

Results of the Austrian Hydrobiological Mission, 1974, to the Seychelles-, Comores- and Mascarene Archipelagos: *)

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

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(With 10 Figures and 17 Plates)

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Zusammenfassung

In Fortsetzung hydrobiologischer und faunistischer Studien an der Tierwelt von Fließgewässern auf geologisch langfristig isolierten kontinentalen und ozeanischen Inseln des Indopazifik wurde eine Untersuchung ausgewählter Fließ- und Stillgewässer auf den Seychellen-, Komoren- und Maskarenen-Inseln im Indischen Ozean durchgeführt. Bei den Aufsammlungen wurden auch ökologische Standortsfaktoren, wie Temperatur, Fließgeschwindigkeit, Art des Bodengrundes und Chemismus berücksichtigt. Der vorläufige Bericht, Teil I der Resultate, gibt eine Übersicht über die Geographie, Geologie, Physiographie, Klima und Vegetation der untersuchten Inseln sowie eine Besprechung aller Fundorte. In der Besprechung der vorläufigen Ergebnisse wird, nach den Inseln geordnet, eine erste Übersicht über die Zusammensetzung der Tier-Assoziationen in den verschiedenen Lebensräumen gegeben (Uferregion, Kolke zwischen Kaskaden mit Sand und Schlamm, in der mittleren Strömung Zonen mit Kiesboden und in der starken Strömung Zonen mit Geröll, bzw. Felsgrund). Außerdem wird die Verteilung und Häufigkeit der gefundenen Arten von der Quell- zur Mündungsregion verglichen.

Abstract

In continuation of hydrobiological and faunistic studies on the fauna of running waters on geologically longtime-isolated continental and oceanic islands in the Indopacific a study was carried out, under consideration of ecological factors, like temperature, velocity of the current, sort of bottom and chemistry, in selected rivers of the Seychelles-, Comores- and Mascarene-islands in the Indian Ocean. The preliminary report, part I of the results, deals with the general situation, geography, geology, physiography, climat and vegetation of the islands and gives a survey and description of the stations. In the General comment is given, arranged after islands, a first preliminary survey of

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the animal-communities in the different biotops (banks and pools with sand and mud, gravel in the medium current, boulders and rocks in the strong current) of the different parts of the running water courses. In consequence is also compared the distribution of the found species from the headwaters down to the mouth-regions.

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1. Introduction

The literature concerning the study of the biology and ecology of the flowing water systems such as springs, brooks, torrents, rivers, and streams has increased immensely in the last few decades. However in view of the ever increasing pollution of the inland waters, specially in the industrialized countries by industrial pollutants, by domestic sewage, and influence from the insecticides and fertilizers of agriculture and forestry, the investigation of the natural, still unaffected, water systems becomes more and more difficult. Primarily in Europe, North America and South Africa have the results of basic researches on the fauna and flora enable us to establish a riverzonation and an ecological classification of the plants and animals living in the water systems (ILLIES 1961a; ILLIES & BOTOSEANU 1963; MACAN 1963; HYNES 1970 and others).

In contrast to those in the temperate zones until recent years, relatively few tropical flowing water systems have been investigated systematically. One of the first important missions concerning tropical inland waters was the DEUTSCHE LIMNOLOGISCHE SUNDA-EXPEDITION 1928/29 (RUTTNER 1931; ULMER 1940, 1951, 1955, 1957; and others). In South America the Amazon River-system especially has been investigated by the members of the Department of Tropical Ecology (Max Planck Institute of Limnology, Plön, Western Germany). The results of these researches on the ecosystem and production of tropical streams have been published by SIOLI 1963, 1964, 1965a and b, 1967, 1968, 1969; SIOLI & al. 1969; FITTKAU 1964, 1967, 1970; FITTKAU & al. 1968/69 (general summary), 1975 (general summary); GESSNER 1960; GEISLER 1974 (summary); ILLIES 1961b, 1964, JUNK 1973; SCHMIDT 1972a, b, 1973a, b, 1974; KNÖPPEL 1970; HAMMER 1965. Further studies of these tropical region were published by SCHUBART 1953; KLEEREKOPER 1955; PATRICK 1964; GIBBS 1967; and GREEN 1970. A preliminary study of the temperature in a tropical stream was made by GEIJSKES 1942, in Surinam, and HYNES 1971, investigated the invertebrate fauna of a stream in West-India.

In Africa were executed studies on subtropical South African rivers by HARRISON 1958a, b, 1965; HARRISON & al. 1958, 1962, 1963; HUGHES 1966; TURNBULL-KEMP 1960; and KEMP 1967. East African tropical streams have been studied by VAN SOMEREN 1945, 1946 and 1952; WILLIAMS 1966; and HYNES & WILLIAMS 1971. The classical studies of the fauna of Central African streams came from MARLIER 1951 and 1954. Further contribution were given by MALAISSE 1969 and BOETTGER 1975, reporting on the emergency of a small

jungle-brook. An older study in the Congo was made by NAN OYE 1926. In Western Africa the Niger was studied by HOLDEN & GREEN 1960, and IMEVBORÉ 1970; streams in Nigeria by WELMAN 1948 and a contribution from Ghana was published by PETR 1970. Some studies, mostly on Potamoplancton, were executed on the river Nile, such as TALLING 1958 and RZOSKA 1961 and 1967 (summary). From East African islands were published some hydrobiological studies made in Madagascar such as PAULIAN 1953; GREJBJINE & MÉNACHÉ 1953; PAULIAN 1949 (island of Nossi-Bé); STARMÜHLNER 1962 and 1969; and RAMANANKASINA 1968.

In South-Asia HORA 1923, 1928, 1930 and 1936 studied the fauna in the fast-flowing torrents of India and described the special adaptations in these biotopes. Further studies on river fauna were made by CHACKO & GANAPATI 1952; LAKSHMINARAYANA 1965 and VENKATESWARLU & JAYANTI 1968, 1969.

A first survey of the tropical freshwater fauna of Ceylon was published by MENDIS & FERNANDO 1962, with different supplements by FERNANDO 1964, 1969 and 1974. Some ecological data from Ceylonese streams were published by GEISLER 1965 and a study of the invertebrate fauna of a small hill-stream in connection with the ichthyofauna was made by COSTA & FERNANDO 1967. An investigation of the fauna and flora of tropical mountain-streams of Ceylon was executed by the Austrian-Ceylonese Hydrobiological Mission in 1970. A first survey of the results of the mission was published by COSTA & STARMÜHLNER 1972 and WENINGER 1972. Further results of different specialists were published in the Bull. Fish. Res. Stn. of Sri Lanka (Ceylon) in Volume 23 (1972), 24 (1973) and 25 (1974).

Intensive studies of the fauna and flora of rivers and their ecosystem in Southeast Asia were executed in Malaya. Based on the works of JOHNSON 1957, 1960 (with general aspects on the freshwater fauna of the Indopacific area), 1967 and 1968, BISHOP (1973) published a fundamental study on the ecosystem and productivity of a small, tropical Malayan river, the Sungai Gombak.

Further studies on Southeast Asian freshwaters were published by MIZUNO & MORI 1970 and LE-VAN-DANG 1970 from Vietnam. Before the mission of the DEUTSCHE LIMNOLOGISCHE SUNDA-EXPEDITION, 1928/29, on the islands of Indonesia was published only by VAN OYE 1922 a study on a river in Java.

On the tropical islands of the South-Pacific very few investigations on the freshwater fauna have been executed, apart from collections of freshwater animals. A first general survey was published by LAIRD 1956 and an hydrobiological study of the rivers of New Caledonia (including Ile des Pins) was executed by the Austrian Hydrobiological Mission to New Caledonia in 1965. The preliminary reports of the mission were published by STARMÜHLNER 1968, WENINGER 1968, specially reports by STARMÜHLNER 1970, 1973a. Further results of specialists are to be found in the Cah. de l'O.R.S.T.O.M., sér. Hydro-

biologie, Paris, in Volume 2 (1) — 1968; 2 (2) — 1968; 2 (3/4) — 1968; 3 (2) — 1969; 4 (2) — 1970; 6 (3/4) — 1972; 9 (2) — 1975.

A monograph concerning the freshwater gastropods of the South-Pacific islands, with comments on their ecology is published by STARMÜHLNER 1976.

These short reviews on hydrobiological and limnological studies in rivers of different parts of the tropical region show that we have now the base on which to compare the zonations of the tropical rivers with the ecological river zonation of the running waters of the temperate region (ILLIES & BOTOSEANU 1963; ILLIES 1961a, b, 1964; BISHOP 1973).

Since 1958 a team of the 1st Zoological Institute of the University of Vienna (Austria), Section of Malacology, has been studying the fauna and flora of tropical rivers in isolated islands of the Indo-Pacific. Most of these continental and oceanic-volcanic islands have been isolated for long geological periods and possess in their mountain regions, primary rain-forests, river-systems until today not disturbed by man. Such limited „islands on an island“ are the freshwater biotops with an adapted fauna, developed in isolation over geologically long periods. Many of the species are endemic, and sometimes derived from ancient ancestors, known as „living fossils“.

In 1958 the team started with studies in the mountain rivers of Madagascar, in cooperation with the former „Institut Recherches Scientifiques de Madagascar“ (now O.R.S.T.O.M.) in Tananarive and the „Service des Eaux et Forêts“. Most of the results of these missions were published in the *Mém. de l'I.R.S.M.*, Tananarive, in *Naturaliste Malgache* (STARMÜHLNER 1962), *Malacologia* (STARMÜHLNER 1969) and *Verh. Int. Ver. Limnologie* (BOURRELLY 1967). A comparative study on a Pacific island was made in 1965 in New Caledonia and the results are published in the *Cah. de l'O.R.S.T.O.M., sér. Hydrobiologie* (between 1968 and 1975). In 1970 were studied the mountain-rivers of Sri Lanka (Ceylon) in cooperation with The University of Sri Lanka, Vidyalandara Campus, Kelaniya. The results of this mission are published in the *Bull. Fish. Res. Stn. Sri Lanka* (COSTA & STARMÜHLNER 1972; WENINGER 1972; STARMÜHLNER 1974 and others). After these studies of the mountain-rivers of Madagascar and Sri Lanka, continental islands of the old Gondwanian-stock, we have executed in 1974 a first comparative survey of the fauna of the running waters of the old continental granitic islands of the Seychelles-Archipelago located in a position between Madagascar, Sri Lanka and South-India. In comparison with these old islands and Madagascar, the mission has also visited the „young“ volcanic islands of Comores (specially Anjouan) and Mascarene (La Réunion and Mauritius, Fig. 1). Their fauna and flora, immigrated from the Ethiopian region and specially from Madagascar has also developed many endemic species. In the cultivated areas of all these islands a high percentage of the recent flora and fauna has been introduced directly or indirectly by man over the last 300 years. Many of the endemic species of the terrestrial fauna and flora (trees, birds, giant turtles etc.) were made extinct

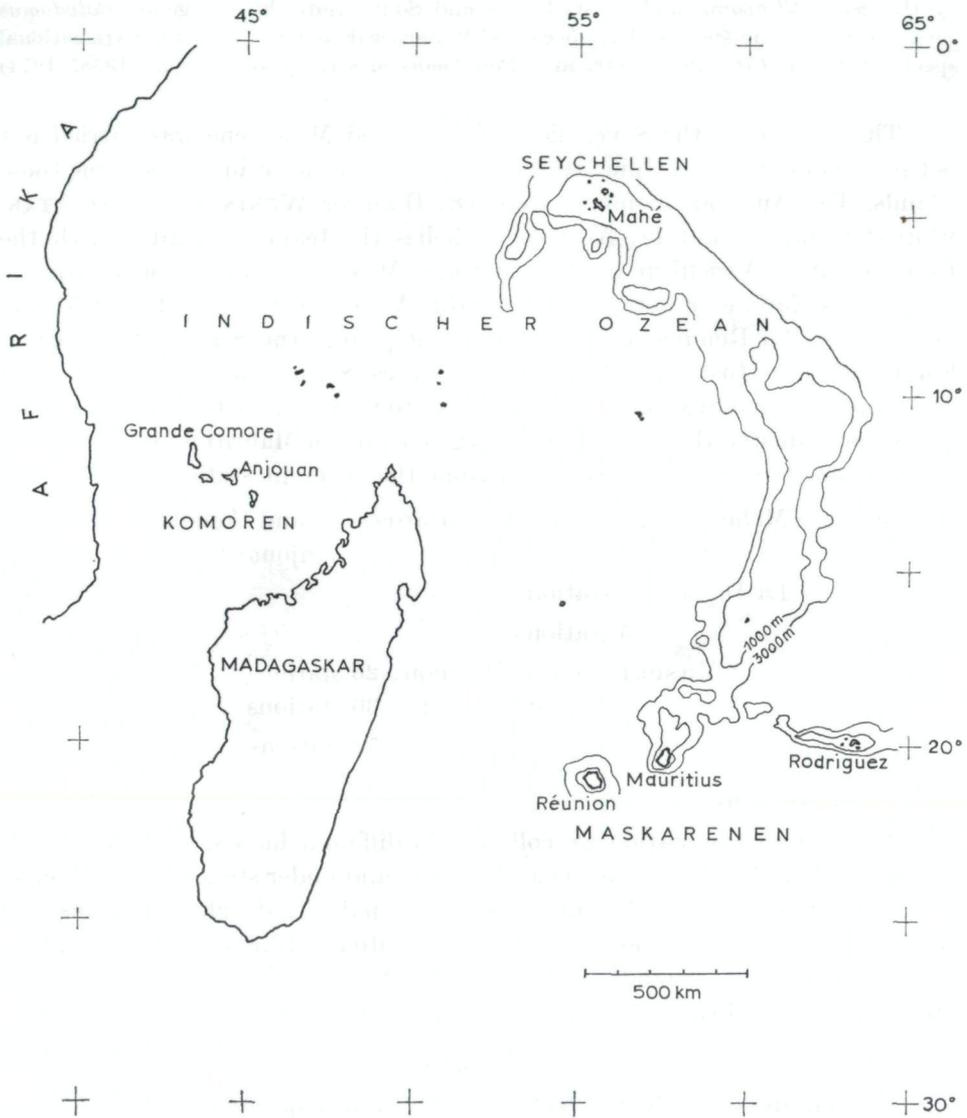


Fig. 1. Map of the Western Indian Ocean with the situation of the Seychelles-, Comores-, and Mascarene-Archipelagos

by man. Only the torrents and mountain-rivers in the rest of the undisturbed rainforests (now protected areas) have conserved the endemic freshwater fauna of early immigrants.

The intermediate position of Madagascar and Seychelles between East Africa (Ethiopian region) and Sri Lanka, resp. South India, is seen in many groups of invertebrates. This is shown, for example by an old freshwater Prosobranchia-family Thiaridae-Paludominae, represented in Africa, Madagascar and Seychelles — beside other genera —

by the genus *Cleopatra*, and in Sri Lanka and South India by the genus *Paludomus* with many endemic species. The species of Madagascar and Seychelles are transitional species between *Cleopatra* s. str. and *Paludomus* s. str. (STARMÜHLNER 1958, 1974)

The mission to the Seychelles, Comores and Mascarene was carried out between February and June 1974, at the end of the rainy season on these islands. The Austrian members were Dr. Günther WENINGER, Edith STARMÜHLNER and the author. At the Seychelles the team cooperated with the Department of Agricultur in Port Victoria (Mahé), at the Comores with the Service des Eaux et Forêts in Mutsamudu (Anjouan), resp. in Moroni (Grand Comore). At La Réunion the mission got help from the Service des Eaux et Forêts and the Institut d'Études Supérieures Scientifiques, Domaine Universitaire du Chaudron and at Mauritius from the Mauritius Institute and the Sugar Industry Research Institute (University of Mauritius) in Reduit.

In total the expedition collected from 109 different stations:

Seychelles: Mahé:	22 stations	Comores: Grand Comore:	1 station
Praslin:	2 stations	Anjouan:	27 stations
La Digue:	1 station		<u>28 stations</u>
	<u>25 stations</u>		
Mascarene: La Réunion:	26 stations		
	Mauritius:	30 stations	
		<u>56 stations</u>	

Total: 109 stations.

At nearly every station we collected in different habits, such as muddy-sandy banks and pools (between cascades), on and under stones in the stronger current and on rocks and boulders in the rapids. If developed it was also collected on the vegetation, such as filamentous algae and higher water-plants. In summary around 700 samples were taken biological, and 110 water-samples were bottled.

2. Methods

The animals were collected both qualitatively and quantitatively. The plants, mostly algae, were collected only qualitatively, scratched of from the stones and rocks. The freely swimming or crawling species of running water, animals such as fishes, tadpoles, crabs, water beetles, water bugs, shrimps etc. were collected by net or larger sieves.

The qualitative collections of the mesofauna were made by means of different wiremesh sieves (mesh-width: 0.1—0.5 mm) with mud, sand and finer gravel soil, whereas on larger pebbles and boulders the collections were made by removing the animals from the stones with tweezers and placing them into a plastic dish or container. Collections from rocks (mostly in rapids, torrents, water-falls) were made exclusively with forceps only.

Regarding the quantitative collections, as a rule stones from a ground of $\frac{1}{16}$ m² (squares of 25 cm length) were taken and the collections were then poured into plastic dishes; the remaining sediments were sieved. Apart from that the density of population of the most frequent species of the mesofauna was determined per 1 dm² or $\frac{1}{16}$ m² (only

for larger species such as bigger gastropods, crabs etc. per $\frac{1}{4}$ m² or 1 m²). Most freshwater animals were conserved in 75% alcohol, but fishes, frogs, tadpoles, oligochaets, algae and water-plants were preserved in 4% formal. Turbellaria (Tricladida), rarely oligochaetes and gastropods, were fixed in BOUIN's liquid for subsequent histological examination. The separation of the animals (and plants), collected from different habitats of a station. took place in the laboratories of the 1st Zoological Institute of the University of Vienna Section of Malacology.

Consequently the specimens were handed over to various specialists for exact determinations:

Algae: M. BOURRELLY (Paris)

Spongiaria: K. RÜTZLER (Washington)

Turbellaria (Tricladida): P. de BEAUCHAMPS (Paris) †

Oligochaeta: W. J. HARMANN (Louisiana)

Hirudinea: P. J. SANJEEVA, Raj (Madras)

Hydracarina: K. O. VIETS (Wilhelmshaven)

Atyidae, Palaemonidae: H. H. COSTA (Colombo)

Telphusidae: G. PRETZMANN (Wien)

Amphipoda: S. RUFFO (Verona)

Ephemera: Baetidae: I. MÜLLER-LIEBENAU (Plön)

other groups: G. F. EDMUNDS jr. (Utah) and
W. L. PETERS (Tallahassee)

Odonata: M. A. LIEFTINCK (Leiden)

Trichoptera: H. MALICKY (Lunz a. See); G. MARLIER (Brüssel)

Hydrophilidae, Hydraenidae: P. SPANGLER (Washington)

Dytiscidae: G. WEWALKA (Wien)

Gyrinidae: P. BRINCK (Uppsala)

Larvae of Aquatic-Coleoptera: H. BERTRAND (Paris) †

Aquatic Rhynchota: J. J. POLHEMUS (Englewood)

Ripicole Orthoptera: A. KALTENBACH (Wien)

Aquatic Lepidoptera: J. REICHOLF (München)

Aquatic Diptera: Chironomidae: R. LICHTENBERG (Wien)

Simuliidae: R. W. CROSSKEY (London)

Limoniidae: A. KALTENBACH (Wien)

Culicidae: G. B. WHITE (London)

Ephydriidae: B. H. COGAN (London)

(Other smaller groups of Diptera were distributed by R. LICHTENBERG
(Wien) to different specialists)

Mollusca: F. STARMÜHLNER (Wien)

Pisces: A. RADDA (Wien)

Amphibia (including tadpoles): P. van den ELZEN (Bonn).

The detailed results of these determinations and studies on the collected material, as well as a summary report with the ecological data, will be published in informal sequence in these periodical, under a common heading.

During the collections some ecological parameters were measured: The speed of the current of the surface waters with marked floating corks, for a given distance of the running waters in the different sections of the stations (banks and pools between cascades, cascade-sections), together with the time-taken by means of a stop watch (in cm/sec or m/sec). The water temperature was determined at hourly intervals with an electrical thermometer TESTOTERM (KIEPE-ELECTRIC), measurable range: 0°–50° C, divided in half degrees and a scooping thermometer, ranging up to 35° C and divided in tenths of a centigrade. The chemical samples were taken by G. WENINGER and are described in his paper 1977. It is to be noted that WENINGER's analysis was made

in place at first and in our laboratory in our quarter at second. Also at the laboratory in Vienna, after the return of the mission with samples sent by Air-cargo to Vienna.

The area of the substrate was measured in place after the sediments were removed to a depth of 10 cm. Such samples were taken from each habitat type, riffle and pool. In sections where large stones and boulders were dominant, the surface of these materials was measured at typical collecting places.

3. Situation on the Islands and Description of the Stations

3.1. Seychelles-Archipelago

3.1.1. Geography

The Seychelles are recently situated between latitudes 4° and 5° S and longitudes 55° and 56° E (Fig. 1, 2). They consists of well over 100 islands. Permanently settled islands 46, 24 being of granitic structure, 17 sandclays and 5 raised reef islands, but there are numerous small islands that are either uninhabited or visited only on occasion by fishermen. The total area of all islands amount to 277 km².

The principal islands of the Archipelago is Mahé (Fig. 2) which is approximately 26 km long, 6 km broad and 142.5 km² in area. The expedition took most samples at Mahé but visited also, for comparative samples the islands of Praslin and La Digue in the Northeast of Mahé. Praslin is at most 16 km long and 4—5 km broad, and approximately 50 km² in area (Fig. 2). La Digue is 6 km long and 4 km broad with an area of approximately 20 km². All three islands are mountainous, resp. hilly, the central line of peaks in Mahé reaching to the altitudes of 911 m (Morne Seychellois, Pl. 1, Fig. 1). The central hills of Praslin and La Digue rise to heights between 300 and 380 m.

3.1.2. Geology, Petrology and Physiography

The granitic islands of the recent Seychelles Archipelago were, like Madagascar, India, and Sri Lanka (Ceylon), a part of Gondwanaland, the old Precambrian South-continent. Intensive study of the ocean floor in the past 30 years has enabled the concept of sea-floor spreading to be examined critically, particularly by means of analysis of the magnetic field arising from the intrusion of basic rocks on ridges in the presence of reversals of the Earth's magnetic field. After DAVIES (1968) the Seychelles and India (including Ceylon) present a good opportunity for examining the points discussed. It is widely held from palaeomagnetic evidence that India (and Ceylon) moved northwards and away from Africa during the late Cretaceous-Tertiary boundary and, they were probably extruded over a period of only 5 million years, during which time all the movement north has occurred. The Seychelles have not as yet revealed satisfactory palaeomagnetic evidence, but their environment is important. To the South the Saya de Malha bank is believed to be a volcanic feature, while the Seychelles themselves have a continental

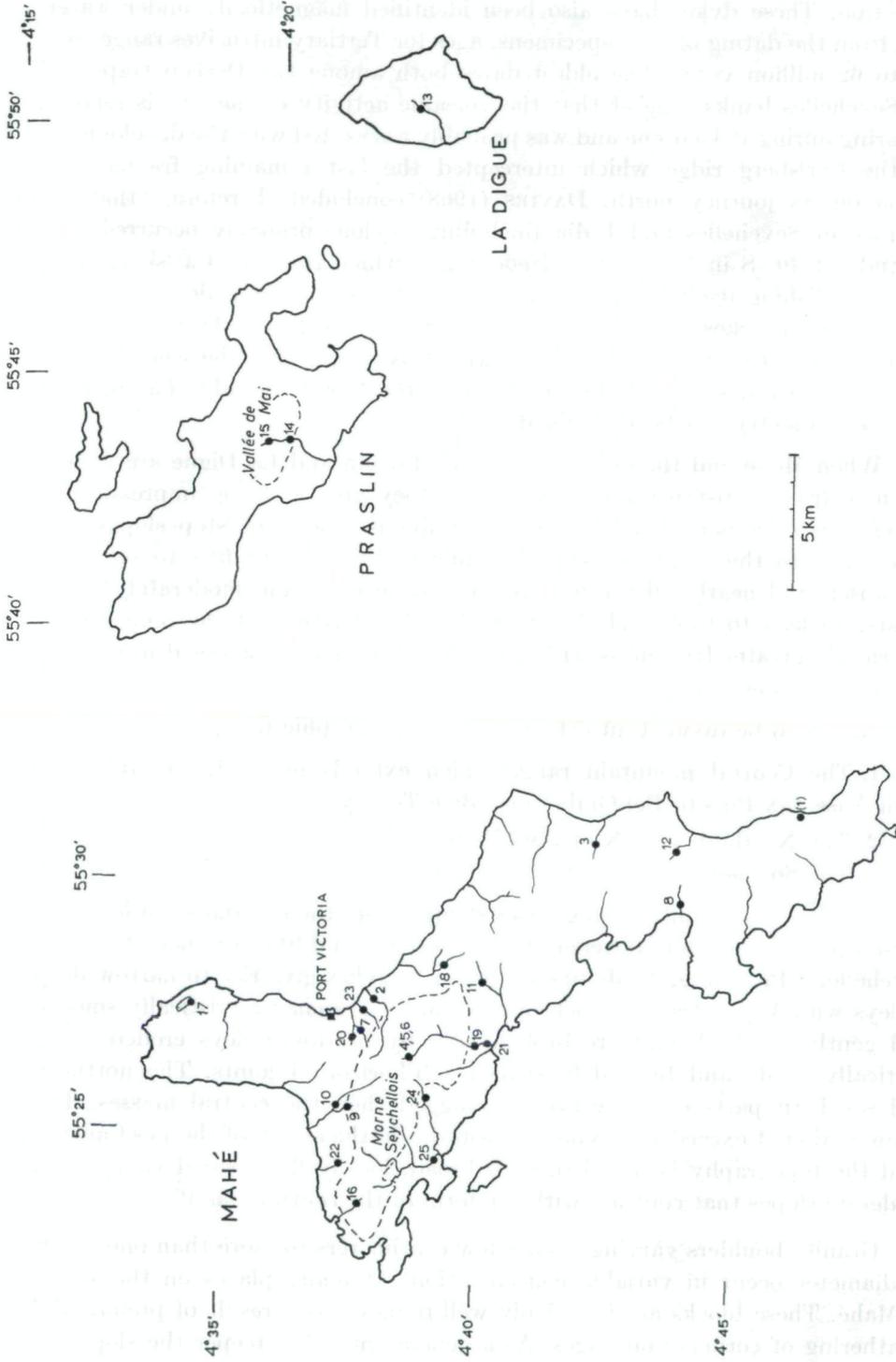


Fig. 2. Seychelles-Archipelago: Mahé, Praslin and La Digue with the numbers of the stations on the rivers

crust and display dykes cutting the Precambrian granite, often in a NW-SE direction. These dykes have also been identified magnetically under water, and from the dating of land specimens, ages for Tertiary intrusives range from 34 to 62 million years. The oldest dates both among the Deccan traps and on Seychelles banks suggest that the volcanic activity of the two is related, occurring during Palaeocene and was probably associated with the development of the Carlsberg ridge which intercepted the last remaining fragment of India on its journey north. DAVIES (1968) concluded therefore, "that the rapture of Seychelles and India (including Ceylon) probably occurred at a latitude of 30° S in the early Palaeocene, at which time the Carlsberg ridge was establishing itself, and that the Deccan traps, the Saya de Malha bank and the older dykes on Seychelles, together with the Indian Ocean magnetic anomaly pattern, are not at variance with this conclusion. The whole system has since moved substantially northwards, the Carlsberg ridge has opened, but the geometry has been retained".

When Mahé and the other islands like Praslin and La Digue are viewed recently from a distance of 30 to 40 km, they give a strong impression on being tops of a partly submerged mountainous land. The steep slopes that descend in to the sea, the lack of grading of the river-profiles to sea-level, the absence of nearly all the features seen on mature and moderately stable coasts, all lead to the conclusion that the islands represent the remnants of a formerly greater land-mass which has become partly submerged in geologically recent times.

Mahé can be divided into three main physiographic regions:

1. The Central mountain range which extends in a SE-NW direction from Anse aux Pins to Bel Ombre and Baie Ternay;
2. The Northern part N of Port Victoria;
3. The Southern area S of the Montagne Posée road.

The Central mountain range rises steeply from the sea and from localized coastal plateau to summits generally between 450 and 911 m in height (Morne Seychellois; Pl. 1, Fig. 1). Joints and dolerite dykes give rise to narrow deep valleys with V-profiles. The rock faces of Mahé are characteristically smooth and gently rounded, and are broken only by narrow gulleys eroded along vertically joints and by widely spaced sub-horizontal joints. The northern and southern parts of Mahé are less rugged than the central masses. The summits do not exceed 450 to 500 m altitude. In the area S of the Les Canelles road the topography is rounded, with broad, locally flat-flooded valleys and moderate slopes that contrast with the form of the central massif.

Granite boulders varying from a few centimeters to more than one meter in diameter occur in variable concentrations at many places on the slopes of Mahé. These blocks are invariably well-rounded as a result of preferential weathering of corners and edges. As a general rule the steeper the slope the

more numerous are the blocks, and in places the whole surface is littered with blocks resting on each other so as to form an almost impenetrable maze. In the higher levels of the rain forest, steep slopes littered with such blocks are covered by ferns and mosses, bushes and trees, and being permanently wet.

The flat low-lying coastal areas with the mouths of the rivers are of calcareous sand and soil built from the debris of the adjacent fringing reefs up to a level of 1 to 2 meters above mean sea level. These areas are the most thickly inhabited and intensely cultivated on Mahé. The running waters of these areas are particularly polluted. To the NW these areas are known locally as the "plateau", join outlying granite hills to the mainland, forming broad tomboles. Most of the "plateau" contains saline or freshwater swamps connected to rivers and streams inland, and to tidal channels on the shore.

In Baie NW and on the Westcoast the steep slopes descending from the hills flatten markedly at the 60 meter level, and descend gently from this level to the sea or to the coastal "plateau". These gentle sediments form belts up to 550 m wide, and are composed of small boulders, quartz sands and alluvium evidently deposited by streams descending from the hills behind. In these areas and in several other places broad gently rounded masses of boulders and soil are found on the floors of valleys immediately inland of the coast. Some of these masses are clearly composed of landslide debris. Traces of small slides, of solifluction and of movement of granite blocks are widespread, and the movement that lead to them occur mainly during the wet season.

The recent land-forms of Mahé typify the results of tropical weathering on massifs of homogenous and resistant rock. The steep slopes are often of rounded bed-rock where soil wash or landslides have occurred. On more stable slopes quantities of boulders litter the surface as a result of removal of soil and the matrix of weathered rock. The land-forms are governed primarily by joints, fractures and dykes, giving the drainage a rectilinear pattern. The valleys are steep-sided and often choked by boulders too large for the rivers to transport. On the coast, marine erosion has had little effect on the resistant rocks, but coastal plateau of coral and algal sands have been built up behind the fringing reef, mainly on the exposed eastern coast.

Praslin and La Digue, NE of Mahé are hilly and steep-sided ranges rising directly from the sea except where the coastal plateau intervenes. The central hills rise to heights between 300 and 380 m. In form the islands are controlled by the major NW joints which traverses the granitic rocks, and all the major valleys trend along these joints, and along dolerite dykes trending NW or W. The coastal "plateau" of Praslin and La Digue are the most extensive among the granitic islands, and in the case of Praslin support almost all the agriculture and population on that island.

The oldest rocks on the Seychelles are the Precambrian granites that forms the principal groups of islands. Mahé is almost formed by hornblende granite, with minor textural varieties such as granite porphyrey. In localized

zones on the coast xenolithic rafts and associated hybrid rocks of tonalitic, dioritic and gabbroic composition are found, and the whole mass is cut by aplitic dykes and veins. Dolerite and basalt dykes of a considerable younger age cut across the granitic massive.

The Praslin and La Digue granite is typically pale reddish grey in colour owing to the fleshy colour of its alkali felspar (BAKER 1963).

The chemical composition of these rocks will be discussed in the paper of G. WENINGER 1977.

3.1.3. Climate

The Seychelles-Archipelago is in the tropical trade-wind belt. The seasonal weather is primarily governed by the two monsoons — the South-East monsoon which blows between May and November, and at intervals during the remainder of the year, and the North-West monsoon which occurs between November and May. During the period of the South-East monsoon temperatures are moderate and little rainfall, while the North-West monsoon is a period of variable winds or calm periods, accompanied by squalls, high rainfall, and generally higher temperature and humidity.

In general the mountainous upper parts of the highest islands, like the Morne Seychellois on Mahé, receive the highest rainfall. The mean annual rainfall rises in the rain forests of Mahé up to 4000 mm, but on the West-coast only up to 1100—1700 mm. On these parts of the island the rivers dry out during the South-East monsoon. From the rainfall records based on a 62 year mean at Long Pier in Port Victoria, August with 74.4 mm was the lowest value, and 382.1 mm in January was the highest value. In February, the month where the mission was 1974 on Mahé, amount of 62 year was 259.9 mm. The total rainfall for 1974 (after records on the Airport) was January 494.9 mm; February 458 mm, with very heavy rainfall, but in May 1974 it was only 6.7 mm. The highest amount of rainfall on the East-coast (Airport) in the last five years was in January 1975 with 520.9 mm!

From the report of the Directorate of Civil Aviation at Mahé, the amount of sunshine is (10 year mean): January: 5.1 hours a day; February: 6.1 hours a day; June: 8.2 hours a day.

The wind speed (in monthly mean): NW-monsoon 5 to 9 Knots (February 1974: 7 Knots mean); SO-monsoon 9 to 13 Knots.

The maximum and minimum temperatures (10 year mean) range on the coast between July to November: 24.4° C; February: 25° to 29.7° C; April: 31° C.

The highest maximum temperature (10 year mean): April: 34.6° C.

The lowest minimum temperature (10 years mean): July: 19.9° C.

The highest maximum temperature (10 year mean) in February: 32° C.

The lowest minimum temperature (10 year mean) in February: 22° C.

The monthly mean for February 1974, the month of the visit of the mission on Mahé, was 26.4° C on the coast.

The relative humidity over 24 hours for February, 1974 (monthly mean) was 82% on the coast. The lowest value in the last five years (1971—1975) it was 75% in September 1971; the highest value, 85% was found in January 1975.

3.1.4. Vegetation

The granitic islands were originally covered by dense tropical rain-forest containing many endemic species (VESEY-FITZGERALD 1947). Human occupation has, however, drastically reduced the forest to a few patches on the upper slopes of Mahé (and Silhouette) islands. On Mahé only approximately 16 km² indigenous forests exists today in the mountain region of the Morne Seychellois, a Natural Reserve above the extensive plantations of coconuts, cinnamon, vanilla and tea.

On the coast are remnants of native flora in certain coves like *Calophyllum inophyllum*, *Hernandia ovigera* and *Terminalia catappa*. Settled areas are planted mainly with exotic flowering shrubs including the usual tropical species such as *Poinsettia*, *Bougainvillea*, frangipani and hibiscus.

On Praslin the most remarkable area is the Vallée de Mai, an 18.6 ha Nature Reserve, famed for its unique and curious Coco-du-Mer palm forest (*Lodoicea seychellensis*). Some of the 4000 palms reach to 30 m high. Other remarkable plants are *Dillenia ferruginea*, *Northea seychellana*, *Deckenia nobilis*, *Verschaffeltia splendida* and near the coast *Pandanus hornei* and *P. seychellarum*.

3.1.5. Description of the Stations

Abbreviations: Alt.: Altitude (in m above mean sea-level);

Br.: Breadth of the river at the station;

Te.: Temperature of the water (in ° Celsius and with date and hour of the measurement);

D.: Depth of the river: b.: near the banks on the border, c.: in the cascade-zone, p.: in pools between cascade-zones;

C.: Velocity of the current (in cm or m/sec);

Col.: Colour of the water;

Gr.: Conditions of the ground (mud, sand, gravel, boulders, rock; growing algae or water-plants; ø: diameter of boulders, gravel);

Gen. Chem.: General chemistry of the water (details on chemistry are to find by G. WENINGER 1977);

Cond.: Electrolytic conductivity (in µSiemens at 25° C)

Tot. H.: Total hardness (in German Hardness degree, 1° dH = 1.25° English Hardness degree = 1.75° French Hardness degree).

A. Mahé

A.1. Upper courses between 500 to 400 m altitude

1. F/Sey/4 / 6. 2. 1974: Rivulet of Grand Bois, a tributary of the River Grande Anse, at the Casse Dent (Morne Seychellois); flowing through primary forest with cascades, interrupted by pools; very shady, border covered with mosses (Pl. 1, Fig. 2).

Alt.: 480 m
 Br.: 0.5 to 3 m
 Te.: 21.6° C (10h)—21.7° C (12h): 6. 2. 1974
 D.: c.: 1 cm, p.: to 30 cm
 C.: b. and p.: 10—50 cm/sec, c.: 1 m/sec

Col.: brownish (humus!)
 Gr.: stones, mostly covered with water-mosses;
 Gen. Chem.: pH: 5.3
 Cond.: 33 µSiemens
 Tot. H.: 0.095° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Maheathraulus scotti (moderate); *Leptocnemis cyanops*-, and *Coenagrionidae*-larvae; tadpoles; Surface: Veliidae gen. spec.

b) Medium to strong current (30—75 cm, resp. >1 m/sec):

Between mosses: *Maheathraulus scotti* (moderate), *Leptodermadopteryx tenuis*-, *Hughscotiella auricapilla* (moderate); *Simulium speculiventre*-larvae (sporadic); *Cricotopus* spec.-larvae (sporadic).

c) On the borders: Imagos and Subimagos of *Maheathraulus scotti*; *Leptocnemis cyanops*.

