Internal Report

A PRELIMINARY SURVEY OF THE MACROINVERTEBRATE FAUNA OF THE RIVERS OF THE FORMER TRANSKEI REGION WITH NOTES ON THE FRESHWATER SNAILS (MOLLUSCA), FRESHWATER PRAWNS (DECAPODA), MAYFLIES (EPHEMEROPTERA), CADDISFLIES (TRICHOPTERA) AND BLACKFLIES (DIPTERA: SIMULIIDAE)

Prepared for Eastern Cape Nature Conservation

Submitted by: S.J. Mangold and F.C. de Moor

Department of Freshwater Invertebrates
Albany Museum
Somerset Street
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INTRODUCTION

Very little is known about the freshwater fauna of the Transkei region. Historically, the region has been grossly undersurveyed, which may be partially attributed to the "homeland era" which spanned almost two decades. This situation is reflected in the records of the National Collection of Freshwater Invertebrates, housed at the Albany Museum, which contains only a few scattered records from river systems flowing through this region.

Biogeographically, the former Transkei falls within a unique climatic transitional zone along the eastern seaboard. The region is characterised by a gradation from the more tropical conditions prevailing in KwaZulu-Natal and the more sub-tropical and temperate conditions associated with the southern Cape. The coastal strip is governed by maritime effects of the warm Mozambique current bringing with it mild weather conditions and summer rainfall. Inland, however, the high altitude of the Drakensberg escarpment gives rise to a different set of climatic conditions governed by cooler temperatures and montane precipitation. As a result, the region generally experiences a high annual rainfall, with an abundance of fresh water draining off the windward side of the slopes into several relatively large, unimpounded river systems.

Rural communities depend on the rivers for drinking water, washing of clothes and bathing. As subsistence farming is prevalent in the rural areas, large scale abstraction of water from these rivers is minimal. However, due to poor land use practices and high levels of erosion, a high silt load prevails in some of the larger systems, especially during peak flow in the summer months (eg. Umzimvubu and Kei rivers).

Nontheless, the majority of rivers appear to be in fairly good condition even at the lower reaches. The fact that the rivers are unimpounded and generally undeveloped at present, provides a unique opportunity to study these rivers under almost natural conditions. The collection of baseline data before the rivers are inevitably altered will be invaluable for future comparison and assessment of the environemental effects of such alterations.

Collection of aquatic invertebrates in addition to fish and amphibians enables a more holistic ecological picture to be developed of the rivers sampled. Invertebrates form an essential functional component in aquatic ecosystems. Being both a food source to higher vertebrates and other animals, as well as playing an important role in removing and recycling nutrients, they fill ecological niches ranging from filtering water (eg. blackfly

larvae) to the scraping of algae off rocky substrates (eg. snails and mayflies) to being voracious predators capable of preying on fish and tadpoles (eg. dragonfly nymphs). Some taxa especially several species of freshwater snails are also intermediate hosts of several parisitic trematodes infecting both man and his livestock. Also, some blackfies can, under regulated flow regimes, become serious pests of both man and his livestock.

The presence or absence of sensitive species or, conversely, the proliferation of pollution tolerant species offers some insight into the overall state of health of the river or lake being sampled. A sudden alteration in the faunal assemblage detected during routine biomonitoring, is normally caused by a concomitant change in water quality. This principle forms the underlying basis water quality assessment using biomonitoring techniques. Due to the vast diversity of aquatic macroinvertebrate species, it is therefore essential to develop a baseline inventory of the fauna of a particular river system before long-term biomonitoring can be used as tool for water quality assessment.

For this reason a survey of the biodiversity of aquatic macroinvertebrates of this region is long overdue. Therefore during a two week survey from 22 October to 2 November 1996 as many rivers as possible were surveyed. The survey, by no means a comprehensive one, does give some insight into the diversity of the aquatic invertebrates found there and their biogeographic affiliations to both the tropical and temperate fauna.

METHODS

Sampling

The aim of this survey is to develop an inventory of the fauna found in the region, thus emphasis was placed on qualitative sampling techniques rather than quantitative ones used for the assessment of abundance of various taxa. Therefore, invertebrates were collected from as many biotopes as possible at each site (see table 1 for description of biotopes and table 2 for sites and corresponding biotopes sampled). Sampling of the stones in current (SIC) biotope was done using a standard handnet (300μm net mesh). The net was held vertically in the water while stones, half a metre upstream, were disturbed, with the current washing dislodged animals into the net. The contents of the net was tipped into a sorting tray where individual animals were selected and preserved in 80% ethanol or in Kahles solution (formalin, glacial acetic acid, ethanol and distilled water). In addition, individual stones were examined and sessile invertebrates were handpicked from these.

Sampling of the marginal vegetation (MV) was done by sweeping a handnet through the emergent vegetation along the river banks. The contents of the net were either preserved in formalin or Kahles solution. Whenever posssible, adult aquatic insects flying around the site were also collected. Where logistically feasible, light traps were set up for the collection of adult aquatic insects at dusk and collected the following morning. Light trap samples however, have yet to be analysed.

Each biotope sampled was given a unique catalogue number and biotopes sampled at each site were kept separate. Details such as the lat./long. co-ordinates, pH and conductivity were recorded for each site.

Analysis of samples

Samples were brought back to the laboratory at the Albany Museum for microscopical identification. Molluscs, freshwater prawns, caddisflies, mayflies and blackflies were identified as far as possible, in the majority of cases to specific level. The latter three taxonomic groups all contain good "water quality indicator" species. Owing to time constraints, all other groups were only identified to family or sub-family level. These will be identified further at a later stage. The estimated number of species for each site was calculated by summing up the number of species found in each biotope at each site (see tables 3A and 3B). Therefore the the estimated number of species found at each site which appear in tables 3A and 3B must be treated as a preliminary reflection of invertebrate biodiversity. It is envisaged that the number of species may well increase upon complete analysis of all samples.

RESULTS AND DISCUSSION

River systems and sites are discussed below. Overall biodiversity is assessed with reference to sensitive species and those warranting special conservation status (refer to tables 3A and 3B). The freshwater snail fauna are discussed with reference to disease transmission and implications for community and livestock health. The Trichoptera, Simuliidae and Ephemeroptera (partially analysed at present) are discussed as relating to prevalent environmental conditions.

Biodiversity and conservation status of rivers sampled:

Mzimkulu River system (sites 1, X., 2, 3, 4, 5)

