# A SOCIO-BIOLOGICAL STUDY OF THE AQUATIC RESOURCES AND THEIR UTILIZATION IN AN UNDERDEVELOPED RURAL REGION, THE MUTSHINDUDI RIVER CATCHMENT

VOLUME 1

REPORT TO THE WATER RESEARCH COMMISSION

by

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The Steering Committee responsible for this project consisted of the following persons:

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|---|---|
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# CHAPTER 1

# INTRODUCTION



## 1.1 MOTIVATION AND BACKGROUND

The underdeveloped rural regions of the Northern Province (former homeland regions) are subject to severe environmental degradation. These regions experience serious socio-economic water related problems due to the fact that specific problems and needs have in the past been largely ignored in water management policies. There also exists a need for local expertise on water and the communities are largely ignorant of the long term negative effects of their actions on water as a resource. Standard management policies for developed regions are inappropriate due to a general lack of infrastructure, the traditional land tenure system and difficulty to enforce legislation. These regions are also unique due to the preference to use unpurified surface water for domestic purposes, the importance of fish as a source of protein, dependence on natural riparian vegetation for energy, food, medicinal purposes, etc.

With the initiation of the Reconstruction and Development Programme it became apparent that these regions require more attention, not only to alleviate serious socio-economic problems, but also, as part of this process, to improve the condition of the environment. Due to poverty and dependence on natural resources of a growing human population, the water resource and the aquatic environment has been seriously degraded in some underdeveloped regions. This study aimed to address these problems by evaluating them, by providing means of assessing them and by creating a centre of expertise to assist government in solving them.

The Mutshindudi River catchment was selected for the study because it is relatively small but includes a diversity of climatic and socio-economic conditions and problems typical of underdeveloped rural regions and because it is closely situated to the University of Venda.

The Mutshindudi River originates west of Thohoyandou in the Entabeni Region of the Soutpansberg at an altitude of 1200m. It flows in an easterly direction and joins the Levuvhu River a few kilometers below the Thohoyandou to Punda Maria road bridge. Two major

tributaries, The Tshinane River and the Mbwedi River, join the Mutshindudi River from the north.

The catchment contains a relatively high human population scattered throughout 20 rural villages. Agriculture is the main economic activity in the catchment and includes exotic forest and two tea estates.

Due to the multidisciplinary nature of water related problems in the region it was necessary to involve a multidisciplinary team of investigators. All disciplines at the University of Venda were invited to participate but only the Departments of Agriculture, Anthropology, Biological Sciences, Chemistry, Sociology and Statistics could participate. The Department of Geography was involved in the planning phase but had to withdraw due to the resignation of a staff member. A consultant was later involved to survey birds as indicator species. The study is deficient due to a lack of information on hydrology, on aquatic invertebrates and on the role of informal business.

Eleven independent but interrelated sub projects, seven of which were of a biological nature, were conducted. Each subproject is reported separately and the findings of the different projects are combined in a general discussion and proposals for the development and implementation of a management strategy for sustainable water resource utilization in underdeveloped (former homeland) regions of the Northern Province.

## 1.2 PROJECT AIMS

The aims of the project were to:

* Provide a scientific basis for implementation of the Reconstruction and Development Programme on water in underdeveloped rural regions of the Northern Province

* Promote the conservation and sustainable utilization of water and associated organisms in under-developed regions of the Northern Province through community participation.

* Develop a centre of expertise on water utilization in the Northern Province.

The following research projects were envisaged :

Knowledge of the socio-economic composition of a typical underdeveloped rural community in the Northern Province, and its needs, problems and expectations in terms of water utilization.

Knowledge of the needs and problems of a water supply network in an underdeveloped rural community.

Knowledge of the water quality of streams and health aspects associated with water use in an underdeveloped rural region.

Knowledge of human induced impacts on natural plant communities in an underdeveloped rural region.

Knowledge of the importance of riparian vegetation in an underdeveloped rural environment as a source of food, for medicinal purposes, for energy, etc.

Knowledge of the importance of fish as a source of protein in underdeveloped rural regions.

Knowledge of the impact of human induced changes on indigenous fish in an underdeveloped rural region.

Knowledge of the cultural aspects of importance in water utilization in an underdeveloped rural region.

Knowledge of the agricultural water demand in an underdeveloped rural region.

Guidelines on methods to improve the socio-economic profile of underdeveloped communities in rural regions.

Guidelines on methods to improve the domestic water supply in underdeveloped rural regions.

Guidelines on the prevention of water related diseases in underdeveloped rural regions.

Methodologies to assess the conservation status of aquatic and riparian environments.

Guidelines on management styles to ensure sustainable utilization of water resources through community participation in underdeveloped rural regions.

During the study it became clear that valuable information was gained on the importance of community participation in research. A chapter on this aspect is therefore also included.

# CHAPTER 2

## A GENERAL DESCRIPTION OF THE MUTSHINDUDI RIVER CATCHMENT

The Mutshindudi River system is situated in the Soutpansberg region north of Thohoyandou , Northern Province, in the former Venda homeland. It drains the south-eastern half of the Greater Thohoyandou Transitional Local Council area north of the Louis Trichardt to Punda Maria Road. The Mutshindudi River originates in the Entabeni State Forest (30° 15' E, 22° 59' S). It flows north-easterly over a distance of about 50 km and joins the Levuvhu River a few km below the Thohoyandou to Punda Maria road bridge. The river receives two main tributaries from the north. The Tshinane River originates in the Thathe Vondo Plantation and flows roughly parallel to the Mutshindudi River to join it at Dzingahe Village. The Mbwedi River (also known as the Ngwedi River) originates near Tshilapfe and also flows roughly parallel to the main river. It joins the Mutshindudi River about 5 km before the confluence with the Levuvhu River.

The Mutshindudi River originates at an altitude of 1200 m. It has a steep gradient for the first approximately 30 km to Lweludi at an altitude of 600m. For the next 20km it only drops a further 150m to its confluence with the Levuvhu River.

The upper reaches of the catchment is situated in one of the highest rainfall regions in South Africa with a mean annual precipitation of just over 2000 mm. Annual rainfall drops with altitude to just less than 900mm at the confluence with the Levuvhu River. High precipitation in the upper reaches is reflected in a flow rate that is high and perennial, with a mean annual runoff 127 million cubic metres. Mean monthly flow is below 5 million $m^3$ during the months of June, July, August, September, October and November and increases from December onwards to over 20 million $m^3$ during February and March (Department of Water Affairs, 1990).

In the upper reaches the natural vegetation consists of montane forest and montane grassland with riparian forest along the river courses. Lower down the catchment is vegetated by woodland with woodland or narrow strips of forest in the riparian zone. Most of the natural vegetation in the middle and lower reaches of the catchment has been removed, either for exotic forestation or tea production in the higher regions or for the cultivation of annual crops in the lower reaches. Pristine indigenous forest still exist between the Entabeni Forest and the

Thathe Vondo Dam and in patches along the upper reaches of the Mbwedi River. Lower down only small, isolated patches of forest remain.

Only two large impoundments have been built in the catchment. The Thathe Vondo Dam in the upper Mutshindudi River has a capacity of 30.5 million $m^3$. It supplies mainly the Thohoyandou TLC with water for household purposes. The Damani Dam in the Middle Mbwedi River with a capacity of 13 million $m^3$, provides water mainly for the Damani Coffee Estate. Several smaller impoundments and weirs also exist. Water is transferred from the upper Mutale River system to the Middle Mutshindudi River for irrigation of the Mukumbani Tea Eastate.

The middle and lower reaches of the catchment is densely populated and apart from Thohoyandou, which obtains its water mainly from the catchment, there are about 20 villages scattered throughout the area. In 1997 the total population of the Thohoyandou TLC, most of which are dependent on water from the Mutshindudi River system, was estimated as 400 0000. Fourty six percent of these are 19 years old and younger indicating a rapidly growing population (Grearter Thohoyandou Transitional Local Council, 1998).

Water is considered to be a scarce resource and an obstacle to development in the broader regional context. Although the Nandoni Dam, presently under construction, will help to alleviate this problem, it can be expected that the demand on water will drastically increase in the near future.

Land use management in the TLC area is done on an ad-hoc basis and in the rural areas land for specific purposes are allocated by traditional leaders. Permits for bush clearing are issued by the Department of Agriculture, Land and Environment. Unfortunately land use planning is not based on economic principles. Due to an increase in population and general overstocking, the environment is rapidly deteriorating. The communal land tenure system in the catchment provides limited opportunity for commercial farming. For this reason most farming activities can be considered to be a form of subsistence farming to sustain wages earned elsewhere.

Public and private investment in the area is low so that limited job opportunities exist. Employment opportunities in surrounding areas is also inadequate to support the growing population. The population also generally lack the required literacy, numeracy and other skills

to cope with the environment, and to contribute to meaningful economic development Greater Thohoyandou Transitional Local Council, 1998).

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## CHAPTER 3

# A SOCIO-ECONOMIC SURVEY OF THE INHABITANTS OF THE MUTSHINDUDI RIVER CATCHMENT

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## 3.1 INTRODUCTION

This project provided the Department of Sociology with the opportunity to test the methodology and techniques of community-based research in a practical context. It served as an exercise for creating a link between the university and the community from which most of its students derives. This was achieved mainly by employing senior sociology students as interviewers as well as a local graduate as liaison worker. This learning exercise is considered to be one of the major achievements of this particular study. This report will therefore, in addition to providing the quantitative results of the study also elaborate on the advantages and disadvantages of participatory research. The quantitative data is also presented and interpreted against a more qualitative, humanistic approach.

## 3.2 STATEMENT OF PROBLEM

The question may arise why a sociological input is necessary in a study which seems to be primarily concerned with natural, rather than human resources. The reason is amongst other, that a large proportion of South Africa's population, including that of the Mutshindudi area, is directly dependent on natural resources for sub-sustence purposes and self-empowerment in the informal sector. This provides an important buffer against poverty. The management [or mismanagement..] of natural resources is consequently mainly the result of human actions. Unsustainable rates of resource consumption therefore, have an increasingly negative impact on the natural environment which in turn threatens human survival.

A sociological input is also necessary because people living in a particular area posses indigenous knowledge, capacities and aspirations that are relevant to the management of such resources as well as of its cultural, religious and recreational values. It is consequently imperative that a socio-economic profile of the inhabitants of the Mutshindudi catchment area is provided in an inter-disciplinary effort which attempts to provide a model for the sustainable use of water in this area.

## 3.3 STUDY DESIGN

### 3.3.1 The survey as study method

The study may be criticised for not making use of participant observation, which would have been a more reliable and valid way of studying communities like these. While this is true, it is also true that researchers working in 3rd World surroundings often have to make use of the most available, not necessarily the most appropriate method of investigation. We simply did not have enough skilled and experienced and, most importantly, Venda speaking interviewers available to conduct the research. We are however, convinced that the study did in a small way, succeed to create some research expertise by involving student interviewers which originate from these communities.

As one of the objectives of the study was to increase people's capacity to participate fully in the project and to gain control over their own lives and environment, the research methodology in itself had to be part of the process.

Undertaking community-based research take much more time than would be the case with a conventional survey. While the actual fieldwork took only about 3 months, permission to conduct the study took more than a year. Just this one aspect, namely entrance, distinguish research as a purely academic exercise considerably from those who actively want to engage the community. Liaison with the community had to be channeled through the local government as well as tribal authorities, civic organisations, headmen and chiefs. Time consuming as it is, it is a very necessary step if the research is to educate local communities about the research process rather than only advancing scientific objectives. Tribal authorities can become severe enemies blocking any positive outcomes of a study if their co-operation is not obtained. They can, conversely become vehicles for change and development if they are properly informed about the objectives, the methods and the possible outcome of the study. It is in addition imperative that they receive the report and it is discussed with them in detail.

### 3.3.2 Questionnaire construction

A pilot study undertaken for the survey, showed clearly that when trans-cultural research is undertaken, it is almost imperative that questionnaires should be translated into the local language. Not only translated, but tested and re-tested to be sure that not only the translation and interpretation are correct, but that the questions are relevant to local conditions. The

questionnaire was translated by both a graduated person and by a typist in order to get rid of any miss-translations or ambiguous interpretations as a result of using too 'educated' language which could confused some members of the community [most of which have the minimum education]. The group of student-interviewers then translated it back into English to ensure that they use it in a uniform manner. The process of questionnaire construction and translation served in itself as an instrument for participatory research. Not only did it check the elitist attitudes university students so energetically adopt when removed from their communities, but they also had to put themselves [back] into their family's situation of chronic poverty, underdevelopment and disease in order to construct a relevant measuring instrument.

The pilot study was also very useful for checking the validity and reliability of individual questions. By following these seemingly time-consuming methods it eventually saved time as questions serve as scientifically relevant measuring instruments in terms of both the respondents and the research problem.

The questionnaire is outlined in Appendix 1.

### 3.3.3 Selection and training of students as interviewers

There are several reasons why senior sociology students were chosen as interviewers. Apart from the fact that the study was a sociological effort, the students had to undertake a project for their course in research methodology. Experience have shown that they have a lot of difficulty marrying theory and practice if the project is only hypothetical in nature. It was consequently an excellent opportunity to engage them in a 'real' project witch not only employ them as paid interviewers, but where time as well as marks were of prime importance. For the purposes of community-friendly research the student -interviewers actually had to fulfil two roles - that of scientific investigator and, in a sense that of social worker or health professional. Most researchers in developed countries will frown upon this techniques, but we believe strongly that researchers in developing countries inundates with the socio-economic problems of neighboring communities, do not have the time for 'idle-academicism'. This type of research paradigm forces investigators to disengage themselves from their role as neutral observer in order to become involved members. Students had to be trained to consult with communities rather than just 'asked' questions, when information is collected about their socio-economic circumstances. It has also not be done in a paternalistic way, but in a manner which acknowledges the wealth of experience and indigenous knowledge community

members have about their environments, their culture and their needs.

The training of students as interviewers working in their own communities, is particularly complicated. On the one hand it improves reliability and validity of data, but on the other hand it can easily led to interviewer bias. One has to remember that most Third World communities [including universities] have a severe lack of trained and experienced researchers so that even the theoretical knowledge about surveys can be very shaky. The rationale was however, that students are members of the community to be investigated, that they speak the local language and understand the culture.

To obtain the objectives of community-based research, students had, on the one hand, to be trained to be particularly adaptable, friendly and responsive to respondents. On the other hand they had to be scientifically correct as the study was also an academic exercise. As this study was an effort to genuinely involve people and to put them in command of their own destination, interviewers were requested to listen as far as possible sympathetically to problems not directly related to the research topic and in turn discuss these with the project leader. If necessary these items, which in most cases are the more and immediate problems people have to struggle with, can be included in follow-up studies as well as discussions with officials who may be able to solve them. In this way it is possible to create a better linkage between research as a scientific exercise and research as a problem-solving exercise as health and socio-economic problems could be situated in a holistic community development perspective. An example of this are the visits that the liaison worker paid to the clinics in the area to obtain information about problems they experienced. This information will be presented to the local health authorities.

### 3.3.4 Sampling technique

Sampling in deep, rural areas is seldom a straight forward task that can be achieved by following textbook rules. Villages which are not planned according to streets, blocks, suburbs or even street or house numbers, requires techniques which may be questioned by researchers who are only familiar with urban and regional planning devices. In this case photos of the villages were taken from a nearby hill to obtain a view of the general layout. The villages were then visit by car and on foot to divide it roughly into streets and blocks, which could then be implemented for the sampling process. Systematic, random sampling was employed - selecting every fourth house. The sampling process took a lot of time as students not only had

to be trained to conduct the process in their own villages without any preferences for selecting or avoiding family and friends, but the method had also to be explained to the community as we went along. It was both amusing and painful to see students who are mostly from a first generation of university-trained people, trying to avoid their humble origins. It provided the perfect opportunity to explain the main objective of community-based research, namely that all parties are experts - the students with their academic background, the community with their indigenous knowledge - all contributing equally to the learning process. This was necessary if the project was to serve as an empowering process to enable communities to conduct their own research and evaluations in future.

Only women, usually the mother or caretaker of the particular household, served as respondents. Men were not included as many of them are migratory workers and therefore not available. The most important reason for choosing women, was however, that they are the people who are burdened with most of the household and agricultural chores including the use of water which is the main subject of this study.

The following four villages were selected in terms of size, geographical locality, and state of development:

Makula - sample size = 150
Gondeni - sample size = 75
Ngwenani - sample size = 75
Mweli - sample size =100 N = 400

Twelve questionnaires could not be used and the statistical evidence is therefore based on an N of 388. Statistical data was not calculated for each individual village as the objective of the study did not include a comparative study but to present a socio-economic profile of the entire Mutshindudi catchment area.

### 3.4 RESULTS

The processing of the data was done by Prof. A Schubarga using the statistical package for the social sciences. Data are presented in graphical format, or the results of some of individual questions are merged to illustrate a particular trend or activity, while others present relationships between relevant variables. As the main area of concern for the study as a whole is water and water-related aspects , data on this aspect will also in this specific study be

emphasised.

### 3.4.1 Socio-demographic information

The data reveals that the inhabitants of the Mutshindudi catchment area, are for the bigger part poor, have little education and live in an area with restricted infrastructure. The fertility rate is 4.0 [i.e. children per women] which is lower than the fertility rate of 5.7 for the whole of South Africa's rural women [Gilbert et al, 1996: 154] Estimates of the total fertility rate for the whole of South Africa range from 3.9 to 4.09 [South African health Review, 1997:4]. Thirty per cent of the women are either single, divorced or widowed, are mostly unskilled and struggle to eke out a subsistence living. A more detailed analysis of these and related data , are presented below.

#### 3.4.1.1 Educational level

An alarming result is that 35.3% of respondents have no education at all, while 21.3% have a St.5 qualification, 17.7% a St. 8 -and only 12.2% a St 10 or a form of tertiary education [4.7%]

One must however keep in mind that these figures represent the state of only older women [only mothers served as respondents] and is in all probability not a true reflection of the educational level of the whole population.[The Mail & Guardian; 17/3/1995], estimate the illiteracy rate for South Africa to be 30%] It does, however reflect on the desperate plight of black women. Women with no education faced with very little job opportunities and most of their husbands migrant workers, are some of the reasons for the high poverty risk among rural female-headed households.

#### 3.4.1.2 Income

Seventy four per cent of respondents has an income of less than R500 per month, while only 26% have higher incomes. It is significant that 51% earns between R200 and R500 per month. This correspond with question 7 where 25% of respondents indicated that their main source of income is a pension. Question 7 also revealed that only 12% of the respondents own a salary while 13% obtain an income from some form of trade usually selling fruit and home made articles. This incomes are usually owned in the least paid, least skilled jobs which offer little legal protection, such as domestic or agricultural work or work in the informal sector.

Without access to an independent income, women find it difficult, if not impossible, to lift themselves out of poverty [Klugman et al, 1992]. This low employment rate has a positive relationship with the low educational state of the women and cumulates in a subsistence way of living. Although the main source of income of 49% is a husband , question 5 reveals that 22% of husbands are migrant workers. Migrant workers very often have two households to support [one where they are working and one in their area of origin] with the result that the salary must also be divided by two, with the rural family usually getting very little. With an average of six people per household, it is obvious that many respondents live under the breadline.

Comparing education (q3) with income (q6), it is obvious that education does make a difference. Of the 22 respondents who earn more than R2000 per month, 19 have matric or a tertiary qualification. Faced with this information it is possible to link education, poverty and environment into a development model. Improvement in women's social status can only be significantly improved by locating it in the context of economic and social development in general. One of the most clear-cut indicators of poverty within the family is the child. Improvement of women's educational level is recognised as a major causal factor in the improvement of women's and children's health and in limiting the number of pregnancies women choose to have.

Confronted with this model the student interviewers were challenged to expose the risks of children from their own community growing up in conditions of chronic poverty. Students could also be made aware of their responsibility in terms of literacy programs, adult education classes, skills training etc. which can all help to alleviate some of these problems experience by their own communities.

3.4.1.3 Income and type of housing

When income is compared with housing it is interesting to note that the housing of rural families are, despite their poverty, in many cases better than their counterparts in urbanised, slum areas where whole families have to make do with one room shacks. With an average size of six people per household, almost 60% of the respondents in this study live in 3 to 4 room houses. Despite their poverty they have the skills to manufacture bricks from local clay, while grass is fairly available for thatching. This does not mean that they live under favorable circumstances.

3.4.1.4 Infrastructure

Except for the access roads to villages, no roads are tarred and are in addition in a very bad condition. Many inhabitants live on hills with the result that vehicles cannot reach them in the rainy season. One of the main complaints of clinic personnel is that the roads are inaccessible for ambulances. Postal and electrical services are only available in a few villages with only about 5% of respondents having electricity in their houses. More than 90% of the respondents prepare food on open fires increasing deforestation which in turn has the result that women must walk further and further to gather enough wood for cooking. Given the amount of time consumed in the act of providing fuel, more time is spent on food preparation than on food production.

When this information is compared with the results represented by Table 3.1 where respondents were asked to name the most serious problem in their community, the following, sometimes surprising, picture is revealed:

[Table 3.1]: MOST SERIOUS PROBLEMS RELATED TO INFRASTRUCTURE

| **Problem lack of :** | **Frequency** | **%** |
|---|---|---|
| Educational facilities | 9 | 2.2 |
| Health care facilities | 16 | 4.2 |
| Clean water | 83 | 21.6 |
| Electricity | 44 | 11.4 |
| Sanitation | 3 | 0.8 |
| Roads | 116 | 30.1 |
| Telephones | 5 | 1.3 |
| Job opportunities | 97 | 25.2 |
| Housing | 11 | 2.9 |
| Other | 1 | 0.3 |

The most serious problem seems to be the lack of good roads [30% of responses]. As can be expected the scarcity of job opportunities also figures high on the list [25%], then clean water [22%], followed by electricity [11%]. With the educational level being at such a low level as the results suggest, it is surprising that only 2.3% regard this a major problem. It is on the other hand also to be expected that women who struggle just to make a mere living cannot conceptualise education as a tool for their own upliftment. The lack of health education is also obvious when one considers that only 0.8 % of respondents regards the lack of proper sanitation facilities as a problem. Housing also figures very low and can be contributed to the fact that people living in traditional housing do not consider larger and better houses as an immediate necessity. Because people build their own houses and are primarily dependent on natural resources from their environment, these are often not being used in a sustainable manner.. Bricks are manufactured from water and clay from the river beds, grass and wood, both for building and fires, are being cut and collected as near as possible from where it is needed – often from the riparian forest.

Theses three activities, brick making, grass cutting and wood collecting, were used as examples for an ecological lesson for student interviewers. Brick making within river beds, depletion of grass and cutting of trees indiscriminately or without replacement are some of the most serious problems in rural areas. It provided an opportunity to explain why land degradation, soil erosion and deforestation, coupled with competition for scarce resources as well as human fertility and population growth and, particularly at this stage in South-Africa, the influx of refugees [the latter present in large numbers in Venda] are some of the major threats to the welfare of the future South Africa. All of these are quite evident in the Mutshindudi area. If students however, only experience it as an academic problem and not as one effecting their own communities, they take on the role of neutral observers. Confronted with the reality in their own environments they have to become active participants, trying to solve the problems in a sustainable way.

### 3.4.2 Water and water related issues

#### 3.4.2.1 Income and source of drinking water

The study under discussion focused primarily on problems of water provision, water usage, water-borne diseases and related aspects. A few of these results are graphically represented.

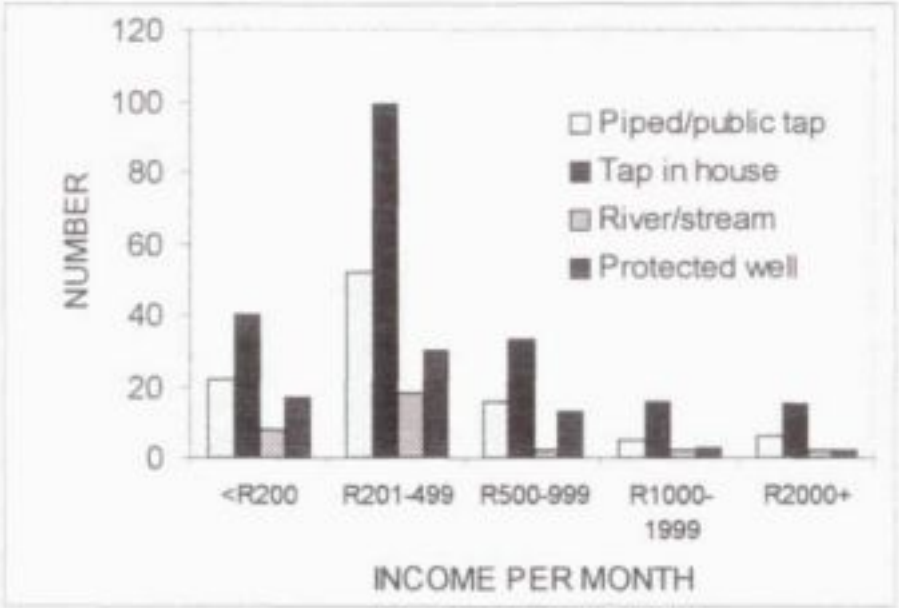



Figure 3.1 Income and source of drinking water

Although it is generally accepted that income is positively correlated to the source of drinking water available to people, this assumption is not always valid. While it is true that almost 90% of the few respondents with an income higher than R1000 per month, do have access to piped water, it is also true that 75% of the majority with an income lower than RI000 per month also have access to piped water. The reasons for this are that in deep rural areas with most of the communities forced to subsistence living , water provision has much more to do with a committed government, civic organisations, NGO's or a community which is determined to solve their own problems than with personal income.

3.4.2.2 Reliability of water provision

The favorable water provision revealed through Figure 3.1 is, however, not a true reflection of the real state of water provision in this area. While 76% of respondents have access to water from either a public tap or a tap in their yards or houses, Fig. 3.2 reveals that almost 70% of these respondents judged the taps to be very, or occasionally unreliable. Although only 7.5% of respondents indicated that their main source for drinking water is a river or stream, when taps are not running, many more have to use water from the river. Sixteen per cent use water from a protected spring or well but during the study period most of these pumps were broken with the result that women and children have to queue for long periods in order to obtain water

from the few working ones. The problem of accessible and clean water becomes critical in periods of drought. Some wells and bore holes become dry with the result that the pressure on the river increases dramatically

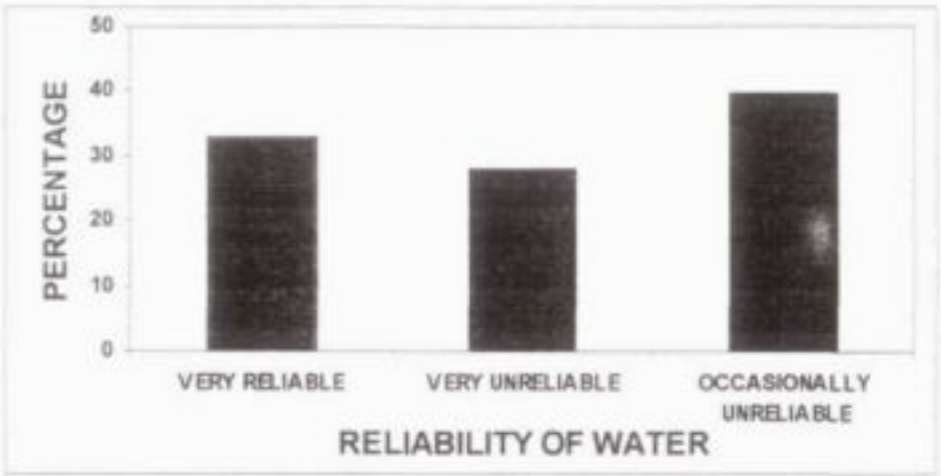



Figure 3.2 Reliability of water provision

3.4.2.3. Distance from and time spent for water [Figures 3.3(a) & 3.3(b)]

Although 80% only carry water from a few meters up to a kilometer it is still a daunting task if you have to carry 5x25 litters [as some do] steeply uphill. Forty eight per cent of respondents said that they have to wait from 1 to more than 2 hours to obtain water. Under such circumstances it is not surprising that the average consumption per person is about 14 liters per day. This is very far from the WHO requirement of 50 liters per day the source of which should be safe and within a 15 minute walk from the household.

3.4.2.4 Water and water related diseases.

Although the study was not primarily concerned with the establishment of a profile of health and disease, some relationships between water and water related diseases had been investigated

When Figure 3.4 is considered, it is obvious that the incidence of water-related diseases is relatively low despite the fact that the population quite often have to use the river and streams for drinking water. Taken into consideration the fact that 30% also indicated that they use the river water without any type of purification it is surprising that only 46 cases of gesture-enteritis were reported.

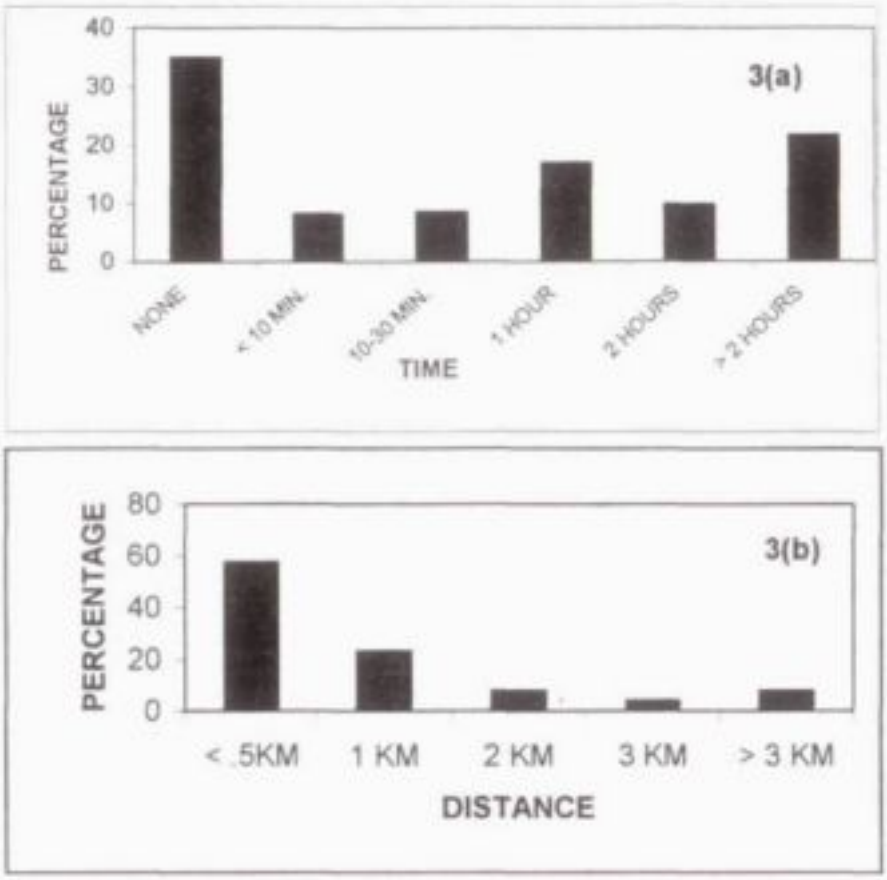



Figure 3. Distance from and time spent for water

Question 18 indicated however, that almost 80% of the respondents bathe or do their laundry in the river. The 86 cases of Bilharzia comes, therefore, as no surprise. On would also suspect that the incidence of this water-borne disease, is much higher, but many people do not consider it to be a disease as it is so widespread that they don't recognise it as such.

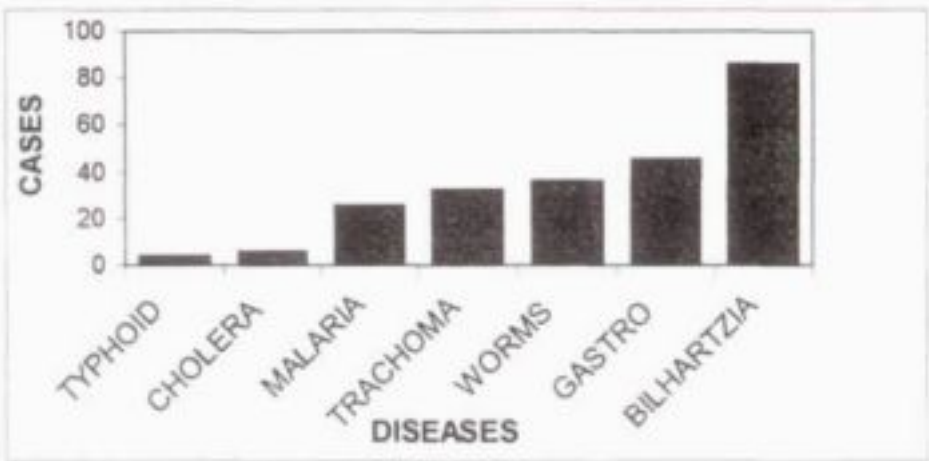



Figure 3.4 Water and water related diseases

When the relationship between disease and source of drinking water was calculated, the only statistically significant relationship was between bilharzia and source. This is expected as bilharzia is directly related to how often people make use of the river for bathing and laundry.