A sample of drift (2^h) was taken.

2. F/Sey/5 / 6. 2. 1974: Source-brook, a small tributary to the rivulet of Grand Bois (No. 1: F/Sey/4); flowing over granitic rocks with laterite on the borders; on the border of the forest, sunny.

Alt.: 410 m
 Br.: 10—30 cm
 D.: 0.5 cm
 C.: 50 cm/sec

Gr.: granitic rock, covered with blue-green algae; in pools: green algae
 Gen. Chem.: pH: 5.9
 Cond.: 25 µSiemens
 Tot. H.: 12.0° dH

A sample of algae was taken.

3. F/Sey/6 / 6. 2. 1974: River of Grand Bois, about 2 km beyond No. 1/ F/Sey/4 near the bridge crossing the Forêt Noire Road; very shady.

Alt.: 400 m
 Br.: 2—4 m

D.: b.: 5—10 cm
 Gr.: granitic gravel, on the banks sandy and vegetable debris

No chemical sample was taken!

Fauna: From the banks (0—30 cm/sec): *Macrobrachium* (?) spec. were captured.

A.2. Upper to Middle courses between 400 to 200 m altitude:

1. F/Sey/7 / 6. 2. 1974: River Rochon, beside the Forêt Noire Road, near the Val Riche; the river is flowing in a steep valley with cascades and pools, partly shady (Pl. 1, Fig. 3).

Alt.: 360 m
 Br.: 30 cm to 2 m
 Te.: 23° C (16h): 6. 2. 1974
 D.: b.: 5—10 cm, c.: 2—5 cm, p.: to 50 cm
 C.: b. and p.: 30—50 cm/sec, c.: 75 cm—1.5 m/sec

Col.: slightly brownish-red
 Gr.: granitic boulders and gravel, covered with blue green algae and mosses
 Gen. Chem.: pH: 5.4
 Cond.: 25 µSiemens
 Tot. H.: 0.095° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevirostris f. *gardneri* (very frequent).

b) Medium to strong current (30 cm/sec to 1.5 m/sec):

Hagenulodes braueri, *Maheathraulius scotti* (3–5/dm²); Anisoptera-larvae (sporadic under stones); *Hydromanicus seychellensis*-larvae (2–3/dm²), *Helicopsyche palpalis* (2–5/cm² in small depressions of stones); *Cardiocladius* spec., *Cricotopus* spec.-larvae, *Simulium speculiventre*-larvae (3–5/cm² on rocks: 1–1.5 m/sec).

c) On the borders: Imagos of Orthocladiinae gen. spec. ♀, *Leptocnemis cyanops*.

A drift-sample (1^h) was taken.

2. F/Sey/22 / 18. 2. 1974: River Athanas, upper course; on the NW-coast a very steep torrent, coming from Mt. Simpson, flowing free over granitic rocks, some parts on the border are hygropetric, pools between the cascades, sunny (Pl. 1, Fig. 4).

Alt.: 300–350 m

Gr.: granitic rocks, p.: gravel and sand

Br.: 0.2 m–1 m

Gen. Chem.: pH: 6.7

Te.: 24.6° C (13h): 18. 2. 1974

Cond.: 31 µSiemens

D.: 0.5–2 cm, p.: to 30 cm

Tot. H.: 0.09° dH

C.: 50–75 cm/sec, p.: 30 cm/sec,

c.: > 1 m/sec

Fauna: a) Pools between cascades (0–30 cm/sec):

Caridina brevirostris f. *typica*; Surface: Veliidae gen. spec., Gerridae gen. spec.;

b) Medium to strong current (50 cm–>1 m/sec):

Hagenulodes braueri (2–3/dm²: 50–75 cm/sec); *Hydromanicus seychellensis*-larvae (2–3/dm²: 1 m/sec); *Helicopsyche palpalis* (5–10/dm²: 50 cm/sec); *Endochironomus*-, *Cricotopus* spec.-larvae (10–20/dm²: 50–75 cm/sec), *Simulium speculiventre*-larvae (5–10/dm²: 75 cm–>1 m/sec).

c) Hygropetric habitats on the border:

Limonia sp.-larvae (1–2/dm²).

3. F/Sey/11 / 9. 2. 1974: River Seche, upper course; partly shaded by *Pandanus* sp.; deep pools between small cascades of 5 cm heigh; polluted by farm-houses nearby (Pl. 1, Fig. 5).

Alt.: 310 m

Gr.: boulders and gravel (10–50 cm ø)

Br.: 2–5 m

covered with mud, on the banks
muddy mosses

Te.: 23.5° C (10h): 9. 2. 1974

Gen. Chem.: pH: 6.6

D.: c.: 10–20 cm, p.: to 1 m

Cond.: 47 µSiemens

C.: c.: 75 cm/sec, p.: 10–30 cm/sec

Tot. H.: 0.55° dH

Col.: brownish; in pools visibility to
50 cm; putrid smell

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina typus; *Orthetrum stemmale wrighti*, *Gynacantha stylata*-larvae; *Gyraulus* cf. *mauritanus*; tadpoles; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm—75 cm/sec):

Dugesia aff. *gonocephala* (1/dm²: 30 cm/sec); *Cricotopus* spec.-larvae;
Gyraulus cf. *mauritanus* (2—3/dm²).

c) Free water:

Pachypanchax playfairi

d) On the borders:

Imago of *Orthetrum stemmale wrighti*.

4. F/Sey/20 / 16. 2. 1974: River Rochon, upper to middle course; after the dam of a water-reservoir (15 m in diameter and about 3 m depth), flowing off as a torrent with cascades and pools; partly sunny, partly shady (Pl. 2, Fig. 6).

Alt.: 300 m

Br.: 2—5 m

Te.: 25° C (in the middle), 25.5° C (near the banks) (10h) — 27° C (12h):
16. 2. 1974

D.: 10—30 cm (flowing off), p.: to 50 cm

C.: 50—75 cm/sec, c.: >1 m/sec, p.:
0—30 cm/sec

Gr.: granitic boulders (50 cm—3 m ø),
gravel, p.: sand

Gen. Chem.: pH: 7.2

Cond.: 33 µSiemens

Tot. H.: 0.25° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Dugesia aff. *gonocephala* (1—2/dm²: 10—30 cm/sec); *Caridina brevirostris*,
C. typus, *C. brachydactyla*; *Orthetrum stemmale wrighti*-, *Zygonyx luctifera*-,
Rhyothemis semihyalina-, *Pantala flavescens*-larvae; Notonectidae gen. spec.;
Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Hagenulodes braueri, *Maheathraulus scotti* (sporadic: 30—50 cm/sec);
larvae of Anisoptera like a) (sporadic); *Simulium speculiventre*-larvae (3—5/cm²;
>1 m/sec), *Cricotopus*-, *Rheocricotopus*-, *Endochironomus*-, *Dicrotendipes* spec.-
larvae.

c) Free water:

Pachypanchax playfairi.

d) On the borders:

Imagos of *Orthetrum stemmale wrighti*, *Rhyothemis semihyalina*.

Samples of algae were taken from the banks after the dam and from a hypopetric rock.

5. F/Sey/24 / 19. 2. 1974: River Desert; on the Road of Forêt Noire; NW-coast; small brook, partly shady.

Alt.: 270 m

Br.: 50 cm to 1 m

Te.: 23.5° C (11h): 19. 2. 1974

D.: c.: 1—3 cm, p.: 5—30 cm

C.: b. and p.: 30 cm/sec, c.: 50 cm—
> 1 m/sec

Gr.: granitic gravel (10—30 cm ø)
covered with mosses, sand, vegetable
debris

Gen. Chem.: pH: 6.4

Cond.: 47 µSiemens

Tot. H.: 0.27° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevivrostris f. *typica*, *gardneri*, *C. typus*; Nepidae gen. spec.;
Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Dugesia aff. *gonocephala* (sporadic: 30–50 cm/sec); *Hagenulodes braueri*
(2–3/dm²: 50 cm/sec); Anisoptera-larvae (sporadic); *Hydromanicus seychel-*
lensis-larvae (sporadic), *Helicopsyche kantilai* (20–30/dm²: 30 cm/sec); *Simulium*
speculiventre-larvae (5–10/dm²: 75cm/sec — > 1m/sec), *Cricotopus* spec.-larvae.

6. F/Sey/9 / 8. 2. 1974: River Grand St. Louis or River Boulay, tributary
of the middle course; torrent in primary forest, very shady (Pl. 2, Fig. 7).

Alt.: 220 m

Br.: 1–5 m

Te.: 23.5° C (11h)—24.1° C (14h): 9. 8. 1974

D.: c.: 10–30 cm, p.: to 1 m

C.: b. and p.: 10–20 cm/sec, c.: 30–
50 cm to > 1 m/sec

Gr.: granitic rock, boulders (30–50 cm \varnothing),
gravel (5–20 cm \varnothing), on the banks
sandy, vegetable debris

Gen. Chem.: pH: 6.6

Cond.: 31 μ Siemens

Tot. H.: 0.2° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Dugesia aff. *gonocephala* (sporadic); *Caridina brevivrostris* f. *similis*, *typica*,
gardneri, *C. typus*; *Maheathraulius scotti* (1–2/dm²: 30 cm/sec); Anisoptera-
larvae (sporadic); Surface: Veliidae gen.spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Hagenulodes braueri, *Maheathraulius scotti* (1–2/dm²); Anisoptera-larvae;
Hydromanicus seychellensis-, *Ecnomus insularis*-larvae (1/dm²); Orthocladii-
nae, *Endochironomus*-spec.-larvae, *Simulium speculiventre*-larvae (> 1 m/sec:
1–2/cm²).

A drift-sample was taken.

A.3. Middle to Lower courses between 200 m and 10 m altitude:

1. F/Sey/10 / 8. 2. 1974: River Grand St. Louis, middle course; near
the tank of Leniol; primary and secondary forest, very shady (Pl. 2, Fig. 8).

Alt.: 200 m

Br.: 1–5 m

Te.: 24.3° C (16h): 8. 2. 1974

D.: 20–30 cm, c.: 1–2 cm

C.: c.: 50 cm—1.5 m/sec,
p.: 20–30 cm/sec

Gr.: granitic boulders (50 cm—3 m \varnothing),
gravel, sand

Gen. Chem.: pH: 6.8

Cond.: 29 μ Siemens

Tot. H.: 0.15° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Dugesia aff. *gonocephala* (sporadic); *Caridina brevivrostris* f. *similis*, *typica*,
gardneri, *C. typus*; *Maheathraulius scotti* (1–2/dm²: 30 cm/sec); Surface:
Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1.5 m/sec):

Hagenulodes braueri, *Maheathraulius scotti* (1–2/dm²: 30 cm—1 m/sec);
Hydromanicus seychellensis-larvae (1/dm²); Pentaneurini-, *Cricotopus* spec.-
larvae, *Simulium speculiventre*-larvae (1–2/cm²: > 1 m/sec).

c) Hygropetric habitats on the border:

Limonia sp.-larvae

d) Tank of Leniol:

Caridina sp.; *Tramea* (?) sp.-larvae; *Culex tritaeniorhynchus*-larvae

e) On the borders of the river and the tank:

Imagos of *Leptocnemis cyanops*, Pentaneurini gen. spec., ♂.

2. F/Sey/19 / 15. 2. 1974: River Grande Anse; middle course on the W-coast in a deep V-valley; after the barrage, on the border shrub, the course free and sunny (Pl. 2, Fig. 9; Pl. 16, Fig. 80).

Alt.: 200 m

Gr.: granitic rock, boulders (1 m \varnothing),
gravel, sand

Br.: 5–10 m

Te.: 26.5° C (16h): 15. 2. 1974

Gen. Chem.: pH: 6.8

D.: 10–50 cm

Cond.: 35 μ Siemens

C.: 50–> 1 m/sec, b. and

Tot. H.: 0.2° dH

p.: 20–30 cm/sec

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevirostris, *C. typus*, *C. brachydactyla brachydactyla*; tadpoles;

Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec–>1 m/sec):

Hagenulodes braueri (2–3¹/₁₆ m²: 50–75 cm/sec); *Hydromanicus seychellensis*-larvae, -pupae (3–5/dm²: 75 cm – > 1 m/sec); *Endochironomus*-, *Cricotopus* spec.-larvae, *Simulium speculiventre*-larvae, -pupae (3–5/cm²: >1 m/sec).

A drift-sample was taken (1^h).

3. F/Sey/18 / 15. 2. 1974: River Plaisance beyond a water-fall of 20 m height; NW-coast; near the sampling-area the stream flows through meadows with few trees, scrub and palms; in the meadows are pools with water from overfloatings of the stream, partly shady.

Alt.: 100 m

Gr.: boulders (10–50 cm \varnothing), gravel,
sand, p.: muddy sand, vegetable
debris

Br.: 20 cm–1 m

Te.: 24.7° C (10³⁰)–24.9° C (12h):

Gen. Chem.: pH: 6.5

15. 2. 1974

D.: 5–20 cm, p. (after waterfall): 1–2 m,

Cond.: 35 μ Siemens

p. (in the meadows): 20–50 cm

Tot. H.: 0.15° dH

C.: 30–75 cm, c.: >1 m/sec, p.: 0–10 cm

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevirostris f. *gardneri* (very frequent); Anisoptera-larvae; tadpoles, frogs; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec–>1 m/sec):

Dugesia aff. *gonocephala* (1–2/dm²: 30–50 cm/sec); *Maheathraulius scotti* (sporadic); *Hydromanicus seychellensis*-larvae (sporadic); *Cricotopus* spec.-larvae, *Simulium speculiventre*-larvae (5–10/dm²: >1 m/sec).

c) Pools in the meadow (stagnant water):

Copelatus gardineri; tadpoles; on the border: *Lymnaea (Radix) cf. natalensis*.

d) On the border of the river and pools:

Imagos of *Leptocnemis cyanops*.

A sample of algae from stones in the cascades was taken.

4. F/Sey/16 / 14. 2. 1974: River Jasmine; deep slope on the W-coast; surrounded by scrub and bush; sometimes on the borders hygropetric areas over granitic rocks; sunny.

Alt.: 85–100 m

Gr.: granitic rock, boulders

Br.: 1–3 m

Gen. Chem.: pH: 6.1

Te.: 25.3° C (12h): 14. 2. 1974

Cond.: 34 μ Siemens

D.: 2–5 cm, p.: to 50 cm, hygropetric areas: to 0.5 cm

Tot. H.: 0.12° dH

C.: b. and p.: 10–30 cm/sec, c.: > 1 m/sec

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevivirostris f. gardneri, *C. brachydactyla brachydactyla*; *Pachypanchax playfairi* (in pools between cascades); Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Dugesia aff. gonocephala (sporadic: 30–50 cm/sec); *Maheathraulus scotti* (sporadic); *Hydromanicus seychellensis*-larvae (1–3/dm²); *Endochironomus*-, *Orthocladius*-, *Cricotopus* spec.-larvae (on hygropetric areas, under muddy web in gaps: 10–20/dm²); *Simulium speculiventre*-larvae (1–3/dm²: > 1 m/sec).

c) On the borders:

Imagos of *Leptocnemis cyanops*.

5. F/Sey/3 / 5. 2. 1974: River Du Cap; flowing in a steep sloped valley, surroundings: scrub, palms; mostly sunny.

Alt.: 40–60 m

Gr.: granitic boulders (10–50 cm \varnothing), gravel

Br.: 1 m

Gen. Chem.: pH: 7.2

Te.: 26° C (14h): 5. 2. 1974

Cond.: 49 μ Siemens

D.: 10–50 cm, c.: 1–3 m

Tot. H.: 0.31° dH

C.: c.: 75 cm/sec—>1 m/sec, b. and p.: 20–30 cm

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevivirostris f. gardneri (very frequent); Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Hagenulodes braueri, *Leptocnemis cyanops*-larvae (30 cm/sec); *Hydromanicus seychellensis*-larvae (3/dm²: 50 cm/sec—1 m/sec); *Orthocladius* spec.-larvae (sporadic), *Simulium speculiventre*-larvae (10–20/dm²: >1 m/sec).

c) On the borders:

Imagos of *Leptocnemis cyanops*.

6. F/Sey/2 / 5. 2. 1974: River Mamelle; torrent flowing through dense secondary forest on the transition between middle to lower course; very shady (Pl. 2, Fig. 10).

Alt.: 20–40 m

Br.: 2–10 m

Te.: 24.4° C (10^h, 11³⁰): 5. 2. 1974

D.: 5–15 cm, p.: 50 cm–1.5 m, c.:
1–2 cm

C.: 50 cm/sec, b. and p.: 0–20 cm/sec,
c.: 1–1.5 m/sec

Gr.: granitic rock, boulders (1–10 m ø),
gravel, sand, blue-green algae on
rocks

Gen. Chem.: pH: 6.9

Cond.: 54 µSiemens

Tot. H.: 0.65° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina typus; *Pachypanchax playfairi*; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Macrobrachium australe (Pl. 17, Fig. 81), *Sesarma (S.) impressa* (Pl. 17, Fig. 82), *Hydromanicus seychellensis*-larvae (sporadic); Chironomini-, *Cricotopus* spec.-larvae (sporadic), *Simulium speculiventre*-larvae (sporadic); *Neritina gagates* (sporadic), on the transition to the lower course in an altitude of about 20 m: *Neritina pulligera knorri*, *N. p. stumpfi*, *Neritilia consimilis*.

7. F/Sey/23 / 18. 2. 1974: River Quenet or R. Seychelles College near the tennis court of the Seychelles College; flowing through dense secondary forest, plantations; polluted by villages nearby; very shady (Pl. 3, Fig. 12).

Alt.: 30 m

Br.: 1–3 m

Te.: 25.5° C (16^h): 18. 2. 1974

D.: 1–5 cm, p.: 5–30 cm

C.: 50 cm/sec, b. and p.: 0–30 cm/sec,
c.: >1 m/sec

Gr.: granitic boulders (50 cm–1 m ø),
gravel (5–10 cm ø), boulders
covered with mosses, b. and p.:
muddy sand and vegetable debris

Gen. Chem.: pH: 6.9

Cond.: 46 µSiemens

Tot. H.: 0.33° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina typus, *C. brachydactyla brachydactyla*, *Pachypanchax playfairi*;
Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Dugesia aff. *gonocephala* (5–15/dm²: 30–50 cm/sec); *Hydromanicus seychellensis*-, *Helicopsyche kantilai*-larvae (sporadic); *Cricotopus* spec.-larvae (sporadic), *Simulium speculiventre*-larvae (1–2/cm²: > 1 m/sec); *Neritina gagates*, *Neritina pulligera stumpfi*, *Gyraulus* cf. *mauritanus*; under boulders: *Macrobrachium* lar, *M. australe*.

A sample of algae and mosses was taken.

8. F/Sey/12 / 9. 2. 1974: River Royal on the Canelle-Road; torrent in a narrow gorge; surroundings with secondary forest, plantations and villages, polluted; very shady.

Alt.: 30 m
 Br.: 20–50 cm
 Te.: 26.3° C (16h): 9. 2. 1974
 D.: 5–20 cm
 C.: 30–50 cm/sec, c.: >1 m/sec, b. and
 p.: 10–30 cm/sec

Gr.: granitic boulders (20–50 cm ø),
 covered with mosses, near the b. and
 in p.: sand with red lateritic mud
 Gen. Chem.: pH: 7.2
 Cond.: 116 µSiemens (!)
 Tot. H.: 1.39° dH (!)

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevirostris, *C. typus*, *C. brachydactyla* (very frequent); *Melanoides tuberculata* (1–2^{1/16} m² on muddy stones and vegetable debris), *Gyraulus* cf. *mauritanus* (sporadic); Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Orthocladiinae gen. spec.-larvae (in muddy tubes).

9. F/Sey/25 / 19. 2. 1974: River Cascade, near the barrage, before the passage to the Mangrove-zone in the range of the estuary, torrent in a broad valley, surrounded by scrub and plantations; sunny (Pl. 2, Fig. 11).

Alt.: 30 m
 Br.: 8–10 m
 Te.: 26° C (14h): 19. 2. 1974
 D.: 20–50 cm, p.: 1 m
 C.: 50–75 cm/sec, b. and p.: 10–30 cm/
 sec, c.: >1 m/sec

Gr.: granitic rock, boulders, gravel and
 sand
 Gen. Chem.: pH: 6.6
 Cond.: 33 µSiemens
 Tot. H.: 0.18° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Dugesia aff. *gonocephala* (1–2/dm²: 30 cm/sec); *Caridina brevirostris* f. *gardneri*, *C. typus*, *C. brachydactyla brachydactyla*, Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Macrobrachium idaei; *Hagenulodes braueri*, *Maheathraulus scotti* (1–2/dm²: 50–75 cm/sec); *Hydromanicus seychellensis*-, *Ecnomus insularis*-, *Helicopsyche palpalis*-larvae (3–5/dm²: 50 cm—1 m/sec); *Dicrotendipes*-, *Endochironomus*-, *Orthocladus*-, *Cricotopus* spec.-larvae, *Simulium speculiventre*-larvae (3–5/dm²: >1 m/sec); *Septaria borbonica* (sporadic).

c) On the borders:

Imagos of *Leptocnemis cyanops*.

A drift-sample and samples of algae, covering the stones in 50–75 cm/sec, and algae near the banks and pools were taken.

A.4. Lower courses to the mouths between 10 m and 0 m altitude:

1. F/Sey/21 / 17. 2. 1974: River Grande Anse (below the station A.3.2. F/19); near the bridge of the coastal road; partly shady.

Alt.: 2 m
 Br.: 3–6 m
 Te.: 28° C (16h): 17. 2. 1974
 D.: 10–50 cm
 C.: 50–75 cm/sec, b.: 0–30 cm/sec

Gr.: granitic rock, boulders (10–30 cm
 ø), gravel, sand
 Gen. Chem.: pH: 6.8
 Cond.: 35 µSiemens
 Tot. H.: 0.2° dH

Fauna:

a) Banks (0–30 cm/sec):

Caridina brevirostris

b) Medium to strong current (50—75 cm/sec):

Hydromanicus seychellensis-larvae (sporadic); *Endochironomus*-, *Cricotopus* spec.-larvae, *Simulium speculiventre*-larvae (3—5/cm²: 75 cm/sec); *Septaria borbonica* (1—2¹/₁₆ m²: 50—75 cm/sec, very thin shells!), *Neritina gagates*, *Neritilia consimilis* (3—5¹/₁₆ m²).

2. F/Sey/8 / 7. 2. 1974: River Anse de la Mouche, near the Les Canelles-Road, crossing to the Anse de la Mouche; the mouth-region damed up by high tide, surroundings coconut-plantations with pools and ditches, filled with brackish-water during the recurrent flow of the high tide (Pl. 3, Fig. 13).

Alt.: 0.5—1 m

Br.: 2—3 m (during low tide!)

Te.: 32°—32.5° C (16h); in the p. (flooded by brackish water): 37° C (16h);
7. 2. 1974

D.: 5—50 cm (during low tide!), p.:
1—20 cm

C.: 30 cm/sec (during low tide!)

Gr.: Dead coralls, sand of coralls,
filamentous blue-green, brackish
water algae

Gen. Chem.: Cond.: more than 30.000
µSiemens (brackish)

Fauna: a) Stream: banks (0—30 cm/sec):

Melanoides tuberculata (more than 100/dm² on and in corall sand; pygmy population of small individues!); *Syncera* (= *Assimineae*) *nitida* (very frequent on dead coralls, bivalve-shells etc.), *Melampus caffra* juv.; *Uca* sp., *Periophthalmus* sp. and different species of sea-water and brackish-water fishes.

b) Pools (filled with brackish water during high tide):

Terebralia palustris (5—7/m²).

A.5. Stagnant waters

1. F/Sey/17 / 14. 2. 1974: Backwater-swamp and pools on the Anse NW, behind the coastal road, surroundings: scrub and plantations; sunny (Pl. 3, Fig. 14).

Alt.: 1 m

D.: 1—10 cm

Te.: 32°—35° C (16h): 14. 2. 1974

Gen. Chem.: pH: 7.2

Cond.: 75 µSiemens

Tot. H.: 0.53° dH

Gr.: overflowed meadows, swamp and
pools with muddy bottom, dense
vegetation of Characea, Juncacea,
Eichhornia crassipes and algae

Fauna: a) On the bottom and in the free water:

Caridina typus, *Cloëon* sp.; *Ceriagrion glabrum*-, *Ischnura senegalensis*-larvae, Anisoptera-larvae; *Hydrocoptus subvittulus seychellensis*; *Pachypanchax playfairi*; tadpoles.

b) On the borders:

Imagos of *Ceriagrion glabrum*, *Ischnura senegalensis*.

B. Praslin

B.1. Upper courses in 200 m altitude:

1. F/Sey/15 / 13. 2. 1974: River Cascade du Vallée du Mai; flowing through dense primary forest of *Lodoicea seychellensis* (Coco du Mer), very shady (P. 3, Fig. 15).

Alt.: 200 m

Br.: 1 m

Te.: 24.1° C (11h): 13. 2. 1974

D.: 5–10 cm

C.: 10–30 cm/sec, c.: >1 m/sec

Gr.: granitic boulders (20 cm \varnothing), covered with mosses, filamentous algae, sand, much vegetable debris

Gen. Chem.: pH: 6.5

Cond.: 72 μ Siemens

Tot. H.: 0.45° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevirostris f. *typica*; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Dugesia aff. *gonocephala*; *Hagenulodes braueri*, *Maheathraulius scotti*; Anisoptera-larvae; *Hydromanicus seychellensis*-larvae, *Simulium speculiventre*-larvae. A sample of filamentous algae from stones was taken.

B.2. Upper to Middle courses between 200 m and 100 m altitude:

1. F/Sey/14 / 12. 2. 1974: River Cascade du Vallée du Mai, behind a waterfall of 15 m height; flowing off from the forest of the Vallée du Mai in a deep, narrow gorge, surrounded by forest of *Lodoicea seychellensis*, but not so shady, like station B.1.1.

Alt.: 100 m

Br.: 0.5–3 m

Te.: 25.5° C (17³⁰): 12. 2. 1974

D.: 5–20 cm

C.: b. and p.: 0–20 cm/sec, c.: 30–

50 cm/sec — >1 m/sec

Gr.: granitic rock, boulders (30 cm—1 m \varnothing), gravel, sand

Gen. Chem.: pH: 6.9

Cond.: 68 μ Siemens

Tot. H.: 0.47° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brevirostris f. *typica*, *similis*, *gardneri*, *C. typus*; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Dugesia aff. *gonocephala* (sporadic); *Hagenulodes braueri*, *Maheathraulius scotti* (1–2/dm²); Anisoptera-larvae (sporadic); *Hydromanicus seychellensis*-larvae (1–2/dm²); *Cricotopus*-, *Rheotanytarsus* spec.-larvae (sporadic); *Simulium speculiventre*-larvae (1–2/cm²: >1 m/sec).

C. La Digue

C.1. Upper course in 30 m altitude:

1. F/Sey/13 / 12. 2. 1974: River Choppy; flowing off from a enclosed reservoir of a spring; surrounding: scrub and dense plantations, farm houses; partly shady (Pl. 3, Fig. 16).

Alt.: 30 m	Gr.: granitic boulders (10–30 cm \varnothing), gravel, sand, vegetable debris
Br.: 1–2 m	Gen. Chem.: pH: 6.1
Te.: 25.2°–25.4° C (12h): 12. 2. 1974	Cond.: 89 μ Siemens
D.: 10–30 cm	Tot. H.: 0.51° dH
C.: 10–30 cm/sec	

Fauna: a) Enclosed reservoir of the spring:

Caridina brevirostris; Surface: Veliidae gen. spec.

b) Flowing off of the river:

Macrobrachium lar (under floating roots of plants of the border); *Pachypanchax playfairi*.

c) On the borders:

Imagos of *Ceriagrion glabrum*, *Orthetrum stemmale wrighti*.

A sample of blue-green algae and Characea from the run-off of the spring was taken.

3.2. Comores Archipelago

3.2.1. Geography

The Comores Archipelago comprises from East to West four principal islands: Grand Comore, Anjouan, Mohéli, and Mayotte (Fig. 1). They are situated in a WNW—ESE line at the northern end of the Mozambique Channel between 43° and 45°30' E longitudes and between 11° and 13° S latitudes, and are extending over 270 km. The islands cover an area of 2170 km², Grand Comore, lying 280 km from East Africa, is the largest island, approximately 60 km long and 20 km broad. Anjouan, the second largest island, cover an area of 424 km² and has the form of a triangle (W to E: 45 km, N to S: 40 km; Fig. 3).

3.2.2. Geology, Petrology and Physiography

The islands are almost entirely volcanic and show a simple age progression along the length of the archipelago with youngest from E—SE to oldest W—NW. The older islands of Mohéli, Anjouan and Mayotte all show clear evidence for small-scale late-stage or rejuvenescent activity. From de SAINT OURS (1960) comparative studies on the geomorphology of the Comores volcanoes and those of northern Madagascar we are led to conclude that basaltic activity commenced on Mayotte, the oldest island in the East, in Miocene or possibly even Cretaceous times.

Grand Comore shows in its regular coastline and undissected shield volcanoes, its relative youthfulness. Two main volcanic centres, the Massif de la Grille (1087 m) and the Karthala (2361 m) form its northern and southern halves. Both have been the site of historic volcanism and are coalescing shield volcanoes built up by a combination of flows from central and fissure eruptions (ESSON & al. 1970). It has nearly no river erosion on the flanks of the mountains. The waters of the heavy rainfalls during the NW-monsoon seep away in the

lava-slacks. The population of Grand Comore has constructed large cisterns to collect rainwater during the rainy season. No running waters occurs on Grand Comore.

The mission 1974 has collected and studied the fauna of the streams of Anjouan, the second largest island of the Comores Archipelago. This triangular-

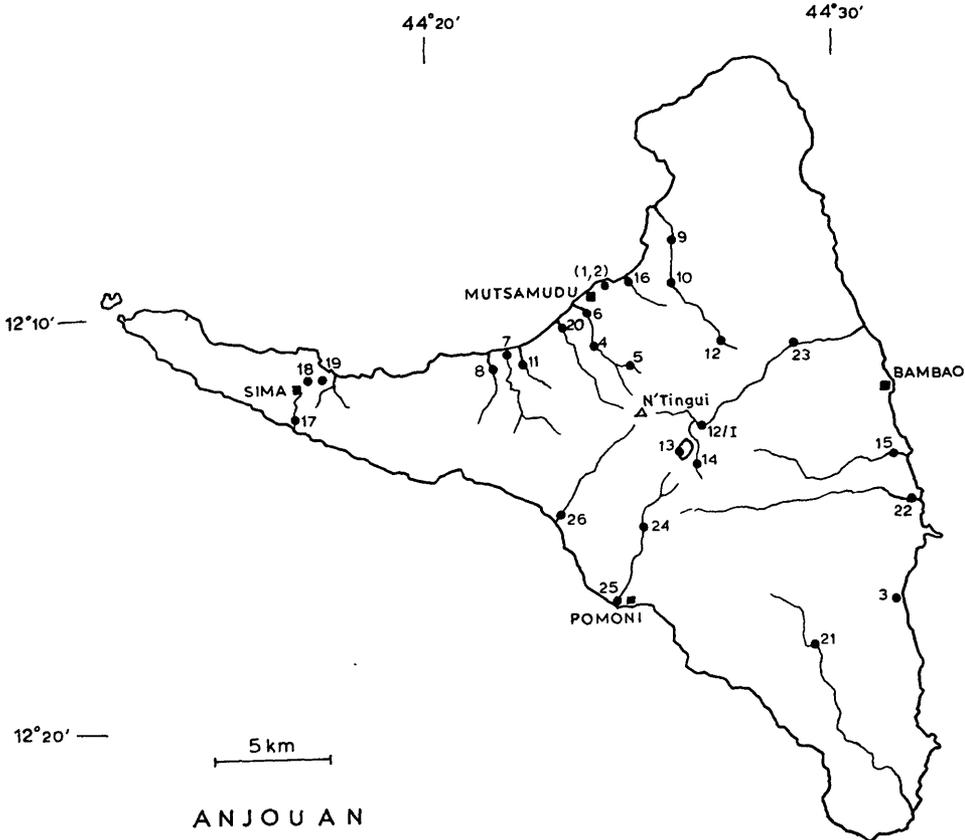


Fig. 3. Comores-Archipelago: Anjouan with the numbers of the stations on the rivers

shaped island contains rugged, forest-clad topographies, with deep river gorges and amphitheatre-headed valleys. The highest peak N'Tingui (1595 m) is centrally situated (Fig. 3; Pl. 4, Fig. 17). The coasts are strongly embayed and the original constructional surfaces have been almost entirely obliterated.

The precipitous mountains of N'Tingui, Djadjana, Habakari and Trindrini appear to be composed of a relatively monotonous succession of basalts and ankamarites similar to those of Grande Comore. Whereas these older rocks are compositionally analogues to those of Grand Comore, the younger lavas

are predominately highly alcaic and feldspathoidal, and include basanites, hornblende-trachybasalts and phonolithes (ESSON & al. 1970).

The curved northern coastline with the broad bay of Mutsamudu has been defined by fracturing associated with subsidence towards the deep gulf that lies between Anjouan and Grand Comore. SAINT OURS (1960), has shown the topography to be dictated by deep river erosion of older basaltic sequences, modified by the constructional slopes of younger lava flows and wellpreserved cinder cones. Fringing reefs are relatively mature compared to those of Grand Comore and barrier reefs are in the early stage of development around the western part of Anjouan.

3.2.3. Climate

The Comore Archipelago is, like the Seychelles, in the tropical trade-wind belt. There are two seasonal periods: the West-monsoon and the South East-trade-wind. The first wind, coming from the equator, blows between November and April and brings very heavy rainfalls to the western sides of the islands, specially in the mountains.

The dry trade-winds occur between May and October, when there is very little rain. The mission visited in March 1974 Anjouan. Some meteorological data of the Service Meteorologique des Comores from three different stations at Anjouan between 1965 and 1974 are given below.:

Rainfall-Amount (in mm)	Mremani (800 m)	Mutsamudu (20 m)	Ouani (8 m)
1. 10 year annual mean between 1965—1974	2450.31	2262.83	1887.44
2. Absolute highest annual mean between 1965— 1974	1974: 2987.8	1971: 3590.3	1965: 2275.7
3. Absolute lowest annual mean between 1965— 1974	1966: 1427.8	1969: 1513.8	1972: 1813.8
4. Highest 10 year monthly mean between 1965—1974	January: 369.05	January: 414.33	January: 398.13
5. Absolute highest monthly mean between 1965—1975	March 1974: 757.9	January 1972: 563.8	March 1974: 705
6. Lowest 10 year monthly mean between 1965—1974	September: 64.15	August: 48.69	July: 13.25
7. Absolute lowest monthly mean between 1965—1974	May 1973: 4.3	May 1973: 0.3	July 1971: 0.5
8. Mean of March 1974 (visit of the mission)	757.9	457.2	705
9. 10 year mean for March between 1965—1974	365.28	281.65	323.55

The liste abow shows that (see 8 and 9) the month March 1974, where the mission was on Anjouan, was extremly rainy and wet, compared with the 10 year rainfall — amount of the month March!

Number of days with rainfall (in days)	Mremani (800 m)	Mutsamudu (20 m)	Ouani (8 m)
1. Absolute highest number of days with rainfall in a month between 1965—1974	January 1970 and February 1974: 23	January 1970: 23	February 1974: 23
2. Absolute lowest number of days with rainfall in a month between 1965—1974	November 1974: 4	May 1973, July 1966, August 1966, 1968: 1	July 1974: 1
3. Absolute highest total number of days with rainfall between 1965—1974	1970: 179	1973: 164	1973: 153
4. Absolute lowest total number of days with rainfall between 1965—1974	1966: 143	1966: 84	1969: 131
5. The month with the highest mean total number of days with rainfall between 1965—1974	March: 20	January: 15.2	March: 19.5
6. The month with the lowest mean total number of days with rainfall between 1965—1974	September: 8.2	August: 4.9	July: 4.7
7. Annual mean total number of days with rainfall between 1965—1974	161.2	120.6	146.1
Monthly mean air-temperatures (in ° C)	Mremani (800 m)	Mutsamudu (20 m)	Ouani (8 m)
1. The months with the absolute highest mean air-temperatures between 1965—1974	March 1973: 25.2	March 1967, 1970: 29.1	March 1967: 27.7
2. The months with the absolute lowest mean air-temperatures between 1965—1974	August 1967, July 1968: 18.8	September 1974: 22.8	August 1971: 22.7
3. Monthly mean air-temperature in March 1974 (visit of the mission)	no dates	26.7	26.3

4. Absolute highest mean air-temperatures of a year between 1965—1974	1973: 22.9	1967: 27.6	1966, 1967, 1969 26
5. Absolute lowest mean air-temperatures of a year between 1965—1974	1974: 20.4	1974: 25.3	1974: 25.6
6. Monthly highest mean air-temperatures between 1965—1974	March: 23	March, April: 27.7	March: 27
7. Monthly lowest mean air-temperatures between 1965—1974	July, August: 19.3	August: 15.2	July: 23.9
8. Annual mean air-temperatures from the period 1965—1974	22.2	26.6	25.6

3.2.4. Vegetation

The volcanic islands were originally covered by dense tropical rain-forests containing many endemic species, originating from species immigrated from East-Africa and Madagascar. The massiv of N'Tingui has a reserve of 2000 ha endemic primary forest. The dominating trees are *Albizzia*, *Mimusops comorensis* and the tree-fern *Marattia* sp. On the trees near the tops are beard-lichens (*Usnea barbata*) and many endemic orchids. The ground is sometimes covered with *Calanthe silvatica*, *Impatiens sultani*, *Lycopodia* sp., *Selaginella fissidentoides* and the liver-moss *Marchantia*.

