UNIVERSITY OF JOHANNESBURG

South African NATIONAL PARKS

Junior Scientist Programme
The Future of Science & Conservation

The occurrence of heavy metals in *Labeobarbus marequensis*, water and sediments in Crocodile River

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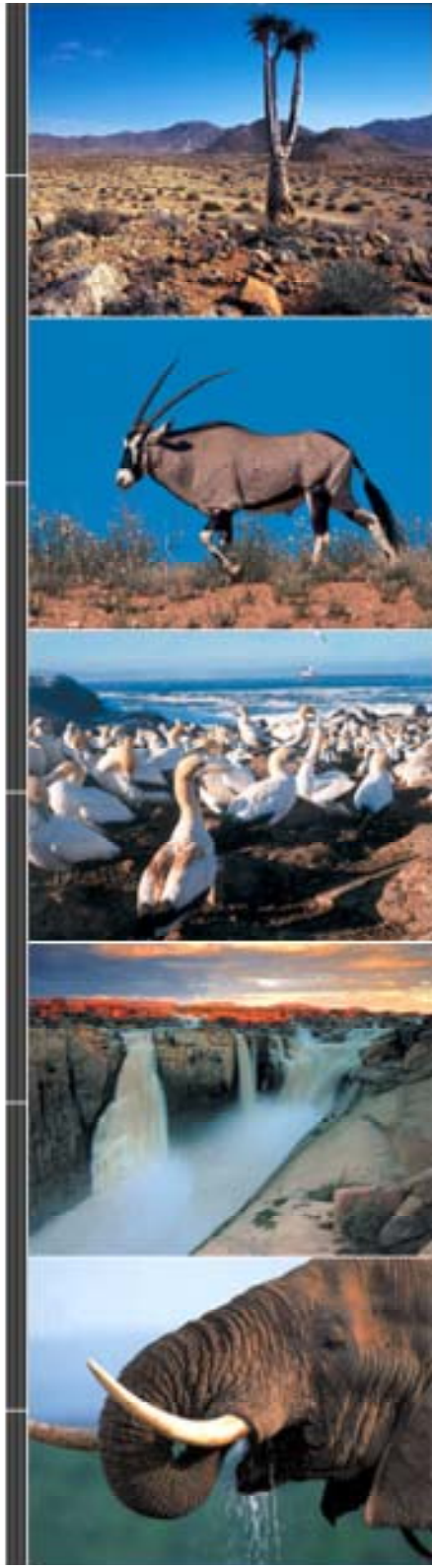
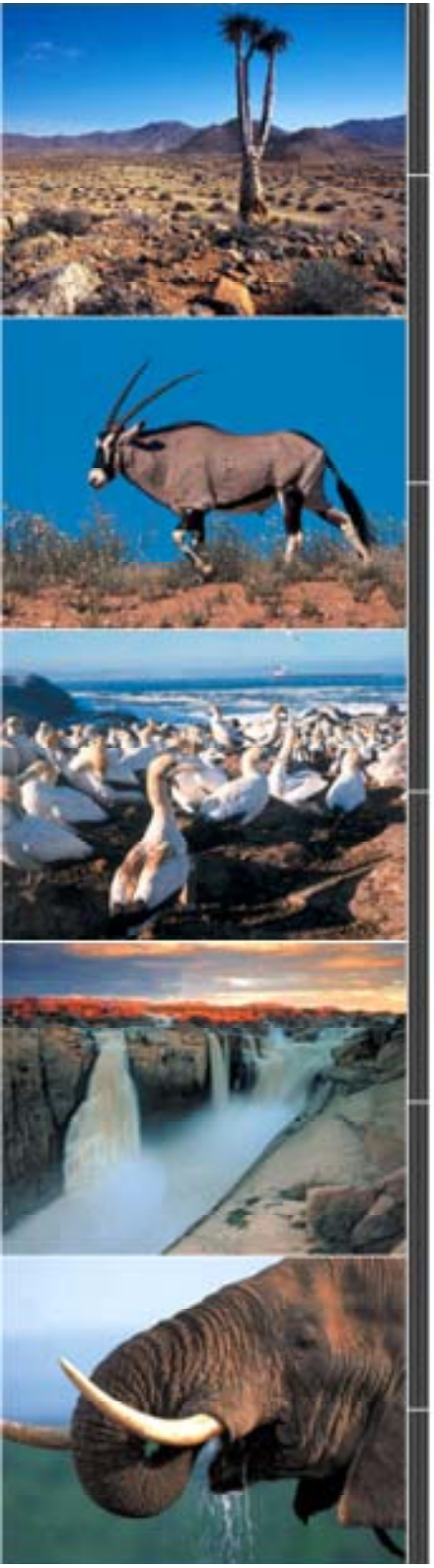
Layout

