

Getting ahead in a cutthroat world

Optimizing culture conditions for
Snake River, Colorado River
and Yellowstone cutthroat trout

Christopher Myrick & Mandi Brandt

Colorado State University

Greg Kindschi

US Fish and Wildlife Service (Bozeman)

Rick Barrows

USDA/ARS Hagerman Fish Experiment Station

Jeremy Liley – Liley Fisheries, Inc.



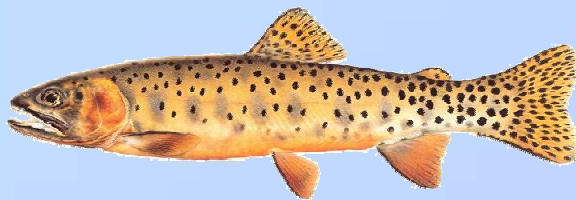
Why cutthroat trout?

- Most cutthroat trout subspecies are rare, threatened, or endangered
- Cutthroat trout are produced for put-and-grow fisheries or conservation/restoration efforts
- Limited research and production experience on cutthroat trout culture
 - Substituting rainbow trout techniques → poor survival and growth

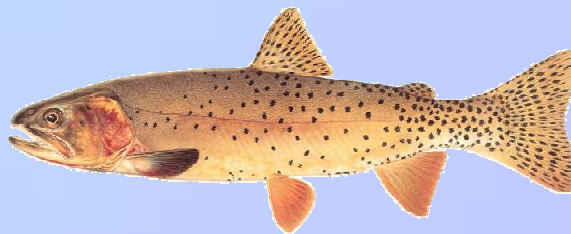


Project Goals

- Investigate the effects of diet, water temperature, and rearing density on the growth and survival of:
 - Snake River cutthroat trout (SRCT)
 - Colorado River cutthroat trout (CRCT)
 - Yellowstone cutthroat trout (YCT)
- Results should be transferable to other cutthroat subspecies
- Develop a culture manual for inland cutthroat trout



**Colorado River cutthroat
trout**



Yellowstone cutthroat trout



Snake River cutthroat trout

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Research Approach

- 120-d feeding trials
 - Start w/first-feeding fry
- Feed with 12-h belt feeders
- Feed at 4% tank biomass/day
- 4 replicate tanks per treatment
 - 48" x 14" x 10" tanks
- Flows of ≥ 4 L/min
- CRCT at CSU
- SRCT + YCT at Bozeman Fish Technology Center



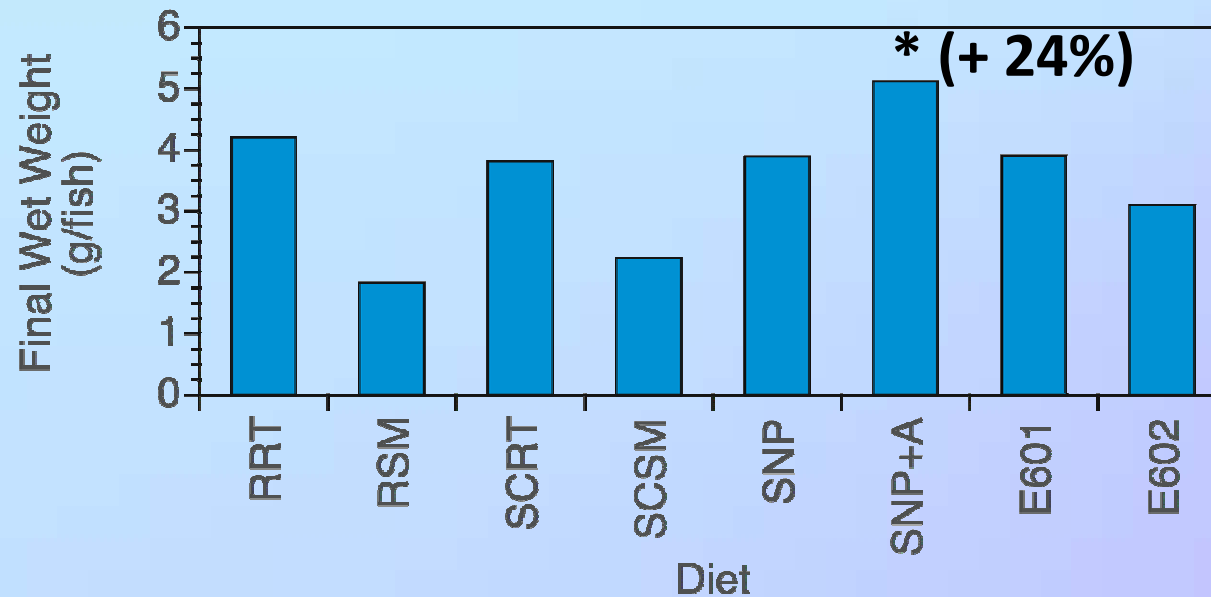
Diet Experiment Details

- Diet selection criteria
 - Commercially available trout or salmon diets
 - Open formula diets from USDA
- CSU also looked at 21 days of *Artemia* supplementation
- Water temperature
 - CSU: $10.3 \pm 0.1^{\circ}\text{C}$
 - BFTC: 10.0°C

