

Feigning death in the Central American cichlid *Parachromis friedrichsthalii*

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Feigning death, a hunting strategy in which a healthy individual acts as if it was dead to trick prey into its reach, is reported for a population of the Central American cichlid *Parachromis friedrichsthalii*. Possible mechanisms leading to the evolution of such a behaviour are discussed.

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Cichlids are not only astonishingly diverse in morphology and body colouration but are also especially diverse in behavioural characteristics (Baerends & Baerends-van Roon, 1950; Fryer & Iles, 1972; Keenleyside, 1991; Barlow, 2002; Stauffer Jr. *et al.*, 2002). The diversification of cichlid species has often been accompanied by trophic adaptations (Streelman & Danley, 2003) and convergent evolution has led to strikingly similar morphological and behavioural adaptations to obtain food in various even distantly related lineages of cichlids (Liem & Osse, 1975; Liem, 1979, 1980; Winemiller *et al.*, 1995; Roe *et al.*, 1997; Stiassny & Meyer, 1999).

One of the most outstanding hunting behaviours is the strategy embarked on by a predatory cichlid species from Lake Malawi in East Africa, *Nimbochromis livingstonii* (Günther), which feigns death and mimics a rotting fish. The fish lies on its side on a sandy bottom, sometimes even partially buried in sand, and with its colour pattern, it appears not only dead but in the early stages of decay (Fryer & Iles, 1972). Small scavenging fishes appear to be attracted by this behaviour and colour pattern and are attacked by the feigning predator when they try to feed on the putative cadaver (Fryer & Iles, 1972; McKaye, 1981).

This study reports the first observation of a feigning death hunting strategy in the cichlid *Parachromis friedrichsthalii* (Heckel) that can be found on the Atlantic slope of Central America, from the Rio Usumacinta drainage in Mexico south to Honduras (Conkel, 1993).

Feigning death in *P. friedrichsthalii* was recorded in April of 2004 during 4 days of underwater observations in the Cenote Escondido (20°13' N; 87°28' W), a water-filled limestone sinkhole, c. 3 km south of Tulum on the Yucatán Peninsula (Quinatana Roo, Mexico). The Cenote Escondido is only c. 40 m in length and 3–5 m in width. The shores slope very steeply to a maximum depth of 5 m. Macrophytes are lacking but on the rocky substratum algae grow and organic deposits can be found. *Astyanax fasciatus* (Cuvier) and *Poecilia cf. sphenops* (Valenciennes) were the most abundant fish species in the Cenote Escondido. Furthermore, five cichlid species were observed: '*Cichlasoma octofasciatum* (Regan), *Amphilophus robertsoni* (Regan), *Thorichthys meeki* Brind, *Vieja synspila* (Hubbs) and *P. friedrichsthalii*. Presumably, *Rhamdia guatemalensis* (Günther) occurs in Cenote Escondido since it was observed in the nearby Cenote Cristal.

Subadult individuals of *P. friedrichsthalii* were mainly observed near the water surface hidden between overhanging leaves, whereas larger adult individuals usually stayed in shady areas in deeper water. During the first dive, a seemingly dead individual of *P. friedrichsthalii* was noticed with frayed fins resting on the substratum [Fig. 1(a)], however, the fish disappeared quickly. One day later, three more seemingly dead individuals of the same species were recorded distributed in the whole cenote but again these animals were just feigning death. Although all of these individuals had frayed fins and were comparatively 'skinny', they were otherwise apparently healthy and vital.

Further observations revealed that disturbed feigning death individuals swam for 1 or 2 m, let themselves sink to the ground again very slowly and then turned over on one side. They rested in this position for several minutes. The longest period of time *P. friedrichsthalii* was observed lying on its side was >15 min. Feigning death occurred on algae covered rocks exposed to the sun as well as between the leaf litter in shady areas of the cenote. Other fishes were attracted by the feigning predator [Fig. 1(b)] and could be observed picking on the body and the fins of the putative cadaver. The fin damages of the predator were therefore probably caused by its scavenging prey. Twice an attack of the predator was observed when a *P. cf. sphenops* came close enough (c. 10 to 15 cm) to the head of the *P. friedrichsthalii*. After one attack, the predator swam for c. 2 m and started feigning death again, after the other attack, the predator retreated to deeper parts of the cenote.

Interestingly, the body colouration of *P. friedrichsthalii* is mostly described as bright yellow with black vertical bars (Conkel, 1993). The *P. friedrichsthalii* observed in the Cenote Escondido differed in colouration. In the adults, the vertical bars were very broad and had a dark brown colouration leaving only narrow stripes that were somewhat brighter, but not yellow. This colouration does not mimic a rotting corpse as strikingly as the colouration of *N. livingstonii*. Nonetheless, the other fish species in the Cenote Escondido responded to feigning death in *P. friedrichsthalii*. Almost all observed individuals of *P. friedrichsthalii* in this cenote were surrounded by other fishes during feigning death. When *P. friedrichsthalii* continued feigning death after disturbance through the observer, other fishes approached the putative cadaver within 1 or 2 min.

