

Cortisol and Thyroxine responses to water temperature change

- Arimune Munakata
 - Sendai, Japan
- Carl Schreck
 - USGS, Oregon State University

Cortisol and Thyroxine responses to water temperature change

Object:

To know the effect of water temperature increase/decrease on the change of plasma cortisol and thyroxine levels in downstream migrants and residents

Fish:

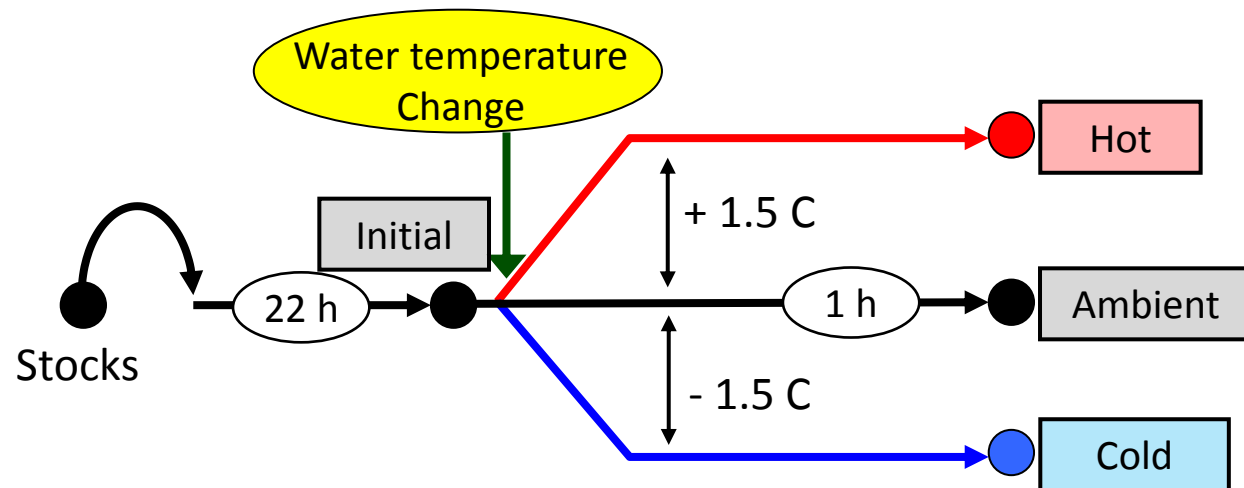
1⁺ Steelhead (Migrants), 2⁺ Rainbow trout (Residents)

Treatments:

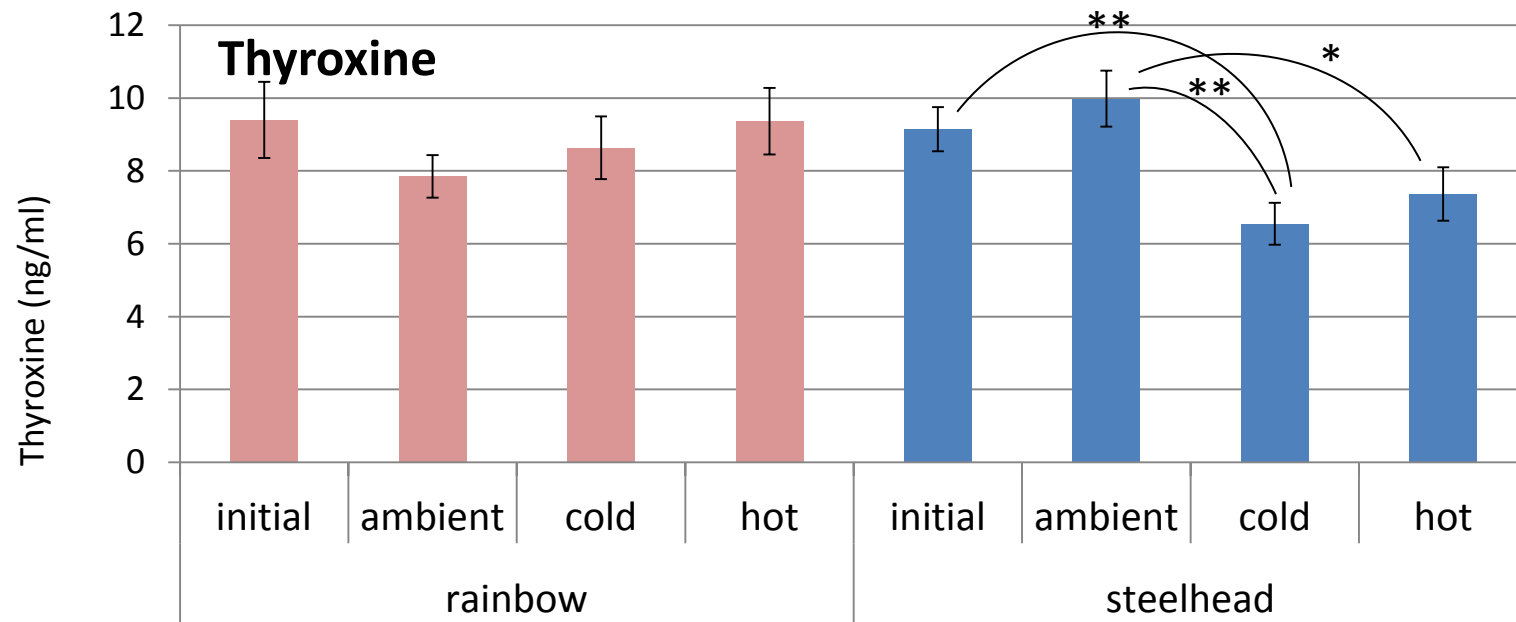
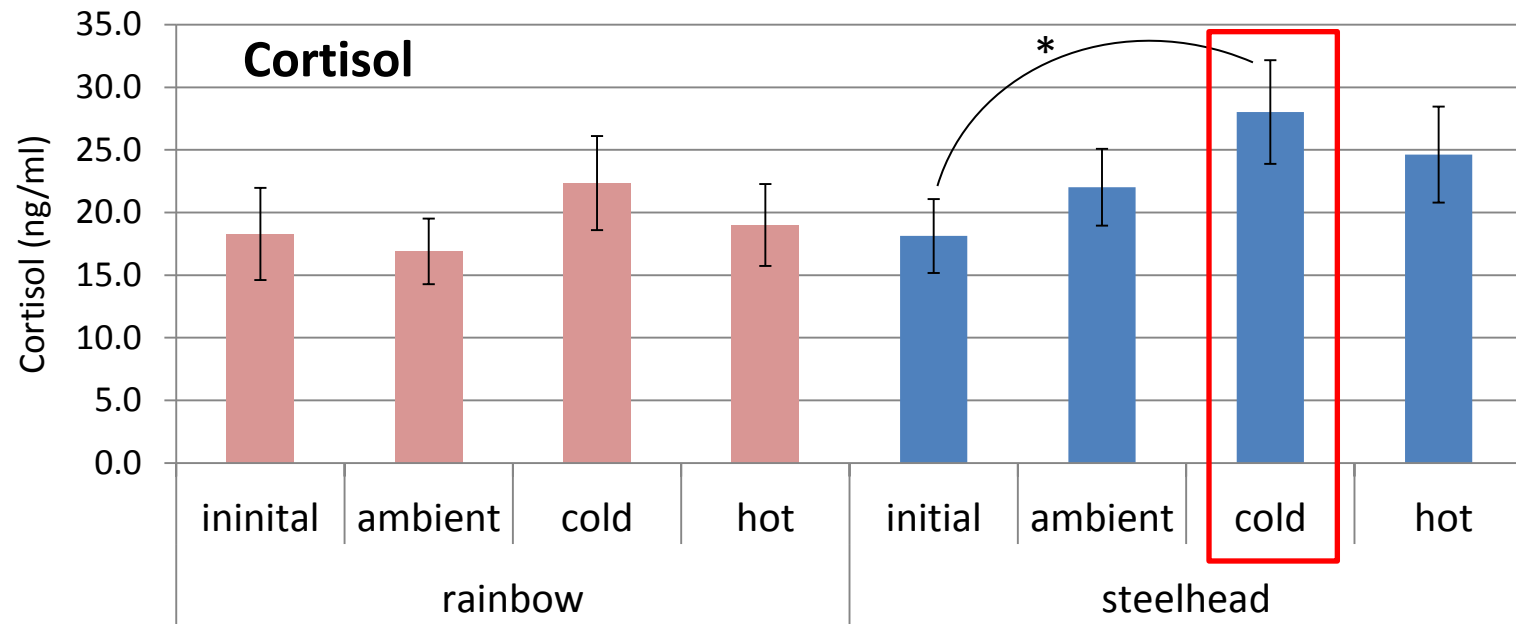
- Transfer fish from stock tank to each experimental tanks individually
- Rearing 22h
- Sample Initial groups and heat/chill water temperature of Hot/Cold group's tank
- 1h later, sample Hot, Cold, and Ambient groups
- Measure plasma F and T4 concentration in TR-FIA



