BRGMON-1 Lower Bridge River Aquatic Monitoring Program

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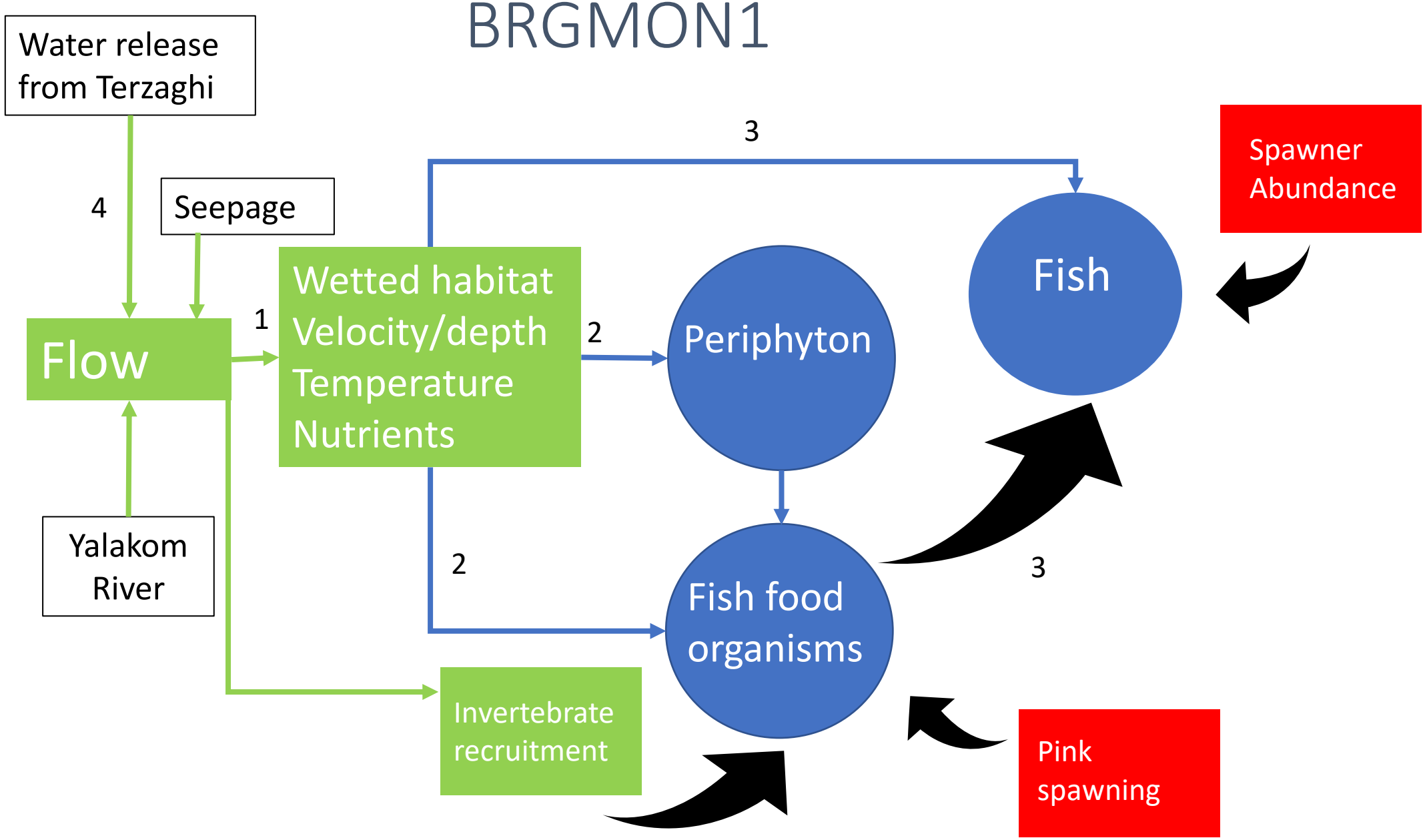
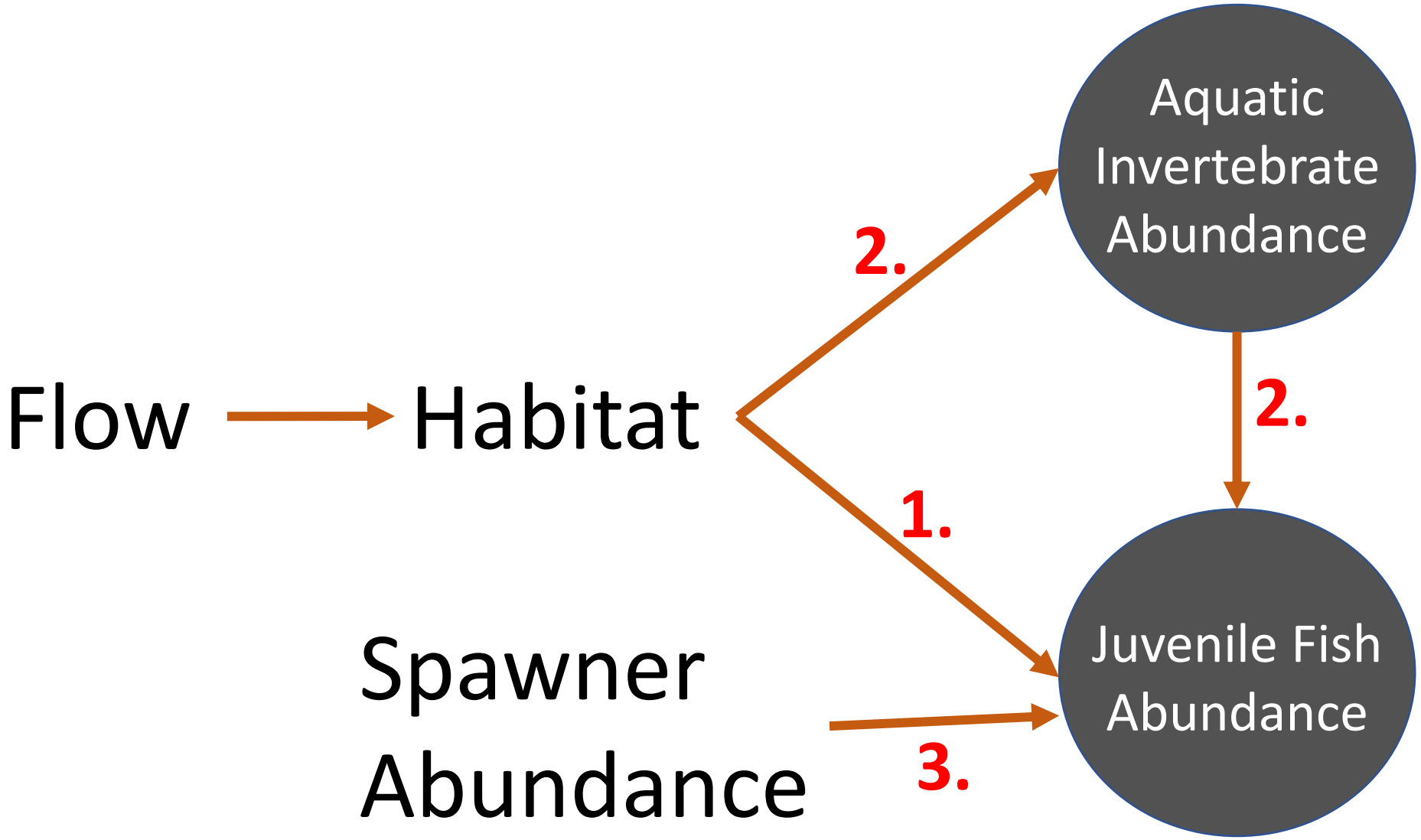
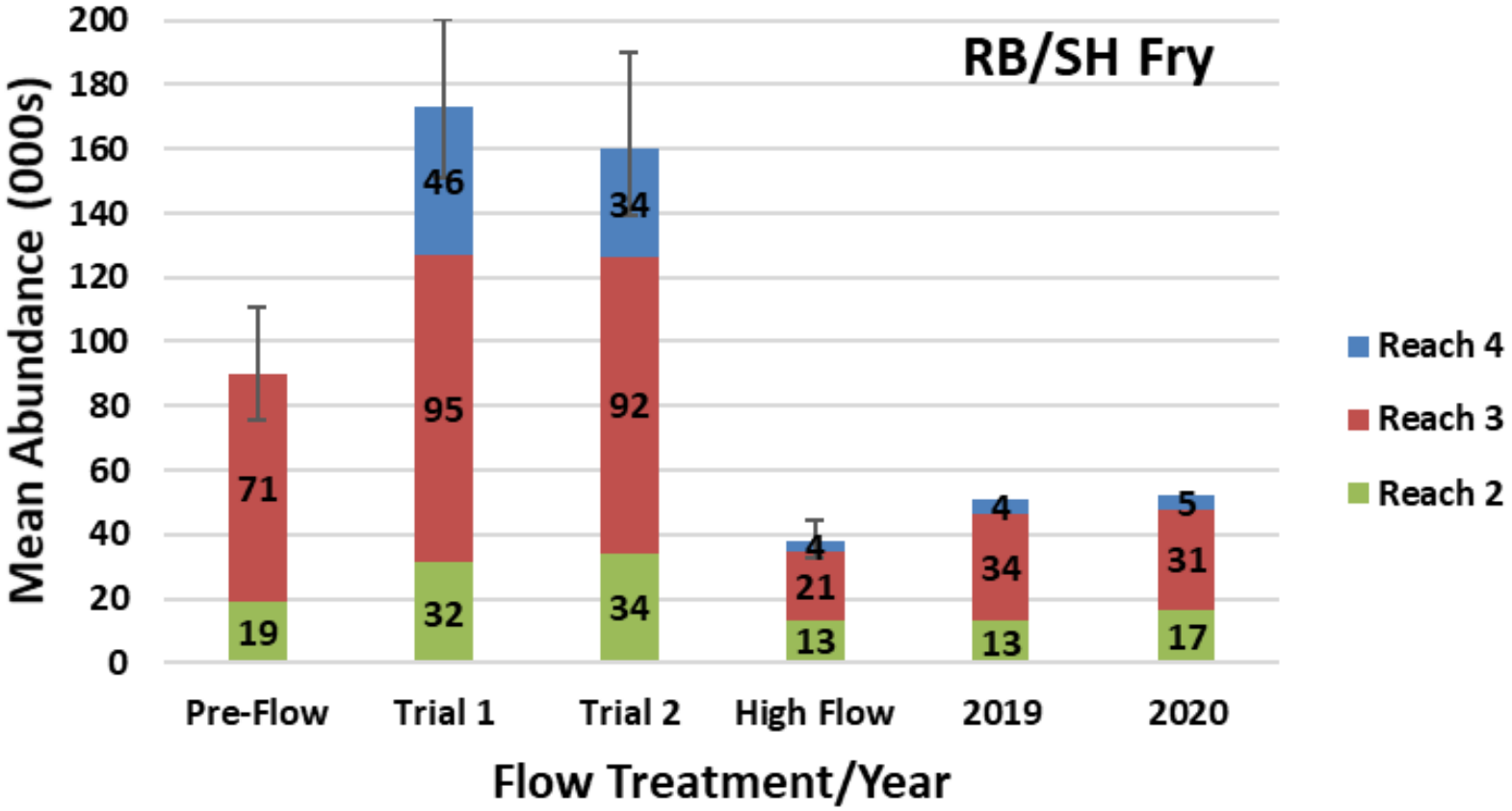


