water affairs
Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

SOUTH AFRICAN ENVIRONMENTAL HEALTH MONITORING PROGRAMME

MINI TECHNICAL REPORT: July 2010
KEISKAMMA RIVER BIOMONITORING TRENDS

Prepared for:

Chief Director: Eastern Cape Region
Department of Water Affairs: Southern Cluster
Private Bag 7485
King Williams Town
5600

Prepared by:

Mbikwana Mlondolozi
Resource Protection, Department of Water Affairs & Forestry (ELS)

Gaulana Lungile
Resource Protection, Department of Water Affairs & Forestry (ELS)

Weni Elliot.
Resource Protection, Department of Water Affairs & Forestry (ELS)

BIOMONITORING TEAM:

M.N. Mbikwana (DWA), E. Weni (DWA), L. Gaulana (DWA), K Ravele (Graduate Trainee), N. Nkuhlu (Graduate Trainee) and A. Mgobozi (Graduate Trainee)

EXECUTIVE SUMMARY

The main objective of the South African National Aquatic Environmental Health Monitoring Programme (NAEHMP) combines both physiochemical and Biomonitoring data in order to get an impression about the state of the rivers. Biomonitoring 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 draft report provides the results of the Keiskamma River Biomonitoring winter survey that was undertaken from 30 June to 2nd July 2010. The draft report also provides for overall trends between period March 2008 and July 2010. Field indices used for data collection included the Geomorphology (GAI), South African Scoring System version 5.0 (SASS5) for Macro invertebrates, Water Quality (Both onsite and laboratory detail physiochemical analysis).
The Fish Assemblage Integrity Index for fish (FAII) was not done due to faulty fish shocker. The final report will include the latest physiochemical data from Talbot & Talbot Laboratories

Table 1: 11 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
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 at St Mathews low bridge	S32o 38' 25.7", E27o 11' 26.2"	R1Keis-Smbr
5	Keiskamma below St Mathews	S32o 40' 59.3", E27o 09' 17.4"	R1Keis-Besma **
6	Keiskamma below Sandile Dam	S32o 43' 18.8", E27o 06' 20.2"	R1Keis-Besad
7	Keiskamma below Amatola Water Treatment Plant	S32o 45' 35.1", E27o 04' 06.5"	R1Keis-Beamw
8	Keiskamma below Xesi low bridge R67	S32o 49' 07.3", E26o 59' 39.0"	R1Keis-Bexeb
9	Keiskamma Gcinisa	S33o 01' 25.02", E27o 05' 09.26"	R1Keis-Gcini
10*	Keiskamma Above N2 bridge	S33o 03' 49.39", E27o 12' 39.29"	R1Keis-Abn2b *
11	Keiskamma Above R72 to Port Alfred, Xesi Village	S33o 10' 25.7", E27o 22' 39.7"	R1Keis-Abr72

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

Overall trends in the Keiskamma River basin indicate a decline in water quality conditions in Tyume River downstream of Alice, Fort Hare. Trends also indicate presence of Sandelia bainsii in the upper reaches.

GOALS AND OBJECTIVES OF BIOMONITORING

The goal of the South African National Aquatic Environmental Health Monitoring Programme (NAEHMP) 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 Resource Protection 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:

Eight sites were selected in the Keiskamma River which also represent all thee Eco-regions in the R 10 catchment. Five sites chosen in the first Eco-region (South Eastern Mountain Highlands, Upper reaches), three 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)

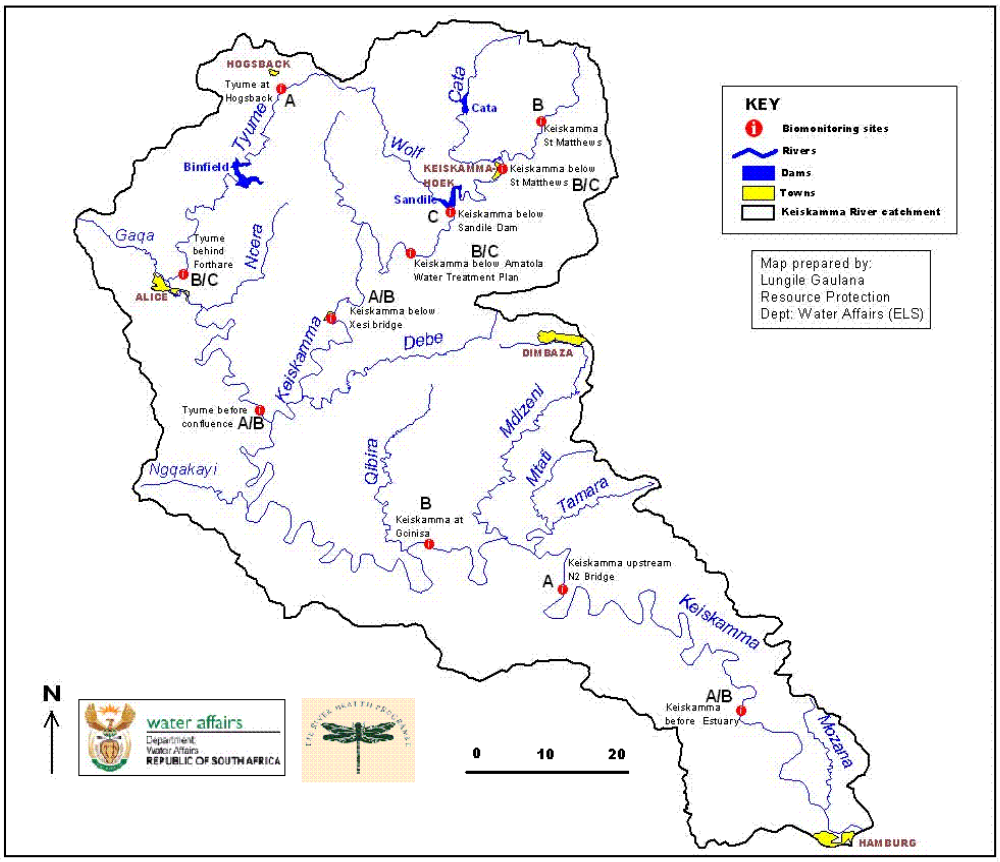


Figure 1. The Keiskamma Sub-area (R 10 catchment), showing main stem, tributaries, major dams and towns. The map also shows Biomonitoring sites along with updated Present Ecological Status (PES) for Geomorphology, June/July 2010.

Study Area

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.

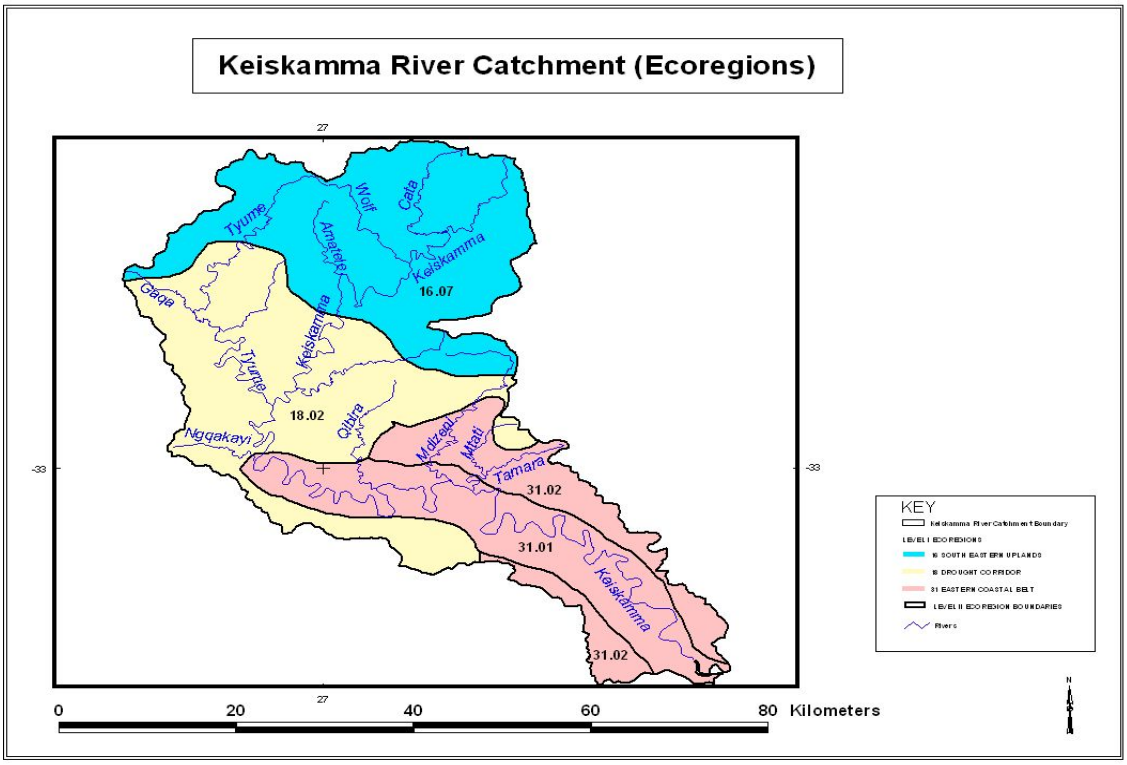


Figure 2; Map showing three topographic zones/Eco-Regions in the R10 catchment

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

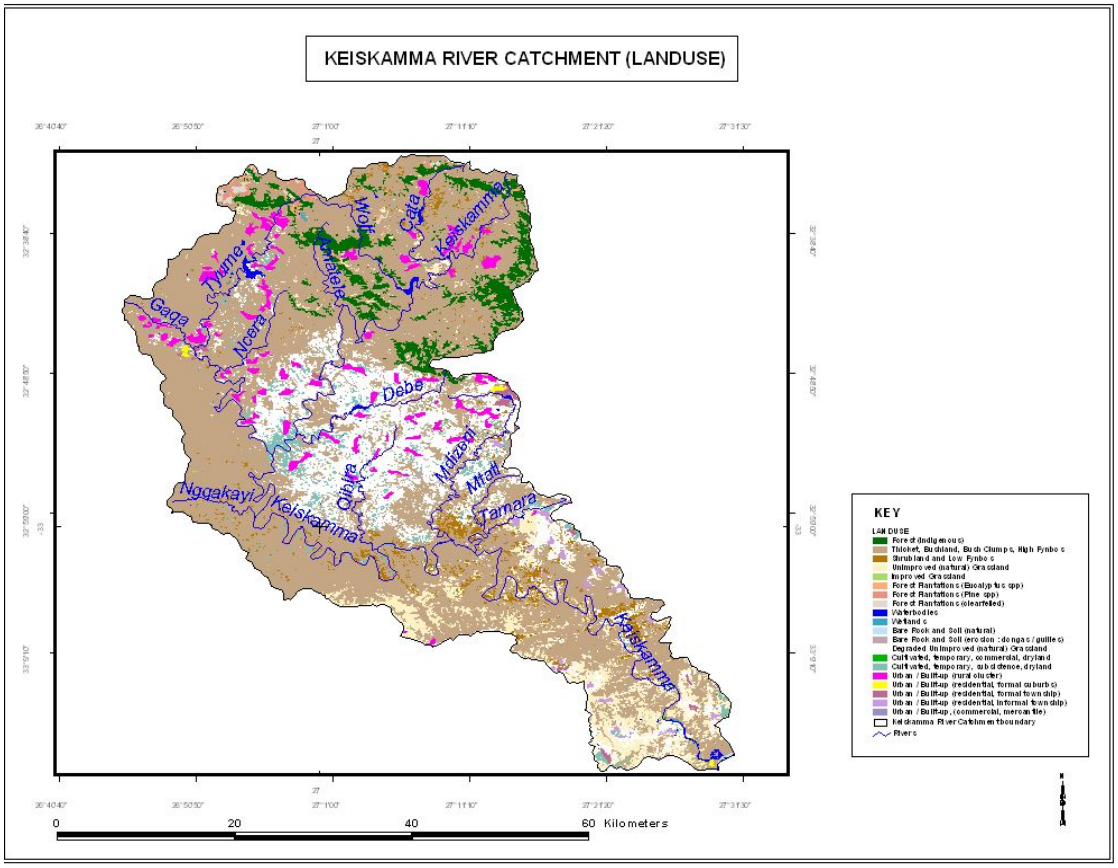
4.1.2 Climate and Rainfall

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 Keiskammahoek 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 catchment.

4.1.5 Demography

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.

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 2: Main Rivers and Dams in the Keiskamma Sub-area

Catchments	Rivers	Dams	Owner	Management
R10	Keiskamma	Mnyameni	DWA	Not sure
		Cata	DWA	Not sure
		Sandile	DWA	Amatole District Municipality
	Tyume River	Bin Field Park	DWA	Amatole
		Pleasant View	DWA	Not sure
	Debe River	Debe	DWA	Not sure

Table 3. Biological and physical indicators used during biomonitoring (Murray, 1999)

ECOSYSTEM COMPONENT	RELEVANCE TO BIOMONITORING
Fish	Fish comprise one of the main biological components of aquatic ecosystems. Because they are relatively long-lived and mobile, they can indicate long-term influences (years) and general habitat conditions in a river reach. They represent a variety of trophic levels and hence integrate effects of environmental changes.
Geomorphology	Geomorphological processes determine river channel morphology which provides the physical environment within which stream biota live. Changes to channel form occurs both naturally and as a result of man-made changes to rivers or their catchments (e.g. impoundments, water transfers, agriculture).
Water quality	Aquatic ecosystems and their biota are affected by turbidity, suspended solids, temperature, pH, salinity, concentrations of dissolved ions, nutrients, oxygen, biocides and trace metals. Changes in these due to pollution, geomorphological or hydrological factors can have detrimental or even lethal effects on aquatic organisms.
Macro-Invertebrates	Invertebrate communities respond relatively quickly to localized conditions in a river, especially water quality, though their existence also depends on habitat diversity. They are common, have a wide range of sensitivities, and have a suitable life-cycle duration that indicate short- to medium-term impacts of water quality.

Table4: Meanings of Present Geomorphological state (PGS) categories A to F (Rowntree, 2003)

CATEGORY	GEOMORPHOLOGICAL CHANGE	ANTHROPOGENIC INDICATORS
A: unmodified natural	No changes, erosion and deposition within reach are in balance.	No human impacts identified in the catchment.
B: largely natural	Short-term changes that can be reset within the frequency of the 'bankfull' flood.	Human impacts identified, but no clear evidence of channel response.
C: moderately modified	Slow trajectory of change, can be reset within five to ten 'bank full' events by restoring natural flow / sediment regime and bank stability.	Significant human impacts, changes to bed structure evident, localised bank erosion and channel widening, or deposition and narrowing. Changes reversible in the short term.
D: largely modified	Well into the trajectory of change, may be difficult to restore natural conditions; river adjusting its form to the current sediment load and flow regime.	Major human impacts resulting in significant long term changes to channel geometry, pattern or reach type that may be irreversible.
E: seriously modified	Engineering intervention required for rehabilitation.	Channel structure largely engineered, but bed perimeter includes some natural materials that can be worked by fluvial processes (includes gabions, engineered bank stabilisation, channel straightening or re-alignment, bulldozing.
F: critically modified	Major engineering intervention required for rehabilitation.	Totally engineered channel, no natural material in the channel perimeter.

For the purposes of state-of-rivers reports which are produced from technical reports, PGS categories 'A' to 'F' are reduced to four larger classes, namely **Natural**, **Good**, **Fair** and **Poor**. PGS categories are translated to these four classes in a standardized way as follows:

A	=	Natural
A/B, B + B/C	=	Good
C, C/D + D	=	Fair
E + F	=	Poor

Water Quality:

Physiochemical assessment for Freshwater Aquatic Ecosystem:

South African Water Quality Guidelines (DWA, 2008, version 4.1) are a series of documents which provide main information about the water quality requirements for different purposes. The document gives Target Water Quality Ranges (TWQR) for the most parameters which are assessed for different water requirements (e.g. domestic, fresh water aquatic ecosystem, industrial, agriculture, etc). These target water quality values are compared with the actual on site or laboratory test results.

And for the purpose of water quality reporting for Keiskamma, the following symbols will be used for reporting compliance or non-compliance with TWQR:

C – Compliance with TWQR
NC- Non compliance with TWQR

Macro-Invertebrates (SASS 5)

Table 5: The river health classification system used in the NRHP (adapted from Roux, 2003)

RIVER HEALTH CLASS	ECOLOGICAL PERSPECTIVE	MANAGEMENT PERPECTIVE
Natural	No or negligible modification of instream and riparian habitats and biota.	Protected rivers; relatively untouched by human hands; no discharges or impoundments allowed.
Good	Ecosystem essentially in good state; biodiversity largely intact.	Some human-related disturbance, but mostly of low impact potential.
Fair	Sensitive species may be lost; lower abundances of biological populations are likely to occur: or sometimes, higher abundances of tolerant or opportunistic species occur.	Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation.
Poor	Habitat diversity and availability have declined; mostly only tolerant species present; species present are often diseased; population dynamics have been disrupted.	Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve river health, e.g. to restore flow patterns, river habitats or water quality.

Table 6: Default benchmark river health class boundaries for SASS5

CLASS BOUNDARY	RANGE OF ASPT SCORES
Natural	7
Good	6
Fair	5
Poor	< 5

MATERIALS AND METHOD

The Geomorphological Assessment Index (GAI), which was used to assess the Present Geomorphological State of a river at a particular reach.
On site physiochemical analysis was done using Hanna pH & EC Combo tester and grab samples were send to Talbot and Talbot Laboratories for physiochemical analysis. Sampling of fish 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 (Fish survey was done only in march and July of 2008).

Winter Survey Results

Geomorphology: Driver component**,** first assessment (Site one, upper reaches)

Site one: Tyume Hogsback (upper reaches)

Plate 1: Tyume River at Hogsback

Altitude: 789 masl.

Present Ecological Status (PES) using GAI: **A**

Water Quality Trends on a river reach scale: Driver component

Site one, upper reaches: Tyume Hogsback

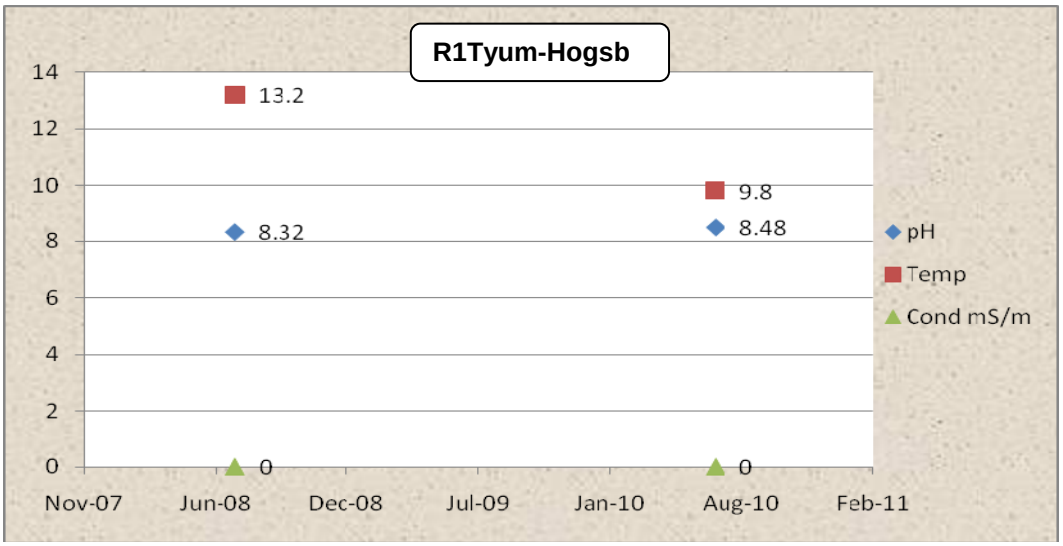


Figure 1: On site pH, Temperature and Conductivity flacuations ,period March 2008 to July 2010, using Hanna pH & EC combo.

