Freshwater macro-invertebrates of Namibia

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ABSTRACT

The identification and conservation status of Namibian representatives of eight freshwater invertebrate phyla are discussed, as are the faunas of different wetland types. The species identified and localities recorded form only a fraction of those that actually occur. About 50 species are probably endemic (occurring only in Namibia). The greatest recorded speciation and number of endemics is in the Ostracoda. All seven amphipod and isopod species are likely to be endemic due to their unique stygobiotic (cave-dwelling) habitat. The two largest groups, the Coleoptera and the dipteran larvae, together have 14 potentially endemic species. Most identified species are from the Kavango River, springs throughout the country, and man-made waterholes. The Cunene River fauna is unique in Namibia, but probably represents the southern limit of the Angolan fauna. The number of identified species from the Cunene, East Caprivi, Bushmanland and the southern pans probably grossly under-represents the actual number of species occurring there.

INTRODUCTION

Invertebrates form a very important part of any ecosystem since they comprise the major portion of the biomass. In freshwater systems, they are abundant in or on the substrate and among the submerged vegetation. They are also found in open waters, where crustacea comprise most of the zooplankton, and larger species swim to the surface or hunt for prey. Invertebrates are responsible for much of the nutrient cycling, especially in standing water lentic systems where the detritivores convert decaying organic matter into food for other invertebrates. Invertebrates form a complex foodchain, which in turn provides a food source for numerous vertebrates, notably fish and birds. Some taxa are confined to the water for their entire life cycle, while others rely on water for the development of their immature stages. Yet others are associated with the waters' edge or water-associated vegetation. Different habitats have their own characteristic assemblage of organisms and the distribution of many taxa is limited by the availability of suitable habitats. Numerous texts deal with the role of freshwater invertebrates in aquatic systems as well as the kinds of systems found. The reader is referred to Beadle (1981), Davies & Day (1986) and Allanson et al. (1990) for a discussion of African systems.

The task of discussing the conservation status of freshwater invertebrates is a rather monumental one since they form a vast and diverse fauna about which little is known in Africa, and particularly in Namibia. Collections have been made randomly and much of the early material is scattered in museums throughout the world. In the past, certain areas of the country were better sampled than others, giving a somewhat distorted idea of the distribution of invertebrates. Keppel Barnard of the South African Museum collected extensively, mainly in Owambo and Kaokoland and described numerous new species from such diverse groups as the Entoprocta (1927), Crustacea (1929, 1935), Ephemeroptera (1932, Demoulin 1970), Plecoptera (1934a) and Trichoptera (1934b). The Swedish expedition of 1950/51 collected all species which they came across in the extreme south-east, Owambo, Kaokoland and a few scattered localities in between (Hanström et al. 1955-1970). Bethune and Day (Day 1990) have collected in the Namib Desert.

Many taxa are in need of revision and often there are no experts working on the group; thus much of the material housed in the State Museum of Namibia (SMColl) and other museums has not been identified beyond family level. Because of this poor state of knowledge it is impossible, in most cases, to speak about numbers of endemics and Red Data species or to assess the faunal composition of any wetland. Among the groups which have been better studied and identified recently are the Ostracoda (Martens 1984, 1986, 1988, 1989, 1990), the Hirudinea (Oosthuizen 1978, 1979, 1982; Oosthuizen & Curtis 1990), the Mollusca (Curtis & Appleton 1987; Curtis 1990; Brown & Curtis in prep.) and the Dytiscidae (Biström & Wewalka 1984; Biström 1982, 1983a-c, 1984, 1986, 1987a-b, 1988a-d). This review serves to bring together what little is known about the freshwater fauna of Namibia and to highlight the need for further research in this field. New species described from Namibia and not recorded elsewhere are regarded here as potential endemics.

The review deals only with the macro-invertebrates, including the planktonic Crustacea. The Arachnida have been excluded, since the only ones which are truly aquatic are the water mites (Hydracarina), about which nothing is known for this country. Virtually no work has been done on the microscopic groups such as the Protozoa and Rotifera, which will therefore not be covered. I shall firstly outline the current state of knowledge of each of the phyla represented in Namibian freshwaters and mention any taxa which may be endangered. Secondly, I shall briefly consider the invertebrate faunas of the different wetland types dealt with in more detail in this monograph; finally I shall briefly discuss the conservation threats to wetland invertebrates in this country. The Appendix gives an annotated checklist of all species known from Namibia at the time of going to press.

INVERTEBRATE PHYLA AND CLASSES

Phylum Porifera (sponges)

Very little is known about freshwater sponges in general. Two families are represented in Africa and only three species have been collected from Namibia. Sponges require clear, fairly permanent water, and are thus not widespread. Two unidentified species of *Potamolepis*, which has a tropical distribution (J. Heeg, in litt.), have been found in the perennial rivers in the north - one in the Kwando and Chobe River systems and the other at Popa Falls in the Kavango River (SMColl). *Ephydatia fluviatilis*, a species with a worldwide distribution (Burton 1958), has been collected from Nama Pan in Bushmanland. It is able to survive long dry periods by virtue of its resistant gemmules, which can be transported overland by wind, insects and birds. An unrecorded species of sponge must occur in Owambo as well, because *Sisyra producta*, a neuropteran larva parasitic on freshwater sponges, was described from Owambo (Tjeder 1957). Annandale (1914) lists seven species of sponges from the

Zambezi and three from south of the Limpopo, all of which may also occur in Namibia. The species mentioned are fairly rare in this country because of its aridity and would thus be seriously threatened by any changes to the wetlands in the north of the country.

Phylum Cnidaria/Coelenterata

Freshwater Cnidaria belong to the Class Hydrozoa and are also uncommon and little studied, with limited distributions. Two groups occur in Namibia - hydras and "freshwater jellyfish". *Hydra* spp. have been collected from rainwater pools in the Kuiseb River, from the Omatako Dam (SMColl) and from streams in the Naukluft (S. Bethune, pers. comm.). Because they are very small they are easily overlooked and may thus be more numerous than records suggest.

The freshwater jellyfish, *Limnocnida tanganyicae*, is widespread in Africa (Dumont & Verheye 1984). This small, free-living medusa has been collected in Lake Liambezi and the Kwando River (SMColl), Lake Lisikili (van As & Basson 1986) and the Chobe River (Jordaan 1935).

These animals are spread through rivers but only develop in lakes and pools (Dumont & Verheye 1984). Thus they would be adversely affected by the draining of wetlands.

Phylum Platyhelminthes (flatworms)

The free-living flatworms (Turbellaria) are not abundant and little work has been done on them. Only one species, *Mesostoma brincki*, has been positively identified from Namibia (Marcus 1970). *Metamesostoma damariense* was described by Schubotz (1922) from Neudamm, near Windhoek, but Marcus (1955) questioned this identification. Various unidentified specimens have been collected from running water in different sites in the Naukluft mountains, from rainwater pools in East Caprivi and Bushmanland, in other pans in Bushmanland and from farm dams (SMColl). Day (1990) has also collected them from pools in the Namib.

Although the parasitic flukes (Trematoda) are not strictly freshwater species, many require freshwater snails as intermediate hosts. Four species of *Schistosoma* (bilharzia) occur in the Kavango and rivers of East Caprivi (Pitchford 1976, La Grange & Steyn 1983, Curtis 1990). *Calicophoron microbothrium* (formerly *Paramphistomum*), the conical fluke parasite of livestock, has been collected from scattered localities, but few snails dissected contained the parasites. Clinical veterinary occurrences are confined to the north and north-eastern areas of the country. *Fasciola gigantica*, a livestock liver fluke, occurs in the north-east, with scattered clinical records from the south (Curtis 1990).

Other parasites presumably occur in large numbers as well, but have not been well documented. The tapeworm, *Cephalochlamys namaquensis*, was described from a Clawed Toad (*Xenopus laevis*) from Namibia, but is widely distributed in Africa (C.C. Appleton, in litt.).

Phylum Ectoprocta (moss animalicules)

The Bryozoa have recently been divided into two phyla, the Entoprocta, which have not been recorded in freshwater in southern Africa (J. Heeg, in litt.), and the Ectoprocta. These sessile, colonial animals, which superficially resemble moss or algae, may often be overlooked and are thus rarely collected. They may be found in both temporary and permanent water bodies. Five species belonging to two families have been recorded from Namibia (Kraepelin 1914, Barnard 1927, SMColl - see appendix). The three species of *Plumatella* are all cosmopolitan, while *Lophopodella capensis* and *L. thomasi* both occur elsewhere in southern Africa.

Phylum Nematoda (roundworms)

Free-living roundworms have been poorly collected in Namibia. Being small substratum-dwellers they are easily overlooked. Steiner (1916) lists five species, collected either in the Grootfontein or Neudamm areas, four of which he described as new species. Heyns and Coomans (1989) described a new species from the Fish River at Ai-Ais. A few unidentified specimens have been collected from small pans in the Etosha National Park and Bushmanland. It is likely that there may be a number of endemic species in this country, but more work would be required before anything could be said about the conservation status of this group. Nematodes are generally abundant in any kind of waterbody, where they form an important component of the decomposer trophic group. Heyns (1976) mentioned that in most of the South African freshwater habitats which he sampled, there was comparatively low species diversity compared to the high diversity in terrestrial habitats. The parasitic nematodes have not been considered in this paper.

Phylum Annelida (segmented worms)

Although predominantly terrestrial, the Class Oligochaeta (earthworms) has freshwater and amphibious representatives. This group, however, has been poorly studied in southern Africa, particularly in Namibia. Michaelsen (1914) lists ten species in five families for Namibia, but some of his identifications are questionable (Brinkhurst 1964, 1966). Unfortunately, no more recent work has been done on Namibian Oligochaeta. Unidentified specimens have been collected from a variety of habitats including Arnhem and Dragon's Breath caves, Makuri Pan in Bushmanland, springs at Sesfontein and Kaoko-Otavi, a rainwater pool in Hereroland West, the Orange River and East Caprivi (SMColl). Seaman et al. (1978) also found two unidentified species from two different genera in Lake Liambezi.

The leeches (Hirudinea) have been far more extensively studied in southern Africa and have been well collected in Namibia by J.H. Oosthuizen and myself. This predominantly freshwater group is represented by two families and fifteen species, of which three are still to be described, in Namibia. Many of the species are fairly widespread in farm dams and natural waterbodies in the country and all the described species have a wider distribution in southern Africa. In Namibia *Placobdelloides jaegerskioeldi* and *Asiaticobdella fenestrata* have been found only in East Caprivi, while *Aliolimnatus obscura* has not been found anywhere other than its type locality in the Naukluft mountains (Oosthuizen & Curtis, 1990). Two other species, *Alboglossiphonia cheili* and *A. conjugata* both have their type localities in Namibia (Oosthuizen 1978). Species that can be regarded as endangered in Namibia are those known only from single localities, such as *A. obscura*, and *P. jaegerskioeldi* which are dependent on hippopotami as their hosts. All play an important role in the ecosystem as predators and scavengers.

Phylum Mollusca

The molluscs of the Kavango and East Caprivi have been well collected recently by Appleton, Bethune and Curtis, and throughout the country by Curtis (1990). The latter paper updates the distributions given in Connolly's (1939) monograph.

The taxonomy of some genera is in a state of confusion at present and a revision is currently in progress by David Brown. Curtis & Appleton (1987) discuss the malacofauna of the Kavango River, and three other papers on the taxonomy, distribution and ecology of Namibian molluscs are currently in preparation.

By far the greatest diversity of species occurs in the Kavango and rivers of East Caprivi (23 species of gastropods and eleven of bivalves), with many species having the southern-most range of their distribution here. The Cunene River appears to have a far less diverse malacofauna (eight species of gastropods and seven of bivalves). This is due partly to less intensive collecting (the area is far less accessible than the eastern rivers), and partly to the fact that the river is cut off from the other major rivers. All species found in Namibia have a wider range, although *Bellamya monardi* is endemic to the Kavango and Cunene River systems and would thus be threatened by any interference with these rivers. *Pila occidentalis* is endemic to the Angola/Namibia/ Botswana region.

The Class Gastropoda (snails and limpets) is represented by 25 snail and two limpet species in nine families. Most of these are restricted to the permanent rivers in the north, but a number occur throughout the country, notably *Bulinus tropicus*. Species of medical importance as hosts to human bilharzia parasites (schistosomes) (see Platyhelminthes) are *Bulinus globosus*, which is confined to the rivers of the north and *Biomphalaria pfeifferi*, which occurs in the northern rivers as well as the springs of the Karstveld. *Biomphalaria salinarum*, a closely related Angolan species (Brown 1980), is reported to have been collected in the Karstveld in the past (National Snail Collection, P.S. Visser, pers. comm.), but Brown (pers. comm.) is skeptical of those identifications and recent collections from this area produced only *B. pfeifferi*.

