

A contribution to the knowledge of the microcrustacean and aquatic beetle fauna of Wildcliff Nature Reserve: a preliminary report

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Introduction

Freshwater ecosystems of the world have a diverse invertebrate fauna, consisted of very different animal groups. Although zoologists (unlike botanists) do not treat the Cape Region as a separate zoogeographical kingdom, but as a part of the Ethiopian region, the Western Cape is known as a faunal diversity "hotspot," harboring many endemic taxa. Compared to other Ethiopian regions, the fauna of the Western Cape is well known, which means that a large proportion of freshwater invertebrate species had been described scientifically. However, taxonomic revisions of many groups are urgently needed, and in most cases very little is known about the biology (geographic distribution, life cycle, habitat preference, ecological demands) of the region's freshwater invertebrates. Some special freshwater habitats, such as interstitial waters, are worldwide underexplored, as they are also in South Africa.

The present study takes place in the Wildcliff Nature Reserve (see map, Figure 1), which was created in 2007 with the goal of conserving the unique fynbos ecosystem of the Cape Floristic Region. Wildcliff has a number of freshwater habitats, including sections of the Wildekrantz and Platteklouf rivers as well as some small tributaries, springs and swamps. Aquatic fauna of this particular area has never been previously investigated, although there are some data from the nearby Heidelberg region.

The selection of microcrustaceans and water beetles as study groups was somewhat arbitrary, and reflects only the interests and experience of the author. Other aquatic invertebrate groups like trichopterans, dipterans or water mites would be as worthy to study as the groups treated in this report.

During July and August 2008 qualitative samples were taken from different aquatic habitats of Wildcliff, trying to sample all representative habitat types. This report is preliminary, because the collected samples have been only partly analyzed, and animals only partly identified up to the moment. Neither the number of samples, nor the short collection period, restricted to winter months, allowed one to collect all taxa occurring at Wildcliff.

Brief description of the selected groups

"**Microcrustaceans**" is an artificial group (like "four legged animals", or "edible plants") consisting of three different phylogenetic lineages of crustaceans. The three lineages are the cladocerans, copepods and ostracods. These have little in common except for their size, which ranges from approx. 0.4 to 5 mms.

- **Cladocerans** (also known as "water fleas") belong to the phyllopod crustaceans. The group may be polyphyletic, consisted of four different phyllopod orders, sharing common features like small size, two branched antenna and other features. All Wildcliff species belong to the order Anomopoda. All cladocerans are freshwater animals (several species tolerating brackish water). Most cladocerans are planktonic crustaceans and filter feeders (feeding on fine-particled organic material, planktonic algae and bacteria dispersed in water). Like other planktonic organisms, they inhabit mostly standing waters, or the lower reaches of rivers. Several cladoceran families, like macrotrichids and chydorids however, are benthic or metaphytic (living on bottom or on aquatic plants) and they are able to colonize even the mountain rivers and springs. Carapaces of cladocerans are not calcified. An important feature of this group is that almost all (or all?) species can produce drought resistant eggs, which is an adaptation to the temporary freshwater habitats. Drought resistant eggs remain viable over years, and being very small, they can be carried hundreds of miles by the wind, or stuck into the mud on the legs of migratory waterbirds. Because of this, some species may have very wide, intercontinental or cosmopolitan distributions. The very widespread species are not always ubiquitous in the ecological sense: they

can have very specific habitat demands.