Rangen regular trout	RRT
Rangen soft moist	RSM
Silver Cup regular trout	SCRT
Silver Cup soft moist	SCSM
Skretting nutra-plus	SNP
Skretting nutra-plus + <i>Artemia</i>	SNP+A
USDA HFCES Experimental 601	E601
USDA HFCES Experimental 602	E602



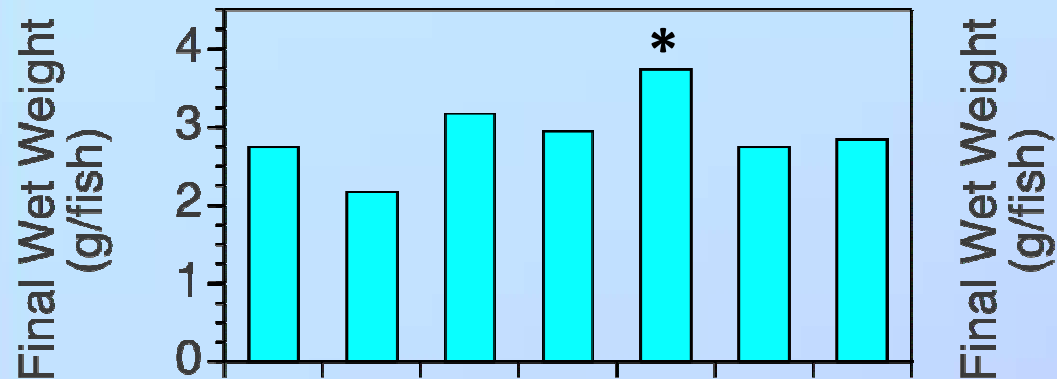
Diet Results – Colorado R. Cutthroat



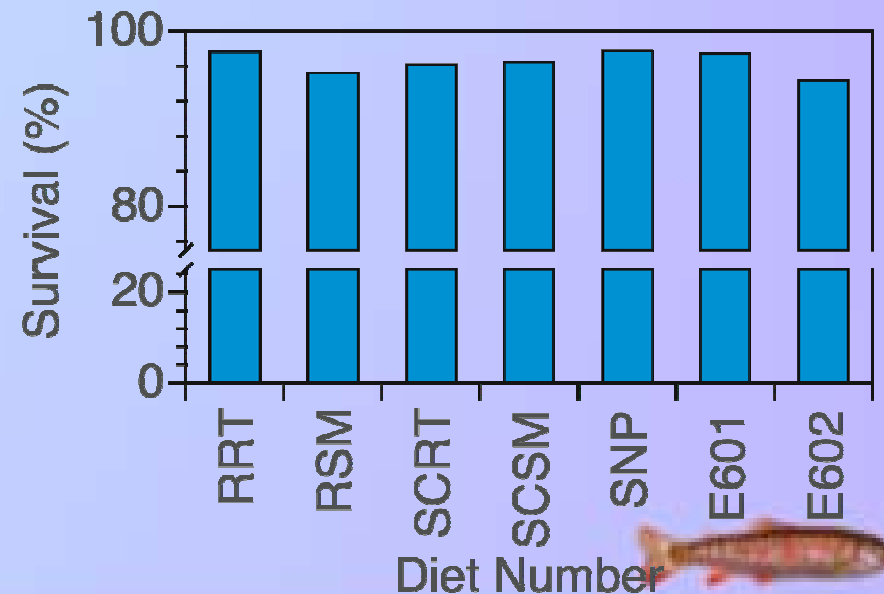
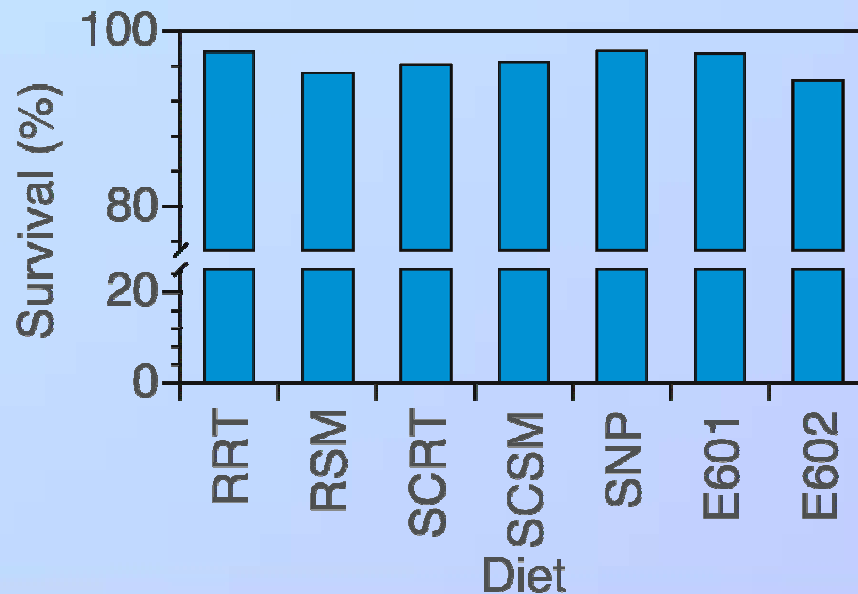
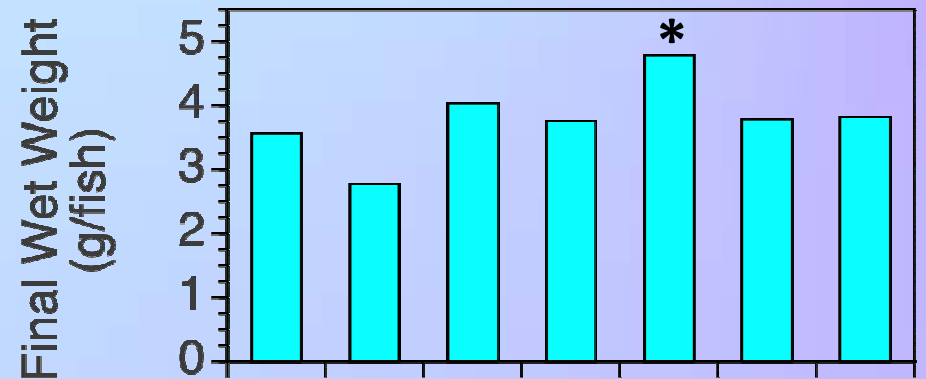
Diet Results

