

Checklist of the fauna of mountain streams of tropical Indopacific Islands

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(Mit 5 Abbildungen)

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Abstract

A comparative survey on the ecological conditions (such as water-temperature, electric conductivity and total hardness) and on the fauna of mountain streams of isolated tropical islands of the Indopacific is presented here. For that, Continental islands, such as Madagascar, Seychelles, Sri Lanka (Ceylon), Andamans in the Indian Ocean, New Caledonia in the Southern Pacific and also Oceanic islands, such as the Comoros (Anjouan), La Réunion and Mauritius in the Indian Ocean are taken into consideration.

Résumé

Apercu comparatif sur les conditions écologiques (température de l'eau, conductivité électrique, dureté totale) et sur la faune des eaux courantes des montagnes des îles tropicales isolées de l'Indopacifique. Pour cela, des îles continentales, comme Madagascar, les Seychelles, Sri Lanka (Ceylon), les Andamanes dans l'océan Indien, la Nouvelle Calédonie dans l'Océan Pacifique, ainsi que des îles océaniques, comme les Comores (Anjouan), La Réunion et l'île Maurice dans l'Océan Indien sont prises en considération.

Zusammenfassung

Vergleichende Übersicht über die ökologischen Parameter (Wassertemperatur, elektrische Leitfähigkeit, Gesamthärte) und die Fauna tropischer Bergbäche auf isolierten Inseln des Indopazifik: Kontinentale Inseln, wie Madagaskar, die Granitinseln der Seychellen, Sri Lanka (Ceylon) und Andamanen im Indischen und Neukalodien im Südpazifischen Ozean sowie Ozeanische Inseln, wie die Komoren (Anjouan), La Réunion und Mauritius im Indischen Ozean.

Introduction

The literature concerning the typology and longitudinal distribution of the Meso and Macrofauna of flowing systems in mountain areas has increased in the last few decades (summaries by ILLIES, 1961a; HYNES, 1970; ILLIES & BOTOSEANU, 1963 and BOTOSEANU, 1979). In contrast to those in the temperate zones, relatively few tropical mountain areas have been investigated systematically until recent years (ILLIES, 1961b, 1964; HYNES, 1971; HYNES & WILLIAMS, 1971; BOETTGER,

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1975; HORA, 1923, 1928, 1930 and 1936; BISHOP, 1973; STATZNER, 1975 and some others). On tropical mountainous islands of the Indopacific a first survey of the longitudinal distribution and a checklist of the fauna of running waters was given by several missions of the Institute of Zoology of the University of Vienna (Austria):

Madagascar: STARMÜHLNER, 1962, 1969, 1979b and others; Sri Lanka: STARMÜHLNER, 1972; WENINGER, 1982; other results are summarized in Vol. 23 (1972), Vol. 24 (1+73), Vol. 25 (1974) and Vol. 29 (1979) of the Bulletin of the Fisheries Research Station of Sri Lanka (Ceylon); further results are published by JÄCH, 1984; STARMÜHLNER, 1977a, 1979b, 1984a, 1984b; Seychelles, Comoros (Anjouan), La Réunion, Mauritius: STARMÜHLNER, 1976b, 1976c, 1977b, 1979a; WENINGER, 1977; other results are published in Vol. 83 (1980) of the Annalen des Naturhistorischen Museum Wien; further results by MARLIER, 1977; MARLIER & MALICKY, 1979; Andaman-Islands: STARMÜHLNER, 1977c, 1982; RÜTZLER, 1978; MALICKY, 1978 (1979); WEWELKA, 1982; New Caledonia: STARMÜHLNER, 1968, 1970, 1973, 1979b; WENINGER, 1968; other results are published in the Cahiers de l'O.R.S.T.O.M., sér. Hydrobiologie, Vol. II (2), 1968; Vol. II (3/4), 1968; Vol. III (2), 1969; Vol. IX (3/4), 1970; Vol. VI (3/4), 1972; Vol. IX (2), 1975; Vol. IX (3), 1975; Vol. X (3) 1976; Different South Pacific Islands (Freshwater-Mollusca): STARMÜHLNER, 1976 a.

The collections of these missions are all stored in the Natural History Museum of Vienna in the Sections 2 (Entomology) and 3 (Mollusca and Lower Invertebrates).

Types of Islands

Since the fundamental studies of WALLACE, 1880, it is usual to distinguish between Continental and Oceanic islands: 1) Continental islands were connected in former geological times with land masses of continents. Separated since more or less geological times, the continental old islands have often conserved in flora and fauna so called „living fossils“ and have evolved many endemic families, genera and species. Examples for these old islands are Madagascar in the Indian Ocean or New Caledonia and New Zealand in the South-Pacific. Sri Lanka (Ceylon), a former part of South-India, consists in the granitic central mountains of the South-West („island on the island“) and also old so called „Gondwanic“ elements. But till the last ice-age these island was connected by land bridges with the Indian subcontinent and influenced by faunistic immigrations from the subcontinent and South East Asia. Therefore, Sri Lanka shows today a mixture of older and younger elements in his island fauna. A group of very old granitic continental islands are found in the Seychelles Archipelago (Mahé, Praslin, La Digue and some others). It is widely held from palaeomagnetic evidence that India (and Sri Lanka) moved northwards and away from the African part of the Gondwana-continent during the late Cretaceous Tertiary boundary. During these movement (about over 5 million years) the rupture of the Seychelles and India (and Sri Lanka) probably occurred at the latitude of 30° S in the early Palaeocene.

The continental islands of Andamans in the Gulf of Bengal appear today as a series of hills (400–750 m altitude) and the unsubmerged portions of a continuous ridge which connects the mountain ranges of Manipur-Burma belt in the North with the festoon of islands of Sumatra in the South. They consist of eocene Sedimentaries and younger volcanic serpentine Series, which have uplifted during the Pleistocene as a „young“ continental island.

New Caledonia was folded up in the late Tertiary and consists of marine sediments of the Papuan geosynclinal from New Guinea to New Zealand between Australia and Tasmania continent. In the South of New Caledonia the sediments are partly superposed by serpentine rocks from later volcanic eruptions. 2) Oceanic islands without former connections to continents or bigger land masses are to distinguish in 2a) Volcanic islands and in 2b) uplifted old coral reefs (coral-islands). In the last group mostly no freshwater biotops, such as lakes, pools, ponds or running waters are found. Volcanic islands with higher elevations are mostly relatively youthfull. In the Indian Ocean islands mountain streams are found on three islands of the Comoro-Archipelago (Anjouan, Mohéli and Mayotte; Grand

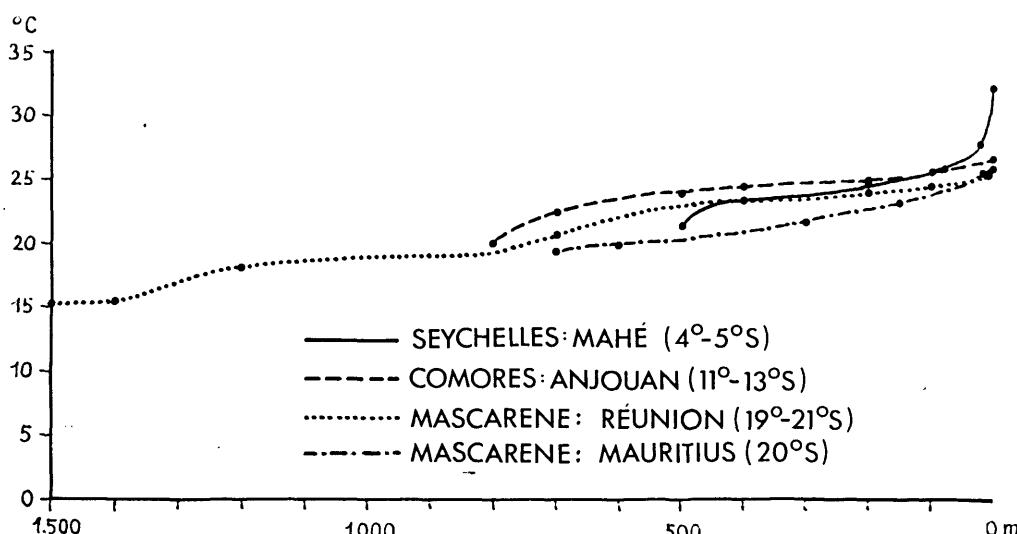


Fig. 1. Water-temperatures between headwaters and mouth in mountain streams of the islands of Mahé (Seychelles), Anjouan (Comoros), La Réunion and Mauritius (Mascarene). (After STARMÜHLNER, 1979a).

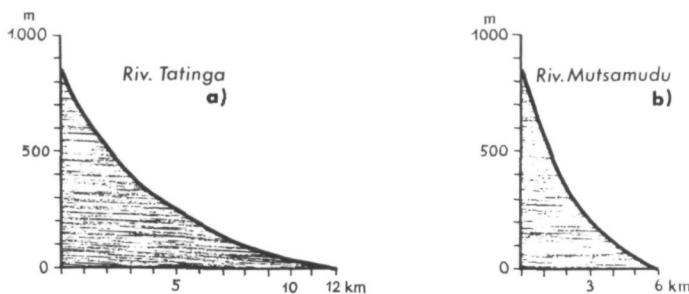
Comoro with two active volcanoes has no river erosion on the slopes). In the East of Madagascar are situated the volcanic Mascarene islands with La Réunion and Mauritius. La Réunion possesses an active and three extinct volcanoes, up to 3000 m altitude and steep slopes. Mauritius is about three million years older, the extinct volcanoes are partly eroded and the altitudes reach up only to 800 m in maximum. Many volcanic islands are in the transition of the Indian Ocean to the South Pacific, between the Malay Archipelago, New Guinea, Bismarck Archipelago South to the Solomons, New Hebrides, parts of the Fiji Archipelago, Samoa and the Society islands with Tahiti and Moorea.

