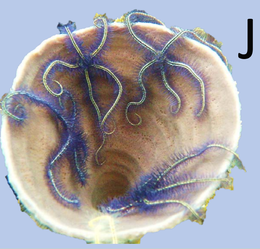


Just Breathe: Ophiuroid reacts to hypoxic conditions, and the anatomy responsible for bursal ventilation

MacKenna A. Hainey
Oregon Institute of Marine Biology – Smithsonian Tropical Research Institute

Smithsonian Tropical Research Institute | PANAMA

Introduction

- Ophiuroids make a significant component of biomass, species diversity, and abundance world wide (Hyman 1955, O'Hara 2014, 2017).
- Changing climate and resulting detrimental effects like oxygen minimum/dead zones can have profound, negative effects on ophiuroid populations, and on their surrounding ecosystem.
- Understanding how ophiuroids cope with hypoxic situations including their physiological responses may help us predict how their populations will be effected hypoxic events.
- I hypothesize *O. suensoni* will increase its rate of bursal ventilation when exposed to hypoxic conditions

O. suensoni disc exhibits an expansion and compression cycle

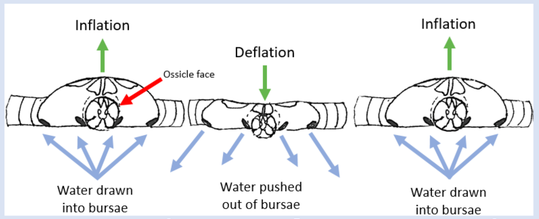
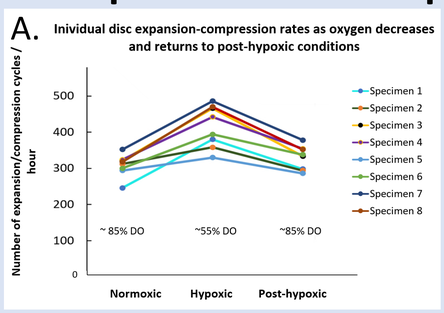
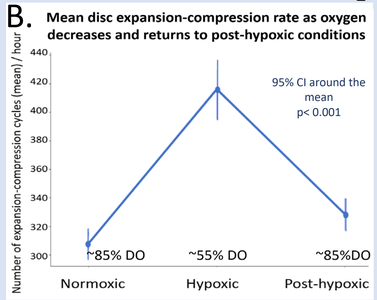


Illustration of ophiuroid disc, undergoing one cycle of expansion and compression (arms reduced for clarity)

Disc expansion and compression rate increases as $[O_2]$ decreases

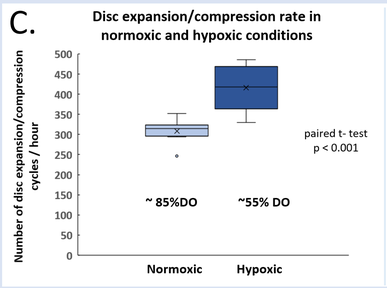


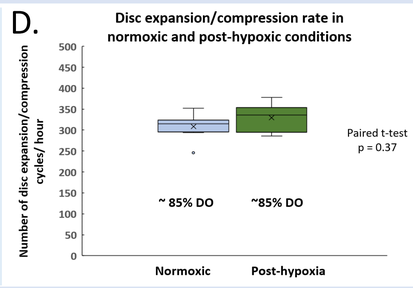


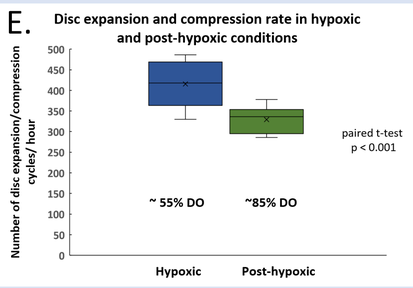
Mauchly's Sphericity test:
W = 0.48, p = 0.11
ANOVAR:
($F_{2,14}$ = 44.08, p < 0.001)
η_G^2 = 0.58

A. Each specimen increased its rate of disc expansion and compression, then returned to near the initial rate once [DO] rose to ambient conditions (~85%)

B. Repeated measures ANOVAR: The [DO] effect on disc expansion-compression rate is significant. Generalized eta squared (η_G^2) demonstrates a large effect size







C. Disc expansion-compression rates increase significantly when dissolved oxygen (DO) concentrations decrease, suggesting a respiratory functionality

D. There is no significant difference in the rates of disc expansion and compression for the normoxic treatment and the post-hypoxia treatment

