Building Context: Establishing Inputs to Enable Adaptive Monitoring and Inform Decision-Making

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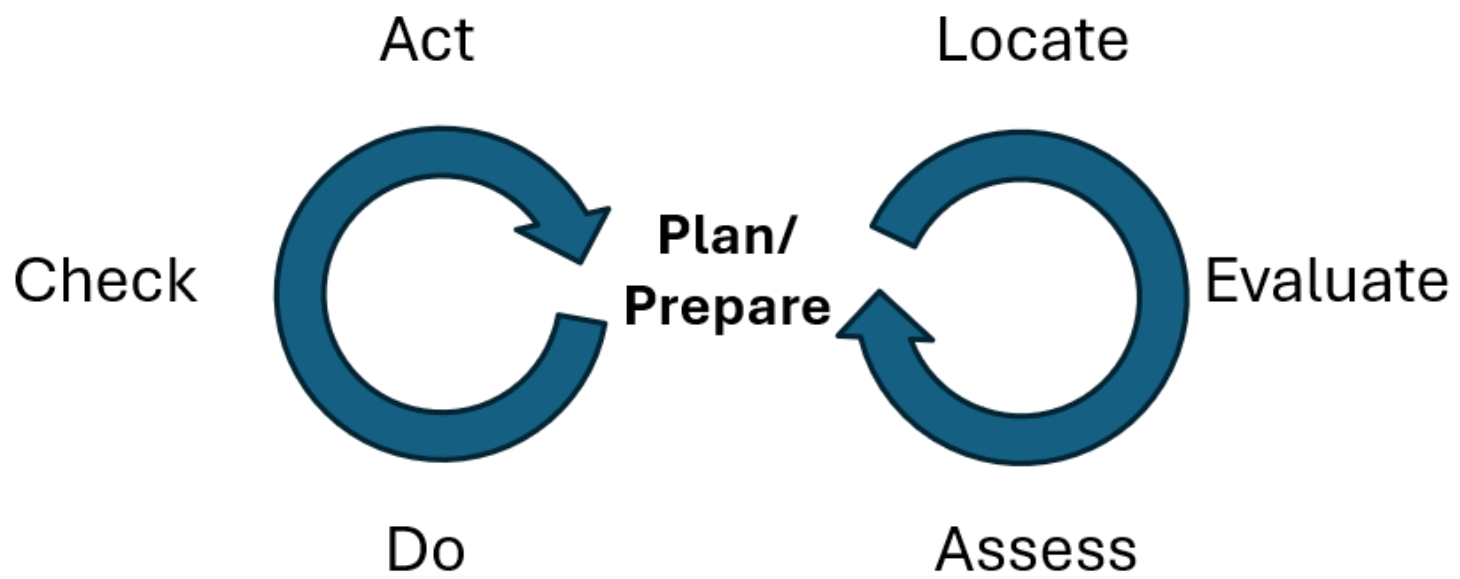
Adaptive Management Standard

Adaptive Monitoring Standard



ISO14001 Environmental Management approach

Taskforce of Nature-Based Financial Disclosures approach

Building Context

Establishing inputs to enable adaptive monitoring and inform decision-making

The management question

Are controls protecting river health?

Where would improvement matter most?

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DEVELOPMENT OF AN ADAPTIVE MONITORING AND MANAGEMENT FRAMEWORK FOR ENVIRONMENTAL SUBSTANCES OF CONCERN IN WASTEWATER

Prepared for:

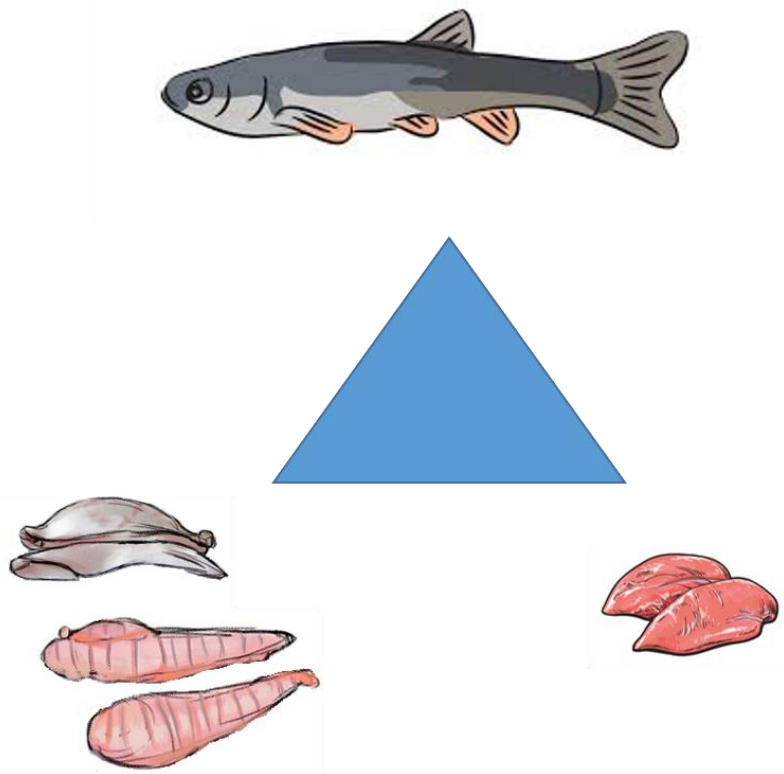
Norma Ruecker, Ph.D.
Lead, Watershed Assessment
City of Calgary – Water Quality Services