- Introduction
- Aim
- Study Area layout
- Methods
- Results
- Discussions



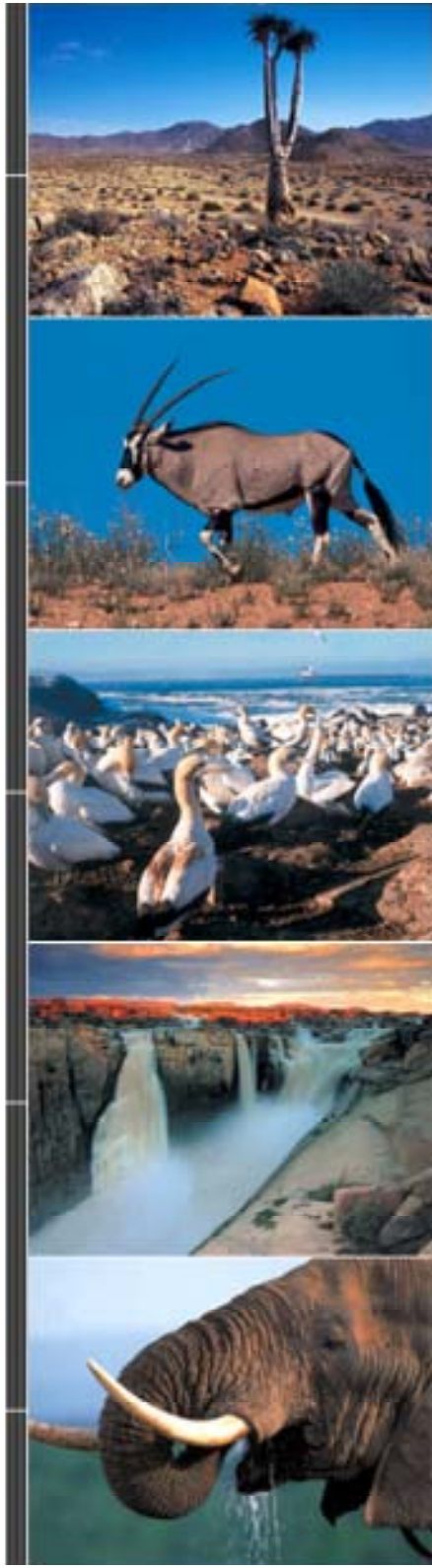


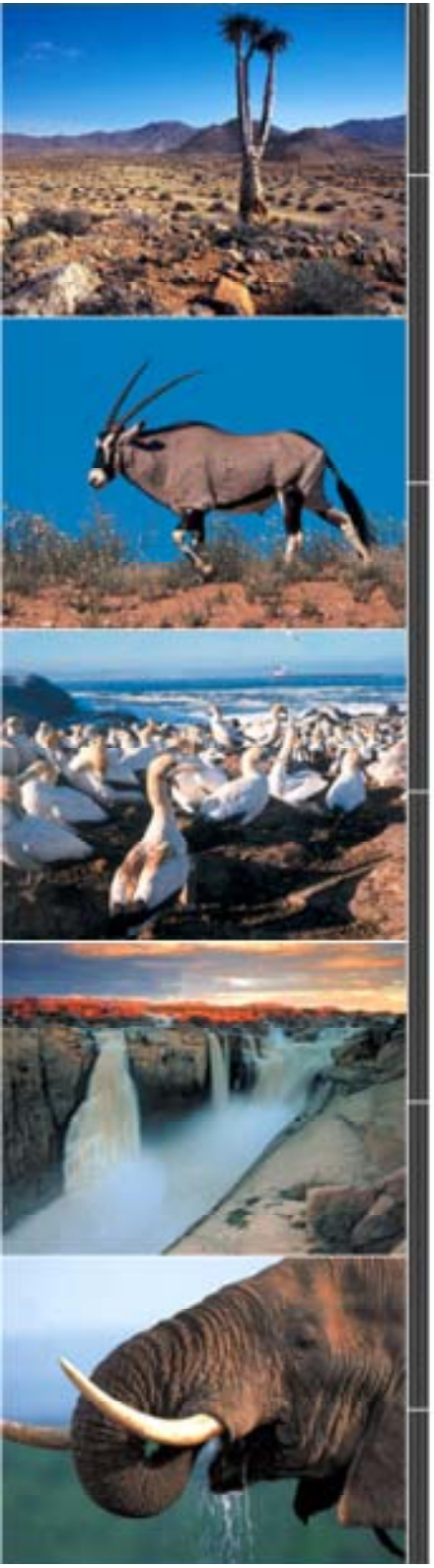
Introduction

- Rivers are linear systems in nature
- Transverse various landscapes with different land use
- Crocodile River rises in the Steenkampberg Mountains north of Dullstroom and drains a total area of about 10 400 km^2
- There are four main topographic zones that can be distinguished in the Crocodile River catchment:
    - Central Highland that ranges from 1 400 to >2 000 m a.m.s.l.
    - The Great Escarpment of the Drakensberg Mountains located between the Central Highland and the Middleveld.
    - The Middleveld that ranges from 800 to 1 400 m a.m.s.l.
    - The Lowveld at the range below 800 m a.m.s.l
- Approximately 320 km in length
    - 1 200 km of tributary streams
- 63 km forms southern boundary of KNP

Introduction

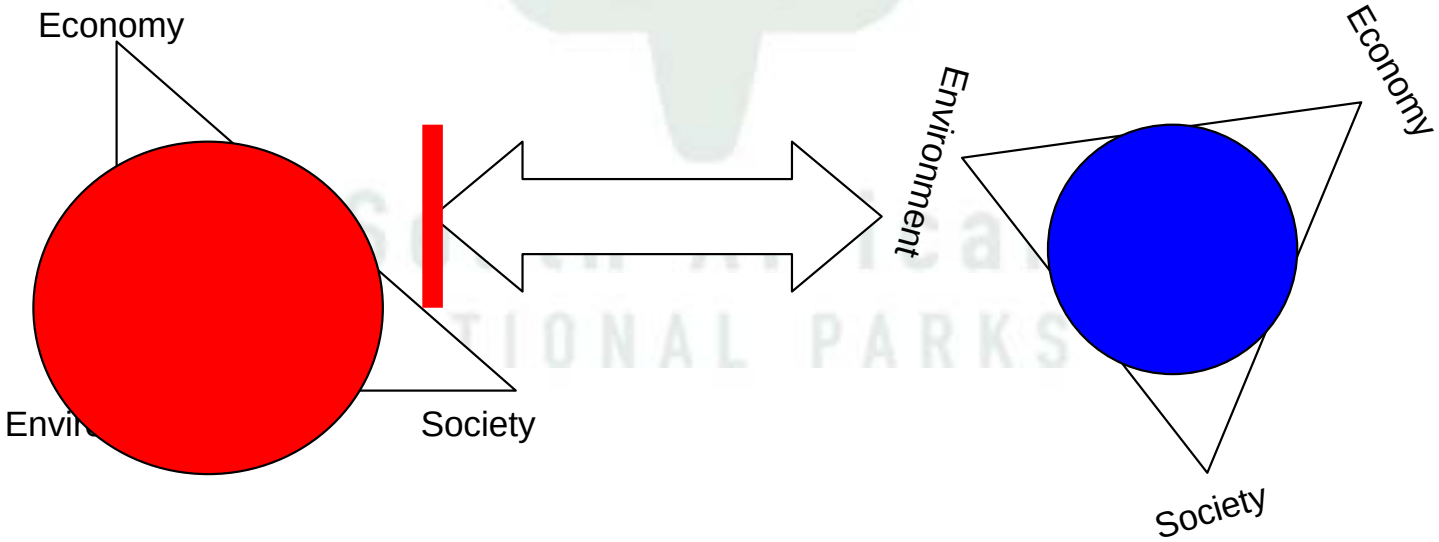
- Agriculture, mining, industry, and human settlement are the major contributors of pollution in aquatic environments
- Heavy metals: mining and industry
- 6 industrial activities in Crocodile catchments
    - pulp and paper, fruit processing, saw mill, sugar refinery, metal refinery, and mining
- Agriculture in the catchment
    - 172 000 ha afforested area; 95 000 ha irrigated area
- Stream flow reduction
    - 21% during low flow
- Dilution capacity
- Impacts on aquatic biota (growth, reproduction, etc.)
- Terrestrial biota (direct or indirect)





