Fish populations, gill net catches and gill net selectivity in the Zambezi and Chobe Rivers, Namibia, from 1997 to 2000

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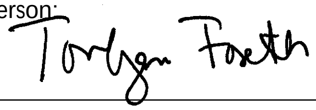

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Preface

The White Paper "Responsible Management of the Inland Fisheries of Namibia" was finalised in December 1995, and forms the basis for a new law and regulations concerning fish resources management in the different freshwater systems in Namibia. Since all perennial rivers in Namibia border on neighbouring countries, management of the fish resources also depends on regional co-operation. It must also be taken into consideration that the fish resources might be exploited through subsistence, commercial and recreational fisheries. When implementing fisheries regulations for such complex systems, information on the fish resources and their exploitation are needed.

Based on a series of studies, recommendations will be given for management actions in the Zambezi and Chobe Rivers to involve local, national and international authorities and stakeholders, and to secure a sustainable utilisation of the fish resources for the benefit of local communities and future generations. The studies involve a description of parts of the recreational fisheries (Næsje et al. 2001) and of the migration and habitat utilisation of important fish species (Økland et al. 2000 and Hay et al. in prep). Økland et al. (2000) and an ongoing study (Hay et al. in prep) have shown that important fish species may perform migrations between countries. Furhermore, the biological and sociological aspects of the subsistence and semi commercial fisheries will be studied in 2001/2002. In the present report, the fish populations in the Zambezi and Chobe Rivers are described on the basis of six surveys performed in the period 1997 - 2000.

The project is a collaboration between the Freshwater Fish Institute of the Ministry of Fisheries and Marine Resources, Namibia, and the Norwegian Institute for Nature Research (NINA). The work has received financial support from the Norwegian Agency for Development Cooperation (NORAD), the Ministry of Fisheries and Marine Resources and the Norwegian Institute for Nature Research.

We would like to express our gratitude towards the Director, Resource Management, Dr. B. Oelofsen and the Deputy Director, Resource Management, Dr. H. Hamukuaya for their support and encouragement during the project. We are also thankful to Prof. Dr. P. Skelton and Mr. R. Bills from South African Institute for Aquatic Biodiversity (SAIAB, formerly: J.L.B Smith Institute of Ichthyology), Grahamstown, South Africa, who verified the identification of some of the fish species.

The Department of Water Affairs, Windhoek, provided the water level data of the Zambezi River.

The following staff members from the Freshwater Fish Institute were all involved in the field surveys or data punching: T.P. Windstaan, Ms. S. Stein, J.H. Engelbrecht, J. May, A. Mulundu, A.N. Mulundu, S. Beukes, the late S. Pootinu, S. Jonas, A. Kahuika, J. Kahuika, E. Kahuika, the late F. Fillipus, N. Lukas, E. Shikambe, E. Hayango, B. May and S. Hay. They are all gratefully acknowledged.

Windhoek/Trondheim, August 2002

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Objective

The objective of this report is to provide baseline information about the fish resources in the Zambezi and Chobe Rivers to form the biological foundation for recommendations for a sustainable management of the fisheries. Based on fish survey data from the period 1997-2000, the fish resources are described through studies of species diversity, relative importance of the different species, life history parameters, catch per unit effort and selectivity of gill nets.

Methods

Fish were collected in five areas (Katima Mulilo, Kalimbeza, Lake Lisikili, Impalila and Kabula Bula) with survey gill nets (multi-filament, 22–150 mm stretched mesh size) and ten other sampling methods, such as seine nets, cast nets, electrofishing apparatus and rotenone. These are collectively called "other gears" in this report. The gill nets were used to survey open, deep water habitats (> 1 m) in the main stream near the shore and deep backwater areas with some aquatic vegetation. The other gears targeted mainly small species and juveniles of long-lived species in shallow, vegetated and rocky habitats. Nordic multi mesh sized mono-filament gill nets were included during the survey in 2000 to improve sampling in the deep-water habitats and of the smaller species. Furthermore, fish caught during a fishing competition were sampled in 2000 to include biological data from larger specimens. Data from sampling with Nordic nets and the fishing competition were only included in the life history analyses of selected species, and not in other analyses. The restrictive use of these data ensures comparable data sets with previously reported Okavango River surveys, where these methods were not used (Hay et al. 2000)

Surveys were carried out three years in the spring during 1997-2000 and three years in the autumn during 1997-1999. A total of 66875 fish were sampled, 39852 in gill nets, 7005 in Nordic nets, 562 during the fishing competition and 19456 with other gears. The most important species in the survey catches were identified by using an index of relative importance (IRI), which is a measure of the relative abundance or commonness of the species based on number and weight of individuals in catches, as well as their frequency of occurrence. Seventeen of the most important species collected were selected for a more detailed analysis of life history and gill net selectivity.

Results

A total of 69 fish species were recorded during the surveys, in addition to unidentified *Synodontis* species. Due to difficulties with the taxonomic classification in the *Synodontis* spp. group, these species have been pooled, except the easily recognised *Synodontis nigromaculatus*. Seven *Synodontis* species have previously been listed for the Zambezi River, thus there may be up to six *Synodontis* species in the pooled *Synodontis* spp. group. The fish families represented with the highest number of species were the Cyprinidae and the Cichlidae, with 20 and 17 species, respectively.

Six species were considered to be habitat specialists, which means their life history activities are confined to specific habitats, and that they required particular effort and equipment for collection. The habitat specialists recorded were *Barbus codringtonii*, *Nannocharax macropterus*, *Leptoglanis* cf *dorae*, *Clariallabes platyprosopos*, *Chiloglanis fasciatus* and *Chiloglanis neumanni.* Four of the species were difficult to find, whereas *C. platyprosopos* was common in its habitat.

Low numbers of *Barbus kerstenii* and *Clarias stappersii* were caught. These species are, therefore, also considered rare in the Namibian part of the Zambezi/Chobe Rivers.

Fourty species were caught in the gill nets (excluding *Synodontis* spp.). The ten most important species constituted 96 % of the total IRI. The two most important species (*Brycinus lateralis* and *Schilbe intermedius*) contributed to 73 % of the total IRI. The Characidae was the most important family in the gill net catches according to IRI (56 %), whereas the Cichlidae family constituted only a small part (2 %).

Sixty-seven species were caught with the other gears (excluding *Synodontis* spp.). The ten most important species constituted 74 % of the total IRI. The two most important species (*Tilapia sparmanni* and *Pharyngochromis acuticeps*) contributed to 30 % of the total IRI. In contrast to the gill net catches, the Cichlidae was the most important family in catches with other gears, according to IRI (58 %). The species diversity was higher for the catches with other gears than with gill nets, which is attributed to the flexibility of the other gears, and that a much wider range of habitats was sampled.

Thirty-six species were caught with gill nets at Kalimbeza, 33 species at both Kabula-Bula and Lake Lisikili, 28 species at Katima Mulilo and 24 species at Impalila (excluding *Synodontis* spp). Generally, ranking of the ten most important species in the gill net catches were corresponding at the different stations. When listing the ten most important species according to IRI at the five stations, only 15 species

were represented in total. According to IRI, *B. lateralis* and *S. intermedius* dominated the gill net catches at all stations, with the exception of the Lake Lisikili, where *Petrocephalus catostoma* contributed more in number and weight than *S. intermedius*. Species diversity in the gill net catches measured as the Shannon diversity index differed among stations, with the highest diversity in the Lake Lisikili and the lowest at Katima Mulilo. The year round presence of vegetation and lenthic conditions may have contributed to the high species diversity in the Lake Lisikili. All the other stations included main stream habitats that usually yielded a lower catch and less variability in species. *Hydrocynus vittatus* was absent at Kabula-Bula in the Chobe River, both in gill net catches and in catches with other gears. The backwater habitat at Kabula-Bula is considered less favourable for *H. vittatus*.

Among the ten most important species according to IRI, nine species were on the list both during high and low water. *B. lateralis* dominated the gill net catches during both periods. Water level had little effect on the species diversity in the gill net catches. However, three species had a marked decrease in the IRI from the high to the low water period, whereas six species had a marked increase.

The body length of the fish caught was up to 92 cm. The modal length of fish caught in gill nets was 8.0-8.9 cm, whereas for fish caught with the other gears 3.0-3.9 cm. Thus, larger fish were caught with gill nets than with other gears, and this was true both for the species combined and for individual species. Twenty of the species caught had a maximum body length of 6 cm or smaller.

Of the selected species, twelve species had a minimum length at maturity smaller than 10 cm, two species between 11 and 20 cm and two species larger than 20 cm. The minimum length at maturity was larger than or similar to the smallest fish caught with gill nets in all the selected species, except for both sexes of *M. acutidens* and males of *P. catostoma*. The length at 50 % maturity was larger than the minimum length of fish caught with gill nets for all the species of which 50 % maturity could be determined.

The 17 species selected for a more detailed data analysis, contributed to 93 % of the biomass of fish caught with gill nets and 56 % of the biomass of fish caught with other gears (one of the selected species was never caught in gill nets). These species represented a large variation in biology, distribution and sizes. Measured as numbers of fish caught per setting, the smaller gill net mesh sizes were the most effective in catching these species. For nine of the species, catch per unit effort in numbers was highest for the 22 or 28 mm mesh size, and for three of the species the 35 mm mesh size. Only two species were most effectively caught in the larger mesh sizes (57 and 73 mm). Measured as weight per setting, larger mesh sizes were more effective; six species were most effectively caught in the 22-28 mm mesh size, five species in the 35-45 mm mesh size and five species in the 57-150 mm mesh size. For all species combined, the 28 mm mesh size was the most effective measured both as numbers of fish caught and weight per setting.

The Lake Lisikili station showed the highest catch per unit effort, both in terms of number of fish caught and weight. The lake resembles a large backwater habitat, especially during flood, which may increase the productivity of the area. The lowest catch per unit effort in both number and weight was at Katima Mulilo, where the main stream habitat dominates. Main stream habitats are usually less productive than backwater and floodplain habitats.

The results did not show an unambiguous relationship between the catch per unit effort, habitat (mainstream *versus* backwater) and water level (low water *versus* high water). Statistical analyses were carried out in all cases where comparable data for all mesh sizes existed, separating the effects of station, habitat and water level. Furthermore, comparisons were made for small mesh sizes (22 to 35 mm) and large mesh sizes (45 to 73 mm) separately, and for catch per unit effort measured in numbers and weight separately. Backwaters had in all cases a significantly higher catch per unit effort than the mainstream - or no differences between backwaters and the mainstream were found. Regarding high and low water, no particular pattern could be seen.

Conclusions

The results from the surveys in the Zambezi/Chobe Rivers were compared with previous studies in the Okavango River (Hay et al. 2000). Generally, the fish fauna in the Zambezi/Chobe and Okavango Rivers showed great similarities, and there is a considerable overlap in the distribution of species between the rivers.

The complex and diverse nature of the fish fauna in the Namibian part of the Upper Zambezi has been revealed through the present surveys. However, detailed knowledge on the biology and behaviour of most of the species are still lacking. Basic information on life history, reproduction, movements, habitat preferences and habitat utilisation of target species is needed to regulate the fishery among the different countries and exploitation methods, and to evaluate the possible benefits of nature reserves and sanctuaries. The Upper Zambezi is presently still relatively undisturbed by human impacts. For that reason alone, this system should be better studied to provide a baseline for future manipulations.

2 Introduction

Namibia is an arid country and strongly depends on the availability of open waterbodies for human food consumption, industries, irrigation and farming activities. The interior of the country has several man-made reservoirs, mainly for human consumption, where the largest is Hardap Dam in the seasonal southern Fish River. People in the north have to turn to fountains, boreholes, oshanas (shallow interconnected channels and pans) and perennial rivers to obtain potable water for their households. In the Caprivi Region, the Zambezi and Chobe Rivers play a significant role in the daily activities of the local communities such as fishery, agriculture, transport, harvesting of vegetation and activities related to tourism.

Floodplain rivers, such as the Zambezi and Chobe Rivers, are among the most endangered ecosystems, and their fauna are especially under threat of species extinction and population disturbance (Halls et al. 1999). Multi-species floodplains with multi-gear fisheries have complex interactions between the environment, the fish communities and the fishers. Approximately 100 years ago, only 6000 people inhabited the Caprivi area (Mendelsohn and Roberts 1997). At that time, the resources available could sustain the communities, and the anthropological impacts on the environment were insignificant. Today, the human population has increased 18 fold. All natural resources related to the rivers have been impacted by human activities such as farming, deforestation, building of roads, harvesting of vegetation for building materials and fisheries.

Historically, fishing was an important part of the ritual and political power base in the traditional management in the Caprivi region, and also today fish occupy a central place in people's daily life (Tvedten et al. 1994). A common saying goes: "If you don't fish, you are not a Caprivian". Households eat fish daily for most of the year, and fish is the most important protein source ranked over beef, game and poultry (Turpie et al. 1999). Seventy-five percent of the households (Turpie et al. 1999) are engaged in subsistence fishing, with a mean reported catch of 370 kg per year per household (Turpie et al. 1999). A perceived decrease in the fish catches has been reported by the fishermen since the mid 1970's.

The importance of the Zambezi and Chobe Rivers for the local communities cannot be over-emphasised. The fishery in the Caprivi is important for several reasons (Purvis 2001 a, b). The fishery provides a crucial source of protein, employment and income for households in the region. The trade in the fish products is especially important to the poorest households, which have no other means of generating an income. A further important aspect is the barter of fish products for other essential commodities (Purvis 2001 a, b).

The fish resources in the Zambezi and Chobe Rivers are limited. As the local population grows and fishing activities increase, conflicts arise between subsistence, commercial and recreational fisheries. In addition, all the perennial rivers in Namibia, border on neighbouring countries. Management regulations and control measures are different in countries sharing the same fish resources. This has, among other problems, resulted in conflicts between foreign and native fishermen.

The objective of this report is to produce baseline information about the fish resources in the Zambezi and Chobe Rivers to form the biological foundation for recommendations for a sustainable management of the fisheries. Fish were collected in five main areas with survey gill nets and ten other sampling methods during 1997-2000. Based on these monitoring data, the fish resources are described through studies of species diversity in different parts of the rivers, the relative importance of the different species, the life history of important species and the catch per unit effort and selectivity of gill nets.

The stated policy in the White Paper "Responsible Management of the Inland Fisheries of Namibia" (Ministry of Fisheries and Marine Resources 1995) and the draft bill on inland fisheries, aim to ensure a sustainable and optimal utilisation of the freshwater resources, and to favour utilisation by subsistence households over commercialisation. The Zambezi and Chobe Rivers are shared with the neighbouring countries Botswana, Zambia and Zimbabwe. The fish resources play an important role in all these countries and should be co-managed to ensure the effective control of the fish resources to the benefit of all countries and communities. This report should not only benefit future management of the fish resources in Namibia, but also transboundary management actions of the freshwater fish resources in this region.

3 Study area

3.1 The Caprivi Region

The Caprivi Region in Namibia is situated about halfway between the equator and the southern tip of Africa, and midway between the Atlantic and the Indian Ocean (**Figure 3.1**). The region borders on Botswana in the south, Angola and Zambia in the north and Zimbabwe in the east. The Chobe River and the Kwando/Linyanti System border on Botswana.

Within Africa, Namibia's climate is second in aridity, after Sahara (Barnard 1998). Rainfall is lower and more variable than in the eastern subcontinent, and becomes lower and more variable towards the west. The country's average annual rainfall is less than 250 mm, and the mean annual evaporation may be as high as 3700 mm in some areas. The rainfall may be characterised as tropical semi-humid in the northeast, like in the Caprivi, to hyper-arid in the west (**Figure 3.1**). The Caprivi has the highest rainfall in Namibia, although a low rainfall in a global perspective. The average annual rainfall at Katima Mulilo at the Zambian border in the Caprivi is approximately 680 mm, but has varied between 262 mm and 1473 mm during the past fifty years. However, it is important to note that the rainfall in the catchment area of the Zambezi River in Angola and Zambia is much higher, and that the rainfall in the Caprivi region has little effect on the water discharge in the river.

Six different land types are identified in the Caprivi (Mendelsohn and Roberts 1997). The largest portion of the region consists of the Kalahari Woodlands (55 %). The Caprivi Region is very flat, varying from 1100 m in the west dropping gradually to 930 m in the east, and elevations rarely exceed 30 m above sea level (Mendelsohn and Roberts 1997). Due to the flat topography and the presence of perennial river systems, especially the eastern parts experience large annual flooding during summer and early winter. Floodplains cover 19 % of the Caprivi. In times of exceptional flooding, the Kwando - Linyanti and Zambezi - Chobe River systems are inter-linked, and large parts of the eastern Caprivi become one large floodplain (Curtis et al. 1998). In such cases, more than 30 % of the area east of the Kwando River becomes floodplains. The Caprivi wetlands have the highest overall species richness of the Namibian wetland systems, and 82 fish species occur in the Namibian part of this water system (Curtis et al. 1998). The floodplain ecosystems are complex and variable. Most Namibian fish species (78 %) are floodplain dependent for larval or juvenile stages and perform migrations between the floodplains and the main river (Barnard 1998).

The flat topography of the area creates a complicated and variable interaction between the Zambezi River and the Kwando-Linyanti-Chobe River systems. Lake Liambezi (**Figure 3.1**) was dry in the 1940s, filled up around 1952, and dried up again in 1986. However, the lake has partly been filled in 2001. The presence and the size of the lake are largely dependent on periods with floods and drought (Windhoek Consulting Engineers 2000). Flows in the Kwando River, which is the main source of inflow to Lake Liambezi, followed the patterns in the Zambezi River. Until 1999/2000, no significant floods have been recorded in the lower Kwando River since 1982.

The Zambezi-Chobe River systems consist of inter-linked rivers, backwaters, oxbow lakes, swamps and floodplains. Aquatic plants prevail in the open water, which often is fringed by stands of reeds and water adapted grasses (Barnard 1998). The floodplains support a diverse grassland flora characterised by grass, shrub and herb species. The seasonal inundated floodplains form productive wetlands, which account for much of the species richness found in open waters.

Fishery and overgrazing of floodplains in the Eastern Caprivi are possibly the activities with the highest impact on the environment and fish community (Allcorn 1999). Pollution in the area is negligible. Large-scale development and urbanisation is not yet noticeable and, therefore, the physical characteristics and water quality of each river system does not change drastically from one area to another. Dams and weirs do not occur along any of the parts of the rivers that were surveyed.

3.2 The Zambezi River

The Zambezi River is the largest river in southern Africa, draining an area of approximately 1.2 million km^2 (Timberlake 1997). The river rises in south-eastern Angola and in northern Zambia, and flows generally in a south-eastern direction. The Zambezi River reaches Namibia a few kilometres north of Katima Mulilo, forming the border between Namibia and Zambia for a distance of approximately 120 km to Impalila Island. The Chobe-Zambezi junction is at Impalila Island, bordering the Chobe National Park in Botswana. From Impalila Island, the Zambezi River forms the border between Zambia and Zimbabwe (**Figure 3.1)**. The Victoria Falls form the barrier between the Upper and Middle Zambezi.

The river consists of a deep, wide mainstream, with bends and deep pools. Small-vegetated islands, sandbanks, bays, backwaters and narrow side streams occur frequently. There are larger slow flowing channels, such as the Kalimbeza and the Kasai, and isolated pools. The only rapids are at Katima Mulilo and the Mambova Falls at Impalila Island.

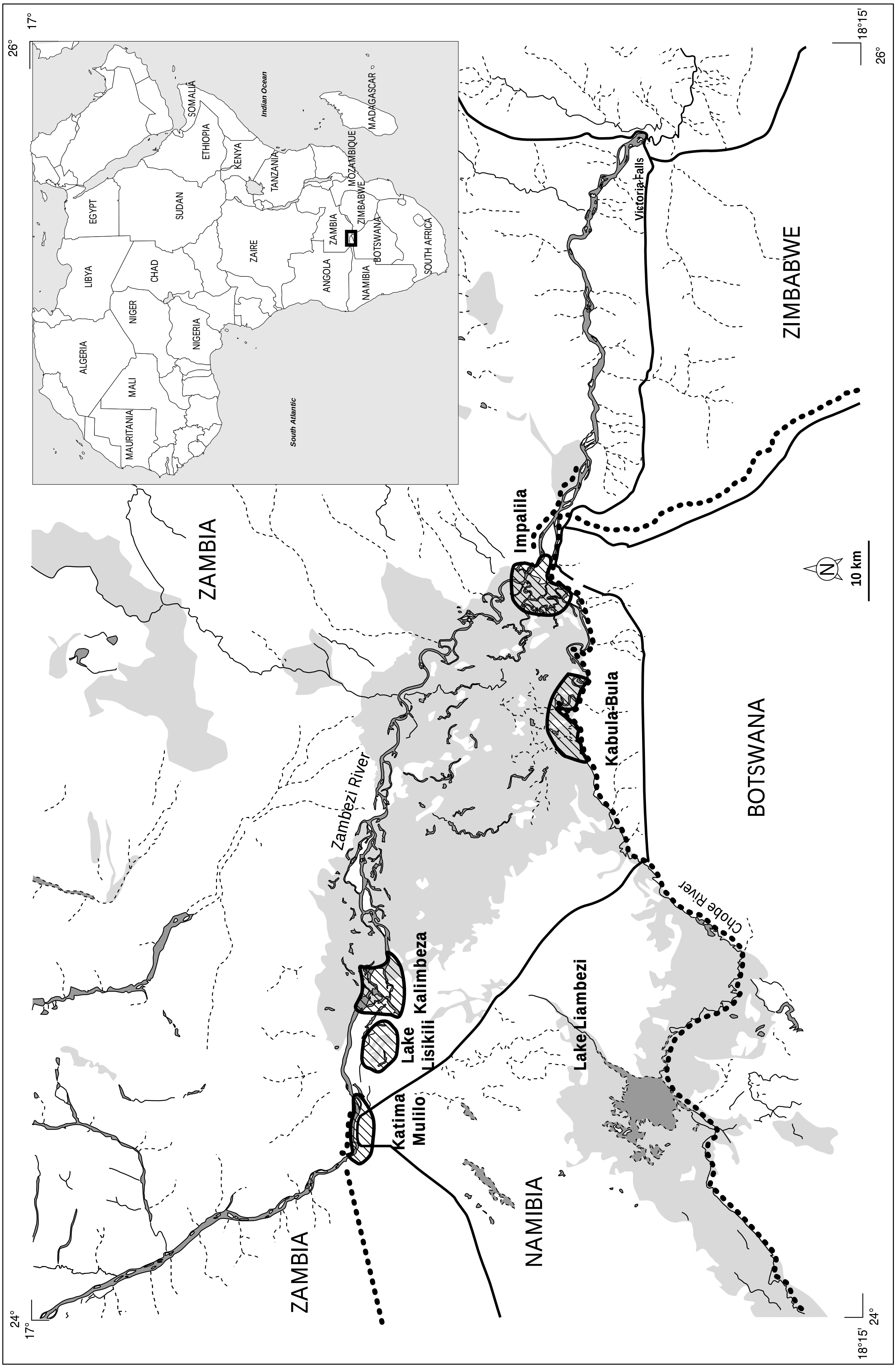


Figure 3.1. *The Zambezi and Chobe Rivers in the north-eastern Namibia and the five main sampling localities (hatched areas).*

In the mainstream of the river, sandy bottom substrate dominates. Muddy bottom substrate is often found in isolated pools, bays, backwaters and on floodplains where siltation occurs. Side channels and smaller side streams usually have a sandy bottom substrate. Few rocky habitats occur, except some near Katima Mulilo and Impalila Island. Pebbles are found in the Impalila Island area.

Water flow in the river has been measured since 1907. The periods 1907-1950 and 1982-1997 were dry, whereas the period 1951-1989 had a higher rainfall (**Figure 3.2 and 3.3**). The water discharge normally peaks in April, although this may vary between March and May (**Figure 3.4**). The annual flood at Katima Mulilo has since 1907/08 fluctuated greatly, with maximum discharges between 870 m^3/s (1914/15) and 8440 m^3/s (1957/58) (**Figure 3.2**). In the same period, the annual water volume passing Katima Mulilo varied between 8300 million m^3 (1914/15) and 68911 million m^3 (1968/69) (**Figure 3.3**). During our study period in 1997-2000, the peak water discharge at Katima Mulilo varied from 2070 m^3/s in 1996/97 to 4541 m^3/s in 1997/98 (**Figure 3.5**). The mean flood level is 5 m above the minimum water discharge, but has varied between 2 and 8 m (Tvedten et al. 1994).

The stream velocity varies from stagnant (backwaters and pools) to fast flowing water or rapids varying with the water discharge in the river. The narrow side streams are usually shallow and have a slow to intermediate flow. Side streams occur frequently during low flood, winding through sandbanks and islands. The water is clear with little suspended particles.

Floodplains occur during high floods, as inundated fields and grasslands. When the floods recede, isolated pools and backwaters are formed. Due to the confluence of the Zambezi and Chobe Rivers, a swamp like floodplain is formed in the Impalila Island area. The vegetation in this area consists mainly of dense impenetrable reeds, where *Scrirpus sp.* dominates (J.H. Koekemoer, pers. obs.). This area gives the impression of a swamped, vast floating mass of reeds, with interconnecting canals.

The river has ample available cover in the form of overhanging marginal terrestrial vegetation (submerged during high floods), marginal aquatic vegetation, and inner aquatic vegetation. Marginal terrestrial vegetation in the Zambezi River area can be described as fringing vegetation or riverbank cover in the form of terrestrial grass, reeds, overhanging

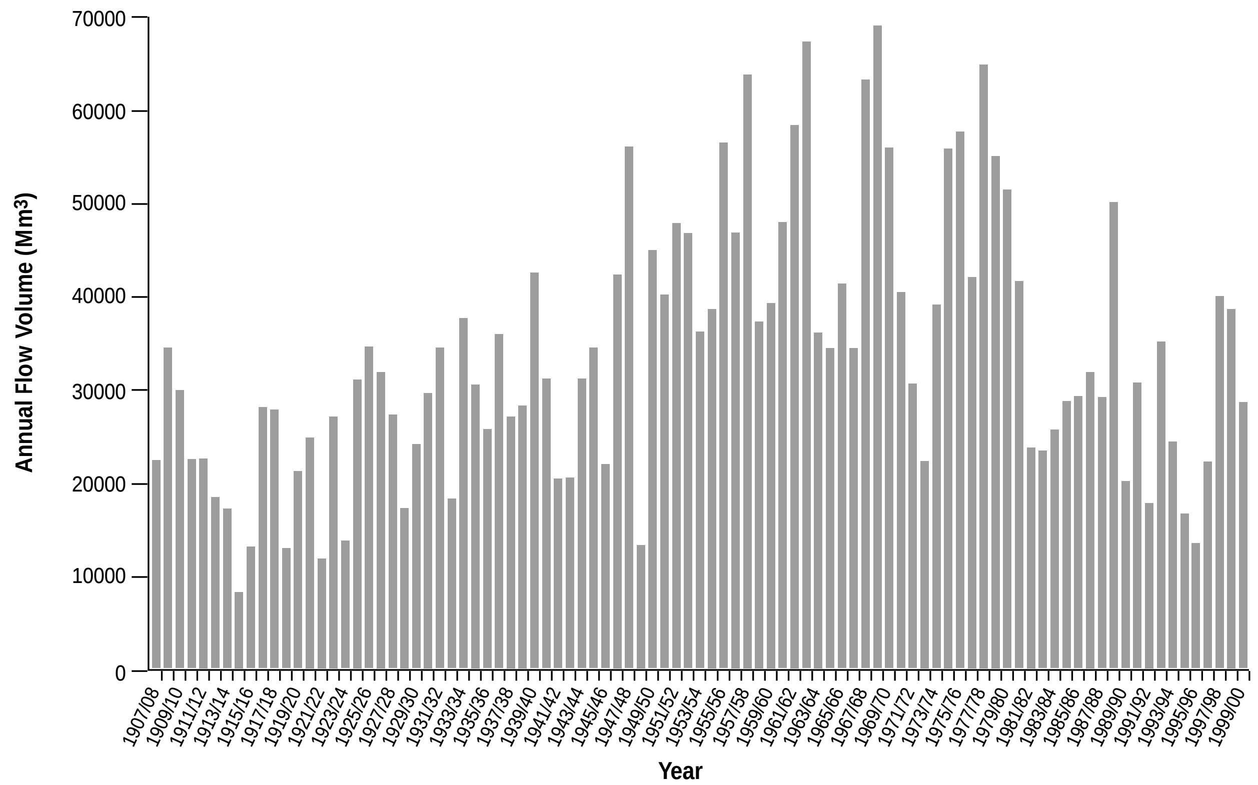


Figure 3.2. *Annual flow volume (Mm^3) for the Zambezi River at Katima Mulilo (from Windhoek Consulting Engineers 2000).*

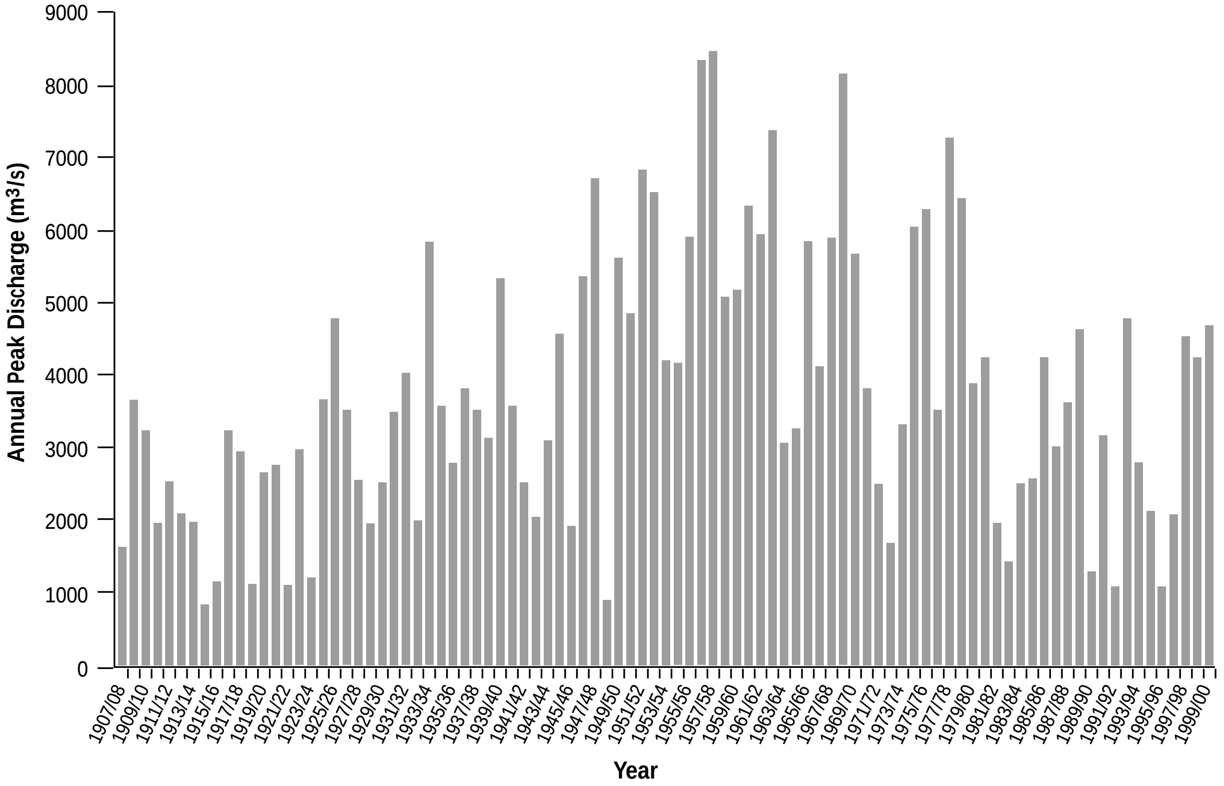
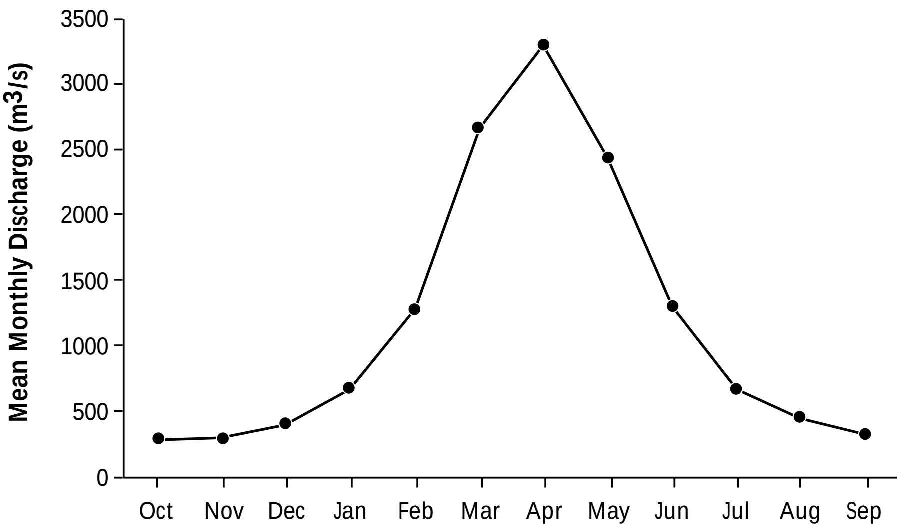


Figure 3.3. *Peak discharge (m^3/s) for the Zambezi River at Katima Mulilo (from Windhoek Consulting Engineers 2000).*

Figure 3.4. *Mean monthly discharge (m^3/s) for the Zambezi River at Katima Mulilo (from Windhoek Consulting Engineers 2000).*



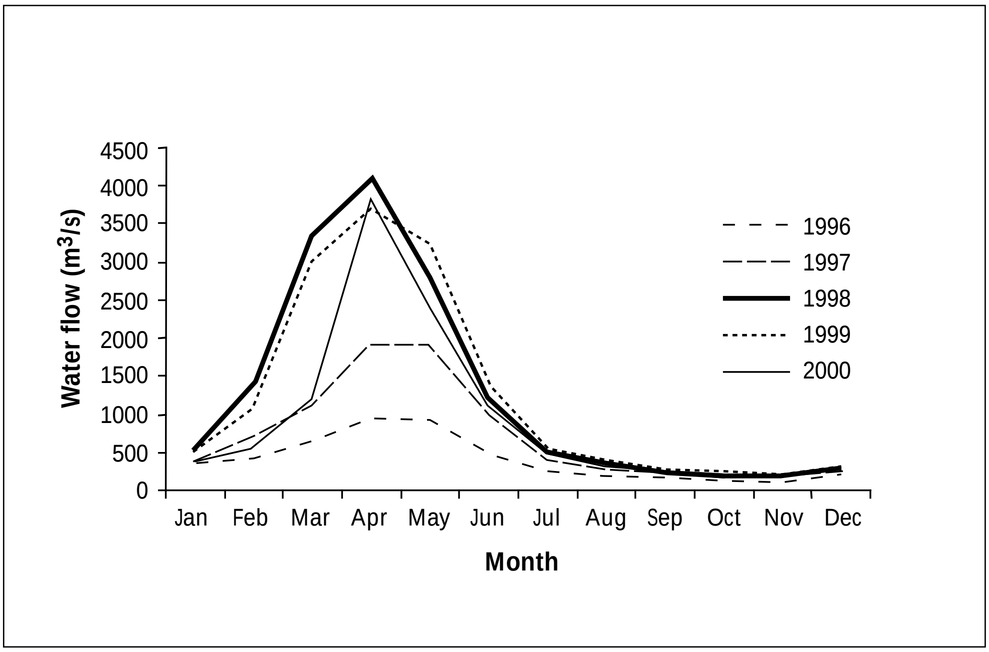


***Figure 3.5**. Water flow (m^3/s) in the Zambezi River (Katima-Mulilo) during the period 1996 to 2000.*

trees and shrubs. Vegetation can be dense in places, making the riverbank impenetrable. In other areas, grass and terrestrial reeds grow on sandy riverbanks and substitute the dominant dense vegetation of trees and shrubs, which grow on more stable ground (clay banks). Fallen or dead submerged trees also occur frequently along the banks. Inundated grassland is the dominant floodplain vegetation. Submerged trees and shrubs also occur on the floodplains. Marginal aquatic vegetation is usually confined to the side of the mainstream due to fast or strong currents and consists of submerged aquatic vegetation, reeds and grass. Aquatic vegetation is marginal in the mainstream, as it is difficult for the plants to anchor in the strong current. Inner aquatic vegetation occurs mostly in side channels and backwaters where there is low water velocity and possible for the root systems to fasten to the bottom. The aquatic vegetation consists of water lilies, water grass, reeds, and submerged and floating vegetation. Floating plants may occur anywhere in the Zambezi River, as it is dependent on wind and water currents for its distribution, and is most commonly found in areas where there are obstacles preventing its further distribution. An alien species, *Salvinia molesta* is a common example of a floating plant in the Eastern Caprivi (J.H. Koekemoer pers. obs.).

Where dense vegetation is present, the riverbanks show little signs of erosion. However, infrequent areas of erosion do occur, especially where deforestation has taken place by local fishermen and lodges to attain easy access to the river. Erosion also occurs in the mainstream along bends, usually during high flood. Overgrazing also causes erosion in certain areas. The gradient of the riverbank varies from steep to moderate and low (J.H. Koekemoer pers. obs.).

3.3 The Chobe River

The Chobe River is a complex system consisting of a mainstream or channel, floodplains, backwaters and side channels. The river gets wider and deeper the closer it gets to the confluence with the Zambezi River. In the southwest near Ngoma, the river is narrow and channel like, but in the northeast near Impalila it develops into a wide, deep, strong flowing river. The mainstream has a low flow gradient, and the water velocity is low in most areas. The water is mostly clear with little suspended materials. Deep side channels and backwaters occur, where aquatic vegetation thrives. Shallow floodplains occur in the southwest, whereas the floodplains in northeast are more swamp-like and deeper with dense reeds.

The direction of the water flow in the Chobe River changes seasonally, provided "natural" conditions with water in the Lake Liambezi, floods in the lower Kwando River and large floods in the Zambezi River. During high floods in the Zambezi River (February to May), the water might be pushed back up the Chobe River, some times as far as to the Chobe Swamps and the Lake Liambezi. However, in periods when the Lake Liambezi has been dry and with small floods in the rivers, only the Zambezi River has influenced the water flow in the Chobe River, forming a "backwater" to the main river.

Several types of aquatic vegetation are present. The water velocity is slow in places, especially during low flood, and it is possible for aquatic vegetation to fasten and grow in the mainstream. Aquatic vegetation may cover the entire riverbed, especially in the southern areas. Reeds, lilies, water grass and water ferns are abundant. Marginal vegetation such as water grass, reeds and submerged terrestrial grass occur all along the river. The fringing vegetation is dominantly grass and small shrub. Few marginal large trees occur on the Namibian side of the river. Dead submerged trees occur infrequently.

On the floodplains towards Ngoma, the vegetation is flooded field and grassland with shrubs and few trees. Near Impalila, the vegetation on the floodplains is marsh or swamp-like with dense reeds and a variety of submerged and protruding aquatic plants.

The riverbanks show little sign of erosion, and are well covered with vegetation. The bank gradient is moderate to low.

3.4 The Lake Lisikili

The perennial Lake Lisikili is formed as a part of the Zambezi River. During high floods, water flows from the river into the lake and the Kalimbeza area. During low flood, the lake becomes isolated. The lake is approximately 4 km long and 0.5-1.0 km wide.

Various aquatic vegetation types are present in the lake. The marginal aquatic vegetation is mostly reeds, while the inner aquatic vegetation is mostly submerged aquatic vegetation. Floating plants such as lilies and water grass is also abundant. Fringing vegetation is dense in areas, with numerous large trees. Terrestrial plants such as grass, shrubs and trees are submerged during high flood. The inundated grass and shrub create a floodplain like habitat on the margin of the lake. Rubble and gravel habitats are available with some small rocks.

The bottom substrate is mostly muddy with patches of sand. The water is clear. The lake deepens with a low gradient, but is deep in some areas (approximately 2m).

4 Materials and methods

4.1 Surveys and stations

Six surveys were conducted in the Eastern Caprivi during the period 1997-2000, of which three were during autumn (post-flood) and three during spring (pre-flood) (**Table 4.1**). The five stations sampled were (1) Katima Mulilo and (2) Kalimbeza in the Zambezi River, (3) Lake Lisikili partly linked to the Zambezi River during high floods, (4) Impalila at the confluence between the Chobe and Zambezi Rivers, and (5) Kabula-Bula in the Chobe River. Stations are named after the closest village or known area.

Stations were chosen with respect to their commonness and similarity to the rest of the river system and its habitat types. Logistical difficulties such as distance, flood levels, accessibility and safety were taken into account when stations were selected. Stations include areas where possible external influences such as fishery, pollution, overgrazing and urbanisation could affect the ecosystem.

Table 4.1. *Survey periods and total catch in numbers for the fish surveys in the Zambezi and Chobe Rivers in the period 1997 to 2000.*

Survey year	Spring*	Total catch (no)	Autumn*	Total catch (no)
1997	X	10296	X	5980
1998	X	13195	X	8609
1999		-	X	15187
2000	X	13608		-

* Autumn 97: 15 May -1 June, spring 97: 13-29 September, autumn 98: 7-28 May, spring 98: 5-25 October, autumn 99: 28 May-16 June, spring 00: 8-15 September and 5-19 November.

Some habitats (localities) occur seasonally and could only be surveyed during high or low floods. Examples of habitats that only occur during low floods are rocky areas and the habitats associated with it, isolated pools next to the river and certain backwaters. Some floodplains and large backwaters only occur during high floods.

4.2 Sampling design and methods

All stations were sampled with gill nets and several other gears (**Table 4.2**). A large range of gears and methods were used to limit the effect of gear selectivity and to survey all habitat types.

The gill nets were brown multi-filament nets with stretch mesh sizes from 22 to 150 mm (**Table 4.3**). The nets were

Table 4.2. Number of fish caught by gill nets, Nordic multi-mesh gill nets and other gears and methods used during the surveys in Zambezi and Chobe Rivers in the period 1997-2000. Specifications of the other gears used and total catches (number of fish) at the stations sampled are also given. 1 = 15 m seine net, 2 = rotenone, 3 = 30 m seine net, 4 = D-net, 5 = traps, 6 = 2 m cast net, 7 = electroshocker, 8 = angling, 9 = hand scoop net, 10 = local gill net and 11 = 5 m seine net.

Station	Gill nets	Nordic gill nets	Other gears	Fishing comp.	Other gears used	Total catches
Katima	4362	478	6386		1, 2, 4, 5, 6, 7, 8, 9, 11	11226
Lisikili	10819	0	4923		1, 2, 4, 5, 6, 7, 11	15742
Kalimbeza	9517	4729	4254		1, 2, 3, 4, 5, 6, 8, 9, 10, 11	18500
Impalila	4928	1798	1851		2, 4, 5, 8, 11	8577
Kabula-Bula	10226	0	2042		1, 2, 3, 5, 6, 7, 8, 11	12268
Zambezi				562	8	562
Total	39852	7005	19456	562		66 875

Table 4.3. Twine and mesh depth (number of vertical meshes) for gill nets of each stretched mesh size used during the surveys in the Zambezi and Chobe Rivers in the period 1997 to 2000.

