

BIOMONITORING OF THE KIESKAMMA RIVER SYSTEM (R 10 CATCHMENT)



Figure 1; Sandile Dam
March 2008

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EXECUTIVE SUMMARY

The main objective of the South African National River Health Programme (NRHP) makes use of the instream and riparian biological communities like the fish, macro invertebrates and vegetation to assess the ecological health or condition of rivers. These biological communities are always found in rivers and they are often affected by any disturbance that occurs in the river ecosystem.

This report provides the results of the biomonitoring survey that was undertaken in November 2007. Field indices used for data collection included the South African Scoring System version 5.0 (SASS5) for Macro invertebrates and the Fish Assemblage Integrity Index for fish (FAII).

Ten biomonitoring sites were selected in the Keiskamma River system; this includes three sites in the Tyume River (a tributary to Keiskamma River) and they are:

Site	Description	Coordinates	Site Code
1	Tyume Head waters (Hogsback)	S32o 36' 39.8", E26o 56' 52.2"	R1Tyum-Hogsb
1a **	Tyume Head waters (Sompondo Village)	S32o 37' 34.2", E26o 57' 19.9"	R1Tyum-Sompo **
2	Tyume Fort Hare	S32o 46' 44.6", E26o 51' 21.5"	R1Tyum-Forth
3	Tyume before confluence with Keiskamma river	S32o 54' 06.2", E26o 55' 40.0"	R1Tyum-Becon
4	Keiskamma above confluence with Tyume	S32o 54' 41.9", E26o 56' 17.6"	R1Keis-abcon
5	Keiskamma at St Mathews low bridge	S32o 38' 25.7", E27o 11' 26.2"	R1Keis-Smbr
5a **	Keiskamma below St Mathews	S32o 40' 59.3", E27o 09' 17.4"	R1Keis-Besma **
6 ND	Keiskamma Below Boma's Farm at the bend	S32o 42' 39.9", E27o 08' 13.8"	R1Keis-Bomaf
7	Keiskamma below Sandile Dam	S32o 43' 18.8", E27o 06' 20.2"	R1Keis-Besad
7a **	Keiskamma below Amatola Water Treatment Plant	S32o 45' 35.1", E27o 04' 06.5"	R1Keis-Beamw
7b**	Keiskamma below Xesi low bridge R67	S32o 49' 07.3", E26o 59' 39.0"	R1Keis-Bexeb
8 ND, HF	Keiskamma Gcinisa	S32o 01' 22.6", E27o 05' 18.5"	R1Keis-Gcini
9* ND, HF	Keiskamma Above N2 bridge	S33o 03' 49.39", E27o 12' 39.29"	R1Keis-Abn2b *
10 ND, HF	Keiskamma Ngxakaxha	S33o 07' 35.2", E27o 19' 19.9"	R1Keis-Ngxak
11 ND, HF	Keiskamma Above R72 to Port Alfred, Xesi Village	S33o 10' 25.7", E27o 22' 39.7"	R1Keis-Abr72

** - These site were visited and sampled but otherwise were removed from the final site selection report.

* - National sites recently added to the final site selection report.

ND – Sites not sampled due to no compliance with RHP

ND, HF – Sites not sampled due to high hydrological flows at that time (Rain)

GOALS AND OBJECTIVES OF RHP

The goal of the NRHP is to obtain information on the ecological state of South Africa's river ecosystems in order to make proper management decisions regarding natural resources.

The main objective is to measure and assess; as well as to detect and report on spatial and temporal trends in the ecological state of aquatic ecosystems. This assists in identifying emerging problems regarding the aquatic ecosystems.

INTRODUCTION

DWAF Eastern Cape River Health Programme involves the use of Biomonitoring tools to determine the health of the aquatic ecosystems. The Programme aims to promote standardized and continuous monitoring and reporting on the Eastern Cape rivers health. Keiskamma River system is one of the systems monitored in the Eastern Cape, hence, monitoring survey was conducted and this report provides information on its current state.

Keiskamma river system has one main tributary (Tyume River). Ten sites were selected for Biomonitoring of this river system.