Bulinus tropicus, which is host to the livestock and game schistosomes as well as to *Calicophoron microbothrium*, is widespread and common throughout the country except in the arid west. *Bulinus forskali*, a potential host for *C. microbothrium*, is apparently also widespread, but is less common than *B. tropicus*. Some of the material previously identified as *B. forskali* is actually the closely related *B. scalaris*, (Brown, pers. comm.). The host snails for the livestock liver fluke *Fasciola* are *Lymnaea natalensis* and *L. columella*. The former is abundant in the northern rivers and occurs intermittently throughout the rest of the country. The latter, an introduced North American species which is rapidly spreading throughout Africa (Brown 1980), has been found only in scattered localities in this country, but not yet in the northern rivers. Both occur in the Orange River (Curtis 1990).

Two other introduced species occur in Namibia. So far the planorbid, *Helisoma duryi*, is confined to fish ponds, but could spread if allowed to escape. *Physa acuta* has been collected in the Fish and Orange Rivers. Both are attractive species used by aquarists to keep fish tanks clean.

Species of importance as a food source to the local people in the north are the snails *Pila wernei* and *Lanistes ovum*, and the mussel, *Mutela dubia*.

Most of the bivalves are confined to the perennial rivers. Three species of *Mutela* have been recorded from Namibia, but this genus is in need of revision and thus this figure may well change (C.C. Appleton, in litt.). So far only *Unio caffer* has been recorded from the Orange River (SMColl). Three species of *Pisidium* which do not occur in the northern rivers have been collected in pans and springs further south.

Phylum Arthropoda
Class Crustacea

The freshwater Crustacea in this country are represented primarily by the subclasses Ostracoda and Branchiopoda, most of which are adapted to life in temporary habitats. The tiny Ostracoda (seed shrimps) are abundant in many waterbodies, but may easily be overlooked and have thus not been well sampled in the past. More extensive collecting has been done recently by Koen Martens, Jenny Day and Curtis. Martens is working on the systematics of this group.

Very little is known about the biology of ostracods in southern Africa. Most species collected in Namibia come from fresh, ephemeral or semi-permanent pools, although the genus *Limnocythere* is one of permanent waters (K. Martens, in litt.). *Ovambocythere milani* was described from specimens hatched from a dry mud sample (Martens 1988). The most common species, *Apatelecypris schultzei*, occurs in a variety of habitats (SMColl). Only three species, *Sarscypridopsis glabrata, S. aculeata* and *S. punctata*, have been found in saline pools (Hartman 1974 in Martens 1984). This low diversity of halobionts is in marked contrast to the fairly high diversity of such species in other countries, notably Australia (De Deckker 1983) where there are numerous large saline lakes. *Sarscypridopsis ochracea*, a species also found in the Cape (RSA) and Tanzania (see Martens 1984), has only been found in pools associated with Rössing Uranium Mine - in tailings dams, natural springs and seepage water below tailings dams (SMColl). A new, interstitial genus (and perhaps tribe) has been found from a spring at Sesfontein (K. Martens, in litt.). A new genus and species has been described from a farm dam in the Gobabis District (K. Martens, in prep.). No ostracods have been identified from the large rivers, and none of the genera that are associated only with permanent waters (De Deckker 1983) occur in Namibia.

Of the 35 species so far identified from Namibia, at least 18 have been collected in this country only and thus are likely to be endemic. *Ovambocythere, Apatelecypris, Eundacypris* and *Afrocypris* are all endemic genera. An additional five species are confined to the arid regions of Namibia and Botswana. Only about ten species are widespread in the rest of Africa. There is, in addition, a large number of unidentified and mostly new species among the material which Martens is working on at present. This includes new species in the genera *Strandesia, Cypris, Hemicypris, Heterocypris, Onocypris, Centrocypris, Physocypria, Parastenocypris, Ilyocypris, Cypretta, Bradycypris, Amphibolocypris, Darwinula, Neocypridella* and *Eucypris*, as well as two new genera (K. Martens, in litt.). Martens estimates that the number of species from Namibia is at least 50, possibly as many as 70.

That many species have only been found in a few localities may reflect the limited amount of collecting which has been done. However, the high degree of endemicity and limited distribution of many species can also be attributed to speciation. This may be due partly to isolation since these crustacea cannot actively disperse from one waterbody to another and are totally reliant on outside agents such as wind and water-birds. They are adapted to survive long dry periods in the form of resistant eggs, buried in the mud, and may thus remain isolated in their pools for many generations. The resistant eggs do blow from one dry pan to another, but most populations are bisexual and for the successful colonisation of newly invaded habitats both males and females must arrive in the same new habitat. The chances of male and female eggs of the same species arriving in the same new habitat simultaneously are low, thus limiting the distribution of these species. This of course, does not apply to the few

parthenogenetic species. The harsh conditions imposed on them by their environment would exert strong selective pressure. In addition, competition with animals already in the new habitat may be an important limiting factor to the spread of the species. Due to the high level of endemicity the ostracods may be regarded as an important group, worthy of protection from a conservation point of view.

The tiny, planktonic Crustacea of the subclass Copepoda are generally plentiful in large, permanent waterbodies, as well as in various temporary habitats. Nevertheless, they are also easily overlooked and have not been well sampled in Namibia. Much of the material in the SMColl is unidentified. Seven species of Calanoida and seven species of Cyclopoida have so far been identified from this country (SMColl; van Douwe 1914; Sars 1927; Barnard 1935) as well as two unidentified species in two genera of Cyclopoida. A new species of *Tropodiaptomus* awaits description (N.A. Rayner, in litt.). A single fish parasite belonging to the order Arguloida has been recorded (Kensley & Grindley 1973), but there are likely to be more. Most copepod species are confined to the drier areas of southern or East Africa and some extend their range to Ethiopia (N.A. Rayner, in litt.). Possibly more systematic collecting will reveal more undescribed species and may prove that this group is also of conservation importance.

Members of the subclass Branchiopoda are among the most characteristic inhabitants of ephemeral pools and are thus very plentiful in Namibia, but the great species diversity found among the ostracods is lacking. This again may be partly due to a lack of sampling and of experts working on the group. The order Anostraca (fairy shrimps) is represented by 16 identified species in three families, plus two unidentified species in two genera (Daday 1910; Barnard 1924, 1929; Day 1990; SMColl). Most of these species are widespread in southern Africa, but six species were described by Barnard (1924, 1929) from Namibia and may be endemic. The Notostraca (tadpole shrimps) comprise only one family with one species, *Triops granarius*, which is found throughout Namibia as well as the rest of Africa. The Conchostraca (clam shrimps) have recently been divided into two orders (L. Brendonck, in litt.), the Spinicaudata with four families in Namibia and the Laevicaudata with one (Barnard 1929; Day 1990; SMColl). Once again, many of the 13 species recorded are widespread in southern Africa, although three described from Namibia may be endemic. The group is presently studied by Luc Brendonck. The Cladocera (water fleas) are another planktonic group which is widespread but rarely collected. So far nineteen species in about five families have been identified, but the taxonomy of this group is in great need of revision (M.T. Seaman, in litt.) and at least five undescribed species occur. Further work on all these orders will no doubt yield a number of new species. The only quantitative data on the planktonic Copepoda and Cladocera were gathered by Bethune (1987) for von Bach, Omatako and Swakoppoort dams.

The Branchiopoda are all worthy of conservation in Namibia because of potential endemism and their unusual habitats.

Most members of the subclass Malacostraca are marine, but there are a few freshwater representatives in three orders. Both the Amphipoda (sand fleas) and Isopoda (sowbugs, pillbugs) are poorly represented in Namibia and have so far only been found in caves. Recently, two new species of Ingolfiellidae (Amphipoda) have been described (Griffiths 1989) and one awaits description (C. Griffiths, in litt.). These are a total of five species which are probably all endemic to Namibia. Two unidentified and possibly new species in two isopod genera have also been collected (SMColl; B. Kensley, in litt.). Because of their unique habitat and limited distribution, they are threatened by any interference with ground water.

The order Decapoda is represented by three genera. One is the river crab, *Potamonautes*, of which there are three species (Balss 1924; Barnard 1935). These are fairly common in the large rivers, and permanent streams of the Naukluft, and have a wider distribution in southern Africa. Freshwater shrimps of the genus *Caridina* are represented by possibly two species which have only been found in the large rivers. The edible freshwater shrimp, *Macrobrachium vollenhoveni* reaches its southern limit in the Cunene River (Kensley 1970) and may be endangered in Namibia if dams built on the Cunene reduce water supply to the lower reaches of the river.

Phylum Arthropoda
Class Insecta

The insects form the dominant component of most freshwater ecosystems, even though a comparatively small proportion of the Class Insecta has colonised aquatic environments. Among aquatic insects, there are those orders in which the larvae are all dependant on water for their development, although the adults are terrestrial; those orders which have some members with aquatic larvae; and those which have members with both adults and larvae living in the water. A fourth group includes species such as the Staphylinid beetles and certain mole crickets (Tetrigidae and Tridactylidae) which are associated with the water's edge or with the wetland vegetation. I shall not be dealing with these.

Generally, when collecting in an aquatic habitat, only the larvae of those species with terrestrial adults are collected. This makes identification difficult or impossible as there are keys to the aquatic larvae of only a few of the insect orders. Thus much of the material in museums is unidentified. In addition, nothing is known of the biology of many of the species described only as adults. This means that, although the adults may have been recorded in Namibia, one cannot always be certain that their young are aquatic. I have included species with young of doubtful habitat, with a note to that effect (see Appendix).

Although the young of five orders are confined to the water, numerically these orders have far less significance than the Coleoptera and Hemiptera. The Megaloptera of southern Africa are thought to be a relict fauna, restricted to the mountainous areas of the south-western and eastern Cape, East Griqualand, Natal and the Transvaal (Mansell 1986) and have not been recorded from Namibia.

Ephemeropteran (mayfly) nymphs live under stones, attached to plants or burrowing into the substratum. They occur in most wetland habitats in Namibia, but prefer cool, clear, running water. Southern Africa has eleven families (Agnew 1986), of which five are represented in Namibia. Unfortunately, at the time of going to press, none of the SM collection had been identified beyond family level, but W.L. Peters (in litt.), who is in the process of identifying specimens from the SMColl, indicated that Namibia has an interesting mayfly fauna which includes one nymph of the rare genus *Machadorythus* and a nymph of a new genus of Tricorythidae. The Baetidae are the most numerous and widespread, but only four species have been positively identified so far (Agnew 1965; Demoulin 1970). The Leptophlebiidae have also been collected from various localities, but the other families tend to be confined to the perennial rivers and streams. All the species identified so far occur elsewhere in southern Africa and some have a wider distribution. None of the identified species is endemic, but further study should

yield many more species, some of which may be endemic.

Only two families of Plecoptera (stoneflies), each with few species, occur in southern Africa. The nymphs develop in running water and are therefore rather limited in their distribution (Picker 1979). The two Namibian species recorded were collected in the Cunene River (Barnard 1934a; SMColl) and have a much wider African distribution, but may be regarded as being of conservation importance in Namibia because of their limited distribution in this country.

The Trichoptera (caddisflies) are also associated with permanent, running water and clean, well oxygenated lakes and dams, and are thus not as abundant in Namibia as elsewhere in southern Africa. The checklist (Appendix) suggests that Trichoptera occur only in the Cunene River. This is definitely due to sampling bias and availability of identified specimens. Unidentified Trichoptera have been collected from such places as the Naukluft streams, the Waterberg Plateau, the Fish River, and the Kavango River. None have been recorded from East Caprivi, but this is more likely to be due to a lack of adequate sampling than to the absence of this group there. Three large, cosmopolitan families and one smaller one are represented. The Hydropsychidae, which is the most important family in southern Africa (Scott 1986), is represented by three identified species in Namibia (Ulmer 1913; Barnard 1934b; Scott 1983). Another important southern African family, the Leptoceridae, is represented in Namibia by eight species (Barnard 1934b; Jaquemart 1963). No members of the Hydrophilidae have so far been identified. Three species have been collected from the Cunene River only and may be endemic, but may also extend further into Angola. At least 100 more species could be added to the list if extensive collecting were done and the unidentified material were studied (F.C. de Moor, in litt.).

The last order with entirely aquatic nymphs is the Odonata (dragonflies and damselflies), the adults of which are conspicuous and well-known. Nymphs may be found in large numbers in virtually all aquatic habitats, but the greatest number of species in Namibia is associated with permanent habitats. Species such as *Pantala flavescens*, *Brachythemis leucosticta* and *Bradinopyga cornuta* are capable of rapid development in temporary rain pools (Pinhey 1978). The former is found throughout Namibia, while the latter two, so far, have only been collected from the north of the country (Pinhey 1985). For a semi-arid region, Namibia has a fairly rich odonate fauna, but many species have been collected only from the northern rivers. Most species have a wide distribution in Africa or are cosmopolitan.