Mesh size (mm)	Twine	Mesh depth
22	210D/4	158.5
28	210D/4	124.5
35	210D/4	99.5
45	210D/4	74.5
57	210D/6	59.5
73	210D/6	49.5
93	210D/9	42.5
118	210D/9	29.5
150	210D/9	24.5

set from approximately 18:00 hrs in the evening to 06:00 hrs the next morning. At each of the five stations, gill nets were set at the same locality whenever possible during each survey. However, the variable water level caused sites to change with time. At some of the localities, gill nets could not be set during low water periods. The gill nets were used to survey open, deep-water habitats in the main stream near the shore and deep backwater areas with some aquatic vegetation. Nets were set either in the middle of a water-body or near marginal vegetation.

The other gear types were used at or close to the gill net localities. These gears targeted mainly small species and juveniles of long-lived species in shallow, vegetated and rocky habitats. The top layer of sandy substrates was also surveyed for species inhabiting these habitats. Nordic monofilament gill nets (Appelberg 2000) were included in the 2000 survey to improve sampling in the deep-water habitats and of the smaller species such as cyprinids (**Table 4.2**). Data from this method are only included in the life history studies of the important fish species, and not in the rest of the analysis. In addition, in 2000 we also sampled all fish caught in a fishing competition in Zambezi River (**Table 4.2**) (Næsje et al. 2001). By doing this, we got data from larger individuals of several species, which had not been caught during ordinary surveys. These data are also included in the analysis of the life history of important fish species. This restrictive use of data from Nordic gill nets and the fishing competition ensures comparable data sets with the Okavango River survey, where these methods were not used (Hay et al. 2000). The different gears used at each station depended on the type of habitats present at the station.

The following gears were used:

- A 15 m seine net with a depth of 1.5 m, made from 30 % black shade cloth. This was used to sample shallower habitats such as backwaters, bays and also in the main stream, usually with a sandy or muddy substrate. It was occasionally used within aquatic vegetation.
- Rotenone was mainly used to survey rocky habitats. This was also the method used to collect fish from aquatic vegetated habitats.
- A 30 m seine net with a depth of 1.5 m, made from green anchovy net with a stretched mesh of 12 mm. This net was operated in large open water bodies with very little water flow. The substrate was usually sandy.
- A dip-net (D-net) was used in vegetated habitats and also in sandy substrates. The top 5 cm of the sand was excavated using the D-net to survey for *Leptoglanis* spp.
- A 2 m cast (monofilament nylon twine) net with a 20 mm stretched mesh was used to collect fish from deep-water habitats in backwaters and within the main stream. The water was either slow or fast flowing.
- A pulsed electrofishing apparatus (2 amperes and 600 volts) was used to sample rocky and vegetated habitats.
- A hand scoop net was used to sample fish within floating aquatic plants.
- A 5 m seine net with a depth of 1.5 m, made from 80 % green shade cloth. This was used to sample areas along

the river edges. The substrate was predominantly sandy with occasional mud.

- Conical-shaped traps were made from wire with approximately 2 mm mesh size. They were placed near the shore in shallow, strong water currents and within aquatic vegetation.
- Nordic monofilament gill nets were used to sample deep-water habitats. These nets consisted of 12 mesh sizes with the following panels: 86, 39, 12.5, 20, 110, 16, 25, 48, 32, 10, 70 and 58 mm stretched mesh. Each mesh panel was 2.5 m with a depth of 1.5 m.
- Angling with a rod and reel was used to catch larger fish.

A total of 66875 fish were caught with different gears during the surveys in the Zambezi and Chobe Rivers between 1997 and 2000 (**Table 4.2, appendix 2a**). Of these, 39852 fish were caught in survey gill nets and 27023 with the other gears.

The length data (**appendix 2b**) were based on measurements of 36834 fish. These fish were distributed among stations according to **table 4.4**, and among different fishing gears according to **table 4.5**.

Table 4.4. *Length measurements of fish caught on different stations during the surveys in the Zambezi and Chobe Rivers in 1997 to 2000.*

Station	Length measured N	Total catch N	Percent of total catch
Katima	6081	11226	54.2
Lisikili	6314	15742	40.1
Kalimbeza	11762	18500	63.6
Impalila	5400	8577	63.0
Kabula	6753	12268	55.0
Fish Comp.	524	562	93.2
Total	**36834**	**66875**	**55.1**

Table 4.5. *Length measurements of fish caught by different gears during the surveys in the Zambezi and Chobe Rivers in 1997 to 2000.*

Gear	Length measured N	Total catch N	Percent of total catch
Gillnet	21477	39852	53.9
Other gears	10401	19456	53.5
Nordic	4432	7005	63.3
Angling	524	562	93.2
Total	**36834**	**66875**	**55.1**

The common names and family classification for all the species (**Appendix 1**) are based on Skelton (1993). Seven *Synodontis* species are listed for the Zambezi River (Hay et al. 1999), but only one species, *S. nigromaculatus*, is easily identified morphologically. The other six species, *S. leopardinus, S. macrostoma*, *S. thamalakanensis*, *S. vanderwaali*, *S. woosnami*, and *S. macrostigma* were, therefore, grouped together and recorded as one species group. When excluding the *Synodontis* spp. group, a total of 69 species were recorded in the total catches (**Appendix 1**).

4.3 Data collection and analysis

4.3.1 Biological data

Fish smaller than 100 mm in length were measured to the closest mm, while fish larger than 100 mm were measured to the closest cm. Fork length was measured on fish with a forked caudal fin, while total length was measured on fish with a rounded caudal fin. Fish weight was measured in the field as wet weight. Fish caught in gill nets were weighed to the nearest gram. Fish caught with other gears smaller than 50 g were weighed to the nearest 0.1 g, while larger fish were weighed to the nearest 1 g. After measuring and weighing a large number of individuals (often 50 or more), the remaining fish were separated into species, counted, pooled and weighed.

Sexual maturity was classified on a scale from 1 to 4 where 1 is immature or not developed gonads, 2 maturing gonads, 3 mature gonads and 4 spent fish.

4.3.2 Selected species

A large number of species (69 excluding *Synodontis* spp.) were caught in this study in the Zambezi and Chobe Rivers, and 17 species were selected for a more detailed data analysis (**Table 4.6.**) The main criteria for selecting these species were a) their importance expressed by the index of relative importance (IRI) in survey catches in gill nets and other gears, and b) their importance expressed by the numeral importance in survey catches in gill nets and other gears. The selected species represent a large variety in habitat use, distribution, trophic status, body size and general ecology. These species contributed 92.5 % of the biomass of fish caught in survey gill nets and 55.7 % of the biomass in other gears. One of the selected species, *Aplocheilichthys johnstoni*, was not caught in gill nets due to its small size. For results dependent on gill net catches, number of selected species, therefore, are 16.

4.3.3 Species diversity

Species diversity is defined as both the variety and the relative abundance of species. To calculate the relative importance and diversity of the different species, an index of relative importance (IRI) was used, as well as a measure of the number species weighted by their relative abundance, expressed as the Shannon diversity index (H`). An index of evenness (J`), which is the ratio between observed diversity and maximum diversity, was also calculated. Information about the species diversity in the Zambezi and Chobe Rivers were based on pooled samples from the five main stations.

Index of relative importance (IRI)

An "index of relative importance", IRI, (1) (Pinkas et al. 1971, Caddy and Sharp 1986, Kolding 1989, 1999) was used to find the most important species in terms of number, weight and frequency of occurrence in the catches from the different sampling localities. This index is a measure of relative abundance or commonness of the different species in the catch and is calculated as:

$$IRI = \frac{(\%N_i + W_i) \times F_i}{(\%N_j + \%W_j) \times F_j} \times 100 \qquad (1)$$

where j = 1–S, $\%N_i$ and $\%W_i$ is percentage number and weight of each species in the total catch, $\%F_i$ is percentage frequency of occurrence of each species in the total number of settings and S is the total number of species.

Table 4.6. *List of the ten most important species according to an index of relative importance (IRI) and numbers (No) in either survey gill nets or other survey gears from 1997 to 2000 (See **Appendix 4 and 5**). The species are ranked in accordance with their importance, and 1 is the most important species.*

Species	Gill nets		Other gears	
	IRI	No	IRI	No
Brycinus lateralis	1	1	9	9
Schilbe intermedius	2	3		
Hydrocynus vittatus	3	6	6	
Marcusenius macrolepidotus	4	4		
Petrocephalus catostoma	5	2		
Hepsetus odoe	6	10		
Clarias gariepinus	7			
Barbus poechii	8	5	7	
Pharyngochromis acuticeps	9	7	2	6
Tilapia sparrmanii	10	8	1	1
Micralestes acutidens		9	10	3
Tilapia rendalli			3	4
Oreochromis macrochir			4	5
Pseudocrenilabrus philander			5	7
Barbus paludinosus			8	2
Barbus unitaeniatus				8
Aplocheilichthys johnstoni				10

Shannon index of diversity (H´)

The Shannon index of diversity (H´) (2) is a measure of the number of species weighted by their relative abundances (Begon et al. 1990), expressed as:

$$H' = \sum p_i \ln p_i, \qquad (2)$$

where p_i is the proportion of individuals found in the ith species. The Shannon index assumes that individuals are randomly sampled from an 'indefinitely large' population, and that all species are represented in the sample. The value of the Shannon diversity index is usually between 1.5 and 3.5. A high value indicates high species diversity.

Index of evenness (J´)

Shannon's index takes into account the evenness of the abundances of species, but we wanted a separate additional measure of evenness. We used the ratio of observed diversity to maximum diversity to calculate the index of evenness (J´) (3) (Begon et al. 1990).

$$J' = H'/H_{max}, \text{ where } h_{max} = \ln H'' \quad (3)$$

J is constrained between 0 and 1.0 with 1.0 representing a situation in which all species are equally abundant. As with H´, this evenness measure assumes that all species in the area are accounted for in the sample.

4.3.4 Gill net selectivity

Gill nets are selective fishing gears. This means that a specific mesh size catches fish in a certain length interval and is often most effective within a narrow length group. In addition, gill nets may discriminate among species according to fish morphology, for example body form and the presence of spines. Gill nets are also restricted to certain habitats, which will also influence the selectivity of this gear.

The body length distribution of fish in the different gill net mesh sizes is the simplest way to express and compare the gill net selectivity of different mesh sizes. For management purposes it is also necessary to calculate the gill net selectivity curve, which is an expression of the probability of capturing a certain size group of fish in a specific gill net mesh size. An analysis of body length distribution in gears, body length of mature fish and gill net selectivity are given for the 17 selected species (selected species, see section 4.3.2).

The general statistical model for gill net selectivity and its application are described in Millar (1992) and Millar and Holst (1997). When the actual distribution of fish in the sampled area is unknown, as in this study, selectivity estimates are based on the assumption that all fish have the same probability of encountering the gear. This may not always be true, as small individuals within a species may have different behaviour compared with larger ones. This uncertainty cannot be quantified without independent information on population structure. This information, however, is rarely available and hard to obtain in natural fish populations. A further assumption is that all mesh sizes have the same efficiency on their optimal length class (the so-called 'modal length'). This may also be erroneous due to different behaviour of small and large individuals. Often, the fishing efficiency may increase with mesh size. Several statistical methods are developed to represent the selection curves. Two functions were used in this study. The standard normal function was applied for species that are mainly entangled by their gills, whereas a skewed normal function (Helser et al. 1991, 1994) was used for species that to some extent can be caught in other body structures such as fin rays, teeth and spines. The selection curves were standardised to unit height by dividing the number of fish in the modal length class.

4.3.5 Catch per unit effort

When standard fishing gear is used, the catch per unit of effort may be used as a rough indicator of the density of fish in the sampled area. For a standard series of gill nets in this study, catch per unit effort (CPUE) was defined as the number or weight of fish caught in 12 hours of fishing in a panel size of 50 m^2 gill net.

Measuring catch in number or weight of fish may give very different results. In this report, the results are generally presented in both units, but with an emphasis on weight, as this unit is more important to fishermen and managers.

4.3.6 Databases and software

All recorded data were compiled in PASGEAR (Kolding 1995), which is a customised data base package intended for experimental fishery data from passive gears. The package is primarily developed to facilitate the entering, storage and analysis of large amounts of experimental data. The program makes data input, manipulation and checking data records easy. PASGEAR also contains predefined extraction, condensing and calculation programmes to facilitate data exploration and analysis from survey fisheries. PASGEAR (version May 2000) and SPSS for Windows (version 9.0) were used to perform the calculations and statistical analysis.

5 Background biology and distribution of selected species

As a background to the results and discussion in this study, an overview of the biology and distribution for the most important species found in the surveys is given in this chapter. The information is mainly collected from Skelton (1993). The reference under the separate species is given only when information is collected from other sources. The species are classified according to family.

Cichlidae

Pseudocrenilabrus philander (Southern mouthbrooder) is widespread in Southern Africa from the Orange River and northwards to Malawi and the southern tributaries of the Zaire River. Several isolated populations are present in Namibia, such as in the Lake Otjikoto and the Otavi fountain. It may reach a length of 13 cm and breeds from early spring to late summer. It is a mouthbrooder with several broods raised in one season. This species lives in a wide variety of habitats, but prefers vegetated areas, feeding on insects, shrimps and even small fish. It is an aquarium species, and is also used in behavioural and evolutionary research.

Pharyngochromis acuticeps (Zambezi happy) occurs in the Okavango and Zambezi Rivers, but is absent from the Kunene River. It may grow to 22 cm, but is usually less than 10 cm. It is a female mouthbrooder and breeds in the summer. It occurs in a wide range of habitats, but needs cover such as vegetation or tree roots. It preys on insects, shrimps, small fish, and eggs and larvae of nesting fishes. It is a potential aquarium species.

Tilapia sparrmanii (Banded tilapia) is widespread in Southern Africa, with a similar distribution as the *Pseudocrenilabrus philander*, and it has been extensively translocated south of the Orange River in the Cape. Individuals have also been translocated to several waterbodies in Namibia (Hay et al. 1999). It attains a length of approximately 23 cm and weighs up to 0.5 kg. It is tolerant of a wide range of habitats, but prefers quiet or stagnant waters with vegetation, where it feeds on algae, soft plants, invertebrates and small fish. It is common in subsistence fisheries and occasionally in angling.

Tilapia rendalli (Redbreast tilapia) is widespread in southern Africa where it occurs in the Kunene, Okavango and Zambezi River systems, in the eastern Zaire basin and in coastal rivers south of the Zambezi. It is also translocated to many catchment areas in southern Africa. It has also been recorded from the Lower Orange River and several waterbodies in Namibia (Hay et al. 1999). This species grows to about 40 cm and 2 kg, and breeds and raises several broods each summer. It prefers quiet, vegetated waters along river littorals or backwaters, floodplains and swamps and feeds mainly on plant material, but may also feed on invertebrates and even small fish. It is an attractive angling species.

Oreochromis macrochir (Greenhead tilapia) occurs in the Kunene, Okavango, Upper Zambezi and Kafue Rivers, as well as the Lake Kariba, the Busi River and in the southern tributaries of the Zaire River. This species may reach 40 cm in length, and the angling record in Zimbabwe is 2.6 kg. It breeds in summer. Preferred habitats are quiet waters along river margins and backwaters, in floodplain habitats and impoundments where it feeds on microscopic foods, such as algae and detritus taken from the bottom. Juveniles live close inshore in shallow water and feed more on zooplankton and insect larvae. It is an important species in aquaculture and fisheries and is also a popular angling species.

Cyprinidae

Barbus poechii (Dashtail barb) occurs in the Okavango and Zambezi Rivers. It can grow to 11 cm and is common in riverine and floodplain habitats, where it feeds on insects and other small organisms. This species is used as bait for tigerfish and kept in large aquariums and ponds. In the Kunene River, it is replaced by *Barbus trimaculatus* (Hay et al. 1999).

Barbus paludinosus (Straightfin barb) is widespread in Southern Africa from coastal rivers in East-Africa south to the Vungu River in Natal, and from the southern Zaire River tributaries and the Quanza River in Angola to the Orange River. This species grows to 15 cm. Females are multiple spawners, which breed during the summer. It prefers quiet, vegetated waters in lakes, swamps and marshes or marginal areas of larger rivers and slow-flowing streams, where it feeds on a wide variety of small organisms such as insects, snails, crustaceans, and algae, as well as detritus.

Barbus unitaeniatus (Longbeard barb) is widely spread in Southern Africa from the Zambian-Zaire system and the Kunene, Okavango and Zambezi Rivers south to the Phongolo River. It is absent from the lower Zambezi River. This species grows to 14 cm, and breeds after rains during the summer months. It is found in a wide range of habitats including flowing and stagnant waters, and thrives in dams and lakes where it feeds on aquatic invertebrates and grass seeds.

Mormyridae

Marcusenius macrolepidotus (Bulldog) is widespread in Central and Southern Africa in the Kunene, Okavango and Zambezi Rivers and in east coastal rivers and lakes from Tanzania to Natal, and also in the upper Zaire River. It may grow to 30 cm and 0.5 kg, and breeds during the rainy season. It shoals in vegetated and shallow waters where it feeds on invertebrates found on the bottom or on vegetation. It is occasionally caught on rod and line and is an interesting aquarium species.

Petrocephalus catostoma (Churchill) is widespread from the Kunene, Okavango and Zambezi Rivers to the Zaire River and the lakes Malawi, Tanganyika and Victoria. It has a maximum size of 13 cm and breeds during the summer rainy season. The preferred habitats are quiet reaches of rivers and floodplains, where it feeds on insect larvae and other small invertebrates. It is a potentially attractive aquarium species and is caught in subsistence fisheries.

Characidae

Micralestes acutidens (Silver robber) occurs in the Kunene, Okavango and Zambezi Rivers, in the east coastal rivers, and is also widespread in the Zaire River system. Maximum size is about 8 cm. It breeds throughout the summer months. It shoals in clear, flowing or standing, open water where it feeds on surface insects and zooplankton. It is a habitat specialist and is used as an indicator species (Hay et al. 1996). This species is an attractive aquarium species and is used as forage and bait for tigerfish and African pike.

Hydrocynus vittatus (Tigerfish) is widespread in Africa, but is absent from the Kunene and the Kafue Rivers. Females may grow to 70 cm, and males to 50 cm, and they may attain a body weight of more than 10 kg. It breeds during summer and spawns in shallow flooded areas. Fish larger than 10 cm prey on other fish, while smaller fish eat invertebrates. Adults prefer open waters in rivers or lakes. It is a popular fish both commercially and for angling.

Brycinus lateralis (Striped robber) is present in the Okavango, Zambezi and Kunene Rivers. It may reach a length of about 14 cm. These species shoals in slow flowing or quiet vegetated waters. It migrates upstream and possibly spawns in the rainy season. It is caught in subsistence fisheries and used as bait for tigerfish.

Schilbeidae

Schilbe intermedius (Silver catfish) is widely distributed in Sub-Saharan Africa. It reaches a length of about 30 cm and can weigh up to 1.3 kg. Generally it is found to mature sexually at approximately 16 cm. It breeds in the rainy season and has a life span of up to 6-7 years. The preferred habitats are stagnant water or slow flowing waters, often shoaling. The varied diet may include fish, invertebrates, plant seeds and fruits. It is important in the subsistence fishery and is also subject to angling.

Cyprinodontidae

Aplocheilichthys johnstoni (Johnston's topminnow) occurs in the Kunene, Okavango and Zambezi Rivers. It can grow to about 5 cm, and prefers standing or slow flowing waters in river backwaters, floodplains or swamps with vegetated areas, often in very shallow waters, feeding on small invertebrates. It is an aquarium species and is also used in mosquito control.

Clariidae

Clarias gariepinus (Sharptooth catfish) is probably the most widespread fish species in Africa. It may reach 1.4 m in length and 59 kg in weight. It occurs in almost any habitat, but prefers floodplains, large sluggish rivers, lakes and dams where it feeds on virtually any available organic food source. This species is a potential species for aquaculture and has been farmed in several African countries. It is important in the subsistence fishery and is also regularly caught during fishing competitions in the Zambezi River (Næsje et al. 2001).

Hepsetidae

Hepsetus odoe (African pike) occurs in the Kunene, Okavango and Zambezi Rivers and is also widespread through central Zaire and West Africa. Maximum length is approximately 47 cm, and it can weight up to 2.0 kg. Breeding takes place during the summer months. It prefers quiet, deep water in channels and lagoons of large floodplains where it feeds on fish. Habitat preferences may be influenced by the presence of *Hydrocynus vittatus*. Juveniles inhabit vegetated marginal habitats where they feed on small invertebrates and fish. It is an angling species and is also taken in subsistence fisheries.

6 Results

6.1 Species diversity, all stations combined

A total of 69 species (excluding *Synodontis* spp.) were recorded at the five stations, while 14 families were observed. The Cichlidae and Cyprinidae families were the best represented in the catches, with 17 and 20 species, respectively (**Appendix 1**).

6.1.1 Catches in all gears

The species caught during all the surveys from 1997 to 2000 were ranked based on the index of relative importance (IRI) (**Figure 6.1**). To be able to compare with catches from the Okavango River (Hay et al. 2000), however, we have excluded catches from Nordic gill nets and the fishing competition in 2000. The IRI for all the species caught in the Zambezi and Chobe Rivers are listed in **Appendix 3**. *Brycinus lateralis* (39 %) was the most important species, while *Schilbe intermedius* (12 %) was the second most important. The *Hydrocynus vittatus* (7 %) were the third most important, followed by *Synodontis* species (6 %). The other species had an IRI lower than 5 %. When omitting *Synodontis* spp., the ten most important species totally comprised an IRI of 83 % (**Appendix 3**).

A total of 946 kg of fish was caught during the surveys (**Appendix 3**). *Brycinus lateralis* and *S. intermedius* had the highest biomass and comprised 21 % and 16 % of the total biomass caught. Also relatively high biomasses of *H. vittatus* and *Clarias gariepinus* were caught, representing 15 % and 13 % of the total biomass.

A total number of 59308 fish were caught during the surveys, when omitting the catches in Nordic gill nets and fish caught during the fishing competition (**Appendix 3**). *Brycinus lateralis* was the most numerous species and comprised 36 % of all of the fish caught. Second most numerous was *Petrocephalus catostoma* with 8 % of all individuals caught, followed by *Synodontis* spp. (7 %), *S. intermedius* (7 %) and *Marcusenius macrolepidotus* (6 %).

The Shannon index (H´) was 2.73 for the total catches, and the evenness index (J´) was 0.64, indicating high species diversity and a variable number of individuals within the different species.

6.1.2 Rare species

For the last six species in the IRI list (**Appendix 3**), only one or two individuals were caught during our survey. These species are *Leptoglanis* cf *dorae, Barbus kerstenii, Barbus* *codringtonii, Nannocharax macropterus, Clarias stappersii* and *Chiloglanis neumanni*. Another seven species have been listed from the Caprivi region (van der Waal & Skelton 1984, Hay et al. 1999), but were not sampled during this study. These are *Barbus lineomaculatus, Barbus afrohamiltoni, Leptoglanis rotundiceps, Amphilius uranoscopus*, *Clarias liocephalus, Nothobranchius* spp. and *Sargochromis greenwoodi*.

6.1.3 Catches in gill nets

For all stations in the Zambezi and Chobe Rivers combined, 40 fish species (excluding *Synodontis* spp.) were caught in the gill nets (mesh size 22-150 mm). More than half (60 %) of the total catches (66875 fish) were taken by gill nets (39852 fish) (**Table 4.3**). Ten fish families were caught in the gill nets, where the Cichlidae family was represented by 15 species and the Cyprinidae by only eight species. The Mormyridae was represented by six species.

The index of relative importance (IRI) for the gill net catches showed similar patterns as for IRI in the total catch, as the ranking of the first five species were the same when *Synodontis* spp. were omitted (**Figure 6.1 and 6.2**). The first five species comprised an IRI of 89 %. The two species *Brycinus lateralis* (49 %) and *Schilbe intermedius* (24 %) comprised an IRI of 73 % (**Appendix 4**). *Hydrocynus vittatus* (7 %) and *Marcusenius macrolepidotus* (6 %) were ranked number three and four. The ten most important species in the gill net catches accounted for an IRI of 96 % when *Synodontis* spp. were excluded.

The Characidae family (56 %) was the most important family in the gill net catches according to IRI. Only 1.9 % of the fish caught in gill nets, however, belonged to the Cichlidae family, where *Pharyngochromis acuticeps* and *Tilapia sparrmanii* accounted for 0.9 % and 0.7 %, respectively (**Appendix 4**).

A total of 837 kg of fish were caught in the gill nets (**Appendix 4**). The relatively small *B. lateralis* made up 23 % (194 kg) of the total biomass of the gill net catches. *S. intermedius* (17 %), the only representative from the Schilbeidae, was the second most important with respect to biomass. *Clarias gariepinus* (15 %) was the third most important species and *Hydrocynus vittatus* (13 %) the fourth. The two species *M. macrolepidotus* (7 %) and *Petrocephalus catostoma* (5 %) from the Mormyridae were also among the ten most important species with respect to

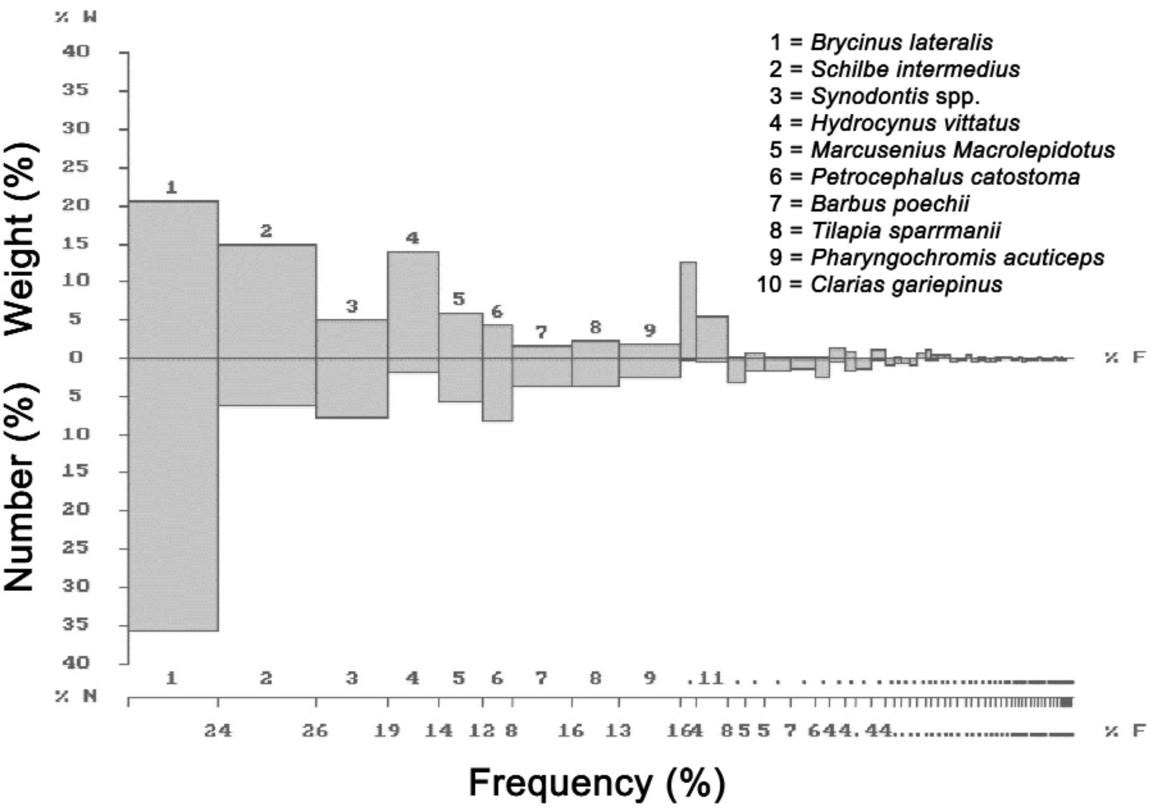


Figure 6.1. *Index of relative importance (IRI) for the most important species caught in the Zambezi and Chobe Rivers between 1997 and 2000.*

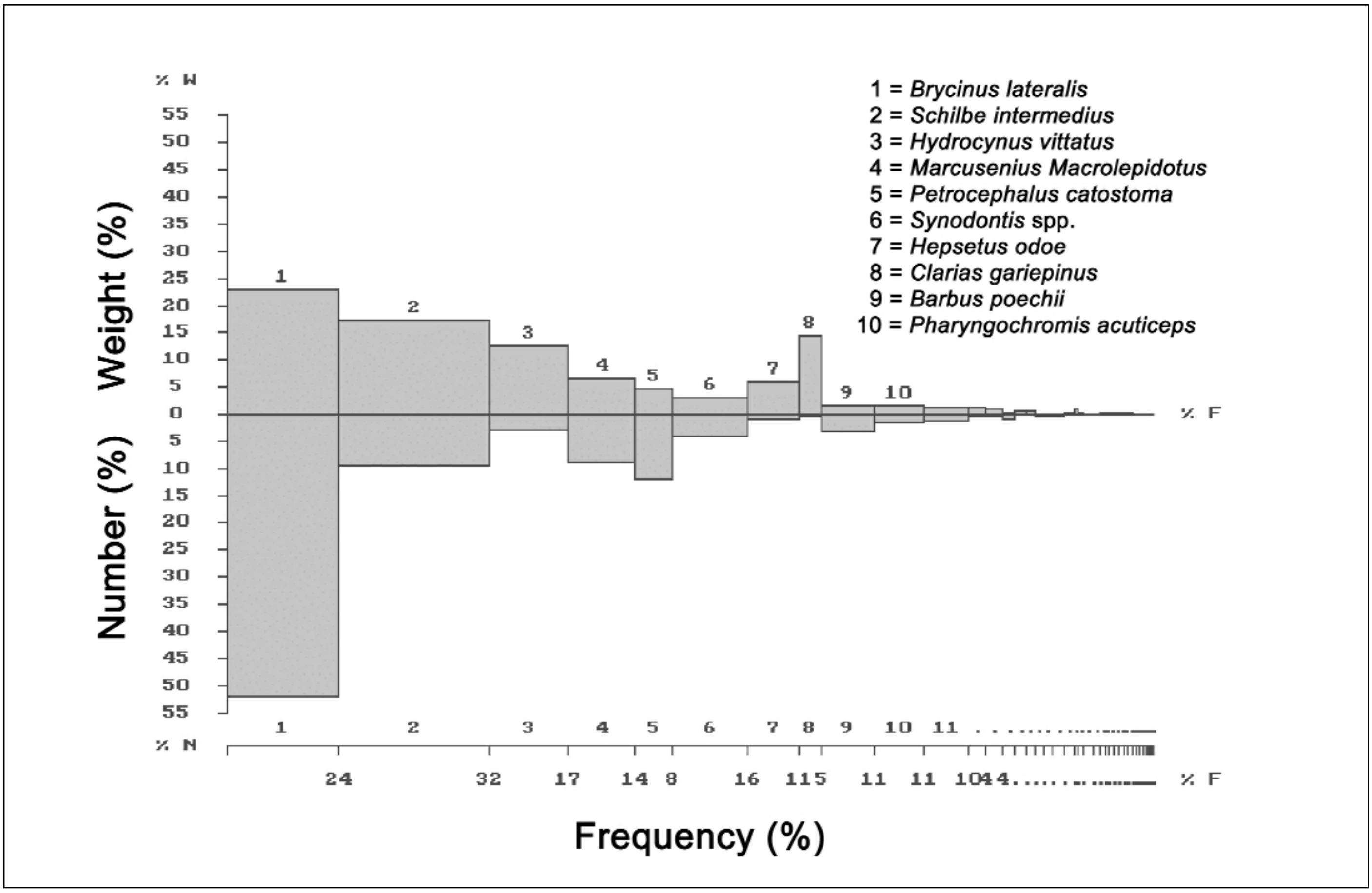


Figure 6.2*. Index of relative importance (IRI) for the most important species caught by gill nets in the Zambezi and Chobe Rivers between 1997 and 2000.*

biomass in the gill net catches. The Characidae family, represented by *B. lateralis*, *H. vittatus* and *M. acutidens*, made up 36 % of the total biomass.

Brycinus lateralis was by far the most numerous species in the gill net catches (52 %), followed by *P. catostoma* (12 %) (**Appendix 4**). *Schilbe intermedius* (10 %) and *M. macrolepidotus* (9 %) were also important with respect to abundance. *Barbus cf eutaenia, Hippopotamyrus ansorgii* and *Tilapia ruweti* were not regularly targeted by the gill nets. The most numerous fish families were the same as for the IRI and biomass.

The diversity of fish species in the gill net catches was lower than for the total catches (Shannon diversity indices H´: 1.78 vs 2.73), and there was a greater variation in number of individuals among species (Evenness index: J´= 0.48).

6.1.4 Catches in other gears than gill nets

When excluding Nordic gill nets and the fishing competition, a total of 67 species (excluding *Synodontis* spp.) from 14 different families were caught with other gears than gill nets, which is 27 more species than in the gill net catches. A total of 19456 fish were caught with the other gears.

The most important species in the total catches with other gears were different from the catches in the gill nets. In other gears, the three most important species according to the index of relative importance (IRI) belonged to the Cichlidae family (**Figure 6.3, Appendix 5**). These species were *Tilapia sparrmanii* (18 %), *Pharyngochromis acuticeps* (12 %) and *Tilapia rendalli* (11 %). The *Synodontis* species group (8 %) were the fourth most important followed by two additional cichlids, *Oreochromis macrochir* (7 %) and *Pseudocrenilabrus philander* (6 %). The ten most important species comprised an IRI of 74 %. In total, 58 % of the catches were from the Cichlidae (**Appendix 5**). Only two species from the Cichlidae family were among the ten most important species in the gill net catches when *Synodontis* spp. were excluded (*P. acuticeps* no 9 and *T. sparrmanii* no 10). Five species were listed under the ten most important species both for the other gears and the gill net catches. These were *T. sparrmanii, P. acuticeps, Hydrocynus vittatus, Barbus poechii* and *Brycinus lateralis.* The *Synodontis* group was also among the ten most important in both gear types. However, the catches were very different in gill nets compared with the other gears. In the gill net catches, *Brycinus lateralis* and *Schilbe intermedius* accounted for 73 % of the total catch, compared to only 5 % in the catches with the other gears. In contrast to this, *T. sparrmanii, P. acuticeps* and *T. rendalli* accounted for 41 % of the catches with the

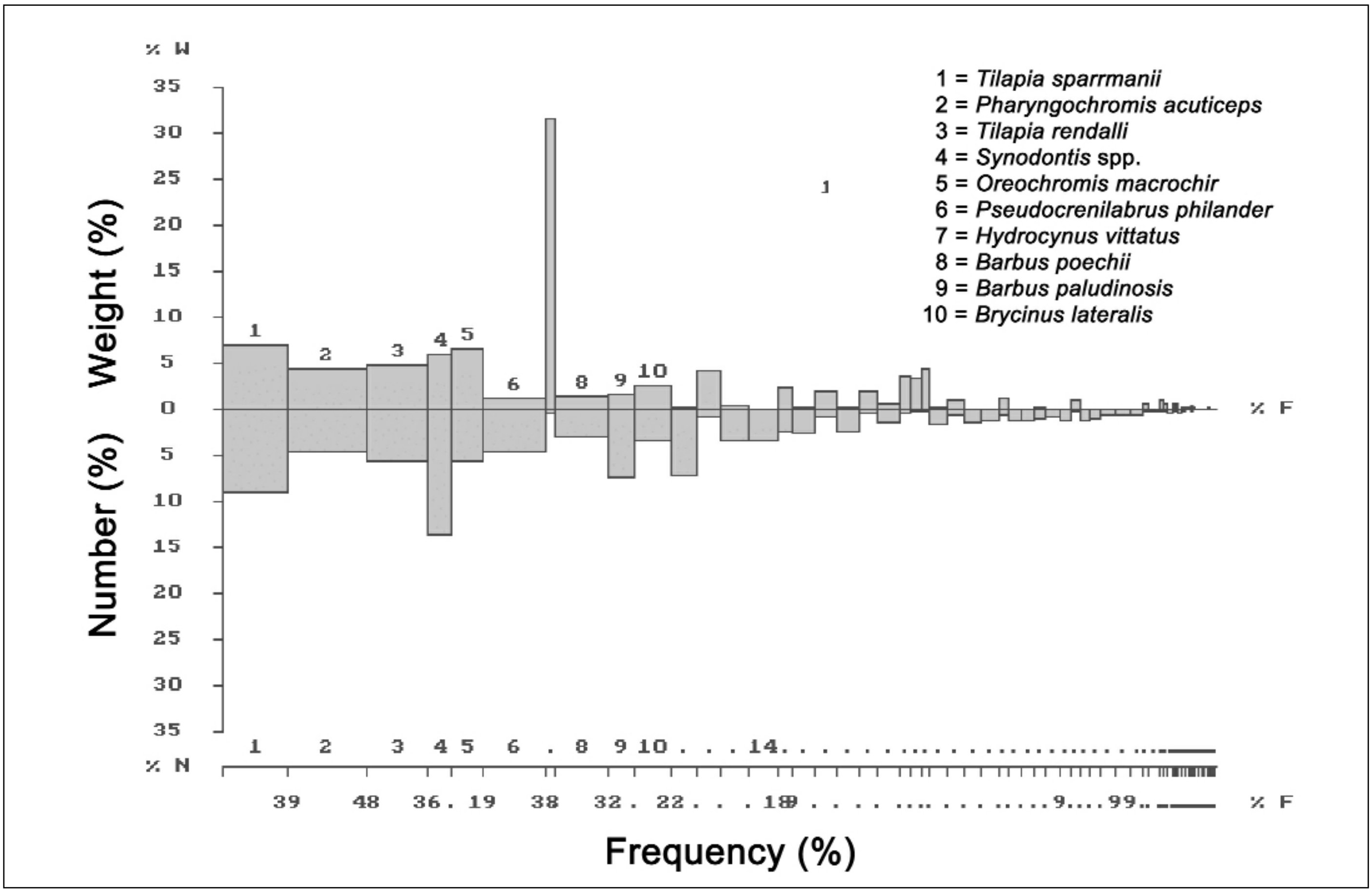


Figure 6.3*. Index of relative importance (IRI) for the most important species caught by other gears than survey gill nets in the Zambezi and Chobe rivers between 1997 and 2000.*

other gears and only 2 % in the gill net catches (**Appendix 4 and 5**).

A total of 109 kg of fish was caught with the other gears (**Appendix 5**). *Hydrocynus vittatus* (32 %) was clearly the dominant species with respect to biomass. *Tilapia sparrmanii* (7 %) was second and *O. macrochir* (6 %) third, while *Synodontis* spp. accounted for 6 % and *T. rendalli* for 5 % of the catches. The Characidae family accounted for 35 % of the biomass with four species, whereas the Cichlidae family accounted for 34 % of the biomass with 16 species.

No species or species group dominated the catches in the other gears with respect to numbers (**Appendix 5**). The *Synodontis* species accounted for 14 % of the total number fish caught. *Tilapia sparrmanii* (9 %) was the second most numerous, followed by *Barbus paludinosus* (7 %) and *Micralestes acutidens* (7 %). The Cichlidae accounted for 33 % and the Characidae for 13 % of the total number of fish caught.

The species diversity was higher for the catches with the other gears than for the gill net catches (Shannon diversity indices H': 3.26 vs 1.78; t-test, $t = 141.465$, $df = 49170$, $p < 0.001$). The number of individuals was also more evenly distributed among the species caught in other gears than in the gill net catches (Evenness indices: J′ = 0.77 vs 0.48).

6.2 Species diversity at the different stations

6.2.1 Catches in gill nets

A total of 36, 33, 33, 28 and 24 species (excluding *Synodontis* spp.) were caught in the survey gill nets at Kalimbeza, Kabula-Bula, Lisikili, Katima Mulilo and Impalila, respectively (**Table 6.1, Appendix 6, 7, 8, 9 and 10**). A total of fifteen species were represented among the ten most important species according to the index of relative importance (IRI) at the different stations (**Figure 6.4**). *Brycinus lateralis* was ranked as the most important species at all stations, and *Schilbe intermedius* was ranked second except at Lisikili (ranked third). *Brycinus lateralis, S. intermedius, Hepsetus odoe, Clarias gariepinus*, *Marcusenius macrolepidotus* and *Synodontis* spp. were all among the ten most important species at all the stations. Five species were among the ten most important species at only one station, and these were *Micralestes acutidens* (Katima Mulilo), *Hemichromis elongatus* (Lisikili), *Clarias ngamensis* (Impalila), *Serranochromis macrocephalus* and

***Table 6.1**. Number of species and diversity indices for the fish caught in gill nets at the five main stations in the Zambezi and Chobe Rivers from 1997 to 2000.*

	Katima Mulilo	Lisikili	Kalimbeza	Impalila	Kabula-Bula
Number of species	28	33	36	24	33
Shannon index (H´)	1.28	1.73	1.64	1.64	1.52
Evenness index (J´)	0.38	0.49	0.45	0.51	0.43

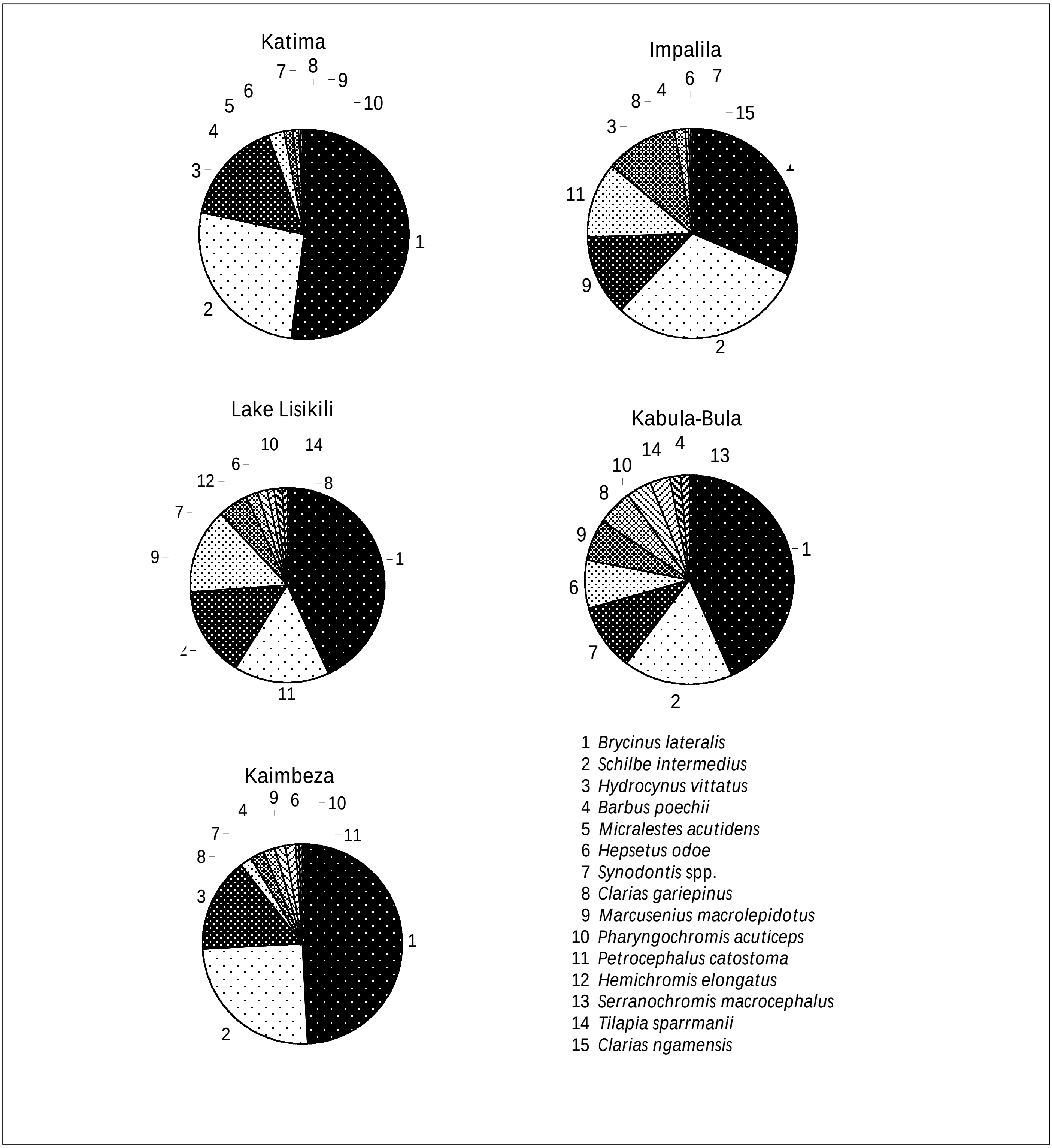


***Figure 6.4**. Index of relative importance (IRI) for the most important species caught by survey gill nets at five different stations in the Zambezi and Chobe Rivers between 1997 and 2000.*

Sargochromis carlottae (both at Kabula-Bula*). Hepsetus odoe* and the cichlids were the most dominant at Kabula-Bula, the only station where *Hydrocynus vittatus* was not among the important species.