Snake R. & Yellowstone Cutthroat

Yellowstone Cutthroat Trout



Snake River Cutthroat Trout

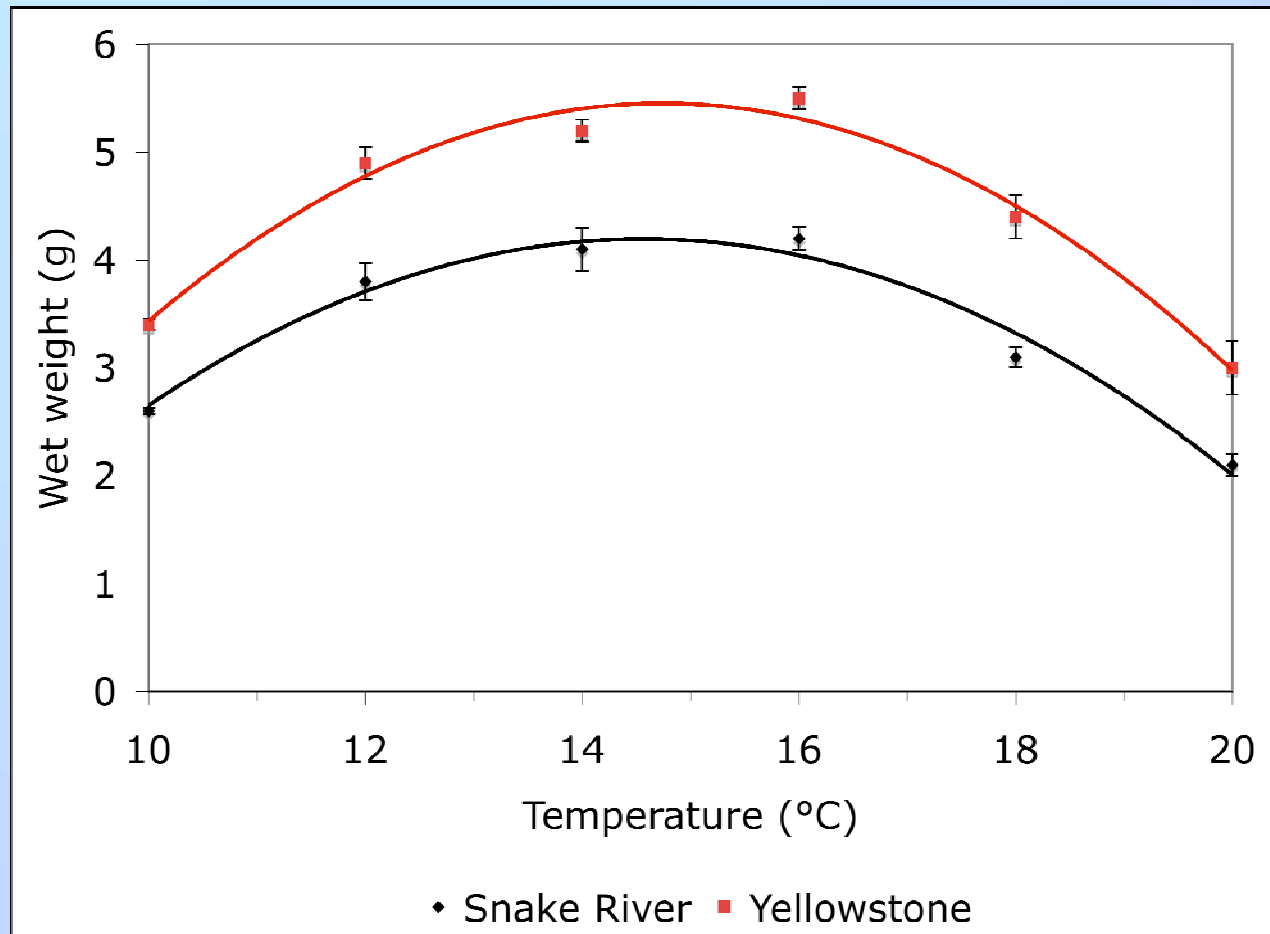


Temperature Experiment Details

- Measured survival & growth at 10 – 20°C
- SRCT & YCT tested 10, 12, 14, 16, 18, and 20°C
- CRCT tested at 10, 12.5, 15, 17.5 and 20°C
 - CSU also looked at SNP & RRT diets (w/*Artemia*)