June 16, 2020

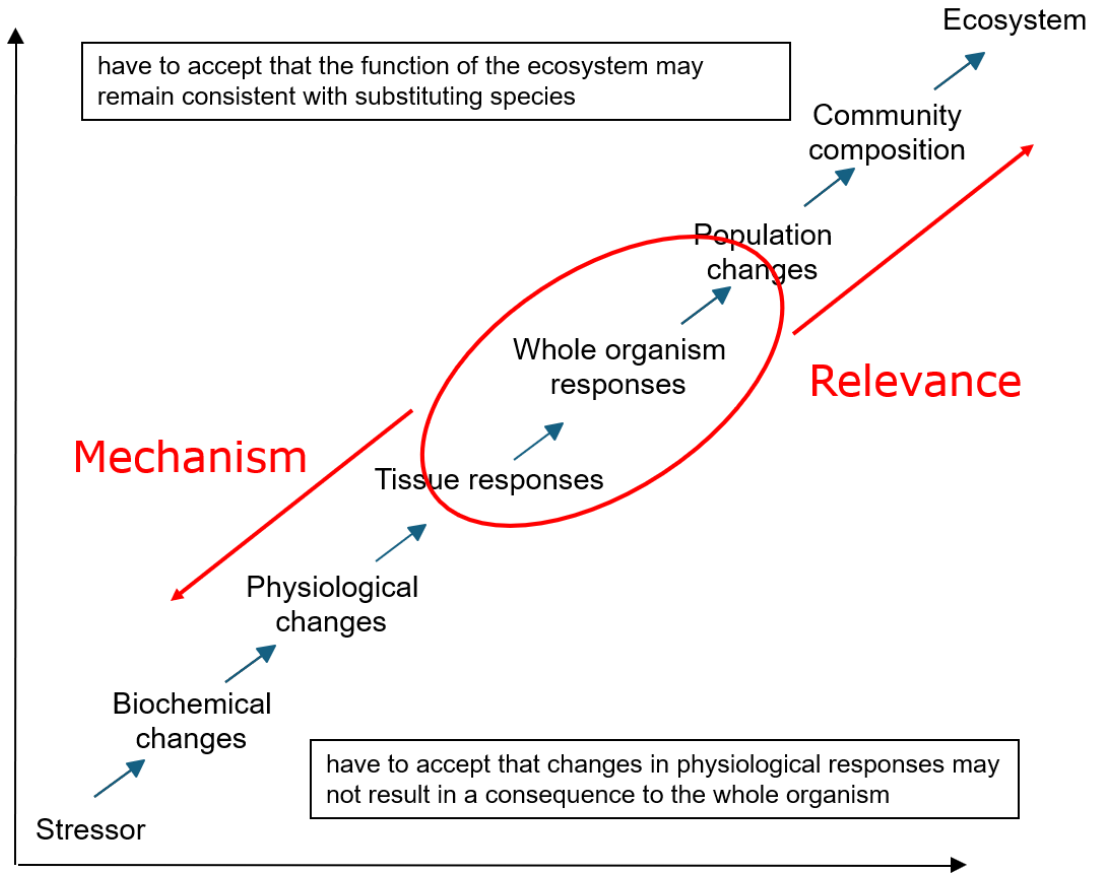
Health and adaptation

The capacity to adapt and maintain:

- Growth
- Metabolism
- Reprodution



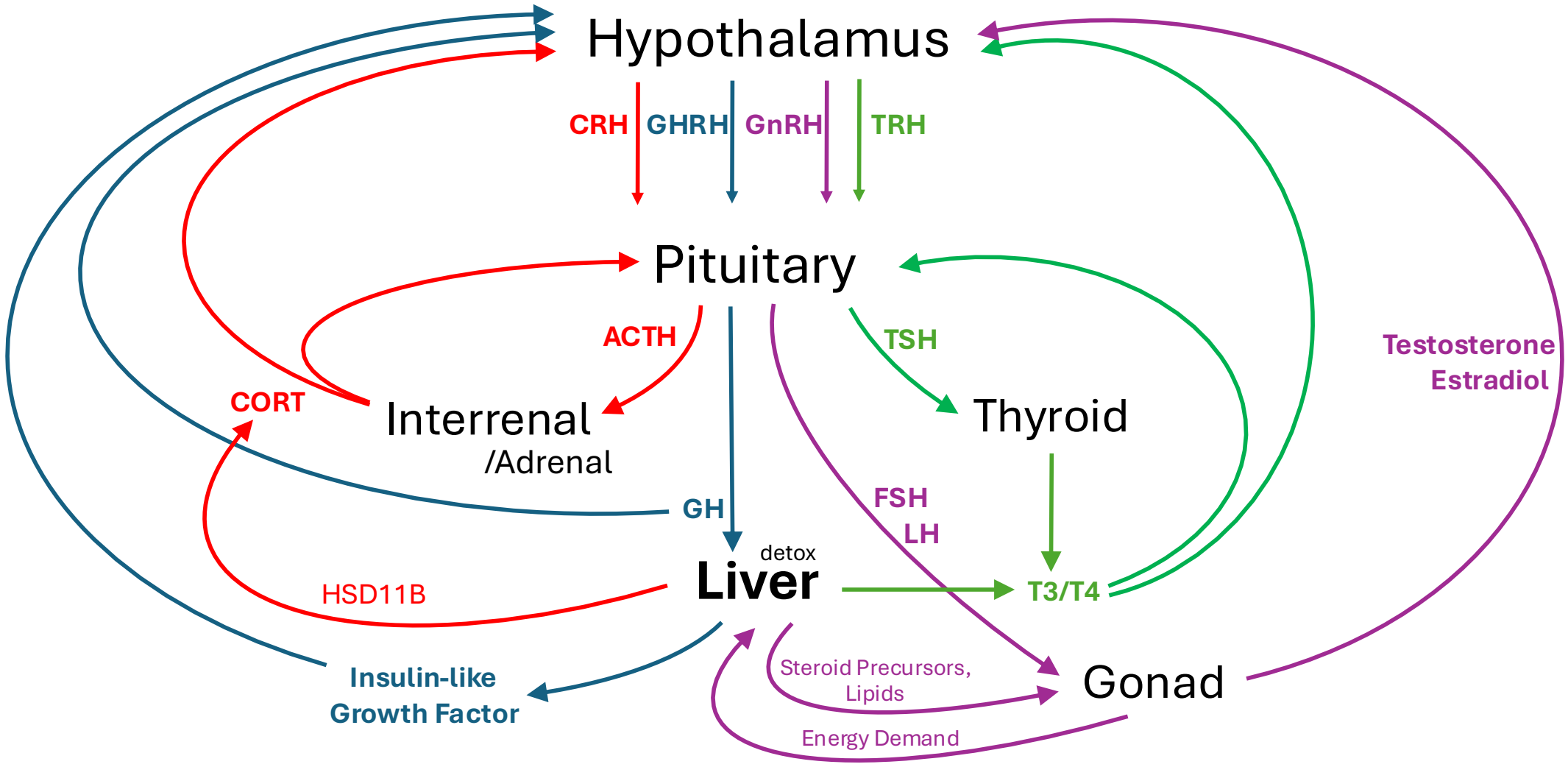
Why fish?