MQ #3 – Pathways to Fish Abundance



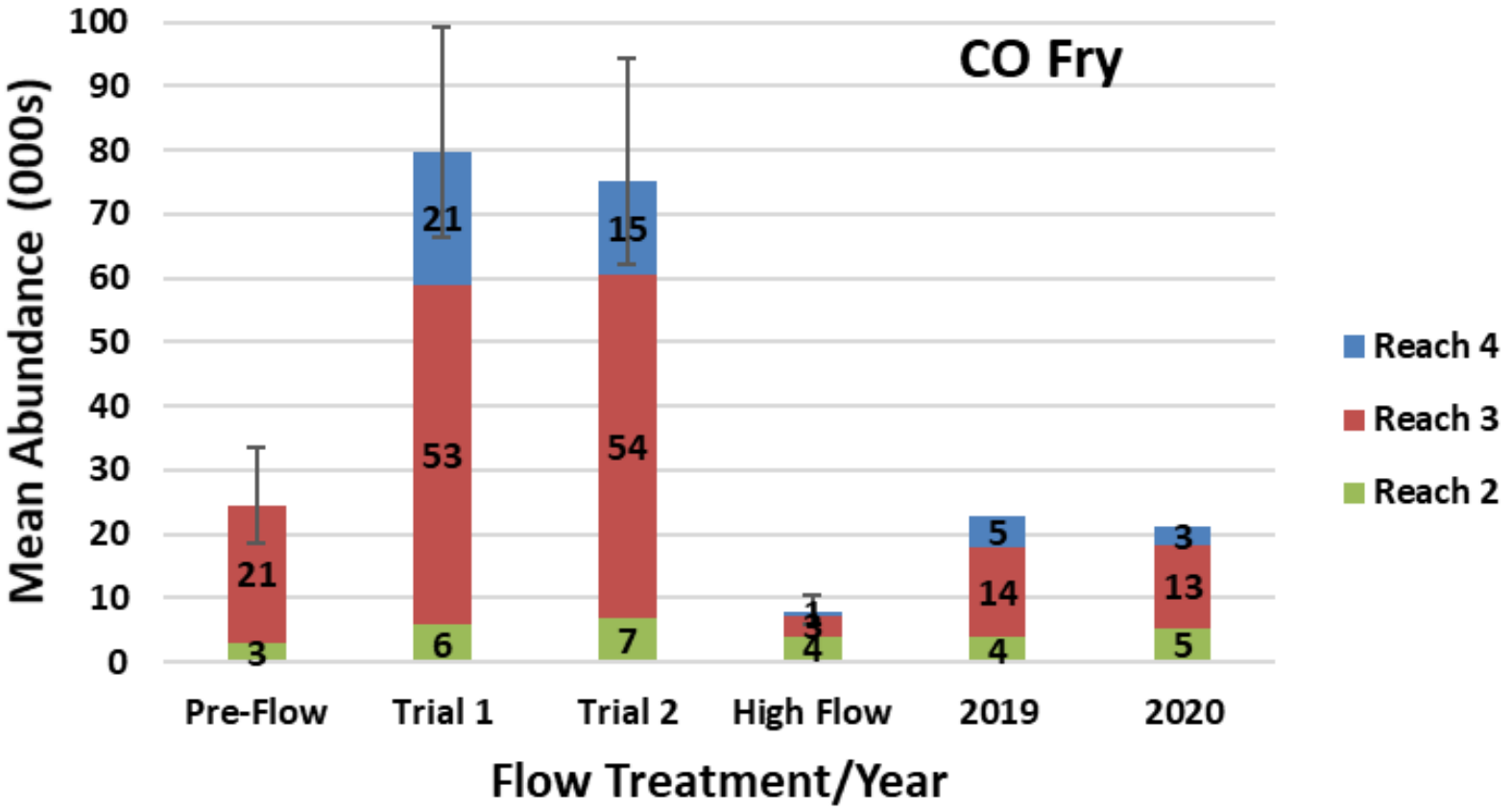
Flow Trial Comparison Rainbow/Steelhead Fry

- **High abundance during Trials 1 & 2**
- **Abundance reduced in all reaches during high flows**
- **Some recovery, but modest, in 2019**
- **No further change in 2020**
- **Most recovery in Reach 3**



