CONSERVATION OPTIONS FOR THE IMPERILLED BARRYDALE REDFIN

Prepared by

Albert Chakona, Martine Jordaan & Aileen Anderson

Objective – A briefing note aims to provide a concise outcome based synopsis of recent research or expert opinion that may inform decision making and activities by Authorities, Industry, NGOs and NPOs. The briefing note series complements the academic peer reviewed literature or reports published by SAIAB.

SAIAB is a Research Institution and not a management agency and as such the views presented are for consideration by all stakeholders and are non-binding.

Purpose: This brief aims to highlight the emerging potential of baited stereo-camera lander systems for surveying deep-sea elasmobranch populations to improve our understanding of their ecology and distributions and advance sustainable management.

March 2024

BACKGROUND

The Cape Fold Freshwater Ecoregion (CFE) located at the southern tip of the African continent (Figure 1) is one of the 200 aquatic ecoregions of the world and one of the eight freshwater ecoregions of southern Africa (Abell et al. 2008). This region is characterised by relatively low diversity of freshwater fishes but a high degree of endemism (Skelton et al. 1990). Of the 10 fish genera within the CFE, *Pseudobarbus*, commonly known as redfins, is the most speciose genus, with 11 formally described species to date (Chakona et al. 2022; Ellender et al. 2017). Previous and ongoing research indicates that there are at least five additional species of this genus that await formal description from the CFE (Swartz et al. 2009, Chakona et al. 2013, Chakona et al. 2017; Ellender et al. 2017, Chakona et al. 2022). The discovery of hidden diversity and description of new species raises the need to review the ecology, distribution and conservation status of stream fishes in the CFE to update the current available information (Kadye et al. 2016; Chakona et al. 2017, 2019). The Red List status of a species, especially if it is listed as Critically Endangered, is a strong driver for determining the nature and urgency of interventions and resources that need to be allocated for the conservation of the species in question.

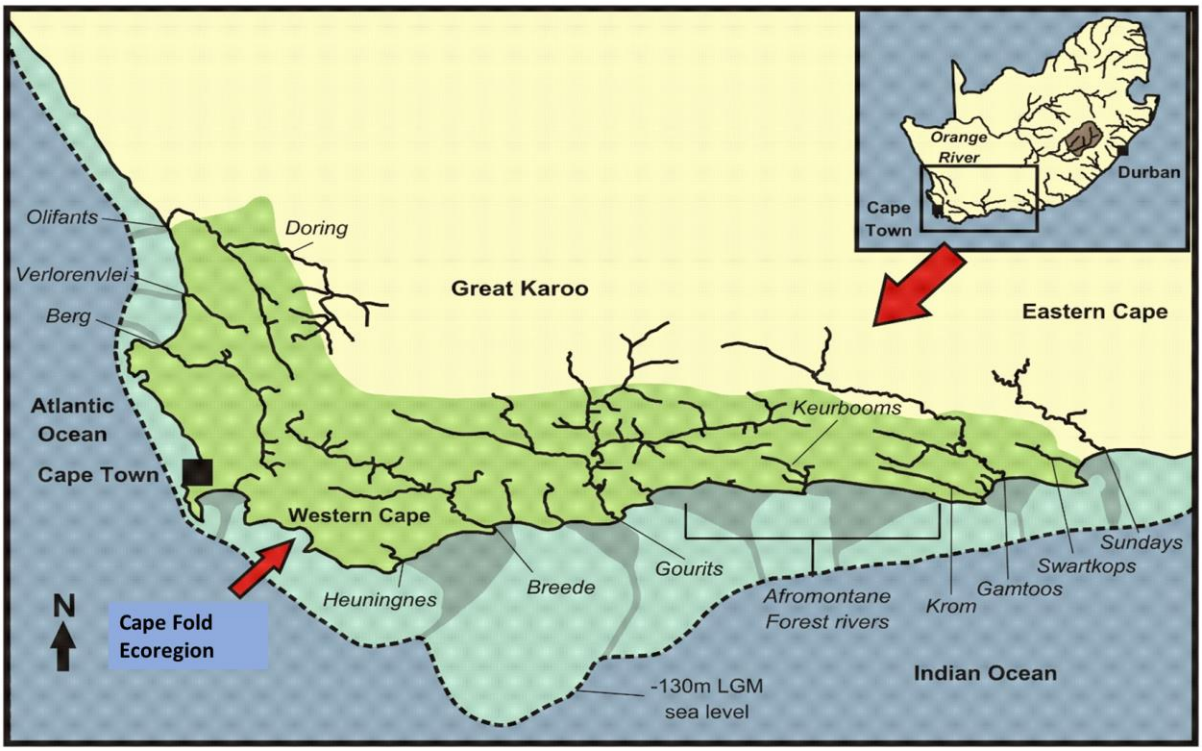

Figure 1: Map of South Africa showing the location of the Cape Fold Freshwater Ecoregion (CFE) at the southern tip of the continent (from Swartz et al. 2007).