Fish integrate local conditions

Organ measures show performance

Liver signals help explain it

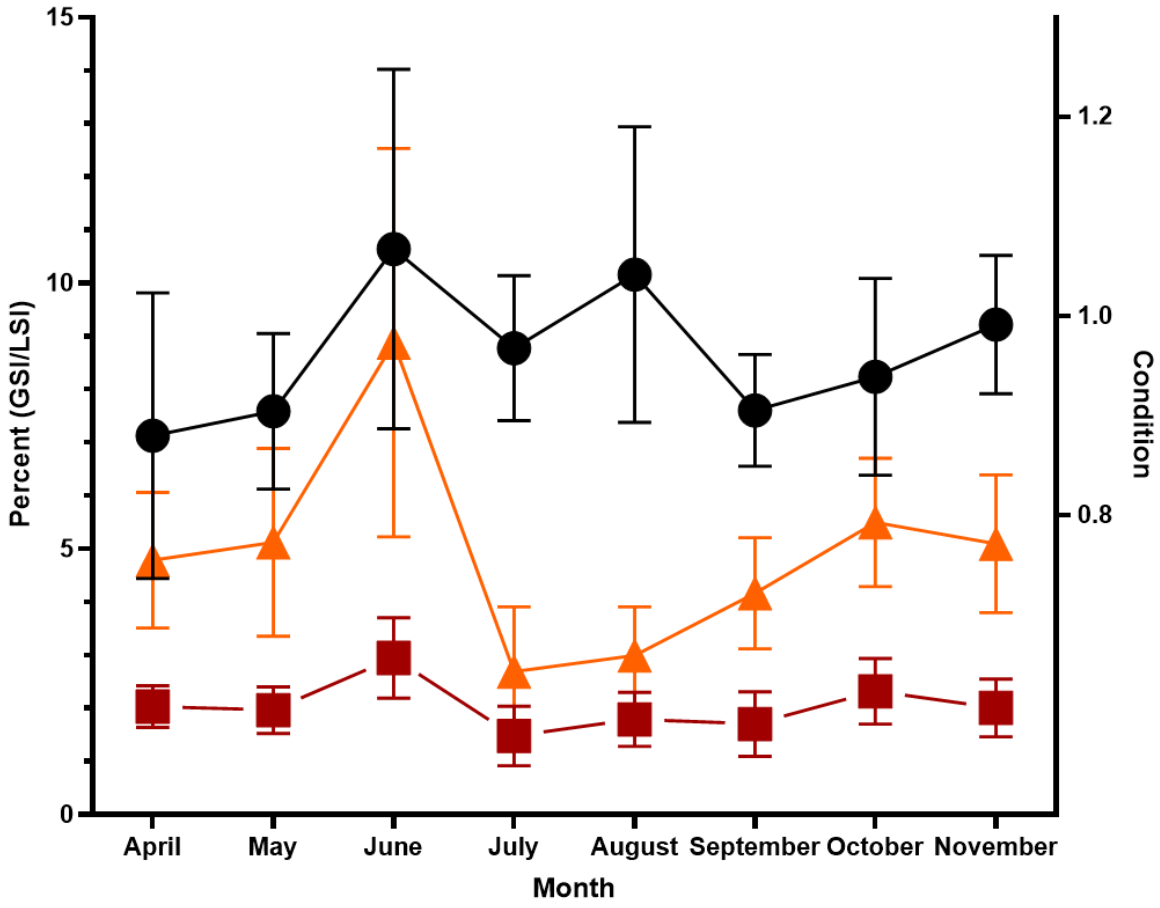

Hypothalamus
CRH
GHRH
GnRH
TRH
Pituitary
ACTH
TSH
Testosterone
Estradiol
CORT
Interrenal
/Adrenal
Thyroid
GH
FSH
LH
detox
Liver
HSD11B
T3/T4
Insulin-like
Growth Factor
Steroid Precursors,
Lipids
Gonad
Energy Demand