As has been indicated, many inhabitants, use the river for these purposes, but more so for those whose main source of water is something else than piped water [90 % of these respondents reported one or more cases of bilharzia in their family during the 3 years preceding the study].

The fact that there are 33 cases of Trachoma is somewhat worrying as this disease was almost wiped out during the late 70's. This information correlates with clinic records which also indicate an increase.

One can reason that if water provision is more reliable and public bathrooms and laundries can be installed that incidence of diseases can be reduced significantly. However, question 21 reveals that only 40% of respondents were in favour of public bathrooms and laundries, emphasising the strength of cultural habits and values. Rivers and streams have been the meeting place for women since ages and it has, apart from the hard work involved, the benefits of a social gathering. If laundry places can however be designed with village women in such a way that it retains the social and cultural patterns, the idea would possibly not be so alien to them.

Asked for which other purposes the river is being used [q30] only 32 people said that they do some fishing, about 55 respondents use it for building purposes and another 29 people perform some religious or cultural activities at the river. The fact that so few people indicated that they used the river for fishing , may be because the respondents in this study were only women [ this information correlates with the findings Prof. van der Waal (Chapter 10 in this report) who also find that a very small percentage of women do fish].

3.4.2.5 Knowledge of disease causation

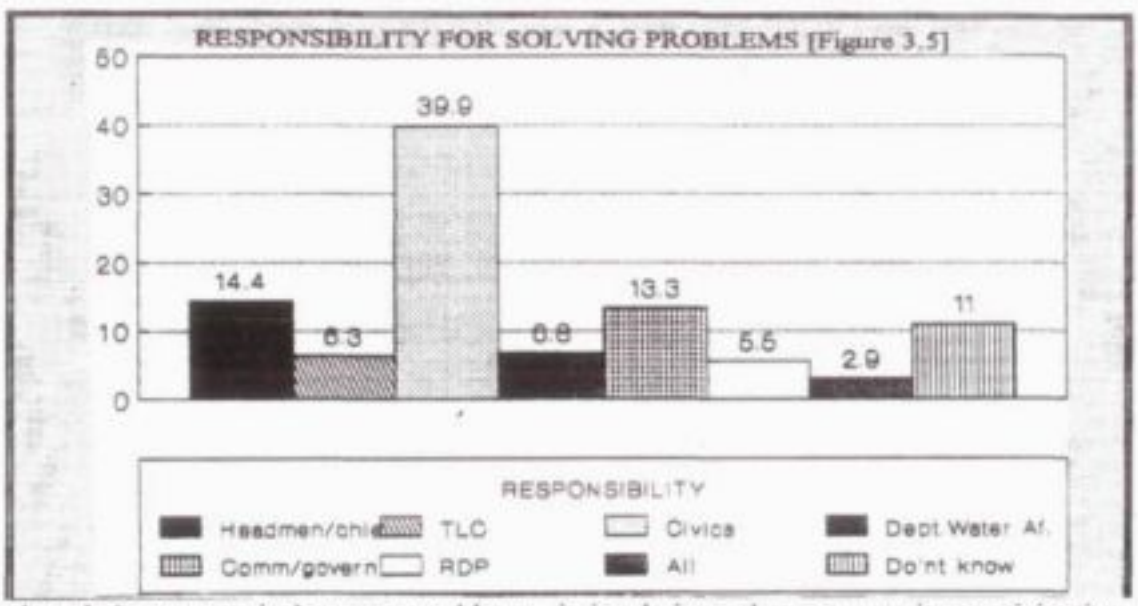
The questionnaire also tested the knowledge of disease causation and it is alarming that there were still about 30% of the population who did not know what causes malaria and bilharzia - both endemic to the region. There is therefore a need for the advancement of health education. As clinic personnel are at the present overburdened by the introduction of free health care, they have to make better use of community health workers. A study by Gaigher [1992] showed a complete lack of co-operation between the Care-group organisation [community health workers] and health professionals. This organisation is well informed about infectious diseases and can be used very successfully if given the opportunity.

The profile of disease and disease causation also provided a good opportunity to inform the student interviewers about the interrelationship between water habits, water provision and water - borne diseases. Coming from these communities they can use this knowledge to inform their families and friends, even more important, to set an example of how to use water safely. It does, however not take away the responsibility of the authorities to provide enough clean water. If people do not have access to clean water they have no other choice than to use water from rivers and streams.

3.4.2.6 Responsibility for solving water and development problems

The study also tried to establish to what extent people are able and prepared to take some community decisions and actions, either individually or collectively. To solve village problems. To establish this, respondents were asked whom they thought, should take responsibility for solving development problems. The results are presented in Figure 5.

If the results of Fig.3.5 is an indication of how respondents consider themselves as able to




solve their community's water problems, it is obvious that community participation (leave alone empowerment) and development is almost non existing. Only 13% is of the opinion that the community together with government can solve the problems. The rest is of the opinion that somebody else, or some other organisation should take the responsibility. It is true that communities who live under conditions of chronic poverty can do little in terms of socio-economic development without the government as a committed partner. It is, however equally true that communities who have to develop their own surplus resources have to turn actions

into strategies for the development of leadership, the acquisition of skills, the creation of jobs, for changing the role of women and for building local organisations.

Asked whether they themselves have done anything to solve any of the many problems the community faces, almost 80% respond in the negative. Only 20% tried to do something - mostly reporting it to the headmen or chief. Taken into consideration that the respondents were all women with limited education, it is not surprising that they perceive themselves as being in a subservient situation not having the skills or power to improve their own lives.
Poor communities need, however to be involved in improving their quality of life together with a responsible non-government and public sector agencies in such a way that detrimental competition for resources is limited.

Asked if anybody representing the government's Reconstruction and Development Plan took any action in an effort to improve the water supply in their village, more than 80% of the responses were in the negative. This situation may be contributed to the fact that water provision and improvement is at present been done on a macro scale and that individual representatives in villages have little to do with it. It is still an unsatisfactorily situation that local RDP officials are not considered to be key figures albeit just as liaison officers, in terms of community problems.

### 3.4.3 Community health

With the water provision as unreliable as indicated it was expected that aspects of community health would be less than desirable.

Table 3.2 : SANITATION

| TYPE OF TOILET | % |
|---|---|
| Flush | 2.6 |
| Pit latrine | 72.4 |
| None | 25 |

Table 3.3 : DISPOSAL OF DRY WASTE

| METHOD OF DISPOSAL | % |
|---|---|
| Pit | 42.2 |
| Open | 12.0 |
| Open and burn | 44.8 |
| Other | 1.0 |

When respondents without toilets were asked where they perform their ablutions, 30 % indicated that they use their neighbor's toilets, while 70% said that they make use of trees, bridges and dry stream beds. One would therefore, expect that the pollution level of the river would increase during the rainy season when all these faeces end up in the river. It is consequently imperative that every household should have proper toilet facilities. This data could also be placed in an environmental educational forum. The fact that 24% of the respondents do not have a toilet while about 20% dispose of dry waste by just throwing it away could be linked to people suffering from diseases associated with poor sanitation. It provides an opportunity to show [not just teach] students that the health of their own people is not so much influenced by the absence or presence of health care facilities but by the presence or absence of good sanitation. In the absence of sanitary facilities, those treated from diseases like gastro-enteritis, worm infection, trachoma and tuberculosis, to name just a few, are continuously re-infected .

In the absence of a waste removal system, people are usually advised to dig a pit and burn their household waste in this manner. While most of them gave this expected response, very few pits could actually been observed by the interviewers. While some of the villages were fairly clean, others were almost buried in paper, plastic and bottles. People know what is expected of them, but most, while keeping their own yards clean, just throw rubbish where-ever they think best. There is consequently a serious need for environmental education.

Apart from being the responsibility of inhabitants as well as local authorities to take responsibility for a clean environment, corporate responsibility for collecting particularly bottles and tins, should also rest with the manufacturers and distributors.

### 3.4.4 Agriculture

#### 3.4.4.1 Land

Agriculture is not practiced on a large scale. Hundred and sixteen [116] respondents do not use any land for agricultural purposes, while only 22 people have more than 2 hectares for this purpose. A large group [122] has less than a hectare, while 128 have 1 to 2 hectares. About 88% of respondents produce maize on this land with a small group [12%] utilising it for fruit and/or vegetables [Question 22]. These produce [mainly maize] are in the case of 92% of respondents exclusively use for household purposes, while 9% also sell some for an income. When one considers only crop production, it is obvious that these respondents only make a subsistence living of the land. Lack of water for irrigation purposes seems to be the major limitation in this regard. Most of the respondents reported that they do not use any form of irrigation - just wait for rain. If a proper irrigation system can be installed for these communities, the income obtained through agricultural activities, might raise the standard of living to some extend.

#### 3.4.4.2 Livestock

In the four villages included in the sample, there were a total of 263 animals, including, cattle [55], donkeys, horses, pigs [55], goats [81] and some 164 chickens. Livestock is consequently, also not contributing much in terms of an income for these people. It does, however provide some protein.

## 3.5 CONCLUSIONS AND RECOMMENDATIONS

When the analysed data is observed in a comprehensive manner, the following conclusions can be made:

### 3.5.1 Socio-economic factors:

The inhabitants of the Mutshindudi area is for the most part very poor - with 74% living on an income of less than R500 per month. Although the respondents were only comprised of women, it is women who have to take care of children and relatives, in fact, of the whole household. Comparing the Mutshindudi area with the rest of women-headed households in South Africa where the average income is R243 per month, it is obvious that they are no better off.

This situation is partly the legacy of the former homeland system whose inhabitants lag way behind the rest of South Africa in terms of wealth and social development. While 45 per cent of the S-African labour force is female, the distribution of women across the labour force is skewed towards the marginal end of the scale: subsistence agriculture and informal-market work [Gilbert et al, 1996:93]. Women in the Mutshindudi area being poorly educated and marginalised in terms of support systems are no exception.

Women's educational status is recognised internationally as a key indicator of society's health. Education increases women's ability to exercise control over their own lives both by gaining information and by developing market related skills. Without education women remain dis-empowered [Klugman et al, 1992]

**To address this problem it is necessary that adult and literacy classes and programmes should be introduced for the following reasons:**

(1) **the general development of impoverished people [particularly women]**

(2) **without people who can read and write, environmental education for the sustainable development of natural resources, is impossible.**

(3) **as students were involved in this study, they should be encouraged to undertake or assist in the establishment of such educational facilities: Such an exercise will create a true community-centered approach which can provide a forum for the utilisation of indigenous knowledge and methods for sustaining the environment. Students can, for example, organise winter schools specifically for environmental education. The university can assist with obtaining funding/sponsors for fieldtrips for participants. As Venda is situated next to the Kruger National Park, liaison with the social-biological division can be established to assist student trainers with information or short courses in environmental education.**

**Many schools are empty during the school holidays and this space can be utilised for recreational activities with an environmental message. If lecturers and other personnel at the university donate journals, magazines and books that they don't have any use for it can already be the beginning of a community library, which can be organised and administered by community members themselves. It is admittedly a small effort, but it can just be the beginning of the creation of a culture for reading and learning as well as addressing the problem of illiteracy.**

### 3.5.2 Income generating activities

**In order to alleviate poverty income generating activities should be introduced:**

**The community together with the government, local authorities and NGO's should create income-generating activities which are market- orientated and sustainable. The Northern Province and particularly the Venda region is earmarked for large tourist developments. With this in mind, people should be trained to produce handy-crafts of superior quality. The existing products are for the most part too expensive for the local market but on the other hand not of the type and quality that the tourist industry requires. The folk-art industry should be revived and refined in order for local people to produce products which can be sold as collectors items to tourist [particularly from abroad]. This will, however necessitate proper market research and proper training of prospective crafts people. Maybe the local university can undertake the research to provide the information for such an exercise and can then in addition assist the effort if funding can be obtained.**

### 3.5.3 Infrastructure

Infra -structure in the region is poor. Except for access roads, the rest are dirt roads in very bad condition, electricity and telephone services in short supply, postal services sporadic, children have to walk long distances to the nearest school and clinics are understaffed, under supplied with none of them offering a 24 hour service.

**The Reconstruction and Development Programme should take responsibility for improvements in terms of the infra-structure of this region. The community should, however see it as its obligation to make sure that the representative of the RDP are informed of the needs of the community and should in addition try to participate as much as possible in alleviating the problems themselves.**

Although 76% of respondents do have access to piped water, water provision is very unreliable resulting in women having to walk long distances, waiting in equally long queues to fetch water from bore holes, rivers or dams. In such circumstances it is not surprising that people cannot meet the WHO criteria of 20 liter of clean water per person per day [WHO.1983]. The Development Bank of South Africa estimates that of the 16 million rural population, rough estimates indicate that only 53% have a safe and accessible water supply

and 14% have access to adequate sanitation. Almost 60% has no electricity [DBSA, 1994]. With almost 85% of inhabitants having to make regular use of untreated water because of the unreliability of taps, the Mutshindudi area is even worse off than the rest of South Africa's rural population.

**The provision of water in a consistent and reliable manner is the responsibility of government and local authorities. Much progress has been made since the introduction of the RDP. It seems however, that the community itself will have to be much more involved into the maintenance of the water system than is the case at present. Small defects that can easily be fixed by the community itself, became big ones when not attended to. The establishment of Water User Associations as outlined in the National Water Act can fulfill this function.**

### 3.5.4 Community health:

Despite this situation and despite the fact that the river is been used extensively for bathing and laundry, the prevalence of water-borne diseases is lower than can be expected. The incidence of bilhartzia is, however worrying. Not only is it of concern for the health of local communities, but because it is a disease that spreads so rapidly, any increase is of grave concern for the whole of South Africa. Politicians and developers should keep in mind that while there is a necessity for building dams and water irrigation systems, there is an equal necessity that these should not become waterways for easier spread of water-borne diseases. Public taps brings running water but running water also brings malaria. Very often the area around public taps becomes breeding places for mosquitoes, flies, worms, etc. because the run-off is not controlled correctly. If people have to queue at these places, the chance of getting infected is much higher.

In addition, animals which are equally affected by bilhartzia, also spread the disease as they make use of the river. **Extensive health educational programmes are needed to inform people about the dangers of water-borne diseases. Valuable help in this regard can be obtained by making better use of community health workers [in this region, the Care Group Organisation..], Water User Associations as well as through the use of student researchers who come from these areas.**

Community health is also adversely affected as most of the population have no access to a

mechanism for refuse removal, or a proper sewage system with hygienic sanitation facilities and having to prepare food on open fires with no electricity for refrigerators to preserve food in the tropical climate in which they live. There is also no system for recycling of waste which put an even heavier burden on the natural resources. It is however doubtful whether such a system will be used if there is not a corresponding environmental educational effort to inform people of the benefits of recycling. The Learning for Sustainability Project is an example of such an effort [Dept. of Environmental Affairs and Tourism, 1998:8]

Many of these problems can be addressed through the RDP in consultation with the communities. While the electrification system seems to make progress in this region it is doubtful if the majority of inhabitants will be able to afford it.

People will still have to use wood for fuel which can result in the increase of deforestation. **Part of the solution may be closer co-operation with the 'Work for water' project so that alien trees which are removed to clear streams, can be made available for fuel. It will not only safe the indigenous trees, but will also take some of the burden away from women. Recycling programmes should be organised with manufacturers of e.g. bottles and cans. Collecting these can generate some income for local communities while at the same time create a healthier environment. Health and environmental education is once again a necessity.**

### 3.5.5 Decision-making processes:

Women in the Mutshindudi area take almost no part in decision-making processes affecting village life. If women have no or little say in community affairs, village life are determined and dominated by men. If women do not learn to take part in decision-making on a small scale, very few will become visible in local, regional and national political organisation. Low social and political status, leaves women dis-empowered. It causes them to suffer not only material disadvantages but also carry an additional physical and psychological burden. **Decision-making should also be based on collaboration with local communities in order to avoid top-down strategy. Policies should be developed in consultation with representatives of the people who are to be affected by the policies. An enfranchised community should be able to elect women representatives who are able to air there most pressing needs [Henry Kaiser Foundation, 191991:18]**

It is obvious that the women of Mutshindudi are not better off than most women living in rural South Africa. It is important to emphasize the plight of women living in circumstances of poverty and unhealthy environments. While many rural people may have health problems associated with inadequate infrastructure, it is largely women who are responsible for the collection of water and wood for fuel. Spending hours collecting and carrying wood and water, does not exempt women from other domestic chores such as child care, cooking, cleaning and washing clothes, which are also time consuming in the absence of labour devices or child care facilities. As a result women have little time to do anything other than domestic work and this pressure is compounded when they are engaged in subsistence agricultural work as is the case with the Mutshindudi community. All these demands grind down women's energy and health in general [Klugman et al, 1992].

The socio-economic profile of the Mutshindudi community presented through this study is in many aspects a bleak one. It is a situation of chronic poverty, of low educational levels, an underdeveloped infrastructure, community health problems and in addition, people who are for the most part disempowered. Development of man implies education, knowledge and skills. It implies health and vitality of the population and a climate of social justice within which the drives of people are channeled to exploit the natural resources for their common good. All of these elements are in short supply in the Third World - including the Mutshindudi area.

Local development activities are however, subject to a change in the still prevailing philosophy of national development programmes in South Africa. **Much more emphasis must be placed on genuine reforms and new approaches for community development in the rural areas. Much of the apparent apathy of this particular community can be rectified if government agencies, local authorities and RDP officials base their actions and programmes on the premise that improvement in quality of life is a precondition to productivity, and not a consequence.**

Only when people have the means to provide for their basic needs, will they have the energy and the dedication to sustain their natural resources in such a manner that it will be available for future generations

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## CHAPTER 4

# THE NEEDS AND PROBLEMS OF THE EXISTING WATER RETICULATION NETWORK IN THE MUTSHINDUDI RIVER CATCHMENT

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## 4.1 INTRODUCTION

Water is one of the most basic requirements for the survival of the living organisms. It therefore goes without saying that the availability and non-availability of water threatens the life of the living and thus may be catastrophic. Resulting from the quest for excellence and better life man came up with ways that will make water which is a scarce resource easily available to him. This was done with good intentions and not having power as an ingredients to the need for a better life. Water delivery was thus

aimed at improving the quality of life without that delivery being political means to some other ends.

The prevailing situation in the former Venda areas depicts a shift from the natural drive to provide water for human consumption to bring about better life for all to the one that appears to be dictated to by political demands and power balance of the areas. Where the political weight and the loyalty does not taste well for the authorities water was used as a means to restore the political correct balance. The reticulation systems that are in the areas that have been investigated suggests that water reticulation infrastructure was to serve as symbols of power and development level and not service delivery mechanism only. This is confirmed by the fact that the networks are of two specific modes ( urban and rural ) and the rural ones are not delivering and also not accommodative of the increasing demand now and in the future. Water delivery appears to have been seen as a favour and not a basic need as defined by the consumers. The understanding of the end users were not as important as the agenda of the provider, in this context the Bantustan government.

In view of the fact that water delivery appears to have been used as a political tool one is thus forced to view the research exercise as having been driven by the need to understand the forces at play and the direction the new government is taking to redress the imbalances of the past. This can only be served positively if one understands that the reticulation system combine both the political driven and the demand driven systems. The systems are thus aimed at both political control and improving the quality of life. It must also be noted that they also served as tension breakers and money making ventures by the government.

## 4. 2 PROBLEM STATEMENT

A number of villages are found in the catchment of Mutshindudi river. Most of them have been in existence for quite a long time. These are villages like Gondeni, Phiphidi, Ngwenani, Vondo, Murangoni, Dzingahe, Ngudza, Malavuwe, Mukula, Duthuni ( upper section ) and many others. Some of them grew into big villages as a result of social engineering activities by the former governments. Matondoni was relocated to a new area to accommodate the building of Vondo Dam whose supply of water will be mainly looked at in the coming discussions. Some smaller villages are also in the catchment area.

These are villages like Nweli, Mbahe, Mangumana,Murangoni Maranzhe and Tshikunda. All these villages have one thing in common. They are not adequately supplied with water. The supply to these area is either non-existent or very irregular. The reticulation network is also non-existent in a number of villages. The situation is in some cases as is , because there is no an adequate source of water but in some villages the quality and extent of the systems is systematically engineered to be what it is.

This study therefore attempts to look at the problems associated with the existing network. It also examines the rationale of delivery as it was seen by the previous governments. An attempt is also made to look at the development needs as seen by the villagers with regard to improving the supply in their areas. This will thus evaluate the indigenous network as existing alongside the modern network.

This study also investigates the problem associated with the existing network relating to its inadequacy, its use as a political tool and the fact that it is not accommodative of the present village expansion and growth as well as the growing demand that stems from the improvement in the quality of life in various villages.

As the existing system is a product of the former apartheid based government, water provision was characterised by the following key features that are now posing problems for the service providers. The reticulation system was divided into two distinct forms namely the urban and rural modes. The delivery modes were dictated by the wealthy / poverty ideology that suggested that urban meant good and efficient systems while rural meant temporary and irregular supply of water.

Vast disparities exist between the urban network and the rural one. Some of them are the following:

- Urban areas have house and yard connections while rural supply is both community standpipes and yard connections ( and subsequently house connections for some).

- Urban areas' supply is regular and reliable while the rural one is very irregular and unreliable.

- Urban areas are supplied with purified water while some rural villages had to live with ground water from bore holes operated by diesel engines.
- There is also a lack of access or unequal access to clean water between urban and rural dwellers. The inequality is a product of social engineering that resulted in a water delivery or supply philosophy which was founded on modernity versus traditional dichotomy.

- There is a lack of involvement and participation of the beneficiaries of the systems in both the design and planning of the existing network. Rural dwellers were excluded from the decision-making process while urban dwellers through the town management structures were given at least a say in how the system has to run. The unequal, not people and demand driven tendencies are observable when one looks at the nature of the network in the catchment area.

The main problems of the reticulation systems are seen to be stemming from the following assumptions:

- Water delivery was used as political tool in the past.
- Water delivery was seen as a basic need but not to be provided in response to the need but to the wishes of the powerful.
- The reticulation systems are not adequate and thus need some improvement.
- The reticulation systems are not geared towards empowerment and thus are not accommodative of the growing demand and not based on the present RDP requirement.
- That the systems accommodated the cultural aspects in that they provided a social point for social meeting places for women.

The aim of the investigation is therefore to:

- assess the physical capacity and adequacy of the existing water supply network in the catchment area.

- assess the needs and problems of the various communities served by the existing network.

- assess the effectiveness of the survival strategies aimed at improving their positions both formal and informal strategies.

- assess their level of expectation that accompanied the coming in of the new era in the form of the new government.

## 4.3 METHODOLOGY

In this investigation 10 villages were selected. The idea for selecting the ten villages was to establish their water distribution network in relation to the supply lines that serves the catchment area. The supply lines in question are served by the Vondo Regional Water Scheme. The are two main lines that were considered namely the Donald Fraser and part of the Sibasa lines. The lines are served by a number of reservoirs that are fed by Vondo and Phiphidi dams while in others this supply is supplemented by bore holes. In those villages that are not served by the scheme, bore holes are the source of supply apart from rivers and streams.

In these settlements the following issues were closely looked at :

- The level of water service

- The position of the villages along the pipeline

- The level and type of water supply

- The adequacy of water supply infrastructure

In addition to practical and physical observation of the villages, face to face interviews with key informants from the villages were also conducted. The key informants are bodies like the civics, development forums, headmen and headmen councils and ordinary people who were met at the water outlets like standpipes, community bore holes and hand pumps, rivers and streams. This study was more of a consultative nature than formal interviews and questionnaire sessions. Through these interviews qualitative

data was gathered. More emphasis was placed on the perceptions, expectations, needs and strategies for survival in relation to the existing water supply network.

## 4.4 THEORETICAL UNDERSTANDING OF DEVELOPMENTAL TRENDS IN WATER DELIVERY SYSTEMS.

Social sciences are used extensively by politicians. In order for one to understand the role they played during the apartheid era one has to look at the nature of service delivery mechanism characteristic of communities of the time. During the Republic of Venda days, social sciences as applied did not locate themselves within the context of actually addressing or partly addressing the problems of poverty, powerlessness and difficulties experienced by the communities but served to provide explanations to justify what was a given political order. It may thus be argued that what was a problem was not poor planning or incompetent forecasting but inflexible thinking. Our thinking did not serve as a tool to navigate the inevitable change that was to come. Alternative pathways to the future were not considered in that the existing resources were not effectively used for the benefit of many but ineffectively used for the benefit of the few people who were then identified as the township dwellers. Everything new and modern was associated with the three dominant townships namely Shayandima, Makwarela and Thohoyandou.

This study is therefore a necessary exercise as it is dealing with a new approach in the social sciences, namely to base findings and recommendations on the real needs of the communities such policies are meant to serve.

### 4.4.1 Water delivery as a development strategy.

One of the RDP principles states that development should be a people driven process. Development must focus on the immediate needs and encourages the empowerment of people. This therefore suggest that it must provide for the people's expectations rather than try to create expectations. For development to work it must be sustainable. Water as a resource necessary for development must also be provided in a sustainable manner. With the irregularity characteristic of some delivery systems the sustainability is lacking and water delivery as a development process is therefore adversely affected. The RDP guidelines put it clearly when suggesting that water delivery and management have these

goals namely , meeting persons health and functional requirements, raising agricultural output and supporting economic development ( ANC, 1994: 29)

In view of the above, water delivery may be used as a development strategy if managed and carried out properly. This can happen if the provision of water is accompanied by what Lombard (1991:87) referred to as community action. For her this community action must of necessity lead to social action and this social action must be characterised by being concerned with a proposal for change, directed towards achieving a goal, target the group that has the necessary power to carry out the people's desire and finally have an educational method aimed at human development. This can only happen if the non-delivery of water services in some villages is not seen as a product of "backwardness of their people or traditions, the lack of an educated elite or by the absence of values considered to be conducive to development" ( Harrison ; 1993: 150 )

Water delivery may also be used as a form of social engineering in which case some form of a relocation process is triggered in pursuit of a better life where the basic needs are systematically provided for. In this case water delivery and services are treated as the benefit that accompanies a movement to the urban centres (namely Thohoyandou, Shayandima and Makwarela townships). This occurs where development is defined as a process of directed change whose objective is to provide a better alternative to what exist in the so called rural settlements. Where this kind of delivery approach is applied one finds a marked urban-rural imbalance. These imbalances can easily be observed in the villages under investigation in relation to the towns that are served by the same scheme.

In this case development and underdevelopment are essentially seen as the result of a process where " if a group has a large slice of the good things of life, others have to settle for a correspondingly smaller share. [ See-saw theory of development]" ( Harrison : 1993 :96 ) In this view the inadequacy and non-existence of water services in some villages may be explained by reference to the geographical position of the villages. This is in contradiction to the present government philosophy on water provision " some for all and not all for some ".

Water delivery and services may also be used as a strategy of development whose objective is to empower communities. This strategy requires that there be creative interpretation of growth and progress as seen by the communities. Development will thus have to promote a desire to improve the conditions within communities without seeing the need to relocate as a priority. An approach to development, in this case, will be founded on the principle that development must take place where people live. Communities must promote the desire to work towards a specific way of life and specific conception of reality. This reality must of necessity accommodate the challenges and opportunities as seen by the villagers. In this case development must " emphasize the spreading of advantages by means of diffusion of the benefit of innovation, knowledge, material investment and general creativity.

## 4.5 PRACTICAL OBSERVATION

### 4.5.1 Present scenario

Water delivery or supply systems in the villages that have been studied are of four types, namely yard connection, standpipes, bore holes served by diesel engines and hand pumps. Apart from these four types, some villages rely on rivers and streams. The villages seem to be experiencing more or less the same difficulties. They only differ in terms of the fact that some of them have two types of reticulation systems ( i.e. standpipes and yard connections) while others have standpipes or bore holes and hand pumps only.

The bulk water supply to the villages in the catchment area is constituted of two main supply lines namely Sibasa and Donald Fraser.

Brief explanation of the Donald Fraser System [ See Figure 4.1 and Figure 4.2 ] (SRK , 1996: 94-95 )

Water is pumped from Phiphidi Water works to R2, being the main bulk storage reservoir of the Donald Fraser supply system.

R2 also services its immediate surrounds area including Ngwenani and Phiphidi.

The Old Phiphidi Works still supplies treated water to R2.

RD1 supplies its immediate area.

RD2 is an in - line reservoir which supplies the immediate area and the remainder of the DF System.

RD3 is an off - line reservoir. It provides water to its immediate surroundings, but also pumps water to RD4 and RD5.

RD6 is supplied from RD5 and dependent on level of RD5, water will be pumped to RD6.

RD7 is an off line storage reservoir with a pump station pumping water to RD8 and Donald Fraser Hospital ( RDF ) reservoir. RD7 is also supplied by bore hole water. RDF supplies the Donald Fraser Hospital and it is operated at full supply all the time unless RD7 is empty.

RD9 is the main off line reservoir that supplies the prison and immediate area. The prison has its own on-site elevated tanks supplied by RD9 and kept full by additional supply from two bore holes.

RD10 is always full due to its close proximity to the bulk supply line and relative low elevation.

RD11 is situated far away from the main line on high ground and is mostly empty.

RD12 is also situated far from the main line route and is supplied by a local bore hole.

RD13 is located next to the main line and can be used as a flow- through reservoir or be bypassed.

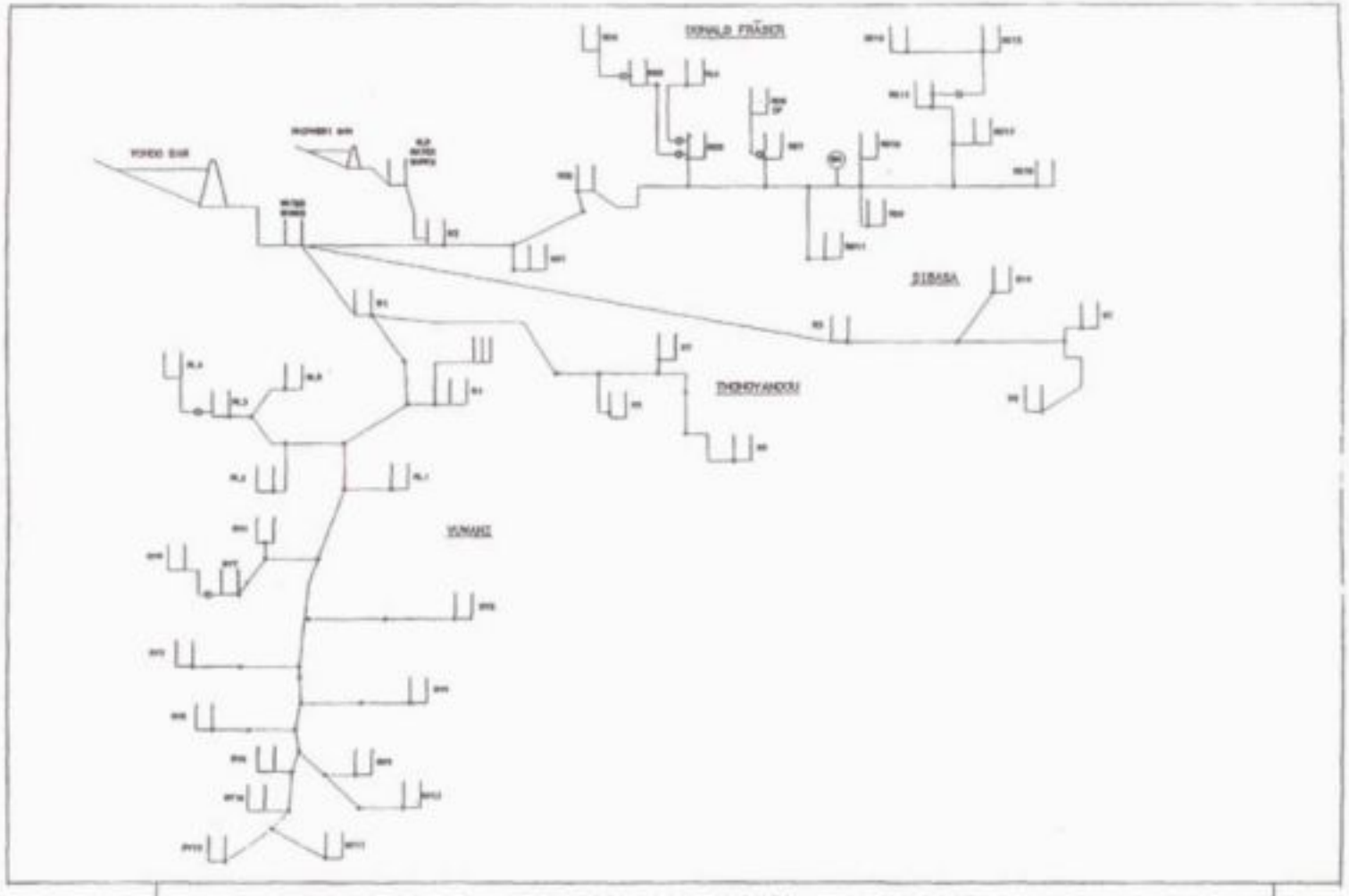


Figure 4.1

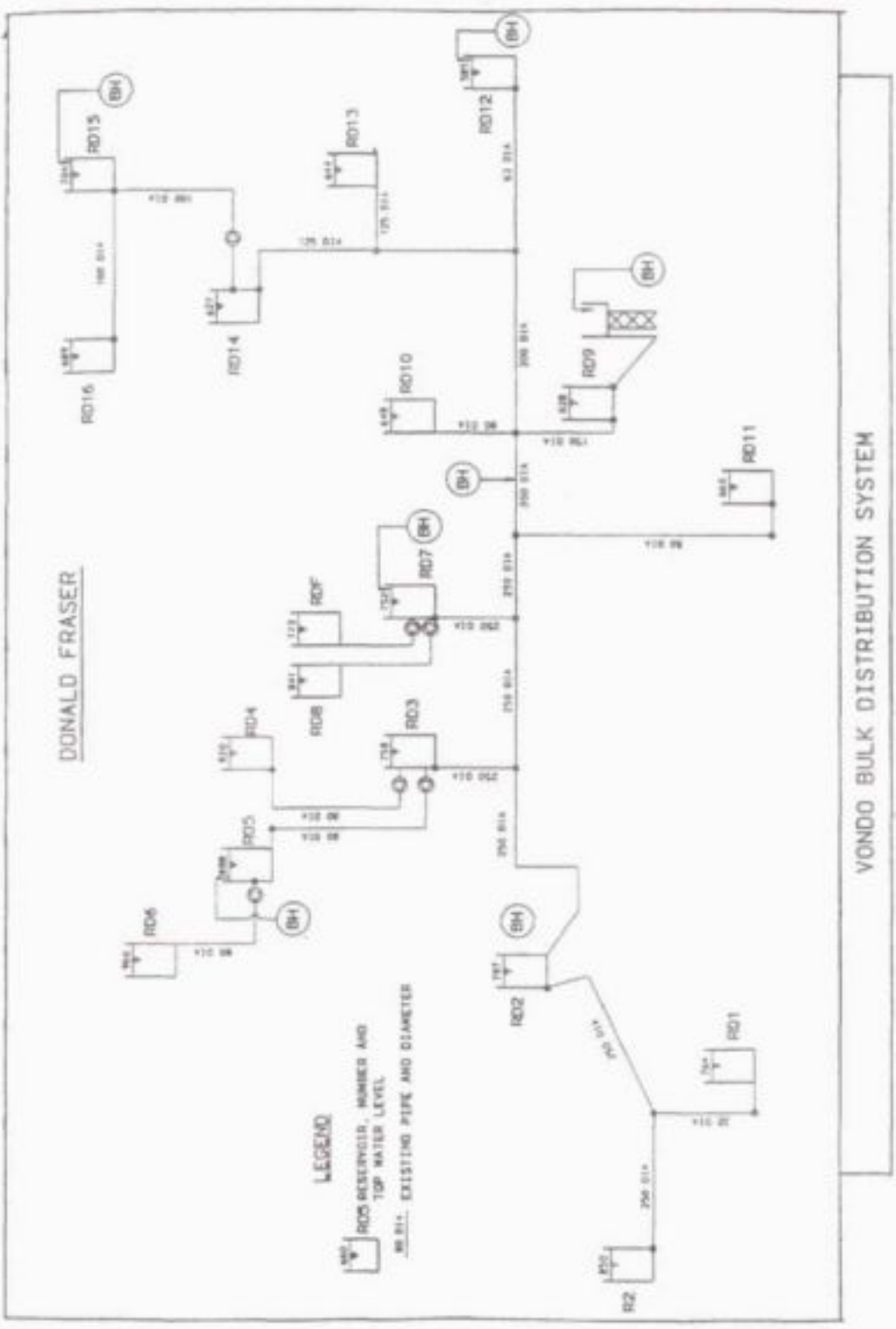


Figure 4.2

RD14 act as a pump sump for pumps supplying RD15 and does not have its own supply area.

