

Project Update: March 2022

Spawning migration

In September 2021, at least 180 adult Clanwilliam sandfish migrated upstream from the Doring River mainstem and 15km up its tributary, the Biedouw River, to spawn. We observed spawning events over the course of a week – only the second time the scientists involved in Saving Sandfish have ever observed this impressive phenomenon. Sandfish up to 60 cm in length rested in the calm, low-flow pools during the day, then moved slowly into the riffles as the sun started to set. Spawning began in full force at dusk, with groups of up to 40 sandfish accumulating in the shallows, writhing over one another and shooting forward in sudden bursts of movement. Witnessing spawning was indescribably special in its own right, but we simultaneously collected data on the habitat preferences of spawning sandfish – the first time such data has ever been recorded for this rare species.



Left: Adult sandfish migrating up the Biedouw River in September 2021. Right: Adult sandfish undertaking the annual migration. © Dr Jeremy Shelton.



Adult sandfish in a spawning aggregation. © Dr Jeremy Shelton.

Release of nursery-reared sandfish into the wild

During the 2 weeks that adult sandfish spent in the Biedouw River before moving back downstream into the mainstem, the Saving Sandfish team was hard at work tagging and releasing 1-year old nursery-reared sandfish back into the wild. These subadults were rescued from the shrinking, alien-infested Biedouw River as 3-month old juveniles (measuring ~5 cm) in November 2020 and placed into three off-stream alien-free "nursery" dams in the catchment with the goal of allowing them to grow to predator-proof size in a safe environment before re-joining their wild relatives. Nearly 10 months later, in September 2021, we released 1,277 of these nursery-reared fish, now measuring ~18 cm, back into the Biedouw River, where we hope they joined their adult counterparts as they moved back down into the mainstem. Of these, we tagged 994 with Passive Integrated Transponder (PIT) tags. These tags are analogous to a barcode and work the same way a pet's microchip does. If the fish is scanned with a special PIT tag reader, its unique ID "barcode" appears on the screen and is recorded. We plan to track the survival of the nursery-reared sandfish in the wild using this powerful technology.

In October and November 2021, we also tagged 100 nursery-reared sandfish and returned them to the same nursery dam. This small cohort will help us track sandfish survival rates in the nursery dams over time and will allow us to monitor the healing process at the PIT tag injection site. A subsample collected in late November 2021 revealed a 69% survival rate of rescued sandfish in one of our nursery dams – an encouraging figure. It was also clear that the injection wounds on the tagged fish were healing nicely.



