



Bleher's **Biotope** in Nature and in Aquaria





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Editorial:

Bleher's Biotopes in Nature and in Aquaria



Dear Reader

First of all I want to mention that this is a unique Catalogue, which was launched extreme successfully in Russia, is finally now available in the English language exclusively from Aquapress Publishers. I must say that it was an immense pleasure for me to provide the Russian people with information about the aquatic world from five continents and it is my aim to pass my knowledge on to the entire nature-loving world.

In this issue, and in future yearly publications, I am showing the real aquatic world in nature, the expeditions to collect life aquatic creatures and plants, how to bring them back alive and introduce them into this beautiful hobby. I want for you dear reader, to see how fishes live naturally and how they should be kept in aquarium, for you to have the healthiest, nature-like environment in your home, office or school.

To stimulate you to have (or to create) a biotope-correct-aquarium, in order to even appreciate it more and your fishes to feel "at home".

It is my aim to not only pass on this information, but also to give you tips of how to decorate the aquarium accordingly and maintain it – for beginners as well as for advanced aquarists. Show you the latest introductions into the hobby talk about well-known aquarium fishes and aquatic plants, as well as what is available in your pet shop – very well illustrated in each issue.

Now you may ask, "why is Heiko Bleher doing this"? Or "who is Heiko Bleher"? Well for those how do not know me (and for those who have no access to the Internet), I would like to introduce myself.

I am born into a family, who has dedicated their life to the aquarium hobby. My grandfather, Adolf Kiel – who's wife was actually Russian descend – thought in the 1880s, when people already did have glass bowls with goldfish in their home and the first public aquariums had opened their doors, that there is something missing. He said "aquatic plants", which bring oxygen to the underwater life (nobody than had aquarium plants) and exotic fishes. So Adolf went out into Europe's wilderness, collected and started his aquatic plant culture and breeding – mostly cold water – fishes and had by 1900 the largest establishment of its kind in the world, in Frankfurt am Main, Germany. Were he is still today known as "The Father of Aquatic Plants".

My mother, Amanda Flora Hilda Kiel (born in 1910) grew up with aquatic plants, fishes, reptiles and amphibians instead of dolls. (The same what happened to me.) She was an amazing woman and the preferred child of three. Her life engagement was the same as her fathers, but she in addition started to do expeditions into Africa and South America to collect new fishes and aquatic plant species – of which she discovered many. And quite a few bear her name "Amanda" or "Bleher", as she married in 1938, my father Ludwig Bleher. (But he was never engaged in this field.) I was the youngest of four children and after world war II she took me with the age of four already to Africa and with seven to South America, collecting and cataloguing fishes and plants, reptiles and amphibians, birds and mammals. I had no choice I grew up in between the aquatic environment and have been with it all my life. Including 30 consecutive years running a company called Aquarium Rio, which I had established in Brazil, were my mother lived for her last 30 years, and from were I moved back to Germany in 1967. Under Aquarium Rio I exported tropical fishes and plants to 86 countries world-wide and travelled collecting and bringing back yearly many new fish species – in the meanwhile I introduced more than 4,000 different aquarium fish species into this hobby and several aquarium plants (and many of both bear my name). With over 800 expeditions collecting and researching in 163 countries, I think I am able to bring to you some of my fishy knowledge. And I shall not disappoint you.

I will give my best to show you the global aquatic world of today, but not only that, also the natural environment, its people, tradition and cultures. From each continent, in each issue a new country will be presented with its fishes, plants and its environment and an adequate biotope-aquaria from one particular biotope (river, creek, lake or bay) of that country.

Once you have read this the first issue, I would very much like you to write to us. Give us your opinion, what you think of this new concept for the most beautiful and educational hobby on planet Earth.

Your nature lover

Heiko Bleher

Bleher's Biotopes in Nature and in Aquaria

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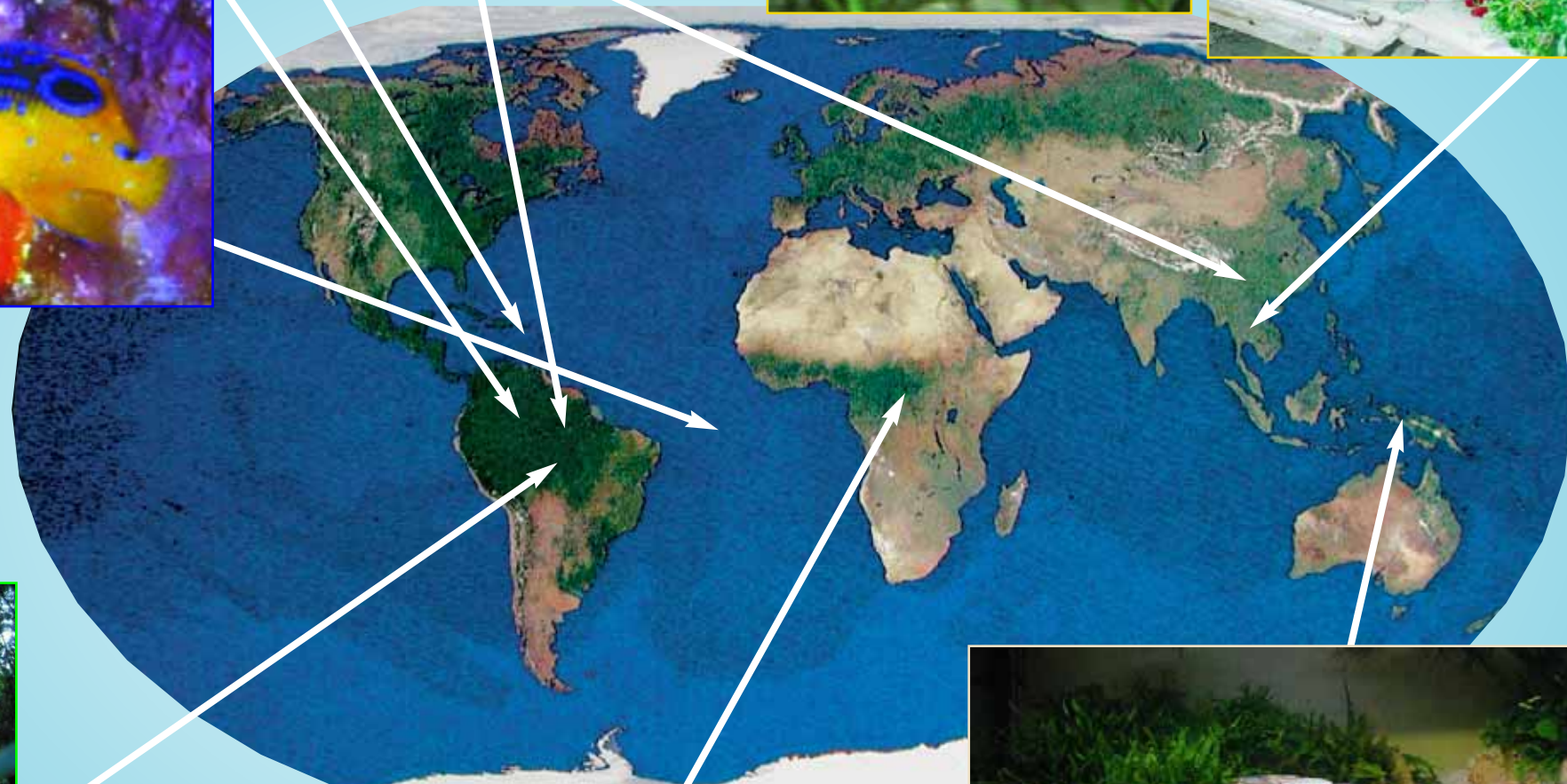
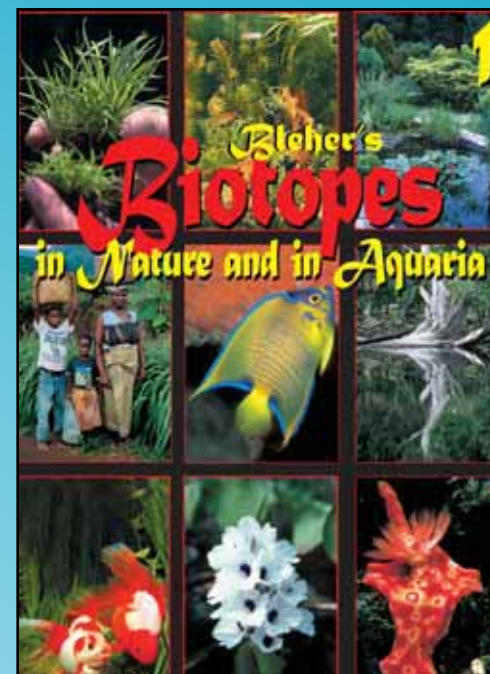
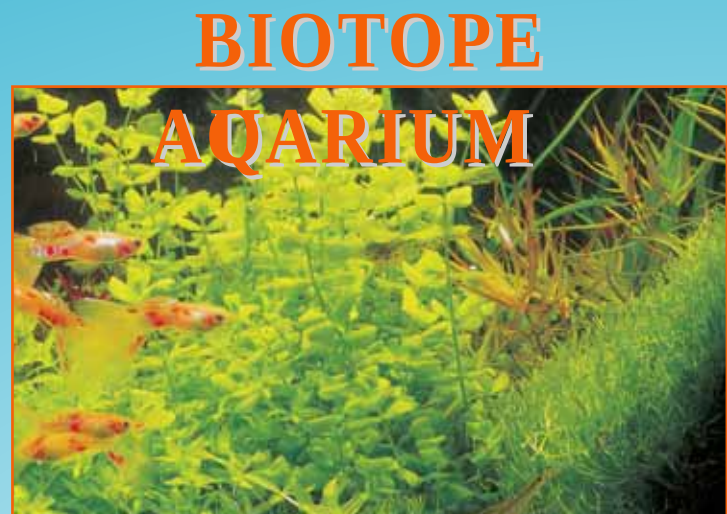
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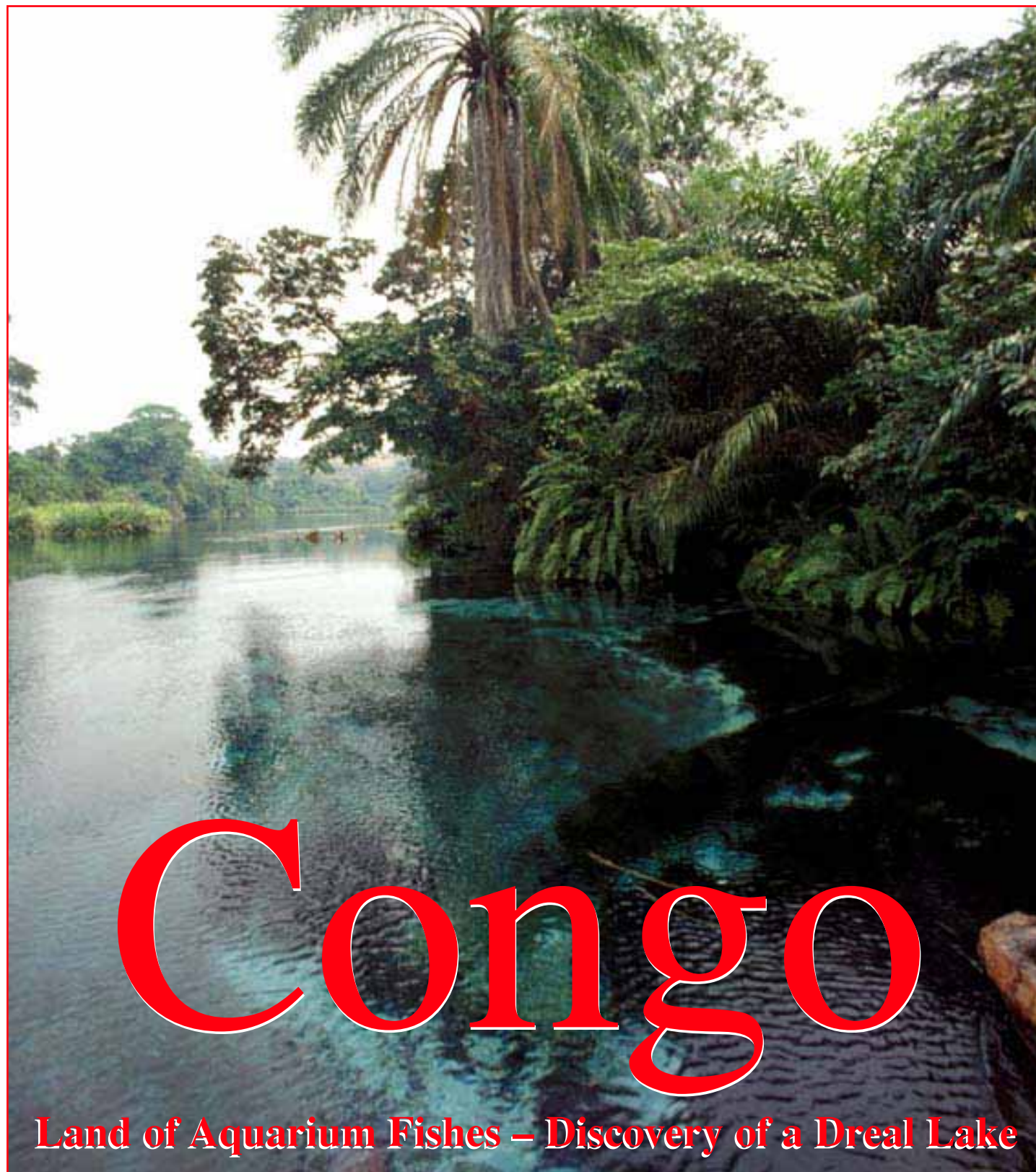




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There are places on this earth which seem only to exist in the human imagination and among these is a lake in the very heart of Africa which surpasses the bounds of that imagination. A unique, fascinating, underwater world; a dream lake; Lake Fwa. Located in the African land of Aquarium Fishes...

Text and Photos: Heiko Bleher

Problem after problem

In Kinshasa, the capital of former Zaïre (now Congo), my luggage disappeared, but nevertheless the next day I flew on to Kananga. It would be sent on... but after a week of preparation for the expedition there was still no sign of it. On the spur of the moment I flew back and found it among thousands of missing bags and suitcases in an obscure semi-derelict warehouse.

Back in Kananga, with the backing of the *Cooperation Régionale Kasai Occidentale*, and driving a sparkling new jeep belonging to the *Projet Pisciculture Familiale*, I set off on the only road to the east. Although there was practically no traffic, every so often I saw the wreck of a car in the ditch. On an earlier attempt at this journey my own vehicle suffered a similar fate. The road was so hazardous one could only contemplate a journey in an emergency, with a 4-wheel drive vehicle and in the dry season.

I reached Lake Mukamba, formerly the weekend resort for Kananga, in the evening. Like most of the area the lake is without any noteworthy stands of trees (apart from a few palms there is just dry savannah in Kasai State). An investigation revealed that the native flora and fauna in this lake had been wiped out by the introduction of tilapiines. The largest fish I caught measured only 6 cm. Normally tilapiines, which have been introduced all over the tropics, measure between 35 and 40 cm. After Mukamba the road became even narrower and was barely passable. The last 50 km to the lake took a day and a night. I was completely lost when suddenly a valley filled with lofty green trees appeared in the savannah. There was no obvious way down. Finally, as darkness fell, I came to a bay. The sight made me forget the hardships of the past 10 days.

The water was on fire

The rays of the setting sun penetrated the surface of the water and tinged the aquatic vegetation with blood-red. It looked as if the water was on fire and the plants were moving to the rhythm of the flames while innumerable fishes

swam through the "conflagration". These jewels, these swimming specks of colour in a dreamlike, but at the same time natural, underwater garden, reminded me of my childhood. It was 1947, I had just turned three, and the aftermath of the Second World War was everywhere. My mother, Amanda, had been a "driving force" in the rebuilding of the Frankfurt Zoo and opened the first aquarium display. I stood proudly (I had only just learned to walk myself) in front of a huge aquarium. For the first time I saw a fascinating aquatic landscape. An underwater garden through which fishes swam hither and thither like glittering jewels. And I could not catch these swimming specks of colour. The tank was too high. I stood in wonderment, my lower jaw sank lower and lower, and only the call of my mother – "Heiko, shut your mouth before the flies get in" woke me up!



In two occasions I was fortunate to reach this remote Lac Fwa in today's Democratic Republic of Congo, former Zaïre. And I was able to bring out for the first time alive some of the most beautiful (and colorful) cichlids the aquarium hobby has ever seen. One of them was *Thorachromis brauschi* (1) former *Haplochromis*. The only access to Lac Fwa is to fly to Kananga and then drive (if there is a car in Kananga...) 150 km east, on an hardly existent track (2). Then, if lucky, one arrives near at the lake (3).

showing the presence of *Bilharzia* infested water had such a drastic effect? Was that why the lake had vanished from the maps? Question upon question, but no answers.

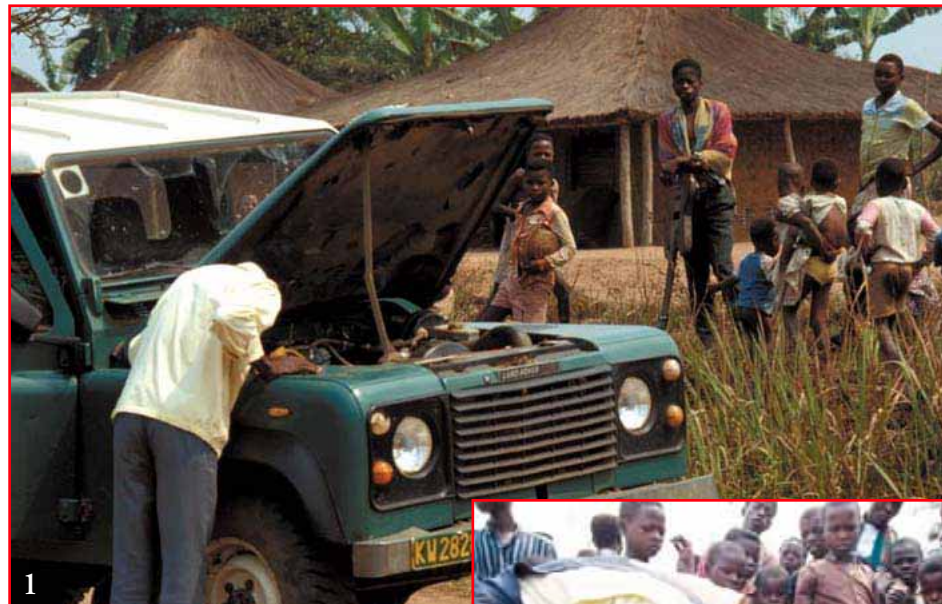
I had only two days left. So in the early morning mist I was straight back out on the water, together with a native who lived in a nearby but. His dugout canoe was leaky. While I baled, he pushed the canoe with a long pole. As the sun rose, Lake Fwa awoke, and with it its flora and fauna. Fishes leapt from the water with joy (or were they hunting), colourful butterflies fluttered from one splendid orchid to the next, red-coloured crabs scuttled round in the deeper water and nasty black wasps with yellow nether regions buzzed around. A group of monkeys leapt away from us through the treetops. The frogs were silent. At this point the lake was more like a river, running swiftly northwards, hemmed in by giant *Colocasia* leaves, *Pandanus* plants protruding from the water higher than the average tree and ferns larger than any I had ever seen before. Philodendrons hung from the overhanging trees and other climbing plants complemented this unique shoreline. It was just the same underwater. The waterscape varied from endless succulent green beds of giant *Vallisneria*, brooken by bizarre rocky outcrops resembling a moonscape, to white underwater sand dunes and rock formations of red lava.

There is an immense richness of water-plants. The genera *Lagarosiphon*, *Potamogeton*, *Nymphaea*, *Nuphar* and *Ottelia* were all represented plus countless aquatic ferns and floating plants – plants which were new to me. All mingled with millions of fishes. Cichlids predominated, generally swimming around in large shoals. Also, I saw single individuals of an exceptionally colourful hap-

lochromine, the largest cichlid in the lake. I named in the “Picasso Fish”, as Pablo Picasso is the only person on earth who was able to create such a combination of colours.

The dugout was ramshackle, more sinking than swimming, but in the slow-moving waters of the bays a five cm long bottom dwelling fish, a *Garra* species, could clearly be seen, even at a depth of 15 metres. The lake was so transparent as to create the illusion that our boat was suspended in mid air. There was better to come. I dived with flippers, spending some six hours exploring. Under the floating plants (*Pistia stratiotes*) I found cichlids with blood-red ventral surfaces (*Hemichromis* species) surrounded by

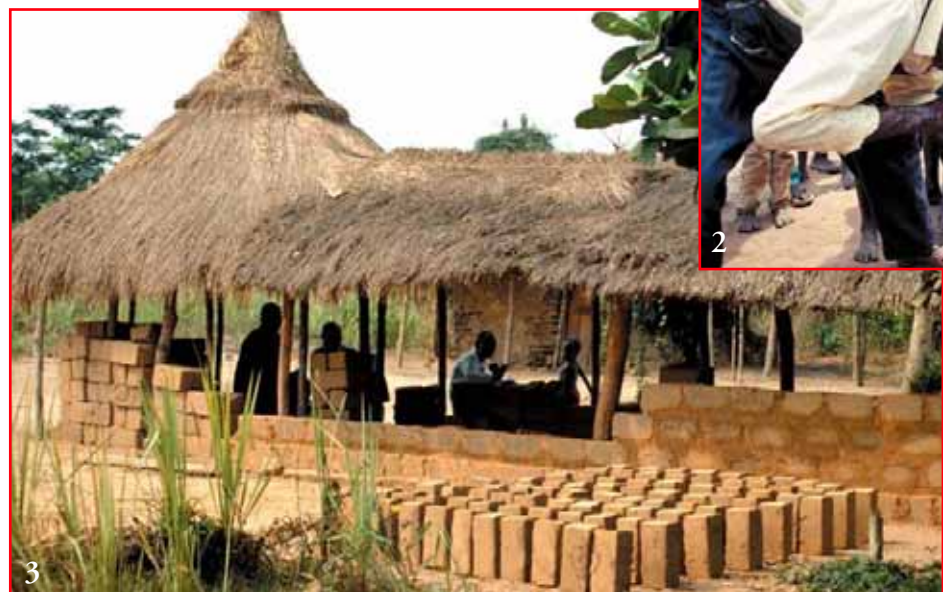
hundreds of fry. Around the rock formations (which resembled those in the garden of the Tenryuji temples in Kyoto, but were rather older, those in Japan having not been built until 1339...) hundreds of partly dark to black coloured cichlids with gleaming golden yellow dorsal fins swam vertically to suck the rocks clean. Others, with silver longitudinal bands, emerald green opercula and pink-red fins with a white border and velvet clack leading edge adorning the dorsal, defended their females. The latter carried up to 50 1.5 cm long fry in their mouths, only releasing their offspring to allow them to urinate in the shadow of large rocks. As soon as danger threatened the almost colourless mothers sucked in all



1



2



3

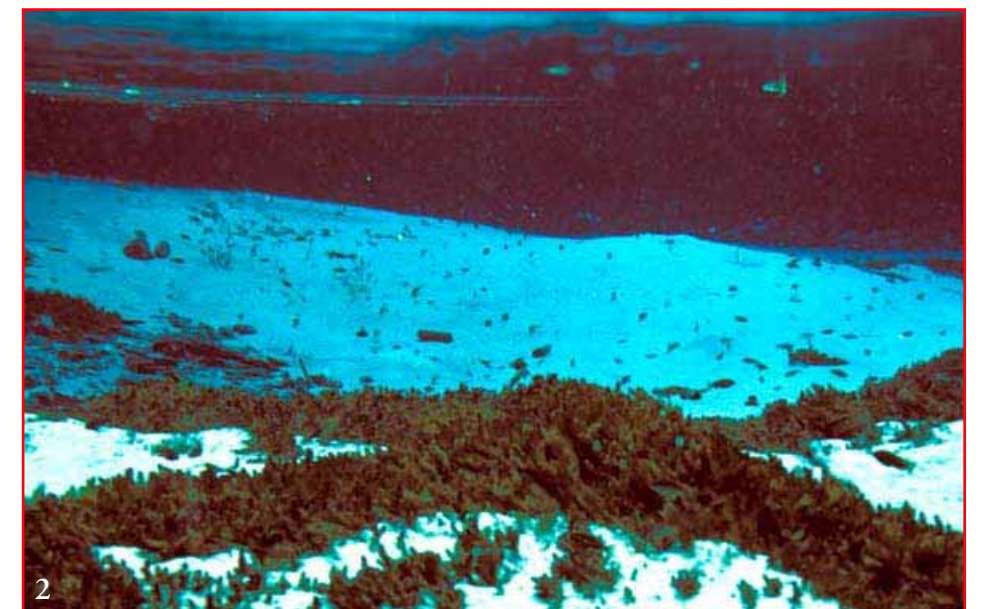
Along the terrible dirt road we run always into car problems (1). At one native settlement the oil plugged and our driver “blew” the dust out (2). The natives, far from any civilisation, built their huts from natural materials, here bricks made from clay (3)



1

their fry again. The males displayed their splendid finnage, the elongate golden spot in the anal being particularly prominent, and chased away each and every intruder. This fish was described by Poll as a monotypic species, *Schwetochromis neodon*, and is, like all the other cichlid species here endemic, that is to say, found only in this lake.

While fishes like the above inhabit mainly the rocky areas, others are found exclusively over sandy substrates. These, led by a dominant individual, forage in the sand for microorganisms (interstitial fauna). They repeatedly take up mouthfuls of sand, sift it for food and spit it out again. I lay on the bottom, totally submerged, and let



2



3

thousands pass by me. It was fascinating to note that all individuals except the leader adapted completely to the colour of the white sand. He was an attractive dark brown with yellow ins and longitudinal bands. Mainly he swam in front of and above the shoal, only deviating if a rival appeared.

Other (possibly small *Haplochromis* spp.) live only among the plants, feeding on algae and micro-organisms. The plants also offer shelter to groups of developing juveniles. The largest swimming creature in the lake, a carp-like *Labeo* species, appears not to eat plant leaves. This grey, harmless fish, which grows up to 65 cm has a long pointed snout with sensory organs on its sucking mouth. The body is marked with large, deep red, almost round spots on

each scale. Less innocuous are the characins of the *Hydrocynus* group, sometimes called tigerfish. Their mouths are armed with very large, pointed, interlocking teeth like those of the cats and can send shivers down your spine – but their prey consists mainly of fish.

The Lake has crystal clear water and one can see to the bottom from anywhere. Here a view of one area where there are rocks in the background and large growth of *Vallisneria aethiopica* in the foreground (1). Underwater one can also see everything. Here *Ceratophyllum demersum* in the foreground and hundreds of cichlids over the white sand (2). Lac Fwa consists of one upper and one lower lake-level area. Towards the lower lake is a tremendous strong current, which can be seen clearly by this underwater photo (3).



The strong current in the middle of the lake, against which it is impossible to swim, drove me a few kilometres downstream to a narrow. Here the upper lake, normally 100 to 300 metres in width, was only 12 metres wide and fropped to a lower level over a kind of waterfall. In the evening, as, restless but unusually happy, I lit my campfire at the edge of a bay, a youth arrived, bringing me a pair of fishes he had caught.

I exchanged these for some German vegetable soup.

Lake Fwa is so clear because its only affluents are a large number of underground springs, some of them massive. The power with which the clear water emerges from the rocks and holes is immense. In a few shallow areas this creates a fountain effect, with water

spurting to a height of up to a metre above the rocks. At many places in the sandy bottom water bubbles through unhindered. The lake has only a single outlet at its northern end. But I did not see that until two years later.

In the 1990s it was to be different, I had intended to spend 14 days at the dream lake, with provisions for this period of time, and accompanied by two very good friends – the cichlid breeder and Tanzania-traveller Peter Schupke of Bayern and the forest expert Karlheinz Freitag. But on this expedition to the Congo everything was to go wrong, as is unfortunately typical of the darkest part of Africa...

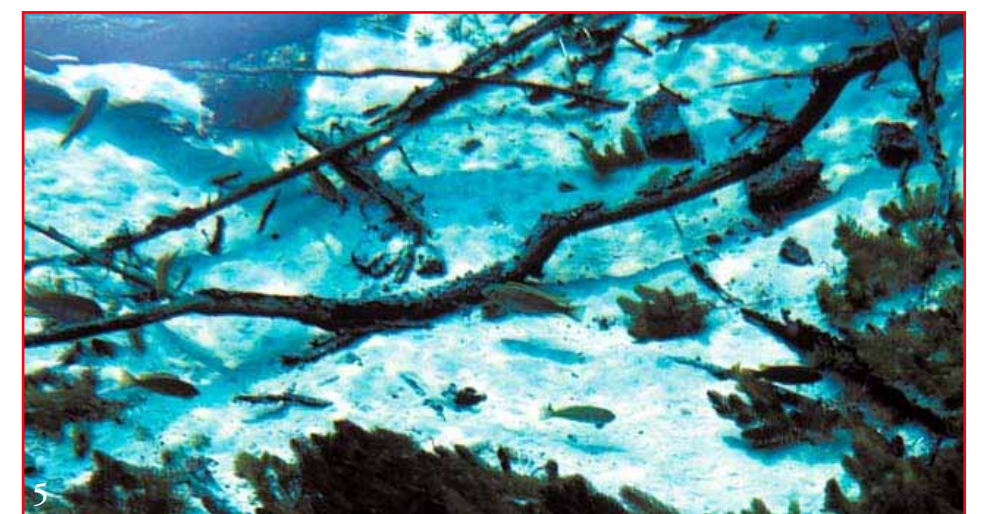
Delays and detention

We were delayed in Kinshasa for three days because the internal airline was

not flying. Then our flight to Kananga was cancelled and no alternative available. When we finally arrived in Kananga on the fifth day, our passports were taken away. It was claimed that we had no travel permits for Kasai. After three days, part spent in custody (my visa was said to be invalid and my presence here thus illegal), we were given residence permits, but only for three days, and only for Kananga – but not our passport. The jeep we had arranged to hire was useless – all the wheels, as well as the engine were damaged or missing and no alternative vehicles were available. At the hotel – the Grand Hotel Kananga – there was nothing: no information, no electricity, no running water and no food. Eventually the mission helped us out with an old Landrover. Finally, on the evening



At the lake site there are no native, nor any other people living. There is no boat or any other sign of human trace, except for a few dugouts made by distant living natives, which come once in a while to fish, a couple of those helped us. Here raising over masses of *Ceratophyllum* (1). The *Vallisneria aethiopica* becomes bright red in shallow water, were also are found many *Lemna gibba* (2). The two recognized species, *Cyclopharynx schwetzi* and *C. fuae* migrate constantly over the fine white sand and ingest large amounts of white sand and diatoms. Always watched and guided (and protected?) by the dark coloured alpha animals (3-4). Another endemic species (and genus) is *Schwetzschromis neodon*. A fascinating cichlid (see also following pages). Here seen in the centre over white sand and *Ceratophyllum demersum*, with its female below (5)





of the tenth day, we reached Lake Fwa. During the journey I noticed that there had been some destruction since my previous visit. There were practically no trees to be seen, just charcoal. The trees had been burned as far as the shore of the lake, and a road to the diamond mining town of Mbuji-Mayi was under constructions nearby. There were now far more fishermen on the lake than two years before. A man dragged past a newly-shot monkey and another a seven metre long python skin. Karlheinz and Peter shared my bewitchment, and on our second, and final day we decided, despite the shortness of the time available, to travel down the lake to its outlet. This proved to be rather more than an adventurous undertaking. From five in the morning until sunset we had to paddle ourselves to the other end of the lake in two sinking canoes. During this time I was able to establish with certainty the reason why all the species in the lake (with one or two possible exceptions) are endemic. In the lower lake (which I term thus, because after the narrows and the waterfall the real lake begins, now up to 1000 metres wide, with barely any current and very deep) there is a six kilometres long stretch which is choked with an impenetrable growth of water plants. A covering of *Potamogeton* species forms a huge carpet, extending down to the bottom some metre below. We could barely push our boats for-

Schwetochromis neodon has fascinating colours, here a male (1-2). In their revision Roberts & Kullander (1994) of the Lac Fwa cichlids, they placed Poll's 1948 described *Callopharynx microdon* in synonymy with *Cyclopharynx fuae*, but not only is their morphology distinct, but also their behaviour: *microdon* (3-4) eats exclusively Aufwuchs (seen on the large photo scraping head down), while *fuae* and *schwetzi* ingest sand and diatoms. Frogs can be seen around Lac Fwa at night (5) and in the lower lake area many *Pistia stratiotes* (6). No one knew the length of LacFwa, but I was able to measure it. At the very end, where the lake merges (at its outflow) with the Lubi river, we lost our stick to bring the dugout back, so I did row with my diving fins. I made 22,000 strokes and each one brought us about 1 m ahead = 22 km long(7). The lake has, at its southern end, incredible quantities of underground springs. In some places the waterfountain is so strong that it blows one away, or they lie near the surface (8).

wards, and swimming and diving were impossible. Neither we, nor the fishermen could find a single fish in this area, just millions of shrimps. The outflow into the murky river Lubi is indescribably strong. Here we again found fishes in a tiny inlet – but they were not species found in the lake, and must have originated in the river. As the sun set over the carpet of plants, glittering golden in its rays, we paddled back, with our flippers, against the current! It was unbelievably hard work: 22,000 beats of the flippers, each producing a metre's progress. I expected to have no arms left by dawn. I could still feel my muscles aching weeks later. We also had to get past the waterfall. My comrades wandered through the undergrowth while I, assisted by a guide,

tried to get my dougout and all our gear up through the rush of water with the second dugout tied to the rear. Naturally this took several attempts, and eventually everything was underwater – including camera, money and food.