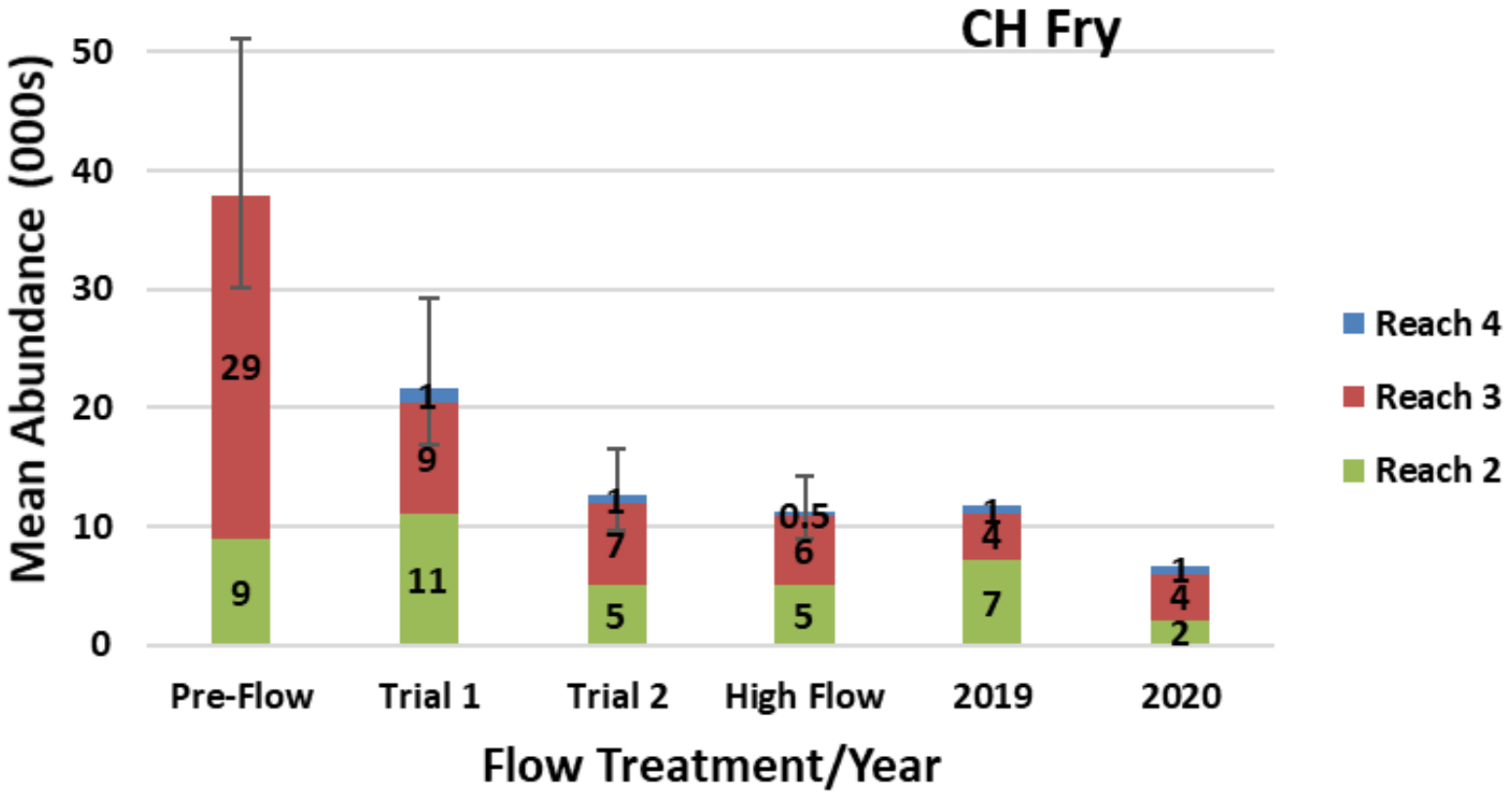
Flow Trial Comparison
Coho Fry

- **Same story as RB/SH fry**
- **They were hit harder by the high flows**



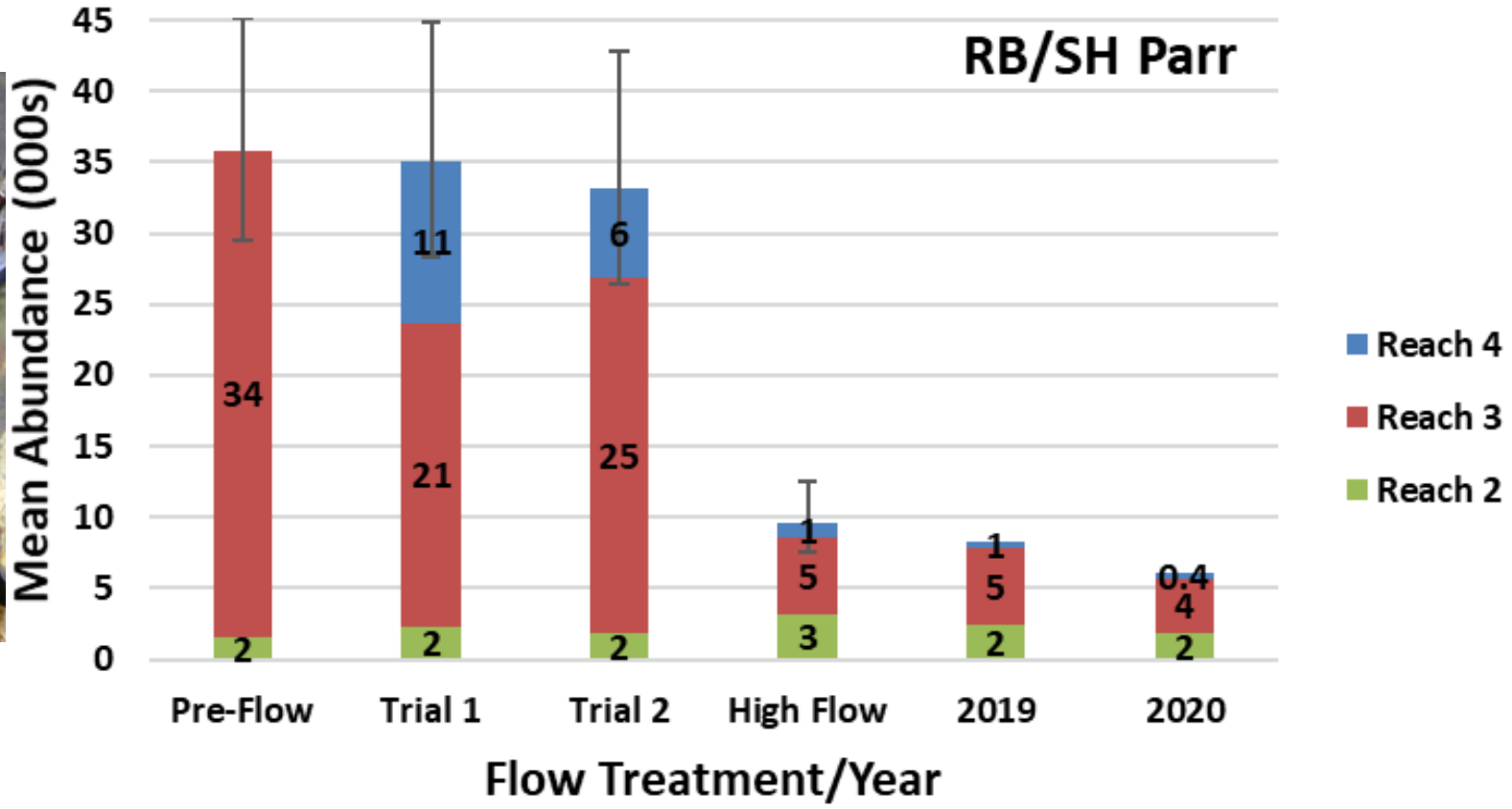
Flow Trial Comparison Chinook Fry

- **Highest abundance prior to the flow release**
- **Abundance diminished during Trial 1 and has remained low, but relatively stable since**
- **No obvious effect of high flows**
- **Biggest change was in Reach 3; limited use of Reach 4**
- **Potentially diverse life history pathways**

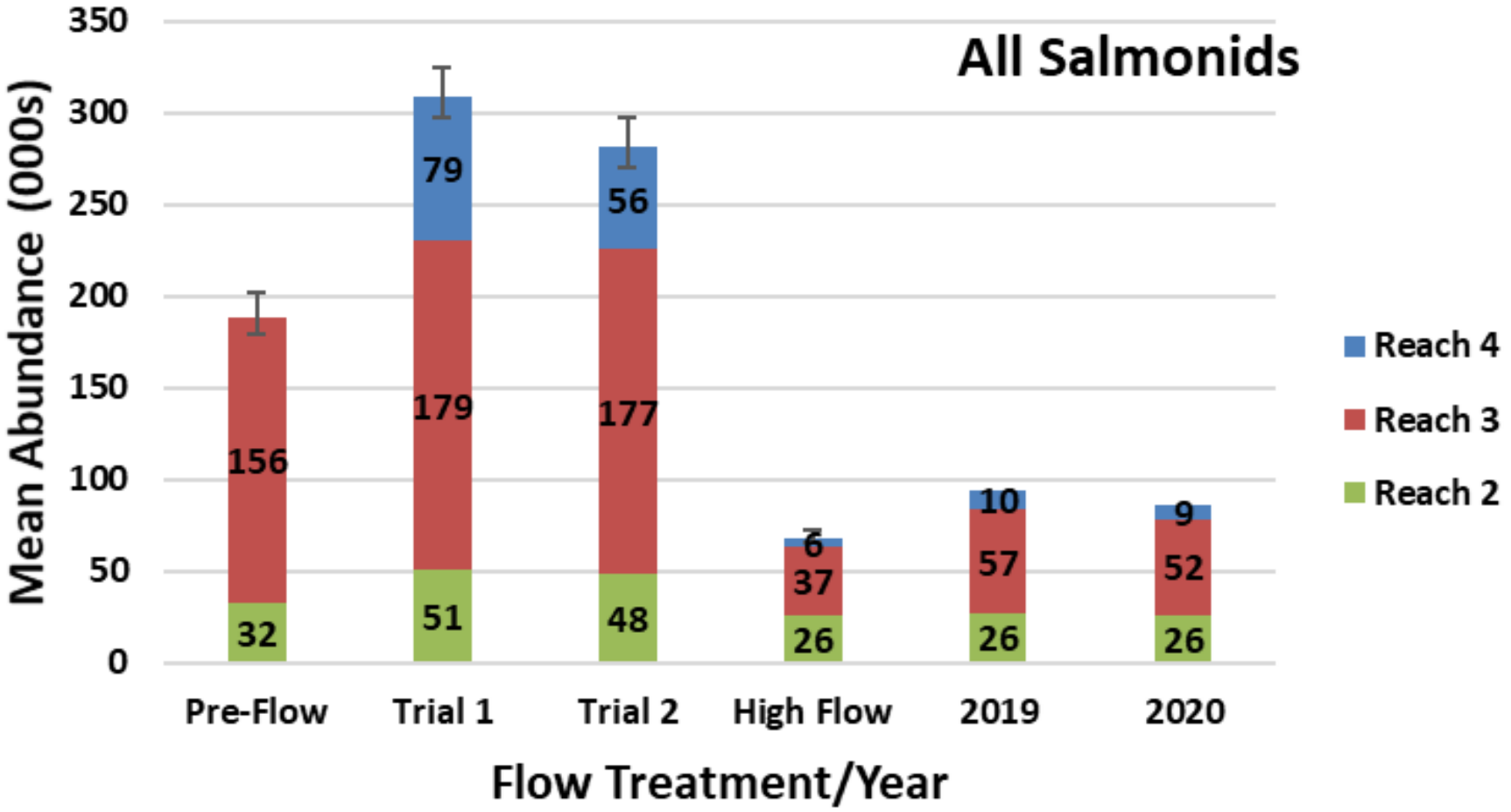


Flow Trial Comparison Rainbow/Steelhead **Parr**

- **Abundance was equivalently high during Pre-Flow, Trial 1 and Trial 2 periods**
- **Substantial decline in all reaches under high flows**
- **No recovery in 2019 or 2020**