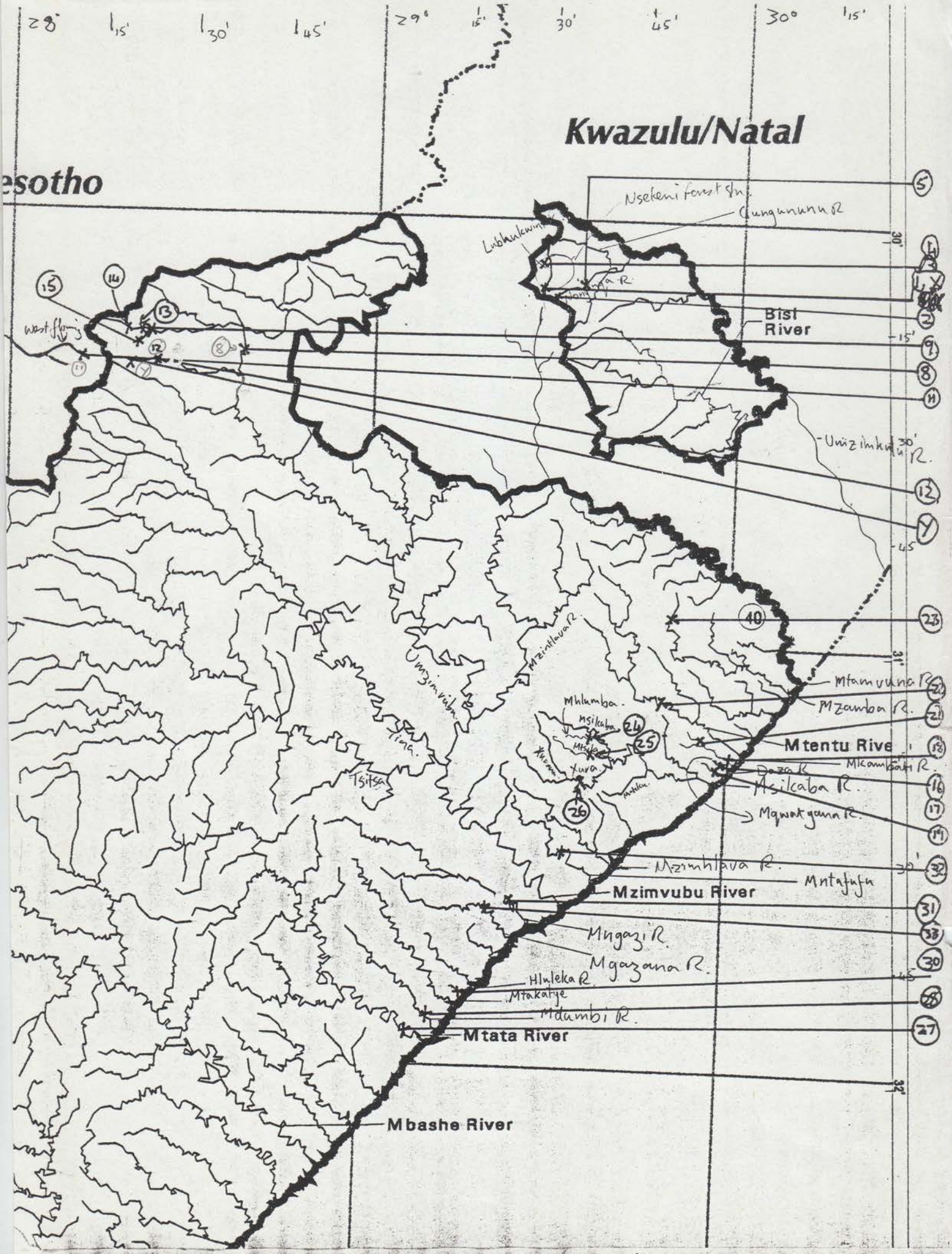
The upper reaches of the Lubbukweni River (sites 1 and X)) was found to have the highest diversity of invertebrates (23 and 26 species respectively) with the lowest habitat diversity, defined as the number of aquatic biotopes at each site (see table 2). The latter is due to the fact that the area sampled is a wetland area with reeds and other emergent vegetation being the chief biotopes available for colonization. The sediments were unfortunately not sampled, which probably resulted in a lower reflection of the estimated number of species living in the wetland system. Fortunately the area falls within the Nsekeni Nature Reserve which should theoretically afford it some conservation protection.

The other sites sampled within this system (sites 2-5) appeared to be lower in species diversity (ranging from 15-17 species) but higher in habitat diversity as they were flowing rivers rather than wetland sponge zones. Notonemourid stoneflies were found at site 2 on the Tom river which are only found in high altitude montane streams with excellent water quality (high dissolved oxygen, low levels of eutrophication, low turbidity and free of heavy metals and pesticides). Tricorythid mayflies and elmid beetles found at site 4 on the Siqubbini River suggest that the water quality there is also good. Sites 3 and 5 show fair diversity with good water quality.

Mzimvubu River system (sites 8, 9, Y, 12, 13, 14, 15)

Biodiversity was found to be fairly high with estimated number of species found ranging from 10 (site 14) to 20 (sites 8, 20). The low number of species collected at site 12 on the Kinira River, only 4 in total, was due to the fact that there was no time to sample the stones in current and marginal vegetation biotopes. The lower diversity of 10 species at site 14 on the Jordan River is probably a result of only the SIC biotope being sampled there.

All sites sampled in the upper reaches of this large river system revealed a comparatively high number of baetid mayflies. Some sensitive leptophlebiid mayflies were found at all sites, except sites 8 and 15, the former site being lower down on the Kinira River outside of the reserve. Hydraenid and helodid beetles also associated with good water quality were found at sites Y, 15 and site 13 respectively. Athericid larvae, another indicator of good water quality was found at site 9 on the Jordan River, while site Y on the Paballong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Kwazulu/Natal
esotho
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Qunqunana R
Lubhulwini
Bisi River
Umzimkulu R.
Mzimhlava R.
Umzimvubu
Tina
Tsitsa
Mhlumba
Msikaba
Xura
Mtentu River
Mtamvuna R.
Mzamba R.
Mkambati R.
Msikaba R.
Mngwatyana R.
Mzimhlava R.
Mntafufu
Mzimvubu River
Mngazi R.
Mgazana R.
Hluleka R
Mtakatye
Mdumbi R.
Mtata River
Mbashe River

managers, conservation authorities and developers involved in EIA's and IEM's which are

Cheum aftn

Type 2

7

1

Chernuti

maculata

H longipenne

Lepto rubtun

Marstem capense

Chinum

Eonus 1

Ecan 2.

Orthetrum hemdi

Hydrpt cunta.

Oecalis sp 1

2.

Gvendes affin

Atty hum

Corndun

Leptodun

Leptocum

River produced blepharocerid fly larvae and pupae. This family is only found in high altitude swift flowing streams with exceptionally high water quality. It was the only site where this family was found. Site 9 also produced another interesting dipteran find which is tentatively identified as a pelechorynchid larva, which is a new family record for Africa.

Orange River system (site 11)

A single site (site 11) was sampled in the upper reaches of the Quthing river in Lesotho, which does not fall in the Ongeluksnek Reserve. Biodiversity was found to be high (20 species) in the stones in and out of current biotopes. A high diversity of baetid mayfly species was found as well as a species of the generally sensitive leptophlebiid family. A representative of the freshwater limpet family Ancylidae was also found here.

Transkei North Coast Rivers

These rivers are especially unique in that they all flow over
Table Mountain Sandstone (TMS). Very low pH values associated with this type of geology were recorded for all rivers in table 3B, with values ranging from 6 (Mqwatyana River) to 3,8 (Mdumbi River). Such low pH values would undoubtedy have an effect on the faunal composition of these rivers.

Mqwatyana River (sites 16 and 17)

A very high diversity of species was recorded from this river (39 species), especially at site 16. Site 17 had less than half the number of species, probably due to the fact that it was sampled just above the tidal reach and no suitable marginal vegetation habitat was apparent. Sensitive species collected include leptophlebiid mayflies, helodid beetles and three species of leptocerid caddisflies. Three species of freshwater prawns were also collected. Water quality assessed on this basis as being good.

Mkambati River (sites 18 and 21)

Biodiversity appears to be fair at the lower site (site 18), but very low at the upper site (site 21). Overall diversity (24 and 7 species respectively) for the above sites was significantly lower than both the Mqwatyana or Daza Rivers. The sensitive leptophlebiid mayfly family and other indicator species such as helodid or psephenid beetles were not

found at either the upper or lower sites.