The total biomass of fish caught in the gill nets at the different stations varied between 104 kg and 240 kg. The weight proportion of the different species also varied between stations (**Appendix 6, 7, 8, 9 and 10**). At Katima Mulilo, *S. intermedius* (29 %) was the most important with respect to biomass, with *H. vittatus* (26 %) and *B. lateralis* (22 %) ranked second and third (**Appendix 6**). At Lake Lisikili, *B. lateralis* was the most important (32 %), with *M. macrolepidotus* (14 %) and *Petrocephalus catostoma* (13 %) from the Mormyridae family ranked second and third (**Appendix 7**). At Kalimbeza, *B. lateralis* was the most important (24 %), with *S. intermedius* (21 %), *H. vittatus* (19 %) ranked second and third (**Appendix 8**). At Impalila, *H. vittatus* was the most important (21 %), with *S. intermedius* (20 %) and *C. gariepinus* (17 %) ranked second and third (**Appendix 9**). At Kabula-Bula, *Clarias gariepinus* (24 %) was the most important, with *B. lateralis* (19 %) and *H. odoe* (13 %) ranked second and third (**Appendix 10**). The three most important species constituted 55 - 76 % of the total biomass caught at the different stations.

The total number of fish caught in gill nets at the different stations varied between 4362 (Katima Mulilo) and 10819 (Lake Lisikili). *Brycinus lateralis* was the most numerous species at all stations, representing between 33 % and 66 % of the total number of fish caught at the different stations (**Appendix 6, 7, 8, 9 and 10**). *Schilbe intermedius* was the second most numerous at Katima Mulilo (14 %) and Kalimbeza (14 %), *P. catostoma* at Lake Lisikili (29 %) and Impalila (27 %) and *M. macrolepidotus* at Kabula-Bula (10 %).

The species diversity measured as the Shannon diversity index (H`) was highest in gill net catches in the Lake Lisikili (1.73), whereas the lowest diversity was recorded at Katima Mulilo (1.28) (**Table 6.1**). The Lake Lisikili showed a higher species diversity than Katima Mulilo (t-test, $t = 18.384$, $df = 7334$, $p < 0.001$), Impalila (t-test, $t = 5.029$, $df = 12446$, $p < 0.001$), Kabula (t-test, $t = 11.325$, $df = 20188$, $p < 0.001$) and Kalimbeza (t-test, $t = 4.958$, $df = 18899$, $p < 0.001$). The species diversity differed among all stations, except for Kalimbeza and Impalila where no differences were observed (t-test, $t = 0.231$, $df = 13784$, $p > 0.5$). Also the species evenness differed among stations. The evenness was smallest at Katima Mulilo (0.38), indicating a large variation in number individuals within each species. None of the stations had an evenly distributed number of individuals among species (**Table 6.1, Appendix 6, 7, 8, 9 and 10**).

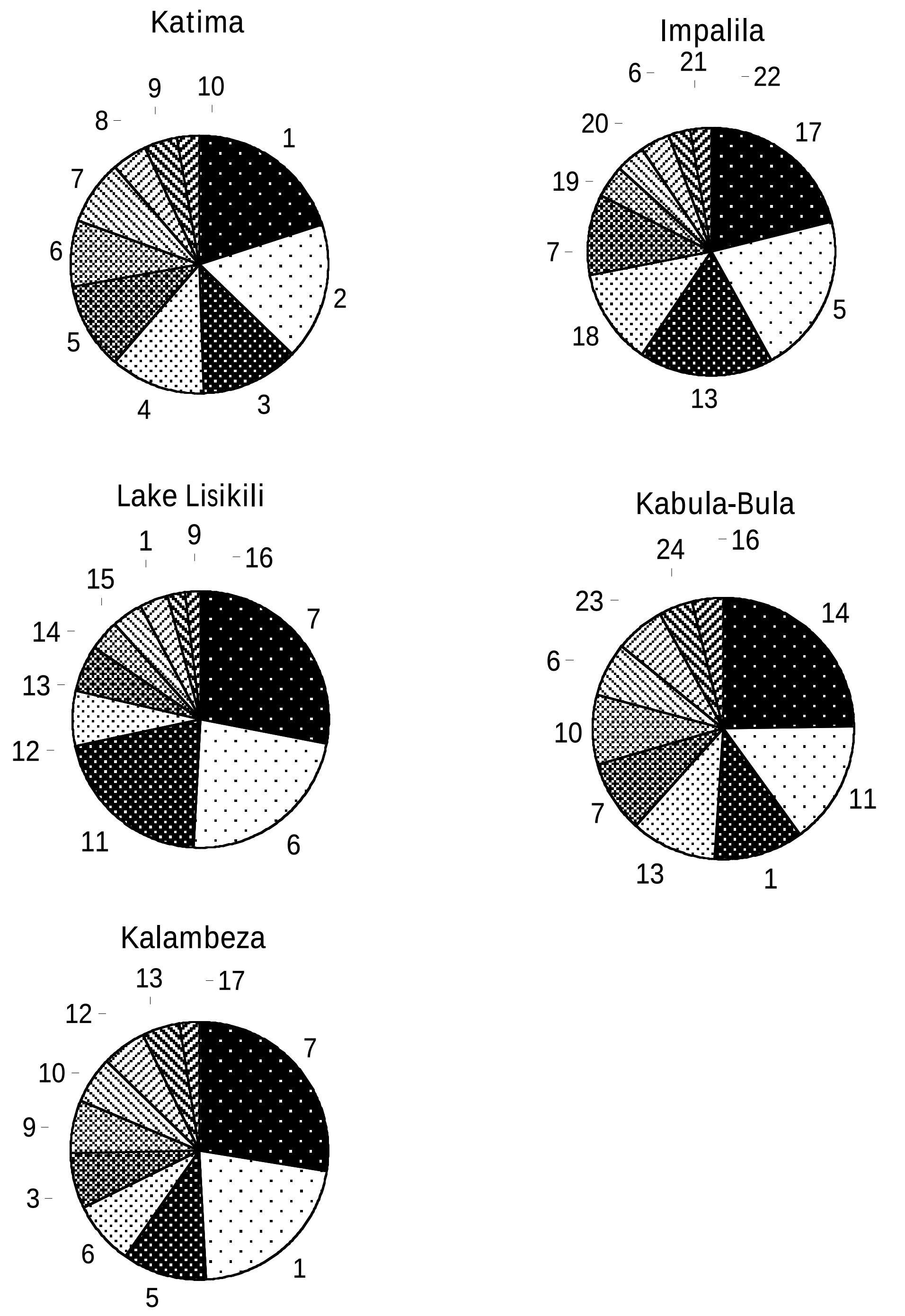
6.2.2 Catches in other gears than gill nets

A total of 54, 49, 45, 45 and 44 species (excluding *Synodontis* spp.) were caught in the other gears than gill nets at Kalimbeza, Katima Mulilo, Lisikili, Kabula-Bula and Impalila, respectively (**Table 6.2**). According to the index of relative importance (IRI), altogether 23 species (excluding the *Synodontis* spp.) are listed among the ten most important species at the different stations (**Figure 6.5**). Only three species are listed among the ten most important at all stations. These were *Tilapia sparrmanii, Tilapia rendalli* and *Pseudocrenilabrus philander*. *Pharyngochromis acuticeps* is listed as one of the ten most important species at all the stations except at Impalila. The most important species was *Pharyngochromis acuticeps* at Katima Mulilo, *Tilapia sparrmanii* at Lisikili and Kalimbeza, *Aplocheilichthys johnstoni* at Impalila, and *Brycinus lateralis* at Kabula-Bula. Ten species were among the ten most important species at only one station. These were *Labeo cylindricus* and *Barbus unitaeniatus* (Katima Mulilo), *Rhabdalestes maunensis* (Lisikili*) Tilapia ruweti, Barbus haasianus, Aplocheilichthys katangae, Barbus multilineatus, Ctenopoma multispine* (all at Impalila) and *Schilbe intermedius and Clarias ngamensis* (Kabula-Bula).

The total biomass of fish caught in other gears at the five stations was much smaller than the catch in survey gill nets (approximately 1/10), and varied between 12 kg (Impalila) and 32 kg (Katima Mulilo) (**Appendix 11, 12, 13, 14 and 15**). The relative proportion of the species' biomass differed among stations. At Katima Mulilo, *Hydrocynus vittatus* (46 %) was the most important with respect to biomass, with *Synodontis* spp. (14 %) ranked second and *L. cylindricus* (8 %) third (**Appendix 11**). These three species made up for 68 % of the total biomass at this station. In Lake Lisikili, the

Table 6.2. *Number species caught and diversity indices for the different stations surveyed with other gears than gill nets in the Zambezi and Chobe Rivers from 1997 to 2000.*

	Katima Mulilo	Lisikili	Kalimbeza	Impalila	Kabula-Bula
Number of species	49	45	54	44	45
Shannon index (H´)	2.50	2.79	3.21	3.08	2.94
Evenness index (J´)	0.64	0.73	0.80	0.81	0.77



1 *Pharyngochromis acuticeps*
2 *Synodontis* spp.
3 *Micralestes acutidens*
4 *Labeo cylindricus*
5 *Hydrocynus vittatus*
6 *Tilapia rendalli*
7 *Tilapia sparrmanii*
8 *Barbus unitaeniatus*
9 *Barbus paludinosis*
10 *Barbus poechii*
11 *Oreochromis macrochir*
12 *Hemichromis elongatus*
13 *Pseudocrenilabrus philander*
14 *Brycinus lateralis*
15 *Rhabdalestes maunensis*
16 *Oreochromis andersonii*
17 *Aplocheilichthys johnstoni*
18 *Tilapia ruweti*
19 *Barbus haasianus*
20 *Aplocheilichthys katangae*
21 *Barbus multilineatus*
22 *Ctenopoma multispine*
23 *Schilbe intermedius*
24 *Clarias ngamensis*

Figure 6.5*. Index of relative importance (IRI) for the most important species caught by other gears than gill nets at five different stations in the Zambezi and Chobe Rivers between 1997 and 2000.*

first four most important species were cichlids. These were *Oreochromis macrochir* (17 %), *T. rendalli* (15 %), *Hemichromis elongatus* (14 %) and *T. sparrmanii* (11 %) (**Appendix 12**). Here the three most important species made up for 46 % of the total biomass. At Kalimbeza and Impalila, *H. vittatus* was also the most important species with respect to biomass, constituting 36 % and 80 %, respectively (**Appendix 13 and 14**). At Kalimbeza, *T. sparrmanii* (11 %) was ranked second and *Hepsetus odoe* (8 %) third, and the three most important species constituted 55 % of the total biomass. At Impalila, *T. ruweti* (4 %) was ranked second and *Serranochromis robustus* (3 %) third, and the three most important species constituted 86 %. Although *A. johnstoni* was ranked as the most important species at Impalila according to IRI, this species constituted only 0.2 % of the total biomass (**Appendix 14**). At Kabula-Bula, the cichlid *O. macrochir* (15 %) was the most important with regard to biomass, *C. ngamensis* (14 %) was second and *B. lateralis* (10 %) third (**Appendix 15**). The three most important species only constituted 39 % of the total biomass at this station.

The number of fish caught in the surveys with other gears than gill nets varied between 1851 and 6386. At Katima Mulilo, the *Synodontis* group of species (33 %) was the most numerous, *M. acutidens* (11 %) was second and *Barbus paludinosus* (9 %) third (**Appendix 11**). In the catches from Lake Lisikili, the three most numerous species were the cichlids *O. macrochir* (18 %), *T. sparrmanii* (16 %) and *T. rendalli* (11 %) (**Appendix 12**). At Kalimbeza, *M. acutidens* was most numerous (14 %), *B. paludinosus* (13 %) was second and *T. sparrmanii* (8 %) third (**Appendix 13**). At Impalila, *A. johnstoni* (15 %) was most important, *P. philander* (10 %) was second and *T. ruweti* (9 %) third (**Appendix 14**). At Kabula-Bula, *B. lateralis* was the most numerous species (17 %), with the cichlids *P. philander* (13 %) and *T. rendalli* (8 %) second and third (**Appendix 15**). There were significant differences among all stations with respect to species diversity, where the Kalimbeza station showed the highest diversity (Shannon diversity index: H` = 3.21) and Katima Mulilo the lowest (H‘ = 2.50) (t = 31.243, df = 10436, p < 0.001) (**Table 6.2**). Impalila (H’ = 3.08) and Kabula (H’ = 2.94) showed the most similar species diversity among the stations, but they were also significantly different (t = 4.285, df = 3890, p < 0.001). At all stations the species diversity for fish caught with the other gears were significantly higher than for the gill net catches. According to the index of evenness (J`), the catches with the other gears also showed a more even distribution of number of individuals among species within stations, compared to the gill net catches (**Table 6.1 and 6.2**).

6.3 Species diversity during high and low water

6.3.1 Catches in gill nets

In the gill net surveys, a total of 39 species during the high water period and 37 species were caught during the low water period (excluding *Synodontis* spp.) (**Appendix 16 and 17**). Also the number of fish caught were higher during high water (N = 21314) compared to low water (N = 18538). The fishing effort differed and, hence, the number of fish caught in the two seasons is not directly comparable. During the two seasons, the species ranked as the ten most important, according to the index of relative importance (IRI), belonged to eight families (**Table 6.3**). These eight families were represented both in the catches from high and low water (**Appendix 1, 16 and 17**). According to the IRI, *Brycinus lateralis* was the most important species during both periods (51 % at low water and 43 % at high water)

Table 6.3. *The relative importance (IRI) of the ten most important species caught in gill net surveys during high and low water in the Zambezi and Chobe Rivers in the period 1997-2000. All stations are pooled. The IRI takes into account the number of individuals, weight (kg) and frequency of occurrence of the species caught.*

Species	Number (%)		Weight (%)		Frequency (%)		IRI (%)	
	High	Low	High	Low	High	Low	High	Low
B. lateralis	48.0	56.3	25.6	18.3	24.5	23.0	(1) 43.0	(1) 51.1
S. intermedius	12.5	6.2	21.6	9.0	41.6	22.5	(2) 33.8	(3) 10.1
H. vittatus	4.0	1.2	14.2	9.5	19.8	13.9	(3) 8.6	(6) 4.5
P. catostoma	17.7	5.3	6.0	2.1	11.0	5.1	(4) 6.2	(11) 1.1
M. macrolepidotus	7.6	10.3	4.4	10.7	10.1	18.1	(5) 2.9	(2) 11.3
C. gariepinus	0.3	0.3	14.9	14.1	5.6	3.9	(6) 2.0	(10) 1.7
Synodontis spp.	1.8	6.4	1.7	6.0	12.2	19.5	(7) 1.0	(4) 7.2
H. odoe	0.5	1.2	3.9	9.9	7.6	13.9	(8) 0.8	(5) 4.6
B. poechii	2.4	4.0	1.3	1.9	8.7	14.1	(9) 0.8	(8) 2.4
T. sparrmanii	0.9	1.9	0.6	2.9	6.8	12.5	(10) 0.3	(9) 1.8
P. acuticeps	0.7	2.9	0.6	3.1	5.6	15.5	(12) 0.2	(7) 2.8

followed by *Schilbe intermedius* (34 %) at high water and *Marcusenius macrolepidotus* (11 %) at low water **(Table 6.3)**. *Brycinus lateralis* and *S. intermedius* dominated at high water representing 77 % of the catches, while *B. lateralis* alone was dominating at low water. When including *S. intermedius* and *M. macrolepidotus*, the three species represented an IRI of 73 %.

Three species, *S. intermedius, H. vittatus,* and *Petrocephalus catostoma* had a marked decrease in the IRI from the high to the low water period (**Table 6.3)**. The reduction in *S. intermedius* was especially large. In the same period, there was a marked increase in the IRI of the species *B. lateralis*, *M. macrolepidotus, Synodontis* spp.*, Hepsetus odoe, Barbus poechii, Tilapia sparrmanii* and *Pharyngochromis acuticeps.*

In contrast to the IRI and relative number, relative weight percent of *B. lateralis* decreased from high to low water (**Table 6.3**). For the other species, IRI, relative number, relative weight and frequency were relativety similar in the high and low water surveys.

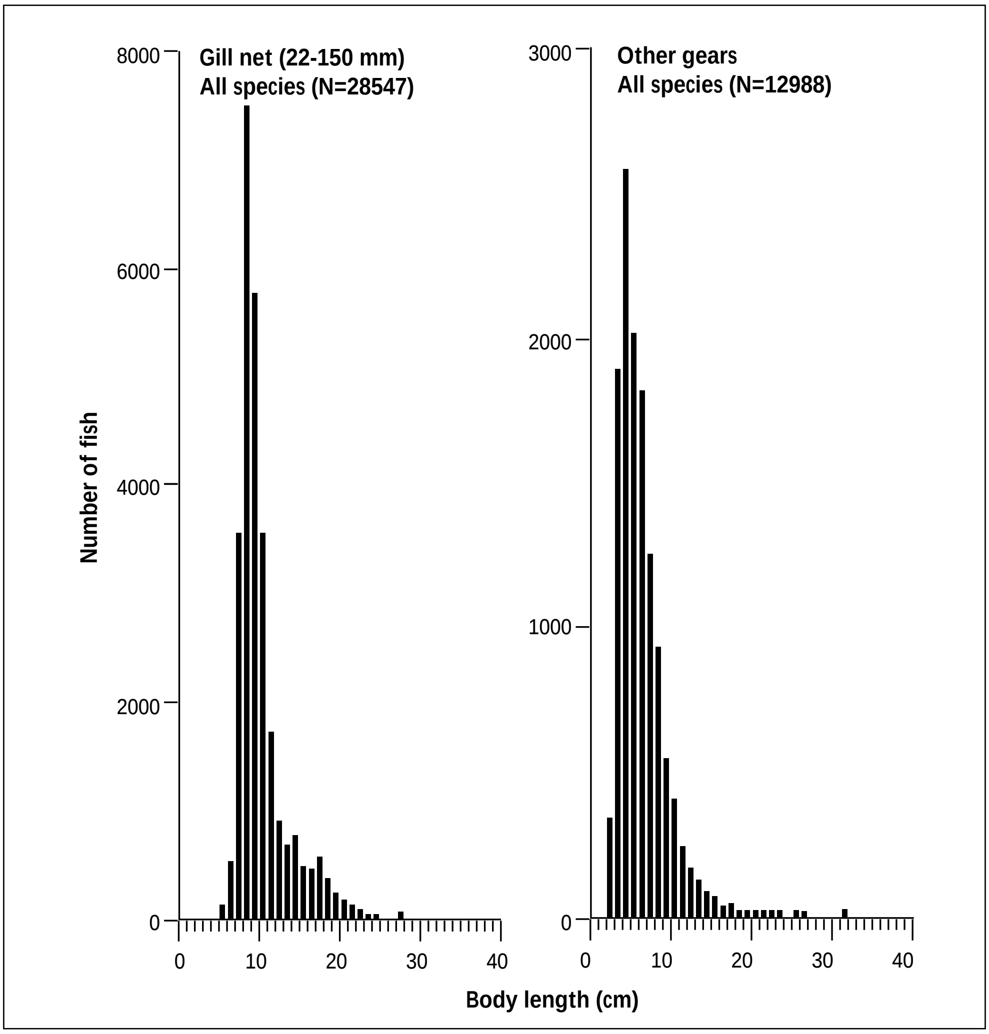
Species diversity for the gill net catches did not differ during high (H` = 1.72) and low water (H' = 1.73) (t-test, $t$ = 0.71, $df$ = 36821, p > 0.4). The evenness index indicated that the number of individuals were not evenly distributed among species, and the distribution did not differ under conditions of high (J` = 0.47) and low (J` = 0.48) water.

6.4 Body length distributions and gill net selectivity

6.4.1 Body length distribution in gill nets and other gears

The body length distribution was significantly different between fish caught with gill nets and other gears (Kolmogorov-Smirnov two-sample test, Z = 71.7, p < 0.001). The mean body length was larger for fish caught with gill nets (10.4 cm) than with the other gears (5.5 cm) (Oneway ANOVA, F = 11733, df = 1, p < 0.001, **Figure 6.6**). Fish caught in gill nets were between 2 and 92 cm in length, with the majority between 6 and 18 cm (95 % of the catches, **Figure 6.6**). The modal length was 8.0 - 8.9 cm. Fish caught in the other gears were between 1 and 66 cm, with most fish having lengths between 2 and 13 cm (95 % of the catches). The modal length in this group was 3.0 - 3.9 cm. The difference in length between fish caught with gill nets and other gears were also reflected when comparing the length distributions of the selected species (**Figure 6.7**).

***Figure 6.6**. Length distribution of all fish caught with gillnets (22 – 150 mm stretch mesh) and with other gears in the Zambezi and Chobe Rivers 1997-2000. Notice the different scales on y-axis.*



6.4.2 Body length at maturity

The smallest size of sexually mature fish varied among the different selected species (selected species, see paragraph 4.3.2) (**Table 6.4**). It should, however, be noted that among the total catch of 69 species, 20 species have a maximum body length of 6 cm or smaller. The smallest minimum size at maturity was found in *Petrocephalus catostoma*, being 4 cm for males. The largest minimum size at maturity was found in *Clarias gariepinus*, being 46 cm for males and 34 cm for females. Twelve species had a minimum size at maturity smaller than 10 cm, two species between 11 and 20 cm and two species larger than 20 cm.

The minimum size at maturity for females was smaller than for males (2 cm or more) for five species (**Table 6.4**). The size difference was especially large for *Hydrocynus vittatus*, *Tilapia sparrmanii*, *Tilapia rendalli*, and *C. gariepinus*. The opposite, with larger males than females, was the case for three species, but the size difference was large only for *Oreochromis macrochir*.

It was only possible to determine the fish size at 50 % maturity for approximately half of the selected species (**Table 6.4**). For males the smallest size at 50 % maturity was found for *Brycinus lateralis* (6.2 cm) and for females for *Petrocephalus catostoma* (6.5 cm). The largest size at maturity was found in *C. gariepinus* (females 39.9 cm).

The minimum length of maturity based on the gill net catches are similar to the minimum length of maturity based on all gears, except for the males of *M. macrolepidotus* and *B. paludinosus* and the females of *M. acutidens*, *P. acuticeps*, *T. rendalli* and *B. unitaeniatus* (**Table 6.4**).

6.4.3 Life history and gill net selectivity for selected species

Of the 17 selected species (selected species, see section 4.3.2), one species (*Aplocheilichthys johnstoni)* was not caught in gill nets. By numbers, the 16 species contributed 93.6% of gill net catches, while the 17 species contributed 61.5 % of catches with other gears. These species represent a large variation in biology, distribution and sizes (**Appendix 4 and 5**). In the following, life history and gill net selectivity was analysed in detail for each of the selected species.

Table 6.4. *Minimum length of mature fish and length at 50 % maturation of fish caught in fisheries surveys (all gears) in the Zambezi and Chobe Rivers during 1997 – 2000, for the selected species listed in **Table 4.4**. Minimum length of maturity for gill net catches only are given in parenthesis.*

Species	Minimum length at maturation (cm)				Length at 50 % maturation (cm)	
	Males	N	Females	N	Males	Females
Cichlidae						
Pharyngochromis acuticeps	7 (7)	181	6 (7)	245	9.9	7.5
Tilapia sparrmanii	10 (10)	97	6 (6)	94	12.5	12.8
Pseudocrenilabrus philander	6 (---)	12	6 (6)	18	-	-
Tilapia rendalli	13 (13)	6	9 (14)	17	-	-
Oreochromis macrochir	18 (18)	8	22 (22)	6	-	-
Cyprinidae						
Barbus poechii	7 (7)	135	7 (7)	223	10.0	9.5
Barbus paludinosus	6 (8)	5	7 (7)	18	-	-
Barbus unitaeniatus	---	0	8 (9)	3	-	-
Mormyridae						
Marcusenius macrolepidotus	8 (9)	537	8 (8)	647	12.7	12.2
Petrocephalus catostoma	4 (4)	375	6 (6)	735	7.6	6.5
Characidae						
Hydrocynus vittatus	26 (26)	45	15 (15)	111	25.7	28.4
Micralestes acutidens	5 (---)	44	5 (6)	258	-	-
Brycinus lateralis	6 (6)	3561	5 (5)	4790	6.2	8.1
Schilbeidae						
Schilbe intermedius	8 (8)	455	8 (8)	1215	-	21.6
Cyprinodontidae						
Aplocheilichthys johnstoni	-	0	-	0	-	-
Clariidae						
Clarias gariepinus	46 (46)	32	34 (34)	69	-	39.9
Hepsetidae						
Hepsetus odoe	25 (25)	57	23 (23)	78	27.0	26.4

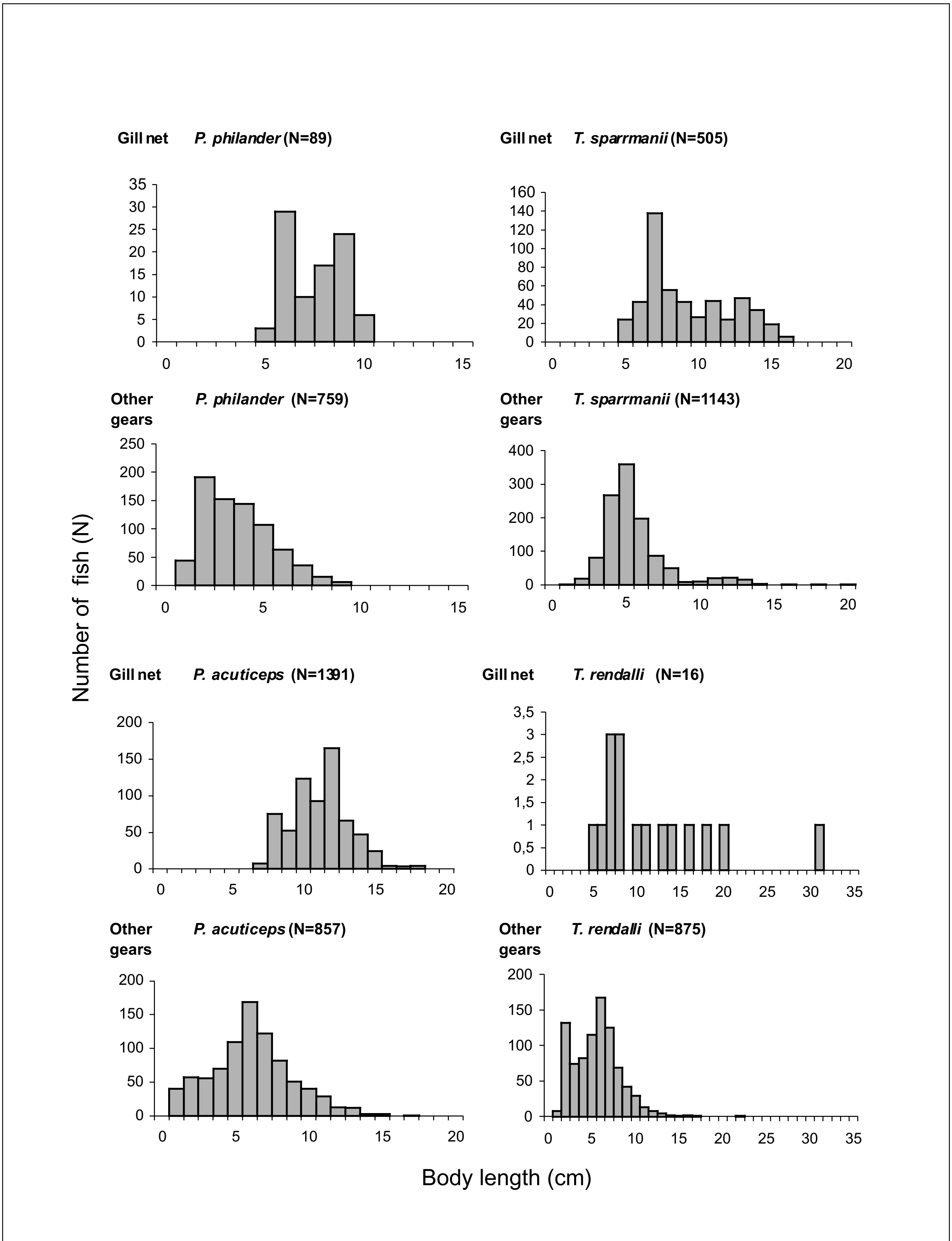


***Figure 6.7**. Length distribution of* B. lateralis, S. intermedius, M. macrolepidotus, H. vittatus, P. catostoma, P. acuticeps, H. odoe, B. poechii, C. gariepinus, T. sparrmanii, P. philander, T. rendalli, A. johnstoni, B. paludinosis, M. acutidens *and* O. macrochir *caught with gillnets and with other gears in the Zambezi and Chobe Rivers 1997 to 2000. Continued on the next pages.*

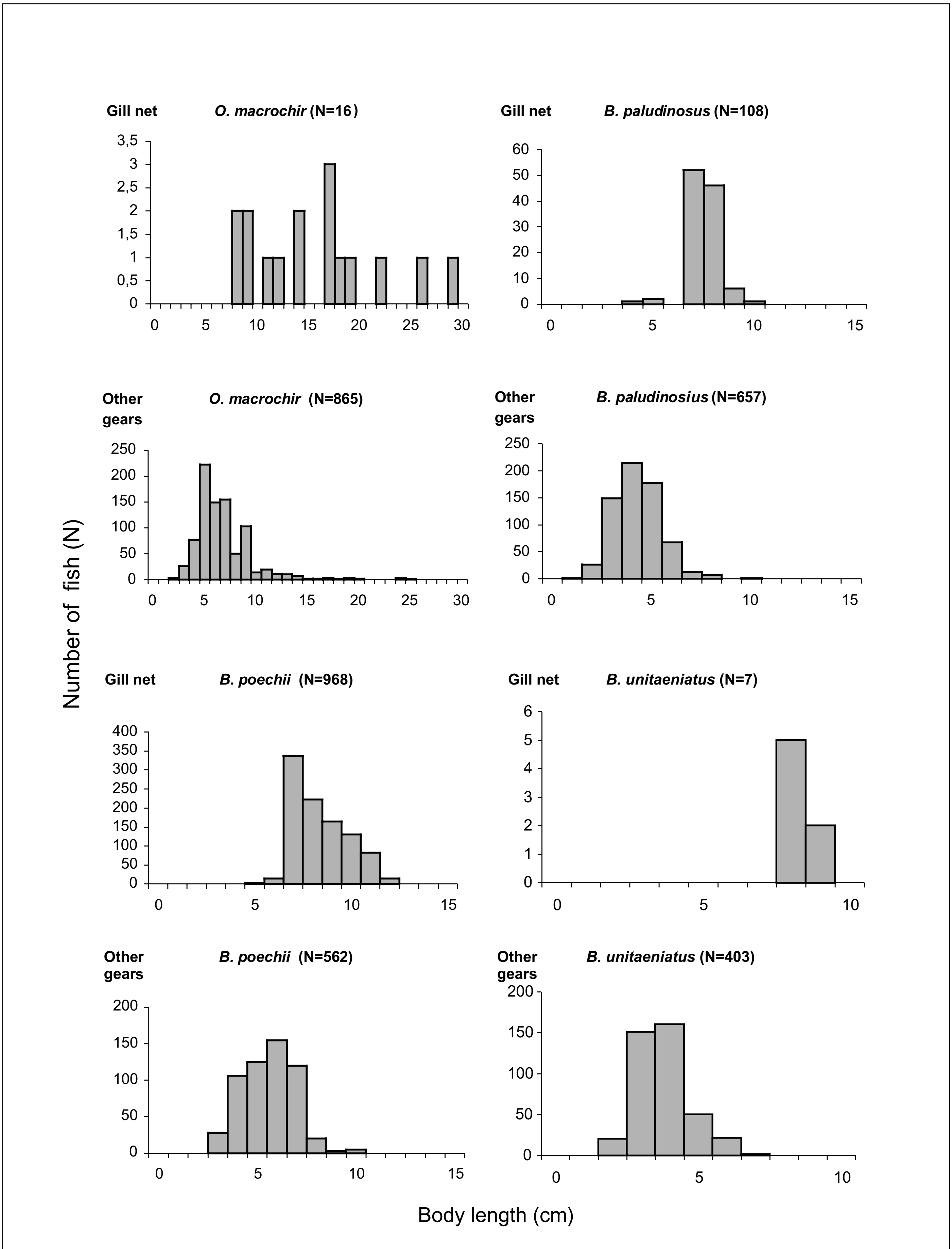


Figure 6.7. *Continued.*

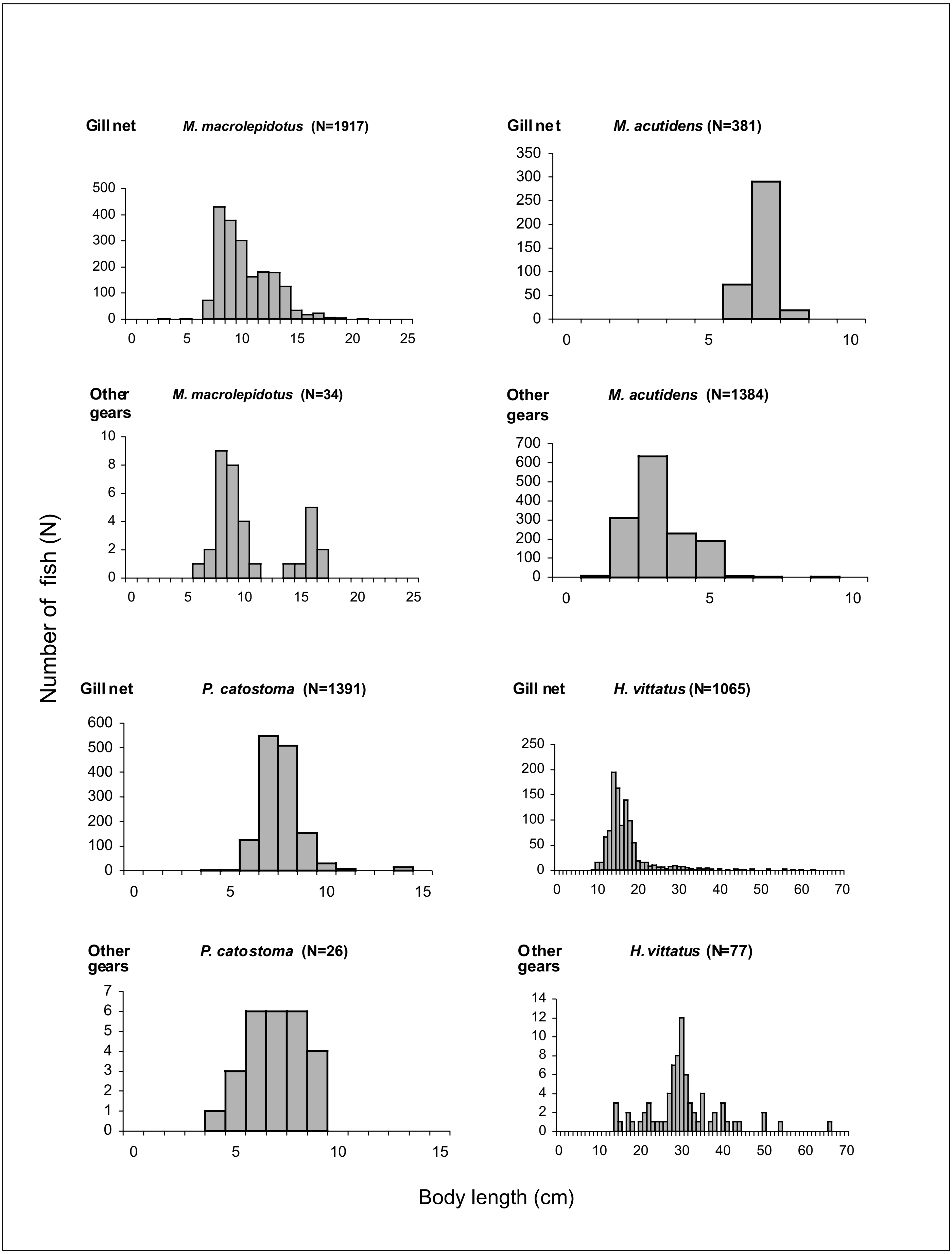


Figure 6.7. *Continued.*

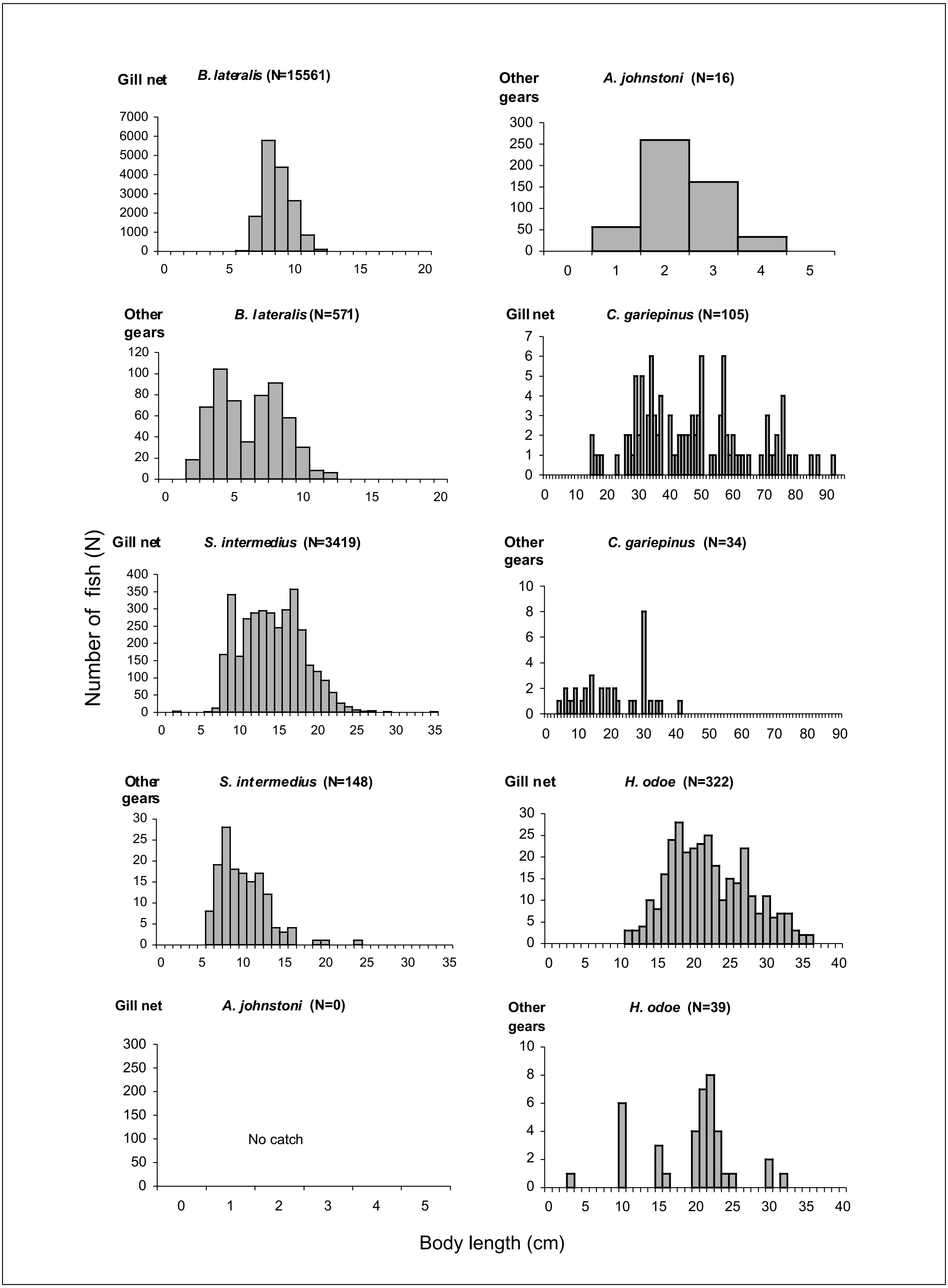


Figure 6.7. *Continued.*

Cichlidae:

Pseudocrenilabrus philander (Southern mouthbrooder)

Pseudocrenilabrus philander was the fifth (excluding the *Synodontis* spp.) most important species (measured as index of relative importance, IRI) in the catches with other gears than gill nets in the Zambezi and Chobe Rivers (**Appendix 5**). However, it was only the eighteenth most important species in the gill net catches (**Appendix 4**). The minimum body length of mature fish was 6.0 cm for both females and males. The length at 50 % maturity could not be determined (**Table 6.4**).

A total of 89 individuals were caught in gill nets during the surveys, while 882 individuals were caught with the other gears. The body lengths of fish caught in gill nets were between 5.5 and 10.5 cm (mean 7.8 cm, modal length 6.0 - 6.9 cm) (**Figure 6.7**). Both the mean and modal lengths were longer than the minimum size at maturity (6 cm) (**Table 6.4**). The lengths of fish caught with other gears were between 1.3 and 9.5 cm (mean length 4.0 cm, modal length 2.0 - 2.9 cm).

The 22 mm mesh size caught the largest number of fish per setting (0.65 fish/setting) (**Table 6.5**). Fish caught with this mesh size had an average length of 6.3 cm. The 35 mm nets had the highest catch in terms of weight per setting (0.008 kg/setting). Fish caught with this mesh size had an average length of 9.5 cm. Only a few fish were caught in the 45 mm net. Larger mesh sizes did not catch this species due to its small body size.

The catchability curve shows that several of the gill nets used were not very efficient for this species (**Figure 6.8**). High catchability values, approximately 0.9 or higher, were only reached for fish lengths of 6 - 10 cm. All mesh sizes mainly caught fish larger than the minimum length at maturity. The 22 mm nets caught fish up to 9 cm. The 28 mm net caught fish between 5 and 10 cm, whereas the 35 mm net caught fish larger than 7 cm.