Physically conditions of Mountain Island streams

Most of the mountain streams are-as consequence of the steep gradients (100–500%; Fig. 2) torrential with waterfalls, cascades with very strong current and

a speed between 1–3 m/sec. These zones are steplike interrupted by more and lesser deeper pools with medium to low current (10–50 cm/sec). Near the borders are developed sometimes creeks with the character of stagnant waters. The formation of the bottom is a consequence of the current. In parts with very strong current he is formed by smooth granitic rocks in old continental islands, such as in the mountains of Madagascar, Sri Lanka or of Mahé (Seychelles), by porous volcanic rocks (lava, basalt) in the mountains of volcanic islands, such as Anjouan (Com-

ANJOUAN (COMORES)



MAHÉ (SEYCHELLES)

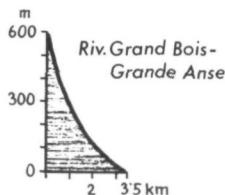


Fig. 2. Gradients of the slopes of the River Tatinga (a), River Mutsamudu (b) from Anjouan (Comoros) and of the River Grand Bois-Grande Anse from Mahé (Seychelles). Altitude: 10× higher
(After STARMÜHLNER, 1979a).

oros), La Réunion and Mauritius in the Indian Ocean or New Hebrides, Solomons or Tahiti in the Pacific. In parts with medium current occur gravel and pebbles (10 cm–1 m Ø); in parts with low current are deposited grit and sand with sporadic stones. At last, in areas with the character of stagnant water are deposited sandy muds, covered with layers of vegetable debris.

The water temperatures of mountain running waters crossing the primary and secondary rain forests show no extremely amplitudes in the different seasons, respectively between day and night. The temperatures are influenced by the altitudes and the geographical latitudes North or South of the equator (see Table 1; Fig. 1, 4 and 5):

Table 1. Water-temperatures of Mountain streams of Indopacific islands

Altitude/ Latitude	Mada- gascar 12°-25° S	Sri Lanka 6°-10° N	Réunion 19°-21° S	Maurit. 20° S	Sey. 4.5° S	And. 12° N	Comor. 12° N	New. Caled. 20°-22° S
2000-1800 m	10°-12°	15°	10°					
1700-1500 m	13°-14°	17°	15°					
1400-1100 m	↓	19.6°	↓					13°
1000 m	↓	20.2°	18°					↓
900-800 m	↓	22.3°	↓				20°	15°
700-600 m	23°	24.8°	↓	19.4°			↓	
500 m	↓	25.1°	24°	↓	21.7°		↓	17°
250 m	↓	25.6°	↓	↓	↓	23°	↓	18°
100 m	25°	26°	25°	↓	↓	25°	↓	21°
50 m	↓	26.3°	↓	↓	↓	26°	↓	22°
20 m	26°	27.2°	↓	↓	↓	28°	↓	↓
mouth	28°	28°-30°	28.4°	26.3°	32.5°	30°	26°	25°

The water-temperatures are in °Celsius and average values. Abbreviations: Maurit. = Mauritius; Sey. = Seychellen (Mahé); And. = Andamans; Comor. = Comoros (Anjouan); New Caled. = New Caledonia.

The lowest mean temperatures of 10-12° C was measured in the headwaters of the Ankaratra Mountains in Madagascar in altitudes between 1800 m and 2000 m; in the central mountains of Sri Lanka, the mean temperatures of the headwaters reaches about 15° C in 1800-2000 m and about 17° C in 1700-1500 m altitudes. In the same altitudes in La Réunion, the water temperature was only 15° C (in 1800-2000 m: 10° C!). In mountain streams in altitudes between 1500 and 500 m, the mean temperatures changes between 18° C and 25° C, below 500 m between 20° C and 28° C (mouth up to 30° C).

Chemically conditions of Mountain Island streams

The chemistry of mountain freshwaters is influenced by the type of the rocks of the bottom. In the old continental islands, such as Madagascar, Sri Lanka or Seychelles, the central mountains consists of old precambrian granitic rocks. In the Andamans it consists of sedimentaries and younger serpentine series and in New Caledonia it consists of old sediments, metamorphic rocks (Grauwacken) and serpentine, respectively periodite of old volcanic eruptions. In the younger oceanic islands such as the Comoros and Mascarenes, but also in many of the South-Pacific islands, the rocks consist of, basalts and different series of lavas (see Table 2).

In old Continental islands, such as Sri Lanka (Fig. 4) or some of the granitic islands of the Seychelles (Mahé, Praslin, La Digue) built by precambrian crystalline granitic rocks, the mountain surface waters are extremely poor in electrolyts, very soft and slightly acidic (pH: 5.5-6.8). These is expressed in very low values of the electrolytic conductivity between only 8.8 µS and 89 µS (mean values: 10-30 µS) and the total hardness between 0.08° dH and 2.35° dH (mean values: < 1° dH).

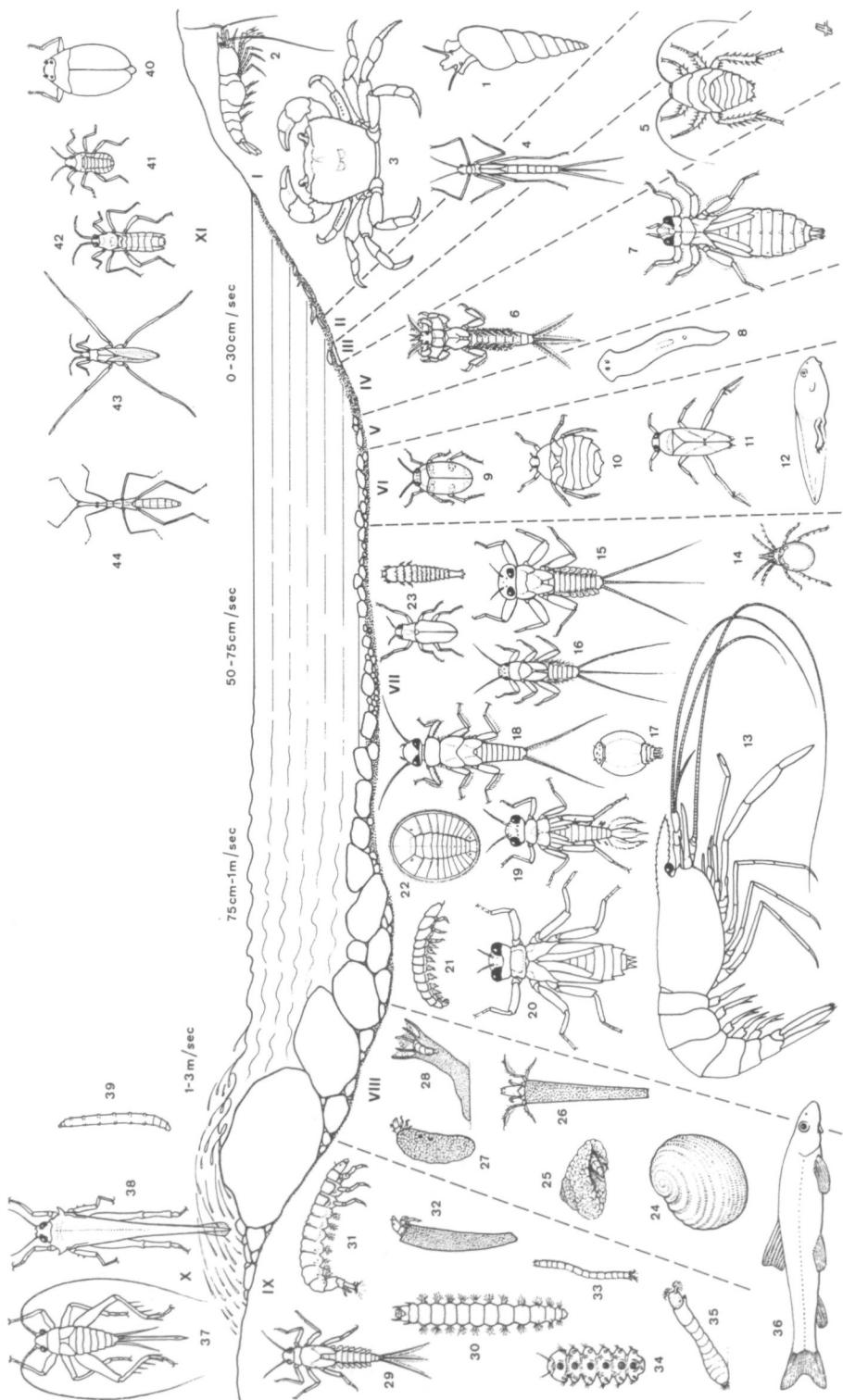


Fig. 3. Cross-Section of the Upper course of a mountain stream of Sri Lanka with schematic diagramm of the microdistribution of different characteristic animals:

- I: On the surface of sand and mud, rich on deposited organic matter (banks and pools between cascades): 1: *Melanoides tuberculata*; 2: different species of small Atyidae (such as species of *Caridina* and *Atya*); 3: *Paratelphusa rugosa*.
- II. On the surface of sand (bank and pools between cascades): 4: larvae of damselflies (such as *Neurobasis chinensis chinensis* and other species).
- III: Under stones near the banks: 5: *Rhabdoblatta* sp. juv.
- IV: Digging in sand (near the banks and in pools between cascades): 6: nymphs of *Ephemera* sp.; 7: different species of Gomphinae, such as *Paragomphus henryi*.
- V: On and under the surface of stones (near the banks and in pools between cascades, but also in the medium current): 8: *Dugesia nannophallus*.
- VI: Swimming in the free water of lentic areas without or with very low current (0–10 cm/sec; banks and pools between cascades): 9: *Lacconectes simoni*; 10: *Aphelocheirus cliviculus*; 11: *Enithares simplex*; 12: tadpole of the frog *Rana temporaria*
- VII: On, under and between gravel in the medium current (20–50 cm/sec): 13: different species of the genus *Macrobrachium* (such as *australe*, *latimanus*, *scrabicum*) under stones; 14: Hydrachnella (water-mites), such as *Atractides schwoerbeli* and others; 15: nymphs of Heptageniidae, such as species of *Compsonaeuriella*; 16: nymphs of Leptophlebiidae, such as *Kimminsula*, *Chloroterpes*, *Megaglena* or *Isaca*; 17: nymphs of the genus *Prosopistoma*; 18: nymphs of the genus *Neoperla*; 19: larvae of *Euphaea splendens*; 20: larvae of *Zygonyx iris ceylanica*; 21: larvae of a lampyrid beetle (*Luciola* or *Pyrophanes*-species); 22: larvae of dascyllide beetles from the genus *Eubrianax*; 23: larvae and imago of different species of Elmidae, such as the genera *Stenelmis*, *Ilamelmis*, *Podelmis*, *Aruelmis*, *Ordobrevia*, *Zaitzeviaria* and others with many endemic species;
- VIII: On, under and between boulders and gravel in the strong current: 24: *Paludomus* (*Tanalia neritooides* (and *loricatus*)); 25: case and larvae of the caddisfly-family Helicopsychidae (genus *Helicopsyche* with many endemic species); 26: case and larvae of the caddisfly-family Leptoceridae (such as the genera *Trichosetodes*, *Adicella*, *Oecetis*, *Setodinella* and others with many endemic species); 27: case and larvae of the caddisfly-family Hydroptilidae (such as the genera *Hydroptila*, *Oxyethira* and others with some endemic species); 28: tube and larvae of the chironomide genus *Rheotanytarsus*;
- IX: On big boulders and on rocks in the rapids and cascades zones with very strong current (75 cm/sec–1 m/sec and more): 29: nymphs of the family Baetidae (also between floating floating algae); 30: caterpillar of the watermoth-genus *Aulacodes* sp. (protected against the strong current by membranous tubes); 31: larvae of the caddisfly family Hydroptilidae (such as the genera *Hydropsyche*, *Oestropsyche*, *Synaptopsyche*, *Macronema*, *Pseudoleptonema*, *Diplectrona*, *Diplectronella* and others with many endemic species); 32: case and larvae of the minute caddisfly family Sericostomatidae with the genus *Ceylanopsyche* and some endemic species; 33: larvae (and pupae) of Orthocladiinae gen. ssp.; 34: larvae (and pupae) of Blephariceridae gen. ssp.; 35: larvae (and pupae) of different, mostly endemic species of blackflies, Simuliidae, such as *Simulium cinquestriatum*; 36: mountain barble (*Garra lamta*);
- X: On sprayed rocks: 37: the cricket *Paranemobius pictus*; 38: the tettigide grasshopper *Euscelimena gavialis*; 39: larvae (and pupae) of the limoniid *Limonia* sp.
- XI: On the water surface near the banks and of pools between cascades (current: 0–30 cm/sec): 40: Whirling beetle (such as species of the genera *Aulonogyrus* and *Orectochilus*); 41: minute water cricket (genus *Microvelia* with some endemic species); 42: water crickets (species of the genera *Rhagovelia*, *Tetraripis* with some, endemic species); 43: Pond skater (species of the genera *Limnogonus*, *Limnometra*, *Meteocoris*, *Onychotrechus*, *Ptilomera*, *Rheumatogonus* and *Ventidius*; many endemic); 44: water measurer (such as *Hydrometra greeni*) (After STARMÜHLNER 1984b, Drawing: M. MIZZARO).

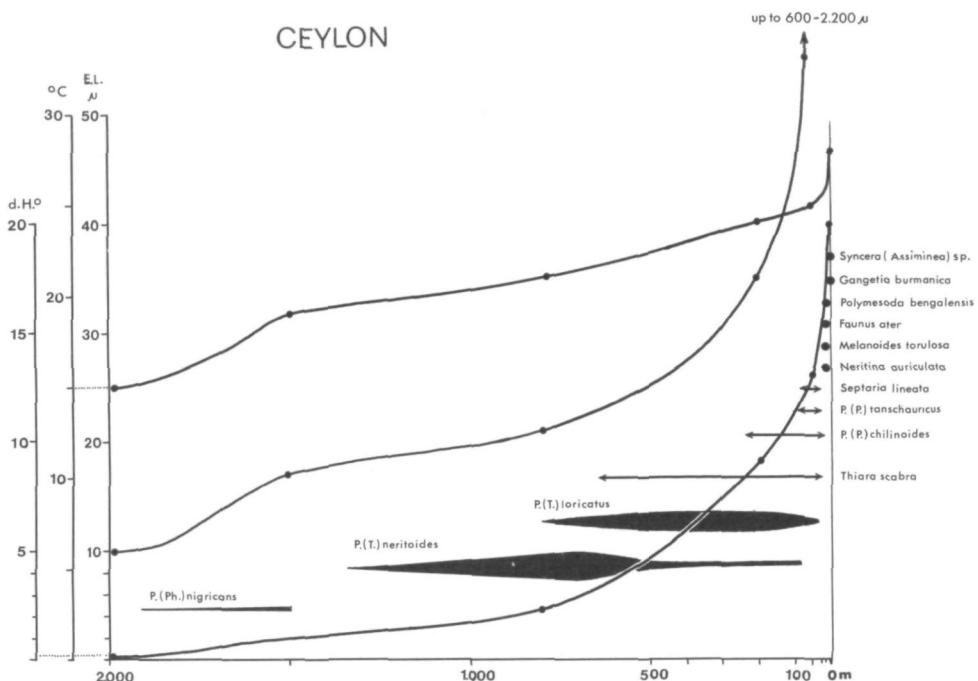


Fig. 4. Diagram showing temperature, hardness degree and electrolytic conductivity of the running waters correlated with the longitudinal distribution of the freshwater gastropods and bivalves between headwaters and the mouth of mountain streams of Southern Sri Lanka (Temperature in °Celsius; Total hardness in °dH (German hardness degree); Electrolytic conductivity (El_{20}) in μ Siemens (at 20° Celsius) (After STARMÜHLNER, 1979b).

Table 2. Electrolytic conductivity (in μ S at 20° C) and total hardness (in dH° mean values) of mountain streams of different Indopacific islands

	Sri Lanka	Seychelles	Réunion	Mauritius	Comoros	Andamans	New Caledonia	Tahiti
El_{20}	8.8–89	25–47	52–105	43–220	94–255	55–401	50–167	132
Total Hardness	0.08–2.35	0.095–0.65	1.15–8	0.28–4.25	1.9–8.4	0.8–10	2.7–4.5	4

In the continental islands with sedimentary series and old volcanic rocks, such as the Andamans in the Indian Ocean or New Caledonia (Fig. 5) in the South-Pacific, the values of El_{20} , reaches up from 59 μ S to 401 μ S and from 50 μ S to 167 μ S. The total hardness reaches up from 0.8° dH to maximal 10° dH and from 2.7° dH to 4.5° dH. In the mountain streams of the younger volcanic islands, the soluble electrolytes are higher, the conductivity consists between 43 μ S and 255 μ S, the total hardness between 0.28° dH and 8.4° dH.

NEW CALEDONIA

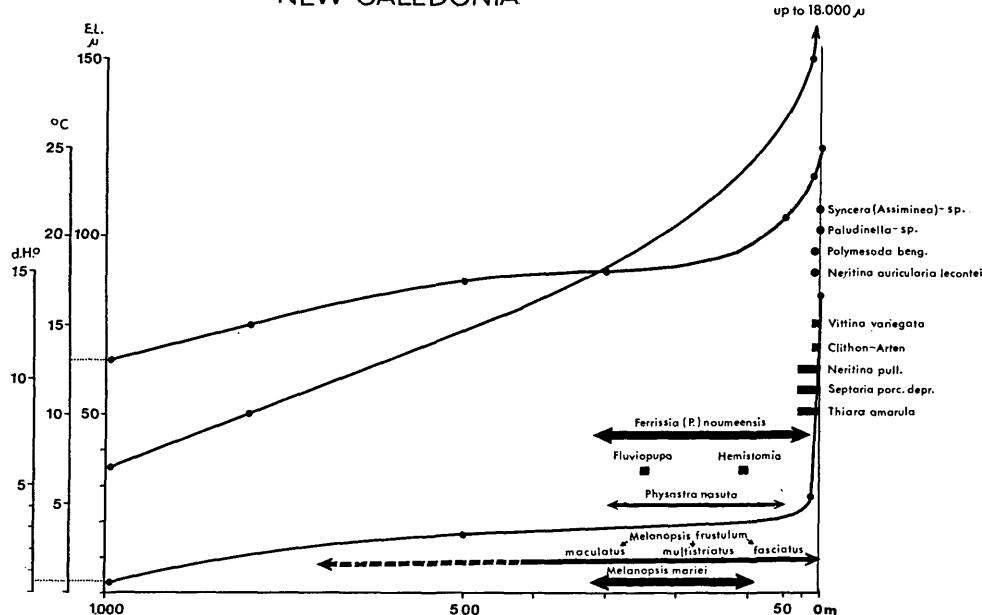


Fig. 5. Diagram showing temperature, hardness degree and electrolytic conductivity of the running waters correlated with the longitudinal distribution of the freshwater gastropods and bivalves between headwaters and the mouth of mountain streams of New Caledonia (temperature in °Celsius; Total hardness in °dH (German hardness degree); Electrolytic conductivity (El₂₀) in μ Siemens (at 20° Celsius) (After STARMÜHLNER, 1979b).