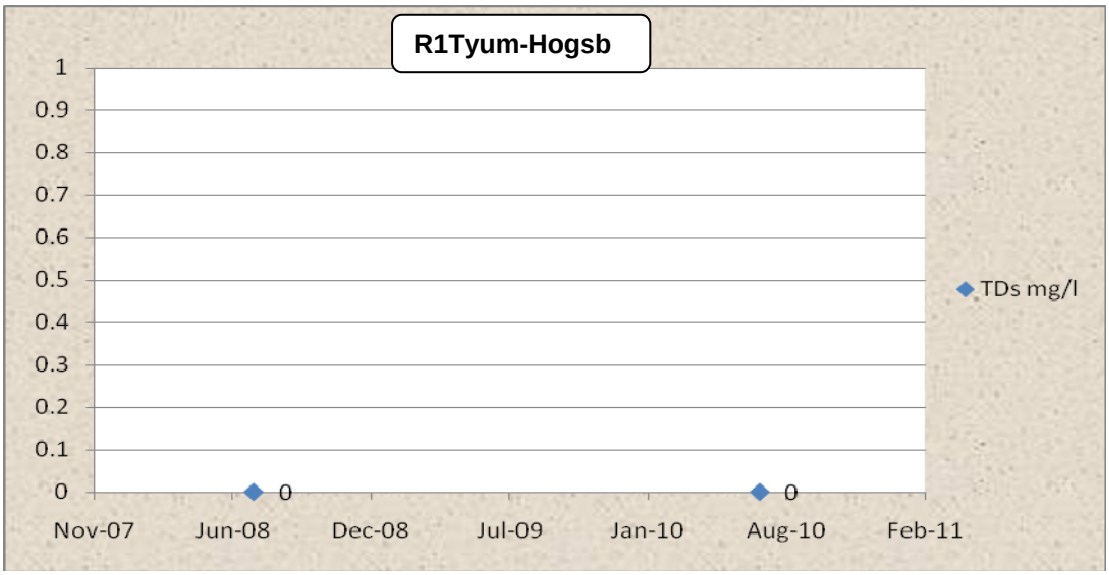


Figure 2: On site total dissolve solids flacuations period March 2008 to July 2010, Using Hanna pH & EC combo. These findings are consisted with unimpacted headwater streams and agrees with geomorphological class A (unimpacted) and SASS 5 rating of 7.0 (natural).

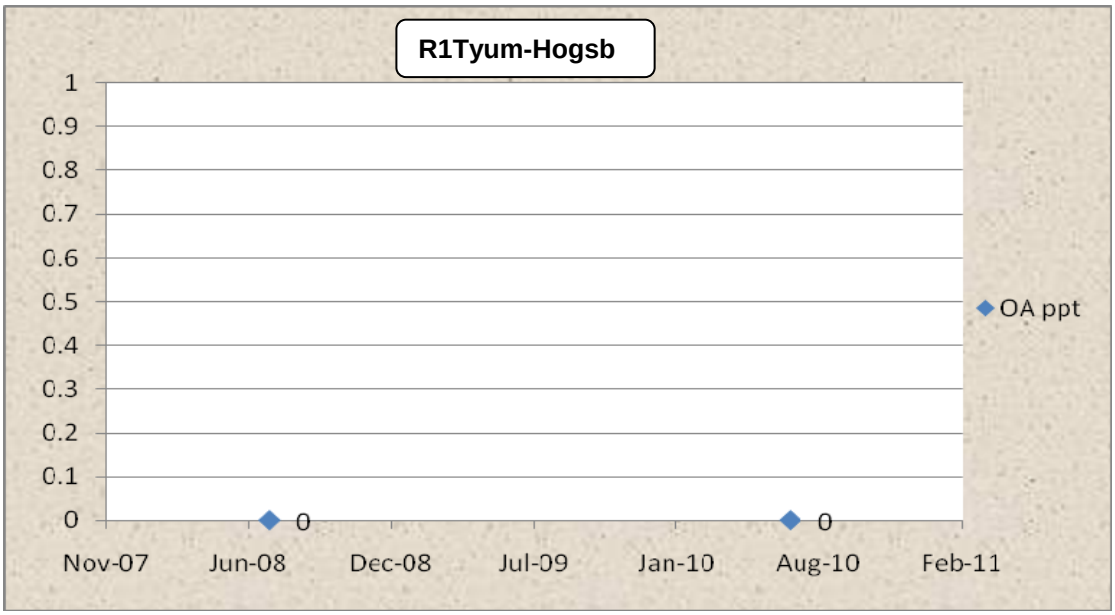


Figure 3: On site Oxygen absorbed assessment, concentrations too low to detect, period July 2008 to July 2010, using Hanna pH & EC combo. These findings are consisted with unimpacted headwater streams and agrees with geomorphological class A (unimpacted) and SASS 5 rating of 7.0 (natural), see figure 4 and discussion under plate one..

Invertebrates (Responses)

Site one: Tyume Hogsback:

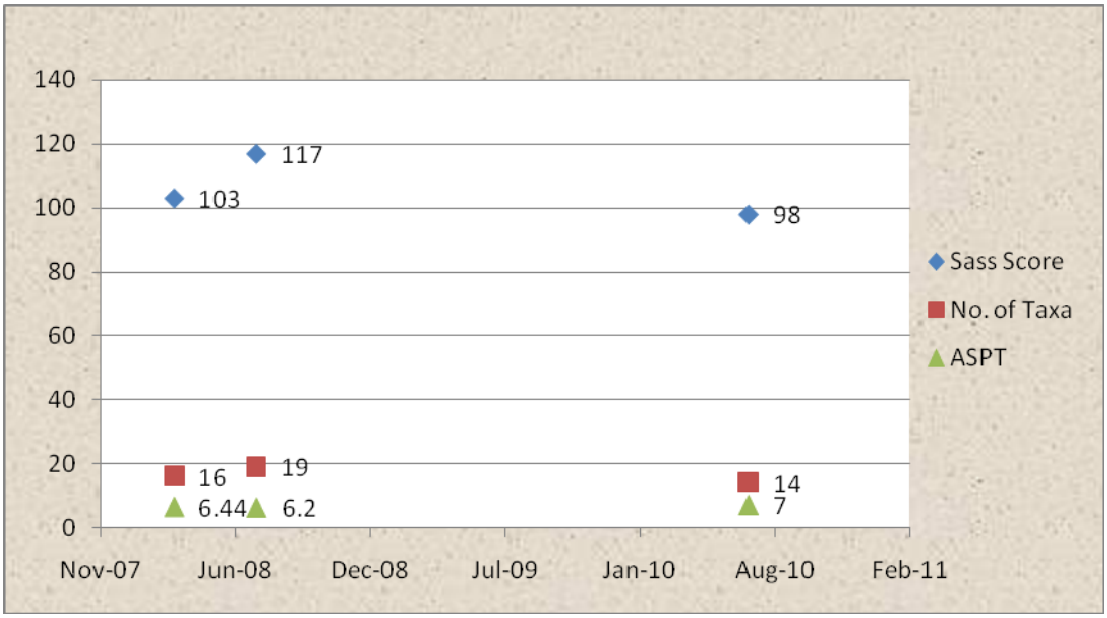


Figure 4: SASS 5 trends, start period march 2008 to July 2010. ASPT has improved over the period of two years from good (6.44) to natural (7.0) and average ASPT is 6.55. Water quality trends fluctuate between pristine conditions and slightly impacted conditions. This is consisted with these head waters. A decline in SASS score might reflect a change in breeding circle.

Fish Assessment (Responses)

Site one: Tyume at Hogsback;

Fish assessment not done due to absence of sampling site (**no pools**).

Site Two:

Geomorphology: Driver component (Site one, upper reaches)

Site name: Keiskamma River above St Mathews

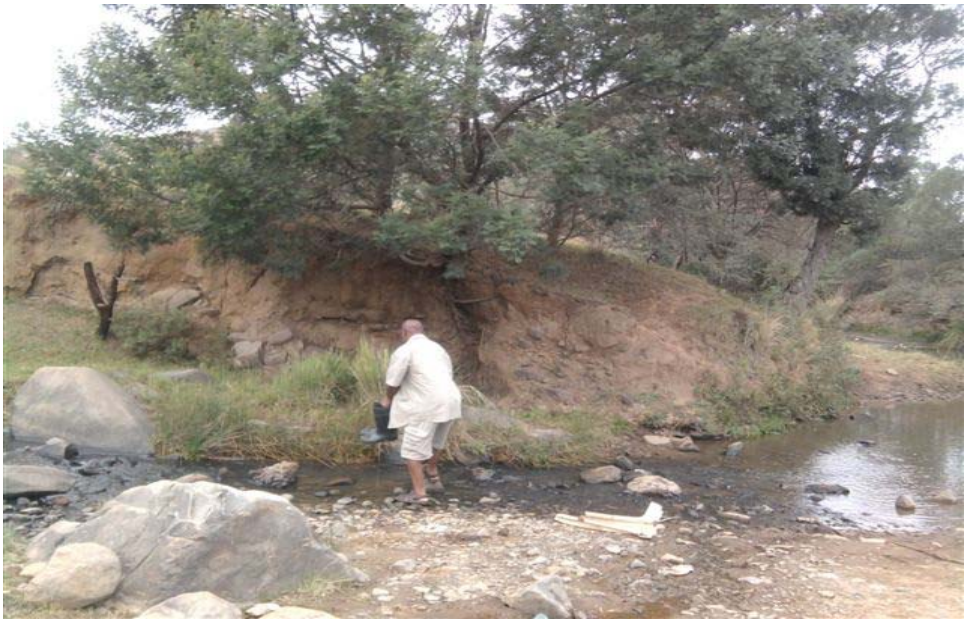


Plate 2: Keiskamma River above St Mathews

Altitude: 687 masl.

Present Ecological Status: **B**

Water Quality Trends on a river reach scale (2nd driver)

Site two, Keiskamma River above St Mathews

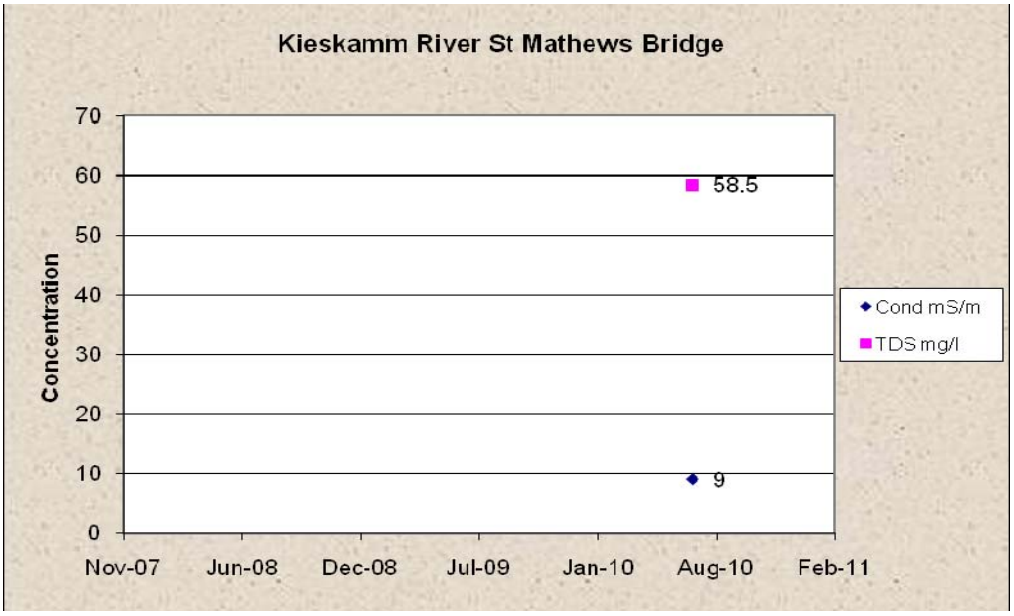


Figure 5: On site conductivity and total dissolve solids trends from march 2008 to july 2010,over apperiod of two years.

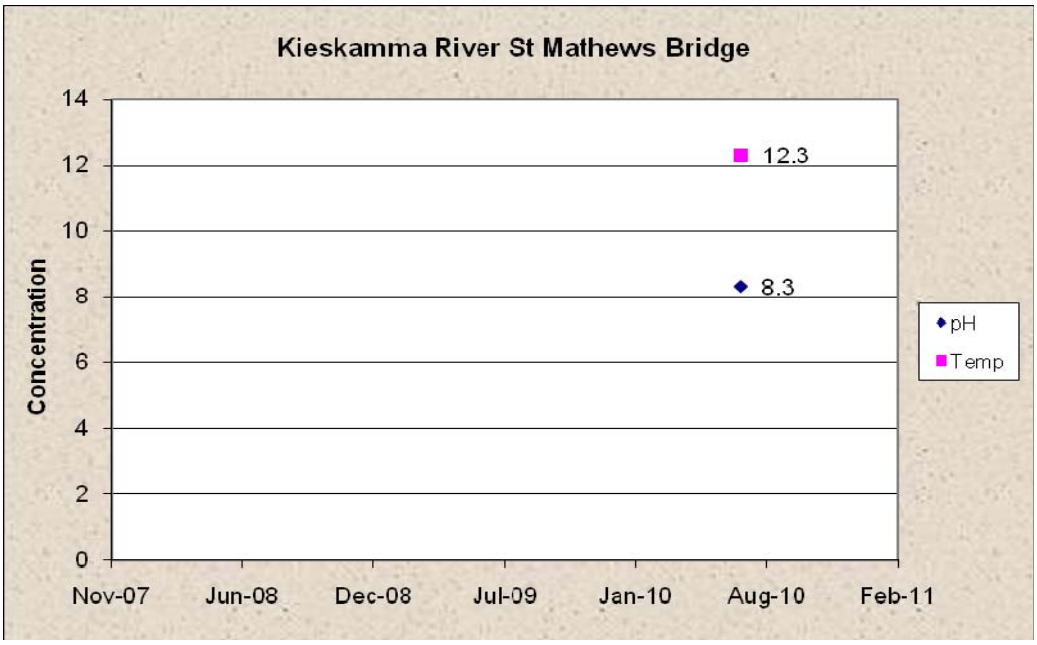


Figure 6: On site pH and temperature trends from march 2008 to july 2010,over apperiod of two years.

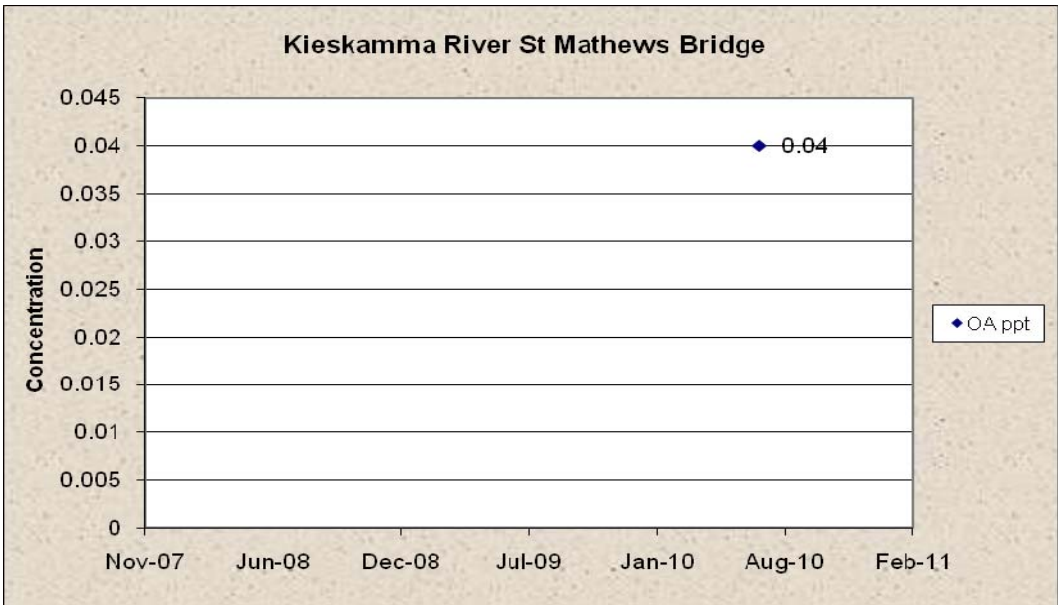


Figure 7: On site oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

Invertebrates (Responses)

Site two: Keiskamma River above St Mathews:

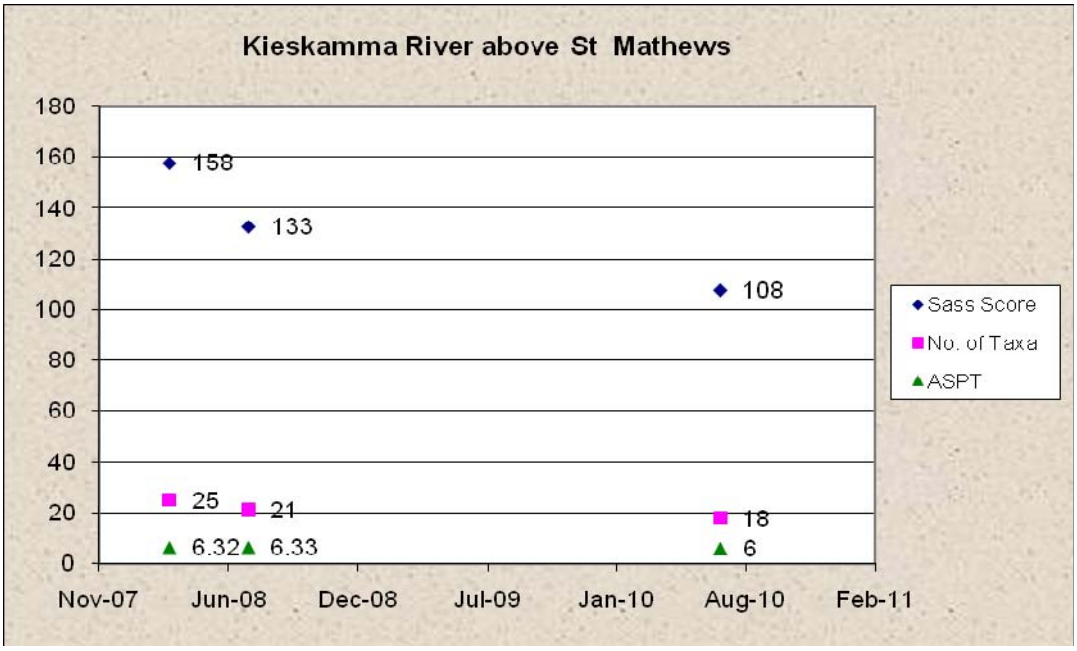


Figure 8: SASS 5 trends, start period march 2008 to July 2010. ASPT remains stable at near natural conditions over the period of two years at an average ASPT of 6.22. This indicates that the water quality conditions are still at natural. Water quality trends fluctuate between pristine conditions and slightly impacted conditions. This is consisted

with these head waters. A decline in SASS score might reflect a change in breeding circle.