Table 6.5. *Gill net selectivity for* Pseudocrenilabrus philander *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	32	6.3	0.65	0.003
28	27	7.8	0.60	0.005
35	28	9.5	0.57	0.008
45	2	8.0	0.04	0.000
Total	**89**		**0.20**	**0.002**

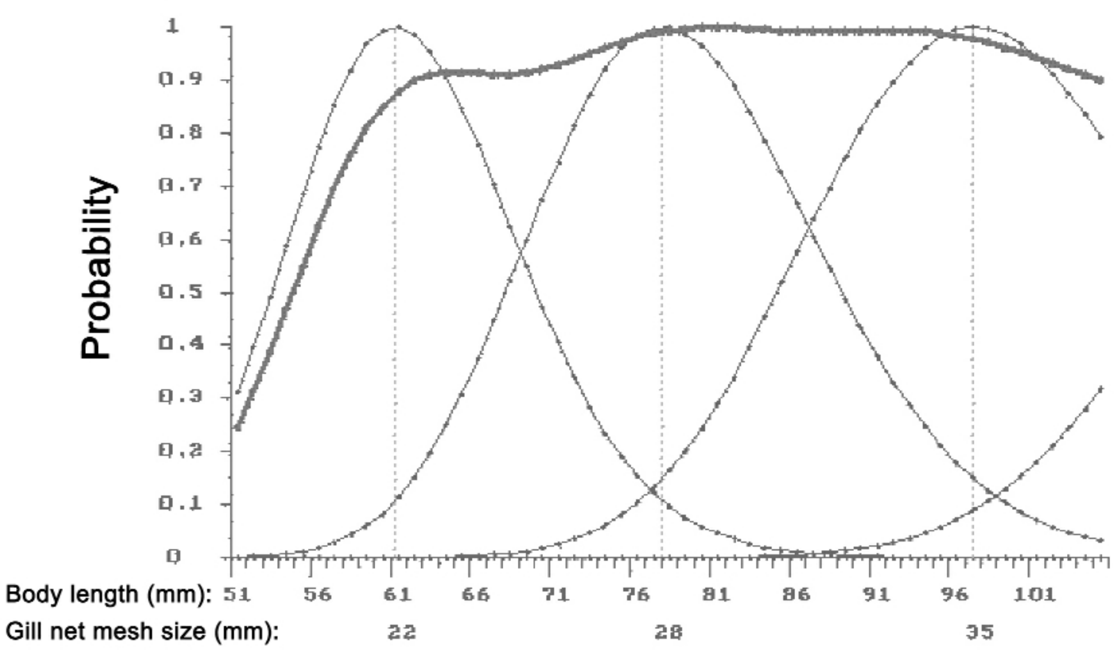


Figure 6.8*. Gill net selectivity curves for* Pseudocrenilabrus philander *for each mesh size from 22 mm to 45 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

Pharyngochromis acuticeps (Zambezi happy)
Pharyngochromis acuticeps was the ninth most important species in gill net catches, and second most important species in catches with other gears (measured as IRI) (**Appendix 4 and 5**). The minimum body length of mature fish was 6 cm for females and 7 cm for males (**Table 6.4**). The length at 50 % maturity was 7.5 cm for females and 9.9 cm for males.

A total of 680 individuals were caught in gill nets during the surveys, while 905 individuals were caught with the other gears. The body lengths of fish caught in gill nets were between 6.0 and 17.0 cm (mean 10.5 cm, modal length 11.0 - 11.9 cm) (**Figure 6.7**). Both the mean and modal length of *P. acuticeps* caught in gill nets were longer than both the minimum size at maturity and length at 50 % maturity (**Table 6.4**). The lengths of fish caught with other gears were between 1.4 and 17.0 cm (mean length 6.5 cm, modal length 6.0 - 6.9 cm).

The 35 mm mesh size caught the largest number of fish per setting (6.09 fish/setting) (**Table 6.6**). Fish caught with this mesh size had an average length of 11.3 cm, which was longer than the minimum size at maturity (**Table 6.4**). The 35 mm nets also had the highest catch in terms of weight per setting (0.12 kg/setting). The gill net mesh sizes used efficiently caught fish between 7 and 15 cm, with the possible exception of fish with body length of approximately 12 cm (**Figure 6.9**). Gill nets from 22 to 35 mm were the most efficient, whereas 45 and 57 mm nets recorded lower catches. Larger mesh sizes did not catch this species at all due to its relatively small size. The 22 mm mesh size had a maximum catchability for fish with a length of 7 cm, which was about the same as the minimum size at maturity of both sexes. The 28 mm net caught fish between 7 and 12 cm. The 35 mm net caught fish between 8 and 15 cm, whereas the 45 mm net caught fish larger than 11 cm.

Table 6.6. *Gill net selectivity for* Pharyngochromis acuticeps *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	106	7.5	2.30	0.011
28	197	9.3	4.01	0.044
35	281	11.3	6.09	0.122
45	86	13.3	1.78	0.068
57	10	15.9	0.20	0.013

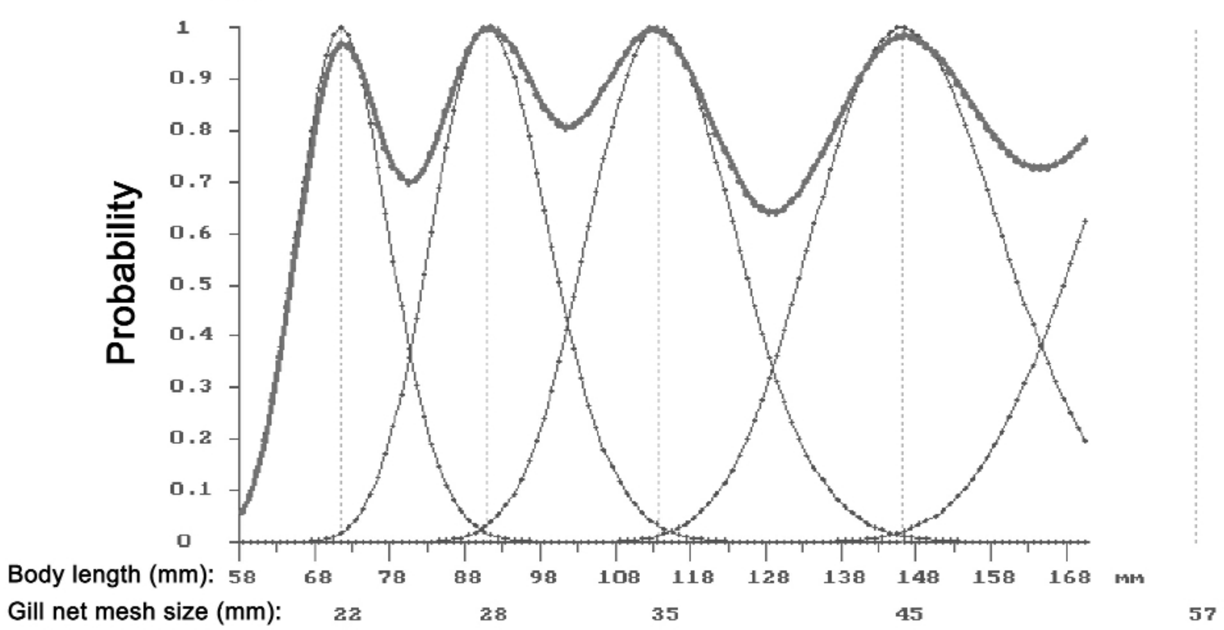


Figure 6.9*. Gill net selectivity curves for* Pharyngochromis acuticeps *for each mesh size from 22 mm to 57 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

Tilapia sparrmanii (Banded tilapia)

Tilapia sparrmanii was the tenth most important species in gill net surveys and the most important species in surveys with other gears (measured as IRI) (**Appendix 4 and 5**). The minimum body length of mature fish was 6 cm for females and 10 cm for males (**Table 6.4**). The length at 50 % maturity was 12.8 cm for females and 12.5 cm for males.

A total of 557 individuals were caught in gill nets during the surveys, while a total of 1748 individuals were caught with the other gears. The body lengths of fish caught in gill nets were between 5 and 16 cm (mean 9.6 cm, modal length 7.0 - 7.9 cm) (**Figure 6.7**). The mean length was about the same as the minimum size at maturity for males, but both mean and modal lengths were larger than minimum mature length of females **(Table 6.4)**. Mean and modal body length, however, were shorter than the length at 50 % maturity. The lengths of fish caught with the other gears were between 1.8 and 20.0 cm (mean length 5.7 cm, modal length 5.0 - 5.9 cm).

The 28 mm mesh size caught the largest number of fish per setting (4.73 fish/setting) (**Table 6.7**). Fish caught with this mesh size had an average length of 7.4 cm, which was smaller than minimum mature length of males and larger than minimum mature length of females (**Table 6.4**). The 22 mm mesh had the lowest catch in numbers, except the 73 mm mesh size, which caught only one individual. The 57 mm nets had the highest catch in terms of weight per setting (0.11 kg/setting). The mesh sizes used in this study efficiently caught fish between 6 and 16 cm (**Figure 6.10**). Mesh sizes from 22 to 57 mm were the most efficient. Larger mesh sizes than 73 mm did not catch any fish. The 45 mm mesh size caught fish between 8 and 17 cm, with maximum catchability for fish with lengths of 12 cm which was about the same as body length at 50 % maturation.

Table 6.7. *Gill net selectivity for* Tilapia sparrmanii *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m²).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	58	6.4	1.19	0.006
28	234	7.4	4.73	0.033
35	82	9.1	1.65	0.023
45	89	11.8	1.79	0.059
57	93	14.0	1.87	0.110
73	1	16.0	0.02	0.001
Total	**557**		**1.25**	**0.026**

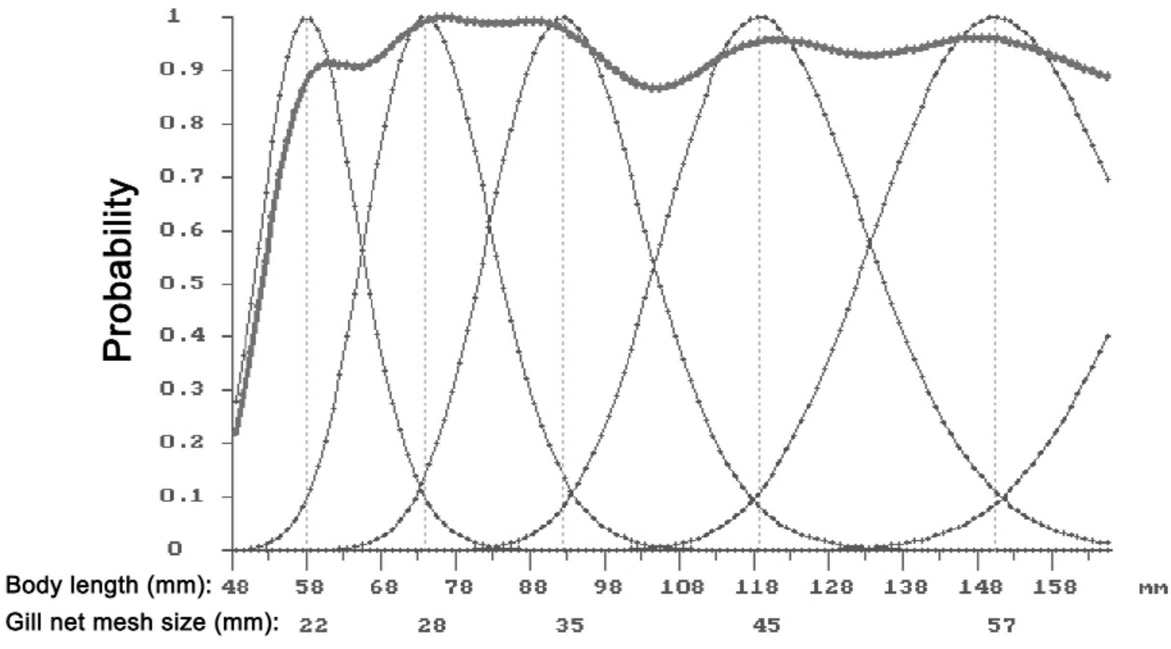


Figure 6.10. *Gill net selectivity for* Tilapia sparrmanii *for each mesh size from 22 mm to 73 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

Tilapia rendalli (Redbreast tilapia)

Tilapia rendalli was only the thirtieth most important species in gill net catches, but the third most important species in catches with other gears (measured as IRI) (**Appendix 4 and 5**). The minimum body length of mature fish was 9 cm for females and 13 cm for males, while lengths at 50 % maturity could not be determined (**Table 6.4**).

Tilapia rendalli was rarely caught in gill nets, only 16 individuals. They were between 5.5 and 31.0 cm long (mean 12.0 cm, modal length 7.0 - 8.9 cm), whereas the 1106 individuals caught with the other gears were between 1.5 and 22.5 cm (mean length 5.9 cm, modal length 6.0 - 6.9 cm) (**Figure 6.7**). The modal length of fish caught in gill nets was shorter than the minimum length at maturity, especially for males.

Fish caught with 35 mm mesh size had an average body length of 8.8 cm, which was about the same as the minimum size of mature females (**Table 6.8**). The mesh sizes used caught fish longer than 5 cm. Due to the low number of fish caught, it was not possible to determine the efficiency of different mesh sizes, but all mesh sizes used in this survey caught *T. rendalli* except for the 45 mm and 150 mm mesh size.

Oreochromis macrochir (Greenhead tilapia)

Oreochromis macrochir was only the twenty-sixth most common species in gill net catches, but the fourth most important species in catches with other gears (measured as IRI) (**Appendix 4 and 5**). The minimum body length at sexual maturity was 22 cm for females and 18 cm for males (**Table 6.4**). The length at 50 % maturation could not be estimated.

Only 16 individuals were caught in gill nets. The body length varied between 8.5 and 29.0 cm (mean 15.7 cm, modal length 17.0 - 17.9 cm). A total of 1095 individuals, however, were caught with the other gears. These fish were smaller, with body lengths from 2.5 to 25.0 cm (mean 7.0 cm, modal length 5.0– 5.9 cm). Both gill nets and other gears caught a large proportion of fish smaller than the minimum length at maturity.

The 73 mm mesh size caught the largest number of fish per setting (0.10 fish/setting) (**Table 6.9**). Fish caught with this mesh size had an average length of 20 cm. Gill nets with mesh size 73 mm also had the highest catches in weight per setting (0.024 kg/setting). The gill nets effectively caught fish between 9 and 29 cm in length (**Figure 6.11**). For mesh sizes between 35 mm and 118 mm and fish lengths between 9 and 29 cm, catchability was mostly larger than 0.9, which is high. Due to low number of fish, studies of gill net catchability and fish maturation could not be done.

Table 6.8. *Gill net selectivity for* Tilapia rendalli *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	2	5.8	0.04	0.000
28	3	7.3	0.06	0.000
35	4	8.8	0.08	0.001
45				
57	3	12.8	0.06	0.003
73	2	17.0	0.04	0.005
93	1	20.0	0.02	0.004
118	1	31.0	0.02	0.012
Total	**16**		**0.04**	**0.003**

Table 6.9. *Gill net selectivity for* Oreochromis macrochir *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
35	4	8.8	0.08	0.001
45	3	12.3	0.06	0.003
57	2	15.5	0.04	0.003
73	5	20.0	0.10	0.024
93	1	22.0	0.02	0.004
118	1	26.0	0.02	0.008
Total	**16**		**0.04**	**0.005**

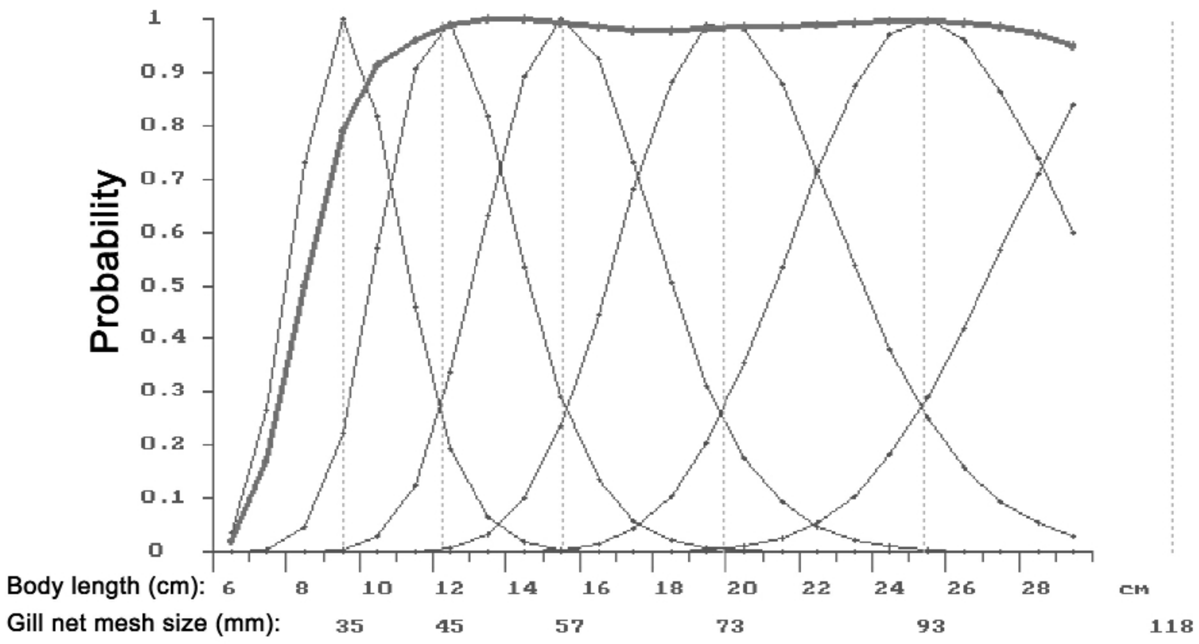


Figure 6.11*. Estimation of gill net selectivity for* Oreochromis macrochir *for each mesh size from 35 mm to 118 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

Cyprinidae:

Barbus poechii (Dashtail barb)

Barbus poechii was the eigth most important species in gill net catches and the seventh most important species in catches with other gears (measured as IRI) (**Appendix 4 and 5**). The minimum length of mature fish was 7 cm for both females and males (**Table 6.4**). The length at 50 % maturity was 10.0 cm for males and 9.5 cm for females.

A total of 1246 individuals were caught in gill nets, whereas a total of 602 were caught with other gears. The body lengths of fish caught in gill nets were between 5.0 and 12.5 cm (mean 8.7 cm, modal length 7.0 - 7.9 cm) (**Figure 6.7**). The modal length was about the same as the minimum size at maturity and smaller than body lengths at 50 % maturity (**Table 6.4**). There was a drastic increase in fish numbers in gill nets from the 7 cm length group (**Figure 6.7**). The lengths of fish caught with other gears were between 3.0 and 10.5 cm (mean length 5.9 cm, modal length 6.0 - 6.9 cm).

The 22 mm mesh size caught the largest number of fish per setting (13.40 fish/setting) (**Table 6.10**). Fish caught with this mesh size had an average length of 7.7 cm, which was about the same as the minimum size of mature fish (**Table 6.10).** The 28 mm nets had the highest catch in terms of weight per setting (0.13 kg/setting). The mesh sizes used effectively caught fish larger than 7.5 cm (**Figure 6.12**). Gill nets with mesh size of 22 and 28 mm were the most effective, whereas 35 and 45 mm nets were less effective (**Table 6.10**). Larger mesh sizes did not catch any fish. The 22 mm mesh size caught fish between 6 and 11 cm, with a maximum catchability for fish with lengths of approximately 8 cm, which is slightly larger than the minimum size at maturity.

Table 6.10. *Gill net selectivity for* Barbus poechii *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	663	7.7	13.40	0.067
28	487	9.8	9.78	0.127
35	79	11.0	1.59	0.038
45	17	11.1	0.34	0.009
Total	**1246**		**2.79**	**0.027**

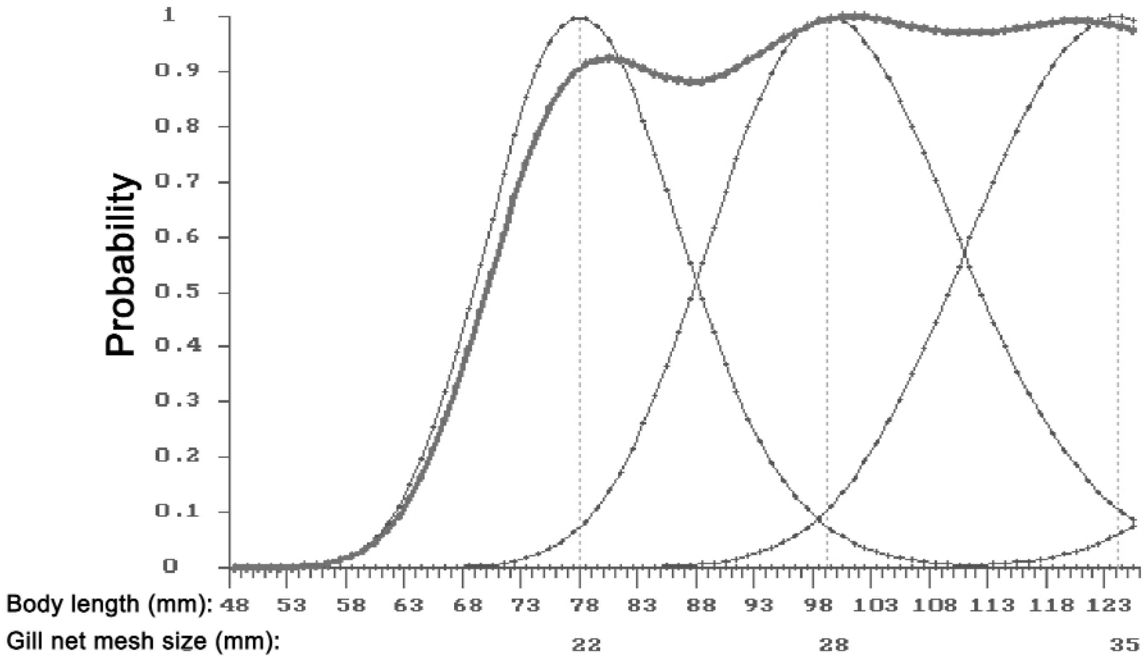


Figure 6.12. *Gill net selectivity for* Barbus poechii *for each mesh size from 22 mm to 45 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker lines).*

Barbus paludinosus (Straightfin barb)

Barbus paludinosus was the sixteenth most important species in gill net catches and the eight most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum body length of mature fish was 7 cm for females and 6 cm for males (**Table 6.4**). The lengths at 50 % maturity could not be determined.

A total of 152 individuals were caught in gill nets, while a total of 1445 individuals were caught with the other gears. The body lengths of fish caught in gill nets were between 4.5 and 10.0 cm (mean 7.8 cm, modal length 7.0 - 7.9 cm) (**Figure 6.7**). The mean and modal length was about the same as the minimum size at maturity (**Table 6.4**). The lengths of fish caught with other gears were between 1.9 and 10.5 cm (mean length 4.6 cm, modal length 4.0 - 4.9 cm).

Table 6.11. *Gill net selectivity for* Barbus paludinosus *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	145	7.8	2.91	0.017
28	5	8.4	0.10	0.001
35	2	6.5	0.04	0.000
Total	**152**		**0.34**	**0.002**

The 22 mm mesh size caught the highest number of fish per setting (2.91 fish/setting) (**Table 6.11**). Fish caught with this mesh size had an average length of 7.8 cm, which was larger than the minimum size a maturity (**Table 6.4**). The 22 mm nets had the highest catch in terms of weight per setting (0.02 kg/setting). The mesh sizes used effectively caught fish larger than 7 cm. Gill nets with a mesh size of 22 mm were the most efficient, whereas 28 and 35 mm nets were not as effective. Larger mesh sizes did not catch any fish.

Barbus unitaeniatus (Longbeard barb)

Barbus unitaeniatus was the thirty-sixth most important species in gill net catches and the twelveth most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum body length of mature fish was 8 cm for females and could not be determined for males (**Table 6.4**). The lengths at 50 % maturity could not be determined.

Only 7 individuals were caught in gill nets during the surveys. They were all caught in gill nets with mesh size 22 mm. A total of 403 individuals were caught with other gears. The body lengths of fish caught in gill nets were between 8.0 and 9.5 cm (mean 8.4 cm, modal length 8.0 - 8.9 cm) (**Figure 6.7**). The mean and modal length was about the same as the minimum size at maturity (**Table 6.4**). The lengths of fish caught with other gears were between 2.5 and 7.1 cm (mean length 4.1 cm, modal length 4.0 - 4.9 cm).

Mormyridae:

Marcusenius macrolepidotus (Bulldog)

Marcusenius macrolepidotus was the fourth most important species in gill net catches, but only the forty-second most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum mature length was 8 cm for both sexes (**Table 6.4**). The length at 50% maturity was 12 cm for females and 13 cm for males.

A total of 3531 individuals were caught in gill nets, which had body lengths from 3.5 to 21.0 cm (mean 10.6 cm, modal length 8.0 cm – 8.9 cm) (**Figure 6.7**). The 34 individuals caught with other gears were between 6.0 and 17.0 cm (mean 10.8 cm, modal length 8.0 - 8.9 cm).

The 22 mm mesh size caught the highest number of fish per setting (29.2 fish/setting) (**Table 6.12**). Fish caught with this mesh size had an average length of 8.3 cm, which was about the same as the minimum size at maturity. Gill nets with a mesh size of 35 mm had the highest catches in weight per setting (0.39 kg/setting). Fish caught with this mesh size had an average body length of 12.4 cm, which was the same as the length at 50 % maturity. Gill nets with mesh size 22 mm - 57 mm had a high efficiency for catching fish between 7 and 22 cm (**Figure 6.13**). For these mesh sizes and fish lengths, catchabilities were mostly larger than 0.9. No fish was caught in mesh sizes larger than 73 mm. The smallest mesh size that only caught fish equal to or larger than the minimum mature size was 28 mm. As much as 70 % of the total gill net catches were recorded from the 22 mm and 28 mm mesh sizes.

Table 6.12. *Gill net selectivity for* Marcusenius macrolepidotus *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	1456	8.3	29.24	0.146
28	1017	9.8	20.45	0.225
35	755	12.4	15.16	0.394
45	268	14.3	5.38	0.242
57	34	17.1	0.68	0.055
73	1	19.0	0.02	0.002
Total	**3531**		**7.88**	**0.12**

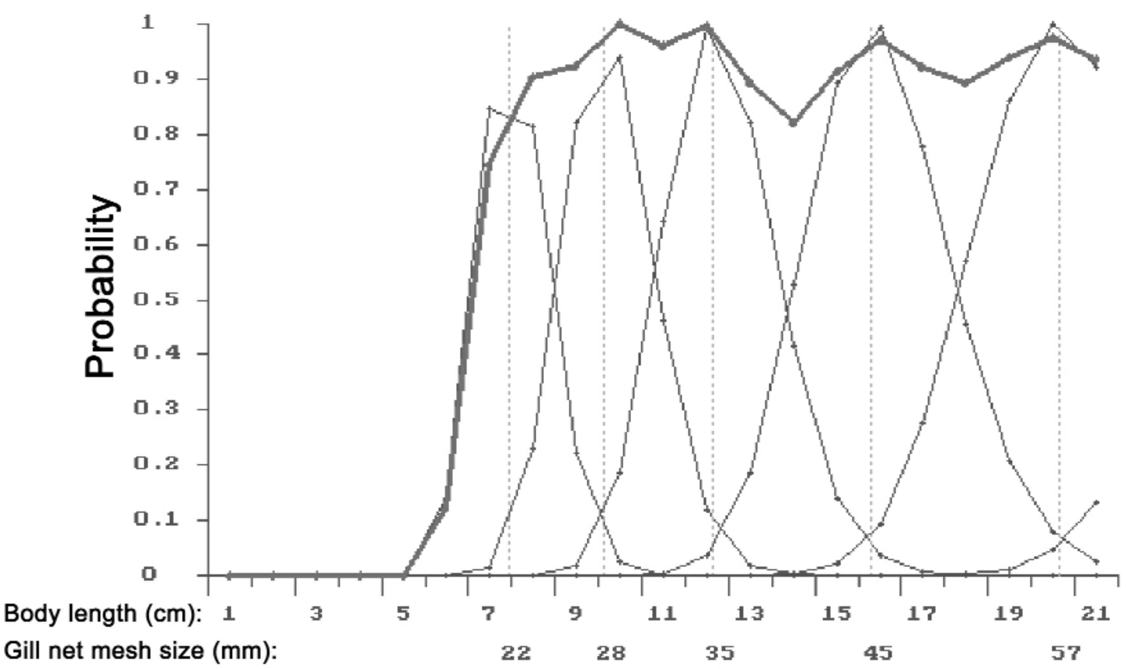


Figure 6.13*. Gill net selectivity for* Marcusenius macrolepidotus *for each mesh size from 22 mm to 73 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

Petrocephalus catostoma (Churchill)

Petrocephalus catostoma was the fifth most important species in gill net catches, but only forty-seventh most important in the catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum body length at maturity was 6 cm for females and 4 cm for males (**Table 6.4**), while the length at 50 % maturity was 7 cm for females and 8 cm for males.

A total of 4758 individuals were caught in gill nets, which had body lengths from 4.2 to 14.0 cm (mean 8.0 cm, modal length 7.0 – 7.9 cm) (**Figure 6.7**). The 26 individuals caught in other gears were between 4.3 and 9.5 cm (mean 7.4 cm, modal length 6.0 – 8.9 cm).

The 28 mm mesh size caught the largest number of fish per setting (74.72 fish/setting) (**Table 6.13**). Fish caught with this mesh size had an average length of 8.4 cm, which was larger than the minimum size at maturity, but about the same as length at 50 % maturity. Gill nets with a mesh size of 28 mm had also the highest catches in weight per setting (0.67 kg/setting). Gill nets with mesh size 22 - 35 mm had a high efficiency for catching fish between 7 and 11 cm (**Figure 6.14**). For these mesh sizes and fish lengths, catchabilities were mostly larger than 0.9. No fish was caught in mesh sizes larger than 35 mm. The smallest mesh size that only caught fish equal to or larger than the minimum size at maturity was 28 mm.

Table 6.13. *Gill net selectivity for* Petrocephalus catostoma *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	984	7.3	19.76	0.099
28	3721	8.4	74.72	0.672
35	53	10.0	1.06	0.016
Total	**4758**		**10.62**	**0.087**

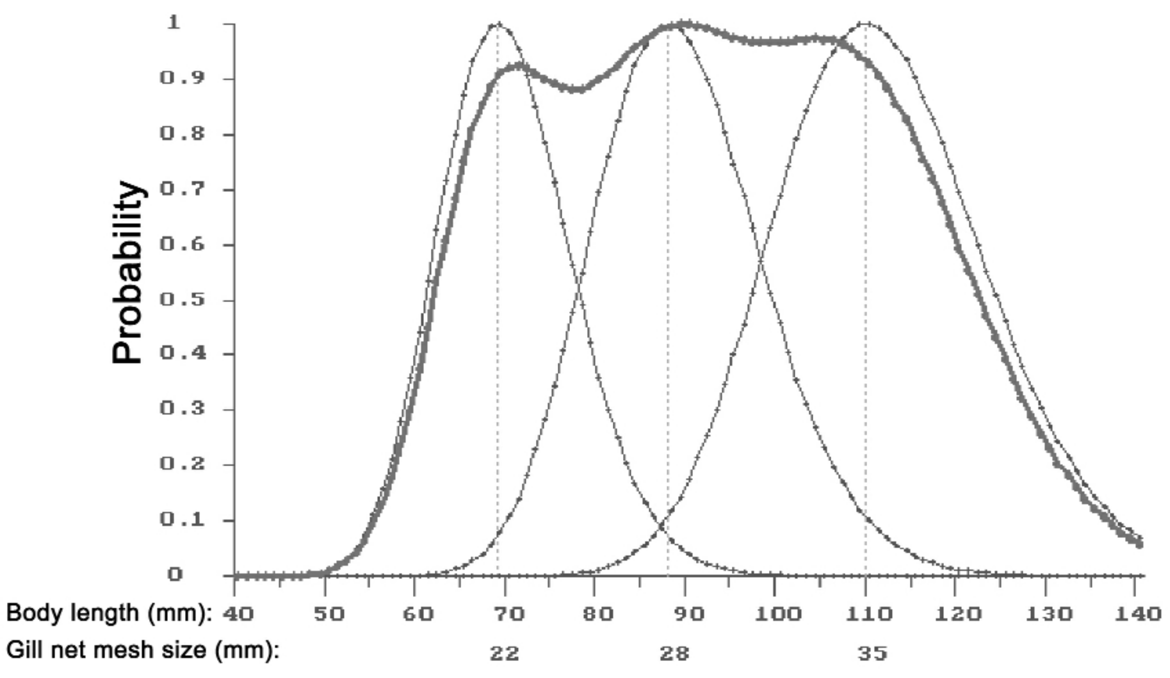


***Figure 6.14**. Gill net selectivity for* Petrocephalus catostoma *for each mesh size from 22 mm to 35 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

Characidae:

Micralestes acutidens (Silver robber)

Micralestes acutidens was the thirteenth most important species in gill net catches and the tenth most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum length at maturity was 5 cm for both females and males (**Table 6.4**). The lengths at 50 % maturity could not be determined.

A total of 387 individuals were caught in gill nets during the survey, while a total of 1404 individuals were caught in other gears. The body lengths of fish caught in gill nets were between 6.0 and 8.4 cm (mean 7.1 cm, modal length 7.0 - 7.9 cm) (**Figure 6.7**). Both the mean and modal lengths were longer than the minimum size at maturity (**Table 6.5**). The lengths of fish caught with other gears were between 1.8 and 9.5 cm (mean length 3.5 cm, modal length 3.0 - 3.9 cm).

The 22 mm mesh size caught the highest number of fish per setting (6.37 fish/setting) (**Table 6.14**). Fish caught with this mesh size had an average length of 7.1 cm, which was larger than the minimum length at maturity. Gill nets with a mesh size of 22 mm also had the highest catches in weight per setting (0.03 kg/setting). No fish was caught in mesh sizes larger than 57 mm. The smallest mesh size that only caught fish equal to or larger than minimum mature size was 22 mm.

Table 6.14. *Gill net selectivity for* Micralestes acutidens *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	317	7.1	6.37	0.032
28	63	7.0	1.27	0.001
57	7	7.7	0.14	0.000
Total	**387**		**0.86**	**0.004**

Hydrocynus vittatus (Tigerfish)

Hydrocynus vittatus was the third most important species in gill net catches and the sixth most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum length of mature fish was 15 cm for females and 26 cm for males (**Table 6.4**). The length at 50 % maturity was 28.4 cm for females and 25.7 cm for males.

A total of 1074 individuals were caught in gill nets, which had body lengths from 9.5 to 63.0 cm (mean 17.1 cm, modal length 14.0 – 14.9 cm) (**Figure 6.7**). The 77 individuals caught with other gears were between 14.0 and 66.0 cm (mean 30.4 cm, modal length 30.0 – 30.9 cm).

The 35 mm mesh size caught the largest number of fish per setting (8.15 fish/setting) (**Table 6.15**). Fish caught with this mesh size had an average length of 15.6 cm, which was about the same as the minimum size of mature fish, but smaller than the length at 50 % maturity. Gill nets with a mesh size of 45 mm had the highest catches in weight per setting (0.44 kg/setting). Fish caught with this mesh size had an average length of 18.2 cm, which was shorter than the length at 50 % maturity. The gill net mesh sizes used in this study effectively caught fish between 10 and 50 cm (**Figure 6.15**). For mesh sizes between 22 mm and 118 mm and fish lengths between 10 and 50 cm, catchabilities were mostly larger than 0.9. The smallest mesh size that only caught fish equal to or larger than the minimum size at maturity was 57 mm. The smallest mesh size that most efficiently caught fish larger than minimum mature size was 35 mm. This mesh size had a maximum catchability for fish lengths of 16 cm and caught fish between 10 and 23 cm.

Table 6.15. *Gill net selectivity for* Hydrocynus vittatus *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	24	10.7	0.48	0.006
28	270	13.7	5.42	0.114
35	406	15.6	8.15	0.359
45	278	18.2	5.58	0.441
57	48	26.1	0.96	0.254
73	27	31.5	0.54	0.240
93	14	44.3	0.28	0.409
118	7	49.0	0.14	0.297
Total	**1074**		**2.40**	**0.236**

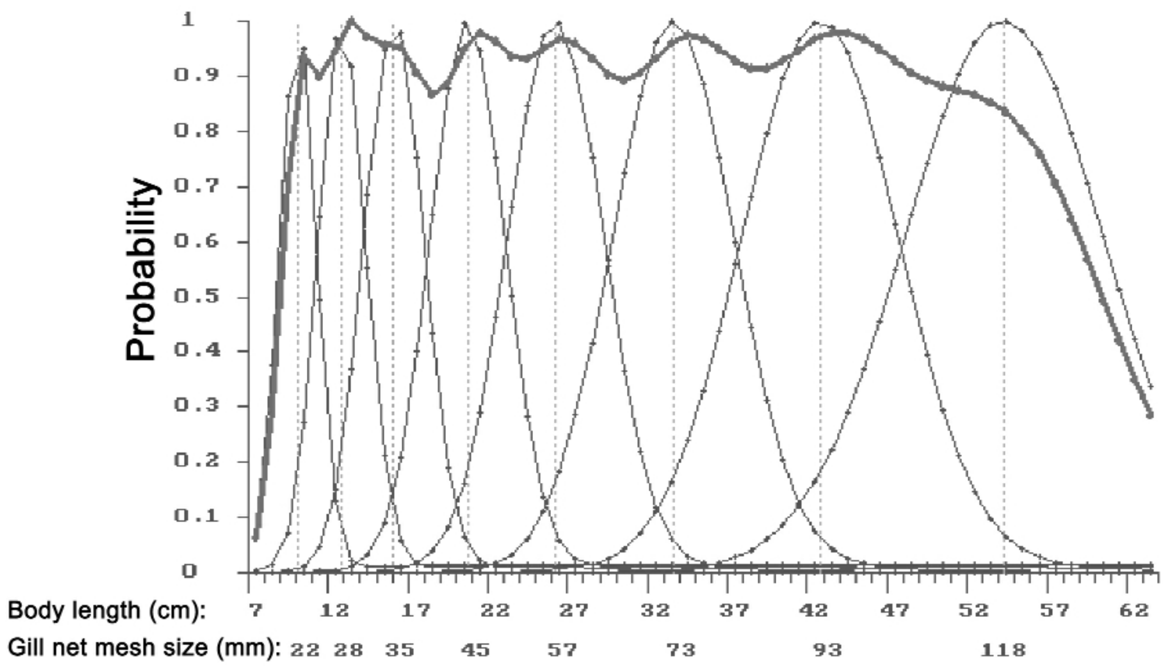


***Figure 6.15**. Gill net selectivity for* Hydrocynus vittatus *for each mesh size from 22 mm to 150 m (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

Brycinus lateralis (Striped robber)

Brycinus lateralis was the most common species in gill net catches and the ninth most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum body length at maturity was 5 cm for females and 6 cm for males (**Table 6.4**). The length at 50 % maturity was 8.1 cm for females and 6.2 cm for males.

A total of 15561 individuals were caught in gill nets, which had body lengths from 5.0 to 20.0 cm (mean 8.7 cm, modal length 8.0 – 8.9 cm) (**Figure 6.7**). The 571 individuals caught with other gears were between 2.0 and 12.0 cm (mean 6.4 cm, modal length 4.0 – 4.9 cm).

The 22 mm mesh size caught the largest number of fish (214.09 fish/setting) (**Table 6.16**). Fish caught with this mesh size had an average length of 8.2 cm, which was longer than the minimum size at maturity, and about the same as the body length at 50 % maturity. Gill nets with a mesh size of 28 mm had the highest catches in weight per setting (0.175 kg/setting). Fish caught with this mesh size had an average length of 9.7 cm, which was longer than length at 50 % maturity. The gill net mesh sizes used effectively caught fish between 8 and 20 cm (**Figure 6.16**) For mesh sizes 22 mm to 57 mm and fish lengths between 8 and 20 cm, the catchability was mostly larger than 0.9. The smallest mesh size that only caught striped robber equal to or larger than the minimum size at maturity was 22 mm. The smallest mesh size that most efficiently caught fish larger than the minimum size at maturity was also 22 mm. This mesh size had a maximum catchability at fish lengths of 8 cm and caught fish between 6 and 11 cm.

***Table 6.16.** Gill net selectivity for* Brycinus lateralis *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	10632	8.2	214.09	0.856
28	8726	9.7	175.45	1.754
35	1124	11.1	22.77	0.524
45	186	10.0	3.73	0.063
57	3	8.7	0.06	0.001
Total	**20672**		**46.23**	**0.355**

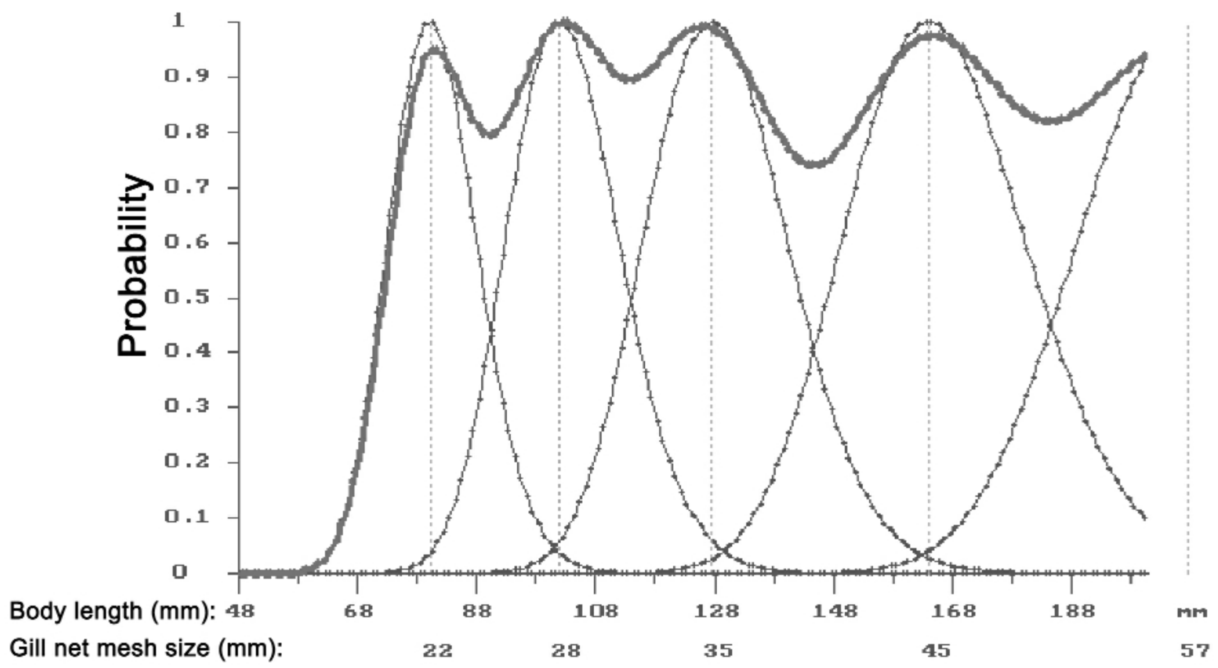


Figure 6.16*. Gill net selectivity for* Brycinus lateralis *for each mesh size from 22 mm to 57 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

Schilbeidae:

Schilbe intermedius (Silver catfish)

Schilbe intermedius was the second most common species in gill net catches and the seventeenth most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum length at maturity was 8 cm for both females and males (**Table 6.4**). The length at 50 % maturity was 21.6 cm for females, and could not be determined for males.

A total of 3817 individuals were caught in gill nets, which had body lengths from 2.0 to 35.0 cm (mean 14.3 cm, modal length 17.0 – 17.9 cm) (**Figure 6.7**). The 150 individuals caught with other gears were between 6.0 and 24.0 cm (mean 10.2 cm, modal length 8.0 – 8.9 cm).