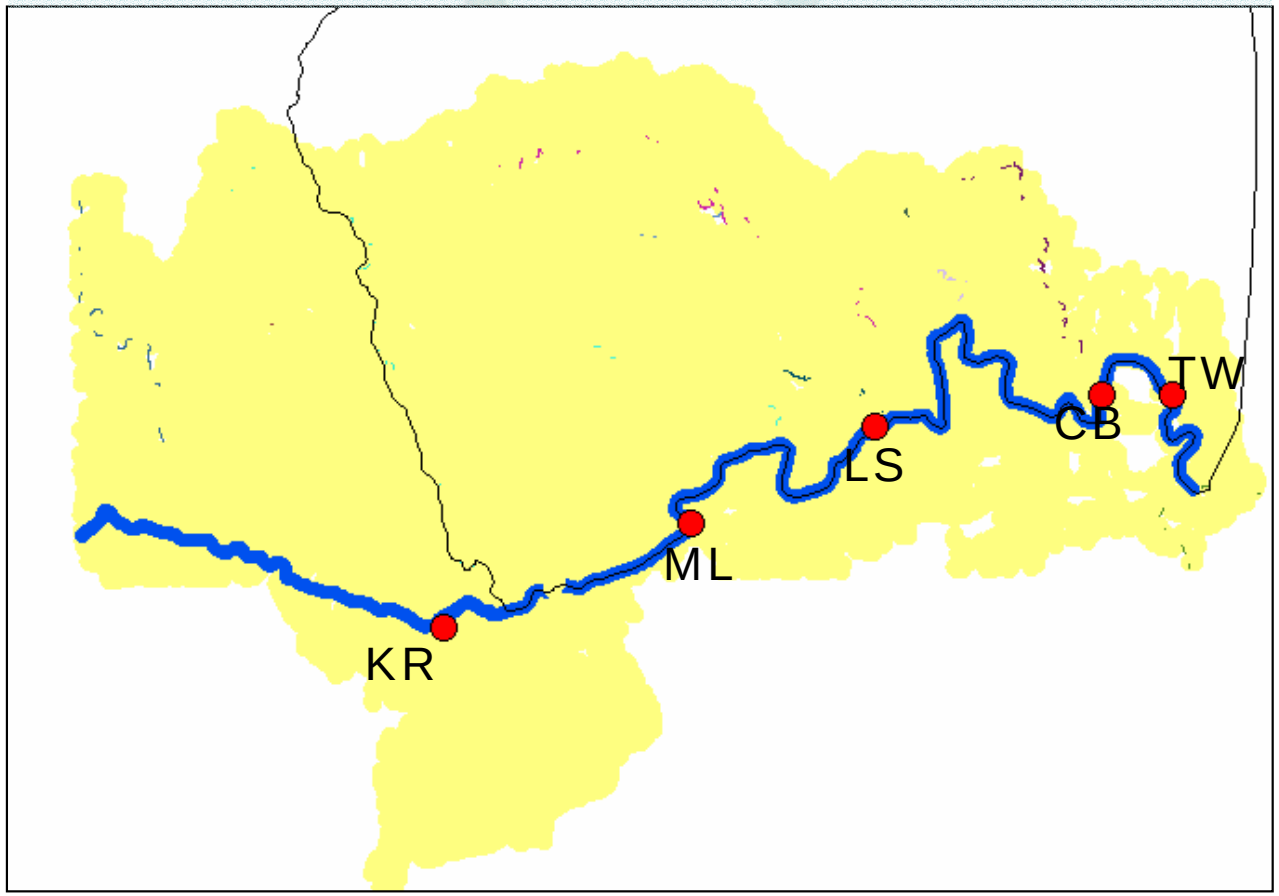
Aim

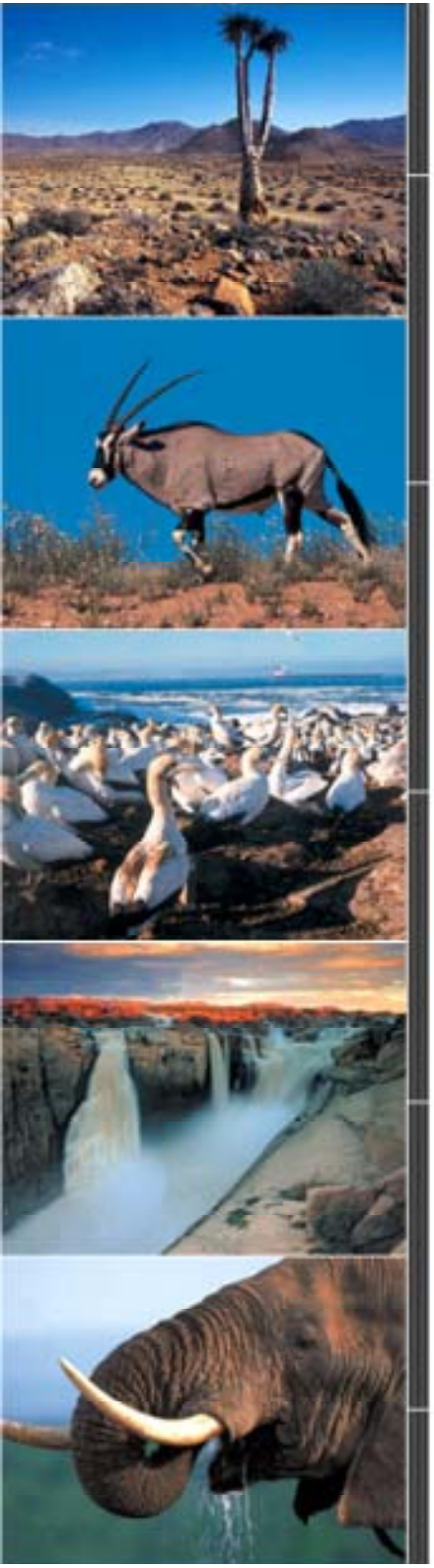
- Documentation of heavy metals in Crocodile River
  - Empower KNP river manager
  - CMF and WUA



Layout of Study Area

Southern Border: KNP



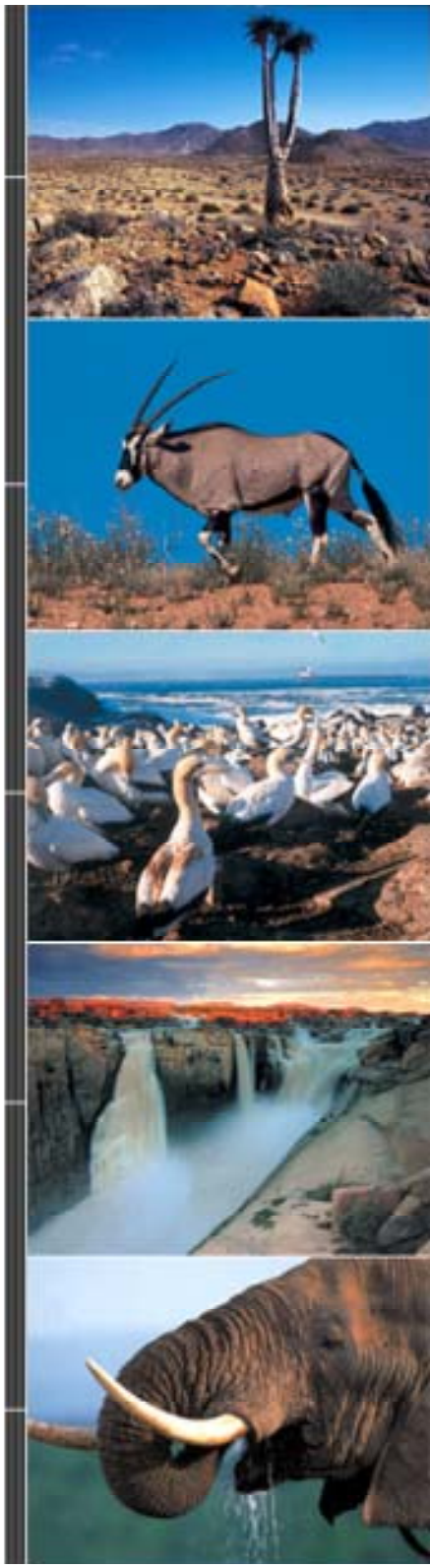


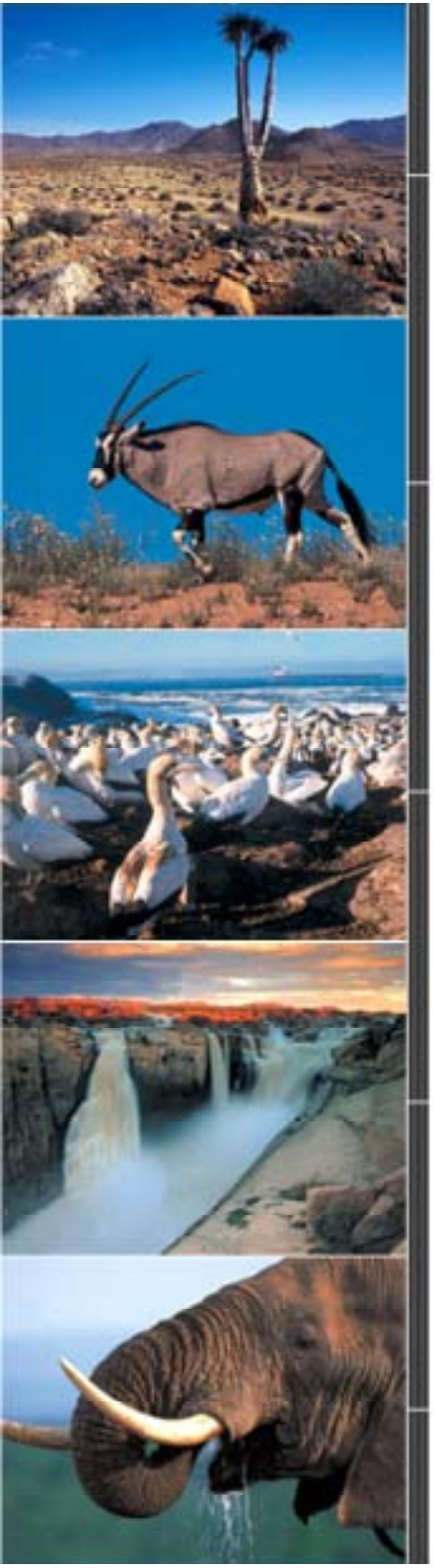
Method

- Sampling frequency
  - High (April) and low (September) flow
- 10 fish from each sampling site
- Water samples were collected in triplicate
- Factors measured on site
  - Conductivity, dissolved O_2, pH and temparature
- One sampling site per day
  - Samples to be frozen
  - Species unavailability
- Fish exterminated by cutting the neck
  - Bone-cutting scissors

