

Conservation and ecology of a new blind fish *Glossogobius ankaranensis* from the Ankarana Caves, Madagascar

In 1981 Fauna & Flora International's 100% Fund assisted an expedition to study the biology of the Ankarana Caves in Madagascar. A follow-up expedition collected examples of a fish that was subsequently found to be a new species. Its restricted distribution as well as existing and potential threats to its habitat mean that it must be considered as endangered.

Introduction

The subterranean and surface-dwelling fauna of the Ankarana limestone massif were extensively surveyed during the 1986 Crocodile Caves Expedition to Madagascar (Wilson, 1987). A reconnaissance expedition in 1981 (Wilson, 1985) had discovered a range of new species of cave-adapted shrimps (Gurney, 1984), so the 1986 team expended considerable effort in searching the subterranean rivers and pools for further cave-adapted species. A range of pale organisms was noticed in various locations within the massif, including a white crab, which evaded capture, and numerous fish. It was not possible to collect many of these. It was suspected that some were fish that possessed eyes and that had probably been washed into the caves from surface streams, subsequently losing their pigment. Others were thought to be blind, cave-adapted fish that had lived in the caves for many generations. Finally, blind white troglomite* (cave-adapted) gobies were collected from the Second River Cave and proved to be a new species. The gobies were not positively

*Note. Troglomites are obligate cave dwellers, peculiarly adapted to the cave environment and never found outside caves. Troglomites can live and reproduce in caves but survive outside them also and are not particularly adapted to life in caves.

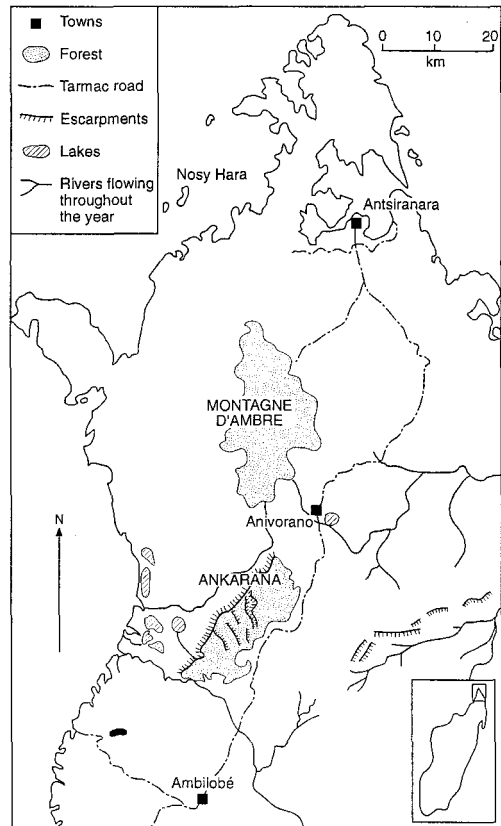


Figure 1. Map showing location and features of Ankarana massif.

identified from any other site. They have now been described and named *Glossogobius ankaranensis* (Banister, 1994).

Blind cave fish in Madagascar and the new goby

Until 1994 only two species of troglomite fish were known from Madagascar, both belonging to the genus *Typhleotris* Petit 1933 of the gobioid family Eleotrididae. They are 70–80

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mm long, blind and depigmented (Arnoult, 1959; Paulian, 1961; Decary and Arnoult, 1981) and inhabit caves in Eocene limestone beneath the arid south-west of the island, about 1200 km from Ankárana.

Glossogobius ankaranensis, although also a gobioid, blind and about 7 cm long, is not a close phyletic relative of the two previously known species. Like other Malagasy troglóbites, *G. ankaranensis* has eye sockets that appear to lack ocular tissue except for a minute black spot in each. The fish has no pigment and in life is pink in colour, where blood and internal organs show through the thin, weak scales. The species has a large mouth and thick lips, and the lower jaws protrude further than the upper jaws; there are several rows of teeth. There are no large obvious specialized sensory appendages of the kind found in other obligate cave-dwellers; there are no perforated lateral line scales, but there is a pelvic sucker formed from united ventral fins. A detailed taxonomic description is given in Banister (1994). Type specimens were deposited in the British Museum (Natural History) (Reference 1994, 12, 1:1,2) as well as in the Malagasy National Collection at Tsimbazaza, Antananarivo. Other pigmented gobies collected at the same time were deposited in the same collections in 1986.

The habitat and sympatric species

The Ankárana massif, a small outcrop of middle Jurassic limestone with its highest points approaching 300 m, lies in the extreme north of Madagascar about 75 km south of Antsiranana (Diégo Suarez). Since 1989 this Special Reserve has been patrolled by six guards using mountain bikes supplied by the World Wide Fund for Nature. Here in Madagascar's western biogeographical zone, there is little rainfall between April and November and during this dry season the savannahs surrounding the massif become parched as many surface rivers dry up. Evergreen forests thrive in the massif's canyons and collapsed caves because they are irrigated by a series of subterranean rivers fed



Gobioides ankaranensis (Jane Wilson).