One of the species that requires re-evaluation of its ecology, distribution range and conservation status is the Breede River redfin, *Pseudobarbus burchelli* Smith, 1841 (Figure 2). This species was previously thought to have a broad distribution range encompassing four river systems in the CFE, but molecular and morphological data led to the description of a new species, *Pseudobarbus skeltoni* Chakona & Swartz, 2013 (Figure 2), and identification of three unique genetic lineages with much narrower distribution ranges (Swartz et al. 2009). The Barrydale redfin, *Pseudobarbus* sp. 'burchelli Tradouw', has the narrowest distribution range of the three lineages of *P. burchelli* as it is confined to a single catchment, the Tradouw River, in the Breede River system (Swartz et al. 2009, 2014; Chakona et al. 2013; Figures 3 & 4). This lineage was listed as Critically Endangered during the most recent IUCN Red List Assessment for all freshwater fishes of South Africa (Chakona et al., 2022; Jordaan and

Chakona 2016). This Policy Brief summarises key findings from dedicated surveys that were undertaken between 2012 and 2016 to determine the spatial and temporal trends in the distribution and population dynamics of the Barrydale redfin (Jordaan et al., 2024).

Figure 2: Natural habitats of the Breede River redfin, *Pseudobarbus burchelli*, from the Vink River, a tributary of the Breede River, and the giant redfin, *P. skeltoni*, from the Tierkloof River, a tributary of the Molenaars River in the upper Breede catchment.