Fish Assessment (Responses)

Site two: Keiskamma River above St Mathews

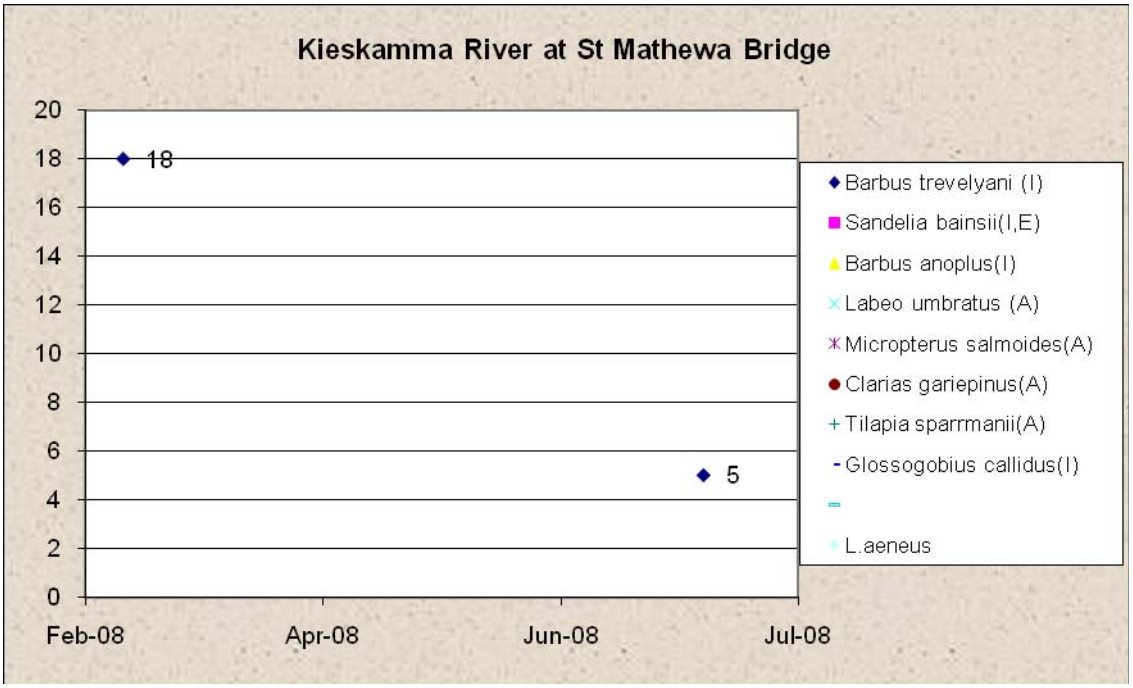


Figure 9: Only indigenous ***Barbus trevelyani*** was caught during march 2008 and July 2008, and the trends show decline in population. Existing data is limited to 4 months.

Site three:

Geomorphology: Driver component (Site one, upper reaches)

Site name: Keiskamma River below St Mathews

Plate 3: Keiskamma River below St Mathews

Altitude: 631 masl.

Present Ecological Status: B/**C**

Water Quality Trends on a river reach scale (2nd driver)

Site three, Keiskamma River below St Mathews

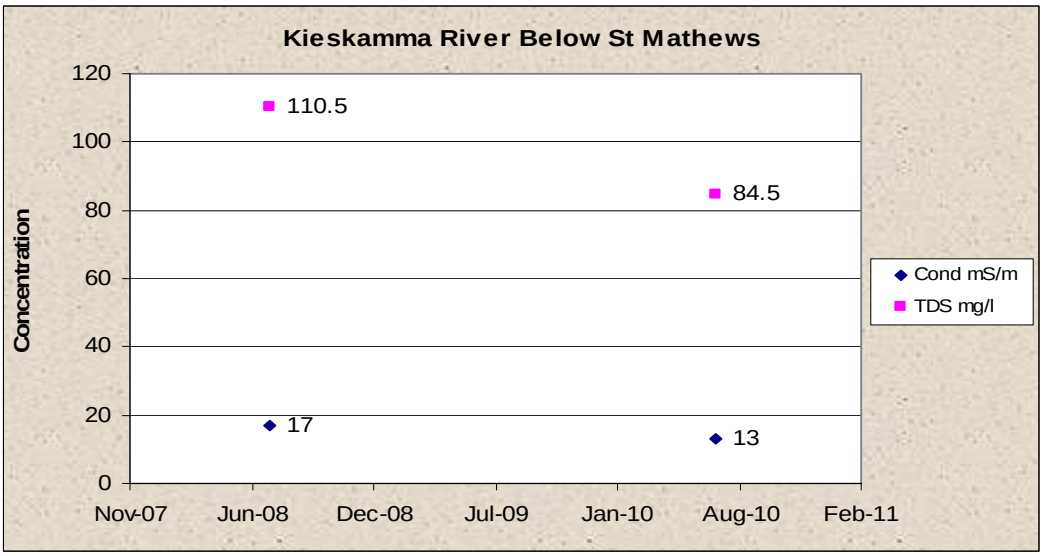


Figure 10: On site conductivity and total dissolve solids trends from march 2008 to july 2010,over apperiod of two years. Average total dissoved inorganic salts (+/- 97.5 mg/l) and the trend indicates water quality improvement. This still suggest that this site has good dilution and buffering capacity. Therefore if one takes into consideration, sourrounding land use activity and other catchment processes, the conditions are quite realistic and acceptable.

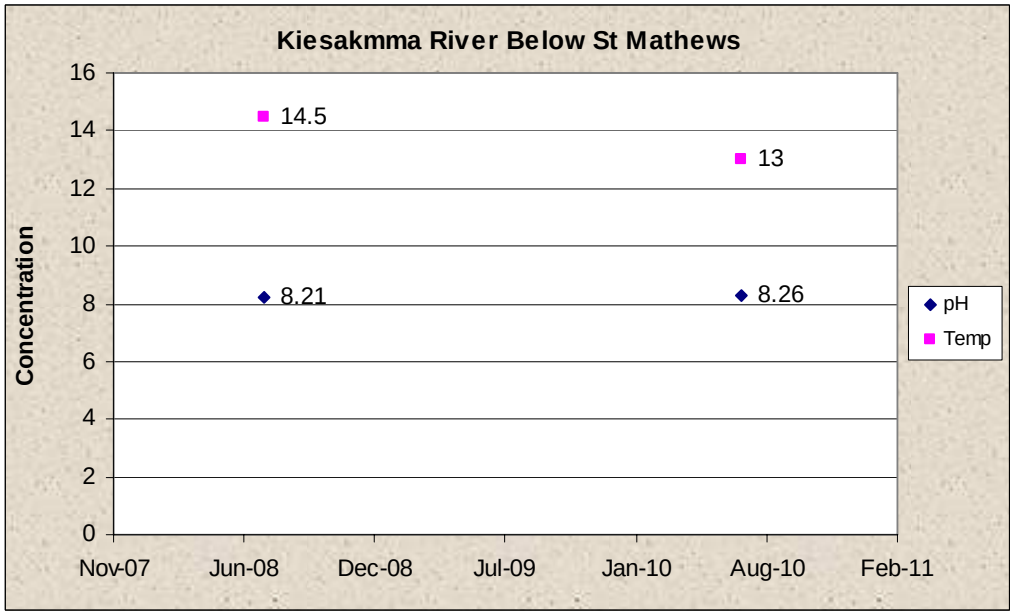


Figure11: On site pH and temperature trends from march 2008 to july 2010,over apperiod of two years. pH still sugest good buffering capacity.

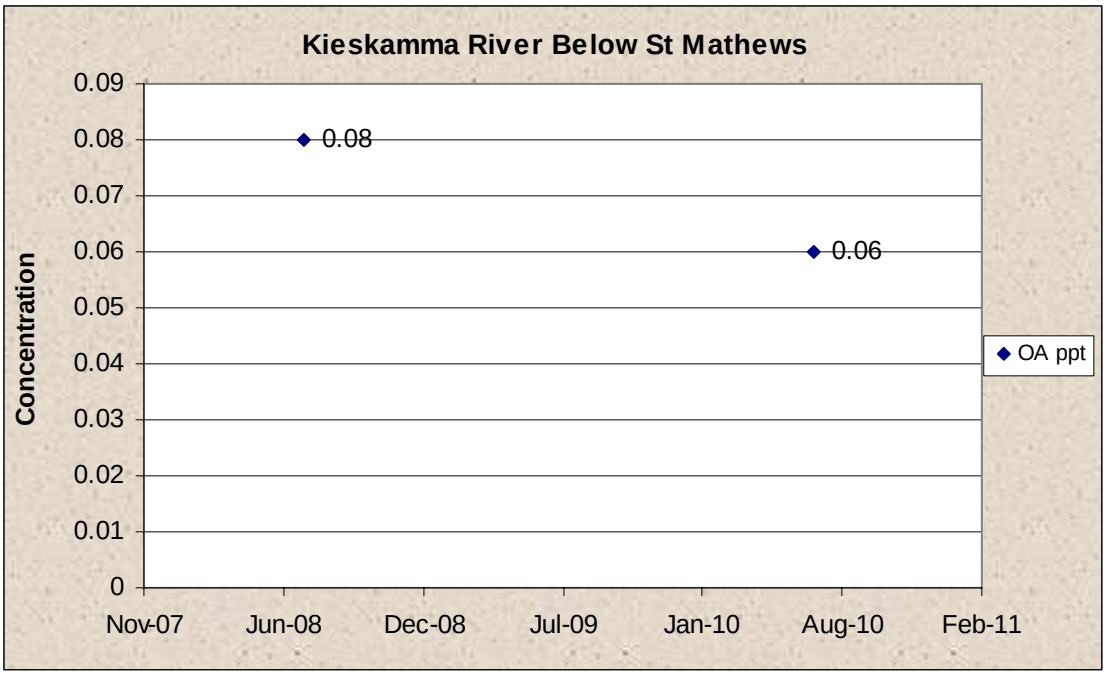


Figure 12: On site oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

Macro-Invertebrates (Responses)

Site three: Keiskamma River below St Mathews:

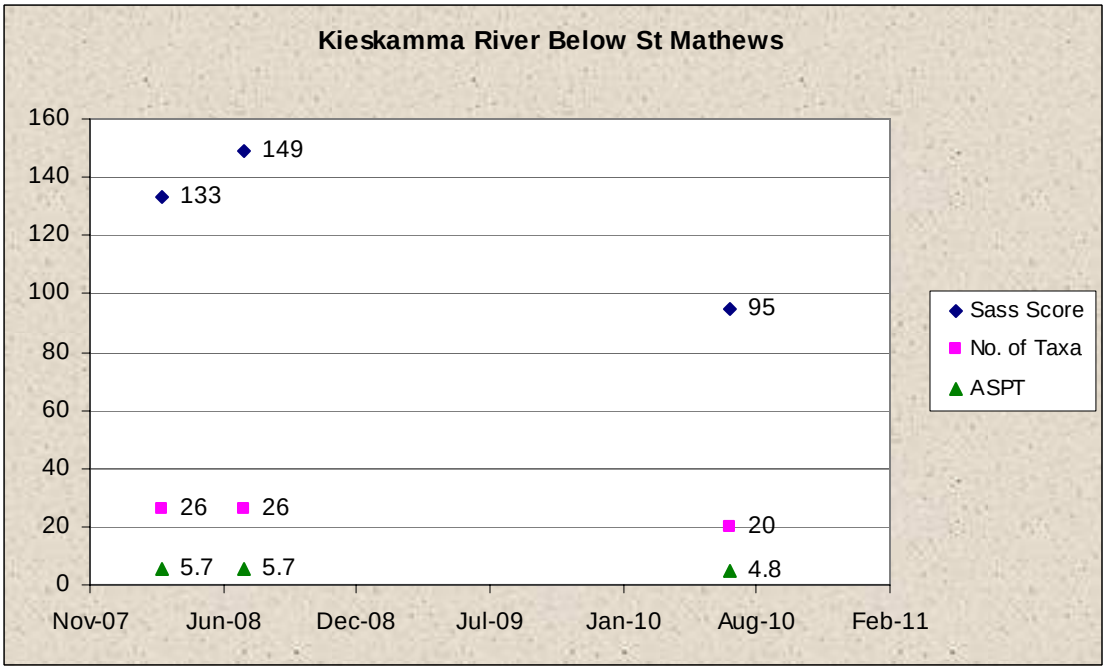


Figure 13: SASS 5 trends, start period march 2008 to July 2010. Average ASPT is 5.4 good over the period of two years at an average ASPT of 5.55.Trends indicates fluctuations between fair conditions and lately slightly poor . This is to be expected as

the site is directly behind Keiskamma town. PES in terms of GAI also dropped to C with corresponds with SASS 5 findings. Average site assessment is fair. This site needs re assessment in terms of macro invertebrates as the SASS 5 data collection sheet indicates some error in recording (not identifying).

Fish Assessment (Responses)

Site three: Keiskamma River below St Mathews

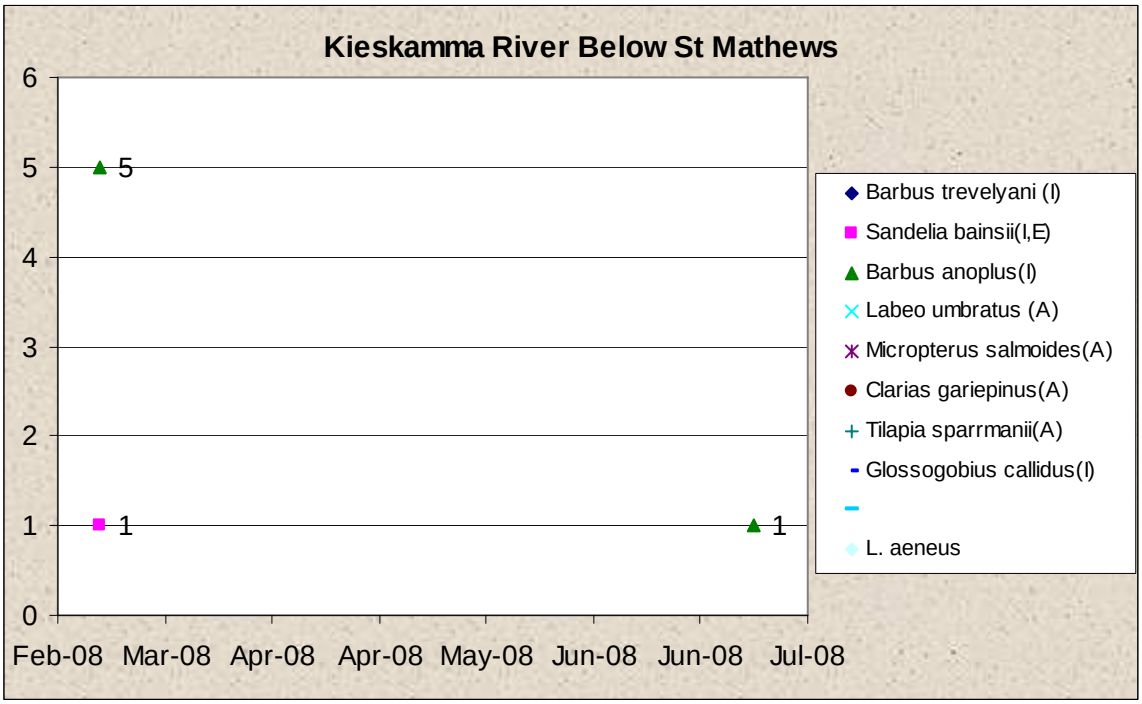


Figure 14: Two different fish species were caught in this site and one of the fish specy (Sandelia bainsii) is red listed (indemic to eastern cape region). It was previously spotted in a tributary of yellowoods and now Kieskamma River main stem.

Site four:

Geomorphology: Driver component (Site one, upper reaches)

Site name: Keiskamma River below Sandile dam

Plate 4: Keiskamma River below Sandile Dam

Altitude: 548 masl.

Present Ecological Status: **C**

Water Quality Trends on a river reach scale (2nd driver)

Site four, Keiskamma River below Sandile dam

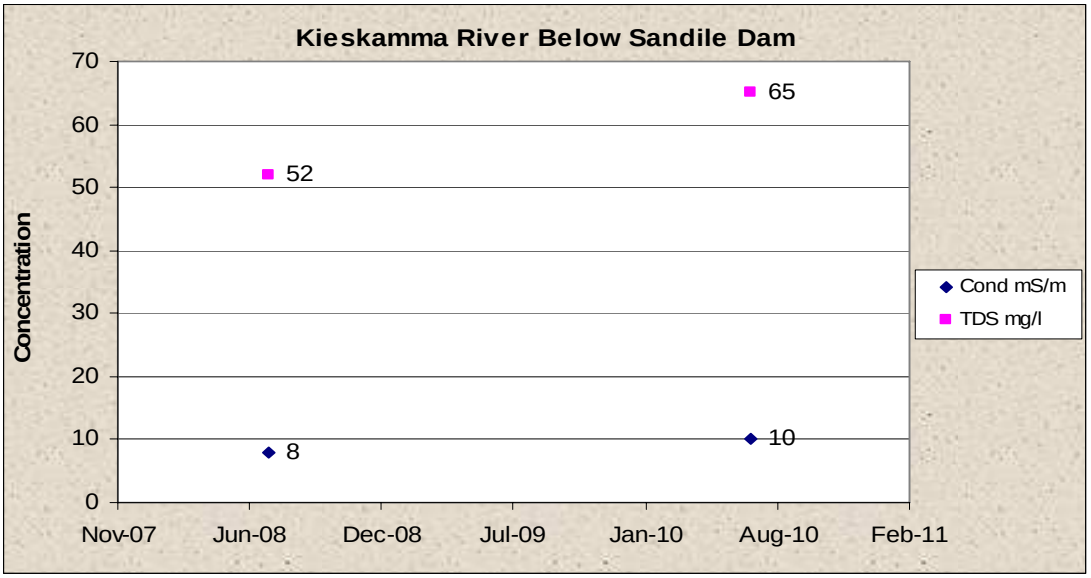


Figure 15: On site electrical conductivity and total dissolve inorganic salts trends from march 2008 to july 2010,over apperiod of two years. These values on average are quite low, therefore chemical driving processes below Sandile dam are still acceptable and sugest good buffering capacity. Water quality downstream of Sandile dam would also be affected byperiodic sludge releases at the dam and this constitute rutine operational rules of the dam.