- **Copepods** form a very large superorder, in which the vast majority of species is marine. Three orders are known in freshwater: calanoids, cyclopoids and harpacticoids, all of them well represented in the Western Cape Region. Calanoids are euplanctonic animals: no calanoid was found at Wildcliff. Cyclopoids are partly euplanctonic, partly benthonic or metaphytic, all active swimmers. They are abundant in almost all types of standing water. In mountain rivers they are restricted to microhabitats where the flow is weak, such as in deeper pools, at the shallow shore region, or in the interstitial waters. Most cyclopids are omnivorous. Almost all (or all?) species have drought resistant forms (eggs and/or resting juvenile) stages. Many species are known to be cosmopolitan. Harpacticoids are creeping benthic forms, unable to swim. They have several species in standing waters, but most of the freshwater species live in springs, streams and rivers. They are common in specific microhabitats, such as interstitial waters or among wet mosses. This is a very diverse and difficult group with many undescribed species. The South African fauna is very poorly known. Copepods do not have calcified carapaces.
- **Ostracods** have calcified bivalved shells. Most of species are marine, but there are many freshwater species. The Ethiopian region has a remarkable freshwater ostracod diversity. Most fresh species are benthic or metaphytic, some of them are capable to swim, others not. They occur in almost all freshwater habitats, some species require special microhabitats. Many species have drought resistant eggs. Western Cape is known as an ostracod diversity centre with many endemic species. However, many "endemic" species can be more widespread in Africa, believed to be endemic only due to the scarce information about their distribution.

Water beetles is a collective name of the several beetle families living in freshwater.

Whirligig beetles (Gyrinidae) are adapted to the life on water surface. They are predators. Their larvae are benthic predators. Many species (some of them endemic) are known from Cape Region, inhabiting both flowing and standing waters.

- **Haliplids** are small, phytophagous beetles, capable of swimming. They prefer standing, warm water bodies, overgrown with plants and algae. They are related to gyrinids and dytiscids, and have some species in South Africa.
- **Dytiscids** (diving beetles) are related to gyrinids, but they live in the water, not on the surface. Adults are able swimmers, adults and larvae are both predators. They have many species in standing and slow flowing, less in fast flowing waters. A diverse group with many species (and endemisms) at Cape Region.
- **Hydrophilids** (water scavenger beetles) are not related to the former groups. Most of species are clumsy swimmers, they prefer to creep on the bottom or on water plants. Adults are herbivores or omnivores, larvae are predators. Most species prefer standing or slow flowing waters, one of their subfamilies contains semiterrestrial and terrestrial beetles.
- **Hydraenids** are very small (1-2 mm) water beetles, most species live in fast flowing streams. Adults and larvae eat algae and detritus. They are creeping forms unable to swim. A difficult group, with many South African species.
- **Dryopoids** form another lineage, unrelated to the others, consisting of the Dryopidae and Elmidae families. Most species are riverine. Dryopoids are creeping forms, unable to swim. Adults and larvae feed on algae and detritus.

Most water beetles are efficient fliers, so they are able to colonize new water bodies and escape droughts. However, unlike drought-resistant eggs, they cannot travel hundreds of miles across oceans, deserts or any uninhabitable areas. Cosmopolitan species are very rare, and at Cape Region many local endemisms occur.

State of knowledge about the South African microcrustacean and water beetle taxa

The first substantial works on South African microcrustaceans are the monographs of G. O. Sars (Sars 1916, 1924, 1927). These remain basic references today, which tells one something about the state of our knowledge. Sars found that many South African cladoceran and copepod (but no ostracod!) species are morphologically identical with the species known from other continents. This finding was easily explicable with the excellent distribution ability of the drought resistant eggs, so the concept of "cosmopolitanism" was widely accepted by taxonomists working on cladocerans and copepods. However, in the case of chydorid cladocerans this concept seems to be seriously threatened, as recent, very systematic studies reveal that some "cosmopolitan" species are in fact a group of morphologically

similar but clearly distinguishable species which are geographically separated (Seaman et al., 1999). Very likely, the same is true to the cyclopid copepods. The South African cladoceran and cyclopid fauna needs a taxonomic revision. Hence identifications in this work have to be treated with caution. Our knowledge of South African ostracod taxa is more reliable, thanks mostly to the recent works of Koen Martens (Martens, 2001). However, riverine ostracods are underexplored in South Africa. Beetles are better known than the microcrustaceans, being larger and more obvious creatures. First collection and description efforts on the South African beetles (including aquatic ones) began as early as in the 18th century. However, the most important monographs and revisions have been published in the 20th century. The most important contributors were (or are) Brinck (Gyrinidae), Omer-Cooper and Bistrom (Dytiscidae), Perkins and Balfour-Browne (Hydraenidae), Endrody-Younga (Hydrophilidae and some related groups) and Deleve (Dryopoidea). Some museums like the Albany Museum in Grahamstown or the Transvaal Museum hold excellent collections, which facilitates research work. Some groups – such as Hydrophilidae – still need taxonomic revision. Much less is known about the life history or ecology of South African water beetles, as few studies have been done on this topic. Labels on museum specimens and even taxonomic publications record only the date and the locality of the collection, at best with a brief mention of the habitat like “swamp” or “river.”