The 35 mm mesh size caught the largest number of fish per setting (22.3 fish/setting) (**Table 6.17**). Fish caught with this mesh size had an average length of 14.6 cm, which was longer than the minimum body size at maturity, but shorter than the length at 50 % maturity. Gill nets with a mesh size of 45 mm had the highest catches in weight per setting (1.11 kg/setting). Fish caught with this mesh size had an average length of 17.2 cm, which was longer than the minimum size at maturity, but shorter than the length at 50 % maturity. The gill net mesh sizes used effectively caught fish between 9 and 35 cm (**Figure 6.17**). For mesh sizes between 22 and 93 mm and fish lengths between 9 and 35 cm, the catchability was mostly larger than 0.9. The smallest mesh size that only caught fish equal to or larger than the minimum size at maturity was 35 mm. The smallest mesh size that most efficiently caught fish larger than minimum mature size was 22 mm. This mesh size had a maximum catchability at fish lengths of 9 cm and caught fish between 6 and 20 cm.

Table 6.17. *Gill net selectivity for* Schilbe intermedius *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	666	9.7	13.60	0.109
28	785	12.2	15.82	0.269
35	1112	14.6	22.33	0.737
45	902	17.2	18.11	1.105
57	314	20.3	6.31	0.674
73	29	23.6	0.58	0.103
93	8	18.5	0.16	0.011
118	1	25.0	0.02	0.004
Total	**3817**		**8.55**	**0.335**

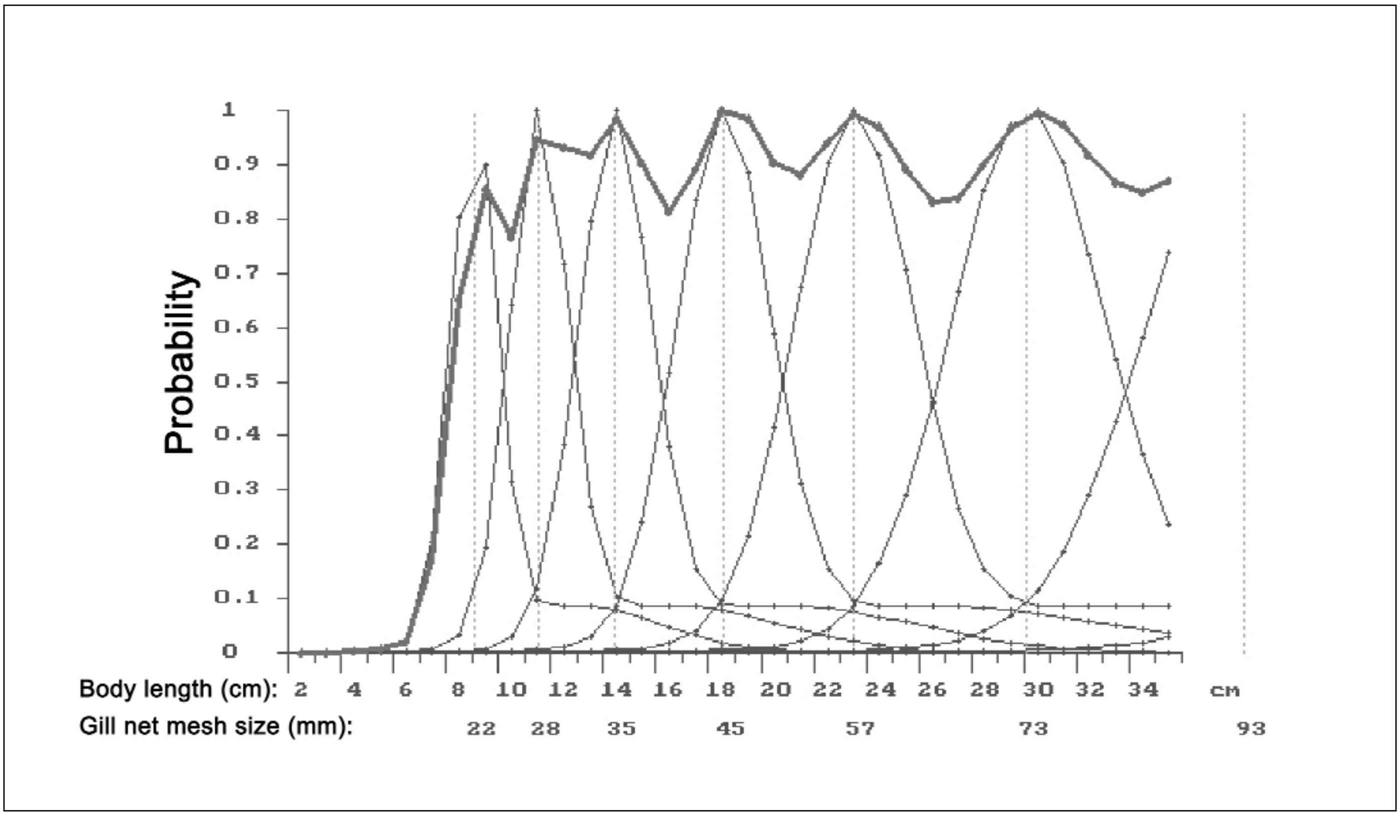


***Figure 6.17**. Estimation of gill net selectivity for* Schilbe intermedius *for each mesh size from 22 mm to 118 mm (thin lines) and combined estimated selectivity curve for all mesh size (thicker line).*

Cyprinodontidae:

Aplocheilichthys johnstoni (Johnston's topminnow)

Aplocheilichthys johnstoni was not caught with gill nets, but only with the other gears in the Zambezi and Chobe Rivers (**Appendix 5**). A total of 645 individuals with body lengths from 1.5 cm to 4.8 cm (mean 2.7 cm, modal length 2.0 – 2.9 cm) were caught (**Figure 6.7**). The body length at maturity could not be determined (**Table 6.4**).

Clariidae:

Clarias gariepinus (Sharptooth catfish)

Clarias gariepinus was the seventh most common species in gill net catches and the twenty-first most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum body length at maturity was 34 cm for females and 46 cm for males (**Table 6.4**). The length at 50 % maturity was 39.9 cm for females, and could not be determined for males.

A total of 105 individuals were caught in gill nets, which had body lengths from 15.0 to 92.0 cm (mean 47.0 cm) (**Figure 6.7**). The 34 individuals caught with other gears were between 4.5 and 41.0 cm (mean 20.6 cm, modal length 30.0 – 30.9 cm).

The 57 mm mesh size caught the largest number of fish per setting (0.48 fish/setting) (**Table 6.18**). Fish caught with this mesh size had an average length of 30.4 cm, which was shorter than the minimum size at maturity. Gill nets with a mesh size of 150 mm had the highest catches in weight per setting (0.976 kg/setting) Fish caught with this mesh size had an average length of 72.4 cm, which is larger than the minimum size at maturity and length at 50 % maturity. The gill net mesh sizes used caught fish with varying effective-

***Table 6.18.** Gill net selectivity for* Clarias gariepinus *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
28	4	16.0	0.08	0.002
35	1	17.0	0.02	0.001
45	1	23.0	0.02	0.002
57	24	30.4	0.48	0.112
73	20	42.1	0.40	0.294
93	21	48.0	0.42	0.381
118	20	61.7	0.40	0.779
150	14	72.4	0.31	0.976
Total	**105**		**0.24**	**0.283**

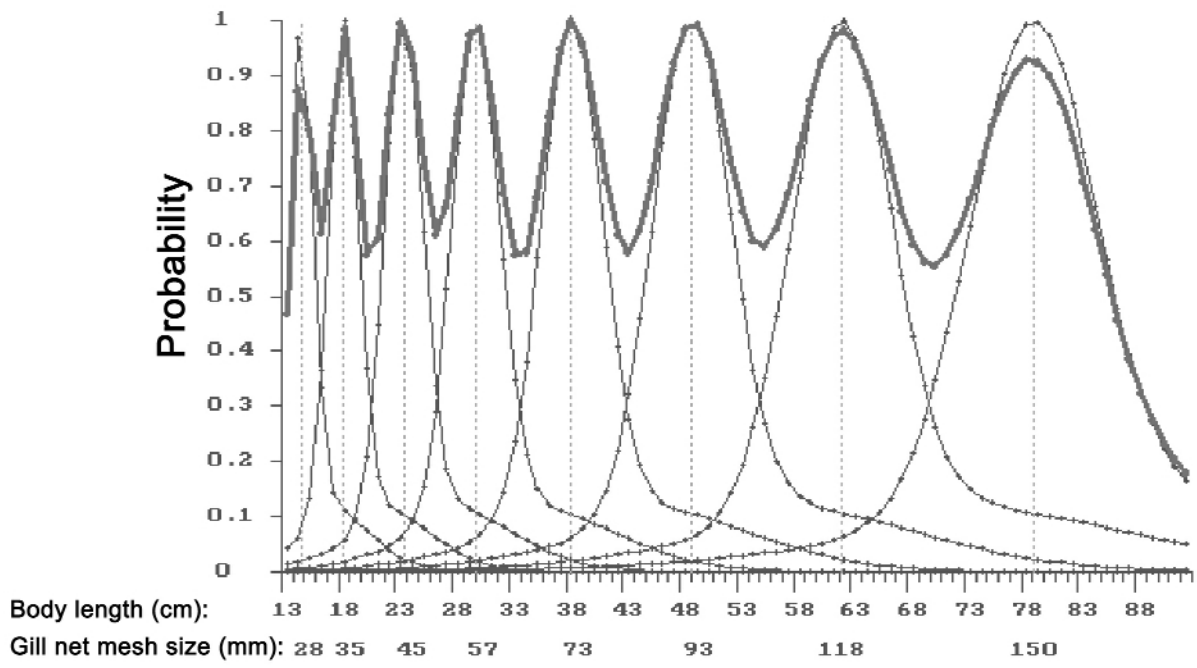


Figure 6.18. *Gill net selectivity for* Clarias gariepinus *for each mesh size from 28 mm to 150 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

ness for the different length groups between 14 and 85 cm (**Figure 6.18**). For mesh sizes between 22 and 150 mm and fish lengths between 14 and 85 cm, the catchability varied between 0.6 and 1.0. The smallest mesh size that only caught fish equal to or larger than the minimum size at maturity was 73 mm. The smallest mesh size that most efficiently caught fish larger than the minimum size at maturity was also 73 mm. This mesh size had a maximum catchability at fish lengths of 39 cm and caught fish between 19 and 69 cm.

Hepsetidae:

Hepsetus odoe (African pike)

Hepsetus odoe was the sixth most common species in gill net catches and the twenty-second most important species in catches with other gears in the Zambezi and Chobe Rivers (measured as IRI) (**Appendix 4 and 5**). The minimum body length at maturity was 23 cm for females and 25 cm for males (**Table 6.4**). The length at 50 % maturity was 26.4 cm for females and 27.0 cm for males.

A total of 322 individuals were caught in the survey gill nets. The body lengths varied between 11.0 and 36.0 cm (mean 22.2 cm, modal length 18.0 - 18.9 cm). Only 39 individuals were caught with the other gears. These fish were smaller, with body lengths from 3.6 to 32.0 cm (mean 19.5 cm, modal length 22.0 – 22.9 cm). Both gear types caught a large proportion of fish smaller than the minimum length at maturity.

The 35 mm mesh size caught the largest number of fish per setting (2.07 fish/setting) (**Table 6.19**). Fish caught with this mesh size had an average length of 18.9 cm, which was smaller than the minimum length at maturity. Gill nets with a mesh size of 57 mm had the highest catches in weight per setting (0.35 kg/setting). The gill net mesh sizes used effectively caught fish between 11 and 36 cm in length

Table 6.19. *Gill net selectivity for* Hepsetus odoe *in catches from the Zambezi and Chobe Rivers from 1997 to 2000. Number of fish caught (N), mean length of the fish and mean standard catch per unit effort (CPUE) are given for each mesh size. CPUE was calculated for all mesh sizes (22 - 150 mm). Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Mesh size (mm)	Number of fish	Mean length (cm)	CPUE (N per setting)	CPUE (kg per setting)
22	7	11.8	0.14	0.002
28	30	15.7	0.63	0.023
35	103	18.9	2.07	0.153
45	84	22.1	1.69	0.214
57	70	27.1	1.41	0.354
73	27	32.1	0.54	0.237
93	1	23.0	0.02	0.003
Total	**322**		**0.72**	**0.110**

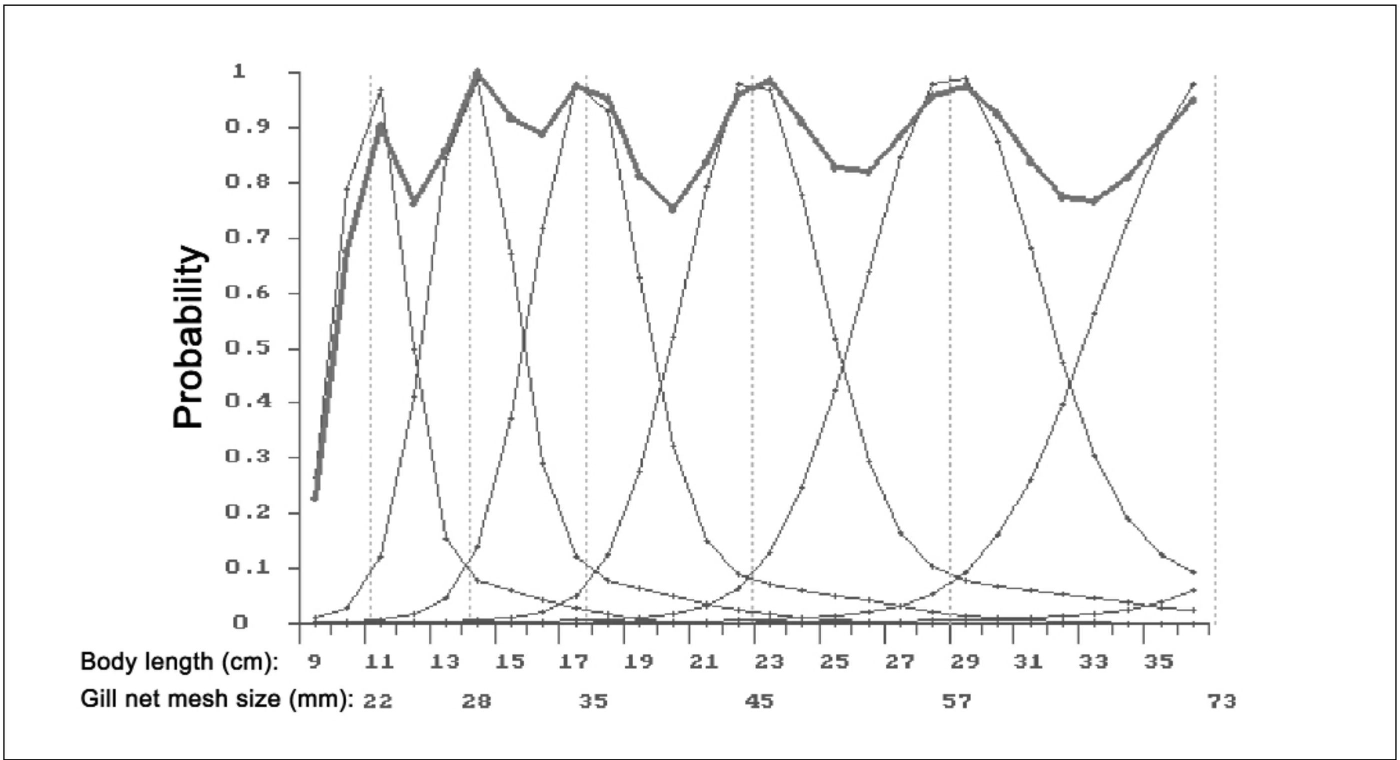


Figure 6.19*. Gill net selectivity for* Hepsetus odoe *for each mesh size from 22 mm to 93 mm (thin lines) and combined estimated selectivity curve for all mesh sizes (thicker line).*

(**Figure 6.19**). For mesh sizes between 22 and 73 mm and fish lengths between 11 and 36 cm, catchability was larger than 0.8 - 0.9. The smallest mesh size that only caught fish equal to or larger than the minimum size at maturity was 73 mm. The smallest mesh size that most efficiently caught fish larger than the minimum size at maturity was also 57 mm. This mesh size had a maximum catchability at fish lengths of 23 cm and caught fish between 15 and 36 cm.

6.4.4 Summary of gill net selectivity

For ten of the selected species, the most effective gill net mesh size was larger in terms of weight of fish caught than number of fish caught (**Table 6.20**). For most of the species, the highest number of fish per setting was caught in the small mesh sizes (22 - 35 mm, 14 species). In fact, nine of these species were most effectively caught in the two smallest mesh sizes (22 and 28 mm). Only two species were most effectively caught in the larger mesh sizes (57 and 73 mm). The larger species were most effectively caught in larger mesh sizes. Only 4 of 17 species had a minimum length at maturity above 10 cm, or were on average above 15 cm in the gill net catches.

The length-weight relationship was estimated for the 17 selected species (**Table 6.21**). There were close to linear relationship between length and weight for the species caught. If the exponent b = 3.0, the relationship is linear, and our results showed small deviations from this value for all species except for *A. johnstoni*. The r^2 value varied between 0.87 and 0.99 among the species.

6.5 Catch per unit effort

6.5.1 Catch per unit effort at different stations

Catch per unit effort (CPUE) was estimated for the gill net surveys at all stations in the Zambezi and Chobe Rivers in order to obtain a rough estimate of the fish density in the area (**Table 6.22**). There were significant differences among the stations both in weight (ANOVA, F = 25.828, df = 4, p < 0.001) and number (F = 20.311, df = 4, p < 0.001). The surveys showed higher CPUE both in weight and number at the Lake Lisikili compared to Katima Mulilo (Tukey test, p < 0.001), Kalimbeza (weight, p = 0.003, number, p = 0.015) and Impalila (p < 0.001), but was not different from Kabula-Bula (weight, p = 0.367, number, p = 0.998). Kabula-Bula showed higher CPUE in weight and number than Katima Mulilo (both p < 0.001) and Impalila (both p < 0.001), and also higher CPUE in number than Kalimbeza (p = 0.021). There were no differences in CPUE in weight between Katima Mulilo and Impalila (p = 0.163), but CPUE in weight were slightly higher at Impalila than at Katima Mulilo (p = 0.033).

6.5.2 Catch per unit effort in different mesh sizes

CPUE was higher for small mesh sizes than for larger (**Figure 6.21 and 6.22**), and we found a negative correlation both for mesh size and CPUE in weight (Spearman rank, r = -0.491, p = 0 .01) and CPUE in number (Spearman rank, r = -0.747, p = 0.01).

Table 6.20. *Most efficient gill net mesh sizes in terms of number of fish and in terms of weight per setting for the 17 selected species. Fish species classified as "large" had a minimum length at maturity larger than 7 cm, whereas those classified as "small" had a minimum length at maturity smaller than 7 cm. Mean length (cm) for all fish caught in gill nets are given.*

Species	Most efficient gill net mesh size (mm)		Size classification		Mean length in gill nets (cm)
	Number of fish	Weight per setting	Large	Small	
Aplocheilichthys johnstoni	-	-		x	2.3*
Micralestes acutidens	22	22		x	6.9
Pseudocrenilabrus philander	22	35		x	7.5
Barbus paludinosus	22	22		x	7.5
Petrocephalus catostoma	28	28		x	7.6
Barbus unitaeniatus	22	22		x	8.3
Barbus poechii	22	28		x	8.4
Brycinus lateralis	22	28		x	8.7
Tilapia sparrmanii	*28*	*57*		*x*	*9.3*
Pharyngochromis acuticeps	35	35		x	10.2
Marcusenius macrolepidotus	22	35	x		10.3
Tilapia rendalli	35	118	x		11.8
Schilbe intermedius	35	45	x		14.2
Oreochromis macrochir	73	73	x		15.6
Hydrocynus vittatus	35	45	x		17.1
Hepsetus odoe	35	57	x		22.2
Clarias gariepinus	57	150	x		38.7

*Aplocheilichthys johnstoni *was not caught in gill nets, and mean length is based on catches with other gears than gillnets.*

Table 6.21. *Length-weight relationship of 17 selected species in the Zambezi and Chobe Rivers in 1997 and 2000. We used the formula: W = a * L (exp b), where a = intercept, b = exponent, W = weight of the fish and L = length of the fish, r^2 = correlation coefficient.*

Species	Intercept a	Exponent b	r^2	Number fish
P. philander	0.016	2.98	0.93	782
P. acuticeps	0.010	3.13	0.97	1509
T. sparrmanii	0.013	3.17	0.97	1364
T. rendalli	0.011	3.28	0.97	727
O. macrochir	0.014	3.15	0.98	311
B. poechii	0.014	3.19	0.95	1735
B. paludinosus	0.009	3.12	0.92	694
B. unitaeniatus	0.007	3.25	0.87	354
M. macrolepidotus	0.005	3.35	0.94	1858
P. catostoma	0.012	3.06	0.96	2065
M. acutidens	0.009	3.21	0.93	738
H. vittatus	0.009	3.12	0.97	987
B. lateralis	0.006	3.36	0.91	10837
S. intermedius	0.004	3.33	0.97	3185
A. johnstoni	0.029	1.62	0.45	390
C. gariepinus	0.006	3.06	0.99	133
H. odoe	0.004	3.35	0.97	369

6.5.3 Catch per unit effort in different habitats

Habitat characteristics such as water discharge, vegetation, depth, the extent of adjacent floodplains, backwaters and bottom substrate is shown to affect CPUE. In our study we were able to compare CPUE in relation to habitat (mainstream and backwater) and water level (spring and autumn) at Katima-Mulilo and Kalimbeza stations where we had comparable data for all mesh sizes.

To test how habitat type influences the CPUE, we had to exclude the mesh sizes larger than 73 mm, due to many empty gill net sets giving a very skewed catch distribution. We divided the rest of the data into two groups, one with mesh sizes 22 to 35 mm (**Table 6.23**) and the other with mesh sizes 45 to 73 mm (**Table 6.24**) to study the effects of mainstream/backwater and water level on CPUE in small and large mesh sizes.

In catches with mesh size ranging from 22 to 35 mm at Katima Mulilo, both the CPUE in number and weight were significantly higher in backwater than in mainstream (MANOVA, univariate analysis; CPUE-number, $F = 11.569$, $df = 1$, $p = 0.001$; CPUE-weight, $F = 16.338$, $df = 1$, $p < 0.001$). CPUE, however, was not affected by water level at Katima Mulilo (CPUE-number, $F = 0.040$, $df = 1$, $p = 0.841$), CPUE-weight, $F = 2.811$, $df = 1$, $p = 0.096$) (**Table 6.23**).

Table 6.22. Mean standard CPUE in number of fish (N) and weight (kg) per setting, number of settings (sets) and recorded gill net catches in number and weight (N and W) in total gill net catches (22-150 mm mesh size) at the main sampling stations in the Zambezi and Chobe Rivers in 1997-2000. SD = standard deviation. Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).

Station	CPUE				Recorded catch		
	N	SD	Kg	SD	Sets	N	W
Katima Mulilo	35.1	101.0	0.84	0.84	414	4 362	104.10
Lisikili	200.4	587.9	3.96	3.96	180	10 819	214.05
Kalimbeza	88.4	230.1	2.24	2.24	359	9 517	240.94
Impalila	53.7	194.6	1.36	1.36	306	4 928	125.11
Kabula-Bula	145.7	365.0	2.18	2.18	234	10 226	153.06
Total	89.0	297.7	1.87	4.23	1493	39 852	837.26

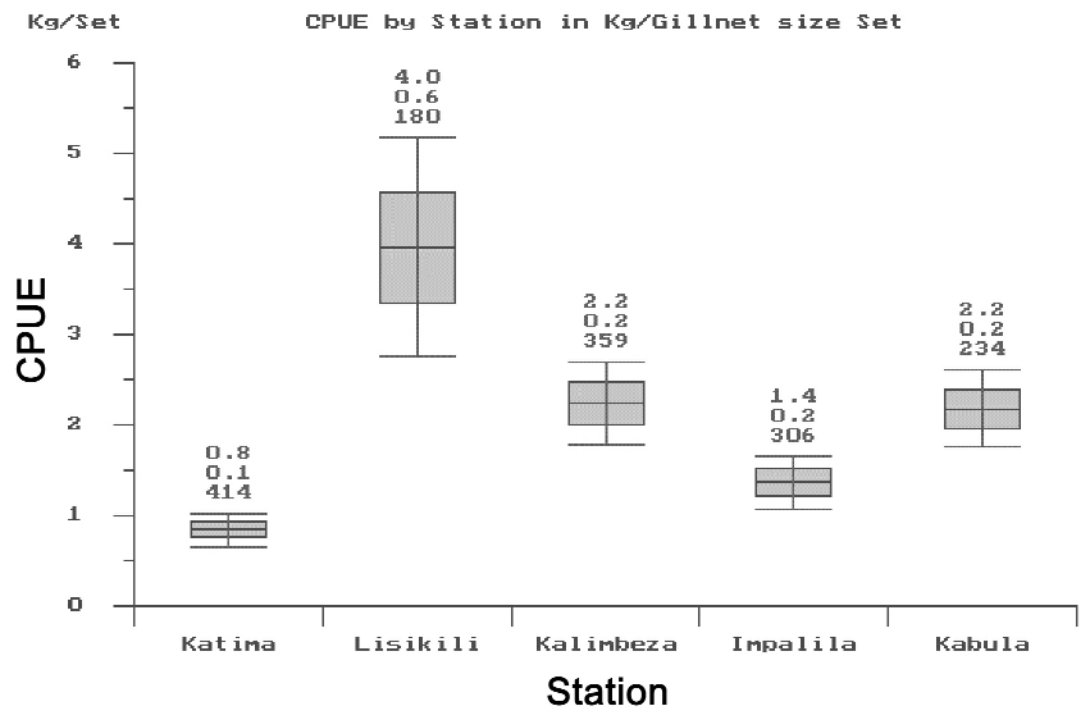


***Figure 6.20.** Mean standard CPUE in weight per setting with 95 % confidence limits in total gill net samples (22-150 mm mesh size) from all habitats at the different stations in the Zambezi and Chobe Rivers during the period 1997-2000. Top number = mean, second number = standard error and third number = sample size. Setting = 12 hours of fishing with one standard gill net (area = 50 m^2)*

At Kalimbeza, the CPUE in number in the 22 to 35 mm mesh size was slightly higher in backwater than in the mainstream habitat (F = 3.980, df = 1, p = 0.048), and higher during high water than during low water conditions (F = 4.625, df = 1, p = 0.034) (**Table 6.23**). The CPUE in weight was significantly affected by water level (F = 25.125, df = 1, p < 0.001), but not by habitat (F = 3.399, df = 1, p = 0.068).

At the stations Impalila and Kabula-Bula, there were no data from backwater low- and high water, respectively, and hence, we were not able to do a multivariate analysis. At Impalila, water level did not affect CPUE significantly, neither in terms of number (ANOVA, F = 1.456, df = 1, p = 0.233) or weight (F = 1.132, df = 1, p = 0.292) (**Table 6.23**). At Kabula-Bula, the CPUE was affected by water level, where low water condition gave higher CPUE than high water, both in terms of number (F = 16.099, d = 1, p < 0.001) and weight (F = 13.716, df = 1, p = 0.001).

For mesh sizes ranging from 45 to 73 mm, the CPUE was significantly affected by water level (season) both at Katima Mulilo and Kalimbeza (**Table 6.24**). At Katima Mulilo, the CPUE in number was higher at low water (MANOVA, univariate analysis; F = 10.325, df = 1, p < 0.01), while at Kalimbeza, the CPUE in number was higher during high water level (F = 13.795, df = 1, p < 0.001). The CPUE in weight was significantly higher during high water (autumn) than during low water conditions (spring) at both Katima Mulilo (F = 12.038, df = 1, p < 0.001) and at Kalimbeza (F = 35.011, df = 1, p < 0.001). CPUE was not affected by habitat neither at Katima Mulilo (number, F = 0.469, df = 1, p = 0.495, weight, F = 0.231, df = 1, p = 0.632) nor at

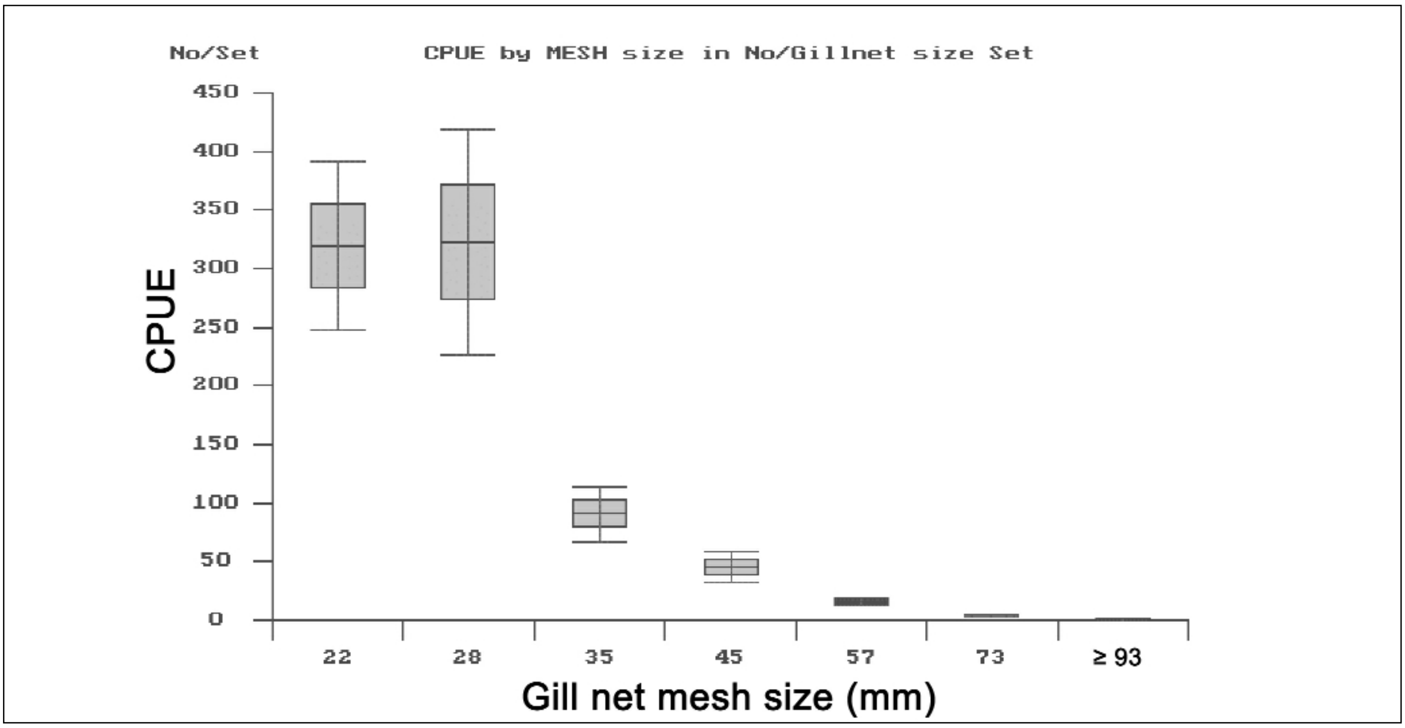


Figure 6.21. *Mean standard CPUE in number per setting for total gill net samples (22-150 mm mesh size) from all habitats at the different stations in the Zambezi and Chobe Rivers during the period 1997-2000. Top number = mean, second number = standard error and third number = sample size. Last mesh size = >73 mm. Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

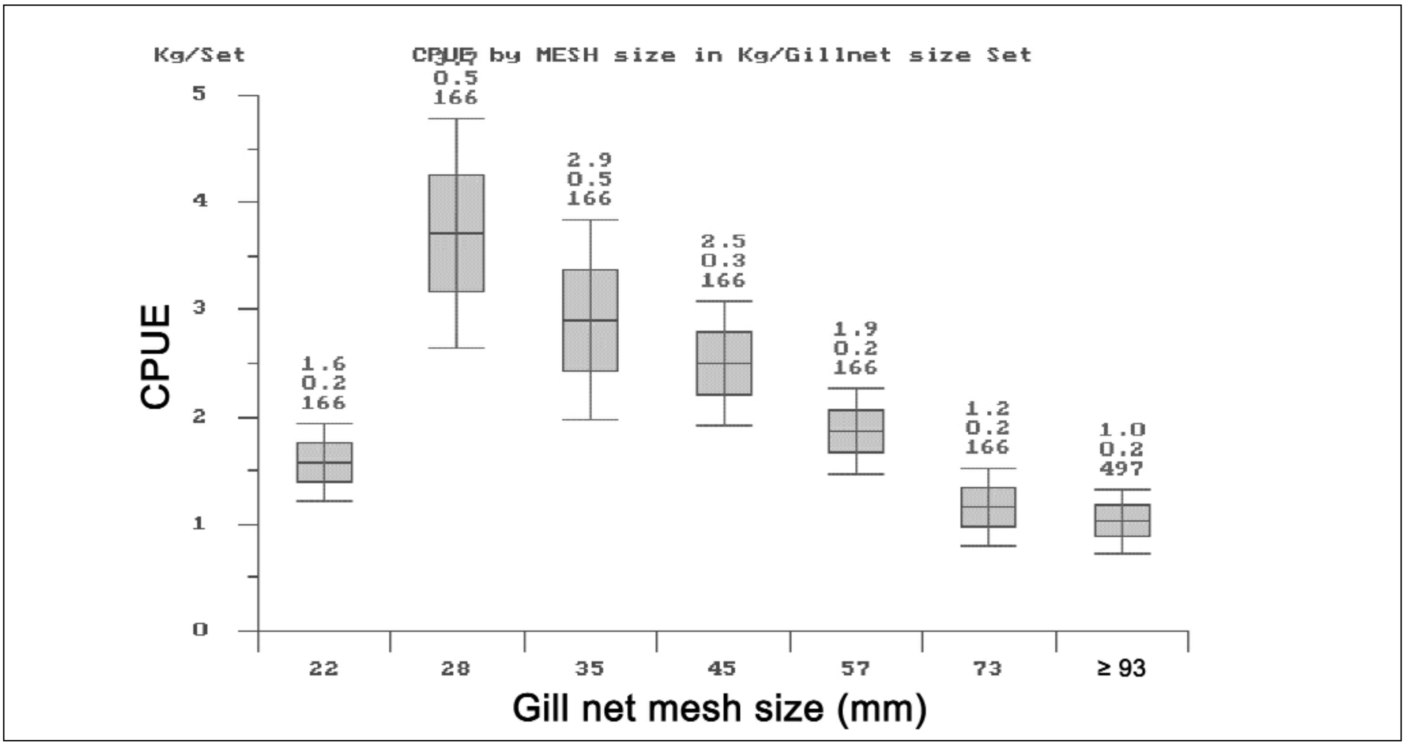


Figure 6.22. *Mean standard CPUE in weight (kg) per setting for total gill net samples (22-150 mm mesh size) from all habitats at the different stations in the Zambezi and Chobe Rivers during the period 1997-2000. Top number = mean, second number = standard error and third number = sample size. Last mesh size = >73 mm. Setting = 12 hours of fishing with one standard gill net (area = 50 m^2).*

Kalimbeza (number, F = 1.209, df = 1, p = 0.274, weight, F = 2.530, df = 1, p = 0.115).

At Impalila, the CPUE in weight was slightly higher during high water than low water conditions (ANOVA, F = 4.153, df = 1, p = 0.047). No differences in CPUE in number were recorded (F = 1.816, df = 1, p = 0.184). At Kabula-Bula, the CPUE was higher during low water conditions both in terms of number (F = 14.039, df = 1, p = 0.001) and weight (F = 26.860, df = 1, p < 0.001) (**Table 6.24**).

***Table 6.23**. Catch per unit effort (CPUE) based on number fish (N) and weight (kg) for different combinations of habitat (mainstaream/backwater) and water level (high/low) for mesh sizes between 22 and 35 mm at all stations in the Zambezi and Chobe Rivers in the period 1997 to 2000.*

	Number of gillnet sets	CPUE N/sets		CPUE Kg/sets	
		Mean	SD	Mean	SD
Katima					
Mainstream-high water	42	65.9	102.9	0.91	1.47
Mainstream- low water	59	102.8	186.4	0.76	1.17
Backwater- high water	15	143.3	141.9	2.75	2.64
Backwater- low water	9	225.6	208.4	1.42	1.36
Kalimbeza					
Mainstream-high water	39	235.3	268.0	4.11	4.48
Mainstream- low water	35	119.6	226.0	1.01	0.99
Backwater- high water	18	528.2	512.7	7.64	7.84
Backwater- low water	24	234.7	393.3	1.37	1.21
Impalila					
Mainstream-high water	30	93.6	128.3	1.30	1.76
Mainstream- low water	29	176.8	250.3	1.47	1.33
Backwater- high water	30	240.2	504.0	2.73	3.70
Backwater- low water	-	-	-	-	-
Kabula-Bula					
Mainstream-high water	24	159.2	180.0	1.30	0.94
Mainstream- low water	23	695.8	757.3	4.17	3.93
Backwater- high water	-	-	-	-	-
Backwater- low water	21	571.3	728.6	4.37	5.36

***Table 6.24** Catch per unit effort (CPUE) based on number fish (N) and weight (kg) for different combinations of habitat (mainstream/backwater) and water level (high/low) for mesh sizes between 45 and 73 mm at all stations in the Zambezi and Chobe Rivers in the period 1997 to 2000.*

	Number of gillnet sets	CPUE N/sets		CPUE Kg/sets	
		Mean	SD	Mean	SD
Katima					
Mainstream-high water	39	16.3	28.9	1.46	2.01
Mainstream- low water	58	3.0	8.58	0.48	0.87
Backwater- high water	15	31.6	50.3	2.55	3.70
Backwater- low water	9	2.6	3.6	0.32	0.45
Kalimbeza					
Mainstream-high water	36	46.0	115.8	3.71	5.69
Mainstream- low water	34	7.0	7.9	0.63	0.67
Backwater- high water	18	50.0	68.6	5.07	5.32
Backwater- low water	24	11.0	17.6	0.91	1.25
Impalila					
Mainstream-high water	27	14.6	21.2	2.23	3.71
Mainstream- low water	28	5.6	6.7	0.67	0.94
Backwater- high water	30	21.3	39.6	1.87	2.72
Backwater- low water	-	-	-	-	-
Kabula-Bula					
Mainstream-high water	21	11.3	10.9	0.85	0.65
Mainstream- low water	22	46.8	45.6	4.85	5.13
Backwater- high water	-	-	-	-	-
Backwater- low water	21	38.3	37.2	3.38	2.15

7 Discussion

7.1 Species diversity, all stations combined

A total of 69 fish species were recorded during the field surveys in the Zambezi and Chobe Rivers during 1997-2000, in addition to unidentified *Synodontis* species. Due to difficulties with the taxonomic classification in the *Synodontis* spp. group, these species have been pooled, except the easily recognised *Synodontis nigromaculatus*. Seven *Synodontis* species have previously been listed for the Zambezi River (Hay et al. 1999), thus there may be up to six *Synodontis* species in the pooled *Synodontis* spp. group. The fish families represented with the highest number of species were the Cyprinidae and the Cichlidae, with 20 and 17 species, respectively.

Fish surveys comparable to the present study in the Zambezi/Chobe Rivers were carried out in the Namibian part of the Okavango River during 1992-1999 (Hay et al. 2000). Results are compared between the studies in the Zambezi/Chobe and Okavango River systems throughout the discussion. The surveys in the Okavango River performed by Hay et al. (2000) recorded 70 species in addition to the unidentified *Synodontis* species. *Barbus eutaenia*, *Clarias liocephalus* and *Amphilius uranoscopus* were only recorded in the Okavango River survey (Hay et al. 2000), whereas *Serranochromis longimanus* and *Chiloglanis neumanni* were only recorded in the present study. The results from the Okavango and the Zambezi/Chobe Rivers (Hay et al. 2000, this study) indicate that the survey methods were efficient, catching most species and size groups of the fish in the areas studied. The Namibian part of the Zambezi River system has 81 fish species, whereas the Namibian part of the Okavango system has 82 species, according to Bethune and Roberts (1991).

Although several fish collections have been made from the Upper Zambezi System and the Okavango Delta area, few reports of collections from the Caprivi area have been published (Van der Waal and Skelton 1984). During 1973-1976, several surveys were carried out in the Lake Liambezi (Van der Waal 1976, 1980, 1985, Van der Waal and Skelton 1984). Studies in the Lake Liambezi were also carried out by Grobler (1987). Van der Waal and Skelton (1984) and Van der Waal (1996) in addition collected fish from the Zambezi River, the Eastern Floodplain, the Chobe River, the Linyanti swamp and the Kwando River during 1973-1977. When appropriate throughout the discussion, the results from the present study are compared with results from these previous surveys. However, since most previous data are from a shallow lake, they may not be directly comparable with data from the Zambezi/Chobe Rivers.

Six species recorded in the present study were considered to be habitat specialists, which means that their life history activities are confined to specific habitats, and that they require particular effort and equipment for collection. Habitat specialists are generally more vulnerable to habitat disruption compared to species that are able to live in various habitats. The habitat specialists recorded were *Barbus codringtonii*, *Nannocharax macropterus*, *Leptoglanis* cf *dorae*, *Clariallabes platyprosopos*, *Chiloglanis fasciatus* and *C. neumanni.* The taxonomic status of *C. fasciatus* and *C. neumanni* is under review (Skelton, pers. com.); they are listed as two different species in this report, but may be the same species. Five of the species were difficult to collect, whereas *C. platyprosopos* was common in its habitat. *B. codringtonii*, *C. fasciatus* and *C. neumanni* were only recorded in rocky areas with current. This was in accordance with Van der Waal and Skelton (1984), who reported that they found these species only in rapids. The limited availability of rapids in the Namibian part of the Zambezi/Chobe Rivers may be the reason for the low numbers of *B. codringtonii*, *C. fasciatus* and *C. neumanni* caught during this study. *N. macropterus* were found in vegetated habitats present in clear fast flowing currents. Sampling difficulties at these habitats probably restricted the number recorded. *L.* cf *dorae* were exclusively found in fine sandy habitats with a clear water current. *Leptoglanis rotundiceps* has previously been listed from the Caprivi region (Van der Waal and Skelton 1984, Hay et al. 1999), but was not found during this study. Both *Leptoglanis* species use to be buried in the sand with only their eyes protruding (Skelton 1993). They are considered vulnerable to any disturbance to sandy, clear water habitats. They are also used as indicator species for the detection of substrate deterioration (Hay et al. 1996). *C. platyprosopos* were only found in rapids, but seemed to be common in that habitat and was not so difficult to collect as the other habitat specialists. However, according to Skelton (1993), the conservation status of this species is rare.

Low numbers of *Barbus kerstenii* and *Clarias stappersii* were caught during this study. These species must, therefore, be considered rare in the Namibian part of the Zambezi/Chobe Rivers. The reason for their low numbers are unknown.

The most important species in the survey catches were identified by using an index of relative importance (IRI), which is a measure of the relative abundance or commonness of the species based on number and weight of individuals in catches, as well as their frequency of occurrence (see Kolding 1989, 1999). When discussing the most important species recorded during the surveys (see below), the unidentified *Synodontis* spp. are not included, although they were numerous in the catches. *Synodontis* species are generally well protected against predators due to their bony skull and large sharp dorsal and well-barbed pectoral fin spines (Skelton 1993). *Synodontis* species may be found in a variety of habitats, typically feeding on detritus, algae and benthic invertebrates (Skelton 1993).