Sorrowful hearts and happy memories

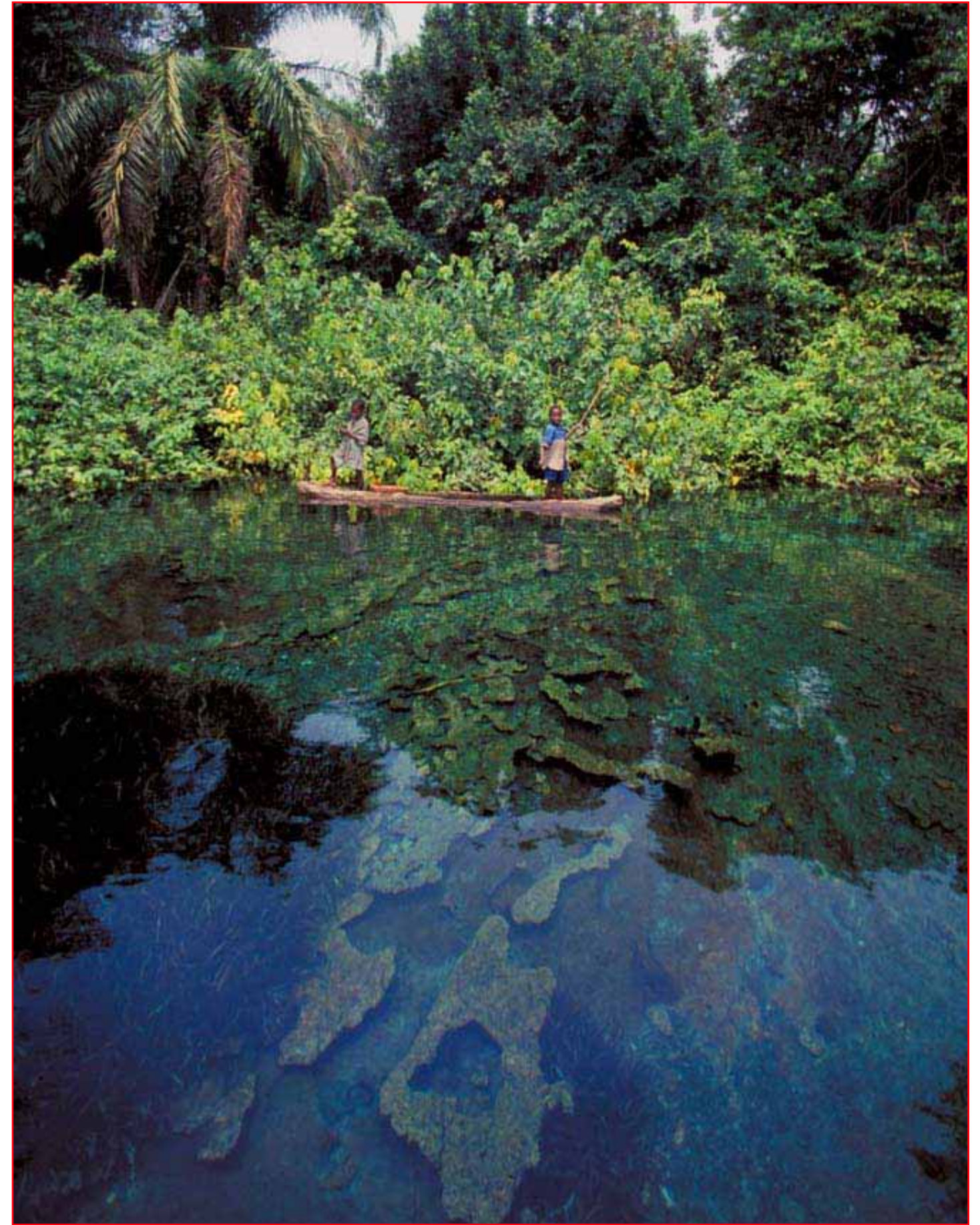
We left the dream lake with sorrowful hearts but happy memories. The lake was unique, as was the adventure of exploring in. In Kananga we retrieved our passports at the last minute; in Kinshasa I was once gain detained because of a missing authorization stamp (undoubtedly a deliberate omission), and it was only through the invention of Karheinz and the help of the German embassy that we boarded our flight that

evening. Later on, first I was tricken by a dreadful attack of Malaria, then Peter and Karleheinz succumbed. All three of us were found to be Bilhazia-positive.

We were also positive that we had confirmed the presence of the families Nothopteridae (1 sp.), Mormyridae (2 spp.), Clupeidae (1 sp.), Cyprinidae (4-5 spp.), Alestidae (2 spp.), Distichodidae (1 sp), Bagridae (3 spp), Clariidae (1 sp), Mochokidae 81-2 spp), Alocheilichthyidae (2 spp.) and Cichlidae (at least 10 spp.), a total of at least 29 species and most probably more than 30. And almost all of these are endemic. We had discovered twice as many species as listed by Pool and Roberts who were responsible for the only previous reports on Lake Fwa.



I called it "Picasso Cichlid", as to my believe only this master (Picasso) was able to produce such colours as I found in *Thoracochromis callichromus* in Fwa.



Lac Fwa is unique on planet Earth, and not only for all its endemic colourful cichlids. It is an giant, unbelievable beautiful, natural aquarium. It has a spe-cies flock (small compared to Tangaganyika, Malawi and Victoria – but there are definately more than the 5 recognized species (by Roberts & Kullander).



For a biotope aquarium with Lac Fwa cichlids (but not only – see main text for other families), here some samples and information about the same: 1. *Thoracochromis callichromis*, the “Picasso fish”, can grow to 15 cm total length (it is the largest cichlid in Lac Fwa), it is by far the most colourful of all, but also the most aggressive one. Only to be kept in very large aquariums and better in groups of five and more. And to decorate their aquarium with many large *Vallisneria gigantea* (see comments at the end). 2. The female of *T. callichromis* is has much less colours. 3. *T. brauschi* is a peaceful cichlid and has been established in the hobby, in Russia, as well as in Europe and America. Thanks to the breeding of Mr. Anatoly (Moscow) and others breeders. 4. The female of *T. brauschi* has more colours, than the female of the Picasso fish. 5. Also *Cyclopharynx schwetzi* is a very nice peaceful cichlid. This as well as the similar *C. fwa* filter the sand for microorganisms – therefore need fine sand on the bottom. 6. *Schwetziichromis neonon*, is another unique Lac Fwa beauty and a peaceful character as well. This mouthbrooder (as all the others), needs some rocky area, because it also eats Aufwuchs from the rocks.

Note: in generell, such an Lac Fwa aquarium should have a rocky area with flat rocks, or rocks in odd shapes (see previous page); some *Vallisneria gigantea* (as shurely *V. aethiopica* is not available in the hobby), *Ceratophyllum demersum*, maybe some water lilies (*Nymphaea* species) and *Lagarosiphon major*, if available, and much white (fine) sand. It could have a strong water flow and be cristal clear water. The pH can go from 7.0 up to 8.5 (or even a little higher) and the conductivity anywhere from 100 up to 500 microsiemens (and even more). Temperatures from 23-24 to maximum of 29°C.



Here some different (African) fish species from Cameroon and the Congo basin with information about behaviour and habitat, as well as how to keep them: 1. *Pelvicachromis taeniata* from Muyuca (Cameroon), is a fantastic small beauty – but only the female has such bright colours. 2. With *P. taeniata* from Dehane, the male has a stricing colour. They all (*P. taeniata* variants) are territorial dwarf cichlids and can be kept in small groups, but once they found their mate, the become very aggressive, even towards each other, so it is imperative to have enough places for them to hide (ie drift woods, ceramic cones or pots, rocks with holes, etc.). 3. Also *Nanochromis* species, here *N. squamiceps* (female), are peaceful dwarf cichlids if kept in groups, but individuals may be aggressive, in such a case they should be separated (specially if there are young, normally leave only the female with the babies, as she takes good care). 4. The true *Nanochromis dimidiatus* (in most publication wrongly identified), is as all other *Nanochromis*, a peaceful dwarf cichlid, except when spawning (or shortly after). But all (*Pelvicachromis* as *Nanochromis*) should be kept in soft water and pH values should be definately below 7.0 – better even below 6.0 if possible. The conductivity must be below 100 microsiemens – in nature it is always below 30 microsiemens. Ideal is filtermaterial such as peat moos and for decoration one must have fine white sand, driftwood, some *Anubias*, and *Bolbitis* species and/or *Crinum natans*. Water temperatures should be above 23°C, better 26-28°C but never over 30°C. And aquariums not to small, except for breeding porpose. 5-6. Good group fishes for any of the above mentioned dwarf cichlids in a joint community aquarium should have characoids, like *Phenacogrammus*, *Nanaethiops*, *Micralestes* or *Rhabdalestes* species. Here just to show two nice ones: the *Micralestes stormsi* (5) from the Congo basin, as well as the neon-luminating *Phenacogrammus bleheri*, discovered by the author.

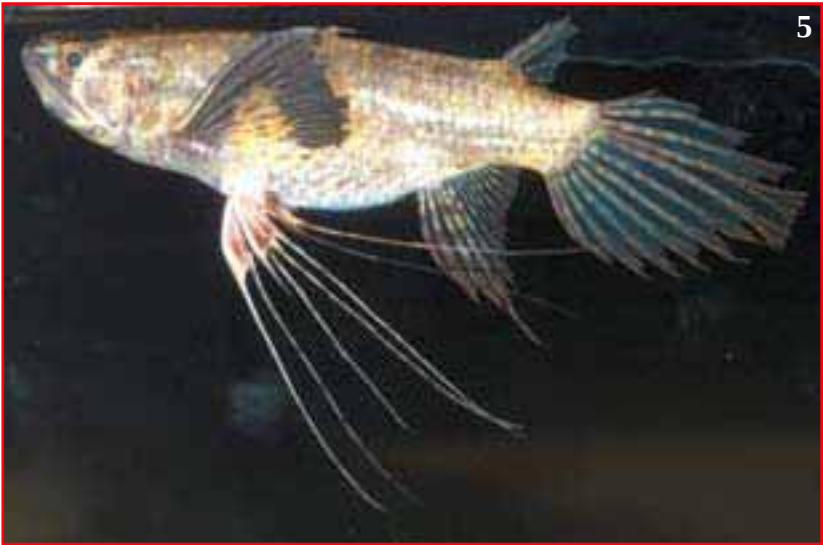


On these two pages we see an authentic Congo-aquarium decoration: a natural Malebo Pool biotope, showing an extract of a bank in this large area near the city of Kinshasa. In this biotope grow very few aquatic plants and small fish species are absent (they are only found near shallow edges, and in affluents of the migh-ty Congo river). This nature-like decoration for its inhabitants shows that the latter feel immediately like "home". The aquarium was only decorated by the author a few hours earlier (that is why the water still not 100% clear – but it is also not clear in nature) and the following photos show that fishes immediately feel well:

1. The Malebo Pool has rocky (lava or other stone) shore with much whitesand (mostly fine) on the bottom. Here we find larger characoids, mostly *Phenacogrammus interruptus*, *P. caudalis* and *Micralestes* species. All three have been placed here and immediately formed schools in mid-water, as in nature. The top water layer are occupied by butterfly fishes (*Pantodon buchholzi*) and the lower midwater region by *Distichodus sexfasciatus* and *D. lussoso* – both larger growing characoids, which also eat soft (and sometimes harder) plants. In the bottom region live *Synodontis* (ie *S. ornatipinnis*, *S. angelicus*, *S. notatus*, etc.) and *Auchenoglanis* species are frequent visitors. The elephant fishes (here *Gnathonemus petersii*) are also bottom dwellers and search continuously for food with their long, lower, snout.

2. The latter started right away.

3. And the *D. sexfasciatus* followed, as they take advantage of the food that comes up from the elephant burrows.



4. *Phenacogrammus interruptus* and *P. caudalis* schooling immediately in such an decorated aquarium in mid water. 5. The African butterfly fish (*Pantodon buchholzi*) feels fine on the top, catching its food from the surface (only). 6. *Synodontis* (here *S. pleurops*) starts to jew the stones for microorganisms (note the size of stones has to be what they can take into their mouth!). 7. The same done by *D. lussoso* (note the stone in its mouth). 8. The elephant fishes school as well (they are group fishes) and search in the fine sand (which is a must for them)



for food also as soon as placed into the tank. Note: Such an authentic biotope aquarium should have only a few plants (like *Crinum natans*, some *Anubias nana* and maybe *Cyperus papyrus* (which should grow out of the water), and the decoration as shown. This is perfect for the fishes mentioned. But it should have no less than 600 l, possibly more (the one shown had 1,600 l). It must have a strong filter and water flow, and the water which evaporates added (and some water change once in a while).

Rio - Guaporé



Hardly any river-system on planet Earth hosts such a variety of natural (aquatic) habitats, so many different species of waterplants and such a variety of freshwater fishes as the Rio Guaporé, a river that borders Brazil with Bolivia (where the same is called Río Iténez) for more than 1,300 kilometers. The Portuguese Alexandre R. Ferreira (1756-1815) was the first naturalist to explore this unique river, followed by the Austrian Johann B. Natterer (1787-1843) and others, but it was the adventures of German woman Amanda F. H. Bleher (1910-1991), my mother, who really opened this area up for the aquarium hobby worldwide. She discovered more than 60 new plant species here, and almost countless fishes, of which many of those grace today aquariums around the globe...

Text and Fotos by Heiko Bleher

It was over 50 years since we – that is, my mother, my brother Michael, my sisters Karin and Irene, and myself – had departed from Vila Bela in a long dugout crewed by three Indians. Then too it had been 4 in the morning and thick fog, but on that occasion we were propelled along the clear, silent, Guaporé (called Iténez on the Bolivian side – as this river makes the border between Brazil and Bolivia) by hand-carved *remos*

(long-handled paddles with a large round plate-like blade), dipped into the water by all three Indians in unison. This time, however, it was the big diesel motor in the towing boat that drove us, although its chugging likewise had a steady rhythm – and made a lot more noise!

We had flown in from Rio de Janeiro on the Friday, landing at Cuiabá, the capital of Mato Grosso state. In 1954 my mother had arrived here in an ancient

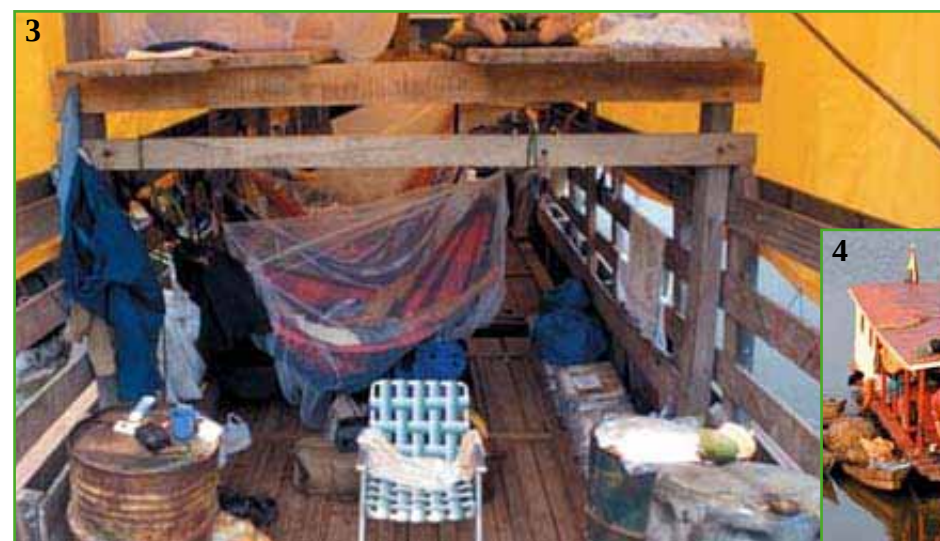
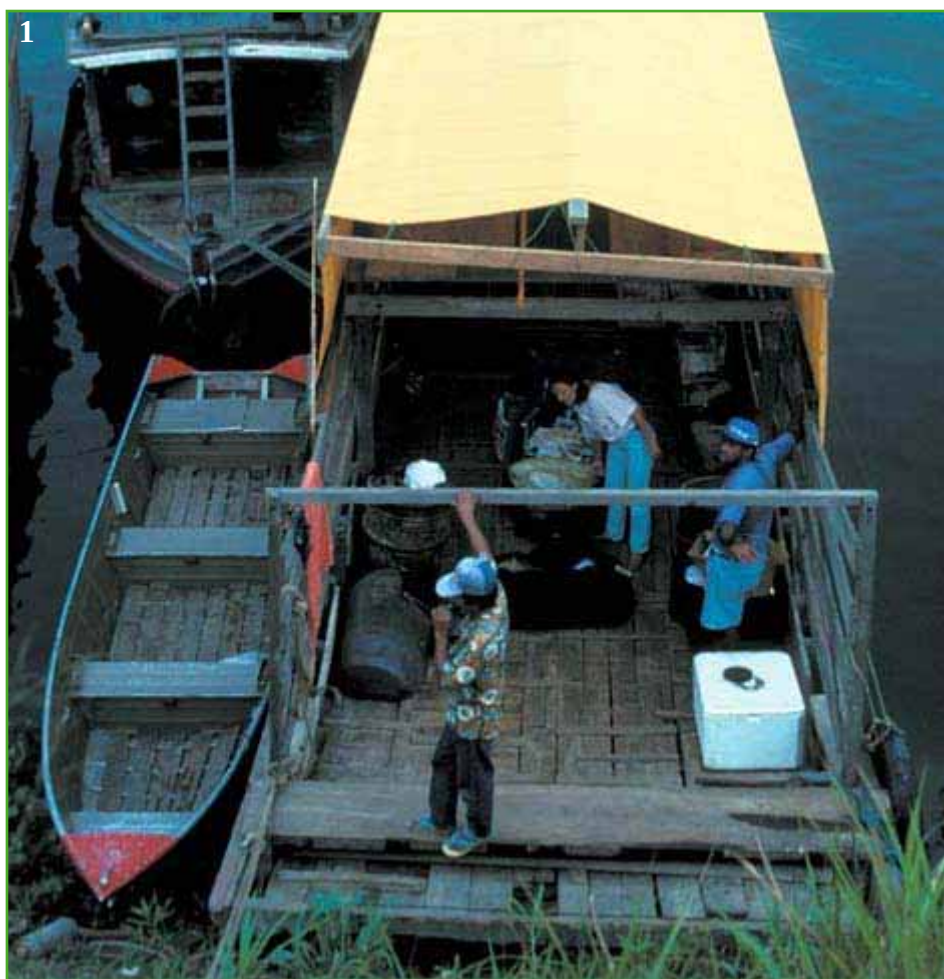
“Perua”(pickup), and both she and the car were on their last legs after 4 weeks of battling through pathless regions with the utmost difficulty, attacked and robbed by villains and beset by hunger and thirst. There were no proper roads in those days (let alone planes), in the main just cart-tracks. Nowadays there are decent metalled roads and several flights per day from Rio or São Paulo, 2,000 km away. While they had to stay in the “Grand Ho-

tel” (the only option), which in no way lived up to its name, we had a huge choice of hotels, some of them four star. But we decided to hire a VW minibus and carry on immediately to Vila Bela. The dauntless Amanda (my mother), by contrast, had to patch up her car (no spare parts available, just *quebra galho* as the Brazilians say – makeshift repairs) and sell it, as all the roads ended here and the only way onward was by chartered single-engined plane.

Shortly before midnight we made a stop in Cáceres, a town on the Rio Paraguay, where I caught thousands of fishes during the 1960s and tried to ship them, in hundreds of boxes, to Rio by pre-war DC3 - a 2-day flight in those days, when planes were only just beginning to penetrate the interior. There were no freight services then – “air freight” was a totally alien concept. “Planes are for passengers and luggage only”, I was told, “Perhaps for the mail as well.....”.

Our stay in Cáceres was spent in the middle of the river, on a floating restaurant. There was *caldada de tambaqui*, a splendid Brazilian bouillabaisse made from *Colossoma macropomum* (the *pacu*!), a real delicacy of a fish. We then continued to Vila Bela, arriving at about 3 am. Of the 547 km from Cuiabá to this remote town, only the last 78 are on unmetalled roads; the main road is well-constructed and heavily used by lorries transporting goods to Porto Velho in the state of Rondonia.

We awoke my old friend Frau Gundi, a German lady who settled in Vila Bela years ago, making the town her second home. With all the trimmings: a lovely house, *fazendas* with more than 60,000 head of cattle, a motorboat business, Frau Gundi originally came here with her deceased husband, a dealer in wild animal hides, and met my mother during her later journeys to the Guaporé. Mother was always going back to Vila Bela – she loved the Guaporé right to the end and visited it almost every year during the last 30 years of her life, when she lived in Magé, right in the middle of an area of forest a mere 40 km from Rio. The *senhora alemão* (German lady) was so interested in my mother’s work that, as the hide business gradually declined, she and her husband started collecting plants and taking them to Magé. Later on fish as well. She became so involved that she even opened an ornamental fish business in the centre



On one of my over 30 exploration-journeys to the Guaporé I took Holger Windelov (Denmark), and his son Martin, as well as Paola Pierucci (Italy) with me (7). And on that journey we followed my mothers footsteps (43 years later) and travelled in a large ferry (1) down river from Vila Bela to Guajará-Mirim, for about 1360 km, collecting plants and fishes (2), sleeping in hammocks (3) and getting sometimes even supplies from other ferry boats (4). We docked and fished often on large sandy beaches (5), as well as in the deep mud (6) and entered practically every affluent (7) along this long stretch, discovering additional new species of aquatic plants and fishes, some to be seen on the following pages...

of Rio. But today she once again spends most of her time in the little town on the Iténez and is well and truly engrossed in her cattle-breeding business. Her new husband, Bene, is likewise owner of large amounts of land and has even more cattle.



Back when my mother landed in Vila Bela - we had to make two trips from Cáceres in the tiny chartered plane in order to transport ourselves and our by then enormous pile of luggage - the settlement was just a leper colony. Society’s outcasts had been banished to this spot. Only the dying, almost all of them negros, lived here.

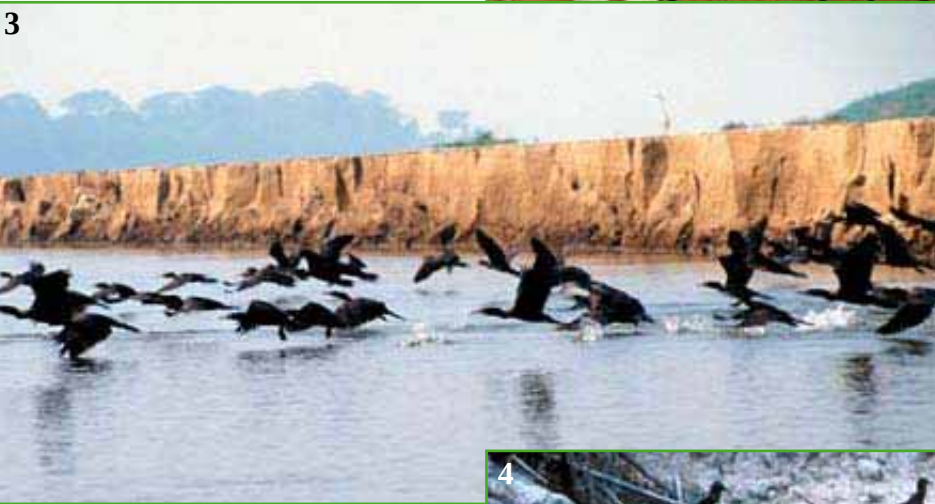
Vila Bela da Santíssima Trindade (= Beautiful Town of the Most Blessed Trinity) was founded on 19th March 1792 by a Portuguese, Dom Antonia Rolim de Moura Traves, the first *Governador da Capitania* of Mato Grosso. It took him and his companions 34 days to hack their way on foot through the dense forest to this place, and when he finally reached



the righthand bank of the Rio Guaporé he was so enchanted with the spot that he immediately gave it the name it still bears today. Years later, in 1818, by which time a village had grown up here on the bank of the fairytale river, a decree designated it the capital of Mato Grosso state. The name of the town became famous beyond the boundaries of the state (and is still marked on many maps today). But all this was of short duration. Dom Pedro I – ironically titled Barão (= Baron) de Vila



A couple of days down river from Vila Bela da Santissima de Trindade (name of the second largest village on the Guaporé, after Guajará-Mirim), lies on it's right bank Costa Marques, a small settlement. Here the candidate for Major claims to have a "clean" city, but below his sign is all the rubbish (1). In even the smallest town the most important tool in Brazil's tremendous bureaucracy is still the rubber-stamp (2). Martin had to photograph it. The Guaporé was named by the German naturalists Spix and Martius already in 1820 the "Birds Paradise" and it still is (in part). Most abundant today are 3 different cormorants (3) and the Urubu (vulture), taking care of the carrion – here a 4 m long dead caiman (4).



Bela, declared the town bankrupt in 1827, and by 1835 everything had been transferred to Cuiabá. In 1873 Dom Pedro II, the emperor of Brazil, sealed the fate of Vila Bela by officially declaring that it no longer existed. In 1878 there was no longer any revenue to indicate that it was there. No white men, only negroes, lived in the village, in total isolation, for the next 150 years, during which it was repeatedly overrun by the Nhambiquara indians. It was, as already mentioned, a place for outcasts and the sick, as well as a few indians, when my mother - the first



white woman - set foot there. Today it has come alive again, and is home to somewhat more than 4,000 souls - still mainly blacks, descendants of the quilombos, brought to Brazil as slaves by the Portugese from Mozambique and Guinea Bissau (formerly Portugese colonies). About 10,000 people live in the region, mostly on fazendas (cattle farms), which in 1985 provided grazing for more than a million head of cattle. It is said that the negros survived here so long only because their dark skins can resist the

mosquitos that carry the deadly malaria that accounted for many whites. In 1982 Vila Bela acquired its first bank, and now there are three. There are telephones and a post office, a doctor and a dentist, a library and three boarding-houses. A filling station and even a bus station with a daily service to Cáceres and Cuiabá. The main source of revenue is cattle-breeding – there are now more than 200 million cattle in this, the second largest state in Brazil. The vast fazendas have, of course, made a major contribu-



The Agouti (*Dasyprocta* sp.) is found here in areas of limestone boulders where it constructs burrows (5). It is one of the many rodent species in the Guaporé region. Some birds take advantage of sandy burrows during the dry season made by sting rays or eartheaters during the flooded period (6). On some occasions we had a Mata-mata turtle (*Chelus fimbriatus*) in our fishing net (7). The Guaporé region is still today a paradise also for Butterflies (8), but unfortunately macaws, such as the yellow and blue one (insert) are rare now. I saw them when I was a child in the 1950s flying in groups of thousands, also the red macaw and the Spix macaw which has become extinct after it had been placed under CITES...



tion to the disappearance of the *mato grosso* (= dense forest), of which little remains. On Saturday morning Frau Gundi woke us with a breakfast of freshly home-baked bread, new-laid eggs, and milk taken from the cow at 6 am that very morning. There was cheese and sausage, honey and marmalade – all home-made. Plus golden bananas, the best and sweetest there are, plus passionfruit and papaya. We ate in the shade of the garden green-



ery, and the table sagged with the weight of all the delicacies. We didn't finish until 11 am, and then she invited us to go to one of her fazendas for lunch! Bene had had an entire sheep slowly roasting there since early that morning; the trick was to cook the animal whole over a 6-hour period, gradually moving it closer to the fire so that it would slowly "ripen". The taste was out of this world, quite fabuloussssssss! (see photo). We had previously only dreamed of such a feast. He had also made the arrangements for



our expedition. For months he had searched for a suitable boat – now, as in my mother's day, very few craft travel the Guaporé, and then only for short distances. There are very few opportunities for refueling along the 1,360 km of the river. The available



lanchas lie too deep in the water to negotiate the very shallow reaches or the rapids near Forte Principe during the dry season (the time of our visit); during the rainy season (November to March) it is a somewhat better proposition. Getting our expedition under way was beset with difficulties almost as great as those faced by my mother more than 50 years previously, when she was trying to organise a dugout and paddlers. But our host managed it!

Bene had arranged the conversion of one of the local cattle rafts, with a carrying capacity of 300 head of stock, to ac-

commodate our hammocks, all our equipment, and the rest of our gear (including material we hoped to collect). At one end of the raft he had erected a superstructure consisting of a kitchen, toilet, and a small room for the cook. In front of this there was a long wooden table for eating and working, and overhead there were beams to support an awning and provide additional storage space. The whole thing was attached to a boat with an equally shallow draft, which was to propel the raft along, crewed by its captain and his 3

Specially the lower Guaporé hosts an immense variety of water and bog plants. Alone of the genus *Echinodorus* 16 species are known – no other place hosts so many swordplants in one spot. Most of them have their yearly emers-period (1-2), and submers time. Also species of *Hygrophila* (4) and the beautiful red *Ludwigia* (5) – classified by some as *L. inclinata* – which is only found here and makes perfect aquarium plant (but needs soft water) grow part-time emers. The submers *Ludwigia sedoides* makes floating leaves (3). One other unique aquatic and very decorative underwater plant (it can only

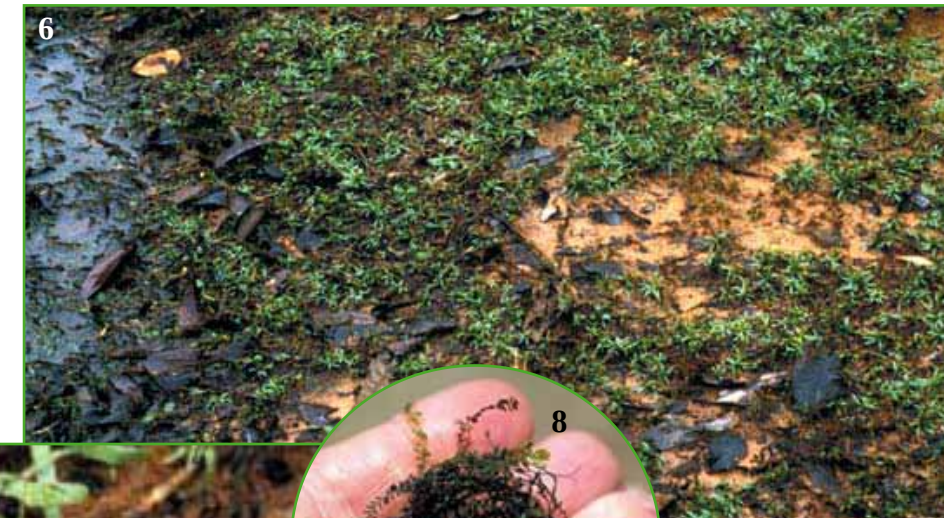


helpers and carrying 4,500 litres of diesel.

After we had cast off, I sat on the bow and peered through the thick fog, trying to recognise the windings of the river that I remembered clearly from 51 years previously. But the mist rising from the water and the swathes of fog reduced visibility to less than 10 metres. And it was so cold (less than 14°C), even without the breeze created by our progress blowing in my face, that I crept back to my hammock and wrapped myself up warmly.



survive a short period emers – see photos 6-7) – was discovered by A. Bleher. Often confused with *Eichhornia diversifolia*, it remains undescribed. Also this aquatic moos (8). Another plant, which Amanda introduced already in 1960 was *Tonina fluviatilis* (some times misspelled Tonia) which she called *Callitriche* sp. (9), as it is classified under this genus by some. Flower are everywhere here (10).



Paola was also muffled up in several layers of clothes and three pairs of stockings, Martin had pulled on two thick pullovers, and Holger was wearing the winter jacket he had brought along. He also tossed a glass of Danish kirsch down his throat to warm himself up. To cap it all it began to pour with rain. And when it rains in the tropics, then serious amounts of water fall from the sky. It rained so hard that we ex-

perienced our first flood on board our raft; the water came through and in under the awning, soaking our photographic equipment, bags of clothes, and the food. All the men battled, amid wind and rain, to secure the awning down tightly. After about an hour, chilled to the marrow, we were able to go back to bed and get some more sleep, as the sun had not yet risen.

Such were the first few hours of our unbelievable 14-day journey, surpassed only by my mother's unique trip over half a century previously – and I have notched up more than 700 other expeditions in the interim!



I recorded approximately 500 different fish species in the Guaporé – almost twice as many in this relatively narrow river with a total length of less than 1700 km than in all of Europe – many of which are still undescribed. Here now some samples of mainly catfishes, the second largest group of fishes after the characoids in this river system: 1. Undescribed *Hypostomus* (and not catalogued under the L-lists). 2. Two different species of *Acanthodoras* live sympatric (together), *A. cataphractus* (upper) and *A. spinosissimus* (lower). Both are peaceful smaller (hardly 10 cm SL) catfishes, which will often hide under wood. 3. *Ancistrus* sp. (male). 4. *Rineloricaria cf. lanceolata*. 5. *Pimelodella cf. gracilis*. 6. *Pseudopimelodus* sp. (possibly *P. variolosus* described in 1914 by Miranda Ribeiro from Mato Grosso, which was synonymized with *P. pulcher* from Ecuador...). 7. *Ituglanis cf. amazonicus* a trichomictid catfish or parasitic catfish. 8. *Lepthoplosternum beni* was only recently described (1997) by Reis. It grows hardly more than 5 cm SL. 9. There are several still unidentified *Pimelodus* sp. in the Guaporé system. 10. Also *Otocinclus caxarari* was only recently described (1997) by Schaefer from the area of Guajará-Mirim. But it is very similar to *O. vittatus* and also to *O. mura* (the latter from the upper Amazon), hard to tell the 3 species apart.

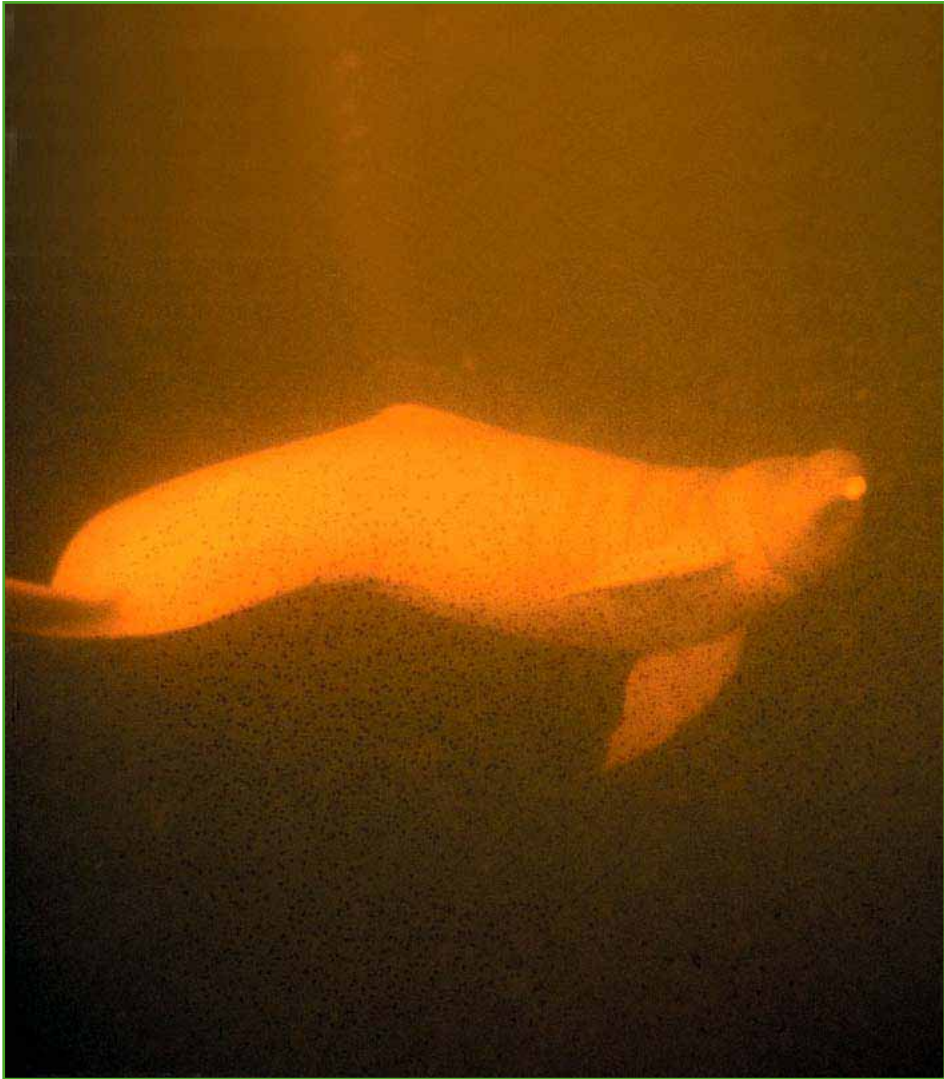


11. *Phenacogaster cf. pectinatus* (upper) and a mimic (below). 12. *Pygocentrus nattereri* – Natterer's Piranha. (The Piranha published in all popular aquarium fish books and magazines up to date is almost all the time the one breed in Hong Kong and elsewhere, which is *P. altus*. Some consider the latter to be a synonym to *P. nattereri*, but *P. altus* has black spots in the juvenile and semi-adult stage, and is only found in the upper Amazon river system.) 13. *Nan-nostomus trifasciatus* from the Guaporé is more colorful than from other river systems, and it is absent from the published distribution maps... 14. A unknown trichomictid (Fam Trichomictidae or parasitic catfishes), which grows to 150 mm TL and luminesces its way. The light is produced by luminous bacteria on its gill cover and helps this night active catfish to find its prey and food. Photophores (light organs) are well studied under marine (Lantern and Flashlight) fishes, but to my knowledge never with freshwater species. I was able to find such light organs present in several Amazonian catfish species and in some characoids as well. 15-17. At least 10 *Corydoras* species have been described from the Guaporé, including the well known *C. sterbai*, *C. harald-schultzi*, *C. caudimaculatus*, *C. guapore*, *C. geryi* and others, but there are still quite a few undescribed species and/or variants like the four shown below.



