

## Project Update: November 2013

### Summary

Non-native invasive species are major drivers of biodiversity loss. In freshwater ecosystems, impacts by non-native fish species on native biota have been observed to range from subtle, such as influencing behaviour, distribution and habitat use, to local extirpation and broad ecosystem impacts, including disruption of food webs. In the Eastern Cape, South Africa, many non-native fish species have established within many rivers, and there are serious concerns on the conservation of native species.

In order to understand the potential consequences of different non-native predators, this study examined the behavioural diel activity patterns for two native species, chubbyhead barb *Barbus anoplus* and the Eastern Cape redbfin *Pseudobarbus afer*. Both species occur within headwater tributaries of rivers where they are an integral component of the ecological functioning and food webs. Anecdotal evidence, based on previous field observations, suggests that chubbyhead barbs occur in sympatry with non-native piscivores, such as largemouth and smallmouth bass and rainbow trout in certain habitats. The Eastern Cape redbfin minnows, by contrast, are IUCN-listed as endangered primarily due to predation by these non-native piscivorous predators. Diel activity patterns and refugia use for both species were therefore examined based on both field experiments within non-invaded streams and laboratory experiments. The aim of this experimental research was to relate the findings of the observed responses for both *B. anoplus* and *P. afer* to the potential invasion of their habitats by different non-native predators. The experiments were conducted from May to September 2013.

Chubbyhead barbs exhibited consistent nocturnal activity based on both field and laboratory observations. Due to the absence of fish predators within its habitat, its nocturnal behaviour suggests a response to the cost associated with diurnal activity, such as predation risk by diving and wading birds. In contrast, redbfin minnows showed high diurnal activity and a shoaling behaviour in the wild. In the laboratory, the redbfin minnows were strongly associated with refuge during both day and night photoperiods, but nonetheless showed high diurnal activity that was consistent with observations in the wild. The diurnal activity of this species suggests a response to the cost associated with nocturnal activity. Such a cost could be inferred from the presence of the longfin eel, a native predator that was active at night, whereas the daytime shoaling behaviour suggests an anti-predator mechanism to diurnal visual predators. Both species were found to be active in habitats with abundant refugia, such as cobbles and boulders.

The implications of these findings relate to the impacts associated with the potential invasions by non-native piscivores that occur in the mainstream sections. Diurnal activity patterns for redbfin minnows, that are endangered, may, in part, explain their susceptibility to high predation by visual non-native piscivores, such as largemouth and smallmouth bass and trout. In contrast, the nocturnal habits of chubbyhead barbs suggest a probable pre-

adaptation to visual predation. The likelihood of invasion by nocturnally-active sharptooth catfish *Clarias gariepinus*, however, may compromise this prior advantage.

Examination of food web dynamics for both non-native and native species using stable isotope analysis within the invaded mainstem sections is currently ongoing.