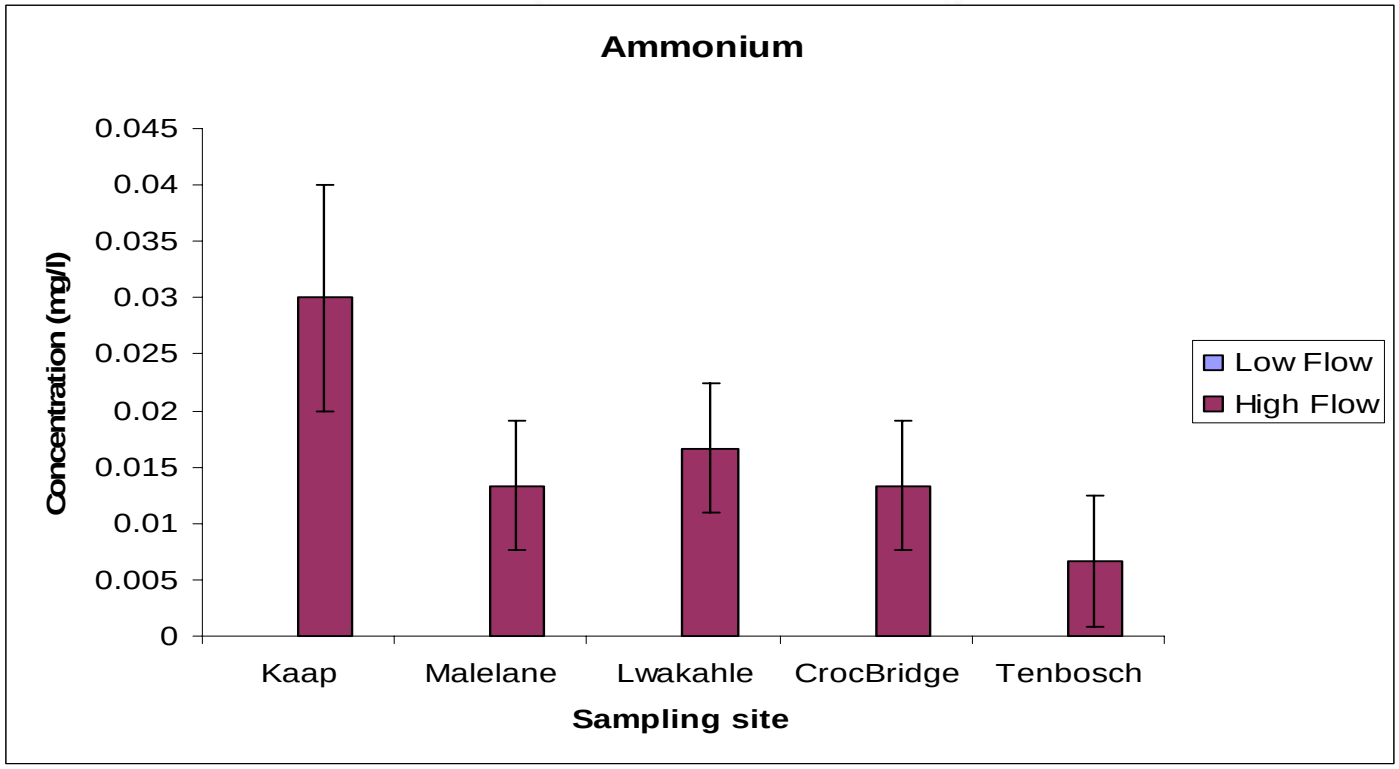
Methods

- Frozen samples transported to UJ
- 24h at room temperature
- Cell tests
  - NH_4^+, NO_2^-, NO_3^-, PMB, Cl^-, SO_4^{2-} and Cn^-