Checklist of the Fauna of Mountain Island streams: Continental Islands of the Indian Ocean

MADAGASCAR	SEYCHELLES	SRI LANKA (Fig. 3)	ANDAMANS
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Turbellaria Tricladida	<i>Dugesia milloti</i>	<i>Dugesia aff. gonocephala</i>	<i>Dugesia nannophallus</i>	<i>Dugesia andamanensis</i>
Amphipoda	<i>Austroniphargus</i> (endem. genus and species: <i>subterraneus</i>)	-	-	-
Decapoda	<i>Astacoides</i> <i>madagascariensis</i> (end.)	-	-	-
Natantia Caridea	2 gen: <i>Caridina</i> , <i>Atya</i> (22, partly end. species)	<i>Caridina</i> (5 species)	<i>Caridina</i> (4 species) <i>Atya spinipes</i>	<i>Caridina</i> (6 species) <i>Atya spinipes</i>

	MADAGASCAR	SEYCHELLES	SRI LANKA (Fig. 3)	ANDAMANS
Palaemonidae	<i>Macrobrachium</i> (5 species)	<i>Macrobrachium</i> (2 species)	<i>Macrobrachium</i> (3 species)	<i>Macrobrachium</i> (5 species)
Brachyura	<i>Bottia</i> (3 end. species) <i>Hydrotelphusa</i> <i>agilis</i> ;	<i>Sesarma impressa</i>	<i>Paratelphusa</i> (2 species)	<i>Labuania finni</i> ; <i>Geosesarma</i> <i>starmühlneri</i> ; <i>Varuna litterata</i> ;
Hydracarina	<i>Atractides</i> <i>madagascariensis</i> <i>Torrenticola</i> ssp.; <i>Arrenurus</i> ssp.; (most species end.)	?	<i>Atractides</i> <i>schwoerbeli</i> ; <i>Torrenticola pusta</i> ; <i>T. oxyostomata</i> <i>hamata</i> ; <i>Arrenurus</i> <i>maderassi</i> ;	<i>Atractides</i> <i>angulipalpis</i> ; <i>Hydrodroma</i> <i>monticola</i> ;
Insecta Ephemero- ptera	20, mostly endemic genera and more than 50 end. species of the families: Baetidae; Leptophlebiidae, Heptageniidae, Oligoneuriidae; Pro-sopistomatidae: <i>Proboscidiplocia sikorai</i> (endemic);	<i>Maheathraulus scotti</i> ; <i>Hagenulodes braueri</i> (endemic)	More than 20, mostly endemic genera and about 50 end. species of the families: * Leptophlebiidae (<i>Kimminsula</i> , <i>Chlorotterpes</i> , <i>Megaglena</i> , <i>Isaca</i>); Baetidae (<i>Baetis</i> , <i>Cloeon</i> , <i>Indobaetis</i> , <i>Indocloeon</i> , <i>Procloeon</i> , <i>Pseudocloeon</i>); Caenidae (<i>Caenis</i> , <i>Clypeocaenis</i>); Ephemerellidae (<i>Telaganodes</i>); Ephemeridae (<i>Emphemera</i>); Heptageniidae (<i>Compsoneuriella</i>); Oligoneuriidae (<i>Chromarcys</i>); Polymitarcyidae (<i>Povilla</i> , <i>Ephoron</i>);	Baetidae, Leptophlebiidae (<i>Chlorotterpes</i> , <i>Afronurus</i>); Caenidae, Heptageniidae, <i>Povilla andamanensis</i>

* After HUBBARD, M. D. & W. L. PETERS, Ephemeroptera in Sri Lanka: An introduction to their ecology and biogeography. Monographiae Biologicae. Vol. 57: Ecology and Biogeography in Sri Lanka. Dr. W. JUNK Publ., 1948. The Hague.

	MADAGASCAR	SEYCHELLES	SRI LANKA (Fig. 3)	ANDAMANS
			Prosopistomatidae (<i>Prosopistoma</i>); Tricorythidae (<i>Neurocaenis</i>);	
Plecoptera	2 genera (end) 5 species (end.) (<i>Madenemura</i> , <i>Tsarenemura</i>)	absent!	2 genera and 3 species endem. <i>Neoperla angu-</i> <i>lata; triangulata;</i> <i>Phanoperla</i> sp.	absent!
Odonata Zygoptera	Many, partly en- demic genera and endemic species (<i>Pseudagrion</i> , <i>Nesolestes</i> , <i>Tato-</i> <i>cnenmis</i> , <i>Oeriagrion</i> and others)	Coenagrionidae; <i>Leptocnemis</i> ssp.	9 genera, 12 species (partly endemic): <i>Lestes elata</i> ; <i>Euphaea splendens</i> ; <i>Libellago greeni</i> ; <i>L.</i> <i>finalis</i> ; <i>Neurobasis</i> <i>chin. ch.</i> ; <i>Dre-</i> <i>panosticta</i> sp.; <i>Elattoneuris tenax</i> ; <i>E. centralis</i> ; <i>Pro-</i> <i>dasineura sita</i> ; <i>Ves-</i> <i>talis apicalis</i> ; <i>V.</i> <i>nigescens</i> ; <i>Copera</i> <i>marginipes</i> ;	3 genera; 3 species; <i>Ischnura</i> <i>senegalensis</i> ; <i>Agriocnemis</i> sp.; <i>Copera</i> <i>marginipes</i> ;
Anisoptera	6 genera and more than 6 endemic species: <i>Para-</i> <i>gomphus ob-</i> <i>literatus</i> ; <i>Nesocordulia</i> ssp.; <i>Zygonyx hova</i> ; <i>Z.</i> <i>ranavalonae</i> ; <i>Or-</i> <i>thetrum</i> sp.; <i>Trithemis</i> sp.	5 genera and 5 mostly endemic species: <i>Zygonyx luctifera</i> ; <i>Orthetrum stem-</i> <i>male</i> ; <i>Pantala</i> <i>flavescens</i> ; <i>Rhyo-</i> <i>themis semihyalina</i> ; <i>Gynacantha stylata</i> ;	7 genera and 8 mostly endemic species: <i>Zygonyx iris cey-</i> <i>lanica</i> ; <i>Trithemis</i> <i>festiva</i> ; <i>Tr. aurora</i> ; <i>Macromia zeylanici-</i> <i>a</i> ; <i>Heliogomphus</i> <i>sp.</i> ; <i>Megalogom-</i> <i>phus ceylonicus</i> ; <i>Pa-</i> <i>ragomphus henryi</i> ; <i>Microgomphus wi-</i> <i>jaya</i> ;	6 genera, 8 species: <i>Trithemis</i> <i>festiva</i> ; <i>Tr. pallidinervis</i> ; <i>Orthetrum sabina</i> ; <i>Or. chrysitis</i> ; <i>Neurothemis</i> <i>fluctuans</i> ; <i>Crocothemis</i> <i>servilia</i> ; <i>Pantala</i> <i>flavescens</i> ; <i>Diplacodes</i> <i>trivalis</i> ;
Trichoptera	More than 20 ge- nera with about 100, mostly en- demic species: <i>Hydropsyche</i> ; <i>Mac-</i> <i>ronema</i> ; primitive <i>Leptoceridae</i> ; <i>Lep-</i>	5 genera and 6 en- demic species: <i>Hydromanicus</i> <i>seychellensis</i> ; <i>Helicopsyche pal-</i> <i>palis</i> ; <i>H. kantilai</i> ; <i>Ecnomus insularis</i> ;	More than 25 gen- era with about 100, mostly en- demic species: <i>Apsilochroma</i> ; <i>Sy-</i> <i>nagapetus</i> ; <i>Hydrop-</i> <i>tila</i> ; <i>Oxyethira</i> ;	12 genera, 19 en- demic species: <i>Ecnomus</i> ; <i>Paduniel-</i> <i>la</i> ; <i>Polypelectropus</i> ; <i>Agapetus</i> ; <i>Polycen-</i> <i>tropidae</i> gen. ssp.; <i>Oecetis</i> ; <i>Setodes</i> ;

