

Fisheries scientist Dr Leon Barkhuizen gives us the first comprehensive record of the occurrence, distribution and population structure of smallmouth yellowfish at dams in the Free State province.

These pages: Sterkfontein Dam with its crystal-clear water is considered to be one of the prime destinations to catch smallmouth yellowfish.

Being an arid country and as a result of the need to store water for domestic, industrial and agricultural use, South Africa has invested heavily in the construction of dams, which now cover a total of approximately 3000km². The country is increasingly considering developing fisheries in dams to provide economic opportunities and food security in especially rural areas. In order to be effective, such development needs to be guided by information on current utilisation, fish species composition and abundance, as well as the impact of potential harvest methods.

The Free State has the largest inland water surface area (estimated at 145,677ha) in South Africa and is situated centrally within the Orange-Senqu River basin. The Orange-Senqu and Vaal River systems, which are the home of the smallmouth and largemouth yellowfish species, drain this basin. There are just over 410 registered dams in the Free State, resulting in fewer free-flowing rivers, which has impacted negatively on especially yellowfish populations.



Smallmouth

YELLOWFISH : RESEARCH RESULTS



Nationally there is a general lack of even basic information on fish communities in dams and their utilisation. In order to address this paucity of information in the Free State, a four-year study was initiated in 2012 by conducting a rapid appraisal of the fisheries potential of impoundments using empirical approaches; collating a 35-year time series of catch returns from recreational angling tournaments and commercial fisheries; conducting surveys to determine fish species composition in 21 of the largest and most important dams in the province, and testing new fishing gear. Experimental fishing surveys conducted during this study sampled 23,831 fish of 16 different species from the 21 dams surveyed. The bulk of the catches consisted of four large cyprinid species, namely the Orange River mudfish, moggel, smallmouth yellowfish, carp and the sharptooth catfish. This article provides the first comprehensive record of the occurrence, distribution and population structure of smallmouth yellowfish at dams in the Free State.

THE ECOLOGY AND BIOLOGY OF THE SMALLMOUTH YELLOWFISH

The maximum age for smallmouth yellowfish is estimated at between 12 and 15 years; males may reach a maximum age of 19 years and females 16 years. The maximum fork length (FL – measured from the tip of the snout to the fork in the tail fin) for males is estimated at 427mm and for females at 496mm. Males are sexually mature at ages four to six years at lengths of 260mm to 300mm, and females at ages five to seven years at lengths of 310mm to 390mm. Smallmouth yellowfish are known for late maturity and a slow growth rate of approximately 100mm to 120mm per year. Growth rate for this species is influenced by the water quality, water temperature and food availability.

Smallmouth yellowfish prefer flowing streams and rivers with clear water and a rocky or gravel bottom, although results of the recent study show that they have successfully adapted to standing waters. They are omnivorous bottom feeders, feeding on aquatic organisms and plants, water fleas and small fish. Juveniles prefer zooplankton and invertebrates, while adults become more herbivorous (eating plant material).

It is estimated that a female of 300mm FL can produce up to 6000 eggs in a season, and females larger than 500mm can produce 25,000 to 45,000 eggs. Eggs that are laid do not attach to any substrate, but lie loose among gravel or rocks. Hatching time is directly affected by water temperature and varies from two to eight days. Spawning takes place between October and February, the required habitat for this being well-oxygenated water at the preferred water temperature (21°C - 24°C) in flowing streams and rivers with gravel beds or rocky bottoms. At some impoundments (eg Sterkfontein Dam), spawning takes place when the water is at the preferred temperature and when wave action caused by strong wind over gravel beds and rocky areas creates suitable spawning conditions.

STUDY AREA AND SAMPLING METHODS

Fisheries-independent sampling using gill, seine and fyke nets was done to collect fish. Experimental gill netting was done using three fleets of multifilament gill nets with stretched mesh sizes of 28mm, 44mm, 50mm, 75mm, 100mm and 144mm. A 100m x 3m seine net with a stretched mesh size of 75mm was used to sample fish in the shoreline areas, while a 10m x 2m seine net with a stretched mesh size of 10mm was used in the shallower areas. Three double-ended Dutch-type fyke nets, which were not baited, were set parallel to the shore

A smallmouth yellowfish from Knellpoort Dam.