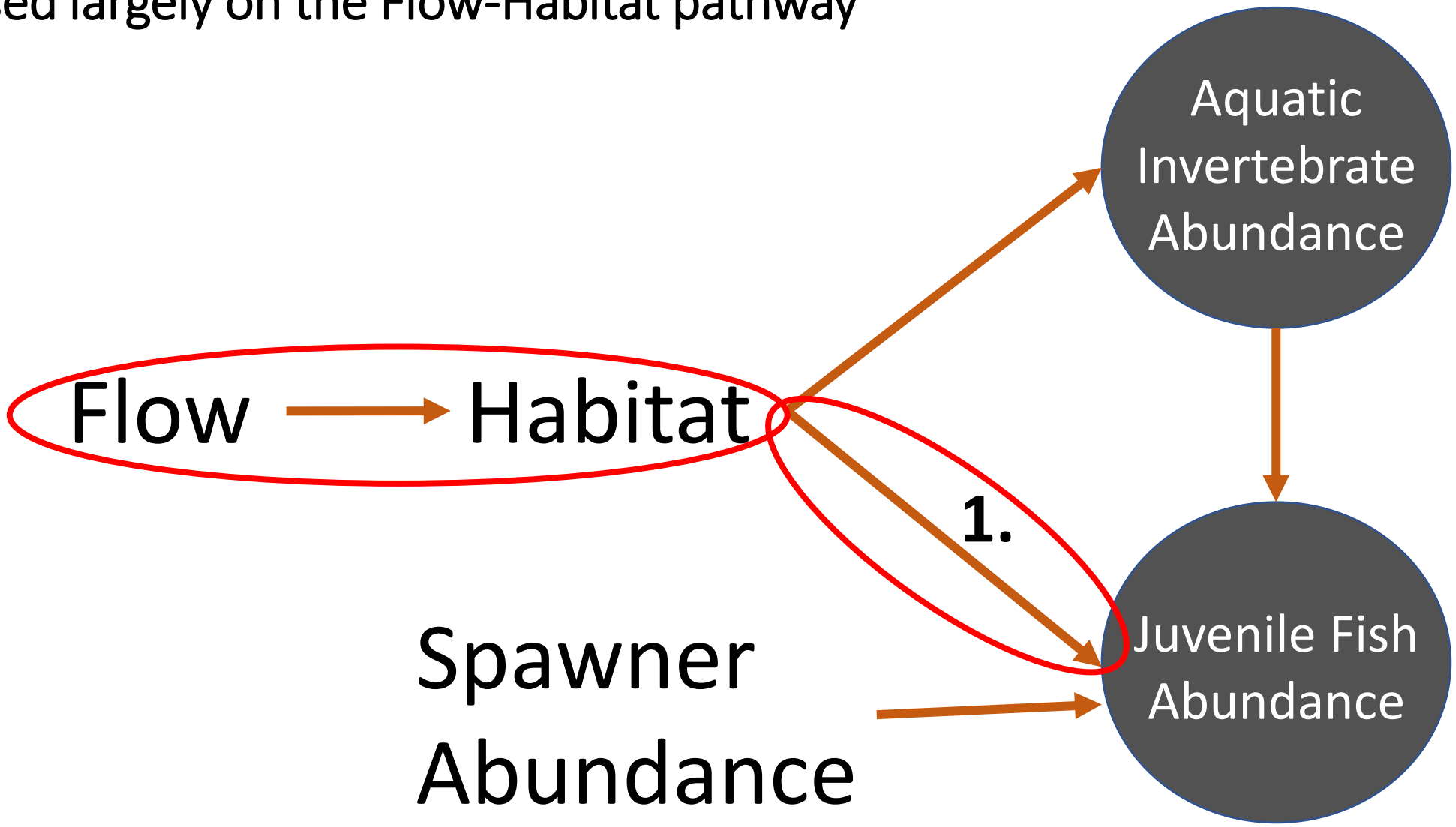


Juvenile Fish Abundance – Overview

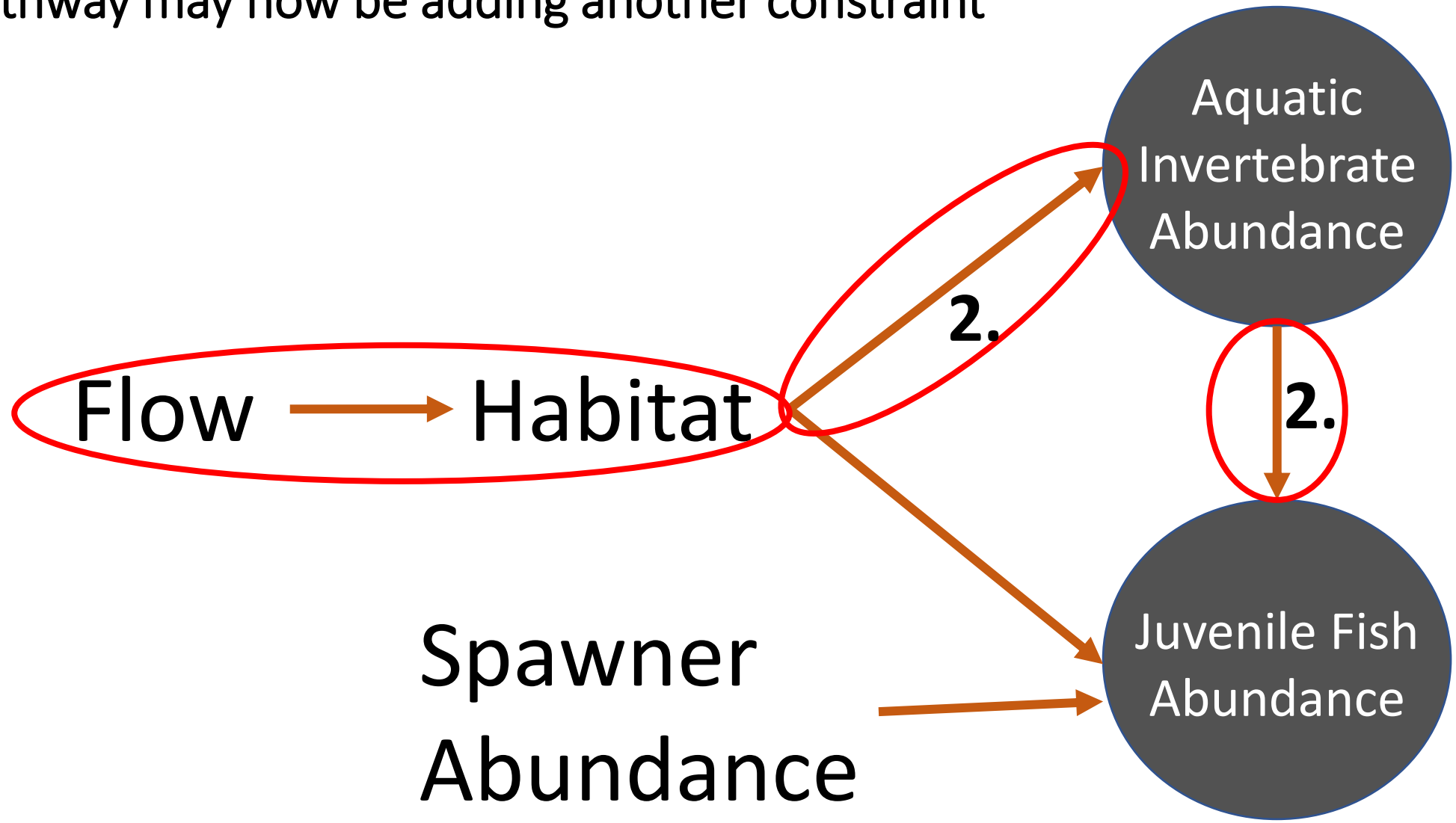


- **Overall, dramatic declines during the high flow years**
- **Some recovery in 2019/2020, but increases have been very modest relative to what was expected**
- **Like the invertebrates, recovery for fish was stronger in Reach 3 than in reaches 2 and 4**

Previously, the juvenile fish abundance results lined up with explanations based largely on the Flow-Habitat pathway



Inclusion of the 2019 and 2020 results suggest that the Food Supply pathway may now be adding another constraint

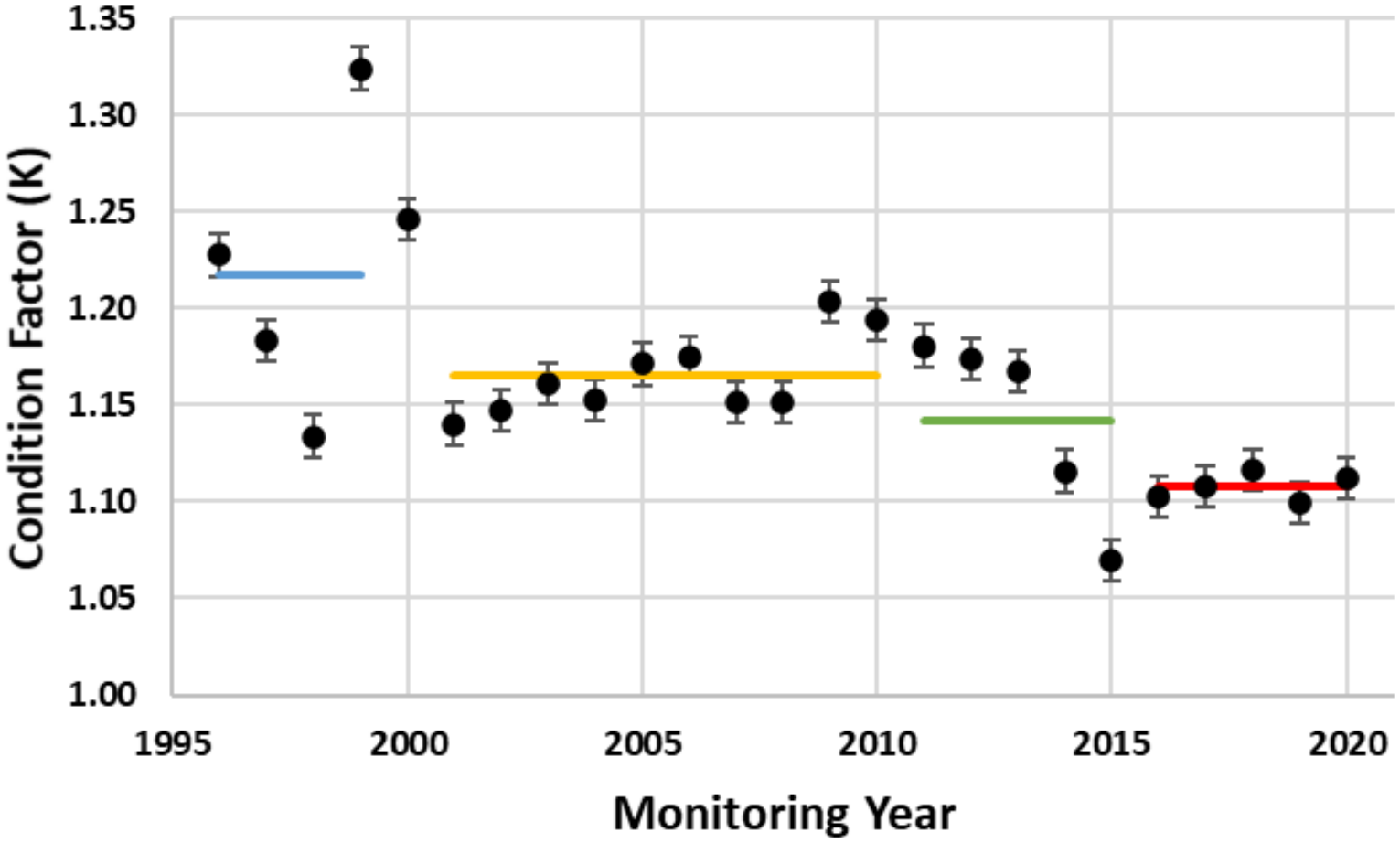


Fish Condition Over Time

Evidence for reduced condition factor for juvenile fish across the entire monitoring period.

