Rainbow Trout fishery: status update

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U.S. Department of the Interior
U.S. Geological Survey

Photo Credit. David Herasimtschuk, ©Freshwaters Illustrated

Background & Outline

- **Angler reports of low catch rates – perception of Rainbow Trout fishery collapse**

- **Are we meeting the Long-term Experimental and Management Plan (LTEMP) goal?**
  - *"Achieve a healthy high-quality recreational Rainbow Trout fishery in Glen Canyon National Recreation Area…"*

- **Review <u>preliminary</u> post-Annual Reporting Meeting Trout Recruitment and Growth Dynamics (TRGD) and AZGFD data:**
  - **January 25-30 (TRGD)**
  - **March 11-13 (AZGFD)**
  - **April 4-9 (*TRGD data summary in progress*)**

≋ **USGS**

Background & Outline

- **Rainbow Trout trends in condition, growth, and abundance or catch-per-unit-effort**

- **Discuss hypothesized drivers of recent trends**

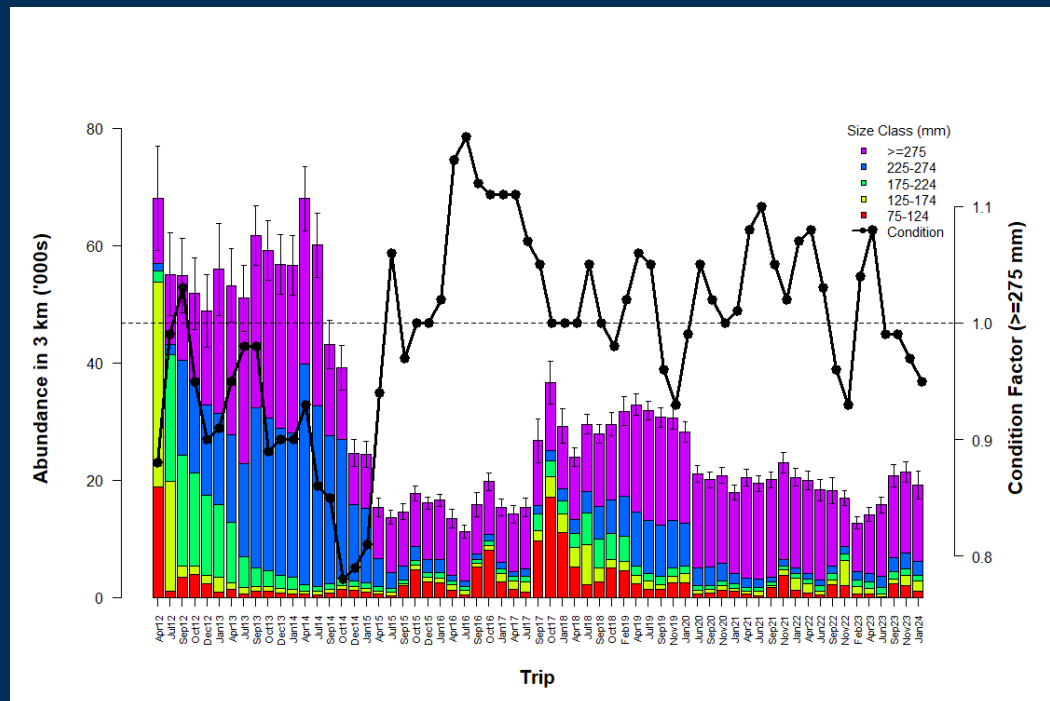- **Review sampling changes/next steps**

Growth and Condition

- **Rainbow Trout: through January 2024 (TRGD)**
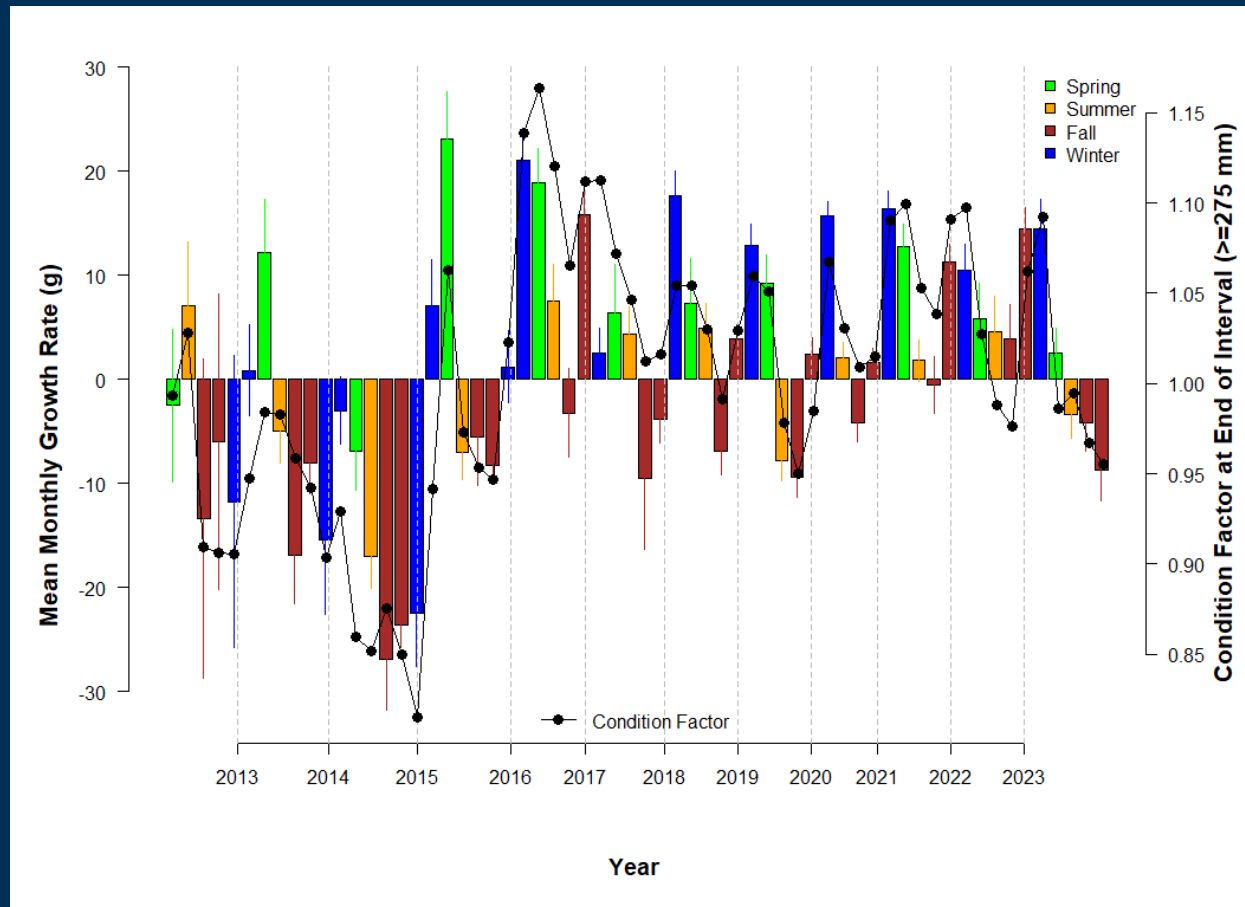
Trends in Abundance

Rainbow Trout abundance

- **TRGD mark-recapture abundance estimates through January 2024**
  - **Limited recruitment**
  - **Abundance not reflecting dramatic/recent declines (surprising)**
    - Caveat: future mark-recapture data analysis may result in revisions

Trends in Abundance

Rainbow Trout abundance

- **TRGD catch data through April (*incomplete*)**
  - **3 of 4 nights of sampling**
    - **Proportional catch comparison to January trip**

		Catch/trip		Proportion of previous trip catch
		Jan24	Apr24	Apr/Jan
Rainbow Trout	1C (night 1 & 2)	1070	414	0.39
	1A (night 1)	132	53	0.40
Brown Trout	1C (night 1 & 2)	315	168	0.53
	1A (night 1)	33	23	0.70