RD15 is reliant on water from RD14 and from a local bore hole. It provides water to RD16 and on rout users.

RD16 is the last reservoir on the system and can stay for a long period without water.

4.5.1.1 Vondo and Matondoni Communities

These are the villages that are situated in high lying area between the two main dams serving the Vondo Regional Water Scheme namely Vondo and Phiphidi dams. These are the hardest hit in relation to the main supply lines. They are not part of the system and are served by a bore hole from which water is pumped to a small reservoir. This is the only source of water apart from the streams and rivers. The reservoir supplies water to randomly positioned standpipes in the two communities. Matondoni has 23 standpipes for about 600 households and Vondo has 11 such pipes to serve about 300 households.

When considering that Matondoni is one village that had to relocate to accommodate the building of Vondo dam, the situation for them becomes political. The sharing and distribution of the development advantages ( in the form of the dam's supply ) never provided for their expectations and aspirations. For them the relocation that they have to live with is a worthless sacrifice because they never benefited directly.

Although the villages are experiencing difficulties they came up with ways and means of improving their conditions. Matondoni residents were, during the time of investigations, raising funds to financially compel the government to install yard connections. But this move had to be balanced with the inter-community conflict that could arise between them and Vondo residents who could also demand the

same treatment from the government only to find that maybe the source ( a bore hole in this case ) may not accommodate the increased demand and usage that accompanies yard connections. One other problem was that the lines that serves the standpipes cuts through the villages and high lying areas may not have water because of low pressure. The prevailing conditions may consequently continue for a considerable period of time.

4.5.1.2 Phiphidi and Ngwenani villages

Phiphidi's village network is of three types i.e. yard connections, standpipes and house connections. The number of standpipes is declining because those that are broken are mostly not repaired as there are many people having yard or house connections. About 60 per cent of households have yard connections and 10 per cent house connections. The few remaining standpipes are used by those who do not have yard connections. This village is served by reservoir R2 which is an on-line source.

Ngwenani village has 22 standpipes and a fair amount of yard and house connections. This village is served by reservoir R2 which provides a reliable and regular supply. In response to property and self development that is taking place a greater number of community members are in favour of yard and house connections. The refurbishment of the Vondo Water Scheme will result in a greater per centage being accommodated. This will leave the village being in a slightly better position with about 70 per cent yard and house connections.

4.5.1.3. Ngudza and Dzingahe Villages

These are villages that are in the opposite sides of Mutshindudi river. The nature and regularity of the supply is the worst. Each of the villages have both standpipes and yard connections.

Ngudza is served by reservoir RD9 which is an off - line reservoir supplying the prison and immediate areas. The supply capacity of RD9 cannot provide for the prison's water demand as well as that of the surrounding areas. This result in villages like Ngudza having a serious irregular and unreliable supply. This village has 26 standpipes that are on the only line that cuts through the villages and have yard connections made off it and this creates difficulties for people at the end of the line.

Dzingahe village has about 30 per cent house and yard connections and 24 standpipes. Unfortunately the village is to be served by the reservoir RD11 which is situated far from the main line on high ground and is mostly empty. Most of the yard connections never had water for the past two years and this suggests that those on lower parts of the village are better off.

4.5.1.4 Matsika, Malavuwe, Nweli , Mangumana Communities.

Matsika and Malavuwe villages being the villages closest to the confluence of the Luvuvhu and Mutshindudi rivers are not even part of the Vondo regional water Scheme. They only have one type of water distribution network. Each of them has a diesel-engined bore hole from which water is pumped to elevated tanks and thereafter to a number of standpipes.

At Matsika, there are four taps where the tank is located and people had to go there to fetch water. In case of an engine break – down, they rely on one hand pump whose quality of water is not so good. The village has about 300 households who mostly wash their clothes at the rivers while they the bore hole provide water for drinking purposes.

The situation at Malavuwe is different in that there are 5 elevated tanks randomly positioned in various parts of the village and these tanks provides water for about 400 households. Since they rely on this source any form of breakdowns leads them to the river for survival.

There are no yard connections in both villages.

Nweli and Mangumana villages are the two villages that have handpumps only. There was an indication that a better system was planned for the two villages. There are equipped engine houses were the handpumps are. It appears that the idea was abandoned in response to the poor yield of the bore holes and there is no any other source that could be made use of.

The two villages are reasonably small compared to all others. Mangumana has 80 households while Nweli has 160. Due to the fact that the handpumps are mostly non - operational the villagers make use of the river for their water needs.

**4.5.2 The perceived scenario**

Almost every village that is part of the Vondo Regional Water Scheme holds an opinion that the government offered them a raw deal in not installing yard connections

or not constructing the reticulation network that could accommodate the increased demand.

Most villages are again not so convinced that, considering the present network, that the nature and capacity of the reticulation network is determined by the source of water and the relative demand of water. The incapacity is seen as confirmation of the " all for some and not some for all" rationale of the existing supply.

In villages where there are bore holes and handpumps the unreliability of their supply is confirmed. This thus makes inhabitants believe that their needs and problems are only provided for temporarily and can only be made permanent if they trouble the authorities. Hence the emergence of water committees in almost every village. Water committees are therefore created as both a proactive and reactionary force. Some of these water committees have already consulted locally based consulting engineers to help prepare business plans to submit to the authorities.

The residents of Vondo village attempts to improve their conditions involve an effective use of indigenous wisdom. This is in the form of connecting the streams to their self - engineered network of pipes that are loosely laid out in some parts of the village in order to augment the formal supply of water to their area. This reflect a need to have a better system in their area which could cater for yard connections. Since this is not guided by clear strategic conceptions it may not last for a very long time. The necessary strategic conceptions may emerge if the community is enabled to not deny its resource weaknesses and thus capacitated to asses its situation, problems, power realities, options and opportunities objectively.

## 4. 6 DEDUCTIONS

From the analysis of the overall responses in the interviews and consultation meetings, there seem not to be a lack of interest in viewing water delivery problems as a resource-linked problem. This reflect the effect that the urban biased development strategy had on the various communities. It may thus be argued that the duality of the delivery mode or network divided the communities to an extent that some communities see others as being favourable treated at their expense.

There is also a lack of knowledge in so far as the workings of the reticulation network or systems are concerned. This makes it difficult for some people to understand the technical issues surrounding the problematic flow of water to and from various parts of their villages. This lack of knowledge also makes people believe that the very same technical issues can be manipulated to give water to some villages and not others.

There is also a lack of the necessary structures to co-ordinate knowledge dissemination in the villages. Although there is an emergence of structures like water committees they seem to be structures accompanying the dawn of democratic practices without having a well conceptualised strategy to tackle the problems related to water delivery.

## 4.7 CONCLUSION AND RECOMMENDATIONS

**In order to have a sound water delivery network and effective water service in the Mutshindudi river catchment area, broad participation and broad educational campaign processes must be allowed to play an effective role in the management process. The reticulation systems must of necessity be well understood by those benefiting from it. The system must be aimed at service rendering and intellectual production of the relevant attitude, skills and knowledge that will be important for proper management. A situation must be created in which the struggle between the government or Transitional Local Council ( TLC ) as service providers and communities must not be over income distribution or redistribution but service distribution. The emerging scenario with regard to water service is based on user pay philosophy. This need to be made clear to various communities that effective service had to be accompanied by an effective pay system.**

**Since the water distribution network is now guided by the Reconstruction and Development Programme ( RDP ) principles and will automatically need some kind of unnatural and artificial / scientific facilitation, there should be a well planned governmental policy ( for the Region ) to address the imbalances between the urban and rural delivery modes. This catchment area does not need an approach to water delivery that ignores, demeans or regards communities as susceptible to manipulation in the interest of any other objectives. Some of the communities ( like Matondoni ) sacrificed their history, culture and properties to accommodate the backbone of the existing source of water service in the area ( Vondo Dam )**

Water delivery and service must be a process that involves a win-win situation. Since government / TLC and communities cannot agree on all issues, some mechanisms are necessary to facilitate the smooth functioning of both government operated and community-based water delivery systems. The overall objective of the efforts by the water suppliers and beneficiaries must be to share their responsibilities regarding a better quality of life for all.

The overall findings reflected some discrepancies that are in line with the assumptions as stated in the beginning. The imbalances regarding the two delivery modes ( urban and rural ) were confirmed. The inherent inefficiency and ineffectiveness of the existing reticulation network became very obvious.

The former governmental approach which appears not to have been socially sensitive, clear and open, suggests the active role that it played in disempowering some villages. Water provision as it occurs in the various villages, lacks the foundational structures that could have made community participation and empowerment easier. The emerging structures ( water committees, development forums, civics etc. ) if managed and capacitated properly could be very effective in creating awareness, knowledge gathering and dissemination regarding the operations and maintenance of the reticulation networks. This process may produce community members who are knowledgeable and able to take part in the management of water delivery systems and treat water as a scarce resource.

The investigation resulted in the following major findings:

Almost all villages in the catchment area experience problems regarding the existing water reticulation system.

- Some villages make use of water from unreliable and unhygienic sources.

- Fair and equitable sharing of the available water in the catchment area is complicated by the planned, engineered and systematic discrepancies in existing the reticulation systems.

- Several development options are available ( some of them have already been introduced during the course of study e.g. Refurbishment of Vondo Regional Water Scheme and modification of Damani Dam to also provide for domestic water utilization )

- The existing reticulation network did not provide for the increase in demand that came along with property and self-development by members of the various communities. It also did not provide for the villages' expansions.

- The existing network does not meet the RDP requirements ( 200 radius from the supply point ) and that new improvements need to achieve that.

**In terms of the findings mentioned above the following can be done to improve the situation.**

- **Greater participation by community structures is essential for effective service delivery. Participation must be encouraged in order to promote satisfaction, effective decision-making and personal development.**

- **Creation of an environment conducive to greater participation will serve to improve the acceptance of the possible network with its inherent deficiencies in relation to the source. This will automatically trigger a need to seek solutions based on and in response to the available limited resources to minimise deficiencies. Feelings of alienation will be reduced when communities gain control of their immediate environment. This may strengthens their loyalty and attachment to the service provider.**

- **An effective education campaign in water management and water service is also necessary. This may reveal the mutual effect of the government / TLC's problems while creating an awareness of their common approach in an attempt to solve their problems.**

- **The education campaign is imperative because of the following reasons:**

- **The attitude of communities to water use and water service need systematic and gradual transformation through effective and detailed education about the role, functions and objectives of water committees. The service providers have not been actively involved in giving technical, theoretical and practical explanations about the existing network. This resulted in an intellectual vacuum that now appears to be a difficult hurdle to cross.**

- **The indigenous knowledge that exists needs to be integrated with the scientific and formal wisdom in order to minimize incongruencies in the objectives of the two types of wisdom.**

- **The existing bulk water supply network need to be looked at in order to implement a number of recommendations suggested by a number of consulting engineers who have discovered some technical problems with regard to the positioning of a number of reservoirs in the network ( whether a reservoir should be an in-line or off-line reservoir )**

- **The two-pronged nature of the network obtainable in the urban and rural areas must be changed so that the two sectors are treated equally in terms of the proclamations that include all villages in Thohoyandou as part of the town.**

## 4.8 FURTHER RESEARCH NEEDS

The problems and limitations of the study indicate that there is a need for further intensive investigations before one may come up with an informed assertion as to whether or not scholars, political role players, communities and researchers in the region are taking water delivery and water service problems seriously.

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# CHAPTER 5

# THE UTILIZATION OF RIPARIAN PLANTS IN THE MUTSHINDUDI RIVER CATCHMENT

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## 5.1 INTRODUCTION

Indigenous plants are important sources of medicine, energy, building material, food etc. for communities in underdeveloped rural regions. Although these resources were used rationally in the past, population growth pressure often causes over-utilisation. For the purpose of this study it was necessary to determine which plants are utilised and whether over-utilisation is taking place. Information was gathered by unstructured interviews and by personal observation of the condition of riparian vegetation.

## 5.2 MATERIALS AND METHODS

Unstructured interviews were conducted at Phiphidi, Ngudza, Dzingahe, Mukula, Mangodi, Ngwenani-ya-ha-Themeli, Mbilwi, Mangondi and Matsika and Tshaulu. Passers by or occupants of houses were asked which plants they utilize and for which purpose. Where possible they were also asked to point out the plants. The age of respondents were recorded. Possible solutions to over-utilisation ware also discussed with respondents. The condition of riparian vegetation was evaluated by walking along the banks.

## 5.3 RESULTS

The general response of the people interviewed was that the majority of riparian plant species are used for firewood, garden construction, and wild fruits (mainly enjoyed by kids) as well as for medicine. Juveniles had little or no knowledge about indigenous plants, those from 25 to 49 years old were more knowledgeable and the most knowledgeable respondents were those

in the age group 50 plus. Table 5.1 lists the species and their uses as pointed out by respondents.

Table 5.1 Riparian plants that are utilised by inhabitants of the Mutshindudi River catchment

| SPECIES AND VENDA NAME | USES |
|---|---|
| *Acacia karoo* : Musu | Firewood and shade, and fencing |
| *Afzelia quanzensis* : Mutokota | Firewood and shade |
| *Albizia adiantifolia* : Muelela | Firewood and water saver |
| *Anthocleista grandiflora* : Muenene | Medicine for cattle and water saver |
| *Antidesma venosum* : Mapulakhwali | Fruit and firewood |
| *Acacia ataxacantha* : Muluwa | Arts and crafts (basket making), and fencing |
| *Bauhinia galpinii* : Mutswiriri | Firewood, and ropes for tying thatch |
| *Berchemia discolor* : Munia | Firewood and fencing |
| *Bidens pilosa* : Mushidzhi | Vegetable |
| *Breonadia salicina* : Mutulume | Thin poles used in thatching, shade, arts and crafts, water saver, for making mortars and pestles, fruit and fencing |
| *Bridelia micrantha* : Munzere | Medicine for livestock, fruit, for making mortars and pestles and fencing |
| *Bridelia molis* : Mukumbakumba | Holding soil together |
| *Burkea africana* : Mufhulu | Firewood and fencing |
| *Canthium mundianum* : Mupfuka | Holding soil together |
| *Carissa spinosa* : Murungulu | Fruit |
| *Combretum imberbe* : Mudzwiri | Firewood, fencing, mortars and pestles |
| *Combretum molle* : Mugwithi | Firewood, fencing, mortars, pestles and medicinally |
| *Cussonia spicata* : Musenzhe | Used medicinally, i.e. for new-born babies |
| *Dichrostachys cinerea*: Murenzha | Firewood, fencing |
| *Dombeya rotundifolia* : Muluvhari | Leaves are used for tea-making, firewood, medicinal and fencing |
| *Combretum erythropyllum* : Muvuvhu | Water saver and firewood |
| *Ficus sycomorus* : Muhuyu | Fruit, medicinal and firewood |

| | |
|---|---|
| *Cynodon dactylon* : Tshitanzhela | Pasture grass and could be used for lawns |
| *Dichrostachys cinerea* : Murenzhe | Firewood and medicine |
| *Grewia flavescens* : Mupharatsheni | Fruit and firewood |
| *Heteromorpha trifoliata* : Muthathavhanna | Medicinally |
| *Heteropyxis natalensis* : Mudedede | Firewood and fencing |
| *Ricinus communis* : Mupfure | Useful for oil-making and also used medicinally |
| *Sporobolus africanus* : Mushingidzhane | Mat and hat-making, also a pasture grass |
| *Themeda triandra* : Fundwi | Pasture grass, thatching and prevention of soil erosion |
| *Ziziphus mucronata* : Mukhalo kana Mutshetshete | Fruit, firewood and fencing |

The interviews also showed that community members are concerned about the over-utilisation of riparian vegetation and that they are aware of the fact that this leads to a deterioration of water quality.

Evaluation of the status of riparian vegetation showed that this resource is generally severely over-utilised or removed for crop production in the reaches below the Thathe Vondo Dam.

## 5.4 DISCUSSION

The study showed that riparian vegetation is an important resource, mainly for medicinal purposes, for energy, for food and for building material. It also showed that this resource is severely degraded in most parts due to removal for cultivation and due to over-utilisation.

The fact that older people are more knowledgeable about the resource than younger people indicate that the importance of this resource is declining. It can also be concluded that the resource is mostly used by people with a low income. The lack of knowledge amongst young people who still utilize the resource due to poverty is reason for concern because it shows disinterest in sustainability.

Concern by the rural population about the state of the riparian vegetation and an apparent understanding of the negative effect this might have on water quality is encouraging and indicate that the population might be receptive for environment awareness education. Villagers also indicated that negotiation and consensus between villagers and the authorities on land allocation for gardens and fields would help to alleviate the problem They are also aware of the importance of the natural environment for the development of tourism. A solution to this problem should therefore be sought in environment awareness education and the involvement of all sectors of the community in decision making. Villagers could be made to understand the importance of the river around them as long as there is joint positive interaction between them and "the authorities". It is also recommended that an alternative form of energy such as electricity be provided to reduce the dependence on indigenous wood for this purpose.

# CHAPTER 6

# THE IMPORTANCE OF FISH AS A RESOURCE IN THE MUTSHINDUDI RIVER CATCHMENT

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## 6.1 INTRODUCTION

A large portion of the underdeveloped rural population of South Africa is in some way directly dependent on natural resources for subsistence. Many of these areas experience water related problems and a lack of expertise to manage resources. Till recently, rivers in South Africa were not considered to constitute recognised consumers of water (DWAF Green Paper 1995). This situation is now being changed and the human needs together with the ecological requirement of the river itself, are now safeguarded in the new Water Act. Although the consumption of water by rivers has been acknowledged in principle, the possible benefits of rivers to the local community have not been evaluated. This can result in neglect of important resources to the communities living around rivers and gradual deterioration of the rivers themselves.

A considerable amount of attention has been directed to the presence and biology of the fish life in rivers (Skelton 1993) (See also Chapter 9) but little to the use of fish in smaller rivers the size of the Mutshindudi. Welcomme (1979) refers to river fishing activities in Africa and especially the floodplain fisheries in various large rivers of Africa, including the Niger and Zambezi.

Fisheries in smaller rivers are generally not considered important and benefits to local communities ignored in planning and management. The potential contribution that rivers can have to the nutritional and general well-being of the local population and also the fish production potential of our rural rivers is generally not considered as reason or motivation for the protection and maintenance of rivers in rural areas.

The present study of the fishing activities on the Mutshindudi River was partly motivated to fill this gap in our knowledge. An earlier study on the use of grasshoppers in the Venda region (Van der Waal 1996) brought the 'hidden' home consumption value of this neglected protein source into focus. Fish may play a similar role as grasshoppers in providing a valuable resource in the form of protein and recreation to the local population.

This study attempts to determine and evaluate some aspects of the importance fish and fishing to the local population. The following key questions were asked:

- To what extent is local fish acceptable as food in the catchment.

- What portion of the rural community is engaged in fishing activities in the Mutshindudi catchment.
- What fishing methods and gear is used to fish?
- What is the fishing success and what species are caught?
- What is the catch per unit effort and harvest of fish from the Mutshindudi River.
- How is the fish that is caught, utilised.
- What are the possible effects of this fishing on the fish community in the river?
-

## 6.2 METHODS

The project is divided into three phases that can run simultaneously but are not directly dependent on each other.

- Survey of the attitude of the population in the catchment towards fishing and fish consumption.
- Survey of fishing activities in the study area.
- Possible impact fishing has on the fish life in the river.

For the survey of the attitude of the population towards fishing, a structured questionnaire was designed after consultation with Dr M J Gaigher, sociologist (see Chapter 3) and a small pilot survey conducted. The survey itself was conducted over a two-month period and planned to cover all main villages in the catchment. Representativeness of sampling was ensured by selecting every fifth stand in a village for questioning. An older female graduate person Me Edzisani Negukula, was chosen to conduct this survey as most residents in the villages were female and could be approached more easily by a female person when they felt free to answer questions about fishing and fish eating activities.

The second task was carried out over a period of two years and proved to be more demanding. Four senior Biology and Zoology students or graduates were trained in the identification of the relevant fish species and collection of information from the sometimes suspicious fishers. They were also asked to collect samples of collected fish for verification of the local Tshivenda names.

Surveys were conducted during different months of the year in an effort to cover all fishing conditions, water temperatures and water levels. An attempt was made to include all sections

of the Mutshindudi River and the Tshinane and Ngwedi Rivers. Fishers were approached whilst fishing, and after the surveyor had created a good relationship, a number of open ended questions were asked and the catch recorded.

Fish caught were recorded as identified by the fisher using local names, forklength or total length measured on a ruler to the nearest millimetre and fresh mass determined with a small spring scale, sensitive to 10 g.

For the third phase a graded fleet of gill nets (9 nets of 10 m each with meshes 21 to 150mm) was used to close off and entrain all fish in two pools where regular fishing took place. Three efforts were attempted and nets placed in pools over 24 hour periods. Nets were lifted every 12 hours and then laid out in a new pattern in order to collect as many fish as possible. All fish collected were measured on a fish measuring board to the nearest mm and mass determined with a electronic field scale to the nearest g.

## 6.3 RESULTS

### 6.3.1 Fish use and fishing activities in the catchment as determined by questionnaires

The number of questionnaires completed in 23 villages in the Mutshindudi catchment are tabulated in the table below.

TABLE 6.1 Villages and areas covered with the questionnaire on fishing and fish eating habits.

| AREA AND VILLAGE | NUMBER OF QUESTIONNAIRES | DATE |
|---|---|---|
| Dzhingahe, Dzumbane, Madevhele | 12 | 14-11-1995 |
| Ngudza, Tshiswinzwani | 21 | 15-11-1995 |
| Khubvi, Lungane, Tshiseluselu | 28 | 16-11-1995 |
| Tshikunda, Mathondoni, Vhutshavhelo | 28 | 23-11-1995 |
| Ngwenani-ya-Themeli, Madimbo, Magovhani | 26 | 24-11-1995 |
| Gondeni, Tshilaphala, Magovhani | 12 | 25-11-1995 |
| Mukula, Mukondeni, Tshapala | 27 | 27-11-1995 |
| Vhufuli, Tshivhulana, Tshindindini | 26 | 28-11-1995 |
| Mukumbane | 20 | 29-11-1995 |
| Malavuwe, Thondoni, Tshivhazwaulu | 28 | 30-11-1995 |
| Luvhimbi(Georgenholtz), Vhunga, Makalangani | 15 | 30-11-1995 |
| Duthuni, Thsiawelo, Vhutanda | 25 | 5-12-1995 |
| Phipidi, Dohe, Maha | 25 | 6-12-1995 |
| Vondo, Matondoni | 25 | 7-12-1995 |
| Makonde, Tshitasini, Tshiungani | 25 | 8-12-1995 |
| Luvhimbi, Vhuvumba, Fungudimba | 25 | 9-11-1995 |
| Lumungwi, makwelegwe, Thondoni | 25 | 11-12-1995 |

| | | |
|---|---|---|
| Gondeni, Thondoni, Nondwe | 25 | 12-11-1995 |
| Tshilapfene, Newstands, Radali | 25 | 13-12-1995 |
| Matsika, Tshivhonzhe, Mafenya | 25 | 14-12-1995 |
| Tshamutilikwa | 25 | 18-12-1995 |
| Nweli, Mafhawe, Thembaluvhilo | 25 | 19-12-1995 |
| Mbahe, Tshilantsi, Mphadi | 24 | 20-12-1995 |
| | Total 542 | |

The questionnaires were analysed statistically by Prof. Szubarga using SSPS software data interpreted and presented in graphical form using MSExcel software.

6.3.1.1 Socio-economic characteristics of the human population sampled by questionnaires

- Age composition of the respondents to questionnaires:

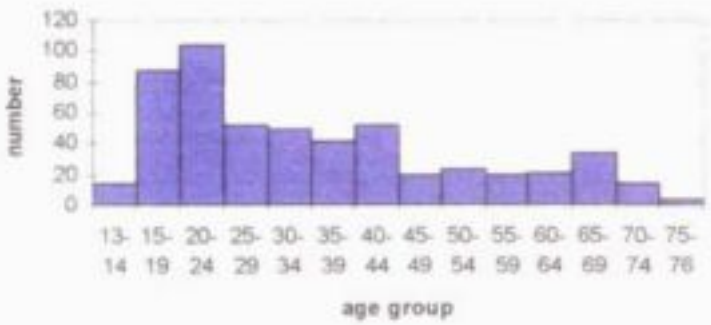



Fig. 6.1 Age composition of respondents to fishing and fish eating questionnaires in villages of the Mutshindudi catchment.

Most respondents were young females and proved willing and capable to answer questions on fishing and fish consumption. The mean age of the respondents was 35,1 years. No reports of unwilling respondents were made by the enumerator.

- Number of persons per stand

The mean number of persons was 6,66, including 2.62 adults, 3.05 school-going children and 1,00 pre-school children. There were 3,01 huts or rooms per stand. This information tallies well with that found in the socio- economic study of this catchment (Chapter 3) where similar data were obtained.

- Wealth - possession of animals and fruit trees

A family unit possessed on average 1,52 goats and 0,61 cattle, but 72,5 % of the respondents indicated that they had no goats and in the case of cattle this value rose to 90,9%. When asked

about fruit trees, an average of 6.89 trees was indicated with a skewed distribution as shown in the figures below:

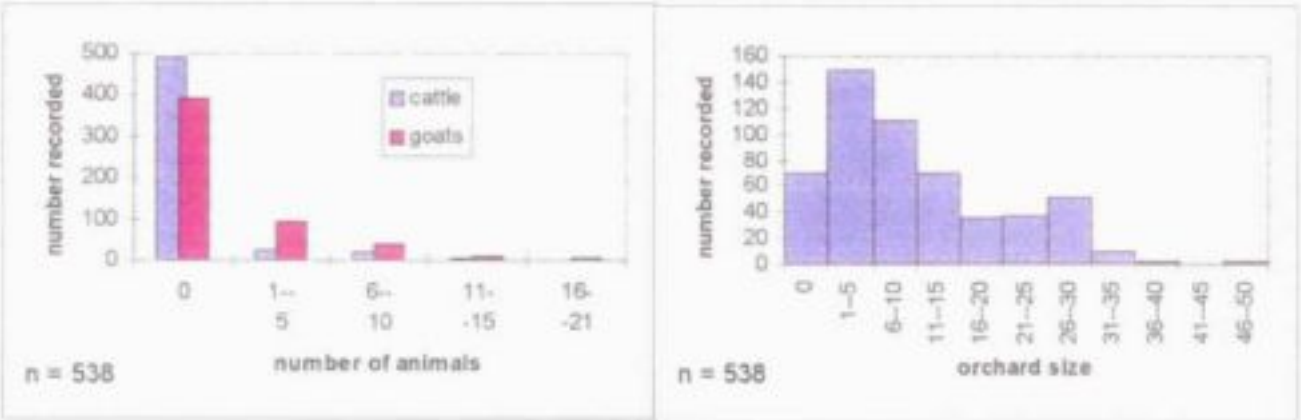



Fig 6.2 Number of stock and fruit trees per household in villages of the Mutshindudi catchment

Although the area has a high rainfall and soils are considered as fertile, the small plots and limited resources of the average families are small with little potential of a regular income from farming activities.

- Distance of home to nearest river:

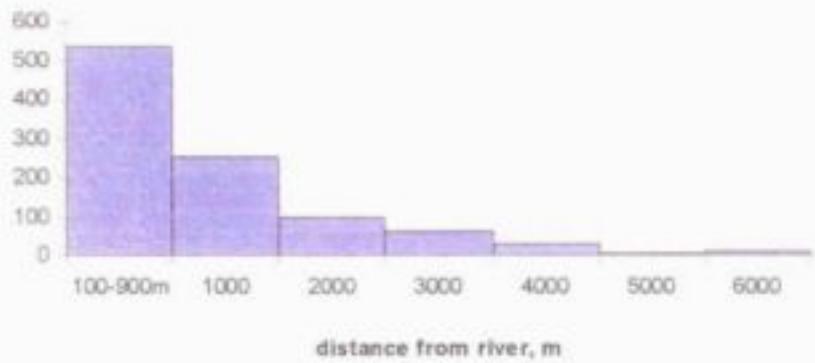



Fig 6.3 Distance of homes to the nearest river in the Mutshindudi catchment.

Most persons live within easy walking distance of the nearest river. The reported distance fishers travelled to reach their fishing destination is however in many cases much further, indicating a preference for certain popular fishing spots.

6.3.1.2 Fish eating patterns of the community in the Mutshindudi catchment

Questions were asked about fish eating habits and acceptability of freshwater fish and fish in general:

- Acceptability of locally caught fish.

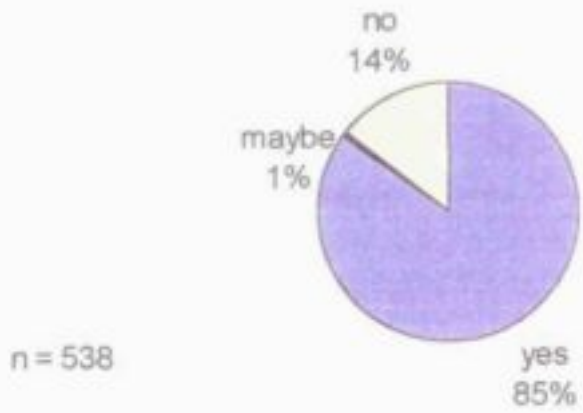



Fig 6.4 Acceptability of local fresh water fish as food in the Mutshindudi catchment.

