

## List of the Physalopteridae from African freshwater fishes

*Heliconema* Travassos, 1919

*Heliconema africanum* (von Linstow, 1899) [syn. *Spiropterina africana* von Linstow, 1899]  
from ***Anguilla mossambica*** (South Africa) [Fig. 4.8.5F]

Physalopteridae gen. sp. from *Clarias gariepinus*, *Serranochromis angusticeps*

\*\*THELAZIOIDEA Skryabin, 1915

\*\*Rhabdochonidae Travassos, Artigas et Pereira, 1928

## Key to the genera/subgenera of the Rhabdochonidae from African freshwater fishes

- 1(2) Two small unarmed pseudolabia, without teeth. Oesophagus long, not clearly divided into muscular and glandular portions .....genus ***Prosungulonema***
- 2(1) Pseudolabia rudimentary, prostom with teeth. Oesophagus divided into muscular and glandular portions (genus ***Rhabdochona***).....3
- 3(2) Prostom with 8 or 12 anterior teeth.....subgenus ***Globochona***
- 4(3) Prostom with 14 anterior teeth.....subgenus ***Rhabdochona***

## List of the Rhabdochonidae (adults) from African freshwater fishes

*Prosungulonema* Roytman, 1963

*Prosungulonema africanum* (Moravec et Puylaert, 1970) [syn. *Johnstonmawsonia africana* Moravec et Puylaert, 1970] from ***Thoracochromis schwetzi*** (Angola) [Fig. 4.8.6A]

*Prosungulonema campanae* (Puylaert, 1973) [syn. *Johnstonmawsonia campanae* Puylaert, 1973] from ***Aphyosemion camerounense*** (Cameroon), *Thoracochromis schwetzi*

*Rhabdochona* Railliet, 1916

*Rhabdochona (Rhabdochona) centroafricana* Moravec et Jirků, 2014 from ***Enteromius miolepis*** (Central African Republic) [Fig. 4.8.6B]

*Rhabdochona (Rhabdochona) esseniae* Mashego, 1990 from *Enteromius lineomaculatus*, *E. paludinosus*, *E. trimaculatus*, *Labeobarbus marequensis* (South Africa)

*Rhabdochona (Rhabdochona) gendrei* Campana-Rouget, 1961 from ***Barbus* sp.** (Gambia), *Enteromius camptacanthus*, *E. lineomaculatus*, *E. paludinosus*, *E. trimaculatus*, *Labeobarbus altianalis*, *L. bynni*, *L. intermedius*, *L. marequensis*

*Rhabdochona (Rhabdochona) marcusenii* Moravec et Jirků, 2014 from ***Marcusenius greshoffii*** (Central African Republic)

*Rhabdochona (Rhabdochona) moraveci* Puylaert, 1973 [syn. *Afrochona camerounensis* Puylaert, 1973] from ***Aphyosemion camerounense*** (Cameroon)

*Rhabdochona (Rhabdochona) srivastavai* Chabaud, 1970 from ***Sicyopterus fasciatus*** (Madagascar)

*Rhabdochona (Globochona) gambiana* Gendre, 1922 [syn. *Cystidicola minuta* Rodhain et Vuylsteke, 1934] from *Enteromius eutaenia*, *Raiamas moorii*

*Rhabdochona (Globochona) paski* Baylis, 1928 [syns *Rhabdochona aegyptica* El-Nafar et Saoud, 1974; *Rhabdochona congolensis* Campana-Rouget, 1961; *Rhabdochona versterae* Boomker et Petter, 1993] from *Alestes baremoze*, *A. dentex*, ***A. macrophthalmus*** (Tanzania), *Anguilla anguilla*, *Bagrus bajad*, *B. docmak*, *Brycinus imberi*, *B. nurse*, *Chrysichthys nigrodigitatus*, *Clarias gariepinus*, *Coptodon zillii*, *Ctenopoma kingsleyae*, *Haplochromis eduardii*, *H. elegans*, *H. graueri*, *H. ishmaeli*, *H. nigripinnis*, *H. nubilus*, *H. serridens*, *H. squamipinnis*, *Haplochromis* sp., *Hydrocynus brevis*, *H. forskahlii*, *Labeobarbus altianalis*, *L. bynni*, *Oreochromis niloticus*, *Phenacogrammus aurantiacus*, *Polypterus senegalus*, *Schilbe mystus*, *Synodontis batensoda*, *S. nigromaculatus*, *S. notatus*, *S. schall*, *Thoracochromis wingatii*

*Rhabdochona (Globochona) tricuspadata* Moravec et Jirků, 2014 from ***Raiamas christyi*** (Central African Republic)

*Rhabdochona (Globochona)* sp. from *Epiplatys multifasciatus*

*Rhabdochona* sp. from *Anguilla anguilla*, *Clarias gariepinus*, *Coptodon rendalli*, *Hydrocynus forskahlii*, *Labeobarbus bynni*, *Schilbe intermedius*, *Serranochromis meridianus*, *Synodontis zambezensis*

### List of the Rhabdochonidae (larvae) from African freshwater fishes

*Rhabdochona* Railliet, 1916

*Rhabdochona (Globochona) paski* Baylis, 1928 [syn. *R. congolensis* Campana-Rouget, 1961] from *Auchenoglanis occidentalis*, *Synodontis nigromaculatus*, *Thoracochromis wingatii*

*Rhabdochona* sp. from *Brycinus macrolepidotus*, *Labeo niloticus*, *Mormyrus caschive*

HABRONEMATOIDEA Chitwood et Wehr, 1932

Cystidicolidae Skryabin, 1946

### Key to the genera of the Cystidicolidae from African freshwater fishes

- 1(2) Cephalic cuticle forming collarete similar to that of physalopterids. Parasitic in the alimentary tract of marine and freshwater fishes.....***Pseudoproleptus***
- 2 (1) Cuticle with marked ornamentation in form of numerous transverse rings with spines. Parasitic in the alimentary tract of fishes, generally in freshwater.....***Spinitectus***

## List of the Cystidicolidae from African freshwater fishes

- Pseudoproleptus* Khera, 1953
- Pseudoproleptus africanus* Khalil, 1973 from ***Mormyrus* sp.** (Democratic Republic of the Congo) [Fig. 4.8.4C]
- Spinitectus* Fourment, 1883
- Spinitectus allaeri* Campana-Rouget, 1961 [syns *Spinitectus macheirus* Boomker et Puylaert, 1994; *Spinitectus macilentus* Boomker et Puylaert, 1994; *Spinitectus minusculus* Boomker et Puylaert, 1994; *Spinitectus moraveci* Boomker et Puylaert, 1994] from ***Alestes dentex*, *Bagrus bajad*, *B. docmak*, *Clarias gariepinus*, *Clarias* sp., *Heterobranchus isopterus*, *Lates niloticus*, *Malapterurus electricus*, *Mormyrus caschive*, *Pantodon buchholzi*, *Schilbe mystus*** (type host not explicitly mentioned, all from Democratic Republic of the Congo), *Synodontis schall*, *Xenoclarias eupogon*
- Spinitectus macilentus* Boomker et Puylaert, 1994 from ***Heterobranchus isopterus*** (Ivory Coast)
- Spinitectus maleficus* Boomker et Puylaert, 1994 from ***Mastacembelus flavidus*** (Democratic Republic of the Congo)
- Spinitectus micropectus* Boomker et Puylaert, 1994 from ***Mastacembelus micropectus*** (Democratic Republic of the Congo)
- Spinitectus monstrosus* Boomker et Puylaert, 1994 from ***Mormyrops boulengeri*** (Democratic Republic of the Congo)
- Spinitectus mormyri* Campana-Rouget, 1961 from ***Mormyrus caschive*** (Democratic Republic of the Congo), *M. rume*
- Spinitectus mucronatus* Boomker et Puylaert, 1994 from ***Mormyrops anguilloides*** (Democratic Republic of the Congo), *Mormyrops boulengeri*, *M. zanclirostris*
- Spinitectus petterae* Boomker, 1993 from ***Clarias gariepinus*** (South Africa)
- Spinitectus polli* Campana-Rouget, 1961 [syn. *Spinitectus zambezensis* Boomker, 1993] from *Synodontis decorus*, *S. nigromaculatus*, ***S. schall*** (Democratic Republic of the Congo), *S. zambezensis* [Fig. 4.8.4G]
- Spinitectus thurstonae* Ogden, 1967 from ***Mormyrus* sp.** (Uganda)
- Spinitectus* sp. from *Alestes macrolepidotus*, *Hydrocynus forskahlii*, *H. vittatus*, *Schilbe intermedius*, *Synodontis nigromaculatus*