The suborder Zygoptera (damselflies) is represented by 22-26 species in six families (Longfield 1936; Pinhey 1961, 1984; Balinsky 1963; SMColl), the most numerous and widespread of which is the Coenagrionidae. Two species with a limited distribution are *Agriocnemis angolensis*, which occurs in southern Angola, extending to the rivers of our northern border (Pinhey 1984), and *Metacnemis valida*, said to be endemic to the Cape Province by Pinhey (1984) but recorded from the Transvaal and Zimbabwe (Balinsky 1958) and Rundu (SMColl). The former is the only species which could thus be regarded as being endangered.

The suborder Anisoptera (dragonflies) is represented in Namibia by some 50 species in four families (Longfield 1936; Pinhey 1985). The large, robust Libellulidae are the most numerous and widespread. *Aeshna minuscula* (Aeshnidae) from Otjiwarongo is one of seven species endemic to South Africa (Pinhey 1985) and apparently rare in Namibia. Two species have been described from Namibia, *Rhyothemis mariposa* and *R. notata fenestrina*, both of which extend further north into central Africa (Pinhey 1985). The picture may look very different when the large number of unidentified larvae in the SMColl have been identified, or when more adults have been collected.

Of those orders where some taxa have aquatic larvae, only the Diptera and the Neuroptera have been found in Namibia. The Diptera (flies) is represented by twelve families, of which the largest and best known is the Culicidae (mosquitoes), which have been well studied because of their medical importance. All species have aquatic larvae, but not all carry disease. In Namibia, 52 species in eight genera have been recorded, but only five are of medical importance. *Aedes caballus* and *Ae. lineatopennis*, carriers of Rift Valley Fever, have been collected from Owambo, Rundu and Okakarara (Edwards 1941; McIntosh 1971, 1973). The malaria vectors, *Anopheles funestus*, *An. arabiensis* and *An. gambiae* s. str. occur in northern Namibia, with unidentified members of the latter group present in central Namibia as well (Gillies & De Meillon 1968). These species are all widespread in Africa. *Anopheles fontinalis* and *An. namibiensis* have only been collected in Namibia and may be endemic (Gillies & De Meillon 1968; Coetzee 1984), along with a new species being described by M. Coetzee (in litt.).

The next largest family, the Chironomidae (midges), is more widely spread in Namibia. The larvae live in benthic sediments. So far, 27 species in 18 genera have been described, largely from Kaokoland (Freeman 1955, 1956; Crosskey 1980). Once again, the bias in sampling and identification is obvious since larvae have been collected from almost every type of waterbody throughout the country. Most species have a widespread African distribution, but *Archaeochlus biko* and *Knepperia gracilis* were described from Namibia and may be endemic (Cranston et al. 1987; Kieffer 1908).

Very little is known about the biology of the Afrotropical Tabanidae (horseflies), which are widespread in Namibia. Thus it is difficult to be sure whether the larvae of species collected here as adults are in fact aquatic. The larval habitat for *Philoliche* spp. is probably damp soil or stiff mud. Similarly, species of *Tabanus* and *Haematopota* may live in saturated mud under water while others may occupy marginal habitats just out of the water (B. Stuckenberg, in litt.). There are three species described only from Namibia which may be endemic, with the others being fairly widespread in Africa.

Another widespread, but less commonly collected family is the Ceratopogonidae (punkies, biting midges), which have some species with truly aquatic larvae, while other species breed in damp habitats. Those with aquatic larvae possibly comprise eight species in four genera in Namibia, most of which are widespread in Africa. At least three other genera are represented by undescribed species. Twelve species of Tipulidae (crane flies) have been identified from the north of Namibia, most of which are fairly widespread in Africa. There is one possible endemic, *Eugnophomyia xenopyga*, and probably quite a few species still to be found and recorded (B. Stuckenberg, in litt.).

The Simuliidae (blackflies) are of importance in central and eastern Africa since the females are vectors of various parasitic diseases of man and other animals. According to Barraclough & Londt (1985), the most important vector of human onchocerciasis, *Simulium damnosum* s.l., does not extend down to southern Africa. However, a specimen in the SMColl from the Kavango was recently identified as *Simulium damnosum* s.l. by Rob Palmer (in litt.). In addition, four other species of *Simulium* have been collected from Namibia, mainly in the Kavango, although *S. ruficorne* is widespread. *Simulium chutteri*

and *Prosimulium gariepense* have both been collected from the Orange River at Upington and Prieska (Albany Museum records) and probably also occur further downstream. The low numbers of species recorded from Namibia reflects a lack of research rather than the absence of the insects. Extensive sampling of the perennial rivers would probably yield at least 30 - 40 species of Simuliidae. A common southern African species which could be expected to occur in Namibia is *Simulium mcmahoni* (F.C. de Moor, in litt.). *Prosimulium*, a genus endemic to southern Africa, with two species described from Namibia, may have additional undescribed species in Namibia and is worthy of conservation and further research (F.C. de Moor, in litt.).

Other families which are less well represented and poorly sampled are the Psychodidae, Stratiomyidae, Ephydridae, Dolichopodidae, Syrphidae, Empididae, Muscidae, and Sciomyzidae. Not enough is known about these families at present to be able to comment on their conservation status.

Only one family of Neuroptera, the Sisyridae, has aquatic larvae and these are parasitic on freshwater sponges. *Sisyra producta* (Tjeder 1957) was described from Owambo, and larvae of *Sisyra* sp. have been collected with freshwater sponges from Popa Rapids, Kavango River. Because of the limited distribution of freshwater sponges, this species is also limited in distribution and therefore of conservation importance.

The two orders which have species in which both adults and larvae are dependent on water are the Coleoptera and the Hemiptera. Both form an important part of any freshwater system. The adults of most species are able to fly from one habitat to another, thereby distributing the species more widely. Selection pressure may, therefore, be strongest on the larvae, which are confined to the water.

By far the larger of the two orders is the Coleoptera (beetles), where many species have evolved an aquatic lifestyle, largely in the littoral habitats, and often associated with decaying vegetation (Endrödy-Younga, in press). The largest and most abundant aquatic coleopteran family is the Dytiscidae (diving beetles), comprising at least 63 species in 20 genera in Namibia (see appendix), compared with about 230 species in 38 genera in southern Africa (Endrödy-Younga, in press). This is also the best studied family in Namibia, and revisions of various genera are still in progress (O. Biström, in litt.). Dytiscids are found in all kinds of aquatic habitats, including temporary ones. Most of the species found in Namibia are widespread in Africa, although they may only have been recorded from a few localities in Namibia so far. Some occur only in southern Africa. Species such as *Yola endroedyi* and *Yolina brincki* are confined to the arid areas of Namibia and Angola, while others, such as *Hyphydrus esau*, occur only in the wetlands of East Caprivi and Botswana. *Clypeodytes roeri* was discribed recently from the Kavango river in Namibia (Biström 1988d), but probably occurs in Botswana as well. *Canthyporus guttatus* and *Hydaticus fulvoguttatus* have only been collected from Namibia (Windhoek district) and may be endemic (Omer-Cooper 1956, 1965). These species may all be regarded as of conservation concern.

The other Coleopteran families have been far less well studied in Namibia and much of the material in the SMColl has not been identified beyond family level, or at most genus. The second most common family is the Hydrophilidae (water scavenger beetles). This family is represented, at present, by 14 species in nine genera (D'Orchymont 1935; SMColl) of a potential 80 aquatic species in 16 genera for southern Africa (Endrödy-Younga, in press). The Gyrinidae (whirligig beetles) are most often seen in groups skimming along the water surface, but are also capable of diving and swimming rapidly to avoid predators. They are found less commonly along the vegetated margins of the large rivers, in standing water, streams and temporary habitats. So far they are represented by seven species, most of which are widespread. *Orectogyrus elongatus* is probably confined to northern Namibia and Angola, while *Aulonogyrus abdominalis* is endemic to southern Africa. *Dineutus aereus* is the only species which occurs near the desert (Brinck 1955).

Other families which are sparsely represented and largely unidentified are the Sperchidae, Hydraenidae, Limnichidae, Heteroceridae, Dryopidae, Georyssidae and Elmidae. The last are fairly well represented in southern Africa as a whole, but almost unrecorded from Namibia. This may be due partly to the fact that they are only 1-3 mm long and thus overlooked by collectors, but also because they prefer running water habitats which are less common in Namibia. Three species which occur in the Cape Province and Angola and can thus be expected in boundary rivers are *Ctenelmis incerta, Leielmis georyssoides* and *Potamodytes brincki*. Members of the other families are all tiny and easily overlooked, but none of the families have many aquatic species in southern Africa.

It appears that many species are confined to the permanent rivers of the north of the country, or to the springs of Kaokoland and the westward-flowing rivers. This apparent distribution is likely to be due to a bias in collecting, but also reflects the importance of permanent habitats for Coleoptera. Most beetles are able to fly from one waterbody to another and thus can spread fairly easily and also avoid desiccation should their habitat dry up.

The Hemiptera (bugs) have not been very well studied in Namibia. The two most common and widespread families are the Notonectidae (backswimmers) and the Corixidae (water boatmen). The Notonectidae, members of which tend to occur in shady but clear patches of standing or slowly flowing water, is represented by the genus *Anisops*, with at least ten species, plus *Enithares sobria* (J. Londt, in litt.; Hesse 1925; Poisson 1956). With the exception of a new species described by Truxal (1990) from Namibia, all these species are fairly widespread in Africa. The Corixidae can be found in any type of freshwater habitat and members of this group are among the first to arrive in a newly filled ephemeral habitat or man-made pool. Ten species in three genera have been identified from Namibia, most of which are widespread and common. *Micronecta hessei* and *M. browni* were described from Namibia and may be endemic (Hutchinson 1929). Other less common families such as the Belostomatidae, Naucoridae, and Nepidae are represented by only three or four species.

The best known of the semi-aquatic bugs is probably the Gerridae (water striders), since members of the genera *Gerris* and *Limnogonus* can be 20 mm or longer and are conspicuous as they skate over the water surface. Although only three species have been recorded for Namibia (Poisson 1956), gerrids are found throughout the country on almost all waterbodies. In addition to these two genera which have been recorded in Namibia, Andersen (1982) has *Naboandelus, Neogerris* and *Tenagogonus* in his distribution maps for Namibia. Other semi-aquatic families, the Mesoveliidae, Veliidae, Hebridae, Hydrometridae and Pleidae, are poorly represented. Two genera of Veliidae have been recorded, but again Andersen (1982) also shows *Xiphoveloidea, Rhagovelia* and *Angilia* as occurring in Namibia. The paucity of some of these families may be due to sampling bias since they are tiny and easily overlooked. Many are widely distributed in Namibia and most are widespread throughout Africa.

INVERTEBRATE FAUNA OF NAMIBIAN WETLANDS

Perennial Rivers

The only perennial rivers in Namibia are those which flow along the northern and southern borders. All have their headwaters many hundreds of kilometres away in higher rainfall areas, and relatively small sections of each river actually border Namibia. The riparian vegetation along the banks of these rivers supports faunas which are different from those of more ephemeral habitats and standing waters. Many species found in these rivers have been brought down from the headwaters and are more characteristic of their mesic origins than of the arid systems of Namibia. This is particularly true of the Orange River (see van Zyl, this volume). The most extensively sampled river is the Kavango (see Bethune, this volume), which appears to have the greatest species diversity of the perennial rivers (see appendix). The lower figure for the East Caprivi is probably due to less extensive sampling. In fact, a higher species diversity is expected for the East Caprivi, since it has an extensive network of floodplains and oxbow lakes which increase the habitat diversity and thus the potential species diversity (see Schlettwein et al., this volume).

The higher diversity of these two systems compared with the Cunene and Orange is in part due to better sampling, but mainly due to differences in the topography of the rivers themselves. The latter two rivers, for the most part, flow through rocky canyons with only occasional patches of marginal vegetation which support aquatic invertebrates. Neither has the quiet backwaters and floodplains associated with the Kavango and rivers of East Caprivi. Both rivers have an estuarine component to their fauna, which is discussed in this volume by Noli-Peard and Williams.

The increased species diversity of the north-eastern rivers is also due to the fact that many tropical species with ranges extending up to central and East Africa have their southern limits here. These rivers share much of their fauna with the swamps of Botswana and the river systems of Zimbabwe, and many species identified from these two countries may be expected to occur in Namibia as well.

With the exception of the larger Crustacea, which are confined to the perennial rivers, the crustaceans are not well represented in these permanent habitats, with insects forming the major part of the biota. There is also a high diversity of Mollusca, particularly in the Kavango.

Ephemeral Rivers

Because of the low rainfall and short rainy season, all the rivers in the interior of Namibia are dry for most of the year, with short, sharp floods during the rains. Years can go by without any flooding in some rivers. Immediately after the floods subside, pools are left in the eroded bends of the rivers which harbour species capable of rapid colonization of new habitats; notably notonectid and corixid bugs and dysticid beetles. If these pools remain for a while, various dipteran larvae such as culicids and chironomids start to develop and later odonate and ephemeropteran nymphs may be found. Since these pools have elements typical of ephemeral pools, they have rather a diverse fauna (Day 1990).