These observations suggest that feigning death in *P. friedrichsthalii* is a hunting strategy similar to the one of *N. livingstonii* from Lake Malawi (Fryer & Iles, 1972; McKaye, 1981). These species are the only cichlids known to use

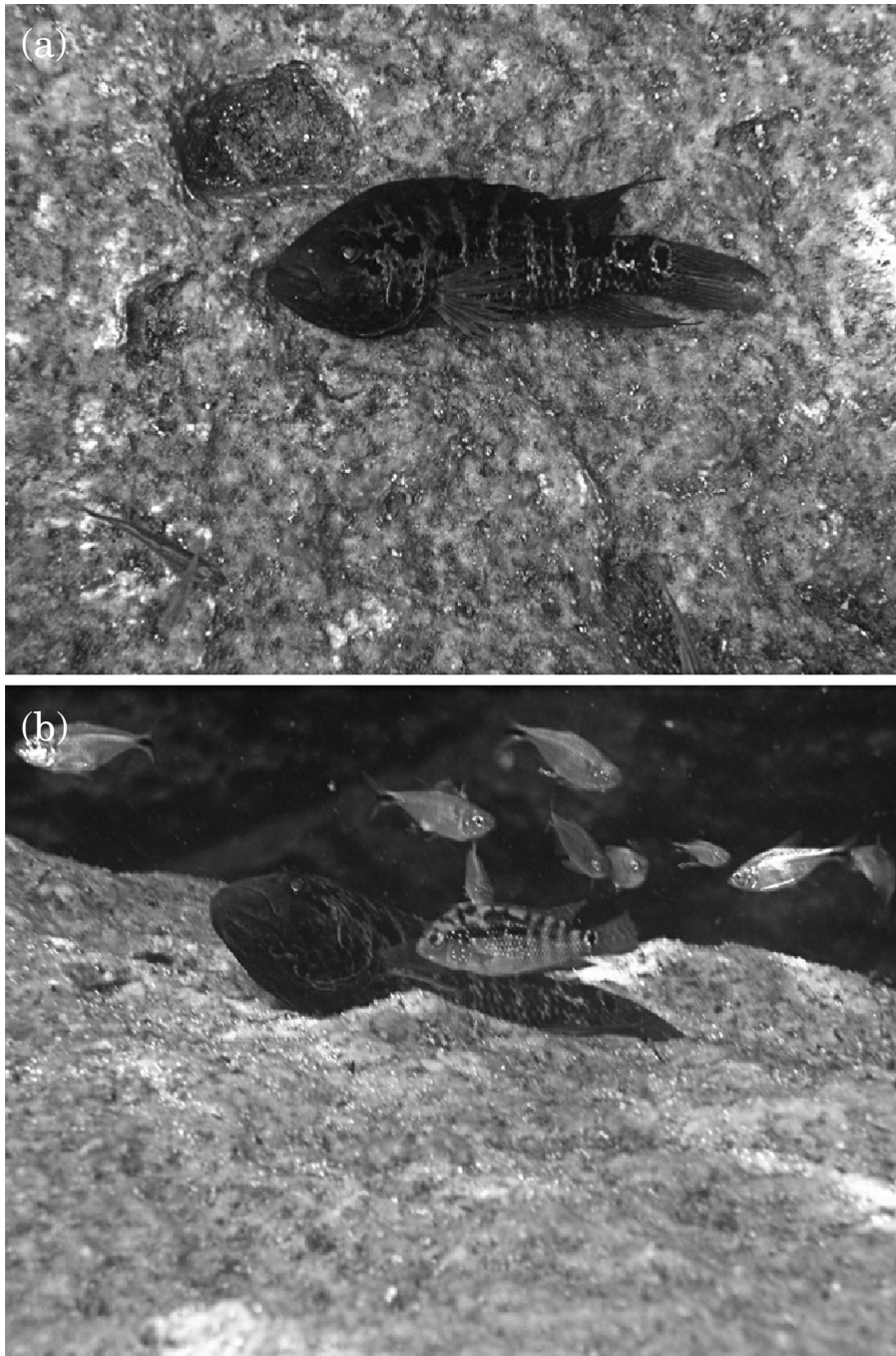


FIG. 1. (a) View from above on a feigning death *Parachromis friedrichsthalii* in the Cenote Escondido. Note the frayed fins of the predator. (b) A feigning death individual of *P. friedrichsthalii* surrounded by potential prey.

feigning death to trick prey into their reach. A similar strategy named dying or illness feigning was only recently reported in the serranid *Mycteroperca acutirostris* (Valenciennes) (Gibran, 2004).

Feigning death hunting strategies apparently have evolved at least twice within the cichlids. The habitats of both species embarking on this strategy, Lake Malawi and the cenotes on the Yucatán Peninsula, have very clear water (Fryer & Iles, 1972; pers. obs.) and both species are diurnal predators. Capturing prey by surprise attacks in such clear water may be difficult, and hence this might have promoted the evolution of alternative hunting strategies like feigning death reported here and sit-and-wait tactics. Feigning death might have evolved under clear water conditions as a strategy of attracting any kind of fish species, since a corpse can be seen over long distances and many small fish species tend to feed opportunistically on recently dead fishes. The high variation in colour patterns as well as the ability to change these colours plastically to mimic dead fishes might have increased the successfulness of feigning death. Gibran (2004) also suggested that places without cover to ambush or stalk (low complexity environments) and the ability to change colour patterns lead to the evolution of feigning dying in *M. acutirostris*. Alternatively, high species diversity, competition for prey and a high density of potential prey might have played a role in initiating the evolution of feigning death hunting strategies.

Feigning death and dying hunting strategies are possibly much more abundant than currently known since behavioural and other life-history observations of fishes in their natural habitats are still scarce. Lying-on-the-side behaviour for example was also reported in the South American cichlid *Astronotus ocellatus* (Agassiz) (Gibran, 2004). Up to date, it is not known if other populations of *P. friedrichsthalii* show the same feigning death hunting strategy as the population in the Cenote Escondido. Since all observed feigning death individuals were adults and no subadult or juvenile *P. friedrichsthalii* could be observed hunting in this manner, it is implausible that feigning death is the standard hunting strategy of this cichlid species. Furthermore, *P. friedrichsthalii* also inhabits rivers that at least seasonally are very turbid. It is questionable if feigning death is also successful in turbid environments. Although the species has a wide distribution in Central America, behavioural observations in the natural habitats are mostly lacking.

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