\*\* ACUARIOIDEA Railliet, Henry et Sisoff, 1912

\*\*Acuariidae Railliet, Henry et Sisoff, 1912

## List of the Acuariidae from African freshwater fishes

- \*\**Chordocephalus* Alegret, 1941
- Chordocephalus* sp. [syn. *Skrjabinocara* sp.] from *Clarias gariepinus*

Note: one adult female, three fourth-stage larvae and one unidentifiable nematode found in one catfish; they were very probably ingested by the catfish after regurgitation by a white-breasted cormorant whilst feeding chicks (Boomker 1982).

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## Chapter 4.9.

### CRUSTACEA

Nico SMIT & Kerry HADFIELD

#### **Crustaceans (Crustacea) – basic characteristics, life cycles, classification and principal diagnostic features**

- phylum Arthropoda: subphylum Crustacea
- approximately 67,000 species classified in 65 orders (including free-living and parasitic)
- no internal skeleton – only hard chitinous exoskeleton
- old exoskeleton shed by moulting
- two pairs of antennae
- three pairs of mouthparts
- head with two compound eyes
- biramous appendages (split into two)
- gaseous exchange through gills
- abdominal segments with swimming legs (swimmerets)
- tail segment fan-shaped, ending in a telson and uropods
- sexual reproduction (most have separate sexes but some are hermaphrodites)
- several larval stages (including the nauplius larva)
- circulatory system open (no heart, blood does not circulate in blood vessels)
- two part-nervous system with a ventral nerve cord and system of ganglia

The general classification of free-living and parasitic crustaceans is based on well-defined orders (65 at present). In almost every order of the Crustacea there are species in some kind of association with other species. This ranges from facultative to highly specialised parasitism where the parasite undergoes total morphological adaptation, becoming metabolically completely reliant on the host for its survival. In freshwater, crustaceans are mostly associated with fish, but there are a few examples of lernaeid copepods and branchiurans associated with tadpoles and invertebrates.

Life cycles and strategies differ among the different groups of parasitic Crustacea and range from temporary parasites that move between the hosts and substrate (e.g., *Argulus* spp.) and permanently attached parasites (e.g., *Chonopeltis* spp.) that complete their life cycle on the hosts. The number of life stages also differs between groups where, for example, the larvae of species from the copepod genera *Ergasilus* and *Lamproglena* are free swimming and only females become parasitic after a few moults (as copepodites) [Fig. 4.9.1]. All copepod appendages can exhibit sexual dimorphism, but typically this is most commonly found in the

antennulae, maxillipeds and fifth swimming legs. The precise pattern of sexual dimorphism is highly variable and thus the taxonomy of parasitic copepods is based on the adult female in most cases.

The parasitic Crustacea are characterised mainly by the morphology of the body, mouthparts and appendages. Generic classification and species identification is also based on the size and shape of the various appendages and many other characteristics (see below).

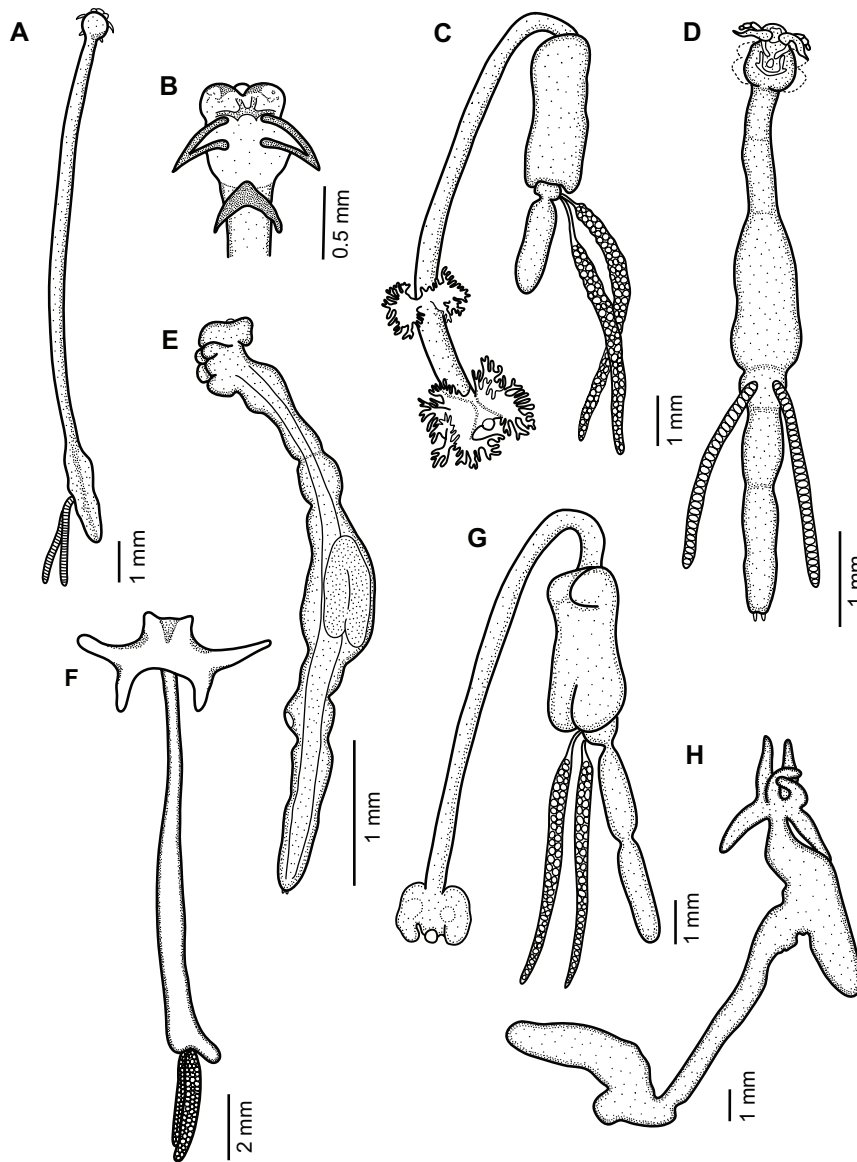


**Fig. 4.9.1.** Life cycle of *Ergasilus* sp. showing the free-living naupliar and copepodid stages as well as the parasitic adult female. (Illustration by M. Luo.)