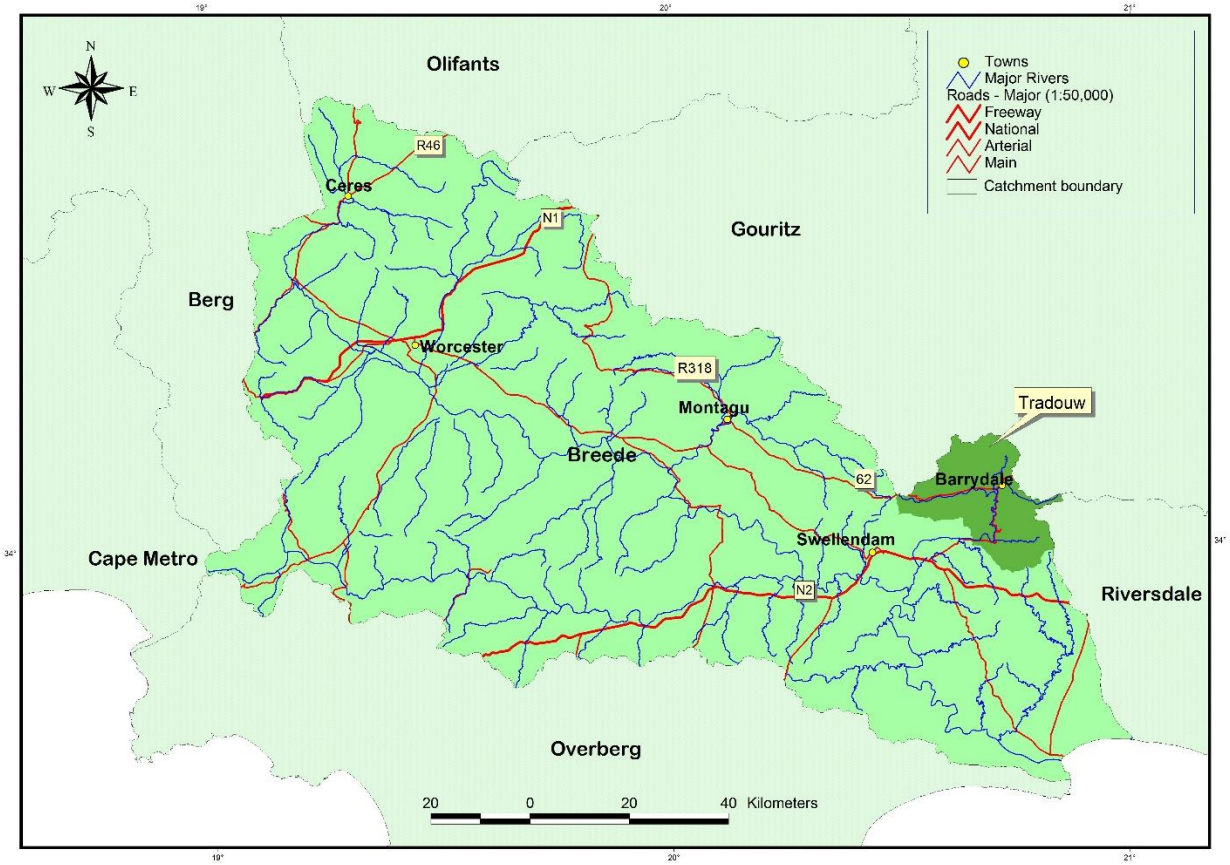

Figure 3: The Breede River catchment in the Cape Fold Freshwater Ecoregion (CFE) showing the entire range for the Barrydale redfin (dark green shading) in the upper Huis, upper Tradouw and Tradouw Pass gorge.