A number of the ephemeral rivers, such as the Ugab, Huab and other westward flowing rivers, have springs and seeps which flow the year round and sustain large reed beds, with pools supporting various sedges and algae. These pools, which tend to be enriched by the droppings of game and livestock, support a fauna whose diversity may be greater than that of the Orange and Cunene Rivers. This is because of the greater diversity of habitats afforded by the pools and slowly flowing streams. These pools have also been well sampled by S. Bethune, J. Day (Day 1990) and myself. Certain taxa, such as Mollusca and Trichoptera are less well represented here but others, like Ostracoda, Coleoptera and Cladocera, are better represented here than in the perennial rivers.

The Fish River, too, has seeps with a permanent fauna but these are essentially lacustrine with a far less diverse fauna than those of the westward flowing rivers. Many species listed under "Fish River" in the appendix are associated with the vegetated pools below Hardap Dam. This river has been far less extensively collected than the western rivers.

The two eastward flowing rivers, the White and the Black Nossob, have a few permanant habitats. Apart from the copepod, *Metadiaptomus colonialis*, recorded by van Douwe (1914), nothing has been collected from these pools, which remains an area in need of study. Another unstudied river is the Brak, near Karasburg. The Omatako, which drains into the Kavango, has a fauna similar to the Kavango at the confluence of the two rivers. For the rest, temporary pools left after flooding appear to have a similar fauna to that of other temporary pools.

The Tsondab and Tsauchab are westward flowing rivers which do not reach the sea, but end in large pans, the Tsondab and Sossus Vleis respectively. To the best of my knowledge, no collecting has been done in the former, but the latter fills with water periodically and has been sampled by Grobbelaar (1976), S. Bethune and myself (SMColl). The fauna of this pan tends to be similar to that found in other unvegetated pans (see Seasonal Wetlands below), with vast numbers of Branchiopoda and Copepoda, plus the ubiquitous Hemiptera, Coleoptera, dipteran larvae and a few odonate nymphs.

Seasonal Wetlands

Apart from the ephemeral rivers which flow after heavy rains, leaving behind temporary pools, there are also extensive pans in Namibia which fill up in the rainy season, but may remain totally dry for years on end. Some of these pans support a diverse flora of algae, reeds, sedges, grasses, waterlilies and other aquatic macrophytes. Others tend to be open, unvegetated expanses of turbid water (see Lindeque & Archibald, this volume).

When the rains fall, much of Owambo becomes a vast wetland, composed of numerous pans, shallow depressions and oshonas (shallow rivers). These drain down into the extensive Etosha Pan (see Lindeque & Archibald, this volume). This area was well sampled in the past by members of the Swedish expedition of 1950/51, and other collectors such as Barnard, who described numerous new species. In later years, sampling here has been difficult because of military activity. The largest species diversity is among the Crustacea, particularly the Ostracoda, many of which have resistant eggs which are capable of withstanding long, dry periods in a dormant form. As soon as the pans fill, they hatch, rapidly grow to maturity and reproduce. The Crustacea also form by far the greatest biomass, particularly in the sparsely vegetated pans. Numerous molluscs are also found in these pans and shonas which are indirectly connected to the large rivers.

The pans of Bushmanland have been less well studied in the past, and much of the recent material collected by C. Meyer and myself has not been identified to species level. There is also a

greater diversity of habitat types among the different pans than occurs in Owambo (see Hines, this volume). Thus they support a greater diversity than is indicated in the appendix.

The mollusc fauna is not as diverse as that of Owambo, with species occurring here being capable of aestivation. There are many undescribed ostracods from Bushmanland (K. Martens, in litt.), which will increase the species number for this region. Similarly, various unidentified copepods, anostracans, conchostracans and cladocerans have been collected from these pans. The same applies to many of the insect orders.

Kavango and Hereroland pans have been totally unsampled. The pans to the south of the country have also been virtually unsampled until good rains in 1989 filled them for the first time in eight years. They were sampled in February and March 1989, but most of the material collected has not been identified to species level, hence the low number of species shown in the appendix. More than 60 species of insect, plus at least 20 species of Crustacea, were collected in 1989, along with two species of snails.

Karstveld

The Karstveld is an area of porous, calcareous rock, with numerous underground caverns and tunnels, which underlies a large part of northern Namibia (see Irish, this volume). These underground caverns may be filled with water which may come to the surface in various places as permanent springs. In the past, these springs were plentiful throughout the area, but extensive extraction of ground water has resulted in many springs drying up. Those which are left form a series of small, vegetated streams and pools which support their own characteristic fauna. There is a high diversity of molluscs in this region, including two species, *Biomphalaria salinarum* and *Pisidium kenianum*, in Namibia, which only occur in the Karstveld. Most of the listed nematodes were collected from this area.

There are also two sinkhole lakes (cenotes) which have little vegetation other than algae, and support the more mobile species such as dytiscids, notonectids and corixids. Lake Otjikoto is home to a species of snail, *Melanoides tuberculata*, which has not been found in any of the Karstveld springs.

In addition to the open water of the springs and sinkhole lakes, there are a few underground lakes which may not form wetlands in the strict sense of the word, but are nevertheless aquatic habitats occupied by a unique invertebrate fauna. Five species of amphipod and two of isopod, all of which are probably endemic, occur only in these caves and thus this habitat should be conserved.

Impoundments

There are no natural permanent lakes in Namibia. Lake Liambezi, which was well studied when it was full of water (eg Seaman et al. 1978), is an ephemeral part of the Chobe/Linyanti/Kwando river system and is presently dry. Lake Lisikili, similarly, is part of the Zambezi floodplain system. Thus the impoundments built by the Department of Water Affairs are the nearest to lakes in this country. However, due to their recent establishment, generally steep, rocky sides and vastly fluctuating water levels, there is sparse or no littoral and marginal vegetation and little variety of habitats, resulting in a poor species diversity of invertebrates. Most of the species found in these impoundments are ubiquitous throughout the country and cannot be regarded as being of conservation importance. The seepages below the dam walls form permanent vegetated, diverse habitats which support a fauna similar to that of the permanent springs in the western rivers.

Artesian and other springs

Throughout Namibia one comes across ground-water which wells up to the surface (see de Wet, this volume). Some of these springs have already been mentioned when the westward flowing rivers and the Karstveld were discussed. The species listed under "Springs" in the checklist exclude those of the former habitats. The variety of springs is great, ranging from the highly saline pools of the Namib (Day 1990) to clear, sweet waters. Some are mere trickles of water supporting only algae, bacteria and a few invertebrates, while others form fairly deep streams and pools, supporting a heterogeneous mix of flora and fauna. Taken collectively, these springs provide a diversity of habitats which is reflected in the comparatively large number of taxa listed in the checklist. These are important habitats, not only for the invertebrates which are dependent on them, but also for vertebrate wildlife, and are thus worthy of preservation.

Two mountainous areas which have a series of springs are the Waterberg and the Naukluft. Both are home to species which, so far, have been identified only from there. The Naukluft is better studied and more richly endowed with springs, which form permanent streams. Here, species such as crabs, otherwise confined to the perennial rivers, may be found.

Other waterbodies

This includes a diverse array of habitats not covered in the other sections, ranging from farm dams and other man-made waterbodies to rainpools and borrowpits. The tailings dams and waterbodies associated with Rössing Uranium Mine near Swakopmund are also included here. References to waterbodies in which the nature or exact locality was not given are also included here.

Although many of these are not strictly wetlands, a glance at the checklist will reveal that many identified species fall into this category. None of these habitats is likely to harbour a diverse or unique fauna, but often species have been recorded only from farm dams near settlements, or from waterbodies of unknown nature, although they may occur in the other wetlands already mentioned. Thus the high figure for number of species found is rather misleading, suggesting erroneously that this category of habitats has a high species diversity. It simply underlies the need for more detailed study of certain habitats and for serious taxonomic work on many groups.

DISCUSSION

Since our present knowledge of invertebrate faunal distribution is so limited and we do not know which species are likely to be endangered, it is difficult to predict what changes may occur in the future. Table 1 shows that there are relatively few known endemics for Namibia, with the notable exception of the Ostracoda. The highest species diversity appears to occur amongst the Coleoptera and Diptera larvae. The most vulnerable species are those which are confined to a few wetlands by virtue of their habitat requirements, like the freshwater jellyfish and sponges, or by their relative immobility, such as the ostracods. Other species of conservation concern are those of economic importance, such as the large crustaceans and molluscs which are eaten by the local people. Potential endemics are worthy of protection simply because we do not know if they occur elsewhere.

TABLE 1: Numbers of families and species of freshwater macro-invertebrates recorded from Namibian wetlands, with numbers of potential endemics. The number of species includes those identified as well as undescribed species.

Phylum	Families	Species	?Endemics
Porifera	2	3	0
Cnidaria	2	2	0
Platyhelminthes	6	9	0
Ectoprocta	2	5	0
Nematoda	6	10	1
Annelida			
Oligochaeta	5	12	1
Hirudinea	2	15	3
Mollusca			
Gastropoda	8	27	0
Bivalvia	5	15	0
Arthropoda			
Crustacea			
Ostracoda	3	43	20
Copepoda	3	15	1
Anostraca	3	16	6
Notostraca	1	1	0
Spinicaudata	4	9	3
Laevicaudata	1	3	2
Cladocera	6	19	1
Amphipoda	1	6	6
Isopoda	1	2	2
Decapoda	3	6	0
Insecta			
Megaloptera	1?	1?	0
Ephemeroptera	5	11	0
Plecoptera	1	2	0
Trichoptera	4	15	3
Odonata	10	77	0
Diptera	13	159	14
Neuroptera	1	1	0
Coleoptera	10	92	6
Hemiptera	12	38	3
TOTAL	120	613	72

Habitats which are unusual or unique to this country should receive top conservation priority since it is in these that endemics are likely to occur. This includes the temporary pools of the Namib and pans to the north and south of the country. It also includes the ephemeral, westward flowing rivers. The permanent waters of the springs are important habitats for various species and should therefore be protected.

Our perennial rivers should also be conserved, since species occur here which do not occur elsewhere in the country, although they have a wider distribution in the subcontinent. The Cunene River appears to support an important wetland with a number of species which have not been recorded from other waterbodies in Namibia. The invertebrate fauna would be seriously affected by the construction of any dams which restrict the flow of water to the lower reaches. The fauna of the Kavango River and East Caprivi would not be as seriously affected, since the species are more widespread, but a number of species are of economic importance to the local people and should therefore receive protection.

The numerous potential threats to wetland habitats have been well documented (Noble & Hemens 1978; Hart & Allanson 1984; O'Keeffe 1986) and will only briefly be mentioned here. All of these threats directly affect the invertebrate faunas of wetlands and should be carefully assessed before any new scheme is undertaken.

The damming of rivers has received much attention in South Africa, where rainfall is also low and erratic, although not as much so as here (O'Keeffe 1986). In perennial rivers, damming results in a decreased water supply to the lower reaches or even total cessation of river flow. In our ephemeral rivers, dams which prevent the recharging of underground water cause permanent seeps and pools downstream to dry up, thus eliminating important wetlands and their associated invertebrate faunas. On the other hand, dams create new wetlands below their walls, which can lead to the spread of unwanted species. The same can happen with irrigation schemes, as was experienced in northern Natal where new sheltered, predator-free habitats provided ideal breeding places for malaria mosquitos of the *Anopheles gambiae* complex (Sharp et al. 1984). Water transport schemes carrying water from one system to another run the risk of introducing alien and perhaps harmful species to the new habitat. For instance, the spread of bilharzia and other snail-borne parasites this way has been well documented (Amin et al. 1976; Abdel-Wahab 1979; Abu-zeid 1983 all in Bethune 1985). The potential spread of snails and their parasites from the Kavango southwards has been investigated (Curtis 1990).

Pollutants such as human/animal excrement in floodplain pools will cause eutrophication, which affects the species composition by changing the phytoplankton community and creating anaerobic conditions in the water (Cullen & Walmsley 1984). Fortunately, in this country we do not have a major problem with industrial pollutants, but effluent from mines and harmful chemicals such as DDT and molluscicides may cause the death of a number of species. These chemical are used extensively in the East Caprivi and Kavango at present and should be strictly controlled.

Salinisation is a particular threat in semi-arid regions (Williams & Noble 1984). This is the process whereby the concentration of total dissolved solids in inland waters is increased, by either natural or unnatural means, thus affecting the biota of the system. Man can elevate the salt concentrations by accelerating the rates of salt accretion from natural sources or by adding salts as a result of mining, industry, urban and other activities. Irrigation can also contribute to this process. Over-extraction of groundwater in the Karstveld, the ephemeral rivers and other areas with natural springs may cause these springs to dry up, which will destroy the endemic species and seriously affect the distribution of many other species.