The E-coast is more aride and baobabs and Lantana-scrub are to find. On the more humide N-coast grow the almond (*Terminalia catappa*) and on the SE-end is scrublike bush with *Flacourtia indica*, *Indigofera schimperi*, *Jatropha* sp., *Woodfordia suffruticosa*, *Cissus quadrangularis*, *Leptadenia reticulata*, tamarind and *Erythrina*-trees.

Up to 600 m altitude the indigenous forests and scrubs are disrupted by plantations. Dominating are plantations of parfume-plants, like Ylang, Patchouli and Citronell, but also bananas, sugar-cane, coffee, sisal, vanille, and, near the coasts of coconuts.

3.2.5. Descriptions of the stations

A. Grand Comore

A.1. Cistern

1. F/Gr. Co/1 / 28. 2. 1974: Cistern with collected rain-water in an village N of Moroni; the walls are covered with filamentous green algae.

Gen. Chem.: pH: 8.1

Cond.: 118 μ Siemens

Tot. H.: 2.58° dH

Fauna: a) Free water (collected by net):

Ostracodes; cf. *Cloëon* sp.-larvae; Odonata-larvae; *Sternolophus* sp.; Culicidae gen. spec.-larvae.

A sample of algae was taken.

B. Anjouan

B.1. Upper courses between 900 m and 400 m altitude:

1. F/An/14 / 12. 3. 1974: River Mdzihe, tributary of the River Tatinga, near the Mt. Chacojou; torrent on a steep slope; surrounding-dense primary forest; very shady (Pl. 4, Fig. 18).

Alt.: 800 m

Br.: 50 cm

Te.: 20° C (13³⁰): 12. 3. 1974

D.: 1–5 cm

C.: 50–75 cm/sec, c.: >1 m/sec,

p.: 10–30 cm/sec

Gr.: basaltic boulders (30 cm \varnothing), gravel, sand; in pools between cascades with 10–50 cm diameter: sand with vegetable debris, mostly woods

Gen. Chem.: pH: 7.8

Cond.: 94 μ Siemens

Tot. H.: 1.9° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Dugesia milloti (5–10/dm²); *Potamodytes africanus*-larvae (5/dm² on vegetable debris); Surface: *Orectogyrus speculum*.

b) Medium to strong current (30 cm/sec–1 m/sec):

Baetidae gen. spec.-larvae (3–5/dm²); Hydropsychidae gen. spec.-larvae (1/dm²); Orthocladiinae gen. spec.-larvae (sporadic), Simuliidae gen. spec.-larvae (sporadic).

c) Hygropetric habitats on rocks:

Limonia sp.-larvae; imagos of *Potamodytes africanus*

d) On the borders:.

Paratettix cinereus; Gryllodea fam. gen. spec.-larvae.

2. F/An/21 / 21. 3. 1974: River Santsa, near Adda-Douéni; torrent below a waterfall of 15 m height; flowing through a narrow gorge; surrounding: scrub; sunny.

Alt.: 750 m

Br.: 50 cm–1 m

Te.: 23.9° (11^h)–24.5° C (12³⁰): 21. 3. 1974

D.: 2–10 cm

C.: 50 cm–>1 m/sec; b.: 30–50 cm/sec

Gr.: basaltic rock, boulders (10–30 cm \varnothing), gravel, sand on the borders: floating roots of plants

Gen. Chem.: pH: 8

Cond.: 125 μ Siemens

Tot. H.: 2.4° dH

Fauna: a) Banks, with floating roots of plants from the border (30–50 cm/sec):

Dugesia milloti (5–10/dm²: under stones); *Caridina typus* (very frequent); *Thraulur turbinatus*, *Choroterpes starmuehlneri*-larvae; Lepidostomatidae (?) gen. spec.-larvae; *Hyphydrus separandus*, *Laccophilus tigrinus*; Ranatridae-, Naucoridae-, Nepidae-gen. spec.; Surface: Veliidae-, Gerridae gen. spec.; *Dineutus sinuosipennis comorensis*.

b) Medium to strong current (50 cm/sec–>1 m/sec):

Dugesia milloti (5–10/dm²: under stones till 75 cm/sec); Baetidae gen. spec.-larvae (3–5/dm²: 50–75 cm/sec); Hydropsychidae gen. spec. (1–3/dm²); *Cardiocladius* sp., *Cricotopus* sp.-larvae (3–5/dm²), *Rheotanytarsus* sp.-larvae, Simuliidae gen. spec.-larvae (5/dm²: >1 m/sec).

c) On the borders:

Imagos of *Trithemis kirbyi ardens*, *Zygonyx torrida*, *Orthetrum julia falsum*; *Paratettix cinereus*.

A drift-sample was taken.

3. F/An/12 I / 11. 3. 1974: River Tatinga, upper course near Dindi; the tributaries are coming from the slopes of the N'Tingui and Mt. Chacojou (No. 1: F/An/14); flowing through a broad valley, surrounding: primary and secondary forest, scrub; on the left borders of the river rise some mineral sources and flow in; their border is covered with red iron-ochre mud; borders of the river partly shady, partly sunny (Pl. 4, Fig. 19).

Alt.: 600 m

Br.: 3–8 m

Te.: 22.9° C (16h)–22.2° C (18h): 11. 3. 1974

D.: c.: 5–10 cm, p.: 20–50 cm

C.: c.: 75 cm—>1 m/sec, p.: 30–50 cm/sec, b.: 10–30 cm/sec

Gr.: basaltic rock, boulders, gravel, sand; on stones filamentous green algae

Gen. Chem.: pH: 7.95

Cond.: 120 µSiemens

Tot. H.: 2.6° dH

(mineral-sources: pH: 6; Cond.: 1600 µSiemens; Tot. H.: 53° dH; CaO: 221 mg/l, MgO: 102 mg/l, Fe: 13 mg/l, HCO₃: 1312 ppm; CO₂ (free): 550; all values after the analysis of G. WENINGER)

Fauna: a) Banks and pools (0–30/50 cm/sec):

Dugesia milloti (5–10/dm²); Surface: Veliidae gen. spec., *Orectogyrus speculum*.

b) Medium to strong current (30/50 cm/sec—>1 m/sec):

Dugesia milloti (5–10/dm²: till 50 cm/sec); Baetidae- gen. spec.-larvae (10–20/dm²: 50 cm—1 m/sec); Anisoptera-larvae (1¹/₁₆ m²); Hydropsychidae gen. spec.-larvae, -pupae (10–15/dm²); Orthocladiinae gen. spec.-larvae, Simuliidae gen. sp.-larvae, -pupae (3–5/cm²: >1 m/sec).

c) Hygropetric areas on rocks

Limonia sp.-larvae (5–10/dm²)

d) On the borders of the river:

Paratettix cinereum

e) On the borders of the mineral-sources in spray-water:

Paratettix cinereus; *Lymanea (Radix) natalensis*-group (with spawn).

A drift-sample was taken, also a sample of floating, filamentous, dark-green algae from the cascades and light-green algae from pools near the border of the river.

4. F/An/12 / 9. 3. 1974: River-source and reservoir with tributary and run-off near the village of Bazmini, on the road Oueni to Col de Patsi; confluence of two river-sources, one of them flows in a water-reservoir for the village (5 m × 5 m, 50 cm deep); surrounding: plantations, scrub; shady.

Alt.: 520 m
 Br.: 50 cm—1 m
 Te.: river: 23° C (9h), reservoir: 23.5° C (9h): 9. 3. 1974
 D.: 3—10 cm
 C.: 50—75 cm/sec, c.: >1 m/sec, b.: 10—30 cm/sec

Gr.: basaltic boulders and gravel (5—20 cm ø), banks: muddy sand, vegetable debris, floating *Trandescantia* from the border
 Gen. Chem.: pH: 7
 Cond.: 130 µSiemens
 Tot. H.: 2.5° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Dugesia milloti (5—10/dm²); *Dero (Aulophorus) hymanae*; *Caridina typus* (in floating plants from the border); *Choroterpes starmuehlneri*-, Baetidae- gen. spec.-larvae; *Orthetrum julia falsum*-larvae; Hydropsychidae gen. spec.-larvae (sporadic: 30 cm/sec), *Lymnaea (Radix) natalensis*-group; Surface: Veliidae gen. spec., *Dineutus sinuosipennis comorensis*.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Dugesia milloti (5—10/dm²: to 50 cm/sec); Baetidae gen. spec.-larvae; *Orthetrum julia falsum*-larvae; Hydropsychidae gen. spec.-larvae; *Polypedium* spec.-larvae.

c) Hygropetric areas on rocks:

Limonia comorensis-larvae, -pupae; *Potamodytes africanus* (imago)

d) Water reservoir:

Caridina typus; Notonectidae gen. spec.; *Lymnaea (R.) natalensis*-group (on the walls: 10—20/dm², spawn); Surface: Gerridae gen. spec.

e) Border of river and reservoir:

Imagos of *Orthetrum julia falsum*.

5. F/An/5 / 5. 3. 1974: Tributary of the upper course of the River Mutsamudu; flowing through forest and scrub; partly shady.

Alt.: 500 m
 Br.: 1—2 m
 Te.: 22.5° C (10h)—23° C (12h): 5. 3. 1974
 D.: 2—5 cm
 C.: 50—75 cm, b. and p.: 10—30 cm/sec, c.: >1 m/sec

Gr.: basaltic boulders and gravel (1—10 cm ø), near the banks: stones covered with mud and green algae
 Gen. Chem.: pH: 8
 Cond.: 142 µSiemens
 Tot. H.: 3.15° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Dugesia milloti (5—10/dm²: 20—30 cm/sec); *Atya pilipes*; *Choroterpes starmuehlneri*-larvae (sporadic); *Pseudagrion pontogenes*-larvae, *Orthetrum julia falsum*-larvae; Lepidostomatidae (?)-, Sericostomatidae gen. spec.-larvae (10—20/dm²), Hydropsychidae gen. spec.-larvae, -pupae (sporadic: 30 cm/sec); Nepidae gen. spec., Naucoridae gen. spec.; Surface: Veliidae gen. spec.; *Orectogyrus speculum*, *Dineutus sinuosipennis comorensis*; *Melanoides tuberculata* (rare).

b) Medium to strong current (30 cm/sec—>1 m/sec):

Dugesia milloti (5—10/dm²: till 50 cm/sec); Baetidae gen. spec. larvae; *Orthetrum julia falsum*-larvae; Hydropsychidae gen. spec.-larvae (3—5/dm²: 30—75 cm/sec, 5—10/dm²: 75 cm—>1 m/sec); Simuliidae gen. spec. (3—5/dm²: 75 cm—>1 m/sec).

c) Hygropetric areas on rocks:

Limonia sp.-larvae; *Potamodytes africanus* (imago)

d) On the borders:

Imagos of *Pseudagrion pontogenes*, *Orthetrum julia falsum*.

A sample of green-algae from stones was taken.

B.2. Upper to Middle courses between 400 m and 150 m altitude:

1) F/An/4 / 4. 3. 1974: River Mutsamudu; broad valley of the N'Tingui mountains; surrounding: secondary forest, plantations, scrub; sunny (Pl. 4, Fig. 20).

Alt.: 250 m

Br.: 5–7 m

Te.: 24.8° C (15h): 4. 3. 1974

D.: 10–20 cm

C.: 75 cm/sec, b. and p.: 10–30 cm/sec,

c.: >1 m/sec

Gr.: basaltic boulders (5–20 cm ø),
gravel, sand

Gen. Chem.: pH: 8.1

Cond.: 117 µSiemens

Tot. H.: 2.7° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Atya pilipes; *Choroterpes starmuehlneri*-larvae; Anisoptera-larvae; Limnophilidae gen. spec.-larvae; Naucoridae gen. spec.; *Lymnaea* (*R.*) *natalensis*-group; Surface: Veliidae gen. spec.; *Orectogyrus speculum*, *Dineutus sinuosi-pennis comorensis*.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Hydropsychidae gen. spec.-larvae (sporadic); *Cardiocladius*-, *Eukiefferiella*-, *Thienemanniella* sp.-larvae (1–2/dm², forming tissues), Simuliidae gen. spec.-larvae (3–5/cm²: >1 m/sec)

c) On the borders:

Grylloidea fam. gen. spec.-larvae.

A drift-sample (1^h) and a sample of algae from stones was taken.

2. F/An/10 / 8. 3. 1974: River Ouani, flowing off from head waters near Patsi; surrounding: scrub and plantations; narrow gorge, partly sunny, partly shady; outside of the river are some pools filled with water from floods (Pl. 4, Fig. 21).

Alt.: 250 m

Br.: 4–8 m

Te.: River: 24.3° C (9h–12h), Head waters: 25.3° C (9h–12h), Flood-pools: 26.3° C (9h–12h): 8. 3. 1974

D.: River: 5–10 cm, p.: 50 cm, Head waters: 2 m (10 m ø), Flood pool: 1–2 m (3–5 m ø)

C.: 50 cm/sec, b. and p.: 0–10 cm/sec, c.: >1 m/sec

Gr.: basaltic boulders (50 cm ø), partly covered with mosses, gravel, muddy sand; Head waters: sand; Flood pools: muddy sand, much vegetable debris,

Col.: brownish

Gen. Chem.: pH: River: 8.4,

Head waters: 7.1

Cond.: River: 180 µSiemens

Head waters: 180

µSiemens

Tot. H.: River: 3.5° dH,

Head waters: 3.3° dH

Fauna: a) Banks and pools (of the river; 0–30 cm/sec):

Dugesia milloti (10–20/dm²); *Caridina typus* (sporadic); *Choroterpes starmuehlneri*-larvae (in floating plants and roots from the border); Naucoridae gen. spec. (very frequent); *Lymnaea* (*R.*) *natalensis*-group, *Gyraulus* sp.; Surface: Veliidae gen. spec.; *Dineutus sinuosipennis comorensis*.

b) Medium to strong current (30 cm/sec— >1 m/sec):

Baetidae gen. spec.-larvae (20–30/dm²); *Orthetrum julia falsum*-larvae (1¹/₁₆ m²); Hydropsychidae gen. spec.-larvae (3–5¹/₁₆ m²); *Cricotopus bicinctus*, *Cardiocladius*-spec.-larvae (30–50/dm²), *Conchapelopia* sp.-larvae, Simuliidae gen. spec.-larvae (sporadic).

c) Hygropetric areas on rocks:

Limonia sp. larvae (1 ♀ imago)

d) Flood pools:

Dugesia milloti; *Dero* (*Aulophorus*) *hymanae*; Zygoptera-, (frequent), Anisoptera-larvae; *Hydaticus* sp.-larvae, -imagos; Naucoridae gen. spec., Notonectidae gen. spec.; *Chironomus*-, *Glyptotendipes* sp.-larvae; *Lymnaea* (*R.*) *natalensis*-group (many young specimens, spawn), *Ceratophallus* sp., *Melanooides tuberculata*.

A sample of filamentous green-algae, of diatoms and a driftsample (1^h) were taken.

3. F/An/23 / 22. 3. 1974: River Tatinga, middle course near the bridge on the road to Bambao; broad open V-valley; surrounding: scrub and plantations; sunny (Pl. 5, Fig. 22).

Alt.: 210 m

Br.: 8–10 m

Te.: 24.5° C (10^h): 22. 3. 1974

D.: 20–30 cm (slightly flooded by rain)

C.: 50–75 cm/sec, b.: 20–30 cm/sec,

c.: >1 m/sec

Col.: brownish-grey (flood); sight: 5 cm deep

Gr.: basaltic boulders (10–30 cm ø), gravel, muddy sand, floating plants from the border (flood!)

Gen. Chem.: pH: 8

Cond.: 146 µSiemens

Tot. H.: 3° dH

Fauna: a) Banks (with floating plants, 20–30/50 cm/sec):

Dugesia milloti (5/dm²); *Atya pilipes* (very frequent between floating plants); *Choroterpes starmuehlneri*-larvae; Zygoptera-larvae; Naucoridae gen. spec.; *Potamodytes africanus*-larvae; Surface: Veliidae gen. spec., Gerridae gen. spec.; *Orectogyrus speculum*.

b) Medium to strong current (30/50 cm/sec— >1 m/sec):

Dugesia milloti (3–4/dm²: till 50 cm/sec); *Macrobrachium lar*; Baetidae gen. spec.-larvae (2–3/dm²); Hydropsychidae gen. spec.-larvae (5–10/dm²). A drift sample (20') was taken.

4. F/An/24 / 25. 3. 1974: River Pomoni, near the power station, deep narrow gorge below a water-fall of 20 m height; surrounding: scrub; shady (Pl. 5, Fig. 23).

Alt.: 200 m	Gr.: basaltic boulders (30 cm—2 m ø), gravel, sand
Br.: 5—10 m	
Te.: 22.5° C (12h): 25. 3. 1974	Gen. Chem.: pH: 7.8
D.: 30 cm—1 m (p.)	Cond.: 125 µSiemens
C.: 50 cm/sec, b.: 20—30 cm/sec, c.: >1 m/sec	Tot. H.: 2.6° dH

Fauna: a) Banks (20—30 cm/sec):

Caridina typus, *Atya pilipes*; *Choroterpes starmuehlneri*-, *Thraululus turbinatus*-larvae (sporadic); Surface: Veliidae gen. spec.; *Orectogyrus speculum*.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Baetidae gen. spec.-larvae (sporadic); Hydropsychidae gen. spec.-larvae (sporadic); Simuliidae gen. spec.-larvae (sporadic), Orthocladiinae gen. sp.-larvae.

c) Hygropetric areas on rocks:

Limonia sp.-larvae; *Potamodytes africanus* (imagos).

B.3. Middle to Lower courses between 150 m and 10 m altitude:

1. F/An/18 / 20. 3. 1974: River Foumbani; small torrent near the village Foumbani in the region of Sima (NW-coast); surrounding: scrub, plantations; partly shady.

Alt.: 150 m	Gr.: basaltic rocks with cavities; small flat basalt stones, covered with algae, sand
Br.: 1—2 m	
Te.: 26° C (11h): 20. 3. 1974	Gen. Chem.: pH: 6.8
D.: 1—10 cm	Cond.: 255 µSiemens
C.: 30—50 cm/sec, c.: 50—75 cm/sec	Tot. H.: 5.5° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Dugesia milloti; *Choroterpes starmuehlneri*-larvae (2—5/dm²); Anisoptera arvae; *Culex pipiens cinquefasciatus*, *Anopheles mascarensis*; *Ceratophallus* sp.; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—50/75 cm/sec):

Baetidae gen. spec.-larvae (2—5/dm²); *Conchapelopia* sp.-, *Cardiocladius*-, *Polypedilum*-, *Microtendipes*-, *Rheotanytarsus* spec.-larvae, *Rheotanytarsus* sp.-pupae, Simuliidae gen. spec.-larvae.

A sample of algae, covering the stones, was taken.

2. F/An/6 / 5. 3. 1974: River Mutsamudu; transition from middle to lower course; behind a waterfall and a pool (20 m ø; 2—3 m deep) flowing off in small cascades over boulders; deep sloped V-gorge above the town of Mutsamudu; surrounding: scrub, plantations; very shady (Pl. 5, Fig. 24).

Alt.: 120 m	Gr.: basaltic rock, boulders (30 cm—1 m ø), gravel (5 cm ø), sand
Br.: 10—20 m	
Te.: 24.9° C (16h)—24.5° C (17 ³⁰): 5. 3. 1974	Gen. Chem.: pH: 8.2
D.: 20—50 cm, p.: 1 m—1.5 m	Cond.: 135 µSiemens
C.: >1 m/sec, b. and p.: 20—30 cm/sec	Tot. H.: 2.9° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina typus (between floating plants from the border); Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Macrobrachium australe; Orthoclaadiinae gen. spec.-larvae (in twisted muddy tubes); Simuliidae gen. spec.-larvae (sporadic: >1 m/sec); *Neritina gagates*, *Neritina pulligera knorri*, *Clithon spiniperda* (all species sporadic), *Septaria borbonica* (5–10/dm²: >1 m/sec; 1–3/dm²: 50–75 cm/sec); *Neritilia consimilis* (1–3/dm²: near the water-level).

3. F/An/8 / 7. 3. 1974: River Hanghoué; transition from middle to lower course; flowing through plantations with scrub; partly shady.

Alt.: 90 m	Gr.: basaltic boulders (50 cm–2 m \varnothing),
Br.: 2–8 m	gravel (5–10 cm \varnothing), sand
Te.: 23.6° C (9h)–25.8° C (12h): 7. 3. 1974	Gen. Chem.: pH: 7.9
D.: 5–10 cm, p.: 50 cm	Cond.: 130 μ Siemens
C.: 30–50 cm/sec, c.: >1 m/sec	Tot. H.: 2.6° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina typus; *Thienemanniella* sp.-larvae (5–10/dm²: 30 cm/sec); Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Macrobrachium lar; *Hygrobates soari* (1/dm², near the eggs of Neritidae); *Cardiocladius*-, *Cricotopus* spec.-larvae (in twisted, muddy tubes); Simuliidae gen. spec.-larvae (sporadic); *Neritina pulligera stumppfi* (sporadic), *Septaria borbonica* (sporadic, eggs very frequent); under stones: Atyidae gen. spec.; attached to stones: *Sicyopterus* (? *Sicydium*) *lagocephalus* (with ventral sucker).

One drift-sample (1^h) and one sample of algae, covering stones, were taken.

4. F/An/9 / 7. 3. 1974: River Ouani; approx. 1 km from the mouth, flowing through plantations in a trough-valley; sunny (Pl. 5, Fig. 25).

Alt.: 20 m	Gr.: basaltic boulders (30 cm–1 m \varnothing),
Br.: 3–4 m	gravel (10 cm \varnothing), vegetable debris,
Te.: 26° C (16h)–25.5° C (18h): 7. 3. 1974	floating plants from the border
D.: 10–20 cm	Gen. Chem.: pH: 8.4
C.: >1 m/sec, b.: 30 cm/sec	Cond.: 180 μ Siemens
	Tot. H.: 3.5° dH

Fauna: a) Banks (30 cm/sec):

Caridina typus, *Atya pilipes*; *Hygrobates soari*; *Choroterpes starmuehlneri*-, *Thraululus turbinatus*-larvae, Zygoptera-larvae; Naucoridae gen. spec.; *Sternolophus solieri*; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Baetidae gen. spec.-larvae; Sericostomatidae gen. spec.-larvae; Hydropsychidae gen. spec.-larvae; *Rheotanytarsus* sp.-larvae (30–75 cm/sec), *Orthoclaadiinae* gen. sp.-larvae, Simuliidae gen. spec.-larvae (sporadic).

5. F/An/15 / 13. 3. 1974: River Gégé, near the village Gégé on the SE-coast; flowing through open scrub-land, plantations of coconut; sunny (Pl. 5, Fig. 26).

Alt.: 20 m

Br.: 4–8 m

Te.: 25.6° C (10h) — 27.3° C (12h): 13. 3.

1974

D.: 5–30 cm

C.: b. and p.: 0–30 cm/sec, c.: 75 cm—
1 m/sec

Gr.: basaltic boulders (10–50 cm ø),
gravel (5 cm ø), sand, on the banks:
vegetable debris

Gen. Chem.: pH: 8.02

Cond.: 120 µSiemens

Tot. H.: 2.3° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Caridina brachydactyla brachydactyla (between floating plants of the border); *Macrobrachium australe*, *M. lar* (under stones); *Choroerpes starmuehlneri*-, *Thraulius turbinatus*-larvae, Odonata-larvae, Hydropsychidae gen. spec.-larvae, -pupae (30 cm/sec); Ranatridae gen. spec.; *Potamodytus africanus*-larvae; *Anopheles mascarensis*-larvae, Orthoclauiidae-, *Rheotanytarsus* sp.-larvae; *Eleotris fusca*; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Baetidae gen. spec.-larvae, *Prosopistoma* sp.-larvae; Hydropsychidae gen. spec.-larvae (3–5/dm²); *Rheotanytarsus* sp.-larvae (20–30/dm²), Simuliidae gen. spec.-larvae (sporadic); *Septaria borbonica* (5–10/1/16 m², large specimens; with eggs on the shells).

A drift-sample (1^h) was taken.

B.4. Lower courses to the mouths between 10 m and 0 m altitude:

1. F/An/17 / 20. 3. 1974: River Hachéla; S of Sima on the SW-coast; flowing through plantations; shady.

Alt.: 10 m

Br.: 1–1.5 m

Te.: 26.4° C (10^{so})

D.: 5–10 cm

C.: 30–50 cm/sec, c.: 75 cm—>1 m/sec

Gr.: basaltic boulders (10–50 cm ø),
flat gravel covered with lateritic mud
and muddy algae

Gen. Chem.: pH: 7.7

Cond.: 126 µSiemens

Tot. H.: 1.55° dH

Fauna: a) Banks (20–30 cm/sec):

Caridina brachydactyla brachydactyla

b) Medium to strong current (30 cm/sec—>1 m/sec):

Baetidae gen. spec.-larvae; Orthoclauiidae gen. spec.-larvae; Simuliidae gen. spec.-larvae, pupae (all species sporadic).

A sample of algae from the stones was taken.

2. F/An/19 / 20. 3. 1974: River Bouékouni on the NW-coast; narrow gorge with a waterfall and a pool of 5 m in diameter (1–2 m deep), the river flowing off from the pool about 50 m to the sea; crossing the coast road on the N-coast; shady.

Fauna: a) Medium to strong current (50 cm/sec—>1 m/sec):

Clithon spiniperda (sporadic), *Septaria borbonica* (10—20/1₁₆ m²); shells covered with many young specimens). Only gastropods and a sample of algae were taken.

6. F/An/7 / 6. 3. 1974: River Pouzine, mouth-region, near the bridge of the northern coast road; in the range of the return current during high tide; the sample was taken during the low tide; surrounding: Ylang-plantation, scrub; sunny (Pl. 6, Fig. 27, 28).

Alt.: 2 m

Br.: 2—3 m

Te.: 25.7° C (15h)—26° C (17h): 6. 3. 1974

D.: 10—30 cm

C.: 30 cm/sec, c.: 50 cm—>1 m/sec

Gr.: basaltic boulders (20—50 cm ø),
gravel, sand

Gen. Chem.: pH: 7.7

Cond.: 122 µSiemens

Tot. H.: 2.5° dH

Fauna: a) Banks (0—30 cm/sec):

Caridina brachydactyla brachydactyla, *Atya pilipes*; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Macrobrachium lar (under stones); *Thienemanniella* spec.-larvae, *Rheotanytarsus* sp.-larvae; *Clithon comorensis*, *Clithon spiniperda* (1/dm²; some specimens with spines; both species occurring in the region of the return current during high tide, sometimes also outside of the water); *Septaria borbonica* (3—5/dm²; in the upper part of the frontier of the return current during high tide); *Neritilia consimilis* (5/dm² near the water level, occurring also in the region of the return current during high tide); *Sicyopterus* (? *Sicydium*) *lagocephalus* (with ventral sucker; Pl. 6, Fig. 28); *Kuhlia rupestris*, *Microphis* ?*brachyurus*, *Eleotris fusca*.

c) Hygropetric area on rocks:

Potamodytes africanus (imagos).

A sample of filamentous algae from stones was taken.

7. F/An/22 / 21. 3. 1974: River Jomani on the SE-coast; approx. 100 m from the mouth; surrounding: plantations, scrub; partly shady, partly sunny.

Alt.: 2 m

Br.: 8 m

Te.: 26.5° C (13h): 21. 3. 1974

D.: 20—50 cm (higher water level after rain!)

C.: 50—75 cm/sec, b.: 20—30 cm/sec

Gr.: basaltic boulders (50 cm—1 m ø),
gravel (5—10 cm ø), sand

Chem. Dat.: pH: 7.9

Cond.: 108 µSiemens

Tot. H.: 1.8° dH

Fauna: a) Banks (0—30 cm/sec):

Caridina typus; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec—75 cm/sec):

Macrobrachium lar; *Septaria borbonica* (5—10/dm²).

8. F/An/25 / 25. 3. 1974: River Pomoni, approx. 100 m from the mouth; SE-coast; surrounding: plantations, scrub, villages; sunny (Pl. 6, Fig. 29, 30).

Alt.: 1–2 m

Gr.: basaltic boulders (50 cm–1 m \varnothing),

Br.: 10–20 m

gravel (5–10 cm \varnothing), sand

Te.: 25° C (14^h)

Gen. Chem.: No dates!

D.: 5–20 cm

C.: 50–75 cm/sec, b.: 20–30 cm/sec

Fauna: a) Banks (0–30 cm/sec):

Caridina brachydactyla; Leptophlebiidae gen. spec.-larvae; *Trithemis arteriosa*-larvae; Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm/sec–75 cm/sec):

Macrobrachium lar; *Septaria borbonica* (1¹/₁₆ m², many eggs on stones).

c) On the borders:

Imagos of *Trithemis arteriosa*.

9. F/An/26 / 25. 3. 1974: Mouth of the River Bandoni on the SE-coast; surrounding: coconut-plantation, scrub; sunny.

Alt.: 1–2 m

Gr.: basaltic boulders

Br.: 5 m

Gen. Chem.: pH: 7.4

D.: 10–20 cm

Cond.: 85 μ Siemens

C.: 50 cm/sec–1 m/sec

Tot. H.: 1.7° dH

Fauna: a) On stones near the banks (30–50 cm/sec):

Clithon comorensis (10/dm²).

10. F/An/3 / 3. 3. 1974: Sources of Papani, S of Domboni on the W-coast; from a steep slope to the coast flow many smaller and larger branches which run 10–30 m directly in to the sea; surrounding: above the sources on the slope: dense forest and scrub, around the sources gravel and sand of the sea-shore; one of the sources of Papani is used as a bathing-place.

Alt.: 1–2 m

Gr.: basaltic boulders (20–30 cm \varnothing),

Br.: 1–2 m

gravel (5–10 cm \varnothing), sand

Te.: 23.6° C (15^h)

Gen. Chem.: pH: 7.7

D.: 2–5 cm

Cond.: 216 μ Siemens

C.: 1 m/sec, p.: 0–20 cm/sec

Tot. H.: 3.7° dH

Fauna: a) Small pools between cascades (0–20 cm/sec):

Macrobrachium sp.

b) Medium to strong current (30 cm/sec–1 m/sec):

Neritina pulligera stumpfi (sporadic), *Septaria borbonica* (2–3¹/₁₆ m², going till 10–15 m from the sea), *Neritilia consimilis* (sporadic).

A sample of algae from stones was taken.

B.5. Stagnant waters

1. F/An/13 / 12. 3. 1974: Crater lake, called Lac Sacré or Dzialandze, a pond in an extinct volcano-crater on the slope of the N^oTingui; surrounding:

primary and partly secondary forest and scrub (Pl. 6, Fig. 31). The water level was in March 1974, after very heavy rains, relatively high.

Alt.: 900 m

D.: 200–300 m

Te.: surface near the banks: 25° C (11h):

12. 3. 1974

Gr.: banks: basaltic boulders, gravel, sand, partly muddy with vegetable debris, on the borders stands of rushes (Juncaceae)

Gen. Chem.: pH: 8.6

Cond.: 35 μ Siemens (!)

Tot. H.: 0.6° dH (!)

Fauna: a) On the banks:

cf. *Cloëon* sp.-larvae; larvae of the Odonata: *Enallagma kauderni*, *Trithemis arteriosa*, *Rhyotemis* (?) or *Zygomma* (?) sp., *Orthetrum julia falsum* (all very frequent); *Procladius*-, *Ablabesmyia*-, *Chironomus*-, *Polypedilum* sp.-larvae, Tabanidae-larvae; *Gambusia affinis holbrooki* (introduced).

b) On the borders:

Imagos of *Paratettix cinereus*; *Enallagma kauderni*, *Trithemis arteriosa*, *Orthetrum julia falsum*.

A sample of gelatinous, globular algae, covering stones on the banks was taken.

3.3. Mascarene Archipelago: La Réunion

3.3.1. Geography

The Mascarene Archipelago comprises the three volcanic islands of La Réunion, Mauritius and Rodriguez (Fig. 1). It is situated in the western Indian Ocean, about 700 kms east of Madagascar, between longitude 55°32' to 63°30' and latitude 21°7' to 19°40'.

La Réunion (Fig. 4) has a total surface area of 2512 km², its mountainous and steep topography (highest elevations: Piton des Neiges with 3069 m (Pl. 7, Fig. 32), and Piton de la Fournaise with 2366 m) is concordant with a very narrow submarine plateau having a maximum width of 7 km. The island lies to the SW of the Mascarene Plateau and is separated from Mauritius by oceanic depths of more than 4000 m. At sea level, La Réunion is elliptical in outline, with a major axis (NW–SE) of 75 km and minor axis of 55 km (FISHER & al. 1967; McDOUGALL 1971; MONTAGGIONI 1974).

3.3.2. Geology, Petrology and Physiography

The island is built by two volcanoes, the now extinct Piton des Neiges in the NW and the still active Piton de la Fournaise which forms the SE one-third of La Réunion. Piton des Neiges is a large shield volcano with an average slope of about 7° from sea level. It is approximately circular in outline with diameter of about 50 km. Apart from a number of spectacular gorges with torrents, the original form of Piton des Neiges is quite well preserved (McDOUGALL 1971). In marked contrast, the central regions of the volcano have been eroded into three great cirques, an extreme development of amphi-

theatre-headed valley erosion: Cirque de Cilaos, Cirque de Mafate and Cirque de Salazie (UPTON & WADSWORTH 1965). Piton des Neiges is apparently unique in its combination of extreme dissection and variety of rock types. Not only the youngest lavas and ashes largely preserved but, as a result of

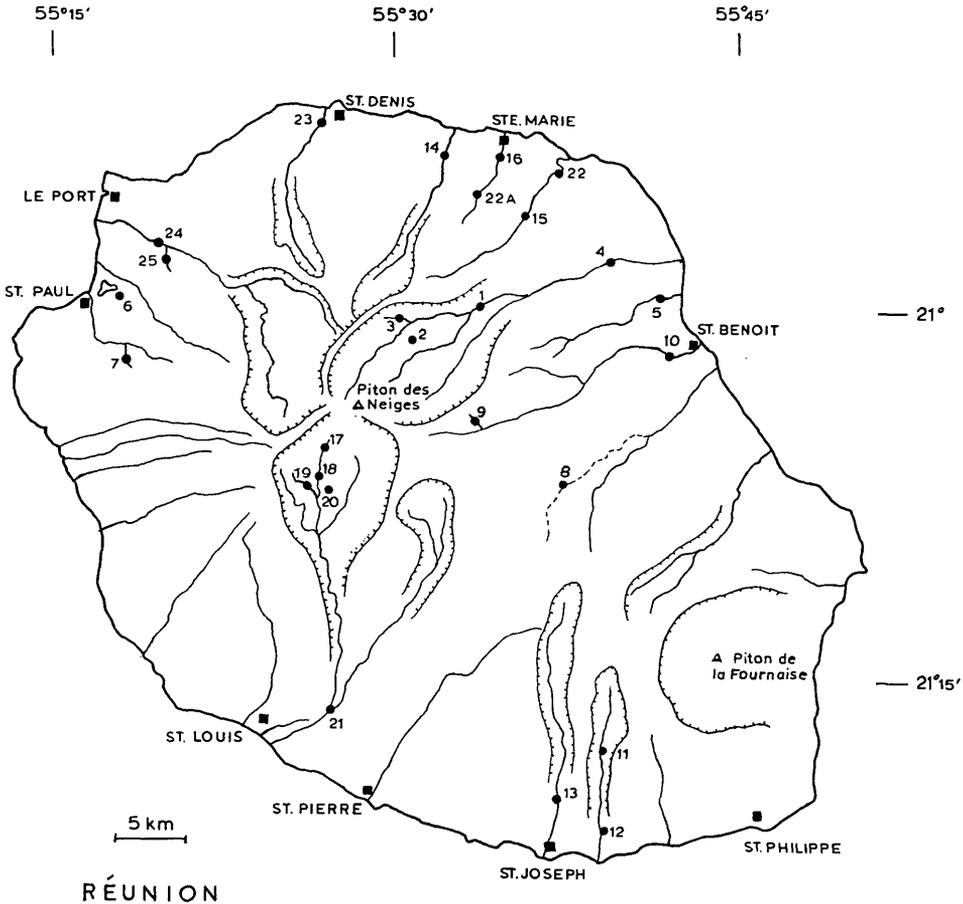


Fig. 4. Mascarene-Archipelago: La Réunion with the numbers of the stations on the rivers

amphitheatre-headed valley erosion on a prodigious scale, relatively ancient suites of effusive and intrusive rock, ranging from ultrabasic to acid in composition, are displayed for examination deep within the core of the original volcano. The oldest exposed rocks in Piton des Neiges occur in the cirques and are altered lavas and agglomerats that are intruded by inclined sheets of basaltic and ultramafic composition, and by basalt dykes. The Cirque agglom-

merate is a thick sequence of olivine basalts. Scoriaceous tops and bottoms are usually developed with marked oxidation at upper surfaces. The exposed thickness of the olivine basalt lavas exceeds 1000 m in some areas. They are disconformably overlain by massive flows of alkali andesite and feldsparphyric basalt. In some central regions these flows attain a thickness of at least 700 m, but thin rapidly outward (McDOUGALL 1971).