Photo: Roger Barrett



Above: Wave action at Sterkfontein creates suitable spawning conditions for yellows. Top: Compared with other dams, some of the largest and most beautiful smallmouths are found in Sterkfontein.

in water with a depth of 1m to 1.5m. Using the variety of sampling gear ensured that all habitat types within dams, as well as all size classes (from fish fry to juveniles to adult fish), were sampled.

All fish caught during the study period were measured for fork and total length, and weighed. Establishment success of the larger fish species in dams was based on an assessment of their population structure. To do this, length data was sorted into 100mm FL-size classes. These classes represent important periods in the life history of these large-bodied fish. Young of year are generally <100mm, immature fish length ranges from 110mm to 300mm, while maturity in the larger cyprinids is attained at lengths of >300mm.

SMALLMOUTH YELLOWFISH POPULATIONS IN FREE STATE DAMS

- Smallmouth yellowfish were sampled at 18 dams, the species being absent from Moutloatsi Setlogelo, Jimmy Roos and Metsi Matso dams.
- Koppies, Erfenis, Sterkfontein, Kalkfontein and Rustfontein dams in the Vaal River System and Gariep and Armenia dams in the Orange River System had the largest smallmouth yellowfish populations.
- Establishment success was based on an assessment of the population structure as described earlier. Smallmouth yellowfish populations were found to be fully established at 13 of the 14 dams where sufficient data was obtained.
- At Allemanskraal, Egmont, Erfenis, Gariep, Kalkfontein, Koppies, Krugersdrift, Rustfontein and Sol Plaatje dams, fry and juveniles as well as adult fish were sampled, indicating successful recruitment of the species during the 2012/2013 and 2013/2014 summer seasons.
- At Armenia, Knellpoort, Sterkfontein and Tierpoort dams, no fry or juveniles were caught, indicating failure in recruitment during the same period.
- The smallmouth yellowfish population at Bloemhof Dam consisted only of individuals in the 201mm to 300mm class, with an absence of specimens in all other size classes.
- Of the total of 2948 smallmouth yellowfish that were sampled during field surveys, the largest individual measuring 555mm and weighing 2.75kg was caught at Armenia Dam, with the second-largest specimen measuring 517mm and weighing 2.22kg caught at Sterkfontein Dam.



Photo: Roger Barrett

Above: The smallmouth yellowfish of Gariiep Dam are thinner and lighter in colour than those from Sterkfontein Dam.

A summary of the total number of all fish species caught during the study period (2012 to 2015), as well as the number of smallmouth yellowfish and this species' contribution to the total catch (expressed as a percentage), is given in the table below. Shaded areas and * denote the dams with large smallmouth yellowfish populations.

System		Total number of fish caught (all species)	Number of smallmouth yellowfish	% of the total catch	Largest specimen caught (FL and weight)
Dams in the Vaal River System					
Alleanskraal	Sand River	1052	28	3	383mm; 0.76kg
Bloemhoek	Jordaan Spruit	627	1	0.2	415mm; 1.02kg
Bloemhof	Vaal and Vet rivers	1256	54	4	330mm; 0.5kg
* Erfenis	Vet River	3530	508	14	496mm; 2.4kg
* Kalkfontein	Riet River	3392	177	5	500mm; 2.04kg
* Koppies	Renoster River	2634	593	23	510mm; 2.42kg
Krugersdrift	Modder River	1582	59	4	410mm; 1.24kg
Metsi Matso	Metsi Matso River	8	0	0	-
Mockes	Modder River	779	9	1	95mm; 0.1kg
Moutloatsi Setlogelo	Kgabanyane Spruit	731	0	0	-
* Rustfontein	Modder River	884	151	17	432mm; 1.43kg
Serfontein	Vals River	54	1	2	165mm; 0.05kg
Sol Plaatje	Liebenbergsvlei River	116	35	30	450mm; 1.38kg
* Sterkfontein	Nuwejaar Spruit	528	180	34	517mm; 2.22kg
Tierpoort	Tierpoort River	505	83	16	335mm; 0.95kg
Dams in the Orange River System					
* Armenia	Leeu River	655	300	46	555mm; 2.75kg
Egmont	Wit Spruit	1797	83	5	455mm; 1.01kg
* Gariiep	Orange River	2297	566	25	510mm; 1.85kg
Jimmy Roos	Onder-Krom Spruit	562	0	0	-
Knellpoort	Riet Spruit	669	117	18	505mm; 1.63kg
Welbedacht	Caledon River	181	3	2	323mm; 0.44kg