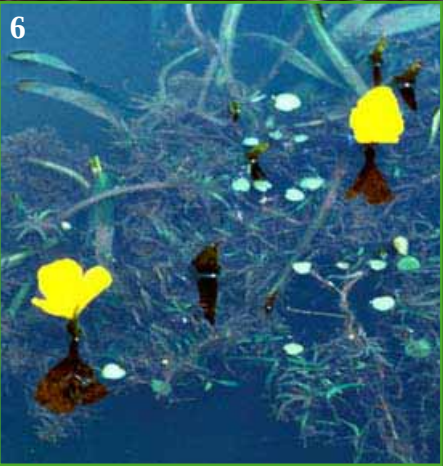
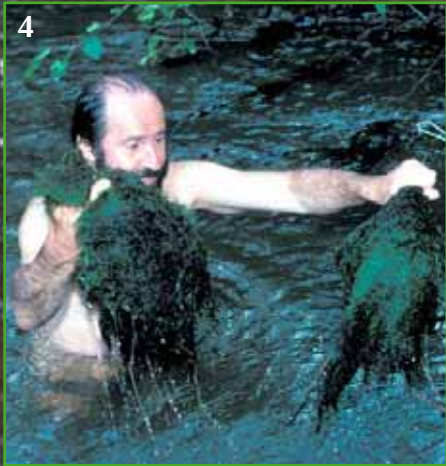
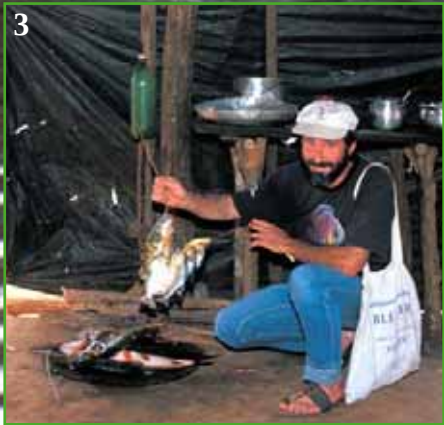
But am I telling you all of this? Simply because in South America, and possibly from what I have seen in 162 countries world-wide – the Guaporé, is the most gigantic tropical freshwater aquarium on planet Earth. The amazing amount of aquatic plants here, is just breathtaking, and the fish species I was able to record so far in this gigantic “aquarium” of clear water (one can see below the water surface up to 20 metres, and more) reaches by now close to 500. That is roughly twice as many species as in all of Europe – and this in a single, hardly 100 brought river. The Guaporé is approximately 1,700 km long and flows into the Rio Madeira, the largest affluent of the mighty Amazon River. But in the lower Guaporé (some call at its lower course al-

so Rio Marmaré, the name of its left hand affluent coming from Bolivia) we find more than 22 cataracts and waterfalls and these are a natural barrier. Therefore many species of fishes and plants are endemic and cannot found anywhere else including a freshwater dolphin species (*Ina boliviensis*). But I want the pictures to talk about this unique and beautiful natural aquarium. Explain along with the photos more details about the environment and the habitats: how fishes and plants live in each biotope. Something to learn from, how an authentic biotope should, and can be, if transferred to our home aquarium as in nature. If you can archive that, you will enjoy an aquarium even more...

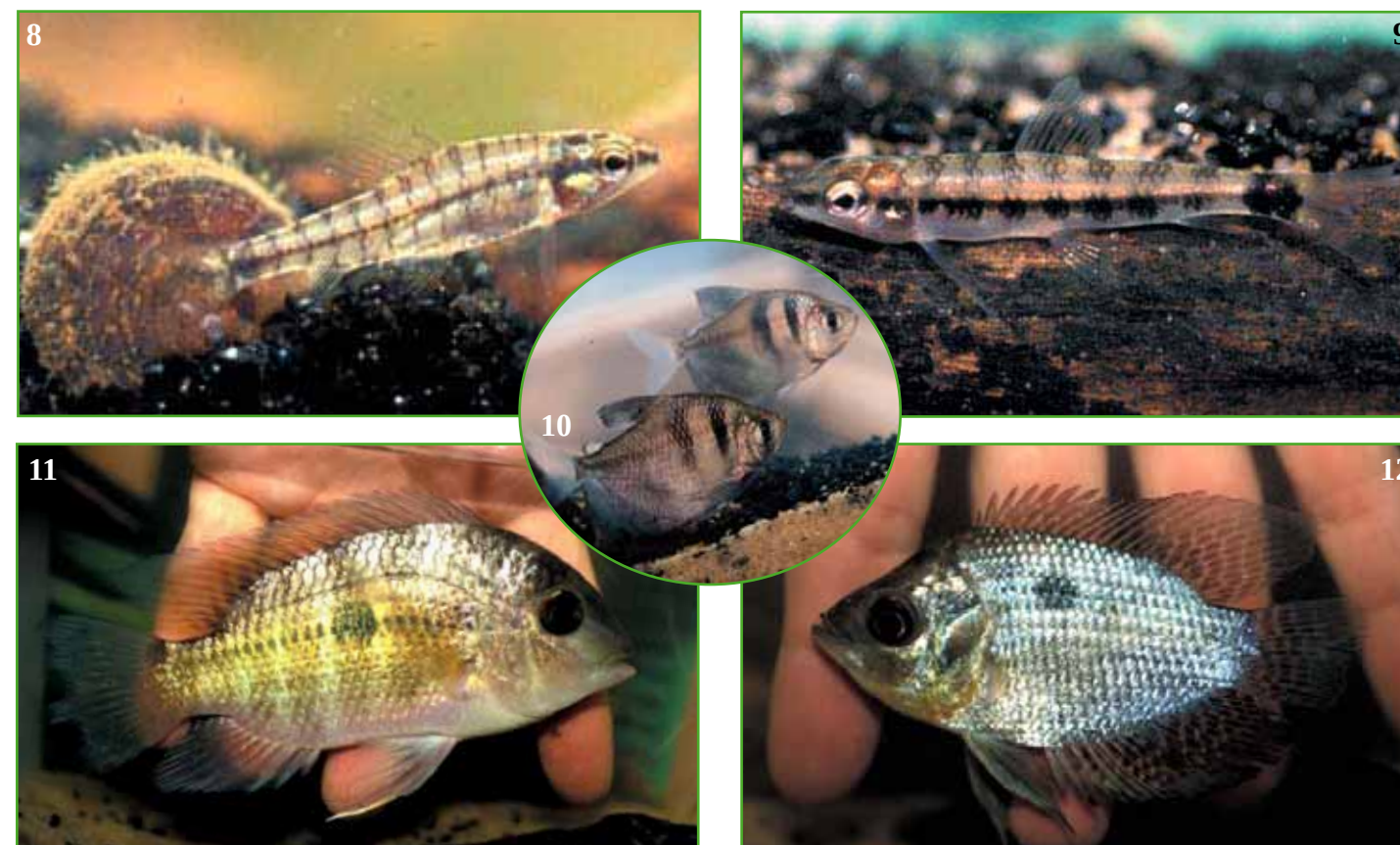


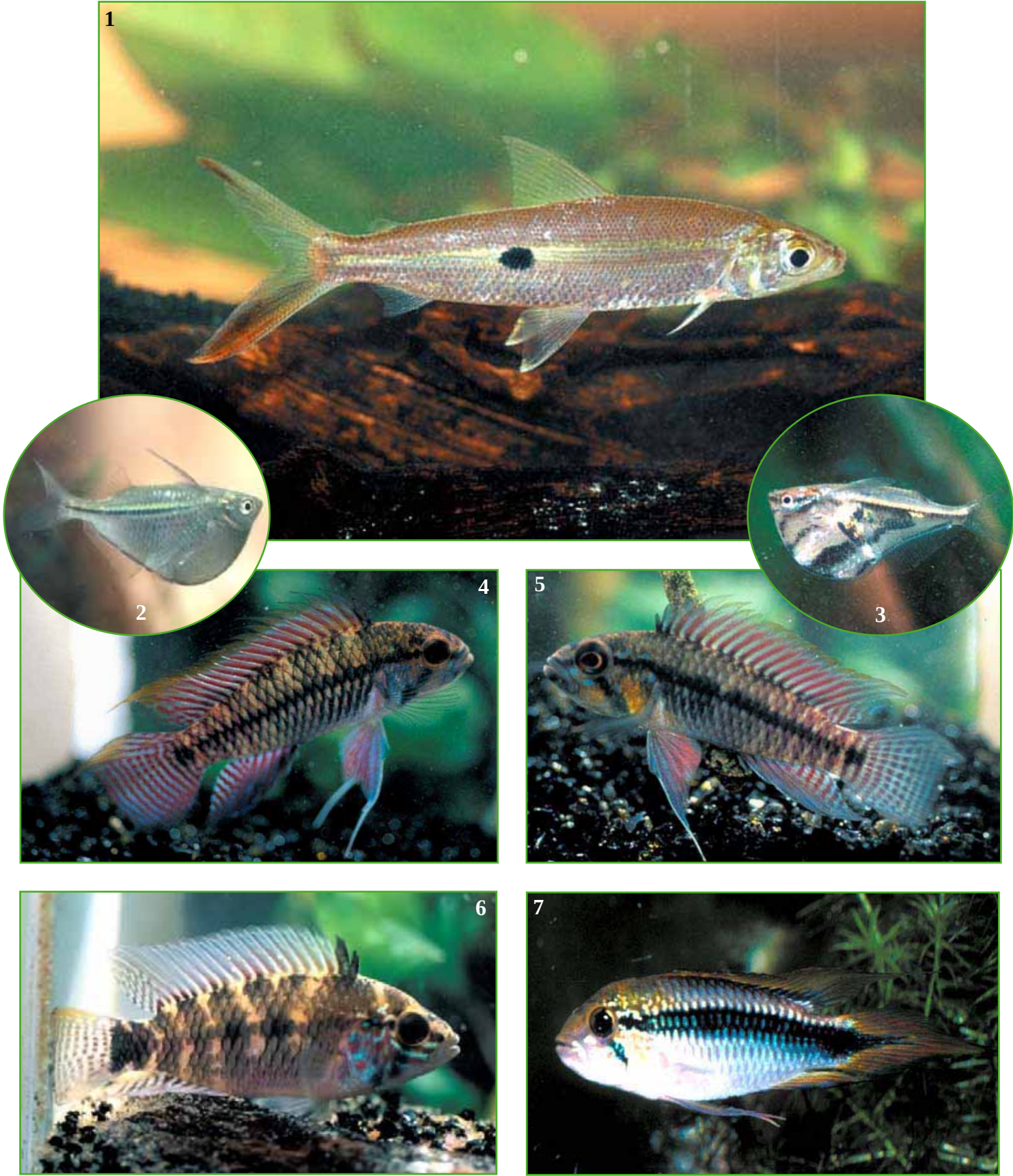
Above: *Inia boliviana* is the most pink of all the three known *Inia* species and endemic to the Guaporé-Marmaré-system. Here a photo while this wild pink freshwater dolphin was playing with me under water in the Guaporé near Vila Bela.
Right: Under such growth of *Eichhornia* and in between their floating roots, are normally in the Guaporé hundreds of fishes, almost unbelievable the fish-biomass in this river. In one occasion I counted 47 different species per square meter floating *Eichhornia* and in their roots. And it is normal to have hundreds of dwarf cichlids (*Apistogrammas*) in the net (insert).





The affluents of the Guaporé-Iténez-river are in part up to this day completely unexplored – virgin rainforest like the one above. Unfortunately from the nine indian tribes and thousands of indians, which once lived along the river only a few, less than 300, are still alive and must stay on a tiny piece of land under the protection on the Funai, the Brazilian Indian Organization (1-2). I visted the indian village of the tribe Cabixi, but they have become extinct. Caboclos live there now, thez gave me some fish to eat (3). In one affluent I found an interesting new underwater moos (4). Certainly good for the aquarium – the natural underwater garden, as in nature. Holger was trying to collect *Echinodorus* species – mother plants – and almost drownnd (5). *Ottelia brasiliensis* in flower (6).





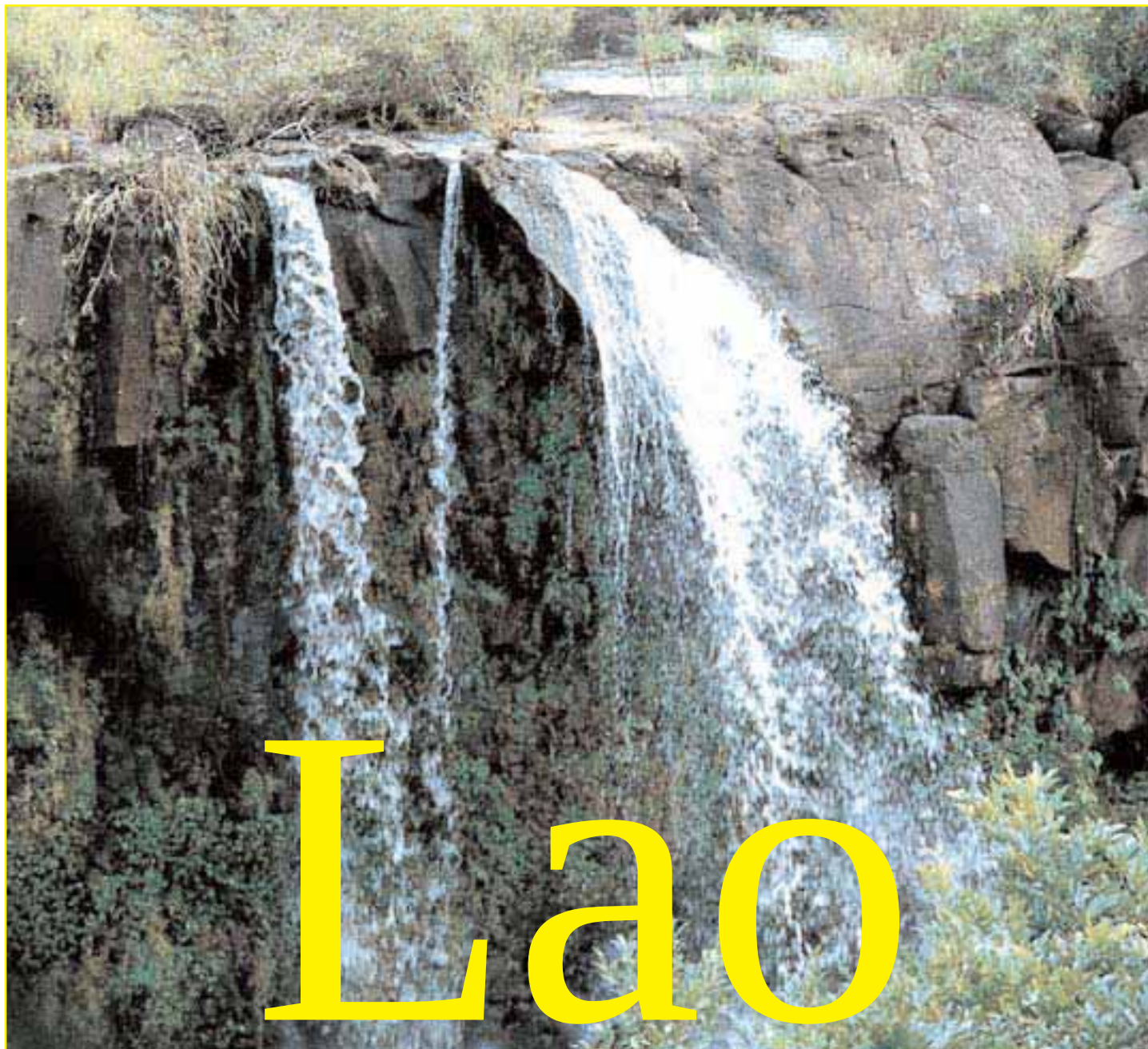
1. *Hemiodus microlepis* from the Guaporé is an open water dweller and needs a larger aquariums, also must be kept in groups of at least four to six. 2-3. Hatchet fishes like *Gasteropelecus sternicla* (2) and *Carnegiella strigata* (3) are always near the surface and must be feed at the surface, as they will not feed from mid-water nor the bottom. Also they are schooling fishes and should always be kept in groups of 6 (at least) or more. 4-7. *Apistogrammas* are found in large numbers (and several undescribed species) in the Guaporé and should be kept as well in small groups, specially *A. trifasciata*. Two species which belong to the *A. trifasciata*-complex, but certainly new (similar) species, are shown here (4-5). Another unidentified *Apistogramma* (6), but close to *A. commbrae*, is this very high body form also from the Guaporé region. And laest but not least is *A. macilienis*, another Mato Grosso beauty. Note: All of these, and many more species (shown on past pages), can be kept very well together in an authentic biotope aquarium (for samples see next page).



Above four typical biotope aquariums of the Guaporé river system, from different habitats. As mentioned (and partly shown), there are plenty of aquatic plants – always with white sand, rarely drift wood and hardly ever rocks or gravel. The variety of plants from such habitats may consists of *Echinodorus* (16 species), *Limnophila indica*, *Hygrophila guianensis*, *Tonina fluviatilis* and species of *Alternanthera*, *Cabomba*, *Cyperus*, *Hydrocotyle*, *Hydrocleys*, *Heteranthera*, *Eichhornia*, *Eleocharis*, *Ludwigia*, *Egeria*, *Najas*, *Potamogeton*, *Sagittaria platyphylla* and more.

Lao





Lao: Mountain ranges, unspoiled nature, picturesque waterfalls. Exotically-clad people of various races, including little-known mountain tribes. A land traversed by one of the 10 greatest rivers on earth, with a huge inland delta and some 4,000 islands. A breathtaking constellation here on planet Earth, waiting to be explored the moment borders were opened and visitors permitted. Outside its borders this little-visited country is known world-wide as Laos, a name which originated in a misinterpretation of the name given it by the French, long ago. They called the region *Les Laos* (plural), referring to the Laotian kingdoms of the past. But the people of this land-locked realm call themselves, and their country, Lao, now as in the past.

Text and Photos by Heiko Bleher

Bøøjj Pen Njang” (it doesn’t matter) replied Yin, my driver, in response to my “*Khooi Bøø Paak Phaasaa Lao*” (I don’t speak the Lao language), an omission I would have to rectify while here, as hardly anyone

speaks English, likewise French, despite the presence of the French from 1893 until 1954. The phrase “*Bøø Pen Njang*” says a lot about the people who live along the mighty Mekong river. It virtually exemplifies the Laotian phi-

losophy of life, “Never lose patience”. Normally my view as well, though I had come close to doing so in the course of entering the country.

The taxi from the Thai border town of Nongkhai has to stop at the terminus at

the end of the 2 km long bridge that crosses the Mekong to Vientiane, the capital of Lao, and then you have to wait for the bus that takes you across the *Mitraphap* (Friendship) Bridge to the actual border crossing. Here I had endured a further wait, before handing over the visa I had obtained in Nongkhai the week before, filling in more forms, and, two hours later, finally receiving my entry permit...

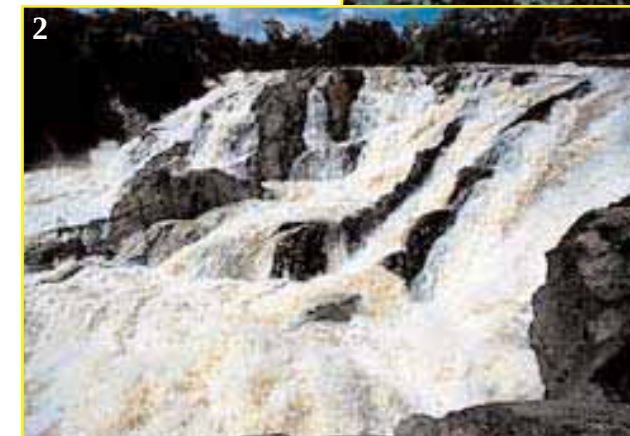
Meanwhile Peter Frech, my travelling companion on a number of expeditions, and Hermann Kunz, an aquatic dealer from Memmingen in Germany, were waiting patiently at the other end of the bridge, which was built by the Australians as recently as 1994, and is the only bridge across the Mekong in the entire country. These friends had arrived earlier, to start planning our expedition, and subsequently accompanied me on the first part of my trip, through southern Lao.

And now here I was, sitting in a Japanese 4-wheel-drive pick-up with Yin, in Pakse (the story of the almost 1,000 km journey, over sometimes hair-raising dirt roads, from Vientiane to Pakse, must wait for another time). My companions had gone back to Germany, and the two of us were on our way to the huge inland delta of the Khong, one of the mightiest rivers on Earth, which the Lao call *Mae Nam Khong*, the mother of waters. The rest of the world knows it as the Mekong.

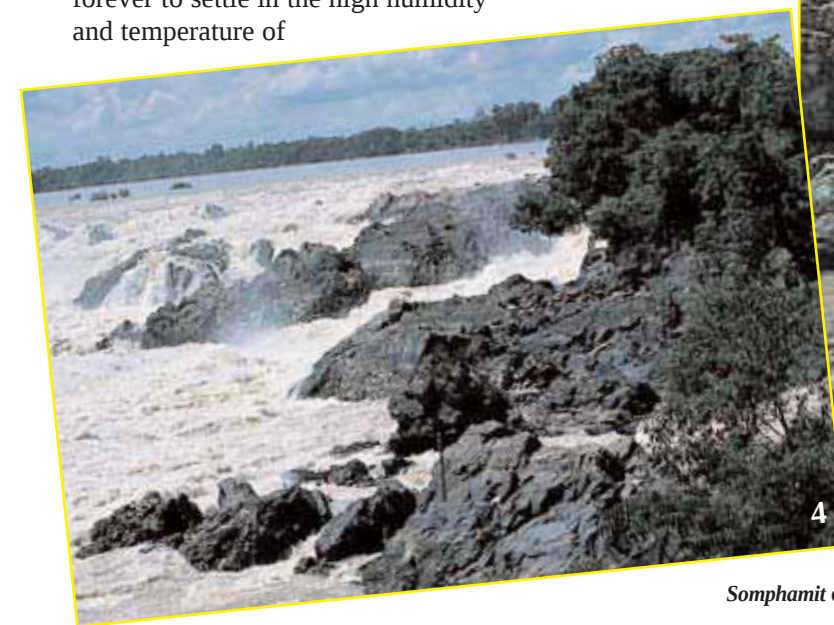
The dust flew up around us, taking forever to settle in the high humidity and temperature of

38°C in the shade; the ox-carts laden with firewood rapidly disappeared in the clouds of dust. If all went well then we might yet make it to the region bordering Campuchia - despite my friend’s warning of the dangers involved - and then to Vietnam in the east.

Our accommodation in Pakse, formerly the French town of Bassac and now the provincial capital, had been perfect. We had stayed at the *Residence du Champa* a secluded villa that was once the home of the governor of the town, and had been



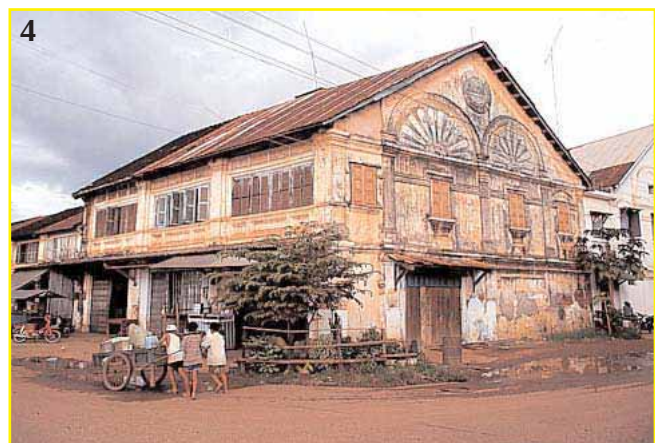
The vast Mekong inland delta lies in the southernmost part of Lao’s Champasak province, close to the border with *Kampuchea* (2-4) and is called *Siphandone* (The 4000 Islands). Giant rocky massifs act as a natural brake on the mighty river. Almost innumerable large, medium-sized, and small waterfalls block the course of the Mekong, which narrows here to a mere 20 km in width (appreciably wider during the rainy season).



Huge masses of turbulent muddy-brown water tumble 21 metres or more over the cliffs. Two of the many waterfalls are famous: the *Khong Phapheng* (4), which translates as “Roar of the Mekong”, is the largest in Asia. The second largest is the *Li Phi* (2), also known as the *Somphamit* or *Khon Nyai*. In addition further inland, near the border with Vietnam, are innumerable very high waterfalls (1 – and left-hand page).

converted into a splendid *auberge* a few years previously. The proprietor, Boualamphone Somphonxay, was kindness personified - he organised a vehicle, maps, information, and driver Yin, as there are no hire cars here. I thanked him gratefully upon my departure, which was not without regret. There was good reason to be ambivalent about leaving, for ahead of us lay not only primeval forest and grassland, but also - a tent!

My teeth were grinding on the dust from the wagons of firewood coming up from the southern border zone,

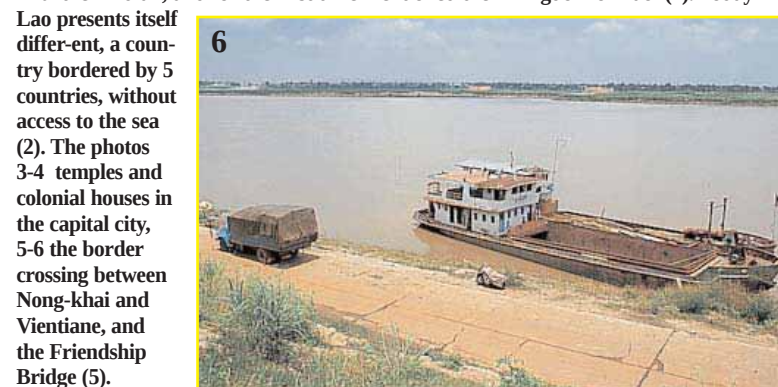


which enveloped us in a cloud. Mercifully there were hardly any other motor vehicles. And tourists were out of the question - the southerly distribution of that species terminates at Pakse! And as I thought about these sometimes strange creatures, it suddenly occurred to me that the first "tourist" to visit this part of the world must have been Marco Polo!

The story of this son of a Venetian merchant is enough to take one's breath away. Together with his father and uncle, he made a "Grand Tour" of Asia lasting many years, travelling as far as the land of Kublai Khan and the latter's summer residence at Shang-tu (in modern Mongolia). His 17-year stay at the court of the mighty Khan is no less interesting, as he was frequently entrusted



Marco Polo is thought to have been the first European to travel across what is now Lao and the Mekong. The Franciscan monk Odoric, from Pordone in Friuli, Italy (1286-1331) wrote, in his travel memoirs of circa 1330, about Champa and its 200 kings. In the 16th century the Portuguese travelled up the "Mother of Rivers" as far as Vientiane (capital of today's Lao), followed in the 17th by a Dutchman, Gerhard van Wuystoff, but the real start of the exploration of Lao began with a Frenchman, Francis Garnier. The first map showing the "mecon R." area, was made by Duval circa 1670 - he called the region *India Extra Gangem*. In 1755 Danville drew a map of "Further India", and for the first time mentioned the "Kingdom of Lao" (1). Today

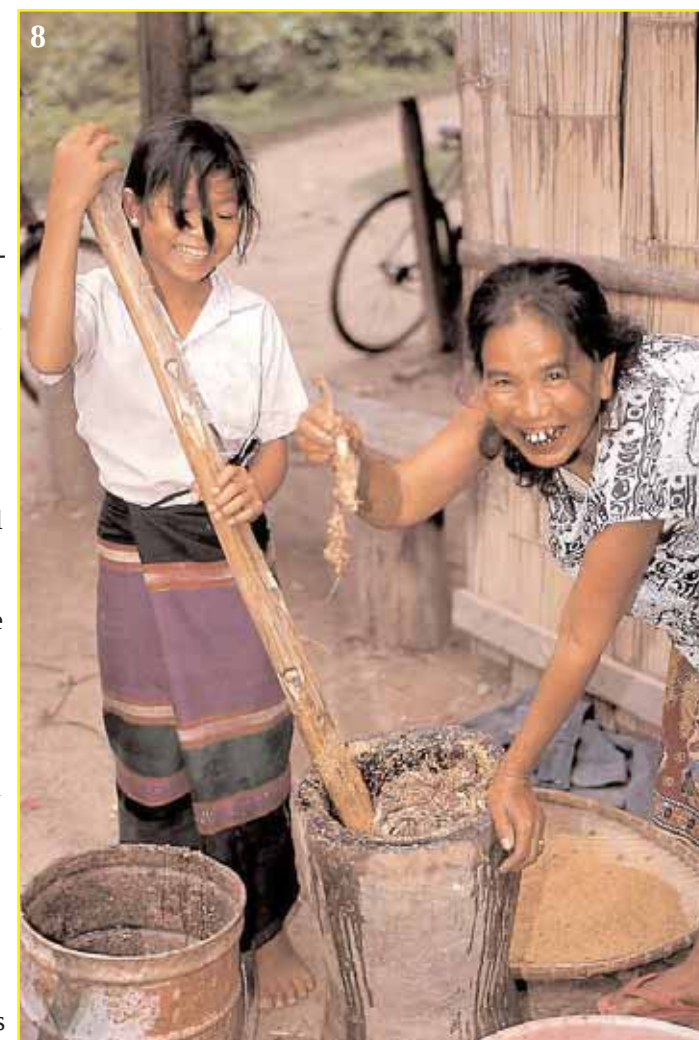


ed with important missions to other places, and once journeyed as far as Pagan, in Myanmar. It was on this journey into the land of the Karen that he became the first European to cross the Mekong. His itinerary ran from Khan-balik (now Beijing) through the whole of southwest China, then northern Lao, and finally into the former Burma, returning via a somewhat more southerly route.

I recalled a passage in his book *Divisament dou Monde*, which appeared in 1301, where he mentions Chamba, a kingdom of many elephants. He also relates the story of his return to Europe, which took 2 years, wherein he writes "Locac - a pleasant and wealthy country (on the mainland), with its own king. Its people are heathens, have their own language, and pay tribute to no-one. The country is so isolated that no-one can come there to do them ill..." (It must have been the huge waterfalls of the Mekong inland delta that prevented any shipping from travelling up from the sea) "They also have elephants", he continues, "and many deer". All this accords exactly with Lao at that time.

For his journey home to Venice the Khan gave Marco 14 large junks with a crew totalling 250, in return for which he was to convey a new wife from Cathay to Arghun, the king of Persia, en route. After the embarkation at Ch'uan-chou, the junks sailed along the coast of China and past mainland Indo-China. That he paused here is suggested by the following extract: "...numerous unicorns almost as large as

elephants...with hair like waterbuffalo (which do not have much!), feet like elephants, and a thick black horn in the centre of the front part of the head... the



head resembles that of a wild boar and the animal always carries it lowered towards the ground....and enjoys wallowing in mud..." My researches suggest that Marco was describing a subspecies of the Javan rhinoceros (*Rhinoceros sondaicus annamiticus*), long since extinct. Despite the introduction of the first measures to protect rhinos at the turn of the century, human greed subsequently led to the total disappearance of this (and other) subspecies. The price of powdered rhino horn on the world market, higher even than that of opium, overshadowed all other considerations. Today only small fragmentary populations of the Java rhino survive, totalling just 50 individuals despite all attempts at conservation and breeding. It is the rarest and most endangered mammal in the world!

A second Italian, the Franciscan monk Odoric, from Pordone in Friuli (see ag 15, *Lago di Cornino*), travelled to Asia between about 1318 and 1330, and, like Marco Polo before him, mentions Champa. In fact Champa was the land of the Cham, like the Khmer an Australasian people, who held sway for more than a thousand years along the coast of Vietnam and inland as far as the southern part of Lao, the modern province of Champasak. Champa is a common name in the region (for villages, squares, streets, and houses - including the governor's residence), but not in Sumatra, which is where the entire literature hitherto has sought to



Impressions of the southern part of Lao, and the road to it: Ox-carts are (still) the commonest form of transport in Lao (7). Lao food in general is appetising looking, however, it is this rather less attractive gruel - duly mixed with live maggots - that is also eaten....(8). There is still little public transport in Lao, though there are buses for long journeys, even if they are mostly converted lorries (9). New bridges are being built across the tributaries of the Mekong, however, to replace the ferries there. Lorries carrying the lumber, clear felt in the south (10).



locate the Chamba of Marco Polo and the Champa of Odoric! (Yet again **ag** makes a contribution to the unravelling of old records!)

But these early Europeans had merely “crossed” the Lao region. It was a Frenchman, Francis Garnier, who has gone down in history for exploring it properly, together with his 4 companions. He was the driving force of the expedition of the Commission for the Exploration of the Mekong (1866-68), which started out from Saigon on 5th June 1866. Another story of adventure which is well worth reading.

While I was lost in the past, the road had become noticeably worse. Potholes made by bogged-down lorries made forward progress difficult, and the differential of the Japanese FWD kept bottoming while the trucks rumbled by. Fallen trees and branches made things worse. “Not exactly a race-track”, thought I. Then, at last, the first small, clear, river, some 5-8 metres wide and only 1-1.5 deep; it was called the



Live in the market: Everyday life: the men go off hunting or fishing, the women and children go to the market. Here is a glimpse of the vast selection of goods for sale in the markets of the south. The fruits are mostly local, from the forest (top). There is a virtually limitless selection of *Phak Hom* and *Phak* (green and other vegetables), most of them unfamiliar to visitors from overseas. This applies equally to the fish, apart from the introduced exotics – sheer lunacy given the wealth of native fish in the river (there is virtually no aquaculture). A brief catalogue of the food fishes (many used to be, or still are, excellent aquarium fishes), with length range, plus other creatures:

Huen Nam Sai. Women were washing, and laughing children jumping into the water from the large rocks. I found some small fishes near the bank, and before long I was in the refreshing water, turning it red with dust....

The hand-net soon produced a labyrinth fish (a *Trichopsis* sp. with an anterior mid-lateral band), a goby (Eleotridae), a halfbeak (Belonidae), a small cyprinid (*Puntius* sp.), and pipefishes (Syngnathidae). The water was extremely soft (conductivity just 24 µS/cm) and acid (pH 5.5), and while atmospheric temperature was more than 28° Celsius in the shade, the cool water was only 24.5°C. The bottom was carpeted in a very small rooted aquatic plant. Unfortunately all the plants we collected died.