USGS

Preliminary unpublished data, do not cite

Trends in Abundance

Catch-per-unit-effort

- **AZGFD data through March 2024**
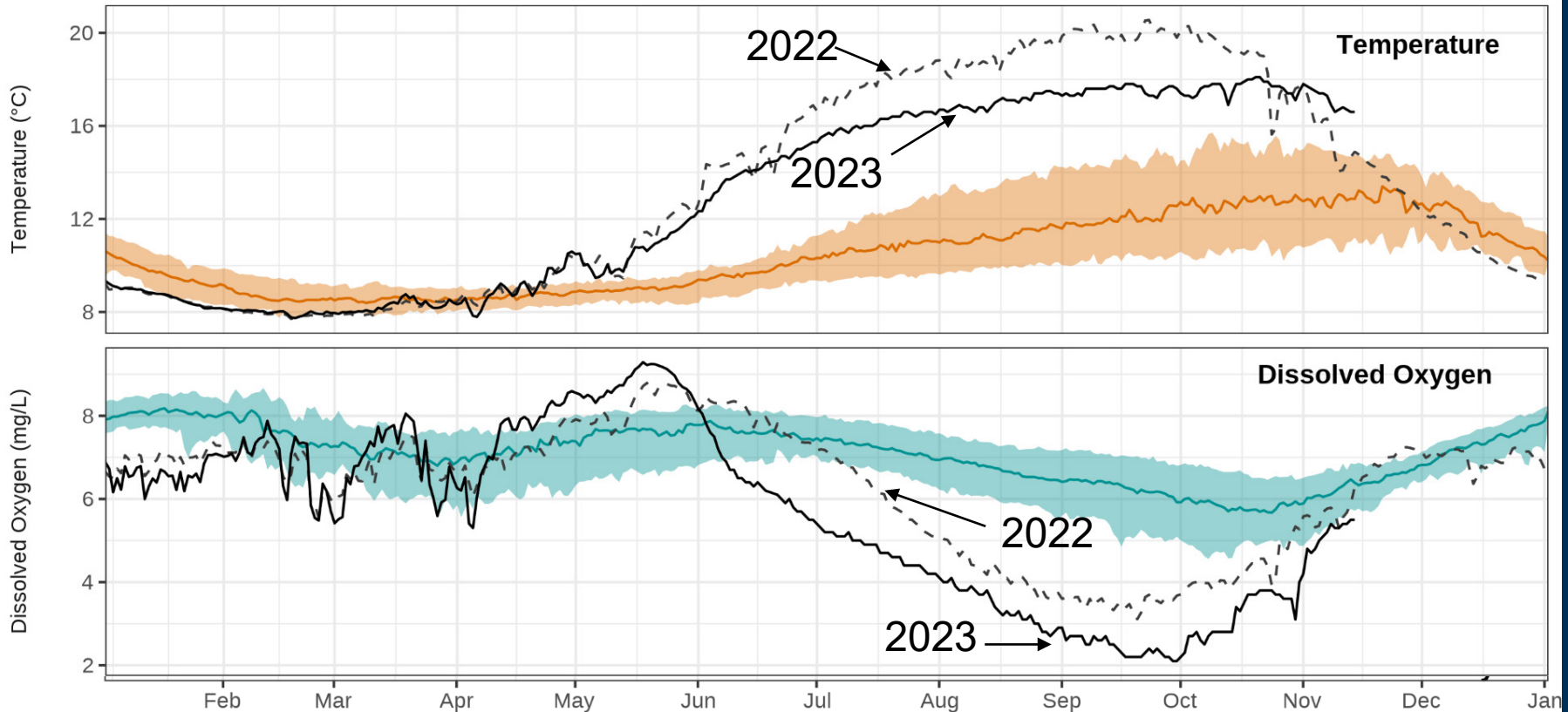   - **Lowest CPUE since 1991**
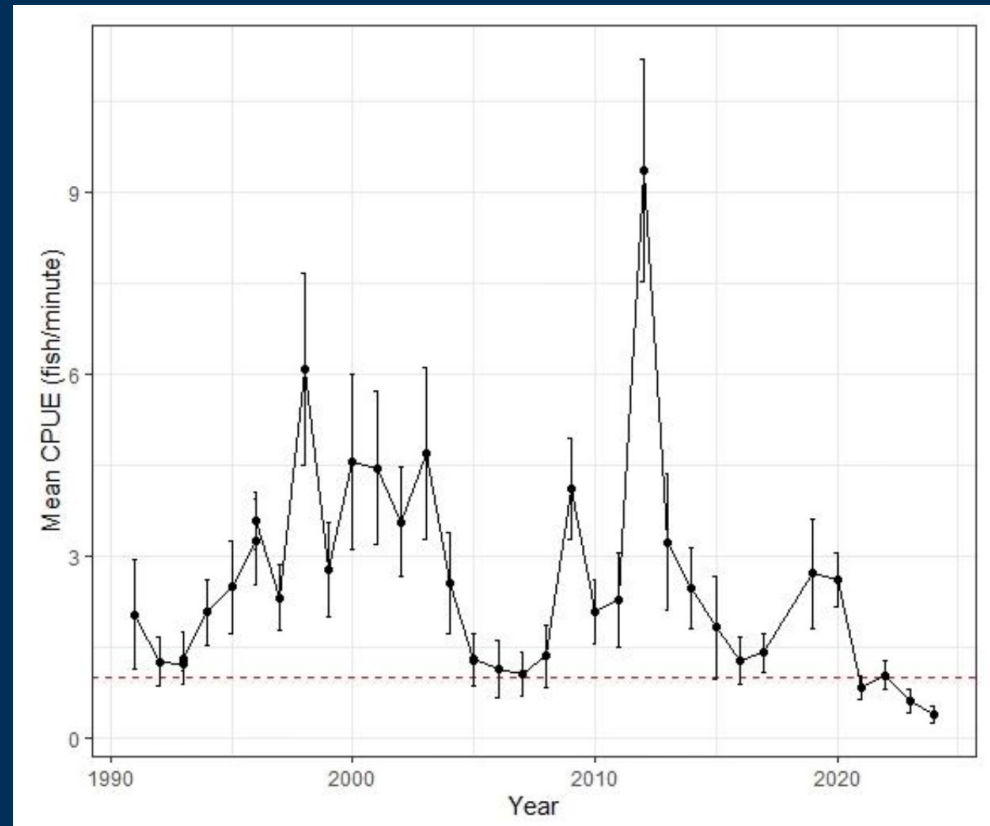
Hypothesized drivers of decline