Site Selection:

Seven sites were selected in the Keiskamma River which also represent all three Eco-regions in the R 10 catchment. Three sites chosen in the first Eco-region (South Eastern Mountain Highlands, Upper reaches), one site was chosen from the 2nd Eco-region (The Coastal Plateau, Drought Corridor, Middle reaches), other three sites were chosen from the 3rd Eco-region (Eastern Coastal Belt, Lower reaches).

All three sites of the Tyume River were taken from the same Eco-region (The Coastal Plateau, Drought Corridor)

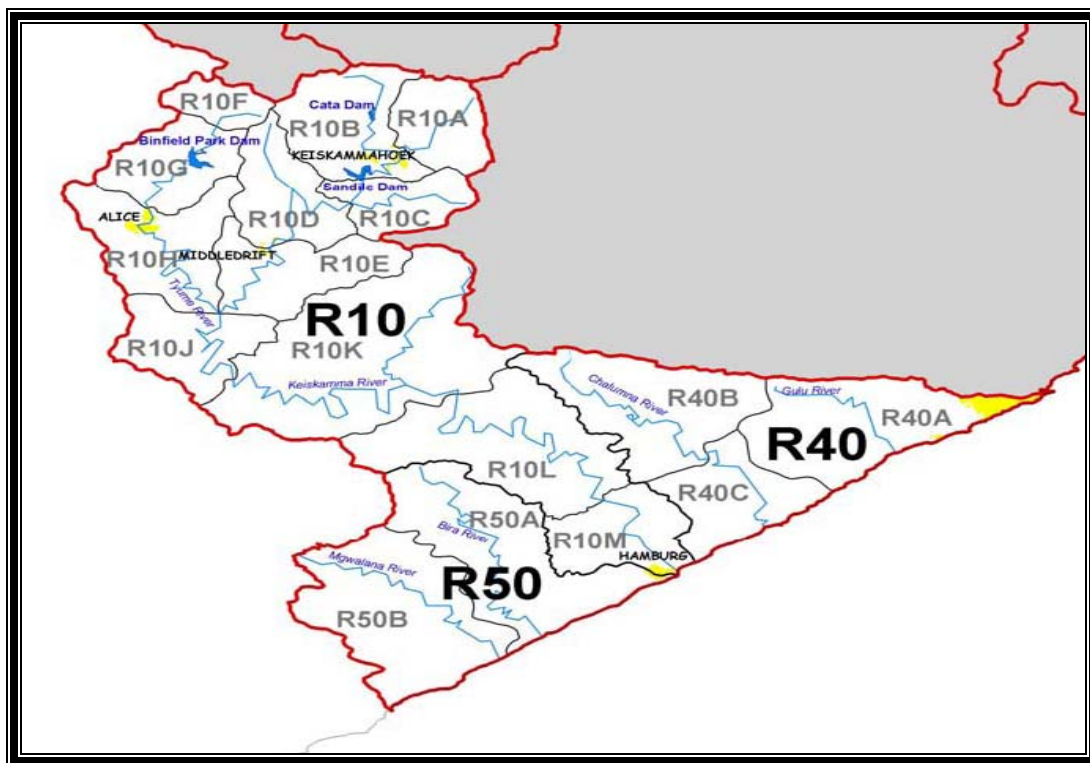


Figure 1 The Keiskamma Sub-area (R 10 catchment)

As with the Amatole sub-area, the area can be divided into the following three basic Topographic zones/ Eco-Regions:

- The coastal belt (Lower reaches)
- The coastal plateau (Drought Corridor, Middle reaches), and
- The mountain highlands or escarpment zone (Upper reaches).

The coastal belt broadens in this sub-area to about 20km wide. The coastal plateau, which extend to the foothills of the Amatola mountain range lies between 600 and 900 masl and covers most of the sub-area. Both the plateau and coastal belt are characterized by the incised Keiskamma River valley, which bisects the area.