Materials and methods

All collections were done during July and August 2008. Microcrustacean samples were taken with a hand planktonic net. Interstitial samples were taken with the Karamann-Chappuis method (small holes were dug in the riverbed, and the interstitial water flowing in the holes was filtered through the plankton net). Beetles were captured with a larger net, or simply picked up with hand, after careful examination of their habitats. All samples must be regarded qualitative.

Samples were conserved with 90% ethanol, and animals from the mud samples were picked out under a binocular stereomicroscope. Identifications were done using the works given in the bibliography.

Preliminary results

In this listing, only the checked and identified material is included.

Cladocera

- *Ilyocryptus sordidus* (cosmopolitan, bottom mud dweller): side spring of Peterkloof, pools under the fall
- *Monospilus dispar* (cosmopolitan, bottom mud dweller): Wildekrantz River, lower fall
- *Alona gr. rustica*: side spring of Peterkloof, wet moss, and rockpools;
- *Alona cf. Intermedia*: moss spring at lower Wildekrantz valley; side spring of Peterkloof, rockpools under the fall

Copepoda

- *Paracyclops gr. fimbriatus*: side spring of Peterkloof, rockpools over and under the fall; Wildekrantz river: bottom at the entrance of Hidden Valley, and rockpool close to the Lower Fall; moss spring at lower Wildekrantz valley
- *Eucyclops gibsoni* (an African species): Wildekrantz river: interstitial habitat at Hidden Valley, bottom at Hidden Valley entrance; side spring of Peterkloof, upper pools
- *Macrocyclus albidus*: rockpool close to the Lower Fall, Wildekrantz River
- *Ectocyclus phaleratus*: rockpool close to the Lower Fall, Wildekrantz River

Ostracoda

- *Penthesilenula brasiliensis* (no males of this species are known): Wildekrantz River, Lower Fall, moss; side spring of Peterkloof, moss
- *Humphycypris greenwoodi* (only females): side spring of Peterkloof, moss and rockpools under the fall
- *Candonopsis sp.* (males and females): large meadow swamp, swamp at Hidden Valley

Gyrinidae

- *Dineutus grossus*: Peterkloof, side spring of Peterkloof
- *Aulonogyrus formosus*: Peterkloof, side spring of Peterkloof

- *Aulonogyrus varians*: Plattekloof River, Wildekrantz River
- *Aulonogyrus capensis*: Plattekloof River, Wildekrantz River

Dytiscidae

- *Laccophilus cyclopiis*: bridge pool
- *Uvarus peringueyi*: bridge pool, large meadow swamp
- *Hydroglyphus infirmus*: bridge pool,
- *Hydrovatus cotumax*: bridge pool
- *Hydropeplus trimaculatus*: bridge pool, Wildekrantz river, misty meadow pool, Hidden valley swamps
- *Hydropeplus montanus*: bridge pool
- *Darwinhydrus solidus*: Misty Meadow swamp
- *Canthyporus hottentotus*: bridge pool, Misty Meadow swamp
- *Canthyporus petulans*: bridge pool, Hidden Valley
- *Canthyporus testaceus*: Hidden Valley
- *Herophydrus gr. inaquinatus*: Misty Meadow swamp
- *Copelatus capensis*: Misty Meadow swamp, bridge pool,
- *Agabus raffray*: Misty Meadow swamp
- *Hydaticus capicola* + *Hydaticus galla* (only the males are distinguishable): bridge pool, Misty Meadow swamp
- *Hydaticus servilianus*: bridge pool