Normal seasonal change

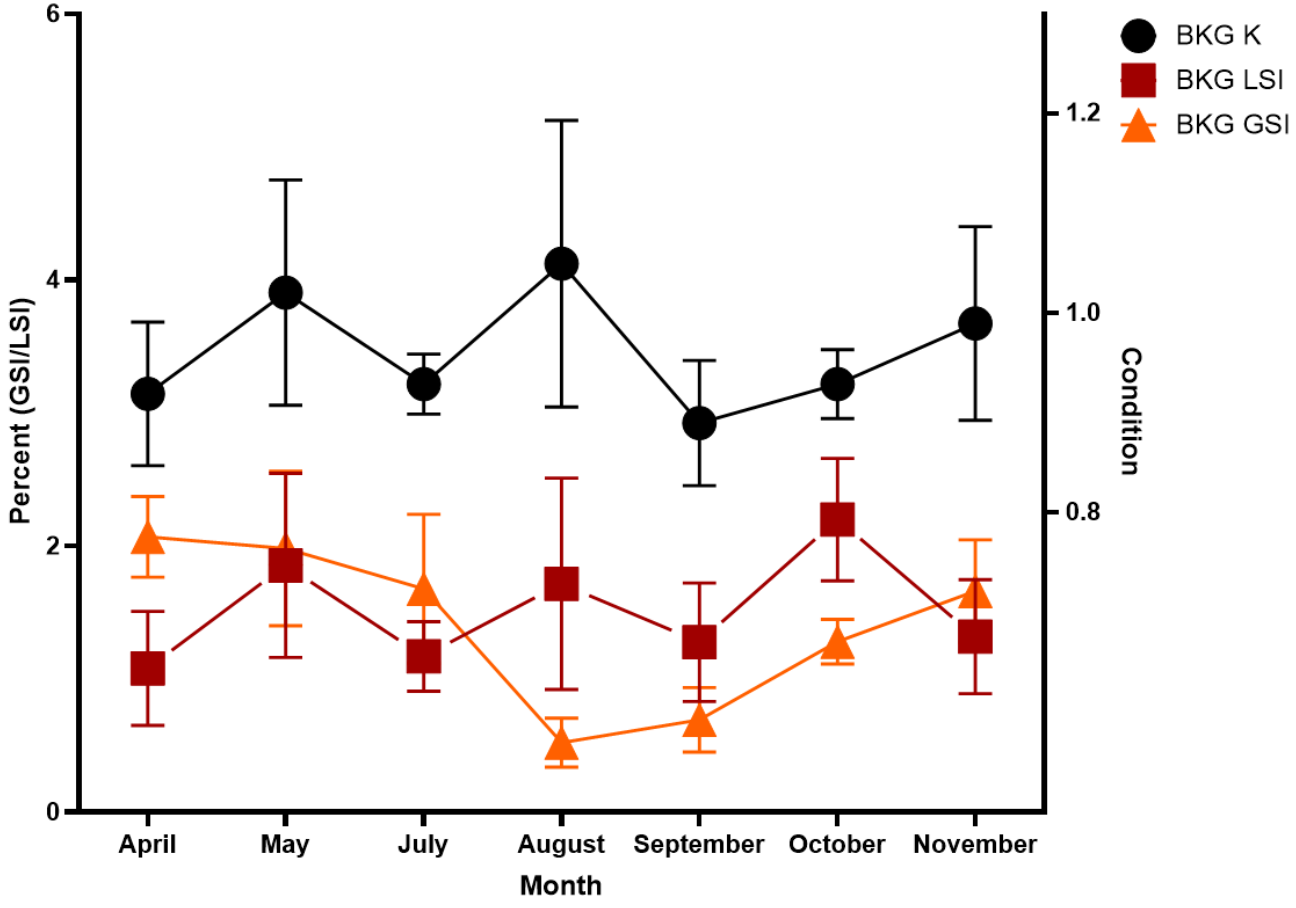
Reproduction changes
energy demand

Natural recovery can
resemble
a pollution response

Females



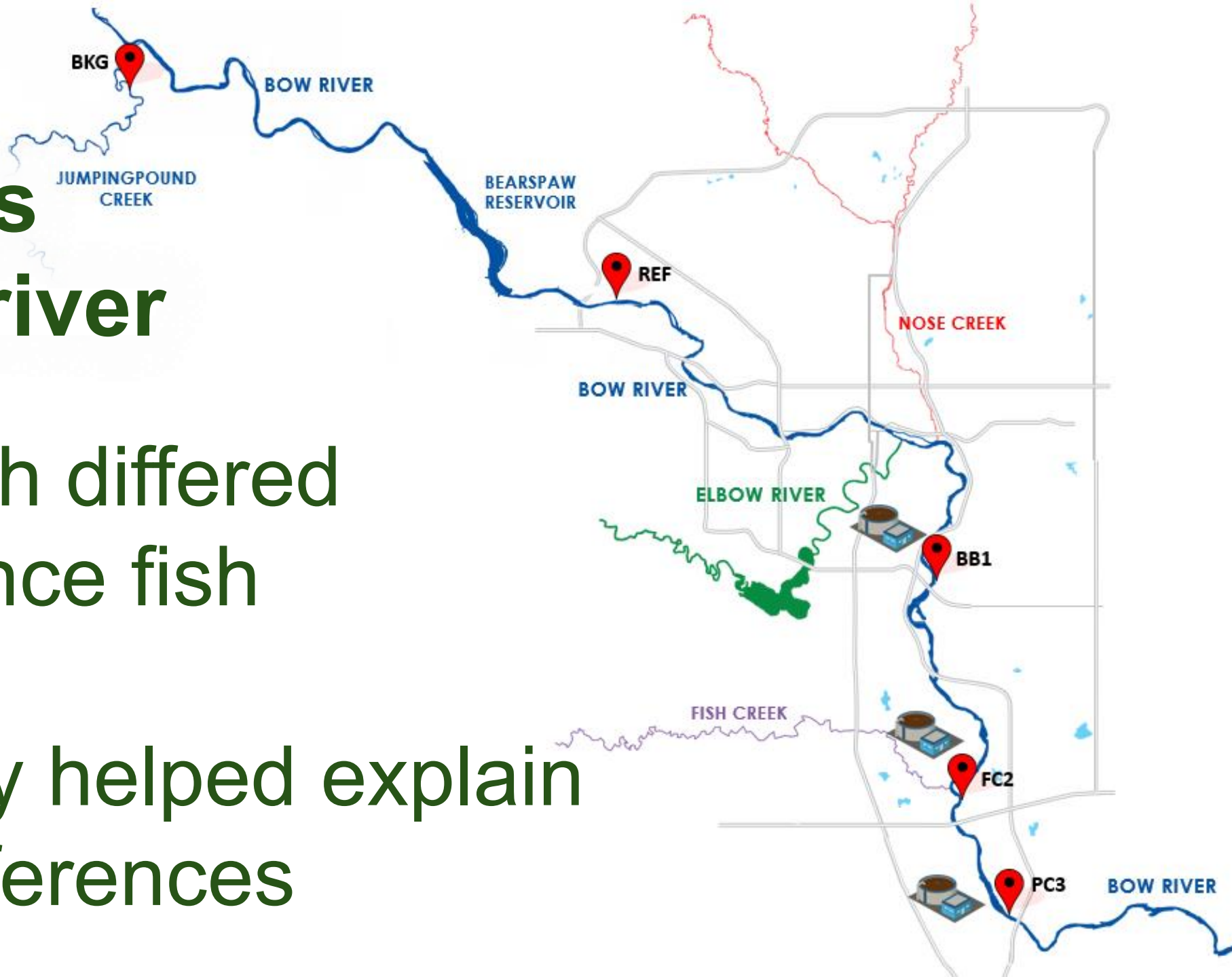
Males