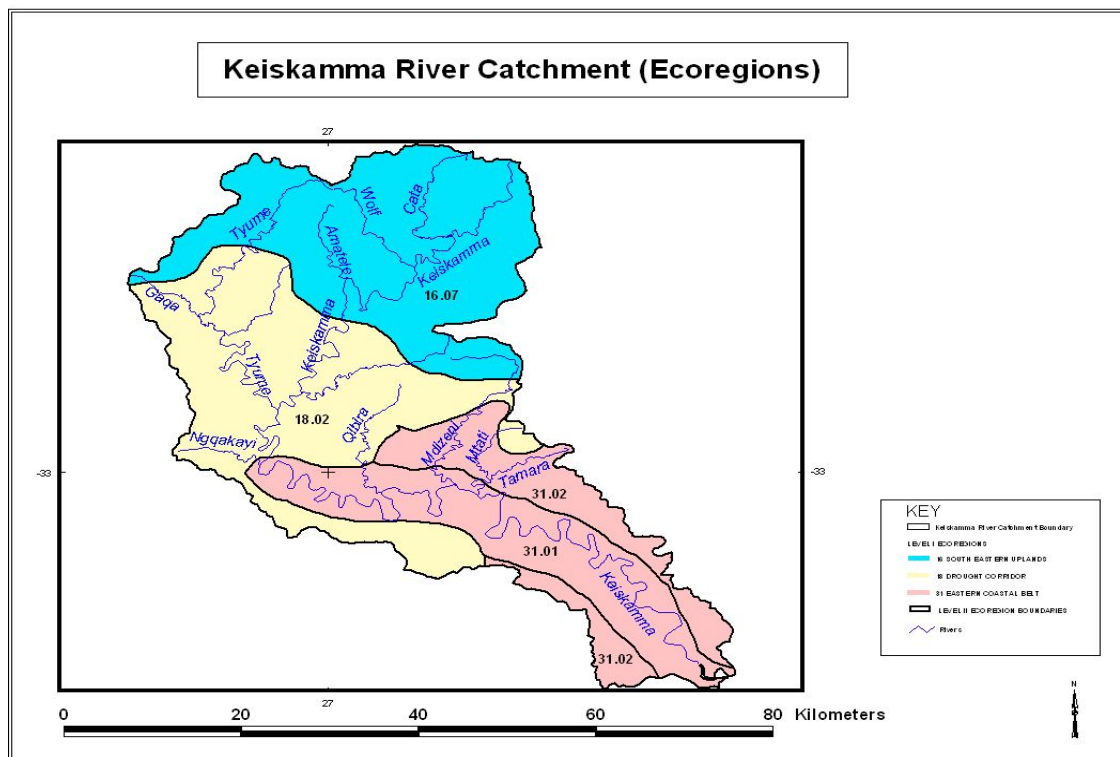


Figure 2; Map showing three topographic zones/Eco-Regions in the R10 catchment

The main source of water for use in the sub-area is the Keiskamma River (R10), which has its headwaters in the mountains above Keiskammahoeek and flows eastwards to enter the Indian Ocean at Hamburg. Its main tributary is the Tyume River with its Headwaters in the Hogsback area.

4.1.2 Climate and Rainfall

The climate in this sub-area is similar to that of the Amatole sub-area but with less humidity and slightly lower average temperatures down the coast and inland. The Amatola mountain areas from above Keiskammahoeek to the Hogsback area experience very cold temperatures during the winter months with occasional snowfalls. The mean annual precipitation (MAP) varies from 600 mm along the coast to a low of

450 mm in parts of the dryer coastal plateau areas to over 1 200 mm on the mountain peaks. Rain falls predominantly in the summer months with June and July being the driest months.

4.1.3 Vegetation

The natural vegetation consists mainly of coastal grasslands, savanna (thornveld or sourveld) in the coastal areas up to the escarpment with areas of dense bush (valley thicket) in the river valleys and indigenous forest in the mountain zone.

Invasions of black and silver wattle are found throughout the area with the largest concentrations in the Upper Keiskamma and Tyume catchments. Exotic weeds are also found in all riparian vegetation but the problem is not as serious as in the Amatole sub-area.

4.1.4 Land Use and Settlement Patterns

The catchment is relatively undeveloped with most land being communal and used predominantly for stock grazing or dry land cultivation. Less than 1 500 ha is cultivated under irrigation. The largest scheduled irrigation areas include the Keiskammahoek (854 ha), Zanyokwe (471 ha) and Tyume (231 ha) irrigation schemes in the upper catchment. These schemes, which were located in the former Ciskei, are not fully operational and rehabilitation of the schemes and establishment of Water User Associations is currently underway. Commercial forestry (less than 1000ha) is located in the Hogsback and Upper Keiskamma catchment in the higher rainfall areas in the Amatola mountain range.