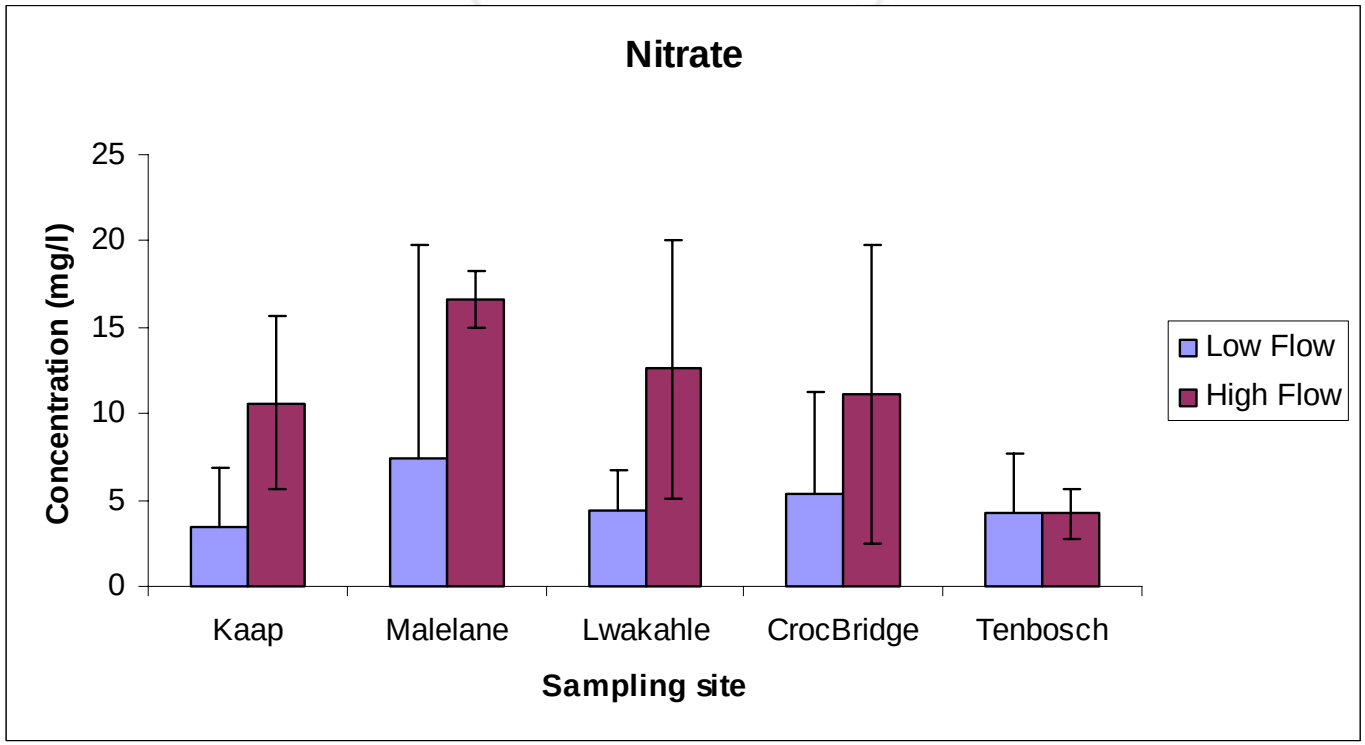


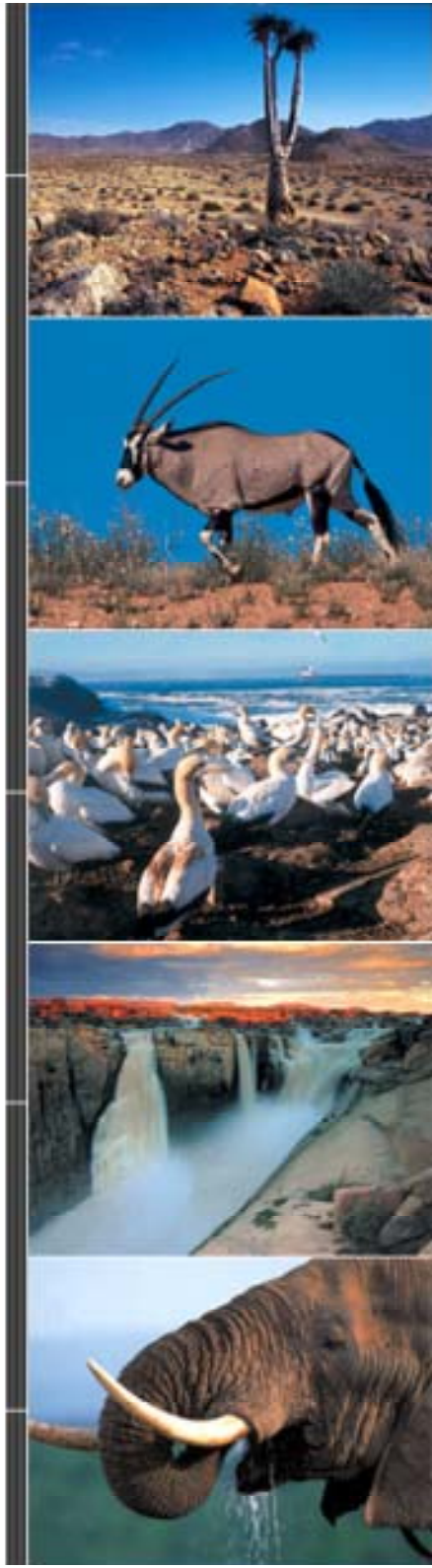


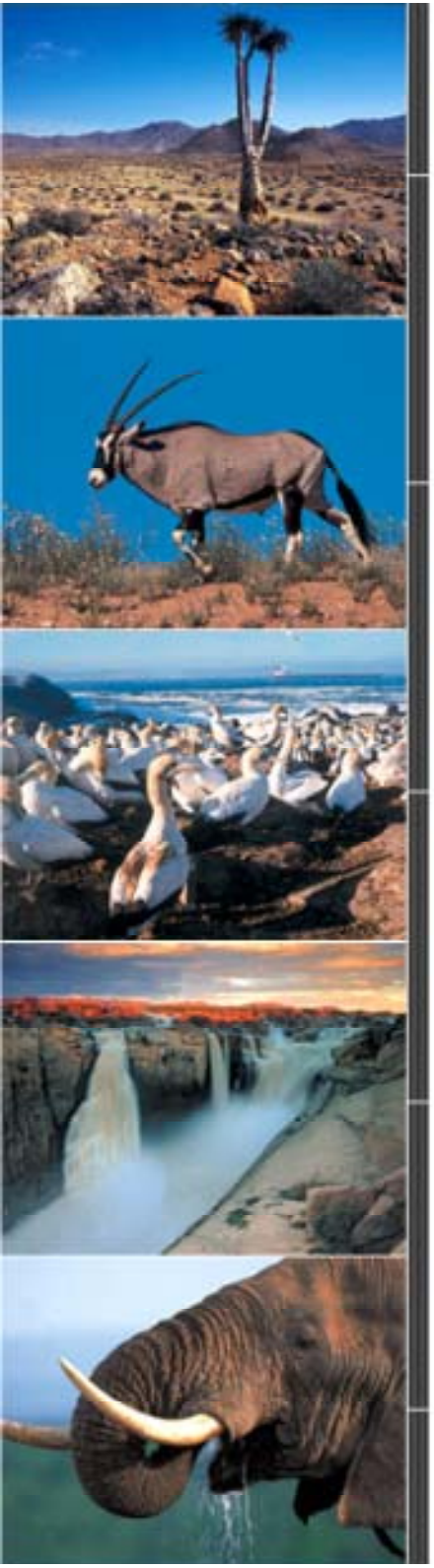
Results


Ammonium
Concentration (mg/l)
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Kaap
Malelane
Lwakahle
CrocBridge
Tenbosch
Sampling site
Low Flow
High Flow

Results


Nitrate
Concentration (mg/l)
25
20
15
10
5
0
Kaap
Malelane
Lwakahle
CrocBridge
Tenbosch
Sampling site
Low Flow
High Flow