In comparison to the other rivers sampled in the Mkambati Nature Reserve species diversity in this river is noticeably lower. This may be attributed to the fact that a municipal cattle dip drains into one of the tributaries of this river, approximately one km upstream from the upper site. The pesticides used in the dipping process may well be impacting negatively on the quality of the water, resulting in the absence of the sensitive species. In addition, a pump abstracts from the river just above site 21. The pump is reported to leak diesel into the river from time to time (Joggie, pers. comm.), which, depending on the volume of fuel leaked, in all probability does have an effect on the quality of the water. However, a recovery in water quality lower down was reflected in the greater diversity of species collected at the lower site.

The complete absence of freshwater prawns is due to the fact that the river has no estuary, with fresh water falling directly into the sea from a fairly high waterfall.

Daza River (site 19)

The number of species collected at site 19, estimated at 42 is the highest recorded for rivers within Mkambati Nature Reserve. All possible biotopes were sampled with the light trap sample still to be analysed. New species may well be found in this sample. Indicator species of good water quality collected include a freshwater amphipod, a diversity of baetid mayflies, heptageniid and leptophlebiid mayflies, a chlorocyphid damselfly nymph, perlid stonefly nymphs, a species of hydraenid beetle and the highest recorded diversity of caddisflies. This relatively small river appears to be in a pristine state.

Mtentu River (site 22)

This large river system produced the second highest number of species recorded (45 species) during this survey from the four biotopes sampled. For such a large system with many tributaries, diversity was found to be remarkably high at the middle reach sampling site. Indicator species of good water quality collected include heptageniid, leptophlebiid, tricorythid and four baetid mayfly species, perlid stonefly nymphs, three leptocerid caddisfly species, psephenid beetles and athericid fly larvae. Water quality in the middle reaches of the river is deemed to be exceptionally high.

Mzamba River (site 23)

This river was sampled in the upper reaches and produced a healthy diversity of species, 30 in total. Both stones in current and marginal vegetation biotopes were sampled. An estimated seven species of mayfly were recorded (the same families found at the Mtentu river site). Psephenid beetle larvae and perlid stonefly nymphs were also collected here. Based on the species collected, water quality is assessed as good.

Msikaba River system (sites 24, 25, 26)

Several tributaries of this river system were sampled with the Mhlumba and Mtsila Rivers producing fair diversity (32 and 30 resectively) and the Xura alarmingly poor diversity (seven species in total). Sensitive species collected in the former two rivers but absent in the latter river include leptophlebiid mayfly nymphs, hydroptilid caddisfly larvae. In addition, psephenid beetle larvae and perlid stonefly nymphs were collected at the Mhlumba River site. Based on these findings, water quality is deemed best at site 24, followed by site 25 and apalling at site 26. The latter site, near the large town of Lusikisiki, was noted to be full of litter with large blooms of algae indicative of eutrophication.

Mtata River system (site 27)

This large river system was sampled at its lower reaches and appeared degraded at this site. Eutrophication was evident, with blooms of brown algae prevalent. Diversity of invertebrates was extremely poor (seven species) except in the crustacea with three species of freshwater prawn collected from this site. As these species were numerically abundant, it is assumed that the algal blooms were being utilized as a food source, either directly or indirectly. All available biotopes were sampled and only produced the hardiest of aquatic species, *Baetis harrisoni* and one air breathing veliid species. Water quality is assessed as poor at this lower reach site.

Mdumbi River system (site 28)

This river was also sampled at the lower reaches in both stones in current and marginal vegetation biotopes. Diversity of invertebrate species was found to be quite high with 33 species collected. Sensitive species collected include a species of leptophlebiid mayfly, chlorocyphid damselfly nymphs, two species of leptocerid caddisfly larvae, one species of

hydroptilid caddisfly larvae and a helodid beetle larva. Water quality is assessed as good.

Hluleka River system (site 30)

With an estimated number of species of 35 from stones in current and marginal vegetation biotopes, diversity of the macroinvertebrate fauna is relatively high for a lower reach sampling site. The light trap sample from this site still has to be analysed and will probably increase the number of species from this site markedly. Indicator species of good water quality include a species of freshwater amphipod, leptophlebiid mayfly nymphs, three species of baetid mayfly nymphs and helodid beetle larvae. Water quality is assessed as good. The catchment of this river falls within the nature reserve with the same name, affording it conservation protection.

Mngazi River system (site 31)

This river produced the highest recorded diversity of freshwater invertebrate species of all the rivers sampled in this survey. The 48 species from stones in current and marginal vegetation biotopes is the highest recorded diversity during this survey. A high diversity of almost all groups including representatives from all five mayfly families appearing in table 3B, perlid stonefly nymphs, chlorocyphid damselfly nymphs, pyralid moth larvae (only site where this family was recorded) and psephenid beetle larvae were found at this site. Based on these findings, water quality is assessed as very good.

Mntafufu River system (site 32)

A comparatively high diversity was recorded for this middle reach sampling site with an estimated 33 species being recorded from both stones in current and marginal vegetation biotopes. Representatives of all five mayfly families appearing in table 3B, three species of hydropsychid caddisflies and athericid dipteran larvae is indicative of good water quality at the site sampled.

Mngazana River system (site 33)

A high diversity of invertebrate fauna was recorded for this middle reach site, with an estimated number of species of 41. Representatives of all mayfly families appearing in table 3B were recorded from stones in current and marginal vegetation biotopes. Other sensitive species collected include perlid stonefly nymphs, two species of hydroptilid

larvae and psephenid beetle larvae. Water quality is assessed as good at this site.

Snails and disease transmission

The gastropod *Bulinus tropicus* was found at sites 1 and X in the Lubbukweni wetland system. This species is a known intermediate host for the conical or stomach fluke *Calicophoron microbothrium*, a trematode worm which causes paramphistomiasis in livestock and wild ruminants (Appleton, 1996). The disease infects the small intestine resulting in acute gastroenteritis with a high mortality rate especially in young animals (Brown, 1980).

The presence of this trematode could have a serious impact on the ruminant mammal population especially buck and the large number of cattle observed on the reserve. This requires urgent investigation especially given that there is little or no flow in the wetland.

Bulinus tropicus was also recorded from site 11 on the Quthing River in Lesotho and a tentative record from the Hluleka River suggests that *Calicophoron microbothrium* may be present in these river systems as well.

Bulinus africanus was recorded from the Mngazi River system. This species serves as an intermediate host for *Schistosoma haematobium*, the parisite causing urinary bilharzia in man. The species is also an intermediate host of *Schistosoma mattheei* which causes bilharzia in sheep and cattle (Brown, 1980 and Appleton, 1996). Appleton (1996) estimates that approximately 60% of the schoolchildren living near a known bilharzia site on this river were infected with *S. haematobium*. The presence of these parasites in this river system presents a grave threat to the health of the local communities who rely on the water for drinking, washing of clothes and recreation. This requires urgent further study.

Biomphalaria pfeifferi, also recorded from the Mngazi River system, is known as an intermediate host of *Schistosoma mansoni* which causes intestinal (rectal) bilharzia in man (Appleton, 1996). The presence of this "blood fluke" would necessarily have far reaching community health implications and therefore requires further attention.

Lymnaea columella, an introduced species from North America, was found in the Mngazi River system and is known to serve as an intermediate host of the liver flukes *Fasciola gigantica* and *Fasciola hepatica* (Appleton, 1996). Both of these trematode parasites infect

the bile ducts and gall-bladders of grazing animals, especially sheep and cattle (Brown, 1980). Their presence or absence in the Mngazi River is in urgent need of investigation. *Lymnaea natalensis* was recorded from the Mntafufu and Mngazana river systems. This species acts as the major intermediate host for *Fasciola gigantica* (Appleton, 1996).