A number of ancient terraces, composed of fluvial sands and pebblebeds, occur in the river gorges draining out from the cirques. Some of these, through which the streams have trenched deep ravines, are more than 100 m thick. At present, deposition of this sort of material is occurring only in the deltaic fans at the seaward ends of the gorges. It is probable that the older deposits were accumulated in large temporary lakes formed by the ponding of the rivers behind dams created by massive landslides from unstable mountain-sides (UPTON & WADSWORTH 1965). Palaeomagnetic measurements with a short-period astatic magnetometer were executed by CHAMALAUN & McDOUGALL (1966), and a detailed K-Ar study of subaerial lavas was made by McDOUGALL (1971).

These studies show the subaerial basaltic shield composing the lavas of Piton des Neiges were erupted from the late Pliocene at about 3 million to 1 million years and 0.55 to 0.43 million years ago. Following a third episode, a hiatus of about 100,000 years, alkali andesites and basalts were erupted in a fourth episode between about 350,000 and 70,000 years ago. The younger and still active volcano, Piton de la Fournaise has been active over at least 360,000 years. It is built entirely of basaltic lavas.

McDOUGALL stated that the focus of basaltic eruption has migrated progressively toward the SE with time. It may indicate that the island has moved to the NW, away from the SW-branch of the Mid-Indian Ocean ridge, across the source region for the magma in the upper mantle.

3.3.3. Climate

The climate of La Réunion, which is tropical on the whole, is actually altered by the Ocean and by altitude—two factors determining a host of microclimates. There are really — as in Seychelles and Comoros — two seasons: The winter or fresh season which lasts from May to November. The feature of this time of year is the general fall in temperature with persistent drought in the zone "Under the wind". Fine weather then prevails on the island, the only disturbance being occasional showers in the "Windy zone".

The summer or hot season consists of three warm and moist months between December and March. The trade winds then lose some of their intensity and the warming of the air affects the island as a whole. Even so, really hot days are uncommon and peculiar to low-lying areas. The nights are fresh, however, above 500 m.

The mission 1974 was on the island during the month April, the end of the hot season. Following are given in a list some average dates of temperature

and rainfall from the "Service Météorologie Nationale" of La Réunion after measurements of the last ten years at points of different altitude.

Abbreviations: P. d. C. = Plain des Caffres (1550 m);
 C. = Cilaos (1200 m);
 P. d. P. = Plain des Palmistes (964 m);
 T. = Takamaka (850 m);
 Le M. = Le Mont (400 m);
 St. D. = St. Denis (10 m);
 St. G. = St. Gilles (5 m);
 E. S. = Etang-Salé (5 m).

Air-Temperature (in ° C)	P. d. C. (1550 m)	P. d. P. (964 m)	Le M. (400 m)	St. D. (10 m)	E. S. (5 m)
1. Long-period annual mean air-temperature	13.2	16.1	21	23.6	23.1
2. Maximum annual mean air- temperature	17.4	20.6	24.4	27.2	27
3. Minimum annual mean air- temperature	9.1	11.6	21	20.1	17.3
4. Maximum monthly mean air-tempera- ture in summer	Feb.: 16.8	Feb.: 19.4	Feb.: 23.7	Feb.: 26.4	Feb.: 26.8
5. Minimum monthly mean air-tempera- ture in winter	Aug.: 9.7	Aug.: 12.5	Aug.: 18.1	Aug.: 20.9	Aug.: 19.5
6. Highest maximum monthly mean air- temperature in summer	Feb.: 20.6	Feb.: 24.1	Feb.: 26.9	Feb.: 29.9	Feb.: 27
7. Lowest minimum monthly mean air- temperature in winter	Aug.: 5.6	Aug.: 8	Aug.: 14.7	Aug.: 17.2	Aug.: 17.3
8. Absolute maximum daily air-tempera- ture in summer	Feb. 1973: 25.2	Feb. 1973: 29	Feb. 1961: 30.8	Jan. 1967: 33.8 (!)	Jan. 1970: 35.9 (!)
9. Absolute minimum daily air-tempera- ture in winter	Sept. 1969: -1.3 (!)	Aug. 1963: 2.8	Aug. 1973: 11.2	Aug. 1954: 12.8	Jun. 1967: 8.8

In the month of April, transition from summer to winter, when the mission was on La Réunion in 1974 the following measurements were made:

1. Mean air-tempera- ture of April 1974	14.8	17.9	22.7	24.8	24.6
2. Maximum mean air-temperature of April 1974	18.7	22.4	26.1	28.3	30.2
3. Minimum mean air-temperature of April 1974	11.1	13.3	19.3	21.3	19.1

Rainfall (in mm)	P. d. C. (1550 m)	C. (1200 m)	T. (850 m)	P. d. P. (964 m)	LeM. (400 m)	St. D. (10 m)	St. G. (5 m)
1. Annual mean	2313	2393.7	7578.1(!)	4667.7	1555	1157	541.7
2. Maximum monthly mean	Jan.: 573	Mar.: 733.1	Mar.: 1562.7 (!)	Mar.: 987.8	Mar.: 327.9	Jan.: 218.8	Mar.: 106.5
3. Minimum monthly mean	Nov.: 373	Aug.: 30.9	Oct.: 320.7	Aug.: 200.6	Aug.: 25.9	Aug.: 21.1	Aug.: 4.8 (!)

In the month April 1974, when the mission was on La Réunion, the following rainfall was measured:

April rainfall, 1974	186.5	261.1	739	412.1	149	100.7	48.5
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3.3.4. Vegetation

The original vegetation of La Réunion included more than 300 endemic species peculiar to these island. The coloured-wood forests convey the impression of a return to the Tertiary age with their tamarind, reed and palmetto woods following one another on the mountain slopes. The moist undercover is rich in mosses, lichens and ferns and flowering orchids. Finally, very high up are the tree-ferns, mountain tamarins, *Cryptomeria* and others, the last trace of vegetation encountered before reaching the aridity of the summits. Among the exotic species, may be noted wild vine, madwort, furze and brown bringellier. Many fruit trees like litchis, mangoes, citrous trees, medlars, coffee and bananas, not to mention many flowers, have been introduced by man near the villages.

The coco palms, filaos, acacias and still more the Japanese cryptomerias, which are not unlike the European fir, have strongly contributed to the great diversity of Réunion landscape. In the lower parts the plantations of sugar-cane dominate, and on high-lying grounds geraniums and vetiver are grown over many acres. Tobacco and tea are in the first stage of production; smaller cultivations include vanilla, maize, beans, pineapples and different vegetables.

3.3.5. Description of the Stations

A. La Réunion

A.1. Upper courses between 1500 m and 700 m altitude:

1. F/Ré/17 / 13. 4. 1974: Headwater in the misty rain-forest of Coteau Kergveguen in the mountains of the Piton des Neiges (Cirque de Cilaos); torrent in a steep slope; shady (Pl. 7, Fig. 33).

Alt.: 1500 m

Br.: 10 cm—1 m

Te.: 16° C (16^h): 13. 4. 1974

D.: 1—3 cm

C.: c.: 75 cm—>1 m/sec, b. and p.:
0—10 cm/sec

Gr.: basaltic boulders (50 cm—1 m ø),
gravel (5—20 cm ø), sand; stones
covered with algae

Gen. Chem.: pH: 7.9

Cond.: 52 µSiemens

Tot. H.: 1.15° dH

Fauna: a) Banks and pools (0—10 cm/sec):

On stones: *Sicilicula borbonica* (frequent)

b) Medium to strong current (50 cm/sec—>1 m/sec):

Cardiocladius spec.-larvae (sporadic).

A sample of algae from stones was taken.

2. F/Ré/18 / 13. 4. 1974: Bras de Benjouin of the River Cilaos, coming from the SW-slope of the Piton des Neiges, near the road from Cilaos; very steep slope; sunny (Pl. 7, Fig. 34).

Alt.: 1400 m

Br.: 1—3 m

Te.: 15.2° C (17h): 13. 4. 1974

D.: 5—10 cm

C.: c.: 1 m—1.5 m/sec, b. and p.: 30 cm/sec

Gr.: basaltic boulders (1—2 m ø), gravel,

b. and p.: sand and stones covered with algae

Gen. Chem.: pH: 8

Cond.: 130 µSiemens

Tot. H.: 3° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Hydroptilidae gen. spec.-larvae; Rhagionidae gen. sp.-larvae, *Cardiocladius*-, *Cricotopus*-, *Rheocricotopus*-, *Chironomus*-, *Polypeditum*- and *Rheotanytarsus* sp.-larvae and -pupae; *Physa borbonica* (5—10/dm²; with spawn).

b) Medium to strong current (30 cm/sec—>1 m/sec):

Hydropsychidae gen. spec.-larvae and -pupae (5/dm²); Rhagionidae gen. sp.-larvae, Simuliidae gen. spec.-larvae (1—2/cm²) and -pupae (5—10/dm²).

c) Hygropetric areas on rocks:

Limonia sp.-larvae.

A sample of algae from the stones was taken.

3. F/Ré/19 / 14. 4. 1974: Confluence of the Bras des Étangs and the Ravine Prudent; affluent of the River Cilaos near the town of Cilaos; 300 m upstream a thermal-source with a temperature of 39° C and high content on ironoxyd flow in; the river crosses a steep meadow-slope; on the borders, shrubby; sunny.

Alt.: 1200 m

B.: 1—5 m

Te.: 18.2° C (11³⁰): 14. 4. 1974

D.: 5—20 cm, p.: 30—50 cm

C.: c.: 75 cm—>1 m/sec, b. and p.:

30—50 cm/sec

Gr.: basaltic boulders (20—50 cm ø), gravel, b. and p.: muddy

Gen. Chem.: No chemical dates!

Fauna: a) Banks and pools (0—30 cm/sec, partly to 50 cm/sec):

Odonata gen. spec.-larvae; *Lymnaea (Radix) mauritiana*, *Physa borbonica* (both species with 5—10/dm²); *Bufo regularis* juv.; Surface: Veliidae gen. spec.; *Dineutus indus olivaceus*.

b) Medium to strong current (50 cm/sec—>1 m/sec):

Hydropsychidae gen. spec.-larvae (2—3/dm²); *Cardiocladius*-, *Cricotopus*-, *Eukiefferiella* spec.-larvae (2—3/dm²), Simuliidae gen. spec.-larvae (5—10/dm²).

A sample of gelatinous, globular algae from the stones in the cascades was taken.

A.2. Upper to Middle courses between 700 m and 200 m altitude:

1. F/Ré/9 / 8. 4. 1974: Ravine Mathérine, near the road St. Benoit-Takamaka, a tributary of the River Marsouin; torrent with waterfalls in a gorge on a steep slope; surrounding: shrubs and misty rainforest; partly shady.
 Alt.: 700 m Gr.: basaltic boulders (30–50 cm ø),
 Br.: 1–2 m gravel (5–20 cm ø), sand
 Te.: 18° C (12h): 8. 4. 1974 Gen. Chem.: pH: 7.85
 D.: 5–20 cm Cond.: 62 µSiemens
 C.: c.: 1.5–2 m/sec, b. and p.: 0–30 cm/sec Tot. H.: 1.25° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Anax imperator-larvae; *Physa borbonica* (5–10/dm²), *Omphalotropis picturata* (from the border).

b) Medium to strong current (50 cm/sec—>2 m/sec):

Baetidae gen. spec.-larvae (sporadic); Hydropsychidae gen. spec.-larvae (sporadic); *Cricotopus*-, *Rheocricotopus* sp., *Tanytarsus*-, *Rheotanytarsus* sp.-larvae and -pupae (sporadic), Rhagionidae gen. sp.-larvae, Simuliidae gen. spec.-larvae (5–10/dm²).

A sample of gelatinous, globular algae on the stones was taken.

2. F/Ré/3 / 4. 4. 1974: Tributary of the upper-course of the River Mât, near the road to Hellbourg in the Cirque of Salazie; torrent flowing through plantations of water-cress, surrounding secondary forest; partly sunny, partly shady.

Alt.: 650 m Gr.: basaltic boulders and gravel, stones
 Br.: 50 cm–1 m covered with gelatinous, globular and
 Te.: 23.2° C (15³⁰): 4. 4. 1974 filamentous green-algae; near the
 D.: 5–10 cm border: mat-like algae
 C.: c.: 50 cm–2 m/sec, b. and p.: 0– Gen. Chem.: pH: 8.3
 30 cm/sec Cond.: 250 µSiemens
 Tot. H.: 5.75° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Dactylosternum sp. (on and between filamentous algae: (30–50 cm/sec); *Thiara scabra* (2–3/dm²: 0–30 cm/sec), *Lymnaea* (*R.*) *mauritiana*, *Physa borbonica* (5–10/dm²: 0–30 cm/sec).

b) Medium to strong current (30 cm/sec–2 m/sec):

Hydropsychidae gen. spec.-larvae (sporadic), Hydroptilidae gen. spec.-larvae (in groups of 10–20/dm²); *Cardiocladius*-, *Eukiefferiella*-, *Cricotopus*-, *Rheocricotopus* sp.; *Thiara scabra* (1–2/dm²: 30–50 cm/sec), *Lymnaea* (*R.*) *mauritiana* (5/dm²: 30–75 cm/sec, under stones), *Physa borbonica* (5/dm²: 30–75 cm/sec, under stones). A sample of algae was taken.

3. F/Ré/1 / 4. 4. 1974: River Mât, near Salazie, cascade-river in a very deep, narrow gorge, the steep slopes on the borders with water-falls of 20–30 m height, covered with shrub and forest; partly sunny (Pl. 7, Fig. 35, 36).

Alt.: 450 m
 Br.: 5–10 m
 Te.: 21.5° C (11^h)–23.4° C (13^h): 4. 4.
 1974
 D.: 30 cm, p.: 1–2 m
 C.: c.: 1–2 m/sec, b. and p.: 0–30 cm/sec

Gr.: basaltic rocks, boulders (50 cm–
 2 m \varnothing), gravel, p.: sand
 Gen. Chem.: pH: 8.3
 Cond.: 235 μ Siemens
 Tot. H.: 4.9° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Lymnaea (R.) *mauritanica*, *Physa borbonica* (spawn); Surface: *Dineutus indus olivaceus*.

b) Medium to strong current (30 cm/sec–2 m/sec):

Hydropsychidae gen. spec.-larvae; *Cardiocladius*-, *Cricotopus*-, *Eukiefferiella*-, *Smittia* sp.-larvae (20/dm²), Rhagionidae gen. sp.-larvae, Simuliidae gen. spec.-larvae (1–2/dm²).

c) Hygropetric areas on rocks:

Limonia sp.-larvae (2–5/dm², *Sarcophaga* sp.-larvae; *Lymnaea* (R.) *mauritanica*, *Physa borbonica*.

A sample of drift (1^h) and a sample of algae, covering the stones were taken.

4. F/Ré/11 / 9. 4. 1974: River Langevin, between St. Philippe and St. Pierre; near the border small pools (Pl. 7, Fig. 37).

Alt.: 400 m
 Br.: 6–8 m
 Te.: 17.8° C (15^h): 9. 4. 1974
 D.: 10–20 cm
 C.: c.: 75 cm/sec–>1 m/sec

Gr.: basaltic rocks, boulders (20–30 cm
 \varnothing), gravel, sand
 Gen. Chem.: pH: 7.75
 Cond.: 69 μ Siemens
 Tot. H.: 1.1° dH

Fauna: a) Pools near the border:

Nais communis; Odonata-larvae; *Chironomus* sp., *Procladius* sp., *Rheotanytarsus* sp.-larvae; Naucoridae gen. spec.; *Berosus vinsoni*, *Laccobius mascarensis*, *Gnignotus lobulatus*, *Laccophilus irroratus*; ta dpoles.

b) Medium to strong current (75 cm/sec–>1 m/sec):

Hydropsychidae gen. spec.-larvae and -pupae (5–10/dm²); *Cardiocladius* spec.-larvae (10–20/dm²).

A sample of gelatinous, globular algae from the rocks was taken.

A.3. Middle to Lower courses between 200 m and 50 m altitude:

1. F/Ré/21 / 14. 4. 1974: River Cilaos, tributary of the River St. Etienne, near St. Louis; sunny.

Alt.: 200 m
 Br.: 20 m
 Te.: 24° C (16^h): 14. 4. 1974
 D.: 5–10 cm
 C.: c.: –>1 m/sec, b. and p.: 0–10 cm/sec

Gr.: basaltic boulders (30 cm \varnothing), gravel
 (5–10 cm \varnothing), near the banks muddy
 and paddings of algae
 Gen. Chem.: pH: 8.8
 Cond.: 258 μ Siemens
 Tot. H.: 8.8° dH

Fauna: a) Banks and pools (0–10 cm/sec):

Odonata-larvae; Hydroptilidae gen. spec. (very frequent); *Lymnaea* (R.)

mauritiana (10–20/dm²), *Physa borbonica* (10–20/dm² — both species partly in copula, many spawn).

b) Medium to strong current (>1 m/sec):

Hydropsychidae gen. spec.-larvae and -pupae (10/dm²); *Rheocricotopus* spec.-larvae (20–30/dm²), *Rheotanytarsus* sp.-larvae (30–50/dm²), Simuliidae gen. spec.-larvae (sporadic).

A sample of paddings of green-algae from the banks was taken.

2. F/Ré/15 / 12. 4. 1974: River St. Suzanne, below the waterfalls of Niagara with a height of 40 m, the river flows out from a basin below the waterfall (diameter: approx. 80 m), the basin and waterfall sunny, the flowing water partly shady by shrubs on the borders (Pl. 8; Fig. 38 and 39).

Alt.: 172 m

Br.: River on the flow-out: 5–10 m

Te.: 23.5° C (10h): 12. 4. 1974

D.: more than 1 m

C.: basin: 0, river: 30–50 cm/sec

Gr.: Basin: basaltic gravel, near the banks: muddy sand and stones, plants from the border hanging in the water; River: basaltic boulders, gravel, near the banks: muddy

Gen. Chem.: pH: 7.4

Cond.: 92 µSiemens

Tot. H.: 1.65° dH

Fauna: a) Banks of the Basin after the waterfall:

Dugesia aff. *gonocephala* (2–3/dm²); *Caridina typus*, *C. brachydactyla brachydactyla* (very frequent); Zygoptera-larvae; *Laccobius mascarensis*, *Paracymus chalceus*; Hydroptilidae gen. spec.-larvae (20–30/dm²); *Melanoides tuberculata* (rare), *Thiara scabra* (very frequent), *Lymnaea* (*R.*) *mauritiana* (10–20/dm²), *Physa borbonica* (sporadic); *Xiphophorus maculatus*; Surface: Veliidae gen. spec.

b) River flowing out from the Basin (30–50 cm/sec):

Eunapius sp.; *Macrobrachium australe*; *Orthocladius* sp., *Dicrotendipes* sp. *Neritina gagates* (1–2¹/₁₆ m²), *Septaria borbonica* (sporadic), *Neritilia consimilis Thiara scabra* (10/dm²).

A sample of algae from the Basin and a sample of algae from stones in the River flowing out from the Basin were taken.

3. F/Ré/22A / 15. 4. 1974: River St. Marie, near Flacourt; border with bamboo cane, shady.

Alt.: 156 m

Br.: 1–2 m

Te.: 21.3° C (16h): 15. 4. 1974

D.: 10–20 cm

C.: c.: 75 cm/sec — >1 m/sec, b. and p.: 30 cm/sec

Gr.: basaltic boulders (30 cm–1 m ø), gravel (3–10 cm ø), near the banks: muddy; algae very rare

Gen. Chem.: pH: 7.6

Cond.: 52 µSiemens

Tot. H.: 1° dH

Fauna: a) Banks (with floating plants from the border: 30 cm/sec):

Caridina typus (very frequent between floating plants); Odonata-larvae; *Physa borbonica* (3–5/dm², spawn); tadpoles.

b) Medium to strong current (75 cm/sec—1 m/sec):

Rheocricotopus spec., *Rheotanytarsus* sp.-larvae, Simuliidae gen. spec.-larvae (sporadic).

4. F/Ré/7 / 6. 4. 1974: Brook near the road Cap Homard—St. Gilles les Hauts, tributary of the Ravine St. Gilles, flowing through bush and meadows; shady.

Alt.: 150 m

Gr.: basaltic gravel, sand; near the banks: muddy

Br.: 1 m

Gen. Chem.: pH: 7.4

Te.: 19° C (15h): 6. 4. 1974

Cond.: 115 µSiemens

D.: 20—30 cm

Tot. H.: 2.3° dH

C.: 30—50 cm/sec

Fauna: a) Banks (30 cm/sec):

Lymnaea (R.) *mauritiana* (3—5/dm²), *Physa borbonica* (5—10/dm²); *Poecilia* (*Lebistes*) *reticulata*; Surface: Veliidae gen. spec.

b) Medium current (30—50 cm/sec):

Hydropsychiade gen. spec. larvae (5—10/dm²); *Cricotopus*-, *Rheocricotopus* sp.-larvae; *Lymnaea* (R.) *mauritiana* (sporadic), *Physa borbonica* (sporadic).

5. F/Ré/4 / 5. 4. 1974: River Mât, near the bridge of the coastal road St. André—Bras Panon—St. Benoit; flowing between plantations and scrub; sunny (Pl. 8; Fig. 40 and 41).

Alt.: 145 m

Gr.: basaltic boulders (1 m—10 m ø), gravel (5—30 cm ø), sand

Br.: 10—20 m

Gen. Chem.: pH: 8.15

Te.: 23.8° C (10h)—24.5° C (13h): 5. 4. 1974

Cond.: 152 µSiemens

D.: 10—30 cm

Tot. H.: 3.1° dH

C.: c.: 1—2 m/sec, b. and p.: 0—30 cm/sec

Fauna: a) Banks and pools (0—30 cm/sec):

Laccobius mascarensis (frequent); *Anopheles gambiae*; *Lymnaea* (R.) *mauritiana*; Surface: Veliidae gen. spec.; *Dineutus aereus*.

b) Strong current (1—2 m/sec):

Hydropsychidae gen. spec.-larvae (sporadic); *Cardiocladius*-, *Cricotopus*-, *Rheocricotopus* spec.-larvae, Simuliidae gen. spec.-larvae (2—3/dm²); *Lymnaea* (R.) *mauritiana* (sporadic: under stones).

c) Hygropetric areas on rocks near the border:

Lymnaea (R.) *mauritiana* (5/dm², copula).

A sample of drift (30 min.) was taken. Two samples of algae: a) paddings of algae from the banks; b) darkgreen filamentous algae and globular gelatinous algae from stones.

6. F/Ré/25 / 17. 4. 1974: Leftside affluent of the River Galets (F/Ré/24).

Alt.: 120 m

Gr.: gravel (5—20 cm ø), sand, mud

Br.: 1 m

Gen. Chem.: see River Galets No. 7,

Te.: 23.8° C (17h): 17. 4. 1974

F/Ré/24

D.: 1—2 cm, p.: 20—50 cm

C.: c.: 50—75 cm/sec, b. and p.: 0—30 cm/sec

Fauna: a) Banks and pools (0—30 cm/sec):

Dugesia aff. *gonocephala*; *Lymnaea* (*R.*) *mauritiana* (very frequent), *Physa borbonica* (very frequent), tadpoles; Surface: *Dineutus aereus*.

b) Medium to strong current (50—75 cm/sec):

Orthocladiinae gen. spec.-larvae (in muddy tubes), Simuliidae gen. spec.-larvae (sporadic).

7. F/Ré/24 / 17. 4. 1974: River Galets; E of the bridge near Le Port; flowing through a broad, trough-like valley coming from the Cirque de Malfat; surroundings: meadows, shrub; sunny (Pl. 8, Fig. 42).

Alt.: 118 m

Br.: 8—10 m

Te.: 24° C (15³⁰): 17. 4. 1974

D.: 20—50 cm

C.: c.: 75 cm/sec—1.5 m/sec, b. and p.:
10—30 cm/sec

Gr.: basaltic boulders (50 cm—3 m \varnothing),
gravel (10—20 cm \varnothing), sand, near
the banks: stones covered with
brown-green, gelatinous algae
Gen. Chem.: pH.: 8.65
Cond.: 142 μ Siemens
Tot. H.: 2.45° dH

Fauna: a) Banks and pools (10—30 cm/sec):

Laccobius mascarensis, *L. starmuehlneri* (both species swimming and crawling over brown-green gelatinous algae, covering the basaltic gravel and sand); *Lymnaea* (*R.*) *mauritiana* (5/dm², spawn, copula), *Physa borbonica* (5/dm², spawn, copula); Surface: Veliidae gen. spec. (very frequent).

b) Medium to strong current (75 cm/sec—1.5 m/sec):

Hydropsychidae gen. spec.-larvae and -pupae (sporadic); *Cricotopus*-, *Rheocricotopus*-, *Eukiefferiella* spec.-larvae (in muddy tubes: 10—20/dm²), Simuliidae gen. spec.-larvae (1—3/dm², in groups).

c) On the borders: Imago of *Trithemis annulata*.

A sample of brown-green, gelatinous algae covering the stones near the banks was taken.

8. F/Ré/12 / 9. 4. 1974: River Langevin, W of St. Philippe (Pl. 8; Fig. 43).

Alt.: 100 m

Br.: 10—15 m

Te.: 20° C (17^h): 9. 4. 1974

D.: 5—10 cm

C.: 30—50 cm/sec

Gr.: basaltic boulders (50 cm — 1m \varnothing),

gravel (10—20 cm \varnothing), sand; stones
covered partially with a gelatinous
film of diatoms and green gelatinous
globular algae and filamentous green-
algae

Gen. Chem.: pH.: 7.75

Cond.: 69 μ Siemens

Tot. H.: 1.1° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Atya pilipes (between floating plants from the border: very frequent); *Lymnaea* (*R.*) *mauritiana* (5—10/dm²), *Physa borbonica* (10—20/dm²).

b) Medium current (30—50 cm/sec):

Cardiocladius-, *Cricotopus*-, *Rheocricotopus*- spec.-larvae, Simuliidae gen. spec.-larvae and -pupae (3—5/dm²); *Lymnaea* (*R.*) *mauritiana* (sporadic), *Physa borbonica* (sporadic).

c) Hygropetric area on boulders:

Limonia sp.-larvae.

A sample of different algae was taken.

9. F/Ré/14 / 11. 4. 1974: River des Pluies, near the village of Rivière des Pluies; flowing through a broad trough-like valley, surrounding scrub, plantations; sunny (Pl. 9; Fig. 44).

Alt.: 100 m

Br.: 5–8 m

Te.: 23.5° C (14h): 11. 4. 1974

D.: 10–20 cm

C.: 50–75 cm/sec, b.: 0–30 cm/sec

Gr.: basaltic boulders (20–50 cm ø),
gravel, sand

Gen. Chem.: pH: 7.85

Cond.: 102 µSiemens

Tot. H.: 2.1° dH

Fauna: a) Banks (0–30 cm/sec):

Cricotopus-, *Rheocricotopus* sp.-larvae (1–3/cm²), *Lymnaea* (*R.*) *mauritiana* (5/dm²), *Physa borbonica* (5/dm²); Surface: Veliidae gen. spec.

b) Medium to strong current (50–75 cm/sec):

Anisoptera-larvae; Hydropsychidae gen. spec.-larvae and pupae (1–2/1/16 m²); *Rheocricotopus* sp.-larvae (1–3/cm²), Simuliidae: gen. spec.-larvae and -pupae (5–10/dm²).

A sample of algae covering the stones was taken.

10. F/Ré/13 / 10. 4. 1974: River Remparts near St. Joseph; this river flows subterranean upstream of the station and came to the surface of basaltic rocks (lava flow) in a waterfall of about 10 m height just before the station; below the waterfall it flows overground in a gorge to the coast; surrounding: shrub and plantations; partly sunny (Pl. 9, Fig. 45).

Alt.: 50–60 m

Br.: 5–8 m

Te.: 20.4° C (1h)–20.5° C (12h): 10. 4.
1974

D.: 5–10 cm

C.: 75 cm–1 m/sec, b.: 10–30 cm/sec

Gr.: flat basaltic gravel (5–20 cm ø),
sand

Gen. Chem.: pH: 7.7

Cond.: 93 µSiemens

Tot. H.: 1.9° dH

Fauna: a) Banks (10–30 cm/sec):

Caridina typus (sporadic); Surface: Veliidae gen. spec.

b) Medium to strong current (75 cm—>1 m/sec):

Caridina typus (only between long filamentous green-algae in the waterfall); *Cricotopus* sp., Ephydriidae gen. spec.-pupae (in the filamentous green-algae); *Sicyopterus* (? *Sicydium*) *lagocephalus* (with ventral sucker, attached on the rock in the waterfall).

Two samples of algae were taken: a) long filamentous green-algae from the waterfall, b) mat-like algae from the banks and ramified red-coloured algae from stones (freshwater-red-algae?).

A.4. Lower courses to the mouth regions between 50 m and 0 m altitude:

1. F/Ré/22 / 15. 4. 1974: River Suzanne; upstream of the road St. Suzanne—St. André on the borders bamboo cane; shady (Pl. 8, Fig. 46).

Alt.: 45 m

Br.: 5–8 m

Te.: 22.1° C (14h): 15. 4. 1974

D.: 50 cm–1 m (slightly flood water)

C.: 30–50 cm/sec

Gr.: Boulders and gravel between mud

Gen. Chem.: pH: 7.4

Cond.: 62 µSiemens

Tot. H.: 1.05° dH

Fauna: a) Banks (30 cm/sec):

Dugesia aff. *gonocephala*; *Caridina brachydactyla brachydactyla* (very frequent); Zygoptera-larvae (sporadic); *Thiara scabra* (very frequent); *Xiphophorus maculatus*; Surface: Veliidae gen. spec.

b) Medium current (50 cm/sec):

Macrobrachium australe; *Septaria borbonica* (sporadic), *Neritilia consimilis*.

2. F/Ré/23 / 16. 4. 1974: River St. Denis; near the capital St. Denis, flowing through a broad gorge, surrounding: scrubs, plantations, villages; influence of sewage; sunny (Pl. 8; Fig. 47).

Alt.: 25 m

Br.: 5–8 m

Te.: 23.2° C (17h): 16. 4. 1974

D.: 10–30 cm

C.: c.: 50 cm–1 m/sec, b. and p.: —
30 cm/sec

Gen. Chem.: pH: 8.4

Cond.: 105 µSiemens

Tot. H.: 2.5° dH

Gr.: basaltic boulders (20–50 cm ø),

gravel (5–10 cm ø); near the banks,

floating plants and roots from the

border (*Tradescantia* sp.) below

Hydrilla sp.; in the stream small

banks of boulders and gravel covered

with plants and mud

Fauna: a) Banks and pools (0–30 cm/sec):

Dugesia aff. *gonocephala* (sporadic); Odonata-larvae; *Thiara scabra* (5/dm²), *Indoplanorbis exustus* (10/dm²), *Lymnaea* (*R.*) *mauritiana* (10/dm²), *Physa borbonica* (10–15/dm²); *Xiphophorus maculatus*, *Poecilia* (*Lebistes reticulata*); Surface: Veliidae gen. spec.

b) Medium to strong current (50 cm/sec—>1 /sec):

Dugesia aff. *gonocephala* (sporadic: up to 50–75 cm/sec); Anisoptera-larvae (sporadic); Hydropsychidae gen. spec.-larvae (2–3/dm²); *Cardiocladius*-, *Cricotopus*-, *Polypedilum*-, *Rheotanytarsus* sp.-larvae (30–50/dm²), Simuliidae gen. spec.-larvae (5–10/dm²); *Melanoides tuberculata*; *Thiara scabra* (30–50 cm/sec: 5–10/dm²; in copula, many juvenile), *Indoplanorbis exustus* (30–50 cm/sec: 1–5/dm²; spawn), *Lymnaea* (*R.*) *mauritiana* (30–50 cm/sec: 3–5/dm²; in copula, spawn), *Ferrissia* (*Pettancylus*) sp. (30–50/dm²), *Physa borbonica* (30–50 cm/sec: 5–10/dm²; in copula, spawn).

A sample of mucous film of Diatoms and dark-green gelatinous, globular algae from the stones in the cascades was taken.

3. F/Ré/16 / 12. 4. 1974: River Ravine de Charpentier; upstream of the town of St. Marie; surrounding: bamboo-cane, partly shady (Pl. 8, Fig. 48).

Alt.: 20 m

Br.: 4–6 m

Te.: 23° C (14h): 12. 4. 1974

D.: 5–10 cm, partly: 10–30 cm

C.: 10–20 cm, c.: 75 cm—>1 m/sec

Gr.: basaltic gravel (5–20 cm \varnothing), sand

Gen. Chem.: pH: 7.1

Cond.: 65 μ Siemens

Tot. H.: 1° dH

Fauna: a) Banks (10–20 cm/sec):

Dugesia aff. *gonocephala* (2–3/dm²); *Caridina serratirostris*, *C. typus*, *C. brachydactyla brachydactyla*, *Varuna litterata*; *Physa borbonica* (sporadic); *Eleotris fusca*; Surface: Veliidae gen. spec.

b) Medium to strong current (50 cm/sec—>1 m/sec):

Macrobrachium lar, *M. australe*; Anisoptera-larvae; Simuliidae gen. sp.-larvae; *Septaria borbonica*, *Neritilia consimilis*.

c) Near the borders:

Bufo regularis

4. F/Ré/5 / 5. 4. 1974: River des Roches; near Beauvallon, 1 km from the mouth; surrounding: scrub and plantations; sunny (Pl. 8, Fig. 49).

Alt.: 10 m

Br.: 10–15 m

Te.: 26.6° C (14h): stream; 28.4° C (14h):
creek near the banks: 5. 4. 1974

D.: 30 cm–1.5 m

C.: 30–50 cm/sec, c.: 1–2 m/sec,

p.: 0–20 cm/sec

Gr.: basaltic boulders (30 cm–1 m \varnothing),

cascades changing with flater courses
of 40–50 m length, stones covered
with algae

Gen. Chem.: pH: 7.4

Cond.: 77 μ Siemens

Tot. H.: 1.5° dH

Fauna: a) Banks and pools (0–30 cm/sec):

Small brackish-water crabs; *Thiara scabra*.

b) Medium to strong current (50 cm/sec–2 m/sec):

Cricotopus-, *Rheocricotopus* spec.-larvae (between algae); *Neritina gagates* (5–10/dm²), *Clithon coronata* (1–2/dm²), *Septaria borbonica* (1–3/dm²), *Neritilia consimilis* (10/dm²: near the water surface).

A sample of algae covering the stones in the cascades was taken.

5. F/Ré/10 / 8. 4. 1974: River Marsouin; near St. Benoit, close to the mouth; surrounding: scrub and plantations; sunny.

Alt.: 10 m

Br.: 10–20 m

Te.: 22.7° C (15h): 8. 4. 1974

D.: 20–50 cm

C.: 50–75 cm/sec, c.: 1–1.5 m/sec,

b.: 0–30 cm/sec

Gr.: basaltic boulders (10–50 cm \varnothing),
gravel (5–10 cm \varnothing), sand

Gen. Chem.: pH: 8.1

Cond.: 80 μ Siemens

Tot. H.: 1.5° dH

Fauna: a) Banks (0–30 cm/sec):

Caridina serratirostris, *C. typus*, *Atya pilipes* (sporadic); Surface: Veliidae gen. spec.

b) Medium to strong current (50 cm/sec—1.5 m/sec):

Hydropsychidae gen. spec.-larvae (sporadic); *Neritina* sp. juv. (sporadic), *Septaria borbonica* (5—10¹/₁₆ m², mostly juvenile).

A sample of filamentous green-algae from the stones in the cascades was taken.

A.5. Stagnant waters:

1. F/Ré/20 / 14. 4. 1974: Mare de Cilaos; two connected ponds near the town of Cilaos; surrounding: scrub, partly polluted by domestic sewage.

Alt.: 1220 m

D.: 20—30 m

Te.: 23.7° C (15h): 14. 4. 1974

Gr.: banks: basaltic boulders, gravel and mud; polluted

Gen. Chem.: pH: 9.2

Cond.: 160 µSiemens

Tot. H.: 3.8° dH

Fauna: a) Banks:

Odonata-larvae; *Orthocladius* sp.-larvae; *Poecilia (Lebistes) reticulata*; *Rana mascariensis* and tadpoles; Surface: Veliidae gen. spec.

2. F/Ré/8 / 7. 4. 1974: Grand Bras de la Ravine Seche in the Plaine de la Palmiste; a temporary river, flowing only short after heavy rain-fall; outside of the rainy season other larger and smaller ponds and pools in basaltic channels and cavities; in a broad valley with scrub; apartly sunny (Pl. 10; Fig. 50, 51 and 52).