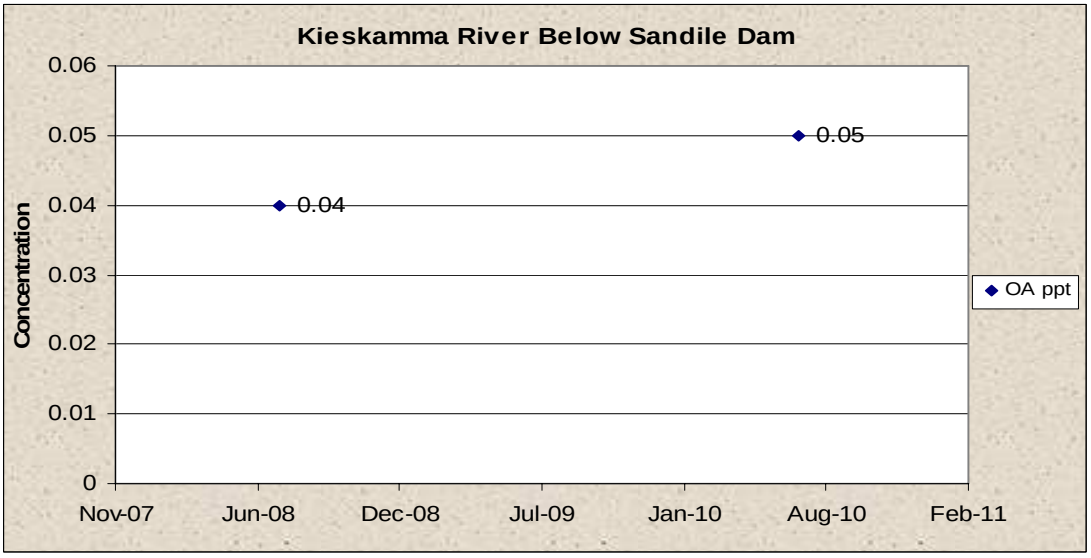


Figure 16: On site Oxygen absorbed trends from march 2008 to july 2010. On average oxygen absorbed is one unit higher, this could be due to non polar

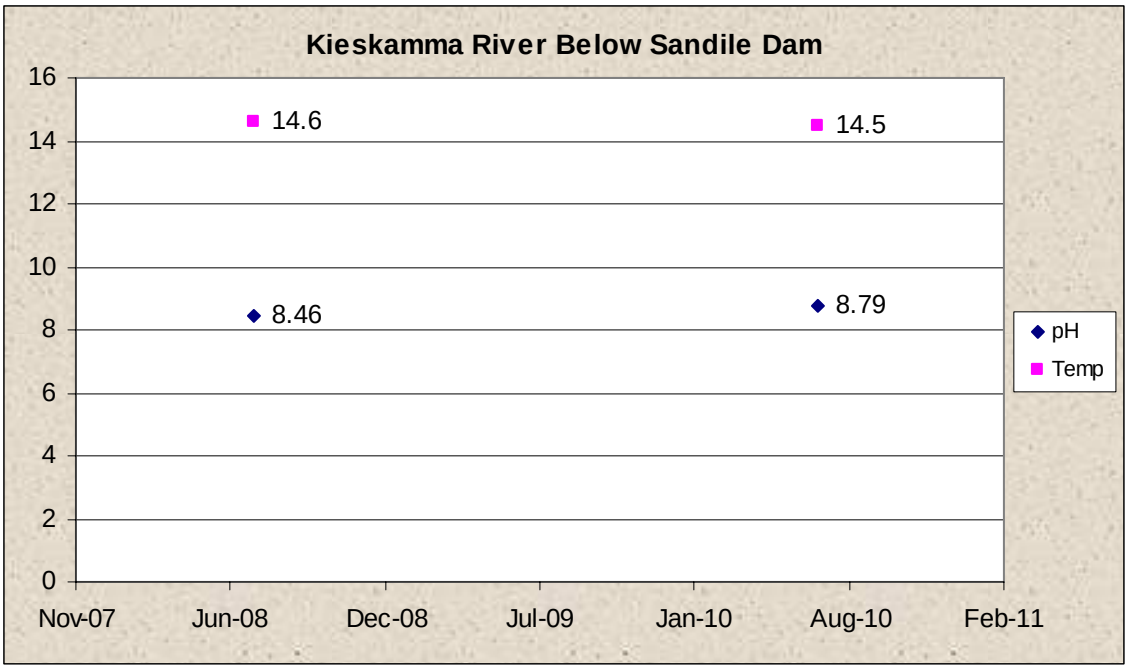


Figure 17: On site pH and temperature trends from march 2008 to july 2010,over apperiod of two years. pH sugest good buffering capacity. Water quality downstream of Sandile dam would also be affected byperiodic sludge releases at the dam and this constitute rutine operational rules of the dam.

Macro-Invertebrates (Responses)

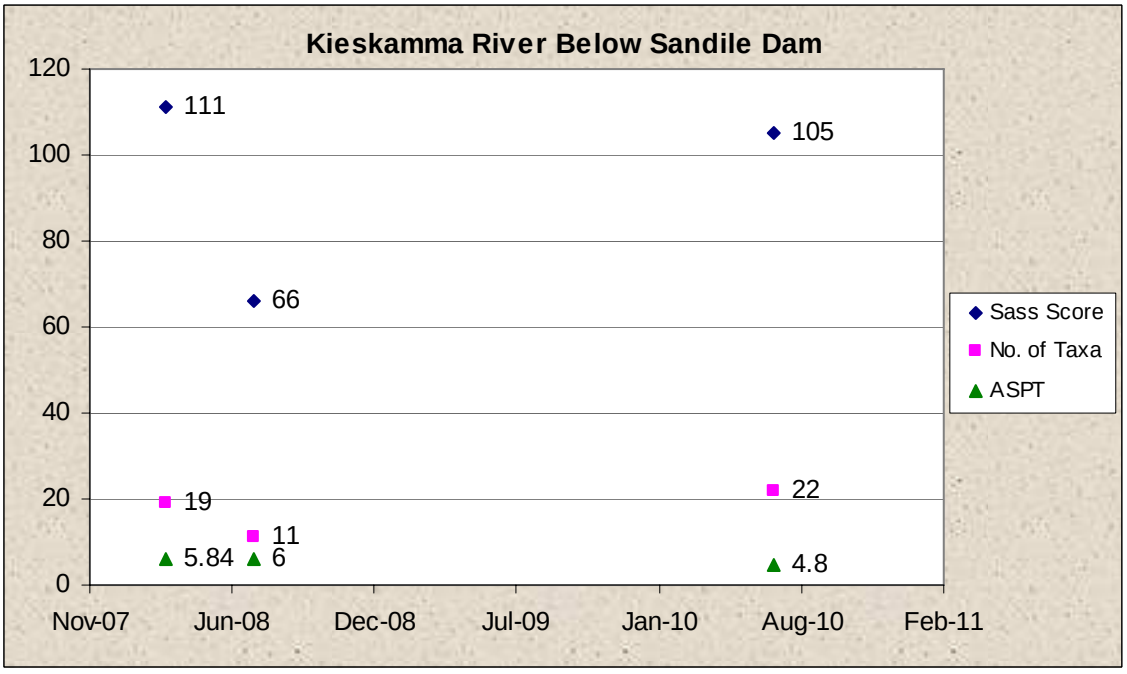


Figure 18: SASS 5 trends, start period march 2008 to July 2010.Trends indicates fluctuations between fair conditions, good and lately slightly poor. But on average ASPT is 5.55 (fair condition).

Fish Assessment (Responses)

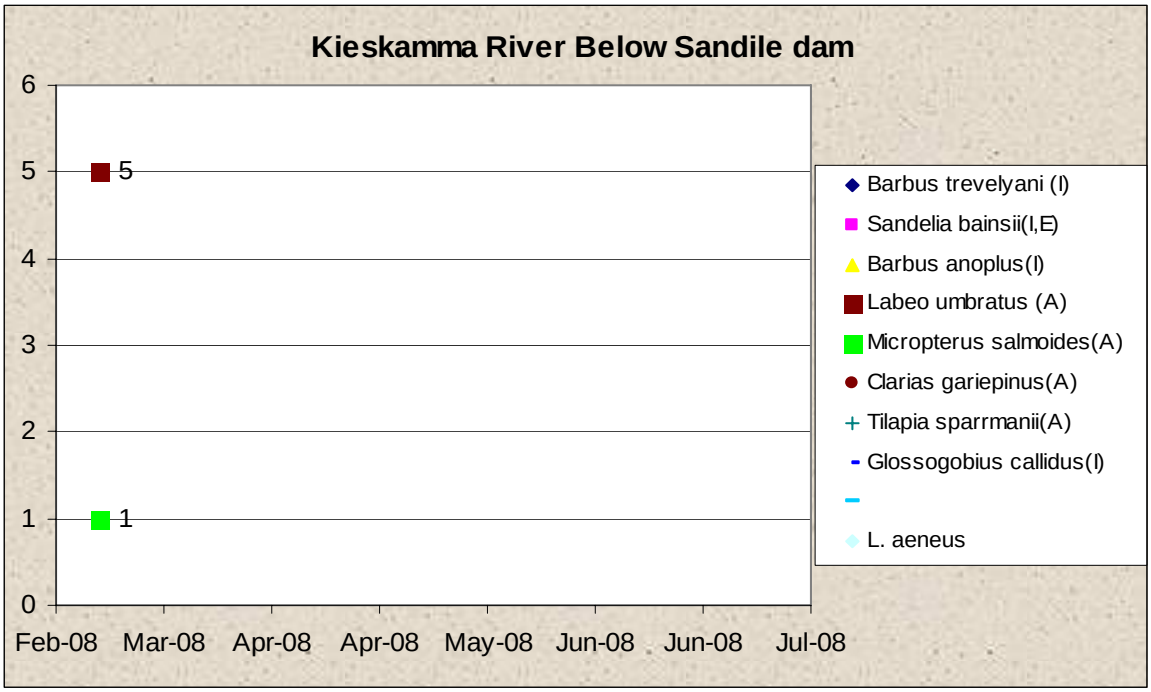


Figure 19: Only alien fish species were caught, therfore there is also biological pollution taking place at this site. Sometimes alien fishes are introduced for sporting activity, but this needs veryfication. Unless fish caught shows signs of ill health, biological pollution does not necessarly means chemical or microbial pollution, but dominace of water pollution resistant species can be used to confirm water quality detoriating conditions.

Site Five:

Geomorphology: Driver component (middle reaches)

Site name: Tyume River at Fort Hare

Plate 5: Tyume River at Fort Hare

Altitude: 524 masl.

Present Ecological Status: C

Water Quality Trends on a river reach scale (2nd driver)

Site Five, Tyume River at Fort Hare

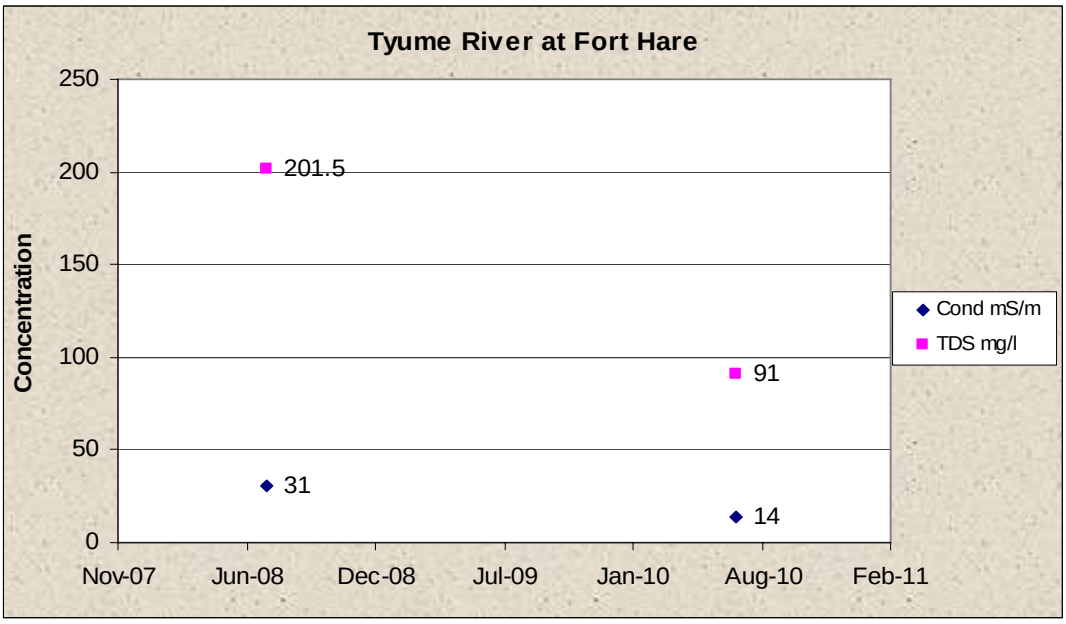


Figure 20: On site electrical conductivity and total dissolve inorganic salts trends from march 2008 to july 2010,over apperiod of two years.

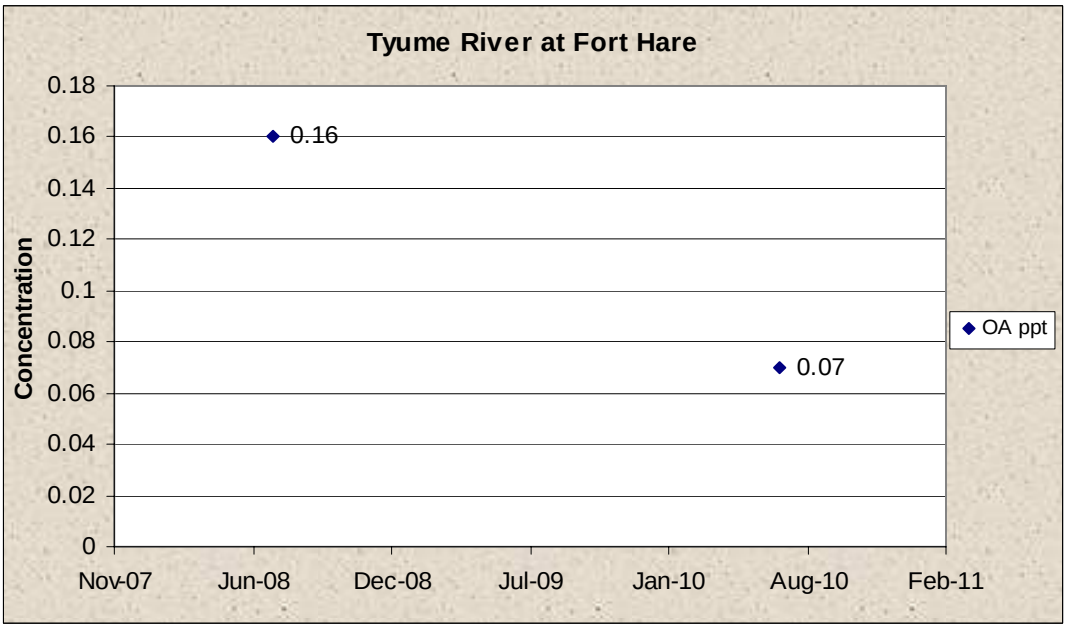


Figure 21: On site Oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

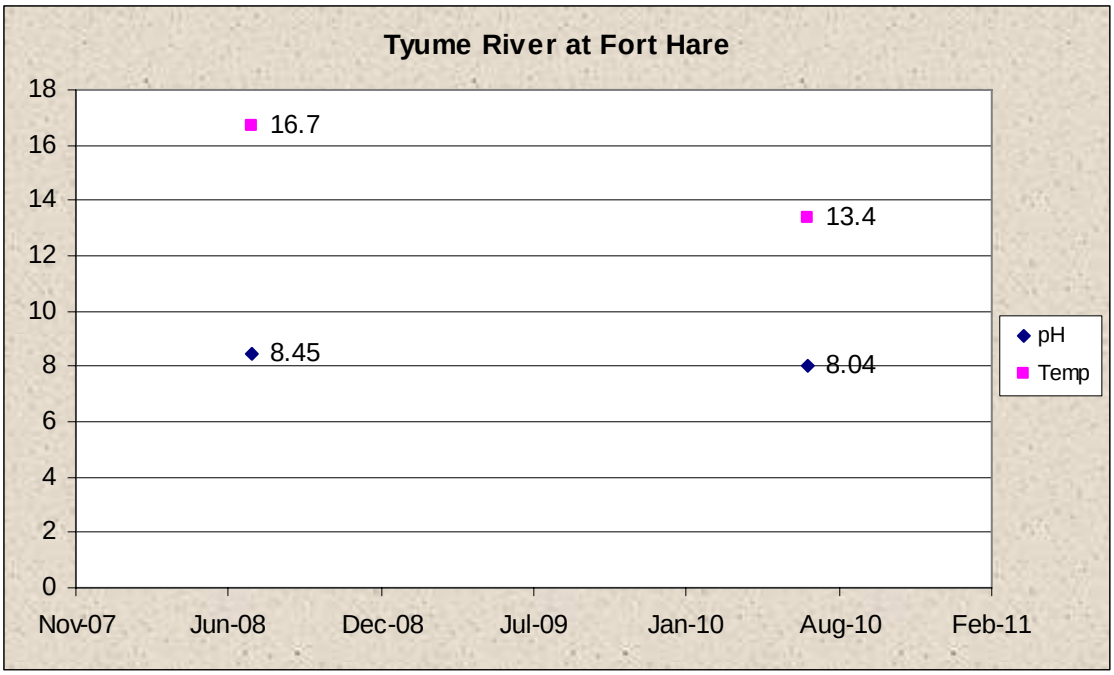


Figure 22: On site pH and temerature trends from march 2008 to july 2010,over apperiod of two years

<u>Macro-Invertebrates</u> (Responses)

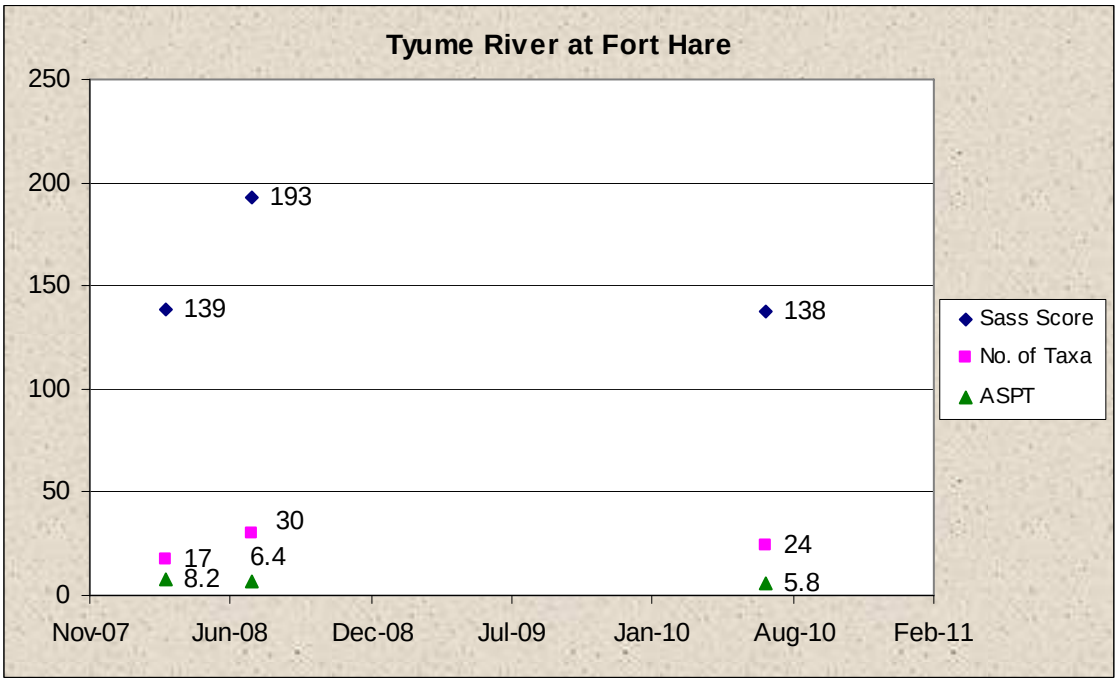


Figure 23: SASS 5 trends, start period march 2008 to July 2010.Trends indicates fluctuations between fair conditions, good and lately slightly poor. But on average ASPT is 6.8 (Good towards natural).