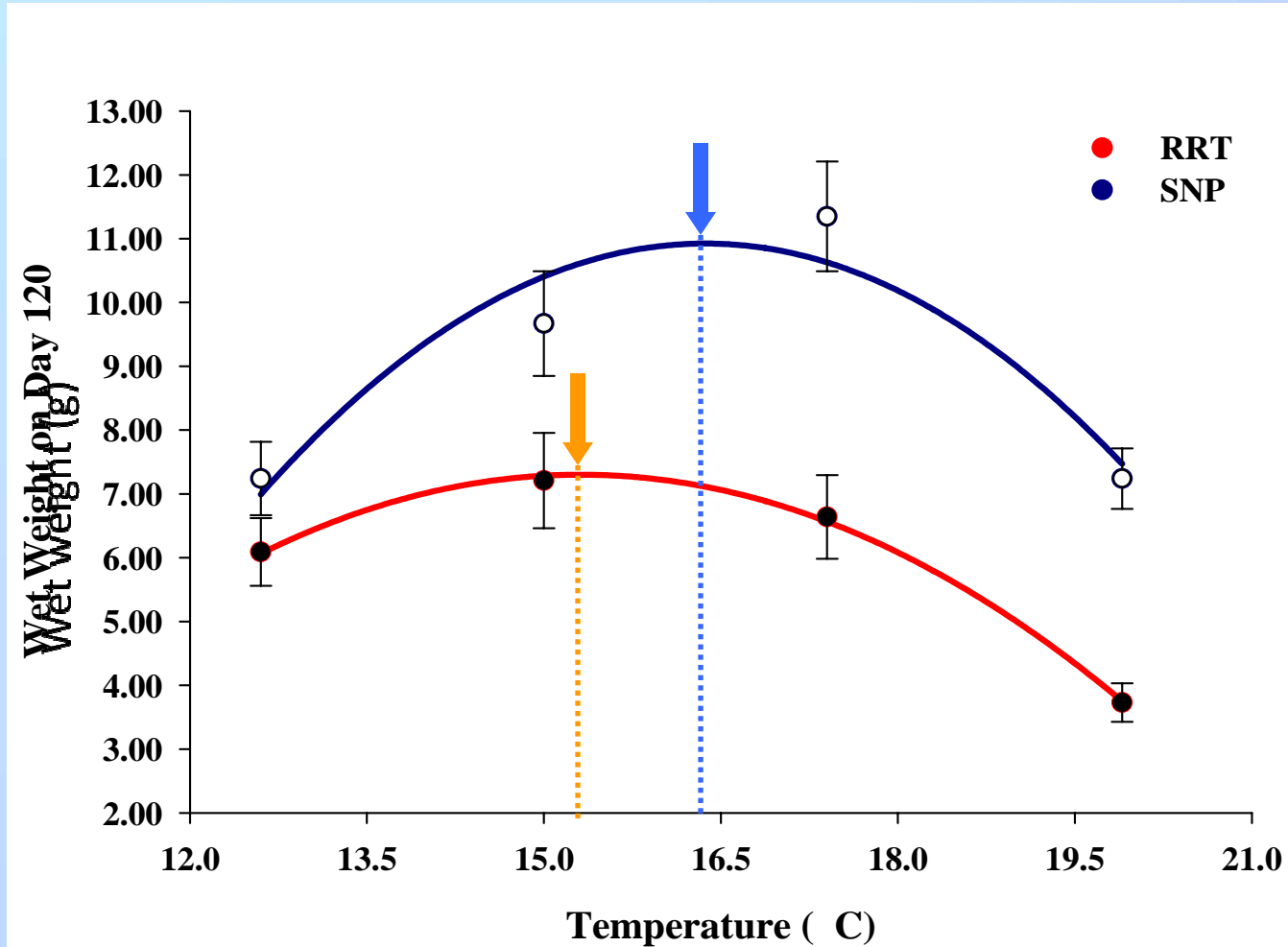
Temperature Results – SRCT & YCT



Optimal growth temperatures at 4%/d (satiation?): SRCT = 14.5°C, YCT = 14.7°C
No survival effect w/temperature



Temperature Results – Colorado R. Cutthroat



Optimal growth temperatures at 4%/d (satiation?): RRT = 15.3°C, SNP = 16.4°C
Survival decreased slightly w/increasing temperature



Density Experiment Methods

- All fish fed SNP 4%/d
- Reared at optimal temp.
- Snake R. & Yellowstone Cutthroat)
 - Densities of 50, 100, 150, 200, 250, 300, and 350 fish/tank
- Colorado R. Cutthroat
 - 150, 300, 450, and 600 fish/tank