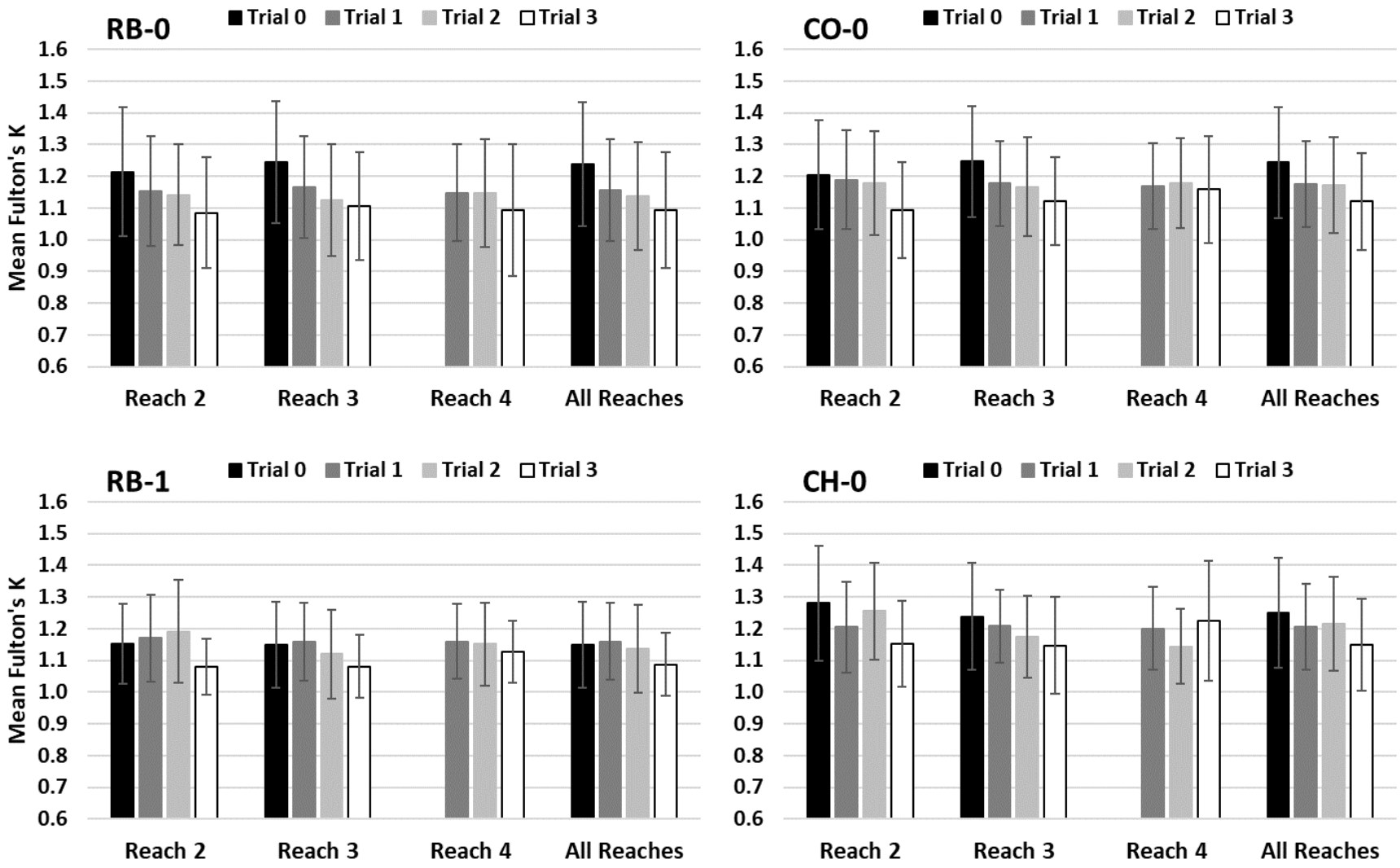
This pattern has similarities to the overall nutrient trend (Chris' presentation)

Lower K during mod. ops. likely linked to reduced food availability (aquatic invertebrate abundance)



Fish Condition by Species & Reach

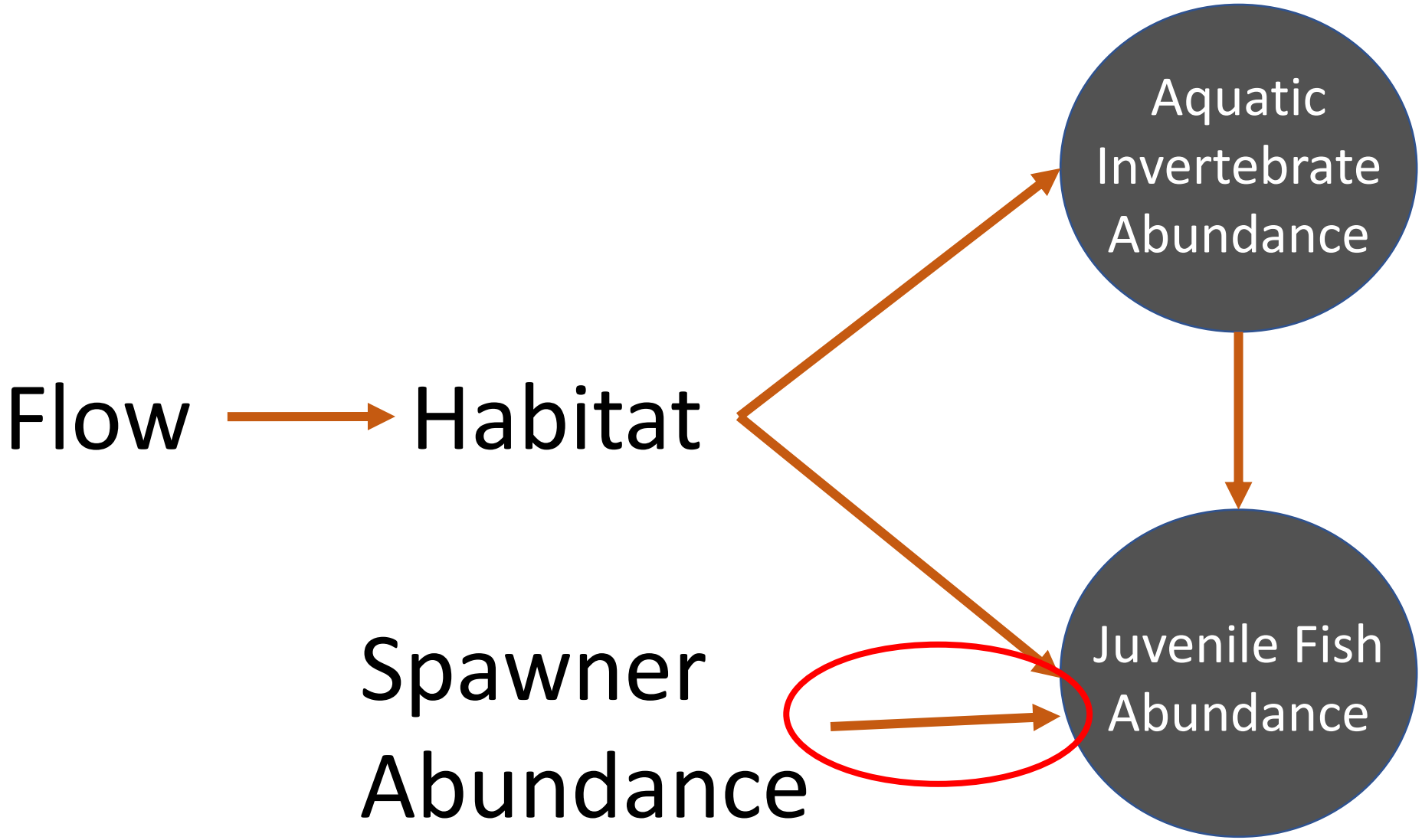
Reduced condition factor was consistently evident for each species & among reaches during Mod. Ops.



Take-aways for the “Food Supply” Pathway

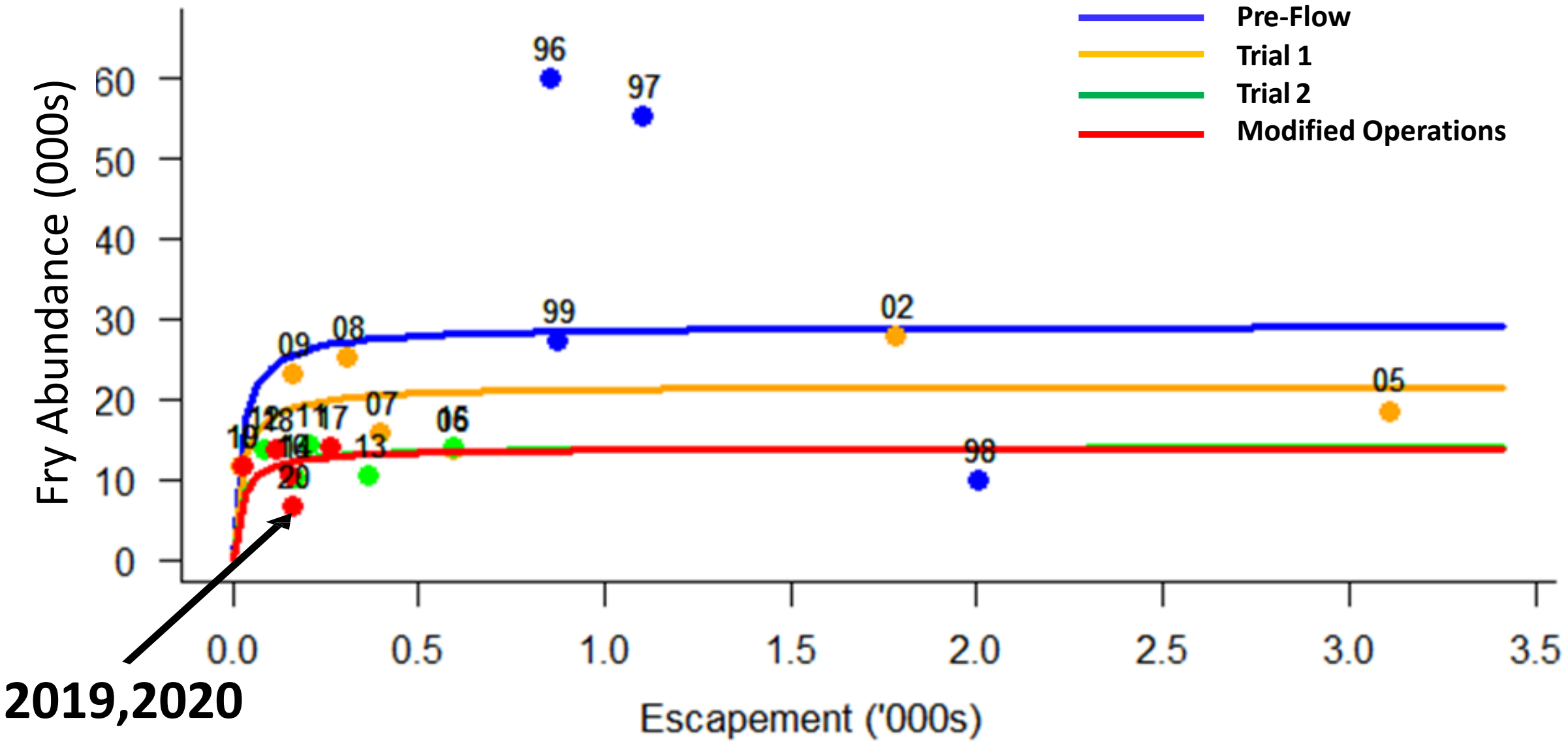
- Given the positive responses of juvenile fish production to Trial 2 flows, we expected better recovery of juv. fish abundance under the resumption of the Trial 2 hydrograph following the high flow years.
- The limited or slow recovery observed to-date may be affected by the coincidence of lower nutrient levels and reduced invertebrate abundance (i.e., food supply) in recent years.
- The reach-based fish abundance results (in 2019/2020) largely mirrored the reach-based nutrient and invertebrate abundance results.
  - Reach 4 = Poor/Limited Improvement
  - Reach 3 = Modest Improvement
  - Reach 2 = Poor/Limited Improvement

