Effects of Anthropogenic Water Demands Against Ecological integrity in Lower Limpopo River

○Osvaldo Silva Zefanias Nhassengo*, Hiroaki Somura**

Introduction

Mozambique is endowed with 104 river basins from which 13 are large basins and Limpopo River is one of them. The total mean annual runoff in the country is estimated at 216 km^3/year. However, the water resources are conditioned by the fact that they form part of international river basins, where neighbouring countries upstream are increasingly exploiting available water resources. This is claimed to exacerbate downstream problems of water shortages and drought in Mozambique (FAO-SAFR, 2004) and the increased demand for water is in part due to increase number of water users. Limpopo River was considered to be a strong-flowing perennial river but is now regarded as a weak perennial river where flows frequently cease and, during drought periods, no surface water is present over large stretches of the middle and lower reaches of the river (Ashton et al., 2001). The over-use of water in the upstream and along parts of the river can cause severe water shortage in the lower catchment. The shortage of water may affect the downstream water users, sensitive ecosystems and people who have a high socio- economic dependence on these ecosystems. The effect of the increase in abstractions had already been apparent in dry season. It is not feasible from socio- economic developmental point of view to maintain or return the natural regime of the river by forcing full reduction of the consumption needs of water for various uses, it is important to identify how balancing these consumption needs for social and economic purposes with the minimum requirements of maintenance of ecosystems. Thus, the research aims to evaluate the influence of human water demand against ecological integrity of Lower Limpopo River in Mozambique, in order to consider a balance between anthropogenic activities and ecological integrity.

Study Area and Methodology

The study was conducted in Lower Limpopo (5618 Km^2), a sub basin in Mozambique of Limpopo River (412,000 km^2) shared with RSA (47%), Botswana (18%), Zimbabwe (16%) and Mozambique (19%) Figure1. The climate varies from humid semi-arid to arid. The mean annual rainfall is 800–1000 mm, declining to less than 400 mm in the dry interior. Annual temperature ranges from 23 to 26^{o}C. The relative humidity is higher than 70%.

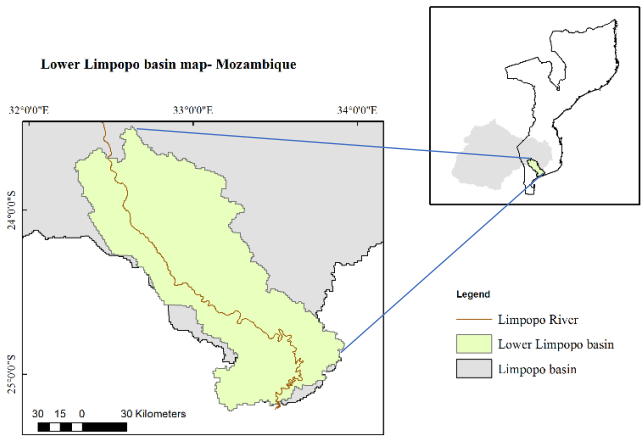

Figure 1. Study area.

*島根大学大学院生物資源科学研究科 Shimane University, Graduate School of Life and Environmental Science
**島根大学生物資源科学部 Shimane University, Faculty of Life and Environmental Science
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To describe the current situation of the river, the procedure developed by Kleynhans (1996) was used. The procedure assess the index of habitat integrity (IHI). The ground surveys were done during the field visit in dry season on 13 and 14 July of 2016. At all sites photos were taken and the exact location was registered on a GPS. The aerial surveys were done through Low- level aerial photography and satellite imagery using Satellite Map. The integrity score was transformed into the ecological category (A to F) according to the Eco Status classification system of South Africa. The Tessman Method was used to estimate Environmental flow requirement (EFR). The rule recommends minimum flow guidelines as follows: 1) MMF, if MMF < 40 % MAF; 2) 40 % of MAF, if 40 % MAF < MMF < 100% MAF; and; 3) 40 % of MMF, if MMF > MAF.

Results

The PES varies from A/B to C, table 1. B means largely natural with few modifications, a small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged. C means Moderately modified, a loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. The major influence in all site was flow modification and there was a clear trend of flow reduction from upstream to downs stream. Although the major abstraction is Macarrentane and Massingir dams, small pumps along the river used for irrigation agriculture and different activities may impact the ecological integrity of the river. From figure 2, the total annual EFR (3297.9Mm^3) is equivalent to 50.6% of the total annual flow (6512.126Mm^3); where 76.9% of total annual flow are concentrated in December to April and 17.5% of flow in dry season (May to September).

Table 1. Current situation of the river in assessed sites

OVERALL RIVER HEALTH	Sites				
Delineation:	**Chibuto**	**Chaimite**	**Mohambe**	**Guijá**	**B. M**
Instream Habitat Integrity	86.16	83.16	83.84	76.24	79.44
Riparian Zone Integrity	89.4	87.2	87.48	76.8	74.6
RIVER ECOSTATU	87.79	85.18	85.66	76.52	77.02
PES	**A/B**	**B**	**B**	**C**	**B/C**

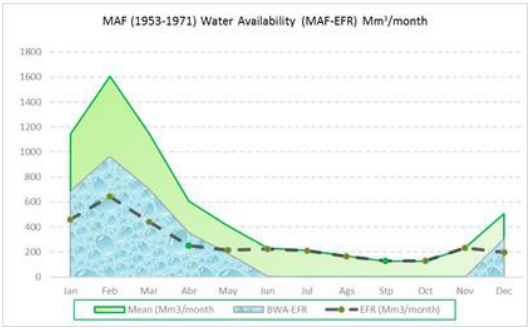

Fig 2. Mean annual flow, water availability and monthly EFR

Discussion and Future Scope

It is evident that from June to November there is possibility of conflict among water users. Water abstraction for human use in this period may intensify the conflict, which can lead to jeopardizing the ecological integrity. The balance among different users will be defined after estimating the present and future human water demand and Sustainability assessment considering the present and future water availability.

Reference

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