Haliplidae, Hydrophilidae: all the material is unidentified at this point

Hydraenidae

- *Ochtebius andronicus*: bridge pool
- *Parastetops nigritus*: Misty Meadow swamp, bridge pool, Plattekloof river, Wildekrantz River at Hidden Valley

Dryopidae

- *Strina sp.*: Wildekrantz river, Plattekloof river

Elmidae

- *Elpidelmis capensis*: Wildekrantz river, Plattekloof river
- *Elpidelmis fossicollis*: Plattekloof river
- *Ctenelmis discrepans*: Wildekrantz river
- *Ctenelmis incerta*: Wildekrantz river
- *Ctenelmis elegans*: Wildekrantz river

Discussion

Aquatic habitats of Wildcliff Nature Reserve and their microcrustacean and water beetle fauna

Most aquatic habitats of Wildcliff are related to mountain stream ecosystem. The Wildekrantz and Plattekloof rivers are typical permanent mountain streams, with fast-flowing riffles, deeply engraved canyons, frequent waterfalls, and rocky bottoms, with little and patchy sediment accumulation. All the examined part of the Plattekloof river, its tributaries and the lower reaches of the Wildekrantz river (downstream from Ena's Falls) are surrounded by forest (indigenous or black wattle, *Acacia mearnsii*).

At the forested stretches most of the organic material available for the animals originates not from the aquatic plants living in the stream itself, but from the litter falling into the stream from the surrounding forest (allochton food). Some autochton food production is also characteristic, produced by the algal coat of the stones, by patches of filamentous green algae in several places (more frequently at Plattekloof river, and usually in pools), and by a grass-like submerged macrophyton characteristic to some riffles. Mosses of the falls and adjacent springs also contribute to the production. The proportion of the autochton food is probably higher at the upper reaches of the Wildekrantz River, along the Hidden Valley, where the river is surrounded by fynbos instead of forest. Here the river receives much less dead plant material from the shores, but the fynbos allows the light to penetrate into the river facilitating the growth of algae. However, there are few large clumps of algae along the Hidden Valley section, as the stream water here is most probably very poor in organic nutrients (oligotrophic). The

grass-like plant is also characteristic to the Hidden Valley riffles, and the margins of large sections are overgrown with the palm rush (*Prionium serratum*). The water column itself contains very little nutrients, so planktonic (floating) life forms are virtually absent, in sharp contrast to the richness of the bottom dwelling fauna. Invertebrates can be grouped as shredders (litter feeders), algal grazers, filter feeders, collectors (fine sediment feeders), predators and parasites.

As in other cold, rapid-flow streams, the water of Wildcliff streams is well oxygenated. Because thick sediment layers cannot build up, even local hypoxic conditions seldom occur.

Almost all Langeberg streams originate from chalk-poor sandstones, so their water has very low ionic content. Due to this, their water is slightly acidic (pH around 6-6.5) due to the dissolved carbon-dioxide and tannic acids. Acidic streams are known to be dominated by insect larvae, molluscs and crustaceans being more abundant in chalk-rich streams.

Both principal Wildcliff rivers are permanent, so drought has little effect to their fauna. Occasional floods cause severe disturbances. Animals can seek shelter at less affected microhabitats, as are the pools, marginal flooded areas and the interstitial habitats.

As the temperature of the mountain stream waters is relatively constant over the year, many riverine invertebrates occur through the year, although their breeding can be seasonal. Only insects with terrestrial adults (like dragonflies, caddisflies or midges, but unlike water beetles) show characteristic seasonality.

Near the invertebrate predators and parasites, in the rivers of Wildcliff rivers also harbor two little fish species preying on invertebrates.