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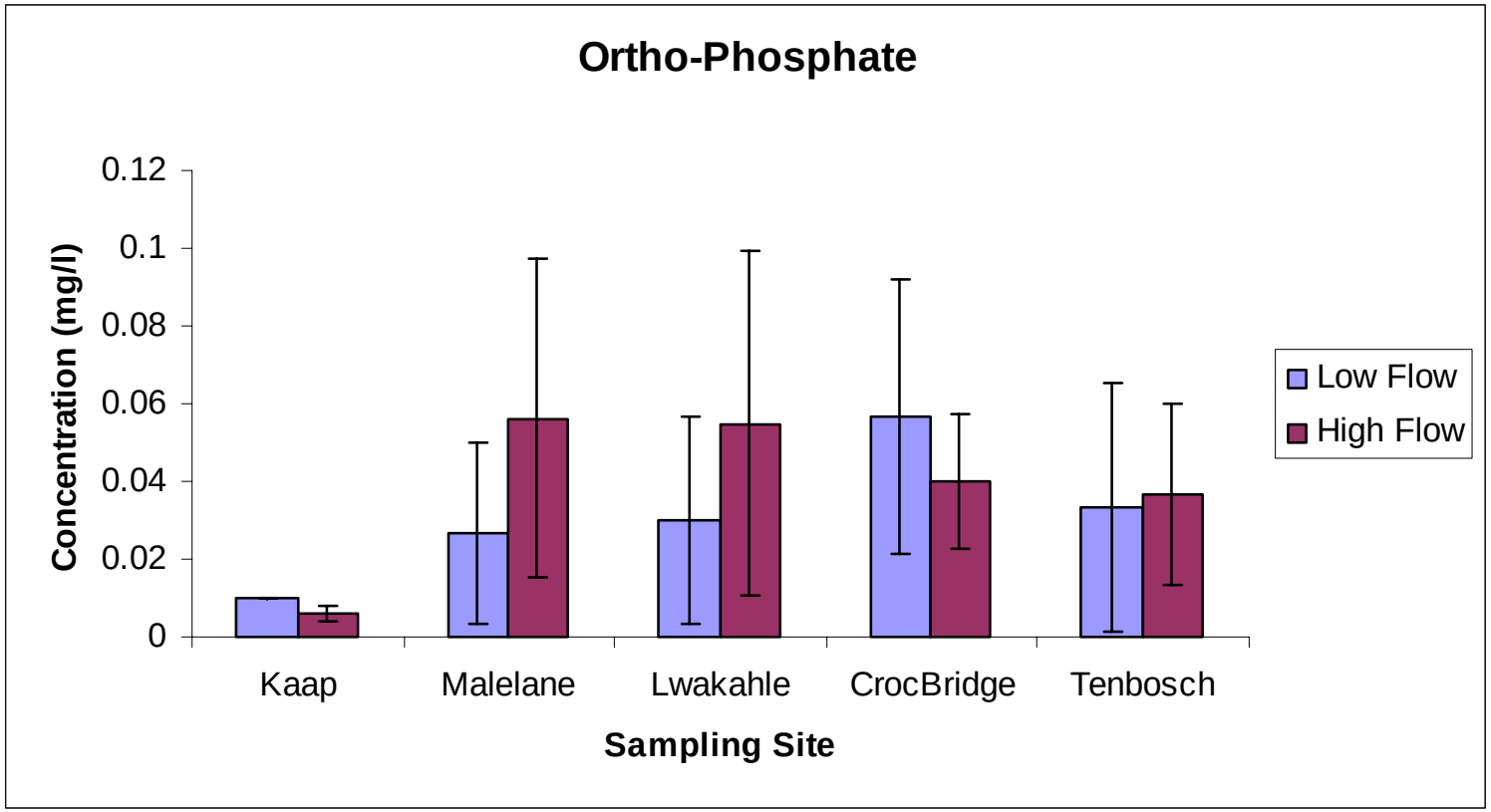
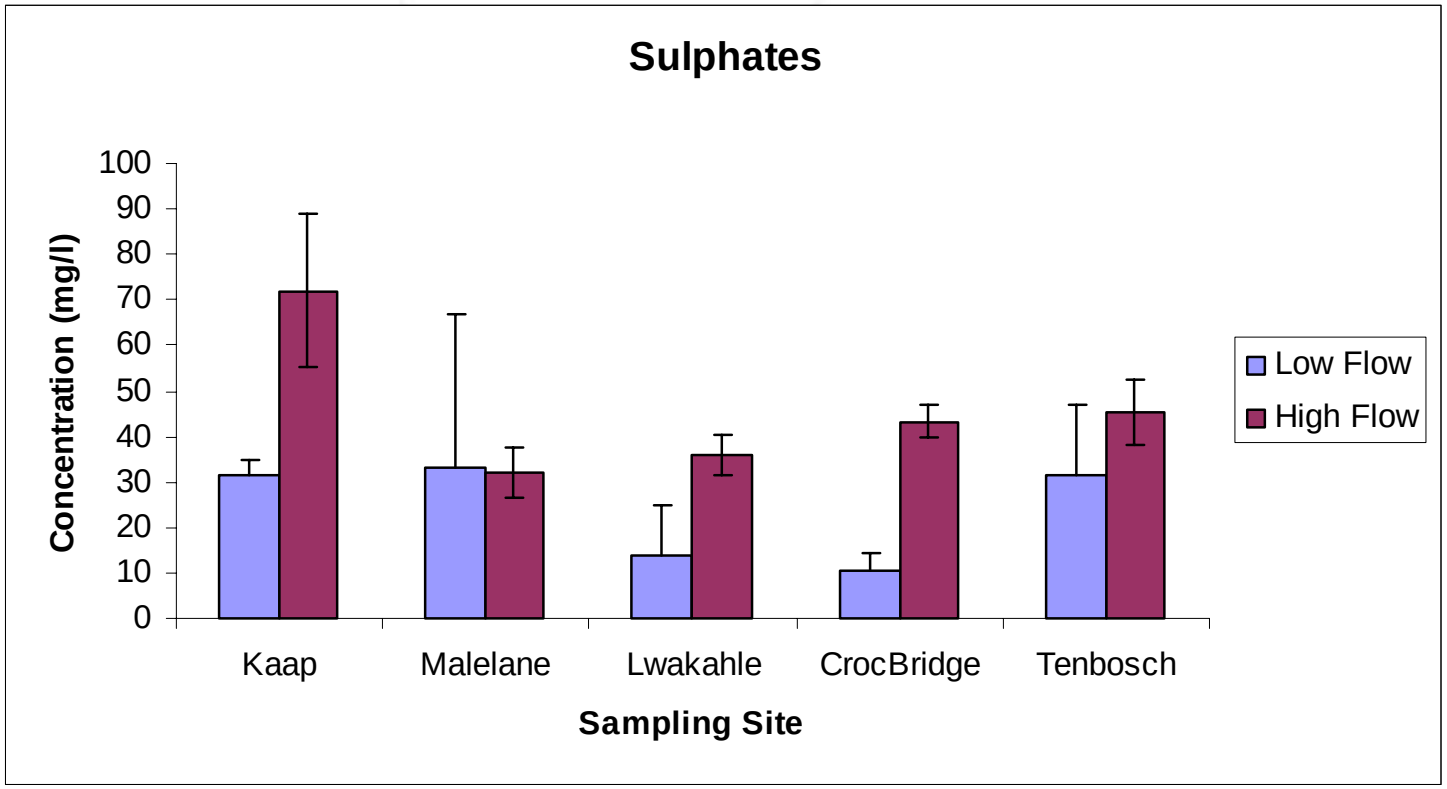
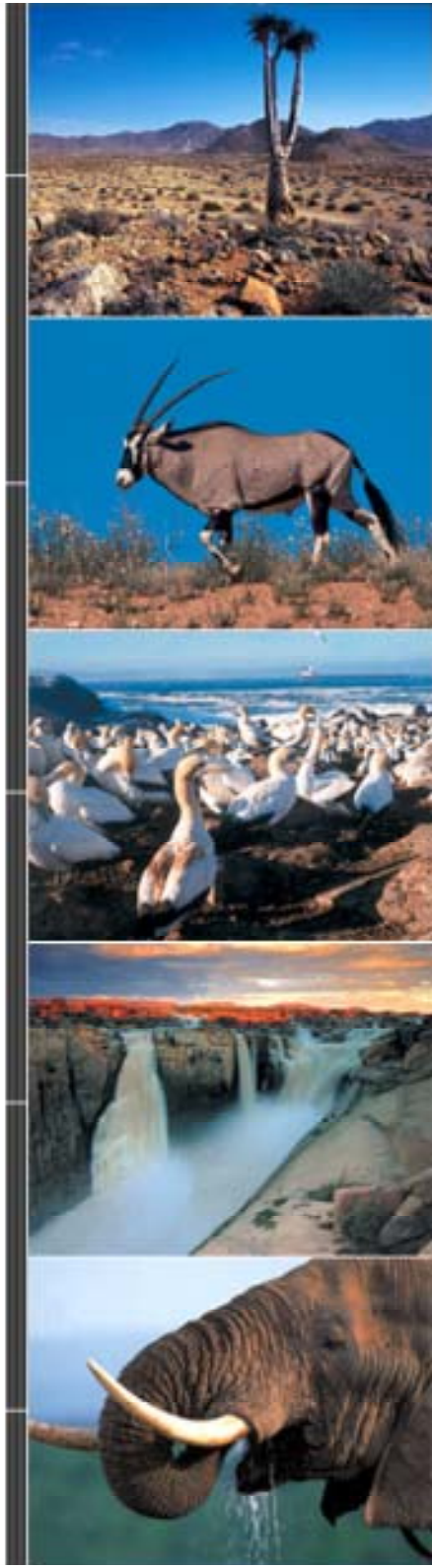
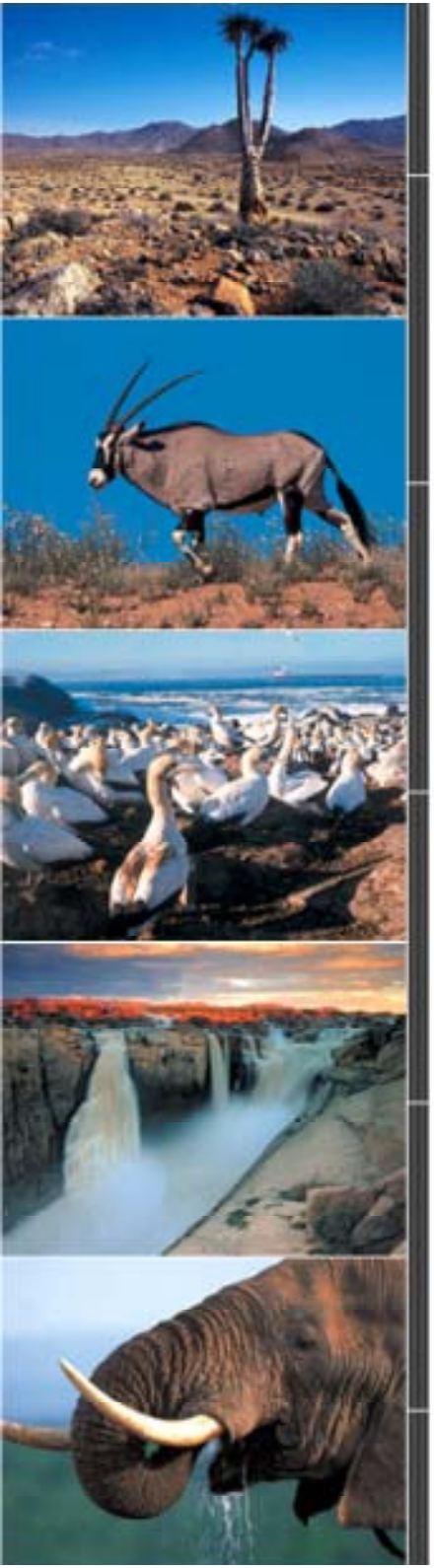