Fish assessment (Responses)

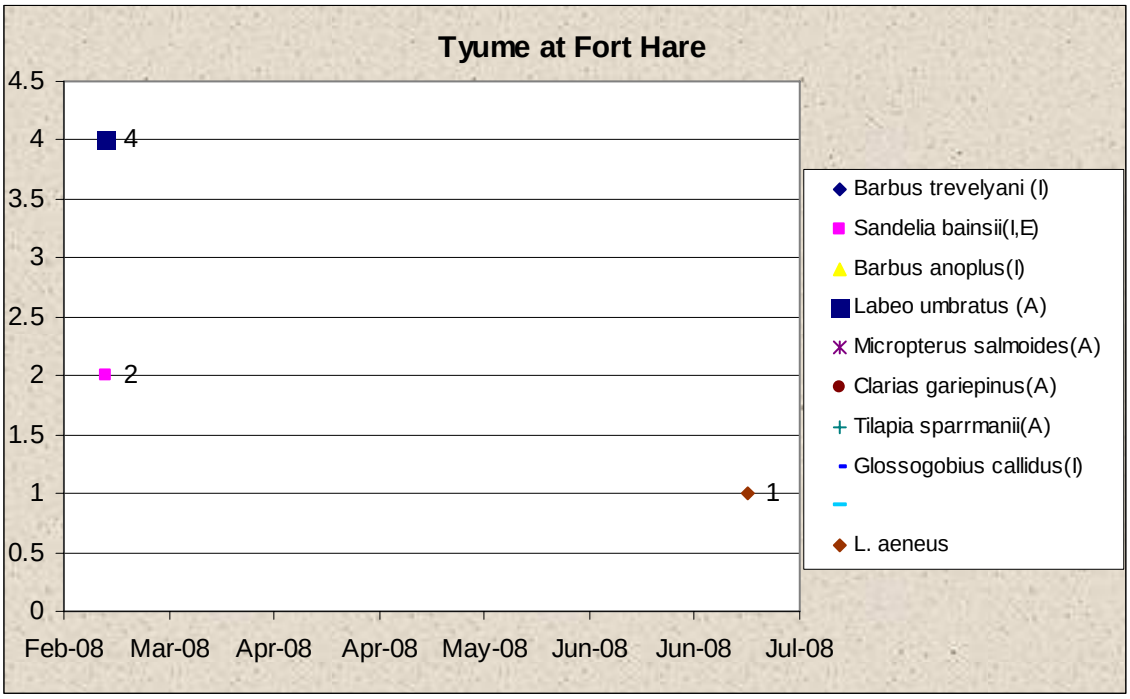


Figure 24: Fish assessment trends from March 2008 to July 2010.

Site Six:

Geomorphology (GAI): Co-driver component (middle reaches)

Site name: Keiskamma River below Amatole Water Treatment Works

No picture

Altitude: 511 masl.

Present Ecological Status: B/C

Water Quality trends: **(Co-driver component)**

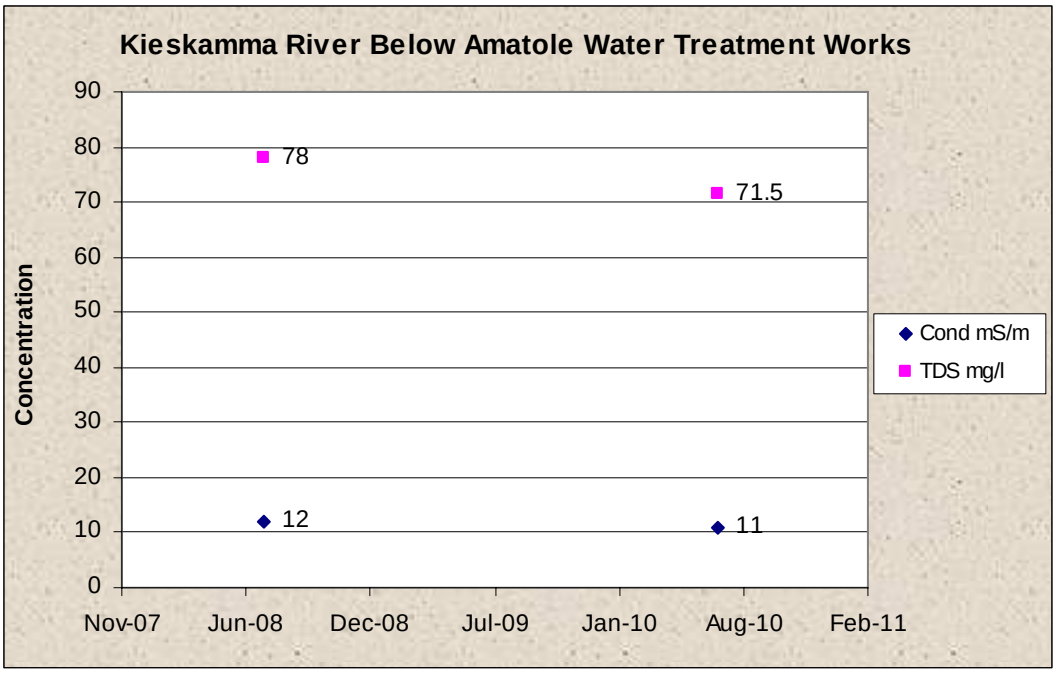


Figure 25: On site electrical conductivity and total dissolve inorganic salts trends from march 2008 to july 2010,over apperiod of two years.

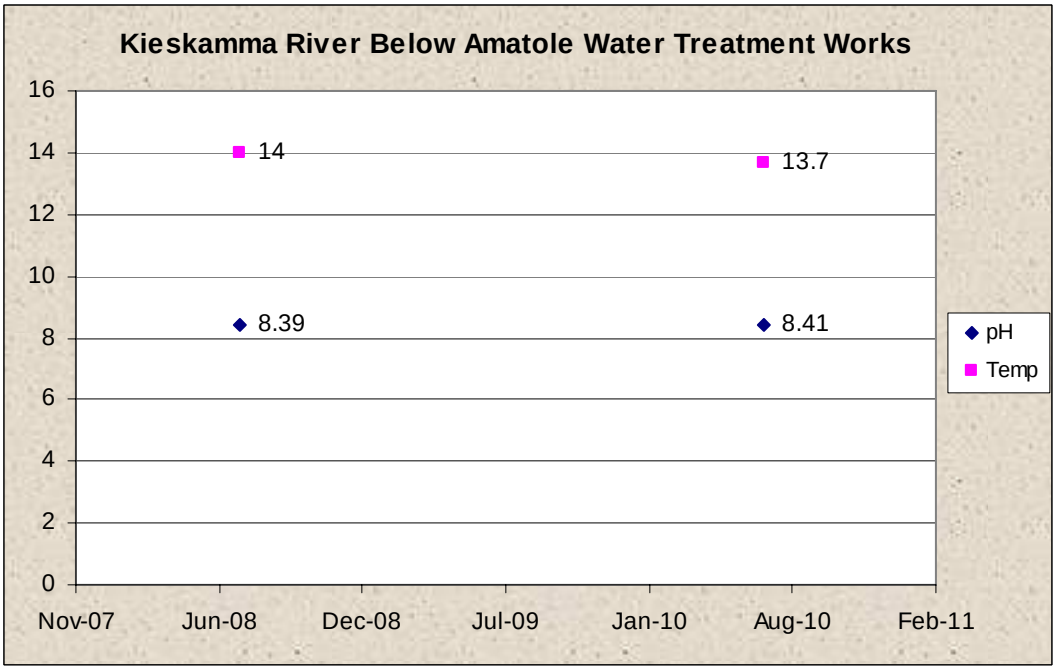


Figure 26: On site pH and temerature trends from march 2008 to july 2010,over apperiod of two years

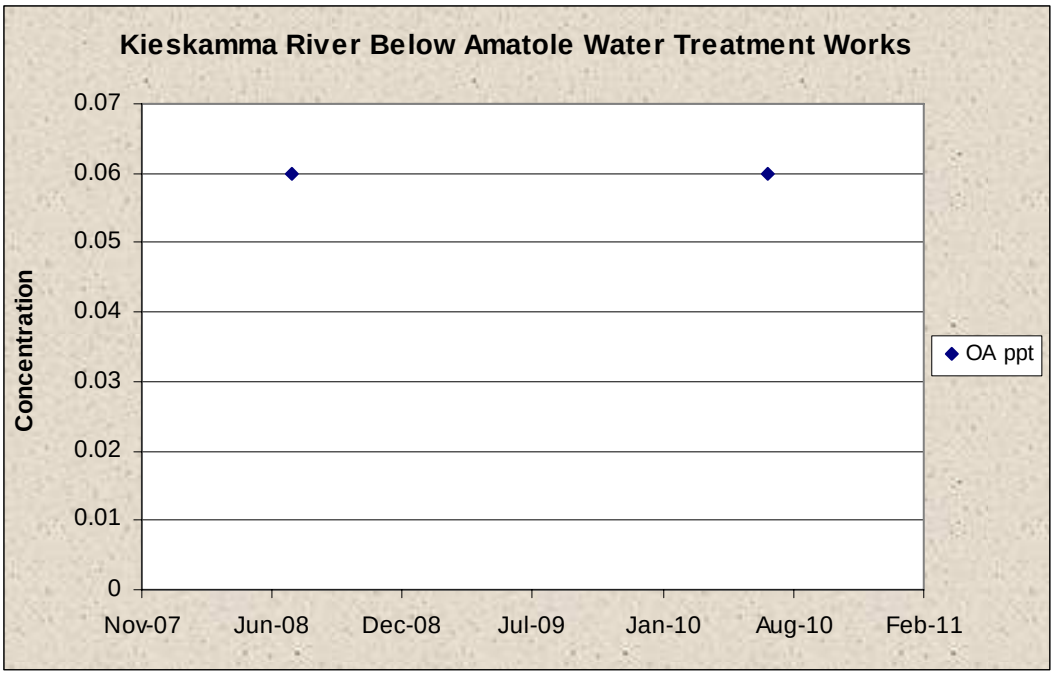


Figure 27: On site Oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

<u>Macro-Invertebrates trends (SASS 5):</u> (Response component)

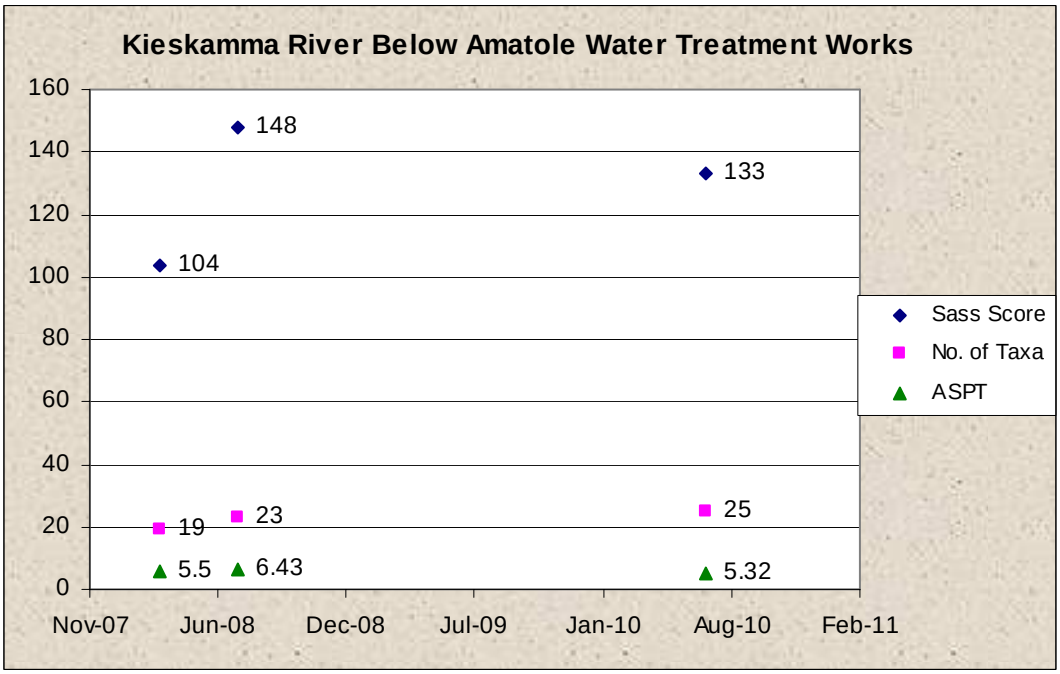


Figure 28: SASS 5 trends, start period march 2008 to July 2010.Trends indicates fluctuations between fair conditions, good and lately slightly poor. But on average ASPT is 5.75 (fair).

Fish assessment: (Response component)

Not assessed (no sampling site)

Site seven:

Geomorphology: Driver component (middle reaches)

Site name: Keiskamma River below R63 Bridge

Plate 7: Keiskamma River below R63 Bridge

Altitude: 433 masl.

Present Ecological Status: A/B

Water Quality trends: **(Co-driver component)**

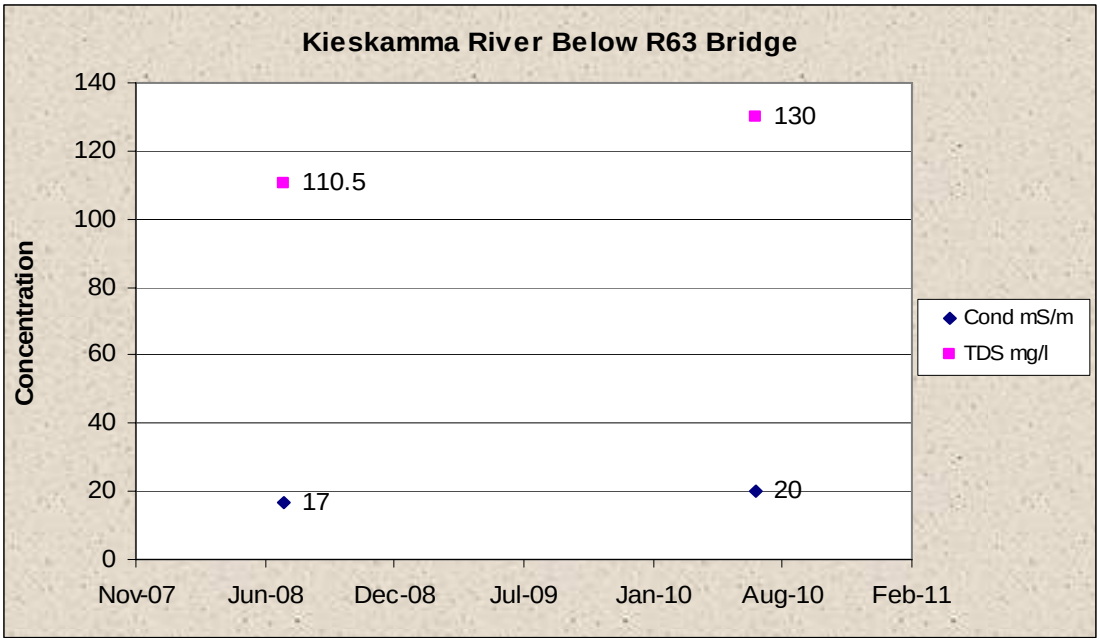


Figure 29: On site electrical conductivity and total dissolve inorganic salts trends from march 2008 to july 2010,over apperiod of two years.

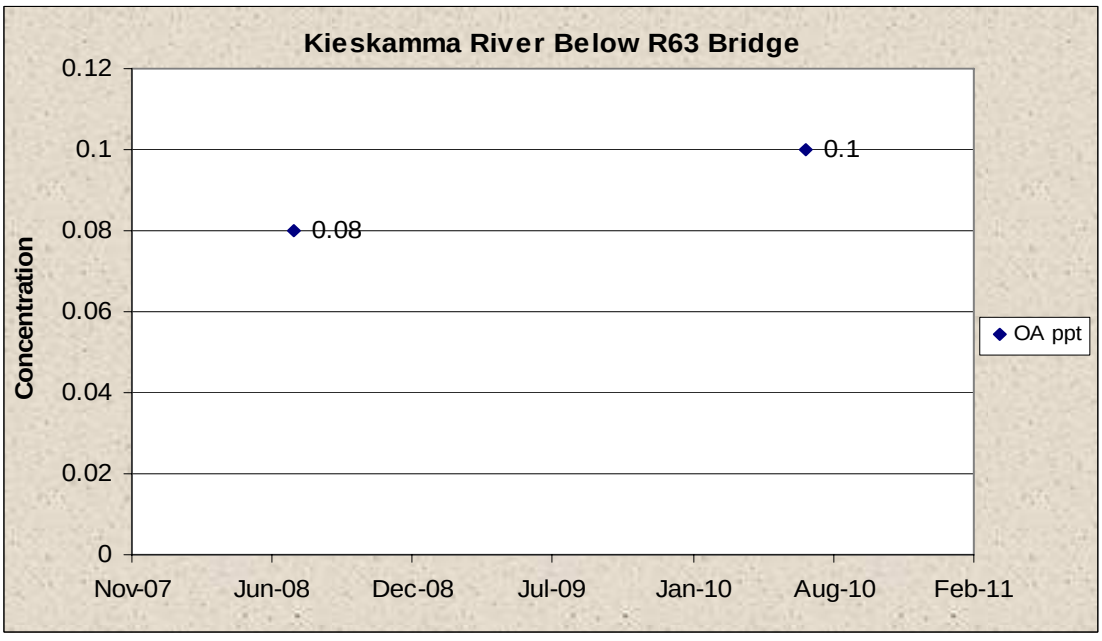


Figure 30: On site Oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

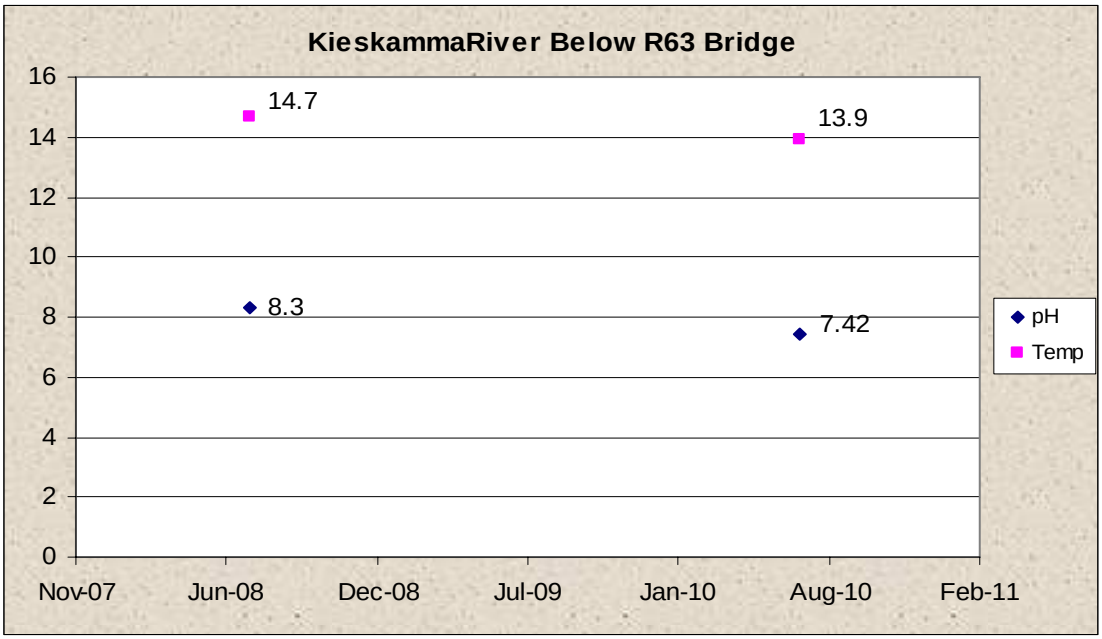


Figure 31: On site pH and temerature trends from march 2008 to july 2010,over apperiod of two years

<u>Macro-Invertebrates trends (SASS 5):</u> (Response component)

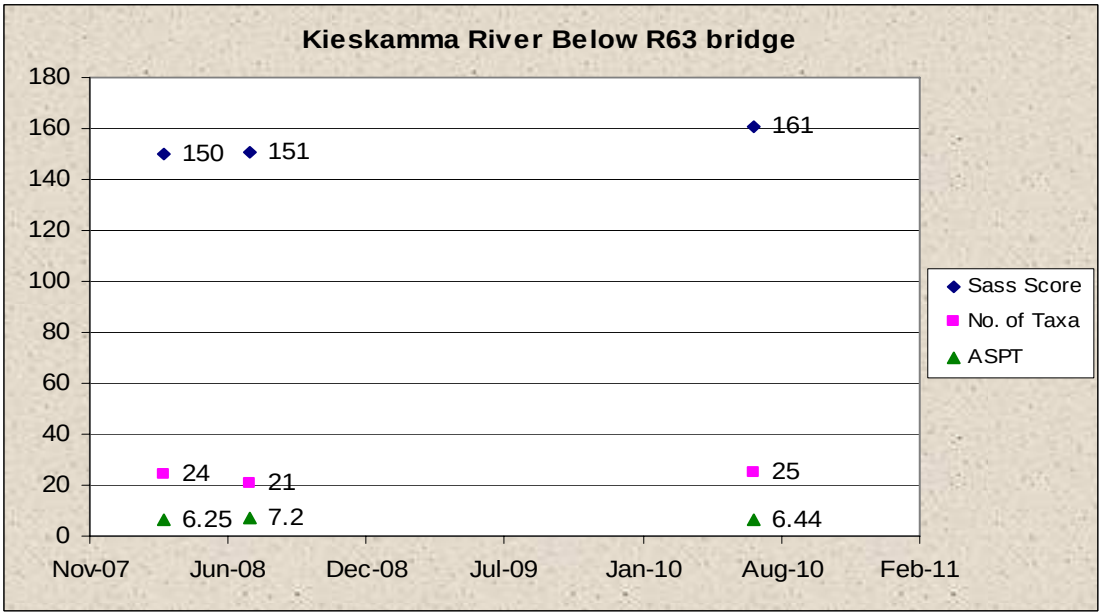


Figure 32: SASS 5 trends, start period march 2008 to July 2010.Trends indicates fluctuations between fair conditions, good and lately slightly poor. But on average ASPT is 6.63 (**good condition**).