Water quality

Water Quality Conditions Immediately Below Glen Canyon Dam

The colored lines and shaded regions depict daily trends from 2009 to 2021 as the 10th, 50th, and 90th quantiles. The thick blank line represents this years (2023) data and the dashed line, 2022. Data collected after 06/01/2023 is provisional.

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Water quality

Water Quality Conditions Immediately Below Glen Canyon Dam

Temperature

Dissolved Oxygen

Decreased production (<4.6-5 mg/l)*

Acute Mortality(<3 mg/l)*

The colored lines and shaded regions depict daily trends from 2009 to 2021 as the 10th, 50th, and 90th quantiles. The thick blank line represents this years (2023) data and the dashed line, 2022. Data collected after 06/01/2023 is provisional.

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*EPA 1986
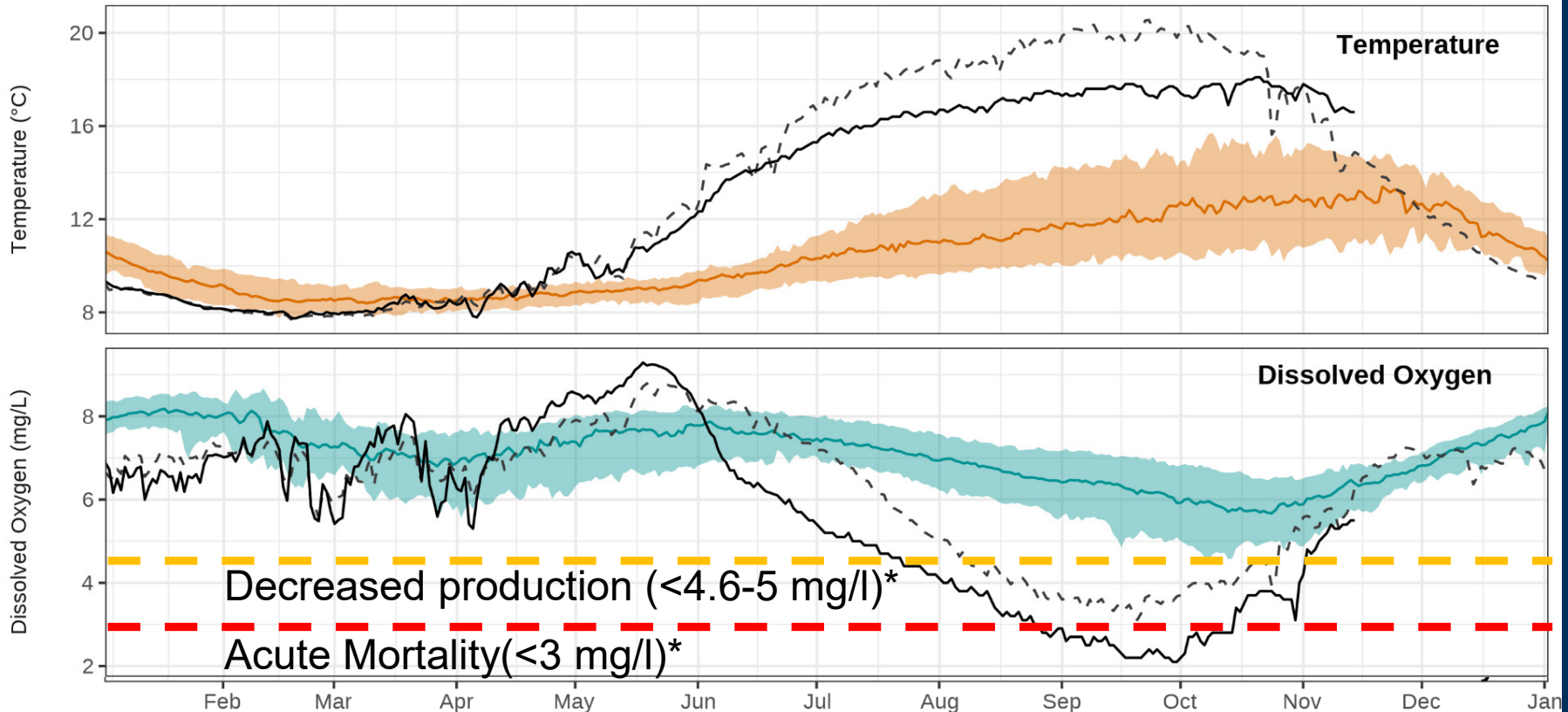
Fish bioenergetics