Gyraulus connollyi was recorded from the Mzamba, Mtsila, Xura, Hluleka and Mngazi Rivers. These rivers fall within its known distribution range. *Gyraulus costulatus* was recorded from Mngazi River, which is a new distribution record for this species. Both species are not known as vectors of disease (Appleton, 1996).

Assiminea ovata, a widely distributed euryhaline species tolerating salinities from 0.8 ppt to 37.6 ppt (Appleton, 1996) was recorded from the Hluleka River. An unidentifiable species possibly belonging to the family Succineidae was also collected from this site. This specimen may be a marine migrant, but an expert opinion is required to clarify this.

Neritina gagates, a species which is tolerant of brackish water (Appleton, 1996) was collected just above the tidal zone of the Mqwatyana River in the Mkambati Nature Reserve. This represents a new distribution record for this species, which was only previously recorded as far south as the Mzamba River.

A number of freshwater limpet specimens belonging to the genus *Burnupia* sp. were collected from several sites (see tables 4A & 4B) during this survey. This genus is widely distributed throughout southern Africa and currently contains twelve species (Appleton, 1996). However, they are difficult to distinguish and require expert identification for specific level differentiation. Another genus of freshwater limpet, *Ferrissia* was collected from the Hluleka and Mngazana Rivers. Eleven species have been recorded throughout southern Africa, which are also difficult to differentiate (Appleton, 1996).

The sphaeriid bivalve tentatively identified as *Sphaerium incomitatum*, was found at site X on the Mangeni River. If this identification proves to be correct, this will constitute a new distribution record for this species which was previously recorded from the north-eastern KwaZulu-Natal and Zimbabwe (Appleton, 1996).

Other bivalves found during this survey are tentatively identified as *Corbicula astartina* and *C. fluminalis* collected from the Mngazi and Mdumbi Rivers respectively. These rivers fall within both species proposed distributional ranges (Appleton, 1996).

Freshwater prawns

Both families of true freshwater prawns were found in the middle and lower reaches of many of the river systems sampled. Three species of atyid prawns and between three and five species of palaemonid prawns were collected from six river systems (see table 8).

As these animals are migratory, depending on an estuary for their breeding cycle (Bok, pers. comm.), the construction of barriers especially dam walls would probably result in the disappearance of these species upstream from the barrier.

Ephemeroptera

Only a partial analysis of the Ephemeroptera was possible in the time alloted. Mayflies were abundant in both numbers and species, altogether 24 species of which 9 were undescribed or new species were represented in the present survey.

The family Baetidae was most numerous with a new species of *Acanthiops* being found at three sites along the Mzimkulu River. Two species of *Acentrella* were recorded in swift flowing upper reaches of the Mzimvubu River and the Quthing a tributary of the Orange River. Besides *Afroptilum sudafricanum* which was common in the upper reaches of the Mzimkulu and Mzimvubu Rivers there was a single record of *A. excisum* in the Mzimkulu and one record of a species of *Afroptilum* also found in the tributaries of the Tsitsa during a previous survey (de Moor and Barber-James 1994). The ubiquitous *Baetis harrisoni* was found to be surprisingly scarce in both the upper reaches of the Mzimkulu and Mzimvubu Rivers. *Baetis latus* and a species of *Baetis* previously collected in tributaries of the Tstitsa River were found at single sites along the Mzimkulu and Mzimvubu Rivers. A species of *Centroptiloides* possibly new was found in many of the coastal Rivers sampled. These mayflies are large predatory species indicative of swift flowing well oxygenated water. There presence would indicate a good conservation status for the rivers and streams where they were found. This is an interesting find and needs further studying to confirm its identity and overal conservation status. *Demoulinia crassi* a species prefering slow flowing reaches of river was found at several sites along the upper reaches of the Mzimkulu and Mzimvubu Rivers.

The Heptageniidae belonging to the genus *Afronurus* were recorded at two sites on the Mzimvubu River. Species in this genus generally require strong, moderately-swift flows of water and are usually found on the underside of large boulders.

The Leptophlebiidae were represented by four species. *Adenophlebia auriculata* a widespread species in upper reaches and tributaries of rivers in the Eastern Cape was common in the Mzimvubu tributaries and in the Quthing River but absent from the Mzimkulu River. This is strange and needs further study. A species apparently near to *Adenophlebia ?peringueyella*, which was described and has previously been recorded only from the Western Cape (Barnard 1932), was found coexisting with an undescribed species of *Castanophlebia* at site Y. This again is an interesting discovery and warrants further research. *Euthraulus elegans* a widespread species found throughout South Africa was only found in the Jordan River a tributary of the Mzimvubu River.

In the family Tricorythidae an undescribed species of *Tricorythus* found at several sites along the upper reaches of the Mzimkulu and Mzimvubu Rivers but also found on the Mkomaas River again suggests an interesting biogeographical transitional region. The discovery of a *Dicercomyzon* sp. in the Mzamba River is a very valuable discovery and represents the southern most distribution record for this essentially tropical genus.

The family Caenidae were represented by four species of undescribed *Caenis* all apparently restricted to the upper reaches of the Mzimkulu, Mzimvubu and Orange Rivers.

Trichoptera

The 30 sites on 14 separate river systems produced 23 species of Trichoptera in seven families. As there was insufficient time to analyse light trap material the number of species is expected to increase with more specific identifications of some of the taxa indicated at only generic level becoming possible.

All species of the family Hydropsychidae are adapted to life in flowing water (Scott 1978). They rely on the water current to carry food in the form of small invertebrates and plant matter to them. Food is gathered in spun silken nets which face the current. Altogether five species of *Cheumatopsyche* were collected three of which are widespread in South Africa. *Cheumatopsyche afra*, the most widespread, was found in most tributaries of the Mzimvubu and Mzimkulu Rivers and in several of the smaller coastal rivers surveyed. *Cheumatopsyche maculata* was only found in the Mntafufu River but should be more common in swift-flowing streams in erosional headwater or rejuvenation sections of rivers (Scott, de Moor and Kohly 1988) which may have been undersampled during the preliminary survey. *C. thomasseti* was restricted to the Mzimvubu system and

the Mngazi and Mntafufu Rivers.

During surveys of the rivers of Natal, Dr Mark Chutter formerly of the CSIR (NIWR) collected a large number of *Cheumatopsyche* larvae that were unnamed and not correlated with adults. They were tentatively designated as FMC types 1-8. The larvae of two species, identifiable as *Cheumatopsyche* FMC type 2 and FMC type 7, were found in this survey. The presence and abundance of these two species in the upper reaches and tributaries of the Mzimkulu and Mzimvubu Rivers as well as in some of the short coastal rivers shows some interesting biogeographical trends indicating an aquatic fauna somewhat different from that found in the southern Cape Rivers (de Moor & Barber-James 1995) and rivers feeding the Tina and Tsitsa Rivers (de Moor & Barber-James 1994) as well as the tributaries of the Tugela River (de Moor 1995, Barber-James and de Moor 1995).

Single records of *Hydropsyche longifurca*, *Macrostemum capense* and *Leptonema natalense* were found in larger streams (Table 5B). It is to be expected that these species will be more widespread.