Deforestation and destruction of riparian vegetation due to overgrazing and agriculture along river banks affects the river fauna, as well as resulting in erosion of river banks and siltation of rivers and streams which in turn affects the biota (Heeg 1986).

At present there appear to be few alien species among our invertebrate fauna. The snail *Lymnaea columella* occurs in scattered localities. So far numbers are low, but an increase in number could have detrimental consequences since this snail is intermediate host to *Fasciola hepatica*, a fluke parasite of livestock. The other two alien snails, *Physa acuta* and *Helisoma duryi*, are not widespread and do not have any medical importance. Potential threats, such as the introduction of alien freshwater prawns or freshwater oysters for commercial purposes, must be considered.

The importance of taxonomic research can only be stressed. There are many unidentified species in these systems about which we can say nothing. A look at Noble & Hemens' (1978) table 12 shows the poor state of knowlege of many invertebrate taxa in South Africa. This work is somewhat dated, but the situation is virtually unchanged today. For example they were only able to list one species of dragonfly as being of conservation importance, simply because of a lack of knowledge of the other fauna.

In an arid land such as Namibia, where most of the wetlands are

ephemeral and dependent upon an erratic rainfall, it is of utmost importance that all wetlands be considered seriously for conservation attention, and that any proposed man-made changes to the environment be carefully assessed before any action is taken.

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APPENDIX 1: A checklist of freshwater macro-invertebrates found in Namibian wetlands.

The list of species given here has been compiled from the literature, from records of the State Museum of Namibia, from other museums in South Africa, as well as personal communications from numerous systematists who are acknowledged at the end of this paper. It must be stressed that the number of taxa listed and the localities from which they have been recorded are only a fraction of what actually occurs since so much material is unidentified or uncollected. I have tried to be as up-to-date and accurate as possible in the time available before the publication of this monograph, but species name changes and generic shifts of which I am unaware may have been omitted.

Published references and personal communications are given numerically, according to their position in the list of references at the end of the paper. Museum records are given by the following letters:
SM1 = State Museum collection, determined by a specialist
SM2 = State Museum collection, determined by a non-specialist or unknown person
AM = Albany Museum collection (Grahamstown)
NCI = National Collection of Insects (Pretoria)
NSC = National Snail Collection (Potchefstroom)
TM = Transvaal Museum collection (Pretoria)
RI = Research Institute for Diseases in Tropical Environments (Nelspruit)

COLUMN HEADINGS
Columns denote various wetlands/wetland types, as far as possible following the chapters of this monograph.

"GENERAL COMMENTS" ABBREVIATIONS
NAM = recorded only as "South West Africa or Namibia" in literature
N = recorded only as "northern SWA or Namibia" in literature
C = recorded only as "central SWA or Namibia" in literature
K = recorded as "Kaokoland or Kaokoveld" in literature
E = Endemic (found only in, or so far only identified from Namibia)
E? = potential endemic
A = Alien
U = Taxonomy/identity/record uncertain or dubious

OTHER ABBREVIATIONS
x = present - recorded at least once
y = not actually recorded there, but expected to occur

a = two species very similar and may easily be confused
b = subfossil from Gobabis (Connolly 1939)
c = subfossil from Kamanjab (Connolly 1939)
e = taxonomy in state of confusion. Divided into species groups by Frey (Seaman & Kok, in press)
f = genus common and widespread, but only a few specimens have been identified to species level
g = the commonest *Herophydrus* sp. in southern Africa (Omer-Cooper 1965)
h = species widespread in Namibia (Gillies & de Meillon 1968)
i = nomen nudum (Crosskey 1980)
j = immatures found in mud or wet soil at edges of pools or streams (J.Chainey, in litt.)
l = uncertain whether larvae are aquatic (B. Stuckenberg, in litt.)
m = commonest and most widely distributed water bug in southern Africa (Hesse 1925)

Checklist of the freshwater macro-invertebrates of Namibia. (Families and species listed alphabetically)

	General comments	East Caprivi	Kavango River	Cunene River	West-flowing rivers	Seasonal wetlands of Owambo/Etosha	Bushmanland and Hereroland	Karstveld wetlands	Large perennial impoundments	Springs/seeps	All other water bodies (e.g. farm dams, gravel pits) and of unknown locality or nature	Orange River	Fish River and Hardap dam	Seasonal wetlands in south	Ephemeral east-flowing rivers	Ref.
PHYLUM PORIFERA (sponges)																
Class Demospongia																
Order Haplosclerida																
Family Potamolepididae																
Potamolepis sp.	U		x													SM1
Potamophloios hispida Brien 1969		x														SM1
Family Spongillidae																
Ephydatia fluviatilis Linnaeus 1758							x									SM1
PHYLUM CNIDARIA/COELENTERATA																
Class Hydrozoa																
Order Hydroidea																
Family Hydridae																
Hydra spp.					x				x	x						SM2
Suborder Limnomedusae																
Family Limnocnididae																
Limnocnida tanganjicae Gunther 1893		x														SM1;89;151
PHYLUM PLATYHELMINTHES																
Class Cestoda (Tapeworms)																
Order Diphyllidea																
Cephaloclamys namaquensis Cohn 1906	NAM															179
Class Trematoda (flukes)																
Family Fasciolidae																
Fasciola gigantica (Cobbold 1855)		x	x													51
Family Paramphistomatidae																
Calicophoron microbothrium (Fischoeder 1901)		x	x			x	x	x	x		x					51
Family Schistosomatidae																
Schistosoma haematobium (Bilharz, 1852)		x	x													94 ; RI
S. leiperi Le Roux 1955		x														132
S. mansoni Sambon 1907		x	x													94 ; RI
S. margrebowiei Le Roux 1933		x														132
Class Turbellaria (flatworms)																
Order Neorhabdocoela																
Metamesostoma damariense Schubotz 1922	U										x					103
Family Dalyelliidae																
Mesostoma brincki Marcus 1970					x											104
PHYLUM ECTOPROCTA (moss animalicules)																
Class Phylactolaemata																
Family Lophopodidae																
Lophopodella capensis (Sollas 1908)	U										x					93
L. cf *capensis*									x		x					SM1
L. thomasi Rousselet						x										13
Family Plumatellidae																
Plumatella emarginata Allman 1856													x			93
P. punctata Hancock											x					93
P. repens (Linnaeus)											x					93
PHYLUM NEMATODA																
Family Dorylaimidae																
Mesodorylaimus merogaster (Steiner 1916)								x			x					146
Family Actinolaimidae																
Neoactinolaimus michaelseni (Steiner 1916)											x					146
Family Mermithidae																
Mermis damarensis Steiner 1916								x								146
Family Monhysteridae																
Monhystera bothriolaima Steiner 1916								x			x					146
M. paludicola de Man 1880								x			x					146
Monhystrella lepidura (Andrassy 1963)										x						84
M. paramacrura (Meyl 1954)					x					x			x			84
M. parvella (Filipjev 1931)										x			x			84
Family Tobrilidae																
Semitobrilus pellucidens (Bastian 1865)								x			x					146
Family Xylidae																
Theristus tessae Heyns & Coomans 1989	E												x			85
PHYLUM ANNELIDA																
Class Oligochaeta (earthworms)																
Family Alluroididae																
Alluroides pordagei Beddard 1894		x														37
Family Glossoscolecidae																
Alma sp.		x														112
Family Naididae																
Aulophorus africanus Michaelsen 1914											x		x			112

	General comments	East Caprivi	Kavango River	Cunene River	West-flowing rivers	Seasonal wetlands of Owambo/Etosha	Bushmanland and Hereroland	Karstveld wetlands	Large perennial impoundments	Springs/seeps	All other water bodies (e.g. farm dams, gravel pits) and of unknown locality or nature	Orange River	Fish River and Hardap dam	Seasonal wetlands in south	Ephemeral east-flowing rivers	Ref.
Nais pseudobtusa (Piguet 1906)											x					38 ; 112
Paranais multispinus Michaelsen 1914	U										x					112
Family Ocnerodrilidae																
Gordiodrilus chuni Michaelsen	E?	x														112
G. luykerleni (Michaelsen)		x														112
Ilyodrilus sp.	U	x														142
Ocnerodrilus occidentalis Eisen													x			112
Pygmaeodrilus arausionensis Michaelsen								x								112
P. rhodesiensis Michaelsen		x														112
Family Tubificidae																
Limnodrilus spp.	U	x						x								112 ; 142
Class Hirudinea (leeches)																
Order Arhynchobdellida																
Suborder Hirudiniformes																
Family Hirudinidae																
Aliolimnatus obscura (Moore 1939)										x						126
Asiaticobdella fenestrata (Moore 1939)		x	x													SM1 ; 126
Hirudo michaelseni Augener 1936		x	x			x		x			x					SM 1 ; 126
Order Rhynchobdellida																
Family Glossiphoniidae																
Alboglossiphonia cheili (Oosthuizen 1978)						x					x					SM 1 ; 123 ; 126
A. conjugata (Oosthuizen 1978)		x				x				x	x					SM 1 ; 123 ; 126
A. disjuncta (Moore 1939)						x					x					SM 1 ; 123 ; 126
Batracobdelloides tricarinata (Blanchard 1897)		x	x	x					x		x	x	x			SM 1 ; 126
Helobdella conifera (Moore 1933)		x						x								SM 1 ; 126
Oosthuizobdella garoui (Harding 1932)		x					x			x						SM 1 ; 126 ; 125
O. stuhlmanni (Blanchard 1897)											x					SM 1 ; 126 ; 125
Placobdelloides jaegerskioeldi (Johansson 1909)			x													126
P. multistriata (Johansson 1909)		x	x		x	x		x	x	x	x					SM 1 ; 124 ; 126
PHYLUM MOLLUSCA																
Class Gastropoda (snails, limpets)																
Family Ampullariidae																
Pila occidentalis (Mousson 1887)		x	x	x		x										SM 1 ; 46
P. wernei (Philippi 1851)	U		x				x									SM 1
Lanistes ovum Peters 1845		x	x													SM 1
Family Ancylidae (limpets)																
Burnupia sp.	U								x	x	c	x				SM 1 ; NSC
Ferrisia victoriensis (Walker 1912)	U	x						x	x				x			SM 2
Family Bithyniidae																
Gabbiella kisalensis (Pilsbry & Bequart 1927)		x	x													SM 1
Family Lymnaeidae																
Lymnaea natalensis Krauss 1848		x	x	x		x		x			b	x	x			SM 1
L. columella Say 1817	A							x				x	x			SM 1
Family Physidae																
Physa acuta Draparnaud 1805	A											x	x			SM 2
Family Planorbidae																
Afrogyrus coretus (de Blainville 1826)	U	x	x					x		x						SM 1
Ceratophallus natalensis (Krauss 1848)	U			x		x					b;c	x				SM 2 ; NSC
Gyraulus costulatus (Krauss 1848)		x	x									x				SM 1 ; 1
Segmentorbis angustus (Jickeli 1874)		x	x													SM 1
Biomphalaria pfeifferi (Krauss 1848)		x	x					x								SM 1
B. salinarum (Morelet 1868)	U							x								SM 2
Bulinus globosus (Morelet 1866)		x	x	x												SM 1 ; NSC
B. depressus Haas 1936		x	x			x										SM 1
B. forskali (Ehrenberg 1831)	U	x	x		x	x	x	x			x	x	x			SM 2
B. reticulatus Mandahl-Barth 1954						x	x				x			x		SM 1
B. scalaris (Dunker 1845)	U	x	x		x	x	x			x						SM 1; SM 2 ; 88
B. tropicus (Krauss 1848)		x	x			x	x				x	x	x	x		SM 1 ; 88
Family Thiaridae																
Cleopatra elata Dautzenberg & Germain 1914	U	x	x	x												SM 1
C. nsendweensis Dupuis & Putzeys 1901			x													SM 1
Melanoides tuberculata (Müller 1774)	a	x	x	x		x		x						x		SM 1 ; NSC
Melanoides victoriae (Dohrn 1865)	a	x	x	x												SM 1
Family Viviparidae																
Bellamya capillata (Frauenfeld 1865)		x	x													SM 1
B. monardi (Haas 1934)			x	x												SM 1
Class Bivalvia (mussels)																
Family Corbiculidae																
Corbicula africana (Krauss 1848)		x	x	x								x				SM 1;NS;46;158
Family Etheriidae (freshwater oysters)																
Etheria elliptica Lamarck 1807				x												7
Family Mutelidae																
Aspatharia pfeifferiana (Bernardi 1860)		x	x	x												SM 1 ; 7

