Deleterious impact of urban communities on the freshwater ecosystem of the Braamfontein Spruit

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Introduction

Urban Freshwater Ecosystems play a variety of very important social, economic and ecological functions. These systems function as recreational areas (Swanwick, Dunnett, and Woolley, 2003), animal and plant habitats, flood control systems (Levy *et al*, 2007) and domestic or industrial treated water disposal systems, as well as a source of bathing or even drinking water in some communities and a source of fish stocks (Berkes, 1979), to mention but a few. However, urban freshwater systems come under considerable stress due to human disturbance, predominately in the form of pollution, to the point that there their natural functions may be entirely compromised.

Much research has already been done into the deleterious effects of pollution on aquatic ecosystems, such as assessing the toxicity and eutrophication relating to nitrate pollution, at a global level (Julio and Alvaro, 2006), or the effect of nutrient pollution on ecosystem processes and species diversity with decreased nutrient uptake and biodiversity resulting from agricultural pollution. (Walsh *et al*, 2005). Other major urban pollutants have also been assess such as storm water,(Walsh *et al*, 2012) establishing a connection between water run off schemes and river ecological condition. Finally water toxicity relating to industrial pollution, most expeciatlly acid mine drainage (Ata and Soner,2006) has also been investigated, and treatment schemes as well as primary prevention schemes proposed. Overall the leading causes of urban freshwater degradation, and their sources are well identified and understood.

The purpose of this resreach is to add to the established body of knowledge concering the human impact on aquatic ecosystems, by inverstigating the effects of urbanisation on the state on a particular innercity freshwater ecosystems. The ecosystem/site selected for analysis was a small section of the Brannfontein spruit located within a recreational public park. The park (Delta Park), lird within a highly populated urban district with many recreational users frequenting the park every day, as well as homeless individuals who inhabit the park, and may use the river waters for bathing or cooking. Furthermore the park was historically a sewerage treatment site any although it has been re-purposed, it is still a hub of the Johannesburg sewerage transport network the the possibility of multiple leaks of raw sewerage directly into the river, as well as storm water drains which empty directly into the river. For assessment of water quality the SASS scoring based on the diversity of aquatic macro-invertebrates invertebrate found, was assign to each sample site (Dickens and Graham, 2002). A relatively pristine section of the Magalies river was also sampled as a control/stand for comparison.

The aim of this investigation was to establish the extent, and origin, of human generated pollution and disturbance on the Delta Park Braamfontein spruit, to assist in the mapping of freshwater pollution across the Johannesburg city area. Within this general aim objectives included Establishing the major sources of disturbance and their origin, as well as assessing the overall ecosystem health as measured by the SASS scoring method, and finally to assess the magnitude of the disturbance by comparison to the relatively undisturbed Magalies headwaters system, located in the same general geographic area but suffering from far less human generated pollution.

Results

Physiochemical data

Summary measures of the physiochemical data collected are shown in Table 1, while statistical analysis of the physiochemical differences between the two sampling sites is shown in Table 2, below.

Table 1: Summary measure of key physiochemical and biological measures of water quality for both sample sites, the braamfotein spruit, and Magalies river.

	Braamfontein Spruit		Magalies River	
	Mean	Standard.Error	Mean.	Standard.Error.
pH	8.21	(0.06)	8.32	(0.02)
Conductitiy (μS)	269.20	(42.12)	224.50	(0.78)
Temperature($^{\circ}C$)	14.40	(0.25)	18.87	(0.1)
Dissolved Oxygen($mg \cdot L^{-1}$)	9.09	(0.43)	6.21	(0.17)
Turbidity(NTUs)	13.56	(1.78)	1.60	(0.26)
IHI	126.57	(17.05)	42.29	(20.8)
SASS	44.25	(3.41)	121.88	(19.94)
taxa	9.38	(0.62)	18.88	(2.58)
ASPT	4.72	(0.2)	6.33	(0.23)

Table 2: Statistical comparison of physiochemical and biological conditions between the two samples sites, the Braamfontein spruit and Magalies River.