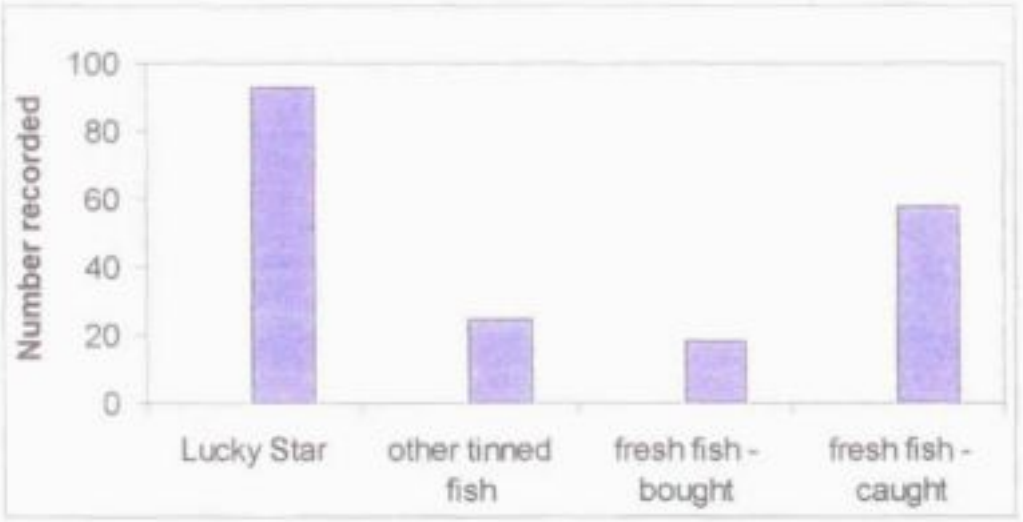



Fig 6.5 Frequency of eating different fish products in the Mutshindudi catchment.

A very high 85% accepts freshwater fish as food. When asked what fish are being eaten at homes, "Lucy Star" tinned fish scored highest, but was followed by fresh fish that was self caught in the second position. Only 2,8 % of the respondents reported that fish was never eaten at their homes.

- Acceptability of the various local fish species as food

No less than 13 different species names were mentioned when asking about acceptability and preference for fish species. There was some confusion about local fish names, but it is interesting that both carp and blackbass are specifically mentioned as fish that are eaten.

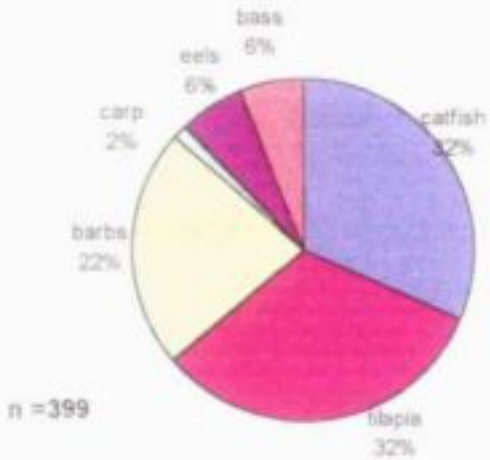



Fig 6 6 Preference of locally obtainable fish species by households in the Mutshindudi catchment.

The most freely available fish species in the river (see below), namely tilapia, barbs and catfish, are also most frequently mentioned as preferred food. No specific preference for these species exists: fish that are available, are consumed. The case for eels and bass may be different and there may be a preference for these relatively scarce fish species.

- Frequency of fish eating by respondents:

Of the respondents, 80,15 % indicated that at their homes, fish is eaten once or more per week.

3,4% indicated that they never eat fish, a value corresponding well with the results obtained for the question on the acceptability of fish.


Fig 6.7 Frequency of eating fish in households in the Mutshindudi catchment

- Most recent occurrence of eating fish of local origin


n = 536

Fig 6.8 Most recent occurrence of eating fresh fish from the local river in households in the Mutshindudi catchment

The frequency of eating fresh fish from a local source was not as high but 25,8% indicated that they had eaten local fish during the last week or more recently [survey undertaken in summer time].

- Preparation methods of fresh fish from the local river

The majority of respondents indicated that fish is fried in cooking oil. By frying fish to a crisp condition, small gutted or even whole fish can be eaten without having any trouble with spines or bones. In contrast to regions in northerly countries such as Zambia and Malawi, the smoking of fish as a preparation method or preservation method is not practised at all.

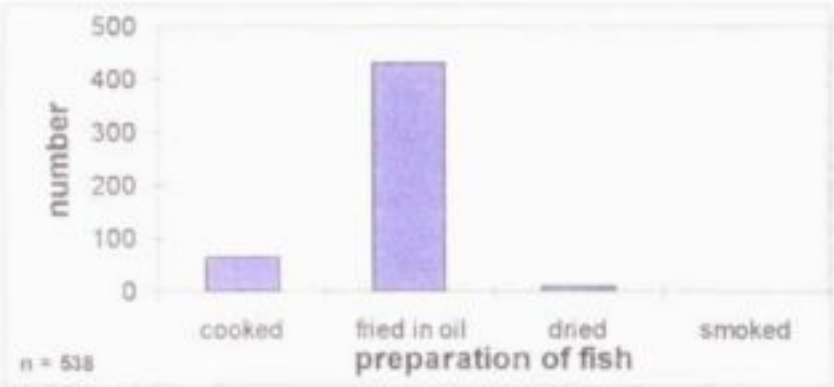



Fig 6.9 Preparation methods of fish from the Mutshindudi River in households in the Mutshindudi catchment.

- Food eaten together with fish

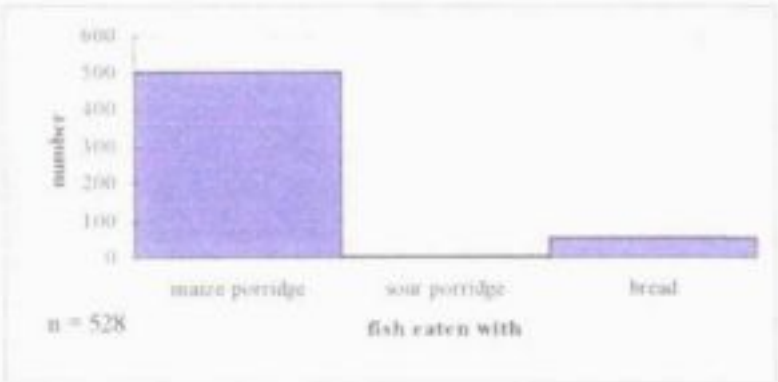



Fig 6.10 Frequency of food types eaten with fish in households in the Mutshindudi catchment.

The following food items were listed as being eaten with fish as a meal, usually the evening meal:

maize porridge, bread, sour porridge, vegetables. Maize porridge is by far the most common main dish eaten with fish. A sauce of tomatoes, onions and sometimes red peppers may also be added.

6.3.1.3 Fishing patterns in the Mutshindudi catchment

- Possession and types of fishing gear used by members of households.

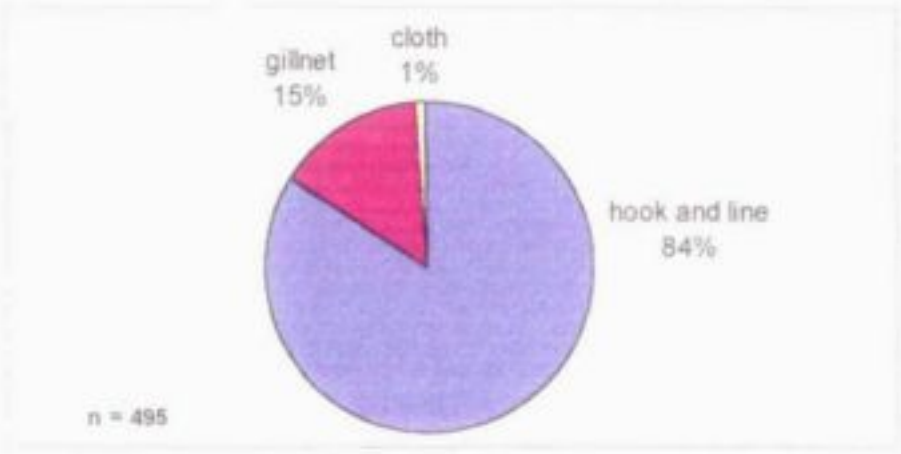



Fig 6.11 Fishing gear used by members of households in the Mutshindudi catchment

Seventy percent of the households indicated that some form of fishing gear was present. Fishing lines with one hook are by far the most important fishing gear used. Gill nets do also feature: this will be discussed in more detail under fishing activities. These gillnets are relatively small, the cloth mentioned refers to shadecloth, open cloth bags or old curtain material used as a small seine.

- Reasons why members of households go fishing

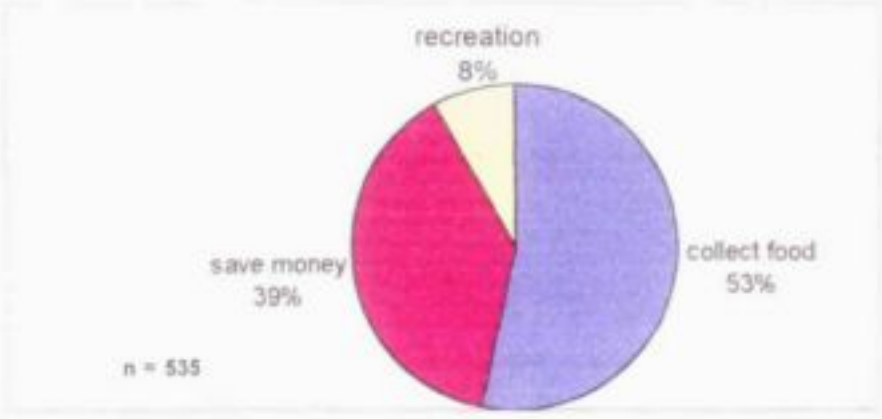



Fig 6.12 Motivation for members of households to go fishing in the Mutshindudi River

The major reason indicated for fishing is the collection of fresh protein which is then eaten as a relish with the main staple dish of carbohydrates. Even when saving of money was recorded, this actually referred to eating as the collection of a meal of fish implied the saving on another relish that possibly had to be bought – chicken, tinned fish, meat, spinach or cabbage.

- Frequency of fishing activities as reported by respondents

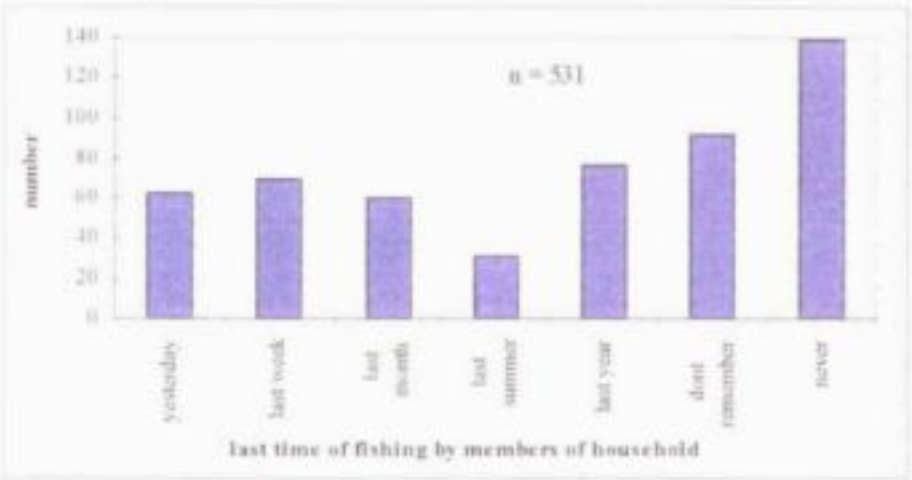



Fig 6.13 Most recent occurrence of fishing activities amongst members of a household in the Mutshindudi catchment

Twenty five % of the persons questioned, had a family member fishing over the last week [survey undertaken in summer]. Additionally, 43% of the respondents reported that no member of their family fished (26%) or could not remember when last a family member caught fish from a local river (17%). This information is supported by answers to the question of when respondents themselves last ate fresh fish from the catchment; 36% of the respondents indicated that they do not remember or have never eaten fish from the local river. The fact that some people in households do catch fish while the respondents themselves do not eat fish, confirms an observation that a considerable portion of the fish is eaten directly at the river.

- Perceived threats and dangers of the river to fishing activities.

Crocodiles and drowning are seen as the most serious threats to people using the river. That these threats are real, is borne out by the fact that during 1996, one person was attacked and killed by a crocodile and another drowned whilst swimming. No fishing took place in a stretch of 10km around Dzingahe for more than a month as result of the crocodile attack and subsequent unsuccessful attempts of conservation authorities to destroy it.

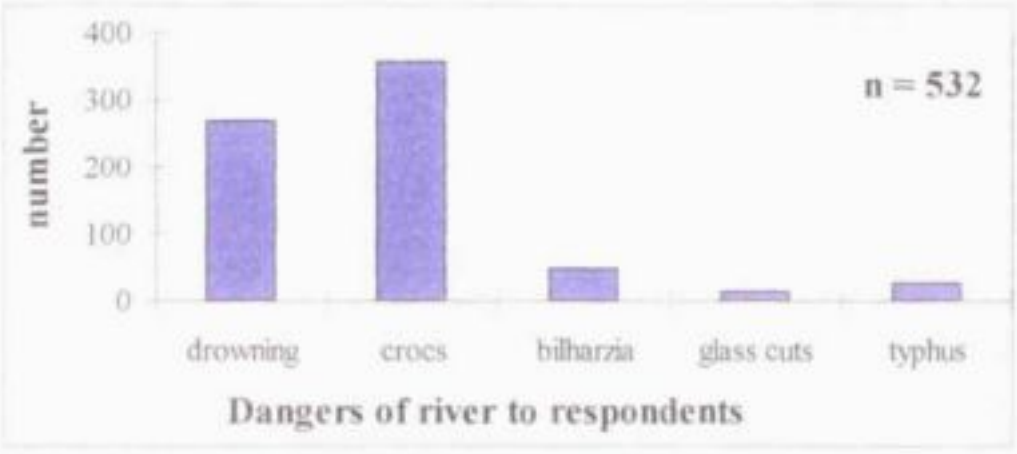



Fig 6.14 Perceived dangers of the Mutshindudi River for anglers by respondents

- Perceived physical benefits of the river to respondents.

More than 54 % of the respondents indicated fishing as a benefit. Washing (including bathing and clothes washing) scored 87% but swimming only 13%. These values may be influenced by the fact that more than 60% of the respondents were younger women, with more interest in washing than in fishing.

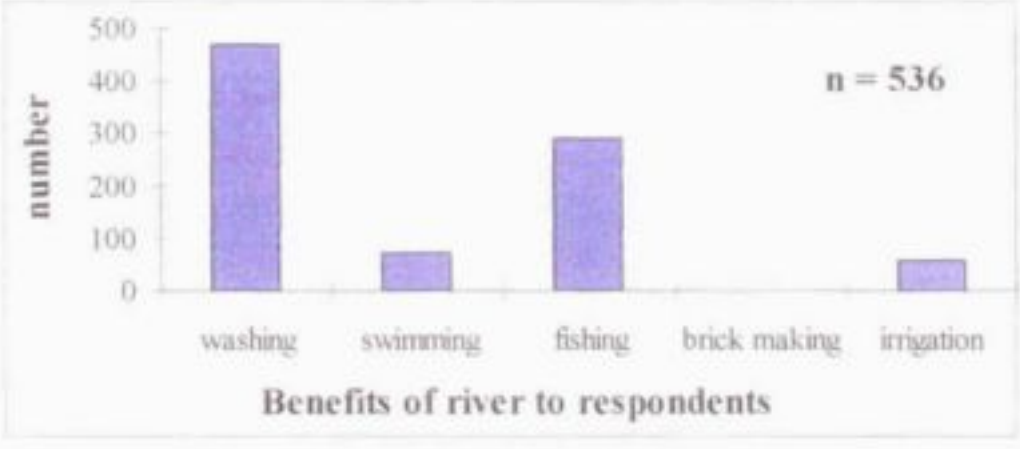



Fig 6.15 Perceived benefits of the river to respondents in the Mutshindudi Catchment.

### 6.3.2 Study of the fishing activities in the Mutshindudi catchment

Surveys of fishing activities were conducted during summer periods as set out in Table 6.2

TABLE 6.2 Number of fishermen recorded during monitoring of fishing activities

| MONTH | 1995 | 1996 | 1997 | 1998 | TOTAL |
|---|---|---|---|---|---|
| JANUARY | | 13 | | 109 | 122 |
| FEBRUARY | | | | | 0 |
| MARCH | | 3 | | | 3 |
| APRIL | | 6 | | | 3 |
| MAY | | 3 | 12 | | 15 |
| JUNE | | 1 | | | 1 |
| JULY | | | | | 0 |
| AUGUST | | | | | 0 |
| SEPTEMBER | | | 16 | | 16 |
| OCTOBER | | 15 | 4 | | 19 |
| NOVEMBER | 90 | | | | 90 |
| DECEMBER | 1 | | | | 1 |

An attempt was made to cover all seasons. However, no fishing activities were reported during the winter months, stretching from June to August. Also, floods and rainy conditions prevented surveys in February. It should also be remembered that surveys could only be undertaken by students during weekends and especially during vacation periods.

6.3.2.1 Socio-economic profile of fishers in the Mutshindudi catchment

- Gender and age composition of fishers

Females formed only 6,3% of the total fisher population sampled. The age composition of the fishers is presented below. Boys of as young as 8 years and girls of 10 years, take part in fishing activities; a clear peak is however found around 15 years, corresponding to early high school age.

The average age of the fishers fishing in the Mutshindudi catchment was accordingly 22,5 years.

TABLE 6.3 Age group distribution of fishing persons in the Mutshindudi River catchment

| age group year | male | female |
|---|---|---|
| 8-10 | 4.4 | 6.3 |
| 11-15 | 29.4 | 50.0 |
| 16-20 | 24.6 | 12.5 |
| 21-25 | 16.7 | 18.8 |
| 26-30 | 12.3 | 0.0 |
| 31-35 | 4.0 | 6.3 |

| | | |
|---|---|---|
| 36-40 | 3.6 | 0.0 |
| 41-45 | 2.0 | 6.3 |
| 46-50 | 0.4 | 0.0 |
| 51-55 | 2.0 | 0.0 |
| 56-60 | 0.8 | 0.0 |

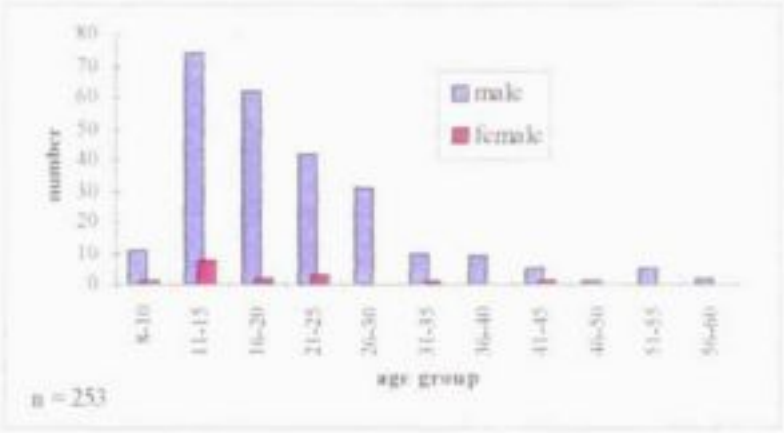



Fig 6.16 Age group composition of fishers

- Marital status of fishers in the Mutshindudi catchment

A high participation of young married as well as old married men was evident - an opportunity to get away from home? As can be expected, most scholars fell in the unmarried group.

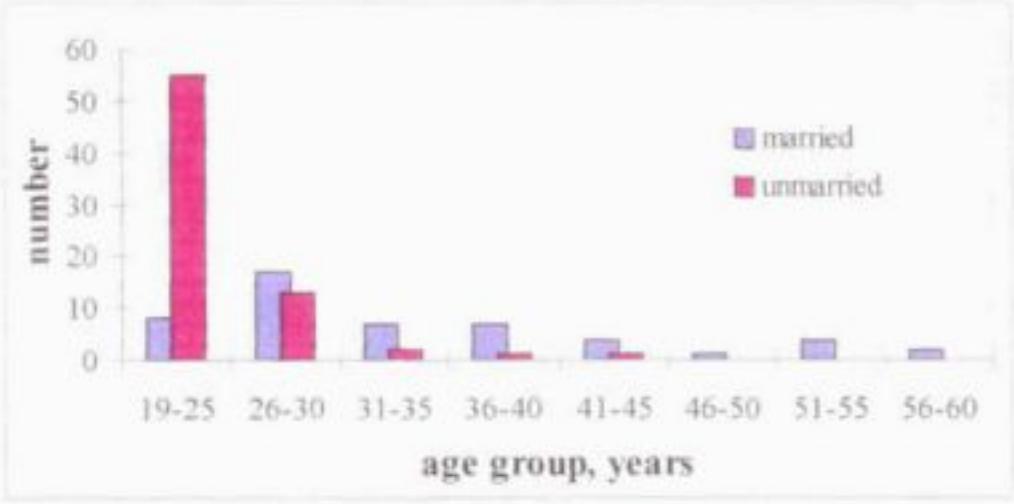



Fig 6.17 Marital status of fishers in the Mutshindudi catchment

- Number of children in families of fishers

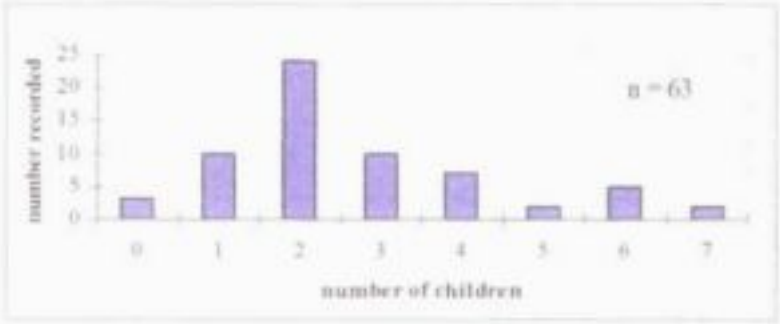



Fig 6.18 Number of children in families of married fishers

The average number of children (2,70) is less than the average value obtained for respondents in the catchment (Gaigher 1998). This may be due to the young age of many married fishermen.

- Educational level of fishers

A very large portion of fishers consists of school-going children and 27% of the anglers had primary school education, 59% secondary education and 7% tertiary education. Matriculants and recently matriculated students form a prominent part (22%) of the fisher population.

In the graph below, the age composition of some school grades is split in persons below and above 20 years of age. This age seemed to be the natural break-off point beyond which persons left the school.

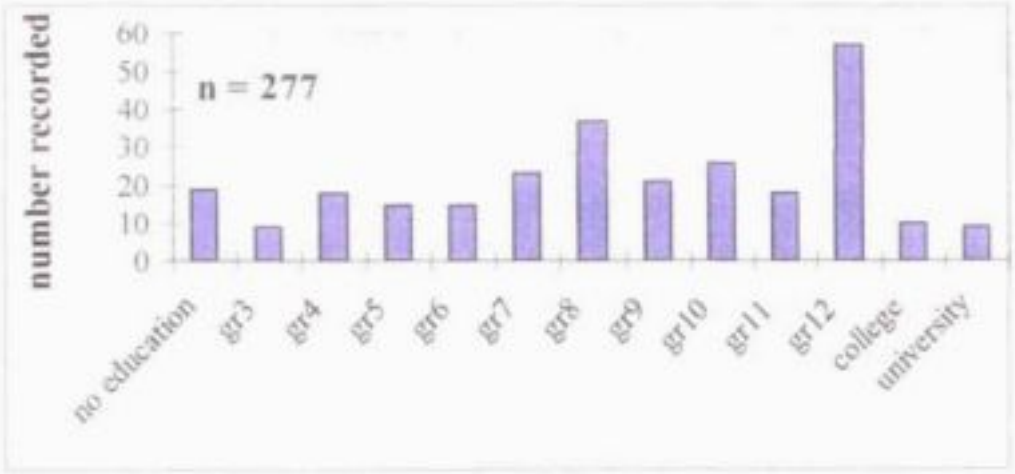



Fig 6.19 Level of education of fishers

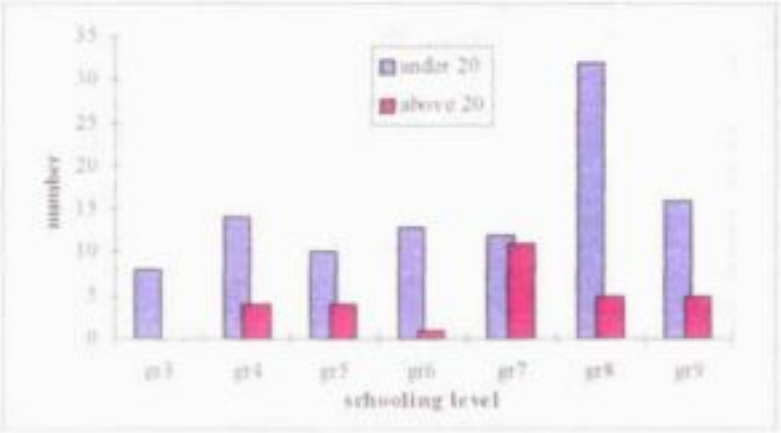



Fig 6.20 Age composition of fishers with a lower grade qualification

There is an increase in older persons with gr7 level, but a small portion of older fishers had lower than gr 7 qualifications. This indicates a general high school qualification than could be expected and certainly does not indicate that only jobless, uneducated persons take part in fishing activities.

The persons who indicated they had no education were between 20 and 58 years old. Of these persons, four indicated that they did not work, five were labourers, two worked at the nearby tea estates, and others were a farmer, shepherd, housewife, schoolworker or self-employed.

- Occupation and employment of fishers in the Mutshindudi catchment

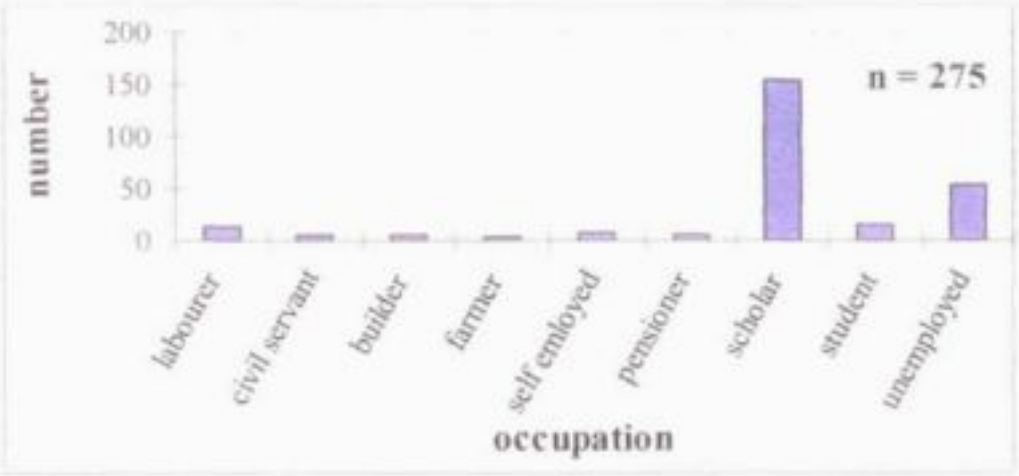



Fig 6.21 Reported occupation and employment of fishers in the Mutshindudi catchment

Those fishers who are employed hold a variety of jobs. A considerable portion is however unemployed and most fishers indicated that they are full-time scholars or students.

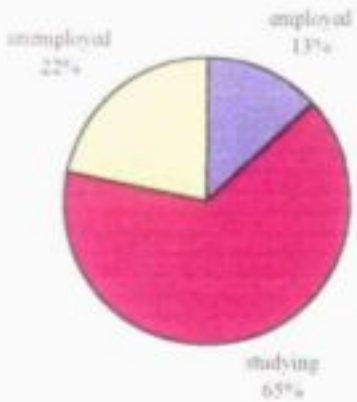



Fig 6.22 Percentage employed, unemployed and studying fishers

6.3.2.2 Perceptions about fishing by the fishers themselves

Reasons why fishers fish in the rivers

When asked why fishers undertake fishing the following reasons were supplied

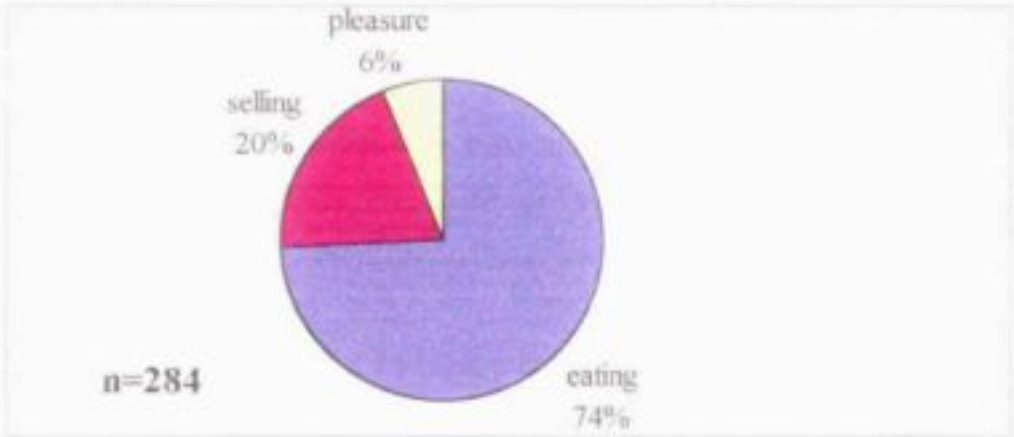



Fig 6.23 Reasons offered for fishing in the Mutshindudi River by fishers.

The acquiring of food in the form of fresh fish protein seems to be the major drive for fishing activities. Together with the indicated low level of personal income, this seems a valid reason. A considerable portion indicated that selling in order to save on expenses on relish with the normal porridge meal, is also an important reason for fishing. Fishing for pleasure and relaxation does not seem to be a prime motivator for fishing in the Mutshindudi catchment. People and schoolchildren in particular, derive some stimulation and spiritual and aesthetic

benefit from being outside and getting involved in an activity that requires skill. So although leisure is not perceived as major motivation, it does play a role.

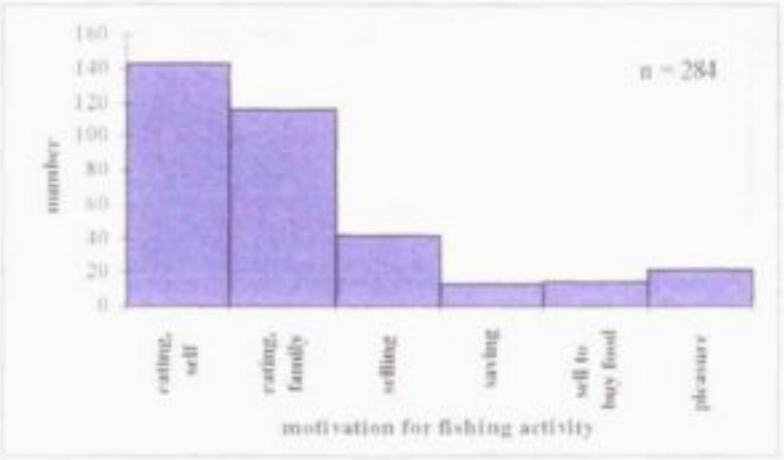



Fig 6.24 Motivation offered by fishers for fishing in the Mutshindudi River

- Satisfaction of fishers with their catches

Questions were asked about how the fishers rate their fishing success, are they satisfied with their catch.

Nearly half of the fishers indicated general satisfaction with their catches. However, 15% indicate that they are never satisfied, yet they fish. This can indicate that some people fish for leisure only and are not so concerned about the catch to take home.

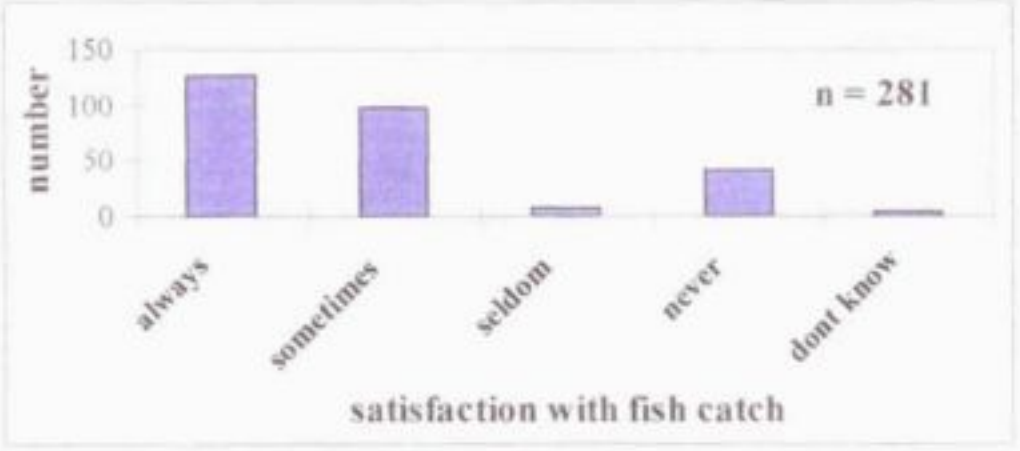



Fig 6.25 Level of satisfaction with present fish catches.