The majority of the area once fell within the borders of the former Ciskei and the residential settlement pattern is mainly scattered rural type villages located throughout the catchment. The main formal towns in the area are Hamburg at the mouth of the Keiskamma River and Alice, Middledrift and Keiskammahoek in the upper

4.3

catchment.

4.1.5 Demography

The total population of the sub-area (R10 catchment) was estimated based on 1995 data (**Ref. 24**) and Census 2001 data (**Ref. 6**) at approximately 161,000 people in the year 2000. The bulk of the population lives in the small formal towns and associated peri-urban areas where services and educational facilities are available. The population is expected to show little growth mainly due to the lack of employment opportunities in the rural areas and the resultant outward migration to large towns and cities. Alice with its educational facilities (University of Fort Hare), middle Drift and Keiskammahoek are expected to be the main growth areas.

Table 4.1 Population Estimates of the Keiskamma Sub-area (Year 2000)

Quaternary Catchment	Population
R 10	161,000.00

4.1.6 Economic Development

Economic related activities in this sub-area are mainly based on commercial agricultural activities including the cultivation of pineapples, oranges, commercial

Forestry and dairy farming. Proposals for the establishment of an export-orientated industry based on eel farming in the catchment have been made, but progress is unknown. Small-scale tourism in the Hogsback area and along the coastline provides some employment to an economically deprived region. Post-school educational activities are based at Fort Hare University and Lovedale College in Alice.

Table 4.2 Main Rivers and Dams in the Keiskamma Sub-area

Catchments	Rivers	Dams	Owner
R 10	Keiskamma River	Mnyameni Cata Sandile	DWAF DWAF DWAF
	Tyume River	BinField Park Pleasant View	DWAF DWAF
	Debe	Debe	DWAF

MATERIALS AND METHOD

Grab samples were sent to Talbot and Talbot Laboratories for physiochemical analysis. Sampling of fish and macro invertebrates was conducted at each Biomonitoring site. Macro invertebrates were sampled using SASS 5 method and fish were sampled using a seine-net. Fish caught were identified to species level with the number of juveniles and abnormalities recorded.

FINDINGS

Invertebrates

Table 1. The SASS 5 results of Keiskamma River and its tributary, with their classes.

River Site Sampled	Total SASS score	Total no. of Taxa	Total ASPT	Class
1. Tyume Hogsback	103	16	6.44	B
1a. Tyume Sompondo Village @	119	19	6.3	B
2. Tyume Fort Hare	139	17	8.2	A
3. Tyume before confluence	155	27	5.74	C
4. Keiskamma above confluence	*	*	*	*
5. Keiskamma St Mathews low bridge	158	25	6.32	C
5a. Keiskamma Below St Mathews @	133	25	5.32	D
6. Keiskamma Above Sandile Dam	***	***	***	***
7. Keiskamma Below Sandile Dam	111	19	5.84	C
7a. Keiskamma below Amatol water works @	104	19	5.5	D

7b. Keiskamma Below Xesi Bridge R67 @	150	24	6.25	C
8. Keiskamma Gcinisa	*	*	*	*
9. Keiskamma Above N2 bridge	*	*	*	*
10. Keiskamma Ngxakaxha	*	*	*	*
11. Keiskamma Above R72, Xesi village	*	*	*	*

* Not done due to high flows

*** Not done (site not a suitable RHP site; it lacks GSM and stones)

@ These site were visited and sampled but otherwise were removed from the final site selection report.

Total ASPT	Rating
< 5.0	Poor
5.0 – 5.9	Fair
6.0 – 6.9	Good
> or = 7.0	Natural



Figure 3. Badly eroded Keiskamma river banks just next to S.S Gida Hospital. The erosion is so bad that a substantial mass of S.S Gida land has been lost, leaving exposed

Power lines and a portion of the property fence hanging in the air.



Figure 4; The erosion around the back of this hospital was so severe and progressive that it threatened taking down some of the hospital buildings.

Water Quality

On site physiochemical analysis was not done due to a faulty Multimeter. Talbot & Talbot water quality results are not yet available.