Alt.: 950 m

D.: of the largest and highest situated pond-like channel: approx. 150 m long and 5—10 m broad; D.: 1—2 m; the deeper situated (downstream) pond and pools only 50 cm—1 m in diameter and 50 cm—1 m deep; Rock-pools: 10—50 cm ø, 5—10 cm deep

Gr.: basaltic rocks, boulders, muddy lava-sand, vegetable debris

Te.: Biggest pond: 23° C (16h): 7. 4. 1974

Gen. Chem.: pH: 6.95

Cond.: 24 µSiemens

Tot. H.: 0.45° dH

Fauna: a) Largest pond:

Odonata-larvae; *Hyphydrus distinctus*, *Laccophilus lobulatus*; *Physa borbonica* (3—5/dm²); *Poecilia (Lebistes) reticulata*; tadpoles; Surface: Veliidae gen. spec., *Gyrinus nitidulus*.

b) Banks of the largest pond, rock-pools:

Notonectidae gen. spec. (very frequent); *Cricotopus* spec.-larvae; *Berosus vinsoni* (very frequent), *Guignotus strigicollis*, *Laccophilus irroratus*; Surface: Veliidae gen. spec., *Gyrinus nitidulus*.

A sample of algae from the banks and rock-pools was taken.

3. F/Ré/2 / 4. 4. 1974: Mare au Poule d'Eau; a pond surrounded by secondary forest of cultivated pines; in the pond are introduced *Tilapia*-species and other fishes.

Alt.: 679 m
 D.: approx. 1 km
 Te.: 27.5° C (15h): 4. 4. 1974

Gr.: near the banks: basaltic stones and
 muddy sand, vegetable debris
 Gen. Chem.: pH: 8.6
 Cond.: 240 µSiemens
 Tot. H.: 5° dH

Fauna: a) Near the banks:

Melanoides tuberculata (moderate), *Lymnaea* (R.) *mauritanica* (very frequent).

b) Near the borders:

Many imagos of Zygoptera and Anisoptera; *Bufo regularis*.

4. F/Ré/6 / 6. 4. 1974: Source de la Moulin d'Eau: source-pond and flowing out of a small brook of some hundred meters in the Étang St. Paul; near the coast is the pond in connection with brackish water; the source is surrounded by scrub, plantations and a dense growth of *Colocasia antiquorum*; sunny (Pl. 10; Fig. 53).

Alt.: 10–20 m
 D.: Source-pool: 20 m, 20–50 cm deep;
 the run-off brook: Br.: 50 cm, D.:
 20–30 cm, C.: 30–50 cm/sec
 Te.: Source-pool: 21.7° C (shady)–
 22.5° C (sunny) (10h)–23.7° C
 (sunny) (12h): 6. 4. 1974
 run-off brook: 21.2° C (10h): 6. 4.
 1974

Gr.: Source-pool: some basaltic boulders
 and gravel between mud; run-off
 brook: basaltic gravel and sand; the
 source-pool is partially covered with
 Lemnaceae, in the brook a dense
 vegetation of *Potamogeton pectinans*,
Naja madagascariensis, *Fissidens* (?)
 sp. and filamentous algae
 Gen. Chem.: pH: 8
 Cond.: 1600 µSiemens (!)
 Tot. H.: 10.7° dH (!)

Fauna: a) Source-pool:

Caridina serratirostris, *C. typus*; *Pseudagrion punctum*-, *Ceriagrion glabrum*-, *Anax imperator*-, *Trithemis annulata*-larvae; *Neritina gagates* (in groups of 5–10/1/16 m²: on stones), *Thiara scabra* (40–60/1/16 m²: on muddy ground); *Poecilia (Lebistes) reticulata*; tadpoles; Surface: Veliidae gen. spec., Gerridae gen. spec. (frequent, partly in copula).

b) Run-off brook of the source-pool (30–50 cm/sec):

Paludinella hidalgoi granum (5/cm²: on stones and between waterplants)

c) Near the borders:

Imagos of *Pseudagrion punctum*, *Ceriagrion glabrum*, *Anax imperator* and *Trithemis annulata*.

3.4. Mascarene Archipelago: Mauritius

3.4.1. Geography

The island of Mauritius lies about 2400 km E of SE-Africa and 850 km E of Madagascar near the southern end of the Mascarene Plateau (Fig. 1). It has a major, aseismic shallow structure that rises abruptly from oceanic depths of more than 3000 m on either side, and extends in a gentle arc from

the Seychelles Archipelago in the north over 2300 km toward the south (McDOUGALL & CHAMALAUN 1969). The island is situated in the Western Indian Ocean at longitude 57°30' E and latitude 20°20' S. It is approx. elliptical in outline with the major axis (NNE—SSW) of 60 km, minor axis about 45 km and covers 1856 km² (Fig. 5).

The central table land, separated from the plains on and near the coast is a plateau of 580 m altitude. It is surrounded by mountains with some prominent peaks, the Pieter Both with 821 m (Pl. 11, Fig. 54), the Pouce with 800 m, and the mountains of Rempart with 770 m altitude (Pl. 11; Fig. 55). The central table land inclines to the West and North. In the East raises the mountains of Grand Port and of Lion near Mahébourg. In the SW are situated the mountains and gorges of the Rivière Noire (Black River) with the highest elevation of Mauritius, the Piton de la Rivière Noire at 827 m.

3.4.2. Geology, Petrology and Physiography

The geology and petrology of Mauritius were described by DE CHATAL & BAISSAC (1949), SIMPSON (1951). WALKER & NICOLAYSEN (1954) and McDOUGALL & CHAMALAUN (1969) have made isotopic dating, geomagnetic polarity studies on the volcanic rocks from Mauritius.

According to these authors the rocks of the island, apart from marginal coral reefs are entirely volcanic. The denuded stumps of an older series of basalts being flooded by a twofold younger series, again basaltic. The older volcanic series represents a vast volcanic dome, comparable to the Piton des Neiges of La Réunion. Erosion and possibly paroxysmal eruptions and foundering, have reduced this to an irregular and broken ring of high serrated ridges reaching a height of 700—800 m above sea-level. Potassium-argon dates indicate that the main shield volcano was built subaerially between 7.8 and 6.8 million years ago in the early Pliocene (McDOUGALL & CHAMALAUN 1969).

The series consists of seaward-dipping layers of compact unvesiculated basalt and hard, coarse agglomerate with discontinuous lenses of tuff. Nearly all the basalts are olivine-bearing, though some are very poor in this mineral. Others are rich in pyric olivine, with or without pyric augite, and correspond to the oceanites and ankaramites of the neighbouring island of La Réunion (LACROIX 1936). Yet other flows contain abundant pyric plagioclase. The series is cut by numerous dykes which may have acted as lava-feeders. A few flows of oligoclase-basalt or trachyandesite were recorded, but the most highly differentiated types are trachytes and phonolitic trachytes, occurring mainly as conspicuous intrusive plugs of which the upper portions may have formed endogenous domes. The lava flows are massive and range from 5—30 m in thickness (WALKER & NICOLAYSEN 1954).

Some evidence is presented for caldera formation following the construction of the volcanic shield. Profound erosion subsequently destroyed much of the volcano, leaving only peripheral steep-sided massifs.

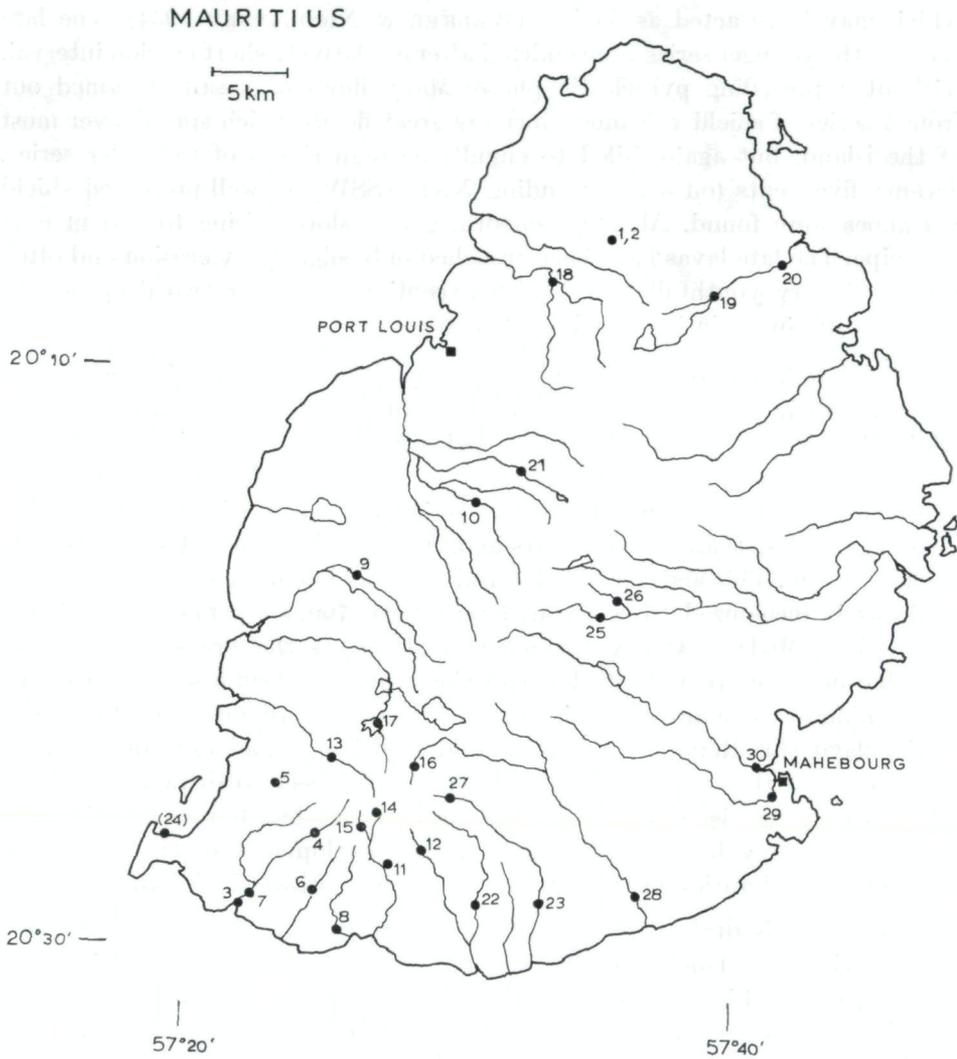


Fig. 5. Mascarene-Archipelago: Mauritius with the numbers of the stations on the rivers

The early lavas of the younger series were poured out as an intermittent flood of basalt following initial explosive activity, represented by basal agglomerate of unknown thickness. The basalt flows failed to submerge the high eroded ridges of the older series. They have a restricted distribution, being confined to the SW of Mauritius. There they have built up a high plateau, now carved by stream erosion into conspicuous amphitheatres headed by rapidly retreating falls. The series consists entirely of olivine-basalts which are generally mildly vesiculated. They are micropyric rather than pyric and the matrix is usually fine-grained, though some doleritic flows occur. Both lavas and basalt agglomerates are penetrated by numerous basalt dykes

which may have acted as feeders (WALKER & NICOLAYSEN 1954). The late lavas of the younger series were emitted after a relatively short erosion interval, without a preceding pyroclastic phase. Many flows of basalt streamed out from a series of shield volcanoes, forming great floods which spread over most of the island, but again failed to engulf the high ridges of the older series. Twenty-five vents (on a line trending NNE—SSW) on well-preserved shield volcanoes were found. All have smooth, gentle slopes rising to 700 m near Curepipe. The late lavas have been trenched only slightly by erosion and often present a very youthfull aspect with exception of one or two deep gorges. Yet they are overlain by raised coral reefs.

The late lavas are of very uniform composition and of much larger grain-size than their predecessors. They are strikingly vesiculated and consists of olivine-basalts and dolerites. Ropy surfaces and lava tunnels are common and fossil soils point to long periods of quiescence (WALKER & NICOLAYSEN 1954). Lavas of the younger volcanic series were erupted from 3.5 million years ago to less than 200.000 years ago, flooding the denuded stumps of the shield volcano. This activity was intermittend, as has been stated above, and a hiatus is recognized from about 2 million to 700.000 years ago, which is taken from MCDUGALL & CHAMALAUN (1969) as the break between the eruption of the early and late lavas of the younger volcanic series. Following the opinion of these authors, it is concluded that each island of the Mascarene Archipelago (La Réunion, Mauritius and Rodriguez) had developped independently, and that no correlation of age with respect to distance from the Mid-Ocean Ridge is observed. The volcanism that has built Mauritius and La Réunion may be a continuation of the development of the Mascarene Plateau with migration of the activity generally southward with time.

Mauritius is drained by many rivers and streams, the largest of which rises on the table land, receiving in their courses numerous tributaries from the mountains (Fig. 5). According to the season they vary in volume and occasionally some of them become quite dry during the winter. They are flowing for the most part on the structural plains of the later lavas, but many of them have had their courses determined from their inception by the primary channels produced where flows of later lavas abut against the slopes composed of the old complex. The most important of these, so called lateral streams, are the Rivers Gallets, Patates, Savanne, Eau Bleu, Créoles, Papayes and Tamarin.

These courses have been maintained to the present day, and erosion action tends to result in lateral movement of the river course, down the slopes of the old topography towards the tract covered by later lava flows. Exemples are the Rivers Tamarin and Rempart at their junction with River Papayes. These rivers have cut deep gorges bounded by actively retreating cliffs of later lavas on the side, and by the slope of the original old topography on the other (SIMPSON 1951).

The other consequent river run down the structural plateau to the sea which they reach apparently at grade, but this impression is given only because the shoreline has undergone recent submergence. They are seen to enter deep embayments so formed as a series of rapids. Examples are the Grand River North West, the Rivers Baie du Cap, des Anguilles, du Poste, Grand River South West and Rempart. The remarkable erosion power of these rivers is shown by deep steep-sided ravines (Pl. 14, Fig. 73, 74) in which they flow.

The Black River (Pl. 14, Fig. 72) has eroded out a 600 m deep gorge of the old complex. It is believed that a considerable amount of gorge-cutting had taken place prior to the outburst of later vulcanism and during the latter the gorges formed a channel-way by which lavas found their way to the western coastal plains. The River Baie du Cap (Pl. 15, Fig. 76, 77) established at the end of the first phase, since which time its erosive history has proceeded without complication due to later lava flow. The River des Gallets was originally initiated as a consequence, flowing down a rapid slope of first phase later lavas, a transverse belt of which it eroded away to reveal the underlying old complex now still exposed.

Subsequently, however, second phase later lavas overflowed the escarpment above and so made their way to sea. The new course of the River Gallets was then directed along the contact between eroded first phase and old lavas. The River Jacotet was initiated along the contact between first and second phase lavas (SIMPSON 1951).

Many spectacular waterfalls confirm the youthfulness of the physiography, like Rochester Falls, Cascade des Gallets, Chamarel Falls, Sept Cascades in the Tamarin gorge and cascades marginal to the Black River gorge where retreat of the later lavas of the central plateau is taking place. These falls are rapidly retreating upstreams as the present erosive cycle proceeds, and most lie at a distance of about 6—7 km from the sea.

From this point to sea level erosional river terraces are formed. Smaller streams usually show only one or two terraces whereas larger streams exhibit as many as four. According to MCINTIRE (1961) the river terraces indicate that the sea has not transgressed over them since their origin. They are indicators that the island has been relatively stable during and since Pleistocene times.

SIMPSON (1951) states that it may seem difficult to reconcile the great degree of gorge cutting and erosion with the almost perfect state of preservation of the volcanic land forms. But the extreme erosive power of the rapidly flowing streams cannot be over emphasized, flowing as they do for the most part in the relatively soft rocks of the later lavas and the dense cover of vegetation has also promoted deep weathering of the surface tracts.

In the interior and near the coast there are lakes, marshes and swamps. The Mare aux Vacaos is converted into the largest reservoir of the island.

Other artificial reservoirs are La Ferme, La Nicolière and Mare Longue. Grand Bassin and Bassin Blanc are true crater lakes (SIMPSON 1951).

3.4.3. Climate

At 20° S latitude Mauritius lies, like La Réunion, within the tropics and also has an oceanic type of climate. Average seasonal and diurnal variations of air-temperature are relatively small both being of the order 5° C which is sufficient, however, to provide a well-marked differentiation of the season. Departure of more than 2° C from the normal seasonal daily air-temperature is not common and usually identifiable with the passage of low pressure systems in the summer months and high pressure systems to the south of the island in the winter months. Increasing humidity accompanies the lower air-temperatures experienced in ascending from coastal region to the central plateau area.

In summer (November—April) the average mid-day air-temperature near sea-level is about 30° C with an absolute maximum of 35° C in February, the hottest month. In the centre of the island at about 600 m—700 m altitude the average mid-day air-temperature in February is 19° C and reaches 25° C as absolute maximum.

In winter (May—October) the average air-temperatures near the coast reaches about 24° C with a maximum of 29° C. August and September are the coldest months. In the centre of Mauritius, the average mid-day air-temperature in February is about 15° C with a dawn air-temperature of 13°—14° C.

Some data of normal mean air-temperatures available from the Meteorological Department of Mauritius are given below:

Abbreviations of the stations: Vac. Centre = Vacaos-Centre (465 m altitude);

Pa.-N. = Pamplémousses, Botanical Garden, North (85 m altitude);

Pl.-S. = Plaisance, Airport, South (60 m altitude).

Air-Temperature (in ° Celsius)	Vac.-Centre (465 m)	Pa.-N. (85 m)	Pl.-S. (60 m)
1. Long-period normal annual mean air-temperature	21.15	23.8	23
2. Maximum annual mean air-temperature	24.7	28.1	26.1
3. Minimum annual mean air-temperature	17.6	19.5	19.8
4. Maximum mean air-temperature of the hottest month	Feb.: 27.8	Feb.: 30.7	Feb.: 30
5. Minimum mean air-temperature of the coldest month	Aug.: 14.6	Aug.: 16.1	Aug.: 17.2
6. Absolute maximum monthly mean air-temperature 1972/73	March 1973: 28.1	Feb., March 1973: 31.3	Jan. 1972: 29.9
7. Absolute minimum monthly mean air-temperature 1972/73	Sept. 1972: 15.2	Sept. 1972: 14.9	Sept. 1972: 17.6

The monthly mean air-temperature in the months April and May 1974, the time when the mission was on Mauritius follow:

	Vac.-Centre (465 m)		Pa.-N. (85 m)		Pl.-S. (60 m)	
	April	May	April	May	April	May
8. Normal monthly mean maximum temperature	26.3	24.1	29.1	27.5	27.9	26.1
9. Normal monthly mean minimum temperature	19.3	17.2	20.4	18.9	21.1	19.4

The rainfall varies with height above sea-level and annual totals range from 1015 mm and less in some coastal districts to nearly 5080 mm on the windward slopes of the high plateau. The heaviest rains occur between January and May. From September to November the rainfall is relatively light. There are no very well defined rainy and dry seasons and almost every where a green cover of vegetation is maintained throughout the year.

Again some data of mean records of rainfall from the Meteorological Department of Mauritius:

Abbreviations: W = West of Mauritius;
 N = North of Mauritius;
 E = East of Mauritius;
 S = South of Mauritius;
 C = Center of Mauritius;
 A. D. = All districts of Mauritius together.

Rainfall-amount (in mm)	W	N	E	S	C	A. D.
1. Long-period annual mean	1149	1432	2632	2364	2273	2133
2. Maximum monthly mean in summer	March: 266	March: 259	March: 430	March: 377	March: 366	March: 352
3. Minimum monthly mean in winter	Aug.: 16	Oct.: 39	Oct.: 87	Oct.: 75	Oct.: 72	Oct.: 66
4. Absolute maximal amount of a month in 1972/73	Feb. 72: 264	Feb. 72: 366	Feb. 73: 405	Feb. 73: 437	Feb. 73: 550	Feb. 72: 373
5. Absolute minimal amount of a month in 1972/73	Sep. 72: 13	Sep. 72: 25	Sep. 72: 22	Sep. 72: 25	Sep. 72: 39	Sep. 72: 28

The monthly normal mean records from long-term measurements in the months April and May, when the mission was on Mauritius 1974:

	W	N	E	S	C	A. D.
6. April	116	175	312	300	240	253
7. May	55	120	206	186	147	161

Between the months of January and March very strong cyclones occur sometimes bringing very heavy rainfall. The highest mean wind velocity over one whole hour of cyclone reaches 150 km p. h., the highest gusts reaches 200—230 km p. h. The frequency of tropical cyclones (as recorded at Pamplemousses in the North) calculated on readings from 1876—1973 (98 years) with hourly wind speed over 40 km p. h. are:

November	December	January	February	March	April	May	Total
2	8	21	30	16	7	2	86

Humidity is generally high, and because of the maritime situation of the island, shows little variation during the day. Some data of humidity from the Meteorological Department of Mauritius from Plaisance in the South in 60 m altitude:

Relative Humidity (in %):

Normal annual mean humidity:	82	Maximum monthly mean humidity in February and March:	86
Minimum monthly mean humidity in September:	79	Normal monthly mean humidity of April	84
		of May	81

The hours of daylight are approximately 5^h to 19^h in the summer and 6^h to 18^h in winter. The duration of bright sunshine according data from the Meteorological Department of Mauritius from Plaisance in the South:

Duration of bright Sunshine (in hours):

Normal annual mean bright sunshine	2477	Maximum monthly mean bright sunshine in Dec. and Jan.	242
Minimum monthly mean bright sunshine in June	173	Normal monthly mean bright sunshine of April	191
		of May	190

From the meteorological data, given above, it is seen that the months April—May, the time of the stay of the mission at Mauritius, are the transition between summer and winter with average air-temperatures, rainfall, humidity and duration of bright sunshine.

3.4.4. Vegetation

Before the arrival of man in Mauritius (17th century) the island was covered by evergreen tropical primeval forest including many endemic species. The remains of these indigenous forests cover in the natural reserves of the mountains in the SW around 2000 ha (Black River Gorge). Among species which attain maximum height of about 15 meters and which yield timber of marketable value are the Ebene (*Diospirea mauritiana*), Natte (*Imbricaria*

maxima), *Tatamaka* (*Calophyllum inophyllum*), *Colophane* (*Canarium mauritianum*) and *Olivo* (*Elaeodendron orientale*). The main body of the forests is made up of *Anona mauritiana*, *Erythrospermum mauritianum*, *Haronga madagascariensis*, *Ochna mauritiana*, *Muscenda arcuata*, etc. among which many species are endemic. Small herbaceous plants and shrubs abound among the low undergrowth.

Forests of secondary growth comprise subspontaneous species such as *Tamarindus indica* and *Ravenala madagascariensis*, the latter forming almost forests in some areas. Dense and impenetrable undergrowths are made up largely of *Rubus moluccans*, *Lantana camera*, *Casuarina equisetifolia*, *Ficus bengalensis*, *Terminalia argiena*, *Erythrina indica*, *Pandanus utilis* etc., besides many species of the bambou and a great variety of edible-fruit bearers which are cultivated (SIMPSON 1951).

In the high plateau of the centre are many reforestations with introduced conifers, camphres and eucalyptus to replace the thicket and bushes. There are also plantations of commercial woods like teak and mahogany.

The coasts are bordered by a fringe of Australian casuarinas or filaos and almonds. Near the border of the sea, special, on the east-coast in the mouth of the rivers with influence of sea-water during high-tide, grow dense stands of mangrove. The rivers in the plains are bordered by *Pandanus*, bambous and *Colocasia antiquarum*.

Many tropical palms and trees are introduced from other regions for parks and gardens such as flamboyants, tulipe of Africa, bauhinia and jaracanda.

More than $\frac{2}{3}$ of Mauritius is cultivated by man and covered with extended plantations of sugar-cane, the most important plant of the island. In the dryer zones these plantations are sometimes under artificial irrigation. In the higher situated plains of the centre with high amount of rainfall are tea-plantations (Midland Reserves, La Flora).

On smaller areas — near the built-up areas with dense population — are to be found plantations of tobacco, bananas and different vegetables. Scrubs including *Aloë*, are to be found on the steep slopes of the mountains, interrupted by savanna and rock areas.

3.4.5. Descriptions of the stations

B. Mauritius

B.1. Upper courses between 700 m and 400 m altitude

1. F/Mau/14 / 2. 5. 1974: One of the sources of the River Gallets in the Plaine Champagne; surrounding shrub and marsh; sunny (Pl. 11; Fig. 56).

Alt.: 700 m

Br.: 1–2 m

Te.: 20° C (12^h): 2. 5. 1974

D.: 10–20 cm, p.: 50 cm

C.: c.: 75 cm/sec, b. and p.: 10–20 cm/sec

Gr.: red-brown (iron-ochre) mud on basaltic stones; waterplants, on the border bunches of Juncacea

Gen. Chem.: pH: 6.1

Cond.: 43 µSiemens

Tot. H.: 0.28° dH

Fauna: a) Banks and pools (10–20 cm/sec):

Odonata-larvae (on mud and between roots of plants of the border); Lepidostomatidae (?) gen. spec.-larvae; *Tanytarsus*-, *Chironomus* group-larvae; *Hyphydrus scriptus*, *Herophydrus vittatus*, *Cybister desjardinsi*; *Poecilia (Lebistes) reticulata*; Surface: Veliidae gen. spec., *Gyrinus nitidulus*, *Dineutus indus* f. typ.

b) Medium to strong current (50–75 cm/sec):

Zygonyx sp.-larvae.

A sample of algae from stones of the cascades was taken.

2. F/Mau/15 / 2. 5. 1974: Headwater of the River Gallets, before the confluence with the brook of No. 1. F/Mau/14 / and other brooks to a waterfall of 100 m in a deep gorge; surrounding: rests of primary forest; shady.

Alt.: 700 m

Br.: 2 m

Te.: 20.3° C (13h): 2. 5. 1974

D.: 10 cm, p.: 50 cm

C.: 50–75 cm/sec, c.: 1–2 m/sec, b. and p.: 20–30 cm/sec

Gr.: basaltic rocks, boulders, pools: sand and vegetable debris

Gen. Chem.: pH: 6.4

Cond.: 44 µSiemens

Tot. H.: 0.3° dH

Fauna: a) Banks and pools (20–30 cm/sec):

Caridina spathulirostris, *C. richtersi*; Odonata-larvae; *Cybister* sp.-larvae; *Polypedilum* spec.-larvae; Surface: Veliidae gen. spec.; *Gyrinus nitidulus*, *Dineutus indus* f. typ.

b) Medium to strong current (50 cm/sec–2 m/sec):

Eunapius michaelsoni; *Limnodrilus hoffmeisteri* (between muddy, gelatinous algae).

A sample of algae from stones in the cascades was taken.

3. F/Mau/16 / 2. 5. 1974: Upper course of the River du Poste; near the Grand Bassin Road, between Le Petrin and Grand Bassin; surrounding: shrub, marsh, near the border *Pandanus* sp., *Ravenala madagascariensis*; sunny (Pl. 11, Fig. 57).

Alt.: 700 m

Br.: 4 m

Te.: 21.2° C (14³⁰): 2. 5. 1974

D.: 10–30 cm, p.: 50 cm–1 m

C.: c.: 75 cm–>1 m/sec, b. and p.: 10–30 cm/sec

Gr.: basaltic rocks and boulders, floating filamentous green-algae and water-mosses

Gen. Chem.: pH: 6.55

Cond.: 54 µSiemens

Tot. H.: 0.52° dH

Fauna: a) Banks and pools (10–30 cm/sec):

Caridina richtersi (very frequent); *Pentaneura* sp.; Surface: Veliidae gen. spec.; *Dineutus indus* f. typ.

b) Medium to strong current (75 cm–>1 m/sec):

Caridina richtersi (only in small cavernes of the lavabasalt boulders!); Talitridae gen. spec. (like *Caridina*!); Zygoptera-larvae (under the stones),

Zygonyx sp.-larvae (between water-mosses); Hydropsychidae gen. spec.-larvae ($1-2^{1/16}$ m²).

A sample of filamentous algae and water-mosses from the stones in the cascades was taken.

4. F/Mau/27 / 7. 5. 1974: River des Anguilles, upper course near the tea-estate of Bois Cheri; surrounding: tea plantations and rests of secondary forests; partially shady (Pl. 11; Fig. 58).

Alt.: 580 m

Br.: 4-6 m

Te.: 19.4° C (11h)-19.5° C (12h): 7. 5. 1974

D.: 20 cm, c.: 3-5 cm, p.: 50 cm-1 m

C.: c.: 75 cm->1 m/sec, b. and p.: 20-30 cm/sec

Gr.: basaltic rocks and boulders (30 cm-1 m ø); on the stones filamentous green-algae, banks: muddy sand and bright-green cushions of tubelike algae

Gen. Chem.: pH: 7.65

Cond.: 97 µSiemens

Tot. H.: 1.95° dH

Fauna: a) Banks and pools (20-30 cm/sec):

Caridina richtersi (between floating roots, algae and vegetable debris); Lepidostomatidae (?) gen. spec.-larvae; Nepidae gen. spec.; *Conchapelopia* sp.; *Melanoides tuberculata* ($1-2^{1/16}$ m²), *Thiara scabra* (sporadic), *Lymnaea (Radix) mauritiana* ($5-10^{1/16}$ m²), *Physa borbonica* ($5-10^{1/16}$ m²); *Gambusia affinis holbrooki*; Surface: Veliidae gen. spec.; *Dineutus indus* f. typ.

b) Medium to strong current (75 cm/sec->1 m/sec):

Zygonyx sp.-larvae (between water-mosses); Hydropsychidae gen. spec.-larvae ($2-5^{1/16}$ m²); *Eukiefferiella*-, *Dicrotendipes* sp.-larvae; *Melanoides tuberculata* (sporadic under stones till 75 cm/sec).

Three samples of algae (and water-mosses) were taken: a) cushions of tubelike bright-green algae and waddings of green-algae; b) and c) filamentous green-algae from the stones and water-mosses.

5. F/Mau/25 / 6. 5. 1974: River Douady, upper course; a tributary on right side of the Grand River du Nord Est; surrounding: scrub and plantations; partly shady.

Alt.: 400 m

Br.: 3-5 m

Te.: 19.9° C (12h): 6. 5. 1974

D.: 5-10 cm, p.: 20-30 cm

C.: c.: 50-75 cm/sec, b. and p.: 20-30 cm/sec

Gr.: basaltic boulders (20-30 cm ø), gravel (2-5 cm ø), dense growth of Characea and filamentous algae, on stones globular algae

Gen. Chem.: pH.: 6.6

Cond.: 66 µSiemens

Tot. H.: 1° dH

Fauna: a) Banks and pools (20-30 cm/sec):

Caridina richtersi, *C. brachydactyla brachydactyla* (between floating plants, roots and waterplants very frequent); Odonata-larvae; Lepidostomatidae (?) gen. spec.-larvae; *Melanoides tuberculata* (sporadic), *Omphalotropis globosa* (sporadic), *Lymnaea (R.) mauritiana* ($1-5/\text{dm}^2$), *Physa borbonica* ($1-5/\text{dm}^2$); Surface: Veliidae gen. spec.; *Dineutus indus* f. typica.

b) Medium current (50—75 cm/sec):

Caridina richtersi, *C. brachydactyla brachydactyla* (between floating water-plants); *Zygonyx* sp.-larvae; Lepidostomatidae gen. spec.-larvae (between waterplants); *Melanoides tuberculata* (sporadic under stones).

A sample of filamentous algae and gelatinous globular algae from stones was taken.

6. F/Mau/26 / 6. 5. 1974: River du Nord Est, upper course; surrounding: plantations, scrub; sunny (Pl. 12, Fig. 59 and 60);

Alt.: 400 m

Br.: 10—20 m

Te.: 20.9° C (13^h): 6. 5. 1974

D.: 10 cm, p.: 1—2 m

C.: 50 cm/sec, b. and p.: 10—20 cm/sec

Gr.: basaltic rocks, boulders (1 m ø),
pools with iron-ochre mud; on
stones filamentous algae and water-
mosses

Gen. Chem.: pH: 7

Cond.: 69 µSiemens

Tot. H.: 1° dH

Fauna: a) Banks and pools (10—20 cm/sec):

Caridina richtersi (between floating waterplants: very frequent); Odonata-larvae; Lepidostomatidae (?) gen. spec.-larvae; *Chironomus* spec.-larvae; *Melanoides tuberculata* (2—3/dm²), *Lymnaea* (*R.*) *mauritiana* (3—5/dm²), *Physa borbonica* (3—5/dm²); *Gambusia affinis holbrocki*, *Xiphophorus maculatus*; Surface: Veliidae gen. spec., Gerridae gen. spec.; *Dineutus indus* f. typ., *Dineutus subspinosus*.

b) Medium current (50 cm/sec):

Lumbricidae gen. spec. (between water-mosses); *Zygonyx* sp.-larvae (between water-mosses).

A sample of filamentous algae and gelatinous globular algae from stones was taken.

B.2. Upper to Middle courses between 400 m and 200 m altitude

1. F/Mau/21 / 4. 5. 1974: Tributary of the River Moka, a tributary of the Grand River de North West; flowing through meadows, surrounded by sugarcane plantations; near the border dense vegetation of *Colocasia antiquorum*; slightly polluted (laundry place of a village nearby); sunny (Pl. 12; Fig. 61).

Alt.: 380 m

Br.: 1 m

Te.: 21.2° C (15^h): 4. 5. 1974

D.: 10—50 cm

C.: c.: 50 cm/sec, b. and p.: 10—30 cm/sec

Col.: opalescent

Gr.: basaltic boulders (50 cm— 1 m ø),
gravel (1—10 cm ø), banks with
mud and dense vegetation of water-
plants and filamentous algae

Gen. Chem.: pH: 6.65

Cond.: 116 µSiemens

Tot. H.: 1.85° dH

Fauna: a) Banks and pools (10—30 cm/sec) and medium current (50 cm/sec):

Caridina richtersi (between waterplants and algae); *Zygonyx* sp.-larvae (between floating waterplants and algae 30—50 cm/sec); *Melanoides tuberculata* (5—10/dm²: on muddy stones), *Lymnaea* (*R.*) *mauritiana* (10/dm² on water-

plants), *Physa borbonica* (10/dm² on waterplants); *Gambusia affinis holbrooki*, *Poecilia (Lebistes) reticulata*, *Xiphophorus maculatus*, tadpoles of *Bufo regularis*; Surface: Veliidae gen. spec., Gerridae gen. spec.; *Dineutus indus* f. typ.

A sample of filamentous algae from the stones was taken.

2. F/Mau/4 / 28. 4. 1974: Ruisseau Le Canal, tributary of the River Baie du Cap, near the road Fantaisie-Chamarel; surrounding: scrub; *Colocasia antiquorum*; partly shady (Pl. 12; Fig. 62).

Alt.: 300 m

Br.: 2–5 m

Te.: 21.2° C (10^h): 28. 4. 1974

D.: 5–30 cm

C.: 50–75 cm/sec, b. and p.: 10–

30 cm/sec

Gr.: basaltic boulders (30 cm–1 m ø),

gravel (10 cm ø), banks with muddy

sand

Gen. Chem.: pH: 7.7

Cond.: 130 µSiemens

Tot. H.: 1.85° dH

Fauna: a) Banks and pools (10–30 cm/sec):

Caridina typus; Zygoptera-larvae; Ranatridae gen. spec., *Melanooides tuberculata* (0–20 cm/sec: 5/dm², 20–50 cm/sec: sporadic), *Thiara scabra* (0–20 cm/sec: 5–10/dm², 20–50 cm/sec: sporadic), *Lymnaea (R.) mauritiana* (0–20 cm/sec: 5/dm²: on vegetable debris, 20–50 cm/sec: sporadic), *Physa borbonica* (0–20 cm/sec: 5/dm²: on vegetable debris, 20–50 cm/sec: sporadic); tadpoles of *Bufo regularis*; Surface: Veliidae gen. spec.; *Dineutus indus* f. typ.

b) Medium current (50 cm–75 cm/sec):

Macrobrachium australe; *Orthetrum stemmale stemmale*-, *Thalassothemis marchali*-larvae; Hydroptilidae gen. spec.-larvae (5–10/dm²: in groups on stones), Hydropsychidae gen. spec.-larvae (sporadic); Orthocladiinae gen. spec.-larvae; *Neritina gagates* (20–50 cm/sec: sporadic on stones, 50–75 cm/sec: 1–3^{1/16} m²: under stones), *Septaria borbonica* (50–75 cm/sec: 1–2^{1/16} m²: on stones).

c) Near the border:

Imagos of *Orthetrum stemmale stemmale*, *Thalassothemis marchali*; *Bufo regalis*.

Two samples of algae were taken: a) paddings of algae from the banks, b) filamentous algae from stones in the cascades.

3. F/Mau/10 / 30. 4. 1974: River Cascade after confluent with River Terre Rouge, tributary of the Grand River du North West; near the bridge of the road between Rose Hill and Reduit; deeply cut in basaltic rocks; surrounding: scrub, near the border dense growth of *Colocasia antiquorum*; sunny (Pl. 12; Fig. 63).

Alt.: 300 m

Br.: 4–6 m

Te.: 23.8° C (14^h): 30. 4. 1974

D.: c.: 3–5 cm, b. and p.: 30–50 cm

C.: 30–50 cm, c.: 50–75 cm/sec, b. and

p.: 10–30 cm/sec

Gr.: basaltic boulders (50 cm–1 m ø),

gravel, dense vegetation on floating

waterplants like *Hydrilla* sp., filamen-

tous algae, banks with *Salvia* sp.