	General comments	East Caprivi	Kavango River	Cunene River	West-flowing rivers	Seasonal wetlands of Owambo/Etosha	Bushmanland and Hereroland	Karstveld wetlands	Large perennial impoundments	Springs/seeps	All other water bodies (e.g. farm dams, gravel pits) and of unknown locality or nature	Orange River	Fish River and Hardap dam	Seasonal wetlands in south	Ephemeral east-flowing rivers	Ref.
A. wahlbergi (Krauss 1848)		x	x	x												SM 1 ; 7
Mutela dubia (Gmelin 1793)		x	x	x												SM 1
M. rostrata (Rang 1835)			x			x										46
M. zambesiensis Mandahl-Barth 1988		x														101
Family Sphaeriidae																
Eupera ferruginea (Krauss 1848)		x	x	x												SM 1 ; NSC
Pisidium casertanum (Poli 1791)								x								SM 1
P. kenianum Preston 1911								x								SM 1 ; NSC
P. ovampicum Ancey 1890						x										46
Sphaerium capense (Krauss 1848)		x	x													SM 1 ; NSC
S. incomitatum (Kuiper 1966)		x														SM 1
Family Unionidae																
Caelatura kunenensis (Mousson 1887)		x	x	x												SM 1
Unio caffer Krauss 1848		x										x				SM 1 ; 7
PHYLUM ARTHROPODA																
Class Crustacea																
Subclass Ostracoda (Seedshrimps)																
Order Podocopida																
Family Candoniidae																
Candonopsis nama Daday 1913	E												x			105
Family Cyprididae																
Afrocypris barnardi Sars 1924	E					x	x									SM 1 ; 135
Amphibolocypris sp. nov.	E										x					56
A. exigua Rome 1965	NAM															169
Apatelecypris schultzei (Daday 1913)	E				x	x		x		x						SM 1
Cypridopsis viduella Sars 1895										x						54
Cypris decaryi Gauthier 1933		x					x									SM 1 ; 169
Eucypris cf *trigona* (Sars 1895)											x					56
Eundacypris superba (Sars 1924)	E					x										106
Hemicypris spp.	NAM															SM 1
Heterocypris cf *congenera* (Vavra 1897)					x						x					56
H. cf *giesbrechti* (Muller 1898)											x					56
H. ovularis Sars 1924						x										135
Homocypris oblonga (Sars 1924)	E				U	x	x									SM 1 ; 135
Isocypris perangusta Muller 1908											x					56
Parastenocypris fascigera (Sars 1924)						x										135
Plesiocypridopsis sp.											x					56
P. inaequivalva (Klie 1933)											x					56
P. insidiosa (Rome 1965)	E									x						134
Potamocypris mastigophora (Methuen, 1910)		x			x	x	x				x					SM 1
Pseudocypris circularis Sars 1924		x				x	x									SM 1 ; 135
P. gibbera Sars 1924					x	x	x				x			x		SM 1 ; 135 ; 169
Sarscypridopsis aculeata (Costa 1847)				x												107
S. cf *glabrata* (Sars 1924)											x					105
S. katesae (Hartmann 1957)	E										x					105
S. ochracea (Sars 1924)											x					SM1
S. cf *punctata* (Sars 1924)											x					105
S. cf *pygmaea* (Sars 1924)											x					56
Sclerocypris coomansi Martens 1986	E				x						x					107
S. dayae Martens 1988	E				x	x										107
S. dedeckkeri Martens 1988	E						x				x					107
S. dumonti Martens 1988	E					x										107
S. exserta Sars 1924	E					x	x									107
S. major Sars 1924	E					x										107
S. sarsi Martens 1987	E						x									107
S. superba Sars 1924	E					x										107
S. zelaznyi Martens 1988	E					x	x									107
Stenocypris major (Baird 1859)	NAM	x														SM 1
Strandesia sp. nov.					x											56
S. vavrai (Muller 1898)	NAM															
Family Limnocytheridae																
Limnocythere tudorancea Martens 1990	E					x										109
Ovambocythere milani Martens 1989	E					x										108
Subclass Copepoda																
Order Arguloida																
Family Argulidae																
Chonopeltis inermis Thiele			x													91
Order Calanoida																
Family Diaptomidae																
Lovenula falcifera (Loven 1845)		x				x	x		x		x					SM1;18;136;153
Metadiaptomus colonialis (Douwe 1914)									x		x				x	SM 1 ; 153
M. meridianus (Douwe 1912)					x				x		x		x	x		SM 1 ; 78 ; 153
Paradiaptomus schultzei van Douwe 1912					x						x					SM 1 ;153
P. similis van Douwe 1912											x			x		SM 1
Thermodiaptomus congruens (Sars 1927)		x				x										136 ; 142
Tropodiaptomus sp.nov.	E	x									x					SM 1

	General comments	East Caprivi	Kavango River	Cunene River	West-flowing rivers	Seasonal wetlands of Owambo/Etosha	Bushmanland and Hereroland	Karstveld wetlands	Large perennial impoundments	Springs/seeps	All other water bodies (e.g. farm dams, gravel pits) and of unknown locality or nature	Orange River	Fish River and Hardap dam	Seasonal wetlands in south	Ephemeral east-flowing rivers	Ref.
Order Cyclopoida																
Family Cyclopidae																
Cryptocyclops inopinatus Sars 1927		?									x					136
Cyclops diaphanus Fischer 1853	U										x					153
Eucyclops gibsoni (Brady 1904)					x					x						SM 1
Mesocyclops major (Sars 1927)					x						x					SM 1 ; 153
Microcyclops sp.											x					SM 2
Microcyclops inopinatus (Sars 1927)											x					56
Thermocyclops sp.		x			x				x		x		x			SM 1; 142
T. macracanthus Kiefer 1929									x							SM 1
T. oblongatus (Sars 1927)					x						x					56
Subclass Branchiopoda																
Order Anostraca (fairy shrimps)																
Family Branchinectidae																
Branchinella ondonguae (Barnard 1924)	E?					x	x									SM 2 ; 14
Family Branchipodidae																
Branchipodopsis sp.							x				x					SM 2 ; 56
B. browni Barnard 1924	E?									x						14
B. deprane Barnard 1929	E?												x			14
B. kalahariensis Daday 1910	U												x			SM 2
B. kaokoensis Barnard 1929	E?										x					14
B. cf *kaokoensis*											x					56
B. simplex Barnard 1924	E?					x										14
B. tridens Daday 1910					x	x				x	x		x			SM 2 ; 18 ; 56
B. wolfi Daday 1910						x				x	x		x			14 ; 18
Family Streptocephalidae																
Streptocephalus sp.		x			x		x				x					SM 2 ; 56
S. indistinctus Barnard 1924		x	x			x	x			x	x			x		SM 1; SM 2 ; 14
S. proboscideus (Frauenfeld 1873)						x	x				x			x		14
S. macrourus Daday 1907		x				x	x				x					SM 1 ; 14
S. kaokoensis Barnard 1929	E?										x					14
S. papillatus Sars 1905										x						14
S. cafer (Loven 1847)						x					x		x	x		SM 1 ; 14 ; 56
S. ovamboensis Barnard 1924						x					x	x				14 ; 56
S. cladophorus Barnard 1924						x										14
Order Notostraca (Tadpole shrimps)																
Family Triopsidae																
Triops granarius (Lucas 1864)						x	x				x			x		SM 2 ; 14 ; 18
Order Spinicaudata																
Family Cyclestheriidae																
Cyclestheria hislopi (Baird 1859)		x				x										14 ; 18
Family Cyzicidae																
Cyzicus australis (Loven 1847)						x				x	x		x			14
C. cf *australis*					x											56
Eocyzicus sp.					x						x					56
E. gigas Barnard 1924						x										14
Family Leptestheriidae																
Leptestheria brevirostris Barnard 1924	E?										x					14
L. rubidgei (Baird 1862)	E?					x					x					SM 2 ; 56
L. striatoconcha Barnard 1924						x					x					SM 2 ; 14
Leptestheriella calcarata Daday 1923	E?												x			14
L. cf *inermis* Barnard 1929					x						x					56
Family Limnadiidae																
Eulimnadia africana (Brauer 1877)						x					x		x			14 ; 56
Order Laevicaudata																
Family Lynceidae																
Lynceus bicarinatus Barnard 1924	E?					x										14
L. lobatianus Barnard 1929		y	y													161
L. truncatus Barnard 1924	E?					x										14
Order Cladocera (waterfleas)																
Family Chydoridae																
Alona sp.	e	x														142
Alona gr *karua* King 1852											x					56
Alona sp.(*rectangula* group)					x						x					56
Oxyurella singalensis					x											56
Pleuroxus sp.		x														142
Family Daphniidae																
Ceriodaphnia dubia Richard 1895					x				x							SM 1 ; 56
C. reticulata (Jurine 1820)		x														142
C. rigaudi Richard 1894											x					56
Ctenodaphnia sp.					x											78
Daphnia sp.					x											78
Daphnia sp.nov.	E						x									170
D. barbata Weltner 1897									x				x			SM 1
D. laevis Birge 1878									x							SM 1
D. pulex Leydig 1860									x							SM 1

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Family Macrothricidae																
Macrothrix sp.		x														142
Macrothrix cf *gouldi*					x						x					56
M. triserialis					x											56
Family Moinidae																
Moina sp.									x							SM 1
M. belli Gurney 1904					x						x					56
M. cf *hartwigi*					x											56
M. micrura Kurz 1874		x			x											78 ; 142
M. cf *micrura*					x						x					56
M. cf *reticulata*					x											56
Family Sididae																
Diaphanosoma excisum Sars 1886		x							x							SM 1 ; 142
Subclass Malacostraca																
Order Amphipoda (scuds)																
Family Ingolfiellidae																
Sternophysinx sp.nov.	E							x								165
Stygobarnardia caprellinoides Ruffo 1985	E							x								77
Troglolelupia sp.nov.	E							x								165
T. dracospiritus Griffiths 1989	E							x								77
T. eggerti (Ruffo 1964)	E							x								77
T. gobabis Griffiths 1989	E							x								77
Order Isopoda (sowbugs, pillbugs)																
Family Protojaniridae																
Protojanira sp.	E?							x								SM 1
? *Protojaniroides* sp.	E?							x								SM 1
Order Decapoda - Brachyura																
Family Potamonautidae (crabs)																
Potamonautes bayonianus (Brito-Capello 1864)		x	x	x												11 ; 18
P. perlatus (Milne-Edwards 1837)											x	x				AM ; 11
P. warreni Calman 1918													x			18
Order Decapoda - Macrura																
Family Atyidae (freshwater shrimps)																
Caridina africana Kingsley 1882	U	y	y	y								x				SM 1 ; 180
C. nilotica (Roux 1833)		x	x	y								x				SM 1
Family Palaemonidae (freshwater prawns)																
Macrobrachium vollenhoveni (Herklots 1857)				x												90
Class Insecta																
Order Ephemeroptera																
Family Baetidae		x	x	x	x	x	x		x	x	x		x	x		SM 1
Baetis bellus Barnard 1932												x				1
B. latus Agnew 1961												x				1
Centroptiloides bifasciata (Esben-Petersen 1913)	NAM															177
Cloeon sp.					x			x			x					AM ; 56
Procloeon rhodesiae (Barnard 1932)				x												66
Pseudocloeon vinosum Barnard 1932												x				1
Family Caenidae		x	x	x		x				x	x		x	x		SM 1 ; 1
Family Heptageniidae			x													SM 1
Afronurus peringueyi (Esben-Petersen 1913)				x												66
Family Leptophlebiidae			x	x						x	x	x				SM 1
Adenophlebiodes sp.			x													AM
Choroterpes sp.			x													AM
C. elegans (Barnard 1932)					x											66
Family Polymitarcidae																
Povilla adusta Navas			x													AM
Order Plecoptera																
Neoperla kunenensis (Barnard 1934)				x												16
N. spio (Newman)				x												SM 1
Order Trichoptera																
Family Dipseudopsidae																
Dipseudopsis capensis Walker				x												17
Family Ecnomidae																
Ecnomus barnardi Kimmins 1957				x		x										87
E. kunenensis Barnard 1934				x												17
E. thomasseti Mosely 1932				x									x			AM ; 139
Family Hydropsychidae																
Aethaloptera maxima Ulmer 1906				x												17
Cheumatopsyche diminuta (Walker, 1852)							x									149
C. thomasseti (Ulmer 1931)													x			AM ; 140
Family Leptoceridae																
Ceraclea cuperea (Barnard 1934)				x												17
Homilia vetulata Barnard 1934	E			x												17
Leptocerus didymata Barnard 1934				x												17
L. fissus Ulmer 1912	U			x												17