Experimental tanks



Cortisol and Thyroxine responses to water temperature change



Body temperature responses to water temperature change

Object:

To know the difference of body temperature changes during water temperature decrease in downstream migrants and resident

Fish:

1⁺ Steelhead (Migrants), 2⁺ Rainbow trout (Residents)

Tag:

Vemco V9TP (It can be measure temperature and depth of water)

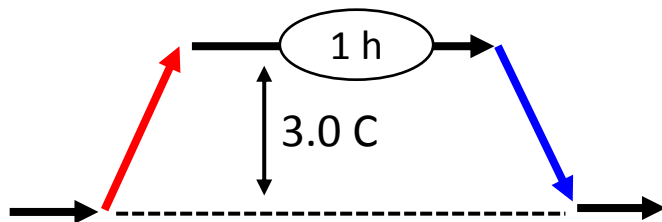
Length 4 cm x Dia 9 mm, 5.2g in air and 2.7g in water

Treatments:

Day 1 : Implant tags to abdominal cavity of 4 Rainbow trout and 4 Steelhead

Day 2~9 : Rearing 8 fish in same tank

Day 10~ : Changing water temperature (heat to +3.0C, and 1h later chill to -3.0C)



Experimental tanks



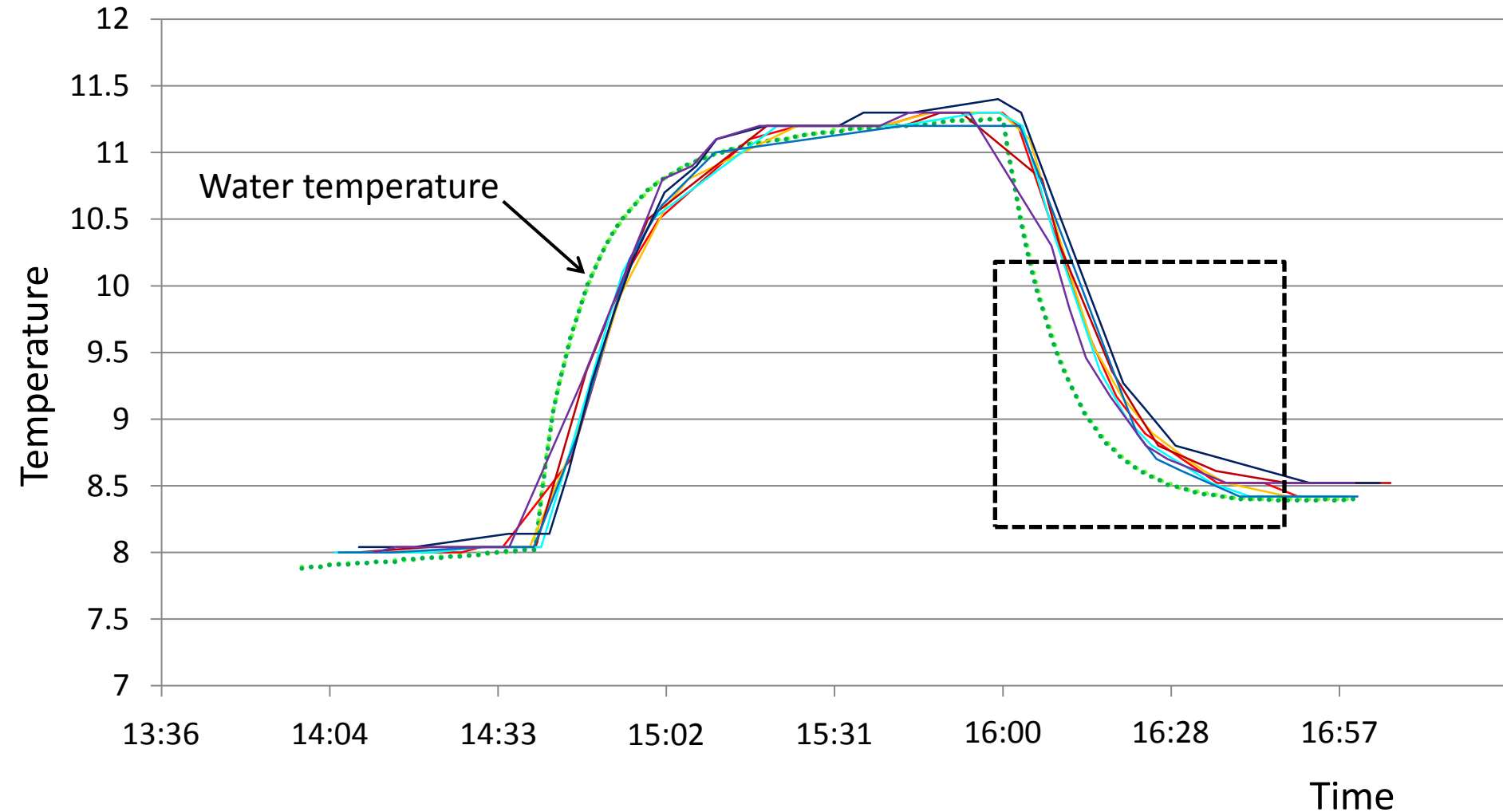
Tag implanting



Suture of silken threads

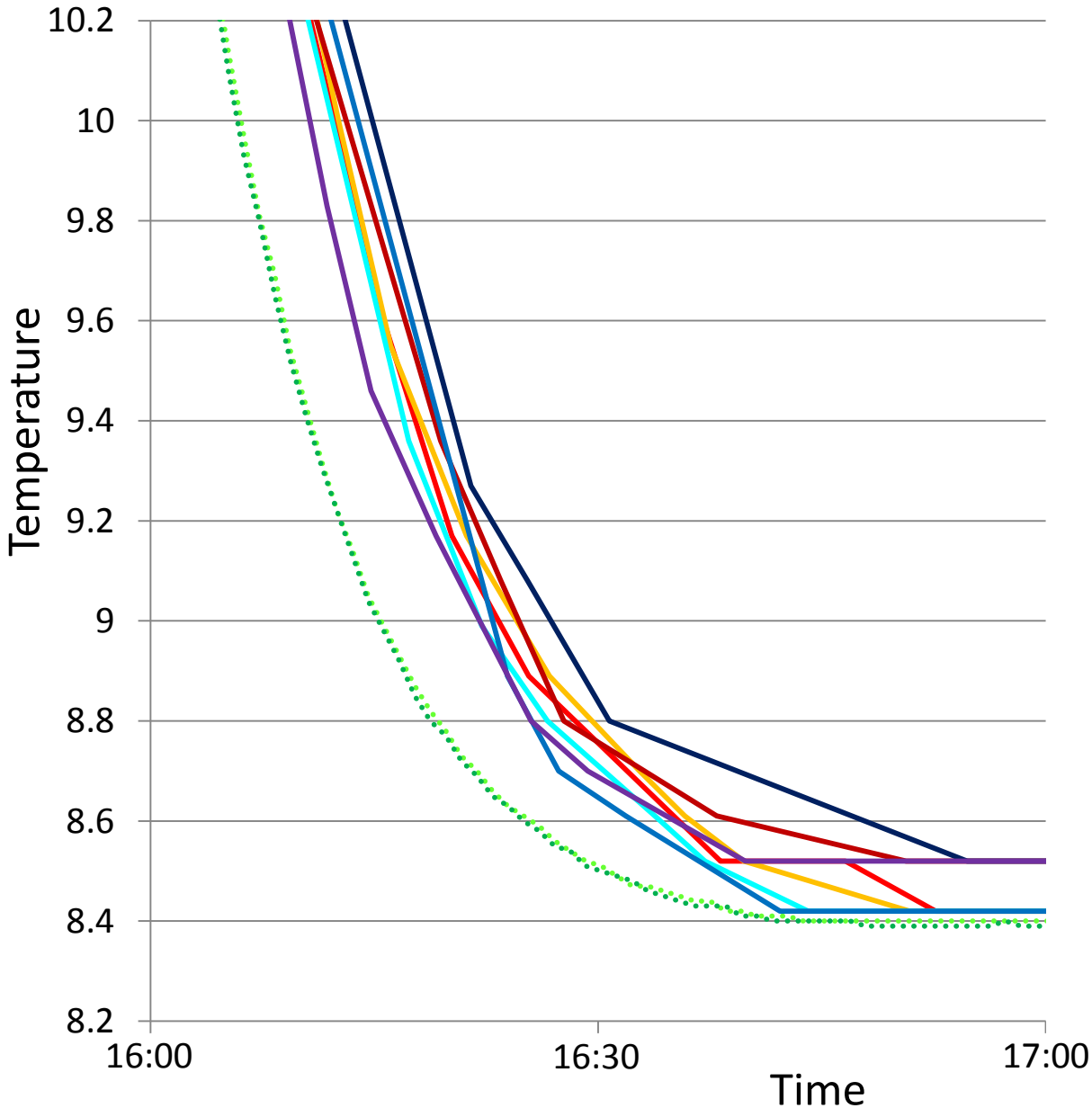
Body temperature responses to water temperature change

