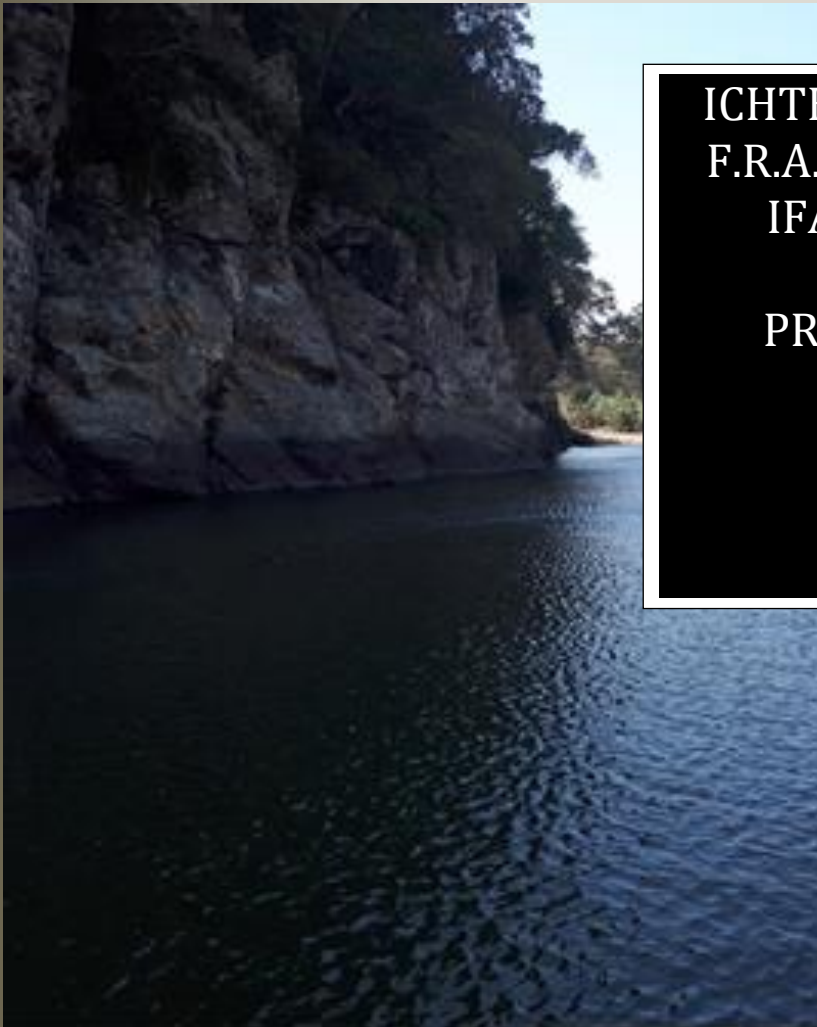


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**ICHTHYOFAUNAL SURVEY AND
F.R.A.I.* FOR THE IFafa RIVER,
IFafa, KWAZULU-NATAL**

**PROPOSED SAND MINING
OPERATION**

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*Fish Response Assessment Index

**ICHTHYOFAUNAL SURVEY AND F.R.A.I. FOR THE IFAFA RIVER, IFAFA,
KWAZULU-NATAL**

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1. INTRODUCTION

SDP Ecological and Environmental Services were approached to undertake an ichthyological survey of a portion of the Ifafa River, just upstream of the bridge that serves the N2 freeway (Figure 1). The findings reported herein will inform an application for a water use license and mining permit for the removal of sand from the identified reach of the river.

The section of the Ifafa River is approximately 14 km in length (DWS 2015). According to the Desktop Present Ecological Status (PES) data from the Department of Water and Sanitation (DWS) (2012), the river reach in question has a PES score of "B" and is considered to be largely natural.

The purpose of this survey is to provide an indication of the ichthyofaunal community present within the affected section of river, with a focus on identifying species that undertake migrations between river reaches and are prevalent generally within the general catchment. Potential impacts on such species are identified and mitigation measures in respect of the mining operations proposed. This ichthyological survey was a once off survey and an assessment undertaken during a spring period when river flow was low.