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Oecetis kunenensis Barnard 1934				x												17
O. ovampoensis Barnard 1934	E			x		x										87
Parasetodes sp.	U			x												17
Triaenodes siculus (Barnard 1934)	E			x												17
Order Odonata																
Suborder Zygoptera (Damselflies)																
Family Calopterygidae																
Phaon iridipennis (Burmeister 1839)			x													130
Family Chlorocyphidae																
Platycypha sp.			x													SM 1
P. caligata (Selys 1853)			x													130
Family Coenagrionidae (Coenagriidae)																
Aciagrion sp.	U											x				SM 1
Agriocnemis sp.			x													SM 1
A. angolensis Longfield 1945			x													SM 1 ; 130
A. exilis Selys 1872			x													130
A. gratiosa Gerstaecker 1891			x													130
Ceriagrion bidentatum Frazer 1941		x														130
C. glabrum (Burmeister 1839)						x		x	x				x			SM 1 ; 130
C. suave Ris 1921			x													SM 1
Enallagma sp.				x					x	x			x			SM 2
E. glaucum (Burmeister 1839)	K									x	x					100 ; 128
E. subtile Ris 1921						x										130
Ischnura sp.	K				x	x			x	x			x			SM 1
I. senegalensis (Rambur 1842)	K		x		x	x				x						SM 1 ; 100 ; 128
Pseudagrion sp.			x		x							x				SM 1 ; 128 ; 180
P. acaciae Förster 1906		y		x								x				SM 1 ; 130
P. hamoni Fraser 1955			x	x												SM 1 ; 130
P. kirsteni (Gerstaecker 1869)								x								1 ; 130
P. massaicum Sjoestedt 1909						x						x				SM 1 ; 130
P. nubicum Selys 1876		y	x													10
P. salisburyense Ris 1921												x				130
P. sublacteum (Karsch 1893)			x	x												SM 1 ; 130
P. sudanicum Pinhey 1956			x													130
Family Lestidae																
Lestes ictericus Gerstaecker 1869											x					100
L. pallidus Rambur 1842						x	x			x	x			x		SM 1 ; 130
L. uncifer Karsch 1899			x													SM 1
Family Platycnemididae																
Mesocnemis singularis Karsch 1891			x													130
Metacnemis valida Hagen, in Selys 1863	U		x													SM 1
Family Protoneuridae																
Elattoneura glauca (Selys 1860)			x													130
Suborder Anisoptera (dragonflies)																
Family Aeshnidae												x				180
Aeshna minuscula McLachlan 1896											x					131
Anax sp.											x					SM 1
A. imperator (Leach 1815)	K		x		x		x			x	x					SM 1 ; 128
A. speratus Hagen 1867										x						SM 1
A. tristis Hagen 1867								x			x					SM 1 ; 131
Hemianax ephippiger (Burmeister 1839)	K							x		x	x					SM 1 ; 131
Family Corduliidae																
Macromia bifasciata (Martin 1912)		x														131
Family Gomphidae												x				180
Crenigomphus cornutus Pinhey 1956			x													131
Ictinogomphus ferox Rambur 1842		x														131
Lestinogomphus angustus Martin 1912		y	x													SM 1 ; 131
Paragomphus sp.											x					SM 1
P. elpidius (Ris 1921)				x												SM 1
P. genei (Selys 1841)											x					NCI
P. hageni								x								SM 1
P. sabicus Pinhey 1950			x													131
Family Libellulidae																
Acisoma panorpoides Rambur 1842	K					x				x	x					131
Aethriamanta rezia Kirby 1889			x													131
Brachythemis lacustris (Kirby 1889)		x	x													131
B. leucosticta (Burmeister 1839)	K					x										131
Bradinopyga cornuta Ris 1911	K										x					131
Crocothemis sp.	U									x	x					SM 2 ; 56
C. erythraea (Brulle 1832)	K									x						100 ; 131
C. sanguinolenta (Burmeister 1839)	K									x						100 ; 131
Diplacodes lefebvrei (Rambur 1842)			x			x										131
Hemistigma albipuncta (Rambur 1842)			x			x		x								131
Nannothemis sp.	U				x						x					56
Olpogastra fuelleborni Grünberg 1902		x														131
O. lugubris Karsch 1895		x	x			x										131
Orthetrum abbotti Calvert 1892			x													131

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O. brachiale (Palisot de Beauvois 1817)			x					x		x						131
O. caffrum (Burmeister 1839)								x								131
O. chrysostigma (Burmeister 1839)	K		x								x					131
O. guineense Ris 1910						x										131
O. stemmale Calvert								x		x						100
O. trinacria (Selys 1841)								x		x						100
Palpopleura jucunda Rambur 1842	K									x						131
P. lucia (Drury 1773)								x		x						131
Paltothemis sp.	U				x						x					56
Pantala flavescens (Fabricius, 1798)								x		x	x					NCI ; 100
Philonomon luminans (Karsch 1893)			x													131
Rhyothemis mariposa Ris 1913						x										131
R. notata (Rambur 1842)						x										131
Sympetrum fonscolombei (Selys, 1840)								x				x				NCI ; 100 ; 131
S. navasi Lacroix 1921		x														131
Tholymis tillarga (Fabricius, 1798)			x								x					NCI ; 131
Tramea bisilaris (Palisot de Beauvois 1817)								x								131
Trithemis annulata (Palisot de Beauvois 1807)			x							x						100 ; 131
T. arteriosa (Burmeister 1839)			x					x	x		x	x				AM ; 131
T. hecate Ris 1912		x														131
T. kirbyi Selys 1891	K	x						x			x					131
T. monardi Ris 1931											x					131
T. stictica (Burmeister 1839)			x													131
Urothemis edwardsi (Selys, in Lucas 1849)		x	x													131
Zygonyx torrida (Kirby 1889)			x								x					131
Order Diptera (Flies)																
Family Ceratopogonidae (Biting midges)		x	x		x			x	x	x						SM 2
Brachypogon sp.nov.	E										x					175
Culicoides sp.						x					x					SM 1
C. herero (Enderlein 1908)											x					SM 1
C. ravus de Meillon 1936										x						62
C. schultzei (Enderlein 1908)										x	x					62
Dasyhelea sp.					x	x				x	x					SM 1
D. divergens de Meillon 1959	NAM															48
Forcipomyia iphias de Meillon 1936										x						62
F. vesicula de Meillon & Wirth 1983	E										x	x				163
Leptoconops dixi de Meillon 1936											x					59
L. interruptus (Enderlein 1908)											x					71
Serromya sp.nov.	E										x					175
Stilobezzia sp.										x						62
Family Chironomidae																
Ablabesmyia nilotica Kieffer 1923	K															72
Archaeochlus biko Cranston, Edward & Colless 1987	E				x						x					47
Chironomus caffrarius Kieffer 1914	K										x					AM ; 72
C. calipterus Kieffer 1908											x					72
C. callichirus Kieffer 1911	K															72
C. formosipennis Kieffer 1908	K															72
C. latilobus Kieffer 1923	K															72
C. pulcher Wiedemann 1830	NAM															48
C. tetraleucus Kieffer 1914	NAM															48
C. transvaalensis Kieffer 1923	NAM															48 ; 98
Cladotanytarsus pseudomancus Goetghebuer 1934	K															72
Clinotanypus niligenus Kieffer 1923	K															72
Conchapelopia trifascia Freeman 1954	NAM															48
Dicrotendipes pilosimanus Kieffer 1914	K										x					AM ; 72
Endochironomus disparilis Goetghebuer 1963	NAM															48
Knepperia gracilis Kieffer 1908	U;E?										x					73
Microtendipes umbrosus Freeman 1955	K															72
Nilodorum dewulfi Goetghebuer 1934	K															72
Paramerina nigromarmorata Goetghebuer 1935	K															72
Paratendipes crosskeyi Freeman 1956											x					AM
Pentapedilum anale Freeman 1954	K															72
Polypedilum scotti Freeman 1954	K															72
Procladius brevipetiolatus (Goetghebuer 1935)	K										x					AM ; 72
Smittia eonigera Freeman	U										x					AM
Stictochironomus caffrarius (Kieffer 1921)	K															72
S. puripenne (Kieffer 1921)	K															72
Tanytarsus balteatus Freeman 1955	K															72
Family Culicidae																
Aedes sp.nov.											x					162
Ae. aegypti (Linnaeus 1762)											x					SM 1

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Ae. caballus (Theobald 1912)						x	x									70 ; 111
Ae. fowleri (de Charmoy 1908)						x					x					70 ; 114
Ae. hirsutus (Theobald 1901)	N															64
Ae. lineatopennis (Ludlow 1905)			x				x									110
Ae. metallicus (Edwards 1912)	NAM															64
Ae. minutus (Theobald 1901)								x								65
Ae. ochraceus (Theobald 1901)						x	x									70 ; 114
Ae. pseudonigeria (Theobald 1910)						x										70
Ae. scatophagoides Theobald 1901	U					x				x	x					114
Ae. sudanensis (Theobald 1908)	N															114
Ae. taylori Edwards 1936											x					114
Anopheles arabiensis Patton 1905			x													45
An. azevedoi Ribeiro 1969											x					74
An. cinereus Theobald 1901	N;C															75
An. coustani Laveran 1900			x	x		x					x					60
An. demeilloni Evans 1933	C										x					75 ; 115
An. distinctus (Newstead & Carter 1911)		x														75
An. fontinalis Gillies & de Meillon 1968	E									x						75
An. funestus Giles 1900	N															75
An. gambiae Giles 1902	N;C															75
An. listeri de Meillon 1931	h									x	x					SM 1 ; 114
An. maculipalpis Giles 1902	N;C															75
An. marshallii (Theobald 1903)								x								75
An. namibiensis Coetzee 1984	E		x													44
An. nili (Theobald 1904)		x	x													75
An. pharoensis Theobald 1901			x													113
An. pretoriensis (Theobald 1903)	h									x	x					75 ; 115
An. rhodesiensis Theobald 1901										x	x					75 ; 60
An. ruarinus Edwards 1940											x					75
An. rufipes (Gough 1910)								x								75
An. squamosus Theobald 1901	N		x													SM 1 ; 75
An. wellcomei Theobald 1904			x													75
Culex argenteopunctatus (Theobald 1913)	NAM															64
Cx. decens Theobald 1901					x					x						64 ; 65
Cx. duttoni Theobald 1901											x					64
Cx. ethiopicus Edwards 1912										x						64
Cx. nebulosus Theobald 1901										x	x					64
Cx. cf *pipiens* Linnaeus 1758							x									SM 1
Cx. poicilipes (Theobald 1903)			x							x	x					114
Cx. quinquefasciatus Say 1823	N										x					114 ; 115
Cx. simpsoni Theobald 1905								x		x	x					64 ; 114
Cx. theileri Theobald 1903											x					SM 1 ; 70
Cx. tigripes Grandpre & Charmoy 1900								x			x					64 ; 114
Cx. trifoliatus Edwards 1914											x					64
Cx. univittatus Theobald 1901			x								x					SM 1 ; 70
Culiseta longiareolata (Macquart 1838)										x	x					SM 1 ; 70
Mansonia africana (Theobald 1901)											x					114
Mimomyia mediolineata (Theobald 1904)											x					64
Mi. mimomyiaformis (Newstead 1907)	N;U															64
Mi. plumosa (Theobald 1901)	U										x					64
Uranotaenia balfouri Theobald 1904											x					64
Family Dolichopodidae		x								x	x					SM 2
Chrysosoma munroi Curran 1924								x								50
Hydrophorus hydrophylax Parent 1939	K															154
H. jaenneli Parent 1938	K															154
Family Empididae																
Clinocera sp.										x						172
Drapetis aenescens Wiedemann 1830	NAM															145
Tachyempis dichroa Bezzi 1908	NAM															48
Family Ephydridae																
Dryxo ornata (Macquart 1843)	N															157
Ephydra stuckenbergi Wirth 1975											x					48 ; 56
Karema loewella Cresson 1929					x											157
Notiphila bipunctata Loew 1862											x					156
N. ignobilis Loew 1862	U									x						157
N. obscuricornis Loew 1862	NAM															148
Ochthera angustitarsis Becker & Bezzi 1908	U;NAM															156
O. chalybescens Loew 1862	U											x				157
Parathyroglossa africana Wirth 1955	U					x										97
Family Psychodidae (mothflies)					x					x	x					SM 2
Psychoda alternata Say 1824	i										x					137
P. coprina Satchell 1956	U;i										x					137
Family Sciomyzidae																
Ditaeniella sp.nov.a							x									176
Ditaeniella sp.nov.b							x									176