Fish assessment: (Response component)

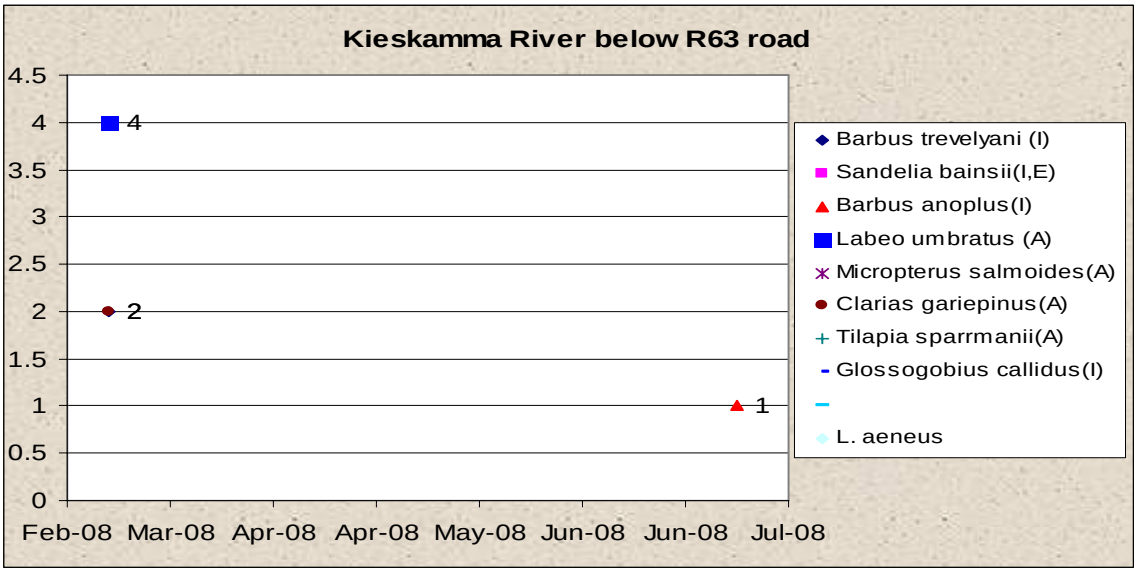


Figure 33: Fish assessment trends from March 2008 to July 2010

Site Eight:

Geomorphology: Driver component (middle reaches)

Site name: Tyume River before confluence with Keiskamma River

Plate 8: Tyume River before confluence with Keiskamma River

Altitude: 355 masl.

Present Ecological Status: A/B

Water Quality trends: **(Co-driver component)**

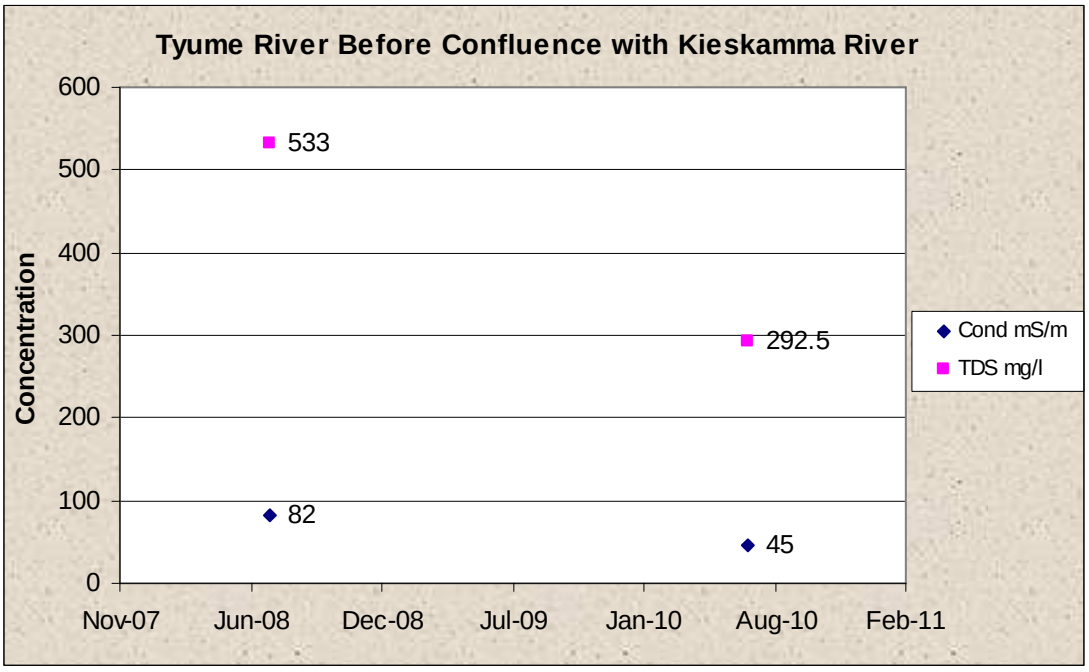


Figure 34: On site electrical conductivity and total dissolve inorganic salts trends from march 2008 to july 2010,over apperiod of two years.

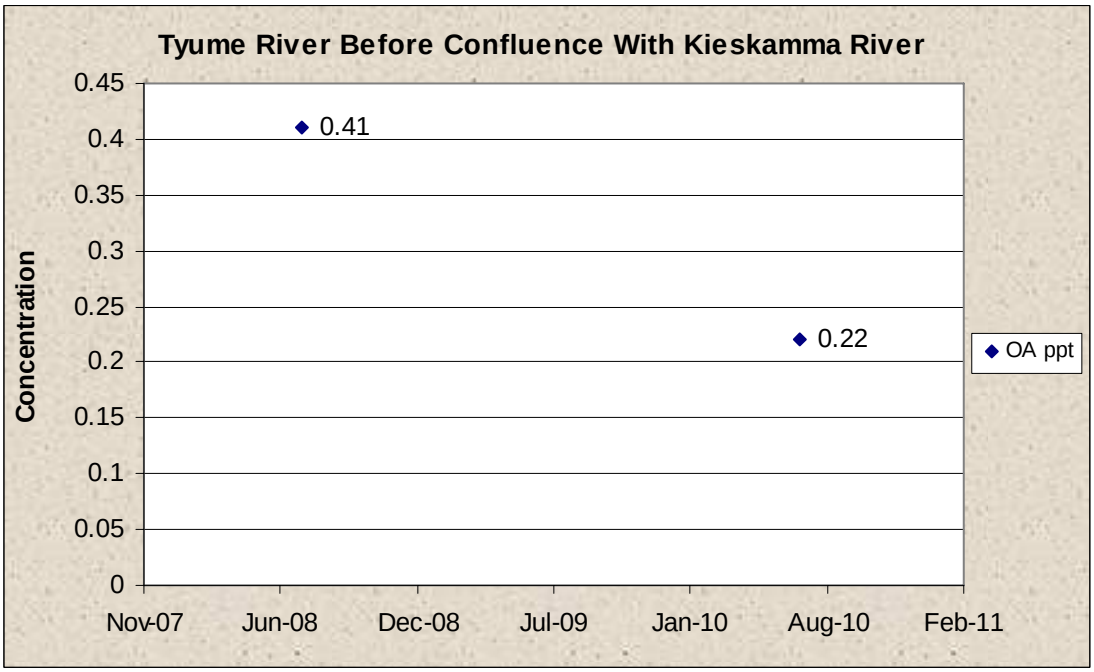


Figure 35: On site Oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

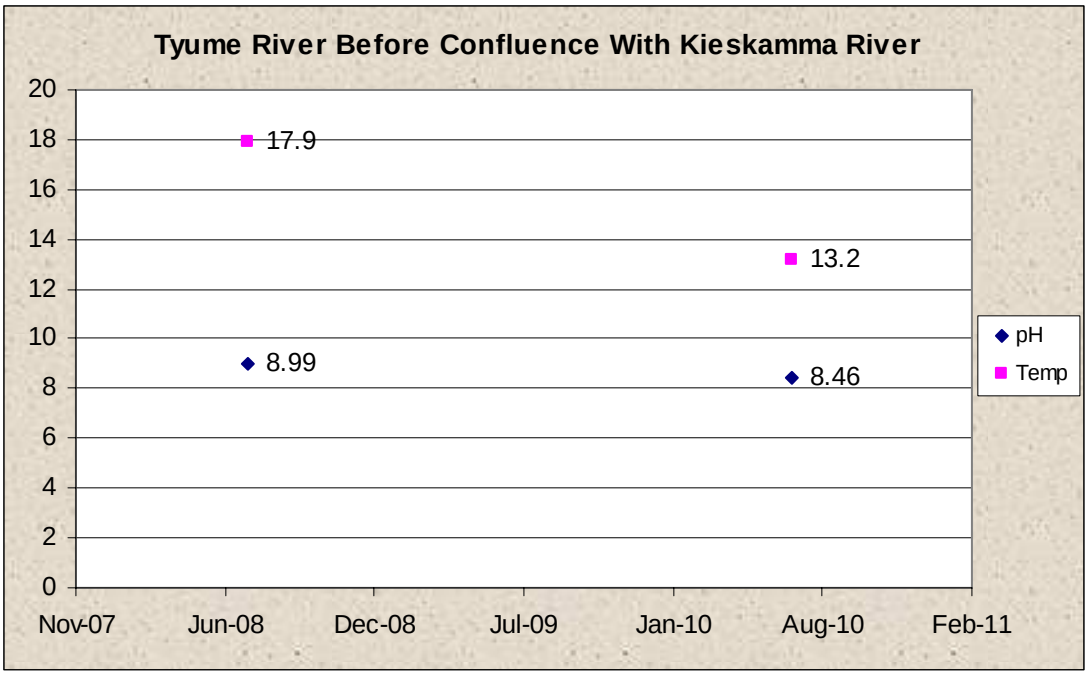


Figure 36: On site pH and temerature trends from march 2008 to july 2010,over apperiod of two years.

<u>Macro-Invertebrates trends (SASS 5):</u> (Response component)

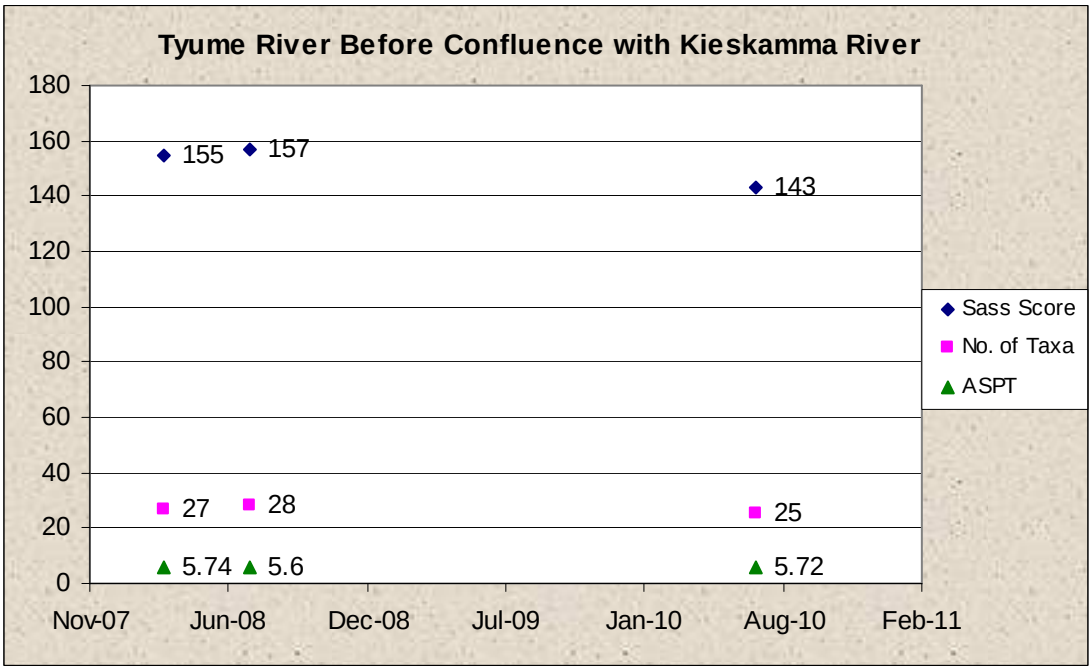


Figure 37: SASS 5 trends, start period march 2008 to July 2010.Trends indicates fluctuations between fair conditions, good and lately slightly poor. But on average ASPT is 5.69 (**fair condition**).

Fish assessment: (Response component)

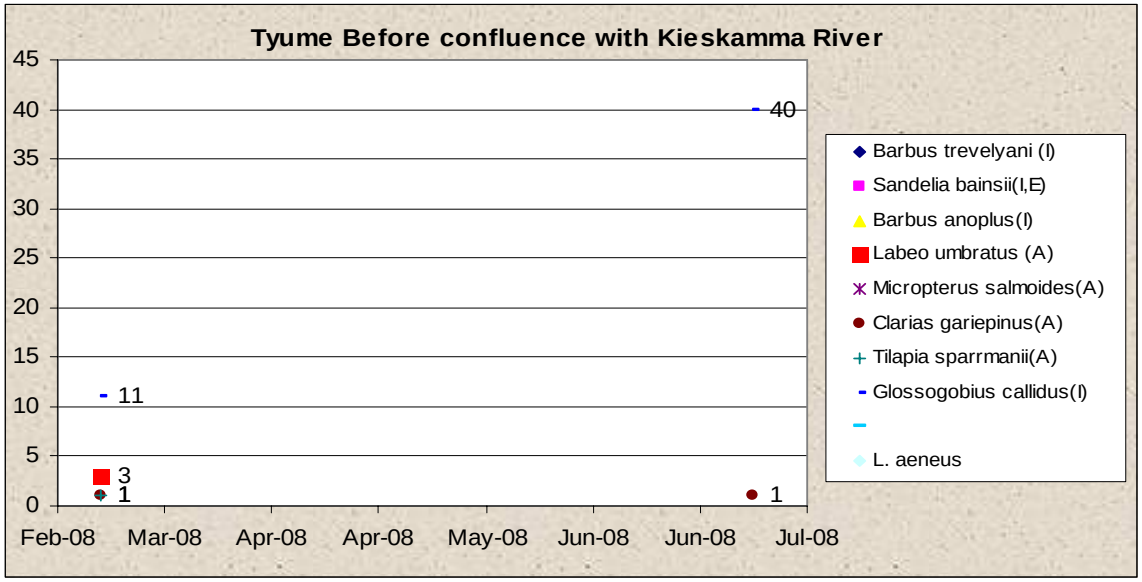


Figure 38: Fish assessment trends from March 2008 to July 2010

Site Nine:

Geomorphology: Driver component (middle reaches)

Site name: Keiskamma River at Gcinisa

Plate 9: Keiskamma River at Gcinisa

Altitude: 206 masl.
Present Ecological Status: B

Water Quality trends: **(Co-driver component)**

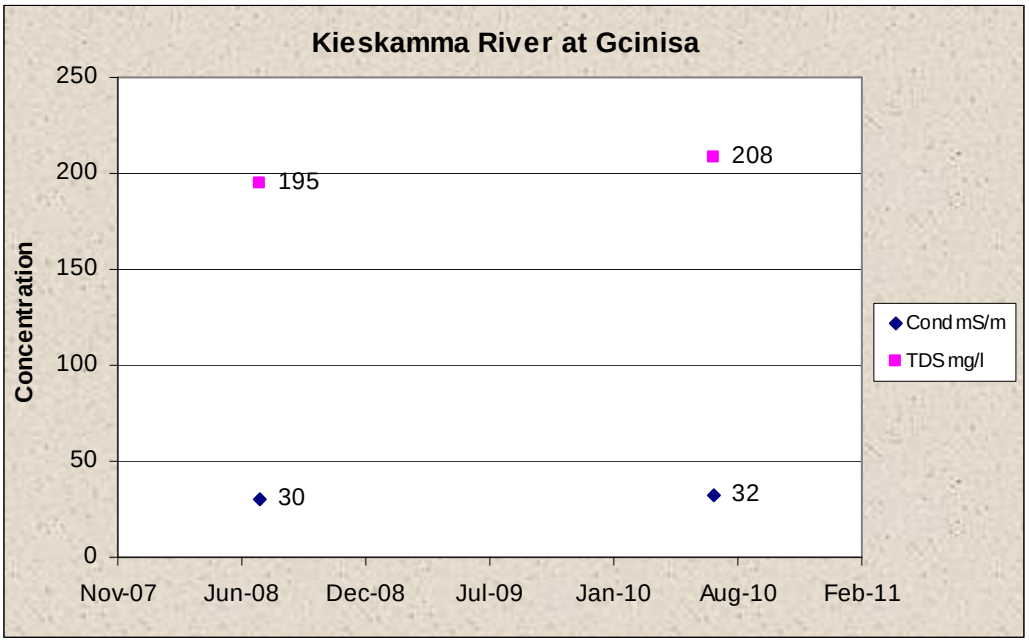


Figure 39: On site electrical conductivity and total dissolve inorganic salts trends from march 2008 to july 2010,over apperiod of two years.