Body temperature response



Body temperature responses to water temperature change

Body temperature response



Rainbow trout :

BL 24.7 cm

BW 224 g

CF 1.49

BL 24.6 cm

BW 227 g

CF 1.52

BL 25.6 cm

BW 268 g

CF 1.60

Steelhead :

BL 26.0 cm

BW 243 g

CF 1.38

BL 25.0 cm

BW 197 g

CF 1.26

BL 27.0 cm

BW 280 g

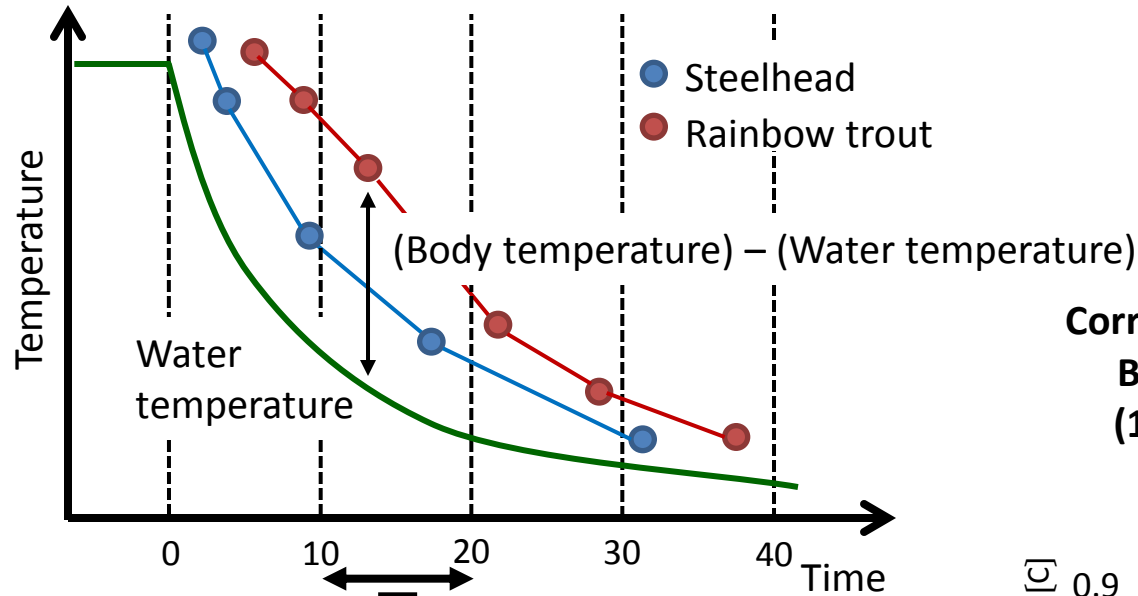
CF 1.42

BL 25.5 cm

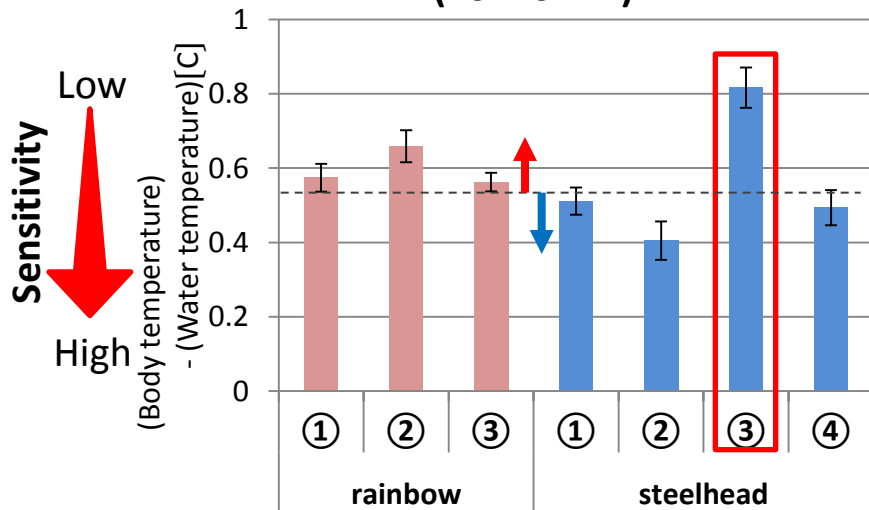
BW 197 g

CF 1.19

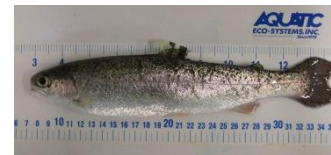
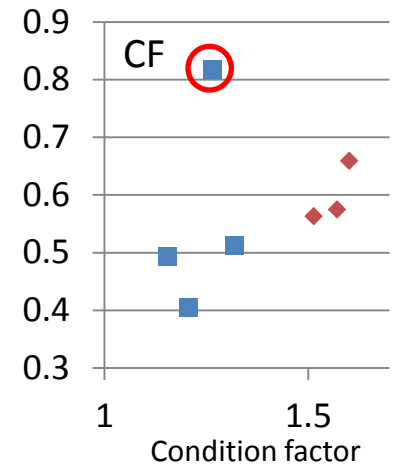
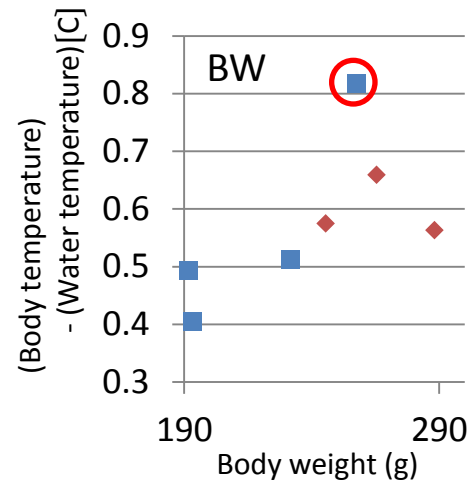