Gen. Chem.: pH: 7.65

Cond.: 155 µSiemens

Tot. H.: 2.8° dH

Fauna: a) Banks and pools (10–30 cm/sec):

Caridina richtersi, *C. spathulirostris* (very frequent between floating roots, *Salvia* and floating *Hydrilla*); Zygopteralarvae, *Anax* sp.-larvae; *Aulacodes* sp.-larvae; *Melanoides tuberculata*, *Thiara scabra* (5–10/dm²), *Lymnaea* (*R.*) *mauritianae* (20–30/dm²!), *Physa borbonica* (20–30/dm²!), *Gyraulus mauritianus* (10/dm²); *Poecilia* (*Lebistes*) *reticulata*, *Xiphophorus maculatus*; Surface: Veliidae gen. spec., *Dineutus indus* f. typ.

b) Medium current (50–75 cm/sec):

Zygonyx sp.-larvae (between algae and water-mosses); Hydropsychidae gen. spec.-larvae (2–3¹/₁₆ m²); *Aulacodes* sp.-larvae (2–3¹/₁₆ m²); *Cricotopus* sp.

c) Near the borders:

Imago of *Trithemis annulata*

A sample of waterplants, *Salvia* sp., filamentous green-algae and of gelatinous globular algae from the stones was taken.

4. F/Mau/9 / 30. 4. 1974: River du Rempart West; near the road Trois Cavernes-Quatres Bornes; surrounding: scrub, sugar-cane plantations, near the border dense vegetation of *Colocasia antiquorum*; partly shady (Pl. 12; Fig. 64).

Alt.: 260 m

Br.: 3–6 m

Te.: 22.6° C (10h): 30. 4. 1974

D.: 20–50 cm, p.: 1–2 m

C.: 30 cm/sec, c.: 75 cm—>1 m/sec,

b. and p.: 10 cm/sec

Gr.: basaltic rocks with caverns, boulders, gravel dense vegetation of mosses,

Hydrilla sp. and other waterplants

near the banks

Gen. Chem.: pH: 7.5

Cond.: 200 µSiemens

Tot. H.: 4.25° dH

Fauna: a) Banks and pools (10 cm/sec):

Caridina richtersi (very frequent between roots and floating plants, *Hydrilla*); Zygoptera-larvae, Lepidostomatidae (?) gen. spec.-larvae; Nepidae gen. spec.; *Aulacodes* sp.-larvae; *Melanoides tuberculata* (3–5/dm²: on vegetable debris and rocks), *Lymnaea* (*R.*) *mauritianae* (10–20/dm²: on waterplants and debris), *Physa borbonica* (10–20/dm²: like *Lymnaea*); Surface: *Dineutus indus* f. typ.

b) Medium to strong current (30 cm/sec—>1 m/sec):

Eunapius carteri (under stones); *Zygonyx* sp.-larvae (between water-mosses); *Cricotopus*-, *Eukiefferiella* spec.-larvae; *Neritina gagates* (sporadic).

A sample of water-mosses from the stones was taken.

5. F/Mau/12 / 1. 5. 1974: Ruisseau Patates, a small river NE of Chemin Grenier, on the southern slope of the Piton Savanne of the Savanne Mountains; secondary forest with dense vegetation; partly shady (Pl. 13, Fig. 65).

Alt.: 220 m

Br.: 2–3 m

Te.: 22.6° C (13h): 1. 5. 1974

D.: 20–30 cm, p.: 50 cm—1 m

C.: c.: 75 cm—>1 m/sec, b. and p.:

10–20 cm/sec

Gr.: basaltic boulders (20 cm—1 m ø), gravel, very few algae

Gen. Chem.: pH: 7.9

Cond.: 93 µSiemens

Tot. H.: 1.45° dH

Fauna: a) Banks and pools (10–20 cm/sec):

Caridina richtersi (sporadic); Zygoptera-larvae; Lepidostomatidae (?) gen. spec.-larvae; *Melanoides tuberculata* (3–5/dm²) *Thiara scabra* (sporadic), *Lymnaea* (*R.*) *mauritiana* (5/dm²), *Physa borbonica* (5/dm²); *Gambusia affinis holbrooki*; *Poecilia* (*Lebistes*) *reticulata* (very frequent); Surface: Veliidae gen. spec., Gerridae gen. spec.; *Dineutus indus* f. typ.

b) Medium to strong current (75 cm—>1 m/sec):

Zygonyx sp.-larvae; Hydropsychidae gen. spec.-larvae; Simuliidae gen. spec.-larvae (sporadic); *Melanoides tuberculata* (sporadic: under stones up to 75 cm/sec).

B.3. Middle to Lower courses between 200 m and 10 m altitude

1. F/Mau/19 / 3. 5. 1974: River Rempart Est near Amaury-Bridge; flowing through plantations, mostly sugar-cane; on the borders dense growth of *Colocasia antiquorum*; slightly polluted (laundry place of a village nearby); sunny (Pl. 13; Fig. 66).

Alt.: 140 m

Gr.: basaltic boulders, gravel and sand covered with mud

Br.: 5–7 m

Gen. Chem.: pH: 7.6

Te.: 24° C (12h): 3. 5. 1974

Cond.: 163 µSiemens

D.: 30–50 cm, p.: 50 cm–1 m

Tot. H.: 2.3° dH

C.: c.: 75 cm—> 1m/sec, b. and p.:

10–20 cm/sec

Fauna: a) Banks and pools (10–20 cm/sec):

Caridina typus; Odonata-larvae; *Melanoides tuberculata*, *Thiara scabra* (10–20/dm²), *Lymnaea* (*R.*) *mauritiana* (sporadic), *Physa borbonica* (sporadic).

b) Medium to strong current (75 cm/sec—>1 m/sec):

Neritina gagates (1–2^{1/16} m²), *Thiara scabra* (sporadic under stones).

2. F/Mau/5 / 28. 4. 1974: Small brook near the road from Chamarel to Grande Case Noyal; flowing in small cascades from a slope covered with scrub; sunny.

Alt.: 130 m

Gr.: basaltic rocks

Br.: 30 cm

Gen. Chem.: pH: 8.2

Te.: 23.6° C (13h): 28. 4. 1974

Cond.: 220 µSiemens

D.: 10 cm

Tot. H.: 3.3° dH

C.: 50 cm/sec

Fauna: a) Stones near the banks (50 cm/sec):

Thiara scabra, *Lymnaea* (*R.*) *mauritiana*, *Physa borbonica*.

3. F/Mau/6 / 28. 4. 1974: River des Citronniers; near Bel Ombre.

Alt.: 130 m

Gr.: basaltic rocks and boulders covered with brown mud and algae

Br.: 1–3 m

Gen. Chem.: pH: 7.8

Te.: 23.5° C (17h): 28. 4. 1974

Cond.: 175 µSiemens

D.: 10 cm, p.: 50 cm

Tot. H.: 2.35° dH

C.: 30–50 cm/sec, p.: 0–10 cm/sec

Fauna: a) Banks and pools (0—10 cm/sec):

Caridina typus, *C. serratirostris*; Zygoptera-larvae; *Melanoides tuberculata*, *Thiara scabra* (5—10/dm²), *Lymnaea* (*R.*) *mauritiana*, *Physa borbonica* (both species sporadic); Surface: Veliidae gen. sp., Gerridae gen. spec.

b) Medium current (30—50 cm/sec):

Macrobrachium lar; *Septaria borbonica* (1¹/₁₆ m²), *Neritina gagates* (sporadic: under stones), *Neritilia consimilis*.

4. F/Mau/11 / 1. 5. 1974: Confluence of the brooks Rivulet Jacquot and Ruisseau Fayd'Herbe, tributaries of the middle course of the River des Gallets; near Chemin Grenier; flowing in a ravine between sugar-cane plantations; laundry place of a village nearby; partly shady (Pl. 13; Fig. 67).

Alt.: 130 m

Br.: 1 m, after the confluence a pool of 10 m in diameter, flow-off a brook of 1—2 m

Te.: 22.4° C (9³⁰)—23.4° C (12^h): 1. 5. 1974

D.: brooks: 2—5 cm, pool: 10—50 cm

C.: Fayd'Herbe flows as waterfall of 10 m height with 1—2 m/sec in the pool; Jacquot and flow off from the pool: 75 cm/sec—>1 m/sec, p.: 0—30 cm/sec

Gr.: basaltic rocks and boulders, gravel; pool with brown mud and some stones with filamentous algae

Gen. Chem.: pH: 7.45

Cond.: 134 µSiemens

Tot. H.: 2.35° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Dugesia aff. *gonocephala* (3—5/dm²); cf. *Glossosiphonia* (?) sp. (sporadic); *Caridina typus* (between roots and on ironochre mud, vegetable debris); Lepidostomatidae (?) gen. spec.-larvae; Zygoptera-, Anisoptera-larvae; *Melanoides tuberculata* (3—5/dm²), *Thiara scabra* (3/dm², found up to 50 cm/sec), *Lymnaea* (*R.*) *mauritiana* (5—10/dm²), *Physa borbonica* (5—10/dm²); *Poecilia* (*Lebistes*) *reticulata*; Surface: Veliidae gen. spec., Gerridae gen. spec.; *Dineutus indus* f. typ.

b) Medium to strong current (50 cm/sec—1 m/sec):

Zygonyx sp.-larvae (frequent); Hydropsychidae gen. spec.-larvae, Lepidostomatidae (?) gen. spec.-larvae (under stones).

c) Hygropetric areas near the waterfall:

Melanoides tuberculata, *Thiara scabra*, *Lymnaea* (*R.*) *mauritiana*, *Physa borbonica*.

A sample of algae from the stones was taken.

5. F/Mau/22 / 5. 5. 1974: River Savannes; downstream of the Rochester Falls, below the falls a pool of 20 m × 8 m, from where the river flows out; the water level of the river and the intensity of the falls is varying: upstream is a power station using a part of river waters, in consequence a portion of the water is diverted and downstream the falls, the pool and the current have a low-water level, but sometimes full water flows in the river and the water level

is increased for 30—50 cm; near the station the river flows through plantations of sugar-cane; borders partly shady by scrub, partly sunny (Pl. 13; Fig. 68 and 69).

Alt.: 100 m

Br.: Rochester Falls: 15 m, flow-out:
2—3 m

Te.: 21.7° C (10h): 5. 5. 1974

D.: low water level: 5—10 cm, high water
level: 40—60 cm (flow out)

C.: flow out: 50 cm/sec (low water level);
75 cm/sec—1,5 m/sec (high water
level), p.: 0—30 cm/sec

Gr.: basaltic boulders and gravel (5—
20 cm \varnothing), sand, vegetable debris, no
growth of algae

Gen. Chem.: pH: 7.9

Cond.: 96 μ Siemens

Tot. H.: 1.55° dH

Fauna: a) Banks and pool (0—30 cm/sec):

Caridina spathulirostris, *C. brachydactyla*; *Melanoides tuberculata* (10—15/dm²), *Thiara scabra* (10—15/dm²); Surface: Veliidae gen. spec.; *Dineutus indus* f. typ.

b) Medium to strong current (50 cm—1.5 m/sec):

Macrobrachium lar; *Neritina gagates* (10—12^{1/16} m²; Pl. 13, Fig. 69), *Clithon coronata* (1—2^{1/16} m²), *Neritilia consimilis*, *Sicyopterus* (?*Sicydium*) *lagocephalum* (with ventral sucker; attached to stones).

6. F/Mau/1 / 27. 4. 1974: Small brook in the Botanical Garden of Pamplemousses; flowing through meadows and scrub; sunny (Pl. 13; Fig. 70).

Alt.: 70 m

Br.: 50 cm

Te.: 25.7° C (13h): 27. 4. 1974

D.: 10 cm

C.: 30 cm/sec, b.: 10 cm/sec

Gr.: sporadic basaltic stones between mud
and vegetable debris

Gen. Chem.: pH: 7.6

Cond.: 125 μ Siemens

Tot. H.: 1.8° dH

Fauna: a) Banks (10 cm/sec):

Caridina typus; Nepidae gen. spec.; *Melanoides tuberculata* (5/dm²), *Thiara scabra* (10—20/dm²), *Lymnaea* (*R.*) *mauritiana* (sporadic), *Physa borbonica* (sporadic); *Gambusia affinis holbrooki*; Surface: Veliidae gen. spec., *Dineutus aereus*.

b) Medium current (30 cm/sec):

Diplacodes sp.-larvae; *Melanoides tuberculata*, *Thiara scabra*, *Lymnaea* (*R.*) *mauritiana*, *Physa borbonica*.

7. F/Mau/18 / 3. 5. 1974: River Tombeau, near the bridge of the road between Terre Rouge and Petite Rosalie; flowing through meadows, scrub and sugar-cane plantations; on the border dense growth of grass and *Colocasia antiquorum*; sunny (Pl. 14; Fig. 71).

Alt.: 70 m

Br.: 2 m

Te.: 22.5° C (10h): 3. 5. 1974

D.: 10—30 cm

C.: 50—75 cm/sec, b.: 0—20 cm/sec

Gr.: basaltic rocks, partly overgrowing
by watermosses, banks with floating
plants and roots from the border

Gen. Chem.: pH: 7.6

Cond.: 180 μ Siemens

Tot. H.: 2.5° dH

Fauna: a) Banks (0—30 cm/sec):

Caridina richtersi; Zygoptera-larvae; *Dineutus* sp.-larvae; *Melanoides tuberculata* (5/dm²), *Thiara scabra* (5—10/dm²), *Lymanea* (*R.*) *mauritanica* (10/dm²), *Physa borbonica* (10/dm²); Surface: Veliidae gen. spec.; *Dineutus aereus*.

b) Medium to strong current (50—75 cm/sec):

Zygonyx sp.-larvae (between water-mosses), *Aulacodes* sp.-larvae (between water-mosses), *Neritina gagates* (3—5¹/₁₆ m²), *Septaria borbonica* (1—2¹/₁₆ m²).

A sample of algae and water-mosses from stones was taken.

8. F/Mau/23 / 5. 5. 1974: River des Anguilles, near the road bridge of the town Rivière des Anguilles; right borders very steep with old river terraces, left border with plantations of sugar-cane; borders with dense growth of *Colocasia antiquorum*; sunny (Pl. 14; Fig. 73 and 74).

Alt.: 60 m

Br.: 10 m

Te.: 22.3° C (11³⁰)—23.8° C (13^h):

5. 5. 1974

D.: 10—30 cm

C.: 50 cm/sec, c.: 75 cm—>1 m/sec, b.:

0—30 cm/sec

Gr.: basaltic boulders (30 cm—1 m ø), gravel (10—20 cm ø), sand; dense vegetation of *Hydrilla* sp., water-mosses and filamentous algae

Gen. Chem.: pH: 8.2

Cond.: 132 µSiemens

Tot. H.: 2.5° dH

Fauna: a) Banks (0—30 cm/sec):

Caridina mauritii, *C. spathulirostris*, *C. richtersi*; *Anax imperator*-larvae; *Melanoides tuberculata* (20/dm²), *Thiara scabra* (20/dm²), *Lymanea* (*R.*) *mauritanica* (10—20/dm²), *Physa borbonica* (10—20/dm²); *Poecilia* (*Lebistes*) *reticulata*; Surface: Veliidae gen. spec., Gerridae gen. spec.; *Dineutus indus* f. typ.

b) Medium to strong current (50—>1 m/sec):

Macrobrachium australe; *Zygonyx* sp.-larvae (between water-mosses); Hydropsychidae gen. spec.-larvae; *Aulacodes* sp.-larvae (between water-mosses); *Cardiocladius*-, *Rheocricotopus*-, *Eukiefferiella* sp.; *Neritina gagates* (sporadic); *Sicyopterus* (?*Sicydium*) *lagocephalus* (with ventral sucker, attached on stones), *Anguilla mossambica* (between gravel).

A sample of filamentous algae from stones was taken.

9. F/Mau/13 / 1. 5. 1974: Black River; in the lower Black River gorge; cascade steps changes with pig pools of 10—20 m length; near the borders small rock-pools filled with water from floods; surrounding scrub and secondary forest; partly sunny (Pl. 14; Fig. 72).

Alt.: 30—40 m

Br.: 15—20 m

Te.: 24.5° C (16^h): 1. 5. 1974

D.: 10—30 cm, p.: 1—2 m

C.: 50—75 cm/sec, c.: 1—2 m/sec, b. and

p.: 10—30 cm/sec

Gr.: basaltic rocks and boulders (30 cm—2 m ø), gravel; rocks and boulders covered with water-mosses and filamentous algae

Gen. Chem.: pH: 7.8

Cond.: 123 µSiemens

Tot. H.: 1.9° dH

Fauna: a) Banks and pools (0—30 cm/sec):

Caridina typus; Lepidostomatidae (?) gen. spec.-larvae; *Melanoides tuberculata* (5—10/dm²), *Thiara scabra* (3—5/dm²), *Lymnaea (R.) mauritiana* (5/dm²), *Physa borbonica* (5/dm²); Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium to strong current (50 cm/sec—2 m/sec):

Zygonyx sp.-larvae (between water-mosses); Hydropsychidae gen. spec.-larvae; *Cricotopus*, *Rheocricotopus*, *Eukiefferiella* spec.-larvae; eggs of Neritidae (no snails found at the station).

c) Rock-pools near the borders:

Lepidostomatidae (?) gen. spec.-larvae; Notonectidae gen. spec.; *Hydaticus bivittatus*; *Chironomus* sp. larvae; *Lymnaea (R.) mauritiana*; Surface: Gerridae gen. spec.

A sample of drift (20') and two samples with water-mosses and filamentous algae were taken.

10. F/Mau/20 / 3. 5. 1974: River Remparts Est; near Haute Rive, surroundings: plantations of sugar-cane; on the borders dense growth of *Colocasia antiquorum*; partly shady (Pl. 14; Fig. 75).

Alt.: 20 m

Br.: 10—15 m

Te.: 25.4° C (13h): 3. 5. 1974

D.: 20—50 cm

C.: 30—50 cm/sec, b.: 10—20 cm/sec

Gr.: basaltic gravel (5—20 cm ø), sand, near the banks muddy; stones covered with water-mosses and filamentous algae

Gen. Chem.: pH: 8.15

Cond.: 175 µSiemens

Tot. H.: 2.65° dH

Fauna: a) Banks (10—20 cm/sec):

Eunapius carteri (with symbiotic green algae; 5—10 colonies /¹/₁₆ m²); *Caridina mauritii*, *C. serratiostris*, *C. brachydactyla brachydactyla*; Zygoptera-larvae; *Cricotopus* spec.-larvae (in *Eunapius carteri*); *Melanoides tuberculata* (3—5/dm²), *Thiara scabra* (3—5/dm²), *Bellamyia bengalensis zonata* (10—15/¹/₁₆ m²); *Poecilia (Lebistes) reticulata*; tadpoles from *Bufo regularis*; Surface: *Dineutus aereus*.

b) Medium current (30—50 cm/sec):

Eunapius carteri; *Neritina gagates* (5/¹/₁₆ m²).

11. F/Mau/8 / 29. 4. 1974: River Jacotet; near Beau Champ; approx. 50 to 100 m upstream of the return current during high tide; shady by scrub.

Alt.: 15 m

Br.: 1—5 m

Te.: 23.8° C (16³⁰): 29. 4. 1974

D.: 10—50 cm

C.: b.: 0—10 cm/sec, c.: 50—75 cm/sec

Gr.: basaltic rocks, boulders and gravel (5—20 cm ø), banks with ironochre mud

Col.: opalescent

Gen. Chem.: pH: 7.6

Cond.: 195 µSiemens

Tot. H.: 2.65° dH

Fauna: a) Banks (0—10 cm/sec):

Eunapius michaelsoni; *Caridina serratirostris*, *C. richtersi* (between roots of plants from the border), *Varuna litterata*; *Melanoides tuberculata*, *Thiara scabra*, *Neritilia consimilis* (20—30/dm², near the water level); Surface: Gerridae gen. spec.

b) Medium to strong current (50—75 cm/sec):

Eunapius michaelsoni (with green, symbiotic algae; very frequent); *Septaria borbonica* (3—5^{1/16} m², small specimens), *Neritilia consimilis* (20—30/dm², near the water level on stones).

A sample of algae from stones in the cascades was taken.

B.4. Lower courses to the mouths between 10 m and 0 m altitude

1. F/Mau/7 / 29. 4. 1974: River Baie du Cap; upstream of the brackish water influence of the return current during high tide; 500 m upstream of No. 5/F/Mau/3, the mouth-region of the river; surroundings: scrub, sugar-cane plantations; sunny (Pl. 15; Figs. 76, 77, 78).

Alt.: 10 m

Br.: 6—7 m

Te.: 22.3° C (9h)—22.6° C (12h): 29. 4. 1974

D.: 10—30 cm

C.: 30—50 cm/sec, c.: 75 cm/sec, b.: 20—30 cm/sec

Gr.: basaltic gravel (10—30 cm ø), sand; dense growth of *Salvinia* sp. Potamogetonacea, *Hydrilla* and filamentous algae

Gen. Chem.: pH.: 8.2

Cond.: 165 µSiemens

Tot. H.: 2.65° dH

Fauna: a) Banks (20—30 cm/sec):

Caridina serratirostris, *C. brachydactyla brachydactyla* (between roots of plants from the border: medium frequency); *Melanoides tuberculata*, *Thiara scabra* (very frequent), *Neritilia consimilis* (very frequent), *Clithon coronata* (1—3^{1/16} m²: under stones; Pl. 15, Fig. 78).

b) Medium to strong current (30—75 cm/sec):

Eunapius michaelsoni (very frequent on stones up to 10 cm ø; with symbiotic green-algae; Pl. 15; Fig. 78); Hydropsychidae gen. spec.-larvae (1—2^{1/16} m²); *Clithon coronata* (Pl. 15; Fig. 78); *Neritina gagates* (1—3^{1/16} m²); *Neritina (Neripteron) auriculata mauriciae* (5—10^{1/16} m²: under stones in the region just before the return current), *Septaria borbonica* (5—10^{1/16} m²).

c) On the border:

Imago of *Trithemis annulata*.

A sample of algae and waterplants was taken.

2. F/Mau/28 / 8. 5. 1974: River du Poste; near the bridge of the coastal road to Mahébourg; surroundings: sugar-cane plantations; sunny.

Alt.: 10 m

Br.: 10—15 m

Te.: 23.6° C (10h): 8. 5. 1974

D.: 30—50 cm, p.: 1 m

C.: 50 cm/sec, b. and p.: 10 cm/sec

Gr.: basaltic boulders (30 cm—1 m ø), gravel

Gen. Chem.: pH.: 7.8

Cond.: 150 µSiemens

Tot. H.: 2.5° dH

Fauna: a) Banks and pools (10 cm/sec):

Atya pilipes; *Melanoides tuberculata* (1/dm²), *Thiara scabra* (5–10/dm²), *Lymnaea* (*R.*) *mauritanica* (sporadic), *Physa borbonica* (sporadic); Surface: Veliidae gen. spec.

b) Medium current (50 cm/sec):

Hydropsychidae gen. spec.-larvae; *Septaria borbonica* (2–3/dm²), *Neritilia consimilis* (5–8/dm²).

3. F/Mau/29 / 8. 5. 1974: River Le Chau, near Mahébourg; surroundings: scrub, plantations, garden of houses of Mahébourg, near the border large trees; on the river lavatory places and nearby slightly polluted; partly sunny, partly shady (Pl. 15; Fig. 79).

Alt.: 10 m

Br.: 15 m

Te.: 24.3° C (1h): 8. 5. 1974

D.: 20–30 cm, p.: 1–2 m

C.: 50 cm/sec, p. and p.: 10 cm/sec

Gr.: basaltic boulders (30–50 cm ø), gravel (5–10 cm ø), sand; banks and pools with mud and vegetable debris

Gen. Chem.: pH: 7.8

Cond.: 133 µSiemens

Tot. H.: 2.3° dH

Fauna: a) Banks and pools (10 cm/sec):

Thiara scabra (2–3/dm²).

b) Medium current (50 cm/sec):

Eunapius michaelsoni (under stones); *Neritina gagates* (2/dm²), *Clithon coronata* (1–2/1/16 m²), *Septaria borbonica* (5/1/16 m²), *Neritilia consimilis* (5/dm²).

A sample of bluegreen-algae from the stones was taken.

4. F/Mau/30 / 8. 5. 1974: River des Créoles; near the bridge of the coastal road Ville Noire to Ferney; surroundings: scrub and plantations, villages; sunny.

Alt.: 10 m

Br.: 10–20 m

Te.: 24.5° C (13h): 8. 5. 1974

D.: 20–50 cm

C.: 50 cm—>1 m/sec, b.: 20–30 cm/sec

Gr.: basaltic boulders (30–50 cm ø), gravel, sand; banks with mud

Gen. Chem.: pH: 8

Cond.: 130 µSiemens

Tot. H.: 2.4° dH

Fauna: a) Banks (20–30 cm/sec):

Bellamyia bengalensis zonata, *Thiara scabra* (2–3/dm²).

b) Medium to strong current (50 cm—>1 m/sec):

Neritina gagates (2/dm²), *Septaria borbonica* (5/1/16 m²), *Neritilia consimilis*.

5. F/Mau/3 / 28. 4. 1974: Mouth-region of the River Baie du Cap; in the reach of the return current during high tide (500 m downstream of 1. F/Mau/7); near the coastal road of Baie du Cap; surroundings: scrub and bush; sunny.

Alt.: 1 m

Br.: 20–30 m

Te.: 26.3° C (10h): 28. 4. 1974

D.: 10–50 cm (during low tide)

C.: 10–30 cm/sec (during low tide)

Gr.: basaltic gravel, mud, vegetable debris; stones with dense growth of (brackishwater-?) algae

Fauna: a) Banks (10 cm/sec):

Marine and brackish shrimps, amphipods and crabs.

b) Medium current (50 cm/sec):

Serpulidae gen. spec. (very frequent on stones); *Neritina gagates* (sporadic), *Ostrea* sp. (very frequent).

B.5. Stagnant waters

1. F/Mau/2 / 27. 4. 1974: Artificial pond in the Botanical Garden of Pamplémousses; with *Victoria regia*, *Eichhornia crassipes*, *Nymphaea* sp., *Hydrilla* sp. and other tropical waterplants; sunny.

Alt.: 70 m

Diameter: 200–300 m

D.: 30 cm

Te.: 26.3° C (13h): 27. 4. 1974

Gr.: basaltic stones, mud, vegetable debris, the borders with cement walls

Gen. Chem.: pH: 7.6

Cond.: 125 µSiemens

Tot. H.: 1.8° dH

Fauna: a) On the walls of the pond and on the bottom:

Melanoides tuberculata (frequent), *Thiara scabra* (frequent), *Bellamyia bengalensis zonata* (1/m²); in the free water: *Gambusia affinis holbrooki*, *Tilapia* spp., *Carassius auratus*, *Osphromenus gourami*.

2. F/Mau/17 / 2. 5. 1974: Reservoir du Mare Long; artificial reservoir in the plain of the highland; borders with basaltic stones and iron-ochre mud and sand, rests of trees, no waterplants; on the stones muddy crusts of algae; sunny.

Alt.: 630 m

Te.: 22.2° C (15³⁰): 2. 5. 1974

Gen. Chem.: pH: 7.2

Cond.: 50 µSiemens,

Tot. H.: 0.45° dH

Fauna: a) Banks:

Anisoptera-larvae; *Procladius*-, *Cryptochironomus*-larvae (both groups sporadic).

4. General Comments on the Distribution of the Fauna in the Running Waters

Here are given preliminary results of the faunistic and ecological research on the rivers of the different islands in comparison with the fauna of the streams. A definitive analysis of the ecosystem of these tropical island rivers is not possible until after the receipt of all determinations from the specialists. That will be given later as the final part of the results of the mission in this same journal.

4.1. Rivers of the Seychelles-Archipelago

The mission collected from Mahé, the main-island of the Archipelago at 20 stations situated on 16 rivers; from the island of Praslin at 2 stations on

one river, and on the island of La Digue at 2 stations on a small river. On Mahé collections were also made in stagnant water near the coast.

4.1.1. Physical conditions:

In consequence of the relatively high altitude of the central mountains of the Morne Seychellois (911 m) and the short distance of the rivers between the source and the mouth (1 to 3.5 km), the running waters of the island of Mahé have a very steep gradient (Fig. 6). The average gradient lies between 100 and 125‰. In the upper courses the gradient reaches 260‰; in the middle courses

MAHÉ (SEYCHELLES)

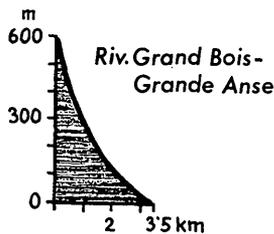


Fig. 6. Gradient of the River Grand Bois-Grande Anse (Mahé) (altitude 10× higher)

around 90‰, and in the lower courses of the hilly or plain coast-land only 20‰. The steep gradients, especially in the upper and middle courses, produce cascades and waterfalls, interrupted by pools in the slope steps. The consequence of the strong current of more than 1 m/sec is a bottom of slippery, polished granitic rocks and boulders with a diameter between 50 cm and some metres. Only near the banks and in the pools between cascade-zones are there sections with lower current (10–30 cm/sec) with gravel and sandy bottom, sometimes there covered with mud and vegetable debris.

The water temperatures of the rivers of Mahé increased, from the headwaters at about 500 m altitude from 21.7° C to 32.5° C, in the region of the mouth (Fig. 7). This gives a difference of 10.8° C (from measurements in February, 1974). In the mountain regions with primary forests the difference between the highest and lowest daytime temperature in running waters was about 2° C; in the mouth region only 1° to 0.5° C. The temperatures of the running waters of Mahé (4° to 5° S latitude) correspond with those of the running waters in the mountains of SW-Ceylon (7° N latitude) at altitude between 800 m and the mouth on the coast (STARMÜHLNER 1972). The highest water temperatures are to be found in pools flooded by brackish water during high tide on the E-coast of Mahé, where the temperatures reach to 32.5°.

4.1.2. Chemical conditions

The largest islands of the Seychelles Archipelago are, as indicated above, built by precambrian crystalline granitic rocks. The surface waters contain very little dissolved mineral salts and the development of algae is very poor. In the regions of the headwaters and brooks in the mountains with primary

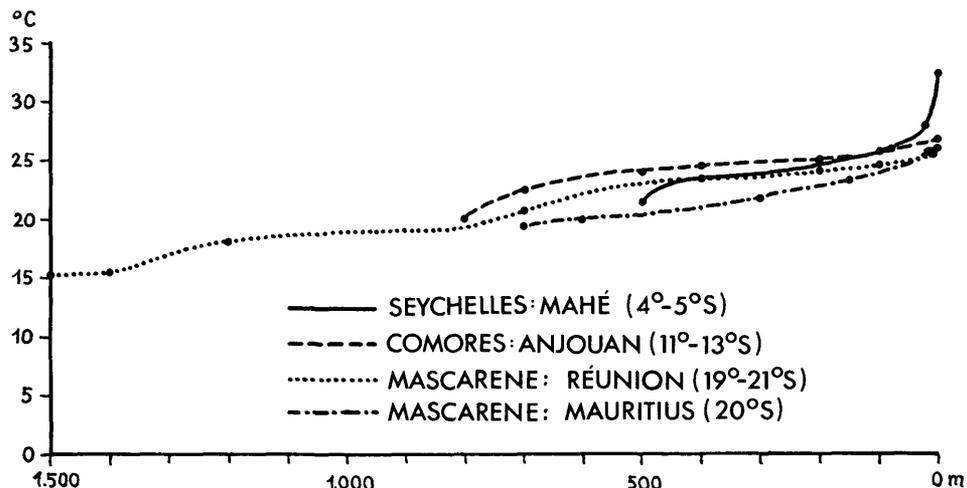


Fig. 7. Water-temperatures between headwaters and mouth in rivers of Mahé, Anjouan, La Réunion and Mauritius

forests, the conductivity ranges only between 25 and 33 μ Siemens; the total hardness between 0.095° dH (!) and 0.12° dH, and the pH between 5.3 and 5.9. In the upper and middle courses at the transition between primary and secondary forests respectively cultivated areas increase the conductivity slightly to 47 μ Siemens, the total hardness to 0.27° dH, and the pH between 6.4 and 7.2. At one station, at an altitude of 310 m, near a village with cultivations, the slightly polluted water indicated a conductivity of 47 μ Siemens and a total hardness of 0.55° dH.

In the lower courses from about 200 m latitude to the mouth-region the conductivity ranged between 33 and 45 μ Siemens (in a station with slightly polluted water: 116 μ Siemens), and the total hardness between 0.15° and 0.65° dH (polluted station: 1.39° dH), with a pH between 6.1 and 7.2. The highest conductivity of about 30.000 μ Siemens at the mouth of a river on the flat E-coast, indicates the influence of brackish-water during high tide.

The investigated rivers on Praslin and La Digue, also granitic, are similar to those of Mahé:

	Conductivity	Total Hardness	pH
Praslin	68 to 72 μ Siemens	0.45°-0.47° dH	6.5-6.9
La Digue	89 μ Siemens	0.51° dH	6.1

4.1.3. The animal communities in the different zones

A. Upper courses between 500 m and 400 m altitude

a) Banks and pools (0—30 cm/sec):

Maheathraululus scotti (30 cm/sec); *Leptocnemis cyanops*, Coenagrionidae gen. spec.; tadpoles; (in the upper courses from about 400 m: *Macrobrachium* (?) sp.); Surface: Veliidae gen. spec.

b) Medium to strong current (30 cm—1 m/sec):

Maheathraululus scotti (in mosses); *Leptodermatoperlyx tenuis*, *Hughscotiella auricapilla*; *Cricotopus* sp.

B. Upper to Middle courses between 400 m and 200 m altitude

a) Banks and pools (0—30 cm/sec):

Dugesia aff. *gonocephala*; *Caridina brevirostris* f. *gardneri*, *typica*, *similis*, *C. typus*, *C. brachydactyla*; *Maheathraululus scotti*, *Hagenulodes braueri* (30 cm/sec); *Leptocnemis cyanops*, *Orthetrum stemmale*, *wrighti*, *Pantala flavescens*, *Rhyothemis semihyalina*, *Zygonyx luctifera*, *Gynacantha stylata*; Nepidae gen. spec., Notonectidae gen. spec.; *Gyraulus* cf. *mauritanus*; *Pachypanchax playfairi*; tadpoles; Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium current (30—75 cm/sec):

Dugesia aff. *gonocephala*; *Maheathraululus scotti*, *Hagenulodes braueri*; *Orthetrum stemmale*, *Pantala flavescens*, *Rhyothemis semihyalina*, *Zygonyx luctifera*, *Gynacantha stylata*; *Hydromanicus seychellensis*, *Helicopsyche palpalis*, *H. kantilai*, *Ecnomus insularis*; *Endochironomus*-, *Dicrotendipes*-, *Rheocricotopus*-, *Cricotopus*-, *Cardiocladius* sp., *Simulium speculiventre*; *Gyraulus* cf. *mauritanus*.

c) Strong current (75 cm—>1 m/sec):

Hydromanicus seychellensis; *Rheocricotopus*-, *Cricotopus* sp.; *Simulium speculiventre*.

d) Hygropetric areas on rocks:

Limonia sp.

C. Middle to Lower courses between 200 m and 10 m altitude

a) Banks and pools (0—30 cm/sec):

Dugesia aff. *gonocephala*; *Caridina brevirostris* f. *similis*, *typica*, *gardneri*, *C. typus*, *C. brachydactyla* *brachydactyla*; *Sesarma* (*Sesarma*) *impressa*; *Maheathraululus scotti*; *Hagenulodes braueri* (30 cm/sec); Anisoptera-larvae; *Culex* sp.; *Copelatus gardineri*; *Melanoides tuberculata* (only found by a cond. of 116 μ Siemens and a tot. h. of 1.39° dH!), *Lymnaea* (*R.*) cf. *natalensis*, *Gyraulus* cf. *mauritanus*; *Pachypanchax playfairi*; tadpoles; Surface: Veliidae gen. spec.

b) Medium current (30—75 cm/sec):

Dugesia aff. *gonocephala*; *Macrobrachium australe*, *M. lar*, *Sesarma* (*Sesarma*) *impressa* (under stones); *Maheathraululus scotti*; *Hagenulodes braueri*; Anisoptera-larvae; *Hydromanicus seychellensis*, *Helicopsyche kantilai*, *Ecnomus*

insularis; *Endochironomus*-, *Dicrotendipes*-, *Cricotopus*-, *Orthocladius* sp., *Pentaneurini* gen. spp., *Simulium speculiventre*-larvae; *Neritina gagates* (from 40 m altitude!), *Neritina pulligera knorri* and *stumpfi* (from 20 m altitude), *Septaria borbonica* (from 30 m altitude); *Neritilia consimilis* (from 20 m altitude).

c) Strong current (75 cm—>1 m/sec):

Hagenulodes braueri, *Maheathraulius scotti*; *Hydromanicus seychellensis*; *Cricotopus*-, *Orthocladius* spp., *Simulium speculiventre*; *Neritina gagates* (under stones, from 40 m altitude), *Neritina pulligera knorri* and *stumpfi* (under stones; from 20 m altitude), *Septaria borbonica* (upper side of stones; from 30 m altitude), *Neritilia consimilis* (near the surface; from 20 m altitude).

d) Hygropetric areas on rocks:

Limonia sp., *Endochironomus* sp. (under muddy web in gaps).

D. Lower courses to the mouth between 10 m and 0 m altitude

a) Banks and pools (0—30 cm/sec):

Caridina brevirostris; *Syncera* (= *Assimineae*) *nitida*, *Melanoides tuberculata* (in dense population of small specimens; brackish water); *Terebralia palustris* (only in flooded, brackish pools near the mouth).

b) Medium current (30—75 cm/sec):

Hydromanicus seychellensis; *Endochironomus*-, *Cricotopus*-sp.; *Neritina gagates*, *Septaria borbonica*, *Neritilia consimilis*, *Syncera* (= *Assimineae*) *nitida*, *Melanoides tuberculata* (in dense population of small specimens, in the sand or between gravel).

c) Strong current (75 cm—1 m/sec):

Hydromanicus seychellensis; *Cricotopus* sp., *Simulium speculiventre*; *Neritina gagates* (under stones), *Septaria borbonica* (upper side of stones), *Neritilia consimilis* (near the surface).