What about Spawner Escapement Effects?

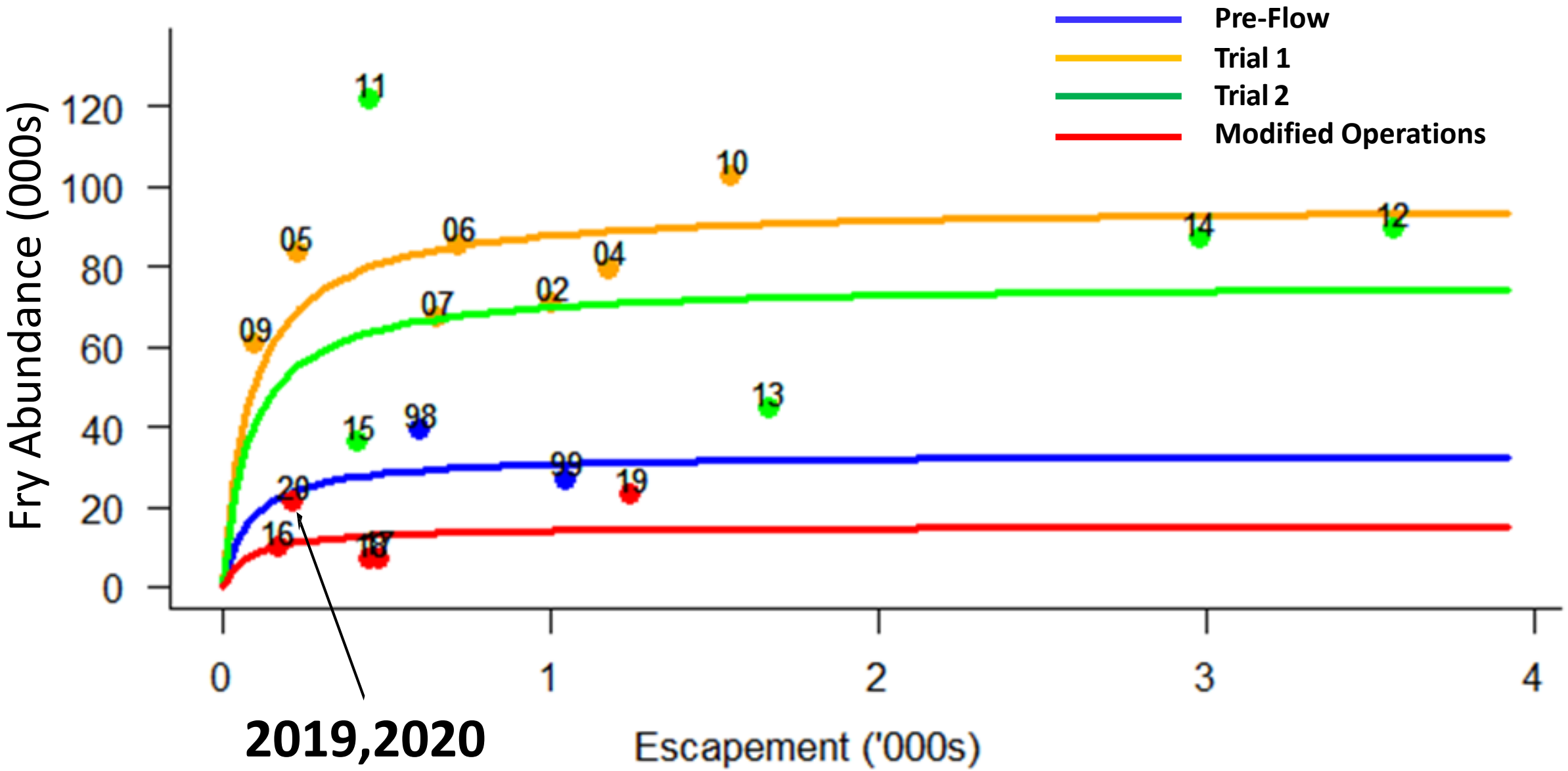


Annual estimates provided by MON-3 (Instream)

Stock Recruitment – Chinook



Stock Recruitment – Coho



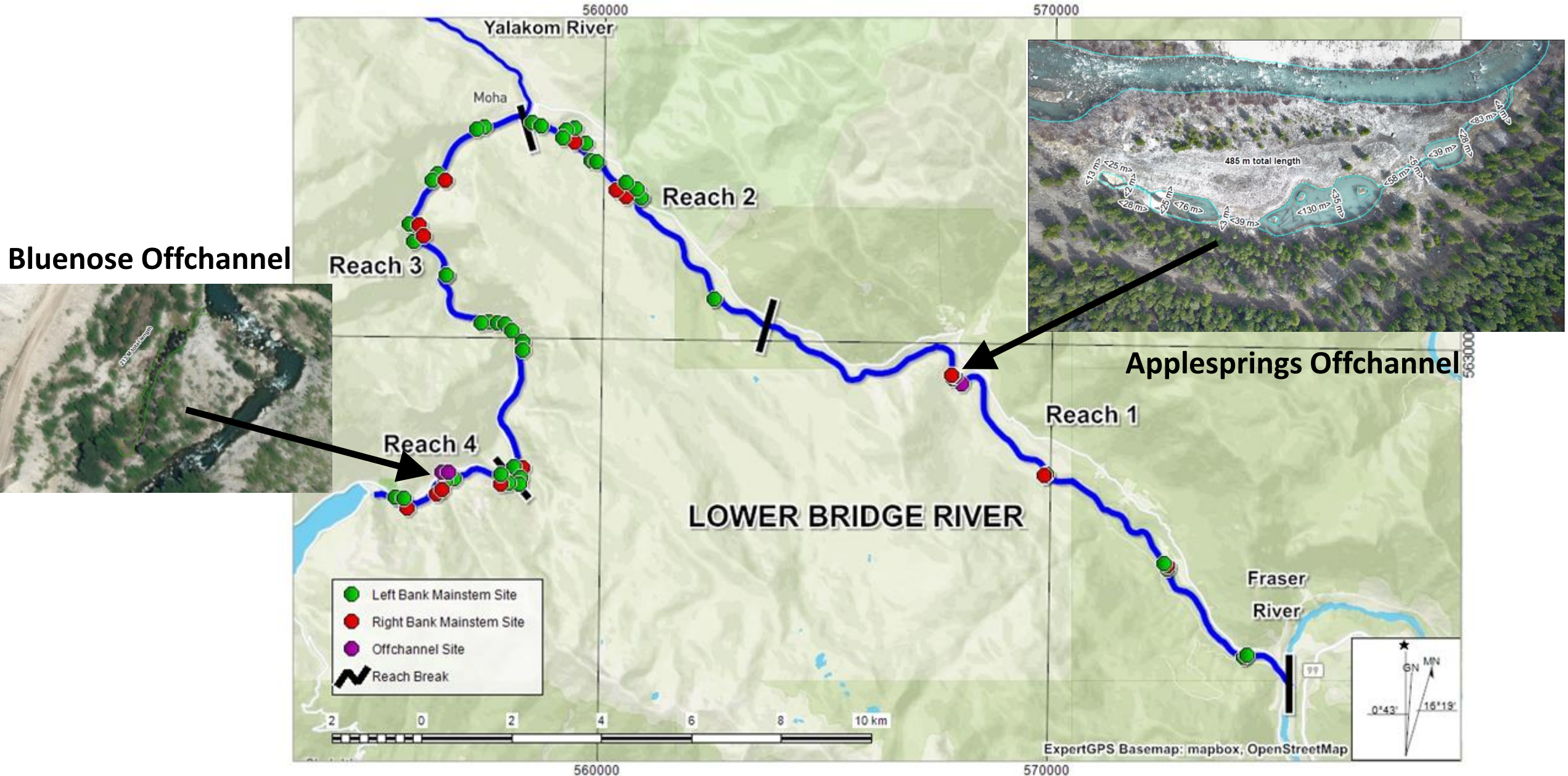
Stock-Recruitment Take-aways

- Spawner numbers alone do not appear to be limiting juvenile production
- In other words, if spawner numbers increase we may not see a dramatic increase in juvenile numbers
- Would be nice to have a wider diversity of spawner escapements to better define the flow trial-specific curves (particularly for chinook)

Modified Operations Components

- **Reach 1 Monitoring (2019-2020)**
  - Stock assessment sampling at 12 sites
  - No data at high flows
- **Offchannel Habitat Sampling (2018-2020)**
  - Bluenose – Reach 4 (3 sites)
  - Applesprings – Reach 1 (3 sites)
  - 1 year of data at high flows