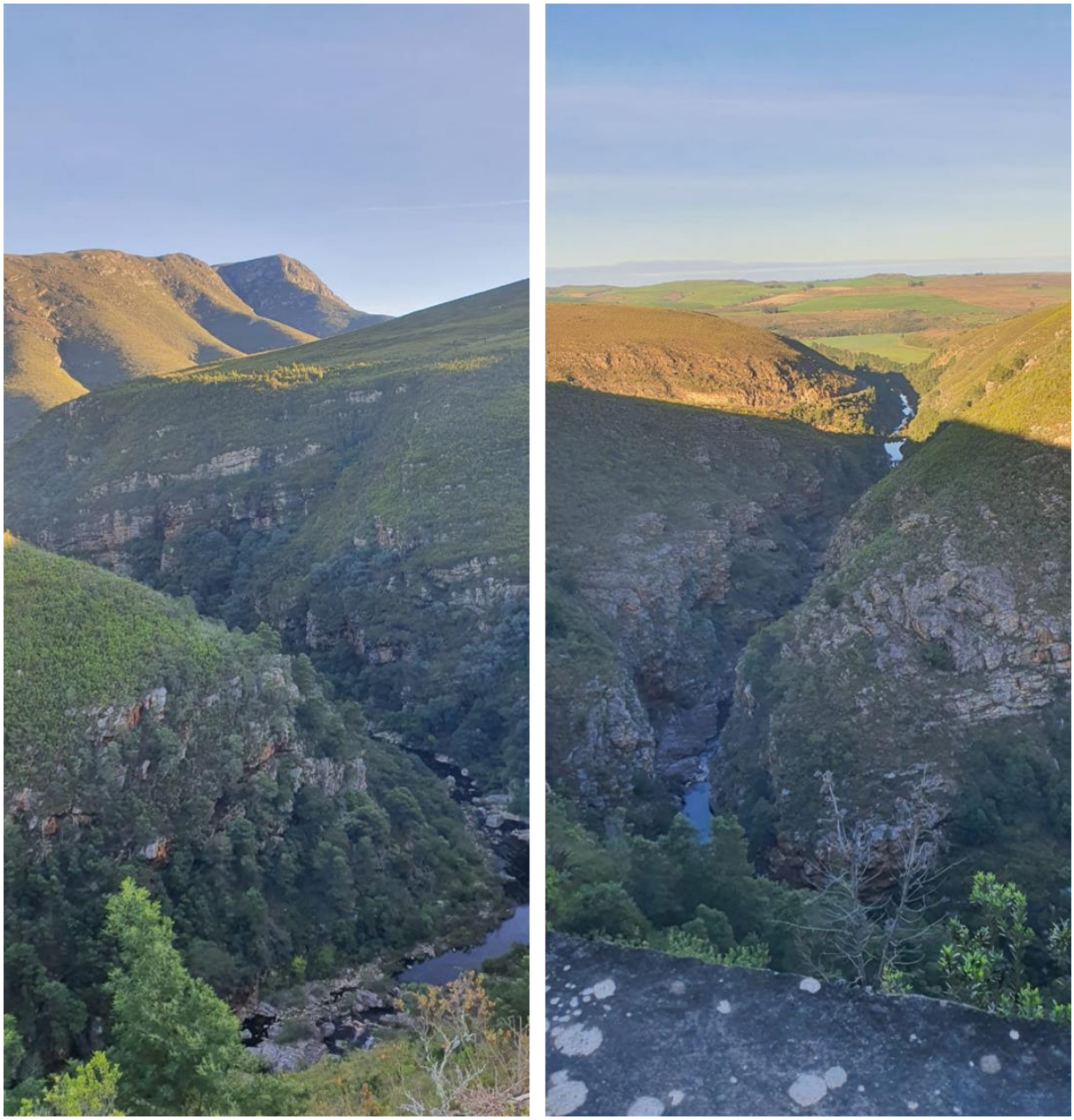

Figure 4: Pictures of the Tradouw gorge as viewed from the Tradouw Pass.

METHODS

Field surveys

Fieldwork was conducted within the Tradouw River catchment within the greater Breede River system (Figures 3, 4 & 5). The Tradouw River and its major tributary, the Huis River, comprise the known distribution of this taxon. For this study, 13 sites were sampled throughout the catchment in 2012 and 2013 to determine the fish community composition within the system and identify alien fish invasion barriers (Figure 5). Following this baseline distribution survey, sampling was conducted annually in the first two weeks of March at selected sites where redfins were detected to determine short-term population trends. Population monitoring is still ongoing, but in this Policy Brief we present findings of population trends for the period 2012-2016.