Preliminary results of the recent study indicate that smallmouth yellowfish in dams do not grow as big as those found in rivers and streams, an aspect that requires further investigation, although it may be linked to food availability. A trend being observed for smallmouth yellowfish populations at Bloemhoek, Knellpoort, Sol Plaatje and Sterkfontein dams, which receive water via inter-basin water-transfer schemes, is the total lack, or limited number, of specimens within the 0mm to 100mm and the 101mm to 200mm size classes. This could be attributed to the artificial manipulation and regulation of water levels and the absence of suitable spawning areas. This trend was especially noted for the smallmouth yellowfish population at Sterkfontein Dam, one of the best fly fishing venues for the species in South Africa. Results of research done during the early 1980s noted that all indigenous fish species had a very low recruitment, which was attributed to a lack of suitable spawning areas. Results also revealed that more than 80% of the smallmouth yellowfish population then comprised individuals ranging from 280mm to 550mm.

CONSERVATION STATUS AND UTILISATION OF SMALLMOUTH YELLOWFISH

Because this species attains small sizes in dams, one of the recommendations emanating from the study is that the current strict regulations pertaining to the catch and keep of smallmouth yellowfish by recreational and especially bank anglers in the Free State (ie all fish smaller than 45cm to be returned to the water immediately and anglers may only catch and keep ten individuals larger than 45cm per day) be reviewed. A major point of contention from the recreational and bank angling sector is that these regulations differ significantly among all the provinces bordering the Free State, with the Free State having the strictest regulations. This species has considerable potential for harvest by bank and subsistence anglers. New regulations, however, should take into consideration the prevalent population structure and potential yield of this species at each dam.

HOW DOES THIS AFFECT FLY ANGLERS?

The first question that comes to mind is what impact this might have on the yellowfish fly fishing sector. The reality is

that the dam where those fly fishermen targeting smallmouth yellowfish were and are mostly found is Sterkfontein Dam (and these days Vanderkloof Dam in the Northern Cape). No yellowfish fly fishermen were observed at any of the other 20 dams surveyed from 2012. The water in Sterkfontein Dam is of the clearest and cleanest in South Africa that allows for sight-fishing for yellowfish. This is not possible at any of the other 20 dams surveyed due to the high turbidity levels and silt load that makes visibility extremely poor. Anecdotal reports from bank anglers that fish at the 20 other dams indicate that at, for example, Koppies, Rustfontein and especially Gariep Dam, smallmouth yellowfish are regularly caught on gear and bait targeting mostly carp. Some bank anglers at Gariep Dam report that up to five out of every six fish caught with baited hooks are smallmouth yellowfish. During angling competitions in the Free State, smallmouth yellowfish that are caught may not be kept to add to the tally of anglers' catches, leading to frustration as large numbers of these fish are often caught.

In Sterkfontein Dam, although the best fly fishing venue for smallmouth yellowfish, the population is facing quite a number of challenges. In light of the very low recruitment and the fact that most of the current population consists mostly of adult fish, the invasion and rapid spread of largemouth bass in the dam, and the impact of this alien predatory species on the indigenous biodiversity and especially smallmouth yellowfish requires urgent attention. Anecdotal reports received from fly fishermen who regularly fish at Sterkfontein Dam have indicated that there has been a rapid increase in the numbers of black bass in recent years, while catches of smallmouth yellowfish are declining. Where exactly the bass are coming from is debatable as there are as many opinions as there are bass in the dam. In order to determine the impact of bass on the smallmouth yellowfish, a study will be implemented soon and, depending on the results, recommendations will be made as to how best to ensure the sustainability of fly fishing for smallmouth yellowfish in Sterkfontein Dam.

Ed's note: The article is based on information from Leon Barkhuizen's thesis, which was completed in 2015 at the Department of Zoology and Entomology, University of the Free State.

Below: Besides Sterkfontein, Vanderkloof Dam has of late become a hot spot for fly anglers.

Photo: Gerhard Laubscher