Ortho-Phosphate
Concentration (mg/l)
0.12
0.1
0.08
0.06
0.04
0.02
0
Kaap
Malelane
Lwakahle
CrocBridge
Tenbosch
Sampling Site
Low Flow
High Flow

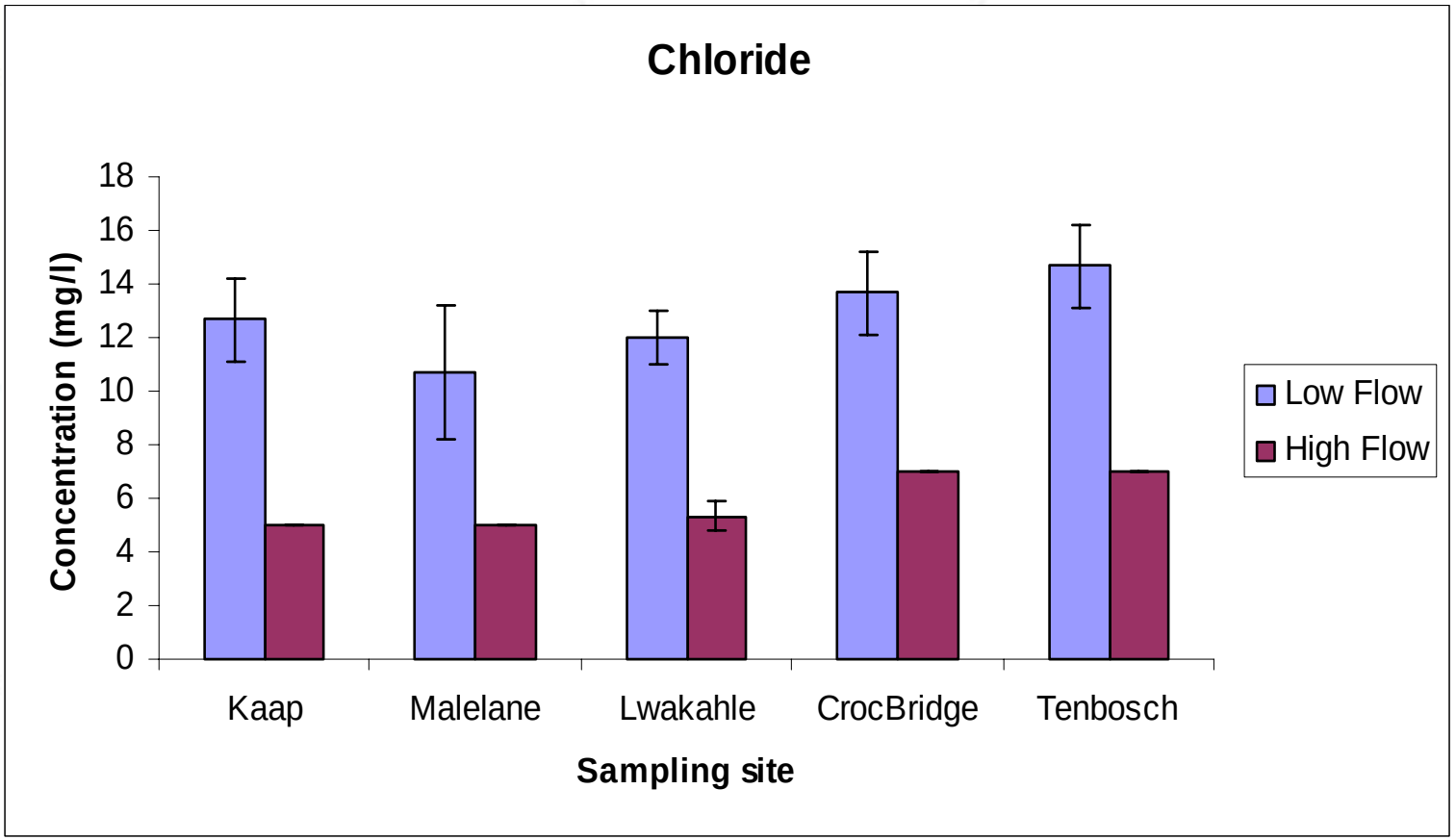
Results


Sulphates
Concentration (mg/l)
100
90
80
70
60
50
40
30
20
10
0
Kaap
Malelane
Lwakahle
CrocBridge
Tenbosch
Sampling Site
Low Flow
High Flow