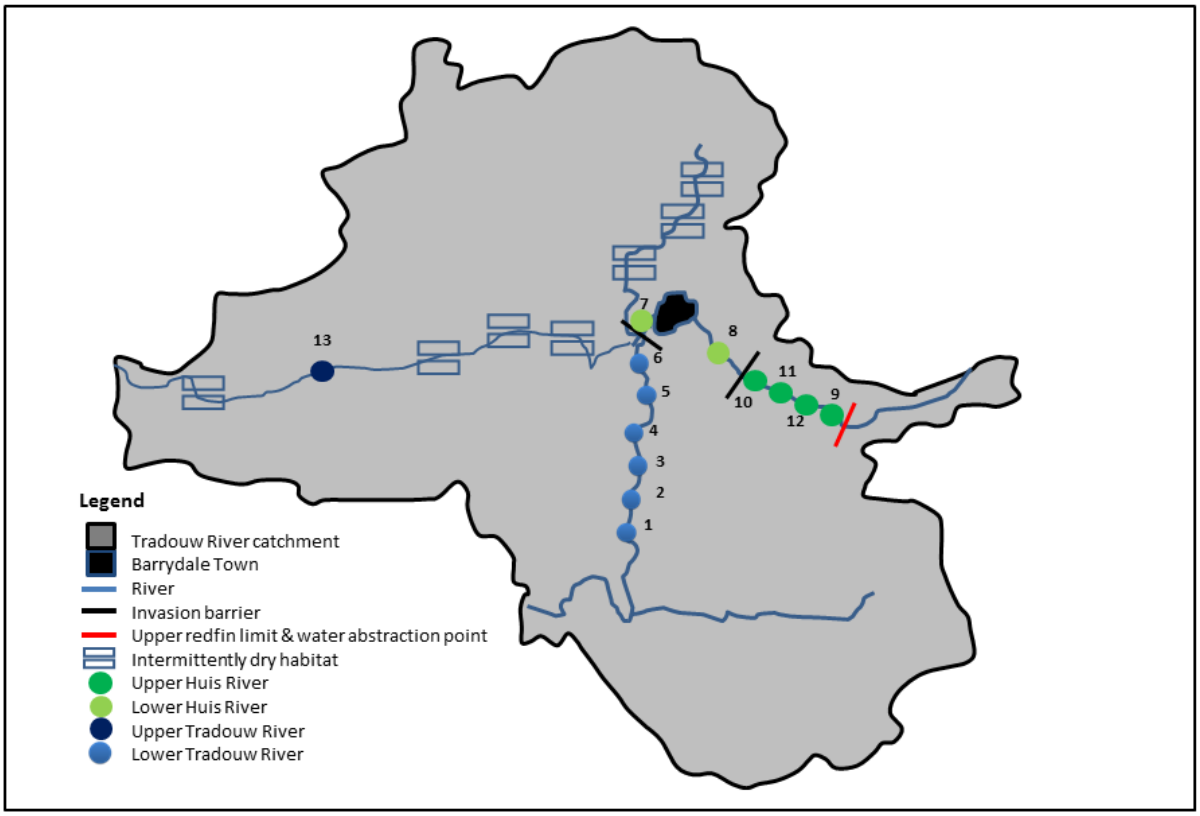

Figure 5: Map of the Tradouw River catchment showing the localities that were sampled between 2012 and 2016. Instream fish barriers are indicated in black and the upper distribution limit of *Pseudobarbus* sp. "burchelli Tradouw" is indicated in red. The upper distribution limit is also the water take off point for a canal that supplies domestic and agricultural water to the town of Barrydale and surrounding farmlands (Figure 6).

Figure 6: Donkerget pool below waterfall that marks the upper limit for the Barrydale redfin in the upper Huis River. Note the canal that diverts water from the upper section of the river for domestic and agricultural purposes, leaving very little flow downstream.

Habitat assessment

The predominant habitat type in the study area are pools (Figure 7) with either rocky or sandy substrate. Sampling was conducted using both seine and fyke netting, depending on the habitat characteristics of the sample sites, and sampling methodology was kept consistent for each site over the monitoring period. Fyke nets were used for deep pools with rocky substrate, while seine netting was done in shallow pools with sandy or flat bedrock substrates. Sampling gear specifications were as follows: seine net 10m × 2m in length and height respectively, with a mesh size of 4mm; square fyke net with four hoops of 600 x 600mm, 4mm mesh size and two side panels 5m in length with a height of 600mm. Fyke nets were deployed overnight with a soak time of 16±1.5 hr. Catch per unit effort (CPUE) values for each sampling site and sample interval was obtained by dividing the number of fish caught by the number of netting efforts. Fish were measured to total length (TL), and the size data were collected from a random subsample of 30-40 fish at each site. All fishes were released unharmed post sampling. Water quality parameters (dissolved oxygen, pH, electrical, conductivity and temperature) were recorded at all sampling sites using an Aqualytic AL15 water quality meter and the presence of instream invasion barriers were noted.

Figure 7: Pictures of the Huis River showing the predominant habitats during low-flow periods. Pictures: Aileen Anderson (Grootvadersbosch Conservancy Trust (GVBCT)).

Assessment of threats

Threats to the redfins were recorded at each site and categorised according to the IUCN Threat Classification Scheme (Version 3.2). To determine impact, threats were also assessed in terms of their (i) timing (i.e., past, ongoing or future), (ii) scope (i.e., proportion of the total population affected) and (iii) severity (i.e. the overall declines caused by the threat) as recommended by the IUCN guidelines.

KEY FINDINGS

- Remnant populations of the Barrydale redfin are highly fragmented due to the presence of non-native predators; large-mouth bass (*Micropterus salmoides*) and bluegill sunfish (*Lepomis macrochirus*), as well as potential competitive exclusion due to presence of the introduced banded tilapia, *Tilapia sparrmanii*.
- All size classes were recorded in pools above the town of Barrydale, indicating that the upper Huis River, particularly the Donkerget Pool above the town of Barrydale, is the last safe refuge for this lineage. The habitat in this section is generally in a near natural state, but there is an emerging black wattle, *Acacia mearnsii*, invasion. The most significant impact in this zone of river is a water diversion canal at the upper end of the redfin's distribution range (Figure 6), which abstracts all surface flow during low flow summer months, despite the Huis River being assigned a Category C management class (Government Gazette Notice 42053, 2018).
- Currently, fish habitat is reduced to less than one kilometre in the upper section of the Huis River and is limited to 4-5 isolated pools for most of the year.
- Although a release valve enabling limited amounts of water to be released was installed in 2016 (Figure 8), this is still inadequate in terms of the ecological flow requirements of the river in downstream areas.
- Results from the surveys showed that establishment of connectivity during the rainy season allows the redfins to recolonise the lower sections of the river, indicating a high possibility for the fishes to naturally recover with minimal human intervention if the prevailing threats and pressures are removed.

