

Birds and fishes in the “ecosystem palm oil plantation”

The nutritional basis of kingfishers from New Guinea

New Guinea is home to 25 species and subspecies of the family of kingfishers – in Europe lives only one species of kingfishers. The kingfishers of New Guinea are substantially larger, they have the size of a jackdaw up to a crow. The food of New Guinean kingfishers basically consists of fish and insects. Larger species certainly include small rodents and reptiles to their diet.

A high proportion to the diet of kingfishers consist of rainbowfishes, hence the investigation of those birds is interesting because they provide information about the types and the distribution of rainbowfishes simultaneously.

Since eight years, examinations are going on in Papua New Guinea focusing on a population inventory of kingfisher species. At the same time, the basic food of those species is reviewed. For this purpose, in the first year 157 birds were equipped with GPS transmitters and foot rings (up-to-date 573). With this setup, an almost complete motion profile of each species could be created. These movement profiles will be used in the near future for nature conservation projects.

There are interesting results, showing that in regions with introduced fish species like *Tilapia* or *Channa* kingfishers feed dis-

proportionately high on these fish, whereas endemic fish species amount only 12 % to the diet. This led to the conclusion that the introduced fish could not camouflage as well as the endemic fish and therefore are better visible for the kingfishers. Many species of rainbowfishes are very well camouflaged in their natural habitat. In particular *Chilatherina* and *Glossolepis* species are nearly perfectly camouflaged.

Some of the natural rainforest habitats are destroyed by massive exploitation of resources or plantations with monoculture. While small and scattered orchards have only a very minor impact on biodiversity and the individual populations, the large oil palm plantations are responsible for the vanishing of almost all species.

Investigations on Nemayer River

To study the habitat “oil palm plantation” our studies were conducted for five years in the area of the Nemayer River and the Seren Creek, a tributary of the Nemayer River.

The devastating realization: The variety of animals and plants was reduced by about 80 %. It is not yet clear how many endemic species became extinct under this pressure, because a high proportion of the fauna consists of insects, such as beetles, butterflies and ants, feeding on nectar and pollen. Many of the insects depend on the



▲ Northern cassowary (*Casuarius unappendiculatus*) live in the northern New Guinea lowland rainforests with dense undergrowth.
(all photos: Michael Wagner)

occurrence of certain plants. Some of these certain plants are also endemic and limit the distribution of their dependent animals likewise.

Many of the companies that “use” the rainforest behave very reckless to the indigenous population. Since most natives hold on to their traditional way of life, there are always conflicts between the companies and the native people. With the destruction of their habitat, many also lose their home and some get addicted to alcohol. Some of our local observers were attacked by the operators of plantations. A much more ag-

gressive approach can be observed from the Malay loggers. These are very ruthless against the local tribes. If shot at them with bows and arrows, they often answer with automatic weapons. A very unequal fight, that the Papua New Guinean government seems to tolerate.

In the area of the Nemayer River, three species of kingfishers are present. Two of these are specialized in fish, but can switch to insects, small reptiles and amphibians for a short period of time. The third type feeds mainly on rodents and reptiles, but can also occasionally feed on fish.



▲ F1 males of *Chilatherina axelrodi* from the type collection site. This type disappears as one of the first in oil palm plantations.

In the plantation of Imbio

In the study area, the plantation of Imbio, 21 birds equipped with transmitters were living in the surveyed area. Another 38 pairs could be sighted and viewed. In the annual average every pair breeds 26 squabs. One species uses tree holes, the two others are digging caves in clay walls at the river banks.

The conducted area hosts introduced fish only occasionally, mostly a *Channa* species. *Tilapia* could not establish in this region. Gouramis were introduced in some small lakes but could not establish either.

The following fish species could be recorded in 2008: *Chilatherina axelrodi*, *Chilatherina* cf. *crassispinosa*, *Chilatherina* cf. *fasciata*, *Glossolepis kabia*, *Melanotaenia* cf. *affinis*, a very slender *Melanotaenia* spec., four species of gudgeons, two species of catfish, one perch species and one *Craterocephalus*

lus spec. Some glass shrimp and a relatively large species of crayfish were recorded, too.