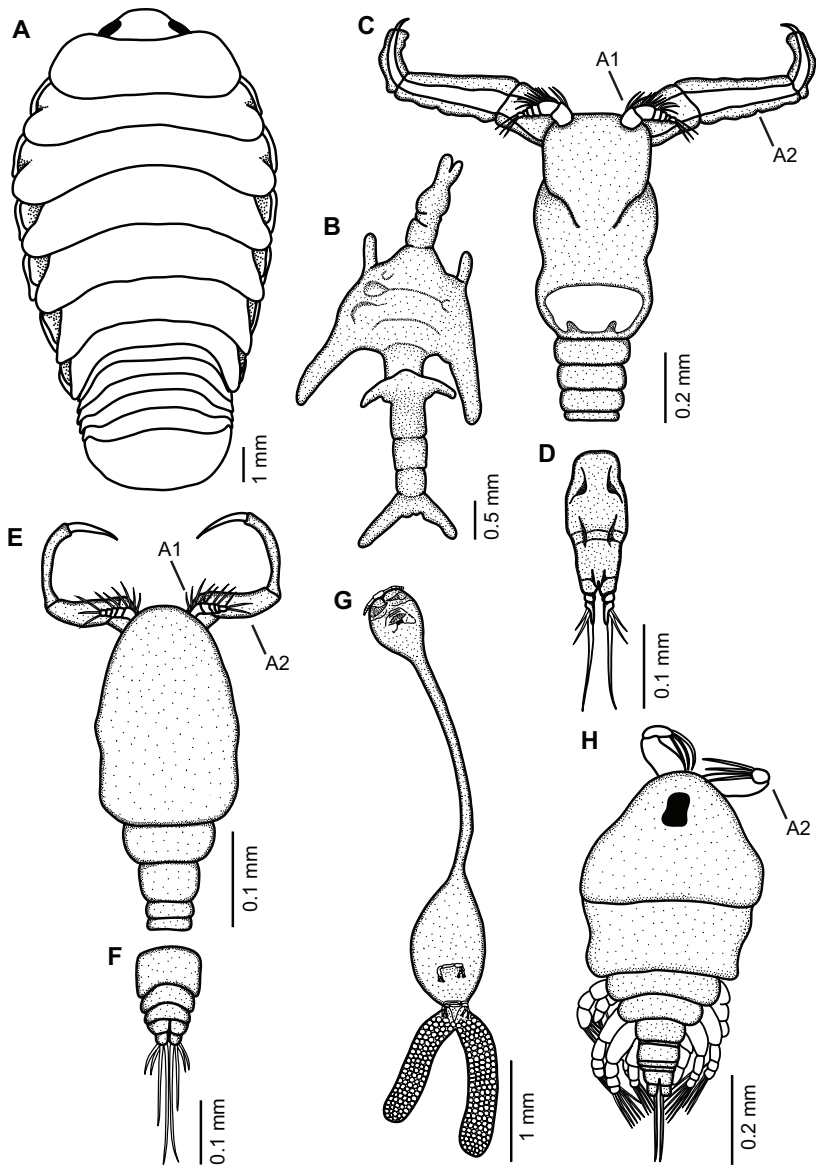
### Key to the orders of crustaceans (Crustacea) from African freshwater fishes

- 1 (2) Body dorsoventrally flattened; 4-7 pairs of legs.....3
- 2 (1) Body elongate and not flattened.....5
- 3 (4) Suction discs or hooks present; cephalic shield present; second maxillae terminating with large hooks; egg-sacs present; four pairs of legs on the thorax [Fig. 4.9.2A,B]..... **Arguloidea**
- 4 (3) Suction discs and shield absent; no cephalic shield; mouthparts form a tightly sealed mouth cone; egg sacs absent (young in brood pouch); seven pairs of legs on the thorax [Fig. 4.9.4A].....**Isopoda**
- 5 (6) Worm-like body shape, body clearly segmented; anteriorly there is a singular mouth and two pairs of hooks; egg-sacs absent [Fig. 4.9.5F] .....**Porocephalida**
- 6 (5) Body cylindrical or irregularly shaped, not always clearly segmented; egg-sacs present (from female abdomen).....7
- 7 (8) Oral cone present with stylet-like mandibles [Fig. 4.9.6B] .....**Siphonostomatoida**
- 8 (7) Oral cone absent; often falcate mandibles.....9
- 9 (10) Long, cylindrical body; antennulae long (but shorter than the length of the body); uniramous antennae [Fig. 4.9.3D].....**Cyclopoida**
- 10 (9) Body cylindrical or abdomen narrower than the thorax; antennulae reduced in size; antennae modified into hooks [Fig. 4.9.4C].....**Poecilostomatoida**