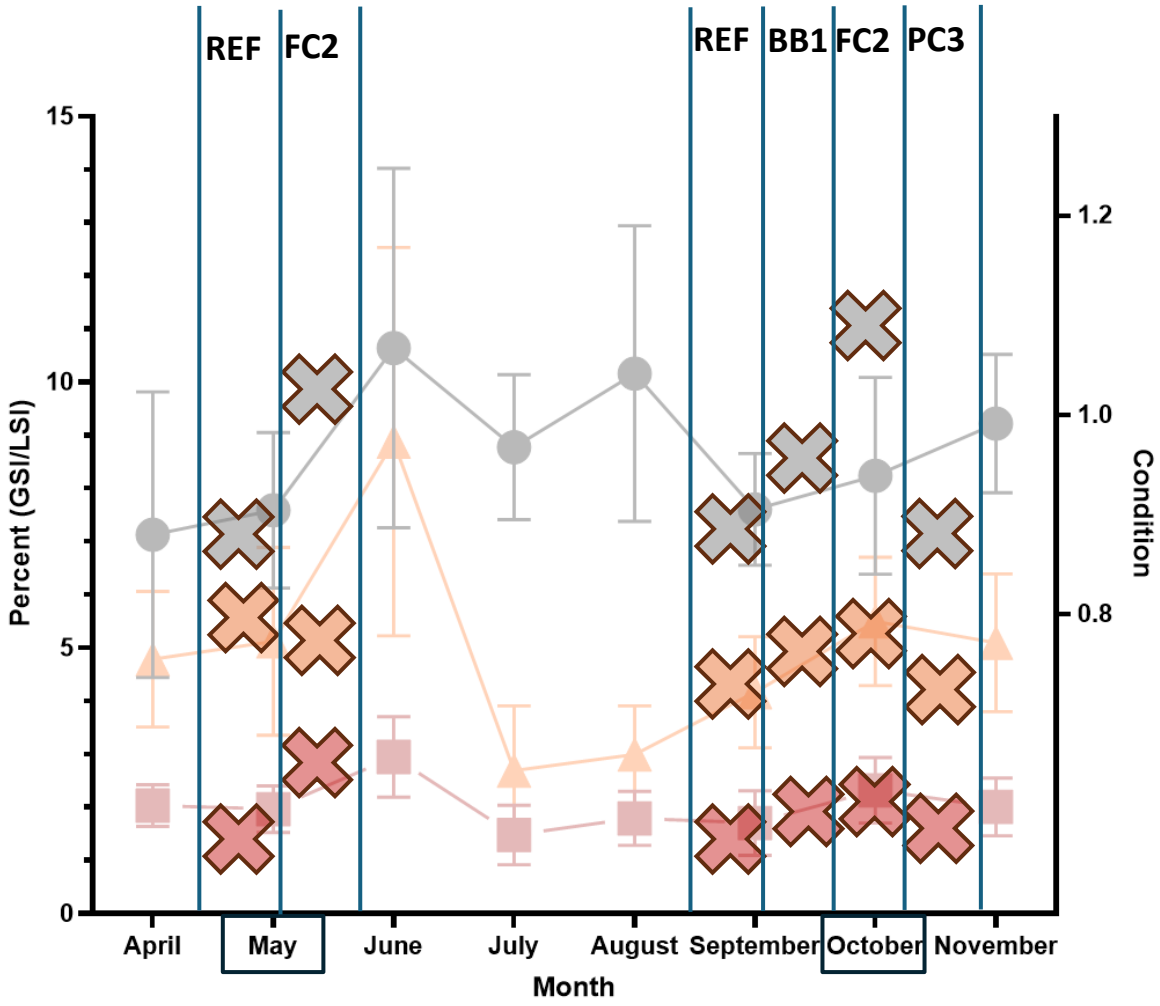
Differences along the river

Exposed fish differed from reference fish

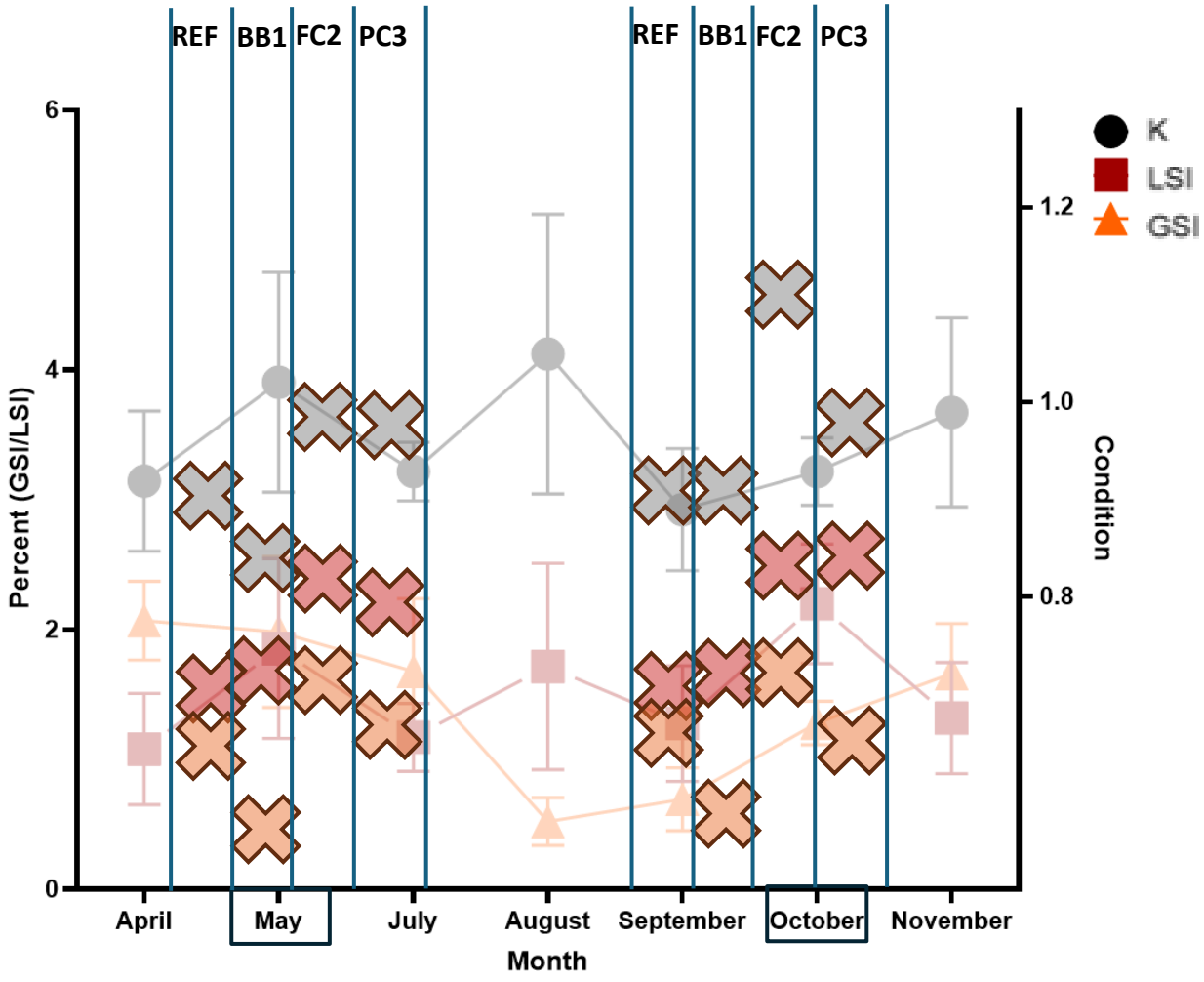
Liver activity helped explain physical differences