Gill nets are selective gears in the sense that different mesh sizes catch different fish species and size groups. They are also passive gears, thus, the outcome of the sampling is dependent on movements of the fish. Furthermore, gill nets are most often set in open water or along vegetation, and can not be used in strong currents. Gill net catches, therefore, does not reflect the entire fish population. On the other hand, gill nets yield a more standardised data set than the other gears, and are more suitable for comparisons among years, stations, rivers and between high and low water periods. The sampling with other gears than gill nets were used to collect fish sizes and in habitats not accessible with gill nets, and the samplings were not standardised. Comparisons of the most important species among stations, rivers and between high and low water periods based on sampling with other gears should, therefore, be interpreted with caution.

7.1.1 Catches in gill nets

The species diversity in gill net catches in the Zambezi/Chobe Rivers resembled species diversity in the Okavango River (this study, Hay et al. 2000). In the Zambezi/Chobe Rivers, 40 different species were caught, whereas in the Okavango River, 41 species were caught (excluding *Synodontis* spp.). Species recorded in the Zambezi/Chobe Rivers with gill nets were also recorded in the Okavango River gill net catches, except for four species sampled in the Zambezi River not collected in the Okavango River. These were *Hemichromis elongatus, S. longimanus, Opsaridium zambezense* and *Barbus* cf *eutaenia. S. longimanus* has never been recorded from the sampled section of the Okavango River, but has been identified from the Okavango Delta (Skelton 1993, Merron and Bruton 1988). Of the ten dominant species according to the index of relative importance, IRI, in the Zambezi/Chobe Rivers, eight were found to be also among the ten most important in the Okavango River gill net catches. The only two not listed in the Okavango River were *Petrocephalus catostoma* and *Pharyngochromis acuticeps*. *S. nigromaculatus* and *Serranochromis macrocephalus* in the Okavango River replaced these two.

The ten most important species in the gill net catches constituted a larger proportion of the IRI in the Zambezi/Chobe Rivers (96 %) than in the Okavango River (84 %). The two most important species (*Brycinus lateralis* and *Schilbe intermedius*) contributed to 73 % of the total IRI in the Zambezi/Chobe Rivers, whereas the two most important in the Okavango River (*S. intermedius* and *Marcusenius macrolepidotus*) contributed to only 58 % of the total IRI.

A noticable difference between the Zambezi/Chobe and Okavango Rivers was the relative dominance of *B. lateralis* in numbers in the Zambezi/Chobe Rivers (52 %, compared to 26 % in the Okavango). This difference was also reflected in the catch per unit effort (46 *B. lateralis* per setting in the Zambezi/Chobe *versus* 3 in the Okavango), indicating that *B. lateralis* was lower in absolute numbers during the surveys in the Okavango River. Another noticeable difference was the high occurrence of *S. nigromaculatus* in the Okavango River (9 % of the total catch in numbers) compared to the Zambezi/Chobe Rivers (< 0.1 % of the total catch in numbers). The reasons for these differences are not known. *S. nigromaculatus* was mainly recorded at the survey station Kwetze in the Okavango River, with few individuals recorded from the other stations (Hay et al. 2000).

B. lateralis was relatively common in the gill net catches in the Lake Liambezi during the surveys of Van der Waal (1976), whereas Grobler (1987) recorded no individuals. The absence of small mesh sizes (22 and 28 mm) in the sampling gears of Grobler (1987) could have contributed to the fact that no *B. lateralis* was collected during that period. In the present study, most *B. lateralis* were caught in the smaller mesh sizes. The three most dominant species in numbers caught by Van der Waal (1976) were *S. intermedius*, *M. macrolepidotus* and the *Synodontis* spp. These species were number 4, 5 and 3, respectively, in dominance in numbers in the present study. Grobler (1987) reported the three most abundant species in numbers to be *M. macrolepidotus, P. catostoma* and *Oreochromis andersonii*. These species were number 5, 2 and 41, respectively, in dominance in numbers in the present study.

In contrast to the dominance of the Characidae in the Zambezi River gill net catches (56 %), this family comprised only 12 % of the catches in the Okavango River (expressed as IRI, this study, Hay et al. 2000). The Cichlidae almost had the same percentage in the Zambezi/Chobe Rivers (2 %) and the Okavango River (3 %). The Mormyridae had a higher IRI in the Okavango River (19 %) than in the Zambezi/Chobe Systems (10 %), mainly due to the abundance of *M. macrolepidotus* in the Okavango River (this study, Hay et al. 2000).

7.1.2 Catches in other gears than gill nets

Also the species diversity in catches with other gears than gill nets in the Zambezi/Chobe Rivers resembled species diversity in the Okavango River (this study, Hay et al. 2000). In the Zambezi/Chobe Rivers, 67 different species were caught, whereas in the Okavango River, 70 species were caught (excluding *Synodontis* spp.). From the list of the ten most important species in the Zambezi/Chobe Rivers, only three species were not listed under the ten most important species in the Okavango River. These were *Oreochromis macrochir, Hydrocynus vittatus* and *Micralestes acutidens*. *Labeo cylindricus*, *Aplocheilichthys johnstoni* and *S. intermedius* replaced these three in the Okavango River.

The catch of 27 additional species with other gears compared to gill nets was mainly due to the small size of the fish and their residency in habitats unsuitable for gill net surveys. Many Cyprinidae species are small, as well as the Distichodontidae, Amphiliidae, Cyprinodontidae, Anabantidae and Mastacembelidae, which were families with many species only caught with other gears than gill nets. The high species diversity recorded with the other gears compared to gill nets is attributed to the flexibility of these gears, and that a much wider range of habitats were sampled. In addition, many of these other gears can be classified as active gears, in contrast to the gill nets.

Reasons for the lower biomass recorded with the other gears are twofold, namely smaller species are sampled with the other gears and the habitats targeted are seldom deep water areas where large fish reside. The importance of *H. vittatus* in weight can be attributed to large individuals caught with a hook and line.

7.2 Species diversity at the different stations

7.2.1 Catches in gill nets

Thirty-six species were caught with gill nets at Kalimbeza, 33 species at both Kabula-Bula and Lake Lisikili, 28 species at Katima Mulilo and 24 species at Impalila (excluding *Synodontis* spp). Generally, the rank of the ten most important species was corresponding at the different stations. When listing the ten most important species according to index of relative importance, IRI, at the five different stations, only 15 species were represented in total. According to IRI, *B. lateralis* and *S. intermedius* dominated the catches at all the stations, with the exception of the Lake Lisikili. In the Lake Lisikili, *P. catostoma* contributed more in number and weight than *S. intermedius*. The possible reason for this is the lenthic conditions present in the shallow lake and the vegetation, which may benefit *P. catostoma*.

Species diversity measured as the Shannon diversity index differed among stations, with the highest diversity in the Lake Lisikili and the lowest at Katima Mulilo. The year round presence of vegetation and lenthic conditions may have contributed to the high species diversity in the Lake Lisikili. The majority of the species in the Caprivi prefer vegetated habitats, contributing to the high species diversity in the lake. All the other stations included main stream habitats that usually yielded a lower catch. Another possible reason may be the high fishing intensity in the lake, stimulating a high turnover benefiting the smaller size species (Hay et al. 2000).

H. vittatus was absent at Kabula-Bula in the Chobe River, both in gill net catches and in catches with other gears. This section of the Chobe is considered a backwater habitat with no strong water current present. During the high water period in the Zambezi River, the water pushes towards the Lake Liambezi and during the low water period in the Zambezi, the water changes direction, moving back towards the Zambezi River. This habitat is not considered favourable for *H. vittatus*. *Hepsetus odoe* probably replace *H. vittatus* at this station, supported by the fact that the highest abundance of *H. odoe* was at Kabula-Bula. This is also the tendency in the Kunene River, where *H. vittatus* is absent (Clinton Hay, pers. obs.). Similarly, *H. odoe* was present where *H. vittatus* was absent during the surveys of Van der Waal (1985). Winemiller and Kelso-Winemiller (1994) stated that the presence of *H. vittatus* will restrict the occurrence of *H. odoe* in open areas of the main channel in the Upper Zambezi River. *H. vittatus* has a strong effect on the behaviour of fish species living in the same habitat due to its active feeding behaviour in open water, and may have an important role on the structuring of fish communities within the Zambezi system (Jackson 1961, 1986).

7.2.2 Catches in other gears than gill nets

No single species dominated the catches with the other gears at any of the stations, in contrast to the gill net catches. Only three species were listed as one of the ten most important species at all the stations. The higher species diversity and the wider range of habitats sampled with the other gears contributed to this.

Only a few sampling methods are effective in rocky river habitats. Rocky habitats are present at Katima Mulilo and Impalila and are only accessible for sampling during low water periods using either the electro-shocker or rotenone. The *Synodontis* spp. and *L. cylindricus* were effectively collected from rocky habitats using rotenone at Katima Mulilo.

Kalimbeza had the highest species diversity among the stations, and Katima Mulilo the lowest. Habitat difference between Kalimbeza and Katima Mulilo may be the main reason for the higher species diversity at Kalimbeza compared to Katima Mulilo. Kalimbeza has a wide range of habitats, including floodplains, backwaters, channels and main stream habitats with riverine vegetation, whereas Katima Mulilo has only two main habitat types, namely rapids and main stream. These differences may strongly influence species diversity and composition as well as size distributions of individuals. However, the sampling with other gear than gill nets were not standardised. Varying sampling efforts and use of different gears among stations makes comparisons among stations doubtful.

7.3 Species diversity during high and low water

7.3.1 Catches in gill nets

Among the ten most important species according to the index of relative importance, IRI, nine species were on the list both during high and low water. *B. lateralis* dominated the gill net catches during both periods. Hence, water level seemed to have no profound effect on the species diversity in the gill net catches during the study period. However, three species had a marked decrease in the IRI from the high to the low water period, whereas six species had a marked increase.

S. intermedius markedly decreased in IRI in catches during low water, although high catches were recorded during both periods. The reason for this phenomenon is not known.

The decrease in IRI for *H. vittatus* from high to low water was responded by an increase in *H. odoe* over the same period. The hypothesis still holds that *H. odoe* replaces *H. vittatus* in the absence or low number in the latter species (see section 7.2.1). The reduction in the IRI for *P. catostoma* from high to low water can probably be attributed to the decrease in vegetated habitats.

Simultaneously with the increase in number of *B. lateralis* from high to low water, the average weight decreased over the same period. Smaller individuals were recruited into the sampling during the low water period, which coincided with the onset of the breeding season of this species.

There may be several reasons for changes in catches between high and low water periods. For example, variation in habitats, fishing effort, gill net efficiency, fish behaviour, abundance, size and life history stages may all contribute to variations in the catches. Thus, differences seen in the data between high and low water may both be due to differences in the sampling efficiency, habitats and in the fish populations.

7.4 Body length distributions and gill net selectivity

7.4.1 Body length distribution in gill nets and other gears

Larger fish were caught with gill nets than with other gears, both in the Zambezi/Chobe Rivers and in the Okavango River (this study, Hay et al. 2000). This scenario was both for the species combined and for individual species.

Larger fish were sampled with gill nets in the Zambezi/-Chobe Rivers (body lengths up to 92 cm) than in the Okavango River (body lengths up to 79 cm), but the modal length was slightly smaller in the Zambezi/Chobe Rivers (8.0-8.9 *versus* 9.0-9.9 cm). The smaller modal length can be attributed to the large number of *B. lateralis* caught in the Zambezi/Chobe Rivers, which is a relatively small species. The same circumstance was found for catches with the other gears; larger fish were sampled in the Zambezi/Chobe Rivers compared to in the Okavango River, but the modal length was smaller.

7.4.2 Body length at maturity

The minimum length at maturity was larger than or similar to the smallest fish caught with gill nets in all the selected species, except for both sexes of *M. acutidens* and males of *P. catostoma*. The length at 50 % maturity was larger than the minimum length of fish caught with gill nets for all the species where 50 % maturity could be determined.

Comparable data for minimum length at maturity between the Zambezi/Chobe and Okavango Rivers exist for 13 species (this study, Hay et al. 2000). For males, seven species had a larger minimum length at maturity in the Zambezi/Chobe Rivers Caprivi compared to in the Okavango River, whereas four species had a smaller and two species had the same minimum length at maturity. For females, three species had a larger minimum length at maturity in the Zambezi/Chobe Rivers compared to in the Okavango River, whereas seven species had a smaller and three species had the same minimum length at maturity. Comparable data for 50 % maturity exist for nine species, although only for females in two of the species. For males, 50 % maturity was larger in the Zambezi/Chobe Rivers in four species and in the Okavango River in three species (this study, Hay et al. 2000). For females, 50 % maturity was larger in the Zambezi/Chobe Rivers in six species and in the Okavango River in three species.

Van der Waal (1985) found larger minimum lengths at maturity in the Lake Liambezi for *S. intermedius* and *M. macrolepidotus* (both sexes) and for females of *Tilapia* *sparrmanii* and *Tilapia rendalli* compared to the present study. The males for the latter two species had a larger minimum length at maturity in the present study than recorded by Van der Waal (1985). Also both sexes for *H. odoe, O. macrochir* and *Clarias gariepinus* had a larger minimum length at maturity in the present study than recorded by Van der Waal (1985).

7.4.3 Life history and gill net selectivity for selected species

The 17 species selected for a more detailed data analysis, contributed to 93 % of the biomass of fish caught with gill nets and 56 % of the biomass of the fish caught with other gears. These species represented a large variation in biology, distribution and sizes.

Pseudocrenilabrus philander were, in addition to being collected by the other gears, only targeted by the smaller meshed gill nets in the present study. Only five individuals were sampled with gill nets in the Okavango River (with the 22 mm mesh size, Hay et al. 2000), and no individuals were sampled with the gill nets in the Lake Liambezi (Van der Waal 1985). The small size and the preference for vegetated habitats makes this species prone to the subsistence fishery, and it was the most important species in numbers in the subsistence fishery in the Okavango River (Hay et al. 2000).

P. acuticeps were caught both with gill nets and other gears. This was not the case in the Okavango River, where only the other gears targeted this species (Hay et al. 2000). Although not very important in the gill net catches, it was the sixth most important species in numbers listed in the subsistence fishery in the Okavango River (Hay et al. 2000). Van der Waal (1985) documented that this species was regularly sampled with small seine nets in the Lake Liambezi, however, no specimens were reported from the commercial gill net catches in the Caprivi (Van der Waal 1990).

T. sparrmanii were frequently sampled both in the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). This is a small cichlid, with the majority of specimens caught with other gears than gill nets. The reason for the majority of catches with other gears can also be linked to the preference for vegetated habitats, which were frequently sampled with the other gears. Larger individuals were sampled with gill nets. Van der Waal (1990) recorded low experimental gill net catches of this species from the Zambezi/Chobe Rivers and the Lake Liambezi, with no records from the commercial gill net catches. The gill net efficiency in the present study differed from that of the Okavango River, where the 35 mm mesh caught the highest number and weight per unit effort. In the present study, the highest catch per unit effort measured as numbers of fish caught and weight was recorded with the 28 and 57 mm mesh, respectively.

Few *T. rendalli* were recorded with the gill nets both in the Zambezi/Chobe and Okavango Rivers, whereas large catches were recorded with other gears (this study, Hay et al. 2000). This is probably due to their habitat preference for vegetated habitats and the difficulty in setting gill nets in such habitats. Also, this species is known to avoid gillnets, resulting in an underestimate of the abundance (Kenmuir 1984). *T. rendalli* played an important role in the commercial catches in the Lake Liambezi, the Linyanti swamp and the Chobe River (Van der Waal 1990). It is still an important species in the subsistence fishery in the area, when considering the abundance in the Katima Mulilo fish market (pers. obs.). In the Okavango Delta, it constituted 11 % of the commercial catches in weight (Mosepele 2000).

O. macrochir were rarely caught with the gill nets. However, large numbers were recorded with the other gears both in the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). This species, together with *O. andersonii*, dominated the commercial gill net catches in the Lake Liambezi, the Zambezi River and the Linyanti swamp, but were lower in the Chobe River (Van der Waal 1990). Low but regular catches have also been recorded from the Lake Kariba since 1975 (Karenge and Kolding 1995).

Barbus poechii were regularly sampled both with gill nets and other gears in the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). Van der Waal (1990) reported a similar abundance in numbers in gill net catches for this species from the Caprivi, with slightly higher percentages for the Chobe and Kwando Rivers. Although abundantly sampled with experimental gear, it has not been recorded from the commercial catches in the Lake Liambezi (Grobler 1987, Van der Waal 1990). Merron and Bruton (1988) reported it to be a shoaling species commonly caught in small mesh gill nets and an important species in the commercial and artisanal fishery in the Okavango Delta.

Barbus paludinosus is a small species with a maximum length of 10.5 cm. Due to the small size, the majority of the fish were caught with other gears than gill nets both in the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). This species is capable of withstanding large environmental fluctuations and can dominate pool habitats during the receding phase of the flood cycle (Van der Waal 1996). The small size prevented it from being caught by the commercial fishery in the Lake Liambezi (Grobler 1987, Van der Waal 1990).

Barbus unitaeniatus is a small species, targeted mainly with other gears than gill nets in the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). It has never been recorded as an important species in the commercial or subsistence fishery either in the Caprivi (Van der Waal 1990) or in the Okavango River (Hay et al. 2000, Merron and Bruton 1988), although traditional gears may target the species.

In contrast to the smaller cyprinids, *M. macrolepidotus* were seldom sampled with other gears than gill nets. This was also the tendency in the Caprivi surveys of Van der Waal (1990). Grobler (1987) reported *M. macrolepidotus* to be the most common species caught by gill nets in the Lake Liambezi. The nocturnal and shoaling behaviour of this species may contribute to the large catches with gill nets. A smaller minimum length at maturity was recorded from the Zambezi/Chobe Rivers than from the Okavango River, which was also the case for the length at 50 % maturity (this study, Hay et al. 2000). The smallest mesh size that caught equal or larger fish than the minimum length at maturity was 28 mm in the Zambezi/Chobe Rivers, in contrast to 45 mm in the Okavango River (Hay et al. 2000). *M. macrolepidotus* forms the major prey for *C. gariepinus, Clarias ngamensis* and *H. vittatus* in the panhandle in the Okavango Delta during the low water period (Merron and Bruton 1988).

Similar to *M. macrolepidotus*, *P. catostoma* were seldom caught with other gears than gill nets. This was also the situation in the Okavango River (Hay et al. 2000) and in the Okavango Delta (Merron and Bruton 1988). According to Van der Waal (1990), lower catches were recorded from the Zambezi/Chobe Rivers than from the Lake Liambezi. The most effective gill net mesh size in number of fish caught differed between the Zambezi/Chobe (28 mm) and Okavango Rivers (22 mm), whereas the most effective mesh size in weight was similar (28 mm) (this study, Hay et al. 2000). A smaller mesh size in the Zambezi/Chobe Rivers (28 mm) than in the Okavango River (35 mm) caught individuals equal to or larger than the minimum size at maturity.

Although *M. acutidens* was the fourteenth and eleventh most important species recorded with gill nets and other gears, respectively, it contributed to a large number of individuals in the total catch in the Zambezi/Chobe Rivers. In contrast, only eight individuals were collected with gill nets in the Okavango River (Hay et al. 2000). Recognised as a riverine species, no individuals were recorded from the Lake Liambezi (Grobler 1987, Van der Waal 1990), and very few individuals from the Okavango Delta (Merron and Bruton 1988). Similarly, it was not recorded in gill net catches in the Lake Lisikili in the present study, and only a few specimens were caught with other gears. Van der Waal (1990) listed it as one of the species exclusively sampled with traditional gear by the subsistence fishermen, and not with gill nets. It was also listed as the fifth most important species in numbers in the subsistence fishery in the Okavango River (Hay et al. 2000).

H. vittatus was important both in the gill net catches and in the catches with other gears in both the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). It was also the third most important species (according to IRI) caught during a fishing competition held in the Zambezi River (Næsje et al. 2001). The most effective gill net mesh size differed between the Zambezi/Chobe and Okavango Rivers, both measured as number of fish caught (35 mm in the Zambezi/Chobe, 28 mm in the Okavango) and weight (45 mm in the Zambezi/Chobe, 93 mm in the Okavango) (this study, Hay et al. 2000). The smallest mesh size that most effectively caught specimens equal to or larger than the minimum length at maturity was 57 mm for the Zambezi/Chobe Rivers and 45 mm for the Okavango River (this study, Hay et al. 2000). Minimum length at maturity was larger for the males and smaller for the females in the Zambezi/Chobe Rivers compared to the Okavango River (this study, Hay et al. 2000). The length at 50 % maturity was larger for the males and approximately similar for the females in the Zambezi/Chobe compared to in the Okavango River. Very low catches of *H. vittatus* were recorded from the Lake Liambezi, both in the commercial and experimental gill nets (Van der Waal 1990). The dense vegetation in the lake probably limited the number of *H. vittatus* entering the lake. This habitat preference is also highlighted by Merron and Bruton (1988) for the Okavango Delta, who it reported that *H. vittatus* prefer permanent, deep flowing water bodies.

B. lateralis was the most important species in the gill net catches and the tenth most important in the other gears in the Zambezi/Chobe Rivers. Although not as abundant as in the Zambezi/Chobe Rivers, it was frequently sampled in the Okavango River in all gear types (Hay et al. 2000). The 22 mm and 28 mm gill net mesh sizes recorded the bulk of the catch in both the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). The largest mesh size in which this species was recorded, was 57 mm. *B. lateralis* were not recorded in the commercial catches in the Lake Liambezi, probably due to the large mesh sizes used (Grobler 1987, Van der Waal 1990). No individuals were caught in the commercial catches in the Okavango Delta, and relatively low numbers were caught with the Nordic experimental gill nets (Mosepele 2000). The males in the Zambezi/Chobe Rivers had a larger minimum length at maturity than in the Okavango River, whereas females had a smaller minimum length at maturity (this study, Hay et al. 2000).

The majority of *S. intermedius* were caught with gill nets both in the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). It was the second most important species caught with gill nets in the Zambezi/Chobe Rivers, and the most important in the Okavango River (this study, Hay et al. 2000). Van der Waal (1990) reported low catches of this species in the commercial fishery in the Lake Liambezi, in contrast to the high gill net catches with experimental gill nets. High catches were also recorded from the Zambezi and Chobe Rivers (Van der Waal 1990). Merron and Bruton (1988) stated that this species was underexploited in the Okavango Delta and recommended the use of small mesh gill nets to increase the annual yield. Kenmuir (1984) reported that *S. intermedius* was uncommon in early catches at Lakeside in the Lake Kariba. Although still low in numbers, the catches in the Lake Kariba have increased slightly since 1965 (Karenge and Kolding 1995). In the Zambezi/Chobe Rivers, the 35 mm mesh size recorded the largest number of fish per setting, compared to the 28 mm for the Okavango River (this study, Hay et al. 2000). Mean sizes of fish recorded with these mesh sizes were smaller than the minimum length at maturity. The highest catches in weight were in the 45 mm mesh size in the Zambezi/Chobe Rivers and in the 57 mm mesh size in the Okavango River (this study, Hay et al. 2000). Fish lengths sampled with these mesh sizes were larger than the minimum length at maturity. The minimum length at maturity for both sexes was smaller in the Zambezi/Chobe Rivers than in the Okavango River (this study, Hay et al. 2000).

A. johnstoni were not recorded with gill nets due to their small size either in the Zambezi/Chobe or Okavango Rivers (this study, Hay et al. 2000). Large numbers were recorded in the other gears than gill nets, but the weight contribution was small (this study, Hay et al. 2000). *A. johnstoni* is a species that prefers vegetated habitats and is also sampled in shallow areas.

C. gariepinus was the eighth most important species in the gill net catches in the present study. The total number caught was usually low, but individuals collected were large. Weight and frequency were the two factors contributing to the high IRI score. This was also the situation in the Okavango River (Hay et al. 2000). *C. gariepinus* has a wide habitat tolerance, increasing the frequency of collection. *C. gariepinus* had the highest IRI for the catches with multifilament research nets (50-125 mm) in the Okavango Delta (Mosepele 2000). The minimum length at maturity was larger for the males and smaller for the females in the Zambezi/Chobe Rivers compared to in the Okavango River (this study, Hay et al. 2000). The minimum length at maturity was smaller for both sexes in the Lake Liambezi than in the present study (Van der Waal 1985).

The majority of *H. odoe* were caught with gill nets both in the Zambezi/Chobe and Okavango Rivers (this study, Hay et al. 2000). This species was also recorded in the Lake Liambezi, being an important species in the commercial fishery (Grobler 1987, Van der Waal 1985, 1990). The 35 mm and the 57 mm mesh sizes were the most effective gill nets both in the Zambezi/Chobe and Okavango Rivers. Minimum lengths at maturity were smaller in the Zambezi/Chobe System than in the Okavango River (this study, Hay et al. 2000), whereas the minimum lengths at maturity were even smaller in the Lake Liambezi (Van der Waal 1985).

Four of the 17 selected species had bimodal gill net selectivity curves. These were *H. vittatus, S. intermedius, C. gariepinus* and *H. odoe.* Bimodal selection curves can be seen for species that are caught in gill nets by different mechanisms than being gilled, such as being entangled by their spines or teeth. *H. vittatus* and *H. odoe* often get caught by their teeth when they touch the net or attack entangled fish in the gill nets. *S. intermedius* and *C. gariepinus* are regularly entangled in the nets due to their spines.

The most efficient gill net mesh sizes in terms of weight of fish caught in the Zambezi/Chobe Rivers was similar to the results from the Okavango River for the 14 species in which comparable data exist (Hay et al. 2000). For seven species in the Zambezi/Chobe Rivers, the most efficient mesh size was the same as found in the Okavango River, whereas three species had a smaller most efficient mesh size and four had a larger most effective mesh size in the Zambezi/Chobe Rivers. When measured as number of fish caught, the most efficient mesh size was the same as found in the Okavango River for six species, smaller for four species and larger for four species. The mean length of species caught in gill nets was also very similar to the results from the Okavango River. Of 14 species, one had a similar mean length, seven had smaller mean lengths, and six had larger mean lengths compared to in the Okavango River (Hay et al. 2000).

7.5 Catch per unit effort

7.5.1 Catch per unit effort at different stations

The Lake Lisikili survey station showed the highest catch per unit effort, both measured as number of fish caught and weight. *B. lateralis* and *P. catostoma* were the two species responsible for the high number and weight recorded at this station. The Lake Lisikili resembles a large backwater habitat that most likely increases the productivity of the area. The lake is also intensively harvested by the subsistence fishery. The lowest catch per unit effort, both in number and weight, was at Katima Mulilo, where the main stream habitat dominates. Main stream habitats are usually less productive than backwater and floodplain habitats.

In general, there were large variations in the catch per unit effort among the stations, both when measured as number of fish caught and weight. Many factors may affect the catch per unit effort, such as water discharge, vegetation, depth, the extent to adjacent floodplains, backwaters, bottom substrate, time of the year and other factors that may affect movements and habitat utilisation of the fish. Many factors may, therefore, explain differences among stations (se also section 7.5.3).

7.5.2 Catch per unit effort in different mesh sizes

The catch per unit effort decreased with an increasing mesh size. A drastic decrease was seen from the 28 mm to the 35 mm mesh size. This can partly be explained by the decrease in the catchability of *B. lateralis* between these two mesh sizes.

A similar tendency is found when considering the catch per unit effort in weight. The only exception was the 22 mm, which had a relatively low value. This matched the results from the unexploited station Kwetze in the Okavango River (Hay et al. 2000).

7.5.3 Catch per unit effort in different habitats

The results did not show an unambiguous relationship between the catch per unit effort, habitat (mainstream *versus* backwater) and water level (low water *versus* high water). Statistical analyses were carried out in all cases where comparable data for all mesh sizes existed, separating the effects of station, habitat and water level. Furthermore, comparisons were made for small mesh sizes (22 to 35 mm) and large mesh sizes (45 to 73 mm) separately, and for catch per unit effort measured in numbers and weight, separately. Backwaters had in all cases a significantly higher catch per unit effort than the mainstream - or no differences between backwaters and the mainstream were found. Regarding high and low water, no particular pattern were found; the catch per unit effort was significantly higher during low water, significantly higher during high water or no differences were found in approximately an equal number of cases.

7.6 Conclusion

The Upper Zambezi is the part of the entire Zambezi system that is the least influenced by man (Jackson 1986). Fishery and overgrazing of floodplains in the Eastern Caprivi are possibly the activities with the highest impact on the environment and fish community. Pollution in the area is negligible, and large-scale development and urbanisation is not noticeable. The Namibian part of the Okavango River is, in contrast, a more densely populated area with a higher fishing intensity, and the fish populations seemed influenced by this at the most densely populated sampling stations (Hay et al. 2000). This may also be the reason for the occurrence of very large individuals of some fish species in the Zambezi/Chobe Rivers, which were absent in the Okavango River surveys (Hay et al. 2000).

Generally, the fish fauna in the Zambezi/Chobe and Okavango Rivers showed great similarities, and there is a large overlap in the distribution of species between the rivers (this study, Hay et al. 2000). Similarity indexes for Namibia's perennial rivers have been calculated, and the highest index (0.86) was found for the Okavango/Zambezi comparison (Hay et al. 1999). The distribution of species provides evidence for past drainage connections between the Okavango and the Upper Zambezi basins, and some of these connections occurred relatively recently (Skelton 1993).

The complex history and development of the Zambezi system has produced a fairly rich fish fauna. With almost 160 species, it is about the third largest riverine fish community in Africa (Jackson 1986). The complex and diverse nature of the fish fauna in the Namibian part of the Upper Zambezi has been revealed through the present surveys. However, detailed knowledge on the biology and behaviour of most of the species are still lacking.

Basic information on life history, reproduction, movements, habitat preferences and habitat utilisation of target species is needed to give recommendations on the management of fisheries in neighbouring countries, and to evaluate the possible benefits of nature reserves and sanctuaries. Any changes to the flood regime caused by factors such as water abstraction, impoundment, canalization and construction of roads on the floodplains can have a serious negative effect on the functioning of the floodplain system. The Upper Zambezi is presently still relatively undisturbed by human impacts. For that reason alone, this system should be better studied to provide a baseline for future manipulations, as pointed out by Van der Waal (1996).

8 References

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9 Appendix

Appendix 1. *Scientific, common names (English) and local names (in Caprivi, after J. Purvis unpublished) of species caught during the surveys in the Zambezi and Chobe Rivers in 1997 to 2000 classified by family.*

Family number	Family	Species: Latin name	Species: English name	Species: Local name
1	**Cyprinidae**	*Barbus afrovernayi*	Spottail barb	
	(barbs, yellowfish,	*Barbus barnardi*	Blackback barb	Mbala
	labeos)	*Barbus barotseensis*	Barotse barb	Linyonga
		Barbus bifrenatus	Hyphen barb	Mbala
		Barbus codringtonii	Upper Zambezi yellowfish	Ljungwe
		Barbus eutaenia	Orangefin barb	
		Barbus fasciolatus	Red barb	Linyonga
		Barbus haasianus	Sickle-fin barb	
		Barbus kerstenii	Redspot barb	Linyonga
		Barbus multilineatus	Copperstripe barb	
		Barbus paludinosus	Straightfin barb	Linyonga
		Barbus poechii	Dashtail barb	Ijungwe
		Barbus radiatus	Beira barb	Liminolale
		Barbus thamalakanensis	Thamalakane barb	
		Barbus unitaeniatus	Longbeard barb	Linyonga
		Coptostomabarbus wittei	Upjaw barb	
		Labeo cylindricus	Redeye labeo	Linyonga
		Labeo lunatus	Upper Zambezi labeo	Linyonga
		Mesobola brevianalis	River sardine	Mbala
		Opsaridium zambezense	Barred minnow	Mbala
2	**Distichodontidae**	*Hemigrammocharax machadoi*	Dwarf citharine	
	(citharines)	*Hemigrammoch. multifasciatus*	Multibar citharine	
		Nannocharax macropterus	Broadbar citharine	
3	**Characidae**	*Brycinus lateralis*	Striped robber	Mbala
	(characins)	*Hydrocynus vittatus*	Tigerfish	Ngweshi
		Micralestes acutidens	Silver robber	Mbala
		Rhabdalestes maunensis	Slender robber	Mbala
4	**Mormyridae**	*Hippopotamyrus ansorgii*	Slender stonebasher	Ninga
	(snoutfishes)	*Marcusenius macrolepidotus*	Bulldog	Nembele
		Mormyrus lacerda	Western bottlenose	Ndikusi
		Petrocephalus catostoma	Churchill	Ninga/Kupandula
		Pollimyrus castelnaui	Dwarf stonebasher	Ninga
		Hippotamyrus discorhynchus	Zambezi parrotfish	Sakulo
5	**Hepsetidae** (African pike)	*Hepsetus odoe*	African pike	Mwelu
6	**Amphiliidae** (mountain catfish)	*Leptoglanis cf dorae*	Chobe sand catlet	
7	**Schilbeidae** (butter catfishes)	*Schilbe intermedius*	Silver catfish	Lubango
8	**Clariidae** (air-breathing catfish)	*Clariallabes platyprosopos*	Broadhead catfish	Ndombe-Nenge/Silutupuri
		Clarias gariepinus	Sharptooth catfish	Ndombe-Mbundamusheke/ Mangwana
		Clarias ngamensis	Blunttooth catfish	Ndombe-Stama/Nkoma
		Clarias stappersii	Blotched catfish	Lihwetete/Ndombe-Mabbozwa

Appendix 1. *Continued.*

Family number	Family	Species: Latin name	English name	Local name
		Clarias theodorae	Snake catfish	Kaminga/Ndombe-Kakokwe
9	**Mochokidae** (squeakers, suckermouth catlets)	*Chiloglanis fasciatus*	Okavango suckermouth	
		Chiloglanis neumanni	Neumann's suckermouth	
		Synodontis spp.	Squeakers	Singongi
		Synodontis nigromaculatus	Spotted squeaker	
10	**Cyprinodontidae** (topminnows)	*Aplocheilichthys hutereaui*	Meshscaled topminnow	
		Aplocheilichthys johnstoni	Johnston's topminnow	
		Aplocheilichthys katangae	Striped topminnow	
11	**Cichlidae** (cichlids)	*Hemichromis elongatus*	Banded jewelfish	Liulyungu
		Oreochromis andersonii	Threespot tilapia	Njinji
		Oreochromis macrochir	Greenhead tilapia	Imu
		Pharyngochromis acuticeps	Zambezi happy	
		Pseudocrenilabrus philander	Southern mouthbrooder	Kambanda
		Serranochromis altus	Humpback largemouth	Mushuna (Naluca)
		Serranochromis angusticeps	Thinface largemouth	Mushuna
		Serranochromis longimanus	Longfin largemouth	
		Serranochromis macrocephalus	Purpleface largemouth	Ngenga
		Serranochromis robustus	Nembwe	Nembwe
		Serranochromis thumbergi	Brownspot largemouth	Ngenga
		Sargochromis carlottae	Rainbow happy	Imbuma (Mbuma)
		Sargochromis codringtonii	Green happy	Imbuma
		Sargochromis giardi	Pink happy	Siyeo
		Tilapia rendalli	Redbreast tilapia	Mbufu
		Tilapia ruweti	Okavango tilapia	
		Tilapia sparrmanii	Banded tilapia	Situhu
12	**Anabantidae** (labyrinth fishes)	*Microctenopoma intermedium*	Blackspot climbing perch	Singulungwe
		Ctenopoma multispine	Manyspined climbing perch	
13	**Mastacembelidae** (spiny eels)	*Aethiomastacembelus frenatus*	Longtail spiny eel	Musiaka
		Aethiomastacembelus vanderwaali	Ocellated spiny eel	
14	**Claroteidae**	*Parauchenoglanis ngamensis*	Zambezi grunter	Siabela

***Appendix 2a**. Total catches (N) from the surveys with gill nets, standard nordic series and other gears at the different stations in the Zambezi and Chobe Rivers in 1997 to 2000. Included are also fish sampled during a fishing competition in the Zambezi River in 2000.*

Family	*Species*	Station					Fishing gears				Total N
		Katima	Lisikili	Kalimbeza	Impalila	Kabula	Gill net	Other gears	Nordic	Fish comp.	
Cyprinidae											
	Barbus afrovernayi	24	35	30	33	6	0	128	0	0	128
	Barbus barnardi	11	7	242	8	49	0	292	25	0	317
	Barbus barotseensis	114	1	154	3	0	0	219	53	0	272
	Barbus bifrenatus	104	212	160	30	6	0	457	55	0	512
	Barbus codringtonii	1	0	0	0	0	0	1	0	0	1
	Barbus cf. *eutaenia*	36	0	67	8	1	1	109	2	0	112
	Barbus fasciolatus	23	0	46	18	0	0	61	26	0	87
	Barbus haasianus	0	59	22	126	11	0	218	0	0	218
	Barbus kerstenii	0	0	2	0	0	0	2	0	0	2
	Barbus multilineatus	14	24	120	57	18	0	233	0	0	233
	Barbus paludinosus	554	208	721	44	131	152	1445	61	0	1658
	Barbus poechii	424	260	1034	297	438	1246	602	605	0	2453
	Barbus radiatus	58	104	830	70	28	59	303	728	0	1090
	Barbus thamalakanensis	151	9	52	14	3	0	224	5	0	229
	Barbus unitaeniatus	314	263	182	79	1	7	660	172	0	839
	Coptostomabarbus wittei	0	72	96	42	14	0	224	0	0	224
	Labeo cylindricus	463	25	9	9	2	27	477	4	0	508
	Labeo lunatus	10	14	48	0	1	43	4	26	0	73
	Mesobola brevianalis	2	0	0	5	0	0	7	0	0	7
	Opsaridium zambezense	68	0	118	0	0	8	178	0	0	186
Distichodontidae											
	Hemigrammocharax machadoi	0	8	11	92	86	0	197	0	0	197
	Hemigrammoch. multifasciatus	52	11	77	23	2	0	165	0	0	165
	Nannocharax macropterus	0	0	2	0	0	0	2	0	0	2
Characidae											
	Brycinus lateralis	3103	4590	6663	2755	6629	20672	649	2419	0	23740
	Hydrocynus vittatus	164	130	713	159	24	1074	77	39	40	1230
	Micralestes acutidens	1117	38	864	88	0	387	1404	316	0	2107
	Rhabdalestes maunensis	2	366	149	56	17	0	493	97	0	590
Mormyridae											
	Hippopotamyrus ansorgii	8	0	1	0	0	1	8	0	0	9
	Marcusenius macrolepidotus	39	1081	529	1086	1008	3531	34	178	0	3743
	Mormyrus lacerda	1	7	2	0	9	7	10	2	0	19
	Petrocephalus catostoma	53	3145	543	1743	18	4758	26	718	0	5502
	Pollimyrus castelnaui	3	114	28	19	10	126	46	2	0	174
	Hippotamyrus discorhynchus	39	16	2	21	0	58	15	5	0	78
Hepsetidae											
	Hepsetus odoe	21	69	88	20	177	322	39	14	0	375
Claroteidae											
	Parauchenoglanis ngamensis	28	0	18	9	7	17	23	22	0	62
Amphiliidae											
	Leptoglanis cf. *dorae*	1	0	1	0	0	0	2	0	0	2
Schilbeidae											
	Schilbe intermedius	612	677	1530	491	863	3817	150	206	0	4173
Clariidae											
	Clariallabes platyprosopos	21	0	0	0	0	0	21	0	0	21
	Clarias gariepinus	6	22	35	14	63	105	34	1	99	239

Appendix 2a.*Continued*

Family	*Species*	Station					Fishing gears				Total N
		Katima	Lisikili	Kalimbeza	Impalila	Kabula	Gill net	Other gears	Nordic	Fish comp.	
	Clarias ngamensis	1	15	6	8	53	10	73	0	0	83
	Clarias stappersii	1	0	0	0	0	0	1	0	0	1
	Clarias theodorae	11	8	85	4	11	11	108	0	0	119
Mochokidae											
	Chiloglanis fasciatus	0	0	6	0	0	0	6	0	0	6
	Chiloglanis neumanni	1	0	0	0	0	0	1	0	0	1
	Synodontis spp.	2152	868	1332	54	768	1573	2654	947	34	5208
	Synodontis nigromaculatus	4	2	20	5	2	14	0	19	71	104
Cyprinodontidae											
	Aplocheilichthys hutereaui	0	75	3	2	6	0	86	0	0	86
	Aplocheilichthys johnstoni	6	86	187	281	85	0	645	0	0	645
	Aplocheilichthys katangae	0	5	13	76	9	0	103	0	0	103
Ciclidae											
	Cichlidae spp.	0	1	16	0	0	0	1	16	0	17
	Hemichromis elongatus	55	198	82	0	5	176	164	0	0	340
	Oreochromis andersonii	2	35	10	3	39	13	76	0	34	123
	Oreochromis macrochir	11	902	33	56	110	16	1095	1	13	1125
	Pharyngochromis acuticeps	493	214	492	28	493	680	905	135	0	1720
	Pseudocrenilabrus philander	130	236	134	181	292	89	882	2	0	973
	Serranochromis altus	0	2	5	0	12	16	3	0	21	40
	Serranochromis angusticeps	0	6	8	0	9	18	4	1	4	27
	Serranochromis longimanus	0	3	12	0	35	47	3	0	0	50
	Serranochromis macrocephalus	5	19	35	9	65	76	32	25	0	133
	Serranochromis robustus	11	3	10	7	20	20	29	2	187	238
	Serranochromis thumbergi	3	0	0	3	1	0	7	0	1	8
	Sargochromis carlottae	1	20	15	2	35	56	13	4	0	73
	Sargochromis codringtonii	0	15	19	0	3	21	7	9	5	42
	Sargochromis giardi	0	0	0	0	0	0	0	0	21	21
	Tilapia rendalli	259	520	119	58	170	16	1106	4	32	1158
	Tilapia ruweti	1	47	23	176	21	3	264	1	0	268
	Tilapia sparrmanii	389	862	578	168	366	557	1748	58	0	2363
Anabantidae											
	Microctenopoma intermedium	0	3	0	5	2	0	10	0	0	10
	Ctenopoma multispine	0	27	64	32	34	22	135	0	0	157
Mastacembelidae											
	Aethiomastacembelus frenatus	1	3	4	0	0	0	8	0	0	8
	Aethiomastacemb. vanderwaali	48	0	0	0	0	0	48	0	0	48
Sum		**11226**	**15742**	**18500**	**8577**	**12268**	**39852**	**19456**	**7005**	**562**	**66875**

***Appendix 2b**. Mean, minimum, and maximum length (mm) for all species caught with standard survey gill nets, Nordic gill nets and other gears in the Zambezi and Chobe Rivers in 1997 to 2000. Included are also the fish sampled during the fising competition in the Zambezi River in 2000. N = total number of fish caught. Percent = percent of total catch.*