More equally beautiful rivers followed: the Ban Nizier, Huey Mesang, Huey Nam Say, and then the Huay Wat (which means “blood-

- 1) *Mystus mysticetus* (8-13 cm);
- 2) *Paralabuca barroni* (7-8 cm);
- 3) above *Macrognathus maculatus* (?) (28 cm) and *M. siamensis* (8-30 cm), and below *Xenentodon cancila* (?) (15 up to 40 cm);
- 4) introduced carp (*Cyprinus carpio*) (50 cm);
- 5) introduced *Oreochromis niloticus* (14-25 cm);
- 6) *Clarias batrachus* (20-50 cm or more);
- 7) *Monopterus albus* (?) (30-100 cm);
- 8) *Ophisternon bengalensis* (?) (40-100 cm);
- 9) *Belodontichthys dinema* (50-100 cm);
- 10) *Hemibagrus nemurus* (20-70 cm);
- 11) aqua-tic scorpion (family Nepidae);
- 12) a huge selection of frogs;
- 13) snakes, varanus, and squirrels; 14) owls; and
- 15) native rod-ents. All are eaten.

sucking stream”!), whose edges were lined with *Barclaya rotundifolia*. I jumped in without further ado, and could not understand why my legs suddenly started to hurt like hell while I was fishing. As if something was sucking at them! Which was in fact the case. About 20 bright green leeches with yellow longitudinal stripes were sucking blood from my nice hairy legs! Yin, who was looking down from the bridge high above, was laughing himself half silly. I had a terrible job to prise these almost 20 cm long little monsters free, leaving an awful mess - good-sized holes and blood everywhere, which attracted even more of



them! It was difficult to believe that this lovely water could be infested with leeches, but they came darting towards me like arrows aimed at a mark. I was out of there like a shot. By now Yin was doubled up...

Further upstream, where the river was slowly drying up, there were ranks of *Barclaya* and *Cryptocoryne*, apparently stricken with the so-called “*Cryptocoryne* rot”, and their leaves all dying. This discovery demonstrated that this problem has nothing to do with aquarium conditions, but is simply a case of the old leaves dying off before the river dries up completely. When the rains come the plants grow back - another of Mother Nature’s miracles. She has thought of everything.

Lost in thought, I watched as the road

became narrower, all the time taking us further away from the “Mother of all Rivers”. Suddenly a vast panorama spread out in front of us: the inland delta and its thousands of islands, and, in their midst, the largest, Don Khong. Here and there huge rocks, carved by the mighty waters of the Mekong, poked out of the muddy yellow flood. Time seemed to stand still.

Yin jumped out of the pick-up and spoke with a long-boat man, haggling over the cost of transporting me and my baggage. Soon we were slowly crossing the water, against the backdrop of a fantastic orange-red sunset behind serried coconut palms growing

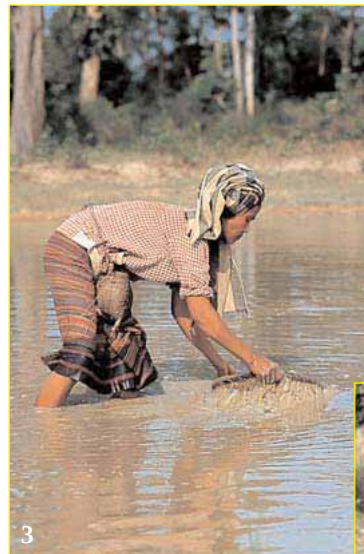


The barely 5 million inhabitants of Lao are divided in (4) large ethnic “families” made up of a total of 119 different tribes and some live very remote, almost isolated, like the Alak (left). But all are very friendly, like the girl above.

scene gave him a new impetus, for he nevertheless continued with his arduous expedition, which lasted a further two years, although one of his 5 companions turned back earlier. The leader himself succumbed to the hardships of the journey, and died; and another member of the party fell so ill that he too departed this life shortly after his return to France.

It was Francis Garnier who also ascertained where the source of the Mekong lay, and that it is more than 4,350 km long, rising on the Tibetan plateau in China, where it is known as the Lancang Jiang (Turbulent Flood), before flowing for almost 1900 km across Lao, as the Mae Nam Khong; first of all along the border with Myanmar and then that of Thailand, marking the boundary for more than 1500 km. After descending over the largest waterfalls in Asia, it continues its journey as the Tonle Thom (Great Water), crossing Campuchea where its waters are augmented, albeit indirectly by, *inter alia*, the 2nd largest inland sea on the continent, the Tonle Sap. At last, in southern Vietnam, the Cuu Long (Nine Dragons) enters the China Sea via its huge delta.

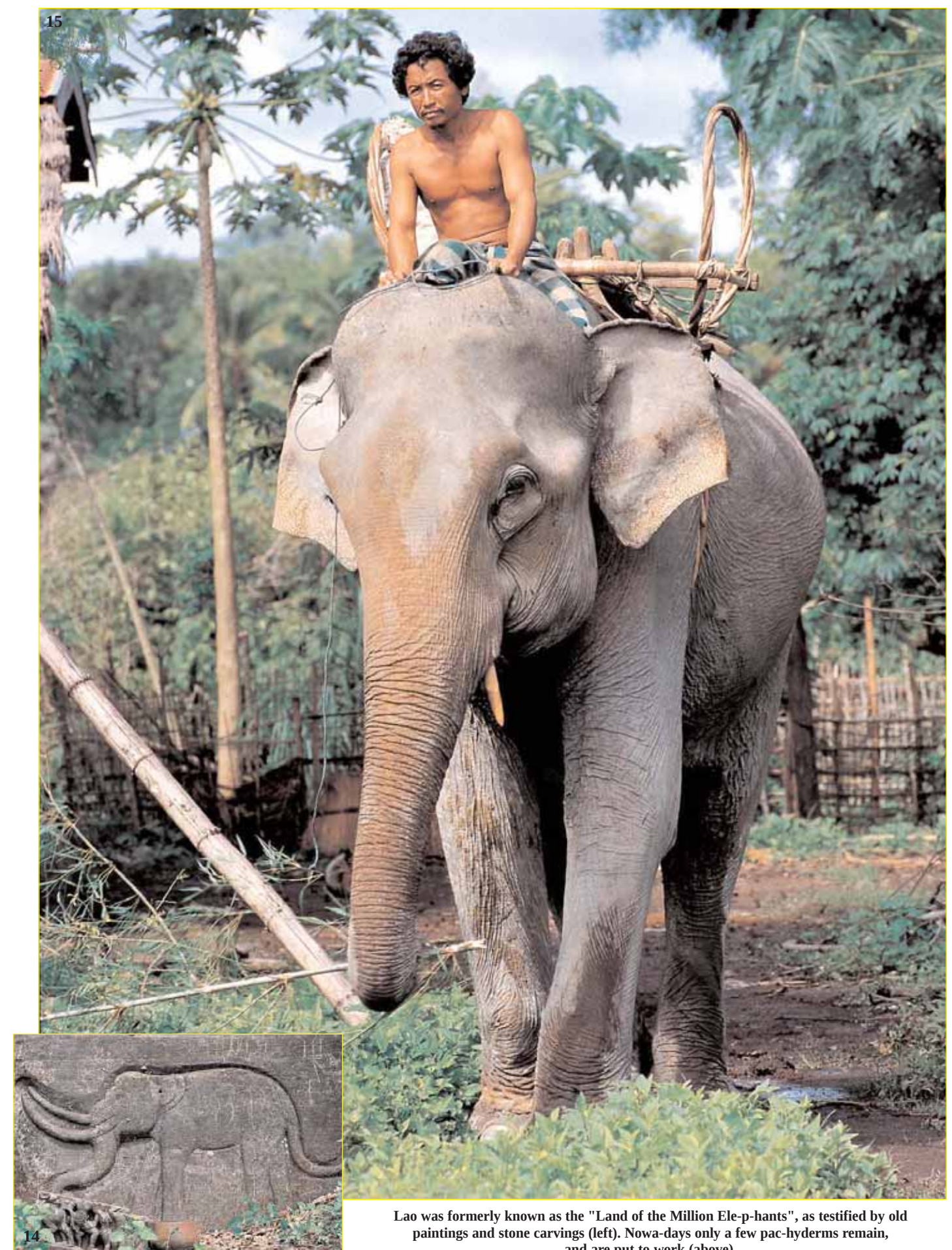
“Everything in this country is huge”, wrote Garnier when he first set foot in Lao. “The waterfalls are between 7 and 8 miles wide, and the river at least 12 miles from shore to shore, with innumerable islands.” He continues: “The number of people, their garments, the highly cultivated region and the forests, are all outside.”! And that was my experience too, wherever



In the country rice-growing and fishing provide the daily bread: while young girls catch fish in the rice fields (1-2), the women are busy with larger nets in the inundation zone along the Mekong (3-4).



The men catch normally larger fish (13), and/or build fish-traps (11-12), and take the latter to the chosen site. They use the traps to catch fishes like the giant freshwater rays (6), *Himantura chaophraya* (which can weigh up to 600 kg), or large freshwater "sharks" (Labeos) such as the black *Morulus chrysophekadion* (up to 60 cm – not shown). But also small cyprinids such as *Para-lau-buca barroni* (8) and *P. typus* (9 female and 10 is a male), as well as gobies, *Papuligobius ocellatus* (5), snails (7), and freshwater shrimps.



Lao was formerly known as the "Land of the Million Ele-p-hants", as testified by old paintings and stone carvings (left). Nowa-days only a few pac-hyders remain, and are put to work (above).



Hemibagrus cf. microphthalmus. This beauty is also similar to *H. wyckioides*, but has all fins blood red and the adipose with a red seam vs. a red or a redish tail.



Hemibagrus wyckii. This must be one of the most (if not the most) aggressive freshwater fishes it will even kill its partner. Only to be kept alone in an aquarium.



Hemibagrus nemurus. Formerly this species was collected in sizes up to 65 cm long, but rarely now.



Micronema micronemus. The mouth of this unusual catfish – also a midwater dweller found in muddy water (like the others). But its food is vegetable matter.



Bagarius yarrelli. Although it grows large, it is rare to be found on markets, as its flesh is fibrous. Good for larger aquariums



Hemibagrus cf. microphthalmus, possibly a new species with such blood-red fins (detail left). Only good for large aquariums, although it does not grow as large.



Hemibagrus wyckii, its mouth is made to kill, it penetrates like an arrow and opens up terrible wounds in his prey. That is a fish that grows to 75 cm (but rarely).



Ompok bimaculatus. adult a more in midwater swimming catfish, which can grow up to 50 cm and feeds on vegetable matter, crustaceans and mollusks.



Bagarius yarrelli. A bottom dwelling catfish, that has very unusual barbels, they are fixed – not flexible. A giant bottom-catfish that can grow to 200 cm length.



Wallago attu. This is one (if not the) largest mid-water catfishes, can grow up to a length of 250 cm. It is a predatory catfish only for giant aquariums.



Hemibagrus wyckioides is known to grow to 95 cm SL and can weigh up to 80 kg. Normally its fins are transparent, only its tail is rose or redish coloured.



Hemibagrus nemurus. Another one of the larger catfishes from the Mekong, also aggressive, but by far not as much as *H. wyckii*.



Micronema micronemus – is a very peculiar looking catfish from the Mekong (also found in Kapuas). It can grow over 50 cm. (Placed in *Kryptopterus* by some.)



Bagarius yarrelli. Its mouth is large enough to swallow smaller fishes (and when it grows large, also larger ones...), but feeds mainly on aquatic invertebrates.



Wallago attu. Also this catfish has a very large mouth. Bites strongly if handled, with its huge mouth, has formidable jaws, with a band of conical teeth.



Hemibagrus filamentus. It is one of the “smaller” bagrids in the Mekong grows only to about 50 cm. Feeds on crustaceans and small fishes.



Clarias batrachus, juvenile. It grows only to about 45 cm, but can leave the water to migrate over land to other water bodies using its auxiliary breathing organs.



Danio cf. acrostomus. This Danio was only recently described from the Nam Leuk and is to grow up to 7.7 cm. This one I found much further in the south of Lao.



Hampala macrolepidota. A beautiful cyprinid when small, once it reaches maturity most of the red disappears and part of the black band. Size: up to 60 cm.



Yashuhikotakia sp. A fantastic, probably new, loach – emerald green with bright red fins. On this photo the spine over the eye is visible (defense-organ).



Mystus cf. wolffii. It is said to be found only below the waterfall in Kampuchea, but it seems to be the same species up here. Grows only to about 25 cm.



Pangasius conchophilus, adult. This unusual pangasid can look down and grows to about 130 cm. It feeds on prawns, insects and particularly mollusks, no fish.



Labiobarbus siamensis. Nice aquarium fish up to 20 cm length, that lives in midwater to bottom and feeds on phytoplankton benthic algae and some zooplankton.



Gyrinocheilus pennockii. This algae eater (and it is very good at it) can grow up to almost 30 cm. It is endemic in the Mekong and hardly exported.



Yashuhikotakia sp. The colours were so striking that I thought immediately that this one is different from *Y. modesta* known from this area. Size is less than 20 cm.



Mystus aff. singaringan. Another *Mystus*, but with a very large adipose fin. Very interesting peaceful aquarium fish which grows hardly over 25 cm.



Laides longibarbis. Little is known about this strange schilbeid catfish. It grows hardly over 15 cm TL, has a red eye and is a peaceful midwater catfish.



Henicorhynchus cryptopogon. Another smaller (less than 15 cm) peaceful and beautiful aquarium fish with a remarkable pelvic fin colour.



Garra cambodgiensis. Another Mekong-beauty is this, rarely exported, algae and phytoplankton eating cyprinid. The stripe is golden over green. Size: to 15 cm



Syncrossus aff. helodes. Also this loach has much brighter (unseen) colours and looks different. It grows also less, about 20 cm in length.



Pristolepis fasciatus. The perch-like fish belongs to the family Nandidae (Asian leaffishes). It is a peaceful, algae and plant material eating fish that grows to 20cm.



Rasbora borapetensis. Very nice aquarium fish, here with a redish tail colour. Grows hardl to 6 cm and is nice in small groups.



Rasbora cf. paucisqualis. This is an even smaller cyprinid, it hardly ever reaches 4 cm. Nice yellow fins and also a small group fish.



Macrognathus aff. mekongensis. It is a small spiny eel, that is only known from the Meklong river, and grows less than 20 cm in length.



Macrognathus siamensis. This spiny eel grows a little larger, up to 30 cm, and feeds as well on insect larva, crustaceans and worms.



Monotrete aff. turgidus. Probably an undescribed species, with a beautiful red eye and totally freshwater – may grow to 20 cm.



Trichopsis schalleri. This variant has very bright colours. The ones in the hobby never show such colours, but all are very small – up to 3.5 cm.



T. vittata. There must be quite a variety of colour morphs within this species (see also following pages), which can grow up to 7 cm.



Channa aff. orientalis, juvenile. The snakeheads are still not classified very well. There are several dwarf varieties and surely this is one of them, as *C. bleheri*.



Channa cf. gachua. This snakehead species (if it is *gachua*) stays also small, No more than 20 cm in length. Very interesting and beautiful aquarium fishes.



Ambassis kopsii. It is a realatively small glassfish, with less than 10 cm long and a remarkable black dorsal tip. It has a wide distribution in freshwater.



Parambassis wolffii. This larger growing glassfish, up to 20 cm, has already in its juvenile stage an iridescent spot on the head (insert), for what purpose?



Chitala blanci. They call them featherbacks or knife-fishes and this species can grow to 120 cm.



Chitala blanci. This species can be recognized by the black spot at base of pectoral fin and its tail pattern.



Chitala blanci. It is a night active predator, that eats fish and crustaceans. Only good for large aquariums.



Notopterus notopterus. This is a monotypic genus. Only a single species is known. Is also partly predator (grows 50-60 cm long) with a very bright distribution.



Chitala ornata. This is the most popular of the knife-fishes, and more frequently found in aquariums. But it also can grow to 100 cm (in a large aquarium).



Chitala cf. blanci. This species I found, does not have the black spot and a different tail pattern! Is it a new species? Definitely not *ornata* nor the silver *C. lopis*.



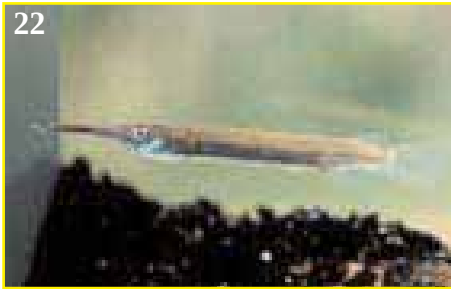
Chitala cf. blanci. Detail of the completely different tail pattern of this, probably undescribed, species. And all specimens I collected had such a pattern.



Chitala cf. blanci. Also in the juvenile stage it shows the typical tail pattern and no black spot (which are found in *C. blanci* in such a stage).



Xenentodon aff. cancella. This needle fish can grow up to 45 cm, Good for large aquariums but definitely needs small fish to feed.



Zenarchopterus cf. dunckeri. This halfbeak I found up from the waterfall, that is has no connection to the Sea. It is purely freshwater and probably undescribed.

Resuming: There are said to be more than 1200 different fish species in the Mekong and its tributaries, and the number is undoubtedly far greater still. After I had travelled the region several times and conducted my researches, I put the number at closer to 2000.

During the short period of my last visit I was able to collect almost 500 different species. Tyson Roberts, the well-known American ichthyologist, has recently discovered 94 new species in a single tributary (how many undescribed species were included in my collection, I cannot say as of today). These pages show just a glimpse – less than 10% of the species I found in the inland delta and the tributaries.

About the aquatic fauna of Lao virtually nothing has been published, or is, indeed, known, about the swamp and aquatic plants. There are, of course, overlaps with the Thai flora, but, as with the fishes, there are endemic species as well, some of them as yet undetermined. 23) This crystal clear river was called (in translation) "Bloodsucker Stream", or so my driver told me later on; 24-25) possibly a *Hygrophila* species, notable for growing both submerge and emerge; 26) and one creek was covered with *Barclaya longifolia*...



I went: whether it were the river, the unbelievable wealth of fishes for the aquariums is almost second to none, the friendliness of the people, or the peace and quiet. I felt as if I was dreaming.

By now the sun had set. I was sitting on the terrace of the wooden inn - the only inn - on Don Khong - and I was the only guest. Not even the Emperor of China was better cared for, in his day. The food consisted of fresh-caught fish which slipped easily down my throat, while giant geckos gobbled up the vermin. Everything was hunky dory.

The next day the weather was glorious and I caught and photographed hundreds of species of fish, each as interesting and colourful as the rest. Everything I needed for my photographic tank was laid on, whether it was water or a towel. These pages show a small sample of the fish fauna of this splendid biotope, together with a selection of the aquatic flora.

I was able to spend only 4 days by the Khong, but I promised myself I would return. And quickly too, as Thailand is planning to turn this paradise into a giant tourist centre, with golf courses, casinos, hotels, etc (though hopefully

the stockmarket crash will have by now have wiped this lunatic project off the schedule). In much the same way there are plans to open up the other dream-world I visited later, on the border with Vietnam, where the native tribes remain almost unaffected by the world outside, and to build 8 new hydro-electric dams there - madness beyond compare. The finest and most unspoiled (and probably the last) primary forest in Asia will vanish. Already heavily laden lorries are carting it away, day and night, to Thailand, as the Thais have long since burned all their forests and have to buy wood from the surrounding countries. The photos show waterfalls which are not to be found on any map or in any travel guide. It was worth travelling halfway round the world to Lao just to see this spectacle alone. To destroy all this would be

Almost half the country is still forested, a large part of it virgin primary forest (the spectrum includes evergreen dry forest, tropical evergreen montane forest, mixed and deciduous woodland, and subtropical and subalpine forest) as well as pineforests. Unfortunately here, as elsewhere, felling is non-stop. Every day huge lorries laden with precious tropical hardwoods roll away from the south (the most heavily forested area) towards Thailand.

criminal. Man seems never to learn...

I promise that before long I will tell you more about this still fascinating country. In the meantime, let me leave you with the last words of Louis de Carne, the original leader of the first Mekong expedition, spoken before he died as a result of the hardships of the journey: "The life of a man has no value except in proportion as he has learned to condemn it by rising above it. To be devoted, is truly to live; to be devoted to the end, is to live beyond it." The words and photos on the following pages



The neighbours buy it all.

There are said to be over than 8300 species of plants, more than 1500 of them threatened with extinction. 100 species of orchids (photos 1-3, 5, 7, and large photo), mostly epiphytic on lofty trees, which, of course, are the first to fall to the chainsaw. For example, the Mekong Commission Expedition of 1866 collected and saw huge numbers of these wonderful pink orchids (5, and large photo). I found just one specimen of this species during my entire trip through the south. On these two pages we see a small selection of species, many of them not yet known to science!



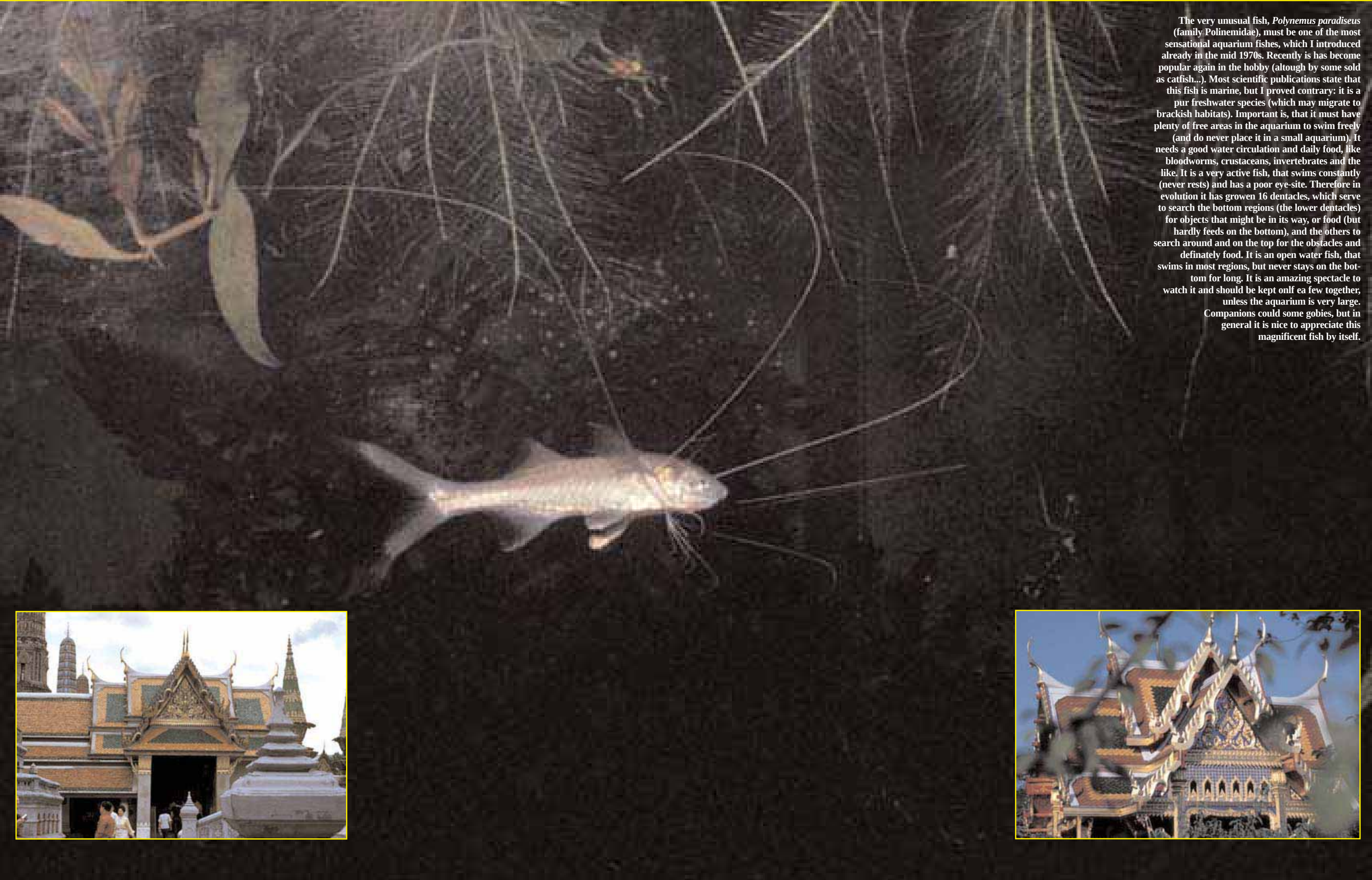
For a biotope aquarium of Lao, or even biotopes from small Thailand-Malaysia (peninsula) some suggestions:

1. *Trichopsis vittata* (here again another colour form from Lao). As it takes atmospheric air it should have a shallow habitat and definately floating plants to build its nest.
2. *Barbonymus altus* is a herbivorous peaceful smaller cyprinid (8-15 cm) and dwells in midwater, in small groups.
3. *Hampala dispar*, adult. Its nice juvenile (reddish) colour disappears with the age, but is still a good peaceful fish for such a aquarium.
4. *Osteochilus hasseltii*, has a very beautiful colour pattern here in the Mekong. A peaceful fish that can grow to 27 cm.
5. *Mystacoleucus atridorsalis*, a peculiar peaceful small (up to 6 cm) midwater barb.
6. *Parachela maculicauda*, peacefull midwater (smaller) group fish that grows only up to 5 cm.



7. *Acanthocobitis* sp. (undescribed), is a peaceful bottom dwelling small (up to 6 cm) loach.
8. *Danio fangfangae*, can grow to 7 cm total length and lives near the surface.
9. *Rasbora hobelmani*, is a peaceful rasborine which grows up to 5 cm.
10. *Raimas guttatus*, another peaceful, bottom oriented, cyprinid that may grow up to 30 cm.
11. *Parambassis wolffii*, adult, is a peaceful glassfish, very different, decorative and easy to keep (need nor salt – is pur freshwater).
12. *Ospronemus exodon* is another peaceful labyrinth fish (endemic to the Mekong), but it may grow up to 60 cm (in large aquariums only).
13. *Ompok bimaculatus* may also grow in large aquariums up to 45 cm and is also peaceful (eats also vegetable matter and crustaceans).
14. This beautiful goby *Rhinogobius maculicervix* stays small (4-5 cm) and preferres gravel-habitat.





The very unusual fish, *Polynemus paradiseus* (family Polinemidae), must be one of the most sensational aquarium fishes, which I introduced already in the mid 1970s. Recently it has become popular again in the hobby (although by some sold as catfish...). Most scientific publications state that this fish is marine, but I proved contrary: it is a pure freshwater species (which may migrate to brackish habitats). Important is, that it must have plenty of free areas in the aquarium to swim freely (and do never place it in a small aquarium). It needs a good water circulation and daily food, like bloodworms, crustaceans, invertebrates and the like. It is a very active fish, that swims constantly (never rests) and has a poor eye-sight. Therefore in evolution it has grown 16 dentacles, which serve to search the bottom regions (the lower dentacles) for objects that might be in its way, or food (but hardly feeds on the bottom), and the others to search around and on the top for the obstacles and definitely food. It is an open water fish, that swims in most regions, but never stays on the bottom for long. It is an amazing spectacle to watch it and should be kept only a few together, unless the aquarium is very large. Companions could be some gobies, but in general it is nice to appreciate this magnificent fish by itself.



FLUVAL®

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> Fluval 05 filters represent the exciting newly refined generation of external filtration technology. Tried and tested by novice and experienced hobbyists alike, Fluval 05 Series offers easy-to-use, accurate, powerful filtration in four sizes to suit all types of aquariums, whether small, simple, large or sophisticated.

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A-201

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EASIER THAN EVER TO INSTALL AND START UP!

The new 05 Series incorporates user-friendly features to help facilitate and speed up filter set up for consumers.

> INSTRUCTIONAL DVD & GUIDE

Eliminate the guesswork. The Fluval User Manual DVD walks consumers through installation, maintenance and filter media considerations in a clear, easy-to-follow manner. This DVD works hand-in-hand with a convenient Quick-Start Guide and a User Manual Book that has simple directives and clear images to guide consumers through the various steps, while providing the information they require to successfully use the product and maximize its effectiveness.



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No more sitting around trying to figure out which piece goes where. The assorted parts come pre-assembled on a card so that consumers can clearly identify the components. The Intake Strainer is already pre-affixed to the Intake Tube, and both the Intake Tube and Output Nozzle have Rubber Hose Adapters on them - just cut the hoses, attach, and it's ready to go!



> REINFORCED CANISTER

For increased strength, durability and ultimate quality, glass fibers have been incorporated into the filter canister housing.



> REINFORCED LIFT-LOCK CLAMPS

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> RIM CONNECTOR ASSEMBLY

Easy-to-use rim connector assembly slides onto and snaps together instantly for extra-quick set-up. The sleek, new connector system can be relied on to hold the intake and output hoses securely in place without being awkward or bulky.



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Promotes the capture of large debris in an innovative way that prevents clogging, reduces maintenance and helps ensure that filter operation is rarely impeded. The new design is also safer for fish. With a larger diameter and extended ribs, the water flow around the strainer is slower, preventing fish from being sucked onto the strainer.



TECHNICAL SPECS

MODEL	105	205	305	405
AQUARIUM CAPACITY	100 L (27 U.S. gal.)	200 L (49 U.S. gal.)	300 L (79 U.S. gal.)	400 L (100 U.S. gal.)
PUMP OUTPUT	480 L/h (128 U.S. gal./h)	960 L/h (253 U.S. gal./h)	1000 L/h (264 U.S. gal./h)	1300 L/h (340 U.S. gal./h)
FILTER CIRCULATION	130 L/h (33 U.S. gal./h)	420 L/h (110 U.S. gal./h)	710 L/h (185 U.S. gal./h)	850 L/h (223 U.S. gal./h)
HEAD HEIGHT (MAX.)	1.55 m (4.4 ft)	1.55 m (4.4 ft)	1.6 m (5.2 ft)	2.05 m (6.7 ft)
MEDIA CAPACITY	3.2 L	4.6 L	6.6 L	8.5 L
WATTAGE	9 W	9 W	15 W	21 W

Note:
* Pump output rates were measured from the filter motor units only, with no hoses or connection to the filter case or other filters.
† Flow rates were measured with intake and output hoses of the same length.
‡ The maximum height at which the unit will continue to pump.

> AQUASTOP™ VALVE

Fluval's proprietary AquaStop™ valve creates an airtight and water-tight seal so that hoses can be disconnected without breaking the vacuum. This means that the system can be started up again without the need for priming after routine maintenance, offering unparalleled convenience and ease of use. The AquaStop™ lever can also be used to reduce water flow without harming the motor or its components.



> SELF-PRIMING INSTANT-START SYSTEM

For convenient, simple and quick filter start-up. No need for manual siphoning.



> Evolution through innovation combines with the intelligent application of technology to produce a first-in-class series of external canister filters. The Fluval 05 series is the filtration system of choice for discerning aquarists who want to achieve maximum versatility and premium performance to create aquatic masterpieces.



The Mamberamo forms the largest river system of the second largest island in the world, and is situated in the northwestern part of New Guinea. Its western branch, the Tariku (formerly Rouffaer), is fed by the rivers Kano, Konda, and Kurogo, which rise in the highlands of the Sudiram range. Its eastern arm is the river named the Idenburg by the earlier Dutch colonists, which rises in the Jayawijaya range and is called the Taritatus by the Indonesians. This river system, which is more than 2000 km in length and only one of the least explored in the world, flows into the Pacific in the northern part of Irian Jaya, Indonesia.

The first white man to visit the Mamberamo was a Dutchman, Captain Franssen Herderschee (1872-1932), who sailed some 150 km up stream in 1907. Only a very few adventurers and scientists followed in his foot steps, the last of them during 1930's, and none of them penetrated as far as the Idenburg. In the 1950's occasional missionaries started to fly to the region, and later their numbers increased. Even today there are only a few landing strips in the Mamberamo region, and where they do exist they are mere clearings where the primeval forest has been felled by the natives, and are used almost exclusively by the missionaries. There are no commercial flights, and travel in or to the area is not permitted. The region has been suggested to become a National Park, the Mamberamo Foja, covering 1,661,000 hectares, and it would be the largest protected zone in Indonesia. An absolute necessity to protect the more than 100 species of mammals, 330 species of birds, and almost innumerable, and largely undiscovered, fishes and insects, almost all of them endemic.

Mamberamo

The Twinotter finally took off at 11.55. We four were the only paying passengers. There were also a native, an Indonesian, and 2 Polri (these policemen had “Polres, Jayapura, Irian Jaya” embroidered on their sleeves) to supervise us (?). The 2 Merpati servants had come along simply to unload our luggage – chests and boxes full of edibles, as well as 5 sacks of rice, live hens, etc, etc - in Dabra, our destination, as there are no ground staff in the jungle of New Guinea.

We flew over the beautiful Lake Sentani, home of the salmon-red rainbow fish, and it began to rain. What a nuisance. The 2 pilots attempted to avoid the wet by looping in a manner more appropriate to display flying, and headed



little sweat to obtain were examined with a fine toothed comb. “Mamberamo is not on the police permit” was the reaction! And this was in fact true. The police in Jakarta had entered only “Jayapura, Wamena, Biak” as permitted destinations on the entry permit bearing our 4 passport photos. I almost had a heart attack!

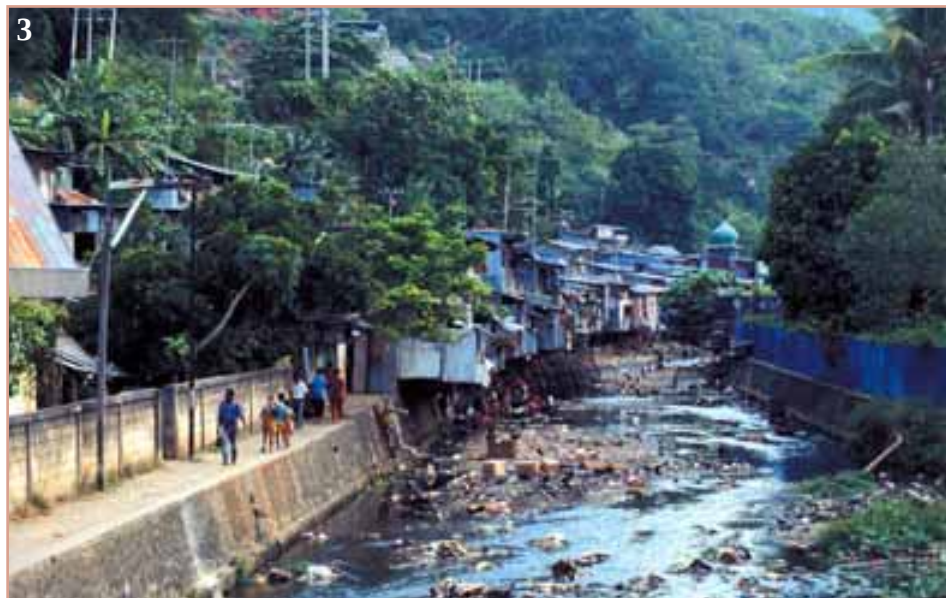
My friend Kamihata’s connections with a multi million dollar shrimp company had failed to have the desired effect. If only I had dealt with the matter myself...

But the battle was at least half won when we produced the second document, the “Surat Jalan” (travel permit from the Ministry for Tourism) which included the entry “Sungai Mamberamo”, and using all our powers of persuasion we man-

for the shore. Soon we were above the clouds and I had only occasional glimpses of the thick primary forest of the Van Rees mountains.

Yet again, as is so often the case at the airport of Jayapura in Irian Jaya, checking had been the occasion for much hair-tearing! Right up to the last minute we did not know whether we were actually going to be allowed to fly. The security police arrived the moment we presented our tickets to Dabra. “Dabra?” came the incredulous enquiry.

“Mamberamo?” ditto! It was almost as if no white man had ever flown in that direction. “Your permit!” were the next words, and the papers it had taken us 6 months of painstaking effort and not a



1-2. Garuda flies to Jayapura – the capital of the province Irian Jaya – three times a week. Its airport is located 60 km from the city, in a village called Sentani (2). 3-4. Jayapura does little for its rubbish, it ends all in the creeks, below the housing (3), were people bath and have their toilette (4). 5-8. The market is always the place to be, to see the local culture and produce (5). The main item is the beetle nut (6), which is chued with shell-powder that makes the mouth turn red (7). They also sell introduced tilapias and goramys (8).

aged to convince the officials. All that was needed now was photocopies – but where were to obtain these? The airport is 60 km from the town. Luckily the flight was running hours late and there were still two and a half hours before take-off. This was just enough time for a 120 km round trip at break-neck speed in a taxi, which almost disintegrated as a result of the countless holes in the asphalt. Then, just before take-off, the official came back to the noisy, overheated, little waiting room and said “The chief in command gave me strict orders that you must report upon your return from Mamberamo and that you must report in each village that you visit and deliver copies of your permit!”