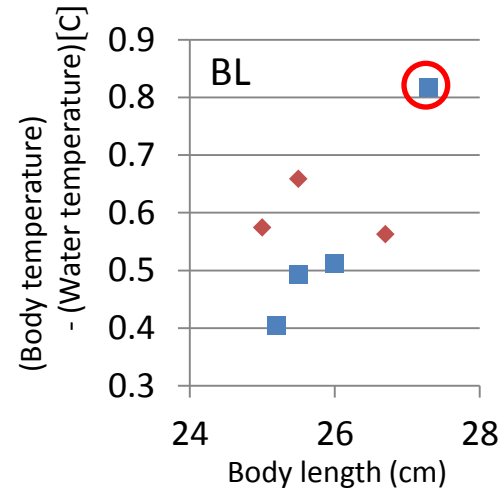
Body temperature responses to water temperature change



Body temperature - Water temperature (10~20min)



Correlation with BL, BW, CF (10~20min)



Conclusion

Hormone response:

- ✓ **F elevation arise from water temperature decrease only in Steelhead (migrants).**
- ✓ **T₄ elevation arise from water temperature increase and decrease only in Steelhead (migrants).**

Body temperature response:

- ✓ **Sensitivity to water temperature decrease depends on BL, BW, and CF rather than species.**