Family	Species	Mean length	Min.	Max.	N	Percent
Cyprinidae	*Barbus afrovernayi*	28.5	12	51	114	0.31
	Barbus barnardi	31.3	18	62	226	0.61
	Barbus barotseensis	31.7	21	48	182	0.49
	Barbus bifrenatus	34.6	21	57	314	0.85
	Barbus codringtonii	105.0	105	105	1	0.00
	Barbus cf. *eutaenia*	37.5	28	54	95	0.26
	Barbus fasciolatus	33.8	22	50	79	0.21
	Barbus haasianus	17.9	13	30	104	0.28
	Barbus kerstenii	0.0			0	0.00
	Barbus multilineatus	25.0	18	50	132	0.36
	Barbus paludinosis	50.6	19	105	713	1.94
	Barbus poechii	73.6	30	125	1805	4.90
	Barbus radiatus	44.8	22	90	723	1.96
	Barbus thamalakanensis	31.4	20	43	114	0.31
	Barbus unitaeniatus	43.6	25	95	390	1.06
	Coptostomabarbus wittei	18.5	11	33	62	0.17
	Labeo cylindricus	76.2	40	140	278	0.75
	Labeo lunatus	181.2	140	260	60	0.16
	Mesobola brevianalis	22.9	20	26	7	0.02
	Opsaridium zambezense	52.8	16	110	186	0.50
Distichodontidae	*Hemigrammocharax machadoi*	24.8	17	35	166	0.45
	Hemigrammoch. multifasciatus	32.5	23	50	112	0.30
	Nannocharax macropterus	28.0	28	28	2	0.01
Characidae	*Brycinus lateralis*	87.1	20	200	11428	31.03
	Hydrocynus vittatus	197.4	81	735	1061	2.88
	Micralestes acutidens	55.1	18	95	829	2.25
	Rhabdalestes maunensis	34.9	15	100	344	0.93
Mormyridae	*Hippopotamyrus ansorgii*	91.0	45	128	9	0.02
	Marcusenius macrolepidotus	109.6	35	210	1933	5.25
	Mormyrus lacerda	188.1	145	350	19	0.05
	Petrocephalus catostoma	77.9	42	140	1737	4.72
	Pollimyrus castelnaui	65.5	20	190	128	0.35
	Hippotamyrus discorhynchus	90.0	58	140	78	0.21
Hepsetidae	*Hepsetus odoe*	219.1	36	360	373	1.01
	Parauchenoglanis ngamensis	164.7	67	273	52	0.14
Amphiliidae	*Leptoglanis* cf. *dorae*	28.5	27	30	2	0.01
Schilbeidae	*Schilbe intermedius*	142.4	20	350	3291	8.93
Clariidae	*Clariallabes platyprosopos*	140.0	60	352	21	0.06
	Clarias gariepinus	539.4	45	1040	197	0.53
	Clarias ngamensis	204.5	70	600	83	0.23
	Clarias stappersii	80.0	80	80	1	0.00
	Clarias theodorae	136.9	35	270	99	0.27
Mochokidae	*Chiloglanis fasciatus*	0.0			0	0.00
	Chiloglanis neumanni	30.0	30	30	1	0.00
	Synodontis spp.	97.5	30	270	2138	5.80
Cyprinodontidae	*Synodontis nigromaculatus*	197.2	110	273	101	0.27
	Aplocheilichthys hutereaui	21.2	12	28	32	0.09
	Aplocheilichthys johnstoni	27.2	15	48	472	1.28

***Appendix 2b**. Continued*

Family	Species	Mean length	Min.	Max.	N	Percent
Ciclidae	*Aplocheilichthys katangae*	23.9	13	35	98	0.27
	Cichlidae spp.	59.3	36	98	15	0.04
	Hemichromis elongatus	123.6	25	190	338	0.92
	Oreochromis andersonii	193.8	35	515	123	0.33
	Oreochromis macrochir	86.4	25	335	354	0.96
	Pharyngochromis acuticeps	84.1	14	170	1549	4.21
	Pseudocrenilabrus philander	45.3	13	105	803	2.18
	Serranochromis altus	298.8	92	535	40	0.11
	Serranochromis angusticeps	209.7	52	465	27	0.07
	Serranochromis longimanus	129.5	55	220	50	0.14
	Serranochromis macrocephalus	149.8	37	280	127	0.34
	Serranochromis robustus	371.1	40	502	238	0.65
	Serranochromis thumbergi	109.0	40	370	8	0.02
	Sargochromis carlottae	152.8	90	260	71	0.19
	Sargochromis codringtonii	168.4	70	300	40	0.11
	Sargochromis giardi	337.4	288	405	21	0.06
	Tilapia rendalli	69.3	15	370	781	2.12
	Tilapia ruweti	48.7	24	85	259	0.70
Anabantidae	*Tilapia sparrmanii*	74.9	18	200	1388	3.77
	Microctenopoma intermedium	40.7	25	62	7	0.02
Mastacembelidae	*Ctenopoma multispine*	87.8	30	260	151	0.41
	Aethiomastacembelus frenatus	190.8	78	255	4	0.01
Claroteidae	*Aethiomastacemb. vanderwaali*	116.0	75	200	48	0.13
	Total	**94.9**	**11**	**1040**	**36834**	**100.00**

Appendix 3*. The relative importance (IRI) of all species caught by gill nets and other gears at all stations combined in the Zambezi and Chobe Rivers in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition in 2000 are excluded. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to* ***Appendix 1****.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	21321	35.95	196.79	20.79	99	36.94	2096	38.97
7	*Schilbe intermedius*	3967	6.69	148.05	15.64	79	29.48	658	12.24
3	*Hydrocynus vittatus*	1151	1.94	140.32	14.82	51	19.03	319	5.93
9	*Synodontis* spp.	4227	7.13	32.72	3.46	78	29.10	308	5.73
11	*Tilapia sparrmanii*	2305	3.89	19.29	2.04	119	44.40	263	4.89
11	*Pharyngochromis acuticeps*	1585	2.67	16.89	1.78	151	56.34	251	4.67
4	*Marcusenius macrolepidotus*	3565	6.01	55.02	5.81	46	17.16	203	3.77
8	*Clarias gariepinus*	139	0.23	126.11	13.32	40	14.93	202	3.76
1	*Barbus poechii*	1848	3.12	14.02	1.48	112	41.79	192	3.57
4	*Petrocephalus catostoma*	4784	8.07	39.53	4.18	37	13.81	169	3.14
5	*Hepsetus odoe*	361	0.61	53.90	5.69	46	17.16	108	2.01
11	*Tilapia rendalli*	1122	1.89	6.56	0.69	102	38.06	98	1.83
11	*Pseudocrenilabrus philander*	971	1.64	2.11	0.22	106	39.55	74	1.37
3	*Micralestes acutidens*	1791	3.02	2.09	0.22	59	22.01	71	1.33
11	*Oreochromis macrochir*	1111	1.87	9.24	0.98	59	22.01	63	1.17
1	*Barbus paludinosus*	1597	2.69	2.62	0.28	54	20.15	60	1.11
11	*Hemichromis elongatus*	340	0.57	14.95	1.58	51	19.03	41	0.76
1	*Barbus unitaeniatus*	667	1.12	0.39	0.04	48	17.91	21	0.39
10	*Aplocheilichthys johnstoni*	645	1.09	0.09	0.01	48	17.91	20	0.37
11	*Serranochromis macrocephalus*	108	0.18	9.78	1.03	30	11.19	14	0.25
1	*Labeo cylindricus*	504	0.85	3.25	0.34	30	11.19	13	0.25
3	*Rhabdalestes maunensis*	493	0.83	0.17	0.02	37	13.81	12	0.22
1	*Barbus radiatus*	362	0.61	0.51	0.05	45	16.79	11	0.21
1	*Barbus bifrenatus*	457	0.77	0.20	0.02	37	13.81	11	0.20
8	*Clarias ngamensis*	83	0.14	11.15	1.18	22	8.21	11	0.20
11	*Oreochromis andersonii*	89	0.15	5.81	0.61	37	13.81	11	0.20
11	*Tilapia ruweti*	267	0.45	0.66	0.07	36	13.43	7	0.13
11	*Sargochromis carlottae*	69	0.12	4.92	0.52	25	9.33	6	0.11
11	*Serranochromis robustus*	49	0.08	4.42	0.47	28	10.45	6	0.11
12	*Ctenopoma multispine*	157	0.26	1.62	0.17	35	13.06	6	0.11
1	*Barbus barnardi*	292	0.49	0.07	0.01	26	9.70	5	0.09
4	*Pollimyrus castelnaui*	172	0.29	0.70	0.07	34	12.69	5	0.09
1	*Barbus multilineatus*	233	0.39	0.04	0.00	29	10.82	4	0.08
1	*Labeo lunatus*	47	0.08	4.63	0.49	19	7.09	4	0.07
8	*Clarias theodorae*	119	0.20	2.02	0.21	21	7.84	3	0.06
1	*Barbus barotseensis*	219	0.37	0.08	0.01	22	8.21	3	0.06
1	*Opsaridium zambezense*	186	0.31	0.39	0.04	23	8.58	3	0.06
1	*Barbus haasianus*	218	0.37	0.02	0.00	20	7.46	3	0.05
2	*Hemigrammoch. multifasciatus*	165	0.28	0.05	0.01	23	8.58	2	0.05
1	*Coptostomabarbus wittei*	224	0.38	0.02	0.00	17	6.34	2	0.04
1	*Barbus thamalakanensis*	224	0.38	0.10	0.01	15	5.60	2	0.04
2	*Hemigrammocharax machadoi*	197	0.33	0.03	0.00	17	6.34	2	0.04
1	*Barbus afrovernayi*	128	0.22	0.03	0.00	24	8.96	2	0.04
1	*Barbus* cf *eutaenia*	110	0.19	0.09	0.01	25	9.33	2	0.03
11	*Serranochromis longimanus*	50	0.08	1.83	0.19	17	6.34	2	0.03
11	*Serranochromis angusticeps*	22	0.04	2.24	0.24	13	4.85	1	0.02
10	*Aplocheilichthys katangae*	103	0.17	0.02	0.00	20	7.46	1	0.02
14	*Parauchenoglanis ngamensis*	40	0.07	2.07	0.22	12	4.48	1	0.02

***Appendix 3**. Continued*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
11	*Sargochromis codringtonii*	28	0.05	1.84	0.19	14	5.22	1	0.02
4	*Hippotamyrus discorhynchus*	73	0.12	0.87	0.09	14	5.22	1	0.02
11	*Serranochromis altus*	19	0.03	2.16	0.23	11	4.10	1	0.02
4	*Mormyrus lacerda*	17	0.03	1.49	0.16	9	3.36	1	0.01
9	*Synodontis nigromaculatus*	14	0.02	1.19	0.13	9	3.36	1	0.01
10	*Aplocheilichthys hutereaui*	86	0.15	0.01	0.00	8	2.99	0	0.01
8	*Clariallabes platyprosopos*	21	0.04	1.03	0.11	5	1.87	0	0.01
1	*Barbus fasciolatus*	61	0.10	0.02	0.00	5	1.87	0	0.00
13	*Aethiomastacemb. vanderwaali*	48	0.08	0.19	0.02	4	1.49	0	0.00
4	*Hippopotamyrus ansorgii*	9	0.02	0.09	0.01	5	1.87	0	0.00
13	*Aethiomastacembelus frenatus*	8	0.01	0.08	0.01	5	1.87	0	0.00
12	*Microctenopoma intermedium*	10	0.02	0.01	0.00	6	2.24	0	0.00
11	*Serranochromis thumbergi*	7	0.01	0.05	0.01	6	2.24	0	0.00
1	*Mesobola brevianalis*	7	0.01	0.00	0.00	2	0.75	0	0.00
9	*Chiloglanis fasciatus*	6	0.01	0.00	0.00	1	0.37	0	0.00
6	*Leptoglanis* cf *dorae*	2	0.00	0.00	0.00	2	0.75	0	0.00
1	*Barbus kerstenii*	2	0.00	0.00	0.00	1	0.37	0	0.00
1	*Barbus codringtonii*	1	0.00	0.02	0.00	1	0.37	0	0.00
2	*Nannocharax macropterus*	2	0.00	0.00	0.00	1	0.37	0	0.00
8	*Clarias stappersii*	1	0.00	0.01	0.00	1	0.37	0	0.00
11	Cichlidae sp.	1	0.00	0.00	0.00	1	0.37	0	0.00
9	*Chiloglanis neumanni*	1	0.00	0.00	0.00	1	0.37	0	0.00
	SUM	**59308**	**100**	**946.62**	**100**	**2236**	**0.00**	**5378**	**100**

***Appendix 4**. The relative importance (IRI) of all species caught in gill net surveys at all stations combined in the Zambezi and Chobe Rivers in the period 1997-2000. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	20672	51.9	193.86	23.2	355	23.7	1779	48.90
7	*Schilbe intermedius*	3817	9.6	145.95	17.4	478	31.9	862	23.70
3	*Hydrocynus vittatus*	1074	2.7	105.74	12.6	252	16.8	258	7.09
4	*Marcusenius macrolepidotus*	3531	8.9	54.32	6.5	210	14.0	215	5.92
4	*Petrocephalus catostoma*	4758	11.9	39.37	4.7	120	8.0	133	3.67
9	*Synodontis* spp.	1573	3.9	26.20	3.1	237	15.8	112	3.08
5	*Hepsetus odoe*	322	0.8	49.11	5.9	161	10.8	72	1.97
8	*Clarias gariepinus*	105	0.3	122.44	14.6	71	4.7	71	1.94
1	*Barbus poechii*	1246	3.1	12.54	1.5	170	11.4	53	1.44
11	*Pharyngochromis acuticeps*	680	1.7	12.17	1.5	158	10.6	33	0.92
11	*Tilapia sparrmanii*	557	1.4	11.57	1.4	144	9.6	27	0.73
11	*Hemichromis elongatus*	176	0.4	10.24	1.2	53	3.5	6	0.16
11	*Serranochromis macrocephalus*	76	0.2	9.19	1.1	54	3.6	5	0.13
3	*Micralestes acutidens*	387	1.0	1.84	0.2	37	2.5	3	0.08
11	*Sargochromis carlottae*	56	0.1	4.26	0.5	37	2.5	2	0.04
1	*Labeo lunatus*	43	0.1	4.41	0.5	28	1.9	1	0.03
1	*Barbus paludinosus*	152	0.4	0.88	0.1	28	1.9	1	0.02
4	*Pollimyrus castelnaui*	126	0.3	0.63	0.1	29	1.9	1	0.02
11	*Pseudocrenilabrus philander*	89	0.2	0.75	0.1	36	2.4	1	0.02
11	*Serranochromis longimanus*	47	0.1	1.79	0.2	31	2.1	1	0.02
8	*Clarias ngamensis*	10	0.0	7.25	0.9	10	0.7	1	0.02
11	*Serranochromis robustus*	20	0.1	3.24	0.4	15	1.0	0	0.01
1	*Barbus radiatus*	59	0.1	0.34	0.0	31	2.1	0	0.01
4	*Hippotamyrus discorhynchus*	58	0.1	0.81	0.1	24	1.6	0	0.01
11	*Serranochromis angusticeps*	18	0.0	1.99	0.2	16	1.1	0	0.01
11	*Oreochromis andersonii*	13	0.0	3.58	0.4	9	0.6	0	0.01
11	*Oreochromis macrochir*	16	0.0	2.10	0.3	14	0.9	0	0.01
11	*Serranochromis altus*	16	0.0	2.02	0.2	14	0.9	0	0.01
11	*Sargochromis codringtonii*	21	0.1	1.64	0.2	14	0.9	0	0.01
5	*Parauchenoglanis ngamensis*	17	0.0	1.67	0.2	13	0.9	0	0.01
11	*Tilapia rendalli*	16	0.0	1.31	0.2	14	0.9	0	0.01
9	*Synodontis nigromaculatus*	14	0.0	1.19	0.1	12	0.8	0	0.00
1	*Labeo cylindricus*	27	0.1	0.57	0.1	13	0.9	0	0.00
12	*Ctenopoma multispine*	22	0.1	0.56	0.1	11	0.7	0	0.00
8	*Clarias theodorae*	11	0.0	0.65	0.1	11	0.7	0	0.00
4	*Mormyrus lacerda*	7	0.0	0.94	0.1	7	0.5	0	0.00
1	*Barbus unitaeniatus*	7	0.0	0.05	0.0	7	0.5	0	0.00
1	*Opsaridium zambezense*	8	0.0	0.05	0.0	5	0.3	0	0.00
11	*Tilapia ruweti*	3	0.0	0.02	0.0	3	0.2	0	0.00
4	*Hippopotamyrus ansorgii*	1	0.0	0.02	0.0	1	0.1	0	0.00
1	*Barbus* cf *eutaenia*	1	0.0	0.002	0.0	1	0.1	0	0.00
	Sum	**39852**	**99.6**	**837.26**	**100**	**2934**	**196**	**3637**	**99.7**

Appendix 5. *The relative importance (IRI) of all species caught in surveys with other gears at all stations combined in the Zambezi and Chobe Rivers in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition are excluded. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to* ***Appendix 1****.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
11	*Tilapia sparrmanii*	1748	9.0	7.72	7.1	101	39.8	638	17.82
11	*Pharyngochromis acuticeps*	905	4.7	4.72	4.3	126	49.6	445	12.37
11	*Tilapia rendalli*	1106	5.7	5.25	4.8	96	37.8	396	10.86
9	*Synodontis* spp.	2654	13.6	6.53	6.0	37	14.6	286	7.96
11	*Oreochromis macrochir*	1095	5.6	7.14	6.5	50	19.7	239	6.49
11	*Pseudocrenilabrus philander*	882	4.5	1.36	1.2	100	39.4	227	6.24
3	*Hydrocynus vittatus*	77	0.4	34.57	31.6	14	5.5	176	4.79
1	*Barbus poechii*	602	3.1	1.48	1.4	83	32.7	145	4.04
1	*Barbus paludinosus*	1445	7.4	1.74	1.6	40	15.7	142	3.95
3	*Brycinus lateralis*	649	3.3	2.92	2.7	59	23.2	139	3.78
3	*Micralestes acutidens*	1404	7.2	0.25	0.2	42	16.5	123	3.42
11	*Hemichromis elongatus*	164	0.8	4.70	4.3	37	14.6	75	2.09
1	*Barbus unitaeniatus*	660	3.4	0.34	0.3	44	17.3	64	1.78
10	*Aplocheilichthys johnstoni*	645	3.3	0.09	0.1	48	18.9	64	1.74
1	*Labeo cylindricus*	477	2.5	2.68	2.5	22	8.7	42	1.20
3	*Rhabdalestes maunensis*	493	2.5	0.17	0.2	36	14.2	38	1.06
1	*Barbus bifrenatus*	457	2.3	0.20	0.2	37	14.6	37	1.00
7	*Schilbe intermedius*	150	0.8	2.09	1.9	33	13.0	35	1.00
11	*Oreochromis andersonii*	76	0.4	2.23	2.0	31	12.2	30	0.80
11	*Tilapia ruweti*	264	1.4	0.65	0.6	35	13.8	27	0.75
8	*Clarias ngamensis*	73	0.4	3.90	3.6	16	6.3	25	0.72
8	*Clarias gariepinus*	34	0.2	3.67	3.4	17	6.7	24	0.64
5	*Hepsetus odoe*	39	0.2	4.79	4.4	12	4.7	22	0.59
1	*Barbus radiatus*	303	1.6	0.17	0.2	31	12.2	21	0.57
12	*Ctenopoma multispine*	135	0.7	1.06	1.0	27	10.6	18	0.50
1	*Barbus barnardi*	292	1.5	0.07	0.1	26	10.2	16	0.44
1	*Barbus multilineatus*	233	1.2	0.04	0.0	29	11.4	14	0.38
8	*Clarias theodorae*	108	0.6	1.37	1.3	16	6.3	11	0.31
1	*Barbus barotseensis*	219	1.1	0.08	0.1	22	8.7	10	0.28
1	*Barbus haasianus*	218	1.1	0.02	0.0	20	7.9	9	0.24
1	*Opsaridium zambezense*	178	0.9	0.33	0.3	18	7.1	9	0.23
2	*Hemigrammoch. multifasciatus*	165	0.8	0.05	0.0	23	9.1	8	0.22
1	*Coptostomabarbus wittei*	224	1.2	0.02	0.0	17	6.7	8	0.21
11	*Serranochromis robustus*	29	0.1	1.18	1.1	16	6.3	8	0.21
2	*Hemigrammocharax machadoi*	197	1.0	0.03	0.0	18	7.1	7	0.20
1	*Barbus thamalakanensis*	224	1.2	0.10	0.1	15	5.9	7	0.19
1	*Barbus afrovernayi*	128	0.7	0.03	0.0	24	9.4	6	0.17
1	*Barbus* cf *eutaenia*	109	0.6	0.09	0.1	24	9.4	6	0.16
10	*Aplocheilichthys katangae*	103	0.5	0.02	0.0	20	7.9	4	0.12
11	*Serranochromis macrocephalus*	32	0.2	0.59	0.5	10	3.9	3	0.08
4	*Pollimyrus castelnaui*	46	0.2	0.07	0.1	19	7.5	2	0.06
4	*Marcusenius macrolepidotus*	34	0.2	0.70	0.6	6	2.4	2	0.06
8	*Clariallabes platyprosopos*	21	0.1	1.03	0.9	4	1.6	2	0.05
10	*Aplocheilichthys hutereaui*	86	0.4	0.01	0.0	8	3.1	1	0.04
11	*Sargochromis carlottae*	13	0.1	0.66	0.6	4	1.6	1	0.03
4	*Mormyrus lacerda*	10	0.1	0.56	0.5	3	1.2	1	0.02
1	*Barbus fasciolatus*	61	0.3	0.02	0.0	5	2.0	1	0.02
4	*Petrocephalus catostoma*	26	0.1	0.16	0.1	5	2.0	1	0.02

Appendix 5.*Continued*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
11	*Sargochromis codringtonii*	7	0.0	0.20	0.2	6	2.4	1	0.01
13	*Aethiomastacemb. vanderwaali*	48	0.2	0.19	0.2	3	1.2	0	0.01
11	*Serranochromis angusticeps*	4	0.0	0.25	0.2	4	1.6	0	0.01
5	*Parauchenoglanis ngamensis*	23	0.1	0.40	0.4	2	0.8	0	0.01
1	*Labeo lunatus*	4	0.0	0.21	0.2	3	1.2	0	0.01
13	*Aethiomastacembelus frenatus*	8	0.0	0.08	0.1	5	2.0	0	0.01
11	*Serranochromis thumbergi*	7	0.0	0.05	0.0	6	2.4	0	0.01
4	*Hippopotamyrus ansorgii*	8	0.0	0.07	0.1	4	1.6	0	0.00
12	*Microctenopoma intermedium*	10	0.1	0.01	0.0	6	2.4	0	0.00
11	*Serranochromis altus*	3	0.0	0.13	0.1	2	0.8	0	0.00
11	*Serranochromis longimanus*	3	0.0	0.04	0.0	3	1.2	0	0.00
4	*Hippotamyrus discorhynchus*	15	0.1	0.06	0.1	1	0.4	0	0.00
1	*Mesobola brevianalis*	7	0.0	0.00	0.0	2	0.8	0	0.00
9	*Chiloglanis fasciatus*	6	0.0	0.00	0.0	1	0.4	0	0.00
1	*Barbus codringtonii*	1	0.0	0.02	0.0	1	0.4	0	0.00
6	*Leptoglanis* cf *dorae*	2	0.0	0.00	0.0	2	0.8	0	0.00
1	*Barbus kerstenii*	2	0.0	0.00	0.0	1	0.4	0	0.00
2	*Nannocharax macropterus*	2	0.0	0.00	0.0	1	0.4	0	0.00
8	*Clarias stappersii*	1	0.0	0.01	0.0	1	0.4	0	0.00
11	Cichlidae sp.	1	0.0	0.00	0.0	1	0.4	0	0.00
9	*Chiloglanis neumanni*	1	0.0	0.00	0.0	1	0.4	0	0.00
	Sum	**19456**	**99.7**	**109.35**	**100**	**1582**	**100**	**3616**	**100**

***Appendix 6**. The relative importance (IRI) of all species caught in surveys with gill nets at the Katima Mulilo station in the period 1997-2000. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	2886	66.2	22.42	21.5	78	18.8	1652	51.90
7	*Schilbe intermedius*	597	13.7	30.30	29.1	81	19.6	837	26.30
3	*Hydrocynus vittatus*	138	3.2	26.85	25.8	73	17.6	511	16.04
1	*Barbus poechii*	214	4.9	2.74	2.6	43	10.4	78	2.46
3	*Micralestes acutidens*	288	6.6	1.32	1.3	23	5.6	44	1.37
5	*Hepsetus odoe*	21	0.5	5.30	5.1	18	4.4	24	0.76
9	*Synodontis* spp.	34	0.8	1.46	1.4	20	4.8	11	0.33
8	*Clarias gariepinus*	4	0.1	8.96	8.6	4	1.0	8	0.26
4	*Marcusenius macrolepidotus*	39	0.9	0.38	0.4	16	3.9	5	0.15
11	*Pharyngochromis acuticeps*	34	0.8	0.29	0.3	18	4.4	5	0.14
4	*Petrocephalus catostoma*	28	0.6	0.24	0.2	12	2.9	3	0.08
1	*Labeo lunatus*	10	0.2	0.98	0.9	8	1.9	2	0.07
4	*Hippotamyrus discorhynchus*	24	0.6	0.17	0.2	10	2.4	2	0.05
1	*Labeo cylindricus*	8	0.2	0.17	0.2	7	1.7	1	0.02
11	*Tilapia rendalli*	3	0.1	0.68	0.7	2	0.5	0	0.01
9	*Synodontis nigromaculatus*	3	0.1	0.42	0.4	3	0.7	0	0.01
1	*Barbus paludinosus*	6	0.1	0.03	0.0	6	1.5	0	0.01
11	*Tilapia sparrmanii*	5	0.1	0.10	0.1	4	1.0	0	0.01
5	*Parauchenoglanis ngamensis*	5	0.1	0.31	0.3	2	0.5	0	0.01
11	*Oreochromis macrochir*	1	0.0	0.60	0.6	1	0.2	0	0.00
11	*Serranochromis macrocephalus*	1	0.0	0.20	0.2	1	0.2	0	0.00
1	*Barbus radiatus*	3	0.1	0.02	0.0	2	0.5	0	0.00
11	*Sargochromis carlottae*	1	0.0	0.13	0.1	1	0.2	0	0.00
1	*Opsaridium zambezense*	2	0.1	0.02	0.0	2	0.5	0	0.00
11	*Hemichromis elongatus*	2	0.1	0.02	0.0	2	0.5	0	0.00
1	*Barbus unitaeniatus*	2	0.1	0.02	0.0	2	0.5	0	0.00
4	*Pollimyrus castelnaui*	1	0.0	0.00	0.0	1	0.2	0	0.00
11	*Pseudocrenilabrus philander*	1	0.0	0.00	0.0	1	0.2	0	0.00
1	*Barbus* cf *eutaenia*	1	0.0	0.00	0.0	1	0.2	0	0.00
	SUM	**4362**	**100**	**104.10**	**100**	**442**	**100**	**3184**	**100**

***Appendix 7**. The relative importance (IRI) of all species caught in surveys with gill nets in the Lake Lisikili in the period 1997-2000. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	4420	40.9	68.01	31.8	50	27.8	2017	42.00
4	*Petrocephalus catostoma*	3145	29.1	28.36	13.3	32	17.8	752	15.66
7	*Schilbe intermedius*	673	6.2	21.15	9.9	78	43.3	698	14.52
4	*Marcusenius macrolepidotus*	1077	10.0	29.60	13.8	50	27.8	661	13.75
9	*Synodontis* spp.	512	4.7	8.51	4.0	49	27.2	237	4.94
11	*Hemichromis elongatus*	143	1.3	8.45	4.0	33	18.3	97	2.01
5	*Hepsetus odoe*	65	0.6	7.89	3.7	33	18.3	79	1.64
11	*Pharyngochromis acuticeps*	129	1.2	3.37	1.6	35	19.4	54	1.12
11	*Tilapia sparrmanii*	96	0.9	2.91	1.4	43	23.9	54	1.12
8	*Clarias gariepinus*	11	0.1	15.61	7.3	11	6.1	45	0.94
3	*Hydrocynus vittatus*	130	1.2	4.09	1.9	26	14.4	45	0.94
1	*Barbus poechii*	121	1.1	1.89	0.9	26	14.4	29	0.60
4	*Pollimyrus castelnaui*	100	0.9	0.50	0.2	13	7.2	8	0.17
11	*Pseudocrenilabrus philander*	45	0.4	0.49	0.2	15	8.3	5	0.11
11	*Serranochromis macrocephalus*	13	0.1	1.92	0.9	9	5.0	5	0.11
11	*Sargochromis carlottae*	19	0.2	1.19	0.6	12	6.7	5	0.10
11	*Sargochromis codringtonii*	14	0.1	1.10	0.5	8	4.4	3	0.06
11	*Serranochromis angusticeps*	5	0.1	1.15	0.5	5	2.8	2	0.03
1	*Labeo lunatus*	14	0.1	0.99	0.5	4	2.2	1	0.03
4	*Mormyrus lacerda*	5	0.1	0.87	0.4	5	2.8	1	0.03
11	*Oreochromis andersonii*	3	0.0	1.13	0.5	3	1.7	1	0.02
8	*Clarias ngamensis*	2	0.0	1.67	0.8	2	1.1	1	0.02
1	*Labeo cylindricus*	17	0.2	0.37	0.2	4	2.2	1	0.02
4	*Hippotamyrus discorhynchus*	16	0.2	0.24	0.1	5	2.8	1	0.02
11	*Serranochromis altus*	2	0.0	1.35	0.6	2	1.1	1	0.02
1	*Barbus radiatus*	19	0.2	0.10	0.1	5	2.8	1	0.01
11	*Tilapia rendalli*	5	0.1	0.29	0.1	4	2.2	0	0.01
11	*Serranochromis longimanus*	3	0.0	0.30	0.1	3	1.7	0	0.01
8	*Clarias theodorae*	3	0.0	0.22	0.1	3	1.7	0	0.00
11	*Oreochromis macrochir*	3	0.0	0.19	0.1	2	1.1	0	0.00
1	*Barbus paludinosus*	3	0.0	0.03	0.0	3	1.7	0	0.00
1	*Barbus unitaeniatus*	3	0.0	0.02	0.0	3	1.7	0	0.00
9	*Synodontis nigromaculatus*	2	0.0	0.09	0.0	1	0.6	0	0.00
12	*Ctenopoma multispine*	1	0.0	0.01	0.0	1	0.6	0	0.00
	SUM	**10819**	**100**	**214.05**	**100**	**578**	**100**	**4803**	**100**

Appendix 8. *The relative importance (IRI) of all species caught in surveys with gill nets at the Kalimbeza station in the period 1997-2000. The IRI takes into account the number of individuals (No), weight (kg), and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to* ***Appendix 1***.

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	5483	57.6	56.91	23.6	95	26.5	2150	48.59
7	*Schilbe intermedius*	1288	13.5	51.09	21.2	113	31.5	1093	24.72
3	*Hydrocynus vittatus*	654	6.9	46.42	19.3	92	25.6	670	15.14
8	*Clarias gariepinus*	30	0.3	40.20	16.7	20	5.6	95	2.14
9	*Synodontis* spp.	280	2.9	5.77	2.4	62	17.3	92	2.08
1	*Barbus poechii*	444	4.7	4.91	2.0	44	12.3	82	1.86
4	*Marcusenius macrolepidotus*	353	3.7	4.71	2.0	52	14.5	82	1.85
5	*Hepsetus odoe*	63	0.7	11.43	4.7	42	11.7	63	1.43
11	*Pharyngochromis acuticeps*	132	1.4	1.83	0.8	45	12.5	27	0.61
4	*Petrocephalus catostoma*	221	2.3	1.83	0.8	30	8.4	26	0.58
11	*Tilapia sparrmanii*	194	2.0	3.27	1.4	25	7.0	24	0.53
1	*Labeo lunatus*	18	0.2	2.34	1.0	15	4.2	5	0.11
3	*Micralestes acutidens*	97	1.0	0.51	0.2	12	3.3	4	0.09
11	*Hemichromis elongatus*	26	0.3	1.45	0.6	14	3.9	3	0.08
1	*Barbus paludinosus*	118	1.2	0.67	0.3	8	2.2	3	0.08
11	*Serranochromis longimanus*	11	0.1	0.61	0.3	9	2.5	1	0.02
11	*Serranochromis macrocephalus*	5	0.1	0.75	0.3	5	1.4	1	0.01
11	*Serranochromis angusticeps*	6	0.1	0.56	0.2	5	1.4	0	0.01
11	*Serranochromis robustus*	3	0.0	1.10	0.5	3	0.8	0	0.01
1	*Barbus radiatus*	14	0.2	0.08	0.0	8	2.2	0	0.01
4	*Pollimyrus castelnaui*	15	0.2	0.06	0.0	7	2.0	0	0.01
12	*Ctenopoma multispine*	13	0.1	0.43	0.2	4	1.1	0	0.01
11	*Sargochromis carlottae*	5	0.1	0.36	0.2	5	1.4	0	0.01
11	*Tilapia rendalli*	5	0.1	0.30	0.1	5	1.4	0	0.01
11	*Pseudocrenilabrus philander*	10	0.1	0.10	0.0	5	1.4	0	0.00
8	*Clarias ngamensis*	1	0.0	1.70	0.7	1	0.3	0	0.00
11	*Sargochromis codringtonii*	4	0.0	0.41	0.2	3	0.8	0	0.00
9	*Synodontis nigromaculatus*	3	0.0	0.17	0.1	3	0.8	0	0.00
11	*Serranochromis altus*	4	0.0	0.13	0.1	3	0.8	0	0.00
5	*Parauchenoglanis ngamensis*	2	0.0	0.29	0.1	2	0.6	0	0.00
1	*Opsaridium zambezense*	6	0.1	0.04	0.0	3	0.8	0	0.00
11	*Oreochromis macrochir*	1	0.0	0.44	0.2	1	0.3	0	0.00
1	*Labeo cylindricus*	2	0.0	0.03	0.0	2	0.6	0	0.00
4	*Hippotamyrus discorhynchus*	2	0.0	0.02	0.0	2	0.6	0	0.00
1	*Barbus unitaeniatus*	2	0.0	0.02	0.0	2	0.6	0	0.00
4	*Hippopotamyrus ansorgii*	1	0.0	0.02	0.0	1	0.3	0	0.00
11	*Oreochromis andersonii*	1	0.0	0.01	0.0	1	0.3	0	0.00
	SUM	**9517**	**100**	**240.94**	**100**	**749**	**100**	**4424**	**100**

Appendix 9*. The relative importance (IRI) of all species caught in surveys with gill nets at the Impalila station in the period 1997-2000. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to* ***Appendix 1****.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	1610	32.7	17.9	14.3	70	22.9	1074	31.42
7	*Schilbe intermedius*	482	9.8	24.9	19.9	107	35.0	1038	30.36
4	*Marcusenius macrolepidotus*	1071	21.7	11.0	8.8	43	14.1	429	12.55
4	*Petrocephalus catostoma*	1347	27.3	8.9	7.1	35	11.4	394	11.52
3	*Hydrocynus vittatus*	128	2.6	26.8	21.4	49	16.0	384	11.24
8	*Clarias gariepinus*	13	0.3	21.4	17.1	10	3.3	57	1.66
1	*Barbus poechii*	170	3.5	0.9	0.7	10	3.3	14	0.40
5	*Hepsetus odoe*	16	0.3	4.7	3.8	10	3.3	13	0.39
9	*Synodontis* spp.	25	0.5	1.0	0.8	17	5.6	7	0.21
8	*Clarias ngamensis*	3	0.1	3.2	2.5	3	1.0	3	0.07
11	*Tilapia sparrmanii*	13	0.3	0.3	0.3	12	3.9	2	0.06
4	*Hippotamyrus discorhynchus*	16	0.3	0.4	0.3	7	2.3	1	0.04
11	*Serranochromis macrocephalus*	3	0.1	0.8	0.7	3	1.0	1	0.02
11	*Oreochromis andersonii*	1	0.0	1.6	1.3	1	0.3	0	0.01
9	*Synodontis nigromaculatus*	4	0.1	0.4	0.3	3	1.0	0	0.01
4	*Pollimyrus castelnaui*	7	0.1	0.1	0.0	5	1.6	0	0.01
5	*Parauchenoglanis ngamensis*	3	0.1	0.4	0.3	2	0.7	0	0.01
11	*Sargochromis carlottae*	2	0.0	0.4	0.3	2	0.7	0	0.01
11	*Pharyngochromis acuticeps*	4	0.1	0.1	0.0	4	1.3	0	0.00
12	*Ctenopoma multispine*	2	0.0	0.0	0.0	2	0.7	0	0.00
11	*Tilapia ruweti*	2	0.0	0.0	0.0	2	0.7	0	0.00
3	*Micralestes acutidens*	2	0.0	0.0	0.0	2	0.7	0	0.00
11	*Serranochromis robustus*	1	0.0	0.0	0.0	1	0.3	0	0.00
11	*Pseudocrenilabrus philander*	2	0.0	0.0	0.0	1	0.3	0	0.00
1	*Barbus paludinosus*	1	0.0	0.0	0.0	1	0.3	0	0.00
SUM		**4928**	**100**	**125.11**	**100**	**402**	**100**	**3419**	**100**

***Appendix 10**. The relative importance (IRI) of all species caught in surveys with gill nets at the Kabula-Bula station in the period 1997-2000. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	6273	61.3	28.65	18.7	62	26.5	2121	42.89
7	*Schilbe intermedius*	777	7.6	18.52	12.1	99	42.3	834	16.85
9	*Synodontis* spp.	722	7.1	9.47	6.2	89	38.0	504	10.19
5	*Hepsetus odoe*	157	1.5	19.80	12.9	58	24.8	359	7.25
4	*Marcusenius macrolepidotus*	991	9.7	8.62	5.6	49	20.9	321	6.49
8	*Clarias gariepinus*	47	0.5	36.31	23.7	26	11.1	269	5.43
11	*Pharyngochromis acuticeps*	381	3.7	6.63	4.3	56	23.9	193	3.90
11	*Tilapia sparrmanii*	249	2.4	4.95	3.2	60	25.6	145	2.94
1	*Barbus poechii*	297	2.9	2.08	1.4	47	20.1	86	1.73
11	*Serranochromis macrocephalus*	54	0.5	5.50	3.6	36	15.4	63	1.28
11	*Sargochromis carlottae*	29	0.3	2.18	1.4	17	7.3	12	0.25
11	*Serranochromis longimanus*	33	0.3	0.88	0.6	19	8.1	7	0.15
11	*Serranochromis robustus*	16	0.2	2.10	1.4	11	4.7	7	0.14
3	*Hydrocynus vittatus*	24	0.2	1.60	1.1	12	5.1	7	0.13
11	*Oreochromis macrochir*	11	0.1	0.88	0.6	10	4.3	3	0.06
11	*Pseudocrenilabrus philander*	31	0.3	0.15	0.1	14	6.0	2	0.05
1	*Barbus radiatus*	23	0.2	0.15	0.1	16	6.8	2	0.04
11	*Serranochromis altus*	10	0.1	0.55	0.4	9	3.9	2	0.04
11	*Parauchenoglanis ngamensis*	7	0.1	0.66	0.4	7	3.0	1	0.03
1	*Barbus paludinosus*	24	0.2	0.15	0.1	10	4.3	1	0.03
8	*Clarias theodorae*	8	0.1	0.42	0.3	8	3.4	1	0.02
11	*Oreochromis andersonii*	8	0.1	0.86	0.6	4	1.7	1	0.02
4	*Petrocephalus catostoma*	17	0.2	0.08	0.1	11	4.7	1	0.02
8	*Clarias ngamensis*	4	0.0	0.71	0.5	4	1.7	1	0.02
11	*Serranochromis angusticeps*	7	0.1	0.28	0.2	6	2.6	1	0.01
11	*Hemichromis elongatus*	5	0.1	0.32	0.2	4	1.7	0	0.01
12	*Ctenopoma multispine*	6	0.1	0.07	0.1	4	1.7	0	0.00
11	*Sargochromis codringtonii*	3	0.0	0.13	0.1	3	1.3	0	0.00
9	*Synodontis nigromaculatus*	2	0.0	0.15	0.1	2	0.9	0	0.00
1	*Tilapia rendalli*	3	0.0	0.05	0.0	3	1.3	0	0.00
4	*Mormyrus lacerda*	2	0.0	0.07	0.0	2	0.9	0	0.00
4	*Pollimyrus castelnaui*	3	0.0	0.01	0.0	3	1.3	0	0.00
1	*Labeo lunatus*	1	0.0	0.10	0.1	1	0.4	0	0.00
11	*Tilapia ruweti*	1	0.0	0.00	0.0	1	0.4	0	0.00
	SUM	**10226**	**100**	**153.06**	**100**	**763**	**100**	**4946**	**100**

***Appendix 11**. The relative importance (IRI) of all species caught in surveys with other gears than gill nets at the Katima Mulilo station in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition in 2000 are excluded. The IRI takes into account the number of individuals (No), weight (kg) and requency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
11	*Pharyngochromis acuticeps*	438	6.9	1.54	4.8	37	56.1	653	18.16
9	*Synodontis* spp.	2118	33.2	4.37	13.6	8	12.1	567	15.77
3	*Micralestes acutidens*	716	11.2	0.15	0.5	23	34.9	407	11.31
1	*Labeo cylindricus*	455	7.1	2.61	8.1	17	25.8	393	10.93
3	*Hydrocynus vittatus*	22	0.3	14.85	46.2	5	7.6	353	9.81
11	*Tilapia rendalli*	256	4.0	0.96	3.0	26	39.4	275	7.66
11	*Tilapia sparrmanii*	384	6.0	1.83	5.7	15	22.7	266	7.40
1	*Barbus unitaeniatus*	305	4.8	0.20	0.6	18	27.3	147	4.08
1	*Barbus paludinosus*	548	8.6	0.69	2.1	8	12.1	130	3.61
1	*Barbus poechii*	121	1.9	0.23	0.7	24	36.4	95	2.63
11	*Pseudocrenilabrus philander*	129	2.0	0.20	0.6	18	27.3	72	2.00
11	*Hemichromis elongatus*	53	0.8	0.59	1.8	14	21.2	57	1.57
8	*Clariallabes platyprosopos*	21	0.3	1.03	3.2	5	7.6	27	0.74
1	*Barbus barotseensis*	102	1.6	0.05	0.2	9	13.6	24	0.67
1	*Barbus bifrenatus*	100	1.6	0.06	0.2	9	13.6	24	0.67
1	*Opsaridium zambezense*	66	1.0	0.19	0.6	9	13.6	22	0.62
3	*Brycinus lateralis*	31	0.5	0.10	0.3	10	15.2	12	0.34
11	*Serranochromis robustus*	11	0.2	0.53	1.7	4	6.1	11	0.31
13	*Aethiomastacemb. vanderwaali*	48	0.8	0.19	0.6	4	6.1	8	0.23
1	*Barbus thamalakanensis*	146	2.3	0.07	0.2	2	3.0	8	0.21
1	*Barbus* cf *eutaenia*	34	0.5	0.02	0.1	7	10.6	6	0.18
5	*Parauchenoglanis ngamensis*	23	0.4	0.40	1.3	2	3.0	5	0.14
8	*Clarias theodorae*	11	0.2	0.08	0.3	7	10.6	4	0.12
8	*Clarias gariepinus*	2	0.0	0.44	1.4	2	3.0	4	0.12
4	*Petrocephalus catostoma*	24	0.4	0.15	0.5	3	4.6	4	0.11
7	*Schilbe intermedius*	15	0.2	0.06	0.2	6	9.1	4	0.11
1	*Barbus radiatus*	24	0.4	0.03	0.1	5	7.6	3	0.10
2	*Hemigrammoch. multifasciatus*	52	0.8	0.02	0.1	2	3.0	3	0.07
1	*Barbus afrovernayi*	24	0.4	0.01	0.0	4	6.1	2	0.07
11	*Oreochromis macrochir*	10	0.2	0.05	0.2	5	7.6	2	0.06
4	*Hippopotamyrus ansorgii*	8	0.1	0.07	0.2	4	6.1	2	0.06
1	*Barbus multilineatus*	14	0.2	0.01	0.0	3	4.6	1	0.03
1	*Barbus barnardi*	11	0.2	0.00	0.0	4	6.1	1	0.03
4	*Hippotamyrus discorhynchus*	15	0.2	0.06	0.2	1	1.5	1	0.02
1	*Barbus fasciolatus*	21	0.3	0.01	0.0	1	1.5	1	0.02
11	*Serranochromis macrocephalus*	3	0.1	0.09	0.3	1	1.5	1	0.01
10	*Aplocheilichthys johnstoni*	6	0.1	0.00	0.0	3	4.6	0	0.01
4	*Mormyrus lacerda*	1	0.0	0.06	0.2	1	1.5	0	0.01
8	*Clarias ngamensis*	1	0.0	0.05	0.2	1	1.5	0	0.01
11	*Oreochromis andersonii*	2	0.0	0.04	0.1	1	1.5	0	0.01
11	*Serranochromis thumbergi*	3	0.1	0.00	0.0	2	3.0	0	0.00
4	*Pollimyrus castelnaui*	2	0.0	0.00	0.0	2	3.0	0	0.00
1	*Barbus codringtonii*	1	0.0	0.02	0.1	1	1.5	0	0.00
3	*Rhabdalestes maunensis*	2	0.0	0.00	0.0	2	3.0	0	0.00
8	*Clarias stappersii*	1	0.0	0.01	0.0	1	1.5	0	0.00
1	*Mesobola brevianalis*	2	0.0	0.00	0.0	1	1.5	0	0.00
11	*Tilapia ruweti*	1	0.0	0.00	0.0	1	1.5	0	0.00
13	*Aethiomastacembelus frenatus*	1	0.0	0.00	0.0	1	1.5	0	0.00
6	*Leptoglanis* cf *dorae*	1	0.0	0.00	0.0	1	1.5	0	0.00
9	*Chiloglanis neumanni*	1	0.0	0.00	0.0	1	1.5	0	0.00
	SUM	**6386**	**100**	**32.13**	**100**	**341**	**100**	**3596**	**100**