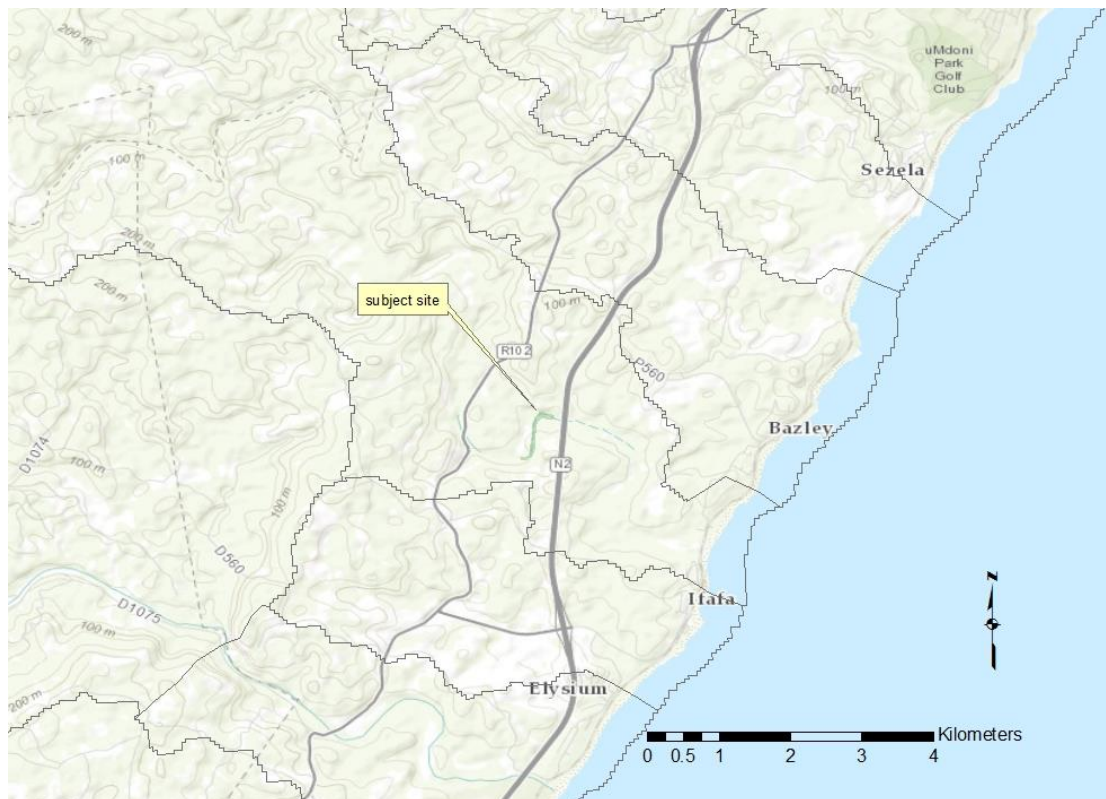


Figure 1. Map indicating subject site within the lower reaches of the iFafa River

2. METHODS

Sampling at the subject site was undertaken on 11th September 2019. A 60m stretch of river was sampled for a period of 40 mins, working upstream (Figure 2). Fish were sampled using a SAMUS 725MS electro-fisher (F: 75 L: 1.50). This ichthyological survey was a once off survey and assessment undertaken during a spring period when river flow was low. The section of river was observed to be severely affected by sedimentation. Sampling was thus limited to areas with sufficient depth and suitable habitat.



Fig 2. Google Earth image indicating the section of river that was sampled

Captured fish were identified to species level, quantified and released. The data was analyzed using the Fish Response Assessment Index (FRAI), Kleynhans (2008). By comparing the expected fish species (reference condition) with those captured at each of the sites as well as the nature of the

habitat (and ecosystem drivers/metrics) at each site, the index serves to provide an estimate of the river reach PES or Ecological Category (EC) as indicated in Table 1. Reference frequency of occurrence data was determined from existing sample data obtained from the upper DWS sample site on the U80G.

Table 1. PES/Ecostatus ratings for river systems (Kleynhans et. al. 2005)

Rating	Description of river system
<i>A</i>	Unmodified, natural.
<i>B</i>	Largely natural. A slight change in ecological processes is discernible but the system remains largely intact.
<i>C</i>	Moderately modified. A moderate change in ecological processes has taken place but the system remains predominantly intact.
<i>D</i>	Largely modified. A large change in ecological processes has occurred and the system is appreciably altered.
<i>E</i>	Greatly modified. The change in ecological processes is great but some features are still recognizable.
<i>F</i>	Modifications have reached a critical level. Geomorphic processes have been modified completely.

3. RESULTS AND DISCUSSION

The sample data and evaluation are presented below.

3.1 Reference FROC

The species list, from which the reference frequency of occurrence (FROC) was determined, was obtained using existing data from the Fafa River site U80G 05097 (DWS 2012). Kleynhans et. al (2008) provides FROC data for similar South Coast Rivers, but unfortunately not the Ifafa River. Table 2 below provides a list of the fish species captured at the single DWS (2012) sample site.