- Fishing season

The overwhelming majority of the fishers (92%) fish in summer. Some persons fish in autumn or a combination of seasons.

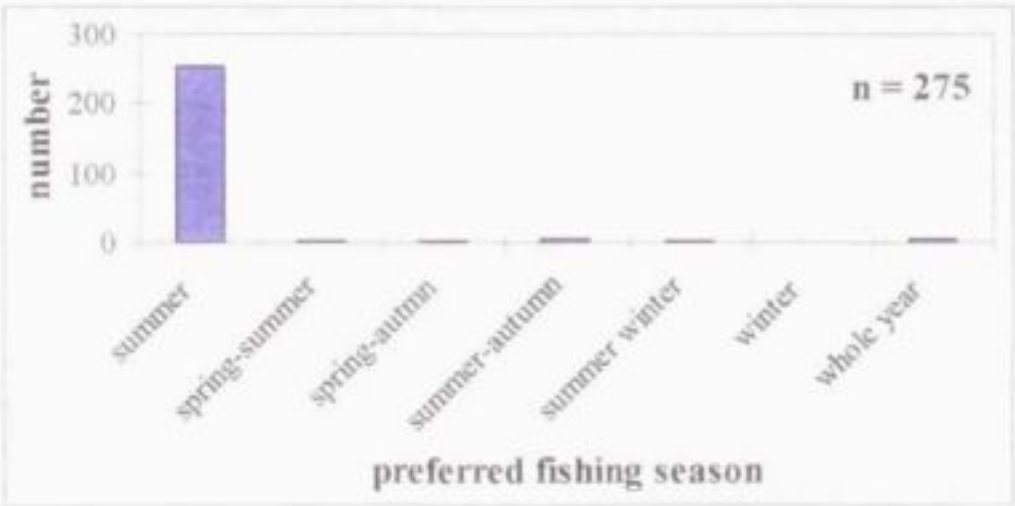



Fig 6.26 Fishing season as indicated by fishers

- Fishing time

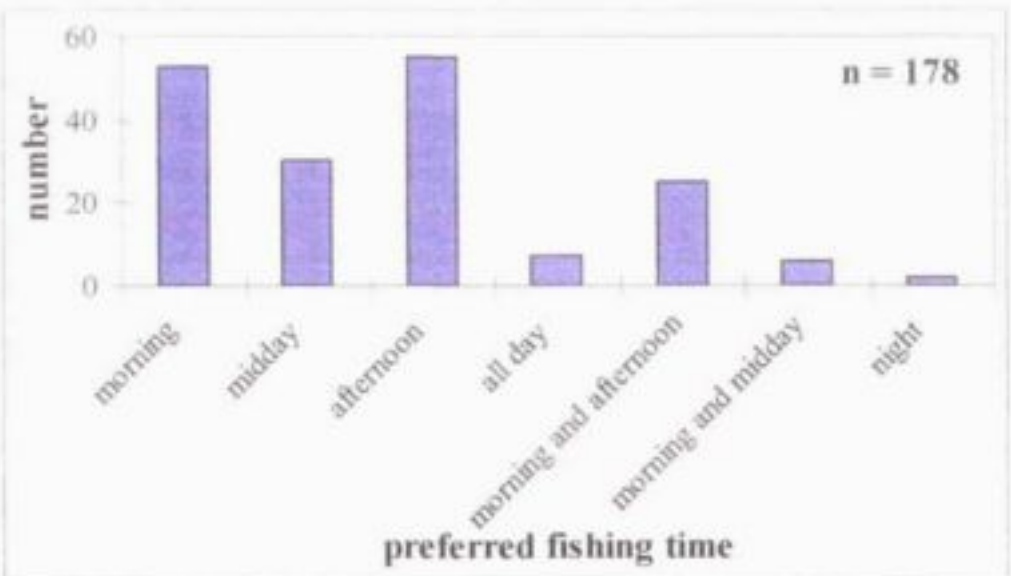



Fig 6.27 Fishing time of fishers in the Mutshindudi catchment

Morning and afternoon periods, the best fishing time for angling, are preferred. It was observed that angling is often accompanied by other duties such as washing of clothes or the body, and that is rather done in the afternoon and midday, as well as fishing with seine nets, when water temperatures are higher. A few night lines were set over night as shown in the graph.

- Reasons for the termination of fishing activities.

This aspect tried to verify some earlier statements about fishing success and motivation for angling.

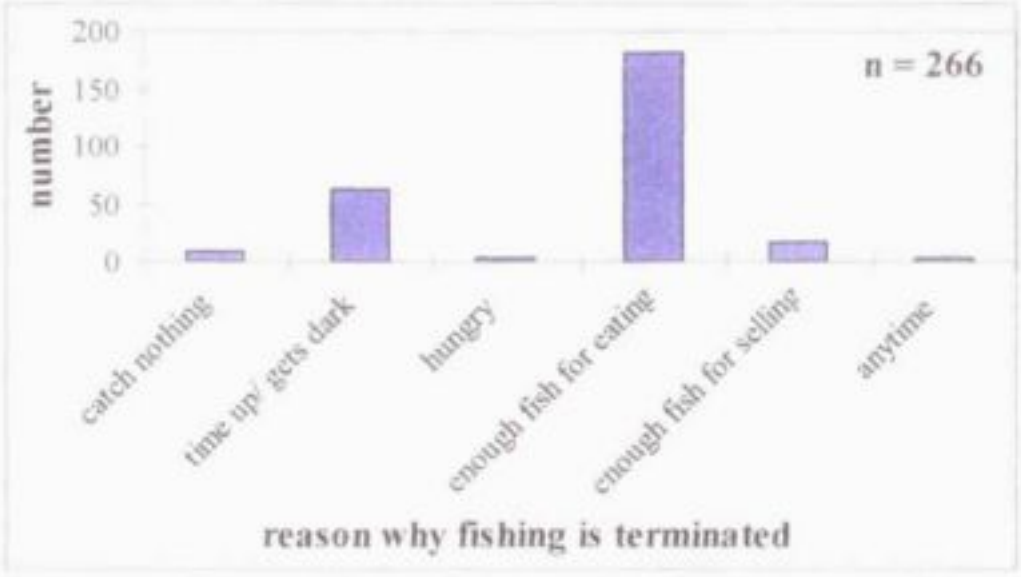



Fig 6.28 Reasons offered by fishers on why and when they stop fishing.

The greater majority indicated that they actually fish until enough fish is collected for their immediate use. Only 3% indicated that they stop fishing because they catch nothing. It thus seems that the fishers are generally content with their catches from the rivers, a finding reflecting earlier results.

10.3.2.3 Fish species caught by fishers in the Mutshindudi catchment

- Species list of fish species recorded from fisher's catches.

The fishers caught eighteen species. Of these fish, the carp and bass are exotic and were stocked purposely in the Vondo and Phiphidi dams. Local people have separate names for most fish species. There is however somewhat confusion over the identity of many species, especially tilapia and barbs. Local names were also collected that may have a restricted use in the Vhavenda speaking area as only persons from certain areas ( e.g. around Phiphidi Dam) used these names e.g.

*"dahamhanzhe", "khala" and "tshena"*. The large variety of names used, the fact that different species are recognised in many cases and especially the apt name giving to many species, describing habits or special features, illustrates a keen observation skill not expected

in a community that are not generally considered a fish catching or fish eating people. Indeed, many fish names may have been borrowed from the neighbouring Xitsonga speaking people living only 30 km further south of the study area.

TABLE 6.4 Names of fish species caught by fishers in the Mutshindudi catchment

| TSHIVENDA NAME | MEANING OF NAMES | ENGLISH NAME | TECHNICAL NAME |
|---|---|---|---|
| Tshikwea<br>Bende<br>Thipende<br>Khala<br>Tshena | small "bende"<br>from "colour", English "white, silvery" | Mozambique tilapia | *Oreochromis mossambicus* |
| Tshaka<br>Tshikwea<br>Getsha | "tribe" | redbreast tilapia | *Tilapia rendalli* |
| Ghetla<br>Tshikwea | | banded tilapia | *Tilapia sparrmanii* |
| Jafrou<br>Dabamhanzhe<br>Fakaroni | from"juffrou", Afrikaans "smoker of dagga" | southern mouthbrooder | *Pseudocrenilabrus philander* |
| Thanzwi<br>Phuphela | "uthanzwa" - to clean<br>"splashing"<br>"water dripping from leaves of a tree or thatch" | largescale yellowfish | *Barbus marequensis* |
| Phopela /phuphela<br>Murungulu | fruit of wild fig tree | straightfin barb | *Barbus paludinosus* |
| Phuphela | | longbeard barb | *Barbus unitaeniatus* |
| Thanzwane | "small thanzwi" | threespot barb | *Barbus trimaculatus* |
| Gozwana<br>Fakaroni | "small fish" | barb, minnow | *Barbus spp* |
| Kuluta | "scrape and polish a wall" | Leadfish | *Labeo molybdinus* |
| Gukhuna tombo | "hitter/scraper of rocks" | redeye labeo | *Labeo cylindricus* |
| Kapa | from "karp", Afrikaans | Carp | *Cyprinus carpio* |
| Khovhendulu | "peanutfish" | silver robber | *Micralestes acutidens* |
| Ramafeila | from "vyl", Afrikaans | black bass | *Micropterus salmoides* |
| Netsenetse | | Churchill | *Petrocephalus catostoma* |
| Tshibobobo<br><br><br><br>Tshikalanomo | "opening and closing of a snuff box"<br>"thing with a sucking mouth"<br>"absence of mouth" (Xitsonga) | Bulldog | *Marcusenius macrolepidotus* |
| Tshithovhe | Refers to a plant characterised by rounded shoots seeking sunlight | Mountain sungazer | *Amphilius uranoscopus* |
| Tshihoko | imitation of sound of squeaking pectoral spine | silver catfish | *Schilbe intermedius* |
| Bavhuri | from "baber", Afrikaans | sharptooth catfish | *Clarias gariepinus* |

6.3.2.4 Aspects of fishing activities in the Mutshindudi catchment

- Selection of rivers for fishing

Fishing activities were reported throughout the portion that is generally accessible to the public of the Mutshindudi and its main tributaries. The origins of both the Mutshindudi and Ngwedi Rivers lie in forestry plantations and are not generally accessible to the people of the Mutshindudi catchment. One important forestry dam, the Ebbe Dam lies at the top of the Mutshindudi River and is used for recreational angling. This dam was stocked with black bass and banded tilapia. Low intensity sport fishing by visiting anglers takes place here. This fishing activity was not monitored during this study.

By far the most fishing activities were recorded in the Mutshindudi River. About 25% of all fishing activities were recorded in the Ngwedi River ( including Damani Dam) and only 5 % of observed fishing took place in the much shorter Tshinane River.

- Habitat types where fishing activities were observed

Fishing was directed at pools in rivers. Stretches of river with slow flow are also used, especially for netting purposes. Pools are selected more often for fishing purposes. Areas with large rocks in the water and riverine vegetation are particularly preferred. Dams were also regularly used for angling purposes. Netting with small gillnets was observed to take place in smaller pools between rocky stretches or in deeper pools amongst reeds.

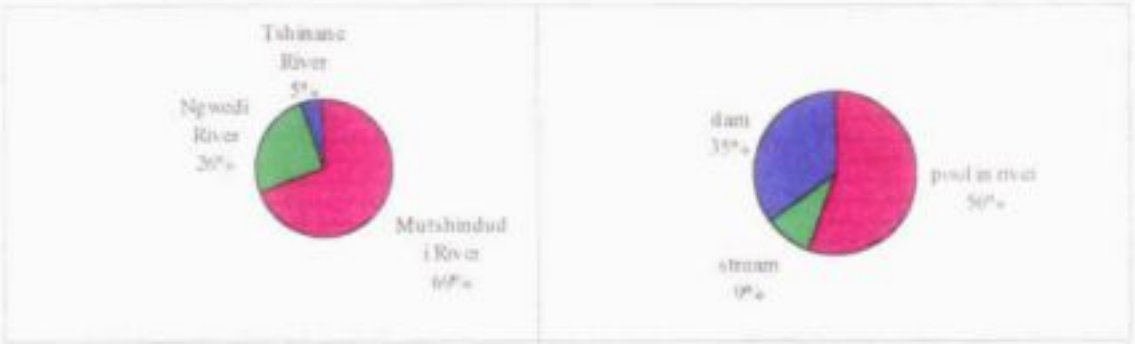



Fig 6.29 Comparison of fishing activities monitored in three rivers and three habitat types in the Mutshindudi catchment.

- Depth of fishing sites

The preferred fishing depth of pools where fishing took place was less than 1m or just below 2m depth. River stretches that were over one m deep, were also fished. Netting with draw

nets was however observed in shallower portions of the river and shallow areas of dams as well.

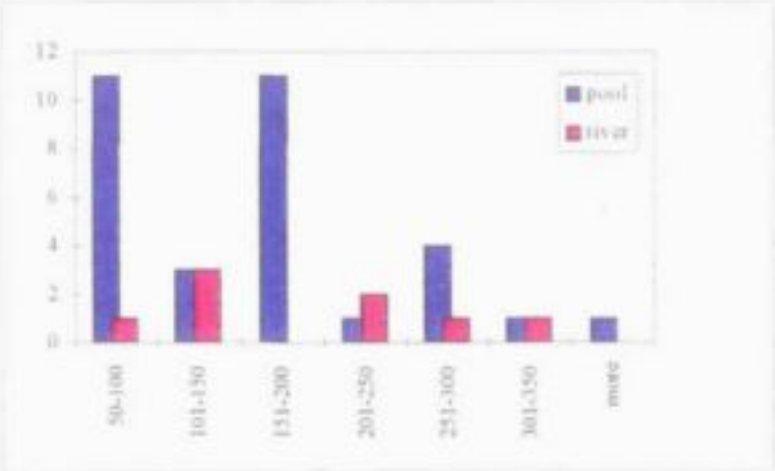



Fig 6.30 Recorded maximum depths at fishing sites in pools and stretches of river.

- Effort and time spent on fishing

The mean period spent on fishing was 2.94 hours per trip. This was the period actually observed, while persons were still fishing. The total time spent on fishing may thus be more than three hours. The time period spent on angling and netting differs only a little: netters spent 3,16 hours on average.

This fishing period is rather short and must be read together with reasons offered for ending the fishing activities. More than 70% indicated general satisfaction with catches and listed that as reason for ending their fishing activities. The relative small amount of 162 g of fish caught on average per day, is thus seen as sufficient to meet the direct needs of the fisher and his dependants.

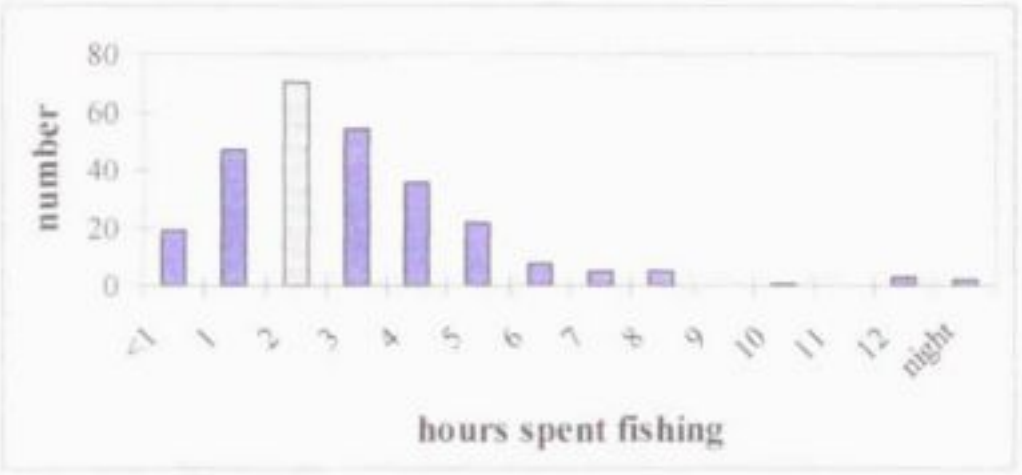



Fig 6. 31 Frequency of recorded time spent on a fishing trip.

3,2,5 Fishing gear used by fishers in the Mutshindudi catchment.

The collected data on fishing equipment used is presented in the table below.

Table 6.5 Composition of fishing gear recorded in the Mutshindudi catchment

| type of fishing gear | Number |
|---|---|
| 1 line and hook | 203 |
| 2 lines and hooks | 10 |
| 3 lines and hooks | 10 |
| 4 lines and hooks | 2 |
| rod and reel | 2 |
| long / set line | 3 |
| draw net | 9 |
| lift net | 1 |
| long handle net | 1 |
| gill net | 35 |
| mathevhe trap | 5 |
| total number | 281 |

The following fishing gear was observed to be used in the Mutshindudi catchment.

*1 Line and hook*

The robust 2-3m long nylon line (10-25kg breaking strength) is attached to the tip of a reed or stick ( species recorded include *Melia, Combretum* spp) of 70-150cm. Sometimes a simple wooden or reed float or otherwise a sinker is attached and one small or medium hook tied to the end of the line. Four examples of self made hooks (steel wire, barbless) and self-made cord were found. The other materials are bought in local shops.

*2 Long line*

The strong line of up to 30m long is supplied with hook and weight and then hurled into the water. It is then pulled tight and attached to a stick and policeman attached to warn the angler. Used for carp in Vondo Dam.

*3 Night line*

A very thick builder's nylon or other strong rope is tied to a root and the large hook baited with a small animal or fish for catfish and eels.

*4 Rod and reel*

Typical modern sophisticated gear.

*5 Draw net*

A piece of shade cloth, old curtain, baby's towel of about 2 by 1 m is used by two persons standing in the water to herd and scoop fish out. Used in shallower parts of rivers or in dams along weeds, rocks etc.

*6 Lift net*

An ingenious construction of two thin poles tied in a cross to a square piece of fine meshed netting that then forms a bag. It is left for a period on the bottom of a pool after having been baited and then lifted up my means of a rope attached to the poles when fish are expected to feed over the net.

*7 Long handle net*

A recent and new local invention consisting of a long handle with a bag of shade cloth. It is baited with maize porridge and lowered in a pool. When fish are observed to enter the net, it is drawn up. This was only seen in use in 1998.

*8 Gill net*

Small nets with small meshes (20 -50 mm stretched mesh) are used in pools to catch especially labeo. These gill nets are different from any gill nets seen anywhere in southern Africa and seem to be successful in smaller pools. They are only 1,0 to 2.5 m long and 40 to 100 cm deep. Some nets were constructed of bought mesh material, but most are hand woven from nylon thread or plastic monofilament string. The top of the net consists typically of a reed acting as a floating top line to which the top meshes have been attached. The bottom consists of a length of robust steel wire, a number of smaller stones or even bags of nylon stocking filled with pebbles attached to the net with rope. The top of the net is supplied with a robust self braided rope to be tied into position in pools.

9 *Muthevhe trap*

A modern trap somewhat imitating the traditional reed valved trap still used in the Limpopo River (BCW v/d W, pers. obs.). The trap or net has a 30 cm round or rectangular (e.g. 16x26cm) opening and a bag made of plastic vegetable bag netting material or shade netting of up to 60 cm long. It is baited with porridge or bread and pulled out by a stout rope attached to the metal ring of the mouth once fish have been observed eating the bait.

- Bait used by fishermen for fishing

TABLE 6.6 Bait types used by fishers in the Mutshindudi catchment

| bait used | number recorded |
|---|---|
| maize porridge | 28 |
| bread dough | 27 |
| sorghum beer waste | 2 |
| Blitz maize bomb | 1 |
| earthworms | 172 |
| flying termites | 5 |
| large flying ants | 9 |
| ant workers | 1 |
| locusts | 2 |
| crickets | 1 |
| small fish | 1 |
| soap | 1 |
| rapala lure | 1 |
| disturb sides of pool | 2 |
| throw rocks into pool | 3 |
| none needed, nets | 23 |
| | total=248 |

A wide variety of bait or attractants are used to fish. Earthworms, maize porridge and bread dough form the main baits used by anglers. Netters indicated that they do not use bait, but apply various methods to herd fish into their nets such as throwing rocks into pools or disturbing marginal vegetation to chase fish out. Only one artificial lure was recorded. In two cases a feeding spot was made before fishing by dumping hands full of sorghum beer waste at the fishing spot before starting fishing.

6.3.2.6 Species composition of fishers catches by number and weight

The data on catches by fishers have been analysed as frequency, numbers caught and weight caught.

- Frequency of occurrence of species in the catches of fishers

Data on the relative frequency of species catches by the fishers on the Mutshindudi and its tributaries are summarised in the figure below.

The catches of fishers are dominated in terms of frequency by *O. mossambicus, T. sparrmanii* and *B. paludinosus unitaeniatus*. In total 18 species were recorded from fishers catches, representing 69 % of the total fish community reported for the Mutshindudi River (See Chapter 9)

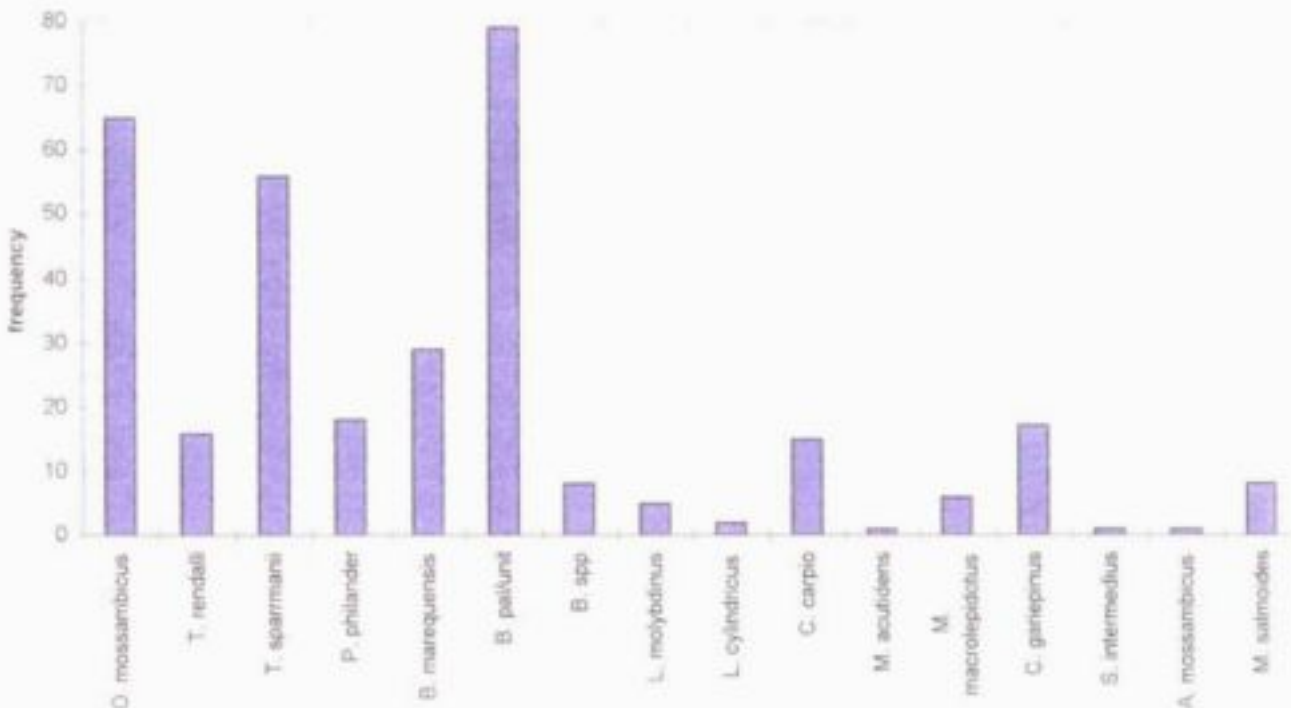



Fig 6.3.2 Frequency of occurrence of fish species in fisher's fish catches

- Composition of catches in terms of numbers caught and weight caught.

The data could be presented on a numerical and weight basis. As there are important differences in average weights of different fish, these two aspects help to characterise the catches of fishers.

Numerically, *T. sparrmanii*, closely followed by *O. mossambicus* and then the smaller barbs, form the main species fished for. The tilapias together form by far the most important

component of the fish removed from the river system. On a weight basis, the picture is different. *C. gariepinus*, followed by *O. mossambicus* and then *C. carpio*, followed by barbs, are the most important fish caught. *C. carpio* was only caught in the Vondo Dam; if it is left out of consideration, *B. marequensis* and small barbs also make an important contribution to the weight of fish caught after tilapias and catfish.

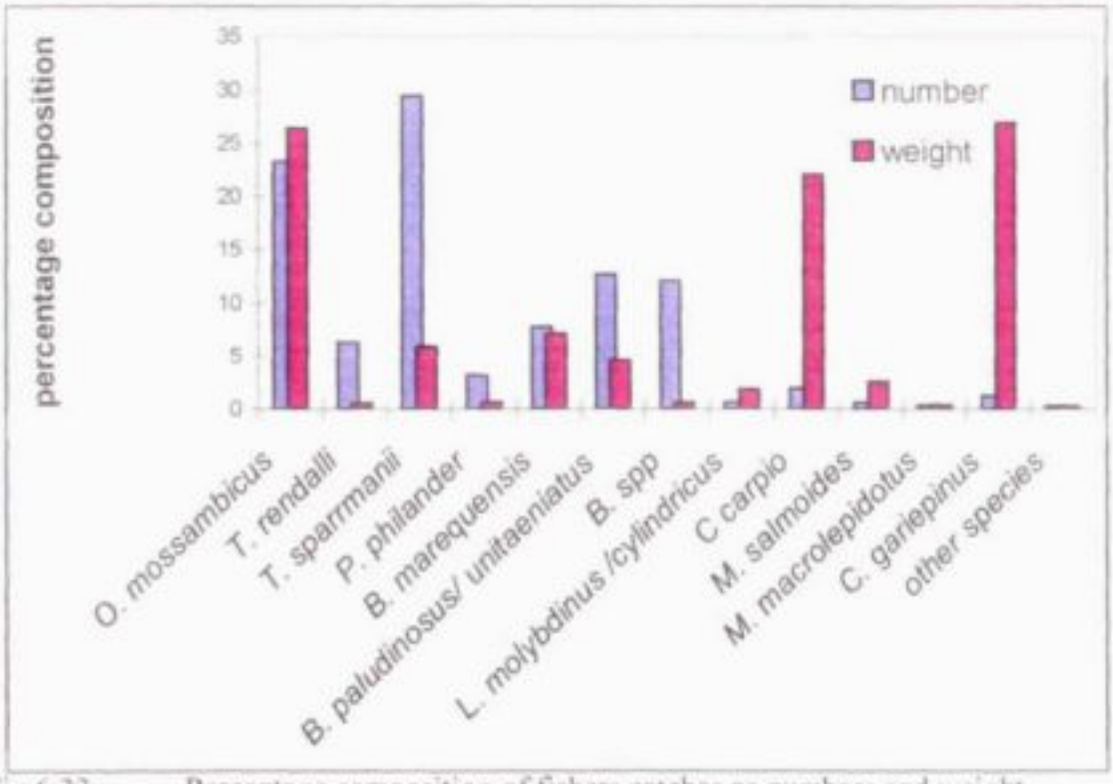



Fig 6.33 Percentage composition of fishers catches as numbers and weight

- Mean weight of fish caught by fishers

The mean weights of the most important fish species as well as the mean number and weight caught per fisher per fishing trip are listed in the tables below.

TABLE 6.7 Calculated mean weight of fish species caught by fishers

| Fish species | weight, g |
|---|---|
| *O. mossambicus* | 29.98 |
| *T. rendalli* | 2.43 |
| *T. sparrmanii* | 5.27 |
| *P. philander* | 5.53 |
| *B. marequensis* | 24.33 |
| *B. paludinosus* | 9.68 |

| | |
|---|---|
| *unitaeniatus* | |
| *B. spp* | 1.37 |
| *L. molybdinus cylindricus* | 71.08 |
| *C carpio* | 300.00 |
| *M. salmoides* | 100.00 |
| *M. macrolepidotus* | 30.00 |
| *C. gariepinus* | 567.18 |
| other species | 20.00 |

TABLE 6.8 Mean number and weight of fishes caught by the average fisher per fishing trip

| fish species | weight caught | Number per Fishing trip |
|---|---|---|
| *O. mossambicus* | 42.70 | 1.424 |
| *T. rendalli* | 0.94 | 0.387 |
| *T. sparrmanii* | 9.51 | 1.804 |
| *P. philander* | 1.08 | 0.196 |
| *B. marequensis* | 11.53 | 0.474 |
| *B. pal unit* | 7.52 | 0.777 |
| *B. spp* | 1.02 | 0.742 |
| *L. molybdinus cylindricus* | 3.00 | 0.042 |
| *C. carpio* | 35.73 | 0.119 |
| *M. salmoides* | 4.22 | 0.042 |
| *M. macrolepidotus* | 0.74 | 0.025 |
| *C. gariepinus* | 43.63 | 0.077 |
| other species | 0.40 | 0.017 |
| mean | 162.02 | 6.129 |

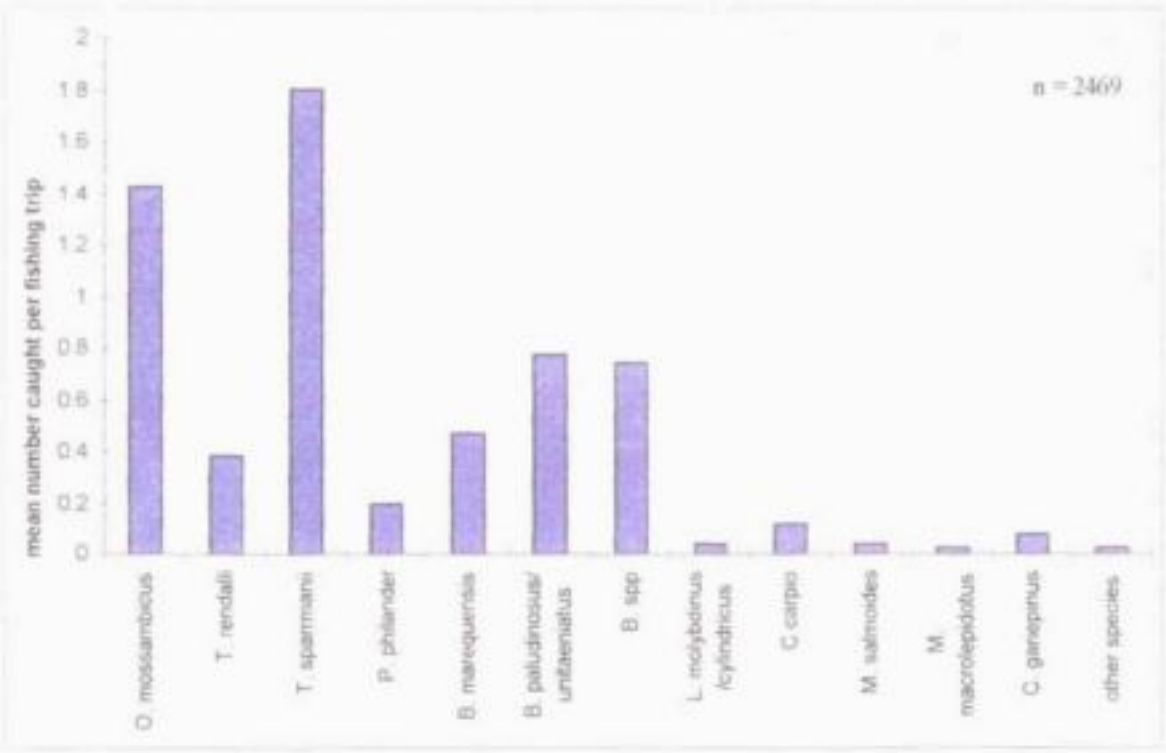



Fig 6.34 Mean number of fishes collected by fishers per fishing trip

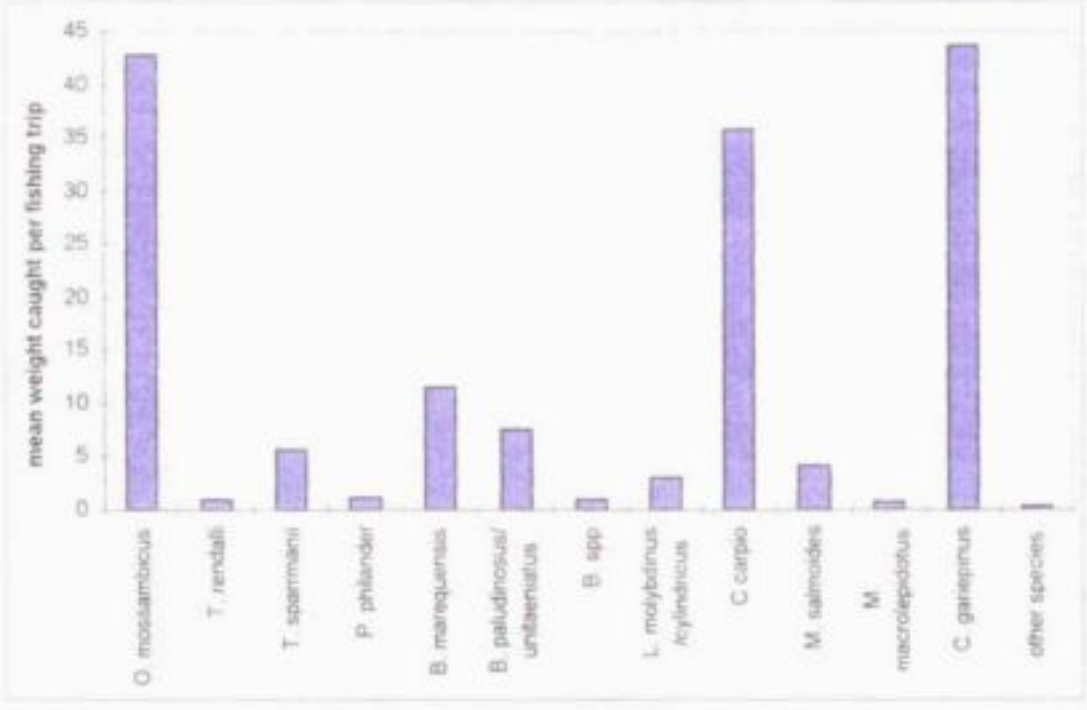



Fig 6.35 Mean weight of fish caught per fisher per fishing trip

The mean number of fish caught per fishing trip was 6,13. This represents a mean weight of 162.02g of fish caught per fisher per trip or 55,1g of fish caught per hour.