	T.statistic	Degrees.of.freedom	p.value
pH	-1.658	12	0.12
Conductitiy (μS)	1.061	12	0.31
Temperature($^{\circ}C$)	-16.474	12	0.00
Dissolved Oxygen($mg \cdot L^{-1}$)	7.089	10	0.00
Turbidity(NTUs)	6.646	12	0.00
IHI	3.133	12	0.01
SASS	-3.837	14	0.00
taxa	-3.578	14	0.00
ASPT	-5.269	14	0.00

Biological indicies

Figure 1 below shows the comparison between the IHIH score calculated for each site, and figure 2 illustrates the relation between (average) ASPT and SASS, to classically the overall state of the system.

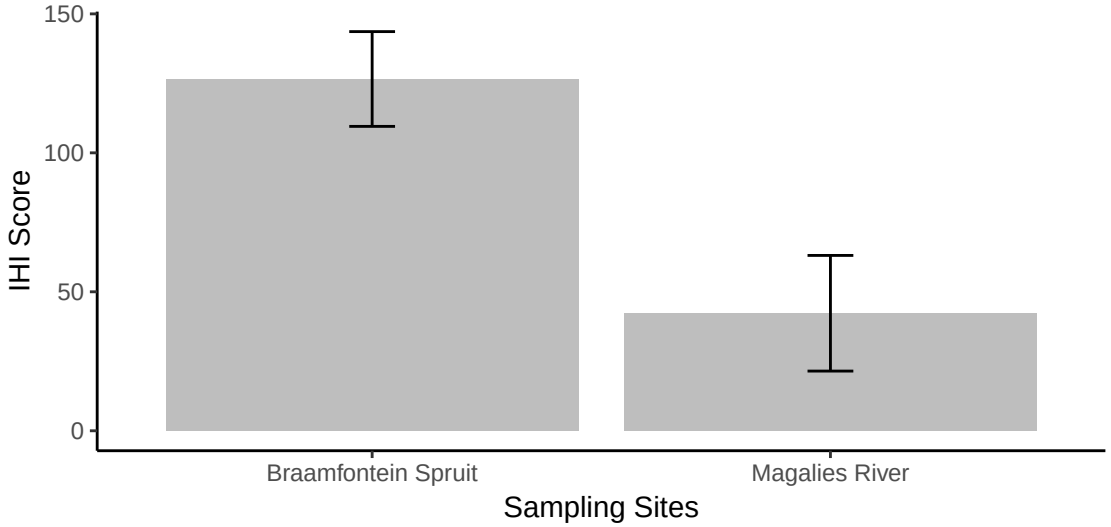

Figure 1: Comparision of IHI scores obtained for each sampling site.
Note the considerably overlaping ranges given by the error bars of the two samples

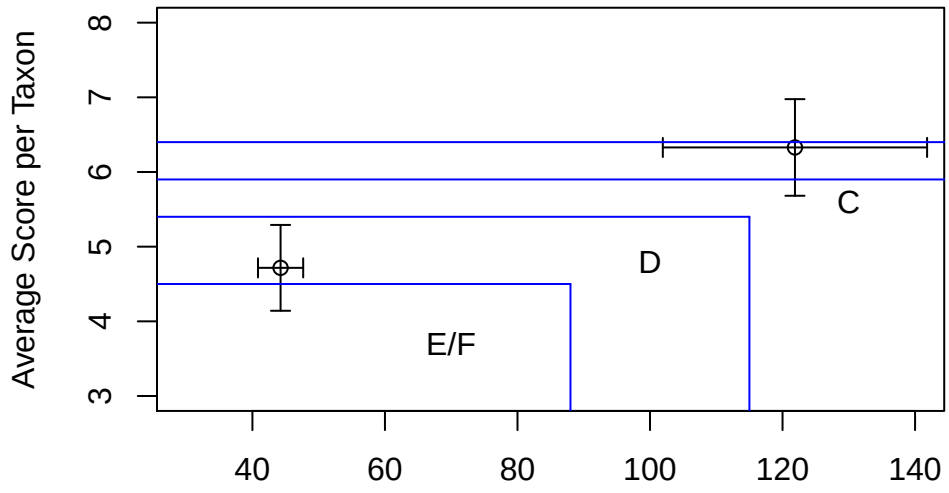

Figure 2: The average score per taxon vs the overall Ecosystem score. Both scores calculated using the South African Scoring system for rapid bioassessment, Version 5.

Discussion

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