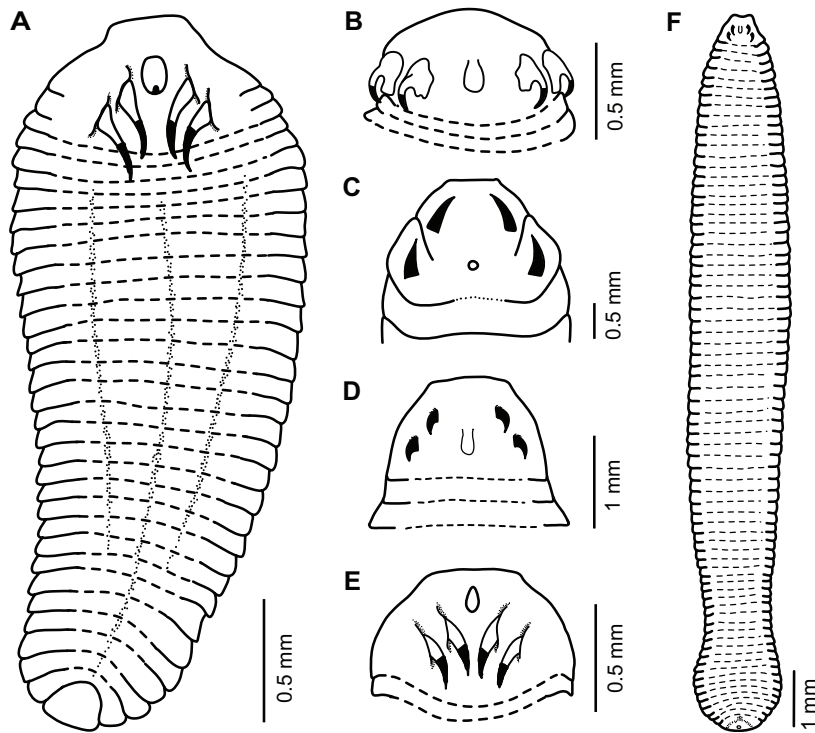




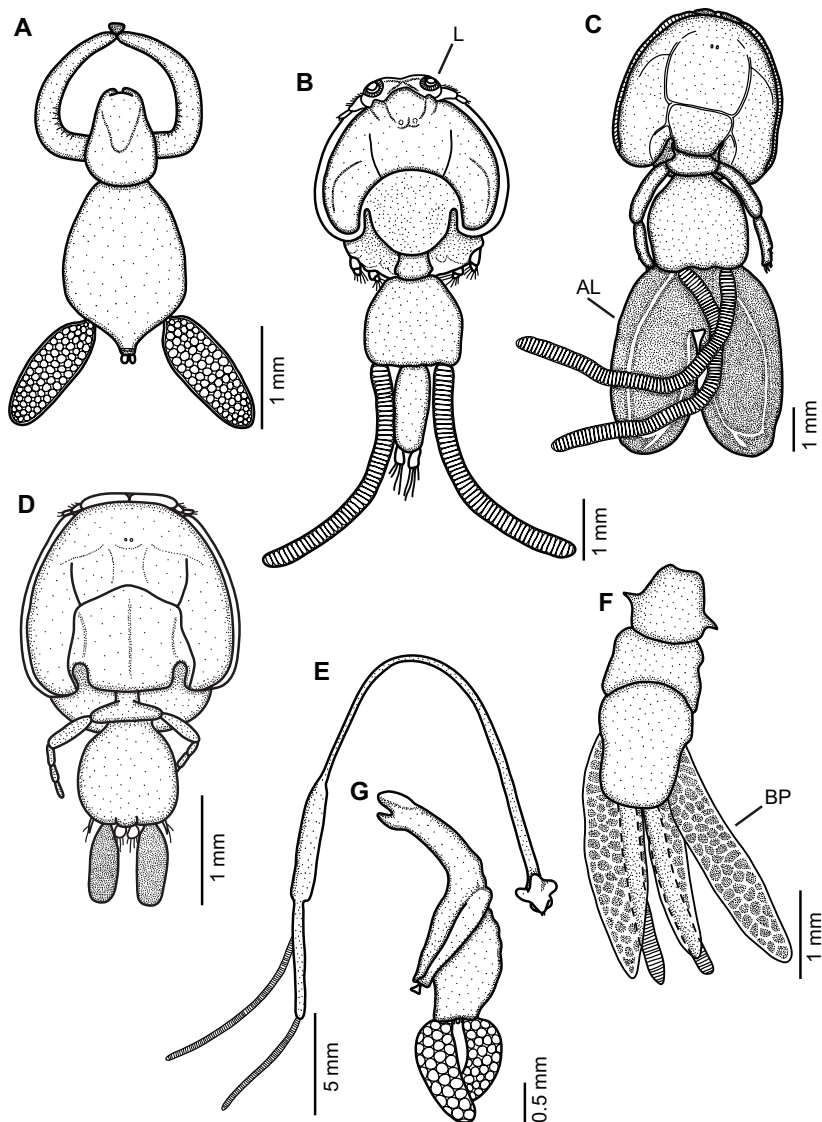
**Fig. 4.9.3.** Cyclopoida. **A, B.** *Arolernaea longicollis* Fryer, 1956, entire body and cephalon; **C.** *Dysphorus torquatus* Kurtz, 1924, entire body; **D.** *Lamproglena clariae* Fryer, 1956; **E.** *Lamproglenoides vermiformis* Fryer, 1964; **F.** *Lernaea cyprinacea* Linnaeus, 1758; **G.** *Lernaegiraffa heterotidicola* Zimmermann, 1922; **H.** *Opistholernaea laterobrachialis* (Fryer, 1959). (Modified from Kurtz 1924; Fryer 1956, 1959, 1964; Marx & Avenant-Oldewage 1996.)



**Fig. 4.9.4.** Isopoda. **A.** *Ichthyoxenos tanganyikae* (Fryer, 1965); Poecilostomatoida. **B.** *Colobomatus mugilis* Raibaut, Caillet et Ben Hassine, 1978; **C, D.** *Dermoergasilus mugilis* Oldewage et Van As, 1988, dorsal view of antennae, cephalothorax and thorax, and ventral view of genital segment and abdomen; **E, F.** *Ergasilus ilani* Oldewage et Van As, 1988, dorsal view of antennae, cephalothorax and thorax, and ventral view of genital segment and abdomen; **G.** *Mugilicola smithae* Jones et Hine, 1978; **H.** *Paraergasilus minutus* (Fryer, 1956). (Modified from Fryer 1956, 1965; Oldewage & Van As 1988b; Radujković & Raibaut 1990; Kruger *et al.* 1998.) A1 = first antenna; A2 = second antenna.



**Fig. 4.9.5.** Porocephalida. **A.** *Subtriquetra rileyi* Junker, Boomker et Booyse, 1998, entire body of infective larva; **B.** *Alofia* Giglioli in Sambon, 1922, cephalon; **C.** *Leiperia* Sambon, 1922, cephalon; **D.** *Sebekia* Sambon, 1922, cephalon; **E.** *Subtriquetra rileyi* Junker, Boomker et Booyse, 1998, cephalon; **F.** *Alofia merki* Giglioli in Sambon, 1922, entire body of female adult. (Modified from Riley 1994; Junker *et al.* 1998; Christoffersen & De Assis 2013.)



**Fig. 4.9.6.** Siphonostomatoida. **A.** *Achtheres micropteri* Wright, 1882; **B.** *Caligus apodus* (Brian, 1924); **C.** *Dartevellia bilobata* Brian, 1939; **D.** *Lepeophtheirus plotosi* Barnard, 1948; **E.** *Lernaenicus neglectus* Richiardi, 1877; **F.** *Lernanthropsis mugilis* (Brian, 1898); **G.** *Parabrachiella mugilis* (Kabata, Raibaut et Ben Hassine, 1971). (Modified from Barnard 1948, 1955; Kabata *et al.* 1971; Raibaut *et al.* 1971; Radujković & Raibaut 1990; Dojiri & Ho 2013.) AL = abdominal alae; BP = bilobate processes; L = lunules.



## A systematic survey of crustaceans (Crustacea) in African freshwater fishes

Keys to genera are provided where applicable. Species are listed alphabetically according to individual crustacean orders. Type species of genera and type host of species are highlighted in bold where available. When no type host is indicated, it means that no type host was originally designated from Africa, and if multiple hosts are indicated it signifies that the original description included more than one host with no specific type host designated. If known, the country where the type locality is situated is also provided. Host names are according to Froese & Pauly (2017) and *Catalog of Fishes* (Eschmeyer *et al.* 2017). Some of the species listed here include those parasitising mullets (Mugilidae) and other fish families that can cross over from marine and brackish regions into the freshwater environment.