E. Disc expansion-compression rates increase significantly when dissolved oxygen (DO) concentrations return to near ambient conditions

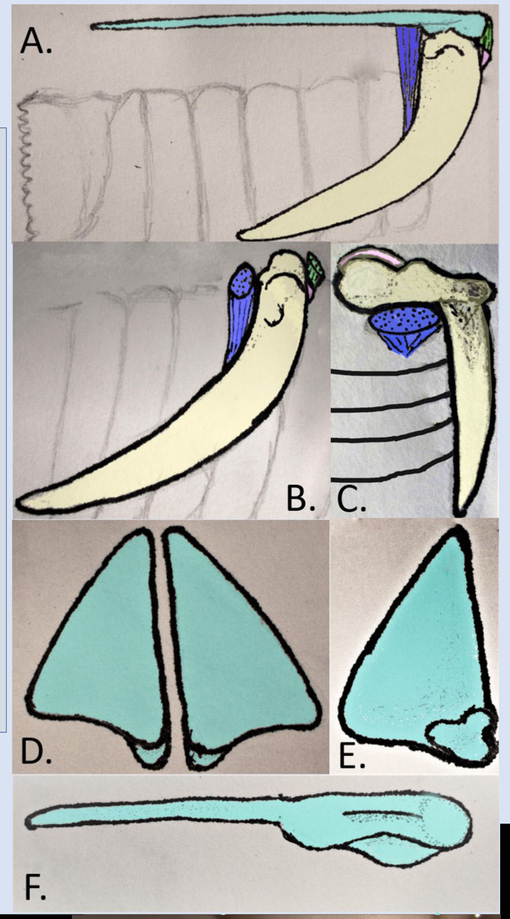
Summary

- *O. suensoni* disc exhibits a expansion and compression cycle
- Disc expansion and compression rate increases as $[O_2]$ decreases
- disc expansion and compression cycle is bursal ventilation
- The increase in bursal ventilation rate suggests a respiratory functionality

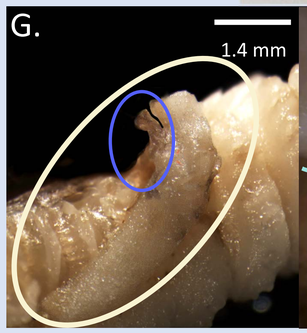
Opposing muscle sets bound to shield ossicles are responsible for bursal ventilation movement

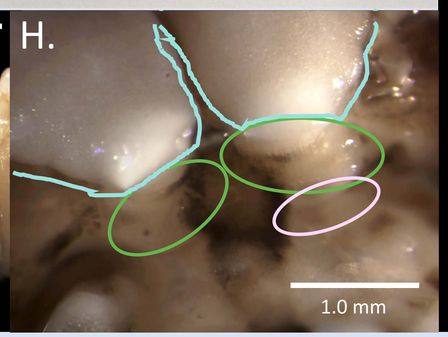
Color legend

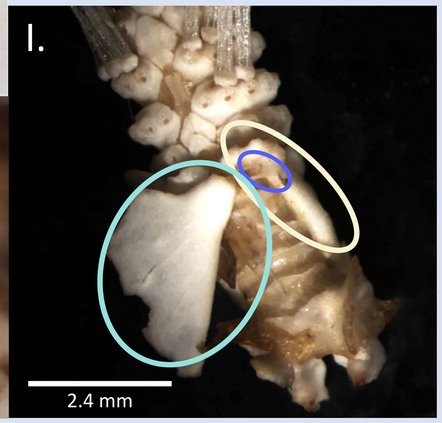
- Radial shield
- Genital plate
- Adductor muscle
- Abductor muscle
- Abductor attachment site



A. Complete radial shield/ genital plate complex with articulating adductor and abductor muscles B. Genital plate with abductor and adductor muscles from the side C. Genital plate with severed adductor muscle from above (1/2 arm) D. Radial shields from above E. Radial shield from below, showing articulating area at the distal end F. Radial shield viewed from the distal end, showing articulating area G. Close up of genital plate with severed adductor muscle (see B) H. Distal portion of radial shields connected to the genital plates via abductor muscles (see D) I. Arm and 1/5 of disc, showing one radial shield and one genital plate







Acknowledgements: Richard Emlet, Jan Hodder & Maya Watts, Brian Bingham, Smithsonian Tropical Research Institute, Oregon institute of Marine Biology, Williams Fund Scholarship for funding assistance, and the ophiuroids

mackenna@uoregon.edu