While I was reminiscing about this and



other adventures connected with this journey – I had spent more than 2 years chasing back and forth between Sentani and Germany in my unsuccessful attempts to obtain a permit – the plane broke through a bank of cloud and for the first time in 10 years I saw the mighty Mamberamo beneath me.

It was a bumpy landing; we were flung together in a heap with our luggage on top as the pilot brought the crate to a halt exactly 3 metres from the edge of the tree-clad mountain! The grass runway, which is only about 500 metres long, runs from the bank of the Mamberamo through the thickest primary forest on earth. Our reception committee consisted mainly of Danis, who had made the 2

month trip on foot from their home in the highlands. In addition there were soldiers from Java, a doctor who had come from southern Sulawesi to work in the as yet only half-built hospital, a man from Ambon, and a mining expert from the Freeport Mining Company in Manado, northern Sulawesi. We were undoubted-



ly the first tourists to visit the Mamberamo and everyone wanted to stare at and touch us. Ringed by spectators, we were led to the police station, a 5 metre square plank-built barracks with a veranda, where our travel papers were yet again examined from back to front by the assembled police. I noticed that at most only one or two were actually able to read.

We were asked about the purpose of our journey and warned about the dangers of travelling on the Mamberamo. We should do so only with a police escort. It was teeming with crocodiles and other hazards. The area was uninhabited and they could offer no guarantee of our safety.

At about 1600 hours – some 5 hours after our landing - we were finally “free”. I needed a breath of fresh air, and went to look at the nearest small stream, in the forest at the end of the runway. A touch of nature is always refreshing, especially after so much hassle.

It was only a metre or two wide, but ran in a stony bed more than 50 metres across, suggesting that during the rainy season incredible masses of water turned it into a raging torrent. The water in the channel was clear, often with strands of green algae waving to and from in the current. I spotted tadpoles and then the first fishes: gobies moving jerkily to and fro among the round stones. They had splendid orange stripes and were possibly an *Oxyeleotris* species. Then the first



1-2. Flying with a chartered plane to Dabra in the Mamberamo region (the only outpost) one can only see endless primary rainforest (1) and a giant river system (2), but no sign of civilisation. 3-5. A civil aircraft (being very rare here) attracted all the natives and the few militaries, who immediately asked for our special permits (5), which had taken me three years to get them...

6-9. One native girl wanted to give us right away a welcome present, a tame bird (6). And another one this young New Guinea crocodile (7), the endemic and protected *Crocodylus novaeguineensis*. Unfortunately, WWF, Cites, or any other organisation cares about the butchering (8) of the last crocodiles, has the natives have to do it for the militaries, so they can sell it stuffed (9), or skins.



rainbow fish; a member of the *Melano-taenia affinis* group! It was only 6 cm long and afflicted with the very rare (in nature) but typical rainbow fish disease. I made my way downstream from pool to pool, clambering over trees and rocks, past splendid orange fungi growing on the rotten wood. In a small pool, 2 metres in diameter and overhung by a bush with yellow flowers and black fruits, I saw many *Chilatherina* sp. and soon had them in the net.

They appeared to belong to the *C. fasciata* group. Further along the stony path there were glorious terrestrial orchids with spikes of small lilac flowers. A real feast for the eyes.

Back at Dabra our Dani guide led us

boards to act as clothes-hooks. The service was perfect.

But just as I was about to pour out the evening cup of tea a new escort arrived. This time it was the military chief of the region together with the local native elders. These dignitaries felt we had slighted them and wanted an explanation.

I repeated my speech for the umpteenth time, and when I was yet again pressured to accept a military escort for the journey along the Mamberamo I refused to give in. My outburst appeared to have the desired effect, and it remained only for me to make a declaration to the effect that we would be responsible for our own safety and that



across a field of sweet potatoes to look for “lodgings”. Before long our guide said “Hospital” and mimed sleeping! This sounded like a good idea.

The village doctor, a Javanese, was kneeling on his prayer mat facing in the direction of Mecca. But before long he was placing at our disposal his 8-roomed hospital, which was lying idle without patients and beginning slowly to disintegrate before it was even finished. It was as clean and bright as a new pin. The floor had been scrubbed and disinfected, mosquito nets draped over the beds, and even nails hammered into the

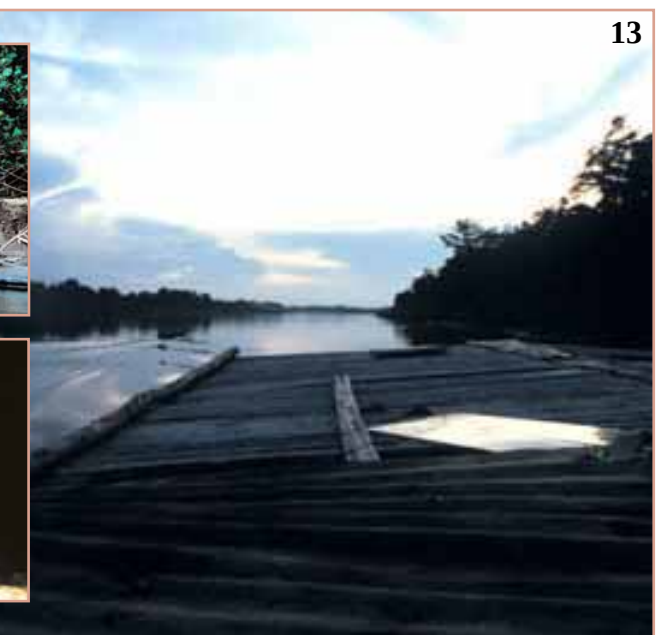


10-13. In Dabra I found an Indonesian man called Hamaru, married to a native women, who said he can build a boat for us to travel the Mamberamo, as no boat exists in this giant river system (except for natives dugouts). And he began to the boat construction that evening (10). Even while traveling (11-13), he always added a piece to the boat... 14. Often we got stuck, as the river bed is quite shallow, and that during rain...

they would not be held to blame if any of us should have an accident. They wanted confirmation that they could wash their hands of us.

And the evening brought still more excitement; music, here in the deepest primeval forest on earth. Until 3 o'clock in the morning “Thriller” boomed out over and over again from Dabra's one and only cassette player, in the police headquarters! Even here Michael Jackson is a hit.

Shortly before sunrise we packed up and walked off through the mist to our boat, the only motor-driven vehicle on the Mamberamo. Hamaru, a native of southern Sulawesi, had agreed, after much late night haggling, to hire us his boat, inclusive of a 3 man crew and



petrol, for 4 days for \$800 in cash. It was a stiff price, especially as the decking was not yet complete, the superstructure was only half built, the air conditioning and electric lighting had not yet been installed, the catamaran was only temporary, and windows, beds, cabins, wash-basins and toilet were still at the planning stage. We were astonished to find that during the night, and in fact throughout the entire trip, there was much hammering and sawing as further construction took place on board the “Mamberamo Yacht”.

We waded through waist-deep mud, sinking in time and again because of the heavy loads on our backs. There are 10-20 metre broad mudflats on either side of the Mamberamo, and in some places it is more than 100 metres to the edge of the forest. We finally reached the boat where Hamaru conjured up some planks to enable us to climb aboard across the black ooze.

We parked ourselves and our baggage on a stack of boards. The corrugated iron roof over our heads appeared quite serviceable despite a few holes. We even

had a “fireplace” in the middle of the “cabin”, which was open to the air on all 4 sides! Our half-finished “yacht” chugged off upstream, towing a 6.5 metre dug-out canoe with an additional out-board motor. What more could we want?

The morning mists slowly began to clear, and the immense, impenetrable, primeval forest, apparently endless in its extent, loomed to both left and right of us. It seemed to me that we were like the first men on a hitherto unex-

plored planet. I could imagine how Neil Armstrong must have felt when he became the first man to walk on the surface of the moon. I had already established that we were in truth the very first group of tourists to visit the Mamberamo since the independence of Indonesia, and

permanent population of 30,000 animals, had commissioned the native tribes of the Mamberamo region to catch every specimen they could lay hands upon! This has resulted in the virtual extinction of *Crocodylus novaguineensis*, as the natives have for the first time come into contact with money which they have used to buy clothes and food, i.e. they have in effect been exchanging the crocodiles for these commodities.

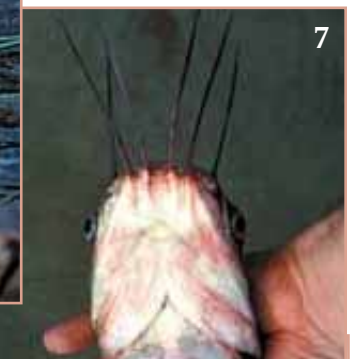
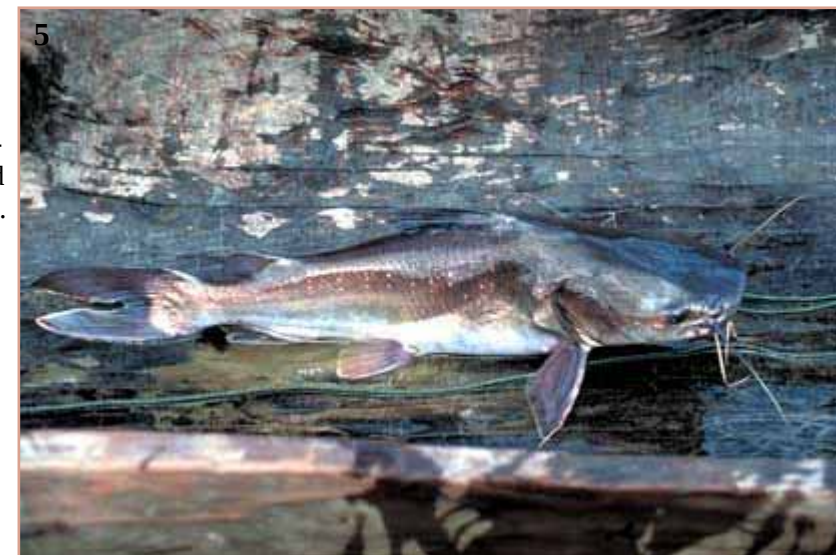
By night I examined the banks of the main stream, the tributaries, and the lakes, but although I did manage to glimpse a mere 4 specimens in the light of my 2000 watt spotlight, none of them measured more than 30 cm! In my opinion a pitiful remnant of this majestic species. But there was plenty of other life on and around the river: white herons with yellow bills (*Bulbucus ibis* – known locally as “Kuntue Kerbaw”) were every-

where to be seen, often at quite close range. The interesting cormorant-like *Egretta sancta* (“Kuntul Karong”) flew across the water, diving after fish and surfacing with their prey in their bills, and a white-bodied eagle (*Haliasius indus*, called “Elang Bondol” locally), snatched a fish from the river with its talons as if there were nothing to it, uttering harsh cries as it soared aloft from the water’s surface.

The most elegant member of the feathered tribe, however, is the hornbill (*Acerosplicatus julang*, also called the Irian or Burung Lipat), which is similar to the South American toucan. Their croaking calls were unmistakable as they glided in pairs above our heads, now and then giving 3 or 4 beats of their wings.

Almost a day’s journey upstream we stumbled upon an approximately 6 metre wide tributary, the Boare, on the right-hand bank, surrounded by endless forest. Hamaru skillfully beached the “Mamber-

amo Yacht” on the mud and moored her! We transhipped ourselves and a reduced amount of equipment to the dugout and chugged away up the tributary. Our fun was shortlived, however, for



Kamihata-san and Tarzan were the first Japanese ever to visit this spot. I was as taut as a bowstring in anticipation of what awaited us in this no mans land.

The bed of the Mamberamo, which wandered in huge meanders through the forest, was up to a kilometre wide. The mudflats along its banks rose high out of the water – despite the fact that it rained every day this was the height of the dry season.

We battled for hours against the current, the milky-grey opaque water, full of suspended particles, demonstrating the pent-up power of this mighty river. There was no human being for miles. No signs of any settlement. No natives. Hamaru told us that hardly any men lived along the Mamberamo because of the large numbers of dangerous cro-

diles. Later on we discovered that to all intents and purposes this is no longer the case. For many years the owners of the well known crocodile farms in Irian Jaya, the largest, in Jayapura, having a

The largest fish in the Mamberamo system are members of the catfish family Ariidae. Only two species have been described from here, but I was able to find at least 5 more, and none could be compared to the described ones, like: 4. One species with a very flat head; 5-6. One with a very large head, and silver spots; and 7. One looking down.

1-2. There are still some areas in the Mamberamo where we came across the endemic crocodile, but it never did attack us, nor do anything, as long as we left them alone. Although they look dangerous and did let us know “do not come closer” opening their mouth wide (1)... Some younger ones, were in pools full of algae (2), looking for easy prey (fishes which were trapped and cannot swim fast because of the low oxygen level in the water). 3. The entire Mamberamo system is nature pure, practically the most uninhabited place on planned Earth today...



1-6. My aim was to enter, as far as possible, the affluents of the large rivers in this giant valley. In most of the affluents has been no man (definitely no white man) before, therefore the rivers and creeks were often (almost all of them) full of fallen-in trees and logs or giant roots. We had to move them out of the way (3) or, in some cases, the only way out was to carry the boat over the trees (5). Some of them were so bad, that we had no chance to enter them (6). Even the very big rivers, such as the Mamberamo itself, or the Taritatus, were full with trunks (4). No one ever moves them away, as, ship or boat traffic is non existing here. 7-9. Some of the lake areas we entered by foot sinking deep into the mud (7). And the only traces we found, were those of animals, like those of cassuary birds (8) or very small birds (9).



after the first bend the river was blocked by fallen forest giants.

But Hamaru overcame this hurdle, as well as others on the 4 km long stretch of river, in his own inimitable way. He pushed the trees to one side, either singlehanded or with our help. At one point, when it really was impossible to go any further, he told us to climb over the tree with our bags and baggage while he used all his strength to push the now empty canoe under water against the current and hefted the outboard motor over the trunk.

Hamaru truly belongs to that class of men whom nothing can daunt. He does not know the meaning of the word impossible.

The Boare became ever clearer and after a journey of about an hour and a half the water was so transparent that it was possible to identify the fishes from the surface! We cast our net wide and a glorious striped *Chilatherina* species came into view, possibly a member of the *C. fasciata* group. They were glittering emerald green, gleaming blue, gold en yellow, and pink-orange coloured creatures with 8 blue bars – fishes with all the colours of the rainbow. No wonder that they are called iRainbow Fishes. But the bright colours are seen only in adults of 14.5 cm or more. Juveniles and semi-adults, the majority of our catch,

have an almost silvery colouration. And then there was a *Glossolepis* species - but which? We found this one again and again in the Mamberamo.

Further up the Boare, after a journey of more than 2 hours in the heat of the sun, we came upon a lake-like lagoon, lying to one side of the river bed, and measuring more than 100 metres wide and about a kilometre long. "Danau Boare" said Hamaru. We waded in with a long drag-net in a temperature of 42 °C in the shade.

The water temperature was 36 °C and felt warm, but nevertheless huge shoals of fishes were disporting themselves in this stagnant broth; the majority were *Tilapia*! Followed by carp (*Cyprinus carpio*) and barbs of the genus *Barbodes* (almost certainly *B. gonionatus*). All these exotics were introduced by the Dutch during their occupation! The intention was to increase the protein available to the natives. But, as has been the case almost everywhere in the world that men have perpetrated such follies, there has been a resulting boomerang effect; the native underwater flora and fauna have been decimated, or in most cases completely exterminated, by the introduction of these aliens. It was just so here in the Danau Boare. The introduction of exotics should be the subject of a total ban by both national governments and international organisations, and punishable by severe penalties in international courts of justice. And not as in Australia, where the powers that be have done nothing but talk rubbish and are now blaming aquarists for the problem!

The Boare, however, also yielded sturdy, very large *Arius* catfishes, specimens of 2-3 kg heavier and carrying more flesh than any of the exotics. The introductions have not been able to decimate these endemics, as these so-called "Crucifix Catfishes" are likewise predators and eat just about everything that comes within reach of their mouths – but not their own eggs. They brood the latter, as well as the developing juniles, in their mouths – and for this reason they have survived!

Some crucifix catfishes have a row of gleaming pearl-like spots on their metallic brown



flanks, and are white only on the belly. The most sensational of them, however, was a catfish of the genus *Doiichthys* (?). The monotypic species (*D. novaguineae*) placed in a family of its own (Doiichthyidae), it is certainly the oddest member of the group, and one can only marvel at the way that both eyes are positioned at the same level as the mouth and can look only downwards. Thus if one looks at these creatures from below one finds oneself looking into their eyes, which are barely visible from above. The 6-8 cm long barbels are pointed forwards, with 2 pairs on the maxillary and a single pair beneath the lower jaw. The head and eye structure reminded me immediately of the South American Dolphin catfish (ag No.6) which likewise can only look downwards. This is an evolutionary adaptation which is used mainly in the search for food.

Doiichthys had never previously been photographed and was known only from southern New Guinea. It may well be that the Mamberamo population repre-

sents a new, second, species. The unmistakable morphology of *D. novaguineae* is the reason for scientists assigning it to a separate family.

A while later Hamaru, at my insistence on examining secluded lakes, managed to find a passage for the dugout from the river through the flooded forest, and an enormous, 20 km long, lake opened in front of us. A dream of a biotope, completely undisturbed. Hardly surprising, as probably never be-

fore in the history of the earth had this spot been visited by white men. Hitherto one could only dream that there might still be something of this kind on our planet shortly before the beginning of the 21st. century.

Hamaru, who had been fishing the central Mamberamo for 19 years during which he had captured many native fishes in his gill nets, knew this area like the back on his hand. He even showed

me a sketch map of the region, quite different to any of the official maps, but I am quite convinced that Hamaru's version gave the true picture. Hamaru called the lake "Tanjum Potus". The water was almost transparent, with roots and trunks protruding in many places, and the bordering rain forest seemed even denser, impenetrable, than ever.

The riparian undergrowth consisted of ferns, nothing but ferns. Millions of plants which during levels of high water would lose their leaves or die off completely, or which, as now at low water, enriched this dream-like biotope still further with their fresh green foliage. There were white herons everywhere, eagles in the sky, and yet more hornbills. A crocodile measuring about 1.5 metres in length quickly submerged into the depths at the approach of our boat.

Unfortunately fishing here failed to produce anything particularly exciting - the lake must be directly connected to the Mamberamo during the rainy season.

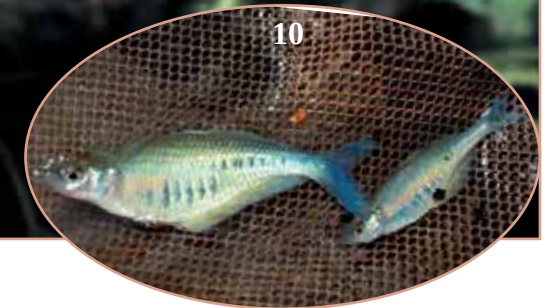


1. From the plane one can see many small affluents, creeks and rivers in this giant valley. None of them explored, probably still containing hundreds of undiscovered species. But extreme difficult to penetrate, or even enter at all.
- 2-4. The dutch (Irian Jaya was Hollandia before, colonized by the Dutch) have, no one knows exactly when, introduced three exotic species here:
1. *Barbonymus gonionotus* from Java. 3. *Cyprinus carpio*, from Europe, and 4. *Oreochromis niloticus* from Africa. With all the fishes here, why?
- 5-7. The halfbeak, probably *Zenarchopterus kampeni*, is a native.

Once again there were rainbow fishes of the genus *Glossolepis* (this time, however, with an orange opercular spot) and silvery *Arius* catfishes, including one specimen measuring more than 50 cm which Hamaru immediately put aside for our evening meal. This splendid creature turned the scales at 3.5 kg.

That evening we continued our journey up the Mamberamo, experiencing an incredibly beautiful sunset amidst unimaginable stillness.

Hamaru anchored his "yacht" in the mud of a bay and we were immediately attacked by swarms of mosquitoes. We were rid of these pests (and then only



in part) only after we had lit our campfire on the boat and were cooking our potato soup, while the Japanese prepared their rice bag - you simply fill this with hot water, wait 20 minutes, and you have instant rice with all the trimmings. As we enjoyed our tea we were serenaded by grasshoppers and frogs, interrupted only by the shriek of the birds.

The campfire was reduced to embers, and we smeared ourselves with mosquito repellent, spread our mosquito nets, and lit the mosquito fumigant. One cannot take too many precautions here; malaria, which infects more than 200 million people every

8-10. In this clearwater affluent (8) we seined and caught a beautiful *Chilaterina* species (9), still undescribed but in the hobby, as the "cameleon rainbowfish" (as it changes its colours). I had a pair in the net (10). It can grow to 18 cm (the ones shown were 14.5 cm), and is probably the largest *Chilaterina*, belonging to the fasciata group. It is a real beauty. 11-12. The most common *Chilaterina* cf. *fasciata* (I call it *Chilaterina* sp. "Mamberamo"), lives almost everywhere in the valley.





1-4. Untouched virgen jungle (2), and unlive, nor visited, hundreds of beautiful lakes (1), in an untouched giant valley full of undiscoverd rivers (3), only herons (4) and other animals live here. No human being, nor trace. 5-6. I was able to visit just a few of the isolated, remote lakes, like this one (6). But we walked for three days to reach it – to find only a goby species in it (5).

Right-hand page: 7-10. The very few native (aborigines) people who live in this Mamberamo valley, are countable on a few hands. In my total of three journeys to this valley I have not seen more than 100 aborigines in this area, bigger than Switzerland. They live like in times of the stone age and are still nomadic tribes. Their huts have only a temporary palm roof (7). Their tools are made of nature products, even their bows and arrows – each one of the arrows to hunt a certain fish or animal species (8). Their cloth (9) are made of barc from certain tree, or given by missionaries ages ago. But all of them were always very friendly and welcomed me to their modest home (10).

year, is endemic to the Mamberamo, another reason why nobody comes here. The Japanese wore an additional safeguard round their wrists – newly invented mosquito armbands, which give off a mosquito repellent aroma. Unfortunately Paola and I did not have very much luck getting to sleep. Mizukami and Kamaihata-san were taking it in turns to perform a symphony of snoring – it was as if the two of them were competing to see which could out-trumpet the other! I must have shaken them awake more than 30 times in the course of the night, but all in vain!

Hamaru and his comrades were up before dawn setting their gill nets in the bay. After only a few minutes they had a mesh bag packed with tilapias, barbs, and catfishes, had lit the fire, and were summoning us to breakfast. Baked potatoes and fish are their daily fare; morning, noon, and night. In the morning mist we all had to join together to push the “Mamberamo Yacht” out of the mud, as it was stuck fast. Plastered in mud up to his waist,

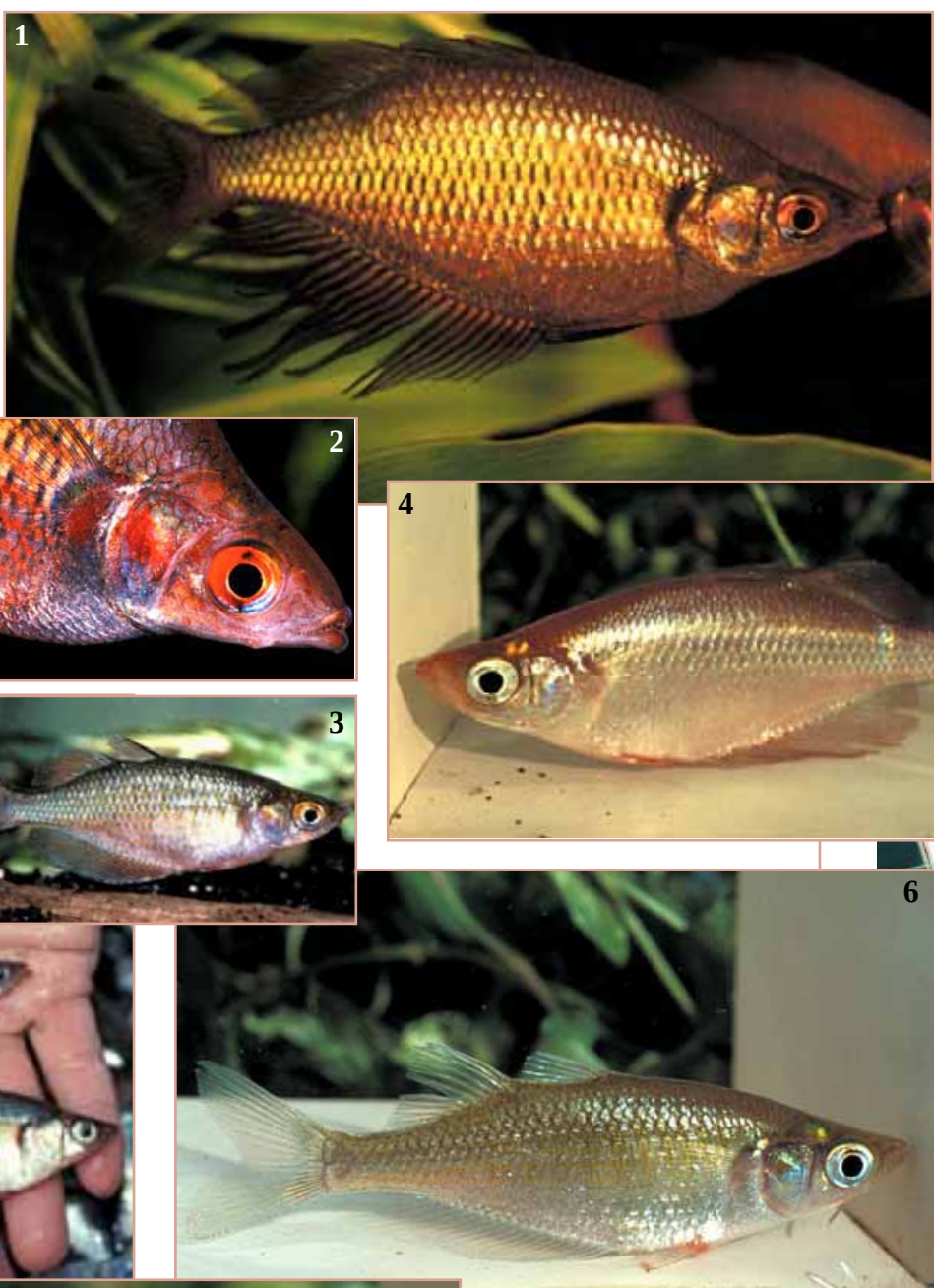
nected with the main river, even at high water, i.e. which were never flooded by the Mamberamo. Inundation lakes – and there were almost innumerable such lakes along the river – would invariably have an aquatic fauna identical to that of the Mamberamo itself. Thus it was that, at noon on the second day, we found ourselves back in the dugout, this time travelling several kilometres up a smaller stream, only 2.5 to 3.5 metres wide. Our Sulawesi ex-

plained that although this watercourse was still navigable at this time of year in a few weeks time it would be impassable. It was simply an outflow of the distant lake Kli, and thus not a proper stream at all! After an adventure-filled journey – this waterway was clearly completely undisturbed, with even more branches, bushes, and giant trees at all angles than the Boare river, and in addition banks lined with spiny *Pandanus* plants, and thus

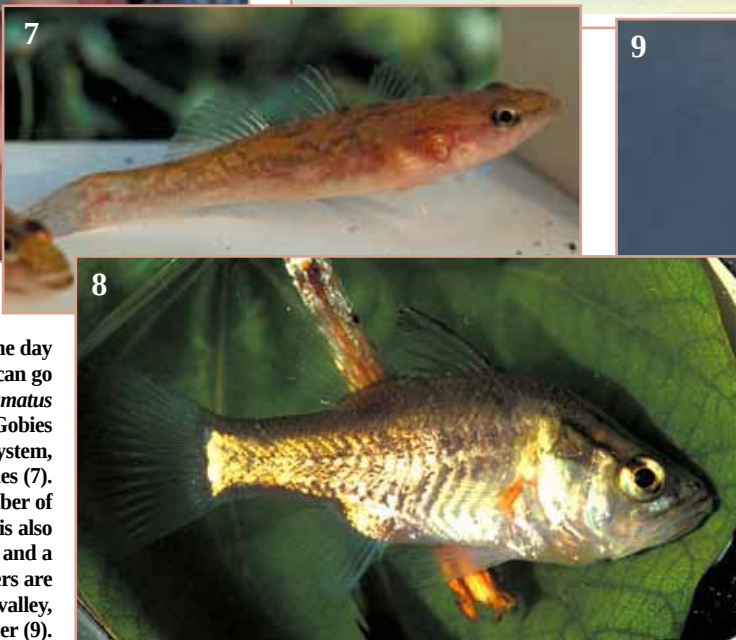


and in places up to his neck, Hamaru steered the boat back into the main current and proceeded upstream; meanwhile a quick dip in the river cleaned us of the clinging ooze. A few *Lorius roratus*, green parrots, flew over us, chattering as if they were trying to tell us that day was dawning, and before the sun had risen above the horizon we also saw white cockatoos, *Cacatua galerita* (known locally as “Kakatua besar” or “Jambul Kuning”), uttering their characteristic cries. This majestic undisturbed river had awoken anew. Hamaru was well aware that I was interested in lakes which were never con-

1-6. In one lake (the aborigines which came with me called it “Kli”), I found a striking rainbow-fish (1-2). It was a *Glossolepis*, but a very red one, and to me still undescribed. Because there is confusion regarding the species named *G. multisquamatus*. It was described 1922, after a fish collected by W. C. Van Heurn in the Idenburg river (not in the remote lake Kli) as *Melanoatenia multisquamata* by Weber & De Beaufort, and they describe precisely the species which I collected also in the Idenburg river (5-6), its type locality. Also: My fish from lake Kli (already introduced in the hobby), has always red eyes and red stripes (1-2), already in its juvenile stage the eyes begin to turn red and the red stripes appear clearly (3). Alone these characters are absent from the species found in the Idenburg, and do not appear in its original description. But G. R. Allen, still calls both *G. multisquamatus* – even the one found in the distant Ramu valley (in Papua New Guinea), which is again a different (also undescribed) species and today in the hobby worldwide as *G. multisquamatus*. So actually the fishes in the hobby are



both new, and the real multisquamatus still in the Idenburg, as I did not bring it (only the photos). So maybe one day they will be described. And maybe I can go back and collect the true *G. multisquamatus* and this time bring it back alive... 7-9. Gobies are found also in the Mamberamo system, her some undescribed *Glossolepis* species (7). The *Glossamia* (8), a freshwater member of the large marine family Apogonidae, is also still not classified. It is a mouthbrooder and a predator, eats small fishes. Spiders are everywhere in the Mamberamo valley, even on sticks on the water (9).



impassable – we eventually reached Danau Kli. The most spectacular vista yet opened in front of us – almost black water, innumerable birds, and an incomparable wealth of fishes. When Hamaru dabbled his fingers in the water hundreds of catfishes came to the surface, squabbling over the prey they thought had landed. I was immediately positive that this lake would harbour at least one endemic species. This is generally the case throughout New Guinea. Lakes which are geographically isolated have endemic species. But in most cases catching them is very difficult. The water was also very deep here – only some 6 metres below maximum (but almost 10 above minimum) – and the nets yielded nothing but a few gobies. Hamaru then attempted to penetrate

further along the lake. We passed small islands with fantastic vegetation in the middle of the lake and groves of trees standing deep in water but seeming nevertheless to be thriving. As we reached the halfway mark I saw a bank where we might be able to land. Despite the thicket on the shore our Sulawesi came up trumps yet again, and in next to no time we two and his two helpers were in the black water. I swam through the lake with the 7 metre net in tow, trying to reach the distant bank as quickly as possible, which was easier said than done. When I had finally reached the shore, and removed from the net the many pieces of root it had collected during my numerous dives (to depths of up to 5 metres) below obstructions, I saw a salmon-red fish in its centre! What a sensation! It rivalled *Glos-*

in a mere 40-80 cm. of water in the inundation zone; here we found huge shoals of the *Glossolepis* species which is found everywhere in the Mamberamo. We also caught another, very silvery, form which was otherwise very similar (female?). In addition there was a *Zenarchopterus* species, a halfbeak with a unique mouth, the lower jaw measuring up to 8 cm long and the upper a mere stump, the two fitting together perfectly, however, when closed. A single specimen, 24.5 cm in length. Only 2 species, *Z. alleni* and *Z. novaguineae*, are known from this region. But a precise identification was not possible at this stage in our journey. Another very unusual fish which we caught was the large-mouthed perch, *Glossamia* sp., probably a new species. The colour pattern did not agree with that of *G. beauforti*, or with that of the



10. Only about 100 species of the carnivorous plant genus *Nepenthes* – generally called pitcher plants or monkey pot – are classified, and most of those are found in New Guinea. This island is (still) so rich in its flora and fauna. 11. Another striking new discovery was this blue eye, *Pseudomugil* species. Also still undescribed.

solepis inciscus, only the red colour in males was distributed in horizontal stripes, mainly on the upper part of the body and fading out on the lower. But it was such a brilliant blood red that I let out a cry, barely able to contain my excitement. The bodies of the females were merely pink, but with a bright red tail. There were 2 in the net on the first cast, but thereafter success eluded me until a small bay on the return journey, where we caught a further 4 specimens after a dramatic battle with the undergrowth. At this spot we were also able to see how abruptly the edges of the lake plunged into its depths. It must have been more than 50 metres deep. During our “exit” from Lake Kli the crew helped us with a fishing experiment

twinbanded *G. gjellerupi*, these 2 being the only described species from this area. A very interesting group of fishes. They are restricted to fresh water habitats, in contrast to the other members of this family (Apogonidae) which inhabit mainly salt water and have a pan-global distribution. There are 7 described species, 6 of which are endemic to New Guinea, and the 7th. species found in Northern Australia, *G. aprion*, as well. They are piscivores which also use their large mouths for brooding their eggs. The water temperature measured 29.5 °C, and at noon the air temperature rose to more than 40 °C on the thermometer. Our return journey to the Mamberamo was somewhat easier than the trip upstream. We lay at our ease in Hamaru’s

dugout for almost 6 km. while he, as usual, manhandled the many tree roots and trunks out of our path. Tonight I would rest easy. I had yet again achieved my ambition, of 13 years standing, of discovering a new rainbow fish every year. It began to pour with rain. It had come down in bucketsful the night before and once during the day, real tropical downpours of brief duration, lasting 10-15, sometimes 30, minutes, but consisting of ice-cold rain. This time it rained all night.

Before the still of night fell upon the Mamberamo Hamaru and I were able to fish the clear Doormann river, a sandy-bottomed fast-flowing stream, at present about 8-10 metres wide but at high water occupying a bed a good 30-40 metres

across, as could clearly be seen from the huge exposed sandbanks and the tree trunks swept down by the force of the torrent and left scattered around like matchsticks. This river is one of only 2 collecting sites where, round about 1920, members of the rainbow fish family Melanotaeniidae were taken from the Mamberamo, preserved, and, 2 years later in 1922, described by the ichthyologists Weber and de Beaufort. The other is *M. praecox* from the former Pioniers bivak.