Females



Males

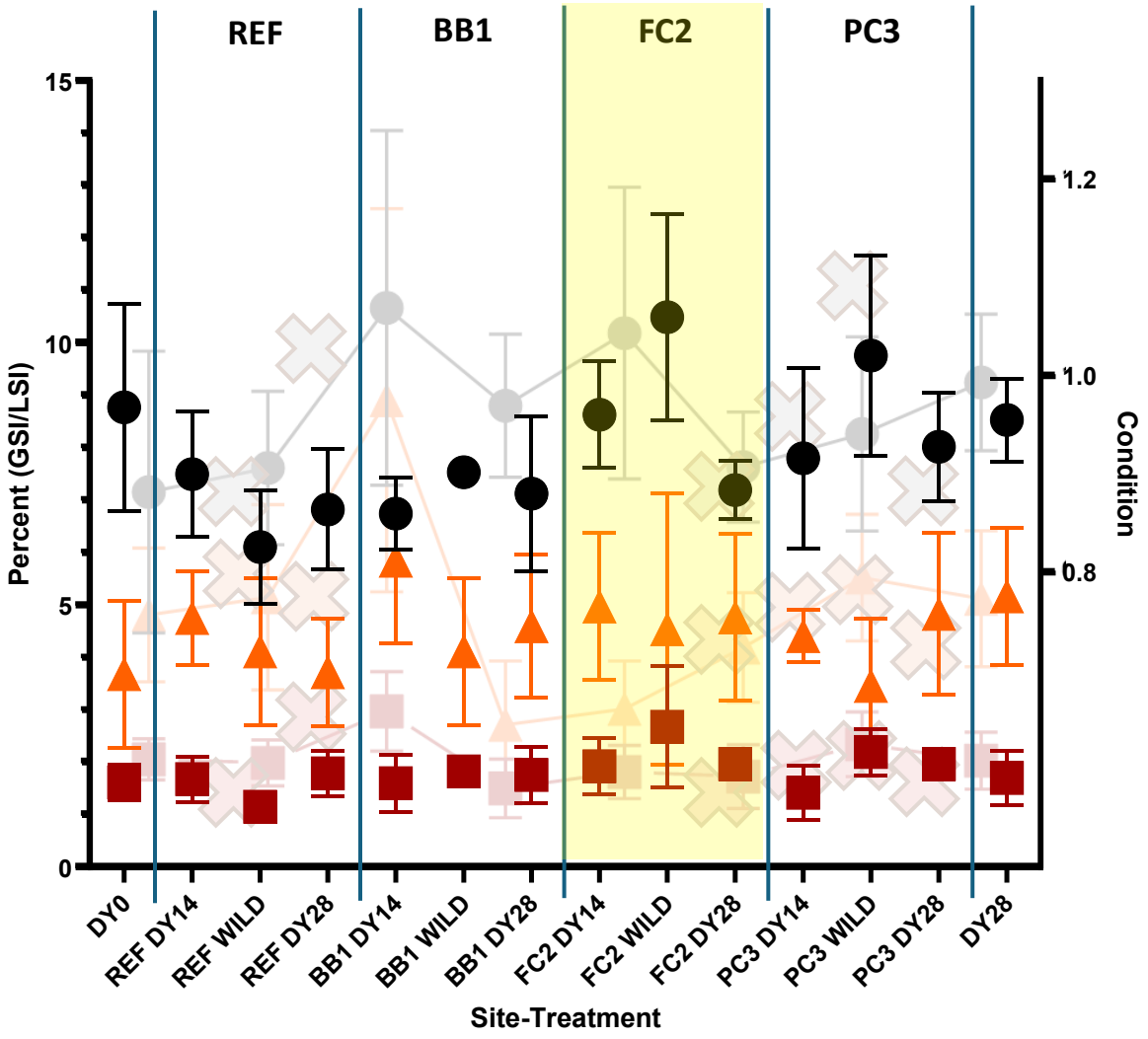


How responses appeared

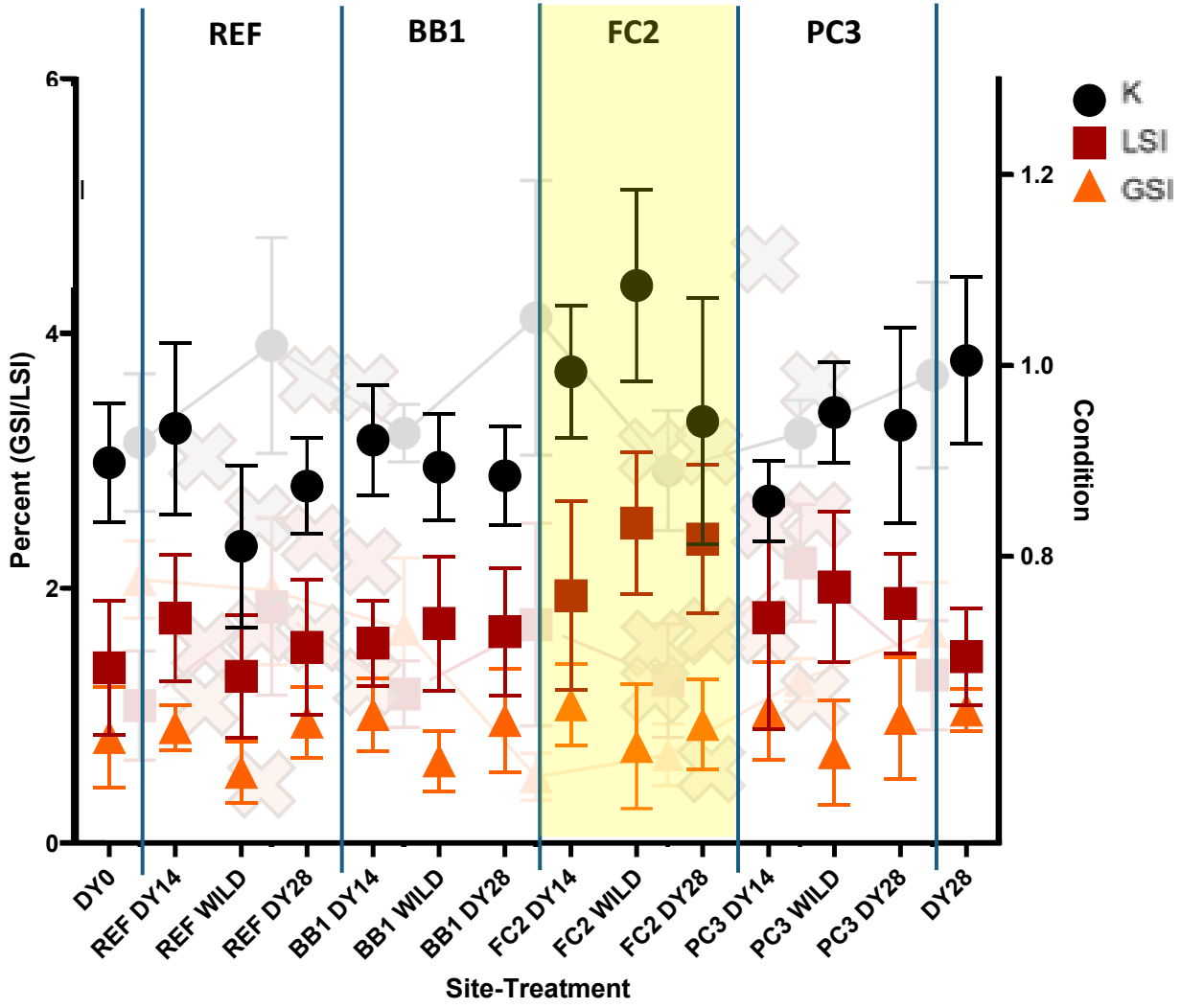
Exposure reproduced responses seen in wild fish