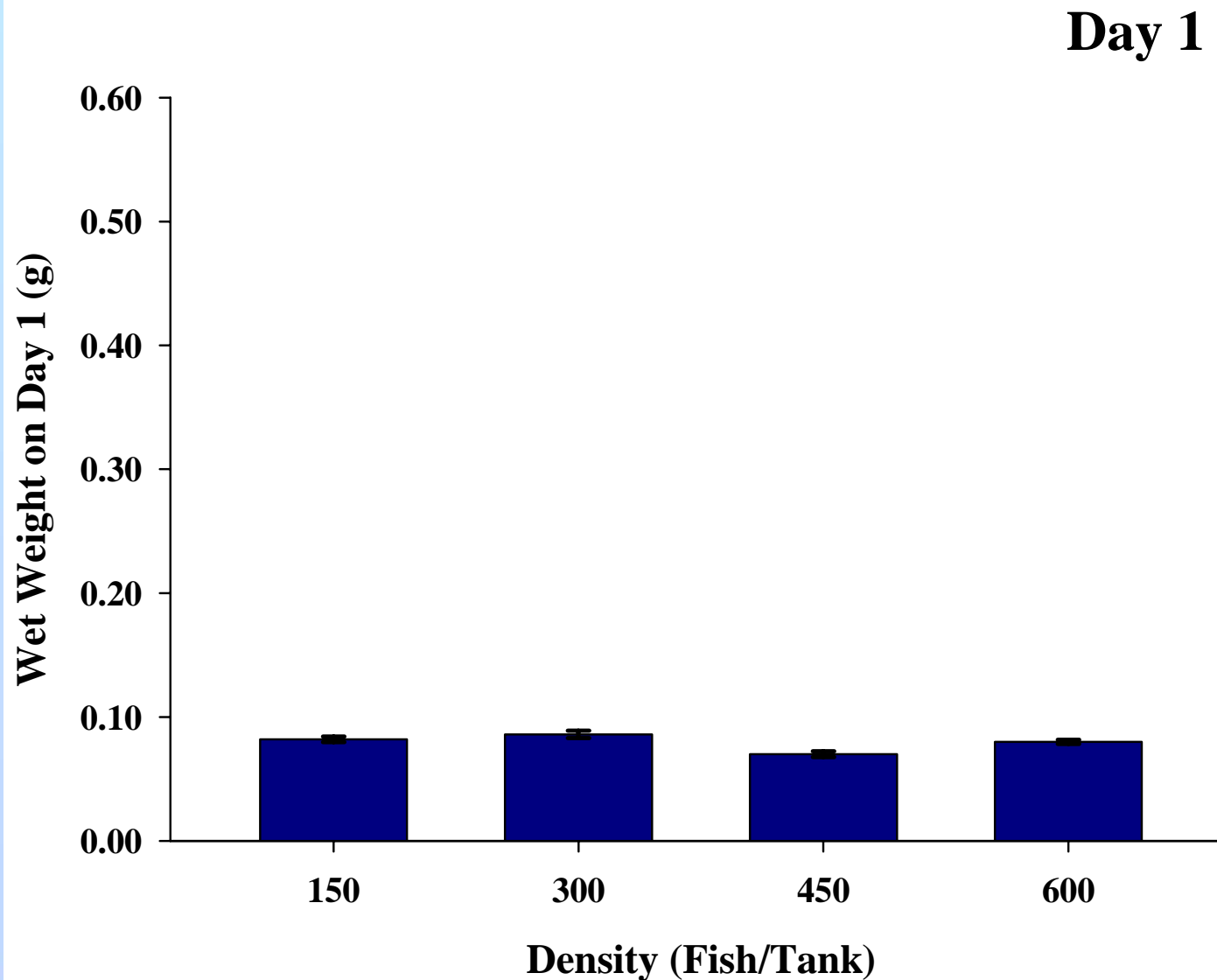


Density Results – All Subspecies

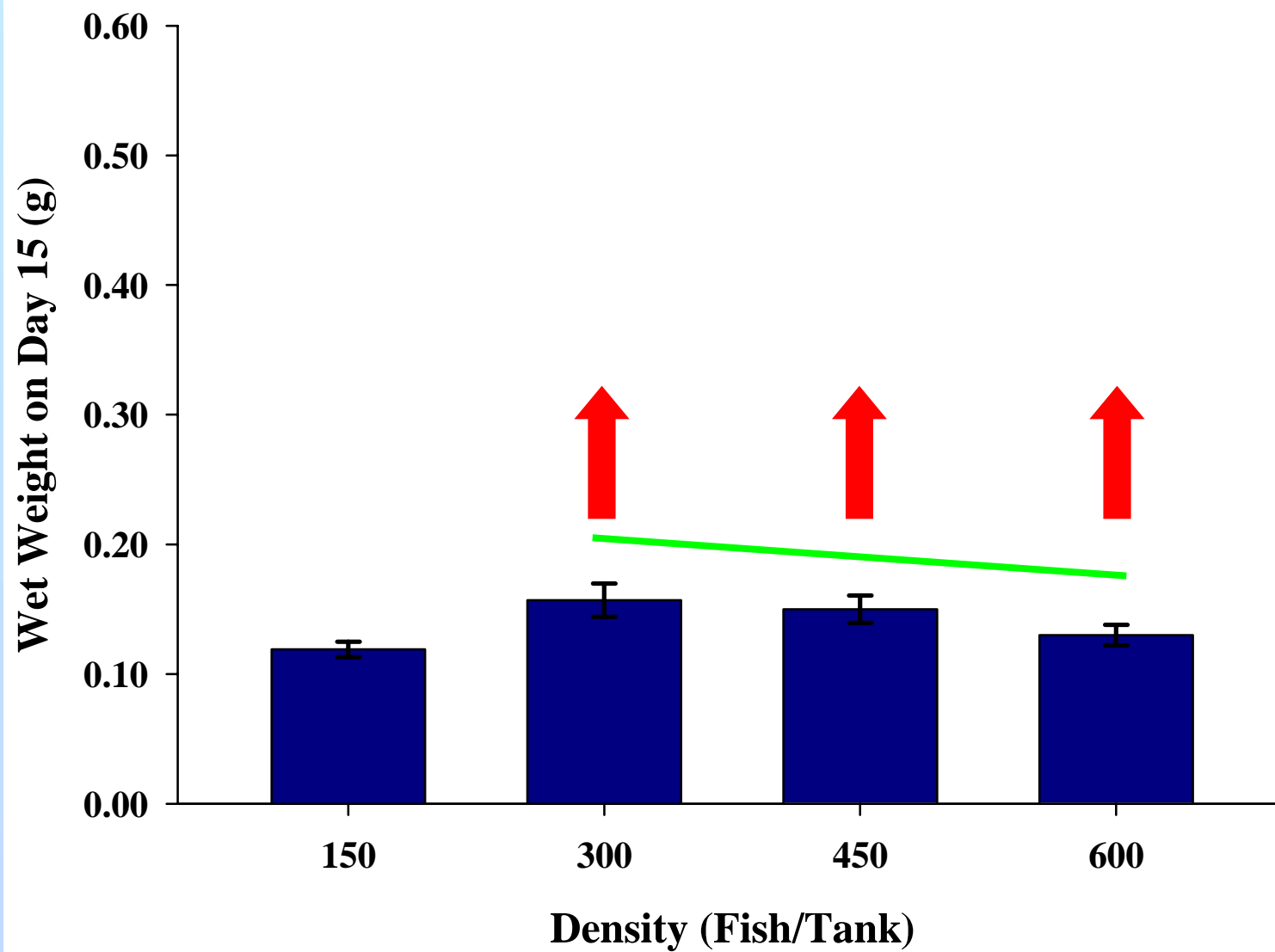
- SRCT & YCT showed decreased growth with increasing density
 - Small difference < 0.5 g/fish between 50 and 350 fish/tank treatments
 - SRCT survival was slightly lower
- CRCT showed decreased growth w/density
 - Interesting time component to density results
 - No survival effect