In the Doormann (the natives still use the Dutch name) I also found the largest of all the Melanotaeniidae (at least of those known from the wild). In the light of the searchlight specimens of up to 16.5 cm swam around my

legs. This species is currently known to science as *Melanotaenia vonheurni*, but the form of both mouth and body are reminiscent of *Chilatherina*, and in addition its habitat and motion likewise suggest it should be assigned to that group.

Chilatherina, in contrast to *Melanotaenia*, are found almost exclusively in fast-flowing rivers and streams – generally in areas of rapids – and only in clear water. They rarely occur in lakes (*C. bleheri* is the exception) or in cloudy or muddy waters. Again we netted a few gobies, but these were nothing like as colourful as those in the black water of Lake Kli. And once again a barb, an exotic!.

Soaked to the skin with rain, we huddled



1-5. Most of the remote lakes in the Mamberamo valley can only be reached over land. We had to anchor the boat and walk (1). And as most of this giant valley is swamp and mud, the walk becomes very unpleasant (5). Unfortunately (for the aquarists), many of such muddy lakes do not have rainbowfishes, but always gobies and gudgeons.



In this lake were two interesting gudgeons: one was definitely *Giurus magaritacea* (2) found all around New Guinea and elsewhere, which can grow to 30 cm and another large, but undescribed species (4). The goby definitely belongs to the genus *Glossogobius* (3) and looks somewhat like *G. bulmeri*. 6. The lake mentioned above, at which we collected these species, can be seen here from the plane.



7-9. We collected and researched in muddy (7-8) and clear waters (9) and found fishes everywhere. All over the place most of the times the earlier mentioned *Chilatherina fasciata* and the *Glossolepis multisquamatus* (10) in mostly turbid waters. *Melanotaenia vanheurni* (11-12) was only in the clearwater affluents (9) of the Idenburg river. Also this interesting *Glossogobius cf. koragensis* (13). Only: in none of those we found *Melanotaenia praecox*, although Van Heurn had collected in in 1907 in the Mamberamo River...



dled over the “fireplace” aboard our “yacht” to dry ourselves, and thought about the wonderful time we had had on the Mamberamo. We were only too well aware that next morning a helicopter from the Airfast Charter Company in Jayapura would be arriving to collect us. Back to “civilization”. I would have preferred to stay, a sentiment which Paola shared, but there were also the Japanese...

Hamaru and his crew motored through the relentless downpour in the direction of *Dabra*, where we dropped anchor at 2 am. It was a wonder how this man found his way back though the maze of rivers in the pitch dark forest night and teeming rain.

Paola and I stayed aboard in order to spend the few remaining hours asleep on our “yacht”. Hamaru hung a large piece of canvas to windward of our beds to keep off the worst of the rain, and then he accompanied Kamihata and Tarzan across the mud to dry land.

I awoke to the tremendous din of a helicopter above my head, sprang from under my mosquito net, and peered up into the sky which was still filled with clouds raining cats and dogs. It was a helicopter belonging to the P.T.Freeport Mining Company in Tembagapura, the largest gold, silver, and copper mine in Irian Jaya (amd the whole of Indonesia!), with more than 140,000 employees. The diggings have already extended into the Mamberamo basin. Two people had been stationed here for several weeks to make a survey of the area, and their needs were supplied almost every day by air. The helicopter even transported large numbers of 200 litre drums of benzene, hung in nets beneath it from Tembagapura which lies high in the mountains.

For my own part I was hoping that our pilot from Sentani would not attempt the journey in this weather. But it turned out quite otherwise.

The very first time that I came to Irian Jaya and to the Mamberamo, on that occasion (1982) together with my friend the world famous ichthyologist Dr. G. R. Allen and the photographer Dr. W. Tims, my pilot told me, when I asked when and at what price I might charter a helicopter, “You must remember 3 things when you come to Irian Jaya:

- 1. Most of the Mamberamo main rivers get influence from the high and low tide - although some parts are 1000 km away from the Ocean...
- 2-4. *Pandanus* (2) are growing almost everywhere in the Mamberamo valley, and more than one species, its red seeds supplies food to the aborigines as well as many other, mostly unknown, endemic fruits (3-4).

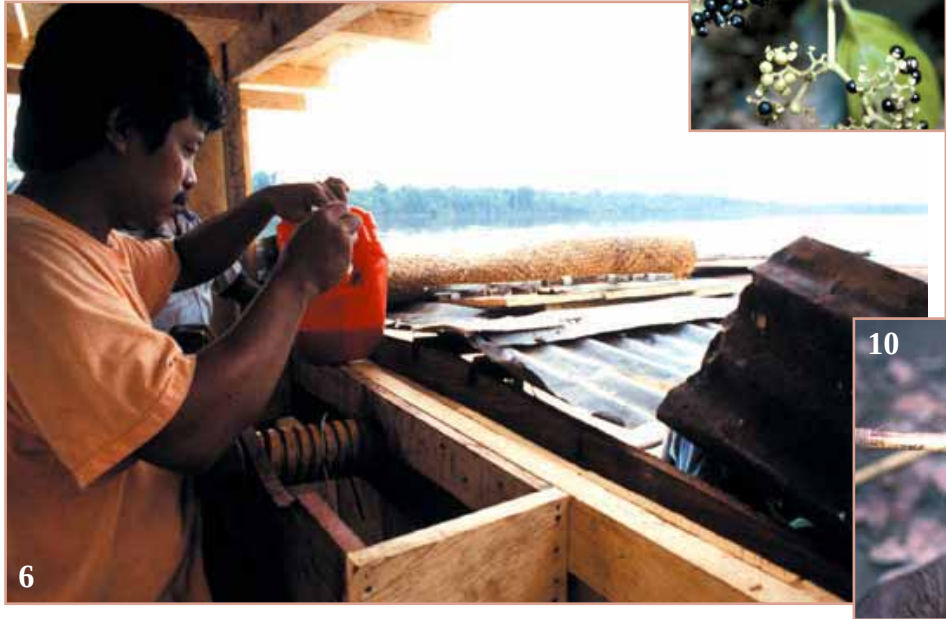


Below: No one has an outboard motor or any kind of engine, only dugouts, in whcih they travel and carry all their belongings, like here darf or Bennett's Cassowaries (*Casuarius bennetti*).



- 1) Forget all about time;
- 2) Everything costs at least 3 times as much as elsewhere; and
- 3) Everything always turns out differently to the way you planned.”

I have to say that this had turned out to be true on every single one of my previous expeditions to this part of Indonesia. Our pilot, an Australian called Captain Threat, a gaunt leathery-faced man with an almost invariably angry expression, wearing a ragged hat, shorts, socks and sandals, did in fact arrive and wanted to leave again immediately. I realised that in this weather we would see nothing of the magnificent Mamberamo panorama as originally planned, nor would we have



the chance to land on one of the lakes. So I asked Hamaru, who had come to say goodbye, to take me to the nearby Uge river to look for fishes and aquatic animals.

Accompanied by 2 boys we slipped away without further ado, unnoticed and without a word to anyone, leaving Threat unable to take off without us! An hour later, after negotiating huge numbers of streams which were pouring down from the mountains after the rains and had transformed the entire area into a flood, we reached the mouth of the Uge. But not surprisingly this slow-flowing stream had turned into a roaring muddy torrent. Although ever the optimist, even I had reservations about the likelihood of us catching anything in these conditions. Faced with a battle against the unchecked strength of the muddy red tor-

- 6. Hamaru worked continuously on improving the boat, as long as we were travelling.
- 7-8. The local, natural fruit made me go mad, I had to try everyone, and each one was more delicious than the previous one...
- 9-10. I always asked the aborigines before and learned from them also their fantastic way of making arrows, ropes and sticks to catch fishes...



rent, the faithful Hamaru nevertheless followed my lead, but 20 casts of the net left us breathless and unsuccessful. We had thorns in our feet, our hands were shredded by stones and roots, and several times we were swept under by the current, swallowing huge amounts of mud in the process. We were both very close to giving up.

Then we spotted a 6 metre wide bay with a weaker current, and our 21st. and final cast resulted in an unforgettable experience.

We used our remaining strength to haul in the 7 metres of heavy wet net – full of roots and leaves – and struggled ashore with it draped around our necks. At first glance it looked as if we had merely caught the *Chilatherina* species captured right at the beginning of our trip. Just as I had really given up, and was about to

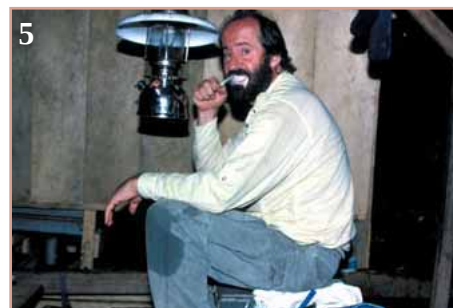
clean out and roll up the net, I spotted something incredibly beautiful glittering among the leaves! It shone like a neon light! A tiny fish! Only a 1 cm wide section of the body was visible, but nevertheless I realized that this was it! The discovery of the decade! The fish of my dreams, with glittering iridescent colours beyond compare. Did it really exist? Could this really be true? As if in a trance I flung myself upon the net to grab it before it could disappear, and in so doing I tripped over a branch and drove a splinter of wood into my right foot. But in the heat of the moment I did not feel a thing. Hamaru suddenly realised what I had been trying to do all this time. Previously he had thought that as usual I was acting the mad gringo. But now he too was astonished, as for the first time in almost 20 years he was see-



ing something unfamiliar in “his” world. There must surely be more than one of these gems! We dragged the river bed again with renewed vigor – but without success. Despite being completely exhausted, wet, and shivering with cold, we redoubled our efforts and on the 41st cast we actually netted another two specimens. I could live with that.

Feeling reasonably contented we made our way back, crossing a 2 metre wide tributary of the Uge which was not so swollen with flood water. We tentatively submerged our net in this secluded spot, and landed first 5, then a further 4, and finally another 3 of these fishes! My delight and joy were by now quite indescribable. I danced in the water like Rumpelstiltskin around his treasure. Only 4 times in my life had I felt like this: in 1954, when, as a boy, I had my first glimpse of a wimple piranha, a still undescribed *Catoprion* species, in the Rio Guaporé in Mato Grosso province, Brazil; In 1964, when I caught the red-headed characin, *Hemigrammus bleheri*, in a tributary of the Rio Negro; in 1971 when I netted a fantastic “Royal Blue” discus, a dominant individual of the subspecies *Symphysodon aequifasciatus haraldi*, in Lake Manacapuru, in the Amazonas; and in 1982 in Lake Ajamaru on the Vogelkop Peninsula of Irian Jaya, when I first saw the living coral rainbow fish, *Melanotaenia boesemani*. All these fishes are now being bred worldwide and are amongst the most beautiful of aquarium fishes.

1993 will also go down in fish history.



There is no doubt that the “Neon Rain-bow Fish” will take the world by storm. Maximum size is 4.5 cm. (only 3.5 cm. in most cases); males have red-edged fins while the fins of females are pure yellow; and both sexes are coloured like brilliant neon lights, as seen previously only in the Cardinal Tetra

1-6. The main rivers in the Valley are full of shrimps, in every net we had hundreds (1). Hamaru, on my third visit, had already started to make its own salt-and-fish, in the middle of the river he salted and dried the collected specimens (2), largely the exotic species... rarely the large catfishes, like the large *Arius* species (3) or the *Doiichthys* species (6), those he fried on our boat fresh (4). The boat he had build was our home for many days, and here we brushed our teeth (5), had our food and bed...



(*Paracheirodon axelrodi*) and my discovery from Zaïre (today Congo), the African Neon (*Phenacogrammus bleheri*). Such brilliance and luminosity are rare in the underwater world. But Nature has created some life forms which stand out from the rest to an almost unbelievable extent. And this was yet another proof of her matchless ability.

All these thoughts passed through my head as I ran proudly through the current with my booty in my hand, not even noticing that my clogs were floating away downstream. As if in the seventh heaven I raced barefoot over sticks and stones without feeling a thing.

And when we got back to the helicopter not even the wrathful Captain Threat or

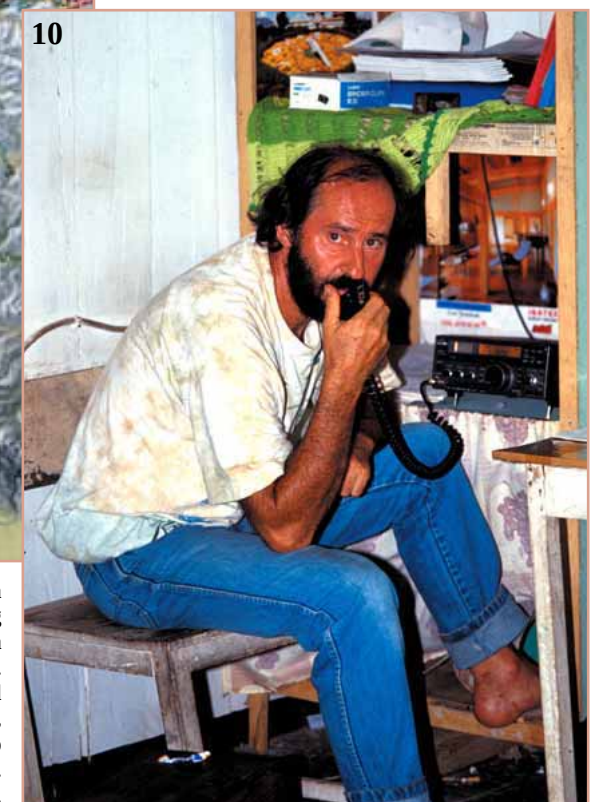
Kamihata-san’s considerable anger at the delay could spoil my mood. For as I had prophesied, the sky cleared, the sun came out, and off we went as I had planned...

A fabulous panoramic view of the Mamberamo spread out in front of us. We shot some 30 reels of film, photographing the most majestic of all the rivers of New Guinea, also the least ex-

plored, and that which still holds the most secrets. We flew over almost innumerable geographically isolated lakes, some of them quite deep, but unfortunately a landing was not possible. I had the feeling that each of them held at least one endemic species, and I was only prevented by Paola from jumping out of the helicopter (something I have actually done on one occasion).

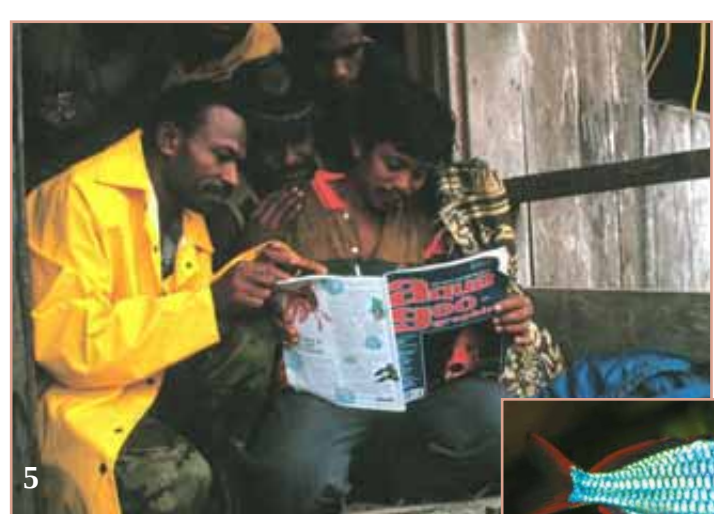
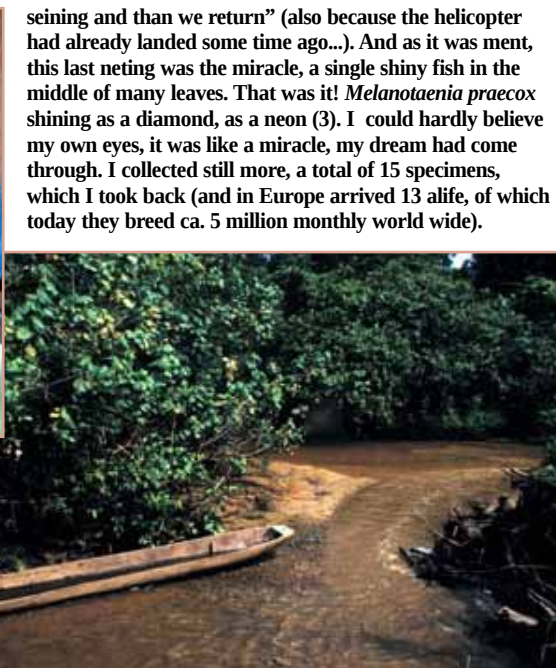


Some photos of my first and last trip: 7. My first landing with a missionary’s, small Cessna aircraft in 1982. Here with aborigines, the pilot and G. R. Allen (in the green shirt) at a landing strip in the Mamberamo. 8-10. On my recent and last trip, although I had the permit from the highest authorities in Jakarta, we were forced out by the military commander of Dabra. Even my radio communication was useless (10). I had to leave 1200 litres of fuel and one outboard motor behind. But we had walked over three days to a remote lake thru deep swamp (8), taking off the leaches with the knife (9). 11. This map shows clearly that the Mamberamo valley is completely surrounded by high mountains, completely isolated from the world. The most untouched place on planet Earth...





1. During the last days on the Mamberamo it rained nonstop, day and night and we had not found the *Melanotaenia praecox*. Everyone was disappointed. But I had this dream during the last night when I slept on the boat and rained non stop: that I was looking much to far aways. When the Dutchman came almost 100 years before, there was only this native village (today's Dabra), and he found it near there. And that is the only place I had not searched... I woke up and decided to leave and look mfor it in the creeks nearby (2-3), although I knew the helicopter was to arrive any moment from Jayapura to take us back. I walked all over the surrounding area while it rained still. I dragged the seine with an native up and down the creeks and several times it carried us completely away, because the water currant was so strong in this rain. We both were completely exhausted and still no fish, when I told him: "only one more



seining and than we return" (also because the helicopter had already landed some time ago...). And as it was ment, this last neting was the miracle, a single shiny fish in the middle of many leaves. That was it! *Melanotaenia praecox* shining as a diamond, as a neon (3). I could hardly believe my own eyes, it was like a miracle, my dream had come through. I collected still more, a total of 15 specimens, which I took back (and in Europe arrived 13 alive, of which today they breed ca. 5 million monthly world wide).



My dreamfish (6), fish of the century (20th) as I called it (or "neon dwarf rain-bowfish"), has conquered the aquarium world, as hardly any other fish before. Kamihata (7), Tarzan, Paola and the pilot had waited 2 hours, and were very mad at me, but inspite of all, he just said "You are a genius". Hamaru finally understud my search and liked aquageo (5).



9. We finally flew back in the chartered helicopter (9) to Jayapura (cost a fortune) with the precious load. 10. On my last trip I was forced (by militaries) to fly out with a chartered plane, leaving the expensive fuel (1200 l) and the outboard motor (10), they confiscated behind. Somehow it seems to me, one has to go through hell, if one wants to achive something, and my hell was, that I did not have enough and while we waited in Sentani for our delayed flight Jakarta, I went fishing in a stream full of rubbish and jumped on a rusty steel bold, which went 2,5 cm deep (11). Two month in a cast (12). No pains no gain.



There were lakes with vegetation along their banks and underwater; lakes with black water (the habitat of some of the most colourful fishes on Earth); lakes coloured green or blue. Surrounded by dense ancient woodland, primary forest in all its glory. The trees were crowned alternately with red and yellow blossoms. Some biotopes were scattered with palms, while in others the spiny pandanus pre-dominated. The flora of the Mamberamo region is truly without equal. The branch over which we were flying was actually the Idenburg, a tributary of the Mamberamo. And the other, western, branch is known not as the Mamberamo but as the Rouffaer (Tariku). But these 2 tributaries, which join to form the Mamberamo proper, are always regarded as integral parts of that river. Together they form what is not only the least explored biological treasure-house but also the largest river system of the second largest island on Earth. It is unlikely that the white man will ever be able to unveil all the secrets of the Mamberamo, that civilized man will ever appreciate the diversity of this unique region, or that scientists will comprehend the complexity of this ecosystem. Luckily the Indonesian government has declared this region "off limits" and it is practically impossible to obtain a permit to visit the area. Hoping that it would remain thus, that the P.T. Freeport Mining Company would not discover minerals here as well as in the mountains, and that the National Pertamina Oil Company, which has drilled for "black gold" in 3 places, would find it here, I took one final look at the endless rainforest of the Mamberamo, the river which is not included in either guidebooks to Indonesia or books about that country.



1



2



3



4



5



6



7



8

Some suggestions for rainbowfish biotope aquariums:
 1. This is the lake Wanam, origin of *Glossolepis wanamensis* (2), a gorgeous rainbowfish. He lives with *Chilaterina fasciata* (3) and gobies, in a rich aquatic biotope, with lots of water lilies and *Lotus* plants, as well as *Ceratophyllum demersum*.
 4. *Chilaterina bleheri* lives also endemic in a lake (Danau Biru), with no other rainbowfish, only gudgeons and gobies.
 5-6. *Melanotaenia boesemani* (6) lives in 2 lakes (connected) full of aquatic ferns (5), *Najas* and *Ceratophyllum* species. Only with *Pseudomugil reticulatus* (7), not with *P. ivantsoffi* (8) as written elsewhere.



9



10



11



12



13



14

9-10 A typical habitat (9) of the beautiful *Glossolepis doryti* (10), which I discovered as well and call the "red zigzag rainbowfish" is full of water lilies again, also *Ceratophyllum* species and some *Barclayas*, rarely *Aponogeton* species. 11. *Melanotaenia alleni* (still not in the hobby), lives over gravel ground, in rivers and creeks that flow, with almost no vegetation. 12. *Melanotaenia* species (by some classified as *M. goldiei*), which I discovered in a creek called Tapini in Papua New Guinea – that is why I call it *Melanotaenia* sp. 'Tapini' – is a real beauty and in the hobby available. It likes some moos (as shown), gravel bottom and some sand. Gobies or gudgeons, possibly some blue eyes (*Pseudomugil novaguineae*, or *P. gertrudae* or *P. paskai*). 13-14. Another recent first collected alive species is the real *Melanotaenia misoolensis* (which is in several publication misidentified). This shown is the correct species, quite high body and with an incredible possibility to change its colour (sometimes in minutes), like from steel blue (13), to orange-red (not shown) or bright yellow-golden (14). This species is only found in one of the two Ycreeks on Misool island, in water without vegetation, only gravel and plants hanging into the water. For all these rainbowfishes (and blue eyes) the water can be hard up to 500 microsiemens no problem, and pH up to 8 and temperatures from 23 to 28°C.



On these two pages same samples of very typical – nature biotope aquariums for rainbowfishes:

1. This one decorated for the species *Melanotaenia praecox* (2), which the previous article is about (and gives additional information). It should have some plants (here *Microsorium pteropus*, which are found throughout New Guinea, attached to driftwood and rocks). Gravel and sandy areas – mixed. I decorated this aquarium at an exhibition and the fishes felt like “at home” immediately and started to lay eggs...

3. This aquarium is on exhibit in Denver, Colorado (USA), as the rainbowfish aquarium. I visited it two years ago and I thought they made a good job. Naturally they placed several different rainbowfish species together (and some gobies and blue eyes), but still it looked good and if you compare it with the underwater photo I took in the *M. boesemani* habitat in nature (shown on the previous page photo 5), then one can see that it looks much like in nature...



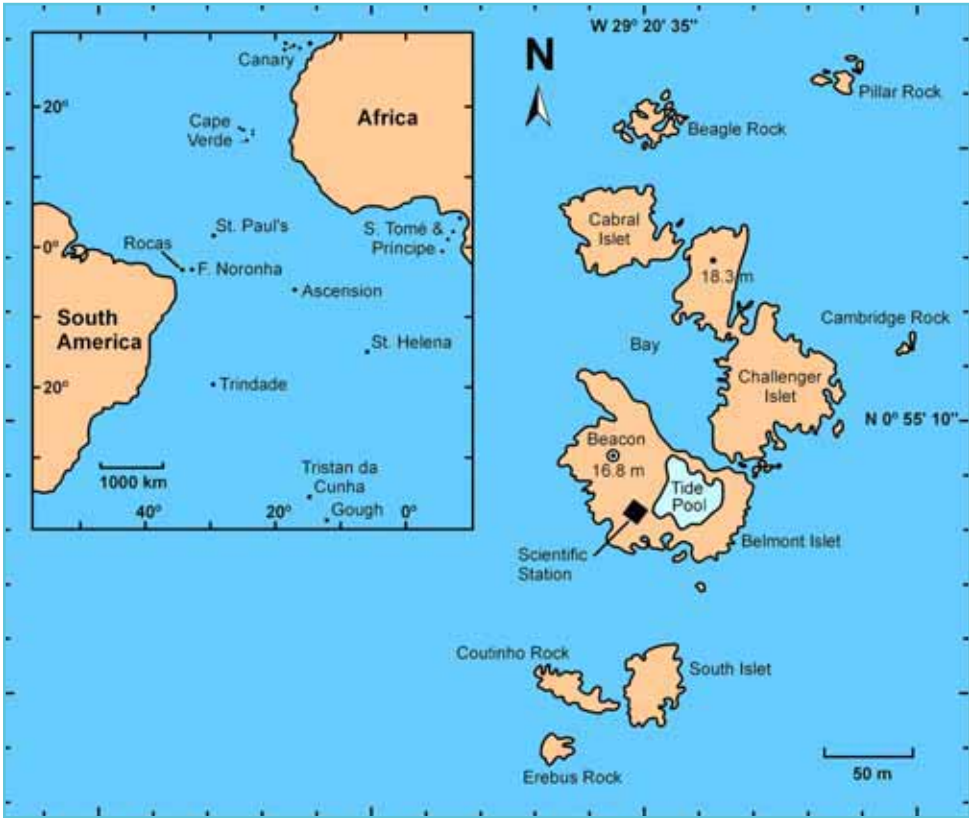
4-6. Another typical exhibition for *Melanotaenia angfa* is the one above (4), decorated with, again, *Microsorium pteropus*, some *Spatiphyllum* species, and floating plants (*Azolla* or *Lemna* species). Lots of fine white sand and colourful (rusty brown) stones.. Also here this rainbowfish species felt like in nature and one could see it in their behaviour. Immediately started with courtships (5) and displayed their full (still juvenile) colours (6). Important is for rainbowfishes and blue eyes: do never overcrowd the tank. They never live in very large schools or groups. The quantity shown here is just right maybe that. Also give them some shade.



Reef fishes of St. Paul's Rocks

St. Paul's Rocks is a very small group of rocky islands located on the mid-Atlantic Ridge just north of the Equator, about 1000 km from the Brazilian coast. In the course of four recent expeditions the fish fauna was surveyed in tide pools and over reefs at depths down to 62 m. Seventy-five fish species were recorded, of which 58 are reef inhabitants and 17 are pelagic. The most speciose families found here are Muraenidae (seven species), Carangidae (five), Pomacentridae (five), Labridae (four), Serranidae (three), and Scaridae (three). *Stegastes sanctipauli* (Pomacentridae), *Chromis multilineata* (Pomacentridae), *Melichthys niger* (Balistidae) and *Caranx lugubris* (Caranagidae) were the most visually abundant fishes. Despite being recorded in prior expeditions, *Carcharhinus galapagensis* and *Anthias salmopunctatus* were not observed. It was observed that 60.3% of the reef fish species are carnivores, 15.5% planktivores, 8.6% omnivores, 8.6% territorial herbivores, and 6.9% non-territorial herbivores. Of the 58 reef fishes recorded, four are endemic to St. Paul's Rocks and about 80% also occur off the coast of Brazil.

by Bertran M. Feitoza, Luiz A. Rocha, Osmar J. Luiz-Junior, Sergio R. Floeter, JoJo L. Gasparini and Heiko Bleher



1. Map of St. Paul's Rocks.

St. Paul's Rocks (Arquipélago de São Pedro e São Paulo) is a very small group of rocky islands located on the mid-Atlantic Ridge, just north of the Equator (00°55'N; 29°21'W), 1000 km from the Brazilian coast, and 1890 km from Senegal, Africa. It is one of the smallest, most isolated groups of oceanic islands in the world. The Rocks are particularly interesting from the population biology and biogeographical perspectives because of their very small size and isolation.

population status of reef fishes (the Rocks, now called 'Archipelago' are permanently inhabited). The Archipelago rises from 4000 m deep ocean floor close to the Mid-Atlantic Ridge, and two putative ages are given to it: 9.5 MYBP (million years before present) if it originated from a nearby ridge, or 35 MYBP if it originated from a farther oceanic ridge. It consists of five small rocky islets and four larger islets covering an area of about 16,000 m². Tide pools are present on most of the islets, which are gener-

ally flushed with seawater at high tide. A small shallow bay (2 to 21 m depth) is formed by the encirclement of three major islets. Other reef habitats of St. Paul's Rocks consist almost entirely of nearly vertical cliffs extending beyond 60 m depth. This archipelago has one of the most limited areas of shallow habitats (< 50 m deep) among oceanic islands, with less than 0.2 km². Most of the sublittoral zone is dominated by the soft coral *Palythoa caribaeorum* (from 3 to 8 m depth), and the algae *Caulerpa* sp. (from 3 to about 30 m).

The hermatipic corals *Madracis decactis* and *Scolymia wellsi* Laborel appear where the *Caulerpa* stops at about 30 m, and occur down to at least 45 m where they are quite abundant. Two black corals (*Antipathes* spp.) occur from a depth of 45 m to at least 60 m and a total of 14 alga species have been recorded. During the recent expeditions (May and November 1999, September 2000, and August 2001) about 124 hours of underwater activity (54 scuba dives to depths of 62 m – including two night dives, and 39 snorkelling dives) were involved. The



They are uniquely influenced by both the Equatorial Undercurrent – facilitating eastward dispersal – and the Southern Equatorial Current – directing flow from the central-eastern Atlantic. The area has been visited by scientific expeditions since 1799. However, the first survey involving scuba diving to a depth of 60 m was only carried out in 1979. In the past, the inhospitable nature and inaccessibility of St. Paul's Rocks had prevented detailed biological studies. However, since the establishment of a scientific station by the Brazilian Navy in July of 1998, ichthyologists have been able to visit the island periodically to reassess the

2. Tide pool at the Belmont Islet, it is flushed with fresh seawater at high tide. Photo by B. M. Feitoza.
3. Bay situated between the Belmont, Challenger and Cabral Islets. Photo by B. M. Feitoza.

water temperature ranged from 23 to 26.5 °C and visibility from 12 to 30 m. The fish fauna was surveyed in tide pools and over reefs down to a depth of 62 m, through underwater observations, collections and photographs were done to give an good idea of what lives here and to be able to learn more about the habitat of Atlantic reef fishes.

Three small clove oil stations were conducted aiming to survey cryptic fish not collectable using other methods. Six hours of underwater videos were filmed with a view to investigating fish behaviour. Collected specimens were

ised in alphabetical order.

Current population status – an indication of relative abundance in 1999 – 2001 based on a diver's likelihood of observing a species in its normal habitat and depth range on any given dive, where: AB = abundant (at least several sightings of many individuals – at least 50 – can be expected on nearly every dive), VC = very common (at least several sightings can be expected on nearly every dive, but not necessarily of many individuals), CM = common (sightings are frequent, but not necessarily expected on every dive), OC = occasional

(sightings are not unusual, but are not expected on a regular basis), UN = uncommon (sightings are unusual), and RA = rare (sightings are exceptional); Habitat – where the species has usually been found (adapted from Edwards & Lubbock, 1983a), where: 1 = tide pools (either frequently or infrequently flushed by fresh seawater), 2 = littoral zone (spring-tidal range), 3 = *Palythoa* and *Caulerpa* zone (dominated by *Palythoa caribaeorum*, from the bottom of the littoral zone down to 8 m, and by *Caulerpa*, from 3 to about 30 m), 4 = sub-*Caulerpa* zone (from where

Caulerpa stops, at about 30 m, to at least 60 m), 5 = slope and bay (gently sloping areas with patches of coarse sand, rubble and isolated loose rocks), and 6 = water column (offshore and over reefs, pelagic habitat); Depth range – range commonly seen in underwater observations;

Geographic range of the species; Trophic category – determined from direct behavioural observations and available literature, where: TH = territorial herbivores, NT = non-territorial herbivores, C = carnivores, P = planktivores, and O = omnivores.



deposited in the fish collections of the followings institutions: Universidade Federal da Paraíba, João Pessoa, Paraíba, Brazil (UFPB); and Museu de Biologia Professor Mello Leitão, Santa Tereza, Espírito Santo, Brazil (MBML).

Data and the species list below is based on the fishes observed, photographed and collected during four expeditions, as well as on data from the literature and from fisheries run by commercial fishing boats. Bony fishes are listed in the phylogenetic order of families, following Nelson (1994); elasmobranchs are listed following Compagno (1999). Within the families, species are organ-



4. Vertical cliff, the typical reef habitat of St. Paul's Rocks. Photo by O. J. Luiz-Junior.
5. Underwater view at St. Paul's Rocks, with the green algae *Caulerpa* sp. dominating most of the sublittoral zone. Photo by O. J. Luiz-Junior.

Record status – how the species was recorded. We consider 'reef fishes' to be species either associated with hard substrate or epipelagic forms that regularly associate with the reefs (such as carangids, belonids, sharks and pelagic rays). Surveys of the abundance and the occurrence of juveniles and adults of various sizes were used to estimate which members of the fish fauna are residents, i.e. have self-sustaining populations, or vagrants, i.e. exceedingly rare and probably arriving from other sites.

Results

Our team recorded a total of 75 fish species (25 new records) belonging to 36 families. Fifty-eight species were recorded over reef areas (referred to as "reef fishes"), eleven of which are midwater species that are regularly observed on reefs, and 47 are dependent on rocky-reef habitats. Seventeen species are pelagic and are not included in the list below (new records are

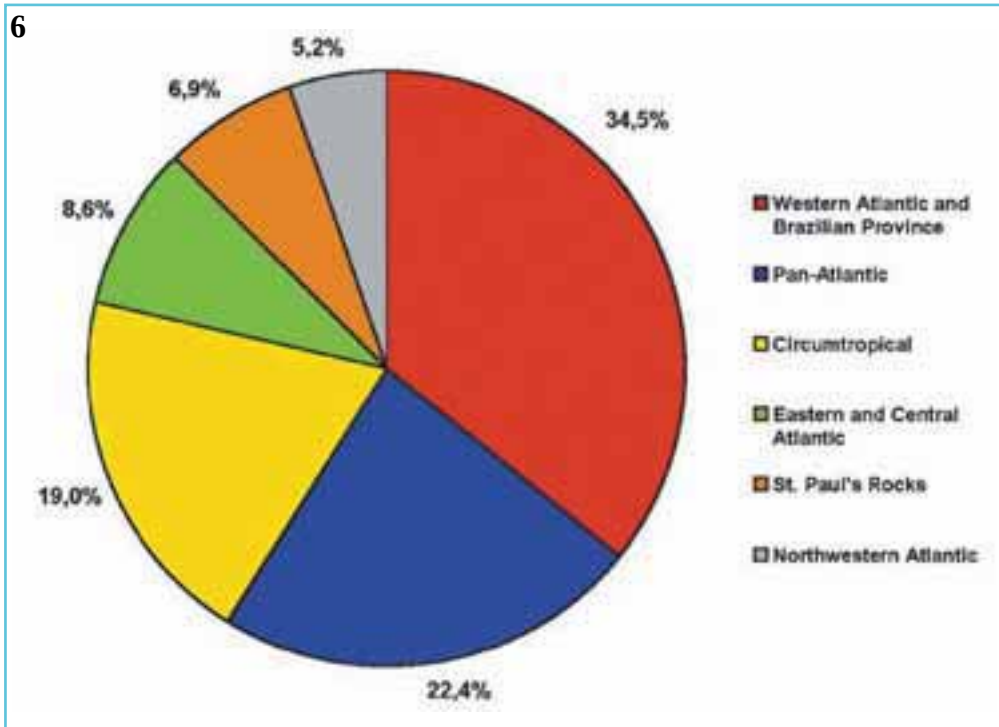
in bold): *Rhincodon typus* Smith, 1829; *Carcharhinus falciformis* (Bibron in Müller & Henle, 1839); *Prionace glauca* Linnaeus, 1758; *Isurus oxyrinchus* Rafinesque, 1810; *Cypselurus cyanopterus* (Valenciennes, 1847); *Exocetus volitans* Linnaeus, 1758; *Paraexocoetus* sp.; *Remora brachyptera* (Lowe, 1839); *R. osteochir* Cuvier, 1829; *Remorina albescens* (Temminck & Schlegel, 1845); *Coryphaena hippurus* Linnaeus, 1758; *Acanthocybium solandri* (Cuvier, 1832); *Scomberomorus cavalla* (Cuvier 1829); *Thunnus albacares* (Bonnaterre, 1788); *T. obesus* (Lowe, 1839); *Makaira nigricans* Lacépède, 1802; and *Mola* sp.