***Appendix 12**. The relative importance (IRI) of all species caught in surveys with other gears than gill nets at the Lake Lisikili in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition in 2000 are excluded. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
11	*Tilapia sparrmanii*	766	15.6	1.64	11.3	25	59.5	1600	25.13
11	*Tilapia rendalli*	515	10.5	2.11	14.5	22	52.4	1308	20.55
11	*Oreochromis macrochir*	899	18.3	2.51	17.3	14	33.3	1185	18.62
11	*Hemichromis elongatus*	55	1.1	2.08	14.3	11	26.2	404	6.35
11	*Pseudocrenilabrus philander*	191	3.9	0.46	3.2	20	47.6	337	5.29
3	*Brycinus lateralis*	170	3.5	0.56	3.8	13	31.0	225	3.54
3	*Rhabdalestes maunensis*	366	7.4	0.13	0.9	11	26.2	217	3.42
11	*Pharyngochromis acuticeps*	85	1.7	0.38	2.6	19	45.2	197	3.09
1	*Barbus paludinosus*	205	4.2	0.23	1.6	10	23.8	137	2.15
11	*Oreochromis andersonii*	32	0.7	0.57	3.9	10	23.8	109	1.71
1	*Barbus bifrenatus*	212	4.3	0.08	0.6	9	21.4	105	1.64
1	*Barbus poechii*	139	2.8	0.13	0.9	11	26.2	98	1.54
1	*Barbus unitaeniatus*	260	5.3	0.06	0.4	7	16.7	95	1.49
8	*Clarias gariepinus*	11	0.2	1.17	8.0	3	7.1	59	0.93
11	*Tilapia ruweti*	47	1.0	0.12	0.8	11	26.2	46	0.73
10	*Aplocheilichthys johnstoni*	86	1.8	0.02	0.1	10	23.8	44	0.69
9	*Synodontis* spp.	356	7.2	1.08	7.4	1	2.4	35	0.55
8	*Clarias ngamensis*	13	0.3	0.42	2.9	4	9.5	30	0.47
12	*Ctenopoma multispine*	26	0.5	0.07	0.5	10	23.8	24	0.38
1	*Barbus radiatus*	85	1.7	0.03	0.2	5	11.9	23	0.37
10	*Aplocheilichthys hutereaui*	75	1.5	0.01	0.0	4	9.5	15	0.23
1	*Coptostomabarbus wittei*	72	1.5	0.01	0.0	3	7.1	11	0.17
1	*Barbus afrovernayi*	35	0.7	0.01	0.0	5	11.9	9	0.14
1	*Barbus haasianus*	59	1.2	0.01	0.0	3	7.1	9	0.14
3	*Micralestes acutidens*	38	0.8	0.02	0.1	4	9.5	9	0.13
1	*Barbus multilineatus*	24	0.5	0.00	0.0	6	14.3	7	0.11
11	*Serranochromis robustus*	3	0.1	0.11	0.7	3	7.1	6	0.09
4	*Pollimyrus castelnaui*	14	0.3	0.01	0.1	4	9.5	4	0.06
8	*Clarias theodorae*	5	0.1	0.07	0.5	2	4.8	3	0.04
11	*Serranochromis macrocephalus*	6	0.1	0.04	0.3	3	7.1	3	0.04
11	*Serranochromis angusticeps*	1	0.0	0.11	0.8	1	2.4	2	0.03
7	*Schilbe intermedius*	4	0.1	0.02	0.1	4	9.5	2	0.03
4	*Mormyrus lacerda*	2	0.0	0.09	0.6	1	2.4	2	0.02
5	*Hepsetus odoe*	4	0.1	0.08	0.6	1	2.4	2	0.02
1	*Labeo cylindricus*	8	0.2	0.02	0.1	2	4.8	1	0.02
2	*Hemigrammoch. multifasciatus*	11	0.2	0.00	0.0	2	4.8	1	0.02
4	*Marcusenius macrolepidotus*	4	0.1	0.05	0.3	1	2.4	1	0.02
2	*Hemigrammocharax machadoi*	8	0.2	0.00	0.0	2	4.8	1	0.01
1	*Barbus barnardi*	7	0.1	0.00	0.0	2	4.8	1	0.01
11	*Sargochromis carlottae*	1	0.0	0.03	0.2	1	2.4	1	0.01
10	*Aplocheilichthys katangae*	5	0.1	0.00	0.0	2	4.8	0	0.01
1	*Barbus thamalakanensis*	9	0.2	0.00	0.0	1	2.4	0	0.01
13	*Aethiomastacembelus frenatus*	3	0.1	0.01	0.1	1	2.4	0	0.00
12	*Microctenopoma intermedium*	3	0.1	0.00	0.0	1	2.4	0	0.00
11	*Sargochromis codringtonii*	1	0.0	0.01	0.0	1	2.4	0	0.00
11	Cichlidae sp.	1	0.0	0.00	0.0	1	2.4	0	0.00
1	*Barbus barotseensis*	1	0.0	0.00	0.0	1	2.4	0	0.00
	SUM	**4923**	**100**	**14.529**	**100**	**288**	**100**	**6365**	**100**

***Appendix 13**. The relative importance (IRI) of all species caught in surveys with other gears than gill nets at the Kalimbeza station in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition in 2000 are excluded. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
11	*Tilapia sparrmanii*	326	7.7	2.99	10.7	31	38.3	703	22.00
11	*Pharyngochromis acuticeps*	253	6.0	1.44	5.2	40	49.4	548	17.15
3	*Hydrocynus vittatus*	27	0.6	10.09	36.1	6	7.4	272	8.52
11	*Tilapia rendalli*	110	2.6	1.07	3.8	26	32.1	206	6.44
3	*Micralestes acutidens*	594	14.0	0.08	0.3	10	12.4	176	5.51
1	*Barbus paludinosus*	542	12.7	0.67	2.4	9	11.1	168	5.26
1	*Barbus poechii*	177	4.2	0.41	1.5	22	27.2	152	4.77
11	*Hemichromis elongatus*	56	1.3	2.04	7.3	13	16.1	138	4.33
11	*Pseudocrenilabrus philander*	122	2.9	0.23	0.8	26	32.1	119	3.72
10	*Aplocheilichthys johnstoni*	187	4.4	0.03	0.1	12	14.8	67	2.09
1	*Barbus barnardi*	217	5.1	0.03	0.1	10	12.4	64	2.01
9	*Synodontis* spp.	129	3.0	0.49	1.8	10	12.4	59	1.85
3	*Brycinus lateralis*	92	2.2	0.11	0.4	14	17.3	44	1.38
1	*Barbus bifrenatus*	110	2.6	0.04	0.1	12	14.8	40	1.27
5	*Hepsetus odoe*	11	0.3	2.18	7.8	4	4.9	40	1.25
1	*Barbus radiatus*	129	3.0	0.05	0.2	10	12.4	40	1.24
11	*Oreochromis macrochir*	31	0.7	0.92	3.3	8	9.9	40	1.24
1	*Barbus barotseensis*	115	2.7	0.03	0.1	11	13.6	38	1.19
1	*Opsaridium zambezense*	112	2.6	0.14	0.5	9	11.1	35	1.09
2	*Hemigrammoch. multifasciatus*	77	1.8	0.03	0.1	11	13.6	26	0.81
7	*Schilbe intermedius*	37	0.9	0.41	1.5	8	9.9	23	0.72
1	*Barbus* cf *eutaenia*	66	1.6	0.06	0.2	10	12.4	22	0.68
1	*Barbus unitaeniatus*	51	1.2	0.04	0.1	13	16.1	21	0.67
8	*Clarias theodorae*	85	2.0	1.02	3.7	3	3.7	21	0.65
3	*Rhabdalestes maunensis*	52	1.2	0.01	0.0	12	14.8	19	0.58
1	*Barbus multilineatus*	120	2.8	0.01	0.1	5	6.2	18	0.55
1	*Coptostomabarbus wittei*	96	2.3	0.00	0.0	6	7.4	17	0.53
11	*Oreochromis andersonii*	9	0.2	0.33	1.2	5	6.2	9	0.27
11	*Serranochromis macrocephalus*	7	0.2	0.42	1.5	4	4.9	8	0.26
1	*Barbus thamalakanensis*	52	1.2	0.01	0.1	5	6.2	8	0.25
12	*Ctenopoma multispine*	51	1.2	0.50	1.8	2	2.5	7	0.23
11	*Tilapia ruweti*	22	0.5	0.04	0.1	7	8.6	6	0.17
11	*Sargochromis codringtonii*	6	0.1	0.20	0.7	5	6.2	5	0.16
4	*Marcusenius macrolepidotus*	10	0.2	0.52	1.9	2	2.5	5	0.16
1	*Barbus afrovernayi*	30	0.7	0.01	0.0	5	6.2	4	0.14
11	*Serranochromis robustus*	6	0.1	0.21	0.8	4	4.9	4	0.14
1	*Barbus fasciolatus*	37	0.9	0.00	0.0	3	3.7	3	0.10
1	*Barbus haasianus*	22	0.5	0.00	0.0	5	6.2	3	0.10
1	*Labeo lunatus*	4	0.1	0.21	0.8	3	3.7	3	0.10
8	*Clarias ngamensis*	5	0.1	0.17	0.6	3	3.7	3	0.08
4	*Pollimyrus castelnaui*	11	0.3	0.04	0.1	5	6.2	2	0.08
11	*Sargochromis carlottae*	6	0.1	0.35	1.3	1	1.2	2	0.05
2	*Hemigrammocharax machadoi*	11	0.3	0.00	0.0	4	4.9	1	0.04
13	*Aethiomastacembelus frenatus*	4	0.1	0.07	0.3	3	3.7	1	0.04
10	*Aplocheilichthys katangae*	13	0.3	0.00	0.0	3	3.7	1	0.04
8	*Clarias gariepinus*	4	0.1	0.08	0.3	2	2.5	1	0.03
11	*Serranochromis altus*	1	0.0	0.07	0.3	1	1.2	0	0.01
11	*Serranochromis angusticeps*	1	0.0	0.05	0.2	1	1.2	0	0.01

***Appendix 13**. Continued*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
1	*Labeo cylindricus*	3	0.1	0.01	0.0	2	2.5	0	0.01
9	*Chiloglanis fasciatus*	6	0.1	0.00	0.0	1	1.2	0	0.01
10	*Aplocheilichthys hutereaui*	3	0.1	0.00	0.0	2	2.5	0	0.01
1	*Barbus kerstenii*	2	0.1	0.00	0.0	1	1.2	0	0.00
2	*Nannocharax macropterus*	2	0.1	0.00	0.0	1	1.2	0	0.00
11	*Serranochromis longimanus*	1	0.0	0.00	0.0	1	1.2	0	0.00
6	*Leptoglanis* cf *dorae*	1	0.0	0.00	0.0	1	1.2	0	0.00
	SUM	**4254**	**100**	**27.949**	**100**	**428**	**100**	**3196**	**100**

***Appendix 14**. The relative importance (IRI) of all species caught in surveys with other gears than gill nets at the Impalila station in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition in 2000 are excluded. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
10	*Aplocheilichthys johnstoni*	281	15.2	0.02	0.2	16	48.5	746	17.48
3	*Hydrocynus vittatus*	28	1.5	9.63	79.7	3	9.1	738	17.30
11	*Pseudocrenilabrus philander*	179	9.7	0.15	1.2	19	57.6	627	14.70
11	*Tilapia ruweti*	174	9.4	0.44	3.7	11	33.3	436	10.21
11	*Tilapia sparrmanii*	155	8.4	0.26	2.2	12	36.4	383	8.97
1	*Barbus haasianus*	126	6.8	0.01	0.1	7	21.2	146	3.42
10	*Aplocheilichthys katangae*	76	4.1	0.01	0.1	11	33.3	140	3.27
11	*Tilapia rendalli*	58	3.1	0.14	1.1	10	30.3	130	3.04
1	*Barbus multilineatus*	57	3.1	0.01	0.1	11	33.3	105	2.45
12	*Ctenopoma multispine*	30	1.6	0.28	2.4	8	24.2	96	2.26
1	*Barbus radiatus*	60	3.2	0.04	0.4	7	21.2	76	1.78
2	*Hemigrammocharax machadoi*	92	5.0	0.01	0.0	5	15.2	76	1.78
3	*Rhabdalestes maunensis*	56	3.0	0.01	0.1	8	24.2	75	1.75
11	*Oreochromis macrochir*	56	3.0	0.16	1.3	5	15.2	66	1.54
3	*Micralestes acutidens*	56	3.0	0.00	0.0	6	18.2	55	1.30
1	*Barbus unitaeniatus*	43	2.3	0.04	0.4	6	18.2	49	1.14
11	*Pharyngochromis acuticeps*	17	0.9	0.09	0.7	9	27.3	45	1.06
1	*Barbus poechii*	24	1.3	0.07	0.6	7	21.2	40	0.94
1	*Barbus afrovernayi*	33	1.8	0.00	0.0	7	21.2	38	0.90
1	*Barbus paludinosus*	43	2.3	0.03	0.2	4	12.1	31	0.72
1	*Coptostomabarbus wittei*	42	2.3	0.00	0.0	4	12.1	28	0.65
1	*Barbus bifrenatus*	29	1.6	0.01	0.1	5	15.2	25	0.59
2	*Hemigrammoch. multifasciatus*	23	1.2	0.00	0.0	6	18.2	23	0.54
11	*Serranochromis robustus*	5	0.3	0.30	2.5	2	6.1	17	0.39
1	*Barbus thamalakanensis*	14	0.8	0.00	0.0	6	18.2	14	0.33
4	*Pollimyrus castelnaui*	12	0.7	0.01	0.1	5	15.2	11	0.25
7	*Schilbe intermedius*	8	0.4	0.04	0.3	4	12.1	9	0.22
1	*Barbus* cf *eutaenia*	8	0.4	0.00	0.0	6	18.2	8	0.19
5	*Hepsetus odoe*	4	0.2	0.04	0.3	3	9.1	5	0.12
8	*Clarias ngamensis*	5	0.3	0.03	0.3	3	9.1	5	0.11
9	*Synodontis* spp.	5	0.3	0.02	0.1	4	12.1	5	0.11
8	*Clarias theodorae*	4	0.2	0.11	0.9	1	3.0	3	0.08
12	*Microctenopoma intermedium*	5	0.3	0.01	0.1	3	9.1	3	0.07
1	*Barbus barnardi*	8	0.4	0.00	0.0	2	6.1	3	0.06
11	*Serranochromis thumbergi*	3	0.2	0.02	0.1	3	9.1	3	0.06
1	*Labeo cylindricus*	9	0.5	0.02	0.2	1	3.0	2	0.05
11	*Serranochromis macrocephalus*	5	0.3	0.02	0.1	1	3.0	1	0.03
11	*Oreochromis andersonii*	2	0.1	0.01	0.1	2	6.1	1	0.02
4	*Marcusenius macrolepidotus*	3	0.2	0.02	0.1	1	3.0	1	0.02
1	*Mesobola brevianalis*	5	0.3	0.00	0.0	1	3.0	1	0.02
8	*Clarias gariepinus*	1	0.1	0.02	0.2	1	3.0	1	0.02
1	*Barbus fasciolatus*	3	0.2	0.00	0.0	1	3.0	1	0.01
10	*Aplocheilichthys hutereaui*	2	0.1	0.00	0.0	1	3.0	0	0.01
4	*Petrocephalus catostoma*	1	0.1	0.00	0.0	1	3.0	0	0.00
1	*Barbus barotseensis*	1	0.1	0.00	0.0	1	3.0	0	0.00
	SUM	**1851**	**100**	**12.09**	**100**	**242**	**100**	**4267**	**100**

Appendix 15*. The relative importance (IRI) of all species caught in surveys with other gears than gill nets at the Kabula-Bula station in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition in 2000 are excluded. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to* ***Appendix 1****.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	356	17.4	2.15	9.5	22	47.8	1287	21.19
11	*Oreochromis macrochir*	99	4.9	3.50	15.4	18	39.1	794	13.08
11	*Pharyngochromis acuticeps*	112	5.5	1.27	5.6	24	52.2	580	9.55
11	*Pseudocrenilabrus philander*	261	12.8	0.32	1.4	18	39.1	555	9.14
11	*Tilapia sparrmanii*	117	5.7	0.99	4.4	21	45.7	461	7.59
1	*Barbus poechii*	141	6.9	0.65	2.9	21	45.7	445	7.33
11	*Tilapia rendalli*	167	8.2	0.97	4.3	13	28.3	352	5.80
7	*Schilbe intermedius*	86	4.2	1.57	6.9	13	28.3	315	5.18
8	*Clarias ngamensis*	49	2.4	3.23	14.2	6	13.0	217	3.58
11	*Oreochromis andersonii*	31	1.5	1.28	5.6	13	28.3	202	3.33
8	*Clarias gariepinus*	16	0.8	1.96	8.7	9	19.6	184	3.04
9	*Synodontis* spp.	46	2.3	0.57	2.5	15	32.6	156	2.56
1	*Barbus paludinosus*	107	5.2	0.14	0.6	10	21.7	127	2.09
5	*Hepsetus odoe*	20	1.0	2.49	11.0	4	8.7	104	1.71
10	*Aplocheilichthys johnstoni*	85	4.2	0.02	0.1	7	15.2	64	1.06
2	*Hemigrammocharax machadoi*	86	4.2	0.02	0.1	6	13.0	56	0.92
1	*Barbus barnardi*	49	2.4	0.04	0.2	8	17.4	45	0.74
12	*Ctenopoma multispine*	28	1.4	0.21	0.9	8	17.4	40	0.65
11	*Tilapia ruweti*	20	1.0	0.05	0.2	6	13.0	15	0.25
3	*Rhabdalestes maunensis*	17	0.8	0.03	0.1	4	8.7	8	0.14
1	*Barbus multilineatus*	18	0.9	0.00	0.0	4	8.7	8	0.13
11	*Sargochromis carlottae*	6	0.3	0.28	1.2	2	4.4	7	0.11
1	*Coptostomabarbus wittei*	14	0.7	0.00	0.0	4	8.7	6	0.10
1	*Barbus haasianus*	11	0.5	0.00	0.0	5	10.9	6	0.10
4	*Marcusenius macrolepidotus*	17	0.8	0.11	0.5	2	4.4	6	0.09
4	*Mormyrus lacerda*	7	0.3	0.41	1.8	1	2.2	5	0.08
10	*Aplocheilichthys katangae*	9	0.4	0.00	0.0	4	8.7	4	0.06
8	*Clarias theodorae*	3	0.2	0.09	0.4	3	6.5	4	0.06
1	*Barbus radiatus*	5	0.2	0.02	0.1	4	8.7	3	0.04
4	*Pollimyrus castelnaui*	7	0.3	0.01	0.0	3	6.5	2	0.04
11	*Serranochromis robustus*	4	0.2	0.03	0.1	3	6.5	2	0.03
1	*Barbus afrovernayi*	6	0.3	0.01	0.0	3	6.5	2	0.03
11	*Serranochromis angusticeps*	2	0.1	0.09	0.4	2	4.4	2	0.03
11	*Serranochromis macrocephalus*	11	0.5	0.02	0.1	1	2.2	1	0.02
1	*Barbus bifrenatus*	6	0.3	0.00	0.0	2	4.4	1	0.02
11	*Serranochromis longimanus*	2	0.1	0.03	0.2	2	4.4	1	0.02
11	*Serranochromis altus*	2	0.1	0.06	0.3	1	2.2	1	0.01
10	*Aplocheilichthys hutereaui*	6	0.3	0.00	0.0	1	2.2	1	0.01
12	*Microctenopoma intermedium*	2	0.1	0.00	0.0	2	4.4	0	0.01
2	*Hemigrammoch. multifasciatus*	2	0.1	0.00	0.0	2	4.4	0	0.01
1	*Labeo cylindricus*	2	0.1	0.02	0.1	1	2.2	0	0.01
11	*Serranochromis thumbergi*	1	0.1	0.03	0.2	1	2.2	0	0.01
1	*Barbus thamalakanensis*	3	0.2	0.00	0.0	1	2.2	0	0.01
4	*Petrocephalus catostoma*	1	0.1	0.00	0.0	1	2.2	0	0.00
1	*Barbus unitaeniatus*	1	0.1	0.00	0.0	1	2.2	0	0.00
1	*Barbus* cf *eutaenia*	1	0.1	0.00	0.0	1	2.2	0	0.00
	SUM	**2042**	**100**	**22.66**	**100**	**303**	**100**	**6071**	**100**

***Appendix 16**. The relative importance (IRI) of all species caught in surveys with gill nets during the low water condition in the period 1997-2000. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	10441	56.3	50.69	18.3	172	23.0	1719	51.09
4	*Marcusenius macrolepidotus*	1915	10.3	29.50	10.7	135	18.1	379	11.28
7	*Schilbe intermedius*	1149	6.2	24.84	9.0	168	22.5	341	10.14
9	*Synodontis* spp.	1181	6.4	16.67	6.0	146	19.5	242	7.20
5	*Hepsetus odoe*	222	1.2	27.37	9.9	104	13.9	154	4.59
3	*Hydrocynus vittatus*	226	1.2	26.42	9.5	104	13.9	150	4.46
11	*Pharyngochromis acuticeps*	540	2.9	8.70	3.1	116	15.5	94	2.80
1	*Barbus poechii*	736	4.0	5.11	1.9	105	14.1	82	2.43
11	*Tilapia sparrmanii*	360	1.9	8.12	2.9	93	12.5	61	1.80
8	*Clarias gariepinus*	49	0.3	38.90	14.1	29	3.9	56	1.65
4	*Petrocephalus catostoma*	990	5.3	5.76	2.1	38	5.1	38	1.12
11	*Serranochromis macrocephalus*	65	0.4	7.18	2.6	46	6.2	18	0.54
11	*Hemichromis elongatus*	96	0.5	4.69	1.7	32	4.3	9	0.28
11	*Sargochromis carlottae*	40	0.2	2.18	0.8	25	3.4	3	0.10
11	*Pseudocrenilabrus philander*	79	0.4	0.69	0.3	29	3.9	3	0.08
1	*Labeo lunatus*	28	0.2	2.35	0.9	15	2.0	2	0.06
11	*Serranochromis robustus*	17	0.1	3.10	1.1	12	1.6	2	0.06
11	*Serranochromis longimanus*	38	0.2	1.14	0.4	23	3.1	2	0.06
1	*Barbus paludinosus*	132	0.7	0.77	0.3	14	1.9	2	0.06
11	*Oreochromis macrochir*	15	0.1	1.88	0.7	13	1.7	1	0.04
5	*Parauchenoglanis ngamensis*	16	0.1	1.61	0.6	12	1.6	1	0.03
4	*Hippotamyrus discorhynchus*	38	0.2	0.51	0.2	15	2.0	1	0.02
11	*Serranochromis altus*	15	0.1	0.79	0.3	13	1.7	1	0.02
8	*Clarias ngamensis*	5	0.0	2.41	0.9	5	0.7	1	0.02
9	*Synodontis nigromaculatus*	10	0.1	0.99	0.4	9	1.2	0	0.01
11	*Serranochromis angusticeps*	12	0.1	0.82	0.3	10	1.3	0	0.01
1	*Barbus radiatus*	26	0.1	0.16	0.1	15	2.0	0	0.01
11	*Tilapia rendalli*	8	0.0	0.86	0.3	7	0.9	0	0.01
11	*Oreochromis andersonii*	8	0.0	1.31	0.5	4	0.5	0	0.01
4	*Pollimyrus castelnaui*	28	0.2	0.14	0.1	7	0.9	0	0.01
11	*Sargochromis codringtonii*	6	0.0	0.56	0.2	5	0.7	0	0.00
3	*Micralestes acutidens*	26	0.1	0.14	0.1	6	0.8	0	0.00
1	*Labeo cylindricus*	8	0.0	0.13	0.1	7	0.9	0	0.00
1	*Barbus unitaeniatus*	6	0.0	0.04	0.0	6	0.8	0	0.00
4	*Mormyrus lacerda*	3	0.0	0.19	0.1	3	0.4	0	0.00
12	*Ctenopoma multispine*	2	0.0	0.07	0.0	2	0.3	0	0.00
4	*Hippopotamyrus ansorgii*	1	0.0	0.02	0.0	1	0.1	0	0.00
11	*Tilapia ruweti*	1	0.0	0.00	0.0	1	0.1	0	0.00
	SUM	**18538**	**100**	**276.79**	**100**	**1547**	**100**	**3364**	**100**

Appendix 17. *The relative importance (IRI) of all species caught in surveys with gill nets during the high water condition in the period 1997-2000. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to* ***Appendix 1****.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
3	*Brycinus lateralis*	10231	48.0	143.18	25.6	183	24.5	1804	43.02
7	*Schilbe intermedius*	2668	12.5	121.11	21.6	310	41.6	1418	33.81
3	*Hydrocynus vittatus*	848	4.0	79.32	14.2	148	19.8	360	8.58
4	*Petrocephalus catostoma*	3768	17.7	33.61	6.0	82	11.0	260	6.21
4	*Marcusenius macrolepidotus*	1616	7.6	24.82	4.4	75	10.1	121	2.88
8	*Clarias gariepinus*	56	0.3	83.54	14.9	42	5.6	85	2.04
9	*Synodontis* spp.	392	1.8	9.53	1.7	91	12.2	43	1.03
5	*Hepsetus odoe*	100	0.5	21.74	3.9	57	7.6	33	0.79
1	*Barbus poechii*	510	2.4	7.43	1.3	65	8.7	32	0.77
11	*Tilapia sparrmanii*	197	0.9	3.45	0.6	51	6.8	11	0.25
3	*Micralestes acutidens*	361	1.7	1.70	0.3	31	4.2	8	0.20
11	*Pharyngochromis acuticeps*	140	0.7	3.47	0.6	42	5.6	7	0.17
11	*Hemichromis elongatus*	80	0.4	5.55	1.0	21	2.8	4	0.09
4	*Pollimyrus castelnaui*	98	0.5	0.49	0.1	22	3.0	2	0.04
1	*Labeo lunatus*	15	0.1	2.06	0.4	13	1.7	1	0.02
11	*Sargochromis carlottae*	16	0.1	2.08	0.4	12	1.6	1	0.02
8	*Clarias ngamensis*	5	0.0	4.84	0.9	5	0.7	1	0.01
11	*Serranochromis macrocephalus*	11	0.1	2.01	0.4	8	1.1	0	0.01
1	*Barbus radiatus*	33	0.2	0.19	0.0	16	2.1	0	0.01
11	*Sargochromis codringtonii*	15	0.1	1.08	0.2	9	1.2	0	0.01
11	*Oreochromis andersonii*	5	0.0	2.27	0.4	5	0.7	0	0.01
8	*Clarias theodorae*	11	0.1	0.65	0.1	11	1.5	0	0.01
12	*Ctenopoma multispine*	20	0.1	0.49	0.1	9	1.2	0	0.01
1	*Barbus paludinosus*	20	0.1	0.11	0.0	14	1.9	0	0.01
11	*Serranochromis angusticeps*	6	0.0	1.18	0.2	6	0.8	0	0.00
4	*Hippotamyrus discorhynchus*	20	0.1	0.30	0.1	9	1.2	0	0.00
11	*Serranochromis longimanus*	9	0.0	0.66	0.1	8	1.1	0	0.00
1	*Labeo cylindricus*	19	0.1	0.44	0.1	6	0.8	0	0.00
11	*Tilapia rendalli*	8	0.0	0.45	0.1	7	0.9	0	0.00
4	*Mormyrus lacerda*	4	0.0	0.75	0.1	4	0.5	0	0.00
11	*Pseudocrenilabrus philander*	10	0.1	0.06	0.0	7	0.9	0	0.00
1	*Opsaridium zambezense*	8	0.0	0.05	0.0	5	0.7	0	0.00
11	*Serranochromis altus*	1	0.0	1.23	0.2	1	0.1	0	0.00
9	*Synodontis nigromaculatus*	4	0.0	0.20	0.0	3	0.4	0	0.00
11	*Serranochromis robustus*	3	0.0	0.14	0.0	3	0.4	0	0.00
11	*Oreochromis macrochir*	1	0.0	0.23	0.0	1	0.1	0	0.00
11	*Tilapia ruweti*	2	0.0	0.02	0.0	2	0.3	0	0.00
5	*Parauchenoglanis ngamensis*	1	0.0	0.05	0.0	1	0.1	0	0.00
1	*Barbus unitaeniatus*	1	0.0	0.01	0.0	1	0.1	0	0.00
1	*Barbus* cf *eutaenia*	1	0.0	0.00	0.0	1	0.1	0	0.00
	SUM	**21314**	**100**	**560.47**	**100**	**1387**	**100**	**4194**	**100**

Appendix 18*. The relative importance (IRI) of all species caught in surveys with other gears than gill nets during the high water condition in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition in 2000 are excluded. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to* ***Appendix 1****.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
11	*Tilapia sparrmanii*	667	7.9	1.36	3.8	53	39.9	464	13.23
11	*Tilapia rendalli*	537	6.4	1.36	3.8	51	38.4	387	11.06
3	*Hydrocynus vittatus*	57	0.7	23.48	64.9	7	5.3	345	9.85
11	*Pseudocrenilabrus philander*	481	5.7	0.61	1.7	56	42.1	310	8.85
11	*Pharyngochromis acuticeps*	311	3.7	0.90	2.5	62	46.6	287	8.19
3	*Micralestes acutidens*	699	8.3	0.18	0.5	35	26.3	230	6.57
1	*Barbus paludinosus*	802	9.5	0.90	2.5	24	18.1	216	6.17
1	*Barbus unitaeniatus*	480	5.7	0.32	0.9	36	27.1	177	5.06
11	*Oreochromis macrochir*	433	5.1	1.36	3.8	24	18.1	160	4.57
1	*Barbus poechii*	234	2.8	0.36	1.0	44	33.1	124	3.54
3	*Brycinus lateralis*	395	4.7	0.88	2.4	22	16.5	118	3.36
1	*Barbus bifrenatus*	417	4.9	0.18	0.5	27	20.3	110	3.14
3	*Rhabdalestes maunensis*	433	5.1	0.16	0.4	22	16.5	92	2.62
11	*Tilapia ruweti*	228	2.7	0.53	1.5	25	18.8	78	2.22
10	*Aplocheilichthys johnstoni*	313	3.7	0.05	0.1	25	18.8	72	2.06
1	*Labeo cylindricus*	212	2.5	0.68	1.9	15	11.3	49	1.41
1	*Barbus radiatus*	197	2.3	0.12	0.3	20	15.0	40	1.14
1	*Barbus multilineatus*	185	2.2	0.03	0.1	19	14.3	33	0.93
1	*Barbus barotseensis*	195	2.3	0.07	0.2	17	12.8	32	0.91
1	*Opsaridium zambezense*	147	1.7	0.24	0.7	13	9.8	23	0.67
1	*Barbus thamalakanensis*	177	2.1	0.08	0.2	11	8.3	19	0.55
12	*Ctenopoma multispine*	49	0.6	0.32	0.9	16	12.0	18	0.50
1	*Barbus barnardi*	103	1.2	0.05	0.1	16	12.0	16	0.47
7	*Schilbe intermedius*	42	0.5	0.26	0.7	16	12.0	14	0.41
11	*Hemichromis elongatus*	38	0.5	0.24	0.7	16	12.0	13	0.38
2	*Hemigrammocharax machadoi*	138	1.6	0.02	0.1	10	7.5	13	0.36
1	*Barbus afrovernayi*	79	0.9	0.02	0.1	16	12.0	12	0.34
13	*Aplocheilichthys katangae*	83	1.0	0.01	0.0	12	9.0	9	0.26
1	*Barbus haasianus*	103	1.2	0.01	0.0	9	6.8	8	0.24
11	*Oreochromis andersonii*	21	0.3	0.14	0.4	11	8.3	5	0.15
8	*Clarias gariepinus*	16	0.2	0.29	0.8	7	5.3	5	0.15
11	*Serranochromis robustus*	10	0.1	0.34	0.9	6	4.5	5	0.13
1	*Coptostomabarbus wittei*	53	0.6	0.01	0.0	9	6.8	4	0.12
8	*Clarias theodorae*	11	0.1	0.15	0.4	8	6.0	3	0.09
9	*Synodontis* spp.	14	0.2	0.09	0.2	8	6.0	2	0.07
1	*Barbus* cf *eutaenia*	18	0.2	0.01	0.0	9	6.8	2	0.05
8	*Clarias ngamensis*	11	0.1	0.07	0.2	5	3.8	1	0.04
5	*Hepsetus odoe*	6	0.1	0.08	0.2	5	3.8	1	0.03
11	*Serranochromis macrocephalus*	17	0.2	0.04	0.1	3	2.3	1	0.02
2	*Hemigrammoch. multifasciatus*	9	0.1	0.00	0.0	6	4.5	1	0.02
4	*Pollimyrus castelnaui*	8	0.1	0.03	0.1	4	3.0	1	0.01
11	*Serranochromis angusticeps*	2	0.0	0.11	0.3	2	1.5	0	0.01
11	*Serranochromis thumbergi*	6	0.1	0.02	0.1	5	3.8	0	0.01
12	*Microctenopoma intermedium*	5	0.1	0.01	0.0	3	2.3	0	0.01
4	*Marcusenius macrolepidotus*	3	0.0	0.02	0.0	1	0.8	0	0.00
10	*Aplocheilichthys hutereaui*	3	0.0	0.00	0.0	2	1.5	0	0.00
1	*Mesobola brevianalis*	5	0.1	0.00	0.0	1	0.8	0	0.00
6	*Leptoglanis* cf *dorae*	2	0.0	0.00	0.0	2	1.5	0	0.00

***Appendix 18**. Continued*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
1	*Barbus fasciolatus*	3	0.0	0.00	0.0	1	0.8	0	0.00
11	*Sargochromis codringtonii*	1	0.0	0.01	0.0	1	0.8	0	0.00
11	*Serranochromis longimanus*	1	0.0	0.00	0.0	1	0.8	0	0.00
4	*Petrocephalus catostoma*	1	0.0	0.00	0.0	1	0.8	0	0.00
13	*Aethiomastacembelus frenatus*	1	0.0	0.00	0.0	1	0.8	0	0.00
	SUM	**8462**	**100**	**36.17**	**100**	**821**	**100**	**3503**	**100**

***Appendix 19**. The relative importance (IRI) of all species caught in surveys with other gears than gill nets during the low water condition in the period 1997-2000. Catches in Nordic gill nets and in the fishing competition in 2000 are excluded. The IRI takes into account the number of individuals (No), weight (kg) and frequency of occurrence (Freq) of the individuals caught. Values are given in absolute values and percentage. Fam. no = number designation for family classification according to **Appendix 1**.*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
9	*Synodontis* spp.	2640	24.0	6.44	8.8	30	22.2	729	18.99
11	*Tilapia sparrmanii*	1081	9.8	6.36	8.7	51	37.8	700	18.23
11	*Pharyngochromis acuticeps*	594	5.4	3.83	5.2	67	49.6	528	13.75
11	*Tilapia rendalli*	569	5.2	3.89	5.3	46	34.1	357	9.31
11	*Oreochromis macrochir*	662	6.0	5.78	7.9	26	19.3	268	6.98
11	*Pseudocrenilabrus philander*	401	3.7	0.75	1.0	45	33.3	156	4.06
1	*Barbus poechii*	368	3.4	1.13	1.5	41	30.4	148	3.87
3	*Brycinus lateralis*	254	2.3	2.03	2.8	37	27.4	140	3.63
11	*Hemichromis elongatus*	126	1.2	4.47	6.1	22	16.3	118	3.08
1	*Barbus paludinosus*	643	5.9	0.84	1.2	17	12.6	88	2.29
3	*Hydrocynus vittatus*	20	0.2	11.09	15.2	7	5.2	80	2.07
10	*Aplocheilichthys johnstoni*	332	3.0	0.04	0.1	23	17.0	52	1.36
8	*Clarias ngamensis*	62	0.6	3.82	5.2	12	8.9	51	1.34
11	*Oreochromis andersonii*	55	0.5	2.09	2.9	20	14.8	50	1.29
7	*Schilbe intermedius*	108	1.0	1.84	2.5	19	14.1	49	1.28
3	*Micralestes acutidens*	705	6.4	0.07	0.1	8	5.9	39	1.01
8	*Clarias gariepinus*	18	0.2	3.38	4.6	10	7.4	35	0.92
5	*Hepsetus odoe*	33	0.3	4.72	6.5	7	5.2	35	0.91
1	*Labeo cylindricus*	265	2.4	2.00	2.7	8	5.9	30	0.79
2	*Hemigrammoch. multifasciatus*	156	1.4	0.05	0.1	17	12.6	19	0.49
12	*Ctenopoma multispine*	86	0.8	0.74	1.0	12	8.9	16	0.42
8	*Clarias theodorae*	97	0.9	1.22	1.7	8	5.9	15	0.39
1	*Barbus barnardi*	189	1.7	0.02	0.0	10	7.4	13	0.34
1	*Barbus unitaeniatus*	180	1.6	0.02	0.0	9	6.7	11	0.29
1	*Barbus* cf *eutaenia*	91	0.8	0.07	0.1	15	11.1	10	0.27
11	*Serranochromis robustus*	19	0.2	0.84	1.2	10	7.4	10	0.26
1	*Coptostomabarbus wittei*	171	1.6	0.01	0.0	8	5.9	9	0.24
1	*Barbus haasianus*	115	1.1	0.01	0.0	11	8.2	9	0.22
1	*Barbus radiatus*	106	1.0	0.05	0.1	11	8.2	8	0.22
3	*Rhabdalestes maunensis*	60	0.6	0.01	0.0	15	11.1	6	0.16
8	*Clariallabes platyprosopos*	21	0.2	1.03	1.4	5	3.7	6	0.15
11	*Serranochromis macrocephalus*	15	0.1	0.55	0.8	7	5.2	5	0.12
4	*Pollimyrus castelnaui*	38	0.4	0.04	0.1	15	11.1	5	0.12
4	*Marcusenius macrolepidotus*	31	0.3	0.68	0.9	5	3.7	4	0.12
11	*Tilapia ruweti*	36	0.3	0.12	0.2	11	8.2	4	0.10
10	*Aplocheilichthys hutereaui*	83	0.8	0.01	0.0	6	4.4	3	0.09
1	*Barbus multilineatus*	48	0.4	0.00	0.0	10	7.4	3	0.09
11	*Sargochromis carlottae*	13	0.1	0.66	0.9	4	3.0	3	0.08
1	*Barbus bifrenatus*	40	0.4	0.02	0.0	10	7.4	3	0.07
2	*Hemigrammocharax machadoi*	59	0.5	0.00	0.0	7	5.2	3	0.07
1	*Barbus afrovernayi*	49	0.5	0.01	0.0	8	5.9	3	0.07
13	*Aethiomastacemb. vanderwaali*	48	0.4	0.19	0.3	4	3.0	2	0.05
4	*Mormyrus lacerda*	10	0.1	0.56	0.8	3	2.2	2	0.05
1	*Barbus fasciolatus*	58	0.5	0.02	0.0	4	3.0	2	0.04
1	*Opsaridium zambezense*	31	0.3	0.09	0.1	5	3.7	2	0.04
1	*Barbus thamalakanensis*	47	0.4	0.01	0.0	4	3.0	1	0.03
4	*Petrocephalus catostoma*	25	0.2	0.16	0.2	4	3.0	1	0.03
11	*Sargochromis codringtonii*	6	0.1	0.20	0.3	5	3.7	1	0.03

Appendix 19*. Continued*

Fam. no	Species	No	%	Weight	%	Freq	%	IRI	%
14	*Parauchenoglanis ngamensis*	23	0.2	0.40	0.6	2	1.5	1	0.03
10	*Aplocheilichthys katangae*	20	0.2	0.00	0.0	8	5.9	1	0.03
1	*Barbus barotseensis*	24	0.2	0.01	0.0	5	3.7	1	0.02
1	*Labeo lunatus*	4	0.0	0.21	0.3	3	2.2	1	0.02
13	*Aethiomastacembelus frenatus*	7	0.1	0.08	0.1	4	3.0	1	0.01
4	*Hippopotamyrus ansorgii*	8	0.1	0.07	0.1	4	3.0	0	0.01
11	*Serranochromis altus*	3	0.0	0.13	0.2	2	1.5	0	0.01
11	*Serranochromis angusticeps*	2	0.0	0.14	0.2	2	1.5	0	0.01
4	*Hippotamyrus discorhynchus*	15	0.1	0.06	0.1	1	0.7	0	0.00
12	*Microctenopoma intermedium*	5	0.1	0.00	0.0	3	2.2	0	0.00
11	*Serranochromis longimanus*	2	0.0	0.03	0.1	2	1.5	0	0.00
9	*Chiloglanis fasciatus*	6	0.1	0.00	0.0	1	0.7	0	0.00
11	*Serranochromis thumbergi*	1	0.0	0.03	0.1	1	0.7	0	0.00
1	*Barbus codringtonii*	1	0.0	0.02	0.0	1	0.7	0	0.00
1	*Barbus kerstenii*	2	0.0	0.00	0.0	1	0.7	0	0.00
2	*Nannocharax macropterus*	2	0.0	0.00	0.0	1	0.7	0	0.00
1	*Mesobola brevianalis*	2	0.0	0.00	0.0	1	0.7	0	0.00
8	*Clarias stappersii*	1	0.0	0.01	0.0	1	0.7	0	0.00
11	Cichlidae sp.	1	0.0	0.00	0.0	1	0.7	0	0.00
9	*Chiloglanis neumanni*	1	0.0	0.00	0.0	1	0.7	0	0.00
	SUM	**10994**	**100**	**73.19**	**100**	**784**	**100**	**3839**	**100**