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Family Simuliidae			x			x		x		x	x					SM 2 ; AM
Prosimulium damarense de Meillon & Hardy 1951										x						63
P. gariepense (de Meillon 1953)												y				AM
P. herero (Enderlein 1935)											x					61
Simulium adersi Pomeroy 1922	U		x													178
S. chutteri Lewis 1965												y				AM
S. damnosum s.l. Theobald 1903			x													178
S. lumbwanum de Meillon 1944			x													178
S. nigritarse Coquillett 1902										x						178
S. ruficorne Macquart 1838				x	x	x		x	x	x	x					178
Family Stratiomyidae	K					x		x		x			x			SM 2
Odontomyia adusta Loew 1856										x						96
O. ophrydifera Lindner 1935										x						96 ; 48
Family Syrphidae		x								x	x		x			SM 2
Ceriana brunnea Hull 1944	NAM															48
Cerioides caffra Loew 1853											x					152
Eristalinus nigricans Wiedemann 1830	NAM															48
E. tabanoides (Jaennicke 1867)											x					97
Sphiximorpha ugandana (Kertesz 1913)	NAM										x					48 ; 152
Family Tabanidae	U															
Ancala africana (Gray 1832)			x	x												48
Atylotus agrestis (Wiedemann 1828)	j		x			x	x									SM 2
A. albipalpus Walker 1850	U;j		x					x			x					SM 2
Haematopota decora Walker 1850	j	x														150
H. infernalis Oldroyd 1952											x					150
H. insidiatrix Austen 1908	NAM						x									SM 1 ; 48
H. ochracea Bezzi 1908			x	x												SM 1
H. vittata Loew 1858				x												150
Rhigioglossa decora (Macquart 1850)			x								x					SM 2 ; 150
R. edentula (Wiedemann 1828)											x					42
R. namibiensis Chainey 1987	E										x					42
Philoliche sp.nov.1	U;E;l										x					SM 1
Philoliche sp.nov.2	U;E;l										x					SM 1
Philoliche sp.nov.3	U;E;l									x						SM 1
P. adjuncta (Walker 1848)	l						x									150
P. caffra (Macquart 1847)	l										x					150
P. flavitibialis Chainey 1983	E				x											41
P. ovambo Oldroyd 1957	E;l					x										150
P. rostrata Linnaeus 1764	l									x						SM 1
Tabanus gratus Loew 1858	K;j				x											150
T. leucostomus Loew 1858	K;j				x						x					118 ; 150 ; 48
T. obliquemaculatus Macquart 1838	l									x						SM 2 ; 150
T. taeniola Palisot de Beauvois 1806	j		x													SM 2
T. tritaeniatus Ricardo 1908	l		x	x							x					SM 2
Family Tipulidae (Crane flies)																
Conosia angustissima Alexander 1927											x					3
C. irrorata (Wiedemann 1828)	U									x						158
Erioptera pilipes (Fabricius 1787)					x						x					3
Gonomyia fimbriata (Alexander 1959)					x											3 ; 48
G. tuckeri (Alexander 1921)											x					3 ; 48
G. xenopyga (Alexander 1964)	E?										x					3 ; 48
Limonia atomaria (Loew 1866)										x						3 ; 48
L. tipulipes (Karsch 1886)											x					3
Pseudolimnophila frugi (Bergroth 1888)					x											3
Trichoneura munroi Alexander 1920	N															48
Order Neuroptera																
Family Sisyridae																
Sisyra sp.			x													SM 2
S. producta Tjeder 1957				x		x										147
Order Coleoptera (beetles)																
Family Dryopidae					x					x						SM 2
Family Dytiscidae																
Bidessus seydeli Biström 1985			x													32
Canthydrus notula (Erichson 1843)			x					x		x						AM ; 121
C. quadrivittatus (Boheman 1848)		x	x							x						AM ; 116 ; 79
Canthyporus guttatus Omer-Cooper 1956	E?										x					119 ; 117
Clypeodytes densepunctatus Biström 1988	E?		x													34
C. meridionalis (Régimbart 1895)	E?		x								x					34
C. roeri Biström 1988	E		x													34
Copelatus kalaharii Gschwendtner 1935											x					121
Cybister gschwendtneri Guignot 1935	U															122
C. natalensis (Wehncke)		x														24
C. senegalensis Aubé 1838							x									121
C. tripunctatus Laporte de Castelnau 1835	U	x	x	x	x	x	x	x	x	x	x	x	y	x	y	AM ; SM 2 ; 121
Eretes strictus (Linnaeus 1767)		y	y	y	x	x	x	x	y	x	x	y	y	y	y	SM 2 ; 121
Graphoderus sp.										x						56

	General comments	East Caprivi	Kavango River	Cunene River	West-flowing rivers	Seasonal wetlands of Owambo/Etosha	Bushmanland and Hereroland	Karstveld wetlands	Large perennial impoundments	Springs/seeps	All other water bodies (e.g. farm dams, gravel pits) and of unknown locality or nature	Orange River	Fish River and Hardap dam	Seasonal wetlands in south	Ephemeral east-flowing rivers	Ref.
Herophydrus sp.	f	x	x		x		x	x		x	x					SM 2
H. gigas Régimbart 1895						x				x						121
H. mutatus (Gemminger & Harold 1868)										x						121
H. oscillator Sharp 1882	g							x			x					AM ; 121
Hydaticus bivittatus Laporte de Castelnau 1835		x			x			x								AM ; 121
H. dorsiger Aubé 1838					x											121
H. exclamationis Aubé 1838											x					121
H. fulvoguttatus Guignot 1951	E?										x					121
H. servillianus Aubé 1838								x								121
Hydroglyphus aethiopicus (Régimbart 1907)	f								x							AM
H. farguharensis (Scott 1912)					x											SM 1
H. flavoguttatus (Régimbart 1895)	NAM						x				x					TM ; 28
H. geminodes (Régimbart 1895)	NAM															28
H. infirmus (Boheman 1848)					x					x	x					SM 1 ; 121
H. kalaharii (Pederzani 1982)	NAM															28
H. koppi (Régimbart 1895)	NAM															28
H. lineolatus (Boheman 1848)		y	y	y	x	x	y	x	y	x	x	y	y	y	y	AM ; SM 1 ; 121
H. paludivagus (Omer-Cooper 1959)	NAM															28
H. roeri Biström & Wewalka 1984		x														28 ; 35
H. transvaalensis (Régimbart 1894)					x	x				x	x					121
H. zanzibarensis (Régimbart 1906)		y	y	x	x	x	x	x	y	x	x	x	y	y	y	SM 1 ; 121
Hydrovatus amplicornis Régimbart 1895										x						121
H. ferrugineus Zimmermann 1919								x								121
H. galpini Omer-Cooper 1957											x					121
H. glomeratus Guignot 1945										x						121
H. simoni Régimbart 1894								x		x						121
Hyphydrus esau Biström 1982	E?	x														23
H. impressus Klug 1833		x		x		x	x				x					SM 1 ; 23
H. parvicollis Sharp 1882			x													29
H. residuus Omer-Cooper 1971		x														29
H. signatus Sharp 1882					x	x		x		x	x					SM 1 ; 120 ; 121
Laccophilus sp.					x	x		x	x	x	x					SM 2
L. addendus Sharp 1882		x														121
L. adspersus Boheman 1848		x			x					x						121
L. congener Omer-Cooper 1957								x			x					121
L. cyclopis Sharp 1882	NAM										x					121
L. lineatus Aubé 1838											x					121
L. simplicistriatus Gschwendtner 1935					x						x					121
L. vermiculosis Gerstaecker 1867								x								AM
Leiodytes evanescens (Boheman 1848)	NAM															30
L. hieroglyphicus (Régimbart 1894)	NAM															119
Pseuduvarus vitticollis (Boheman 1848)	NAM															33
Rhantaticus congestus (Klug 1833)		x			x											121
Uvarus gschwendtneri (Guignot 1942)	NAM															31
Yola sp.									x							SM 2
Y. dohrni (Sharp 1882)						x	x	x		x	x					SM 1 ; 25 ; 26
Y. endroedyi Biström 1983						x										25 ; 26
Y. sp.gr. *mocquerysi*						x										SM 1
Y. peringueyi Guignot 1942										x						27
Y. subopaca Régimbart 1895										x	x					25 ; 26
Yolina brincki (Omer-Cooper 1965)					x	x				x	x					SM 1 ; 25 ; 26
Y. sima (Omer-Cooper 1965)					x				x	x	x		x			26
Family Elmidae											x					56
Family Georissidae																
Georissus marlieri Delève 1967										x						58
Family Gyrinidae																
Aulonogyrus abdominalis (Aubé 1838)											x					36
A. algoensis Régimbart 1883					x											36
A. alternatus Régimbart 1892													x			AM
Dineutus sp.					x					x						56
D. aereus (Klug 1834)		x	x	y				y	y	x	x	y				36
D. fauveli Régimbart 1884		x	x	x												36
D. subspinosus (Klug 1834)					x			x		x	x					36
Orectogyrus elongatus (Régimbart 1886)			x	x												36
Family Heteroceridae																
Heterocerus sp.					x					x						SM 2
H. alluaudi Grouvelle 1906					x	x										43
H. thebaicus Grouvelle 1896					x	x				x						43
Family Hydraenidae																
Ochthebius sp.A					x					x	x					56
Ochthebius sp.B											x					56
Family Hydrophilidae	U															
Amphiops phallicus D'Orchymont 1935		x														67
Berosus spp.					x					x						SM 1
B. kalahariensis D'Orchymont 1935		x														67
Caelostoma rufitarse Boheman					x					x						SM 1

	General comments	East Caprivi	Kavango River	Cunene River	West-flowing rivers	Seasonal wetlands of Owambo/Etosha	Bushmanland and Hereroland	Karstveld wetlands	Large perennial impoundments	Springs/seeps	All other water bodies (e.g. farm dams, gravel pits) and of unknown locality or nature	Orange River	Fish River and Hardap dam	Seasonal wetlands in south	Ephemeral east-flowing rivers	Ref.
Helochares sp.		x			x	x	x			x	x					SM 2
Helochares subgen. *Helochares*					x											SM 1
H. subgen. *Hydrobaticus*					x											SM 1
H. bohemani D'Orchymont 1935											x					67
H. dilutus Erichson		x														TM
H. longipalpis (Murray)		x														TM ; 67
Helophorus aethiops Balfour-Browne 1954											x					8
Hydrochara flavipalpis Boheman					x						x					TM
Regimbartia obsoleta (Régimbart)		x														67
Sphaeridium caffrum		x														67
S. senegalense Castelnau		x														67
Sternolophus angolensis (Erichson)		x														67
S. solieri Castelnau		x														67
Tropisternus sp.					x											56
Family Limnichidae										x						SM 2
Family Sperchidae									x							SM2
Order Hemiptera																
Family Belostomatidae		x				x		x		x		x				SM 2
Belostoma niloticum Stål 1854								x			x					82
Lethocerus cordofanus Mayr 1852	K											x				133
Sphaerodema sp.												x				180
S. nepoides Fabricius 1803						x										82
Family Corixidae																
Corixa hieroglypha Dufour 1833										x						82
Micronecta sp.												x				180
M. browni Hutchinson 1929	E?									x						85
M. eupompe Hutchinson 1930	K					x										95 ; 133
M. gorogaiqua Hutchinson 1929						x										95
M. hessei Hutchinson 1929	E?			x												85
M. scutellaris (Stål 1858)	K;m				x						x					AM; 85; 95; 133
Sigara sp.					x					x						56
S. contortuplicata (Kirkaldy 1908)					x			x		x		x				56 ; 95
S. meridionalis (Wallengren 1875)	K															133
S. wahlbergi Lundbald 1928	K															133
Family Gerridae		x	x			x	x	x		x	x			x		SM 2
Gerris severini Kirkaldy 1900	K															133
G. swakopensis (Stål 1858)	K					x				x				x		133
Limnogonus sp.										x						56
L. hypoleucus (Gerstaecker 1873)	K															133
Family Hebridae										x						56
Hebrus coeruleus Poisson 1934	K															133
Family Hydrometridae		x						x								SM 2
Hydrometra ambulator Stål 1855	K					x										82
Family Mesoveliidae								x		x	x					SM 2
Mesovelia vittigera Horvath 1895	K															133
Family Naucoridae		x	x	x		x			x	x			x			SM 2
Laccocoris sp.												x				AM ; 180
L. limigenus Stål 1865	K				x								x			82 ; 133
Pelocoris sp.	U				x					x						56
Family Nepidae		x	x				x	x		x	x			x		SM 2
Laccotrephes fabricii Stål 1868						x			x		x			x		82
Family Notonectidae																
Anisops sp.											x	x				168 ; 180
A. apicalis Stål 1855		x														148
A. ares Hutchinson 1928											x					168 ; 148
A. arnoldi Truxal 1990	E?							x								148
A. debilis Gerstaecker 1873					x					x	x					133 ; 168 ; 148
A. elegans Fieber 1852	NAM															173
A. graciloides Brooks 1951	NAM															168 ; 148
A. hancocki Hutchinson 1928					x					x						133 ; 148
A. psyche Hutchinson 1928	K									x	x					133 ; 148
A. sardea Herrich-Schaeffer 1849					x	x	x	x		x	x					56; 82; 133; 148
A. varia Fieber 1851	K							x		x	x					82; 133; 168;148
Enithares sobria (Stål 1855)	K									x						133
Family Pleidae			x			x	x				x			x		SM 2
Plea piccanina Hutchinson 1929	K															133
P. pullula Stål 1855	K															133
Family Saldidae											x					56
Saldula niveolimbata (Reuter 1900)	K															68
S. ornatula Reuter 1881	K															68
Family Veliidae			x							x	x					SM 2
Angilia albidotincta (Stål 1855)	K															133
Microvelia gracillima Reuter 1883	K							x								SM 1 ; 133
Total number of recorded species		118	126	58	98	116	53	86	33	132	227	38	39	19	1	