

Scientific Paper:

Marine Ecology Progress Series 294, 189-200, 2005

Metabolic performance and survival of medusae in estuarine hypoxia

Ladd D. Rutherford Jr*, Erik V. Thuesen

Laboratory One, The Evergreen State College, Olympia, Washington 98505, USA

Abstract:

Increasing eutrophication and hypoxia in marine environments appear to differentially promote the survival of some medusae species and the disappearance of others. To understand the physiological basis for this phenomenon, respiration rates and critical oxygen tensions (P_c) were measured for 12 species of medusae from Puget Sound (Washington State, USA). Mean mass-specific respiration rates ranged between $0.064 \mu\text{mol O}_2 \text{g}^{-1} \text{h}^{-1}$ for *Aequorea victoria* to $0.78 \mu\text{mol O}_2 \text{g}^{-1} \text{h}^{-1}$ for *Cyanea capillata*. Six of 12 species studied were oxyregulators; including the scyphomedusae *Aurelia labiata*, *C. capillata*, and *Phacellophora camtschatica* and the hydromedusae *A. victoria*, *Polyorchis penicillatus*, and *Proboscoidactyla flavicirrata*. Mean P_c s ranged from 5.5 hPa in *Muggiaea atlantica* to 39.5 hPa in *Euphysa flammae*. The relationship between mass-specific metabolic rate and P_c was significant for oxyregulators but not oxyconformers. An apparent metabolic depression occurred variably within all oxyregulating species and 2 oxyconforming species, *Clytia gregaria* and *Sarsia* sp., whereby sub- P_c oxygen uptake decreased by 77 to 99% relative to standard aerobic metabolic rate (SMR). Anoxia survival varied from less than 2 h for *E. flammae* and *Eutonina indicans* to more than 10 h for *A. victoria*. The poor low oxygen tolerance of several Puget Sound species in our study was consistent with the historical disappearance of related species in the Adriatic Sea following increased frequency of dysaerobic events. Interspecies variation in aerobic metabolic characteristics and hypoxia and anoxia tolerance may explain why some medusae thrive in low-oxygen conditions, while others disappear.

Key-words: Medusae, oxyregulation, hypoxia tolerance, critical PO_2 , hydromedusae, scyphomedusae