Riffles are microhabitats with strong flow and stony bottom, without sediment accumulation. Stones can be overgrown with algae (mainly diatoms), and a grass-like macrophyton growing on riffle rocks is abundant at some places at both rivers. Typical riffles are not suitable for microcrustaceans, although in the shadows of rocks, or in the deeper points where some sediment accumulation exists some species mentioned at pools can occur. Some creeping forms of water beetles however are riffle specialists. They are especially abundant among the leaves and roots of the grass-like plant. *Strina* sp. (Dryopidae) is the dominant beetle species of Wildekrantz river, invading even the pools, frequently associated also with dead wood. It also occurs in Platteklouf river, but there is much less abundant. *Elpidelmis* spp. and *Ctenelmis* spp. (Elmidae) also occur in both rivers; they seem to be closely associated with submergent riffle macrophytes. *Strina* and *Elpidelmis* are both endemic to Western Cape (a single *Strina* species is known also from Eastern Cape). Some species of Hydraenidae (especially *Parastetops nigratus*) are also common among riffle macrophytes.

Pools are deeper or marginal stream parts, where the water is quite or standing, and there is a sediment accumulation on the bottom. Pools have a diverse microcrustacean fauna in Wildcliff rivers, mostly consisted of ubiquitous species also frequent in some types of standing waters. Chydorids are abundant, and the species composition of the assemblages is variable. Cyclopids are also frequent: *Paracyclops* gr. *fimbriatus*, *Macrocyclus albidus*, *Eucyclops* sp., *Tropocyclops prasinus* and *Ectocyclops phaleratus* are some characteristic species. There is also a harpacticoid species inhabiting pools. Troops of *Aulonogyrus* whirligig beetles frequently inhabit the surface of the pools. The two larger rivers (Wildekrantz and Platteklouf) are inhabited by mixed flocks of *Aulonogyrus capensis* and *Aulonogyrus varians*, while the Peterklouf and its side-spring are inhabited by *Aulonogyrus formosus* and by the huge *Dineutus grossus*, an afrotropical whirligig beetle. Pools also have some dytiscid fauna, mainly consisted of the ubiquitous *Hydropeplus trimaculatus* (a Cape endemic) and *Canthyporus* spp. Waterfalls are not only among the most beautiful parts of Wildcliff's rivers, but they are also very interesting habitats. Trickling water supports rich moss flora, which represents an always wet, semi-aquatic microhabitat. Although it seems to be less species rich than similar habitats produced by springs, it still has a special fauna, consisted of chydorids like *Monospilus dispar*, harpacticoids, and the cosmopolitan ostracod species, *Penthesilenula brasiliensis*, which seems to be a microhabitat specialist. Some semiterrestrial hydrophilid beetles also inhabit this so called hygropetric habitat. Spring-related wet mosses seem to be even richer in species, among others the ostracod *Humphycypris greenwoodi*, which is known as a South African endemic, reported here first time from the Cape region. (This species was caught right outside the border of Wildcliff).

The water flowing inside the riverbed, in the crevices between sand grains and gravel, is called interstitial water. Many bottom dwelling animals penetrate into the interstitial realm, but there are almost always also specialists, adapted to the interstitial conditions. These species always show adaptations to the subterranean life: they are blind, colorless, adapted to tolerate hypoxic conditions and famine. They are frequently elongated, wormlike or very small, to move effectively in the crevices. The bed of Wildcliff's rivers consists of coarse sand, without much clay, so the water is able to penetrate easily into the crevices. This means quite favorable conditions for interstitial animals – they always get fresh water from the aboveground flow, rich in oxygen and food particles. Surprisingly, I did not find any stygobiont (adapted to subterranean waters) microcrustaceans at Wildcliff. Chydorid and cyclopoid species characteristic to the pools penetrate also into the interstitial waters, sometimes in great numbers. Bathyellaceans form a worldwide distributed ancient malacostracan group (distantly related to crabs, crayfishes, isopods and amphipods), specialized to subterranean waters. They are several millimeters long, slender, wormlike, colorless and blind. The bathinelloids found at Wildcliff mean the first known occurrence of this cosmopolitan group in Western Cape Region. This is because the interstitial realm is very underexplored in Southern Africa. A clearly subterranean (blind, colorless, small and wormlike) isopod species also occurs in Wildekrantz River's interstitial water. (Isopods are known also as woodlice, the latter being the most known representatives of this large and diverse crustacean group. They are distant relatives of crayfishes and crabs, too). (These materials have been left with Gavin Gouvs from Albany Museum, Grahamstown for identification).