Liver signals preceded physical change

Females



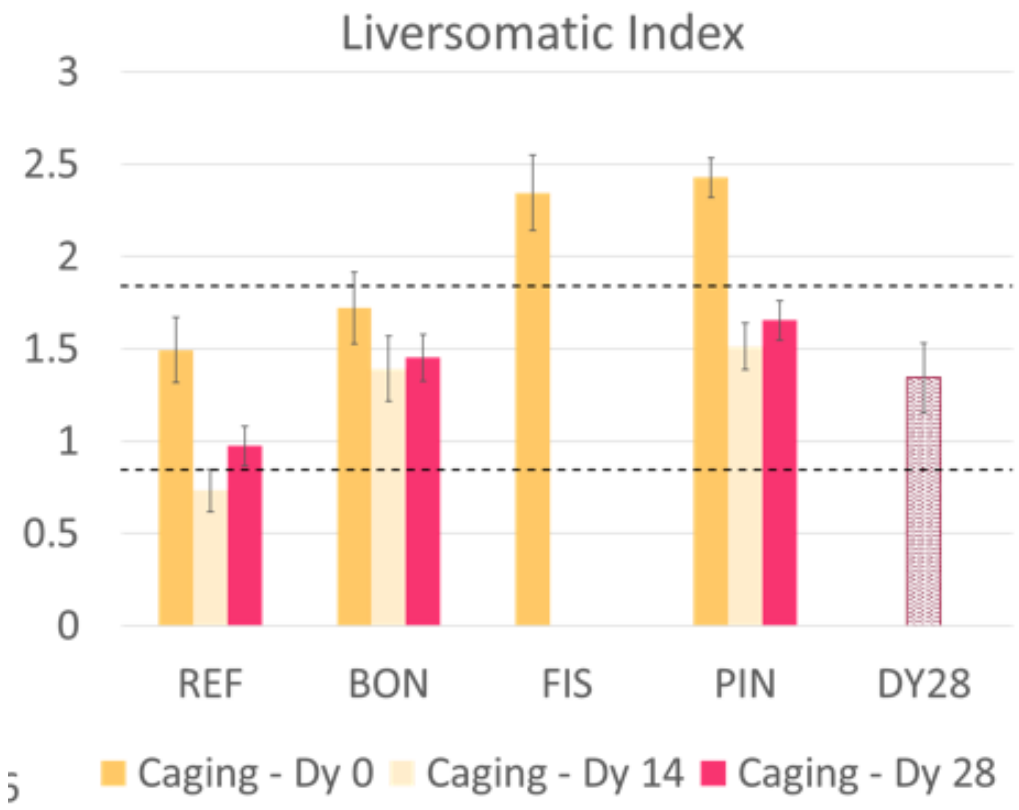
Males



How responses recovered

Some responses subsided after exposure removal

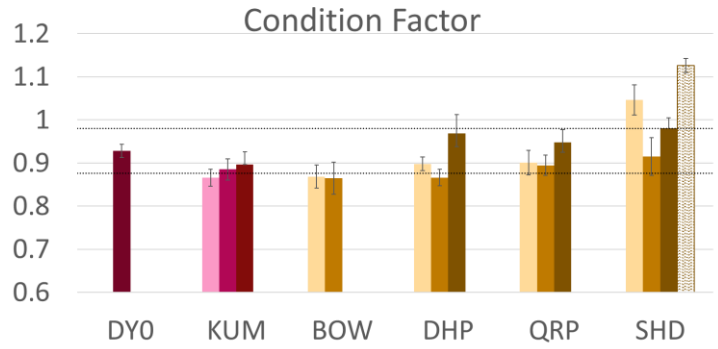
Recovery supports reversibility under the tested conditions