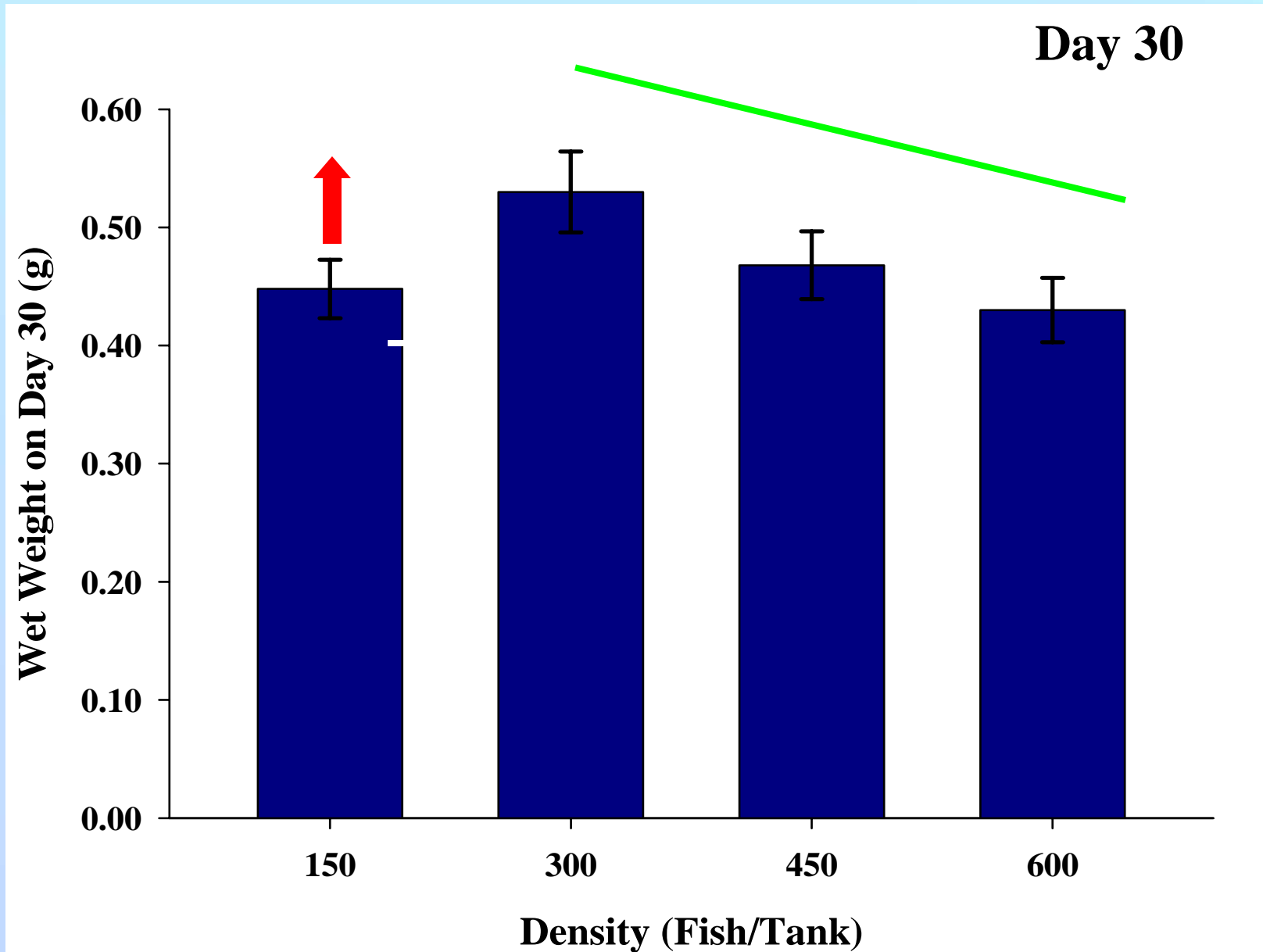


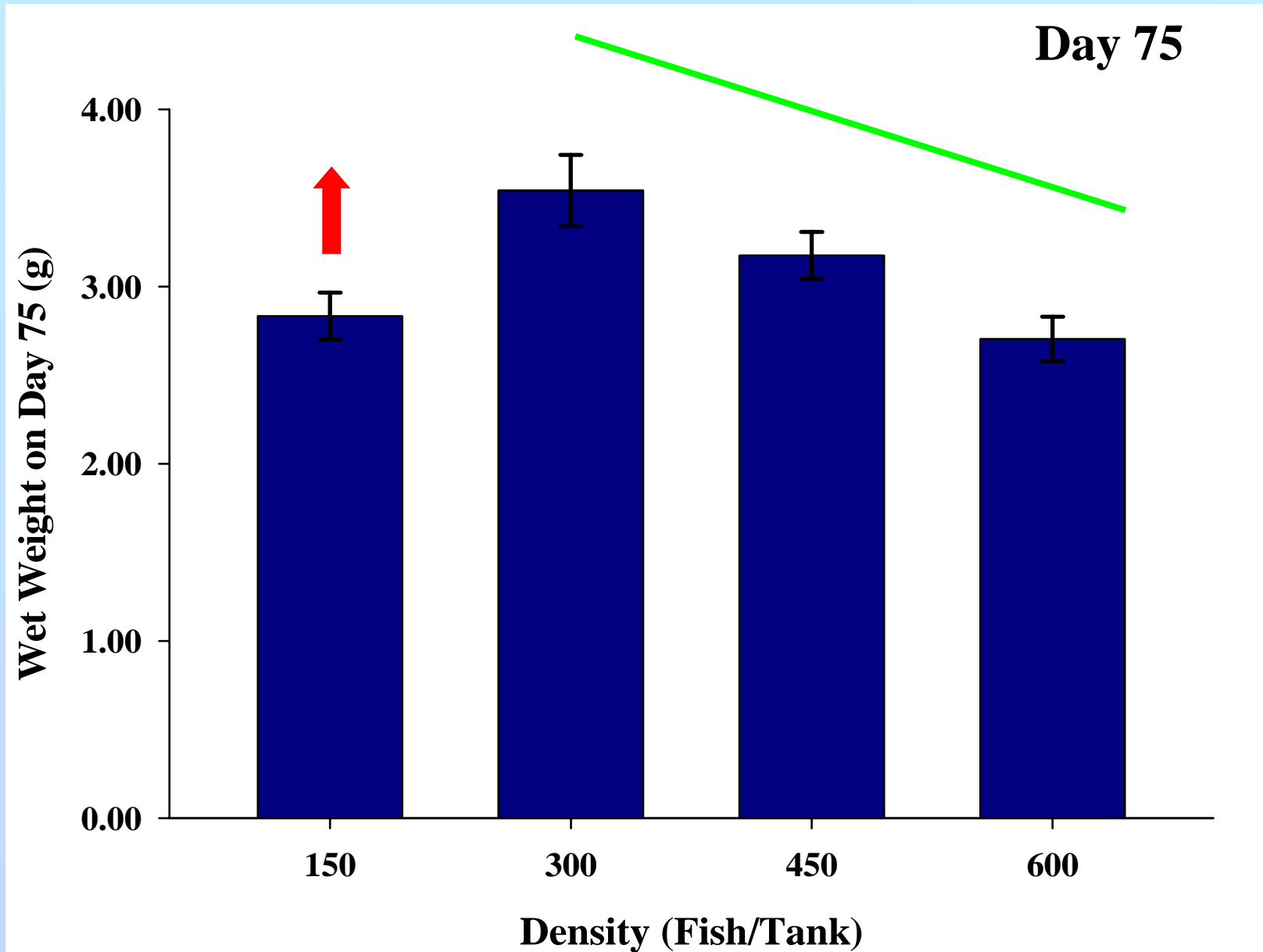
CRCT Density Results – Learning to Feed?

