

## Suckermouth armoured catfishes crack the paradox between respiration and suckermouth attachment

Suckermouth armoured catfishes (Loricariidae) use their suckermouth for respiration, feeding, and attachment to substrates. The combination of respiration and suction attachment appears paradoxal, as a properly functioning suction device would need a suction disc without leakage (yet inspiration must occur via the sucker), and continuous subambient pressure in the sucker cavity (even during expiratory mouth floor elevation). In the loricariid *Pterygoplichthys disjunctivus*, the anatomy of the suckermouth structures was examined, and a kinematic analysis was performed to acquire insights into how these functions are combined. High speed video recordings of external and internal structures (using X-ray equipment) of several specimens were analysed to determine how respiration is adjusted or constrained during weak or powerful suction onto substrates. These recordings show that suckermouth attachment does influence respiratory parameters such as cycle length, excursion amplitudes of the mouth floor and wall, and the way water enters the mouth. Respiration, however, continues during attachment and is not impaired. Our data show that a muscular oral valve can actively separate the buccal cavity from a pre-buccal cavity formed by the lip suction disc. Volume changes of this pre-buccal cavity assure sucker function, and are mediated by the lower lip, the lower jaws, and the oral valve. The maxillary barbels control lateral inflow openings, and can do so unilaterally. These loricariid head structures can be clearly linked to the station-holding capacities of loricariids, even on smooth, inclined surfaces. Morphological and kinematic data also show that the suspensorium has a minor share in the buccal volume changes, and that the opercle is anatomically and functionally decoupled from the gill slit ventilation mechanism.