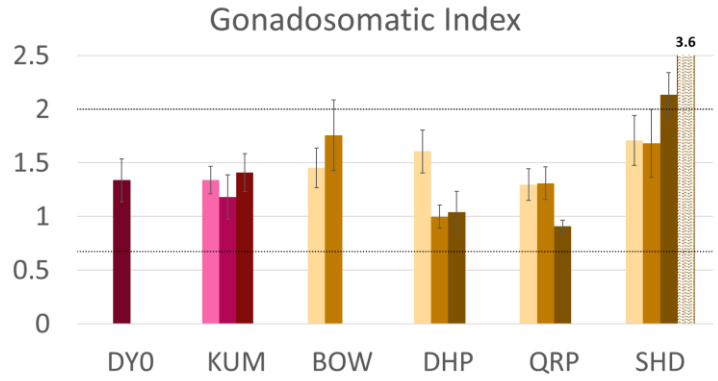


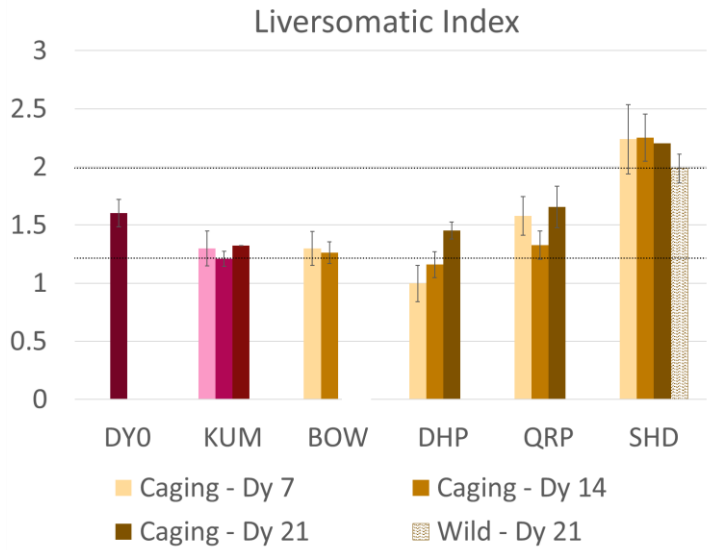
Other sources of change

Stormwater produced
a similar larger magnitude
pattern

Shared responses
complicate
source attribution

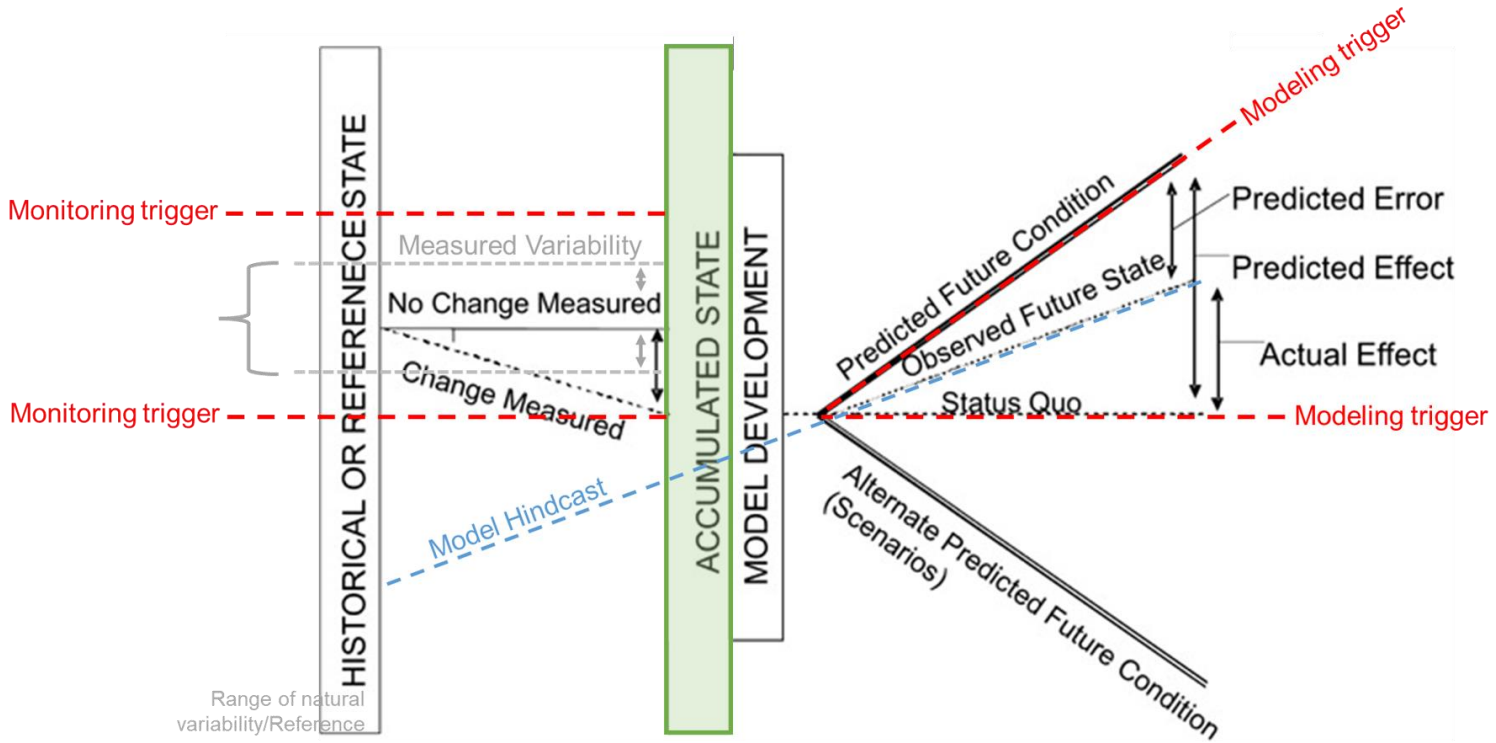






Predictability/forecasting

Multiple influences shape
the biological response – addressing uncertainty
is critical to CEA



What this means for fish health @ Calgary

Encouraging evidence
for fish health

Some responses subsided
when exposure conditions improved

Value Today, Opportunity Tomorrow

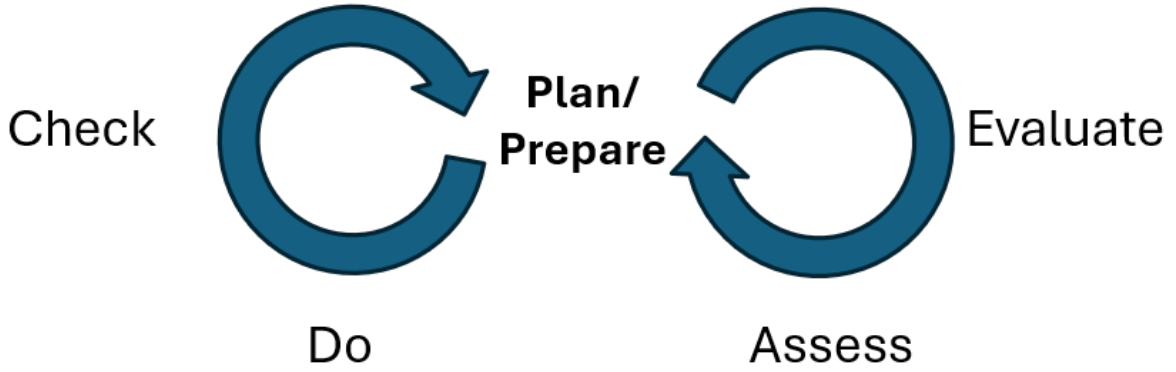
- Nested triggers for performance
- Predictive/management capacity
- Added justification for FC upgrades
- Baseline for PC upgrades

- Ability to improve reliance on chem

Inputs for Adaptive Monitoring

Adaptive Management

Adaptive Monitoring



Extent/Magnitude

Baseline

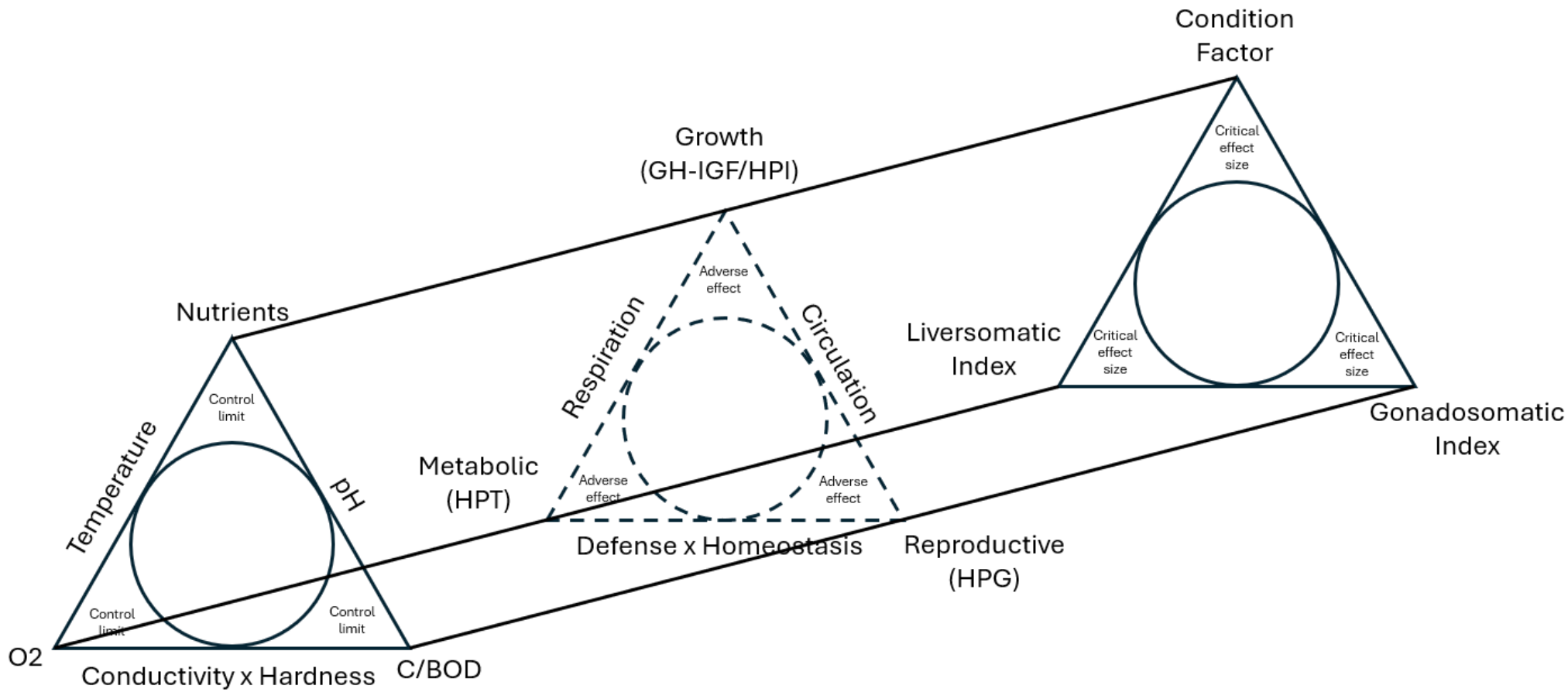
Induction/Causality

Transience/Recovery

External Validation

Integration

CHEMISTRY **BIOCHEMISTRY** **BIOLOGY**



RISK PREDICTION **RISK PREVENTION** **RISK MITIGATION**