ARGULOIDA Yamaguti, 1963 (subclass Branchiura Thorell, 1864)

### Key to the genera of the Arguloidea (adults) from African freshwater fishes (for a key to the species of *Argulus* see Rushton-Mellor 1994; for a key to the species of *Chonopeltis* see Fryer 1977)

- 1 (2) Ventral suction discs absent (stout hooks on the first maxilla) [Fig. 4.9.2E,F]  
.....**Dolops**
- 2 (1) Ventral suction discs present (modified first maxilla).....3
- 3 (4) One pair of antennae (antennula absent); carapace anteriorly constricted; thorax elongate (approximately the same length as the carapace); retractable poison stylet absent [Fig. 4.9.2C,D].....**Chonopeltis**
- 4 (3) Two pairs of antennae; carapace subcircular; thorax short (approximately half the length of the carapace); retractable poison stylet in front of the mouth tube [Fig. 4.9.2A,B].....**Argulus**

### List of the Arguloidea (adults) from African freshwater fishes

(\* indicates marine or brackish water species that might cross over into freshwater)

*Argulus* Müller, 1785

*Argulus africanus* Thiele, 1900 from *Anguilla labiata*, *Bagrus degeni*, *B. docmak*, *B. meridionalis*, *Chrysichthys brachynema*, *Clarias anguillaris*, *C. gariepinus*, **Clarias sp.** (Lake Malawi), *Haplochromis guiarti*, *H. obesus*, *H. obliquidens*, *H. retrodens*, *Heterobranchus bidorsalis*, *H. longifilis*, *Heterobranchus sp.*, *Hydrocynus vittatus*, *Labeo sp.*, *Lates microlepis*, *Mormyrops anguilloides*, *M. longirostris*, *Oreochromis esculentus*, *O. macrochir*, *O. niloticus*, *O. variabilis*, *Polypterus sp.*, *Protopterus aethiopicus*, *Schilbe banguelensis*, *Schilbe sp.*, *Tilapia sp.*

\**Argulus alexandrensis* Wilson, 1923 from **Zeus sp.** (Angola)

*Argulus ambloplites* Wilson, 1920 from *Clarias gariepinus*, *Hydrocynus vittatus*, ***Parachanna obscura*** (Democratic Republic of the Congo)

*Argulus angusticeps* Cunnington, 1913 (Lake Tanganyika) – no hosts recorded

\**Argulus arcassonensis* Cuénot, 1912 [syns *Argulus otolithi* Brian, 1927; *Argulus zeii* Brian, 1924] from *Pseudotolithus typus*, *Zeus faber*

\**Argulus belones* van Kampen, 1909 from *Sphyraena barracuda*

*Argulus brachypeltis* Fryer, 1959 from ***Hydrocynus vittatus*** (Zimbabwe)

*Argulus capensis* Barnard, 1955 from ***Sandelia capensis*** (South Africa)

*Argulus confusus* Rushton-Mellor, 1994 [this species is the male originally described as *A. ambloplites* by Wilson in 1920] – no hosts recorded

*Argulus cunningtoni* Fryer, 1965 from ***Auchenoglanis occidentalis***, ***Bagrus bajad***, ***Clarias gariepinus***, ***Distichodus nefasch***, ***Lates niloticus***, *Lates* sp., *Serranochromis robustus*, ***Synodontis schall*** (all Lake Albert)

\**Argulus dactylopteri* Thorell, 1865 from *Dactylopterus volitans*

*Argulus dagei* Dollfus, 1960 from ***Clarias anguillaris***, ***Heterobranchus bidorsalis***, ***Tetraodon lineatus*** (all Mali)

*Argulus dartevellei* Brian, 1940 from ***Polydactylus quadrifilis*** (Angola), *Promicrops distalis*

*Argulus exiguus* Cunnington, 1913 from ***Lamprichthys tanganicanus***, ***Simochromis diagramma*** (both Lake Tanganyika)

*Argulus fryeri* Rushton-Mellor, 1994 from *Coptodon zillii*

*Argulus gracilis* Rushton-Mellor, 1994 from ***Auchenoglanis occidentalis*** (Lake Tanganyika)

*Argulus incisus* Cunnington, 1913 from ***Auchenoglanis occidentalis*** (Lake Tanganyika)

*Argulus izintwala* Van As et Van As, 2001 from ***Hilsa kelee*** (South Africa)

*Argulus japonicus* Thiele, 1900 [invasive species] [syns *Argulus matritensis* Arevalo, 1921; *Argulus pelucidus* Wagler, 1935] from *Clarias gariepinus*, *Cyprinus carpio*, *Enteromius mattozi*, *Labeo capensis*, *L. umbratus*, *Labeobarbus aeneus*, *L. kimberleyensis*, *L. marequensis*, *Oncorhynchus mykiss*, *Oreochromis mossambicus*, *Tilapia sparrmanii*

*Argulus jollymani* Fryer, 1956 from ***Haplochromis* sp.**, ***Protomelas fenestratus*** (both Lake Malawi)

\**Argulus kosus* Avenant-Oldewage, 1994 [syn. *Argulus smalei* Avenant-Oldewage et Oldewage, 1995] from *Aluterus monoceros*, *Elops machnata*, *Liza luciae*, *Mugil cephalus*, *Oreochromis mossambicus*, *Otolithes ruber*, *Pomadasys commersonii*, *P. multimaculatus*, *Rhabdosargus holubi*, ***Sarpa salpa*** (South Africa)

\**Argulus melita* van Beneden, 1891 from **shark** (Senegal)

*Argulus monodi* Fryer, 1959 from *Coptodon zillii*, ***Hydrocynus vittatus*** (Zimbabwe)

*Argulus multipocula* Barnard, 1955 from *Chelon richardsonii* [Fig. 4.9.2A,B]

- Argulus personatus* Cunnington, 1913 from *Bathybates fasciatus*, **B. ferox** (Lake Tanganyika)
- Argulus reticulatus* Wilson, 1920 from **Hydrocynus goliath** (Democratic Republic of the Congo)
- Argulus rhipidiophorus* Monod, 1931 from *Alestes baremoze*, *Bagrus bajad*, *Barbus* sp., *Clarias gariepinus*, *Clarias* sp., *Haplochromis pappenheimi*, *Haplochromis* sp., *Hydrocynus forskahlii*, *H. vittatus*, **Hydrocynus sp.** (Lake Albert), *Labeo* sp., *Lates niloticus*, *Lates* sp., *Oreochromis leucostictus*, *O. niloticus*, *Synodontis schall*, *Tilapia* sp.
- Argulus rijckmansii* Brian, 1940 – no hosts recorded
- Argulus rubescens* Cunnington, 1913 from **Chrysichthys brachynema** (Lake Tanganyika)
- Argulus rubropunctatus* Cunnington, 1913 from *Lates angustifrons*, **Lates microlepis** (Lake Tanganyika)
- Argulus schoutedeni* Monod, 1928 from *Citharinus gibbosus*, *Distichodus fasciolatus*
- Argulus striatus* Cunnington, 1913 from **Auchenoglanis occidentalis**, **Chrysichthys brachynema**, **Clarias gariepinus**, **Dinotopterus cunningtoni** (all Lake Tanganyika), *Heterobranchus* sp., *Oreochromis tanganicæ*
- \**Argulus trachynoti* Brian, 1927 from **Trachinotus blochii** (Cameroon)
- \**Argulus vittatus* (Rafinesque-Schmaltz, 1814) [syns *Agenor purpureus* Risso, 1826; *Argulus giganteus* Lucas, 1845; *Argulus purpureus* (Risso, 1826); *Diprosia vittata* Rafinesque, 1814] from *Boops boops*, **Pagellus erythrinus**, *Pagrus pagrus*, *Sparus aurata*
- Argulus wilsoni* Brian, 1940 from **Hydrocynus goliath** (Democratic Republic of the Congo)
- Chonopeltis* Thiele, 1900
- Chonopeltis australis* Boxshall, 1976 from **Labeo capensis**, **L. rosae** (both South Africa), *L. umbratus*, *Labeobarbus aeneus*
- Chonopeltis brevis* Fryer, 1961 from *Amphilius grandis*, *Amphilius* sp., *Chrysichthys nigrodigitatus*, *Garra* sp., *Labeo cylindricus*, **L. victorianus** (Lake Victoria), **Labeobarbus altianalis** (Nile River)
- Chonopeltis congicus* Fryer, 1959 [syn. *Chonopeltis inermis* var. *schoutedeni* Brian, 1940 *partim*] from **Marcusenius monteiri** (Zimbabwe)
- Chonopeltis elongatus* Fryer, 1974 from **Synodontis longirostris** (Democratic Republic of the Congo)
- Chonopeltis flaccifrons* Fryer, 1960 from **Cyphomyrus discorhynchus** (Lake Mweru), **Hippopotamyrus wilverthi** (Democratic Republic of the Congo), **Marcusenius sp.** (Malagarasi River Swamps) [Fig. 4.9.2C,D]
- Chonopeltis fryeri* Van As, 1986 from **Clarias gariepinus**, **C. theodora** (both South Africa)
- Chonopeltis inermis** Thiele, 1900 from *Bathyclarias nyasensis*, **Chromis sp.** (East Africa), *Clarias gariepinus*, *C. theodora*