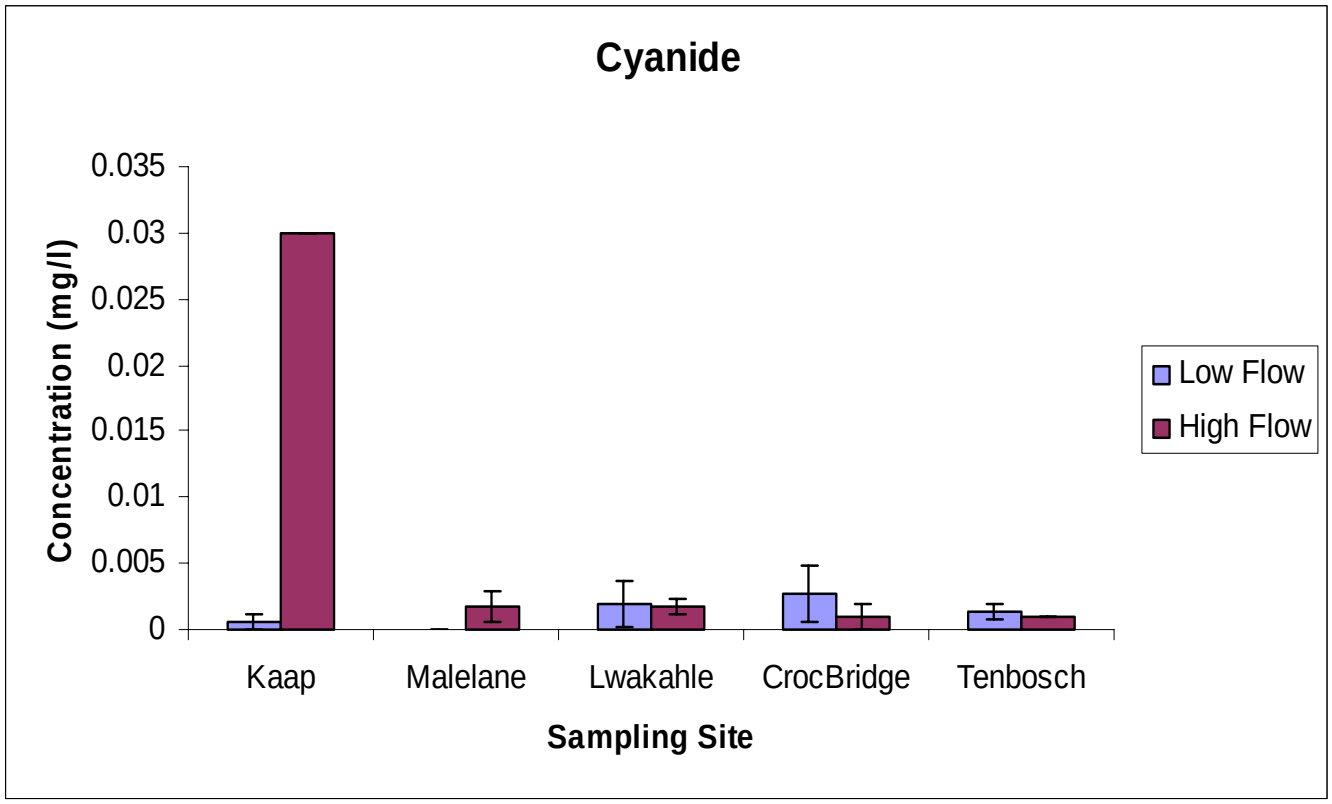


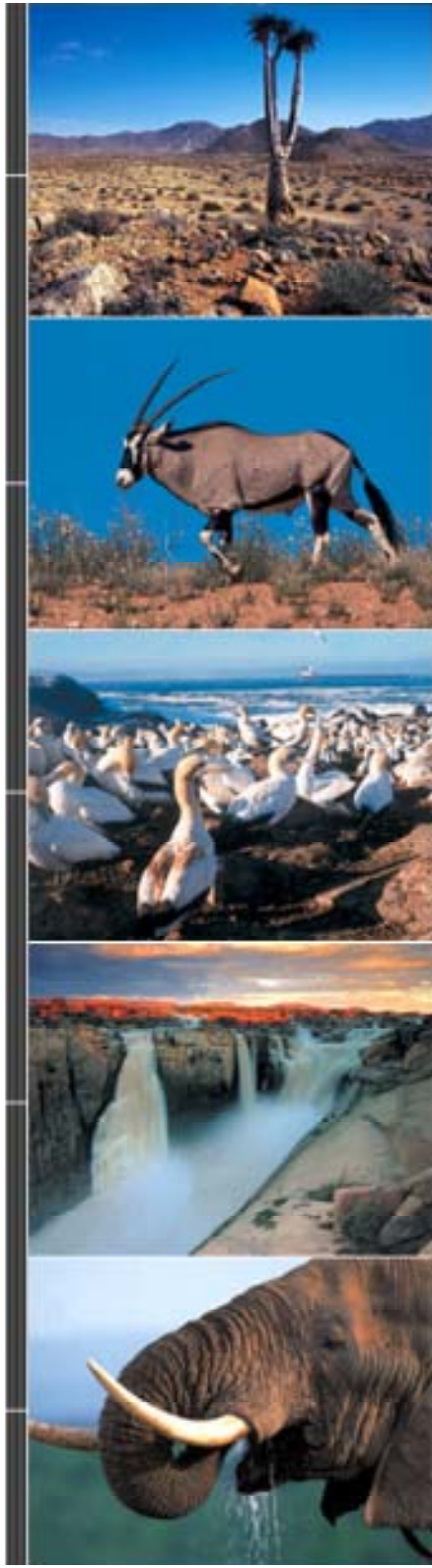


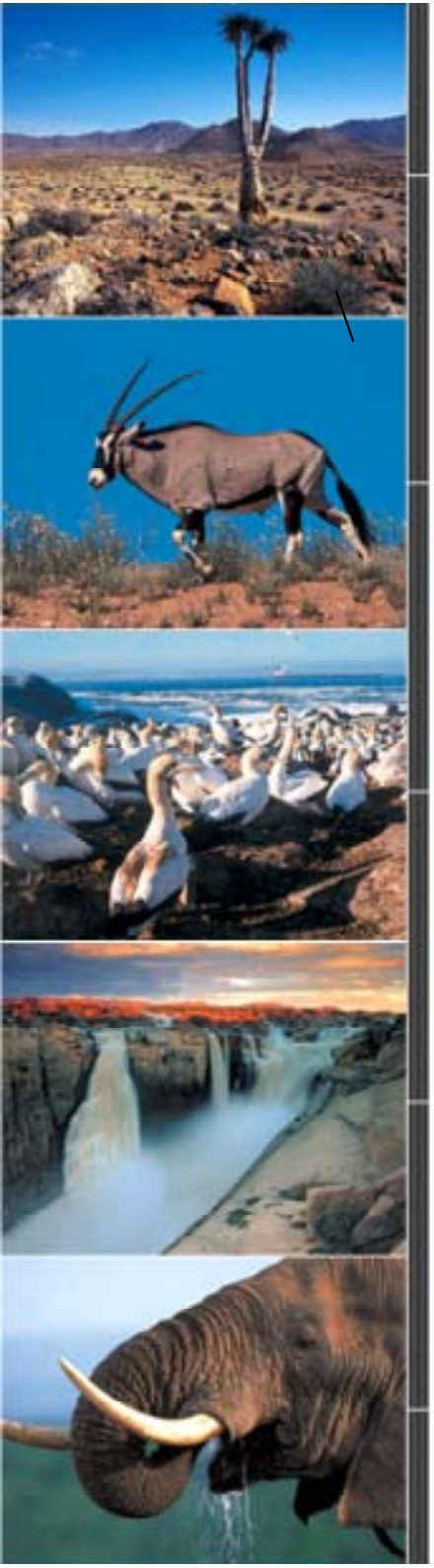
Results


Chloride
Concentration (mg/l)
18
16
14
12
10
8
6
4
2
0
Kaap
Malelane
Lwakahle
CrocBridge
Tenbosch
Sampling site
Low Flow
High Flow

Results


Cyanide
Concentration (mg/l)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Kaap
Malelane
Lwakahle
CrocBridge
Tenbosch
Sampling Site
Low Flow
High Flow





Discussions

- $NH_4^+ \not\Rightarrow NH_3$
- NO_3^- extremely high
  - Hypertrophication
- Phosphates levels very low
- SO_4^{2-} and Cl^- levels acceptable
- Cyanide is a common reagent in gold extraction processes and large quantities of cyanide are found in gold mine tailing dams.

Acknowledgements

- Andrew W. Mellon Foundation
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