Table 2. Sample data from Fafa River (DWS 2012)

Species	Fafa River U80G 05097
<i>Enteromius viviparus</i>	1
<i>Pseudocrenilabrus philander</i>	1
No. sp.	2
Reference	DWS (2012)
River System	iFafa

Table 3. Reference species

Species	Common Name	FROC
<i>Anguilla marmorata</i>	Madagascar mottled eel	2
<i>Anguilla mossambica</i>	Longfin eel	2
<i>Awaous aeneofuscus</i>	Freshwater goby	2
<i>Clarias gariepinus</i>	Sharptooth catfish	4
<i>Enteromius viviparus</i>	Bowstripe barb	3
<i>Glossogobius callidus</i>	River goby	2
<i>Labeobarbus natalensis</i>	Kwazulu-Natal yellowfish	3
<i>Myxus capensis</i>	Freshwater mullet	4
<i>Oreochromis mossambicus</i>	Mozambique tilapia	3
<i>Pseudocrenilabrus philander</i>	Southern mouthbopper	2

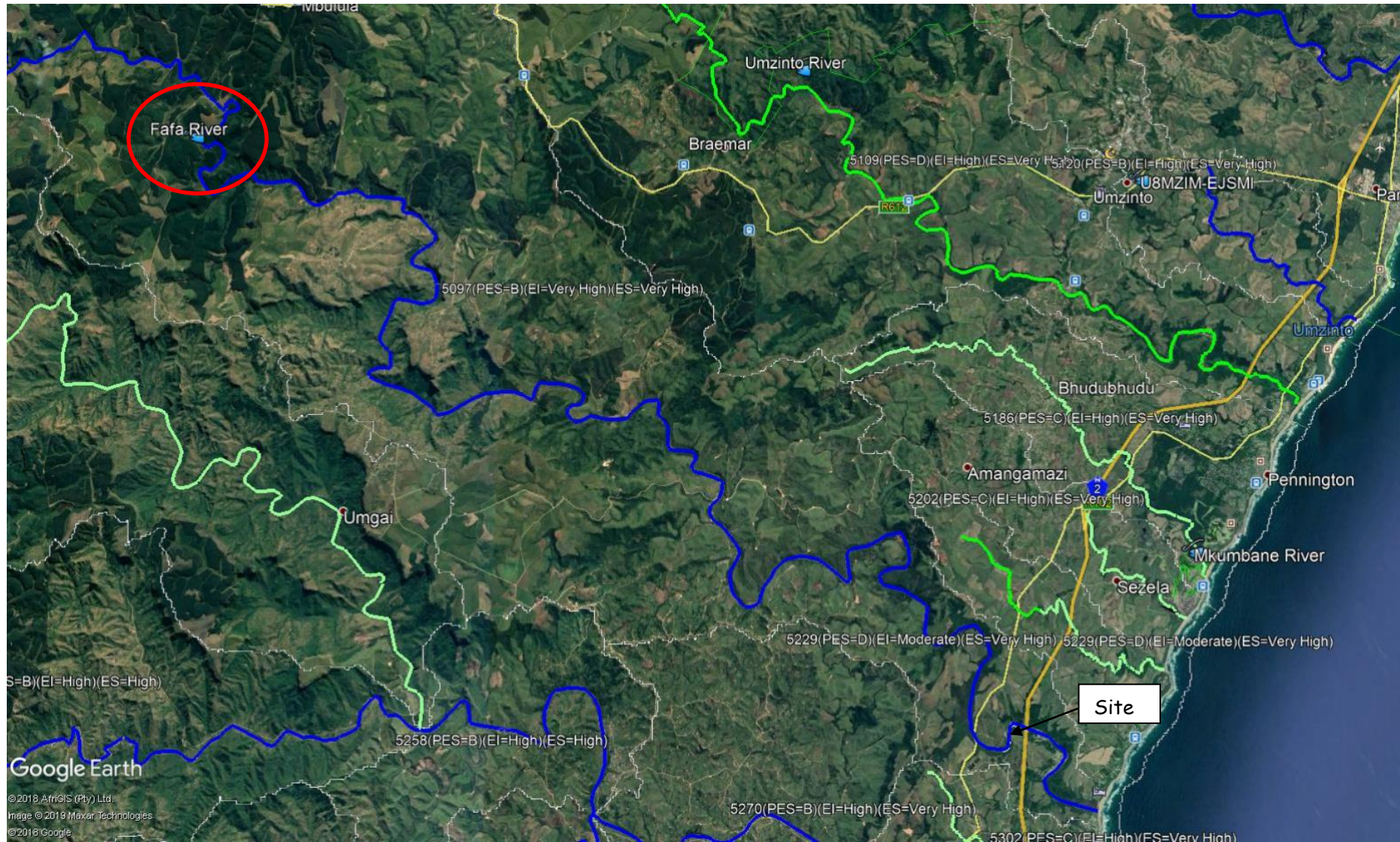


Figure 3. The location of the DWS (2012) sample site on the Ifafa River. The site is located in the upper catchment, relative to the sand mining site, which is situated immediately upstream of the estuary and N2 highway.