There are no large standing waters at Wildcliff, but the deep, probably man-made pool at the bridge is permanent, as are the four pools made by dams. There are also several temporary marshes at the meadow and at the Hidden Valley. The latter are exclusively floodplain marshes heavily affected by Wildekrantz river's water level, while the "Misty Meadow swamp" and the marshy region of Talari stream are unaffected by the river. Dam pools were not investigated: however it seems unlikely they have a rich or unique fauna, because they most probably are poor in nutrients (oligotrophic). Meadow pools and marshes get full sunshine, and are heavily affected by cattle dung. So these habitats are very productive, emergent macrophytes (sedges) and filamentous green algae being the major producers, while the cattle dung presents the most important allochthonous food source. In this case it seems that the organic pollution increases the species number. Organic sediment (peat) accumulation is strong. These shallow, sun-exposed waters can warm up considerably. In sharp contrast to the riverine habitats, hypoxic conditions may occur during the warm period, as warm water can dissolve less oxygen, and the decomposition of the organic matter is also faster in warm water, consuming more oxygen. In addition, all invertebrates, fishes and amphibians require much more oxygen at warm temperatures, as their life supporting functions get faster. The organic pollution increases the frequency and severity of hypoxic conditions, as the decomposition of the organic material needs oxygen. However, it is unlikely that severe hypoxia is characteristic even in the seemingly most polluted "bridge pool," as some riverine species (like the freshwater crab, or the Cape Kurper) also flourish there. The Misty Meadow swamp periodically dries out, which makes it uninhabitable for fishes or crabs, and sometimes causes the death of many tadpoles. Swamp invertebrates (and vertebrates) adapt their life cycles to the seasonal changes as having drought resistant developmental stages (like microcrustaceans) or developmental stages in which they are capable of leaving the water (like adult water beetles or frogs).

The "bridge pool" has a very diverse microcrustacean and water beetle fauna. Diverse chydorid and cyclopoid assemblages, one harpacticoid species, and two or three ostracod species (unidentified yet) form the microcrustacean fauna. Water beetles of the bridge pool belong to four families: Haliplidae (one species unidentified yet), Dytiscidae (most of them identified), Hydrophilidae (unidentified yet) and Hydraenidae (only partly identified), dytiscids and hydrophilids being the most diverse. Dryopoid families are entirely missing, being riffle-adapted beetles. Many chydorid, cyclopoid and dytiscid species found at "bridge pool" also occur in riverine pools (like *Eucyclops* spp., *Hydropeplus trimaculatus*, *Canthyporus* spp.), other species require warm, standing water and/or submergent water plants and organic debris so these species do not occur in rivers. The very small dytiscids *Uvarus* and *Hydroglyphus* for example are warm loving beetles attached to filamentous green algae (although they are predators). *Hydrovatus* spp. belong to a tropical group, and require macrophyte beds as habitats. Almost all members of aquatic hydrophilids prefer the vegetated standing water bodies, with rich, organic debris, and so do some hydraenid species.

The Misty Meadow swamp has a very similar fauna; the differences are mostly caused by the temporary character of the swamp. An ostracod species belonging to *Candonopsis* is very abundant here. The

swamp at Far Meadow is connected to the Wildekrantz River, and holds a mixture of swamp and river pool species.

Floodplain pools at Hidden Valley show an impoverished version of the meadow pool fauna, with fewer species. Their fauna is closer to those of the river pools (in fact, they actually are river pools when the water level is high!), lacking real standing water species. They are nutrient poor habitats, often even shadowed by fynbos plants, as they lie in deeply engraved grooves.

Other aquatic taxa

Bathynellaceans and interstitial isopods (see above). Up to the date they are only known from the interstitial water of the Wildekrantz River at Wildcliff.