Philopotamidae were represented by a single species of *Chimarra* of which larvae were collected in the Daza, Mzamba and Hluleka Rivers. It was expected that Philopotamidae would be more common in the streams and rivers of the region surveyed. Ten species have been recorded from this hydrobiologically categorised region (de Moor 1993).

The family Ecnomidae were rather underepresented being found at only two sites on the Mzimkulu and one on the Mzimvubu. The two species of *Ecnomus* found were collected amongst marginal vegetation. A female of an unidentified genus and species of Ecnomidae is the most striking find of the survey. More collecting, especially light-trapping, will hopefully produce adult males which are identifyable to species. Most Ecnomidae are found in quieter backwaters and pools in rivers and limited collecting in these biotopes may have underestimated the family.

The micro-caddis family Hydroptilidae was represented by two species *Hydroptila ?cruciata* and *Orthotrichi ?barnardi*. Specimens collected were larvae not positively identifiable to species level. Light trap collections not yet analysed should reveal what species they are as well as reveal other species present.

The family Leptoceridae has the largest number of known species of all the Trichoptera

families in South Africa. The larvae of five species have so far been found in this survey. There were two species of *Oecetis* a genus with more than 30 species known from Africa collected. *Athripsodes harrisoni* a widespread species was found only in the Mqwatyana River. The empty larval case of what appears to be a sponge feeding *Ceraclea (Pseudoleptocerus)* sp. caddis collected on the Mtentu River was a very interesting find. Further collecting should be done to confirm this observation. Larvae and two types of cases of a *Leptocerina* sp. were found in several of the coastal rivers.

The lepidostomatid *Goerodes caffrariae* was collected along the upper reaches of the Mzimkulu River. Barnard (1934) described this species from near Grahamstown and mentioned that it represented a remarkable southward distribution of a tropical species. Ecologically this species is a leaf shredder usually found in forest streams.

The xiphocentronid *Abaria ?electa* was collected in a small seep over bedrock running into the Mkambati River. This represents a valuable distribution record of this little known species.

Simuliidae

Simuliidae are represented by 39 species in South Africa (Palmer 1991a). During the present survey 13 species all belonging to the genus *Simulium*, were collected. In some instances only very small larvae were collected and specific identification was not possible, although subgeneric classification, helpful in identifying potential problem or pest species, could be carried out. For this reason subgeneric classification is carried out for all Simuliidae in the discussion below.

Simulium (Nevermannia) nigritarse was found in many streams from swift cascades to small trickles. Larvae and pupae of this species closely resemble *S. (Nevermannia) brachium*, and Palmer (1991b) records these two species as occurring sympatrically in the Buffalo River. *Simulium nigritarse* appears to be commonly found in slow- flowing reaches of rivers and is often found downstream of impoundments. Both species were represented in this survey and for this reason where only small larvae were found they are indicated in tables 5a & 5b as *Simulium brachium/nigritarse*. To complicate the issue further, Fain and Dujardin (1983) revised the systematics of a number of closely-related species and came to the conclusion that *S. nigritarse* also forms a species complex. Keys for 19 species of this complex, mostly from the mountainous regions of central Africa have been devised by Fain and Dujardin (1983).

The torrenticolous *Simulium (Anasolen) dentulosum* was recorded only from the upper reaches of the Mzimvubu River. It is a species that is confined to waterfalls and swift flowing cascades of mountain streams. Crosskey (1969) notes that this species is the only blackfly found at very high altitudes upto 4500 m in central Africa. It is found in southern African rivers down to 760 m above sea level, although its ecological requirements restrict it to cascades and waterfalls. In the rivers sampled it appears to be restricted to high altitudes.

A larva of an apparent *Simulium (Freemanellum* species was found with larvae of *S. dentulosum*. This is an interesting find and more larvae and pupae would be needed to make a specific identification. Members of the subgenus are associated with swift flowing cascading rivers as are those in the subgenus *Anasolen*.

Simulium (Edwardsellum) damnosum s.l. recognised as a species complex with more than 40 described Afrotropical species, were found only on the Mngazi River. Species of this complex, however, are distinguishable only on cytological characters. The species, as yet not identifyable, found in southern Africa are ussually found in moderately swift flowing waters in large streams. In West Africa certain species in this complex are carriers of Onchocerciasis a filarial parasite transmitted to man. Heavy infestations of this parasite, found in people living near rivers, can cause permanent blindness. Fortunately none of the South African species have to date been identified as vectors of Onchocerciasis.

One of the most widespread species in South Africa, *Simulium (Meilloniellum) adersi*, was found only in some of the coastal rivers. It is a pollution and saline tolerant species usually found in slow flowing medium sized rivers with a stable flow regime. This species may be more common than revealed by this survey. It has been recorded biting man.

The subgenus *Metomphallus* contains several species which usually form the dominant simuliid component of swift-flowing, turbulent streams throughout the Afrotropical region. The most frequently encountered species in this survey was *Simulium medusaeforme* (Tables 5a &b). The second species in the subgenus *S. vorax*, was encountered in swift flowing coastal streams. Where man has interfered with the flow regime of large rivers in South Africa *S. chutteri* has frequently become a serious pest species, attacking livestock near river sites where the fly breeds. The present survey did not reveal this species in any of the rivers although it has been recorded in the Tsitsa and Pot Rivers, tributaries of the Mzimvubu (de Moor and Barber-James 1994). This species

may in future pose a serious ecological threat if damming of rivers and regulation of the flow regime associated with interbasin transfers are implimented.

The subgenus *Pomeroyellum* is the largest endemic Afrotropical subgenus contributing about 30% of the species and forms of Simuliidae for the region (Crosskey 1969). Most members of the subgenus are restricted to slower flowing reaches of small to large streams. A species identifiable as belonging in this subgenus could not be placed in any presently known species and is labelled as *Simulium (Pomeroyellum)* sp. nov. It was found at only two sites and was represented by five larvae and one pupa. The species, from the limited sampling carried out, appears to be restricted to the small coastal rivers flowing through the TMS Geological formations. Four other species *S. mcmahoni, S impukane, S, bequaerti* and *S. rotundum* were found in several coastal rivers in small numbers (Tables 5a & b).

The river with the most diverse simuliid fauna was the Mngazi with 6 species. Wherever found *S. medusaeforme* was the dominant species.

CONCLUSIONS

Water quality in the majority of the rivers sampled appears to be good, even at the lower-reach sites sampled. The diversity of invertebrate families encountered at the middle to lower reach sites on the relatively large Mngazi and Mtentu Rivers corroborates this. The Daza River in the Mkabati Nature Reserve was also characterised by a relatively high diversity of invertebrate families. The fact that the catchment of this river is contained by the reserve is reassuring from a conservation point of view.

Comparing the estimated species diversity of rivers sampled in this survey (ranging from 7-48 at different sites) with those of rivers sampled during a North-Eastern Cape rivers survey (de Moor and Barber-James 1994) it is striking that species numbers were far higher in the latter survey (ranging from 8-133 at different sites). The reason for this, discrepancy in species diversity in rivers from nearby catchments, is undoubtedly because sampling effort was not as intense during the present survey, because not all samples have been analysed nor have all identifications been carried out to species level. Further analysis of the remaining data will undoubtedly increase the number of species and provide a better knowledge on the species diversity and hence enhance informed planning and conservation.

On a relative basis comparing sites within the present survey, the lower species diversity observed at the Mkambati River, especially at the upper site, requires further investigation. It is suspected that there are possible sources of pollution mentioned in the discussion. Also, the disturbingly low diversity of invertebrates encountered at Xura and Mtata River sites indicates that these rivers are in a very poor condition. Sources of pollution need to be identified and corrected before the water in these two rivers can be used for human consumption.