Among the 58 reef fishes recorded, the most speciose families were the Muraenidae (seven species), Carangidae (five), Pomacentridae (five), Labridae (four), Serranidae (three), and Scaridae (three). Six mon, nine (15.5%) occasional, 13 (22.4%) common, seven (12.1%) very common, and six (10.3%) abundant. Nine of the 16 rare species (*Cephalopholis fulva*, *Lutjanus jocu*, *Stegastes rocasensis*, *Clepticus brasiliensis*, *Thalassoma noronhanum*, *Sparisoma amplum*, *S. axillare*, *S. frondosum*, and *Bathygobius soporator*) do not seem to have a self-sustaining population and probably come from other

value of their fins. The pelagic fishes on which sharks feed are also targeted by the fishing industry and this may also have contributed to an apparent population decline of *C. galapagensis*. *Anthias salmopunctatus* is endemic to St. Paul's Rocks and was listed as vulnerable by IUCN. This species was common on rock faces below 30 m, as, but was not seen by our team. The St. Paul's Gregory *Stegastes sanctipauli*, the brown chromis *Chromis multilineata*, the black durgon *Melichthys niger* and the black jack *Caranx lugubris* were the most visually abundant fishes in St. Paul's Rocks and certainly account for the most

important part of the fish biomass. The latter two species are usually found up to at least 150 m from the Rocks, forming large aggregations from just below the surface down to about 30 m. *Melichthys niger* appears to be common around isolated oceanic islands. There are reports of the same abundance for Ascension Island, Clipperton Atoll, Trindade Island, and to a minor degree in the vicinity of Rocas Atoll and

Fernando de Noronha Archipelago. Almost two-thirds (60.3%) of the reef fish species are carnivores, 15.5% planktivores, 8.6% omnivores, 8.6% territorial herbivores, and 6.9% non-territorial herbivores. *Stegastes sanctipauli* is primarily considered to be a territorial herbivore, but can also be opportunistic, sometimes preying upon fish eggs and small benthic invertebrates. The same appears to be true of the sergeant major *Abudefduf saxatilis* (primarily treated as a 'planktivore') since it has mostly been seen in mid-water, clearly feeding on zooplankton. *A. saxatilis* has one of the most diversified food habits known, and may be observed in aggregations



6. Geographic distribution of St. Paul's Rocks reef fishes.

sites where they are common (e.g. Fernando de Noronha Archipelago).

The population status of most of the species between 1999 and 2001 seems to be nearly the same as that observed in 1981, except for two species previously recorded were not observed by our team: the Galapagos shark *Carcharhinus galapagensis* and the St. Paul's anthias *Anthias salmopunctatus*. The abundance of sharks at St. Paul's Rocks has been noted by most early visitors and partly attributed to the lack of fishing activity. In the past two decades however, fishing pressure has increased greatly, and sharks are now targeted due to the high commercial

well above reefs, feeding on zooplankton, or grazing on benthic algae, or on sessile animal life on the bottom. This feeding flexibility probably enables opportunistic planktivores (e.g. *S. sanctipauli* and *A. saxatilis*) and the classic omnivores (e.g. *M. niger*) to numerically dominate harsh environments around oceanic islands.

Of the 58 reef fishes recorded at St. Paul’s Archipelago, 20 occur in the western Atlantic, seven of which are endemic to the shores of the Brazilian mainland and one to the Fernando de Noronha Ridge islands. Thirteen are pan-Atlantic, 11 circumtropical, and five are known primarily from the central Atlantic islands, two of which also occur in the eastern Atlantic coast and

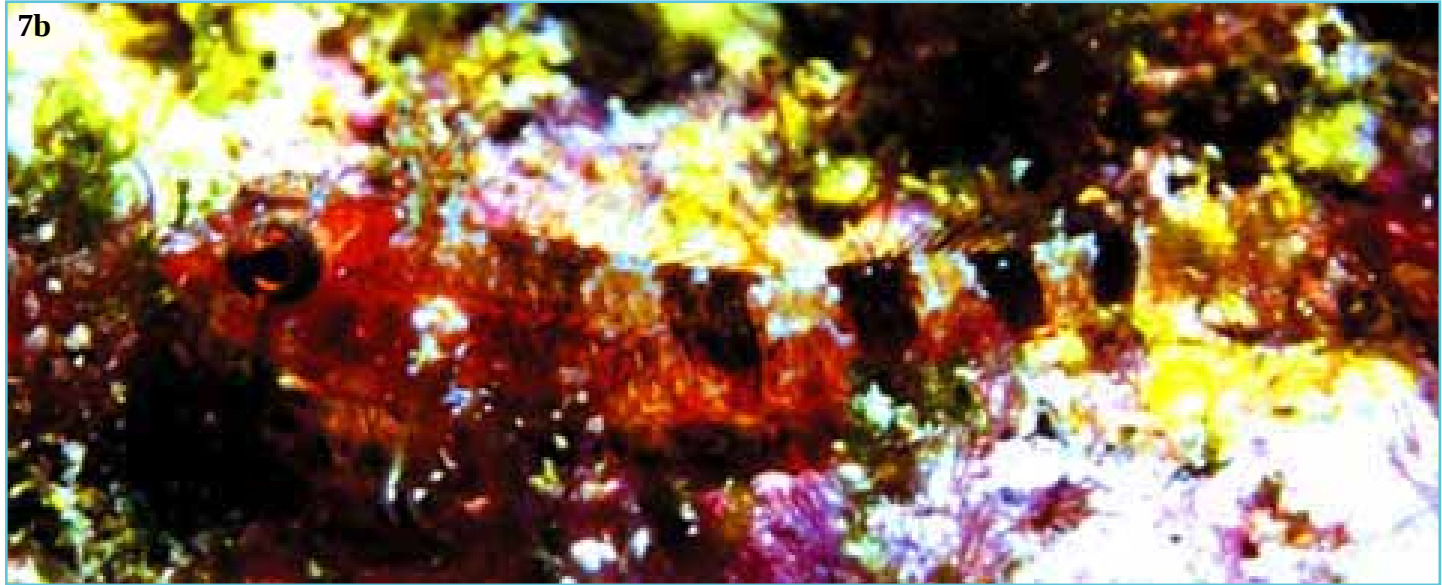
one in the Brazilian Province. Three are north-western Atlantic species, one of which also occurs around the Fernando de Noronha Ridge islands.

Because of the prevailing currents, St. Paul’s reef fish fauna more closely resembles that of the Brazilian Province than of the other mid-Atlantic Ridge islands of Ascension and St. Helena, with about 80% of its reef fishes occurring in the Brazilian Province.

St Paul’s Rocks supports four endemic fish species. Our survey revealed the presence of a possible fifth endemic species of the genus *Emblemariopsis* from St. Paul’s Archipelago. This is the first record of a chaenopsid in the area, but a large population of *Emblemariopsis* sp. has been observed at depths be-

tween 3 and 45 m. This species had not been recorded previously, probably because of its cryptic habits.

One of the most remarkable features of St. Paul’s Rocks is the occurrence of different colour morphs of the queen angelfish *Holacanthus ciliaris*. There are three basic colour morphs, yellow, blue and white, and several variations and mixtures. Moreover, all colour morphs differ from those in all other *H. ciliaris* populations by having shorter dorsal and anal fin filaments. The yellow morph was the most abundant pattern observed at the Rocks, accounting for about 95% of all observed morphs. Colour variations occurring in the *H. ciliaris* population of St. Paul’s Rocks were attributed to the effects of in-

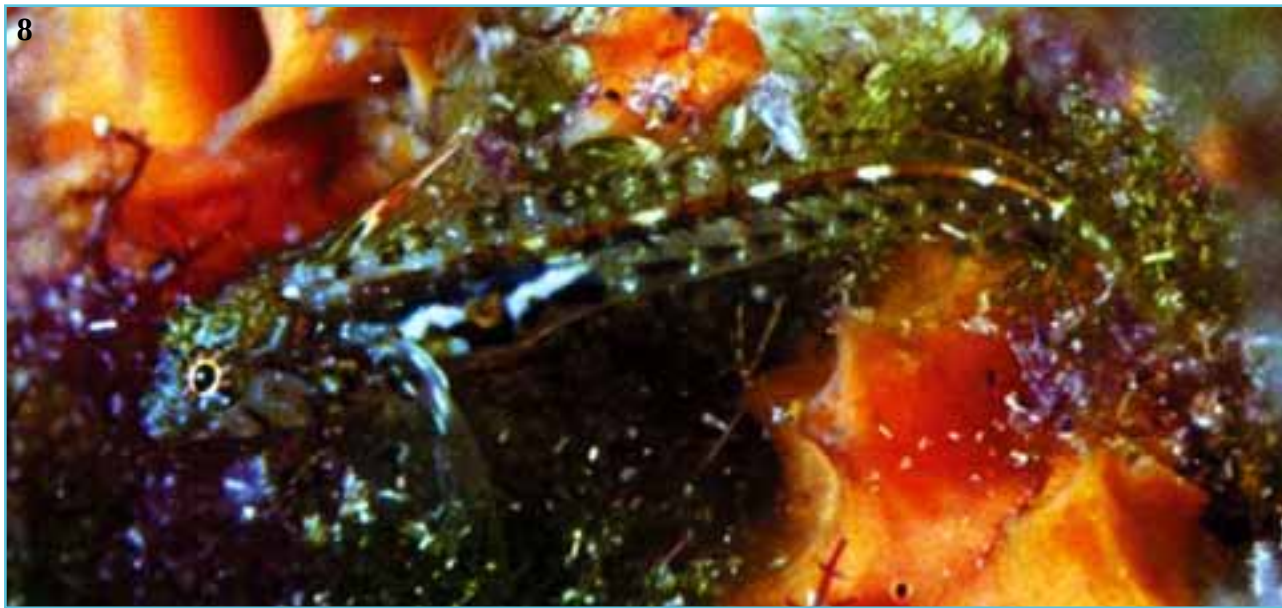


7a-f. Endemic fishes from the Central Atlantic Islands: a-d) St Paul’s; e-f) St. Paul’s, Ascension and St. Helena. a) *Chaetodon obliquus*; b) *Enneanectes smithi*; *Stegastes sanctipauli*, c) juvenile and d) adult; e) *Bodianus insularis*; and f) *Scorpaenodes insularis*. Photos by B. M. Feitoza.

breeding in a small, isolated population. It suggests that no (or very few) recruits are arriving from other sites and the population of *H. ciliaris* at St.

Paul’s is maintaining itself by self-recruitment, a process more common than previously thought. No such colour variation is observed across the

remaining range of *H. ciliaris* in the Western Atlantic. It is suggested a possible on-going differentiation for *H. ciliaris* at the Rocks. Genetic and mor-



8. *Emblemariopsis* sp., a possible fifth endemic species from St. Paul’s Archipelago. Photo by B. M. Feitoza.

phological comparisons of *H. ciliaris* populations across the Atlantic are needed to better assess the inbreeding

and taxonomic status of the queen angelfish population at St. Paul's Rocks. Since Lubbock & Edwards' survey re-

port in 1981, a few presumed albinotic or semi-albinotic *Chromis multilineata* have been recorded from St. Paul's Rocks. The supposed 'albinism' was also related to inbreeding in a small population. However, *C. multilineata* is one of the most abundant fish at the Rocks since 1979. Despite the apparently large population, one presumed 'semi-albinotic' specimen was observed and photographed by our team. Our survey revealed the presence at the Rocks of a typical eastern Atlantic species: the honeycomb moray *Muraena melanotis*. This species is very similar to *M. pavonina* with small but consistent differences in colouration (which remain even after preservation) and the size of the posterior nostril. Both species are frequently misidentified, and records of *M. melanotis* from the north-eastern Brazilian mainland are probably misidentifications of *M. pavonina*. During a six-year study off the north-eastern Brazilian coast, *M. melanotis* has not been observed, whereas *M. pavonina* was found at several sites. However, the record of *M. melanotis* at Fernando de Noronha Archipelago and Rocas Atoll appears to be correct. Adults of the two species can be readily distinguished by their colour patterns: dark background with a white honeycomb-like pattern (absent or indistinct on the belly), with head spots becoming more closely spaced (even fusing) towards the snout in *M. melanotis*; and dark background with round white spots randomly placed (including belly), with more widely-spaced head spots, becoming almost absent towards the snout in *M. pavonina*.

As the zoogeographical analysis implies, the fish fauna at St. Paul's Rocks is derived from that of the Brazilian coast and/or Fernando de Noronha Archipelago. Eventual dispersal of larvae through the equatorial undercurrent may be presumed by the presence of vagrants of species probably coming from Fernando de Noronha Archipelago, where they are very common (e.g. *Cephalopholis fulva*, *Lutjanus jocu*, *Stegastes rocasensis*, *Clepticus brasiliensis*, *Thalassoma noronhanum*, *Sparisoma* spp., and *Bathygobius soporator*). A notable case was observed during September 2000, when about ten



10. Normal colour and morphological pattern of *Holacanthus ciliaris* from Rio Grande do Norte coast, north-eastern Brazil. Photo by B. M. Feitoza.



11. A presumed semi-albinotic specimen of *Chromis multilineata* of St. Paul's Rocks. Photo by B. M. Feitoza.

juveniles of *Stegastes rocasensis* were seen at the bay. In the long run, monitoring programs should be implemented in order to provide information on how species turnover occurs, the extent to which vagrants arrive from distant sources, and if they establish resident populations.

St. Paul's seems to be the only tropical oceanic island that does not have a resident population of surgeonfishes

(Acanthuridae). These fish have a very high dispersal potential and can maintain genetic homogeneity across long distances suggesting that dispersal limitation could not be the main cause of their absence. Surgeonfishes are mainly herbivores and/or detritivores, thus ecological limitations such as the relatively low algal diversity (with *Caulerpa* dominating most of the shallow habitats), the lack of sandy and/or fine sedi-

ment habitats (i.e. organic detritus) could be reasons for their absence, as well as for the very low densities of scarids. Only two of the 27 algae consumed by the south-western Atlantic surgeonfishes (*Acanthurus* spp.) off the Paraíba coast, north-eastern Brazil are known to occur at the Rocks. In addition, it was found that fine sediment, pre-sumably rich in organic matter (e.g. detritus), is one of the most important



9a-h. Colour variations observed in the queen angelfish *Holacanthus ciliaris* at St. Paul's Rocks. a) Yellow morph; b) blue morph; c) white morph; d-h) variations and mixtures between blue, yellow, orange and white. Photos a, d, e and h by B. M. Feitoza; b, c, and g by O. J. Luiz-Junior; and f by E. Fritzsche.

12. The honeycomb moray *Muraena melanotis*. Photo by B. M. Feitoza.



13. The flagged moray *Muraena pavonina*. Photo by O. J. Luiz-Junior.



food items of the ocean surgeonfish *A. bahianus* and the doctorfish *A. chirurgus*. This food resource is virtually absent from the Rocks. It showed that detritus is a valuable nutrient source for grazing reef fishes, and that the biomass of algae and detritus decreases from sheltered mid-shelf reefs to highly exposed outer reefs. Goatfishes (Mullidae) and flounders (Bothidae), which are closely associated with unconsolidated substrate, are also missing at the Rocks.

Inter- and intraspecific associations

Reef fishes are known to interact in a complex manner. Common interactions involve interspecific feeding associa-

tions, such as cleaning, following behaviour, camouflage, and intraspecific aggression, such as territorial defence. These four associations were observed, filmed and photographed at St. Paul's Rocks.

Cleaning involves a cleaner species that removes ectoparasites and dead or diseased tissue from the clients. Although no fish were seen acting as cleaners at the Rocks, the Atlantic White-Striped Cleaner Shrimp *Lysmata grabhami*, was seen in action. Cleaning stations were located either under rocks or in crevices, at depths of 6 to 60 m, and contained one or two cleaner shrimps, always accompanied by a viper moray *Enchelycore nigricans*.

Two client fishes, *Chromis multilineata* and *E. nigricans* were seen being cleaned by the shrimps. Cleaning events usually lasted for five to ten seconds.

Following behaviour is an opportunistic strategy that allows small generalised predators (the followers) to capitalise upon displacement or uncovering prey items, when potential predators, grazers or sand-flat feeders (the nuclear species) cause habitat disturbances. Following behaviour involving two labrids (the island hogfish *Bodianus insularis* and the puddingwife *Halichoeres radiatus*) and three follower carangids (the horse-eye jack *Caranx latus*, the black jack *C. lugubris* and the



14. The Roca Gregory *Stegastes rocasensis*. a) Vagrant juvenile from St. Paul's; b) Juvenile from Fernando de Noronha Archipelago; and c) adult from Rocas Atoll. Photos a and c by B. M. Feitoza, and b by L. A. Rocha.



15. *Lysmata grabhami* cleaning station located at about 60 m depth. Photo by B. M. Feitoza.



16. Following behaviour between *Halichoeres radiatus* (the nuclear species) and *Caranx latus* (the follower species). Photo by B. M. Feitoza.



17. Aggression between two *Halichoeres radiatus* males. Photo by B. M. Feitoza.

blue runner *Carangoides crysos*), was recorded from St. Paul’s. All three carangid species were seen following both *B. insularis* and *H. radiatus*. Following behaviour involving labrids and carangids in the Western Atlantic has also been recorded: *Halichoeres radiatus* vs. *Carangoides ruber*; and the Spanish hogfish *Bodianus rufus*, the spotfin hogfish *B. pulchellus* and the blackear wrasse *Halichoeres poeyi* vs. *Caranx latus*.

Various forms of camouflage are widely used among reef fishes as a means of obtaining food. The Atlantic cornetfish *Aulostomus strigosus* was seen using one of two forms of camouflage: solitarily, making itself “invisible” both drifting vertically orientated through the water column, and immo-

bile near *Caulerpa* turfs; or hiding itself, aligning with other fish. On the former occasion, *A. strigosus* drifted through the water column about 0.6 m or less above the substrate close to rocks or remained still near *Caulerpa* turfs, striking approaching small fishes with a sudden lunge. *A. strigosus* was observed several times aligning with and swimming close to the whitespotted filefish *Cantherhines macrocerus*, but no attack was recorded. It also presented various colour patterns and was seen changing colour according to the background, becoming yellowish, greenish or striped when approaching *Caulerpa* turf, or dark when swimming close to the filefish. Similar behaviour has been described for its congener, the trumpetfish *A. maculatus* Valenciennes,

1837. Intraspecific aggression appears to be common among labrids and aggressive encounters are frequent. Two initial phase coloured *Halichoeres radiatus* were seen and photographed performing agonistic behaviour; they positioned themselves mouth-to-mouth with their dorsal and anal fins erected, losing interest and separating after about a minute. Most morays are known to live in crevices in reefs, usually hiding alone with only the head protruding during the day, and foraging at night . Some species, such as *Gymnothorax miliaris* and *Muraena pavonina* forage in the open during the day. The Muraenidae are the most speciose family at the Rocks and a large population has been observed mainly at the bay and other gently-sloping areas. Some species (*G. miliaris*, *Muraena melanotis* and *M. pavonina*) were frequently observed performing both an intra and interspecific ‘friendly’ behaviour, staying together in the same hole or even interlacing one with each other. Similar behaviour has been observed only a few times at the coast of Paraíba State, in north-eastern Brazil, where two specimens of *Gymnothorax vicinus* sporadically occupied the same hole.

Taxonomic comments

The manta ray tentatively identified is probably *M. tarapacana*, since it was frequently observed in the vicinity of the Rocks.

The trumpetfish from St. Paul’s was previously identified as *Aulostomus maculatus*, presumably because of its morphological similarities with that species. Genetically, however, it is more similar to the Eastern Atlantic and coastal Brazilian *A. strigosus*.

The blue runner is now valid as *Carangoides crysos*. The Brazilian chromis is the brown chromis *C. multilineata*.

The parrotfish is the saddled parrotfish *S. frondosum*, according to the description provided and field observations made by our team.

A recent genetic analysis demonstrated that the *Ophioblennius* species at St. Paul’s Rocks is distinct from the Caribbean species and identical to that from the Brazilian coast and Trindade island. The available name for this

species is *Ophioblennius trinitatis*, and it will be used here.

Three species do not have their taxonomic status well defined: *Chromis* aff. *enchrysurus*, *Starksia* aff. *sluiteri* and *Malacoctenus* aff. *triangulatus*. The senior author and other Brazilian ichthyologists are currently trying to determine their taxonomic status.

Conservation issues

Despite being sporadically replenished with larvae from elsewhere, St. Paul’s Rocks also contains unique, self-sustaining populations and endemic

species. It is now clear that marine species are not exempt from the effects of human impact and the risk of extinction. Some characteristics could impose risks to St. Paul’s reef fish populations, such as: a) Restricted geographic range – the only reported case of extinction of a reef fish was an island-endemic species, at St. Paul’s, endemic species are at risk due to their limited distribution, and genetically distinct, isolated populations should be treated as endemic species for conservation purposes; b) Aquarium trade – the isolation of St. Paul’s Rocks is not an obstacle for

the harvesting of high-priced, rare fishes (especially the white and blue colour morphs of *H. ciliaris*) for the aquarium trade. The collection of some specimens was recently observed and c) Fisheries – shark fin fisheries could not be sustainable in such a small location as demonstrated by the apparent decrease in shark populations in the past two decades, coinciding with increasing fishing pressure. By-catch in the lobster fishery is also a problem; some fishes (mainly morays, *M. niger* and *H. ciliaris*) were continually found in the lobster traps utilised in commercial fisheries . We thereby recommend the establishment of a marine protected area in the Rocks, due to the vulnerability of its isolated fauna.

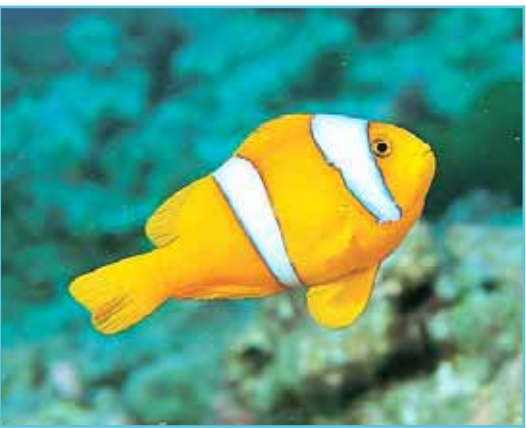


18a-c. ‘Friendly’ behaviour between morays: a) *Muraena pavonina* and *M. pavonina*; b) *M. pavonina* and *Gymnothorax miliaris*; and c) *M. pavonina* and *M. melanotis*. Photos a and c by O. Luiz-Junior; and b by B. M. Feitoza.

List of fish species at St. Paul’s Rock

Family / Species	Depht range (m)
CARCHARHINIDAE <i>Carcharhinus galapagensis</i> (Snodgrass & Heller, 1905)	8 – 36
SPHYRNIDAE <i>Sphyrna</i> sp.	0 – 40
MOBULIDAE <i>Mobula tarapacana</i> (Philippi, 1893)	0 – 30
MURAENIDAE <i>Channomuraena vittata</i> (Richardson, 1845) <i>Enchelycore anatina</i> (Lowe, 1841) <i>Enchelycore nigricans</i> (Bonnaterre, 1788) <i>Gymnothorax funebris</i> Ranzani, 1840 <i>Gymnothorax miliaris</i> (Kaup, 1856) <i>Muraena melanotis</i> (Kaup, 1859) <i>Muraena pavonina</i> Richardson, 1844	15 – 30 3 – 60 2 – 60 0 – 50 2 – 40 3 – 60 2 – 60
BELONIDAE <i>Ablennes hians</i> (Valenciennes 1846) <i>Strongylura timucu</i> (Walbaum 1792)	0 – 3 0 – 3
HOLOCENTRIDAE <i>Holocentrus ascensionis</i> (Osbeck, 1765) <i>Myripristis jacobus</i> Cuvier, 1829	2 – 60 2 – 30
AULOSTOMIDAE <i>Aulostomus</i> aff. <i>strigosus</i> Wheeler, 1955	2 – 30
DACTYLOPTERIDAE <i>Dactylopterus volitans</i> (Linnaeus, 1758)	0 – 30
SCORPAENIDAE <i>Scorpaena</i> sp. <i>Scorpaenodes insularis</i> Eschmeyer, 1971	25 – 30 5 – 35
SERRANIDAE <i>Anthias salmopunctatus</i> Lubbock & Edwards, <i>Cephalopholis fulva</i> (Linnaeus, 1758) <i>Rypticus saponaceus</i> (Bloch & Schneider, 1801)	>30 2 – 35 2 – 62
APOGONIDAE <i>Apogon americanus</i> Castelnau, 1855	0 – 40
CARANGIDAE <i>Carangoides bartholomaei</i> (Cuvier, 1833) <i>Carangoides crysos</i> (Mitchill, 1815) <i>Caranx latus</i> Agassiz, 1829 <i>Caranx lugubris</i> Poey, 1860 <i>Elagatis bipinnulata</i> (Quoy & Gaimard, 1824)	0 – 40 0 – 40 1 – 30 0 – 70 0 – 40
LUTJANIDAE <i>Lutjanus jocu</i> (Bloch & Schneider, 1801)	2 – 40
CHAETODONTIDAE <i>Chaetodon obliquus</i> Lubbock & Edwards, 1980 <i>Chaetodon striatus</i> Linnaeus, 1758	30 – 70 2 – 55
POMACANTHIDAE <i>Holacanthus ciliaris</i> (Linnaeus, 1758) Blue morph	2 – 60 2 – 60

Family / Species	Depht range (m)
White morph Other colour morphs <i>Pomacanthus paru</i> (Bloch, 1787)	30 – 50 2 – 60 2 – 30
KYPHOSIDAE <i>Kyphosus sectatrix</i> (Linnaeus, 1766)	0 – 25
POMACENTRIDAE <i>Abudefduf saxatilis</i> (Linnaeus, 1758) <i>Chromis</i> aff. <i>enchrysur</i> Jordan & Gilbert, <i>Chromis multilineata</i> (Guichenot, 1855) <i>Stegastes rocasensis</i> (Emery, 1972) <i>Stegastes sanctipauli</i> Lubbock & Edwards, 1981	0 – 20 40 – 70 0 – 60 2 – 10 0 – 60
LABRIDAE <i>Bodianus insularis</i> Gomon & Lubbock, 1980 <i>Clepticus brasiliensis</i> Heiser, Moura & Robertson, 2000 <i>Halichoeres radiatus</i> (Linnaeus, 1758) <i>Thalassoma noronhanum</i> (Boulenger, 1890)	6 – 60 5 – 25 2 – 30 2 – 10
SCARIDAE <i>Sparisoma amplum</i> (Ranzani, 1842) <i>Sparisoma axillare</i> (Steindachner, 1878) <i>Sparisoma frondosum</i> (Agassiz, 1831)	15 – 30 10 – 30 10 – 30
TRIPTERYGIIDAE <i>Enneanectes smithi</i> Lubbock & Edwards, 1981	2 – 25
LABRISOMIDAE <i>Malacotenus</i> aff. <i>triangulatus</i> Springer, 1958 <i>Starksia</i> aff. <i>sluiteri</i> (Metzelaar, 1919)	0 – 40 2 – 40
CHAENOPSIDAE <i>Emblemariopsis</i> sp.	2 – 60
BLENNIIDAE <i>Entomacrodus vomerinus</i> (Valenciennes, 1836) <i>Ophioblennius trinitatis</i> Miranda-Ribeiro, 1919	0 – 1 0 – 50
GOBIIDAE <i>Bathygobius soporator</i> (Valenciennes, 1837)	0 – 1
SPHYRAENIDAE <i>Sphyraena barracuda</i> (Walbaum, 1792)	0 – 60
BALISTIDAE <i>Canthidermis sufflamen</i> (Mitchill, 1915) <i>Melichthys niger</i> (Bloch, 1786)	5 – 60 0 – 70
MONACANTHIDAE <i>Aluterus scriptus</i> (Osbeck, 1765) <i>Cantherhines macrocerus</i> (Hollard, 1854)	2 – 40 2 – 40
DIODONTIDAE <i>Diodon hystrix</i> Linnaeus, 1758	2 – 25



The photos above show how some fascinating anemonefishes (here *Amphiprion chagoensis* from the Pazific) live in nature. This should be done exactly the same in aquaria. They live in symbiosis with the anemone (here *Heteractis magnifica* – and note as this anemone has even settled in a large sponge, photo in the centre). And when these fishes feel at “home”, they show amazing colours. Note how their bands turn from marine blue (upper right, left and center right photos), to partly blue (center left and below left photos) to completely white (photos below and on top center).

There are excellent books on marine aquaria in a good library or in a petshop available, it does not have enough space in this catalogue to go into the those details. But one thing, as with all fishes and aquaria, should also be clear for a the marine aquarium, that is, that its decoration and the contents (fishes and invertebrates) should come from a certain area – that is a biotope, to be correct and in harmony. I show here some of the species which are found along the Atlantic coast of Brazil, specially north of Rio de Janeiro, up to near of the mouth of the Amazon, which are ideal for such a biotope aquarium (and with less invertebrates, as they are not as plentiful in those areas). These species are also (in many parts) available in the hobby (exported from Brazil).

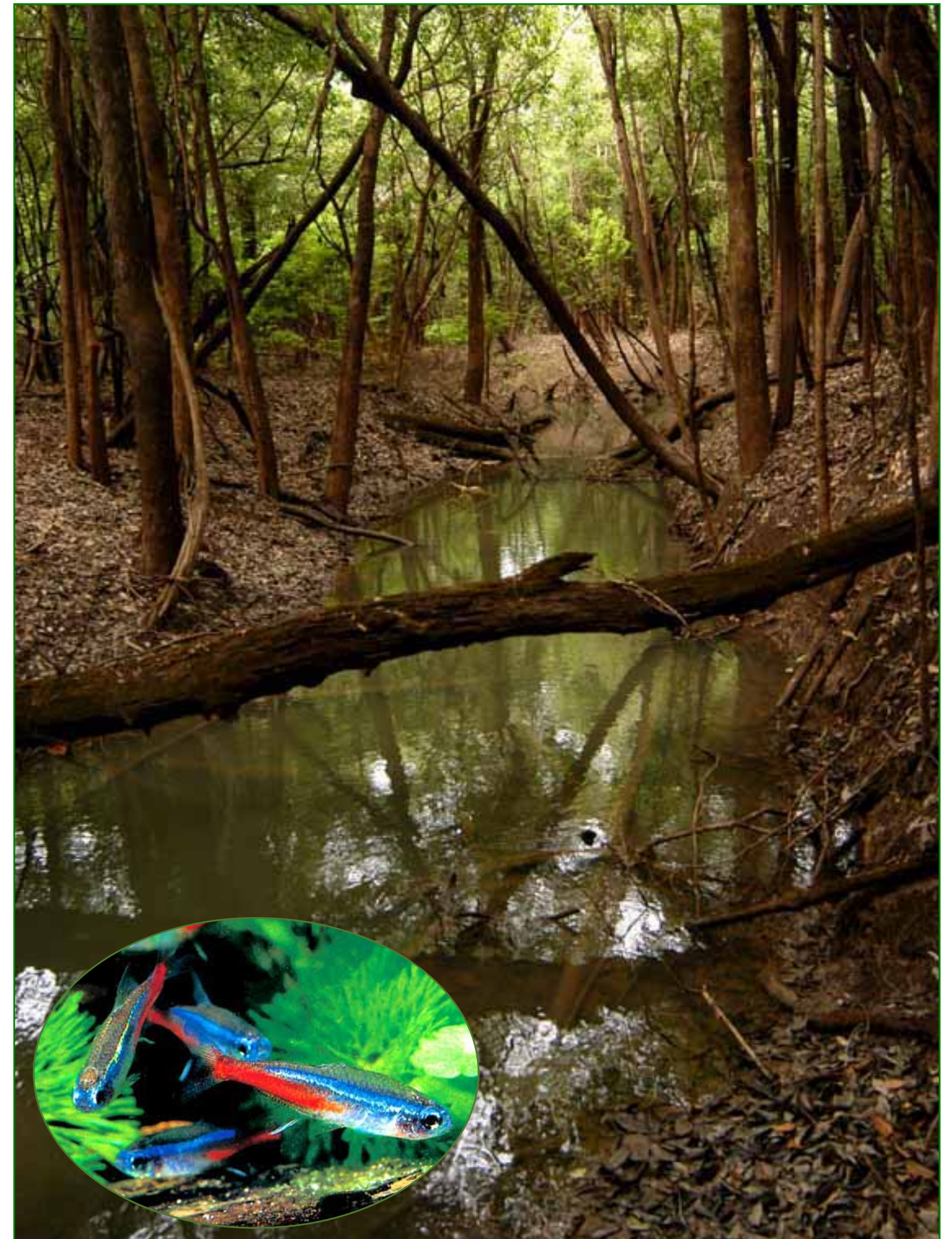
1. *Acanthurus coelestis*. Juvenile blue animal.
2. *A. coelestis*. Juvenile yellow animal.
3. *A. coelestis* adult animal.
4. *Pomacanthus arcuatus*, semi-adult.
5. *P. arcuatus*, juvenile animal.
6. *Segastes variabilis*, juvenile fish.
7. *S. variabilis*, adult fish.
8. *S. variabilis*, semi-adult fish.

Note: Shown here are several species in their juvenile, semi-adult and often even in their adult colours, to understnd how the colours change with the age.



Some more species, ideal for an home (marine) aquarium, again from the Atlantic Ocean, the area between Rio de Janeiro and the mouth of the Amazon – but not limited to (as some are also found in the Caribbean Sea and further up north).

9. *Bodianus rufus*, adult fish.
10. *Elacatinus figaro*, adult – it does not grow very large – up to 3.5 cm, and was only recently described.
11. *Gramma brasiliensis*, also adult and also a small fish – up to 7 cm.
12. *Malacoctenus cf. triangularis*, a beautiful only up to 7.5 cm long fish.
13. *Holacanthus ciliaris* is another beauty, but it can grow up to 45 cm. And two typical invertebrate for such aquarium:
14. *Meandrina brasiliensis*, and
15. *Condylactis* species.





To the text of the biotope aquariums for Neon and Cardinal tetras (and note, that for the blue Neon, *Paracheirodon simulans*, the habitat is the same as for the Cardinal tetra, as they live in identical biotopes), here three more samples of how to decorate it (or not).
Aquarium left: Here we see ad-decoration for a Cardinal biotope which is in part correct, at least most of it. The *Aponogeton ulvaceus* in the far left is wrong and the *Sagittaria platyphylla* in the foreground as well. Better to have a sandy space open and ad a drift wood piece. Also maybe some other fishes (as mentioned in the text).