The average size of the fish caught is 26.43g. The graphs show that this mean figure is greatly influenced by the large average size of carp and catfish caught. The bulk of fish caught consists of small tilapia and barbs and is thus actually smaller.

#### 6.3.2.7 Length frequencies of fish species caught by fishers in the Mutshindudi catchment

- Length composition of fisher's catches

The length distribution of fishes recorded by fishers, presents a reflection of the fish populations if the fishing method is non-selective. This is usually not the case, but the data present some reflection of the fish population structure in the rivers.

The frequency distribution graphs for length groups can give some impression of the selection by the fishing methods. Without a proper understanding of the structure of the existing fish populations in the pools and dams of the rivers, interpretation is however difficult. The data do indicate that a wide length span is caught for most of the larger fish species such as *O. mossambicus, B. marequensis, C. gariepinus, C. carpio, M. salmoides*, and also the smaller fish species such as the barbs (*B. paludinosus, B. trimaculatus, B. unitaeniatus,*) and *M. macrolepidotus, P. catostoma* and *M. acutidens*. Only for *T. rendalli* many small fish and few larger fish were recorded.

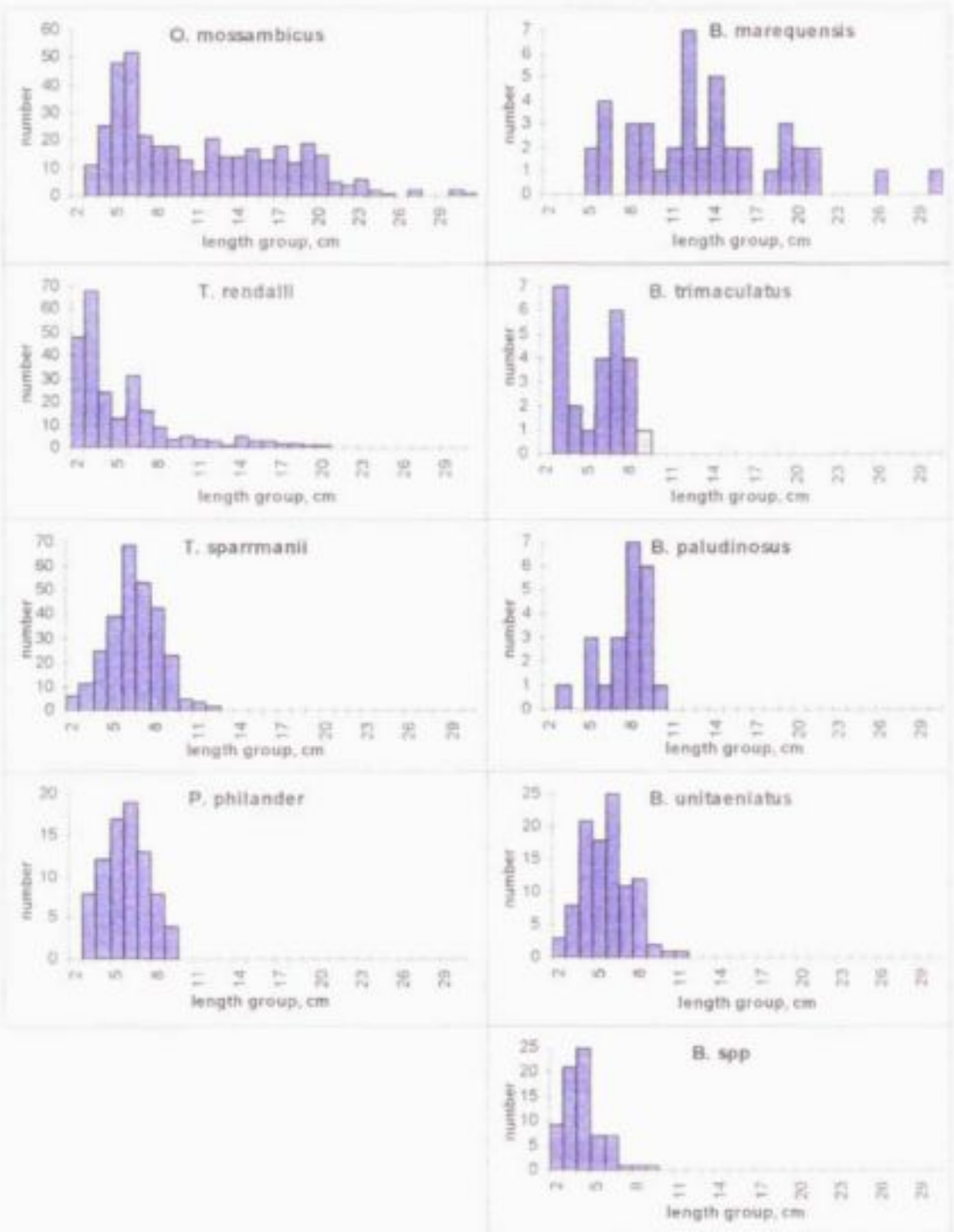



Fig 6.36a Length frequency histograms of fish species caught by all fishing methods in the Mutshindudi catchment.

The presence of larger fish in catches of the fishers community indicates healthy populations with sufficient larger (breeding) individuals available to be caught.

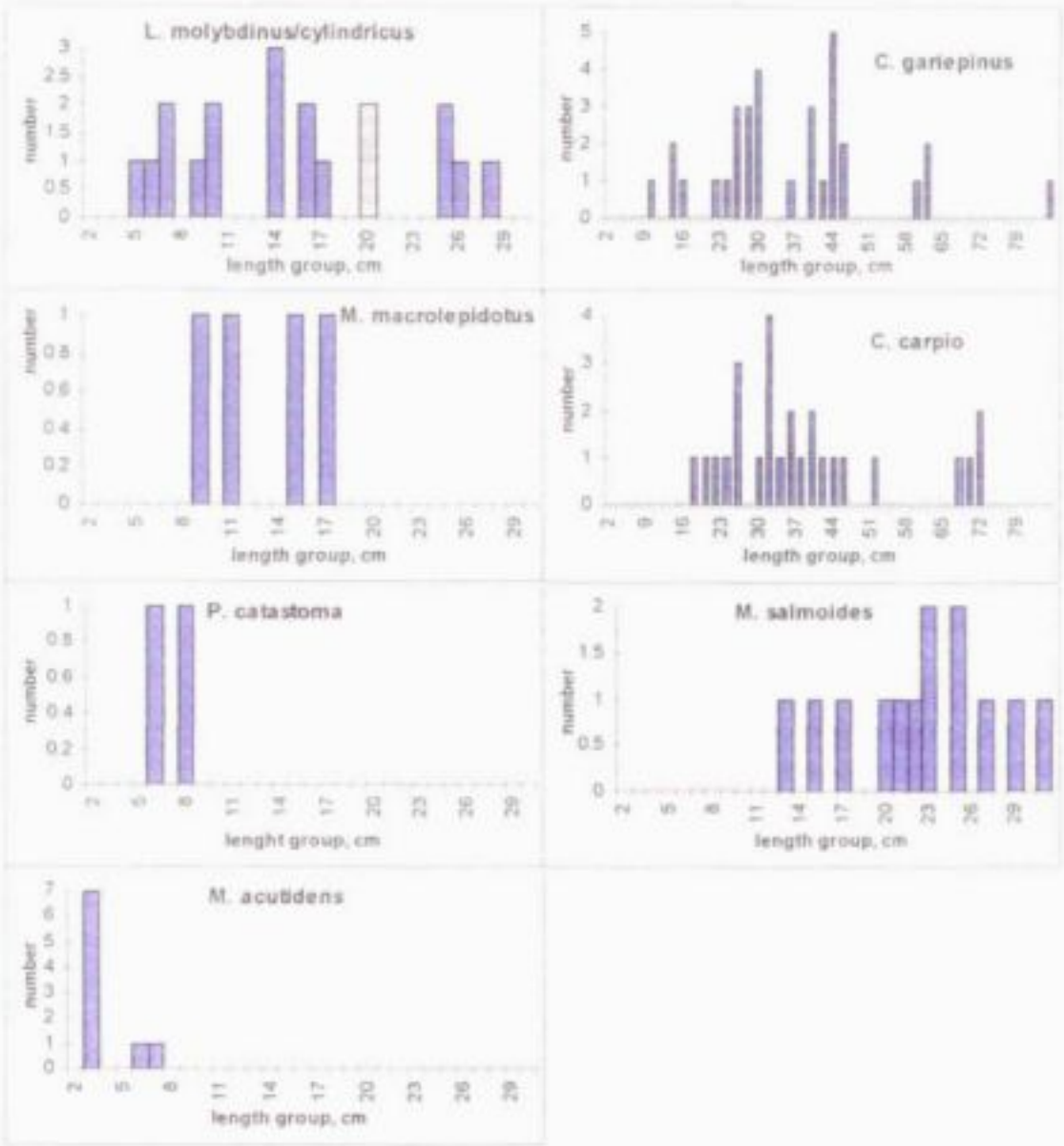



Fig 6.36b Length frequency histograms of fish species caught by all fishing methods in the Mutshindudi catchment

6.3.2.8 Selectivity of different fishing methods

- Composition of line and hook catches, gill net catches and draw net catches

There were not many records for catches by gill nets (16), draw nets ( 9), *muthevha* (7) but a comparison with line and hook catches shows that the small mesh gill nets employed by the fishers catch predominantly *B. marequensis*, *Labeo* spp, *O. mossambicus* and *M. macrolepidotus*. The draw nets again, catch small fish species such as *T. sparrmanii* and barb species. The *muthevha* catch includes *P. philander, O. mossambicus, T. sparrmanii* and barbs.

There seems to be some kind of complementation amongst the various catch methods with the gill nets catching species that are not targeted by other methods.

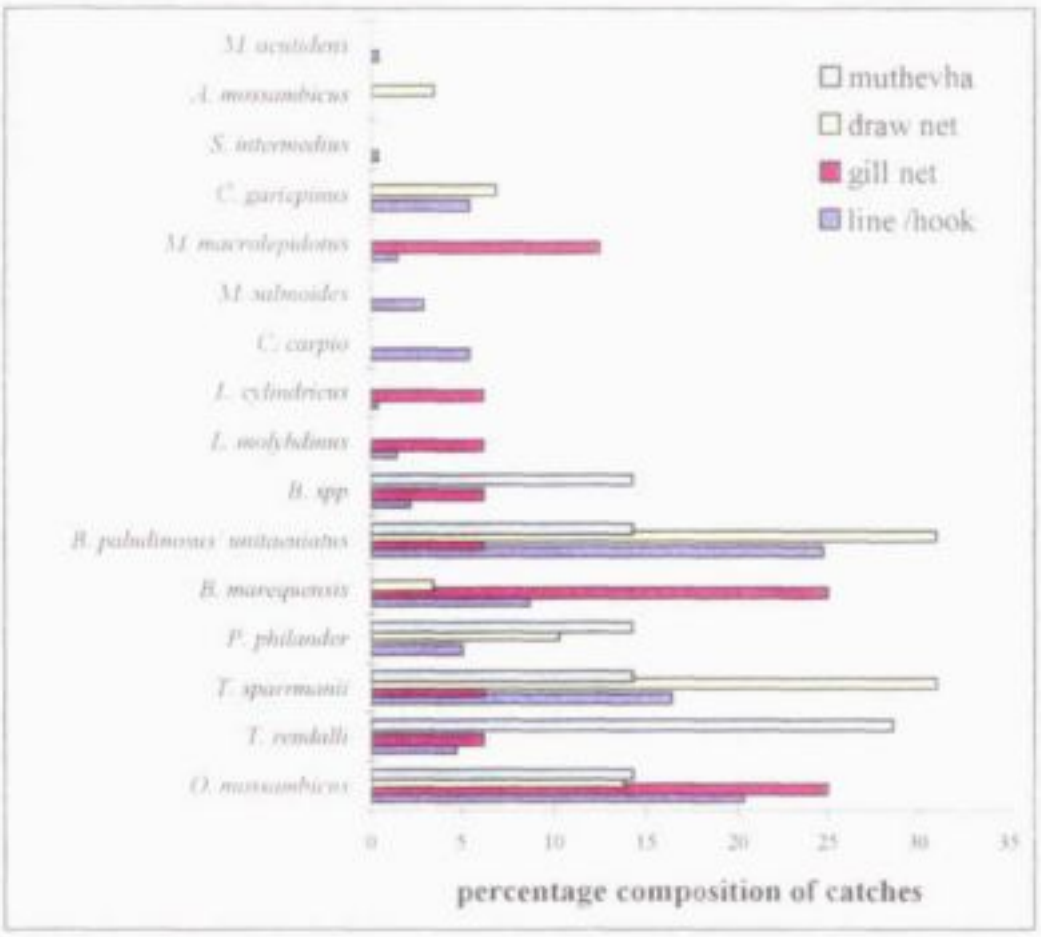



Fig 6.37 Comparison of numerical composition of catches by different fishing techniques

The individual weights of fish collected by the different methods, is vastly different. Whereas the weights reported in TABLE 6.7 closely reflect the mean weight caught by line and hook, the gill nets and draw nets had the following average weights of fish collected.

TABLE 6.9 Average weight of fish caught by means of gill nets and draw nets

| Fish species | gill nets | draw nets |
|---|---|---|
| *O. mossambicus* | 200 | 7.79 |
| *T. sparrmanii* | - | 8.12 |
| *P. philander* | - | 7,25 |
| *B. marequensis* | 142 | - |
| *B. paludinosus unitaeniatus* | - | 3.31 |
| *L. molybdinus /cylindricus* | 160 | - |
| *C. gariepinus* | 50,0 | 55.43 |

The present small gill nets used, catch predominantly adult specimens of species not normally caught by line and hook. Gill nets and line and hook might therefore be considered to be complimentary fishing methods and gill nets need not necessarily be regarded as destructive as is generally believed.

6.3.2.9 Economic aspects of fishing activities

The fishers provided some information on fish sales but were reluctant to give exact data.

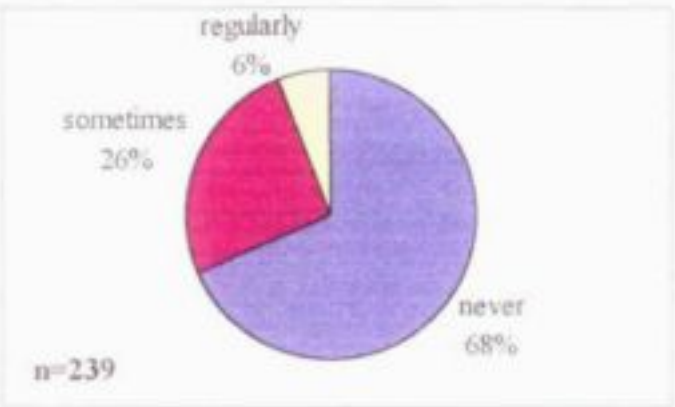



Fig 6.38 Frequency of fish sales by fishers in the Mutshindudi catchment

There is only a minor portion of the fishers that indicated that they sell fish, it is mostly taken home and consumed by the family.

There are however a number of persons, especially fishing in the Vondo and Phiphidi Dams, that seem to regularly catch many and large fishes that are then sold very profitably to restaurant owners. A few persons fishing specifically for carp in Vondo dam indicated prices of over R80 for large *C. carpio* caught. This statement could be verified in the recorded lengths of carp - see length frequency of fish caught by fishers. The accompanying graph supports the statement that some fishermen achieve good income.

The investment in line and hook fishing gear was R1-51 on average and the frequency distribution of recorded investment is presented in the graph. Most persons indicated prices of between 20 and 50 c for hooks and between 30 to 50c per m for heavy-duty (10-20 kg breaking strain) nylon line. These items are available in local general dealer shops in the catchment. Only two modern rod and spinning reel sets were recorded in the surveys. This

may reflect the inability of the fishers to afford more expensive equipment, however, the presently used line and hook gear may be the most effective to use in the relatively small pools where fishing takes place.


Fig 6.39 Declared possible daily income of fishermen that sometimes and regularly sell fish.

The investment for nets ( gill nets and a few draw nets) is presented below. The average investment was calculated at R11-35 but is not reliable (n=10) as many nets were not priced.

In general, the capital investment in fishing gear is small. Additionally, bait used is not sophisticated or bought. Maize porridge or bread is usually taken form home (remnants of previous meal or earthworms or insects collected near the fishing site by the fishers themselves. Mention was however made of special commercial carp bait in one instance and sorghum beer waste in another. Similarly as in the case of bait, transport to the water does generally not demand costs as by far the majority of fishers walk to their fishing site. One item that is however invested in the fishing activities on a large scale, is time.

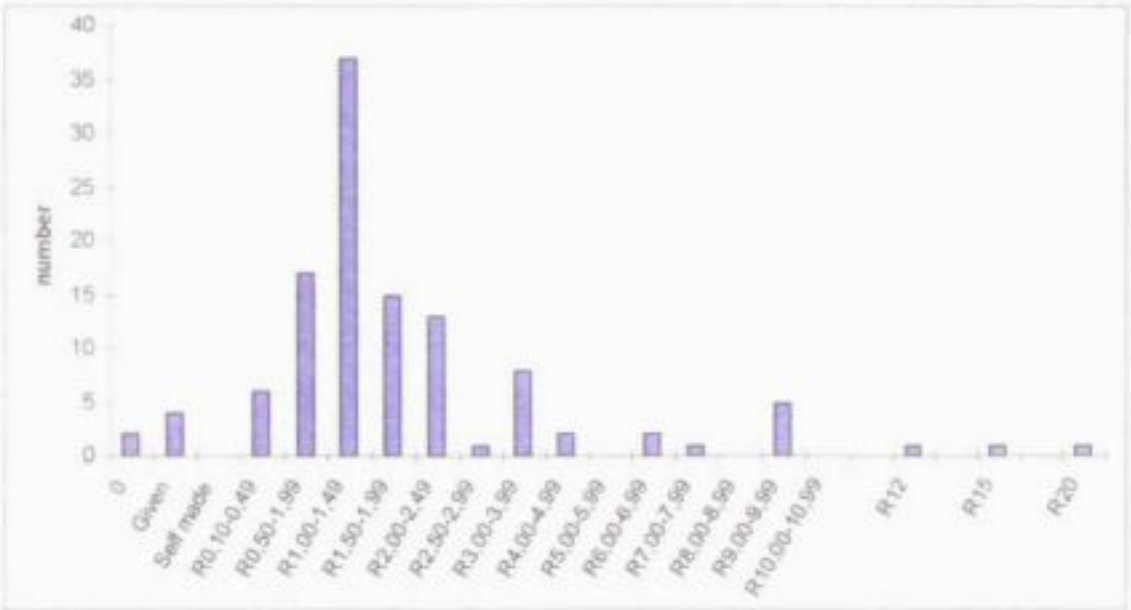



Fig 6.40 Frequency distribution of investment in fishing gear of fishers in the Mutshindudi catchment

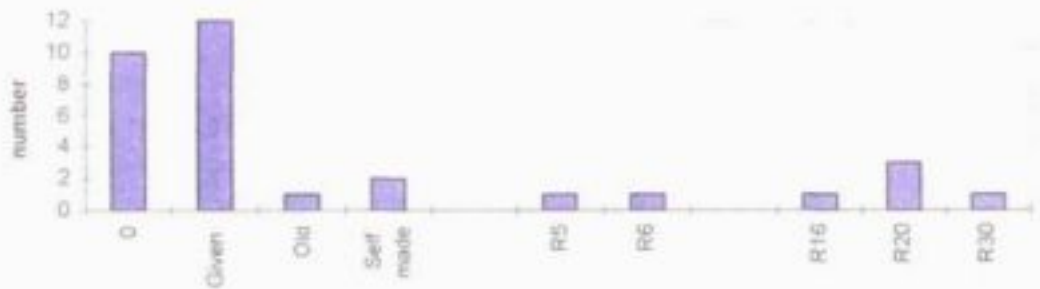



Fig 6.41 Frequency histogram of investment in nets by fishers in the Mutshindudi catchment

With an investment for the basic fishing gear of only R1-50, about 16 kg fish or monetary value of R128-00 could be caught during the estimated 100 fishing trips an active fisher could make per year. So although the catch per unit effort is relatively low, there is a good return on the investment made for fishing gear. This is of course without including the cost in terms of time. The fact that time is not considered as a valuable entity, reflects the general unemployment situation in the Mutshindudi catchment.

In general, the capital investment in fishing gear is minimal. Additionally, bait used is not sophisticated or bought. Even transport to the water does generally not demand costs.

6.3.2.10 Perceptions of fishers towards control and environmental conservation issues

When fishers were asked about satisfaction with their catch, 46% were positive and only 15% said they were never happy with their catch. In general fishers seemed to be happy with the condition of the fish stocks in the river.

The fishers had clear perceptions of whether control was needed and how this control should be applied. On the question on whether they think some kind of control is needed, 55% said yes and 36% said no. Their reasons for saying so included arguments like " if fishing is prevented, we have nothing to eat" or " leave us alone, we will care for the river ourselves". This last group indicated that they were mainly against restrictions in fishing activities, rather than regarding the fish stocks or river fish community healthy. The 55% of the fishers as well as a small portion of the persons indicating that no control is needed, suggested the measures to control fishing activities and conserve fish stocks listed in Figure 6.42.

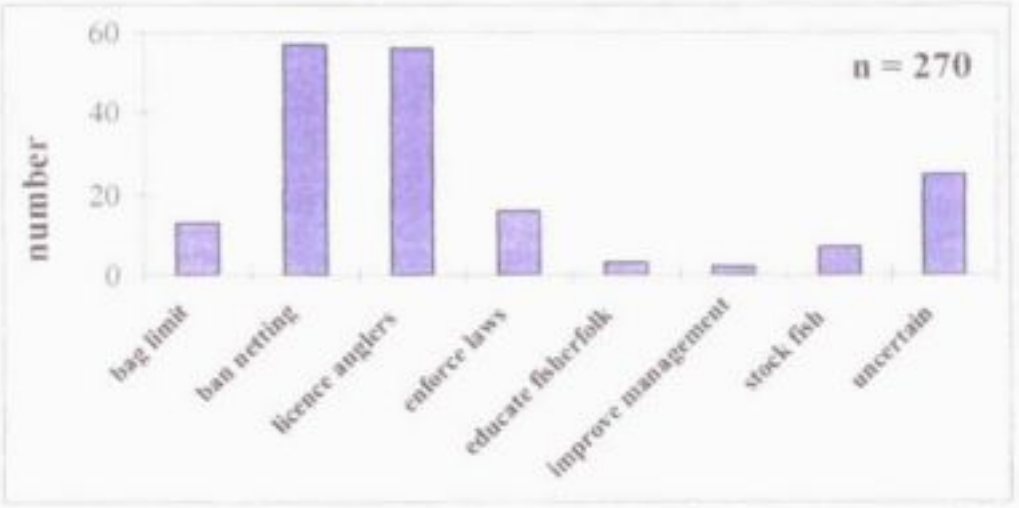



Fig 6.42 Solutions offered by fishers when asked how control of fishing should be affected

All types of management proposals were made - from old traditional licensing and law enforcement (40%) to bag limits (7%), banning of all types of netting, especially dragnetting (31%), and then also more modern approaches including the stocking of fish in the river (4%), protection of the river and its vegetation (1%) and environmental education (2%). The fact that most persons were actually in favour of some kind of control, indicates an awareness that could be activated in environmental conservation campaigns.

### 6.3.3 Comparison between the catches of fishers and experimental determination of fish populations in pools.

- Fish community composition in two pools in the Ngwedi River.

Relatively few fish were sampled during three 24 h periods in two representative pools in the Ngwedi River, about two km upstream of the confluence with the Mutshindudi River. All three efforts were therefor combined and are discussed together.

The fish community structure of the combined catch is dominated numerically by the bulldog (*M. macrolepidotus*) largescale yellowfish ( *B. marequensis*) and barb species ( *B. trimaculatus* and *B. unitaematus*). The important angling species are not represented in large numbers in catches with a series of gill nets. Especially *O. mossambicus* was lacking in the catches, whereas *T. rendalli* was better represented. The mass composition looks a bit different as bulkier fish species easily make up for their lower numbers. Here the two labeos (*L. molybdinus. cylindricus*) dominate catches followed by catfish ( *C. gariepinus*) and tilapias (*O. mossambicus* and *T. rendalli).*

- Comparison of fishers catches with experimental gill net catches in two pools in the lower section of the Ngwedi River.

The next two graphs summarise a comparison between the experimental catches in two pools in the river system and the catches of fishers, expressed as numbers and as mass.

There are significant differences in the results between experimental and the fisher's catch:

1 Absence of species. The following fish species were not collected in the experimental catches:

*T. sparrmanii, B. paludinosus, C. carpio, M. salmoides, M acutidens, A. mossambica* and *A. uranoscopus.* The two exotic species *C. carpio,* and *M. salmoides* are found only in the Vondo Dam and do not occur lower down the river. Other species such as *T. sparrmanii* seem to have a restricted distribution in the higher reaches of the Mutshindudi and Ngwedi only where it is quite successful ( See Chapter 9). Some other species as *A. mossambica* and *A. uranoscopus* are restricted to rocky areas or are relatively rare. The absence of *B. paludinosus* is not an artefact of the relative small sample or collecting technique as it is very easily collected in gill nets.

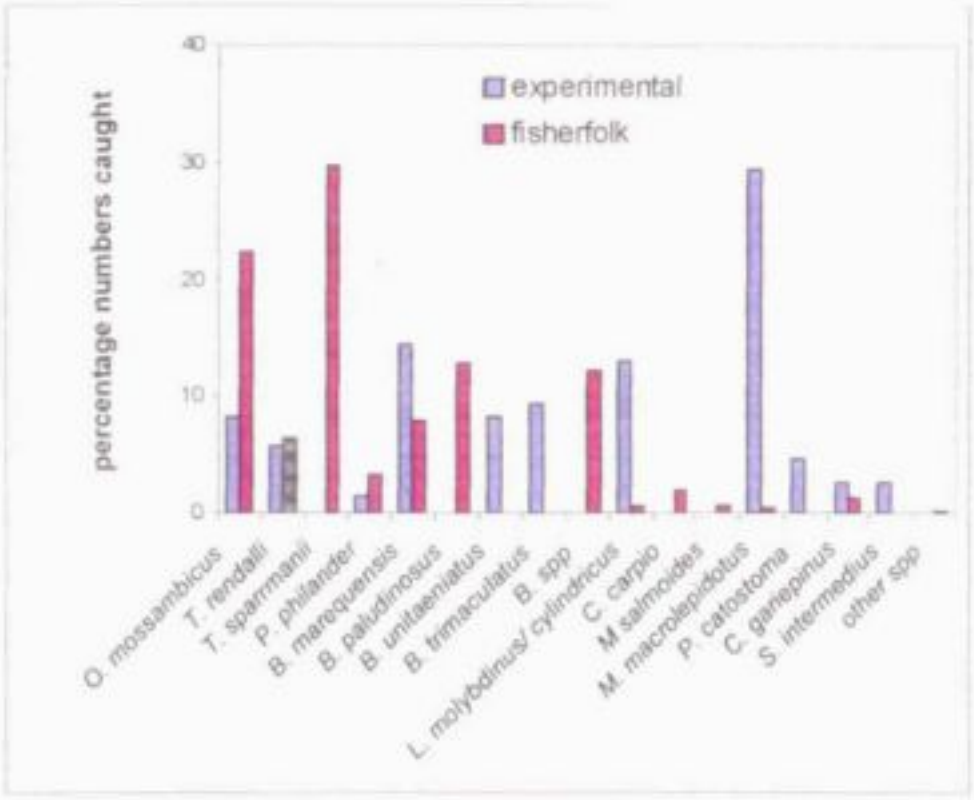



Fig 6.43 Percentage numerical composition of experimental and fishers catches

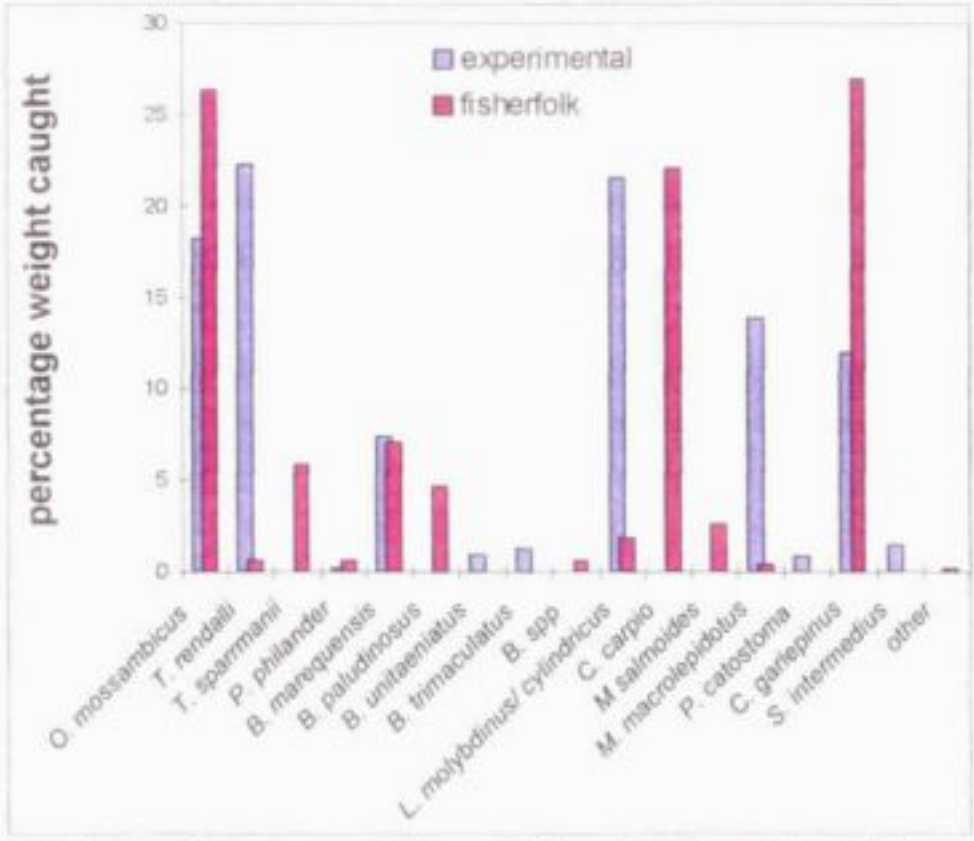



Fig 6.44 Percentage weight composition of experimental and fishers catches

On the other side, the fishers collected no *B. trimaculatus* or *P. catostoma*. This is acceptable for *P. catostoma*, a fish species that is seldomly caught by anglers and would be infrequently

caught with a draw net in pools. But *B. trimaculatus* was most probably collected but not recognised as such and dumped under *Barbus* spp. The differences in species collected can thus be ascribed to absence of species present or to the collecting method used.

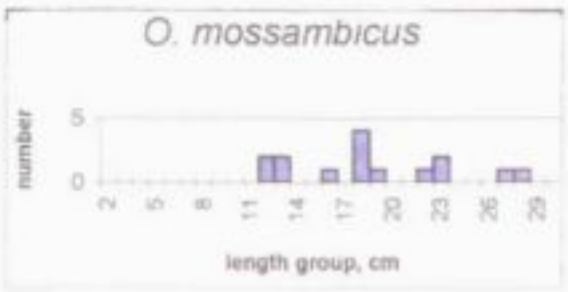
If it is assumed that representative pools in the lower portions of the river were sampled and that a representative collection was made using a series of gill nets over 24 hour periods, then the observed differences in numerical and weight composition between experimental and fishers catches reflect differences between the actual fish community (experimental catch) and what is removed by fishers.