MADAGASCAR	SEYCHELLES	SRI LANKA (Fig. 3)	ANDAMANS	
<i>tonema; Oecetis;</i> <i>Polycentropus; Ec-</i> <i>nomus; Wormaldia;</i> <i>Helicopsyche;</i> <i>Cheumatopsyche;</i> <i>Orthotrichia; Pet-</i> <i>rohrinchus;</i> <i>Psychomyia; Lep-</i> <i>tocella; Chimarra;</i> <i>Anisocentropus;</i> <i>Agapetus; Odon-</i> <i>toceridae, Hydrop-</i> <i>tilidae;</i>	<i>Leptodematopteryx</i> <i>tenuis; Hughscotiel-</i> <i>la auricapilla;</i>	<i>Pseudoneuroclepsis;</i> <i>Ecnomus; Paduniel-</i> <i>ra; Cheumatop-</i> <i>syche; Leptocerus;</i> <i>Oecetis; Setodinella;</i> <i>Goerodes; Helico-</i> <i>psyche; Chimarra;</i> <i>Gunungiella;</i> <i>Pseudoleptroma;</i> <i>Hydropsyche; Di-</i> <i>plectronema; Mac-</i> <i>ronema; Synapto-</i> <i>psyche; Ceylano-</i> <i>psyche; Oestro-</i> <i>psyche;</i>	<i>Goerodes; Chimar-</i> <i>ra; Cheumatop-</i> <i>syche; Leptocerus;</i>	
Orthoptera	-	-	<i>Eucriolettix</i> <i>edithae;</i>	
Heteroptera	23 genera with ab-	Gerridae;	24 genera with 39	Gerridae (<i>Tenago-</i>
Rhynchota	out 38 endemic	Veliidae;	endemic species:	<i>gonus nicobarensis,</i>
	species:	Nepidae;	<i>Limnogonus; Met-</i>	<i>Limnogonus nitii-</i>
	<i>Agraptocorixa; Si-</i>	Notonectidae;	<i>coris; Onycho-</i>	<i>dus, L. fossarum,</i>
	<i>gara, Micronecta;</i>	(Not determi-	<i>trechus; Ptilomera;</i>	<i>Ptilomera harpyia,</i>
	<i>Enithares; Anisops;</i>	nated at present)	<i>Rhematogonus;</i>	<i>Calyptobates n.</i>
	<i>Laccotrephes;</i>		<i>Ventidius; Cylin-</i>	<i>gen., n. sp.);</i>
	<i>Ranatra;</i>		<i>drostenus;</i>	<i>Veliidae (Neo-</i>
	<i>Sphaerodema;</i>		<i>Tenagogenus;</i>	<i>alardus typicus, Mi-</i>
	<i>Tenagenous; Gerris;</i>		<i>Strongyvelia; Mic-</i>	<i>crovelia douglasi,</i>
	<i>Limnogonus; Eury-</i>		<i>rovelia;</i>	<i>Strongyvelia sp.,</i>
	<i>metra, Rhagovelia;</i>		<i>Pseudovelia;</i>	<i>Rhagovelia anda-</i>
	<i>Microvelia;</i>		<i>Rhagovelia;</i>	<i>mana Rh. summa-</i>
	<i>Mesovelia; Milotel-</i>		<i>Xiphovelia; Tet-</i>	<i>treensis);</i>
	<i>la; Hydrometra;</i>		<i>raris; Di-</i>	<i>Mesovelidiidae (Me-</i>
	<i>Pseudambrysus,</i>		<i>plonychus;</i>	<i>sovelia vittigera);</i>
	<i>Naucoris; Mac-</i>		<i>Aphelocheirus;</i>	<i>Nepidae (Ranatra</i>
	<i>rocoris; Heleocoris;</i>		<i>Heleocoris; Cer-</i>	<i>parmata, R. distan-</i>
	<i>Temnocoris; Heb-</i>		<i>cometus; Enithares;</i>	<i>ti, Laccotrephes sp.);</i>
	<i>rus (Paratimasius);</i>		<i>Ochterus; Hyd-</i>	<i>Notonectidae (Eni-</i>
			<i>rometra; Timasius;</i>	<i>thares rogersi, Ani-</i>
			<i>Hydrotrephes;</i>	<i>sops bouvieri, A.</i>
			<i>Tiphotrephes;</i>	<i>nivea);</i>
				<i>Hydrometridae</i>
				<i>(Hydrometra main-</i>
				<i>droni)</i>

MADAGASCAR	SEYCHELLES	SRI LANKA (Fig. 3)	ANDAMANS
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Lepidoptera	genus and species endemic: Pyralidae gen. ssp.	-	genus and species endemic: Pyralidae: <i>Aulacodes</i> ssp.	genus and species endemic: Pyralidae: <i>Aulacodes</i> ssp.
Coleoptera Dytiscidae	14 genera with 20 endemic spec.: <i>Canthydrus</i> ; <i>Laccophilus</i> ; <i>Guig-</i> <i>notus</i> ; <i>Neptoster-</i> <i>nus</i> ; <i>Herophydrus</i> ; <i>Pachynectes</i> ; <i>Hyphydrus</i> ; <i>Copelatus</i> ; <i>Rhantus</i> ; <i>Hydaticus</i> ; <i>Eretes</i> ; <i>Rhantaticus</i> ; <i>Cybis-</i> <i>ter</i> ; <i>Hydrovatus</i> ;	?	6 genera with more than 10 (end.) species in streams: <i>Guignotus flam-</i> <i>mulatus</i> ; <i>Canthyd-</i> <i>rus luctuosus</i> ; <i>Laccophilus cey-</i> <i>lon.</i> ; <i>L. chinensis</i> <i>inneficiens</i> ; <i>Neptos-</i> <i>ternus horai ceyl.</i> ; <i>N. starmuehlneri</i> ; <i>N. taprobanicus</i> ; <i>N.</i> <i>sp.</i> ; <i>Lacconectus si-</i> <i>moni</i> ; <i>Hydaticus</i> <i>luzonicus</i> ;	From 12 genera and 25 species known in streams: <i>Hydrovatus contor-</i> <i>tus</i> ; <i>H. acuminatus</i> ; <i>H. ferrugatus</i> ; <i>H.</i> <i>fusculus</i> ; <i>Guignotus</i> <i>orientalis</i> ; <i>G. incon-</i> <i>stans</i> ; <i>Uvarus livens</i> ; <i>Hydrocoptus subvit-</i> <i>tulus</i> ? <i>Canthydrus</i> <i>morsbachii</i> ; <i>Laccophilus chinен-</i> <i>sis</i> ; <i>L. parvulus</i> ; <i>Copelatus tene-</i> <i>brosus</i> ; <i>Hydaticus</i> <i>vaziranii</i> ; <i>Cybister</i> <i>tripunctatus</i> <i>asiaticus</i> ;
Hydrophi- lidae	10 genera with ab- out 14 endemic species: <i>Hydraena</i> ; <i>Anacaen-</i> <i>na</i> ; <i>Helochares</i> ; <i>Hydrobaeticus</i> ; <i>Be-</i> <i>rosus</i> ; <i>Allecoto-</i> <i>cerus</i> ; <i>Regimbertia</i> ; <i>Enochrus</i> ; <i>Am-</i> <i>phipps</i> ; <i>Ster-</i> <i>nolophus</i> ;	?	5–6 genera with 7–8 species (partly endem.) in streams: <i>Berosus indicus</i> ; <i>Ooclys latus</i> ; <i>Helochares</i> sp. <i>Paracymus</i> sp. <i>Anacaena</i> sp. <i>Pelthydrus</i> ssp. further also <i>Hydraena tubuli-</i> <i>phallis</i> ;	found, but not de- terminated at present!
Elmidae and Dryopidae	about 15, mostly en- demic genera and more than 30 en- dem. species: <i>Potamophilinus</i> ; <i>Potamodytes</i> ; <i>Potamolatres</i> ; <i>Pseudelmanidolia</i> ; <i>Pachelmis</i> ; <i>El-</i>	?	15, mostly endemic genera with 33 endemic species: <i>Potamophilinus</i> (4 species); <i>Stenelmis</i> (2 spec.); <i>Ordobrevia</i> (2 spec.); <i>Leptelmis</i> (1 spec.);	?

MADAGASCAR	SEYCHELLES	SRI LANKA (Fig. 3)	ANDAMANS
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	<i>midolia; Aspidel-</i> <i>mis; Hydrethus; Ex-</i> <i>olimnius; Lobelmis;</i> <i>Helmintocharis;</i> <i>Pachyelmis;</i> <i>Elmiinae gen. ssp.</i> <i>Dryops</i> sp.		<i>Graphelmis</i> (1 spec.); <i>Unguisaeta</i> (1 spec.); <i>Ilamelmis</i> (4 spec.); <i>Cephalolimnius</i> (1 spec.); <i>Podelmis</i> (10 spec.); <i>Ohiya</i> (1 spec.); <i>Aesobia</i> (1 spec.); <i>Taprobanelmis</i> (1 spec.); <i>Zaitzeviaria</i> (2 spec.); <i>Ceradryops</i> (1 spec.); <i>Elmomorphus</i> (1 spec.);	
Helodidae	<i>Hydrocyphon</i> sp.	?	<i>Hydrocyphon</i> <i>atratus</i> ;	?
Psephenidae	-	-	<i>Eubrianax</i> with probably 5 species; only the larvae in streams!	Psephenidae gen. sp.
Lampyridae	-	-	<i>Luciola</i> or <i>Pyrophanes</i> sp.; only the larvae in streams!	-
Haliplidae	<i>Peltodytus</i> sp.	?	?	?
Spercheidae	<i>Spercheus</i> sp.	?	?	?
Sphaeri-	<i>Coelostoma</i> sp.	-	-	-
diidae	larvae			
Ptilo-	<i>Ptilodactylus</i>	-	-	-
dactylidae	sp. larvae			
Gyrinidae	4 genera with 13, endemic species: <i>Dineutus; Au-</i> <i>lonogyrus; Orec-</i> <i>togyrus; Gyrinus;</i>	?	2 genera, more than 10, partly en- demic species: <i>Aulonogyrus;</i> <i>Orectochilus;</i>	<i>Orectochilus</i> <i>andamanarum;</i> <i>O. andamanensis</i> (both. endem.) <i>Gyrinus</i> <i>smaragdinus;</i>

MADAGASCAR SEYCHELLES SRI LANKA ANDAMANS
 (Fig. 3)

Megaloptera Sialidae	<i>Madachauliodes</i> <i>torrentiales</i> (endemic)	-	?	-
Diptera Simuliidae	1 genus with about 15, mostly en- demic species: <i>Simulium</i> ;	<i>Simulium</i> <i>speculiventre</i>	1 genus with 5 sub- genera and 13 en- demic spec.: <i>Simulium</i> (<i>Gom-</i> <i>phostilbia</i> , <i>Eusimulium</i> <i>Simulium</i> , <i>Morops</i> , <i>Byssodon</i>)	<i>Simulium</i> <i>striatum</i> -gr.; <i>S. consimilis</i> ; <i>S. (Gomphostilbia)</i> <i>zonatum</i> ;
Blephari- ceridae	2 endemic genera, 9 endemic species: <i>Eupauliana</i> ; <i>Pauliana</i> ;	-	endemic genera and species (not described at present)	-
Culicidae	5 genera and about 20 mostly en- demic species: <i>Anopheles</i> ; <i>Ficalbia</i> (<i>Mimomyia</i>); <i>Culex</i> (<i>Lutria</i>); <i>Aedomyia</i> ;	?	<i>Aedes lineatus</i>	?
Stratiomyidae	larvae present	?	?	?
Limoniidae	<i>Eriocera</i> sp., <i>Limonia</i> sp.;	<i>Limonia</i> sp.;	<i>Limonia</i> sp.;	?
Rhagionidae	<i>Atherix</i> sp.	?	?	?
Empididae	present (larvae)	?	?	?
Psychodidae	larvae present	?	?	?
Tipulidae	larvae of 4 species found, not deter- mined at pre- sent	?	?	?