Aquarium left: This was to be a biotope Neon tetras and is also not bad, but sould definately have white sand between the rocks and driftwood is missing – actually needed. One can argue about the *Hygrophila difformis* in the right corner, and also the *H. polisperma* in the background (both from Asia), but the others are South Americxan species, although none from a ral neon habitat, except the *Echinodorus tenellus* in the foreground, which are from the Neon biotope area.



Aquarium left: Here we see an authintic, natural biotope (as right side) for cardenal tetras. And one can see that all fishes feel very well, like at “home”, although they have just been placed in the tank. They swim immediately in schools together with *Hemigrammus bleheri*, exactly as in nature. Even the *Corydoras* join in (left corner). This shows again, that a real (close to nature) biotope aquarium brings happyness to the fishes and also to the owner of the aquarium...

Introduction

Nowadays we live in a world where “wildlife conservation” and “appropriate animal husbandry” are written about extens-ively and the subject of legislation in many countries, including much of the European Union. People are no longer allowed to keep animals – or do anything, for that matter – according to their own ideas, and we must bear in mind that sooner or later it will like-wise become obligatory to keep ornamental fishes “in the proper way” for the species in question. But how many people actually know what the proper way is for any particu-lar species? How are they to find out? Nei-ther the legislators nor the existing hobby lit-erature offer any concrete help. How so? Be-cause only a handful of people have conduct-ed on-the-spot research and the legislat-ors rely almost entirely on their data. In rare cas-es this may mean information from just one expert. Assuming there is one!

In addition we will show you how best to simulate the natural habitat of these fishes in your home, so that you not only maintain them in the “proper way” but also find them a source of immeasurable enjoyment.

The neon and cardinal tetra aquarium

First and foremost, we implore you to buy your tetras ONLY at a retail outlet you can trust. One where the fishes are visibly main-tained and cared for properly (eg no dead or dying specimens floating around), and where all purchases are netted and packed with the utmost care – always remember, these are living creatures just like you, and should be treated accordingly. But, before you buy a single fish your tank must be established, ie set up and the filter matured for at least 7 days.

Setting up the aquarium: first of all, bear in mind that both species are shoaling fishes, and hence the aquarium should be at least 80

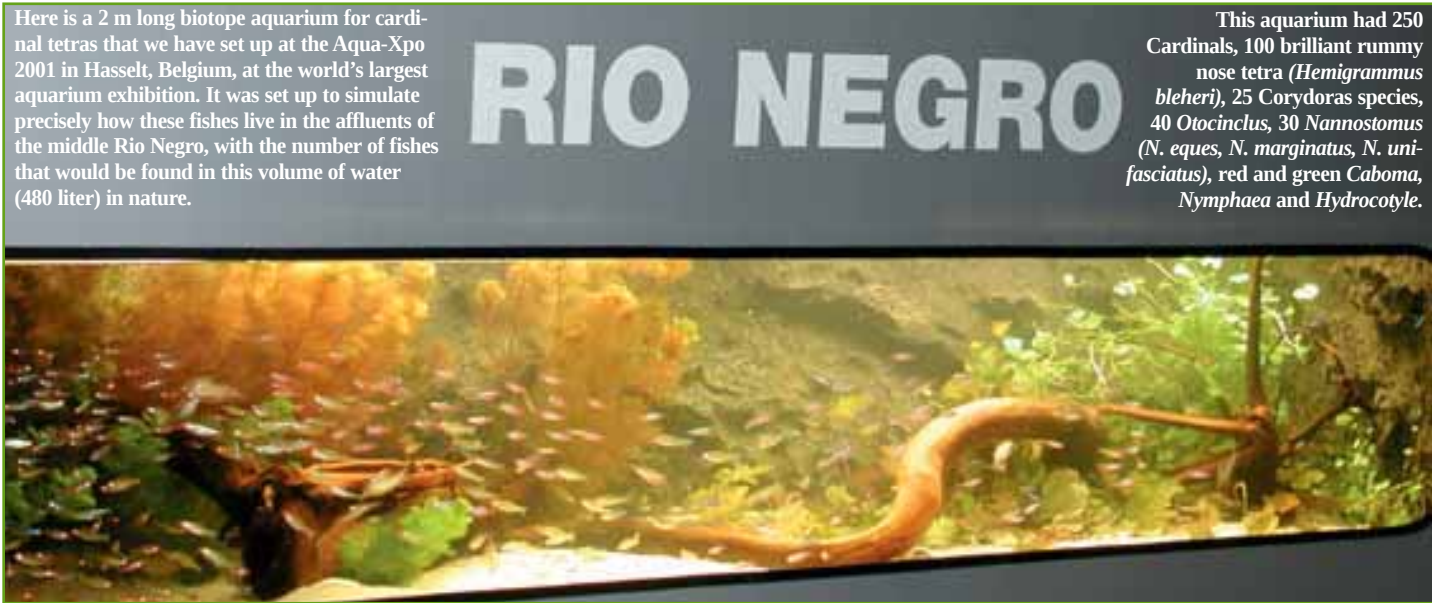
cm, and if possible 100-150 cm (or more), in length, with a width and depth of at least 40 cm (the wider the better, for ease of setting up and from the viewpoint of the fishes). Use very fine white sand for the substrate. Then position one or two pieces of well-washed bogwood or driftwood. Half fill the tank with water before adding the following aquatic plants, if possible: a *Cabomba* species (*C. furcata* or *C. aquatica*), and a reasonable amount of it; then a few tiger lotus (*Nymphaea lotus*) of varying sizes; one of the pennyworts (*Hydrocotyle leucocephala* or *H. ranunculoides*); plus the aquatic moss *Mayaca fluviatilis* or Bleher’s swordplant (*Echinodorus bleheri*) – although the last two are not in fact biotope-correct, they are well suited to the cardinal tetra aquarium. You may also like to include two other sword-plants, *E. parviflorus* and *E. horizontalis*, in the neon tetra aquarium. Both these *Echin-odorus* species occur in the biotope of the neon tetra, but there are no swordplants in the natural habitat of the cardinal. Once the plants have been set in place, the rest of the water can be carefully added.

If your aquarium does not have an integ-ral filter, then you can choose a suitable external filter. Either way, it is import-ant that initially the filter media consists of mechanical and biological media along with activated carbon. Let the filter mature, and do not add your fishes until the minimum of one week has elapsed. (Note: Once your aquarium is bio-logically balanced and the water clear, you can discontinue the activ-ated carbon medi-um and replace it with peat to provide opti-mum water conditions for this particular biotope).

The fish population for the aquarium: As mentioned initially, find a reliable dealer. Purchase a nice shoal of neons or cardinals – the number will depend on the size of your aquarium: you can keep 50-60 medium neons

or 40-50 medium cardinals in a 120 litre aquarium without worries. In addition, a neon aquarium of this size can house about 10 dwarf cichlids of the genus *Apistogramma* (ideally *A. cacauioides* or *A. bitaeniata*), 6-8 splash tetras (*Copella* species), the same number of pencilfishes (*Nannostomus mar-ginatus marginatus*, *N. m. mortenthaleri*, or *N. eques* - or 2 of the three). You will need a few dwarf suckermouth catfishes (*Otocinclus arnoldi*) and mailed catfishes (*Corydoras ele-gans* or *C. leucomelas*) – in each case about 12 individuals. For the cardinal tetra aquarium the general composition of the fish popula-tion can be similar, but omitting *N. m. mor-tenthaleri*, and substituting just *C. schwartzi* as the mailed catfish and, as the dwarf cich-lids, only *Apistogramma mendezi* or *A. stein-dachneri* or *A. iniridae*, and adding 20-30 brilliant rummy-nose tetras (*Hemigrammus bleheri*). Both biotopes can also include about 6 marbled hatchetfishes (*Carnegiella strigata*). Larger fishes are not recommended, apart from the angelfish (*Pterophyllum scalare*) and then only 3 or 4 small speci-mens. For larger or smaller aquaria the popu-lation can be increased or reduced pro rata.

General: maintain the water temperature at 25-27 °C and allow 10-12 hours of good lighting. The water should not be too hard and have a neutral pH (about 7) – but a lower pH will produce better coloration in the fish-es. Change the peat regularly, and periodical-ly wash your filter media in warm water. It remains to wish you good luck.



Here is a 2 m long biotope aquarium for cardi-nal tetras that we have set up at the Aqua-Xpo 2001 in Hasselt, Belgium, at the world’s largest aquarium exhibition. It was set up to simulate precisely how these fishes live in the affluents of the middle Rio Negro, with the number of fishes that would be found in this volume of water (480 liter) in nature.

This aquarium had 250 Cardinals, 100 brilliant rummy nose tetra (*Hemigrammus bleheri*), 25 *Corydoras* species, 40 *Otocinclus*, 30 *Nannostomus* (*N. eques*, *N. marginatus*, *N. uni-fasciatus*), red and green *Caboma*, *Nymphaea* and *Hydrocotyle*.





Above 3 suggestions for a Guppy biotope aquarium (pros and counter): The upper aquarium is nicely decorated, and a real good display for a Guppy aquarium, almost nothing to counter. (you only have to choose, which kind of Guppies you prefere, I would place wild ones, as on the previous page). Center is defiantely fine, but please not *Aponogeton fenestralis* (=Madagascar...). And the lower aquarium:is the taste of Buddha? (maybebecause the Guppies breed in Asia?). In any event, the rest of the decoration is nice, and if tank breed Guppies imported from Singapore, why not a Buddha...

The Guppy Aquarium

Every beginner in the aquarium hobby should start with guppies – but experienced aquarists can likewise find great pleasure in these swimming rainbows. But everyone should first of all ask themselves, “Do I want an aquarium with a population of wild-type guppies, or would I prefer a “tapestry” of the larger cultivated forms – or a mixture of both types?” The wild forms are more active. It is easier to observe their courtship, and they breed more rapidly. On the other hand, the “fancy” types give the aquarium more colour. Once that is decided – there is plenty of advice in the literature and on the Internet (eg at www.altavista.com search for: Guppies, “*Poecilia reticulata*”) – then you can decide which types you like best and visit a high-quality dealer to obtain healthy stock – never buy guppies that can’t swim properly, or from tanks where there are fish lying on their sides, wobbling around, or even dead. But, before you buy any fishes, you must first set up their aquarium.

Setting up the aquarium: When buying an aquarium, always remember that the larger the aquarium the more attractive it will look, and the more space the fishes will have for swimming. But a 60 (long) x 30-35 (wide/deep – the wider the better where the decor is concerned) cm will suffice in this case.

If possible, obtain some fine white sand or light quartz gravel for the substrate – about a 5 cm layer is required, a little deeper at the back. First rinse your new tank well with warm water – no soap or detergent! – and check whether the sand has been well washed (regardless of what it claims on the packing). For decor we recommend a few nice pieces of bogwood and stones, and a good selection of attractive aquatic plants. Particularly good (and biotope correct) choices include *Cabomba* species and the Guiana willowleaf, *Hy-*

grophila guianensis (small-leaved willowleaf, *H. polysperma*, will do instead). The dwarf chain sword (*Echinodorus tenellus*) is ideal for the foreground; it will form a carpet above which the fishes will be seen to best effect. Alternatively you can use the somewhat larger dwarf swordplant *E. quadricostatus* (see below, left-hand biotope). And, finally, one to three specimens of the larger swordplant *E. horizontalis* or *E. osiris* (as in the left-hand corner of the biotope below left) which is highly decorative. You can also plant lots of *Ludwigia repens* (as in the biotope below right) – again very attractive decoration.

Put in the sand, wood, and rocks, then half-fill the aquarium with water before planting. Finally fill up the aquarium. Always bear in mind that guppies feel particularly happy and show their best colours with good plant growth as cover. So don’t stint on the plants.

If the aquarium purchased doesn’t include a built-in filter, then you can add either an internal or an external. The filter should be filled with biological media, and if you use a biological starter then you can add your fishes a day later.

Fishes for the aquarium: As already mentioned, choose the guppies you like. As a rule of thumb you can add 1 cm of fish per 2 litres of aquarium water, ie a 60 litre aquarium will house 30 cm of fish or 15 male guppies at 2 cm (average adult body length) apiece. Note that this rule is based on the body length (= Standard Length, SL), ie not including the tail. If you want to keep other fishes with your guppies, then we recommend other livebearers of the family Poeciliidae, eg green or red swordtails (*Xiphophorus helleri*) and platies (*Xiphophorus maculatus*), which are available in numerous colour varieties at any good aquarium store. Other good tankmates include bristlenose catfishes such as *Ancistrus hoplogynus* and *A. temminckii*.

These “suckermouth cats” remain small and eat unsightly algae. They do not in fact occur in the natural habitat, where there are instead other suckermouths, of the genus *Hypostomus*, but the latter are not recommended as they grow too large and may nibble the plants. Another catfish that does occur in the biotope is the bronze catfish (*Corydoras aeneus*), ideal for sandy substrates. It you decide to keep these then make sure you have a small group and that you leave an area of open sand as they like to “nose around” in the substrate for small organisms.

When you buy your fishes don’t forget that the trade almost always offers cultivated forms of guppies, swordtails, and platies, and these, of course, are not found in nature. So, if you want to be “biotope correct” you will have to hunt for wild fish or captive-bred wild forms. They are available, and then you can proudly display an aquatic microcosm representing Venezuela, Trinidad, or even Mexico in your home. And you will certainly learn more than from the cultivated forms.

General: Maintain the water temperature at 24-27°C and light the aquarium for 10-12 hours each day. The water should be slightly alkaline, pH values below 7 are unnecessary. Let the biological filter media do their job and change some of the water regularly.

The only other thing these little splashes of colour need for successful maintenance and regular breeding is food. And you will have hands-on experience of evolution in your biotope-in-miniature.



These two Guppy aquarium decorations are actually more Guppy nature biotope like, but the Guppies in both are Guppies from breeding stock, this is a question of taste. But what makes it nice: lots of plants and only Guppies, no other fishes mixed into it. This is nice, specially for a small aquarium.





Three sample decorations for angelfish biotopes (the pro and counter):
Aquarium left: This is a very nice nature-like biotope, almost authentic to the Rio Nanay, where these wild angels come from. They felt immediately perfect. In hamony.
Aquarium in the middle: This is an authentic angelfish biotope from the Rio Mineruá, in the Amazon. The angels live together with green discus and swam with the same immediately after placed in the aquariu, formed a natural school, as in their habitat. And one should remember: do never place wild fishes together with tank raise specimens, it can cause (and most of the times) big problems. Wild with wild is fine.
Aquariums below: If one is to have tank raised angelfishes, than please put, as here shown, only those together. The decoration is for these up to its owner, as such altered colour variants have little of the gen from the wild angels left...



The angelfish aquarium

Almost everyone who starts maintaining an aquarium sooner or later becomes aware of the angelfish. It is – and always has been – a majestic creature, an (almost) indispensable adornment for any underwater landscape. Its elegance, its extremely long fins (present in all but a few cultivated forms), jerky swimming movements, inquisitive look, and its constantly repeated search (in adults) for a nice big leaf (or undisturbed spot on the aquarium glass) on which to lay its eggs, all provide endless fascination. Likewise the way two individuals sometimes face up to each other with widespread fins, as if in rivalry, is a real wow. This is, however, not actual aggressive behaviour, as these are truly the most peaceful of fishes – like discus, their close relatives, often found together with the angelfish in nature. (But *P. altum* and *P. leopoldi* are not found with discus in nature.)

Now if you want to provide this former king of the aquarium fishes with an optimal home and enjoy it to the full, here are a few simple suggestions as regards to the biotope.

Setting up the aquarium: As usual, the larger the better, but for the angelfish the aquarium should be at least 100 cm long and 35 cm wide (or wider), and 40-50 cm deep. (For Altum angelfishes at least 120 cm long and 60 cm deep.) We also unreservedly recommend (biotope correct) fine white sand. This should be at least 5 cm deep (8-10 cm deep at the rear) – and, of course previously well washed (always check sand sold as “washed”). A number of nice pieces of bogwood are indispensable – either pre-soaked or weathered over a long period. If you want to add rocks then please use rounded ones, as the fishes may injure themselves on sharp rocks. It is advisable to plant the aquarium: as can be seen from the biotope aquarium below left, the so-called Peruvian Altum is often found with the

large-leaved horizontal swordplant (*Echinodorus horizontalis*). The common angelfish and Bleher’s swordplant (*E. bleheri*) are a good combination. But in all cases a few large swordplants. You may also care to include – more for the foreground and between the pieces of bogwood – the dwarf, grass-like swordplants (*E. quadricostatus* and *E. tenellus*), both of which are carpet-forming. For the sides (or in between) *Hydrocotyle leucocephala* and a further group of *Hygrophila guyanensis*. You must, of course, decide for yourself whether or not to add lots more plant species. Those mentioned are biotopecorrect, except that the majority of angelfishes do not occur in areas where aquatic plants grow. Like discus, for the most part they make their homes among roots, branches, and fallen trees, as well as trailing greenery (at high water). The tank will look rather

different with a population of only, or mainly, tank-bred angelfishes or cultivated forms. Or, if you deviate from the actual biotope and mix cultivated discus varieties with wild-caught angelfishes – and Altum angelfishes (which we really do not recommend), then you can add plants that are alien to the biotope. It is, however, important always to allow a large amount of open swimming space for angelfishes.

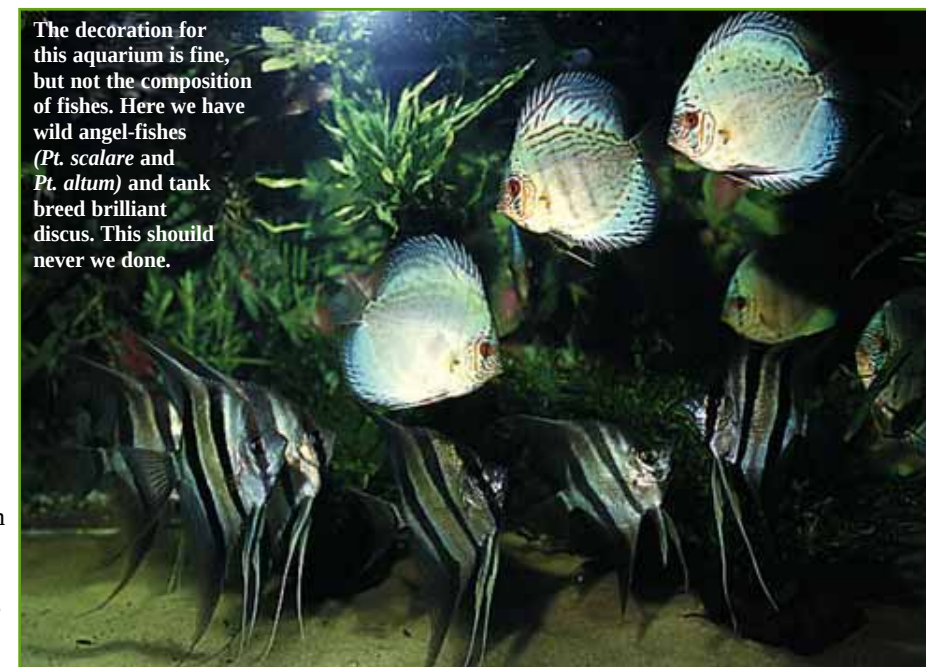
The fish population for the aquarium: Here the question arises: do you want to be biotope correct, as then you should mix only wild-caught individuals or tank-breds of natural forms (ie one, two, or all three of the species mentioned: *P. scalare*, *P. altum*, *P. leopoldi*). Next there is the question of small specimens or those already adult: if small individuals, then start with a group of 8-12 in the size of tank cited. Fewer if larger, and

with Altums only about 4 in 100 l. As tankmates in such a tank you can add a group of mailed catfishes (eg 6-8 *Corydoras leucomelas*, *C. atropersonatus*, *C. trilineatus*, or a mixture). About 10 *Otocinclus arnoldi* to eat algae. Plus 1-2 groups of tetras will look nice. About 10 brilliant rummynose tetras (*Hemigrammus bleheri*) and 6-8 bleeding heart tetras (*Hyphessobrycon erythrostigma*). Always remember that the total number of fishes depends on the rule: 1 cm of fish per 2 l of aquarium water.

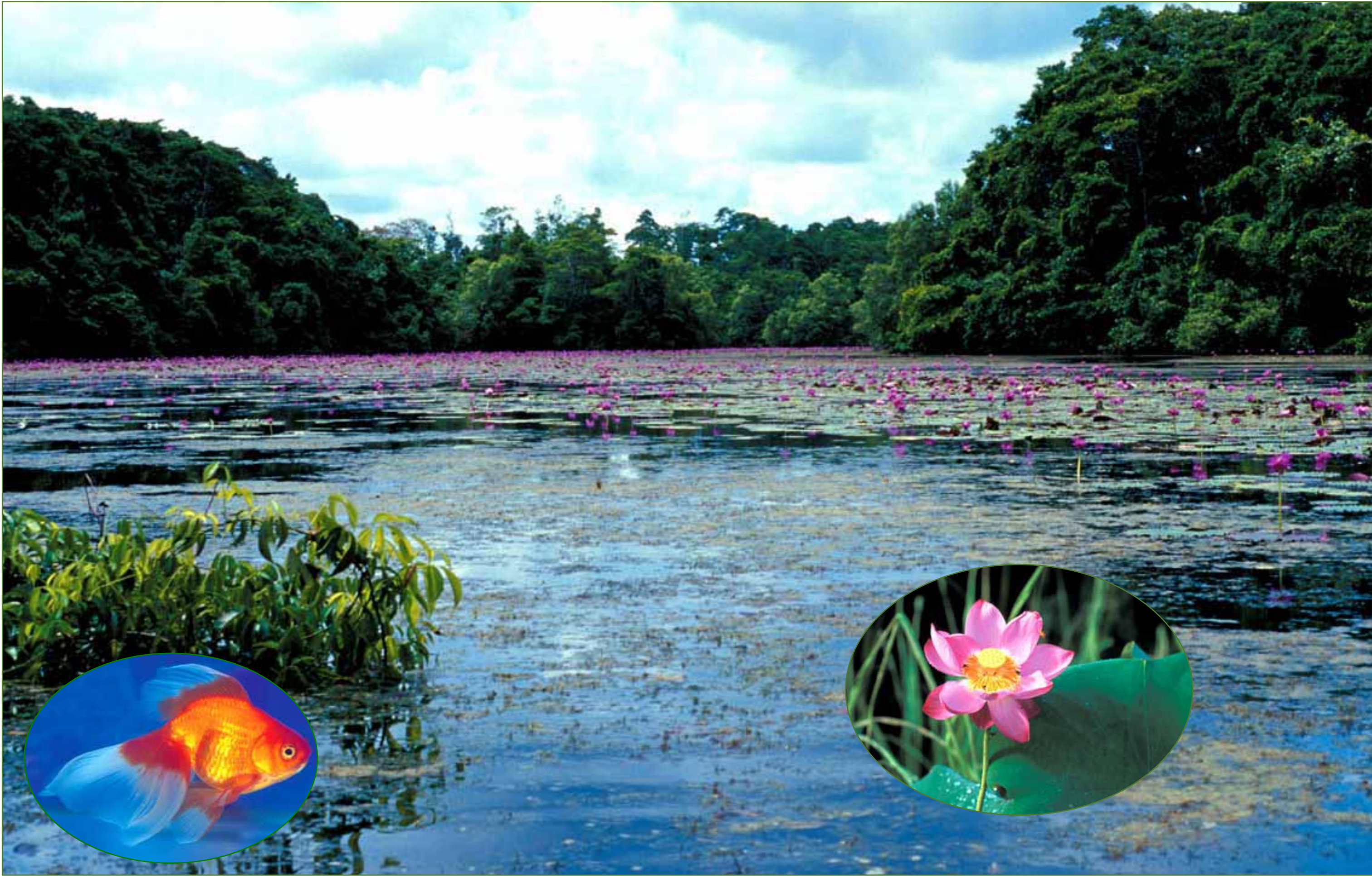
General: The water temperature should be 25-29°C (max. 30°C); The lighting should be on for 10-12 hours per day; the pH about 7 – up to 8 doesn’t matter too much (except for Altums); allow biological filter media to do their work; change water now and then; feed young specimens several times daily, adults once per day; and that’s it. And then you will have many hours of educational viewing – often better than the TV.



This is a good biotope aquarium decoration for angelfishes, although there are, together with the wild angels also tank raised ones – it is still ok.



The decoration for this aquarium is fine, but not the composition of fishes. Here we have wild angel-fishes (*Pt. scalare* and *Pt. altum*) and tank breed brilliant discus. This should never we done.





What can be said or shown for a goldfish biotope? Practic all forms of goldfishes today in the hobby are fishes changed by man (some to the most abstract forms and colours). And I can hardly suggest any of the three aquarium decorations shown on this page, for gold-fishes. But let me shortly mention one by one. *Aquarium on top:* this is a table aquarium – closed from the top (I think made in Russia), those fishes will suffer very much and it is not good (although looks nice). *Aquarium in the center:* This kind of decoration is already somewhat better, but not with *Echinodorus uruguayensis* – much better lots of large *Vallisneria* in the background and a few *Nymphaea* species instead. Also, it should have some natural gravel on the bottom and not lava stones. The larger stones are ok. *Aquarium to the left:* This is terrible, and murder for goldfish. My grandfather already condemd the round glasses (this was back in the late 19th century, when people started to relize, that such round glasses drive the fishes insane, as they must swim in circles all the time, and that is the same if we had to walk our entire life in circles...). Theplants and decoration is nice, but not the round tank...

The Goldfish Aquarium

Every newcomer to the aquarium hobby should start with guppies or a goldfish aquarium (and experienced aquarists can enjoy them too). Goldfishes are amongst the hardest ornamental fishes, and this is one of the reasons they have been kept for more than a thousand years. Today the original goldfish is still found in the waters of China, which freeze during the winter months. It lives beneath the ice (and sometimes in it), at temperatures around freezing point, and survives. In the same biotope where in summer the water heats up to more than 30 °C – I have measured up to 41 °C.

These are points that should also be borne in mind when purchasing goldfishes (young or old), and, of course, you must decide whether to keep them in a pond, an aquarium, or perhaps even in a paludarium. The traditional Asian method, still practised today, of keeping them in open-topped earthenware basins, porcelain bowls, or vessels of jade has never really spread further afield, and for a number of reasons is best reserved for specialists and for the more extreme forms, and hence I will not discuss it here. Likewise the goldfish bowl (in the interests of appropriate maintenance as well). From the viewpoint of the (normal) goldfish a pond is the ideal habitat, and this is generally the only environment where it will breed without the intervention of the owner. But I won't go into pond maintenance here either, as there are (almost) innumerable publications on the subject, and instead we will deal with the aquarium maintenance of goldfishes and provide a few simple (biotope) suggestions. As an aside, however, I do also recommend ornamental carp for a pond, and that the pond should be populated with a natural, native fauna and flora.

Setting up the aquarium: From an aquarium ecology viewpoint, the same general principles apply to a goldfish aquarium as for (almost all) other aquaria. In other words, don't allow anyone to tell you a small aquarium will suffice for goldfishes. I recommend a tank at least 100 cm long (they need swimming space, just like discus, for example) and 35 cm wide (the wider the better), and at least as deep. Use medium (grain size 0.2-0.6 mm) or coarse (0.6-2.0 mm) sand, never more than 2 mm as goldfishes like to dig. Fill the tank with this to a depth of 5 cm – somewhat more towards the rear – but only after rinsing out the tank with warm water and making sure that the sand is also well washed. Don't forget to include some (true) aquatic plants (often people think goldfishes don't need them, or eat them). The plants will enrich the water with oxygen, utilise the inevitable metabolic by-products of fishes and bacte-

ria, and provide micro-organisms with surfaces to colonise. And thriving plants are the most effective answer to algae. Two groups of plants are advisable (as plants are part of the goldfish's natural diet, but they nibble only at soft-leaved plants, and at small or new, tender leaves). One group should be a more robust type such as vallis (*Vallisneria species*), which is both suitable and biotope-correct. One end of the tank, or



These two biotopes above are more goldfish like. The upper is the typical pond, ideal for goldfishes – even in the winter – with *Nymphaea* in it. The aquarium above is actually an paladarium and a perfect environment for goldfishes

part of the background, should be densely planted with such plants, as goldfishes also need a place to hide. Vallis grows well under fairly bright lighting (and maybe CO₂ fertilisation). Other suggestions are a waterlily (eg *Nuphar lutea*), which likewise won't be eaten, a *Bacopa* species, and Java moss (*Vesicularia dubyana*), in which goldfishes love to search for small invertebrates. Useful plants for "snacking" include, for example pondweed, *Egeria densa* or *Elodea canadensis*, which grow rapidly (they can readily be propagated in another tank and transferred as and when required); or hornwort (*Ceratophyllum demersum*), which will generally continue to grow floating – given good light. If you decide on an open-topped tank then floating plants such as water lettuce (*Pistia stratiotes*) or riccia (*Riccia fluitans*) can be added. Other decor can include basalt, granite, or lava rocks, as well as well-weathered bogwood.

Fishes for the aquarium: This is largely a matter of personal taste. On pages 5-6 you will see a few of the many variations in shape and colour. Basically, I suggest avoiding the forms intended to be viewed from above, such as celestials, bubble-eyes, and buffaloheads. Telescope-eyes should also be viewed with caution, as the eyes protrude so far that they can easily be injured (especially during netting). Recommended forms include: veiltails – red/white (also called sarasa) or the colourful calico; the type of veiltail first bred in the USA which is less high-backed; veiltail fantails, a western form; comets, Bristol shubunkins, London shubunkins; plus orandas, lionheads, or eggfishes. (The last of these has almost died out, definitely only a cultural loss.) It is important not to try and keep any of these forms at low temperatures like common goldfishes. The very fancy varieties are acclimated to warmer temperatures.

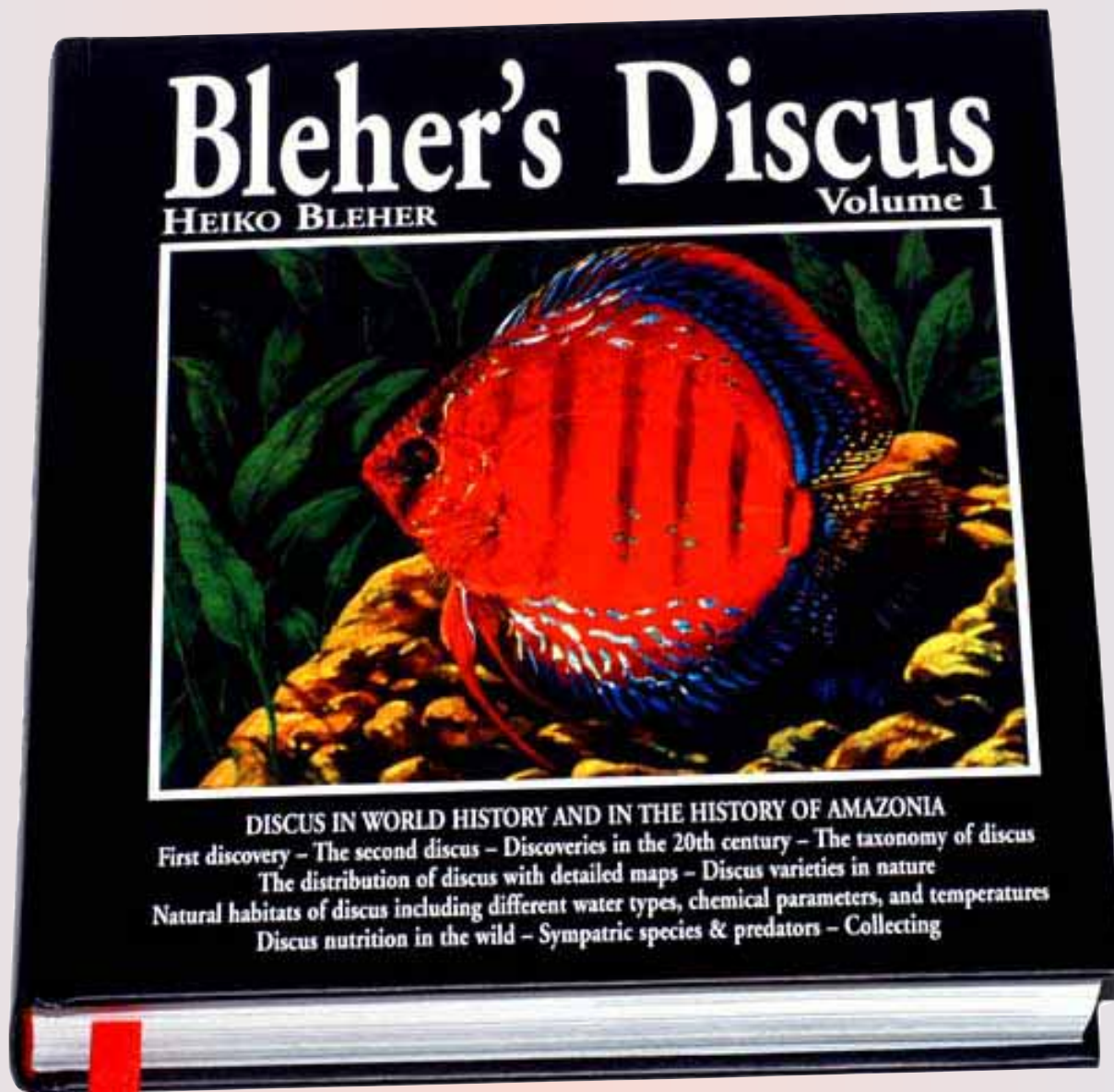
General: Goldfishes require good lighting and a suitable power filter that turns over the aquarium volume a minimum of 2 to 3 times every hour. A heater is unnecessary as long as the water temperature doesn't drop below 18 or 17 °C in winter. Allow the planted aquarium to run without fishes for 14 days to allow it to mature biologically (this will also allow the plants to root), allow your goldfishes adequate swimming space, and don't overpopulate the tank: as a rule of thumb, 1 cm fish (total length) per 3 litres of water.

Bleher's Discus – A Monograph

An unsurpassed and comprehensive study of the genus *Symphysodon*

Whether it was the Emperor Napoleon or Prince von Metternich who was responsible for the original discovery of the discus is something the reader himself must decide, but the rest of this more than 1300 page work – published in two volumes – is far from ambivalent.

In Volume 1 – containing around 5000 photos, paintings, and drawings, plus some 50 maps – Heiko Bleher first of all guides you through more than 150 years of discovery, documented in the finest detail. He brings to life all the scientists who have worked on the genus – with in part unpublished work and photos – and, after almost half a century of debate regarding the systematics of the genus, provides a new and easy-to-understand summary of the taxonomy. Next, the distribution of the genus and the individual species is shown practically down to the smallest igarapé or lago, on eight double-page maps. For the first time with precise details of water type, researched in the field. In the fourth chapter Bleher covers all the wild forms known to date (some hitherto unpublished) and their colour variants, in words and photos – the results of his more than 300 research and collecting expeditions. The locality data have been extensively checked in the field over the years up to 2005. In Chapter 5 he guides the reader through the history of Amazonia – back to the time of its discovery – and tells extensively about the early history of the region and the numerous indian tribes (mainly personal experiences among the aboriginals). In addition the natural habitats of the discus are described and illustrated, with water parameters (measured by both day and night) given for 75 different locations; almost every major water in Amazonia is mentioned at length, with details of which form(s) do or do not occur there; and places that remain unexplored to date are listed. He also details extensively – more than 80 pages – the diet of the discus in nature, the communities of which it forms part (with sympatric species listed) and its enemies, as well as the various methods of capture used from the beginning to the present day.



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