Although species diversity was consistently lower at the upper reach sites in the Nsekeni and Ongeluksnek regions than at the lower sites, species indicative of good water quality were found at all sites except at the Lubbukweni wetland system. This is undoubtedly due to the relatively stagnant, poorly oxygenated water in the wetland. Most aquatic species collected here were found to be atmospheric airbreathers. The fact that pollution tolerant species such as oligochaete worms (normally found in great abundance in polluted waters) were not encountered at these sites suggests that the absence of indicator species in this system is probably due to the lack of suitable habitat and flow conditions rather than water quality problems. The number of invertebrate species recorded from the wetland sites corroborates this.

Three new distribution records for the freshwater snail species *Gyraulus costulatus, Neritina gagates* and *Sphaerium incomitatum* resulted from this survey. Nine undescribed species of mayfly and one species of blackfly have been recorded from the samples analysed thus far. Many new distribution extensions have resulted and have provided valuable biological information. The presence of certain man-biting Simulliidae as well as the notorious livestock bloodsucking pest *Simulium chutteri* in the region (although not collected during the present survey) warrant special precautionary measures for any water abstraction, interbasin-transfer or dam building projects.

Five species of freshwater snails which are known intermediate hosts of trematodes causing bilharzia and fluke infections in man and his livestock were found from several river systems. Although bilharzia is known from the Mngazi River, a thorough investigation into the extent and range of this problem in the Transkei is recommended.

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Table 1. Key to abbreviations of biotopes sampled during the survey of the Transkei Rivers October/November 1996.

Biotope	Description
FNW	Flying near water
LIGHT	Light trap sample
LPIC	Leaf pack in current
MOSSIC	Moss in current
MVIC	Marginal vegetation in current
MVOC	Marginal vegetation out of current
POOL	Collected from pool
SIC	Stones in current
SOC	Stones out of current
SOR	Surface of river

Table 2: List of sites and biotopes sampled for invertebrates, during the Transkei river survey, October - November 1996. * indicates samples still to be analysed.

SITE	RIVER SYSTEM	RIVER TRIBUTARY	CO-ORDINATES	BIOTOPES SAMPLED
1	Mzimkulu	Lubbukweni, Mangeni	30° 09' 11"S : 29° 27' 28"E	MVOC
x	Mzimkulu	Lubbukweni, Mangeni	30° 09' 30"S : 29° 27' 34"E	MVOC
2	Mzimkulu	Tom, Gungununu	30° 11' 19"S : 29° 29' 52"E	SIC, LPIC MOSSIC
3	Mzimkulu	Gungununu	30° 07' 01"S : 29° 27' 39"E	MVOC
4	Mzimkulu	Siqubbini	30° 08' 53"S : 29° 25' 56"E	SOR, SIC, MOSSIC
5	Mzimkulu	Ngwangwane, Gungununu	30° 07' 15"S : 29° 37' 19"E	SIC, LIGHT*
6	Mzimkulu	Trib. of Malenge, Gungununu	30° 11' 15"S : 29° 33' 59"E	No sample
7	Mzintlava	Main channel	30° 22' 54"S : 29° 26' 58"E	No sample
8	Mzimvubu	Kinira	30° 18' 41"S : 28° 38' 12"E	SIC, LPIC
9	Mzimvubu	Kinira, Mabele, Jordan	30° 17' 31"S : 28° 23' 41"E	SIC, LIGHT*
10	Mzimvubu	Kinira, Mabele, Jordan	30° 19' 49"S : 28° 21' 09"E	No sample
11	Orange	Quthing (in Lesotho)	30° 20' 00"S : 28° 13' 09"E	SIC, SOC
Y	Mzimvubu	Kinira, Komalihare, Paballong	30° 20' 15"S : 28° 16' 09"E	SIC
12	Mzimvubu	Kinira, Komalihare, Paballong	30° 20' 39"S : 28° 18' 11"E	FNW, POOL
13	Mzimvubu	Mabele, Jordan	30° 17' 06"S : 28° 22' 20"E	SIC
14	Mzimvubu	Mabele, Jordan	30° 17' 45"S : 28° 19' 39"E	SIC
15	Mzimvubu	Trib. of Mabele	30° 19' 49"S : 28° 21' 19"E	MVOC
16	Mqwatyana		31° 15' 55"S : 30° 01' 47"E	SIC, MVIC

SITE	RIVER SYSTEM	RIVER TRIBUTARY	CO-ORDINATES	BIOTOPES SAMPLED
17	Mqwatyana		31° 15' 46"S : 30° 02' 12"E	SIC, POOL
18	Mkambati		31° 16' 26"S : 30° 01' 23"E	SEEP, SOR MVIC/OC
19	Daza		31° 17' 41"S : 29° 58' 55"E	LIGHT*, SIC, MVIC/OC, FNW
20	Daza		31° 18' 19"S : 29° 59' 45"E	No sample
21	Mkambati		31° 15' 14"S : 29° 57' 34"E	MVIC/OC
22	Mtentu		31° 07' 52"S : 29° 45' 22"E	SIC, MVIC, SOC, SOR
23	Mzamba		30° 55' 45"S : 29° 49' 00"E	SIC, MVIC/OC
24	Msikaba	Mhlumba	31° 11' 52"S : 29° 36' 32"E	SIC, FNW, MVIC/OC
25	Msikaba	Mtsila	31° 14' 12"S : 29° 35' 43"E	SIC, MVIC
26	Msikaba	Xura	31° 19' 07"S : 29° 34' 04"E	SIC
27	Mtata		31° 55' 27"S : 29° 08' 11"E	SIC, MVIC/OC
28	Mdumbi		31° 53' 17"S : 29° 11' 27"E	SIC, MVIC
29	Mshakatye		31° 50' 35"S : 29° 14' 36"E	No sample
30	Hluleka		31° 49' 27"S : 29° 18' 05"E	SIC, MVIC, LIGHT*
31	Mngazi		31° 36' 39"S : 29° 24' 16"E	SIC, MVOC
32	Mntafufu		31° 29' 39"S : 29° 31' 40"E	SIC, MVIC/OC
33	Mngazana		31° 37' 42"S : 29° 20' 38"E	SIC, MVIC

Table 3A. A list of taxa found at sites 1-15 during the Transkei river survey, October/November 1996. OR = Orange River system. Numbers in each column represent the number of species within the group or family collected at each site. The estimated number of species collected at each site is also given.