In 2009 forest clearance was started. Many nesting trees were already destroyed in this year. Of the pairs with transmitters three pairs were remaining in the area and seven without transmitter. The others migrated westwards. The remaining pairs could breed 247 squabs in three broods of which 180 were equipped with transmitters. 72 survived the first year which is under the average of other regions. Most birds migrated westwards.

In the following year five pairs were breeding in the area. As forest clearances were finished mostly at this point of time and 70 % of the surface was planted with oil palms, only two broods with a total of 85 squabs occurred. Only 19 of these survived the first year. One of the parent females with a transmitter died on pollution,



▲ F1 males of *Chilatherina campsi*. Although a locality type in the investigation area but so far we could not detect them here.

another one was killed by a hawk. Many squabs were undernourished and weak.

In 2011 only occasionally pairs could be surveyed at the margin of the plantation. The remaining pairs moved into the vicinity, mostly in westward direction. The plantation was finalized in September 2011.

In September 2012, 21 pairs were breeding in the vicinity of the plantation. The reason was a mass reproduction of *Glossolepis kabia* and *Mogurnda* spec. in the ditches. Increased levels of nitrate and phosphate in the water of the ditches were found. Only occasionally species of *Melanotaenia* and *Chilatherina* could be found in the rivers. The upper reaches of the rivers still hosted all recorded species. Only short time later the first contaminated water samples could be found. Several pesticides were found, among others DDT and Lindane. In particular in the lower reaches of the river, the

maximum permissible values were exceeded by many times.

In 2013 the lower reaches hosted nearly no fish any more. Population density was below 25% compared to the time before planting started. The previously clear water had a visible green colour, sediment freight was much higher than before. This will destroy the reef at the outlet of the Nemayer River in short time. This will be enhanced by the algae that underwent a mass propagation due to the massive overfertilization. Partially the measured phosphate content was 18 mg/l, nitrate at 72 mg/l. At some places potassium could be found of which the source could not be detected.

In 2014 a lot of birds died. In many cases destructions of the liver and purulent infections could be found along the digestion system. In some of the birds the levels of Lindane exceeded the maximum value by 10.

Further surveys will be conducted in 2015 and 2016. At the upper reaches an oil palm plantation of 26 x 6 km is planned (Imbio 2). The impacts on the ecosystem will be even more dramatic than from the Imbio plantation. After finalization the whole river system will be affected.

Various collections have shown that there are at least five rainbowfish species in this region. For details the ongoing DNA studies will give a result. Among others, the following species were detected: *Chilatherina axelrodi*, *Chilatherina* cf. *crassispinosa*, *Glossolepis* cf. *kabia*, *Melanotaenia* cf. *affinis* and *Melanotaenia* spec., of which the latter species may also involve several species. Unfortunately I could not take part in the last collection, so I could determine some species only based on ethanol samples, where the colours have faded away to shades of greyish blue and grey. Live fish were not left for breeding at the camp because many fish in this region are extremely aggressive towards their tank mates.

Investigations of nectar-feeding parrots in the vicinity of Nemayer River

In addition to kingfishers, the island of New Guinea is home to a wide variety of other species, such as birds of paradise and parrots. Especially the nectar-eating parrots, the lories and lorikeets, are in the focus of my interest. They are the goblins of the forest and most of them can be described as culture followers.

The food of lories and lorikeets essentially consists in a mixture of fruits, pollen and nectar. Only in food shortage times

they change to seeds. The digestive system is not able to catch up with this completely, so half-ripe seeds are preferred.

Many types of lories and lorikeets have learned to follow people. Through the agricultural cultivation of certain areas, food sources for lories and lorikeets increased because many of the fruits are also on their menu. In addition to self-sufficiency, the fruits are also available on the local markets for sale, which is the only source of income for many native people.

The increasing land use by large, international agricultural companies disrupted the traditional way of life of native people severely. People are forced to leave their part of land. The agricultural corporations do not take care, the main thing is that people no longer interfere.

The Nemayer River area is home of lories of the genera *Eos*, *Lorius* and *Trichoglossus* and lorikeets of the genera *Chalcopsitta* and *Charmosyna*. All these species are cave breeders, but quite flexible in their choice of accommodation. The large *Eos* and *Lorius* species are quite capable to dig burrows into the soft wood of some palm trees. The smaller *Charmosyna* species and the Rainbow lorikeets of the genus *Trichoglossus* are more seeking existing caves. I could even see some couples in the caves of kingfishers.

