**Background**

- Temperature is increasing in the Southern Ocean surrounding Antarctica and as a result, oxygen levels are decreasing (1).
- White-blooded fish lack hemoglobin while red-blooded fish have hemoglobin allowing for larger oxygen carrying capacity (1).
- To improve oxygen uptake, fish may remodel their gills to increase the gill surface area which results in a loss of the interlamellar cell mass (ILCM) (2). See Figure 1.
- Gill remodeling reduces the ability to regulate blood osmolarity because loss of ILCM increases the surface area for ions to diffuse (3).
- To observe if Antarctic fish are affected by hypoxia, we measured their loss of ILCM increases the surface area for ions to diffuse (3).

**Methods**

- **Red-Blooded Fish**
  - Gambusia affinis (GIB)
  - Nototaenia coriceps (COR)
- **White-Blooded Fish**
  - Chaenocephalus aceratus (ACE)
  - Pseudochaenichthys gibberifrons (GEO)
- **Acclimated to hypoxia for 48hr and 5 days (COR)**
- **Fish exposed to Incipient Lethal Osmotic Saturation (ILOS)**
- **Dissolved oxygen levels determined from measurements of oxygen critical level for each species**
- **Fish held at approximately 15% above oxygen critical level (60% for 5-day hypoxia acclimation)**
- **Fish held in normoxia with a dissolved oxygen level of 100%**
- **Blood obtained immediately after the animal is euthanized and is chilled for 24 hr to allow blood coagulation**
- **Blood Osmolarity measured using Vapro Pressure Osmometer**
- **Fish were captured off the southwestern shore of Low Island (63°30'S,62°42'W) and in Dallmann Bay (64°08'S,62°40'W) in austral winter of 2023**

**Data Analysis**

- **Two-way ANOVA analysis followed by a Tukey's multiple comparisons test to determine significance for blood osmolarity among species and in response to ILOS and 48hr hypoxia acclimation**
- **One-way ANOVA analysis followed by Tukey's multiple comparisons test to determine significance in response to 5-day hypoxia acclimation**

**Results**

**N. coriceps increased blood osmolarity in response to 48hr hypoxia acclimation while C. aceratus decreased blood osmolarity.**

**Conclusions**

- Due to a lower metabolic rate than red-blooded fish, white-blooded fish have a lower demand for oxygen which may be why they showed no significant response in blood osmolarity to hypoxia acclimation.
- G. gibberifrons can tolerate lower oxygen levels than the other fish species and may have remodeled their gills to a greater extent to increase oxygen uptake resulting in the increase in blood osmolarity.
- N. coriceps may be able to regulate blood osmolarity if given enough time to acclimate to hypoxia, as the ILCM can be shed quickly and regrow within days.

**Moving Forward**

- To lower variation in blood osmolarity measurements, use the same individuals in normoxia and hypoxia by collecting blood through a cannula.
- Quantify ILCM loss in Antarctic fish due to gill remodeling that occurs in response to hypoxia to observe the affect hypoxia has on gill composition.

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**References**


