

EXECUTIVE SUMMARY

Freshwater angling activities have become an important recreational activity for people around the globe, bolstering both regional and national economies. A portion of the captured fish is sometimes kept by anglers, but many of them immediately release all of the fish that they catch back into their natural environment. This practice of “catch-and-release” (C&R) fishing is growing as a proportion of total fishing in southern Africa and is widely promoted by international and local angling fraternities, such as the Yellowfish Working Group. This practice is considered to be a very popular conservation strategy as well as a fisheries sustainable management tool, due to the assumption that no serious harm comes to pass on the fish that are being caught. There are only five species of fish for which there is an acceptable understanding of the effects that C&R angling poses to them. These species include largemouth bass *Micropterus salmoides*, walleye *Sander vitreus*, rainbow trout, *Onchorhynchus mykiss*, striped bass *Morone saxatilis* and Atlantic salmon *Salmo salar*. As such no information pertaining to the effects of C&R on local species exists. Two main factors that play a role in the effect of C&R on game fish include the age (size) of the fish angled as well as the reproductive state of the fish. These factors play an important role, since it has been shown that older (larger), sexually mature fish preparing for spawning are more severely affected by C&R sport angling than young, immature fishes of the same species. Therefore the study of the physiological affect of angling on a specific species will only have true application value if information pertaining to the variables of the age and reproductive state of that species are additionally considered.

The Orange-Vaal River system is the natural distribution range of *L. aeneus*. This species typically occupies slow to fast flowing habitats in predominantly the mainstream sections of rivers but also thrives in dams. *Labeobarbus aeneus* is not only renowned for its angling prowess and maintains the larger portion of a 133 million Rand industry in South Africa, but is also a highly sought after protein source by sustenance anglers in many rural communities. The practice of C&R of yellowfish in South Africa is currently considered to be an ecologically sustainable practice. Internationally however, this practice has received some criticism, and in many instances is considered to be detrimental to the long-term viability of specifically sensitive game fish populations. The ultimate success of C&R angling thus depends on ensuring high release survival rates by minimising handling, injury and mortality of caught individual fish.

In a recent review on C&R recreational angling, it is argued that a goal of conservation science and fisheries management should be the creation of species-specific guidelines for C&R practices. These guidelines must take into account the inter-species diversity of fishes and variation in angling techniques. As recreational angling continues to grow in popularity, expanding to many developing countries, it is important that data appropriate for specific fish and fisheries are available. The species specific data needed includes information on the:

- physiological effect of angling on the target species as well as all the different factors that influence the release mortality of that species,
- reproductive size (age) and reproductive period and
- population structure and dynamics of the targeted species.

In the light of the above information, angling stress has been shown to affect fish differently under various conditions, such as time of year (water temperature, spawning period) and fish size and/or age. It is thus of importance to have knowledge of the fish's biology to understand the threats that angling may pose to the individual and populations. To understand the biology of fishes, various parameters such as age, growth and sexual maturity (gonadal development) should be studied. In light that this information is extremely important for the development of proper C&R guidelines for freshwater sport fishing as well as the management of fish stocks, this project on a popular African freshwater angling

species, *Labeobarbus aeneus* (smallmouth yellowfish) was undertaken.

To determine the physiological response of the smallmouth yellowfish (n=96), data was collected from June 2008 through to December 2008 (Vaal River). Fish were collected using standard angling and fly-fishing techniques, anaesthetised in clove oil and blood drawn from the caudal veins; thereafter fish were weighed and measured, revived and released. To serve as reference data, randomly selected fish were kept for 72 h in pools filled with river water. These fish were then anaesthetised and blood was drawn from them again for a relative reference value.

Blood plasma was analysed for concentrations of glucose, cortisol and lactate to determine the effects of angling duration, fish size, and water temperature. Larger fish were shown to be angled for a longer duration compared to smaller fish. Levels of glucose, at times, were affected by water temperature (influenced by time of year). Plasma glucose concentrations in *L. aeneus* decreased with greater angling durations. Few individuals (n=12) showed significantly increased plasma cortisol concentrations. Lactate concentrations were found to increase significantly above reference values in *L. aeneus* angled for > 1 min. Results from the reference fish indicated that baseline levels cortisol and lactate in *L. aeneus* were restored within 72 h of capture.

The relative ages of the *L. aeneus* were determined with the aid of scales and asteriscus otoliths. Males and females were found throughout the age classes. Male and female *L. aeneus* had longevities of 19 years and 15 years respectively. *Labeobarbus aeneus* males matured at a fork length (FL) of 289 mm and females matured at 367 mm FL, corresponding to relative ages of 4 and 6 years respectively.

This is the first study of its type reporting on the physiological response of the Vaal-Orange smallmouth yellowfish, while the age of various *L. aeneus* populations has been studied, this is the first time that otoliths were used for age determination in the Vaal River population. The original aims proposed to test the hypotheses established for this study were to carry out assessments of the effects that selective angling activities (C&R) may pose to populations of *Labeobarbus aeneus* from the Vaal River, South Africa, to determine age, growth and size at maturity for this population. These aims were all achieved and this report presents the approach adopted outcomes, conclusions and recommendations made pertaining to the physiological response of smallmouth yellowfish to angling.