Discussion

Biotic modification relative to current best attainable condition ranged from as high as Class A (site unimpaired) to as low as Class D (site largely impaired). It is to be expected that Keiskamma River site below St Mathews sewage oxidation ponds be largely impaired, this is mainly due to the discharge of effluent high in phosphates, nitrates, ammonia and Chemical oxygen demand. Although the basic ecosystem in this site has changed, overall water quality in this site is still in a fair state. The same goes Keiskamma River site below Amatola Water purification plant, it is also sitting at class D (largely impaired) due to the discharge of water containing waste material (e.g. expired Flocculation by product, back wash, etc), but overall this site is also in a fair condition.

If one looks at figures 3 and 4, it would be noticed that the hospital property is well fenced and the river is deeply incised and forms intervals of fairly deep pools, this means live stock cannot graze easily on the eroded river bank. The duplex and sandy soil nature is clearly visible on these two sample pictures taken along the Keiskamma River. The abundance of this soil type through out this catchment and live stock grazing would lead silting of the river and this could have an effect on the estuarine environment. From an engineering perspective most major dams (if not all) Sandile Dam included are not equipped to have continuous environmental flows. It must also be noted that a recent study of hydrological flows in the R 10 catchment reveals a huge surplus of water available and the fact that the Keiskamma estuary is a permanent open system.

Conclusion

Combining these few physical mostly natural factors (except for the impeding effects caused by the dams), it is to be expected that the Keiskamma estuary would from time to time experience salinity gradient issues. Since most major dams here were not designed to carry out environmental releases, it is very unlikely that they would on their own cause salinity problems at the estuary.

Given the current trends of global climate change it is more likely that the present phenomenon at the Keiskamma estuary is natural and a more integrated approach would be preferred to find the root cause of the problem.

Fish

From the 13 sites in Keiskamma River Catchment that was surveyed in November 2007, fish assessments were only done in 8 sites i.e. (these sites are listed below in the table). Other sites were not sampled due to absence of habitat, deep pools; bad rock i.e. (also listed below in table). All sites were done in 7-8 days due to heavy rain that caused us to take 2 weeks to sample all this sites. See information below for time and condition the assessment were done in all sites.

Fish were sampled using a seine-net. Fish caught were identified to species level.

Findings

TABLE 1. The results of fish caught in Nahoon River and its tributaries and estuaries. The (A) and (I) indicate Alien and Indigenous respectively. A and J next to the number indicates adults and juveniles. E indicates endangered.

Site	Site Code	Species	Number of fish sampled
1. Keiskamma at St Mathews	R1KEIS-STMAT	<i>Barbus trevelyani</i> (I)	18 J
2. Keiskamma below Church	R1KEIS-CHURC	<i>Sandelia bainsii</i> (I, E) <i>Barbus anoplus</i> (I)	1 J 5 J
3. Keiskamma above Sandile Dam	R1KEIS-	<i>Sandelia bainsii</i> (I, E)	1J
4. Keiskamma below Sandile Dam	R1KEIS-SANDI	<i>Labeo umbratus</i> (A) <i>Micropterus salmoides</i> (A)	3A, 2J 1J
5. Tyume at Hogsback	R1TYUM-HOGSB	No pools, therefore no fish sampling	
6. Tyume at Fort Hare	R1TYUM-FORTH	<i>Sandelia bainsii</i> (I,E) <i>Labeo umbratus</i> (A)	2 4J
7. Tyume before confluence with Keiskamma	R1TYUM-CONFL	<i>Clarias gariepinus</i> (A) <i>Tilapia sparrmanii</i> (A)	1A 1J

		<i>Glossogobius callidus</i> (I) <i>Labeo umbratus</i> (A)	10J, 1A 3J
8. Keiskamma river at R67 bridge	R1KEIS-R63BR	<i>Clarias gariepinus</i> (A) <i>Labeo umbratus</i> (A) <i>Barbus trevelyani</i> (I)	2J 2J, 2A 1J, 1A
9. Keiskamma at Amatola WTW	R1KEIS-AMATO	Large boulders, could not use net	
10. Keiskamma at Mangconde	R1KEIS-MANGC		
11. Keiskamma at N2 bridge	R1KEIS-N2BRI	High flows	
12. Keiskamma upstream of Mangconde	R1KEIS-	High flows	
13. Keiskamma at Tsholomnqa	R1KEIS-TSHOL	High Flows	

Note: In sites where there are no fish results fish was either not sampled due to absence of habitat or sampled but not caught or deep pools/bedrock.