4.1.4. The distribution and density of the found animals between the headwaters and the mouth

In the mountain region of Mahé, covered with primary rain-forests, are the acidic running waters rich with humic acids, but poor in mineral salts and very poor on nutrition for freshwater species. In these zones between the headwaters and upper courses with a total hardness of only 0.095° dH to 0.12° dH, molluscs specially are absent. Only the larvae of Zygoptera, like *Leptocnemis cyanops* and a Coenagrionidae gen. spec., Veliidae and tadpoles are found near the banks and pools between cascades. In the cascades occur the endemic Leptophlebiidae *Maheathraulius scotti* and *Hagenulodes braueri*; under stones, in groups, the larvae of *Leptodermatopteryx tenuis* and the curious *Hughscotiella auricapilla* and sporadic *Cricotopus* sp.

The richest fauna in the running waters occurs in the transition from the upper to middle courses and from the middle courses to the higher parts of the

lower courses. Near the banks and in the pools between cascades are species of *Caridina*, such as *C. brevirostris* (with f. *typica*, *similis* and *gardneri*), *C. typus* and *C. brachydactyla brachydactyla* dominant and if the hardness goes up to 0.5° dH and more, a small freshwater gastropod (*Gyraulus* cf. *mauritianus*) is to be found. In polluted sections, near villages, where the increase in hardness is over 1° dH, *Melanoides tuberculata* is also present. On the water surface Veliidae, and sometimes also Gerridae, are present, and under the surface Nepidae and swimming Notonectidae. Under stones, especially in muddy areas, *Dugesia* aff. *gonocephala* is frequent, in caves under stones also *Macrobrachium australe*, *M. lar* and *M. idaei*. In the higher current of the mountain and hill streams the dominating species are *Maheathraulus scotti* and *Hagenulodes braueri* (endemic for the Seychelles), some larvae of Anisoptera like *Orthetrum stemmale wrighti*, *Pantala flavescens*, *Rhyothemis semihyalina*, *Zygonyx luctifera* and *Gynacantha stylata*, under stones and the larvae of *Hydromanicus seychellensis*, *Helicopsyche palpalis* and *kantilai* and *Ecnomus insularis* on stones. Sometimes in muddy tubes are to find the larvae of *Endochironomus*-, *Dicrotendipes* sp. and *Cricotopus*-, *Orthocladus* sp., rarely larvae of Pentaneurini. In rapids and waterfalls over the basaltic rocks larvae and pupae of the endemic *Simulium speculiventre* are found in high density up to 600–2000/1/16 m²!

The lower courses, near the mouth, on flat parts of the coast, under influence of brackish water during high tide, are characterized by the occurrence of a Grapsidae, *Sesarma* (*S.*) *impressa*, and especially by some species of Neritidae. But it is to be noted that the shells of these species, if they occur in pure freshwater of Mahé-streams, are relatively thin, compared with individuals from the same species from other Indopacific islands with water of greater hardness (volcanic-, reef-islands). Only near the mouth with brackish water (during high tide) and dead corals on the bottom occurs the minute *Syncera* (= *Assimineea*) *nitida*. In the brackish flooded pools, as unique species, *Terebralia palustris* is to be found. The euryoec species *Melanoides tuberculata* occurs in the mouth region-if the water is running-in a population of small individuals, but in extremely high density.

The single endemic freshwater fish of Mahé, *Pachypanchax playfairi* is found in pools between cascades and near the banks with lower current, but also in stagnant water with rich vegetation of algae and waterplants near the NW-coast. In pools occur also the Dytiscidae *Copelatus gardineri* and *Hydrocoptus subvittulus seychellensis* and the snail *Lymnaea* (*R.*) cf. *natalensis*.

Near the waterfalls and cascades, on rocks and bigger boulders, sprayed with water, are the characteristic larvae of *Limonia* sp.; sometimes also the larvae of a *Endochironomus* spec. in muddy web in gaps are found there.

The freshwater fauna of the small streams on the little islands such as Praslin and La Digue, has the same species as Mahé, but the number of species is very small and restricted.

Praslin	U. C. 200 m			M. C. 100 m		
	0-30	30-75	75->1	0-30	30-75	75->1
<i>Dugesia</i> aff. <i>gonocephala</i>	+	+	-	+	+	-
<i>Caridina brevirostris</i>	++	-	-	++	-	-
f. <i>typica</i>	++	-	-	+	-	-
f. <i>similis</i>	-	-	-	+	-	-
f. <i>gardneri</i>	-	-	-	+	-	-
<i>Caridina typus</i>	-	-	-	++	-	-
<i>Hagenulodes braueri</i> , <i>Maheathraulus scotti</i>	-	+	+	-	10	10
Anisoptera gen. spp.	-	+	-	-	+	-
Hydropsychidae gen. spp.	-	+	+	-	10	10
<i>Rheotanytarsus</i> sp.	-	-	-	-	+	+
<i>Cricotopus</i> sp.	-	-	-	-	+	+
<i>Simulium speculiventre</i>	-	++	++	-	+	up to 900
Veliidae gen. spec.	++	-	-	++	-	-

La Digue	U. C. 30 m		
	0-30	30-75	75->1
<i>Caridina brevirostris</i>	+++	-	-
<i>Macrobrachium lar</i>	+	+	-
<i>Ceriatrion glabrum</i> ¹⁾	(+)	-	-
<i>Orthetrum stemmale</i> <i>wrighti</i> ¹⁾	(+)	(+)	-
Veliidae gen. spec.	++	-	-
<i>Pachypanchax playfairi</i>	+	-	-

¹⁾ = only imagos taken from the border, but the larvae are to be expected.

4.2. Rivers of Anjouan (Comores-Archipelago)

On the second largest island of the four islands of the Comores Archipelago (the largest and geologically youngest island, Grand Comore, is without any stream) the mission collected from 15 different streams at 24 stations. Another station was Lac Sacré, a crater lake at 900 m altitude, the source of many streams of the island.

4.2.1. Physical conditions

Although the island of Anjouan is much larger than Mahé, and the distance of the rivers from the sources and headwaters in the central mountains at about 1000 m altitude to the mouth on the coast is 6 to 12 km, the rivers show a very steep gradient in the upper courses. The River Tatinga (Fig. 8a) about 12 km long, has an average gradient of 75 to 90‰. The upper courses with torrents have a gradient of 200‰, the middle course in the volcanic "Cirque of

Dindi" with a gradient of 60‰, and the lower course of 30‰. The River Mutsamudu (Fig. 8b) from the steep slopes of the N'Tingui flows for 6 km over a average gradient of 150‰. The upper courses with of 200‰ are often torrents and waterfalls, but also the middle course with 100‰ is characterized by waterfalls and cascades, interrupted by pools. The lower course has also a relatively steep gradient of 50‰.

In consequence of these steep gradients the average velocity of the current reaches more than 1 m/sec, and only near the banks and in the pools between

ANJOUAN (COMORES)

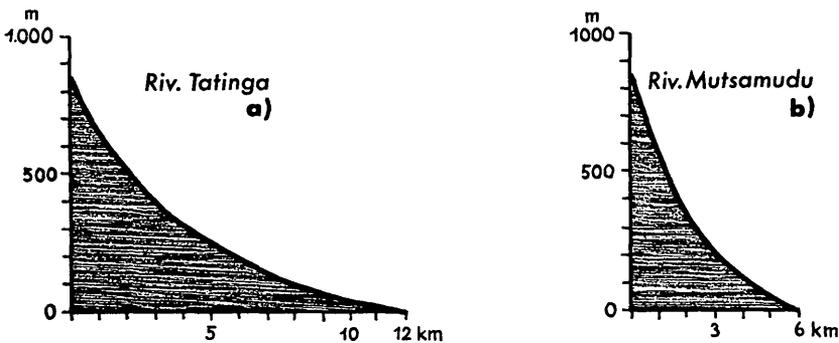


Fig. 8. Gradients of the River Tatinga (a) und River Mutsamudu (b) from Anjouan (altitude 10 × higher)

the cascades are there zones with a current below 50 cm/sec. The bottom of these mountain streams is composed of basaltic rocks, boulders and gravel grade to sand with mud and vegetable debris near the banks and in the pools.

Sometimes a rich growth of floating filamentous green-algae and films of diatoms are developed on rocks and stones. The water temperature of these rivers increases from the source and headwaters in the rainforests of the central mountains from about 20° C in 800 m altitude to 26° C near the mouth, with an average difference of 6° C (Fig. 6; from measurements in March, 1974). The difference between highest and lowest day-temperatures in the brooks of the mountain region was 2°–3° C; near the mouth about 1.5° C.

The average water-temperatures of streams of Anjouan (11° to 13° S latitude) is nearly the same in the upper and middle courses of the mountains of Mahé. Only in the lower courses near the coast it is 3°–5° lower than in the streams of the Seychelles Archipelago (3° to 5° S latitude). These values correspond with the water-temperature of streams near the E- and NW-coast of Madagascar and the island of Nossi-Bé in NW of Madagascar (STARMÜHLNER 1962).

4.2.2. Chemical conditions

The islands of the Comores-Archipelago are volcanic and the mountains of Anjouan are composed of basalts and ankaramites. The younger lavas are highly alkaline. In comparison with the streams of the granitic Seychelles-Archipelago, the content of mineral salts is higher and in consequence also the conductivity, total hardness and pH are higher. In the region of the source and headwaters within the rainforests, the conductivity was between 94 and 125 μ Siemens, the total hardness between 1.9° and 2.6° dH, and the pH between 7.8 and 8. The value of the conductivity increased in the upper courses to 142 μ Siemens, and the total hardness to 3.15° dH. In the middle courses the conductivity increased to 180 μ Siemens, the total hardness to 3.5° dH and the pH sometimes to 8.4. In the transition from the middle to the lower courses, in areas with villages and plantations, the highest value of conductivity was 255 μ Siemens, but mostly between 120 and 180 μ Siemens, the total hardness had values between 1° and 4.25° dH, the highest value, and the pH again slightly alcalic with 7.4 to 8.4.

The lowest values were found in the Lac Sacré, a crater lake on the slopes of the N'Tingui at an altitude of 900 m and filled with rainwater. From this lake, water flows subterraneously to the sources of the mountain-brooks. The conductivity of the lake water was only 35 μ Siemens, the total hardness 0.6° dH and the pH was 8.6 (see also WENINGER 1977).

4.2.3. The animal communities in the different zones

A. Upper courses between 900 m and 400 m altitude

a) Banks and pools (0—30 cm/sec):

Dugesia milloti; *Dero (Aulophorus) hymanae*; *Caridina typus*, *Atya pilipes*; *Choroterpes starmuehlneri*, *Thraululus turbinatus*; *Pseudagrion pontogenes*; Anisoptera gen. spp.; Sericostomatidae gen. spec., Lepidostomatidae (?) gen. spec.; Ranatridae gen. spec., Nepidae gen. spec., Naucoridae gen. spec.; *Hyphydrus separandus*, *Laccophilus tigrinus*, *Potamodytes africanus*-larvae; *Melanooides tuberculata*, *Lymnaea (Radix) natalensis*-group; Surface: Veliidae gen. spec., Gerridae gen. spec.; *Orectogyrinus speculum*, *Dineutus sinuosipennis comorensis*.

b) Medium current (30—75 cm/sec):

Dugesia milloti; *Choroterpes starmuehlneri*, Baetidae gen. spec.; *Trithemis kirbyi ardens*, *Zygonyx torridae*, *Orthetrum julia falsum*; Hydropsychidae gen. spp.; *Cardiocladius*-, *Cricotopus*-, *Rheotanytarsus*-, *Polypedilum* sp., Simuliidae gen. spp.

c) Strong current (75 cm—>1 m/sec):

Baetidae gen. spec.; Anisoptera gen. spp.; Hydropsychidae gen. spp.; *Cardiocladius*-, *Cricotopus*-, *Rheotanytarsus* sp.; Simuliidae gen. spp.

d) Hygropetric areas on rocks:

Limonia comorensis; *Potamodytes africanus* (imago)

e) On the borders:

Paratettix cinereum; Gryllidae gen. spec.

B. Upper to Middle courses between 400 m and 150 m altitude

a) Banks and pools (0—30 cm/sec):

Dugesia milloti; *Caridina typus*, *Atya pilipes*; *Choroterpes starmuehlneri*, *Thraulius turbinatus*; Zygoptera gen. spp.; Lepidostomatidae (?) gen. spec.; Naucoridae gen. spec.; *Potamodytes africanus*-larvae; *Melanoides tuberculata*, *Lymnaea (Radix) natalensis*-group; *Ceratophallus* sp.; Surface: Veliidae gen. spec., Gerridae gen. spec.; *Orectogyrus speculum*, *Dineutus sinuosipennis comorensis*.

b) Medium current (30—75 cm/sec):

Dugesia milloti; *Macrobrachium* lar; *Choroterpes starmuehlneri*, Baetidae gen. spec.; *Orthetrum julia falsum*; Hydropsychidae gen. spp.; *Cardiocladius*-, *Eukiefferiella*-, *Thienemanniella* sp., *Cricotopus bicinctus*, *Chironomus*-, *Glyptotendipes*-, *Conchopelopia* sp.

c) Strong current (75 cm—>1 m/sec):

Baetidae gen. spec.; Hydropsychidae gen. spp.; *Cardiocladius*-, *Eukiefferiella*-, *Thienemanniella* sp., *Cricotopus bicinctus* sp., Simuliidae gen. spp.

d) Hygropetric areas on rocks:

Limonia comorensis, *Potamodytes africanus* (imago).

C. Middle to Lower courses between 150 m and 10 m altitude

a) Banks and pools (0—30 cm/sec):

Dugesia milloti; *Caridina typus*, *C. brachydactyla brachydactyla*, *Atya pilipes*; *Hygrobates soari*; *Choroterpes starmuehlneri*; Zygoptera gen. spp.; Anisoptera gen. spp.; *Anopheles mascarensis*, *Culex pipiens cinque-fasciatus*, *Rheotanytarsus* sp. (30 cm/sec); Hydrometridae gen. spec., Naucoridae gen. spec.; *Sternolophus solieri*, *Potamodytes africanus*-larvae; *Ceratophallus* sp.; Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium current (30—75 cm/sec):

Macrobrachium australe, *M. lar*; *Hygrobates soari*; *Choroterpes starmuehlneri*; Baetidae gen. spec., *Prosopistoma* sp.; Hydropsychidae gen. spp., Sericostomatidae gen. spp.; *Conchopelopia*-, *Cardiocladius*-, *Thienemanniella*-, *Cricotopus* sp., *Polypedilum*-, *Microtendipes*-, *Rheotanytarsus* sp.; *Neritina gagates* (from 120 m), *Neritina pulligera knorri* and *stumpfi* (from 120 m), *Septaria borbonica* (from 120 m), *Neritilia consimilis* (from 120 m); *Sicyopterus* (? *Sicydium*) *lagocephalus* (with ventral sucker).

c) Strong current (75 cm—>1 m/sec):

Hygrobates soari; Baetidae gen. spec., *Prosopistoma* sp.; Hydropsychidae gen. spp.; *Cardiocladius*-, *Thienemanniella*-, *Cricotopus* sp., *Rheotanytarsus* sp., Simuliidae gen. spp.; *Neritina gagates* (from 120 m), *Neritina pulligera knorri* and *stumpfi* (from 120 m), *Septaria borbonica* (from 120 m), *Neritilia consimilis* (from 120 m); *Sicyopterus* (? *Sicydium*) *lagocephalus* (with ventral sucker).

D. Lower courses to the mouth between 10 m and 0 m altitude

a) Banks and pools (0—30 cm/sec):

Caridina typus, *C. brachydactyla brachydactyla*, *Atya pilipes*; *Choroterpes starmuehlneri*, *Thraululus turbinatus*; *Trithemis arteriosa*; *Potamodytes africanus*-larvae; *Neritilia consimilis* (near the surface); *Kuhlia rupestris*, *Microphis* ? *brachyurus*, *Eleotris fusca*; Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium current (30—75 cm/sec):

Macrobrachium lar; *Hygrobates soari*; *Choroterpes starmuehlneri*, Baetidae gen. spec.; Anisoptera gen. spp.; *Chironomus*-, *Polypedilum*-, *Cricotopus bicinctus*, *Thienemanniella* sp.; *Neritina gagates*, *Neritina pulligera stumpffi*, *Septaria borbonica*, *Clithon comorensis*, *Clithon spiniperda* (from 3 m, influence of brackish water during high tide), *Neritilia consimilis*; *Sicyopterus* (? *Sicydium*) *lagocephalus* (with ventral sucker); *Kuhlia rupestris*, *Microphis* ? *brachyurus*, *Eleotris fusca*.

c) Strong current (75 cm—>1 m/sec):

Hygrobates soari; Baetidae gen. spec.; Anisoptera gen. spp., *Cricotopus bicinctus*, *Thienemanniella* sp., Simuliidae gen. spp.; *Neritina gagates*, *Neritina pulligera stumpffi*, *Septaria borbonica*, *Clithon spiniperda*, *Clithon comorensis*, *Neritilia consimilis*; *Sicyopterus* (? *Sicydium*) *lagocephalus* (with ventral sucker).

d) Hygropetric areas on rocks:

Potamodytes africanus; *Neritina gagates*, *Neritina pulligera stumpffi*.

4.2.4. The distribution and density of the found animals between the headwaters and the mouth

The sources and the headwaters of the running waters of Anjouan lie in the central volcanic mountains of the N'Tingui massiv between 1000 m and 700 m altitude. Information, obtained from the Service des Eaux et Forêts, indicated subterranean water from a crater lake, called Lac Sacré or Dzialandze, on the slopes of the N'Tingui at an altitude of 900 m. This lakes collects rain water from the highest humid area of the island. The conductivity of these water is only 35 μ Siemens, total hardness 0.6° dH, but the pH of 8.6 was distinctly alkaline. In contrast to the "collected rain water", the conductivity of the waters from the brooks and torrents was between 94 μ Siemens in the upper courses to a maximal 225 μ Siemens in the lower courses. In the cultivated areas it was much higher. These data show also the values of the total hardness between 1.9° dH in the upper part to 4.25° dH in the lower part. The pH was at all stations higher than 7; the values were between 7.4 and 8.4 always slightly alkaline.

In comparison with the freshwater fauna of the very isolated and very small granitic islands of the Seychelles Archipelago, the number of species and specimens in the running waters of Anjouan is much higher.

The upper courses possess a rich flora of floating and cushionlike green-algae, and also in darker parts of the woods a thick cover of diatoms. The primary production in the volcanic basalt streams of Anjouan is evident higher than in the granitic streams of Mahé!

In consequence of the steep gradient with strong currents and rocky bottom, with boulders and gravel, are the dominant "petricole" forms, living on, under or between stones such as Baëtidae, a *Prosopistoma* sp., some larvae of Anisoptera, like *Trithemis*-, *Zygonyx*- and *Orthetrum*-species, Hydro-psychoidea, further *Cardiocladius*-, *Cricotopus*-, *Eukiefferiella*-, *Thienemanniella*-, *Rheotanytarsus*-, *Polypedilum*-, *Microtendipes* sp. and — in cascades — especially the larvae of Simuliidae. The larvae (and pupae) of the last group are on rocks in very strong currents sometimes in very dense populations up to 2500 indivues¹/₁₆ m²!

A rich fauna of more stillwater forms is developed near the banks, in small creeks, and in pools situated between the cascades. Some of these species are also adapted to settle in regions and under stones or in filamentous, floating algae. The triclad *Dugesia milloti* (a species described from Madagascar, by DE BEAUCHAMPS) often abundant is found on muddy stones and under vegetable debris. Between floating roots and plants from the border, under stones and between vegetable debris *Caridina* species, such as *C. typus* and *C. brachydactyla* (in the transition of middle to lower courses) and *Atya pilipes* are dominant; also the Leptophlebiidae *Choroterpes starmuehlneri* and *Thraulius turbinatus* and larvae of Zygoptera, like *Pseudagrion pontogenes*, further larvae of Sericostomatidae and Lepidostomatidae (?) and sporadic Ranatridae and Nepidae near the border. Very frequent are sometimes Naucoridae, mostly under stones, small Dytiscidae such as *Hyphydrus separandus* and *Laccophilus tigrinus*, and the larvae of *Potamodytes africanus*. Of the molluscs in the banks and pools of the upper and middle courses, only *Melanoides tuberculata* (very rare!), *Lymnaea (Radix) natalensis*-group (a Southafrican-Madagassian species-group) and a *Ceratophallus* sp. are represented.

On the surface Gerridae and especially Veliidae are always very frequent; also two species of Gyrinidae, *Orectogyrus speculum* and *Dineutus sinuosipennis comorensis*. On the borders of the upper courses were found the ripicol grasshopper *Paratettix cinereum* and a species of Gryllidae (only larvae, not determinable) feeding on algae of the banks. Both species are able to swim for short time near the banks. It is to note, that on the border of the mountain streams of Ceylon were found also a typical ripicol Tettrigidae, *Euscelimena gaviialis* and a Gryllidae, *Paranemobius pictus* (KALTENBACH, 1973) feeding also on ripicol algae.

Near the waterfalls and cascades are typically hygropetric areas sprayed with water from the falls. These biotops are characterized by the larvae and pupae of *Limonia comorensis* (*Limonia* also was found on hygropetric areas of Ceylon) and the imagines of the dryopid *Potamodytes africanus*.

Abbreviations: like indicated by 4.1.4., page 704).

	H.-U. C. 900-400 m			U. C.-M. C. 400-150 m			M. C.-L. C. 150-10 m			L. C.-M. 10-0 m			HYG.
	0-30	30-75	75- > 1	0-30	30-75	75- > 1	0-30	30-75	75- > 1	0-30	30-75	75- > 1	
Anjouan													
<i>Dugesia milloiti</i>	45	30	-	70	20	-	+	+	-	-	-	-	-
<i>Dero (Aulophorus) hymanae</i>	+	-	-	-	-	-	+	-	-	-	-	-	-
<i>Caridina typus</i>	+	-	-	+	-	-	+	-	-	-	-	-	-
<i>Caridina brachydactyla</i>	-	-	-	-	-	-	+	-	-	-	-	-	-
<i>Atya pilipes</i>	+	-	-	+	-	-	+	-	-	-	-	-	-
<i>Macrobrachium lar</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Hygrobatas soari</i>	-	-	-	-	-	-	+	5	-	+	1-2	1-2	-
<i>Choroterpes starmuehlineri</i> and <i>Thraulus turbinatus</i>	+	25	-	20	15	-	20	(+)	-	+	+	-	-
Baetidae gen. spp.	-	100	100	-	150	+	-	20	(+)	9	2	2	-
<i>Prospistoma</i> sp.	-	-	-	-	-	-	-	-	-	+	-	-	-
Zygoptera gen. spp.	(+)	-	-	+	-	-	+	-	-	-	-	-	-
<i>Pseudagrion pontogenes</i>	+	-	-	(+)	-	-	(+)	-	-	-	-	-	-
Anisoptera gen. spp.	+	6	6	(+)	+	-	+	+	-	+	+	-	-
<i>Trithemis kirbyi ardens</i>	-	+	-	-	-	-	-	-	-	-	(+)	-	-
<i>Trithemis arteriosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Zygonyx torrida</i>	-	+	-	-	-	-	-	-	-	-	-	-	-
<i>Orithetrum julia falsum</i>	-	1	-	-	6	-	-	-	-	-	-	-	-
<i>Paratetix cinereum</i> ¹⁾	+	-	-	-	-	-	-	-	-	-	-	-	-
Gryllidae gen. spec. ¹⁾	+	-	-	-	-	-	-	-	-	-	-	-	-
Hydropsychidae gen. spp.	-	15	75	-	25	45	-	20	-	-	(+)	(+)	-
Sericostomatidae gen. spp.	100	(+)	-	(+)	(+)	-	(+)	-	+	-	-	-	-
Lepidostomatidae (? gen. spp.	+	-	-	+	-	-	-	-	-	-	-	-	-
Chironomi gen. spp. ²⁾	-	-	-	-	-	-	-	-	-	-	+	-	-
<i>Conchapelopia</i> sp.	-	-	-	-	-	-	-	-	-	-	+	-	-

The lower parts of the streams, with strong currents (>1 m/sec) in the middle section, are characterized by different species of Neritidae, such as *Neritina gagates*, *Neritina pulligera stumpfi* and rarely *knorri*, *Clithon spiniperda* (near the mouth sometimes with spines!), *Septaria borbonica* and *Neritilia consimilis* (from about 120—100 altitude). Just before the mouth, in the zone of brackish water during the high tide, *Clithon chlorostoma comorensis*, is to be found. These occurrence of different species of Neritidae correspond with the observations made in Madagascar, New Caledonia and some Pacific islands (STARMÜHLNER 1969, 1970 and 1976).

The number of species and the density of typically running water forms of freshwater insects decreases in the lower parts with higher temperatures (i. e. Baetidae, Hydropsychidae, Orthocladiinae (such as *Cricotopus*, *Thienemannniella*) and Simuliidae). Only *Rheotanytarsus* sp. — in muddy tubes — and *Polypedilum*-, *Microtendipes* sp. are sometimes very frequent on boulders and gravel. On stones with eggs of Neritidae occurs the hydracarinid *Hygrobates soari* and, in stillwater-creeks of the banks, the larvae of *Anopheles mascarensis* and *Culex pipiens cinque-fasciatus*. In the lower parts a species of Gobiidae, *Sicyopterus* (?*Sicydium*) *lagocephalus*, with a ventral sucker, is always present, attached on rocks and boulders. In the mountain streams of Ceylon lives in the same region the Gobiid *Gobius* (= *Awaous*) *grammepomus* (RADDA 1973). In the mouth region are some species of typically marine or brackish-water fishes present, such as *Kuhlia rupestris*, *Microphis* ?*brachyurus* and *Eleotris fusca*.

4.3. Rivers of La Réunion (Mascarene-Archipelago)

On the island of La Réunion, geologically the youngest of the volcanic islands of the Mascarene-Archipelago, the mission collected on 22 stations in 16 different rivers from the source and headwaters at 1500 m altitude down to the mouths near the coasts. Four samples were taken from stillwater biotopes, mostly near or in connection with streams.

4.3.1. Physical conditions

La Réunion is the largest island of the visited Indian Ocean islands during the mission 1974. The central mountains, built by two shield volcanoes, one extinct and still active, reaches to a height of 3096 m. The slopes from the eroded amphitheatre headed central massives are very steep and the upper courses of the streams are mostly waterfalls and torrents of some hundred meter high. In the following table is given a survey of length and average gradient of some rivers in the different parts of the rivers (Fig. 9).

In consequence of these steep gradients, especially in the upper parts, the streams of La Réunion, like the streams of Mahé or Anjouan (or the streams in SW-Ceylon, STARMÜHLNER 1972, or in Central-Madagascar, STARMÜHLNER 1962) are typically mountain torrents with cascades and strong currents of more than 1 m/sec on the average and a bottom of basaltic rocks, boulders and

RÉUNION (MASCARENE)

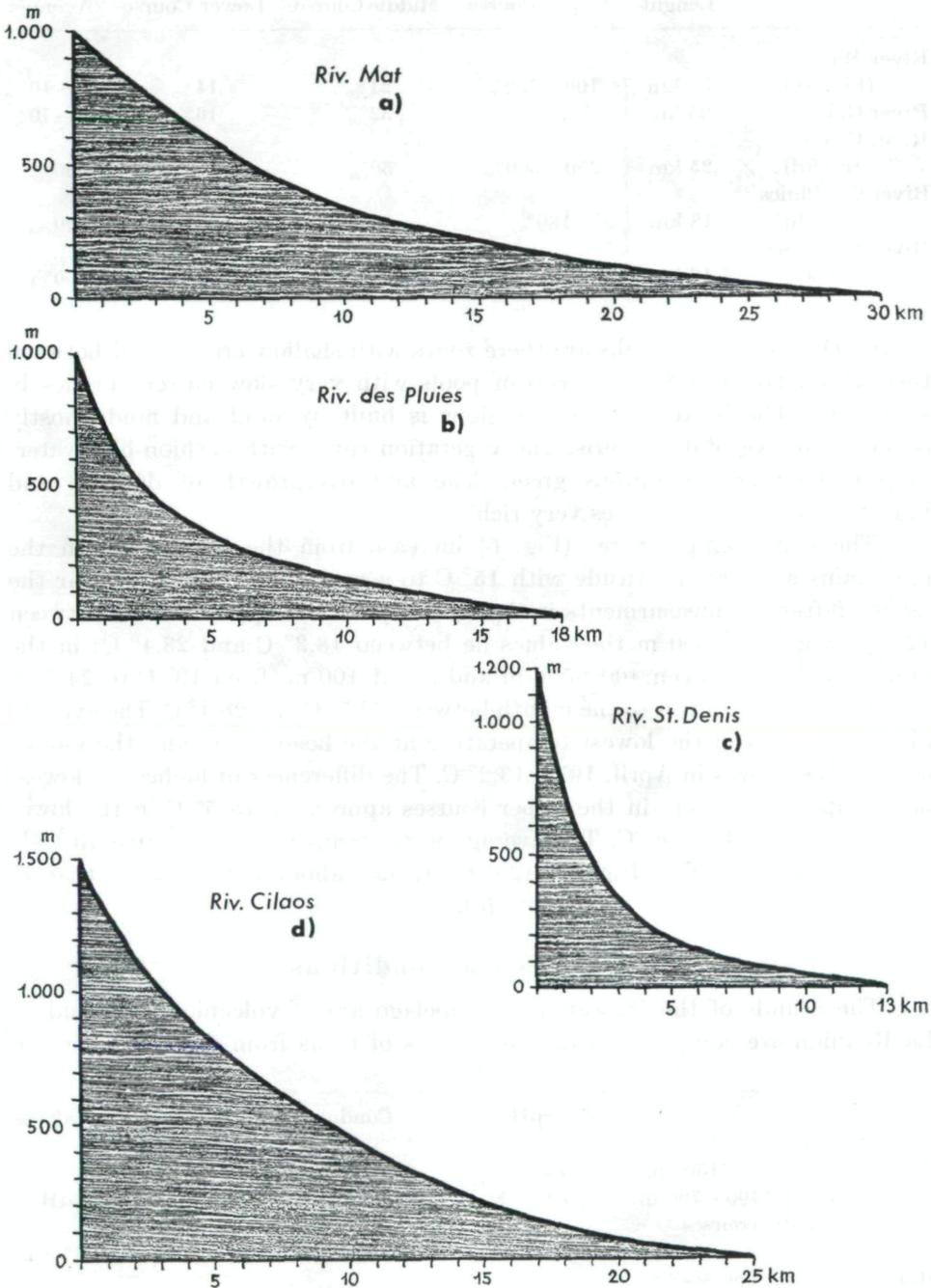


Fig. 9. Gradients of the River Mât (a), River des Pluies (b), River St. Denis (c) and River Cilaos (d) from La Réunion (altitude 10 × higher)

	Lenght	Gradient			Average
		Upper Course	Middle Course	Lower Course	
River Mât (Fig. 9a)	30 km	100—200‰	21‰	14‰	30—40‰
River Galets	25 km	150‰	32‰	16‰	60—70‰
River Cilaos (Fig. 9d)	25 km	250—300‰	50‰	20‰	90‰
River des Pluies (Fig. 9b)	18 km	180‰	80‰	20‰	90‰
River St. Denis (Fig. 9c)	13 km	500‰(!)	40‰	20‰	100‰

gravel. Only near the banks are there zones with shallow creeks, and between the cascade-zones stair-like series of pools with very slow current or nearly stillwaters. The bottom of these regions is built by sand and mud, mostly covered with vegetable debris. The vegetation cover with cushion-like water-mosses, floating filamentous green-algae and overgrowth of diatoms and bluegreen-algae is sometimes very rich.

The water-temperatures (Fig. 6) increase from the headwaters in the mountains at 1500 m altitude with 15° C to a maximum of 28.4° C near the mouth (after the measurements in April, 1974). In the upper courses between 1200 m and 400—500 m the values lie between 18.2° C and 23.4° C; in the middle courses between 400—500 m and about 100 m, from 19° C to 24.5° C and in the lower courses to the mouth between 22.7° C and 28.4° C. The average difference between the lowest temperature at the headwaters and the mouth of the streams was in April, 1974, 13.2° C. The differences of highest to lowest day-temperatures were in the upper courses approx. 4° to 5° C in the lower courses approx. 4° to 6° C. The average water-temperatures in same altitude are in the streams of La Réunion (20° S latitude) about 1° to 2° lower than in the streams of Anjouan (12° S latitude).

4.3.2. Chemical conditions

The islands of the Mascarene Archipelago are of volcanic origin and at La Réunion are composed of different series of lavas from different eruption

	pH	Conductivity	Total Hardness
Source-Headwaters (1500 m)	7.9	52 μ Siemens	1.15° dH
Upper courses (1400—700 m)	7.85—8	62—130 μ Siemens	1.25°—3° dH
Upper to Middle courses (700 m—200 m)	7.75—8.3	69—250 μ Siemens	1.1°—5.75° dH
Middle to Lower courses (200 m—50 m)	7.1—8.8	69—258 μ Siemens	1°—8° dH
Lower courses to mouth (50 m—0 m)	7—8.4	62—105 μ Siemens	1°—2.5° dH

phases, ranging from ultrabasic to acidic in compositions. As in the streams of the volcanic Island of Anjouan, the content of mineralic salts is higher than in the streams of the granitic Seychelles-Islands. In the following table are shown the average values of pH, conductivity and total hardness in the different courses of the rivers of La Réunion from measurements in April, 1974 (WENINGER 1977).

The table shows that the highest values were found in the region of the upper and middle courses down to the transition to the lower courses. The different values depend on the different lavas eroded by the streams, especially in the mountains of the Piton de la Neige which is apparently unique in its combination of extreme dissection and variety of rock types! If the streams courses of the rivers of La Réunion from measurements in April, 1974 (WENINGER 1977).

Different also are the values for the stillwaters:

	pH	Conductivity	Total Hardness
Polluted pond near the town of Cilaos (1220 m)	9.2	160 μ Siemens	3.8° dH
Source-pond in the Plaine de Palmiste, origine of the Ravine Seche, an intermittend stream (950 m)	6.95	24 μ Siemens (!)	0.45° dH (!)
Mare au Poule d'Eau, a small mountain-lake, used as fish-pond (679 m)	8.6	240 μ Siemens	5° dH
Étang St. Paul, swampy pond, in connection with the source-pond Moulin d'Eau, near the E-coast, in the lower part in connection with brackish water (20 m to 10 m)	8	1600 μ Siemens (!)	10.7° dH (!)

4.3.3. The animal communities in the different zones of the rivers

A. Headwater in 1500 m altitude

a) Banks and pools (0—30 cm/sec):

Sicilicula borbonica

b) Medium to strong current (30 cm/sec—>1 m/sec):

Cardiocladius sp.

B. Upper courses between 1500 m and 700 m altitude

a) Banks and pools (0—30 cm/sec):

Pseudagrion punctum, *Ceriagrion glabrum*, Anisoptera gen. spec.; Hydroptilidae gen. spec.; *Chironomus*-, *Polypedilum*-, *Rheotanytarsus* sp. (30 cm/sec); *Lymnaea (Radix) mauritiana*, *Physa borbonica*; *Bufo regularis*; Surface: Veliidae gen. spec.; *Dineutus indus olivaceus*.

b) Medium current (30—75 cm/sec):

Hydropsychidae gen. spp., Hydroptilidae gen. spec. (in troops under stones); *Cardiocladius*-, *Cricotopus*-, *Rheocricotopus*-, *Eukiefferiella* sp., Simuliidae gen. spp.; *Lymnaea* (R.) *mauritiana* (up to 50 cm/sec), *Physa borbonica* (up to 50 cm/sec).

c) Strong current (75 cm—>1 m/sec):

Hydropsychidae gen. spp., Hydroptilidae gen. spec. (in troops under stones); *Cardiocladius*-, *Cricotopus*-, *Rheocricotopus*-, *Eukiefferiella* sp., Simuliidae gen. spp.

d) Hygropetric areas on rocks:

Limonia sp.

C. Upper to Middle courses between 700 m and 200 m altitude

a) Banks and pools (0—30 cm/sec):

Zygoptera gen. spp., *Anax imperator*; Hydroptilidae gen. spec. (in troops under stones); *Chironomus* sp.; *Paracymus chalceus*; *Thiara scabra*, *Omphalotropis picturata* (from the border!), *Lymnaea* (R.) *mauritiana*, *Physa borbonica*; Surface: Veliidae gen. spec.; *Dineutus indus olivaceus*.

b) Medium current (30—75 cm/sec):

Baetidae gen. spec.; Hydropsychidae gen. spec., Hydroptilidae gen. spec. (under stones in troops); *Cricotopus*-, *Rheocricotopus*-, *Cardiocladius*-, *Eukiefferiella*-, *Smittia*-, *Procladius*-, *Rheotanytarsus* sp., Simuliidae gen. spp.; *Melanooides tuberculata*, *Thiara scabra* (up to 50 cm/sec), *Lymnaea* (R.) *mauritiana* (up to 50 cm/sec), *Physa borbonica* (up to 50 cm/sec).

c) Strong current (75 cm—>1 m/sec):

Baetidae gen. spec.; Hydropsychidae gen. spp., Hydroptilidae gen. spec. (in troops under stones); *Cricotopus*-, *Rheocricotopus*-, *Cardiocladius*-, *Eukiefferiella*-, *Smittia*-, *Procladius*-, *Rheotanytarsus* sp., Simuliidae gen. spp.

d) Hygropetric areas on rocks:

Limonia sp.; *Lymnaea* (R.) *mauritiana*, *Physa borbonica*.

