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Continuous measurement of oxygen tensions in the air-breathing organ of Pacific tarpon (*Megalops cyprinoides*) in relation to aquatic hypoxia and exercise

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Abstract:

The Pacific tarpon is an elopomorph teleost fish with an air-breathing organ (ABO) derived from a physostomous gas bladder. Oxygen partial pressure (P_{O_2}) in the ABO was measured on juveniles (238 g) with fiberoptic sensors during exposure to selected aquatic P_{O_2} and swimming speeds. At slow speed (0.65 BL s^{-1}), progressive aquatic hypoxia triggered the first breath at a mean P_{O_2} of 8.3 kPa. Below this, opercular movements declined sharply and visibly ceased in most fish below 6 kPa. At aquatic P_{O_2} of 6.1 kPa and swimming slowly, mean airbreathing frequency was 0.73 min−1, ABO P_{O_2} was 10.9 kPa, breath volume was 23.8 ml kg^{-1}, rate of oxygen uptake from the ABO was 1.19 ml kg^{-1} min^{-1}, and oxygen uptake per breath was 2.32 ml kg^{-1}. At the fastest experimental speed (2.4 BL s^{-1}) at 6.1 kPa, ABO oxygen uptake increased to about 1.90 ml kg^{-1} min^{-1}, through a variable combination of breathing frequency and oxygen uptake per breath. In normoxic water, tarpon rarely breathed air and apparently closed down ABO perfusion, indicated by a drop in ABO oxygen uptake rate to about 1% of that in hypoxic water. This occurred at a wide range of ABO P_{O_2} (1.7–26.4 kPa), suggesting that oxygen level in the ABO was not regulated by intrinsic receptors.

Key-words: Fish; Respiration; Air-breathing; Bimodal gas exchange; Oxygen receptors