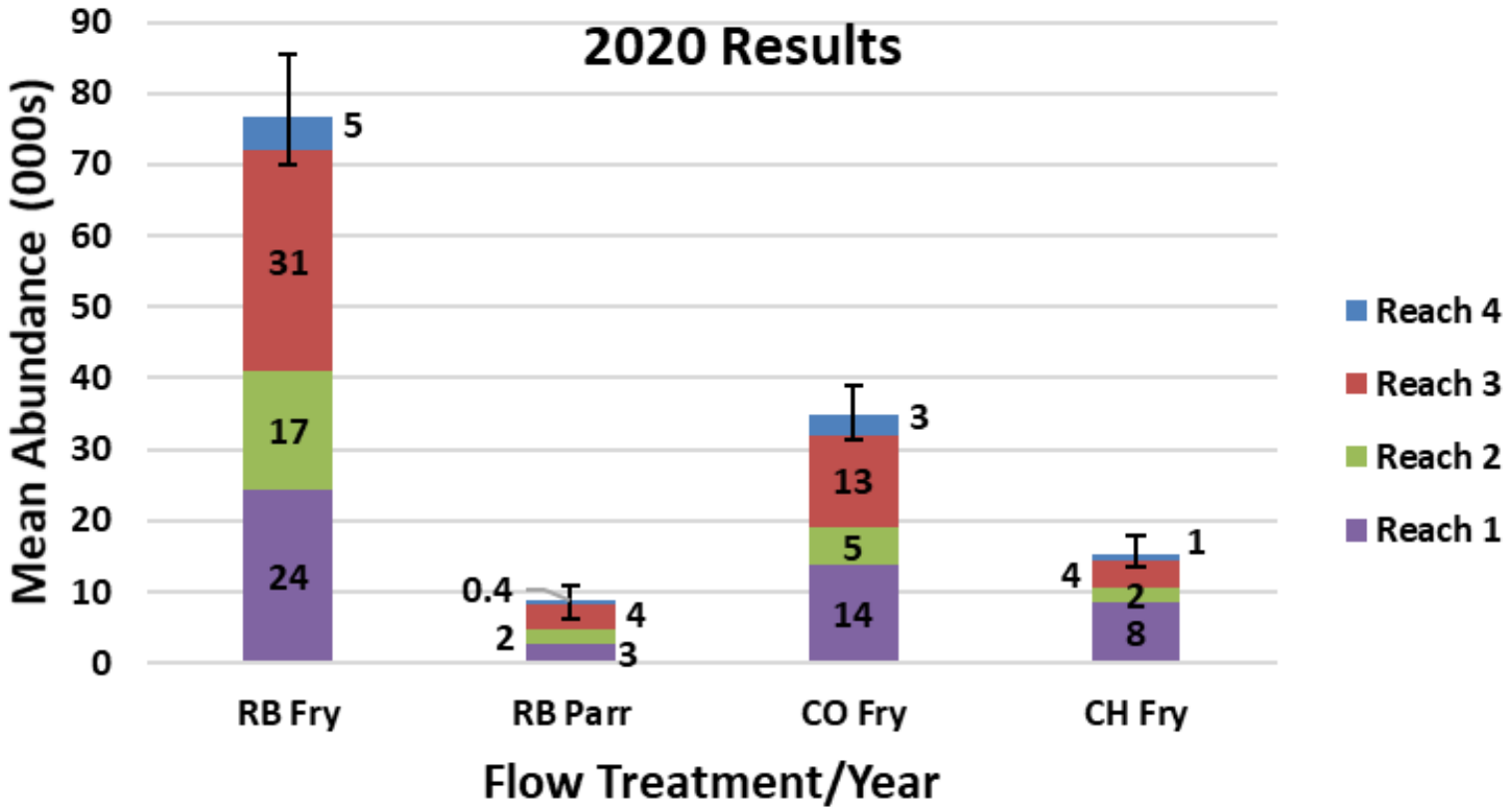
Mod. Ops. Sampling Locations



Bluenose Offchannel

Applesprings Offchannel

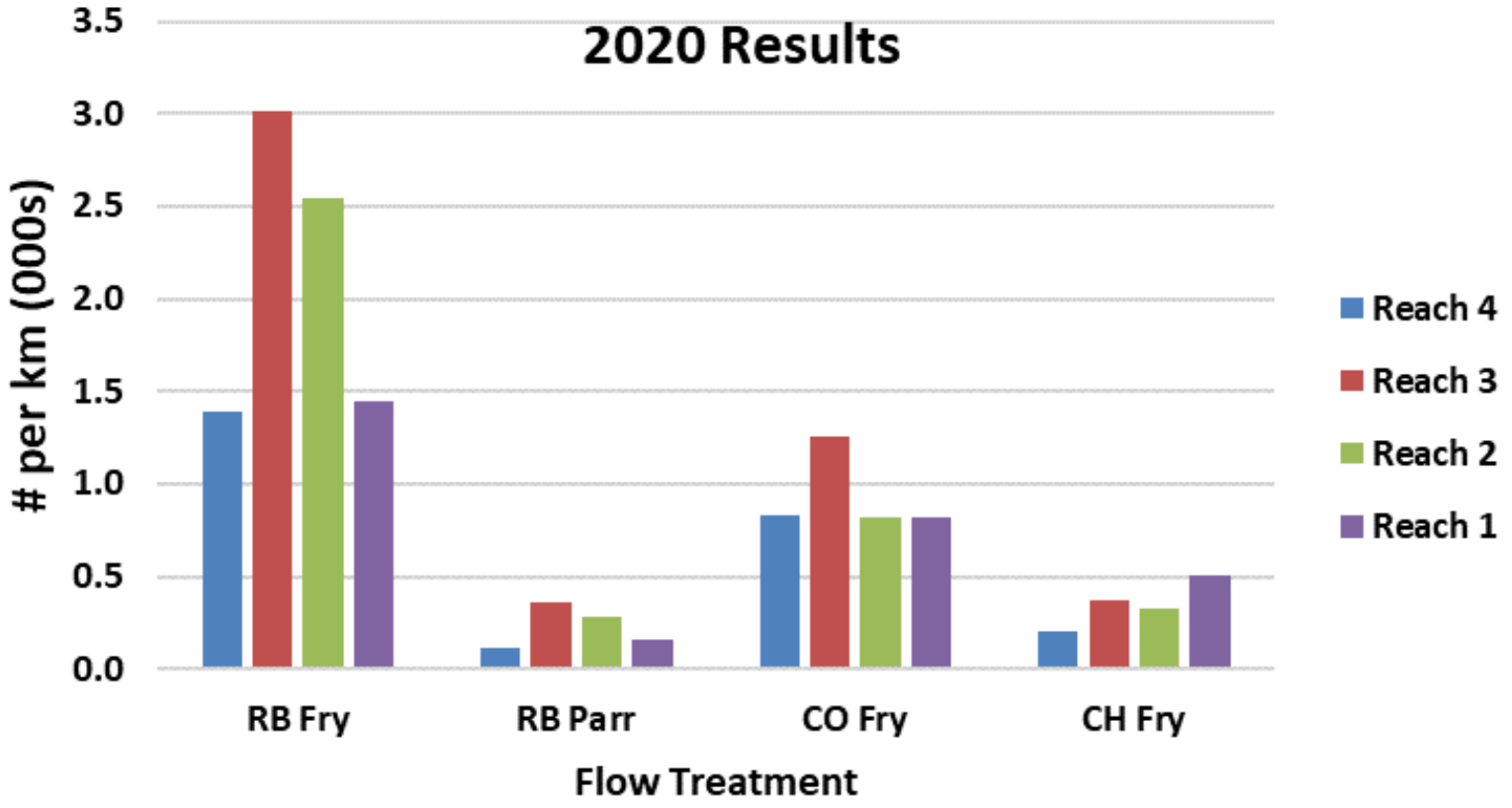
Juvenile Fish Production – 2020 Reach Comparison



Reach 1 sampled for 2nd time in 2020

- **Contributed ~1/3 of the total fish production (~49K out of ~135K total)**
- **Contributes almost ½ of the total length of the study area**
- **Results were very similar in 2019**