	MADAGASCAR	SEYCHELLES	SRI LANKA (Fig. 3)	ANDAMANS
Chironomidae	Many endemic genera and species; not determinated at present	<i>Cricotopus;</i> <i>Rheocricotopus;</i> <i>Cardiocladius;</i> <i>Endochironomus;</i> <i>Dicrotendipes;</i> <i>Pentaneurini;</i>	Orthocladiinae: many genera and species, not determinated at present; <i>Rheotanytarsus</i> ssp.	<i>Larsia</i> sp.; <i>Cricotopus</i> ssp.; <i>Procladius</i> ssp.; Chironomini gen. ssp.; not determinated at present;
Mollusca	12 genera, partly endemic and 20 partly endemic species:	4 genera, one species endemic: <i>Neritina</i> (<i>Vittina</i>); <i>Neritina</i> (<i>Neritina</i>); <i>Neritilia</i> ; <i>Cleopatra</i> ;	10 genera (1 sub-genus end.), 21 partly endemic species: <i>Neritina</i> (<i>Neripteron</i>); <i>Septaria</i> ; <i>Paludomus</i> (<i>Philopotamus</i>); <i>P.</i> (<i>Tanalia</i>); <i>P.</i> (<i>Paludomus</i>); <i>Tricula</i> ; <i>Thiara</i> ; <i>Melanoides</i> (<i>Melanoides</i>); <i>Melanoides</i> (<i>Stenomelania</i>); <i>Faunus</i> ; <i>Bithynia</i> ; <i>Gangetia</i> ; <i>Syncera</i> ;	4 genera, 8 species: <i>Clithon</i> ; <i>Neritina</i> (<i>Neripteron</i>); <i>Melanoides</i> (<i>Mel.</i>) <i>M.</i> (<i>Stenomelania</i>);
Pulmonata	<i>Lymnaea</i> (<i>Radix</i>); <i>Bulinus</i> ; <i>Anisus</i> ; <i>Afrogyrus</i> (<i>Hovorbis</i>); <i>Segmentorbis</i> ; <i>Biomphalaria</i> ; <i>Ferrissia</i> (<i>Pettencylus</i>);	<i>Lymnaea</i> (<i>Radix</i>); <i>Gyraulus</i> ;	<i>Lymnaea</i> (<i>Radix</i>); <i>Gyraulus</i> ; <i>Indoplanorbis</i> ; <i>Ferrissia</i> (<i>Pettencylus</i>);	<i>Lymnaea</i> (<i>Radix</i>); <i>Indoplanorbis</i> ;
Bivalvia	4 genera with 7 partly endemic species: <i>Aetheria</i> ; <i>Unio</i> ; <i>Nodularia</i> ; <i>Corbicula</i> ; <i>Pisidium</i> ;	-	4 genera with 7 partly endemic species: <i>Lamellidens</i> ; <i>Parreyssia</i> ; <i>Polymesoda</i> ; <i>Pisidium</i> ;	<i>Polymesoda</i> ;

	MADAGASCAR	SEYCHELLES	SRI LANKA (Fig. 3)	ANDAMANS
Vertebrata	KIENER (1966)*)	<i>Pachypanchax playfai</i> (endemic)	In mountain streams 17 genera with 23 species, partly end.: <i>Danio; Rasbora; Chela; Barbus; Garra; Noemacheilus; Lepidocephalus; Xenotodon; Anguilla; Aplocheilus; Poecilia; Xiphophorus; Channa; Ophiocelphalus; Glossogobius; Belontia; Macrognathus;</i>	6 genera with 6 spec.: <i>Aplocheilus; Ophiocelphalus; Clarias; Heteropneustes; Eleotris andamanensis</i> (end.); <i>Doryichthys</i> sp. (end.)
Pisces	has noted 19 genera and 32 species as endemic in Madagascar. In mountain streams are found: <i>Agonostomus telfairi; Sicyopterus fasciatus; Pachypanchax playfai</i> var. <i>sakarami</i> ; species of the genera: <i>Bedotia; Rheocles; Rheocloides; Ancharius; Typhleotris; Anguilla; Acentrogobius; Oxylapia; Oryzias; Batrachus</i> ; (many species restricted to distinct areas!)			
Reptilia	-	-	<i>Natrix piscator; Cerberus rhynchos;</i>	<i>Natrix piscator; Cerberus rhynchos;</i>

*) KIENER, A., 1966. – Contribution à la biogéographie de quelques espèces ichtyozogiques malgaches. Compt. Rendu Samm. d. Séances de la Soc. de Biogéographie. No. 373–374: 3–18.

Checklist of the Fauna of Mountain streams of Oceanic (Volcanic) Islands of the Indian Ocean

	COMOROS ANJOUAN	MASCARENES LA RÉUNION	MAURITIUS
Porifera	-	<i>Eunapius</i> sp.;	<i>Eunapius michaelensi; Eunapius carteri;</i>
Turbellaria Tricladida	<i>Dugesia milloti;</i>	<i>Dugesia aff. gonocephala;</i>	<i>Dugesia aff. gonocephala;</i>

	COMOROS ANJOUAN	LA RÉUNION	MASCARENES MAURITIUS
Oligochaeta	<i>Dero (Aulophorus) hymanae;</i>	?	<i>Limnodrilus hoffmeisteri;</i>
Decapoda	3 genera with 5 species:	3 genera with 5 species:	3 genera with 9 species:
Natantia	<i>Caridina;</i>	<i>Caridina;</i>	<i>Caridina;</i>
Caridea	<i>Atya; Macrobrachium;</i>	<i>Atya; Macrobrachium;</i>	<i>Atya; Macrobrachium;</i>
Palaemonidae			
Brachyura	-	<i>Varuna litterata</i> (only lower courses);	<i>Varuna litterata</i> (only lower courses);
Insecta			
Ephemeroptera	<i>Baetidae gen. ssp.</i> <i>Prosopistoma sp.</i> <i>Chloroterpes;</i> <i>Thraulus;</i> (both with endem. species)	<i>Baetidae gen. ssp.</i> <i>Leptophlebiidae gen. ssp.</i> (not determinated at present)	absent!
Plecoptera	absent!	absent!	absent!
Odonata			
Zygoptera	<i>Pseudagrion pontogenes;</i>	<i>Pseudagrion puctum;</i> <i>Ceratagrion glabrum;</i>	<i>Zygoptera gen. sp.</i> (not determinated at present)
Anisoptera	<i>Trithemis kirbyi ardens;</i> <i>Tr. arteriosa;</i> <i>Zygonyx torrida;</i> <i>Orthetrum julia</i> <i>falsum;</i>	<i>Anisoptera gen. ssp.</i> <i>Anax imperator;</i>	<i>Trithemis annulata;</i> <i>Zygonyx sp.;</i> <i>Orthetrum stemmale;</i> <i>Thalassothemis marchali;</i> <i>Diplacodes sp.;</i>
Trichoptera	<i>Hydropsychidae</i> gen. ssp.; <i>Sericostomatidae</i> gen. ssp.; <i>Lepidostomatidae</i> gen. ssp.;	<i>Hydropsychidae</i> gen. ssp.; <i>Hydroptilidae</i> gen. ssp.;	<i>Hydropsychidae</i> gen. ssp. <i>Hydroptiliidae</i> gen. ssp.
	not determinated at present!		
Lepidoptera	-	-	cf. <i>Aulacodes</i> sp.
Heteroptera			
Rhynchota	<i>Veliidae gen. ssp.</i> <i>Gerridae gen. ssp.</i> <i>Ranatridae gen. ssp.</i> <i>Nepidae gen. ssp.</i> <i>Naucoridae gen. ssp.</i>	<i>Veliidae gen. ssp.</i> <i>Gerridae gen. ssp.</i> <i>Ranatridae gen. ssp.</i> <i>Nepidae gen. ssp.</i>	<i>Veliidae gen. ssp.</i> <i>Gerridae gen. ssp.</i> <i>Ranatridae gen. ssp.</i> <i>Nepidae gen. ssp.</i>
	not determinated at present!		

