SAM-A7299), Heidelberg (SAM-7305) and Gobabis (SAM-5986) specimens were previously all described as *S. proboscideus* (Barnard, 1929). Brendonck (1990), in his redescription of that species, noted the fact that both Barnard (1929) and Brauer (1877) had illustrated large and, in Barnard's (1929) redescription, equal-sized teeth on the dorsal margin of the finger, rather than the smaller, unequal teeth of *S. proboscideus*. The importance of the antenna and frontal appendage in specific mate selection has recently gained interest (Belk 1991). According to theory, even slight differences in (primary or secondary) reproductive structures can indicate separate species. Based on several studies, it has also been suggested that temporary pools are relatively isolated habitats, and that regular gene flow between them may thus be restricted (Wiman 1979; Brendonck *et al.* 1990; Fugate 1990). Dispersal of species over large areas is most likely a rare event, occurring in instances such as episodic flooding. Local adaptations and morphological changes from the source population are likely and the possibility of immigrants neutralizing these changes, small. Under these conditions, groups of species with a common basic pattern of morphological features may be expected. This appears to have occurred in the African streptocephalids, which can be divided into ten so-called species groups consisting of species sharing a number of antennal and frontal appendage characters. This division needs to be researched further but, at this stage, it provides a basis for the investigation of streptocephalid evolutionary trends, interspecific relationships, and possibly the zoogeography of the genus. *Streptocephalus namibiensis* can be allocated to a species-group consisting of *S. proboscideus* and *S. trifidus* Hartland-Rowe, 1968.

Wiman (1979) found that, because of the isolated nature of temporary pool habitats, the development of sexual isolating mechanisms in streptocephalids is rare and that hybrids are common under laboratory conditions. In this context, the collection of *S. namibiensis* and *S. proboscideus* from the same localities on two occasions (SMN 51312, 51294) is interesting. No specimens with intermediate morphologies were found and it appears that some form of isolating mechanism prevents the formation of hybrids. No other case of members of the same species-group occurring sympatrically is known.

### ACKNOWLEDGEMENTS

The curators of the material in the SAM, SMN and NMZ are thanked for the loan of material. MLH is in receipt of a post-graduate bursary from the Foundation for Research Development, and LB is research assistant with the National Fund for Scientific Research, Belgium, and research associate with the Koninklijk Belgisch Instituut voor Natuurwetenschappen (K.B.I.N.). The staff of the Electron Microscope

Unit, University of Natal, Pietermaritzburg, assisted with the electron micrographs and Prof. C. Appleton commented on the manuscript.

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6. SYSTEMATIC papers must conform to the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family **Nuculanidae**

*Nuculana (Lembulus) bicuspidata* (Gould, 1845)

Figs 14–15A

*Nucula (Leda) bicuspidata* Gould, 1845: 37.

*Leda plicifera* A. Adams, 1856: 50.

*Laeda bicuspidata* Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).

*Nucula largillierti* Philippi, 1861: 87.

*Leda bicuspidata*: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

*Note* punctuation in the above example:

comma separates author's name and year

semicolon separates more than one reference by the same author

full stop separates references by different authors

figures of plates are enclosed in parentheses to distinguish them from text-figures

dash, not comma, separates consecutive numbers.

Synonymy arrangement according to chronology of bibliographic references, whereby the year is placed in front of each entry, and the synonym repeated in full for each entry, is not acceptable.

In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

*Holotype*

SAM–A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach, Port Elizabeth (33°51'S 25°39'E), collected by A. Smith, 15 January 1973.

*Note* standard form of writing South African Museum registration numbers and date.

7. SPECIAL HOUSE RULES

*Capital initial letters*

- (a) The Figures, Maps and Tables of the paper when referred to in the text  
e.g. '... the Figure depicting *C. namacolus* ...': '... in *C. namacolus* (Fig. 10) ...'
- (b) The prefixes of prefixed surnames in all languages, when used in the text, if not preceded by initials or full names  
e.g. Du Toit but A. L. du Toit; Von Huene but F. von Huene
- (c) Scientific names, but not their vernacular derivatives  
e.g. Therocephalia, but therocephalian

*Punctuation* should be loose, omitting all not strictly necessary

*Reference to the author* should preferably be expressed in the third person

*Roman numerals* should be converted to arabic, except when forming part of the title of a book or article, such as

'Revision of the Crustacea. Part VIII. The Amphipoda.'

*Specific name* must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively. The generic name should not be abbreviated at the beginning of a sentence or paragraph.

*Name of new genus or species* is not to be included in the title; it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.



MICHELLE HAMER  
&  
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A NEW SPECIES OF *STREPTOCEPHALUS*  
(CRUSTACEA, BRANCHIOPODA, ANOSTRACA)  
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