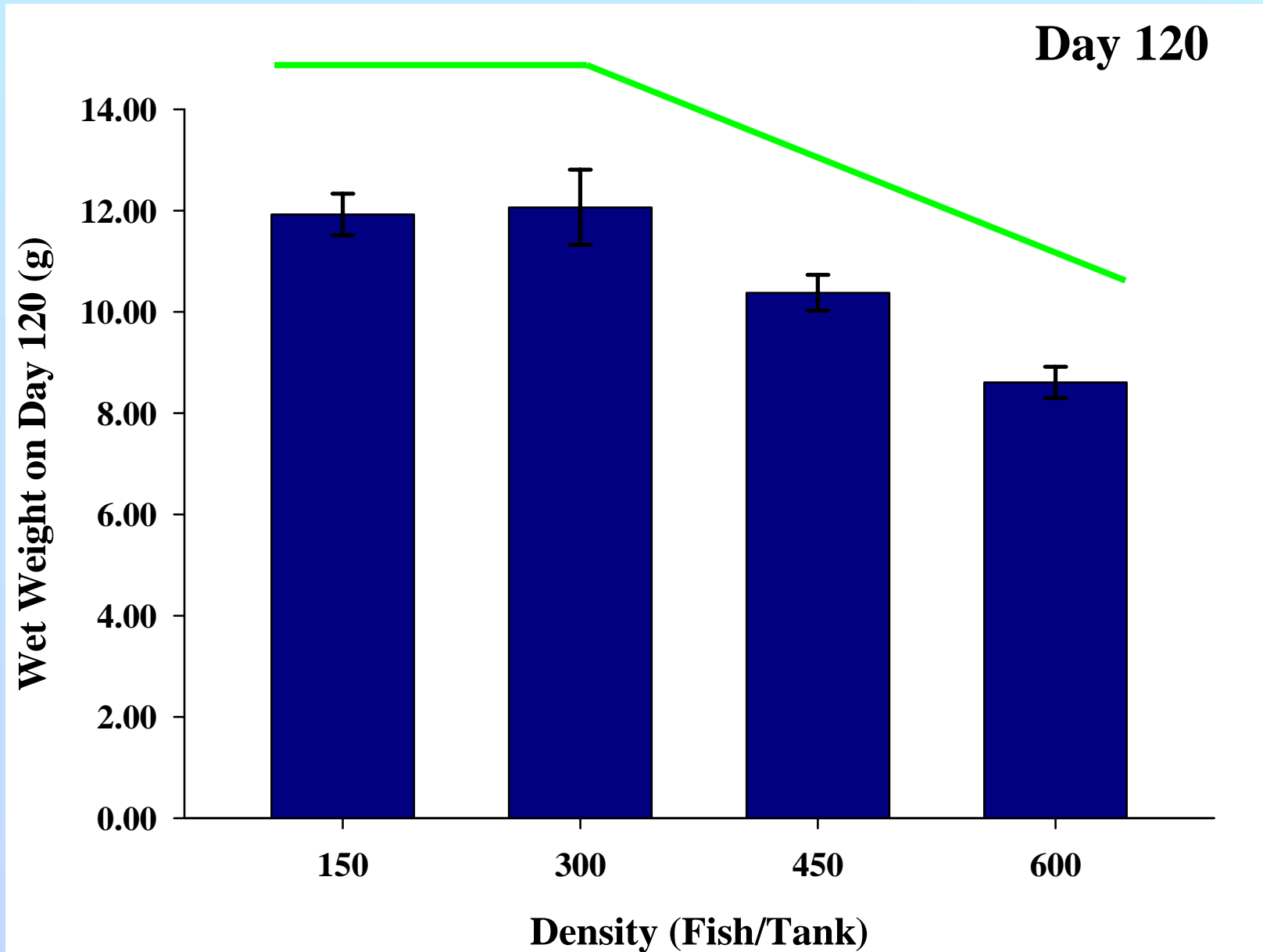


Day 15









Conclusions

- Diet
 - Skretting-Nutra Plus or other premium diets produce higher growth + survival than regular trout diets
 - *Artemia* supplementation, even for only 21 days, produces lasting survival and growth benefits
- Temperature
 - Cutthroat trout optimal temperatures are in 14.5 – 16.5°C range
 - Optimal temperatures are subspecies-specific
 - Evidence of latitudinal variation?
 - Interesting implications for management
- Density
 - Rearing at low to moderate densities appears possible w/o incurring significant growth or survival penalties
 - Using intermediate starting densities followed by thinning may improve early survival (learned feeding behavior)



Acknowledgements

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