*Chonopeltis lisikili* Van As et Van As, 1996 from ***Synodontis leopardinus*** (Botswana),  
*S. macrostigma*, *S. nigromaculatus*, *S. thamalakanensis*, *S. vanderwaali*

*Chonopeltis liversedgi* Van As et Van As, 1999 from ***Mormyrus lacerda*** (Botswana)

*Chonopeltis meridionalis* Fryer, 1964 [syns *Chonopeltis koki* Van As, 1992; *Chonopeltis victori* Avenant-Oldewage, 1991] from *Labeo congoro*, *L. cylindricus*, ***L. rosae*** (Zimbabwe), *L. ruddi*, *Labeobarbus marequensis*

*Chonopeltis minutus* Fryer, 1977 [syn. *Chonopeltis australissimus* Fryer, 1977] from  
*Pseudobarbus burgi*, ***P. calidus***, ***P. erubescens*** (both South Africa)

*Chonopeltis schoutedeni* Brian, 1940 [syn. *Chonopeltis inermis* var. *schoutedeni* Brian, 1940  
*partim*] from *Cyphomyrus discorhynchus*, *Marcusenius macrolepidotus*, *M. monteiri*,  
*Mormyrus longirostris*, *Mormyrus* sp.

*Dolops* Audouin, 1837

*Dolops ranarum* (Stuhlmann, 1892) [syn. *Gyropeltis ranarum* Stuhlmann, 1892] from  
*Astatoreochromis alluaudi*, *Auchenoglanis occidentalis*, *Bagrus bajad*, *B. degeni*,  
*B. docmak*, *Chetia flaviventris*, *Chrysichthys* sp., *Clarias anguillaris*, *C. gariepinus*,  
*C. stappersii*, *Clarias* sp., *Coptodon rendalli*, *C. zillii*, *Enteromius mattozi*, **frog  
tadpoles** (Lake Malawi), *Hepsetus cuvieri*, *H. odoe*, *Heterobranchus bidorsalis*,  
*Heterobranchus* sp., *Labeo altivelis*, *L. congoro*, *Labeobarbus marequensis*, *Lates  
microlepis*, *L. niloticus*, *Micropterus dolomieu*, *M. salmoides*, *Mormyrops anguilloides*,  
*M. longirostris*, *Oreochromis andersonii*, *O. esculentus*, *O. macrochir*, *O. mortimeri*,  
*O. mossambicus*, *O. niloticus*, *O. variabilis*, *Parachanna obscura*, *Protopterus  
aethiopicus*, *Pseudocrenilabrus philander*, *Sargochromis carlottae*, *S. codringtonii*,  
*S. giardi*, *Serranochromis macrocephalus*, *S. robustus*, *Serranochromis* sp., *Schilbe  
intermedius*, *S. mystus*, *Schilbe* sp., *Synodontis nigromaculatus*, *S. zambezensis*,  
*Tetraodon lineatus*, *Tilapia* sp. [Fig. 4.9.2E,F]

CYCLOPOIDA Burmeister, 1834

**Key to the genera of the Cyclopoida (adults) from African freshwater fishes**  
(for a key to the species of *Lernaea* see Harding 1950; for a key to the species of  
*Lamproglena* see Fryer 1964)

- 1 (2) Body clearly segmented; with antennulae and antennae.....3
- 2 (1) Body not clearly segmented; no antennulae or antennae.....9
- 3 (4) Body elongate and cylindrical; caudal rami short or produced  
(extended).....5
- 4 (3) Body sub-cylindrical, irregularly swollen; caudal rami reduced; maxilla and  
maxilliped united laterally [Fig. 4.9.3E].....***Lamproglenoides***
- 5 (6) Body bent (twisted) up to 180° angle; thorax elongate; posterior part of the  
body (abdomen) abruptly thickened.....7

- 6 (5) Body not bent, with robust maxillipeds terminating in 1-5 claws; thorax with legs, first two segments forming a distinct short neck; abdomen not thickened, with three segments [Fig. 4.9.3D].....**Lamproglena**
- 7 (8) Head horns dendritic (head and neck with branched appendages); two abdominal segments [Fig. 4.9.3C].....**Dysphorus**
- 8 (7) Head horns rounded, short and soft; no branched neck appendages; three abdominal segments [Fig. 4.9.3G].....**Lernaeogiraffa**
- 9 (10) Very long and narrow neck; head with short protuberances anteriorly; pair of robust maxillae terminating in a recurved spine [Fig. 4.9.3A,B].....**Afrolernaea**
- 10 (9) Shorter neck; head with noticeable horn-like structures.....11
- 11 (12) Head with 2-3 (rarely 4) large horns (pointed or swollen); body may gradually thicken towards the posterior end [Fig. 4.9.3F].....**Lernaea**
- 12 (11) Head with 4 horns, 2 posterior horns directed backwards to form 90° angle; lateral outgrowth extends from the upper neck region [Fig. 4.9.3H].....**Opistholernaea**

#### List of the Cyclopoida (adults) from African freshwater fishes

- Afrolernaea* Fryer, 1956
- Afrolernaea annemari* Oldewage, 1994 from ***Clarias gariepinus*** (Namibia)
- Afrolernaea brevicollis* Fryer, 1982 from ***Stomatorhinus corneti*** (Gabon)
- Afrolernaea edi* Oldewage, 1994 from ***Marcusenius macrolepidotus*, *Mormyrops anguilloides*, *Petrocephalus catostoma*** (all Namibia)
- Afrolernaea longicollis*** Fryer, 1956 from *Cyphomyrus discorhynchus*, *Marcusenius macrolepidotus*, ***Mormyrops anguilloides***, ***M. longirostris*** (both Lake Malawi), *Mormyrops* sp. [Fig. 4.9.2A,B]
- Afrolernaea mormyroides* Van As, 1983 from ***Marcusenius macrolepidotus*** (South Africa)
- Afrolernaea nigeriensis* (Dollfus, 1960) [syn. *Delamarina nigeriensis* Dollfus, 1960] from ***Mormyrus rume*** (Niger River)
- Dysphorus* Kurtz, 1924
- Dysphorus torquatus* Kurtz, 1924 from ***Heterotis niloticus*** (Sudan) [Fig. 4.9.3C]
- Lamproglena* von Nordmann, 1832
- Lamproglena angusta* Wilson, 1924 from ***Malapterurus electricus*** (Nile River)
- Lamproglena barbicola* Fryer, 1961 from ***Labeobarbus altianalis*** (Lake Victoria)
- Lamproglena clariae* Fryer, 1956 from *Clarias anguillaris*, ***C. gariepinus***, *C. ngamensis*, ***Clarias* sp.** (both Lake Malawi), *Lates niloticus* [Fig. 4.9.3D]