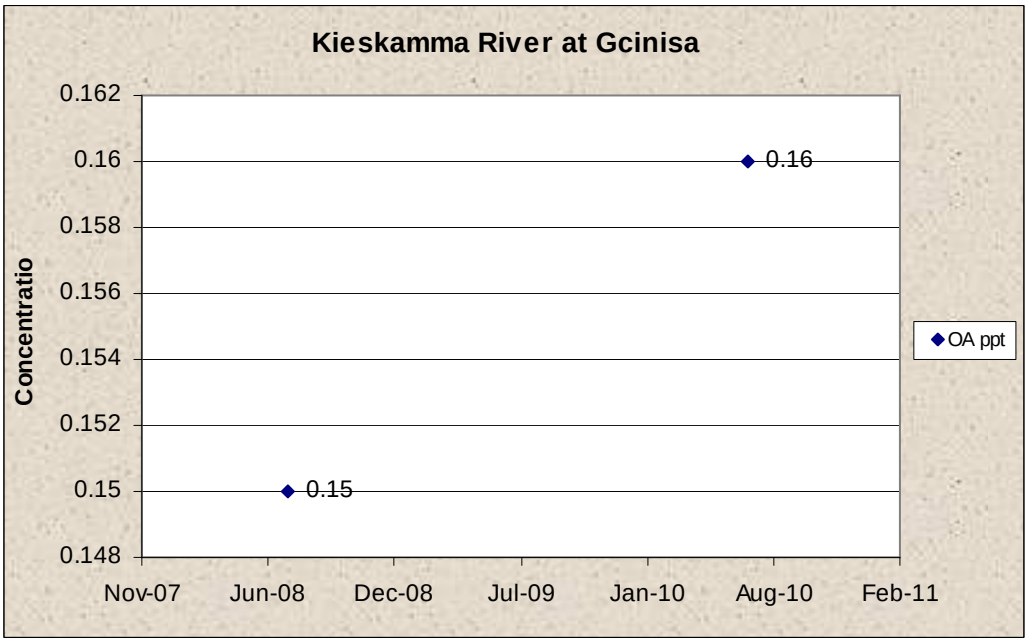


Figure 40: On site Oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

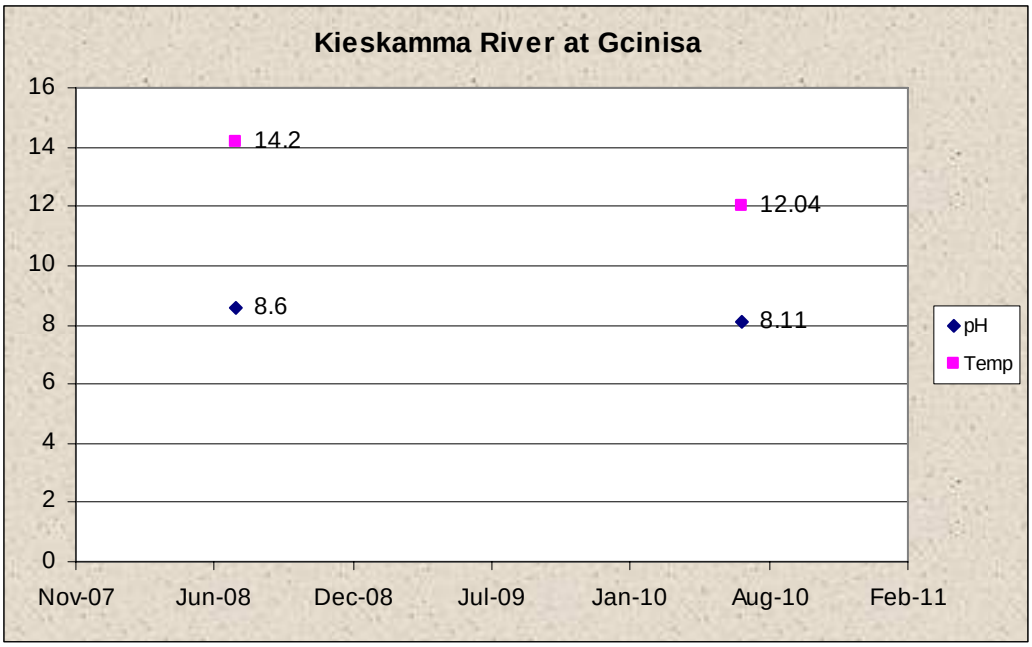


Figure 41: On site pH and temerature trends from march 2008 to july 2010,over apperiod of two years

<u>Macro-Invertebrates trends (SASS 5):</u> (Response component)

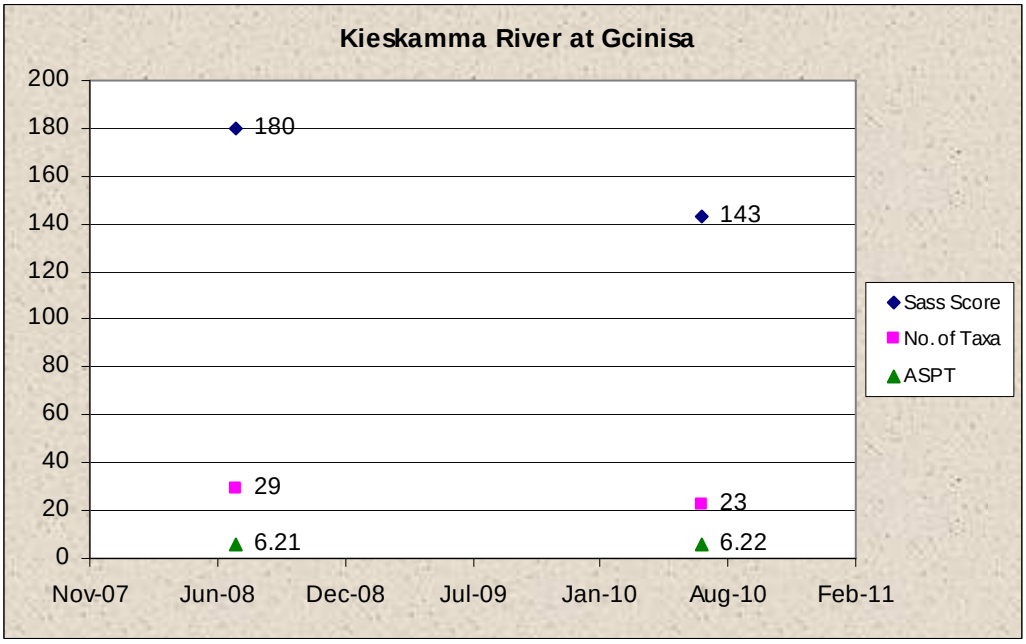


Figure 42: SASS 5 trends, start period march 2008 to July 2010.Trends indicates fluctuations between fair conditions, good and lately slightly poor. But on average ASPT is 6.215 (Good condition).

Fish assessment: (Response component)

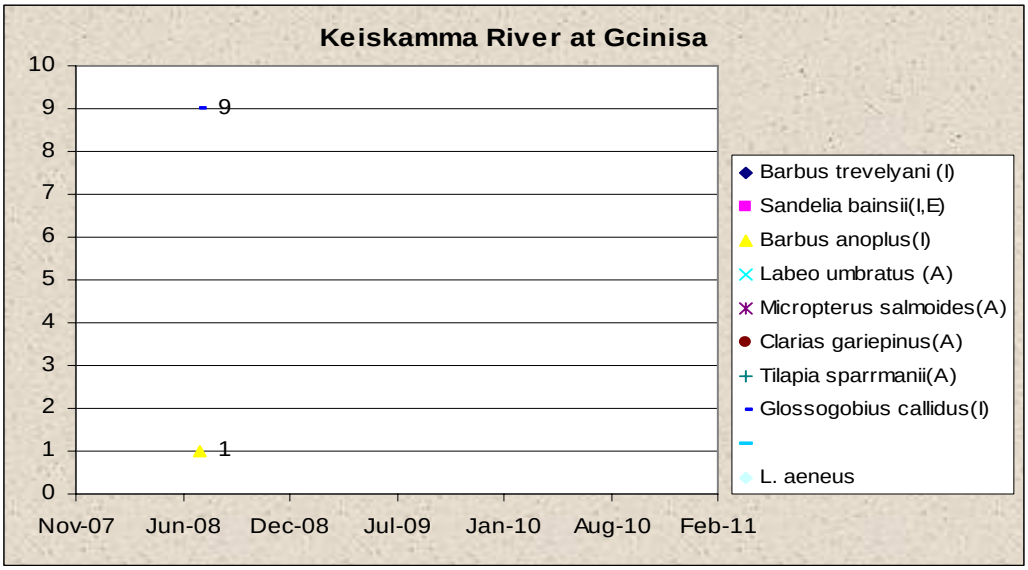


Figure 43: Fish assessment trends from March 2008 to July 2010

Site Ten:

Geomorphology: Driver component (middle reaches)

Site name: Keiskamma River above N2 Bridge

Plate 10: Keiskamma River above N2 Bridge

Altitude: 148 masl.

Present Ecological Status: A

Water Quality trends: **(Co-driver component)**

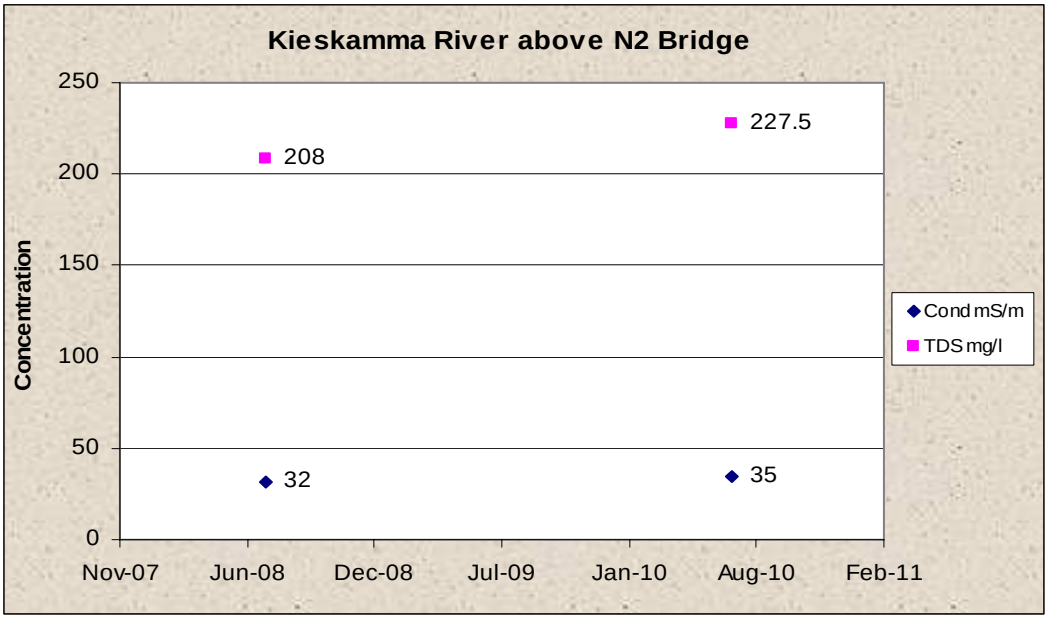


Figure 44: On site electrical conductivity and total dissolve inorganic salts trends from march 2008 to july 2010,over apperiod of two years.

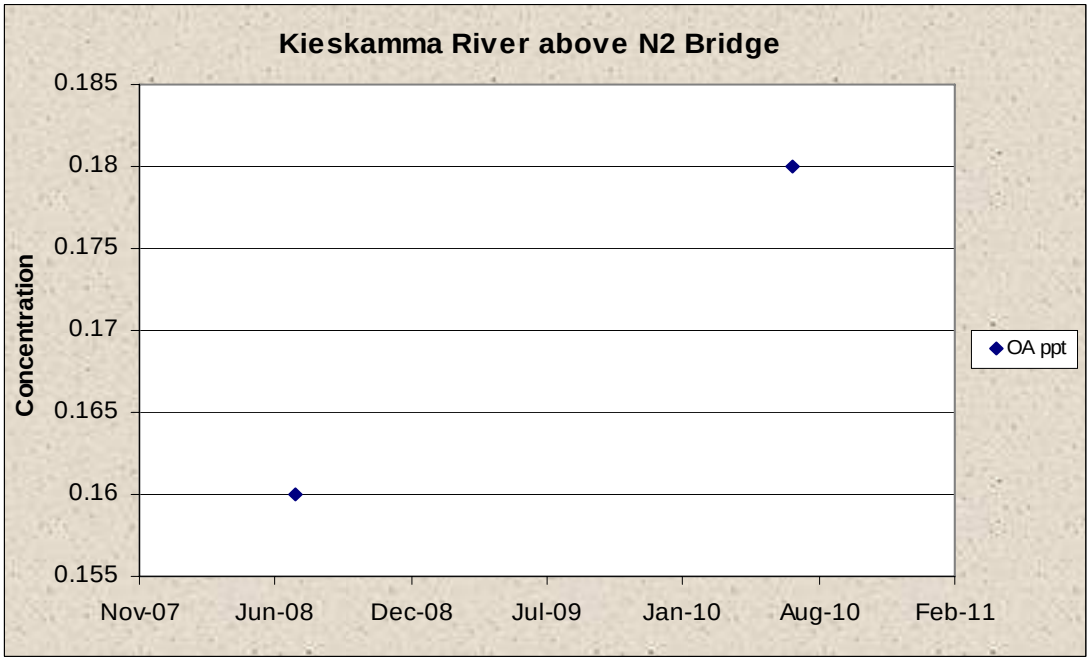


Figure 45: On site Oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

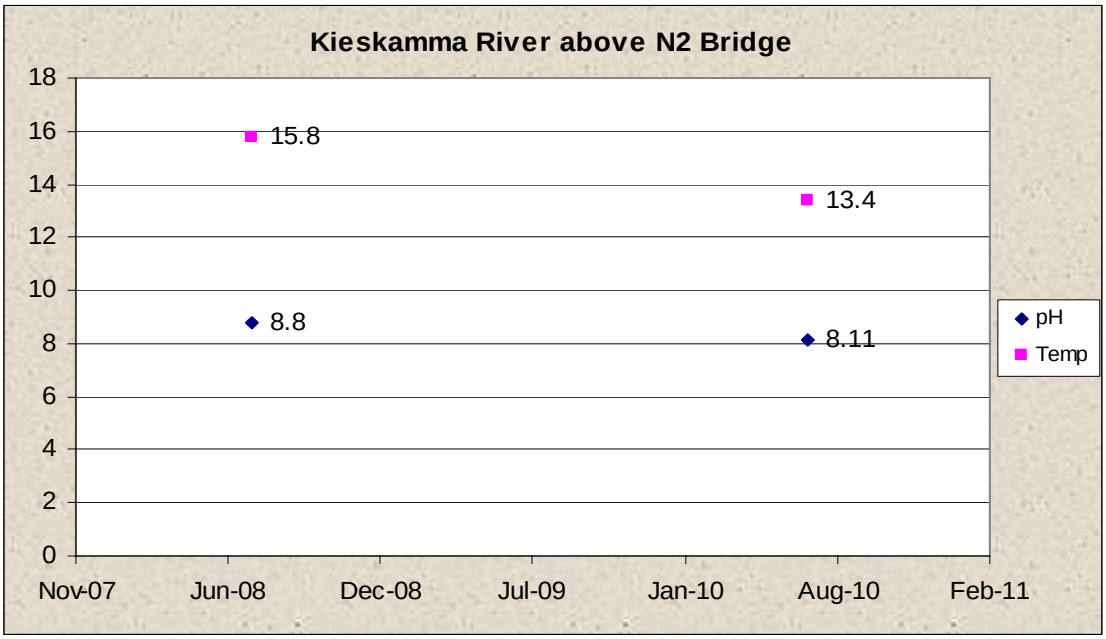


Figure 46: On site pH and temerature trends from march 2008 to july 2010,over apperiod of two years

<u>Macro-Invertebrates trends (SASS 5):</u> (Response component)

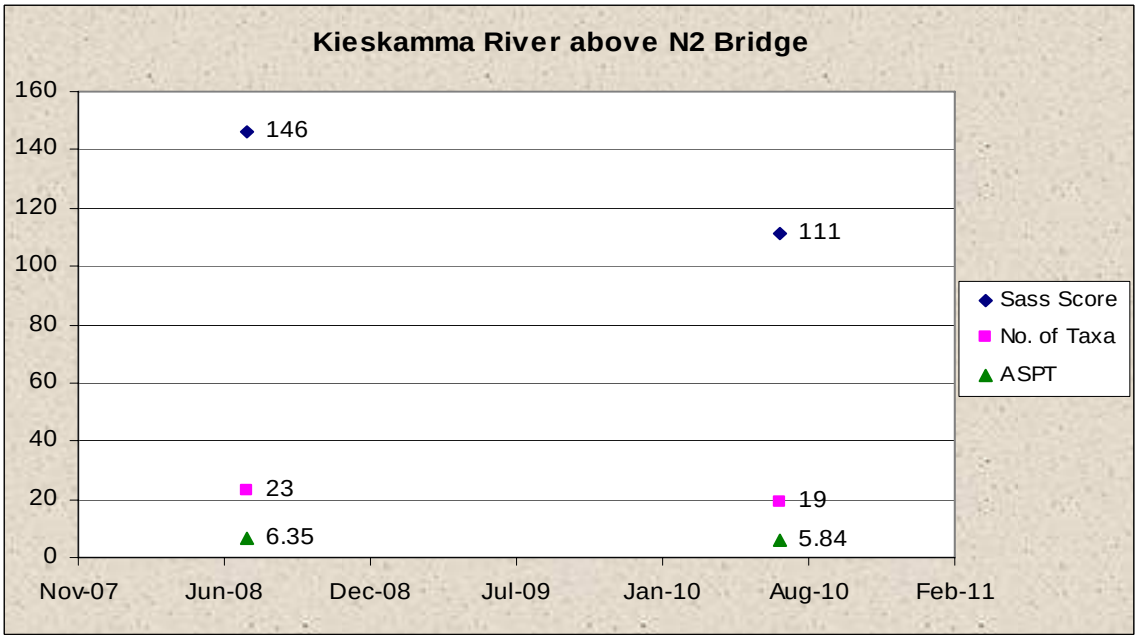


Figure 47: SASS 5 trends, start period march 2008 to July 2010.Trends indicates fluctuations between fair conditions, good and lately slightly poor. But on average ASPT is 6.1 (Good condition).

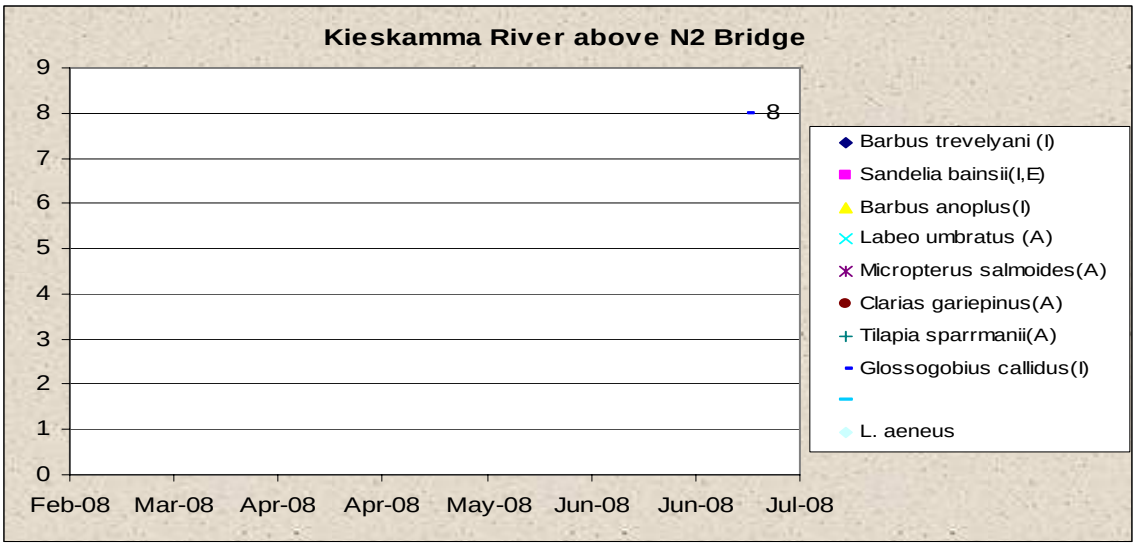


Figure 48: : Fish assessment trends from March 2008 to July 2010

Site Eleven:

Geomorphology: Driver component (middle reaches)

Site name: Keiskamma River above R72 road

Plate 11: Keiskamma River above R72 road

Altitude: 17masl.