Mesamphisopus sp.: members of this highly interesting Western Cape endemic isopod genus, with confusing taxonomy, and scattered distribution in Western Cape rivers were collected only along the Hidden Valley section of the Wildekrantz River, from the river itself, and also from the adjacent pools. They are clearly benthic, detritus-loving animals, seemingly avoiding strong current. They may, or more probably may not, occur also along the forested river stretches: they are possibly associated with palm rush (*Prionium*) stands. Clarifying the microhabitat preferences of this rare (or at least rarely collected) endemic animal is a topic worthy for further research! (The collected material is with Gavin Gouvs for identification).

Paramelita sp.: This amphipod genus is endemic to Western Cape, where many closely related species occur. At Wildcliff I collected them mostly from springs, wet moss falls, but also from the Wildekrantz River at the entrance of Hidden Valley (at the latter place together with *Mesamphisopus*), and from the "bridge pool". Not necessarily all the animals collected belong to the same species. (Most of material is with Gavin Gouvs).

Common Cape freshwater crab (*Potamonautes perlatus*): it is the most widespread and common freshwater crab species at Western Cape. No other freshwater crab species were found at Wildcliff. I collected the crabs from the Plattekloof and Peterkloof rivers, and from the "bridge pool" (where it seems to be abundant). It reportedly also occurs in the Wildekrantz River (Brett Noppe's observation).

Cape Kurper (*Sandelia capensis*): This Cape endemic riverine fish was already known from Wildekrantz River. I collected it from the "bridge pool", where a self sustaining breeding population seems to occur (although during serious floods, the bridge pool can be connected to the river). It occurs also at Duivenshok (I collected it at the palm rush overgrown vlei-stretch crossing the Heidelberg-Wildcliff road). Seemingly avoids the small headwaters (like the Peterkloof).

Cape Galaxias (*Galaxias zebratus*): this small Cape-endemic fish is very abundant at Peterkloof river, and I also collected it from Wildekrantz river (Misty Meadow part), and from a small tributary of Duivenshok (outside the Wildcliff area). It inhabits even the headwaters, where the Cape Kurper is missing, but may be less tolerant to hypoxia and warm water. It seeks pools, and keeps to the bottom to avoid strong current.

Cape ghost frog (*Heleophryne purcelli*): I collected immature animals (not tadpoles) twice from the Wildekrantz River, in Hidden Valley. It is an endemic species with very narrow range, and it is a mountain stream specialist.

Remarks about conservation

The major human impacts affecting some Wildcliff waters are the changes of the riparian vegetation, and the organic pollution caused by the cattle dung.

Rivers are strongly affected by the riparian vegetation. The stretches surrounded by fynbos rely mostly on autochton food production (see above) , while the forested stretches rely mostly of allochton food provided by forest litter. They also offer different microhabitat types: dense palm rush stands are very characteristic to the fynbos stretches, and are entirely absent from the forested parts; twigs and branches fallen into the water, allowing some water beetles (*Strina* sp.) to cling and feed on them are

characteristic to the forest. Most probably the composition of invertebrate community changes markedly, when the forest is cut, or contrary, when the invasive black wattle (*Acacia mearnsii*) overgrows the shores. Such changes were documented in other parts of the world (and I think, several investigations were carried out also at Western Cape: the best is to ask Jenny Day about it). Another interesting (maybe unexamined) question is the difference in the effect of the indigenous forest and the black wattle forest on the freshwater communities. Litter of different tree species can have very different nutritional value and decomposition speed, which can affect strongly the freshwater fauna relying on this food source. My short term and qualitative examinations do not provide answers for these important and complicated questions. Possibly several rare species can be restricted to the fynbos river stretches with palm rush (*Mesamphisopus*?) but only much more detailed quantitative investigations can give any reliable answers.

The impact of cattle dung pollution is simpler to answer. The strongly affected habitats are the meadow swamps and marshes, which are the most diverse aquatic habitats at Wildcliff. Cattle dung turns these waters more productive, while I have not observed signs of hypoxic conditions or toxicity. (That may occur during the summer, but it is not very probable, as some riverine animals also live in the bridge pool). The unaffected, pristine pools at Hidden Valley have a much less diverse fauna, more similar to the riverine faunas, but the lack of cows is not the sole difference between the meadow and fynbos pools.