- Lamproglena cleopatra* Humes, 1957 from ***Labeo forskalii*** (Nile River)
- Lamproglena cornuta* Fryer, 1965 from *Clarias gariepinus*, ***Heterobranchus bidorsalis*** (Nile River)
- Lamproglena elongata* Capart, 1956 from ***Citharinus citharus*** (Sudan), *C. latus*, *Hydrocynus vittatus*
- Lamproglena hemprichii* von Nordmann, 1832 [syn. *Lamproglena aubentoni* Dollfus, 1960] from *Alestes dentex*, *Brycinus nurse*, *Clarotes laticeps*, *Hepsetus odoe*, *Hydrocynus brevis*, *H. forskalii*, *H. vittatus*, ***Hydrocynus* sp.** (Nile River)
- Lamproglena hepseti* Van As et Van As, 2007 from ***Hepsetus cuvier*** (previously *H. odoe*) (Botswana)
- Lamproglena hoi* Dippenaar, Luus-Powell et Roux, 2001 from ***Labeobarbus marequensis*** (South Africa), ***L. polylepis*** (South Africa)
- Lamproglena intercedens* Fryer, 1964 from *Citharinus* sp.
- Lamproglena monodi* Capart, 1944 [syn. *Lamproglena nyasae* Fryer, 1956] from *Coptodon rendalli*, *C. zillii*, *Haplochromis bicolor*, *H. degeni*, *H. eduardii*, *H. guiarti*, *H. macrops*, *H. nubilus*, *H. pappenheimi*, *H. retrodens*, *H. schubotzi*, *H. serridens*, *H. squamipinnis*, *Haplochromis* sp., *Hemichromis bimaculatus*, *H. fasciatus*, *Oreochromis esculentus*, *O. macrochir*, *O. niloticus*, *O. variabilis*, *Orthochromis polyacanthus*, *O. stormsi*, *Pseudocrenilabrus philander*, *Pterochromis congicus*, *Sargochromis codringtonii*, *Sarotherodon galilaeus*, *Schwetzochromis neodon*, *Serranochromis macrocephalus*, *S. thumbergi*, *Thoracochromis callichromus*, *T. moeruensis*, *T. schwetzi*, *T. wingatii*, *Tylochromis labrodon*
- Lamproglena weneri* Zimmermann, 1922 from *Auchenoglanis occidentalis*, ***Bagrus bajad*** (Nile River)
- Lamproglena wilsoni* Capart, 1955 – no hosts reported
- Lamproglenoides* Fryer, 1964
- Lamproglenoides vermiformis*** Fryer, 1964 from ***Labeo cylindricus*** (“African Eastern Rivers”) [Fig. 4.9.3E]
- Lernaea* Linnaeus, 1758
- Lernaea bagri* Harding, 1950 from ***Bagrus meridionalis*** (Lake Malawi)
- Lernaea barbicola* Leigh-Sharpe, 1930 from ***Barbus* sp.** (South Africa), *Malapterurus electricus*
- Lernaea barilius* Harding, 1950 from ***Opsaridium microlepis*** (Lake Malawi), *Raiamas steindachneri*
- Lernaea barnimiana* (Hartmann, 1865) [syns *Lernaea temnocephala* (Cunnington, 1914); *Lernaecera barnimii* Hartmann, 1870; *Lernaecera temnocephala* Cunnington, 1914] from *Coptodon zillii*, *Haplochromis nubilus*, *Labeo altivelis*, *L. capensis*, *L. congoro*, *L. cylindricus*, *L. forskalii*, *L. rosae*, *L. umbratus*, *L. victorianus*, *Labeobarbus aeneus*, *L. altianalis*, *L. bynni*, *L. intermedius*, *L. marequensis*, *Lates niloticus*, *Oreochromis esculentus*, *O. leucostictus*, *O. macrochir*, *O. mossambicus*, *O. niloticus*, *O. variabilis*, *Oreochromis* sp., *Tylochromis mylodon*, *Tylochromis* sp.



- Lernaea bistricornis* Harding, 1950 from *Boulengerochromis microlepis*, *Callochromis pleurospilus*, ***Cardiopharynx schoutedeni*** (Lake Tanganyika), *Cyathopharynx furcifer*
- Lernaea composita* Wilson, 1924 [syns *Lernaea wernerii* (Kurtz, 1922); *Lernaeocera wernerii* Kurtz, 1922] from *Clarias gariepinus*, *Distichodus nefasch*, ***Malapterurus electricus*** (Sudan)
- Lernaea cyprinacea*** Linnaeus, 1758 [invasive species] [syns *Lernaea carassii* Tidd, 1933; *Lernaea elegans* Leigh-Sharpe, 1925; *Lernaea esocina* (Burmeister, 1835); *Lernaea ranae* Stunkard et Cable, 1931; *Lernaea tentaculis* Linnaeus, 1746; *Lernaea tentaculis quatuor* Linnaeus, 1746; *Lernaeocera cyprinacea* (Linnaeus, 1746); *Lernaeocera gasterostei* Bruhl, 1860] from *Bagrus docmak*, *Coptodon rendalli*, *Labeo altivelis*, *L. capensis*, *L. congoro*, *L. cylindricus*, *L. rosae*, *L. ruddi*, *Labeobarbus kimberleyensis*, *L. marequensis*, *Oreochromis aureus*, *O. mossambicus*, *O. niloticus*, *O. placidus*, *Pseudocrenilabrus philander*, *Tilapia* sp. [Fig. 4.9.3F]
- Lernaea diceracephala* (Cunnington, 1914) [syn. *Lernaeocera diceracephala* Cunnington, 1914] from ***Clarias gariepinus*** (Lake Tanganyika), *Heterobranchus longifilis*
- Lernaea haplocephala* (Cunnington, 1914) [syns *Lernaea bichiri* (Kurtz, 1923); *Lernaeocera bichiri* Kurtz, 1923; *Lernaeocera haplocephala* Cunnington, 1914] from *Labeobarbus aeneus*, ***Polypterus bichir*** (White Nile), ***P. congicus*** (Lake Tanganyika), ***P. senegalus*** (White Nile)
- Lernaea hardingi* Fryer, 1956 [syn. *Lernaea* sp. cf. *lophiara* Harding, 1950] from *Brycinus nurse*, *Chrysichthys mabusi*, *Coptodon zillii*, ***Nyassachromis serenus***, *Oreochromis niloticus*, ***Rhamphochromis lucius*** (both Lake Malawi), *Sargochromis mellandi*, *Sarotherodon galilaeus*, *Synodontis nigromaculatus*
- Lernaea inflata* Fryer, 1961 from ***Enteromius argenteus*** (Victoria Nile)
- Lernaea lophiara* Harding, 1950 from *Copadichromis quadrimaculatus*, ***Coptodon zillii***, ***Diploaxodon argenteus***, *Labeo cylindricus*, *Labeobarbus johnstonii*, ***Lethrinops lethrinus***, *L. micrentodon*, *Mylochromis incola*, ***Nyassachromis breviceps***, *N. nigritaeniatus*, ***N. prostoma***, *Otopharynx argyrosoma*, *Placidochromis johnstoni*, ***Rhamphochromis lucius***, ***Taeniolethrinops praeorbitalis***, ***Tropheops tropheops*** (all Lake Malawi)
- Lernaea palati* Harding, 1950 from ***Copadichromis chrysonotus*** (Lake Malawi)
- Lernaea senegali* (Zimmermann, 1922) [syn. *Lernaeocera senegali* Zimmermann, 1922] from ***Polypterus senegalus*** (Sudan)
- Lernaea tilapiae* Harding, 1950 from ***Oreochromis lidole***, ***O. squamipinnis*** (both Lake Malawi)
- Lernaea tuberosa* Harding, 1950 from ***Engraulicypris sardella*** (Lake Malawi)
- Lernaeogiraffa* Zimmermann, 1922
- Lernaeogiraffa heterotidicola* Zimmermann, 1922 from ***Heterotis niloticus*** (Nile River) [Fig. 4.9.3G]