Present Ecological Status: **A/B**

Water Quality trends: **(Co-driver component)**

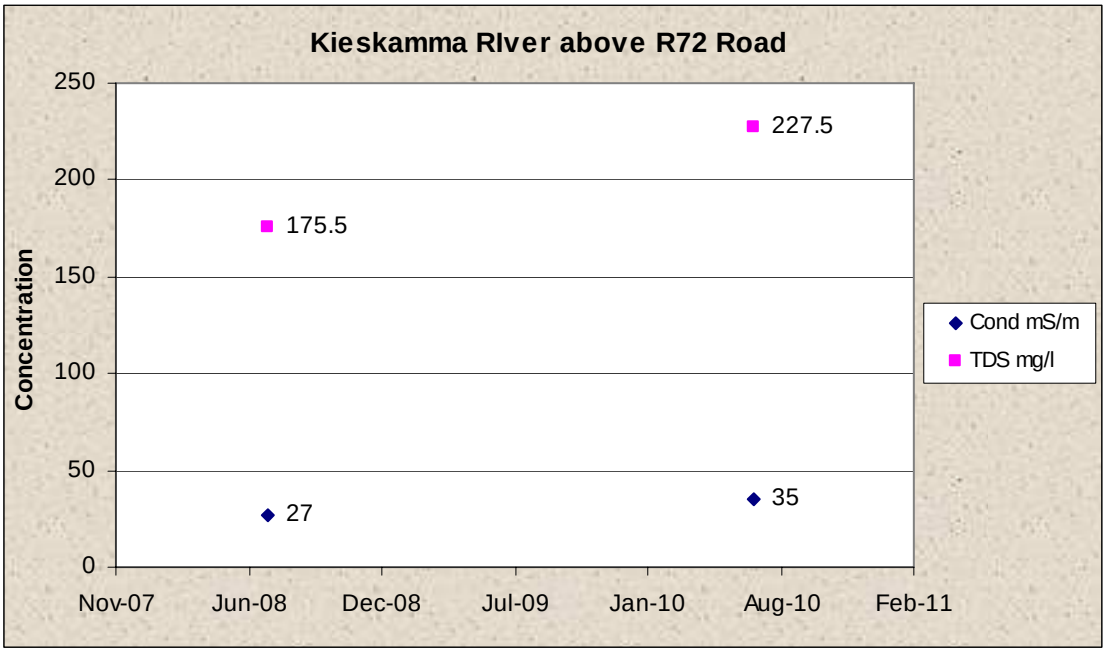


Figure 49: On site electrical conductivity and total dissolve inorganic salts trends from march 2008 to july 2010,over apperiod of two years.

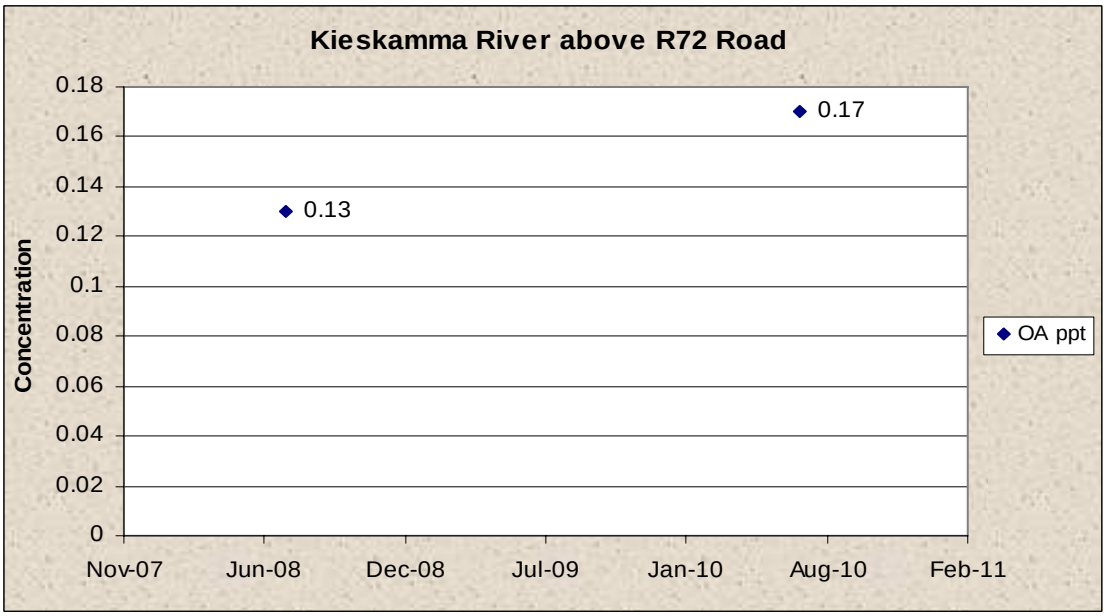


Figure 50: On site Oxygen absorbed trends from march 2008 to july 2010,over apperiod of two years.

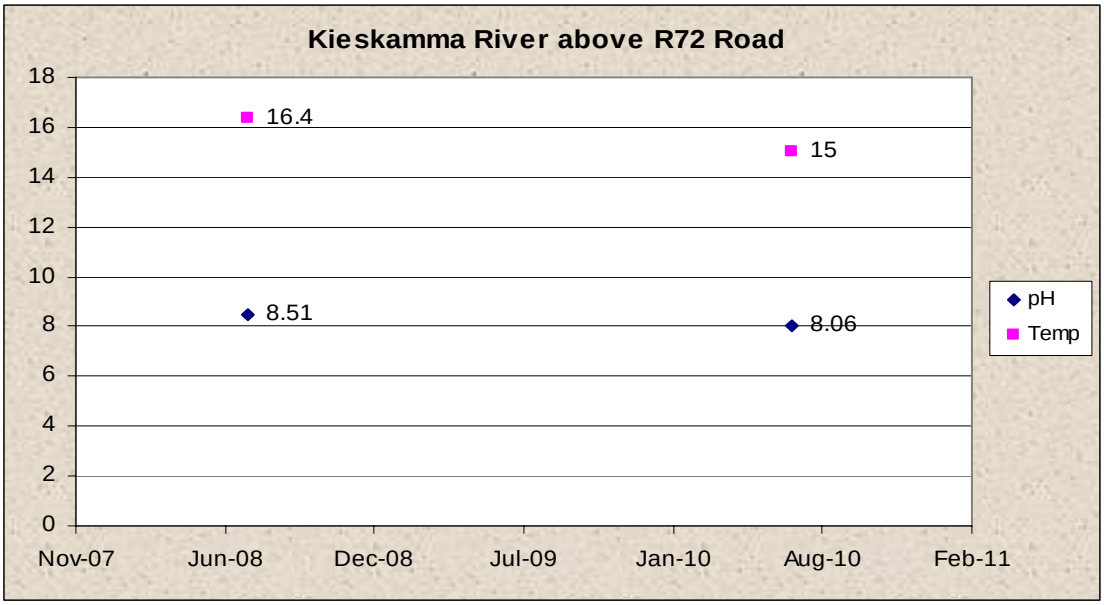


Figure 51: On site pH and temerature trends from march 2008 to july 2010,over apperiod of two years.

<u>Macro-Invertebrates trends (SASS 5):</u> (Response component)

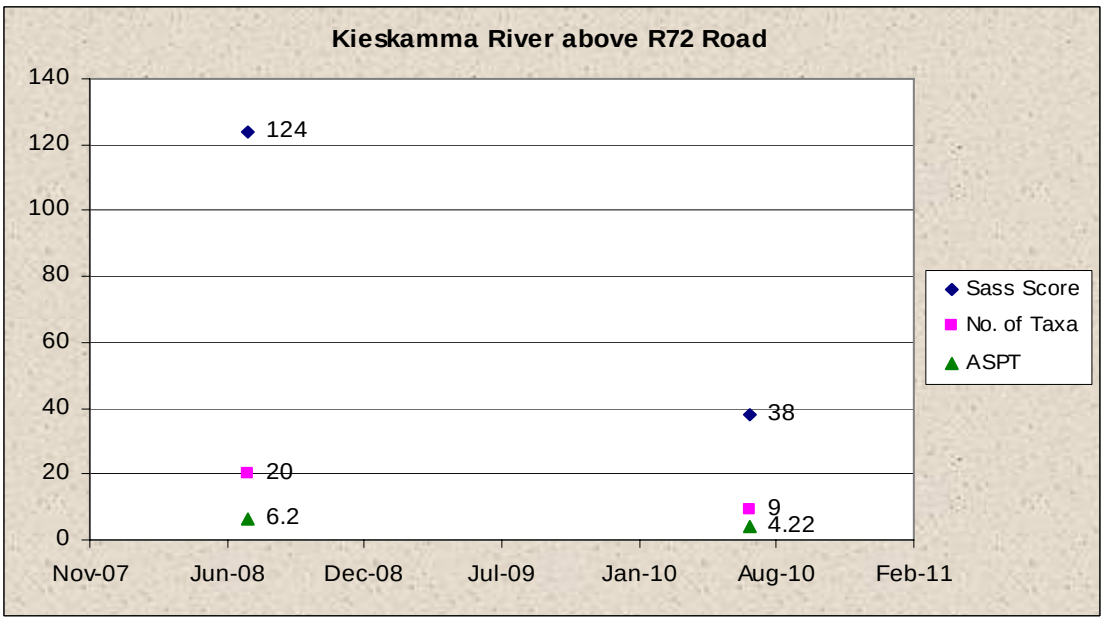


Figure 51: SASS 5 trends, start period march 2008 to July 2010.Trends indicates fluctuations between good and lately poor. But on average ASPT is 5.21 (Fair condition).

Fish assessment: (Response component)

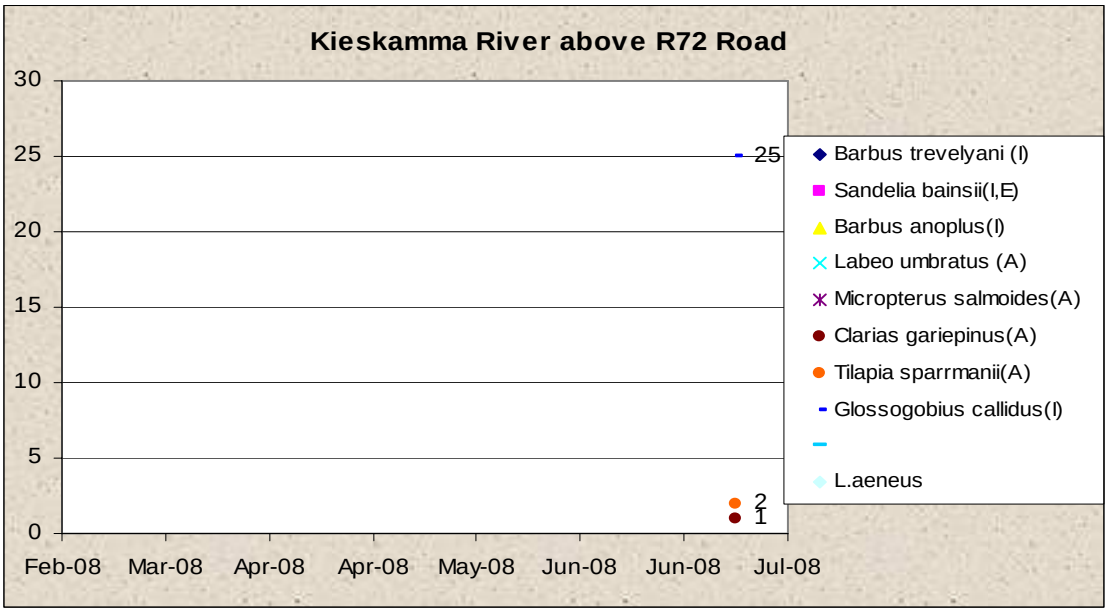


Figure 52: Fish assessment trends from March 2008 to July 2010

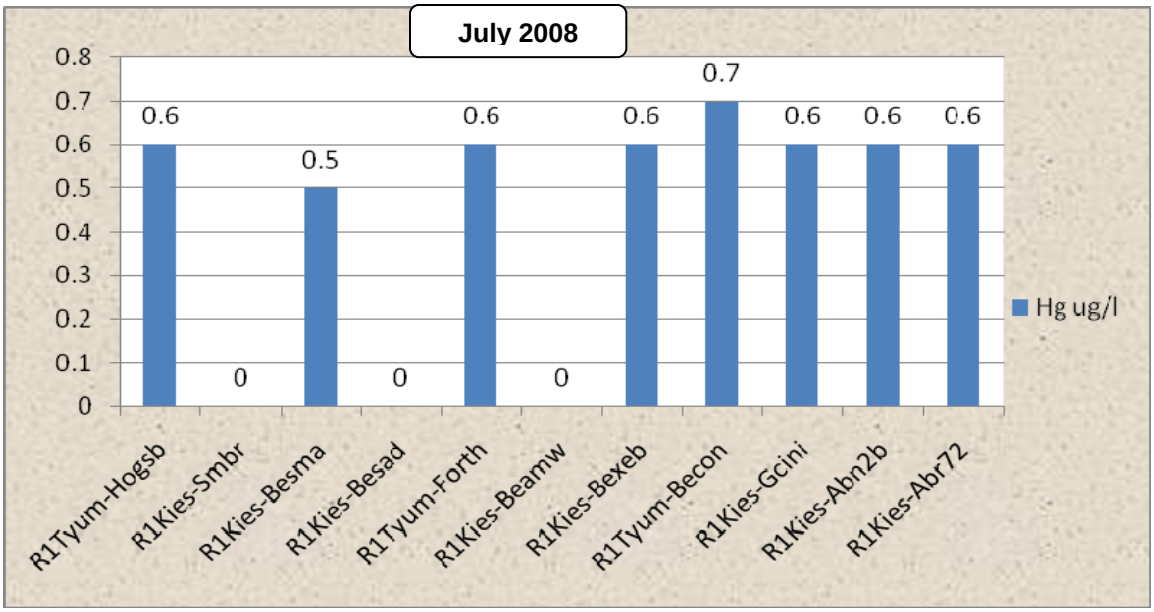


Figure 53: Figure 4: Mercury fluctuations from upper reaches to lower reaches, period July 2008 (Talbot & Talbot Laboratories).

TABLE 7: A summary of the Keiskamma River Basin survey (all assessed components assessed)

SITE	GEOMORHOLOGY : GAI	WATER QUALITY :TWQR	INVERTEBRATES (SASS5); Average	FISH :FAII	Topography
R1Tyum-Hogsb	A	C	Good/Natural	No site	Upper reaches
R1Kies-Smbr	B	C	Good	C	Upper reaches
R1Kies-Besma	B/C	C	Fair	B	Upper reaches
R1Kies-Besad	C	C	Fair	E	Upper reaches
R1Tyum-Forth	B/C	C	Good/Natural	D	Middle reaches
R1Kies-Beamw	B/C	C	Fair	No site	Upper reaches
R1Kies-Bexeb	A/B	C	Good	D	Middle reaches
R1Tyum-Becon	A/B	C/ NC	Fair	D	Middle reaches
R1Kies-Gcini	B	C	Good	Not done	Lower reaches
R1Kies-Abn2b	A	C	Fair	Not done	Lower reaches
R1Kies-Abr72	A/B	C	Fair	Not done	Lower reaches

Target Watery Quality Range

C = Compliance
NC = Non Compliance
C/ NC = some parameters in compliance some not.

Discussion

Upper reaches: The upper reaches have most biomonitoring sites (5 sites) than any other two topographic zones within the Keiskamma River basin and yet there is one site that sits at natural (A) in terms present ecological status using Geomorphological index assessment (GAI). Significant human impacts are evident below Sandile dam with PES (GAI) of C (lowest rating in this catchment). Fish assessment rating is also lowest with class rating of E (all fish caught here were alien). If one looks at both desktop and actual observed land use activities, the upper reaches are dominated by urban built of rural cluster formation, three water major dams (for water supply: refer to table 2), sand mining along the river banks, low water crossings and causeways, soil erosion, etc. There

may be one or two more catchment process that might have negatively contributed to these findings. Water quality results (both physiochemical and macro-invertebrates: SASS 5) have indicated similar trends with presence of mecury at some sites This was also the general observation for fish assessment, but with the highlights of finding an Eastern Cape rocky, ***Sandelia bainsii*** on three different sampling sites on the upper reaches (statistics was quite low and this raises some concerns about survival chances of this Red Listed fish species). Table 7 above also gives an overall summary of Keiskamma River basin survey. Although Eastern Cape is experiencing drought conditions, in general Keiskamma River upper reaches still have good dilution and buffering capacity in terms of water quality.

Middle reaches: Three biomonitoring sites were selected and surveyed in the middle reaches and this topographic zone (drought corridor) is characterized by urban built up consisting of a wide rural cluster and dense formal/town settlements (Alice, Fort Hare). This section boasts huge agricultural activities originating from Fort Hare University. The middle reaches are also characterized by extensive land cover of degraded unimproved natural grasslands. In terms of present Geomorphological state, the Tyume river site at Fort Hare has suffered more man made land transformation as a result of sand mining activities that took place on the riparian area. On site and Talbot & Talbot physiochemical analysis indicates further water quality deterioration and this could be linked to agricultural activities at Fort Hare, sand mining and brick making activities nearby. Interestingly enough water quality using macro invertebrates indicates an overall improvement in terms of aquatic ecosystem health. Fish assessment indicates presence of Sandelia bainsii which is both indigenous and endemic to Eastern Cape, but due to dominant alien fish population the site was rated D, poor. In terms of physiochemical analysis (water quality),Tyume before confluence with Keiskamma River is the worst affected site in the Keiskamma River basin, this is due to upstream human activities from Alice, fort Hare and rural settlements. The activities would primarily include sewage treatment plants, agricultural activities. The dilution and buffering capacity is further reduced low rain fall (drought corridor) nature of this river reach.

Lower Reaches: Geomorphology in the lower reaches indicates good recovery, but down stream physiochemical analysis indicates further decline in water quality (refer to graphs above), this is also confirmed by SASS 5 rating (refer to table 7 above) Fish data is not available for the lower reaches. Previously it was due to high flows and equipment failure. On average water quality chemistry complies with DWA TWQR.

Conclusion & Recommendations

Hydrological information is required to generate more useful information towards setting of resource quality objectives.
More sites could be selected in the middle reaches to give a more balanced account catchment processes that have not been accounted for.

In terms water quality Keiskamma River system still have good buffering capacity in the upper reaches, but middle and lower reaches are slowly losing this dilution and buffering

capacity, particularly during extended drought conditions. There is also concern of wide occurrences of mercury in most of surveyed sites.

Presence of Sandelia bainsii needs to be red flagged to interested and affected parties and hopefully a plan to ensure its continued survival can be found.

It is very difficult to find reference conditions (site) for this catchment. . One site that was identified four to five years ago is non perennial, even during wet or transitional seasons it is difficult to do biomonitoring (flows very low).

Lastly, Eco Status was not done due to lack of in-house expertise.

<u>On training needs</u>

Eastern Cape biomonitoring team has come a long way since the implementation of River Health Programme in this region and has a great potential as far as producing high quality mini technical report. DWA Eastern Cape region also has four accredited SASS 5 practitioners (two based in WMA 15 and the other two based in WMA 12).

Some of the gaps identified are as follows:

1. Index of Habitat Integrity and Eco Status modeling.
2. Need more Geomorphologists or increase internal capacity.
3. Hydrological modeling.
4. Riparian vegetation training.
5. Report writing skills, need a standard template seasonal biomonitoring reporting, trends or mini technical reporting.

RQS could come into assistance in two or three of the above training needs.