Controlled experiments to explore the use of a multi-tissue approach to characterizing stress in wild-caught Pacific halibut (*Hippoglossus stenolepis*)

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Fish condition & survival

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Injury & cortisol response

Bertotto et al. 2010

Baker et al. 2013
Wild-caught adult halibut
- 20 – 31 inches (50.8 – 78.7 cm)
- 10 sampling times (0-84 hrs) post-injection

Treatments
- ACTH
- Cortisol
- Control

Samples collected
- Blood
- Mucus
Expected stress response

Plasma
- Initial cortisol superhighway
- Concentrated

Mucus
- Part of cortisol excretory path
- Larger surface area, passive diffusion

ACTH
- Induces stress response
- 1st half of curve

Cortisol
- Washout/clearance rate
- 2nd half of curve
Bayesian analysis

3rd order polynomial
• $cortisol \sim a + bt + ct^2 + dt^3$
• Same analysis for each subset
• First derivative to find maximum and minimum points

Histograms: predicted timing of initial peak from stressor, $t_{max}$
• Posterior distribution
• Mode, 90% credible interval
**ACTH Injection**

**Induction Time**

- **Plasma, ACTH treatment (0-12 hr)**: 2.7 hr, 4.4 hr
- **Mucus, ACTH treatment (24-84 hr)**: 47.1 hr, 44.4 hr
- **Plasma, Control (0-12 hr)**: 4.4 hr, 21.6 hr
- **Mucus, Control (24-84 hr)**: 26.0 hr

**ACTH Dose**

Plasma vs Mucus
Cortisol Injection

Cortisol concentration (ng/ml) vs Time after injection (hr)

Plasma, Control (0-12 hr)
Plasma, Cortisol treatment (0-12 hr)
Mucus, Control (0-12 hr)
Mucus, Cortisol treatment (0-12 hr)

Cortisol Dose

Handling

Clearance rate

Plasma vs Mucus

3.6 hr
7.4 hr
11 hr

7.7 hr
4.3 hr
12 hr

8.8 hr
3.2 hr
12 hr

8.5 hr
3.5 hr
12 hr

Plasma
Mucus

Repeated sampling

Repeated stressors
- Additive stress
- Stepwise increases in chinook salmon (Barton et al., 1986)
Repeated Sampling – ACTH Injection

- Stepwise increases in plasma - repeated effects of handling
- No habituation evident
Discussion

**Next steps**

- Pair with external fish condition metrics & tagging
- Examine physiological regulatory mechanisms

- **Blood**: Capture condition (2-4 hr prior)
- **Mucus**: Pre-capture conditions (> 21 hr prior)
- **Multi-tissue approach**: blood & mucus samples taken together—more informed view of fish condition
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