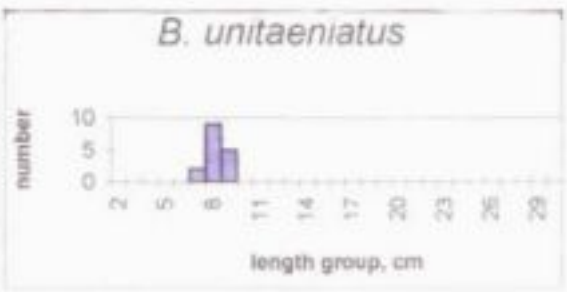
Taking numbers into account, fisher's catches showed a higher percentage of catches of tilapia species as well as catfish. The following fish species were however not present in catches at all or caught in very low numbers: *M. macrolepidotus*, *P. catostoma*, and *T. rendalli* and *B. marequensis*. In terms of weight the picture is similar but catfish seems to be selected for in fisher's catches and there are major under-representations of *M. macrolepidotus* and *P. catostoma* as well as minor under-representations of *T. rendalli* and *Labeo* species in fishers catches.

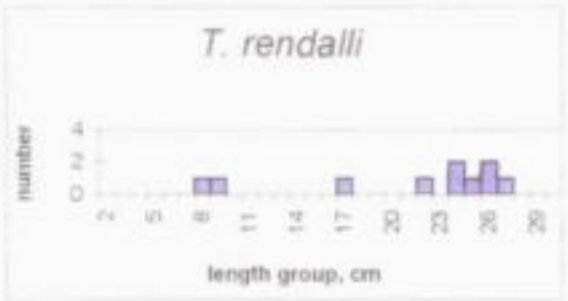
The abundance of non-target fish species in the two pools sampled may indicate some fishing pressure on the fish community by the intensive fishing activities by fishers.

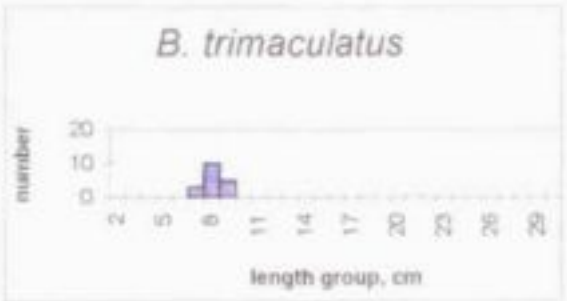
- Length frequencies of fish populations sampled in two pools

The following histograms reflect the length distribution of fishes sampled in the two pools. The fish were small in general, with the noticeable exception of *T. rendalli*, where some large specimens were also seen swimming in the one pool after the 24 hour netting operation - reflecting the difficulty to catch this species with any collection method. Largescale yellowfish ( *B. marequensis*) and catfish were considerably smaller than collected by fishers or than expected. Other fish length distribution profiles appear normal.

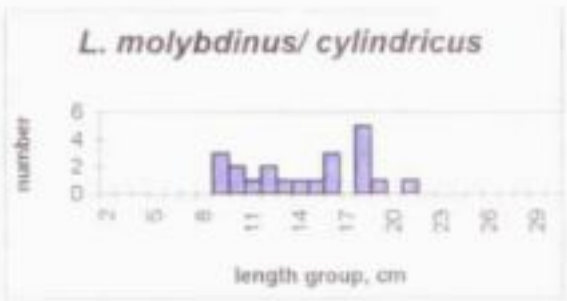

O. mossambicus
number
length group, cm

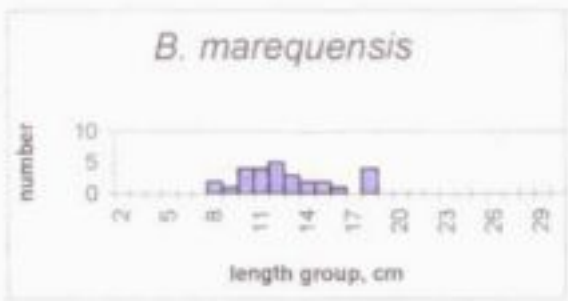

B. unitaeniatus
number
length group, cm

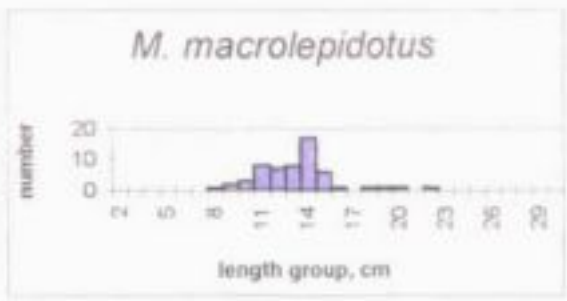

T. rendalli
number
length group, cm

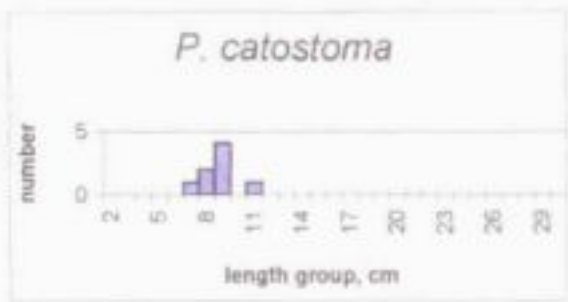

B. trimaculatus
number
length group, cm

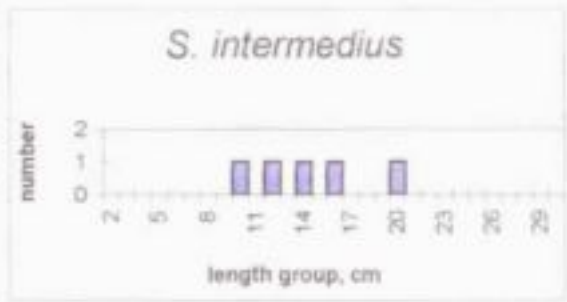

P. philander
number
length group, cm


L. molybdinus/ cylindricus
number
length group, cm


B. marequensis
number
length group, cm


M. macrolepidotus
number
length group, cm


P. catostoma
number
length group, cm


S. intermedius
number
length group, cm

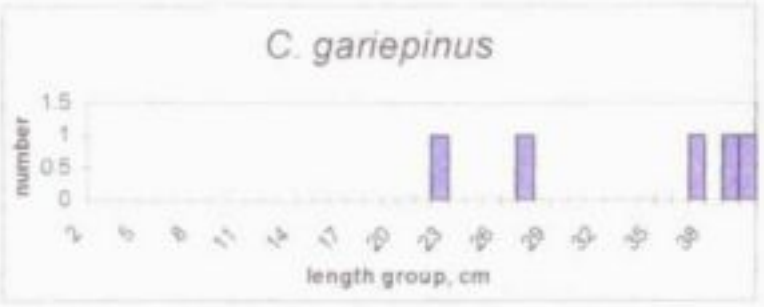



Fig 6.45 Length composition of fish collected in three pools in the Mbwedi River

## 10.4 GENERAL DISCUSSION AND CONCLUSIONS

In spite of perceptions that Venda people do not have a fishing tradition as found amongst the Xitsonga speaking people of Mozambique and that they are not interested in fish as food Stayt (1968) reported that fishing was conducted only by boys and he recorded the following fishing gear in use amongst the Vhavenda speaking people in the 1920s a fence of reeds with a fish trap, bow and arrow, thick bundle of vegetation used as a seine net and a stick with a sharp thorn used as a kind of fishing hook. Older men did not fish at all and it was taboo for women to fish.

This situation seems to have changed recently and freshwater fish is readily consumed and fished for in the Mutshindudi catchment. It must be considered that the people of the Venda region have been exposed to repeated efforts to establish aquaculture and fisheries in the area. One reason for this attention may be that this region is blessed with many perennial streams and dams. Another may be the suitability of aquaculture and fisheries as a tool for rural development. The observed attitude towards fish may partly be due to early attempts to stock the many smaller reservoirs in the relatively water rich area by the then Native Trust Commissioner in the 40s. One of the commissioners, R H Ivy actually translocated tilapia spp into Lake Fundudzi and streams around Palmaryville. He imported blue gill sunfish (*Lepomis macrochirus*, still present in the Ebbe and Vondo Dams) into the Mutshindudi system as well as some forestry dams in the Nzhelele catchment and also black bass (*M. salmoides*) and perch (*Perca fluviatilis*). He even raised and released rainbow trout (*Onchorhynchus mykiss*) in the headwaters of the Mutshindudi!! (Ivy 1941). Later in the 70s a fish hatchery was started at Dzindi where tilapia, carp and later, catfish and silver carp (*Hypophthalmichthys molitrix*) were bred and produced. Regular fish sales were held that proved popular with the local people. Additionally, a commercial fish farm, now Crocodile Ventures, started operating near Thohoyandou since the middle 80s and still makes tilapia and catfish regularly available to

the local public. The observed general acceptance of fresh water fish may thus be the fruits of efforts to popularise fish by earlier commissioners, nature conservation authorities and entrepreneurs.

The socio-economic profile of households as determined by our fish eating and fishing survey agrees to a considerable extent with that conducted by Dr Gaigher (Chapter 3). The population is characterised by low income and lack of employment opportunities. In spite of this, there seems to be some stability and relative prosperity as evidenced by relative low incidence of crime and diseases (Chapter 3). In such an environment, local resources can be utilised in an unhindered way. This explains the relative freedom of children to take part in fishing as a pastime as well as means to obtain a valued protein relish to be added to the main dish.

Fishing gear was reported to be present in 70% of the households, reflecting a high potential to harvest fish. About half of this gear was used regularly. The conclusion is drawn that at least every third household had one or more active fishers. There is a general awareness and ability to exploit the fish resource.

School children form the main portion of fishers and the recorded average age of fishers is only 22.4 years. Most were thus also unmarried and not responsible for feeding a family. The percentage of final year scholars (matriculants) is by far the highest amongst school going children and must include scholars that had just completed their final matriculation exam (written in October, when the fishing season starts in earnest). This high level of participation of matriculants may reflect the present unemployment pattern in the Northern Province. Fishing is thus seen as a handy pastime while waiting for employment/ tertiary study applications.

Sixty five % of the fishers were either scholars or students at college or local university. The non-studying fishers included 63% unemployed persons, the others held jobs like labourer, civil servant, taxi driver etc. Two or possibly three of the more than 300 fishers questioned obtained a regular income from fishing and can thus be regarded as artisenal fishermen. They operated at Vondo and Phipidi Dams where carps were regularly sold and daily incomes of up to R100 were achieved. The relative high unemployment amongst older people fishing reflects some level of absorption of jobless persons into part-time fishing activities. From the

data it does however not seem that real incomes can be secured from this fishing as the general catch per effort is too low (162g) It seems however to be sufficient to provide in the protein requirement and add a dish to the otherwise boring diet. Additionally, some form of occupation and recreation is also provided, although this is not rated high amongst fishers as motivation for fishing. The low rating given by respondents as well as fishers themselves to recreation as a reason for fishing implies a utilitarian outlook, common to rural, unspoilt people that live just beyond the poverty line. The fact that 24 different vernacular names for local fishes were recorded, a variety of fishing gear types were recorded, and that a variety of fish bait are used, all point to a rich fishing culture that seems to have developed over the recent years. This certainly underlines the importance of the river and the resources it offers to the local inhabitants of the Mutshindudi catchment.

Only 6% of the fishers were females, using mainly nets to catch fish. This pattern of low participation in commercial fisheries is common to other African countries (Van der Waal, 1990, Van der Mheen & Van der Mheen 1997. In other regions however, such as the Kavango in Namibia, fish is mainly caught for subsistence and here women formed 80% of the fishers (Van der Waal, 1991).

The fishers were able to select and devise not less than nine methods of fish collection, all of which seem to be efficient and not requiring a high input in terms of capital. The average investment of R1-51 for the basic fishing gear, consisting of a reed, line and hook, can be returned in two days of fishing (accepting the mean recorded weight of 55 g per hour and a value of R8-00 per kg (wholesale price for fresh water fish at Crocodile Ventures,Thohoyandou, 1998)). Only two modern rods and reels were surveyed. During weekends, visitors from nearby towns do however visit Vondo Dam for angling by boat. These anglers were however never encountered during the surveys, possibly as weekends and school holidays were not specifically included and as they often operated from boats.

The amount of fish harvested annually from the Mutshindudi River could not be determined in the present study. If a few assumptions are made, an idea of the contribution the river makes to the lives of people in the form of supplying fish, can however be formed. The average number of actively fishing persons that were questioned during the fishing surveys, was six per day, and a distance of 4km was usually covered by the students, giving a density of 1.5 fishers per km of river. The fishing intensity by fishers is around 100 days per year or

every second day during summertime. If the total length of the three rivers in which fishing takes place, is taken to be 75 km, a total of 112 fishers regularly fish the rivers, each catching 162 g of fish per day for 100 days per year. The total annual fish harvest of the river can then be assumed to be 2000 kg. This value may be a bit low and an estimate of at least 250 regular fishers in the catchment is assumed, who each catch 16 kg per year. Then the total harvest is about 4000kg of fish, representing a value of around R30 000. The contribution of the dams has not been included and may add considerably to the total.

In terms of a contribution in the form of fresh, high value protein and the further esthetical and recreational benefits that accompany fishing, the ultimate value of the river to the community must be considerably higher.

The daily mean catch of 162 g per trip or 55g per hour seems low to an outsider. It is considered superior to the local inhabitants however, and expressed as such by them. One other source of free protein in the catchment that is actively collected (van der Waal 1996) is locusts of which 18 to 44 individuals were caught per hour in 1994 and 1996 respectively, representing 13 and 32 g of insects per hour (Van der Waal 1999). The present fish catches are also comparable to results of studies undertaken in Zimbabwe where 89g per hour were caught by artisenal line and hook fishers in 22 dams (Van der Mheen 1993) and also that of three reservoirs in Eastern Zambia where local subsistence fisheries were studied. The catch per hour with line and hook there varied between 40 and 190g per hour. Some of this fish was however sold to generate an income (Van der Mheen & Van der Mheen 1997). The catch with line and hook by artisenal fishers in the Kavango River in Namibia was calculated at 242g per hour per angler (Van der Waal 1991), considerably higher than recorded in the Mutshindudi. Recreational angling results lie in the same order, for instance, catch success at the Robberg Marine Reserve was 320g per hour of effort (ORI 1998).

These data indicate a relatively lower catch per unit effort in the Mutshindudi catchment. The low presence of the most important angling species in experimental catches and the high portion of non-target species in the fish population of the pools indicates over-harvesting in the Mutshindudi River by the fishers. Conservation measures, including catchment conservation, but also management of the intensity of fishing, is thus necessary. Drag netting is to be considered as the least desirable fishing method and should be discouraged. Gillnetting with the short gill nets described here, should not necessarily be regarded as

detrimental as these nets target fish species not otherwise harvested. Gill netting as well as line fishing, may however have to be regulated. Introduction of angling licenses as was previously practiced, is not proposed but rather the zonation of the river so that certain pools and stretches are conserved and no fishing is allowed. The local community will have to participate in the decision making process as to which areas should be set aside.

In conclusion the fishery on the Mutshindudi can be described as a subsistence fishery. It plays a role in the life of many people by adding a source of fresh protein to the food resources of these people with limited alternative food sources. The fish life of the river itself, is presently harvested optimally, with some signs of overexploitation. This is shown in the great differences in the catch of fishers compared with gillnet catches. Control measures for regulating the escalating fishing pressure in this river seem to become required. This should include the protection of fish stocks through fishing reserves, stocking of desirable fish species that presently seem overexploited, and a ban on drag netting.

Some aspects planned for this study could not be determined. This includes a more thorough investigation of the fish life of the rivers in question. Time and assistance constraints as well as extreme environmental conditions (floods during holiday periods) enabled only the rather limited surveys in two pools. This data had to be dumped together to provide a basis for comparison. Furthermore, three important dams in the catchment did not receive the needed attention. Separate studies would anyway be required to study fish populations in the river and dams.

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# CHAPTER 7

# AGRICULTURAL WATER USE DEMAND OF THE MUTSHUNDUDI RIVER CATCHMENT

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## 7.1 INTRODUCTION

Agriculture is the main economic activity along the Mutshundudi River and its tributaries. Most common agricultural land uses are traditional cattle farming, irrigated estates and schemes, rain-fed orchards and fields, and irrigated informal gardens. Such informal irrigated gardens are prominent along the banks of the Mutshundudi River and its tributaries. Small water pump engines connected to 50mmhose pipes are used to pump water into an earth canal

which feeds transversed sub-canals to irrigate the crops. Several new gardens are being developed because of unemployment in the region.

Traditional cattle and goat rearing and poultry farming are major livestock farming activities in the study area. The average number of cattle and goats per family is 20 and 8 respectively. It is important to caution that only a few families are still keeping livestock. This is mainly caused by the lack of herd boys since the youths spend their time at school. There are numerous poultry farms in the study area, all of which get their water from bore holes. The yields of bore holes are not available.

Details of agricultural land uses were compiled during the on-site investigations of the study area. Individual interviews were also conducted to acquire information on crops and future land use intentions.

## 7.2 RESEARCH METHODOLOGY

The study area was divided into three sub-catchments namely the Mutshindudi River, the Tshinane River and the Ngwedi River and each sub-catchment was studied separately. An average of 10 farmers per sub-catchment were interviewed. Existing maps and relevant information were studied before the study was conducted.

A participatory appraisal approach was used to acquire information on various land uses and the history of land uses. This method ensures exchange of information between the researcher and the interviewee. Farmers were interviewed in their lands. Interviews were informal to ensure participation of land users and to avoid biases which could be caused by a structured questionnaire. Such information as type of crops and seasons during which they are grown were also obtained through interviews. A survey was conducted to confirm the information obtained during the interview. Livestock data was obtained from the Department of Agriculture Land and Environment. Further information on where livestock were kept and grazing systems was obtained through interviews conducted in the same Department. Some statistics on the number of irrigation schemes and their localities was obtained from the Agricultural and Rural Development Corporation of the Northern Province and such information was then confirmed during a field survey.

Field surveys were conducted in order to confirm localities and sizes of dry land and irrigated land use types. Climatic data and crop water use demand were used to calculate irrigation water use demand.

## 7.3 RESULTS

### 7.3 .1 Irrigation farms and food gardens in the sub-catchments

There are four major irrigation projects in the catchment, two of which are situated along the Tshinane and Mbwedi Rivers respectively (which are the major feeder tributaries for the Mutshindudi River). (Table 7.1and Appendix 2).

Table 7.1 Irrigable soils, project locations and development areas in the Mutshindudi River catchment

| *Location* | *Potential Irrigable Area (ha)* | *Irrigated Area (ha)* | *Total developed Area (ha)* |
|---|---|---|---|
| Tshinane | 979 | 500 | 929 |
| Ngwedi | 1350 | 880 | 1180 |
| Mutshundudi | 3010 | 1090 | 2345 |

#### 7.3.1.1 TSHINANE RIVER

The Tshinane River is the major tributary of the Mutshindudi River. There are two major irrigated projects, namely the Mukumbani Tea Estate and the Matatshe Prison Irrigation Scheme. There are several informal irrigated gardens and rain-fed orchards along the river. Details of irrigated agricultural activities are given in Appendix 3.

#### 7.3.1.2 MBWEDI RIVER

Two major irrigation projects, namely: Damani Coffee Project and Easy Farm are situated in the Mbwedi River catchment.. Several irrigated gardens and orchards use a considerable amount of water from the river. Details on irrigated agricultural land utilisation types are given in Appendix 4.

7.3.1.3 MUTSHINDUDI RIVER

The catchment was divided into three divisions during the study, namely- Upper Mutshindudi Valley, Mid-Mutshindudi Valley and the Lower Mutshindudi Valley.

UPPER MUTSHINDUDI VALLEY

The Tshivhase Tea Estate is the major irrigation project in the Upper Mutshindudi valley. A second largest project is the Murara Irrigation Scheme, which is a major water user. In addition, there are a considerable number of orchards and informal gardens along the river. Various land utilisation types are given in Appendix 5

MID-MUTSHINDUDI VALLEY

This extends from Dzingahe to Malavuwe with the main road from Hamuraga to Tshivhilwi as a boundary between the Mid- and the Lower Mutshindudi River. There is no formal agricultural activity in this area, but there is a large number of informal irrigated gardens. Details of land utilisation types are given in Appendix 5.

LOWER MUTSHINDUDI VALLEY

There are two major agricultural projects in the Lower Mutshindudi valley, namely; Malavuwe Community Irrigation Scheme and Phaswana Banana Project. There are several irrigated gardens and orchards along the river. Details of sizes and crops are given in Appendix 5.

**7.3.2 Urban household water usage**

Urban water usage is beyond the scope of this study, but it should be noted that a considerable amount of water is drawn from the Vondo Dam by the Regional Water Supply Scheme for use in urban areas, some of which is in fact used for watering home gardens & sports fields.

We have been unable to establish how much water is drawn off for this purpose. It is estimated that there are approximately 6740 houses in the Greater Thohoyandou Municipal Area and a considerable number of light industries around Shayandima. An estimated water use demand per person per day is 25 litres. Assuming that there are 5 people per house a total of about 307kl/a will be required in the Greater Thohoyandou Municipaity area alone.

### 7.3.3. Unit irrigation water demand

Calculation of the annual irrigation water demand of different crops was based on the following assumptions:

1. Irrigation demand of cash crops is equal to total water demand during a specific season divided by irrigation efficiency.

2. Irrigation demand of orchard crops is equal to crop factor minus 0.6 x mean annual precipitation (MAP) divided by irrigation efficiency (Green, 1985).

3. Irrigation demand of food gardens is equal to a combination of four crops each planted on 25% of the area divided by irrigation efficiency.

#### 7.3.3.1 TSHINANE RIVER

Irrigation water demand for 440 ha of tea and 20 ha Matatshe Prison Scheme varies from 850 mm/a to 1 000mmla. Agricultural water-use demand is given in Table 7.3.

#### 7.3.3.2 MBWEDI RIVER

Water-use demand for 500ha coffee project, 300ha of Easy Farm and 80ha of informal gardens and rain-fed orchards at an estimated application rate of 740mm/a and 650mm/a to 810mm/a are listed in Table7.3.

#### 7.3.3.3 MUTSHINDUDI RIVER

Water demand of the Mutshindudi River catchment and its sub-catchments calculated by estimated unit demands for existing projects and average demands are listed in Table 7.3.

The irrigation water demand for 457ha of tea (Tshivhase Tea Estate), 200ha banana (Phaswana), 40ha (Malavuwe), 103ha (Matsika) and informal gardens is given in Table 7.3

Table 7.2 : Annual irrigation demand for various land uses in the Mutshindudi River catchment

| *Region* | *Crop* | *Irrigation System used* | *Net Irrigation Requirements (mm/a)* | *Total Irrigation Efficiency (%)* | *Total irrigation demand (mm/a)* |
|---|---|---|---|---|---|
| Area of high | Orchards Crops | Microjet | 760 | 86 | 885 |

| | | | | | |
|---|---|---|---|---|---|
| rainfall | Bananas | Microjet | 950 | 86 | 1105 |
| (>1000mm/a | Tea | Sprinkler | 903 | 86 | 1050 |
| MAP) | Coffee | Microjet | 636 | 86 | 740 |
| | Large Cash Crops | Sprinkler | 650 | 86 | 758 |
| | farms | | | | |
| | Informal Gardens | Furrow | 500 | 68 | 750 |
| Area of | Orchards | Microjet | 1000 | 90 | 950 |
| moderate | Crops | | | | |
| rainfall | Bananas | Microjet | 1000 | 80 | 1250 |
| (<1000mm/a | Large Cash Crops | Sprinkler | 970 | 80 | 1213 |
| MAP) | farms | | | | |
| | Informal Gardens | Furrow | 900 | 80 | 1125 |

Table 7.3 Agricultural water-use demand in the Mutshindudi River catchment

| *Project* | *Water Resource* | *Existing Development Area (ha)* | *Water demand (million kl/annum)* |
|---|---|---|---|
| Mukumbani | Tshirovha | 440 | 4.62 |
| Orchards | Tshinane | 40 | 0.35 |
| Gardens | Tshinane | 20 | 0.23 |
| Matatshe | Tshinane | 40 | 0.45 |
| Damani | Mbwedi | 500 | 3.70 |
| Orchards | Mbwedi | 50 | 0.48 |
| Gardens | Mbwedi | 30 | 0.34 |
| Easy | Mbwedi | 300 | 3.64 |
| Tshivhase | Mutshindudi | 457 | 4.80 |
| Orchards | Mutshindudi | 50 | 0.48 |
| Gardens | Mutshindudi | 200 | 2.25 |
| Murara | Mutshindudi | 40 | 0.45 |
| Malavuwe | Mutshindudi | 40 | 0.45 |
| Phaswana | Mutshindudi | 200 | 2.50 |
| Matshika | Mutshindudi | 103 | 1.16 |

| | | | |
|---|---|---|---|
| Tshidzini | Mutshindudi | 5 | 0.06 |
| Total | | 2 535 | 26.14 |

**7.3.4 Livestock water use demand**

Livestock data was obtained from the Sibasa Veterinary Offices of the Department of Agriculture of the Northern Region. Only large livestock data could be obtained. Information on small livestock (goats) was estimated at 8 per 20 large livestock of each dipping area. Livestock are kept under the traditional system whereby they are kraaled at the owner's home at night and range on the communal grazing by day. Livestock water use demands are given Table 7.4 and Appendix 6.

Table7.4 : Annual Livestock Water Use Demand in the Mutshindudi River catchment

| Area | Number of Large Livestock | *Number of Small Livestock | Annual Water use demand(kl) |
|---|---|---|---|
| UpperMutshundudi | 1251 | 499 | 13020 |
| Mid Mutshundudi | 4585 | 1829 | 45670 |
| Lower Mutshundudi | 2757 | 702 | 28270 |
| Total | 8593 | 3030 | 88960 |

*Estimated figures due to lack of data

**7.3.5 Agricultural water demand**

It is evident from Table 7.1 and 7.3 and Appendix 2-5 that the largest quantity of water is used for irrigation. It is important to note that a lot more water is also used for gardening and sports fields in urban areas of Thohoyandou.

## 7.4 CONCLUSIONS

The study showed that significant quantities of water (about 25% of mean annual runoff) are extracted from the system annually for agricultural purposes. All irrigable areas has not been utilised yet so demand can be expected to increase significally in the near future.

**New informal irrigation projects along the Mutshindudi River basin demand proper planning through Catchment Management Agencies and Water User Associations to ensure equitable water distribution amongst various land uses. Intensive studies on the effects of agricultural land uses and their impact on riverine ecosystems are needed during different seasons of the year. Irrigation monitoring is necessary to determine seasonal water demand of food gardens in relation to soil - atmospheric induced water stress.**

**One would conclude that all the developments along the river would have to be re-mapped. Livestock data, particularly distribution and movements (seasonal) to and from the river (both large and small livestock), would need to be evaluated twice a year to ensure proper short - and long - term planning.**

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## CHAPTER 8

# NOTES ON THE CULTURAL IMPORTANCE OF WATER IN THE MUTSHINDUDI RIVER CATCHMENT

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## 8.1 INTRODUCTION

Due to various problems it was not possible to gather any significant field data for this project. This was further complicated by the sacred and restricted nature of the kind of knowledge required. The average informant simply repeats popular knowledge when it comes to discussing aspects such as sacred pools and water oracles. To make matters worse: those who do know are not always inclined to share it with outsiders.

The report focuses on the use of indigenous knowledge for the purpose of issues of water conservation, concentrating on information of a higher, symbolic kind. It relates to the ritual use and meaning of water in local culture.

## 8.2 RATIONALE

Venda is an extremely rich area as far as the cultural use of water is concerned. These cultural data - apart from being exotic curiosities for the anthropologist or providing interesting antiquities in the archaeologist's cabinet - could be used in a contemporary context of rural

development as educational data in programmes or campaigns aimed at raising the awareness of the importance of water resources and related environmental issues. The usefulness of such data could extend beyond the rural context, and feature equally well in the newly designed national OBE curriculum, even more so because of the latter's emphasis on the endigenisation of the teaching content.

## 8.3 WATER AS AN ORACLE

The water oracle is essentially a sacred wooden bowl (400 to500mm in diameter) decorated on the rim, base and back. It was filled by the medico-magical practitioner with water and consulted with the aid of divining dice, a flute and small kernels. The exact method of divination has been fully described in reliable early ethnography from the area (German missionary reports and Hugh Stayt's basic textbook on the Venda).

Because of its link with the great public witch-hunts of the past, it was seemingly banned by colonial authorities and has been discarded as a regular means of divination probably somewhere during the first quarter of the century.

Only half a dozen of these bowls have been documented. The author was extremely fortunate to encounter one quite accidentally during a field trip in 1994. This particular specimen is being used by the owner's family in their annual agricultural rites. It was apparently purchased in Zimbabwe. The bowl in the Museum of Mankind, incidentally, was also purchased in Harare.

A different but related use of water is the tracing of the New Moon in a clay bowl filled with water among the Lemba, a minority group partly assimilated by the three major ethnic groups living in the Northern Province.

The Lemba claim to be descendants of the Israelites. There is both linguistic and cultural evidence to support this claim . The tracing of the New Moon with the aid of water is still practised by Muslims worldwide. The Lemba used this method until recently because of the lunar calendar base of their rituals.

It is still feasible to widen the scarce data base related to this kind of water oracle. The Venda speaking section of the Lemba is fairly well organized as the Lemba Cultural Association . They meet annually at their sacred meeting ground nearby Elim.

## 8.4 WATER AND RITUAL COOLING

The practice of u phasa - spitting out of water on ancestral objects near the graves or in the yard of the homestead - has been extensively documented throughout Southern Africa. The ritual occurs at times of domestic stress, death, illness, drought in order to cool off the anger of the ancestors. U phasa is still practiced even in families converted to Christianity or by members of society holding university degrees.

The use of water as ritual 'coolant' has survived into the present age, in spite of a century of missionary and other forms of acculturation. An indigenously based approach to water conservation issues, therefore, can relate to active, contemporary cul ure, beliefs and activities and to general knowledge (and not only to extinct or specialised practices, beliefs and knowledge).

The dichotomies general-specialised: common/popular-secretive and living-extinct forms of knowledge and culture, however, also imply that the data corresponding with these categories will have to be treated differently in pedagogic usage contexts, which is probably not less a challenge than the data collection process itself.

## 8.5 WATER AND RITUAL CLEANSING

Sprinkling of water, e.g. at funerals, is still commonly used as a method of ritual cleansing, especially by the so-called Zionist or Separatist churches. The latter, with their wide membership in the region, make commonly use of water in their religious ceremonies and practices.

The use of water during the malombo (spirit possession cult) activities was one of the aspects which was followed up. The author had heard of one particular pool in the Sibasa area being associated with a particular family. This family had organized malombo sessions for decades. After tracing some of the members and interviewing them, it appeared that the fantastic stories and miraculous events associated with the particular pool were local myth rather than part of the consciousness of the malombo organisers. Interviews with members of another

famous malombo organiser resulted in establishing the same limited, but nonetheless interesting, importance of the use of water by cult group members, which is seemingly overrated by outsiders.

Once more, however, there exists within local cultures a cognitive base for environmental awareness programmes and projects related to water (mis)use.

## 8.6 WATER AND CREATION

### SACRED WATER SITES

Pools feature in indigenous creation mythology as the sites of creation. Occasionally, particular pools and fossilized footprints in the riverbed are identified as the actual locus of creation.

In the Venda area at least five creation sites exist. Data related to creation cosmology/mythology are however scarce (as is the case elsewhere in Africa: due to the fact that this aspect of cosmology and cults or rituals associated with it, are generally secondary to the cult of the living dead).

Similarly, there are permanent water resources (hot springs, pools and waterfalls) which are considered sacred: Phiphidi, Sagole, Tshatshingo etc.). They are mostly associated with supernatural beings: zwidudwani (watersprites), snakes with human heads etc. I will revisit the topic of water beings shortly. The most famous of these sites is Lake Fundudzi. The latter represents a class of sites, the importance of which lies in their association with the aboriginal ancestors of the land. Like elsewhere in Africa, these sites are tabooed by the more contemporary ruling families and clans, who have conquered the land but not its spirits. In doing so they admit to being recent immigrants in the area (the Singo in the case of Venda). Some of these sites have been published extensively. I did however manage to collect some additional data. Interviews relating to sacred sites in the Rambuda area resulted in interesting local history, but left the knowledge concerning the symbolic meaning of water to be explored further.

Apart from being relevant to indigenised pedagogy as physical data, these sites could be integrated in eco-tourism as well.

## 8.7 WATER, BIRTH AND REBIRTH

There are further symbolic references - at a more abstract level - to water as a site of (re)birth throughout the vast array of cultural and religious beliefs and practices in the region. The initiation of the diviner, e.g., is often linked to the river pool. He or she disappears for training from the village and reappears three to seven years later, from a particular pool in the river.