DISCUSSION

Site 1:

According to the Fuzzy Fish Index (FFI) this site is at C. the fish were in healthy condition (no parasitic infection) this is due to the fact that there is only one indigenous species caught out of three expected. The other expected species is the endangered Eastern Cape rocky, *Sandelia bainsii* together with the chubbyhead barb, *Barbus anoplus*.



Fig 1: *Barbus trevelyani*, caught in St Mathews site

Site 2:



Fig 2: *Sandelia bainsii* and *Barbus anoplus* caught in Keiskamma below the church

According to the Fuzzy Fish Index (FFI) Site 2 is at Category B, there were indigenous fish, in a healthy condition, although very few individuals were caught. This indicates that the site is in good condition. Two out of four expected species were found in this site, that is, *Sandelia bainsii* and *Barbus anoplus*. *Sandelia bainsii* is an endangered species in the Eastern Cape Province. The other expected indigenous species are *Barbus trevelyani* and *Glossogobius callidus* but were not found.

Site 3

Only one *Sandelia bainsii* was found in this site. This does not really give a true reflection of the site. Sampling was discontinued due to presence of very deep pools and bedrock; it was unsafe to sample.

Site 4:



Fig. *Labeo umbratus* and *Micropterus salmoides*, alien species caught in Keiskamma river below Sandile Dam

In this site only the alien species *Labeo umbratus* and the largemouth bass *Micropterus salmoides* were found. This results in this site sitting at category E (FFI) due to alien infestation. As a result of this infestation by aliens, indigenous species were not found.

Site 6:



Fig. *Sandelia bainsii* and *Labeo umbratus* caught in Tyume river at Fort Hare

This site is at Category D, meaning that it is in poor condition. Only two individuals of indigenous, endangered species were caught in this site, and double the number of alien species. That is why this site is in a poor condition.

Site 7:



Fig Top right: The alien *Clarias gariepinus*, Top right: The indigenous *Glossogobius callidus*, Bottom left: Alien *Tilapia sparrmanii*, and Bottom right: The alien *Labeo umbratus*. All were caught in Tyume river before the confluence with Keiskamma river.

According to the Fuzzy Fish Index (FFI) this site is at Category D, due to the presence of alien fish species, the *Labeo umbratus*, *Clarias gariepinus* and *Tilapia sparrmanii*. The *Clarias gariepinus* is a predator of fish. *Glossogobius callidus* is the only indigenous species found in this site. This site is in a poor condition.

Site 8:

This site, according to the Fuzzy Fish Index (FFI), is at Category D, due to the presence of aliens such as *Clarias gariepinus* that predate on fish and *Labeo umbratus*. This means that this site is in a poor condition.

The following sites do not have fish results due to:

Sites 5 and 9:

In site 5 there were no pools for the net, only big boulders were available. This site is at the upper reaches, therefore it is highly unlikely to find pools. In site 9 there is a pool but has a lot of boulders that trap the net.

Sites 10 to 13

In these sites sampling was not done due to very high flows during the survey.

CONCLUSION AND RECOMMENDATIONS

According to the fish assessment, the upper reaches of the Keiskamma River are at a fair to good condition, showing that there is little impact. The sites in the middle reaches of Tyume, together with one site in Keiskamma (at R63 brige) are in a poor condition. The possible impacts are run-off from maize irrigation and a lot of alien infestation by *Labeo umbratus*.

The team that conducted the fish assessment has started removing the alien species by not returning to the site. This will continue until a suitable procedure is found for removing these alien species. An option of using a fish shocker needs to be exploited. It will be more helpful in sites where big rocks hold the net, some fish live/hide well under rocks, deep flows, slow or no flows.

According to lab results, all the results are under the target water guidelines meaning that not much effect/impact on the fish caught in Keiskamma River.

N.B Map for land use is still in a construction phase and hope to have it as soon as humanly possible.