Suggestions for possible further research

1. Study of other freshwater invertebrate taxa (trichopterans, dipterans etc.)
2. Semiquantitative or quantitative sampling year round, comparing different river stretches and microhabitats – if possible, combined with the water chemistry measurements
3. Detailed investigation of hygropetric habitat (wet moss of springs and falls)
4. Detailed investigation of the small scale distribution and biology of several rare and interesting species (I would select *Mesamphisopus*)

Bibliography

- Appleton, C. C. 2002: Mollusca. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 6. Aranea and Mollusca. Water Research Commission, Pretoria
- Bistrom, O., 2007: Dytiscidae. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 10. Coleoptera. Water Research Commission, Pretoria
- Brinck, P., 1955: Gyrinidae. A monograph of the whirligig beetles of Southern Africa. In: Hanstrom, B., Brinck, P. and Rudebeck, G. eds.: South African Animal Life. Vol. 1. Almqvist and Wiksell, Stockholm:329-518.
- Dumont, H. J. 2001: Bathynellacea. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 4. Crustacea III. Water Research Commission, Pretoria
- Griffiths, C. L. and Stewart, B. A. 2001: Amphipoda. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 4. Crustacea III. Water Research Commission, Pretoria
- Hart, R. C., Stewart, B. A. and Bickerton, I. B. 2001: Decapoda. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 4. Crustacea III. Water Research Commission, Pretoria
- Kensley, B. 2001. Isopoda. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 4. Crustacea III. Water Research Commission, Pretoria
- Martens, K. 1997: On two new crenobiont ostracod genera (Crustacea, Ostracoda, Herpetocypridinae) from Africa and Asia Minor, with the description of a new species from dolomitic springs in South Africa.

Southern African Journal of Science 93: 542-554.

Martens, K. 2001: Ostracoda. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 3. Crustacea II. Water Research Commission, Pretoria

Nelson, H.G. 2007: Elmidae. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 10. Coleoptera. Water Research Commission, Pretoria

Nelson, H. G. 2007: Dryopidae. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 10. Coleoptera. Water Research Commission, Pretoria

Omer-Cooper, J. 1965: Coleoptera: Dytiscidae. A review of the Dytiscidae of Southern Africa being the results of the Lund University Expedition 1950-1951, with which are incorporated all other records known to the author. In: Hanstrom, B., Brinck, P. and Rudebeck, G. eds.: South African Animal Life. Vol. 1.

Almquist and Wiksell, Stockholm: 59-214.

Perkins, P. D. 2007: Hydraenidae. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 10. Coleoptera. Water Research Commission, Pretoria

Rayner, N. A. 2001: Copepoda. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 3. Crustacea II. Water Research Commission, Pretoria

Sars, G. O., 1916: The freshwater Entomostraca of Cape Province (Union of South Africa) I. Cladocera. Annals of South African Museum 15: 303-351.

Sars, G. O., 1924: The freshwater Entomostraca of Cape Province (Union of South Africa) Ostracoda. Annals of South African Museum 20: 195-211, pls.21-25.

Sars, G. O., 1927: The freshwater Entomostraca of Cape Province (Union of South Africa). Part III. Copepoda. Annals of South African Museum 25: 85-149.

Seaman, M. T., Kok, D. J. and Watson, M. 1999: Cladocera. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 2. Crustacea I. Water Research Commission, Pretoria

Stals, R. 2007: Gyrinidae. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 10. Coleoptera. Water Research Commission, Pretoria

Stals, R. and Endrody-Younga S. 2007: Hydrophilidae: Hydrophilinae. In: Day, J. A., de Moor, I. J. and Louw, A. E. eds: Guides to freshwater invertebrates of Southern Africa. Vol. 10. Coleoptera. Water Research Commission, Pretoria

Figure 1. Wildcliff Nature Reserve in South Africa.



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