	COMOROS ANJOUAN	LA RÉUNION	MASCARENES MAURITIUS
Coleoptera Dytiscidae	<i>Hyphydrus distinctus;</i> <i>Laccophilus tigrinus;</i>	<i>Hyphydrus distinctus;</i> <i>Laccophilus irroratus;</i> <i>Guignotus strigicollis;</i> <i>G. lobatus;</i>	<i>Hyphydrus scriptus;</i> <i>Herophydrus vittatus;</i> <i>Hydaticus bivittatus;</i> <i>Cybister desjardinsi;</i>
Hydrophilidae	<i>Sternolophus solieri;</i>	<i>Dactylosternum</i> sp.; <i>Laccobius</i> -species (endem.); <i>Paracymus chalceus;</i> <i>Berosus vinosi;</i>	Hydrophilidae gen. ssp. not determinated at present!
Elmidae and Dryopidae	<i>Potamodytes africanus</i>	?	?
Hydraenidae	?	<i>Sicilicula borbonica</i> (endemic)	?
Gyrinidae	<i>Orectogyrus speculum;</i> <i>Dineutus sinuspennis comorensis</i> (endemic);	<i>Dineutus indus olivaceus;</i> <i>D. aereus;</i>	<i>Gyrinus nitidulus;</i> <i>Dineutus indus indus;</i> <i>D. aereus;</i> <i>D. subspinosus;</i>
Diptera Simuliidae	Simuliidae gen. ssp.	Simuliidae gen. ssp.	Simuliidae gen. ssp.
	not determinated at present!		
Limoniidae	<i>Limonia comorensis;</i> (endemic)	<i>Limonia</i> sp.	—
Chironomidae	Orthocladiinae gen. ssp.; Chironomini gen. ssp.; <i>Rheotanytarsus</i> sp.; not determinated at present!	Orthocladiinae: <i>Cricotopus;</i> <i>Rheocricotopus;</i> <i>Eukiefferiella;</i> <i>Smittia;</i> <i>Cardicladius;</i> <i>Rheotanytarsus;</i> <i>Tanytarus;</i> <i>Chironomus;</i> <i>Dicrotendipes;</i> <i>Polypedilum;</i>	Orthocladiinae: <i>Cricotopus;</i> <i>Rheocricotopus;</i> <i>Eukiefferiella;</i> <i>Tanytarsus;</i> <i>Dicrotendipes;</i> <i>Polypedilum;</i> <i>Cryptochironomus;</i>
Rhagionidae	?	Rhagionidae gen. ssp.; (larvae)	?
Ephydriidae	?	Ephydriidae gen. ssp.; (larvae)	?

	COMOROS ANJOUAN	LA RÉUNION	MASCARENES MAURITIUS
Mollusca	5 genera with 6 species:	7 genera with 7 spec.:	8 genera with 9 spec.:
Gastropoda	<i>Neritina</i> (<i>Vittina</i>);	<i>Neritina</i> (<i>Vittina</i>);	<i>Neritina</i> (<i>Vittina</i>);
Prosobranchia	<i>N.</i> (<i>Neritina</i>); <i>Clithon</i> (with endemic species) <i>Septaria</i> ; <i>Neritilia</i> ;	<i>Clithon</i> ; <i>Septaria</i> ; <i>Neritilia</i> ; <i>Omphalotropis</i> (end.); <i>Melanoides</i> (<i>Melan.</i>); <i>Melanoides</i> (<i>Melanoides</i>); <i>Thiara</i> ;	<i>Neritina</i> (<i>Neripteron</i>); <i>Clithon</i> ; <i>Neritilia</i> ; <i>Omphalotropis</i> ; <i>Melanoides</i> (<i>Mel.</i>); <i>Thiara</i> ; <i>Bellamya</i> ;
Pulmonata	2 genera with 2 spec.: <i>Lymnaea</i> (<i>Radix</i>); <i>Ceratophallus</i> ;	4 genera with 4 spec.: <i>Lymnaea</i> (<i>Radix</i>); <i>Ferrisia</i> (<i>Pettanicylus</i>); <i>Physa</i> ; <i>Helisoma duryi</i> (introduced)	3 genera with 3 spec.: <i>Lymnaea</i> (<i>Radix</i>); <i>Physa</i> ; <i>Gyraulus</i> ;
Vertebrata			
Pisces	<i>Sicyopteris</i> <i>lagocephalus</i> ;	<i>Sicyopteris</i> <i>lagocephalus</i> ;	<i>Sicyopteris</i> <i>lagocephalus</i> ; <i>Anguilla</i> ; (introduced: <i>Gambusia</i> ; <i>Poecilia</i> (<i>Lebistes</i>)); <i>Xiphophorus</i> ;
Amphibia	-	introduced: <i>Bufo regularis</i> (tadpoles)	introduced: <i>Bufo regularis</i> (tadpoles)

Checklist of the Fauna of the Mountain streams of the Pacific Continental Island of New Caledonia

Porifera	<i>Ephydatia multidentata</i> ;
Turbellaria Tricladida	<i>Dugesia pinguis</i> ;
Amphipoda	<i>Orchestia</i> (with 2 endemic species) – ripicol! <i>Talitrus</i> (one endemic species)
Decapoda Natantia Caridea	4 genera with 11, partly endemic species: <i>Atya</i> ; <i>Paratya</i> ; <i>Caridina</i> ;
Palaemonidae	genus <i>Macrobrachium</i> ;
Oligochaeta	genera <i>Nais</i> and <i>Limnodrilus</i> with ubiquistic species;

Diptera Simuliidae	<i>Simulium neornatipes</i> ;
Hirudinea	<i>Glossosiphonia novocalaedoniae</i> (species endemic);
Hydracarina	genus <i>Aspidiobates</i> with 5 endemic species;
Insecta Ephemeroptera	Represented only by the family of Leptophlebiidae with 7 endemic genera and 10 endemic species (and some subspecies): <i>Lepeorus</i> ; <i>Lepegenia</i> ; <i>Celiphlebia</i> ; <i>Tindea</i> ; <i>Peloracantha</i> ; <i>Coula</i> ;
Plecoptera	absent!
Odonata Zygoptera	8, partly endemic genera with 14 endemic species: <i>Lestes</i> ; <i>Caledopteryx</i> ; <i>Agriolestes</i> ; <i>Caledagriolestes</i> ; <i>Trineuragrion</i> ; <i>Ischnura</i> ; <i>Agriocnemis</i> ; <i>Isosticta</i> ;
Anisoptera	6, partly endemic genera with 12 partly endemic species: Libellulidae gen. ssp.; Corduliidae gen. ssp.; <i>Synthemis</i> ; <i>Orthetrum</i> ; <i>Diplacodes</i> ; <i>Hemicordulia</i> ;
Trichoptera	With exception of the genus <i>Helicopsyche</i> with 12 endemic species (dominant: <i>H. lapidaria</i>) (not determinated at present; other families with endemic genera and species: Phyacophilidae; Leptoceridae; Hydropsychidae: all are very frequent in mountain streams!)
Coleoptera Dytiscidae	<i>Hydaticus goryi</i> ; <i>Macroporus</i> sp.;
Hydrophilidae	<i>Stethoxus australis</i> ; <i>Berosini</i> gen. ssp.;
Helodidae	Helodidae gen. ssp.; not determinated at present.
Dryopidae	Dryopidae gen. ssp.; not determinated at present.
Gyrinidae	4 genera with 5, partly endemic species: <i>Gyrinus</i> ; <i>Aulonogyrus</i> ; <i>Macrogyrus</i> (genus endemic); <i>Dineutus</i> ;
Blephariceridae	3, partly endemic genera with 5 endemic species: <i>Austricurupira</i> (<i>Curupirina</i>); <i>Nesocurupira</i> (endemic); Paltostominae gen. ssp.;
Culicidae	<i>Culex millironi</i> ;
Chironomidae	Orthocladiinae gen. ssp. (many genera and species!); cf. <i>Rheotanytarsus</i> ssp.; all found larvae not determinated at present!
Limoniidae	3 genera with some endemic species: <i>Dicranomyia</i> ; <i>Ormosia</i> ; <i>Rhamphidia</i> ;
Dixidae	cf. <i>Dixa</i> ssp.;
Sciomyzidae	<i>Tetanocera</i> ssp.;
Muscidae	<i>Limnophora</i> ssp.;

Diptera Simuliidae	<i>Simulium neornatipes</i> ;
Tabanidae	<i>Tabanus</i> ssp.
Heteroptera Rhynchota	10 genera with 14, mostly endemic species: <i>Limnogonus</i> ; <i>Halovelia</i> ; <i>Microrvelia</i> ; <i>Rhagovelia</i> ; <i>Mesovelia</i> ; <i>Hydrometra</i> ; <i>Valleriola</i> ; <i>Sigara</i> ; <i>Anisops</i> ; <i>Enithares</i> ;
Mollusca Gastropoda Prasobranchia (Fig. 5)	14, partly endemic genera with 23, partly endemic species: <i>Clithon</i> ; <i>Neritodryas</i> ; <i>Neritina</i> (<i>Neripteron</i>); <i>Neritina</i> (<i>Vittina</i>); <i>Neritina</i> (<i>Neritina</i>); <i>Septaria</i> ; <i>Heterocyclus</i> ; <i>Fluviopupa</i> ; <i>Hemistomia</i> ; <i>Assiminea</i> ; <i>Paludinella</i> ; <i>Melanopsis</i> ; <i>Melanooides</i> (<i>Melanooides</i>); <i>Melanooides</i> (<i>Stenomelania</i>); <i>Thiara</i> .
Pulmonata (Fig. 5)	3 genera with 4 endemic species: <i>Physastra</i> (<i>Physastra</i>); <i>Ph.</i> (<i>Glyptophysa</i>); <i>Gyraulus</i> ; <i>Ferrissia</i> (<i>Pettancylus</i>);
Bivalvia (Fig. 5)	<i>Polymesoda bengalensis</i> f. <i>sublobata</i> (in the mouthregion);
Pisces	One endemic genus and species: <i>Neogalaxias novaecaledoniae</i> (only in the south of the island in the lakes and affluents!) All other freshwater-fishes are introduced!