3.2 Sample Data

The following results were obtained from the sampling regimen employed at site.

Table 4. Fish species captured during sampling.

Species	Ifafa River
<i>Myxus capensis</i>	>30
<i>Micropterus salmoides</i>	6
<i>Oreochromis mossambicus</i>	1
<i>Pseudocrenilabrus philander</i>	1
No. sp.	4
Total	>38

O. mossambicus and *P. philander* (Figure 4) were noted to be present within the system while, *M. capensis* (Figure 5) was considered to be common and its prevalence is associated with the proximity of the iFafa estuary. Also noted in the system is *M. salmoides*, the large mouth bass (Figure 6), an exotic and invasive species.



Figure 4. *Pseudocrenilabrus philander* located on site



Figure 5. *M. capensis* were common within the sample site



Figure 6. *M. salmoides* an exotic species identified within the system

3.3 Fish Response Assessment Index (FRAI) model

The FRAI is an assessment index based on the environmental intolerances and preferences of the reference fish assemblage and the response of the constituent species of the assemblage to particular groups of environmental determinants or drivers (Kleynhans 2008) Table 1 indicates the

Table 1. Reference ecological category for site

AUTOMATED	
FRAI (%)	38,1
EC: FRAI	D/E
ADJUSTED	
FRAI (%)	38,1
EC: FRAI	D/E

Table 2 Reference species

ABBREVIATIONS: REFERENCE SPECIES (INTRODUCED SPECIES EXCLUDED)	SCIENTIFIC NAMES: REFERENCE SPECIES (INTRODUCED SPECIES EXCLUDED)	REFERENCE FREQUENCY OF OCCURRENCE	EC:OBSERVED & HABITAT DERIVED FREQUENCY OF OCCURRENCE
AMAR	ANGUILLA MARMORATA QUOY & GAIMARD 1824	2,00	0,00
AMOS	ANGUILLA MOSSAMBICA PETERS 1852	2,00	0,00
AAEN	AWAOUS AENEOFUSCUS (PETERS 1852)	2,00	0,00
CGAR	CLARIAS GARIEPINUS (BURCHELL, 1822)	4,00	0,00
BVIV	BARBUS VIVIPARUS WEBER, 1897	3,00	0,00
GCAL	GLOSSOGOBIUS CALLIDUS SMITH, 1937	2,00	0,00
BNAT	BARBUS NATALENSIS CASTELNAU, 1861	3,00	2,00
MCAP	MYXUS CAPENSIS (VALENCIENNES, 1836)	4,00	4,00
OMOS	OREOCHROMIS MOSSAMBICUS (PETERS, 1852)	3,00	2,00
PPHI	PSEUDOCRENILABRUS PHILANDER (WEBER, 1897)	2,00	2,00

Table 3. Metric group weights

WEIGHT OF METRIC GROUPS	
METRIC GROUP	WEIGHT (%)
VELOCITY-DEPTH	100,00
COVER	87,50
FLOW MODIFICATION	84,38
PHYSICO-CHEMICAL	59,38
MIGRATION	75,00
IMPACT OF INTRODUCED	68,75

From the above, it is clear that fish assemblages on site relate to depth, with cover and flow being important. It would thus be important to ensure that depths are improved in the system and flow is maintained with some levels of vegetation and perhaps rocky cover maintained. Figures 7 to 10 indicate the nature of the river systems at the subject site, showing points of depth and some cover.



Figure 7. View downstream of mining site with deep pool in foreground and caisson evident



Figure 8. View upstream of mining site showing extensive deposits



Figure 9. Image showing high levels of sedimentation restricting fish migration



Figure 10. Image indicating clarity of water

3.4. Potential Impact and Mitigation

Given the above information, it is clear that the system is subject to high levels of sedimentation which effectively isolates species into sequestered pools during low flow periods. This appears to favour some of the exotic species and suggests that deeper and improved flows within the system should benefit the ichthyological diversity within the system.

It is recommended that sandmining operations should be pursued at this point and that mitigation measures that may be employed include:

- Maintenance of deeper waters across the reach of the system, suggesting that mining proceeds upstream and is concentrated on one side of the system rather than sporadically across the river bed
- Maintenance or improvement of the existing deeper pool around the caisson be undertaken at an initial stage to offer deep water habitat to fish migrating upstream.
- Some vegetative cover is maintained at points along the mining area.

4. CONCLUSION

It is recommended that mining be sanctioned on this portion of the iFafa River subject to basic environmental management controls. The mining operations are expected to improve diversity in fish and other aquatic species.

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