TAXA	SYSTEM	Mzimkulu						Mzimvubu							OR
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11
COELENTERATA															
Hydridae														1	
TURBELLARIA															
Planariidae				1					1			1	1	1	1
ANNELIDA															
OLIGOCHAETA				1			1	1						1	
HIRUDINEA			1												
MOLLUSCA															
GASTROPODA															
Planorbidae															
Bulininae		1	1		1										1
Ancylidae															1
PELECYPODA															
Sphaeriidae			1											1	
CRUSTACEA															
DECAPODA															
Potamonidae								1	1						

TAXA	SYSTEM	Mzimkulu						Mzimvubu							OR
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11
OSTRACODA			4											1	
CLADOCERA		1	1		1										
ARACHNIDA															
ARANAEIDA								1							
HYDRACARINA		1	1		1										
INSECTA															
EPHEMEROPTERA															
Baetidae		3	1	2		3	3	3	2	3	1	4	2	2	4
Heptageniidae									1			1			
Leptophlebiidae									1	2	1	2	1		1
Tricorythidae						1	1	1	1			1	1		
Caenidae		2	1					2	1		1				1
PLECOPTERA															
Notonemouridae				2						1					
Perlidae								1				1	1		
ODONATA															
ZYGOPTERA															
Coenagrionidae		1	2		2									1	
ANISOPTERA															

TAXA	SYSTEM	Mzimkulu						Mzimvubu							OR
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11
Aeshnidae		1	1		1				1					1	
HEMIPTERA															
Gerridae														1	
Veliidae		1												1	
Corixidae		1	2		2										
Pleidae			1												
Notonectidae		1			1										
TRICHOPTERA															
Hydropsychidae				1		2	3	1	1	1		1	1		1
Ecnomidae		2			1									1	
Hydroptilidae			1												
Leptoceridae									1						
Lepidostomatidae				1											
COLEOPTERA															
Helodidae												1			
Dytiscidae		2	2		1									3	
Gyrinidae		1				1	1								
Hydraenidae		1		2		1				2				1	1
Elmidae						2									

TAXA	SYSTEM	Mzimkulu						Mzimvubu							OR
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11
Hydrophilidae														1	
DIPTERA															
Blephariceridae										1					
Simuliidae				1		2	1	2	2	2		1	1		2
Chironomidae								4							
Tanypodinae			2		1	1							2	2	2
Orthocladiinae		2	2	2	2	2	3					1			3
Chironominae															
Chironomini		1	1				1	1	1	2				1	1
Tanytarsini				1				1	1			2			
Ceratopogonidae		1	1					1	1						1
Tipulidae									2		1	1			
Athericidae									1						
Muscidae				1			1								
Pelechorynchidae?										1					
Total No. Families		**16**	**17**	**10**	**10**	**8**	**8**	**11**	**15**	**9**	**4**	**11**	**8**	**15**	**11**
Est. Total No. Species		**23**	**26**	**15**	**17**	**15**	**15**	**20**	**19**	**15**	**4**	**17**	**10**	**20**	**20**

Table 3B. A list of taxa found at sites 16-33 during the survey of the Transkei rivers, October/Novmeber 1996. MQWAT=Mqwatyana, MKAM=Mkambati, DA=Daza, MT=Mtentu, MZ=Mzamba, TA=Mtata, MD=Mdumbi, HL=Hluleka, MG=Mngazi, MN=Mntafufu, MA=Mngazana River systems. Numbers in each column represent the number of species within the group or family collected at each site. An estimated total number of species is given for each site sampled.

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
COELENTERATA																	
Hydridae		1															
TURBELLARIA																	
Planariidae		1					1		1					1		1	1
ANNELIDA																	
OLIGOCHAETA		1	1						1	1				1	1	1	
MOLLUSCA																	
GASTROPODA																	
Lymnaeidae															1	1	1
Planorbidae																	
Planorbinae							1	1	1	1			1	1	2	1	
Bulininae														1	1	1	
Neritidae			1														
Assimneidae														1			
Succineidae?														1			
Ancylidae							1		1	1	1			2	1	1	1
PELECYPODA																	

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
Corbiculidae													1		1		
CRUSTACEA																	
DECAPODA																	
Potamonidae							1	1		1		1	1	1	1	1	1
Atyidae		2	1			1						2	1	2	2		
Palaemonidae			1									1	1		1		
AMPHIPODA						1								1			
ISOPODA														1			
CLADOCERA														1			
OSTRACODA		2												1	1		2
ARACHNIDA																	
ARANAEIDA				1		1	1			3							
HYDRACARINA												1					
COLLEMBOLA																	
Isotomidae																	1
Poduridae																	1
Sminthuridae								1									

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
INSECTA																	
EPHEMEROPTERA																	
Baetidae		3	2	3	2	3	4	3	3	2	1	1	2	3	4	2	3
Heptageniidae						1	1	1	1						1	1	1
Leptophlebiidae		1	1			2	2	2	1	1			1	1	2	1	2
Tricorythidae							1	2							1	1	1
Caenidae						1	2	1	1	1			1	2	2	2	2
PLECOPTERA																	
Perlidae						1	1	1	1						1		1
ODONATA																	
ZYGOPTERA																	
Coenagrionidae		1			1	1	2	1	1	1			1	1	1	1	
Chlorocyphidae						1							1		1		
Lestidae		1		1		1							1				
ANISOPTERA																	
Gomphidae							1		1							1	
Libellulidae		1	1	1		1	1		1				1		1	1	1
Corduliidae		1															
Aeshnidae		1		1		1	1	1	1					1	1		1

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
HEMIPTERA																	
Gerridae						1	1		1	1				1			1
Veliidae		1		1		1	2	2	2	2		1	1	1	1	1	2
Corixidae														1	1		
Nepidae				1			1						1				
Pleidae													1				
Belostomatidae							1	1									
Notonectidae				1	1	1	1										
Naucoridae		1		1		1	1	1	1	1			1	1	1		
TRICHOPTERA																	
Hydropsychidae		1	1	1		2	2	2	2	2	1			1	3	3	2
Philopotamidae						1		1						1			
Hydroptilidae		1				1	1		1	1			1		1	1	2
Leptoceridae		3		1		2	3						2		1		
Xiphocentronidae				1													
LEPIDOPTERA																	
Pyralidae															1		
COLEOPTERA																	
Helodidae		1											1	1			
Dytiscidae		1				2			1				1	2			1
Gyrinidae		2		1	1	1	1		1	1			1		1	1	1

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
Hydraenidae						1											
Elmidae		1	2			2	1			1			1	1		1	1
Hydrophilidae				2		1				1			1	1			1
Psephenidae							1	1	1						1		1
DIPTERA																	
Psychodidae				1													
Simuliidae		2	2	1	1	3	1	4	1	2	2		2	4	5	2	3
Chironomidae				2		3		3								1	
Tanypodinae		2					1			1			1		1		1
Orthocladiinae		3	2				1		1	2	1		1	2	1	2	2
Chironominae																	
Chironomini		3	1	1		1			1		1			2	1		2
Tanytarsini		1	1		1		2		2	2			2	1		1	1
Ceratopogonidae						1	1		1				1	1			
Tabanidae				1												1	
Tipulidae				1		1	1								1		
Athericidae							1						1			1	
Muscidae									1	1					1	1	
Stratiomyidae														1			
Total No. Families		**23**	**11**	**19**	**6**	**30**	**32**	**19**	**25**	**20**	**5**	**6**	**27**	**32**	**33**	**25**	**26**
Est. Total No. Species		**39**	**17**	**24**	**7**	**42**	**45**	**30**	**32**	**30**	**7**	**7**	**32**	**35**	**48**	**33**	**41**

Table 4A. Mollusca species found at sites 1-15 during the Transkei rivers survey, October 1996.

TAXA	SYSTEM	Mzimkulu						Mzimvubu							Or.
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11
GASTROPODA															
PLANORBIDAE															
Bulininae															
Bulinus tropicus		*	*												*
ANCYLIDAE															
Burnupia spp.															*
PELECYPODA															
SPHAERIIDAE															
Sphaerium ?incomitatum			*											*	

Table 4B. A list of Mollusca species found at sites 16-33 during the survey of the Transkei rivers, October/November 1996. MQWAT=Mqwatyana, MKAM=Mkambati, DA=Daza, MT=Mtentu, MZ=Mzamba, TA=Mtata, MD=Mdumbi, HL=Hluleka, MG=Mngazi, MN=Mntafufu, MA=Mngazana River systems.