- **Model accounts for what comes in and what (must) go out**
- **Order of energy allocation**
  1. **Respiration + Active metabolism + Digestion**
  2. **Egestion + Excretion (wastes)**
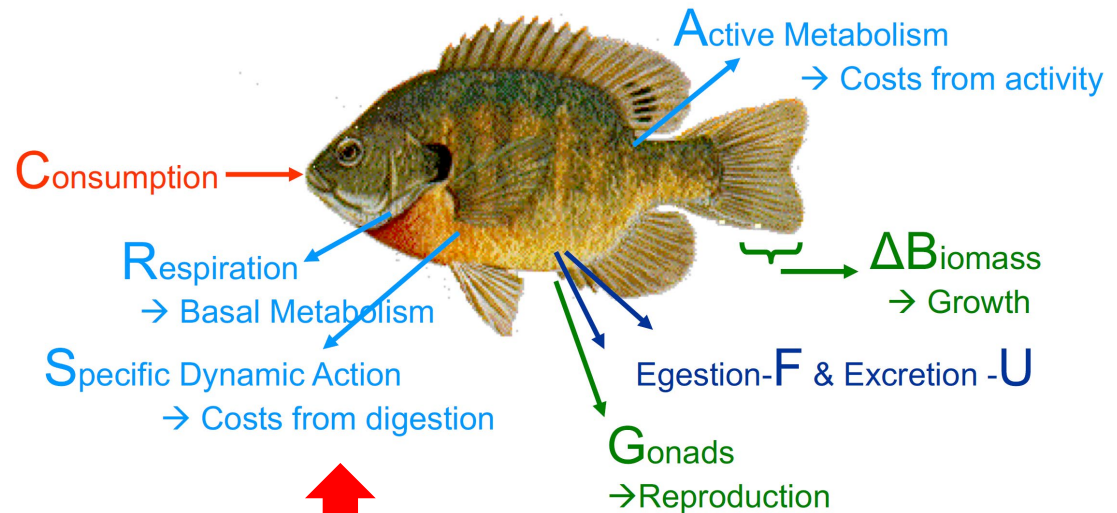 3. **Growth + Reproduction (last!)**

Model Components:

$$C = (R + A + S) + (F + U) + (\Delta B + G)$$

Figure: Utah State University
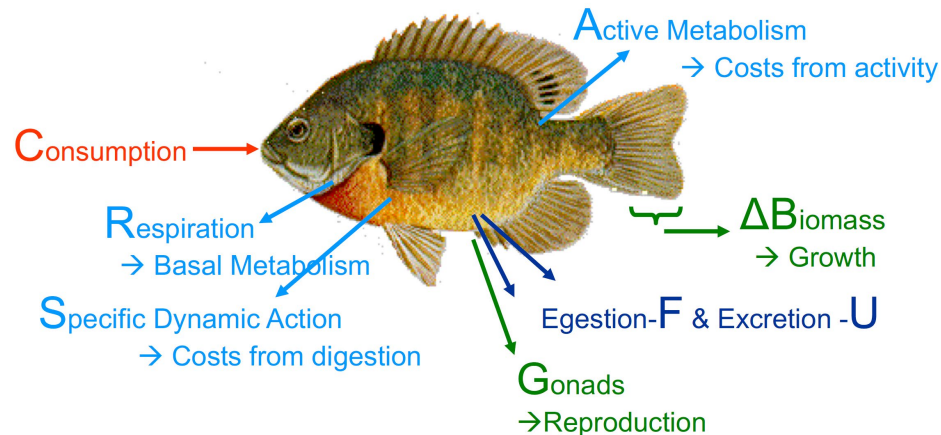
Fish bioenergetics

- **Low dissolved oxygen (and/or high temperature)**
  - **Reduced feeding, increased metabolic costs**
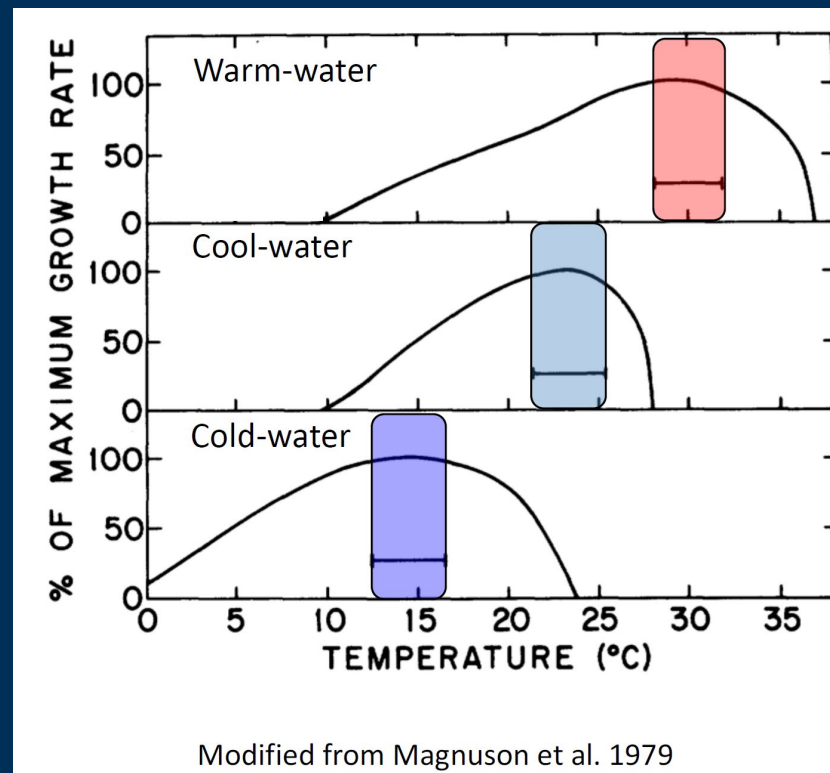   - ➡ **Reduced energy allocated to growth, reproduction**