Juvenile Fish Production – 2020 Reach Comparison



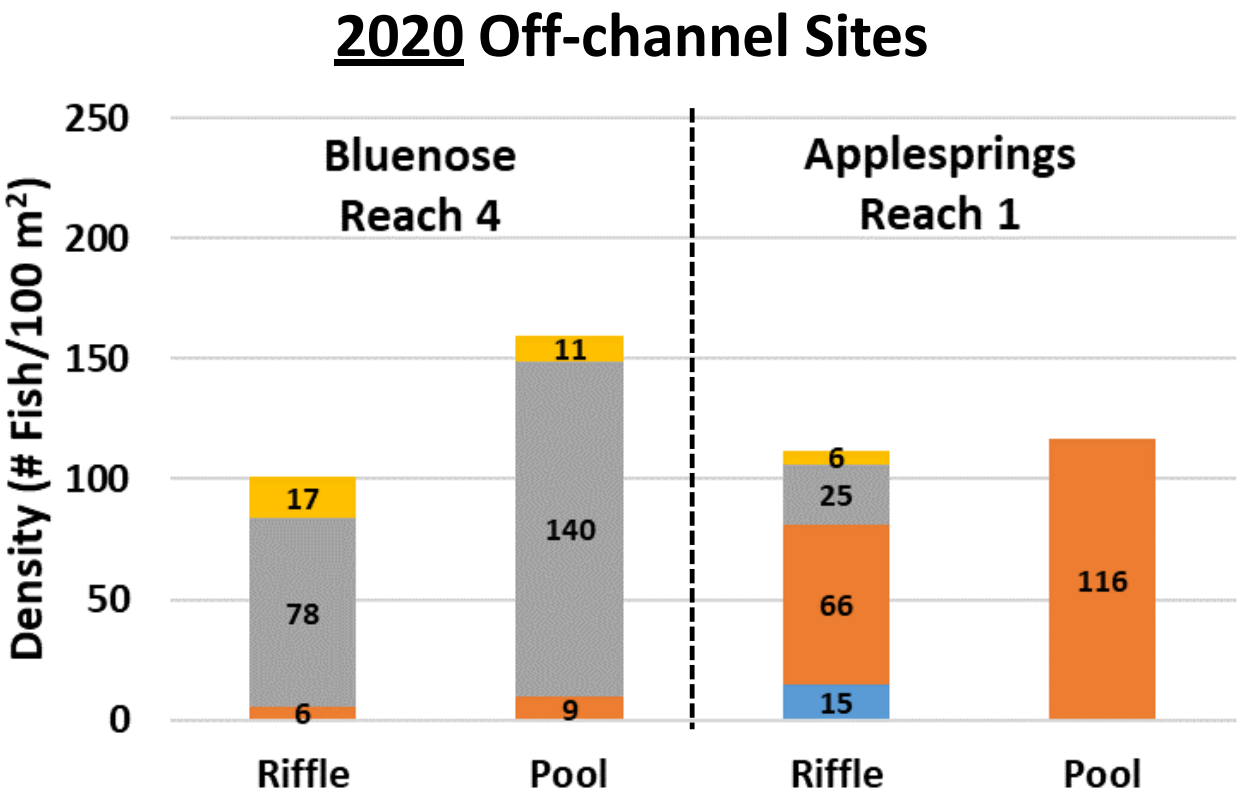
Reach Lengths

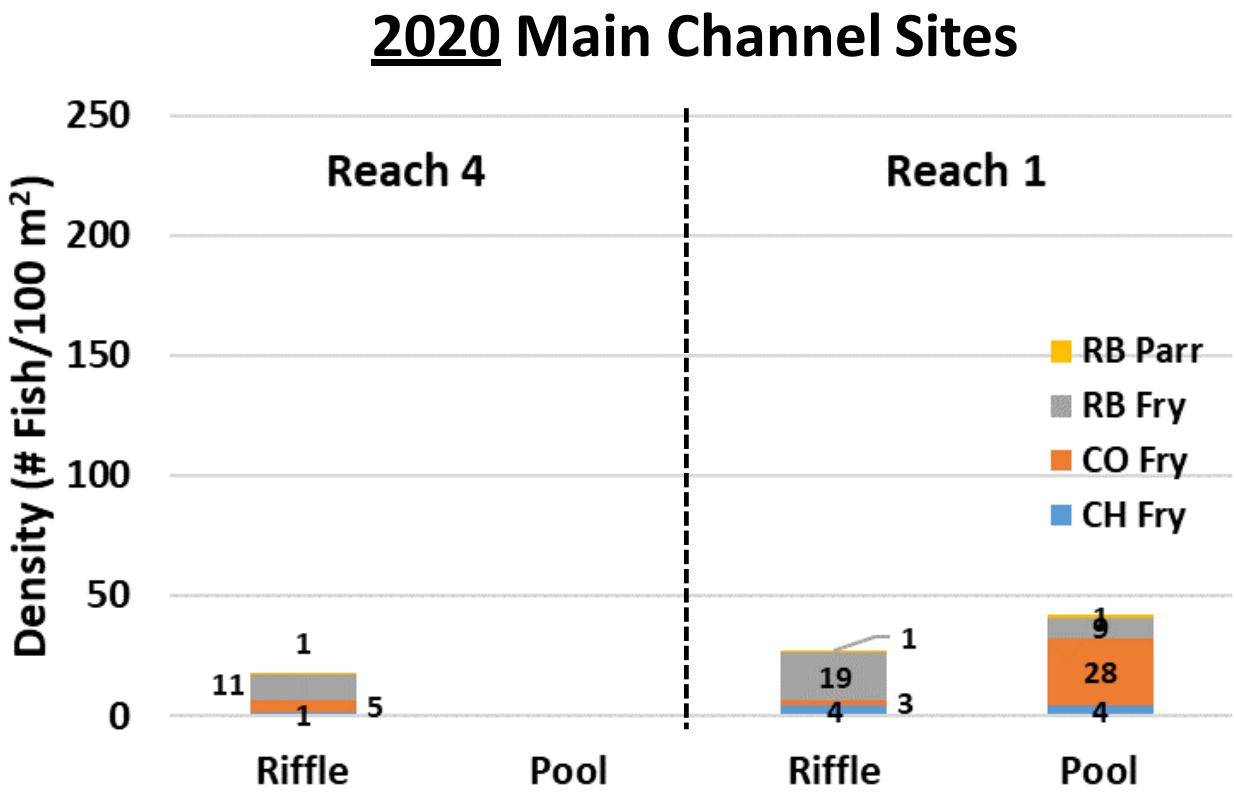
- **Reach 4 = 3 km**
- **Reach 3 = 11 km**
- **Reach 2 = 7 km**
- **Reach 1 = 20 km**

By length, the greatest abundance was in:

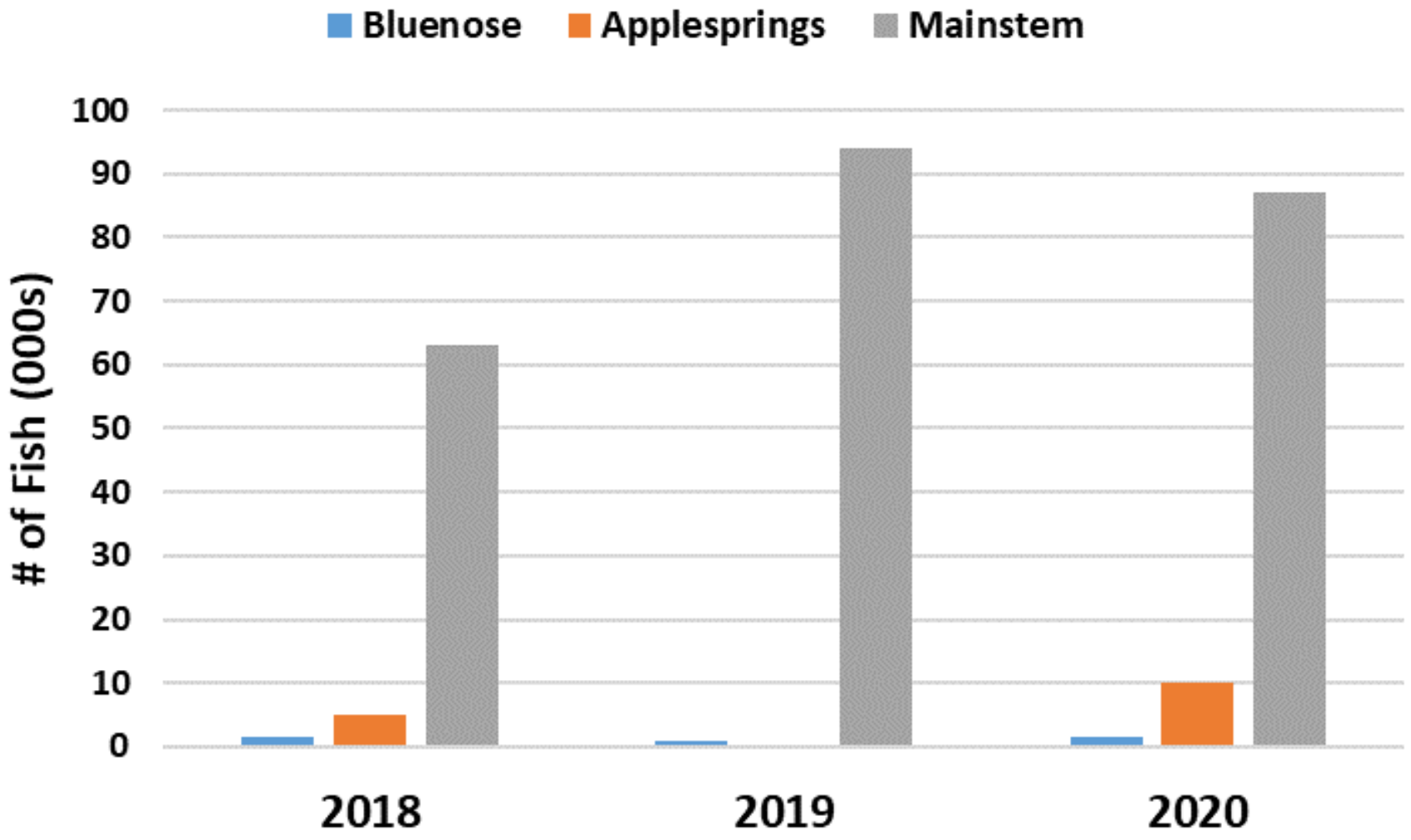
- **RB Fry – Reach 3**
- **RB Parr – Reach 3**
- **CO Fry – Reach 3**
- **CH Fry – Reach 1**

Off-channel Habitat – Fish Densities





Off-channel vs Main Channel Abundance



2 Off-channel sites provide ~ 1 hectare of habitat area

Main channel (reaches 2, 3, 4) provides ~50 ha (at trial flows)

Big difference in potential capacity between these habitat types

No obvious correlation with flow release discharge

Some Thoughts for Discussion

- Declining trend in nutrients documented below Terzaghi Dam warrants further investigation
  - System-wide approach (i.e., Upper Bridge to confluence with Fraser)
  - Project team had already started on a proposal for this in 2020
- Reduction of invertebrates and juvenile fish abundance caused by high flows were sudden and dramatic. Recovery after 2 years of restored Trial 2 flows has been limited.
  - Consider focus on mainstem improvements?
  - Aquatic invertebrate augmentation?
  - Fertilization?
- Addition of Reach 1 monitoring has documented/confirmed that majority of juvenile fish are recruited in top half of the study area (primarily Reach 3). Recommend continued monitoring in this reach to provide context for potential fish distribution/ abundance changes when high flows re-occur in the future.
- Offchannel habitat results indicate high densities of juvenile fish use (at least in some years). Currently no correlation with high flows (but high flow data are limited). These habitats have the potential to provide for year-round use, access at a wide range of flows, and high flow refuge. However, in terms of restoration of fish abundance to Trial 1 or 2 levels, the total capacity of offchannel areas is limited relative to the potential in the mainstem.