Figure 8: Pictures showing the small pipe (release valve) that was installed at the water take-off point in the upper Huis River as a measure to prevent complete abstraction and maintain stream flow below the water take off point. Pictures: Aileen Anderson (Grootvadersbosch Conservancy Trust (GVBCT)).

- Both point and diffuse sources of pollution are additional threats to fish populations in the lower Huis and Tradouw rivers below the town of Barrydale. Fishes from this section of the river were severely infested by trematode parasites. Although further research is required, this heavy parasite load is likely linked to poor habitat and water quality. These parasites were absent from redfins in the upper Huis and upper Tradouw.
- Redfin numbers were highly variable in the impacted lower sections of the rivers, ranging from below detection limits to several hundred individuals. However, these were predominantly dominated by juveniles and subadults, indicating recolonization from the refugial populations in the upper sections.

CONSERVATION RECOMMEDATIONS

- invasive species and natural system modifications (unsustainable levels of water abstraction in this case) were rated to be the most significant threats in terms of timing, scope and severity. Eradication of invasive species using piscicides may not be an ideal option given the discontinuous distribution of redfins throughout their distribution range. Immediate efforts should however focus on preventing the invasion and establishment of non-native species in the upper Huis River.
- a fine scale survey of dams in the upper Huis River that may potentially have invasive species is an immediate requirement, but this needs to be done in collaboration with land owners to get buy-in for possible localised piscicide projects if necessary. Management of the threats and pressures affecting the redfins in this catchment requires close collaboration and awareness campaigns to communicate the plight of this unique narrow range endemic fish.
- Restoration of surface flow in the upper Huis River should be a high conservation priority. Improving surface flow in this section of the river will also benefit redfins in the lower Huis River and improve the overall ecological functioning of the whole tributary.
- Implementing changes to existing water use patterns will however be challenging given the growing water demand for both residential and agricultural use, a situation likely to be exacerbated by climate change predictions for the area.

- Drafting of any conservation plans (BMP) for the Barrydale redfin will require input from stakeholders from various sectors as stipulated in the National Environmental Management: Biodiversity Act (NEM:BA). This will result in a collective and collaborative conservation plan that meets national requirements in terms of its content and also aligns to national and provincial legislation.

PLANNED AND ONGOING WORK

The Grootvadersbosch Conservancy Trust (GVBCT) has, through funding from the IUCN, recently initiated a one year project that aims to secure the remnant populations of the Barrydale redfin and facilitate recovery of this unique narrow range endemic fish. This project is being undertaken in collaboration with the NRF-SAIAB and CapeNature. One of the key aims of this project is to establish a stakeholder action group that will continue to sustain the activities beyond the scope of the IUCN project. The anticipated outcomes and impact from this project include:

Environmental

The activities planned in this project will result in increased flow in the Huis River and overall river health which will support the survival of the Barrydale redfin. The project will evaluate measures to reduce pollution input into the river, and hence improve overall water quality and contribute to reducing the parasite load in populations in the lower sections of the rivers. This is however a long-term target.

Socio-Economic

Many of the poorer residents that live further from the river do not have access to the water for community gardens and stock watering. This is because there is often not enough water in the municipal canal to supply these users as they are supplied with water at the end of the municipal line. Reducing the use of water from the main municipal supply will result in improved access to water for the poorest residents who struggle to gain access to water in the dry months for subsistence farming and stock watering. The project will also directly benefit residents by creating training opportunities in alien clearing and restoration. Initially, because of health and safety concerns, the work will be done by experienced team from a nearby town but the project will mentor a local team who can then take on additional work, beyond the scope of the project. Tourism is an important economic driver for the town, but pollution of the river is limiting the town from realising its full potential. Water is a key component in proving socio-economic development in the town. The project will also establish an edible, traditional herb garden in a public space which will educate the local community on endemic herbs that have nutritional and medicinal value and which require little water to grow. Income sources will also be generated through being able to make and sell firewood from the cut biomass.

Political

Politically, the project will be crucial to bring together diverse stakeholders who will create a collective voice to improve service delivery. Much of the water infrastructure for the town requires maintenance to reduce losses and stop leakage from sewage lines. The municipality is under increasing pressure to supply and improve services but is also wanting to see collective action from the community to implement water conservation activities so that growing demands for water can be met. A collective approach to the problem will ease tensions between the town residents and the municipality. Many residents express frustration that they are unable to access the Huis River because much of the river

runs through private property. Due to growing security concerns, residents that live on the river are reluctant to grant public access to the river. This has resulted in race and class tensions as a privileged few have access to the river that many feel they are spiritually and culturally connected to. The project will overcome this by restoring a piece of ground at the end of town that is owned by the Municipality. The project will include community planting days and litter clean ups will be promoted. Signage will be put up to raise awareness on the plight of the critically endangered fish and highlight actions that are being taken to protect it.