Model Components:

$$C = (R + A + S) + (F + U) + (\Delta B + G)$$

USGS

Fish bioenergetics

- **All processes are temperature dependent**
  - **Higher temperatures require additional food**
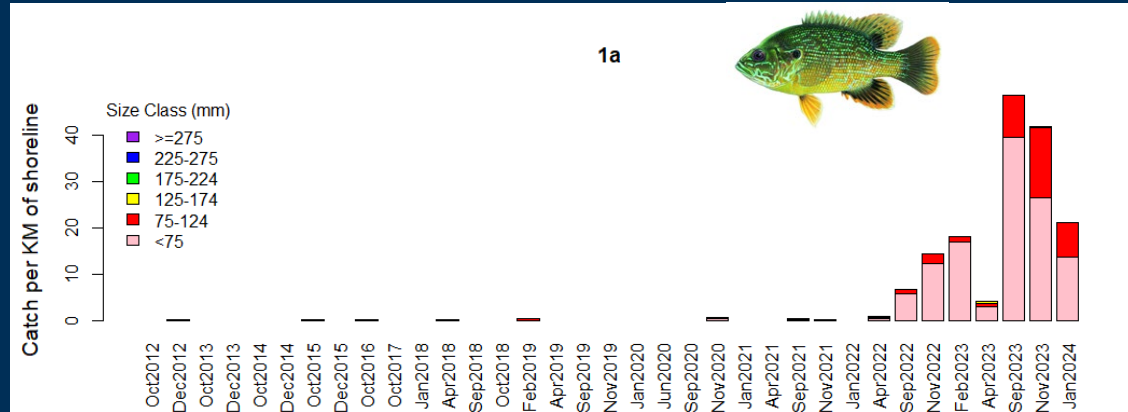- **Growth declines when temperature exceeds threshold**

Modified from Magnuson et al. 1979

Figure:
Utah State
University

New species expansion/invasion

- **Green Sunfish (and other species) expansion**
  - **Competition for food?**
- **Brown Trout**
  - **Predation on Rainbow Trout recruits?**

Summary: Hypothesized causes of decline?

- **Unprecedented, extended periods of low dissolved oxygen**
  - **Surprising temporal lag in trout response given levels below acute mortality threshold**

- **Reduced recruitment over multiple years**

- **Increased competition or predation?**

≋ **USGS**

Next steps

- **Adjust sampling regimes**
    - **Proactively cancel September TRGD trip when warmer temperatures and low DO are likely**
    - **Reduced trips in next workplan (enhance efficiency)**
        - **TWP elements H.1 & H.2**
- **Assess causes of decline to inform management and decision-making**
    - **Modeling and analysis (TWP element H.3)**
    - **Reproductive condition data – relate to conditions**
    - **Structured decision-making? Knowledge assessment?**

Questions?

Fish bioenergetics

■ **All processes are temperature dependent**