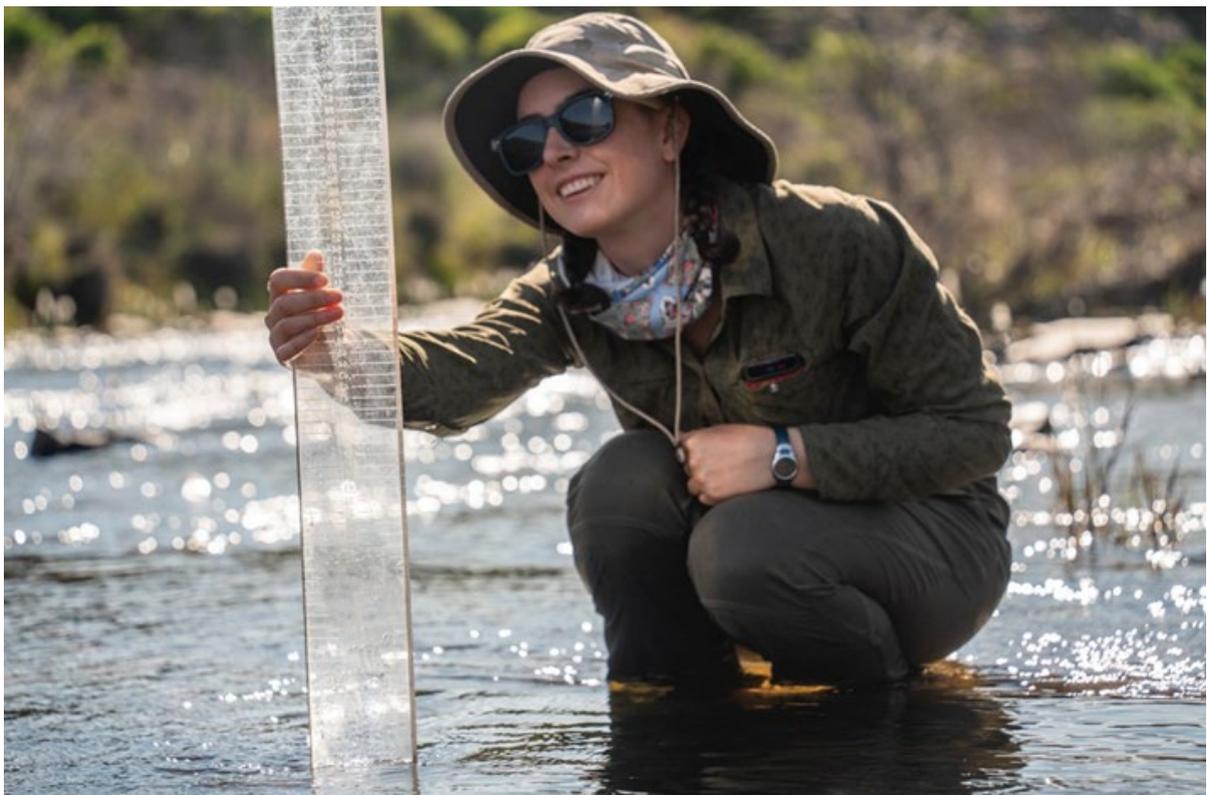
Left: Passive Integrated Transponder (PIT) tag. Right: Tagging one-year-old nursery-reared sandfish prior to their release. © Dr Jeremy Shelton.

Habitat preference data collection

With the help of my invaluable field assistants, I carried out three habitat surveys between September and November 2021. These surveys consisted of collecting relevant environmental data (depth, flow speed, substrate type and cover presence/absence) at 600 points in the Biedouw River during three important life history stages: the spawning, larval, and juvenile periods. The same environmental data were collected everywhere sandfish were observed in the selected reaches. Together, these data will allow us to determine how spawning, larval and juvenile sandfish habitat preferences compare to the habitat that is available to them in the Biedouw River.



Sandfish are released to the Biedouw River after being PIT tagged. © Dr Jeremy Shelton.



Using a velocity head rod to measure current speed. © Dr Jeremy Shelton.

Movement tracking of sandfish in the Biedouw River

Between August 2021 and February 2022, my field assistants and I carried out eight visual surveys along the lower 15 km of the critically important spawning tributary, the Biedouw River. The goal? To track the timing and movement of sandfish during

different critical life stages: migration, spawning, egg, larval, juvenile and subadult. Although I have not yet analysed these data in detail, it is clear from my observations alone that sandfish in different life stages occupy very distinct habitat niches. Migrating adults enjoy resting in the deep, shallow pools during the day and move into the shallow riffles in the evenings to spawn. After spawning, eggs are distributed throughout the Biedouw River in various types of habitats. As larvae and young juveniles, sandfish do not stray beyond the < 10cm deep shallows at the banks of slow-flowing pools, and they congregate in loose groups or not at all. As they grow, they become bolder and start exploring the deeper areas of pools, often schooling and moving together through the different habitats.



Collecting data on migrating sandfish during a visual survey. © Dr Jeremy Shelton.

The most stunning aspect of these walking surveys has been witnessing the change in the river itself between August (peak winter high-flow season) and February (mid-summer dry season). Where there was once a fully connected, steadily flowing river in winter, often punctuated by storm-driven high-flow pulses, there is now a desolate, dry riverbed, interrupted infrequently by shallow puddles and small pools remaining in only the deepest sections of the river.

The most recent survey in early February revealed several stranded schools of sandfish in these isolated, shallow, 30°C+ "pools." If not for our concerted rescue efforts (which are ongoing), these subadults would have no chance of survival.



A Biedouw River pool in August 2021, during peak high-flow season. © Cecilia Cerrilla.



What remains of a Biedouw River pool in February 2022, in mid-summer dry season. © Cecilia Cerrilla.