Sympatric gobies, *Gobioides ankaranensis* and *Glossogobius callidus*, from the Ankárana Caves, northern Madagascar. (Jane Wilson).

from regions of higher rainfall to the north and east. The Ankárana forests form an ecological island, which is home to the richest vertebrate fauna known on Madagascar, including innumerable endemic and several endangered species (Wilson *et al.*, 1988, 1989, and in press; Fowler *et al.*, 1989; Palacios *et al.*, 1990; Wilson, 1995).

Several rivers enter the massif from the north and east but only two are perennial: the Andranotsisiloha (meaning 'river without a start') and the Besaboba. As these rivers flow through the massif they appear to divide and coalesce and eventually re-emerge in the south-west of the outcrop (Wilson, 1987). The hydrology of the massif is complex, local

volcanic activity having disturbed older geological structures including the cave systems.

Second River Cave, where the new species was collected, is located in the northern third of the massif and allows access to part of the underground river system. Although the new fish was only positively identified in this cave, it is probable that it occurs in other, inaccessible parts of Ankárana. The accessible part of this cave river is only about 150 m long and flows slowly through about 100 m of low passage. The river is just over 2 m deep at its deepest point and perhaps 5 m wide. In September the water temperature is 21°C. Several specimens were collected from the cave and survived a journey back to the UK, which indicates that they are not particularly sensitive to temperature fluctuations, as is often the case in cave-adapted species.

Glossogobius ankaranensis occurs in large numbers in Second River Cave and, unusually for a troglobite, many individuals were observed in water that receives some daylight. Some fish inhabit the river itself, while others live in isolated pools located slightly above the dry-season level of the river; these pools are beyond the limit of light penetration into the cave. Specimens up to about 70 mm long were seen but they ranged in size from about 40 mm. They are slow-moving, appearing to search their habitat in a browsing swimming pattern, gently oscillating in the horizontal plane, with the mouth closed. They were seen approaching, and frightening away, blind and sighted shrimps, but not feeding on them. However, presumably these shrimps, which are abundant in the cave rivers, do provide food for the fish, as do dead and dying insects and other detritus stranded on the water surface. Other gobies are recorded as feeding on shrimps and detritus. Lemurs (*Eulemur coronatus*) drink at this cave waterhole and both *Miniopterus* bats and Madagascar black swifts *Apus apus balstoni* roost inside the cave. All these animals probably import detritus, which the fish consume during the dry season; it is possible that the fish are abundant here because food is plentiful. *Glossogobius callidus*, a related goby that has eyes and is pigmented, also lives in Second River Cave in consider-

able numbers (P. Miller, pers. comm., 1992). These troglophile fish are 30–40 mm long and do not seem to compete with the slower-moving *G. ankaranensis*. Unexpectedly, we discovered some *G. callidus* swimming around in absolute darkness in an isolated pool completely sealed with a 2-mm layer of calcite. Any major changes in water-level (as would occur in the rainy season) would allow this calcite lid to crack and replenish the pool's oxygen and probably also detritus for the fish to consume.

Conservation status

At first sight the inhospitable Ankárana massif would seem to be a perfectly, naturally protected environment. There are threats, however. The canyons that transect the outcrop sometimes fill with water to a depth of perhaps 50 m. It is clear from the tree trunks and smaller flotsam that are stranded deep within Ankárana's caves and high up on the canyon walls that the massif is prone to dramatic floods. These scour the caves and must surely kill many cave-dwelling organisms. Annual floods are important in importing food for the cave fish, but catastrophic floods, which may become more frequent with increasing forest losses upstream, may threaten *G. ankaranensis*.

All of the world's 39 known species of blind, cave-adapted fish are endangered and it would seem that *Glossogobius ankaranensis* may be even more threatened than most of these species. Even if it proves to be common and widely distributed throughout the river caves of the Ankárana massif, its geographical distribution is very limited: the massif is only 28 × 8 km at its widest points.

The reserve itself attracts the attention of timber merchants because it contains a range of highly prized rosewoods *Dalbergia* spp: there was a major illegal incursion in 1988 (see Wilson 1995, 206). Deforestation, which continues in the catchment area upstream of Ankárana, is also likely to affect the flow of the massif's perennial rivers and may be responsible for the silting-up of some caves.

Such changes would be likely to threaten the survival of the blind fish and the many other vulnerable or endangered inhabitants of Ankárana, even if the reserve itself is effectively patrolled and completely protected from exploitation. This situation highlights the importance of conserving and protecting whole regions rather than considering each reserve in an area as self-contained and independent.

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