*Opistholernaea* Yin, 1960

*Opistholernaea contorta* Fryer, 1965 from *Distichodus brevipinnis*, *D. rostratus* (both Niger River)

*Opistholernaea laterobrachialis* (Fryer, 1959) [syn. *Lernaea laterobrachialis* Fryer, 1959] from *Oreochromis andersonii*, *O. macrochir* (Zambia), *O. niloticus* [Fig. 4.9.3H]

*Opistholernaea longa* (Harding, 1950) [syn. *Lernaea longa* Harding, 1950] from *Lates angustifrons*, *L. microlepis*, *L. niloticus* (Lake Turkana)

ISOPODA Latreille, 1817

### List of the Isopoda (adults) from African freshwater fishes

*Ichthyoxenos* Herklots, 1870

*Ichthyoxenos africana* (Lincoln, 1972) from *Lepidolamprologus attenuatus*, *L. elongatus* (both Lake Tanganyika)

*Ichthyoxenos expansus* Van Name, 1920 from *Eugnathichthys eetveldii* (Democratic Republic of the Congo)

*Ichthyoxenos tanganyikae* (Fryer, 1965) from *Simochromis diagramma* (Lake Tanganyika) [Fig. 4.9.4A]

POECILOSTOMATOIDA Thorell, 1859

### Key to the genera of the Poecilostomatoida (adults) from African freshwater fishes (for a key to the species of Ergasilidae see Oldewage & Van As 1988a)

- 1 (2) Body form elongate.....3
- 2 (1) Body generally short and teardrop-shaped.....7
- 3 (4) Thorax 6-segmented, segments 3-4 always fused and enlarged, with two pairs of divergent lateral lobes in form of "X" [Fig. 4.9.4B].....  
.....**Colobomatus**
- 4 (3) Thorax without segmentation; long, slender neck with no appendages; three pairs of biramous legs on abdomen [Fig. 4.9.4G]..... **Mugilicola**
- 5 (6) Thick cuticular covering on second antennae [Fig. 4.9.4C].....  
.....**Dermoergasilus**
- 6 (5) No cuticular covering on second antennae.....7
- 7 (8) Terminal segment of second antennae smooth and subdivided into three pointed processes [Fig. 4.9.4H].....**Paraergasilus**
- 8 (7) Terminal segment of second antennae sclerotised and with a single point [Fig. 4.9.4E,F].....**Ergasilus**



## List of the Poecilostomatoida (adults) from African freshwater fishes

(\* indicates marine or brackish water species that might cross over into freshwater)

*Colobomatus* Hesse, 1873

\**Colobomatus mugilis* Raibaut, Caillet et Ben Hassine, 1978 from *Chelon aurata*, *C. labrosus*, *C. ramada*, *C. saliens* [Fig. 4.9.4B]

*Dermoergasilus* Ho et Do, 1982

\**Dermoergasilus mugilis* Oldewage et Van As, 1988 from *Chelon richardsonii*, ***Mugil cephalus*** (South Africa), *Pseudomyxus capensis* [Fig. 4.9.4C,D]

*Ergasilus* von Nordmann, 1832

*Ergasilus cunningtoni* Capart, 1944 from *Brycinus leuciscus*, *B. nurse*, *Campylomormyrus elephas*, *Distichodus atroventralis*, *D. rostratus*, *Enteromius macrops*, *Hippopotamyrus psittacus*, *Hydrocynus forskahlii*, *Marcusenius greshoffii*, *M. moorii*, *Mormyrops anguilloides*, *M. macrophthalmus*, *M. nigricans*, *Pellonula leonensis*, *Petrocephalus grandoculis*, *Phago loricatus*, *Pollimyrus isidori*, *Pterochromis congicus*, *Raiamas senegalensis*, *Schilbe laticeps*, *Synodontis nigriventris*, *Tylochromis lateralis*, *T. microdon*

*Ergasilus flaccidus* Fryer, 1965 from ***Oreochromis tanganicae*** (Lake Tanganyika)

\**Ergasilus ilani* Oldewage et Van As, 1988 from ***Mugil cephalus*** (South Africa) [Fig. 4.9.4E,F]

*Ergasilus inflatipes* Cressey in Cressey et Collette, 1970 from ***Strongylura senegalensis*** (Ghana)

*Ergasilus kandti* van Douwe, 1912 from *Bagrus bajad*, *Citharinus citharus*, *Lamprologus lemairii*, *Lates niloticus*, *Limnotilapia dardennii*, *Oreochromis tanganicae*, *Plecodus paradoxus*, *Pseudosimochromis curvifrons*, *Pterochromis congicus*, *Synodontis membranaceus*, *Tilapia* sp., *Tylochromis bangwelensis*, *T. mylodon*, *T. polylepis*

*Ergasilus lamellifer* Fryer, 1961 from *Astatoreochromis alluaudi*, *Haplochromis bicolor*, *H. degeni*, *H. guiarti*, *H. longirostris*, *H. nuchisquamulatus*, *H. obesus*, *H. obliquidens*, *H. retrodens*, ***Haplochromis* sp.** (Uganda), *Parailia pellucida*

*Ergasilus latus* Fryer, 1960 from *Auchenoglanis occidentalis*, *Chrysichthys nigrodigitatus*, *Coptodon guineensis*, *C. zillii*, ***Oreochromis niloticus***, *Pelmatolapia cabrae*, ***Sarotherodon galilaeus*** (both Lake Turkana), *S. melanotheron*, *S. nigripinnis*, *Schilbe mystus*

\**Ergasilus lizae* Krøyer, 1863 [syn. *Ergasilus nanus* van Beneden, 1870] from *Alosa fallax*, *Barbus barbatus*, *Chelon ramada*, *C. saliens*, *Mugil cephalus*, *Solea solea*

*Ergasilus macrodactylus* (Sars, 1909) [syn. *Ergasiloides macrodactylus* Sars, 1909] from *Brycinus imberi*, *Haplochromis* sp., *Lethrinops* sp., *Pseudotropheus* sp., *Tilapia* sp.

*Ergasilus megacheir* (Sars, 1909) [syn. *Ergasiloides megacheir* Sars, 1909] from *Bathybates fasciatus*, *B. minor*, *Cyphotilapia frontosa*, *Haplotaxodon microlepis*, *Limnotilapia dardennii*, *Plecodus paradoxus*, *Pterochromis congicus*, *Simochromis* sp., *Synodontis granulosus*, *S. multipunctatus*