The training of youths of both sexes in the initiation and circumcision schools also makes use of the river pool as a locus of cleansing and symbolic rebirth into adulthood.

Knowledge related to this aspect of the importance of water is still common. It has been fairly well published but never - apart perhaps from professor Nettleton's doctoral work (Witwatersrand) explored systematically with the main focus being the symbolic understanding of water resources.

## 8.8 WATER AND FERTILITY

The preparation of rain medicine has probably lost most of its former glory. Members of a famous rainmaking family, who belong to the Mbedzi clan, explained that it is not necessary anymore to continue the craft as one can simply switch on the radio and listen to the weather report!

Specialized technology and objects related to the production of rain (e.g. sacred drums and rain pots) have basically disappeared together with the extremely secretive knowledge of their use and the waning power of the royal families who controlled them. More popular forms of medicinal paraphernalia to ensure crops and a normal rainy season are still widely being produced and distributed, in spite of 'official' attitudes of skepticism).

This popular knowledge, provided that it is handled carefully, could make excellent teaching material. The major challenge faced by pedagogists in using this kind of data would be to keep in line with the scientific outcomes of the curriculum 2000 project which is currently being introduced as the new overall policy guideline for all educational systems in South Africa. Given the distinctly other-worldly thought system, this and other aspects of the

traditional understanding of the importance of water are rooted in, -the challenge seems certain.

## 8.9 WATER FUNERALS

Funerals in the royal clans comprise a complex of rituals which can be grouped into a first, initial or temporary burial and a second or final funeral, The purpose of the former is essentially to obtain the bones of the deceased king. The bones are exhumed and reburied either in the royal burial ground, in a sacred grove on the clan's mountain, or alternatively they are cremated and the ashes are thrown in a river pool.

Descriptions and analyses of these rituals are well represented by the literature. The most famous practitioners perhaps of the cremation type second funeral are the members of the Vhafamadi clan (literally: those who die in the water), i.e. the Mashau dynasty in the South West of Venda who bury their kings in the Luvuvhu river.

Both anthropologists and archaeologists have attempted to associate the water funerals with earlier immigrants (i.e. pre 1700) in the historically known area of the Venda polity (Mbedzi, Thavhatsindi e.a.).

## 8.10 WATER BEINGS

The most famous of the water beings - spiritual beings associated with pools, hot springs, fountains and rivers are the Zwidudwani. They are 'famous' both in popular culture and in tourism brochures. The best known habitation sites of these watersprites (they are half bodies moving on one leg) have been identified as Lake Fundudzi, Mahovhohovho and Phiphidi; but their are many more.

There are similar beings associated with water sources which occur outside Venda under a variety of names (e.g. Mamlato in Nguni context). The Njuzi water sprites in Shona culture come closest to the Venda Zwidudwani: troublesome spirits in the rivers and pools who threaten all but the people who live closest to them (often descendants of groups older than the present ruling clans and therefore burdened with their worship and appeasement.

In addition to these - or shall I say overshadowed by these are other water beings at other sacred sites, which are part of localized beliefs and have not really been studied systematically. It is interesting to note that a fountain that fed the Ishaulu sacred grove, supposedly with a a spiritual being living nearby, seemingly run dry because of the area being turned into a state forest.

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## CHAPTER 9

# MULTIDISCIPLINARY RESEARCH IN DEVELOPING COUNTRIES : THE MUTSHINDUDI RIVER CATCHMENT PROJECT

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## 9.1 INTRODUCTION

If the Mutshindudi project was regarded as just a fact-finding exercise to provide technical ways of dealing with the problem of sustainable use of water, a multidisciplinary team, including, particularly the social sciences, would probably not have been necessary. If the sustainable use of water is however, regarded as an independent variable of development in general, then it necessitates insets from both the natural- and the social sciences. Such a multi- or inter- disciplinary research effort has, apart from its advantages, very specific

problems which are even more evident when the research is undertaken in areas which are developing or under-developed.

While it is true that some developing countries have research institutions which rank among the world leaders in certain types of research, they are rare. In most developing countries the tradition of modern scientific research is young and the infrastructure is fragile. Resource constraints - inadequate facilities, lack of technicians and support staff, unreliable equipment and unstable budgetary support - compromise many aspects of research. There is, in addition, often limited access to necessary information and relevant journals. The concept of peer review and constructive criticism has also yet to penetrate sufficiently into the research practices of developing countries. As a consequence the quality of research, admittedly a difficult parameter to measure, tends to be marginal, limiting confidence in the usefulness of research results. This in turn discourages potential researchers to start investigations with the result that experienced and skilled researchers and a research culture are in most developing countries a very scarce resource, while well-compensated, professionally secure, full-time researchers with the freedom to determine their own research agendas are almost non-existing. The Mutshindudi project experienced many of these problems, but could also deal with some of them because it synthesised the limited available resources in a multidisciplinary effort.

## 9.2 WHY A MULTIDISCIPLINARY RESEARCH TEAM ?

There are several reasons why a multidisciplinary effort will provide more valid and reliable information about certain research topics. The following are some of the reasons why it was chosen in the case of the Mutshindudi project. Most of this will however, hold true for communities in similar circumstances.

### 9.2.1 Horizontal versus vertical information

Environmental problems are often the result of development processes in which industrial, agricultural and economic objectives are pursuit without taking into account the possible harmful environmental repercussions, generating unanticipated - and often unprecedented - risks. Sustainable development by which today's people can enjoy the fruits of progress equitably without compromising future generations, has emerged as a prominent research topic throughout the world. These objectives are even more important in developing countries given that the poor of all nations are frequently at a greater risk of exposure to

environmental hazards but have limited access to corrective actions [ Commission on Health Research for Development, 1990:9] Research actions for sustainable development however, requires scientists as citizens who can perform a societal role beyond technology generation. It requires a research effort that is able to involve people, institutions and processes. Its pursuit depends on systematic analysis, creativity and exploration.

Apart from the fact that no single department at the Univ. of Venda do have the human or other resources [knowledge, time money etc.] to undertake a study of this dimensions, the research subject necessitates insets from a variety of both natural and social/human sciences. The aim of inter- disciplinary research is to present ***horizontal*** rather than ***vertical,*** *individual* pieces of information. Not only can it present a more holistic view of the problem under investigation, but it will also reduce the isolation in which academics are trained to undertake research. Furthermore, inter- disciplinary research may create interaction not only between disciplines which are usually not accustomed to work in close liaison, but also between the university, students and the local community. Data obtained through horizontal [multidisciplinary] efforts also facilitates the linkage between research and the utilisation of research results, as objectives and findings can be presented in a comprehensive manner which often communicates the recommendation more effectively to potential users.

### 9.2.2 Environmental education

If environmental resources are to be used in a sustainable way, ***environmental education*** will have to play a major role. Environmental education in developing countries can, however, only be relevant if it is part and parcel of a much more inclusive 'development' educational effort. The ultimate aim of this type of education is to encourage critically aware persons who have the motivation and the skills to participate in development efforts [UNICEF, 1987]. In other words, development education aims at making people become effective workers for a more liveable and equitable world. But environmental education is often perceived as a 'soft' consumption sector which will only follow advances in 'harder' sectors like industry and agriculture. The converse, we argue, is equally true. Investing wisely in environmental education will built human capital, enabling people to take informed decisions about environmental management.

Such educational efforts require the support of specialists in different fields including both natural and social/human sciences. It must, however, also be based on the inputs of 'lay or

indigenous' knowledge if it is to be understood and implemented by the community for which such educational efforts are designed for. Involving local students in the research process and through them the local community, can obtain this objective. Working as a team of professionals, students and community, the multidisciplinary effort involved in the Mutshindudi project can, consequently, provide the basic material for such an environmental educational process.

### 9.2.3 Building research capacity

Multidisciplinary research also provides the opportunity for experienced and skilled researchers to 'sell' their skills and build capacity of those needing them. Working together, provide the ideal environment for young academics to gain experience from those researchers in their particular field but also to become knowledgeable of the potential benefits of related sciences for understanding a problem in a comprehensive or holistic way.

Working in a multidisciplinary team is also a very useful tool in demystifying or removing the 'fearful' connotation of the research concept. Team members are more willing to share experiences and mistakes when engaged in the same project, leaving the inexperienced researcher with the impression that research skills is not a 'given' but is obtained through trial and error. Particularly in historically disadvantaged universities like the university of Venda with its alarmingly poor research output, multidisciplinary research can open the door for academics to become researchers in a less 'exposed' way than what would have been the case when they attempt it as individuals. Multidisciplinary activities can achieve depth and diversity of research capability that would otherwise not be possible.

### 9.2.4 'Hard' versus 'soft' data

There is a general uneasiness amongst natural scientists about the value of qualitative compared to quantitative research data. Qualitative data is treated with less respect and is seen as 'soft' and as having doubtful validity [Ramphele, 1990:12]. It is, however, not possible to speak of sustainability or development or any way in which 'improvement' can be pursued, without delving into the essence of human existence within the social context in which people operate [Coetzee,1989:163]. Omitting to take people's intentions into account, explains the failure of many conservation and development efforts because the community were simply the passive receivers of services when it was already created. It should be realised that science and technology can contribute to the conservation of natural resources *only* if the

people themselves become full partners in safeguarding and promoting environmental resources.

Furthermore, in a number of fields it is more important to make use of existing knowledge than to generate additional knowledge and new tools. At present, this is particularly important in the light of the large increases in expenditure to provide water for the majority of the South African population. In developing countries officials too often focus on 'selling' modern conservation or development practices to the people without giving sufficient thought to whether the modern practices are relevant to the community in terms of its social and cultural background. It is necessary for government agencies to develop a better understanding of what can be called the 'conservation culture' of a community and how this culture is influenced by social forces such as the dynamics of social and cultural change and the political and economic organisation of the community. This information can best be provided by the social sciences and must therefore be seen as fundamental for any research involving human beings rather than being 'soft' and dispensable.

Working together, natural and social sciences will develop the necessary insights into related theories, practices and paradigms and in this way create a spirit of genuine co-operation.

### 9.2.5 Theory versus practice

It is accepted that there is a constant interaction between theory and practice; almost every practical problem is rooted in a theoretical issue, and every theory, if well formulated, should have implications for application to the real world [Merton, 1957: 85-117]. It is also true that some academic disciplines pay more [but not exclusively] attention to the development of theory and knowledge, while others are primarily [but not exclusively] interested in the practical application of their knowledge. If it is in addition, accepted that the environment as well as human societies constitutes analytical systems, it is a logic deduction that when natural and social sciences engage in interdisciplinary research, it will provide the ideal climate for the merging of theory and practice. Whether one analyses the system as 'rational' [physical and operational sciences] or as 'natural' [social sciences] the two approaches are complementary as both are ideal types and therefore not fully valid operating on their own. The products of these diverse investigations enrich one another. A whole variety of factors, social and natural act to produce a given state of degradation or preservation of the environment and determine human response on an individual and collective level to this

situation. If an appropriate multidisciplinary framework can be developed that take this action into account, chances are much better that research products will be applicable and relevant to local circumstances [Wessen, 1972:479]

This is not to say that research undertaken from the perspectives of individual disciplines alone will not continue to contribute to environmental and social research. A secure and comprehensive theory of action in environmental research will, however not develop without this type of integration. Without such a theory, research that can deal with environmental problems in a comprehensive manner, will be very difficult.

### 9.2.6 The generalisation of research findings

Insofar as it is possible to specify, clearly, environmental variables and relationships and insofar as 'human nature' is universally the same, scientific findings ought to have universal validity and applicability. But environmental, human, social and cultural settings vary so widely that it is not possible to assume that any two environments or communities are really comparable. A conflict thus arises between the tendency to assume that all is relative and that generalisation is dangerous and the tendency to assume that findings made in one situation will in all probability be applicable elsewhere. It is perhaps true that natural scientists tend to emphasise universal applicability while social scientists may tend to stress the idiosyncrasy of given situations. Particularly in developing countries where scientists and developers have to rely on crude and 'ill-defined' definitions, e.g. 'developed' versus 'developing' it is very difficult to undertake area-specific research which generate enough information to make it comparable to other sets of data [Wessen, 1972:480]

What is needed then is both better standardised measures to facilitate comparison and therefore theoretical clarification of the interpretive basis upon which these comparisons can be made. In the absence of this, the opposing tendencies to over generalise, and to limit generalisation too severely, will likely persist unchecked. These objectives will be met more readily in genuine collaborative research.

### 9.2.7 Research methods

When multidisciplinary research is undertaken it is necessary to look carefully at the validity and reliability of measuring instruments. This is of particular importance where the participation of he population under investigation is concerned. Many of the natural sciences

are used to work in relative isolation of human considerations and their research instruments are designed likewise. When they have to work in close co-operation with social scientists and the community, the whole team will have to rethink the effectiveness and efficiency of their methods and techniques. The question that has to be answered is not 'how can we individually obtain the best measurement?' but rather 'How can we combine the available instruments into a single data-gathering technique? It does, naturally, not mean that chemistry must throw away their chemicals or anthropologist their ethnographic observations. It does, however, implicate that each method and technique should be evaluated carefully in terms of its contribution to the establishment of an integrated profile of the problem under investigation. Particularly where communities that are inexperienced with research are involved, it is essential that the project is presented to them as a unity with which they can identify and participate and not with confusing and sometimes conflicting methods and techniques which antagonise them rather than produce involvement.

**Maybe the most important aspect to keep in mind is that almost any type of research from whichever discipline, ultimately has human consequences. It may consequently be the most effective way to undertake research which have human beings as the basic assumption.**

## 9.3 PROBLEMS WITH MULTIDISCIPLINARY RESEARCH

### 9.3.1 Co-operation and integration between natural and social sciences:

Historically the natural and social sciences have been separated by a well-established difference in discipline status - the natural science as 'true' - and the social or human sciences as 'quasi -scientific' This barrier is not easily broken down and is not made easier when the variety of conflicting theories is added. In the absence of a well-established and comprehensive ecological theory, it seems unlikely that a widely useful, unified analytical framework from within which natural and social sciences can work together, will develop. One must not forget that the research approach of the two types of sciences are indeed different and probably not many persons in either field are successful in hybridising the divergent concepts and paradigms.

Although it may be much more comfortable to cling to the old, we will have to cross over time into the new uncharted territory of multidisciplinary integration - in a sense we are

already more deeply committed to this new work ethic than we may realise. The Mutshindudi project is but one example of this.

### 9.3.2 Different objectives

In the absence of a holistic ecological concept of human organisation, it is very difficult for people from different research paradigms to agree on a common goal or objective. When a team concentrates on one topic [like in the study under discussion], they naturally do it from different perspectives. These differences [in paradigms, methods, techniques etc.] must however not prevent team members to agree on a common goal. The main problem in agreeing on a set objective or objectives must be looked for in the area of conceptualisation. If there is not general agreement about, and sharing of specific definitions for major concepts, it is inevitable that findings and recommendations will be circular, short-range and conflict-inducing [Thomas, 1956]

It is indeed difficult to locate each individual project in a multidisciplinary effort into an integrated, development approach all centred on sustainable environmental management which put people first.

### 9.3.3 Lack of a research infrastructure for multidisciplinary research

The former homeland universities, these days referred to a 'historically disadvantaged universities' are in a particularly vulnerable position in terms of the availability of democratic institutions favourably disposed to, and supportive of any type of research, leave alone multidisciplinary efforts. Given the vagaries of academic recruitment, they are seldom in a position to release teaching staff for the purpose of particularly applied research. But by virtue of their location and their familiarity with the problems of the essentially rural populations of developing regions, these universities are optimally situated to undertake empirical research necessary to formulate theoretical abstractions. It is unfortunately also so that these universities experience extreme shortages of staff with the result that academics find it difficult to conduct research in addition to their heavy teaching commitments [Tapscott,1982:23] Academics working under such conditions, already isolated from peer support, lack of opportunities for career advancement and professional development, very quickly loose interest in own research projects and do not even consider working together with people in their own field, leave alone those in 'opposite' fields. When they do embark on research, they often find themselves in weak and unstable institutional environments

lacking real understanding and appreciation of the importance of research and with insufficient and erratic funding. The University of Venda for Science and Technology is no exception.

To meet the obvious research needs of these rural, developing areas, there would appear to be the need for the establishment of an additional body or bodies within the university structure, be it an institute or research centre, which has as its primary objective the conducting of particularly development research. It follows that a body of this nature, adequately funded and staffed can undertake at least a portion of the extensive research required and can in addition, do so in an autonomous manner. An institute like this can create the correct climate for a broad-based scientific culture and can penetrate both the university curriculum and local community.

Scientists as citizens perform a role beyond technology generation. Individuals successfully engaged in research can contribute to high standards of creativity, independence and commitment to truth. All these are necessary values for a healthy social and natural environment.

### 9.3.4 Lack of national and international linkages

Few people will disagree that research is important, but many believe that it is for tomorrow and only for affluent and developed countries. Research is however, even more critical for those who must accomplish more with less.. In developing countries, area-specific and country-specific research is of the utmost importance simply because knowledge is not available. Every country, no matter how poor must at least undertake research dealing with the effective application of existing knowledge and technologies. This type of research, much needed as it is, are usually only location-specific and have therefore limited transferability. It is consequently necessary that research should also have national and international linkages taken into consideration that the current knowledge and technologies are inadequate to deal with complicated environmental and social problems.

To speed up progress on the development problems of developing countries, it is necessary both for the research capacity of developing countries to be expanded and for the research capacity of industrialised countries to remain engaged with Third World problems, if possible on a larger scale than at present.

International partnership are being used effectively to strengthen and support research on country-specific problems. International co-operation for the development of research methods, training and technical advice and mutual learning from exchanging results, are highly valuable. Thus research on area- or country-specific problems should not be isolated nationally but should be the subject of lively and stimulating international networks [Breen et al 1991].

At the moment national and international research linkages are, at least at our institution, only starting to take place. Much stronger efforts are needed to ensure that consumers of research participate in the formulation of research activities and that research results are disseminated to appropriate audiences. Building capacity for research in developing countries - both country-specific and global research - requires strong commitment by political, financial and government leaders, backed by an informed and supportive public. In many cases well-known researchers receive excessive support [funding, rewards, etc.] which they can not put to efficient use. More junior investigators who would benefit most, may not be given the opportunity to participate in national and international capacity-building programmes.

Working in a multidisciplinary team may address some of these problems. Such a team of researchers can achieve the depth and diversity of research capability that would not be possible with individual efforts. Sub-Saharan Africa deserves special consideration for building research capacity because environmental and social problems have been aggravated by economic and political difficulties and national resources to respond are severely limited. Multidisciplinary research, stretching over regions and countries linking the scarce resources may be one way to address these problems.

### 9.3.5 Problems in terms of community-based research

Community-based, action or participatory research has a short history in South Africa with the result that its methods and techniques are only understood well by a few, usually social scientists working from within the humanistic perspective. There is a natural reluctance from natural scientists to include this approach in their research as it is so far removed from their positivistic, quantitative based methods and techniques. To put people first, necessitate a paradigm shift - much easier achieved by researchers inclined to qualitative research.

It is not here the time or place to go into a discussion of the benefits of community-based research in developing countries. What should, however be emphasised, is that no research results, recommendations and policies will benefit a community if it is contrary to local belief systems and values [The Earth Charter, 1992]. When social scientist, skilled in community-based research, work together with scientists not used to do so, it can prepare the field for a learning experience which outcomes will be more relevant to local conditions.

Even if you do have a committed and skilled group of researchers willing to participate in action research, it does not follow naturally that the community themselves will participate energetically. People living in chronic poverty, with little education and even less self-esteem, cannot be expected to understand why their inputs in research programmes are necessary. It does, consequently take time, patience and dedication to create a climate of mutual trust and co-operation. Making use of students as fieldworkers, as was the case in this study, is an effective method of breaking down barriers as they originate from these communities and understand the culture and circumstances.

## 9.4 CONCLUSION

A better understanding of - a growing capacity to conduct -, and an increase in the number of research leaders are all critical components for successful multidisciplinary research. Supported by a democratic institution, properly funded and skilled, such research efforts can inform the attitudes with which people think about themselves and their environment. It can foster a scientific, problem-solving culture which is urgently needed in all developing countries,

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# APPENDICES

## APPENDIX 1

### Questionnaire

A SOCIO-ECONOMIC PROFILE OF INHABITANTS OF THE MUTSHINDUDI CATCHMENT AREA

Interviewer:.....

Date.....

Time.....

Project leader: Dr.MJ Gaigher: Dept. of Sociology
Univ. of Venda
P/Bag 5050
Thohoyandou
Tel: 0159628292

INFRASTRUCTURE

1 **Schools :**
Primary----------1
Secondary----------2

2 **Distance from nearest clinic/hospital----------**

3 **Electricity :**
In town----------1
In house----------2

4 **Nearest post office----------**

5 **Telephone service :**
In town----------1
In house----------2

6 **Condition of roads :**

Fair----------1
Good----------2
Bad----------3

7 **Littering :**

Dirty----------1
Clean----------2
Agreeable----------3

1. **Name of town/village/settlement**

---

2 **Age :**

---

3 **Educational level :**

None.....1
Up to std. 2.....2
Up to std.5.....3
Up to std. 8.....4
Up to std. 10.....5
Tertiary education.....6

4 **Marital status :**

Single.....1
Married.....2
Divorced.....3
Widowed.....4
Separated.....5

5 **If married, is your husband working away from home [i.e. a migrant worker]?**

Yes.....1
No.....2

6 **What amount of money do you get per month?**

Less than R200.....1
R201 – R499.....2
R500 – R999.....3
R1000 – R1999.....4
R2000 +.....5

7 **What is the main source of this income?**

Own salary.....1
Husband or supporter.....2
Pension.....3

Trade.....4
Other [explain].....5

**8 How many people are living on this income?**

.....

**9 How many children [dead and alive] did you give birth to?**

.....

**10 How big is your house [how many rooms or huts] ?**

.....

**11 What is the main source of drinking water for your household?**

Piped/public tap.....1
Piped tap in house or yard.....2
River/stream/dam.....3
Protected spring/well/borehole.....4
Unprotected spring/well/borehole.....5

**12 Do you consider water from the river safe for drinking ?**

Yes.....1
No.....2
Don't know.....3
Sometimes unsafe.....4

**13 If you consider it as unsafe, why do you think so?**

.....

**14 If you have piped/tap water, is it reliable [always running] ?**

Very reliable.....1
Very unreliable.....2
Occasionally unreliable.....3

**15 If you use water from a source other than your home/yard, how far do you have to carry it?**

10 to 500 meters.....1
1 kilometer...2
2 kilometers.....3
3 kilometers.....4
More than 3 kilometers.....5

**16 How many buckets of water [25 liters] do you use per day?**

One.....1
Two.....2
Three.....3
Four.....4
Five.....5
More than five.....6

**17 How long do you usually wait at the tap or pump ?**

Less than 10 minutes.....1
10 to 30 min.....2
1 hour.....3
2 hours.....4
Do not have to wait.....5

**18 Do you or your family wash clothing or bathe in the river ?**

Yes.....1
No.....2

**19 Would you prefer to wash your clothes at a communal wash house [laundry]**

Yes.....1
No [provide reasons].....
.....2

**20 Do you wash clothes at the communal tap?**

Always.....1
No.....2
Sometimes.....3

**21 Would you prefer to wash yourself or take a bath at communal, but private bathrooms ?**

Yes.....1
No [provide reasons].....
.....2

**22 If you have land for cultivation, which of the following do you produce mainly ? [choose only one]**

Vegetables and/or fruit.....1
Maize.....2
Other.....3

**23 How big is the land that you cultivate?**

Less than a hectare.....1
1 Hectare.....2
2 Hectares.....3
More than 2 hectares.....4

**24 What do you do with this crop?**

Only for own household.....1
For household and selling.....2
Only for selling.....3

**25 Apart from rain how do you irrigate this land ?**

Flood irrigation from tap.....1
Flood irrigation direct from river/canal/dam.....2
Pumping from dam/river.....3

None.....4

**26 Do you have problems with this irrigation scheme? Explain**

.....

.....

**27 If you use drinking water from the river, how do you treat it to make sure it is safe ?**

No treatment.....1

Boil it.....2

Other [explain].....3

**28 How many cattle, goats, pigs, donkeys, horses or chickens do you own [specify, e.g. 12 cattle] ?**

Type and number.....1

None.....2

**29 Do these animals drink water from the river?**

Yes.....1

No.....2

**30 For which of the following purposes do you use the river?**

Religious ceremonies [like baptism].....1

Medicinal.....2

Cultural [e.g. initiation].....3

Fishing.....4

Building.....5

None.....6

**31 Which type of toilet does your family use [verified by interviewer]**

Flush.....1

Pit latrine.....2

Bucket.....3

None.....4

**32 If you do not have a toilet, where do you perform these ablutions ?**

**[choose only one]**

Behind trees [not river].....1

At the river.....2

Dry stream beds.....3

Under a bridge.....4

Other [explain].....5

**33 Where does your family dispose of dry waste ? [verified by interviewer]**

Pit.....1

Open [just throw away].....2

Open and burn.....3

Other [explain].....4

**34 Do you cook mainly on: [choose only one]**

An electric stove.....1

A wood or mud stove.....2

A paraffin stove.....3

An open fire.....4

**35 Do you know the disease that is caused by mosquitoes?**

Malaria.....1

No.....2

**36 Do you know hoe people get the disease called bilharzia ?**

Contaminated water.....1

No.....2

**37 Did any of your family members suffered from any of the following diseases during the past 3 years?**

Cholera.....1

Gastroenteritis.....2

Typhoid.....3

Trachoma.....4

Worms.....5

Bilharzia.....6

Malaria.....7

No.....8

**38 Which one of the following would you regard as the most serious problem in your community?**

Lack of educational facilities.....1

Lack of health care facilities.....2

Lack of clean water.....3

Lack of electricity.....4

Lack of sanitation.....5

Lack of roads.....6

Lack of telephones.....7

Lack of job opportunities.....8

Lack of proper housing.....9

Other [specify].....10

**39 What is the biggest problem you experience with water?**

.....1

No problem.....2

**40 Whom, do you think, should be mainly responsible for solving these problems [choose only one]**

The headman/chief.....1

The transitional local council.....2

Civic organisation.....3

The department of Water affairs.....4

The community together with the government.....5

The reconstruction and development programme..6

All of the above.....7

Don't know.....8

**41 Did anybody of the RDP took any action in an effort to improve the water supply in your village ?**

No.....1

Yes [explain].....2

Don't know.....3

**42 Did you do anything yourself to solve this problem?**

Yes [explain].....1

No.....2

## APPENDIX 2

**Irrigable Soils, Project Locations, Sizes and Source of Water**

| *Location* | *Project* | *Source of Water* | *Potential Irrigable Area(ha)* | *Irrigated Area (ha)* | *Rain-fed Area (ha)* | *Total Developed Area(ha)* |
|---|---|---|---|---|---|---|
| | **Tshinane** | | | 979.00 | | |
| | Mukumbani | Tshirovha | | 440 | 139 | 579 |
| | Mukumbani | Tshinane | | - | 100 | 100 |
| | Gondeni | Tshinane | | | | |
| | Orchards | Tshinane | | | 40 | 40 |
| | Gardens | Tshinane | | - | 150 | 150 |
| | Matatshe | Tshinane | | 20 | | 20 |
| | | | | 40 | | 40 |
| | | Total | | 500 | 429 | 929 |
| | **Mbwedi** | | | 1.350 | | |
| | Damani | Mbwedi | | 500 | - | 500 |
| | Orchards | Mbwedi | | | | |
| | Gardens | Mbwedi | | 50 | 100 | 150 |
| | Fields | Mbwedi | | 30 | - | 30 |
| | Easy Farm | Mbwedi | | - | 200 | 200 |
| | | | | 300 | - | 300 |
| | | | | 880 | 300 | 1180 |
| | **Mutshindudi** | | 3.010 | | | |
| | Tshivhase | Mutshindudi | | 457 | 45 | 502 |
| | Murara | Mutshindudi | | 40 | 160 | 200 |
| | Gardens | Mutshindudi | | | | |
| | Orchards | Mutshindudi | | *200* | - | 200 |
| | Malavuwe | Mutshindudi | | 50 | 50 | 100 |
| | Matsika | Mutshindudi | | 40 | - | 40 |
| | Phaswana | Mutshindudi | | (103)* | | (103)* |
| | Fields | Mutshindudi | | 200 | | *200* |
| | | | | | 1000 | 1000 |
| | | | | 1090 | 1255 | 2345 |

**To be operational in 1997/98*

## APPENDIX 3

**Tshinane Sub-catchment**

| Project | Size(ha) | Crops | Season |
|---|---|---|---|
| Mukumbani | 440 | Tea | Perennial |
| Orchards | 150 | Mango | Perennial |
| Matatshe | 40 | Cabbage | Winter |
| | | Spinage | Winter |
| | | Carrots | Winter |
| | | Beetroot | Winter |
| | | Tomato | Winter |
| | | Chinese Spinach | Winter |
| Gardens | 20 | Cabbage | Winter |
| | | Chinese Spinach | Winter |
| | | Tomato | Winter |
| | | Maize | Summer |

## APPENDIX 4

**Mbwedi Sub-catchment**

| | Size (HA) | Crops | Season |
|---|---|---|---|
| Damani | 500 | Coffee | Perennial |
| Orchards | 150 | Mango | Perennial |
| Gardens | 30 | Cabbage | Winter |
| | | Spinach | Winter |
| | | Chinese Spinach | Winter |
| | | Tomato | Winter |
| | | Groundnuts | Summer |
| | | Maize | Summer |
| Fields | 200 | Maize | Summer |
| Easy | 300 | Tomato | Winter |
| | | Citrus | Perennial |
| | | Mango | Perennial |
| Total | 1180 | | |

# APPENDIX 5

**Mutshindudi Sub-catchment**

| | Size (ha) | Crops | Season |
|---|---|---|---|
| **Upper Mutshindudi** | | | |
| Tshivhase | 457 | Tea | Perennial |
| Murara | 40 | Cabbage | Winter |
| | | Spinach | Winter |
| | | Tomato | Winter |
| | | Chinese spinach | Winter |
| | | Maize | Summer |
| Orchards | 11 | Mango | Perennial |
| Gardens | 68 | Cabbage | Winter |
| | | Chinese spinach | Winter |
| | | Tomato | Winter |
| | | Carrots | Winter |
| | | | Winter |
| **Mid-Mutshindudi** | | | |
| Gardens | 100 | Cabbage | Winter |
| | | Spinach | Winter |
| | | Tomato | Winter |
| | | Carrots | Winter |
| | | Beetroot | Winter |
| | | Chinese spinach | Winter |
| | | Sweet potato | |
| | | Pepper | Summer/Winter |
| | | Maize | Annual |
| | | Summer | |
| Orchards | 22 | Mango | |
| | | Citrus | Perennial |
| | | | Perennial |
| **Lower Mutshindudi** | | | |
| Malavuwe Gardens | | | |
| | 40 | Cabbage | Winter |
| | | Beans | Winter |
| | | Chinese Spinach | Winter |
| | | Groundnuts | Winter |
| | | Tomato | Winter |
| | | Onion | Winter |
| | | Sweet potato | Winter |
| | | Carrots | Winter |
| | | Chillies | Annual |
| | | Maize | Winter |
| Orchards (Matsika)* | 0.5 | Avocado | Perennial |
| Gardens | 32 | Cabbage | Winter |
| | | Chinese Spinach | Winter |
| | | Tomato | Winter |
| | | Maize | Summer |
| | 17 | Citrus | Perennial |
| Orchards | | Mango | Perennial |
| Tshidzini Gardens | 103 | Cabbage | Winter |
| | | Chinese Spinach | Winter |
| | | Tomato | Winter |
| | | Maize | Summer |
| | | Onions | Winter |
| Phawana | 5 | Banana | Perennial |
| | | Groundnuts | Summer |
| | 200 | Banana | Perennial |
| **TOTAL** | **1 055.5** | * To be operational during 1997/98 | |

## APPENDIX 6

**Livestock water-use demand**

| Subcatchment | Dipping Area | Large livestock units | Number of* small livestock | **Annual water use(kl) |
|---|---|---|---|---|
| Upper Mutshindudi | Phiphidi | 279 | 111 | 2900 |
| | Gondeni | 710 | 284 | 7400 |
| | Murangoni | 262 | 104 | 2720 |
| Mid Mutshindudi | Ngudza | 387 | 154 | 4020 |
| | Natal House | 586 | 234 | 6090 |
| | Tshidimbini | 692 | 249 | 6540 |
| | Tshififi | 1195 | 478 | 12430 |
| | Mukula | 887 | 354 | 7220 |
| | Malavuwe | 901 | 360 | 9370 |
| Lower Mutshindudi | Tshidzini | 664 | 265 | 6900 |
| | Sterkstrooom | 1240 | 95 | 12500 |
| | Tshifudi | 853 | 341 | 8870 |
| TOTAL | | | | 88960 |

*Estimates figures due to lack of actual figures
**25 litre/head/day Bisschop (1964)

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