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Bibliography

- BISHOP, J. E. (1973): Limnology of a small Malayan River Sungau; Gombak. Monographiae Biologicae (Ed. J. ILLIES), **22**: 1–458. W. JUNK, Publ., The Hague.
- BOETTGER, K. (1975): Produktionsbiologische Studien an dem zentralafrikanischen Bergbach Kalengo. – Arch. Hydrobiol., **75** (1): 1–31.
- BOTOSEANU, L. (1979): Quinze Années de Recherches sur la zonation des cours d'eau: 1963–1978. – Revue commentée de la bibliographie et observations personnelles. Bijdr. Dierkunde, **49** (1): 109–134.
- COSTA, H. H. & E. C. H. FERNANDO (1967): The food and feeding relationship on the common meso- and macrofauna in the Maha – Oya, a small mountainous stream near Peradeniya (Ceylon). – The Ceylon J. of Science, Biol. Sc., **7** (12): 74–90.
- & F. STARMÜHLNER (1972): Results of the Austrian Ceylonese Hydrobiological Mission 1970: Part I. Preliminary Report: Introduction and Description of the Stations. – Bull. Fish. Res. Stn. Sri Lanka (Ceylon), **23** (1/2): 43–76.
- HARRISON, A. D. & J. J. RANKIN (1976a): Hydrobiological studies of Eastern Lesser Antillean Islands, I. St. Vincent: Freshwater habitats and water chemistry. – Arch. Hydrobiol. Suppl. **50**: 96–144.
- (1976b): Hydrobiological studies of Eastern Lesser Antillean Islands, II. St. Vincent: Freshwater Fauna, its distribution, tropical river zonation and biogeography. – Arch. Hydrobiol. (Suppl. **50** 2–3): 275–311.
- HORA, S. L. (1923): Observations on the fauna of certain streams in the Kashi-Hills. Rec.-Indian Mus., **25**: 579–600.
- (1928): Animal life in torrential streams. – J. Bombay nat. Hist. Soc., **32**: 111–126.

- (1930): Ecology, bionomics and evolution of the torrential fauna with special reference to the organs of attachment. — Phil. Trans. Roy. Soc., B **218**: 171–282.
 - (1936): Nature of the substratum as an important factor in ecology of the torrential fauna. — Proc. nat. Inst. Sci. India, **2**: 45–47.
- HYNES, H. B. N. (1970): The ecology of running waters. — 555 pag., Univ. Press., Liverpool.
- (1971): Zonation of the invertebrate fauna in a West Indian stream. — Hydrobiologia, **38** (1): 1–8.
 - & T. R. WILLIAMS (1971): A survey of the fauna of streams on Mt. Elgon, East-Africa with special reference to the Simuliidae. — Freshw. Biol., **1**: 227–248.
- ILLIES, J. (1961a): Versuch einer allgemeinen biozönotischen Gliederung der Fließgewässer. — Int. Rev. ges. Hydrobiol., **46**: 205–213.
- (1961b): Gebirgsbäche in Europa und Südamerika, ein limnologischer Vergleich. — Verh. Intern. Ver. Limnol., **14**: 517–523.
 - (1964): The invertebrate fauna of the Huallaga, a Peruvian tributary to the Amazon River from the sources down to Tingo Maria. — Verh. Intern. Ver. Limnol., **15**: 1077–1083.
 - & L. BOTOSEANU (1963): Problèmes et méthodes de la classification et de la zonation écologique des eaux courantes, considérées surtout du point de vue faunistique. — Mitt. Intern. Ver. Limnol., **12**: 1–57.
- JÄCH, M. A. (1984): Die Koleopterenfauna der Bergbäche von Südwest-Ceylon. The beetle fauna of the mountain streams in Southwest Ceylon. — Arch. Hydrobiol./Suppl. **69** (2): 228–332.
- MALICKY, H. (1978/1979): Neue Köcherfliegen (Trichoptera) von den Andamanen-Inseln: Z. Arbeitsgem. Österr. Entom., **30** (3/4): 97–109.
- MARLIER, G. (1977): Les larves et nymphes des Trichoptères des Seychelles. — Proc. 2nd. Int. Symp. Trichoptera, 1977: 31–54. JUNK Publ., The Hague.
- & H. MALICKY (1978/1979): A new *Helicopsyche* from the Seychelles (Trichoptera, Helicosyphidae). — Z. Arbeitsgem. Österr. Entom., **30** (3/4): 110–112.
- RÜTZLER, K. (1978): Results of the Austrian-Indian Hydrobiological Mission 1976 to the Andaman Islands-Part II. Report on a Freshwater sponge (Porifera: Spongillidae) from the Andaman Islands. — Aquatic Biology (Trivandrum, Kerala), **3**: 142–147.
- STARMÜHLNER, F. (1962): Voyage d'études hydrobiologiques à Madagascar, 1958. — Naturaliste Malgache (Tananarive), **13**: 53–83.
- (1968): Études Hydrobiologiques en Nouvelle Calédonie (Mission 1965) Part 1: Généralités et Descriptions des Stations. — Cah. de l'ORSTOM, sér. Hydrobiol., **2** (1): 3–27.
 - (1969): Die Gastropoden der madagassischen Binnengewässer. — MALACOLOGIA, **8** (1/2): 1–434.
 - (1970): Études Hydrobiologiques en Nouvelle Calédonie (Mission 1965). Die Mollusken der neukaledonischen Binnengewässer. (Les Mollusques des eaux douces et saumâtres de Nouvelle Calédonie). — Cah. de l'ORSTOM, sér. Hydrobiol., **4** (3/4): 3–127.
 - (1973): Die Gattung *Melanopsis* auf Neukaledonien. MALACOLOGIA, **14**: 242–243.
 - (1974): Results of the Austrian-Ceylonese Hydrobiological Mission 1970 of the 1st Zoological Institute of the University of Vienna (Austria) and the Department of Zoology of the Vidyalankara University of Ceylon, Kelaniya. Part XVII: The Freshwater Gastropods of Ceylon. — Bull. Fish. Res. Stn., Sri Lanka (Ceylon), **25** (1/2): 97–181.
 - (1976a): Ergebnisse der Österreichischen Indopazifik Expedition 1971: Beiträge zur Kenntnis der Süßwasser-Gastropoden pazifischer Inseln. Ann. Naturhist. Mus. Wien, **80**: 473–656.
 - (1976b): Contributions to the Freshwater-Fauna of the Isle of Anjouan (Comores). — Cah. de l'ORSTOM, sér. Hydrobiology, **10** (4): 255–265.
 - (1976c): Contributions to the knowledge of the Freshwater-Fauna of the running waters of Mauritius. — The Mauritius Inst. Bull., **8** (2): 105–128.
 - (1977a): The genus *Paludomus* in Ceylon. — MALACOLOGIA, **16** (1): 161–164.
 - (1977b): Contribution to the knowledge of the Freshwater Fauna of La Réunion (Mascarene). — Cah. de l'ORSTOM, sér. Hydrobiol., **11** (3): 239–250.
 - (1977c): Results of the Austrian-Indian Hydrobiological Mission 1976 to the Andaman Islands. Part I. — Aquatic Biology (Trivandrum, Kerala), **2**: 139–172.

- (1979a): Results of the Austrian Hydrobiological Mission 1974 to the Seychelles, Comores-mand Mascarene Archipelago. Part I: Preliminary Report: Introduction, Methods, General Situation of the Islands with Description of the Stations and General comments on the distribution of the fauna in the running waters of the Islands. — Ann. Naturhist. Mus. Wien, **82**: 621–742.
 - (1979b): Distribution of Freshwater Molluscs in Mountain Streams of Tropical Indo-Pacific Islands (Madagascar, Ceylon, New Caledonia). — MALACOLOGIA, **18**: 245–255.
 - (1982): Occurrence, Distribution and Geographical Range of the Freshwater Gastropods of the Andaman Islands. — MALACOLOGIA, **22** (1/2): 455–462.
 - (1983): Results of the Hydrobiological Mission 1974 of the Zoological Institute of the University of Vienna. Part VIII: Contributions to the Knowledge of the Freshwater-Gastropods of the Indian Oceanic Islands (Seychelles, Comores, Macarene-Archipelagos): Ann. Naturhist. Mus. Wien, **84/B**: 127–249.
 - (1984a): Checklist and longitudinal distribution of the meso- and macrofauna of mountain streams of Sri Lanka (Ceylon). — Arch. Hydrobiol. **101** (1/2): 303–325.
 - (1984b): Ecology and Biogeography in Sri Lanka (Edited by C. H. FERNANDO) Part 11. Mountain stream fauna, with special reference to Mollusca. — Monographiae Biologicae (Ser. Editor: H. J. DUMONT), **57**: 215–255.
- STATZNER, B. (1975): Zur Longitudinalzonierung eines zentralafrikanischen Fließgewässersystems unter besonderer Berücksichtigung der Köcherfliegen (Trichoptera Insecta). — Arch. Hydrobiol., **76** (2): 153–180.
- WALLACE, A. R. (1880): Island Life or the Phenomens and Comisses of Insular Faunes and Flores including a Revision and attempted Solution of the Problem of geological Climats. London.
- WENINGER, G. (1968): Études Hydrobiologiques en Nouvelle Calédonie (Mission 1965) Part 2: Beiträge zum Chemismus der Gewässer von Neukaledonien (SW-Pazifik). — Cah. de l'ORSTOM, sér. Hydrobiol., **2** (1/2): 35–55.
- (1972): Results of the Austrian – Ceylonese Hydrobiological Mission 1970. Part 2: Hydrochemical studies on mountain rivers in Ceylon. — Bull. Fish. Res. Stn., Sri Lanka (Ceylon), **23** (1/2): 77–100.
 - (1977): On Inland Waters Chemistry of Indian Ocean Islands (Seychelles, Comores, La Réunion, Mauritius). — Cah. de l'ORSTOM, sér. Hydrobiol. **11** (4): 297–319.