D. Middle to Lower courses between 200 m and 50 m altitude

a) Banks and pools (0—30 cm/sec):

Eunapius sp.; *Caridina typus*, *C. brachydactyla brachydactyla*, *Atya pilipes*; Zygoptera gen. spp., *Trithemis annulata* and other Anisoptera gen. spp.; Hydroptilidae gen. spp. (in troops under stones); *Dicrotendipes* sp., *Rheotanytarsus* sp. (30 cm/sec), *Anopheles coustani*, *A. gambiae*; *Laccobius mascarensis*, *L. starmuehlneri*; *Neritina gagates* (from 170 m), *Melanooides tuberculata*, *Thiara scabra*, *Lymnaea* (R.) *mauritiana*, *Physa borbonica*; tadpoles of *Bufo regularis*; Surface: Veliidae gen. spec.; *Dineutus aereus*.

b) Medium current (30—75 cm/sec):

Macrobrachium australe; Anisoptera gen. spp.; Hydropsychidae gen. spp., Hydroptilidae gen. spec. (in troops under stones); *Rheocricotopus*-, *Orthocladius*-, *Cricotopus*-, *Cardiocladius*-, *Eukiefferiella*-, *Rheotanytarsus* sp., Simuliidae gen. spp.; Ephydriidae gen. spec. (in filamentous algae); *Neritina*

gagates (from 170 m), *Septaria borbonica* (from 170 m), *Neritilia consimilis*, *Thiara scabra*, *Lymnaea* (R.) *mauritiana* (up to 50 cm/sec), *Physa borbonica* (up to 50 cm/sec); *Sicyopterus* (?*Sicydium*) *lagocephalus* (with ventral sucker; from 80—50 m).

c) Strong current (75 cm—>1 m/sec):

Hydropsychidae gen. spp., Hydroptilidae gen. spec. (in troops under stones); *Rheocricotopus*-, *Orthocladus*-, *Cricotopus*-, *Cardiocladius*-, *Eukiefferiella*-, *Rheotanytarsus* sp., Simuliidae gen. spp., Ephydriidae gen. spec. (in filamentous algae); *Neritina gagates* (from 170 m), *Septaria borbonica* (from 170 m), *Neritilia consimilis*; *Sicyopterus* (?*Sicydium*) *lagocephalus* (with ventral sucker; from 80—50 m).

E. Lower courses to the mouth between 50 m and 0 m altitude

a) Banks and pools (0—30 cm/sec):

Dugesia aff. *gonocephala*; *Caridina typus*, *C. brachydactyla brachydactyla*, *C. serratirostris*, *Atya pilipes*, *Varuna litterata*, *Pseudagrion punctum*, *Ceragrion glabrum*, *Trithemis annulata*, *Anax imperator*; *Polypedilum* sp.; *Thiara scabra*, *Paludinella hidalgoi granum*, *Lymnaea* (R.) *mauritiana*, *Physa borbonica*, *Indoplanorbis exustus*; *Xiphophorus maculatus* (from about 10 m in the recurrent flow of the high tide: some marine and brackish-water fishes such as *Eleotris fusca*); tadpoles of *Bufo regularis*; Surface: Veliidae gen. spec., Gerridae gen. spec.

b) Medium current (30 cm—75 cm/sec):

Dugesia aff. *gonocephala*; *Macrobrachium australe*, *M. lar*; Anisoptera gen. spp.; Hydropsychidae gen. spp.; *Cardiocladius*-, *Cricotopus*-, *Rheocricotopus* sp., *Rheotanytarsus* sp., Simuliidae gen. spp.; *Neritina gagates*, *Clithon coronata* (from about 10 m; in the recurrent of the high tide), *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra*, *Paludinella hidalgoi granum*, *Lymnaea* (R.) *mauritiana* (up to 50 cm/sec), *Physa borbonica* (up to 50 cm/sec), *Indoplanorbis exustus* (up to 50 cm/sec), *Ferrissia* cf. *modesta*.

c) Strong current (75 cm—>1 m/sec):

Hydropsychidae gen. spp.; *Cardiocladius*-, *Cricotopus*-, *Rheocricotopus* sp., *Rheotanytarsus* sp., Simuliidae gen. spp.; *Neritina gagates*, *Clithon coronata*, *Septaria borbonica*, *Neritilia consimilis*.

4.3.4. The distribution and density of the running water fauna between the headwaters and the mouth

La Réunion the youngest and highest island of the Mascarene-Archipelago is much higher than Mauritius, and than Anjouan in the Comores-Archipelago, or Mahé in the Seychelles-Archipelago. The sources and headwaters of the streams are in altitudes between 1500 m and more. They flow as waterfalls or torrents, depending on the gradient of the slopes of the eroded shield volcanoes to the deep eroded valleys.

In the region of about 1500 m with a water-temperature of 15° C was found the unique element of a typically "Crenon" (after the conception of

ILLIES & BOTOSANEANU 1963) — the fauna of source (Eucrenon) and headwaters (Hypocrenon). This is the hydraenid beetle *Sicilicula borbonica*, endemic in the mountain region of the Piton de la Neige. It is possible that the larvae of *Cardiocladius*, found at the same station, are also from a typical element of the "Crenon", but the determination is not finished.

In the upper courses between 1400 m and 700 m altitude "petricole" forms dominate, attached to rocks, boulders and gravel, such as larvae (and pupae) of Hydropsychidae, Hydroptilidae (in troops on sides and under stones), *Cardiocladius*-, *Cricotopus*-, *Rheocricotopus*-, *Eukiefferiella*-, *Rheotanytarsus* sp. and Simuliidae. The last group mostly found on rocks and big boulders in waterfalls and cascades in very high density with an average of $675/1/_{16}$ m² if the current is more than 1 m/sec!

Near the banks in creeks and in pools between the stair-like cascades are found Zygoptera-larvae, such as *Pseudagrion punctum* and *Ceriagrion glabrum*. *Caridina* species don't occur — in comparison with the mountain-region of Anjouan or Mahé — in these higher regions. This may be explained by the extremely strong current of these torrents, which not admit the deposit of a higher quantity of vegetable debris, the nutrition of the Caridae. The pulmonate snails *Lymnaea (R.) mauritina* and *Physa borbonica*, also the tadpoles of *Bufo regularis* occur in these biotops, feeding on algae. They are to find from the mountains at 1400 m altitude to the coast-region. On the surface of these biotops with low current, regular Veliidae and the gyrid *Dineutus indus olivaceus* are found.

In the transitions from the upper courses to the middle courses, and even in lower courses, in the streams of the deep eroded valleys, where the gradient is lower, there is a *Rheotanytarsus* sp. in muddy tubes very frequent on the surface of stones, covered with mud and algae. Also, species of Orthocladiinae such as *Cricotopus*-, *Rheocricotopus*-, *Eukiefferiella*-, *Smittia* sp., Hydropsychidae and Hydroptilidae are dominant, with only the species of Simuliidae decreases clear in number in comparison with the waterfalls and torrents of the slopes.

In the biotops with low current (banks and pools) live the same species, as indicated above in the mountain streams. On the surface occurs *Dineutus aereus* and Veliidae. In rock-pools, filled with stream water after floods and in creeks at the side of larger pools below waterfalls, rich in algae, are to be found the gyrid *Gyrinus nitidulus* and different small Hydrophilidae, like *Dactylosternum* sp., *Laccobius mascarensis* and *L. starmuehlneri* and *Paracymus chalceus*. Together with the pulmonate snails, cited above, is *Thiara scabra* — and rarely *Melanoides tuberculata* — a typical form of the river-banks and pools, found under stones up to a current of 50 cm/sec. But the highest density, between 15 and $60/1/_{16}$ m² is found in a current between 20—30 cm/sec.

In the transition between the middle courses to the lower courses are *Caridina* species, such as *C. typus*, *C. brachydactyla* and *Atya pilipes* dominating in the regions of banks and pools, rich on vegetable debris, deposit from the

MAURITIUS (MASCARENE)

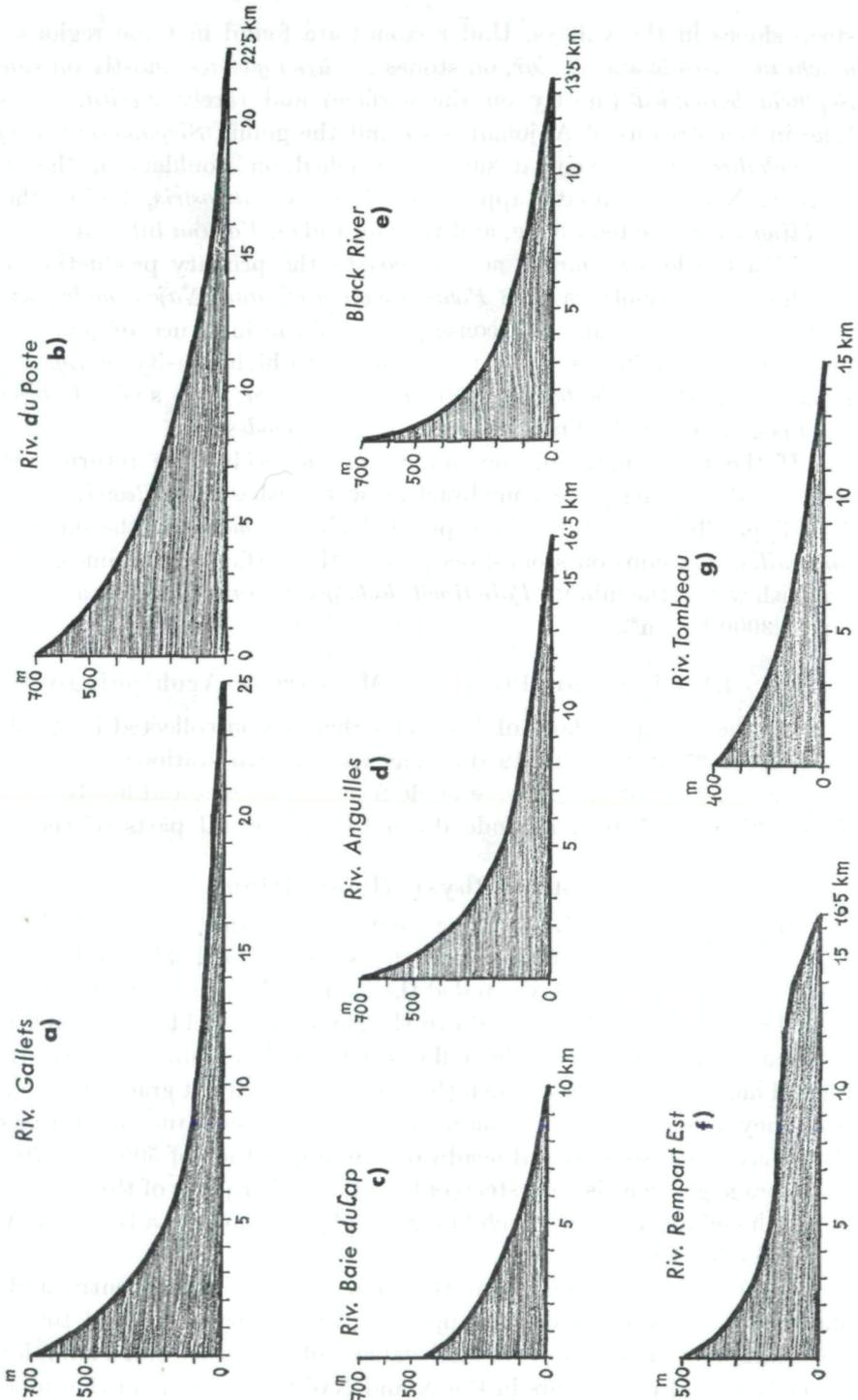


Fig. 10. Gradients of the River Gallets (a), River du Poste (b), River Baie du Cap (c), River des Anguilles (d), River Black (e), River Remparts-Est (f) and River Tombeau (g) (altitude 10 × higher)

steep slopes in the valleys. Under stones are found in these regions *Macrobrachium australe* and *M. lar*, on stones *Neritina gagates* (mostly on sides) and *Septaria borbonica* (mostly on the surface) and rarely *Neritilia consimilis*. Like in the streams of Anjouan is to find the gobiid *Sicyopterus* (?*Sicydium*) *lagocephalus* with a ventral sucker, attached on boulders in the stronger current. Near the mouth appears *Caridina serratiostris*, beside the other *Caridina* species, cited above, and the Grapsidae, *Varuna litterata*.

If in the lower courses, near the coasts, the primary production of algae and higher water-plants, like *Potamogeton pectinans*, *Najas madagascariensis* and others, is very high, as consequence of the influence of pollution from plantations and villages, appear in addition to high density of *Lymnaea* (*R.*) *mauritiana*, *Physa borbonica* and *Thiara scabra*, the snail *Indoplanorbis exustus*-group and the limpet-like *Ferrissia* cf. *modesta*.

If the lower parts of the lower courses receive the return current of seawater during high tide some brackish-water fishes, like *Eleotris fusca*, are to find. Typically snails are the longspined *Clithon coronata* and the small *Neritilia consimilis*, in troops on stones, occur near the surface. Sometimes, in slightly brackish water, the minute *Paludinelle hidalgoi granum* appear in a high density (up to 3000/l₁₆ m²).

4.4. Rivers of Mauritius (Mascarene-Archipelago)

On the volcanic island of Mauritius the mission collected in April–May, 1974, from 27 stations in 19 different rivers. Two stations were stillwaters near rivers. The collections were made from the sources and headwaters in the SW-highland of 700 m altitude down to the coastal parts of the streams.

4.4.1. Physical conditions

Mauritius is, like La Réunion, entirely volcanic, but the origin about 4 to 5 million year older. Older series of basalts are flooded by two-fold younger basalt series. The rivers have eroded the lavas and this action tends to result in lateral movement of the river, down the slopes of the old topography towards the tract covered by older lava flows. Other rivers rundown the structural central highland to the sea which they reach apparently at grade. In the NE and NW they cross the coastal plains with dense sugar-cane plantations. Most rivers have their sources and headwaters in an altitude of 500 m to 700 m and the average gradient is very steep only in the higher parts of the upper courses, but in the middle courses, much lower than by streams of La Réunion, Anjouan or Mahé (Fig. 10).

In the rivers coming from the high plateau in the centre and SE of Mauritius, the gradient of the upper courses is very steep and torrents and waterfalls flow in the deep eroded valleys of the coast (for example: Black River Gorge). In the rivers in the N and NW the gradient in the upper parts flowing through a high plateau is low (for example: Grand River NW with the tributaries River Moka and River Cascade). The middle and lower courses

	Length	Gradient			Average
		Upper course	Middle course	Lower course	
River du Poste (Fig. 10b)	22.5 km	50‰	20‰	15‰	28‰
River des Anguilles (Fig. 10d)	16.5 km	120‰	16‰	13‰	45‰
River Rempart Est (Fig. 10f)	16.5 km	133‰	17‰	25‰	50‰
Grand River NW with					
River Moka	17.0 km	10‰	30‰	20‰	16‰
River Cascade	18.0 km	11‰	30‰	20‰	17‰
River Gallets (Fig. 10a)	15.0 km	250‰	40‰	20‰	70‰
Black River (Fig. 10e)	13.5 km	230‰	26‰	22‰	47‰
River Baie du Cap (Fig. 10c)	10.0 km	70‰	30‰	20‰	41‰

have on the average a medium and low gradient; the stronger current is mostly short over long distances of medium or low current.

The bottom of eroded basaltic rocks is covered with muddy gravel and sand, and crossing the areas with sugar-cane plantations, a dense vegetation of submersed higher waterplants and floating filamentous algae occurs.

The water-temperature (Fig. 6) increases from 19.4° C at the sources and headwaters in the central plateau to a maximum of 26.3° C in the lower courses near the mouth (from measurements in April–May, 1974). The difference is approx. 6.9° C. These values correspond with the water-temperatures of streams in the same altitude of La Réunion. The daily differences of temperatures in the mountain region are between 2° and 3°; in the lower courses between 3° and 4° C.

4.4.2. Chemical conditions

The different volcanic series of Mauritius consist of basalt and layers of tuff. Nearly all basalts are olivine-bearing and correspond to the basalts of La Réunion. Some flows contain plagioclase and are cut by numerous dykes. The chemistry of the streamwaters is similar to that of the volcanic islands of Anjouan and La Réunion. In the table are compiled the average values of pH, conductivity and total hardness from measurements in April–May, 1974.

As in La Réunion, the highest values of conductivity and total hardness are in the transitions of the upper to middle and lower courses, if the streams enter and flow through the cultivated areas with dense cultivations of sugar-cane and highly populated villages and towns. In contrast to these parts of the streams are the slightly acidic headwaters and brooks with low content of mineral salts in the unpopulated southern central high-plateau.

	pH	Conductivity	Total Hardness
Source-Headwaters (700 m)	6.1—6.55	43—54 μ Siemens	0.28°—0.52° dH
Upper courses (700 m—400 m)	7—7.65	69—97 μ Siemens	1°—1.95° dH
Upper to Middle courses (400 m—200 m)	6.65—7.9	93—200 μ Siemens	1.45°—4.25° dH
Middle to Lower courses (200 m—10 m)	7.45—8.2	96—220 μ Siemens	1.8°—3.3° dH
Lower courses to the mouth (10 m—0 m) (by low tide, no influence of the return current!)	7.8—8.2	130—165 μ Siemens	2.3°—2.65° dH

4.4.3. The animal communities in the different zones

A. Sources and Headwaters in 700 m altitude

a) Banks and pools (0—30 cm/sec):

Caridina spathulirostris, *C. richtersi*; Zygoptera gen. spp.; Lepidostomatidae (?) gen. spec.; *Hyphydrus scriptus*, *Herophydrus vittatus*, *Hydaticus bivittatus*, *Cybister desjardinsi*; *Pentaneura*-, *Polypedilum*-, *Tanytarsus*-, *Chironomus* spec.; *Gambusia affinis holbrooki*, *Poecilia (Lebistes) reticulata*; Surface: Veliidae gen. spec.; *Gyrinus nitidulus*, *Dineutus indus* f. typus.

b) Medium current (30—75 cm/sec):

Eunapius michaelseni; *Limnodrilus hoffmeisteri* (in muddy water-mosses); *Zygonyx* sp. (in water-mosses); Anisoptera gen. spec.; Limnophilidae gen. spec. (between waterplants); *Eukiefferiella* sp.

c) Strong current (75 cm/sec—>1 m/sec):

Eunapius michaelseni; Talitridae gen. spec. (in water-mosses); *Zygonyx* sp. (in water-mosses); Hydropsychidae gen. spp.

B. Upper courses between 700 m and 400 m altitude

a) Banks and pools (0—30 cm/sec):

Caridina richtersi, *C. brachydactyla*, *C. spathulirostris*; Lepidostomatidae (? gen. spec.); *Chironomus* sp.; Nepidae gen. spec.; *Melanoides tuberculata*, *Thiara scabra*, *Omphalotropis globosa*, *Lymnaea (Radix) mauritiana*, *Physa borbonica* (all gastropods from about 500—600 m altitude); *Gambusia affinis holbrooki*, *Poecilia (Lebistes) reticulata*; Surface: Veliidae gen. spec., Gerridae gen. spec., *Dineutus indus* f. typ., *Dineutus subspinosus*.

b) Medium current (30—75 cm/sec):

Zygoptera spp. (between floating plants); *Zygonyx* sp. (in water-mosses); Lepidostomatidae (?) gen. spec. (between waterplants); *Conchapelopia*-, *Dicrotendipes*-, *Eukiefferiella* sp.; *Melanoides tuberculata* (up to 50 cm/sec: under stones).

c) Strong current (75 cm/sec—>1 m/sec):

Zygonyx sp. (between water-mosses); Hydropsychidae gen. spp.; Orthoclaadiinae gen. spp.

C. Upper to Middle courses between 400 m and 200 m altitude

a) Banks and pools (0—30 cm/sec):

Caridina richtersi, *C. typus*; Zygoptera gen. spp., *Anax imperator*; Lepidostomatidae (?) gen. spec.; *Aulacodes* sp.; Nepidae gen. spec., Ranatridae gen. spec.; *Neritina gagates* (from about 300 m), *Melanooides tuberculata*, *Thiara scabra*, *Lymnaea* (R.) *mauritiana*, *Physa borbonica*, *Gyraulus mauritianus*; *Gambusia affinis holbrooki*, *Poecilia* (*Lebistes*) *reticulata*, *Xiphophorus maculatus*; tadpoles of *Bufo regularis*; Surface: Veliidae gen. spec., Gerridae gen. spec., *Dineutus indus* f. typ.

b) Medium current (30—75 cm/sec):

Eunapius carteri; *Macrobrachium australe*; *Zygonyx* sp. (in water-mosses); *Orthetrum stemmale stemmale*, *Thalassothemis marchali*, *Trithemis annulata*; Hydropsychidae gen. spp., Hydroptilidae gen. spec. (in troops on the sides of stones); *Aulacodes* sp.; *Cricotopus*-, *Eukiefferiella* sp., Simuliidae gen. spp.; *Neritina gagates*, *Septaria borbonica* (from about 300 m), *Melanooides tuberculata* (up to 50 cm/sec: under stones), *Thiara scabra* (up to 50 cm/sec: under stones), *Lymnaea* (R.) *mauritiana* (up to 50 cm/sec: under stones), *Physa borbonica* (up to 50 cm/sec: under stones).

c) Strong current (75 cm/sec—>1 m/sec):

Eunapius carteri, *Zygonyx* sp. (between water-mosses); Hydropsychidae gen. spp.; *Cricotopus*-, *Eukiefferiella* sp., Simuliidae gen. spp.; *Neritina gagates*, *Septaria borbonica* (from about 300 m).

D. Middle to Lower courses between 200 m and 10 m altitude

a) Banks and pools (0—30 cm/sec):

Eunapius carteri; *Dugesia* aff. *gonocephala*, cf. *Glossosiphonia* (?) sp., *Caridina typus*, *C. serratirostris*, *C. spathulirostris*, *C. brachydactyla*, *C. richtersi*, *C. mauritii*, Zygoptera gen. spp., *Anax imperator*, Lepidostomatidae (?) gen. spec.; *Aulacodes* sp.; *Cricotopus* sp., (in *Eunapius carteri*), *Chironomus* sp., *Anopheles coustani*; Nepidae gen. spec.; *Neritilia consimilis* (from about 20 m), *Bellamyia bengalensis zonata*, *Melanooides tuberculata*, *Thiara scabra*, *Lymnaea* (R.) *mauritiana*, *Physa borbonica*; *Gambusia affinis holbrooki*, *Poecilia* (*Lebistes*) *reticulata*, *Xiphophorus maculata*, *Anguilla mossambica* (in the sand); tadpoles of *Bufo regularis*; Surface: Veliidae gen. spec., Gerridae gen. spec.; *Dineutus indus* f. typus, *Dineutus aereus* (from 70 m altitude).

b) Medium current (30—75 cm/sec):

Eunapius michaelsoni, *Eunapius carteri*; *Macrobrachium australe*, *M. lar*, *Varuna litterata*; *Zygonyx* sp. (in water-mosses), *Diplacodes* sp., Hydropsychidae gen. spp., Limnophilidae gen. spec.; *Aulacodes* sp. (in water-mosses); *Cricotopus* sp. (one species in *Eunapius*); *Neritina gagates*, *Clithon coronata* (from about 100 m), *Neritilia consimilis* (from about 20 m), *Thiara scabra*, *Lymnaea* (R.) *mauritiana*, *Physa borbonica* (the 3 last species occurs up to

50 cm/sec under stones); *Sicyopterus* (?*Sicydium*) *lagocephalus* (with ventral sucker), *Anguilla mossambica* (between gravel).

c) Strong current (75 cm/sec— >1 m/sec):

Eunapius michaelsoni, *Zygonyx* sp. (in water-mosses); Hydropsychidae gen. spp.; *Aulacodes* sp. (in water-mosses); *Cricotopus* sp. (in *Eunapius*), *Cardiocladius*-, *Rheocricotopus*-, *Eukiefferiella* sp.; *Neritina gagates*, *Clithon coronata* (under stones), *Septaria borbonica*, *Neritilia consimilis*, *Sicyopterus* (?*Sicydium*) *lagocephalus* (with ventral sucker), *Anguilla mossambica* (between gravel).

E. Lower courses to the mouth between 10 m and 0 m

a) Banks and pools (0—30 cm/sec):

Caridina serratirostris, *C. brachydactyla brachydactyla*, *Atya pilipes*; *Clithon longispina*, *Neritilia consimilis*, *Bellamya bengalensis zonata*, *Melanoides tuberculata*, *Thiara scabra*, *Lymnaea* (*R.*) *mauritiana*, *Physa borbonica*, *Anguilla mossambica* (in sand), different brackishwater fishes, tadpoles of *Bufo regularis*; Surface: Veliidae gen. spec.

b) Medium current (30—75 cm/sec):

Eunapius michaelsoni; *Trithemis annulata*; Hydropsychidae gen. spp.; *Neritina* (*Neripteron*) *auriculata mauriciae* (from about 10 m; under stones), *Neritina gagates*, *Clithon coronata*, *Septaria borbonica*, *Neritilia consimilis*, *Thiara scabra* (up to 50 cm/sec), *Lymnaea* (*R.*) *mauritiana* (up to 50 cm/sec), *Physa borbonica* (up to 50 cm/sec); *Anguilla mossambica* (between gravel).

c) Strong current (75 cm/sec— >1 m/sec):

Eunapius michaelsoni; Hydropsychidae gen. spp.; *Neritina gagates*, *Clithon coronata* (under stones), *Septaria borbonica*, *Neritilia consimilis*; *Anguilla mossambica* (between boulders and gravel).

4.4.4. The distribution and density of the running water fauna between the headwaters and the mouth

The streams of Mauritius have very steep gradients and torrents only in the upper courses below the headwaters of the southern plateau and, partly, in the middle courses of the SW-mountains. The sources and headwaters in the central plateau with marshy soils are slightly acidic and very soft (0.28°—0.52° dH) and in the chemistry similar to the brooks at granitic islands, like Mahé or Ceylon. The content of mineral salts is very low (conductivity: 43—54 μ Siemens). Gastropods in these brooks are absolutely absent, quite different from the other parts of the streams, where the Gastropods dominate in very high numbers!

The headwaters have in the regions with stronger current only a very poor fauna with some larvae of Hydropsychidae, and in water-mosses, covering the boulders and rocks, the larvae of a *Zygonyx* sp., a species of Talitridae and *Limnodrilus hoffmeisteri*. The fauna is richer in regions with low current, and in the large pool-like sections between small cascades. On the surface are Veliidae,

sometimes Gerridae and 2 species of gyrid (*Gyrinus nitidulus*, and *Dineutus indus* f. *typus*). On the sandy bottom with iron-ochre mud and vegetable debris are dominating *Caridina* species, such as *C. spathulirostris* and *C. richtersi*, the last an endemic species. In these biotope occur also larvae of Zygoptera and Lepidostomatidae (?), with cases from fragments of plants of the border, and sometimes Nepidae and Ranatridae. Very frequent are also some species of Dytiscidae such as *Hyphydrus scriptus*, *Herophydrus vittatus*, *Hydaticus bivittatus* and *Cybister desjardinsi* and their larvae. In the free water the introduced Cyprinodontidae *Gambusia affinis holbrooki* and *Poecilia (Lebistes) reticulata* are always present.

The torrents and waterfalls in the upper and in the transition to the middle courses, especially in the streams of the SW, are characterized by a dense growth of water-mosses and floating filamentous algae, growing on boulders and gravel in the current. In these mosses (and partly in the filamentous algae) are always to be found, as like noted above, the larvae of a specially adapted *Zygonyx* sp. (the legs are angular, to root between the branches of the mosses), additional Limnophilidae and — from the middle courses — the larvae of a Pyralidae species, genus *Aulacodes*. On the sides and below the stones in the medium current are living some species of Anisoptera-larvae such as *Orthetrum stemmale stemmale*, *Thalassothemis marchali*, *Trithemis annulata* and a *Diplacodes* sp. On the surface of the stones are the larvae (and pupae) of Hydropsychidae and Orthocladiinae always present, but in a small density; on the sides of the stones, away from the current, are the cases of a Hydroptilidae-species.

It was astonishing and surprising to find that the larvae of Simuliidae in the waterfalls and cascades were always very rare, in small numbers, or absent! Absolutely absent on Mauritius are the Ephemera and never found by others or by our mission!

Very rich is again the fauna of those sections with low current, especially in the middle and the transition to the lower courses. In these parts the rivers are in transition between the hilly and flat parts of the coastland. They flow through the cultivated areas and the influence of the surrounding plantations of sugar-cane (fertilizer!) and pollution of villages and towns cause a dense vegetation of submersed water-plants and floating filamentous algae. This high primary production (eutrophic) is the base of the development of high densities of several freshwater animal-groups. Near the banks and in pools, between plants and roots from the border, submersed waterplants and vegetable debris occur many species of *Caridina* such as *C. spathulirostris*, *C. richtersi*, *C. typus* and *C. brachydactyla*, in the lower courses also *C. serratiostris*, *C. mauritii* (the last species again an endemic element) and *Atya pilipes*. A high density show also the freshwater gastropods: in sections with a current to maximal 50 cm/sec, mostly with a current between 20—30 cm/sec there are up to 350 individues $1/_{16}$ m² to count, belonging to *Melanoides tuberculata*,

Thiara scabra, *Omphalotropis globosa* (very rare!), *Lymnaea (Radix) mauritiana*, *Physa borbonica* and *Gyraulus mauritianus*.

In the lower courses also a typical stillwater-species, the viviparid *Bellamya bengalensis zonata* appears on the muddy borders with vegetable debris. On the bottom and between roots from plants of the border are to find the larvae of Zygoptera and on the bottom the big larvae of *Anax imperator*. Under stones sometimes larvae of other Anisoptera, further Nepidae and Hydrometridae are always present.

On the surface are again Veliidae, Gerridae and Gyrinidae, especially the large species of *Dineutus (D. indus f. typica* and in lower courses *D. aereus*). On the transition to the lower courses are to find sometimes under bigger stones with small caves *Macrobrachium australe* and *M. lar* and the crab *Varuna litterata*, occurring from brackish-water of the mouth up to the pure fresh-water-zones.

In the free water of the banks and pools swimm the cyprinodontid fishes, such as *Gambusia*, *Poecilia* and *Xiphophorus*. They were introduced to control of the larvae of *Anopheles*, such as *A. coustani*.

The lower courses up to the mouth of the rivers are — like in the other islands of the Indian Ocean — characterized by different species of Neritidae in the parts with medium up to strong current. *Neritina gagates* and *Septaria borbonica* are to find from about 300 m altitude, *Clithon coronata* and *Neritilia consimilis* from about 80 to 100 m altitude, and *Neritina (Neripteron) auriculata mauriciae* near the upper border line of the brackish recurrent during high tide in about 5—10 m altitude.

As at Anjouan and La Réunion the gobiid *Sicyopterus* (?*Sicydium*) *lagocephalus* with a ventral sucker occurs in the medium and stronger current of the lower courses, attached on boulders and gravel. In the larger streams ascends *Anguilla mossambica* (River des Anguilles!) and near the mouth some marine and brackish-water fishes are to be observe.

The tadpoles of *Bufo regularis*, introduced at Mauritius, are nearly always found in pools and regions with low current near the banks.

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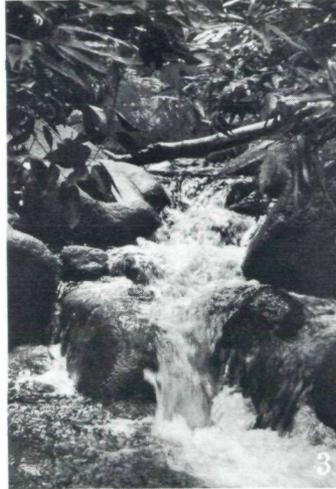
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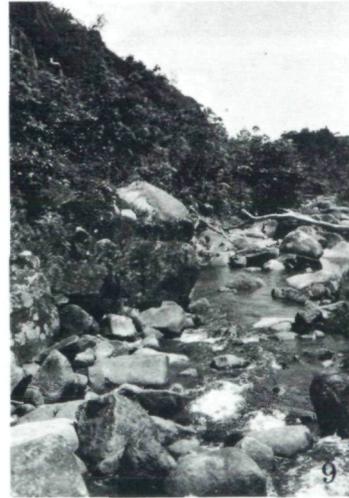
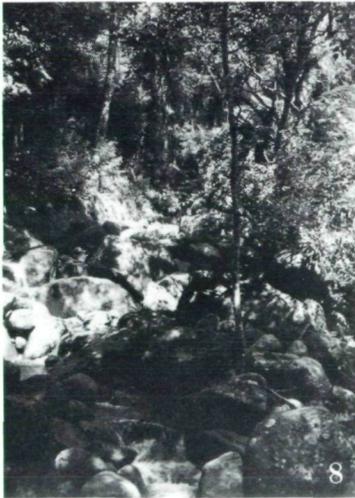
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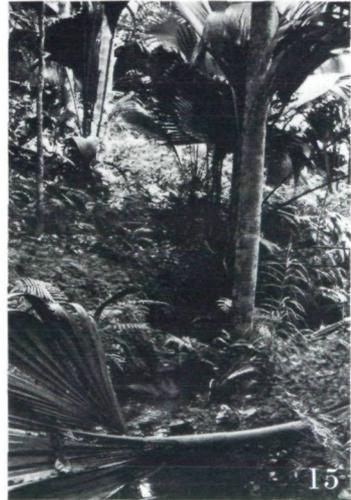
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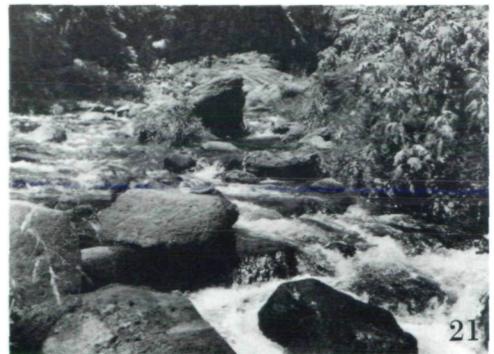
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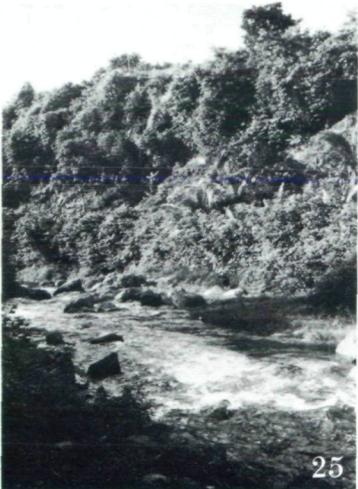
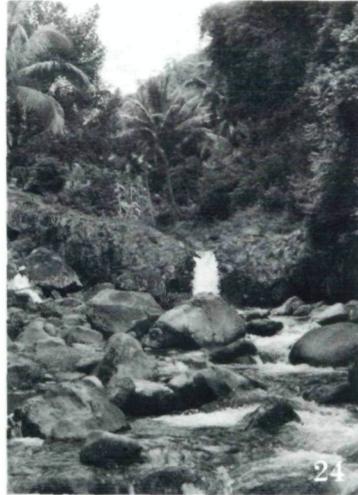
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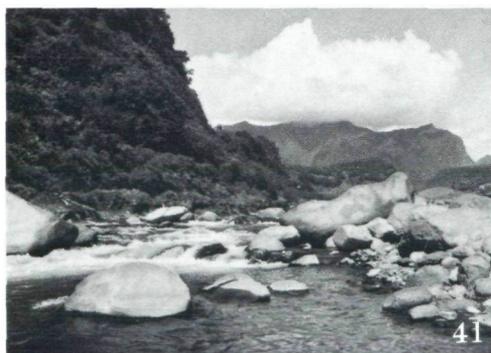






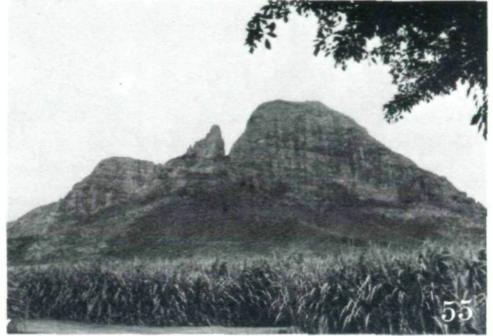






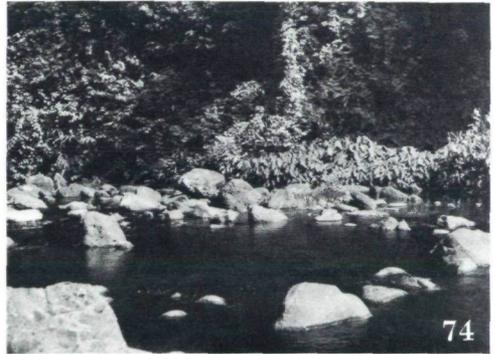














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