Almost all lories and lorikeets are extremely curious and with a little bit of patience you can attract them with a bowl of sugar water. Even more, they are attracted by sweetened condensed milk, sometimes you will be able to get your hand on Papuan lorikeets, *Charmosyna papou*.



▲ *Red-collared lorikeets (Trichoglossus rubritorquis) are synanthropic first beneficiaries.*

Since almost all lories and lorikeets are synanthropic, they can be watched very well in populated areas. We were able to follow them parallel to the observations on kingfishers in the Nemayer River area during the building up of oil palm plantations. They were one of the few beneficiaries of the plantation, because of permanent food supply. They can be found not only in the blooming palm trees, but also in the part of land where the "guest workers" produce their fruit and vegetables. Here they are not always welcome, although many people feed these birds in the village. Also on the plantations

they make trouble. Although they contribute to pollination, many flowers are destroyed in search of nectar and bring no harvest.

Initially the owners tried to reduce the lories and lorikeets by shooting, but this had no success and so it was allowed to grant them. Meanwhile, the tide has turned, because by the use of pesticides, many of the birds were infertile. In particular the Rainbow lorikeets suffer from ulcers and tumours. Since two years, they could no longer breed. Fortunately only very few new animals moved from the vicinity into the plantation.



▲ Satellite map of the Nemayer River area with Seren Creek in north-western Papua New Guinea on the border to West Papua with localities of Chilatherina axelrodi (yellow), Chilatherina cf. crassispinosa (black), Glossolepis cf. kabia (red), Melanotaenia spec. (blue) and Melanotaenia cf. affinis (pink).
 (Mapbase: Google earth/Digital Globe/Landsat)

Final remarks

As can be seen on our observations on kingfishers and lorries and lorikeets and the fishing, the Nemayer system is a very sensitive ecosystem. Any intervention in the habitat has disastrous consequences. We were most surprised how rapidly the consequences can be recognized, and there is no way back. Even species that initially benefited from an oversupply of food, disappear due to over-fertilization and pesticide use. Even at the estuary, these effects can be measured.

As for the decline of fishes, the decline of food animals is the reason because the

insect larvae in the ecosystem are killed by the pesticides. The even larger effect is the entry of phosphate- and nitrate-containing fertilizers affecting the fish. In principle, these are polyphosphates, i.e. long chain phosphates that serve as long-time fertilizer.

A look around in the world shows how much is tried to make globalization “perfectly” work. Their instruments are e.g. TTIP, CETA and TISA. Now it is time that we wake up from our lethargy, stand up and show our governments what *we* want and what *we* not want.

PALM OIL AND PAPUA NEW GUINEA

Palm oil is used for food stuffs, as fuel and in the chemical industry. In Papua New Guinea the palm oil industry is one of the most important agricultural export factors and one of the largest employers. The total palm oil production of Papua New Guinea is exported into the EU, because, in contrast to the oil from Indonesia and Malaysia, there is no import tax levied on it. In 2013 there were 36 projects planned for palm oil plantations covering almost a million hectares, seven times more than what was in use at that time. Experts expect that the land that was leased for the long term will probably largely be deforested, but only one fifth of the area will be replanted with oil palms. [Nelson et al. (2014): Oil palm and deforestation in Papua New Guinea. *Conservation Letters*, 7 (3), 188–195]

In the Nemayer/Bewani region gigantic oil palm plantations are appearing as well. In 2008 one holding from Malaysia has leased there 140,000 hectares for 99 years and has set up oil palm plantations on 26,000 hectares (Bewani Oil Palm Development). These threaten the existence of many species that live there, many of which are endemic to the region. In Papua New Guinea, and especially in the rain forests, live 5 % of all species on earth on only 0.3 % of the surface.

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IRG - Internationale Gesellschaft für Regenbogenfische e.V. (International Rainbowfish Association), founded in 1986, is a community of fishkeepers with special interest in rainbowfishes, blue-eyes, and other freshwater species from Australia, New Guinea and the close-by islands. Most of our 500+ members live in Europe. 100+ species and varieties are kept and homebred in our aquaria. In regional meetings fish and information are exchanged. Our transnational, annual convention brings together many members and sees presentations of experts and the world's largest rainbowfish sale. The date is fixed each year to the second weekend of June.

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