Rescues

In November 2020, the Saving Sandfish project rescued 7,699 young-of-the-year sandfish and translocated them to three nursery dams. The 1,277 fish we released into the wild in September 2021 came from that cohort. Over the past few months, starting in November 2021, we rescued 7,386 young sandfish and relocated them to five nursery dams as part of a second rescue effort. This cohort, along with the 2020 cohort that remains in the dams, will continue to be monitored throughout the year in order to assess body condition, growth rates and survivorship. In August and September 2022, a percentage of nursery-reared fish (which will include individuals from the 2020 and 2021 rescue cohorts) will again be released into the wild.



Left: A team of rescuers from the nearby community of Heuningvlei pulls a seine net through a pool during a sandfish rescue in November 2021. Right: A bucket full of recently rescued sandfish is acclimated to the temperature of the nursery dam prior to release. © Dr Jeremy Shelton.

Catchment-wide population assessment

In October 2021 the Saving Sandfish team undertook an epic 1,000 km journey through harsh Karoo terrain and Cederberg Mountain passes to evaluate the population trajectory of Clanwilliam sandfish in the Doring River mainstem. Over the course of 10 days, we re-sampled nine historic sites where similar data were collected in 2001, 2003, 2011 and 2013. Each day we drove several hours to reach a new site, where we set a large, three-wing fyke net overnight. The next morning, the catch was processed: each fish was identified to species, measured and returned to the river. Alien species occurred at all nine sites: all five alien species previously known to the Doring River were caught during the survey, and two alien species not previously known to the river system were identified. Sandfish occurred at only five of the nine sites. The vast majority of the 111 sandfish caught over the course of the survey were large adults measuring 30-60 cm. Only three individuals measured less than 30 cm and no juveniles were sampled. These findings corroborate previous observations of sandfish in the Doring River system: while there may still be a substantial population of large adults, there are no juveniles and exceedingly few subadults recruiting into the system. These data are critical for focusing our limited conservation resources where they are most needed and will be used in the species' upcoming IUCN Red List assessment.



Left: Researchers use a boat to set a fyke net in the Doring River in October 2021. Right: Researchers retrieve a fyke net during the October 2021 Doring River survey. © Dr Jeremy Shelton.



Left: An adult sandfish is measured during the October 2021 Doring River survey. Right: Black bass in the Doring River. © Dr Jeremy Shelton.

Biology of larval and juvenile sandfish

In October and November 2021, 100 larval and 100 juvenile sandfish (respectively) were collected from the Biedouw River, humanely euthanised, measured and preserved. This year I will be analysing the daily growth increments found in their otoliths (ear bones) in order to age them to their exact hatch dates. These data will be related to their body length at collection and to the temperature and flow conditions occurring in the river at the time, assisted by a level logger installed in the Biedouw River that collects continuous temperature and flow data year-round. These analyses will allow me to 1) determine the environmental conditions necessary for successful hatching and 2) build an age-length relationship which will enable us to age young sandfish in the future using non-lethal, non-invasive methods.



Left: Retrieving the level logger from the Biedouw River prior to downloading the data. Right: Visualising the data from the level logger installed in the Biedouw River. The red curve shows temperature. The blue curve shows pressure (which can be converted into flow). © Dr Jeremy Shelton.

Collection of alien fish

Prior to the start of my project, we knew of two non-native fish species present in the lower reach of the Biedouw River: spotted bass *Micropterus punctulatus* and bluegill sunfish *Lepomis macrochirus*. Due to recent visual and seine surveys, we now know that there is a third non-native species present in the Biedouw River: banded tilapia *sparmannii*. In November 2021 and January 2022, I collected individuals of each alien species, measured them, humanely euthanised them and preserved them. To evaluate each species' relative predatory impact on the young sandfish of the

Biedouw River, I will be dissecting the guts and carrying out stable isotope analyses on these specimens.



Left: A school of juvenile bluegill sunfish collected from a small pool of the quickly drying Biedouw River rests inside a bucket in March 2021. © Dr Jeremy Shelton. Right: A banded tilapia is collected from the Biedouw River in January 2022. © Mohammed Kajee.

I am excited to see what new discoveries this next year of field work, lab analyses and conservation efforts will bring.