SELECTED REFERENCES

Abell R, Thieme ML, Revenga C, Bryer M, Kottelat M, Bogutskaya N, Coad B, Mandrak N, Balderas SC, Bussing W, Stiassny MLJ, Skelton P, Allen GR, Unmack P, Naseka A, Ng R, Sindorf N, Robertson J, Armijo E, Higgins JV, Heibel TJ, Wikramanayake E, Olson D, Lopez HL, Reis RE, Lundberg JG, Sabaj Pérez MH, Petry P. 2008. Freshwater ecoregions of the world: A new map of biogeographic units for freshwater biodiversity conservation. BioScience 58: 403–414.

Chakona A, Skelton PH. 2017. A review of the *Pseudobarbus afer* (Peters, 1864) species complex (Teleostei, Cyprinidae) in the eastern Cape Fold Ecoregion of South Africa. Zookeys 657: 109-140.

Chakona A, Swartz ER. 2013. A new redfin species, *Pseudobarbus skeltoni* (Cyprinidae, Teleostei), from the Cape Floristic Region, South Africa. Zootaxa 3686: 565–577.

Chakona A, Swartz E, Gouws G. 2013. Evolutionary drivers of diversification and distribution of a southern temperate stream fish assemblage: Testing the role of historical isolation and spatial range expansion. PloS One 8, e70953.

Chakona A, Jordaan MS, Raimondo DC, Bills RI, Skelton, PH. and van Der Colff, D. 2022. Diversity, distribution and extinction risk of native freshwater fishes of South Africa. Journal of Fish Biology 100(4): 1044-1061.

Ellender BR, Wasserman RJ, Chakona A, Skelton PH, Weyl OLF. 2017. A review of the biology and status of cape fold ecoregion freshwater fishes. Aquatic Conservation: Marine and Freshwater Ecosystems 27: 867–879.

Government Gazette Notice 42053. 2018. Proposed Classes of Water Resource and Resource Quality Objectives for the Breede-Gouritz Water Management Area, 121pp.

Government Gazette Notice 46798. 2022. Reserve Determination for Water Resources of the Breede-Gouritz Water Management Area, 223pp.

Jordaan M, Barrow S, Kadye W, Chakona A. 2024. Status and distribution of a novel redfin lineage, *Pseudobarbus* sp. 'burchelli Tradouw' from the Cape Fold Ecoregion of South Africa. African Journal of Aquatic Science. 1-11. 10.2989/16085914.2023.2289561.

Jordaan M, Chakona, A. 2017. *Pseudobarbus burchelli*. The IUCN Red List of Threatened Species 2017: www.iucnredlist.org

Skelton PH. 2001. A complete guide to the freshwater fishes of Southern Africa. Pp.395. Struik Publishers, Cape Town.

Swartz ER, Chakona A, Skelton PH, Bloomer P. 2014. The genetic legacy of lower sea levels: does the confluence of rivers during the last glacial maximum explain the contemporary distribution of a primary freshwater fish (*Pseudobarbus burchelli*, Cyprinidae) across isolated river systems? Hydrobiologia, 726: 109-121.

AGENCIES THAT SHOULD BE CONTACTED

- South African National Biodiversity Institute (SANBI)
- CapeNature
- Department of Forestry, Fisheries and Environment (DFFE)
- Grootvadersbosch Conservancy Trust (GVBCT)
- Gouritz Cluster Biosphere Reserve (GCBR)
- Freshwater Research Centre (FRC)
- Nuwejaars Wetlands Special Management Area

Authors

Prof. Albert Chakona	Dr Martine Jordaan	Aileen Anderson
NRF-SAIAB	CapeNature	Grootvadersbosch Conservancy Trust
Chief Scientist & Acting MD	Faunal Ecologist	General Manager
26 March 2024	26 March 2024	26 March 2024

Approved

Dr Angus Paterson

Acting DCEO – NRIP

26 March 2024