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
GASTROPODA																	
LYMNAEIDAE																	
Lymnaea columella															*		
Lymnaea natalensis																*	*
PLANORBIDAE																	
Planorbinae																	
Gyraulus connollyi								*		*	*			*	*		
Gyraulus costulatus																*	
Biomphalaria pfeifferi															*		
Bulininae																	
Bulinus africanus															*		
Bulinus ?tropicus														*			
ASSIMINEIDAE																	
Assiminea ovata														*			
NERITIDAE																	
Neritina gagates			*														

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
SUCCINEIDAE																	
Gen. sp. indet.														*			
ANCYLIDAE																	
Burnupia spp.							*		*	*	*			*	*	*	
Ferrissia spp.														*			*
PELECYPODA																	
CORBICULIDAE																	
Corbicula ?astartina															*		
Corbicula ?fluminalis													*				

Table 5A. Trichoptera species found at sites 1-15 during the Transkei rivers survey October 1996.

TAXA	SYSTEM	Mzimkulu						Mzimvubu							Or.
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11
HYDROPSYCHIDAE															
Cheumatopsyche afra				*		*	*		*	*		*	*		*
Cheumatopsyche "FMC Type 2"							*								
Cheumatopsyche "FMC Type 7"						*	*								
Cheumatopsyche thomasseti								*							
ECNOMIDAE															
Ecnomus sp.1		*			*										
Ecnomus sp.														*	
Gen. nov. sp. nov.		*													
HYDROPTILIDAE															
Orthotrichia sp.			*												
LEPTOCERIDAE															
Oecetis sp.1				*											
Oecetis sp.2									*						
LEPIDOSTOMATIDAE															
Goerodes caffrariae				*											

Table 5B. A list of Trichoptera species found at sites 16-33 during the survey of the Transkei rivers, October/November 1996. MQWAT=Mqwatyana, MKAM=Mkambati, DA=Daza, MT=Mtentu, MZ=Mzamba, TA=Mtata, MD=Mdumbi, HL=Hluleka, MG=Mngazi, MN=Mntafufu, MA=Mngazana River systems.

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
HYDROPSYCHIDAE																	
Cheumatopsyche afra		*	*					*	*	*	*				*	*	*
Cheumatopsyche "FMC Type 1"							*		*								
Cheumatopsyche "FMC Type 7"				*		*		*		*				*			*
Cheumatopsyche maculata																*	
Cheumatopsyche thomasseti															*	*	
Hydropsyche longifurca							*										
Leptonema natalense						*											
Macrostemum capense															*		
PHILOPOTAMIDAE																	
Chimarra sp.						*		*						*			
HYDROPTILIDAE																	
Hydroptila ?cruciata																	*
Hydroptila spp.							*		*	*			*		*	*	*
Orthotrichia ?barnardi																	*
Orthotrichia spp.		*				*											

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	IHL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
LEPTOCERIDAE																	
Athripsodes harrisoni		*															
Ceraclea (Pseudoleptocerus) sp.?							*										
Leptocerina sp.				*		*	*						*				
Leptocerus spp.		*											*				
Oecetis spp.		*				*	*								*		
XIPHOCENTRONIDAE																	
Abaria ?electa				*													

Table 6A. Simuliidae species found at sites 1-15 during the Transkei rivers survey October 1996.

TAXA	SYSTEM	Mzimkulu						Mzimvubu							Or.
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11
Simulium brachium				*											
Simulium brachium/nigritarse						*		*							*
Simulium dentulosum										*		*	*		*
Simulium (?Freemanellum) sp.										*					
Simulium medusaeforme								*							
Simulium (Metomphallus) sp.						*			*						
Simulium ?impukane							*								
Simulium (Pomeroyellum) sp.									*						

Table 6B. A list of Simuliidae found at sites 16-33 during the survey of the Transkei rivers, October/November 1996. MQWAT=Mqwatyana, MKAM=Mkambati, DA=Daza, MT=Mtentu, MZ=Mzamba, TA=Mtata, MD=Mdumbi, HL=Hluleka, MG=Mngazi, MN=Mntafufu, MA=Mngazana River systems.

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
Simulium nigritarse					*			*		*	*			*	*	*	
Simulium nigritarse/brachium			*														
Simulium damnosum s.l.															*		
Simulium adersi													*	*	*		*
Simulium medusaeforme		*	*	*	*	*		*	*	*	*		*	*		*	*
Simulium vorax						*	*										
Simulium bequaerti		*	*			*		*							*		
Simulium impukane														*			
Simulium mcmahoni															*		*
Simulium rotundum								*							*		
Simulium (Pomeroyellum) sp. nov.						*											

Table 7. Ephemeroptera species found during the Transkei river survey, October 1996. OR = Orange, MK = Mkambati, DA = Daza, MT = Mtentu, MZ = Mzamba, MG = Mngazi River systems. Ephemeroptera from sites 16-33 are incompletely analysed at present and therefore are not reflected in this table.

TAXA	SYSTEM	Mzimkulu						Mzimvubu							OR	MK	DA	MT	MZ	MG
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11	18	19	22	23	31
BAETIDAE																				
Acanthiops sp. nov.				*		*	*													
Acentrella monticola										*		*	*		*					
Acentrella natalensis										*		*	*		*					
Afroptilum excisum								*												
Afroptilum "Mondi sp.3"															*					
Afroptilum sudafricanum		*		*		*	*		*	*	*	*								
Baetis harrisoni							*	*				*								
Baetis latus		*																		
Baetis "Mondi sp.2"								*												
Centroptiloides sp.																*	*	*	*	*
Demoulinia crassi		*	*			*			*											
Gen. spp. unident.														*						
HEPTAGENIIDAE																				
Afronurus oliffi												*								
Afronurus sp.									*											

TAXA	SYSTEM	Mzimkulu						Mzimvubu							OR	MK	DA	MT	MZ	MG
	SITE NO.	1	X	2	3	4	5	8	9	Y	12	13	14	15	11	18	19	22	23	31
LEPTOPHLEBIIDAE																				
Adenophlebia auriculata									*		*	*	*		*					
Adenophlebia ?peringueyella										*										
Castanophlebia sp. nov.										*										
Euthraulus elegans												*								
TRICORYTHIDAE																				
Dicercomyzon sp.																			*	
Tricorythus "umkomaas"						*		*	*			*	*							
CAENIDAE																				
Caenis sp. nov. 1		*													*					
Caenis sp. nov. 2			*																	
Caenis sp. nov. 3								*												
Caenis sp. nov. 4									*											
Caenis spp.								*			*									

Table 8. A list of freshwater prawns found at sites 16-33 during the survey of the Transkei rivers, October/November 1996. MQWAT = Mqwatyana, MKAM = Mkambati, DA = Daza, MT = Mtentu, MZ = Mzamba, TA = Mtata, MD = Mdumbi, HL = Hluleka, MG = Mngazi, MN = Mntafufu, MA = Mngazana River systems.

TAXA	SYSTEM	MQWAT		MKAM		DA	MT	MZ	MSIKABA			TA	MD	HL	MG	MN	MA
	SITE NO.	16	17	18	21	19	22	23	24	25	26	27	28	30	31	32	33
ATYIDAE																	
Caridina ?africana						*											
Caridina nilotica		*	*									*		*	*		
Caridina typus		*	*									*	*	*	*		
PALAEMONIDAE																	
Macrobrachium equidens			*														
Macrobrachium spp.													*		*		
Palaemon sp.												*					