Bioenergetics

PhD. student

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5- Bioenergetics models

Bioenergetics models

- Bioenergetics models either
  - (1) predict growth from predictions of food consumption and metabolism/reproduction, or
  - (2) back-calculate food consumption from growth and predictions of metabolism/reproduction
- Back-calculation of food intake (needed for analysis of trophic interactions) can be done from growth curves.
- Bioenergetics models that account for seasonal variation in food, temperature effects are needed for interpretation of tagging data.
- Share of energy to reproduction is critical for understanding growth curves .

Bioenergetics models

Bioenergetics models are based upon the balanced energy equation (Winberg 1956)

- Based on 1st law of thermodynamics (E not created or destroyed).
- C = G + M + SDA + F + U

or

- G = C – M –SDA – F – U

G = growth C = Consumption

M = metabolism SDA = heat

F = egestion U = excretion

Knowledge of 5 values allows us to solve for the unknown 6th value.

C

$$C = G + M + SDA + F + U$$

$$C = 0.020 + 0.020 + 0.003 + 0.001 + 0.001$$

$$C = 0.045$$

Statistical and practical models

- Statistical is based on observations, mathematical in nature e.g. regression equations.

- Practical is derived from data/obs.

Two Basic Types of Models:

1. **Qualitative** - more like a hypothesis, predicts direction of response, not amount.

2. **Quantitative** - predicts (statistically or non-stats) the amount of the response.

What affects energetics?

1. Temperature
2. Body size
3. Activity levels
4. D.O., pH, or other stressors
5. Prey type and other exp. Set up.

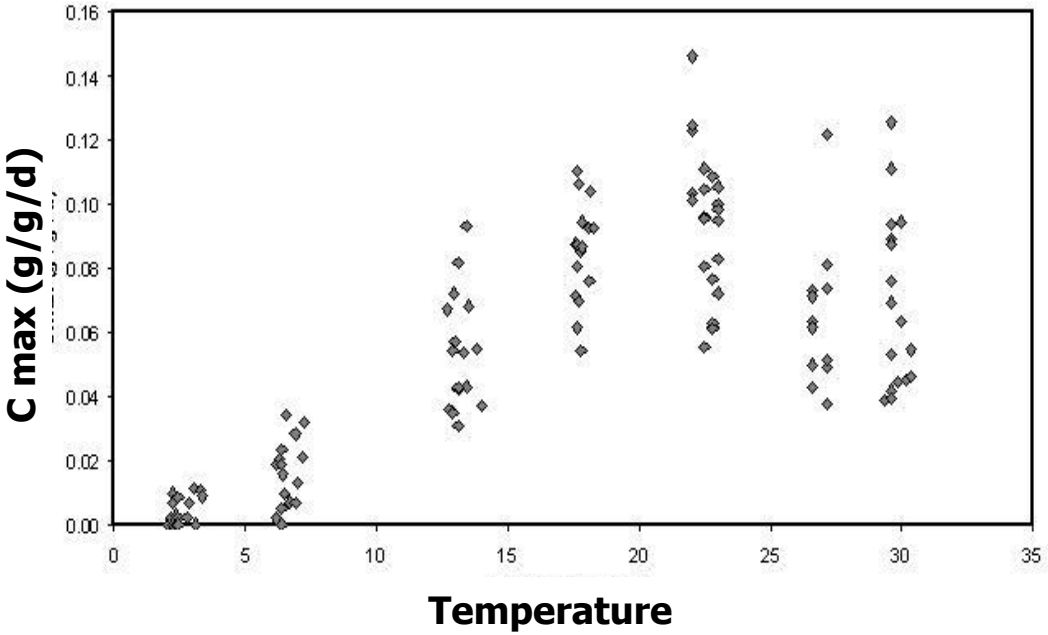

Figure 12.2. Variability in Cmax estimates among individual striped bass is greatest near the optimum temperature for consumption – 23 C. In assessing sample size requirements for energetics studies, pilot studies near the expected optimum temperature for consumption can be run to provide a measure of variability for calculation of sample size requirements.

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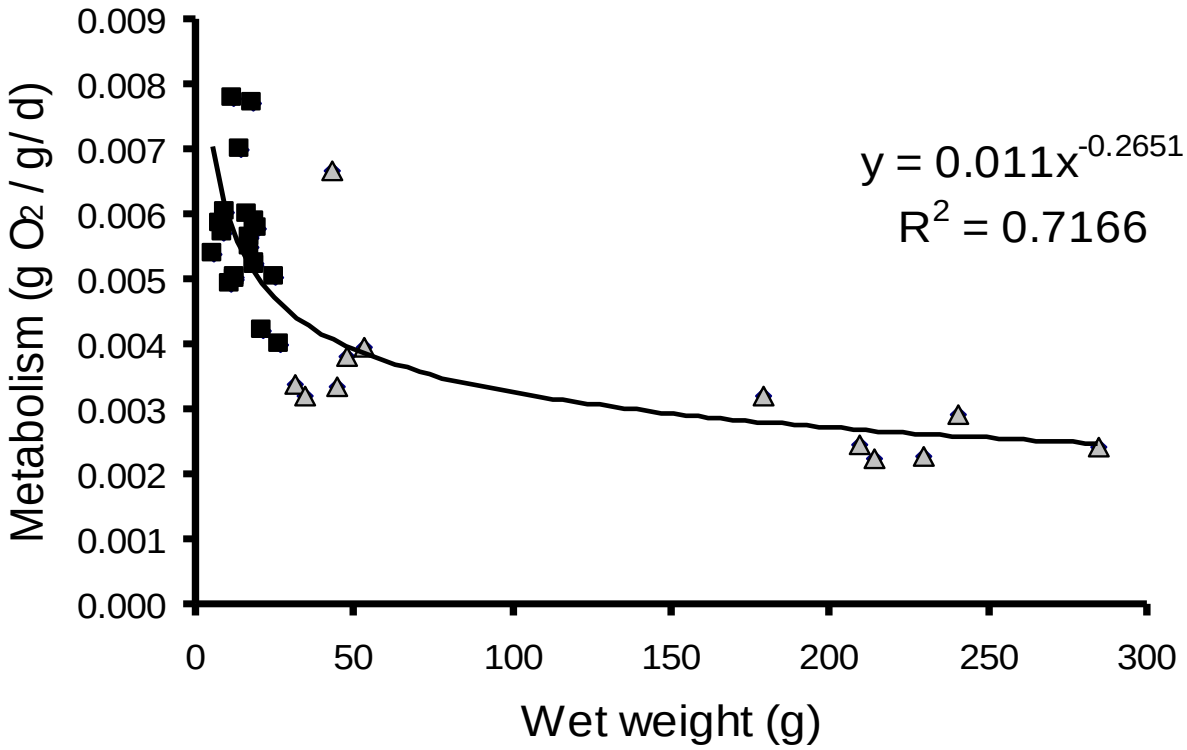

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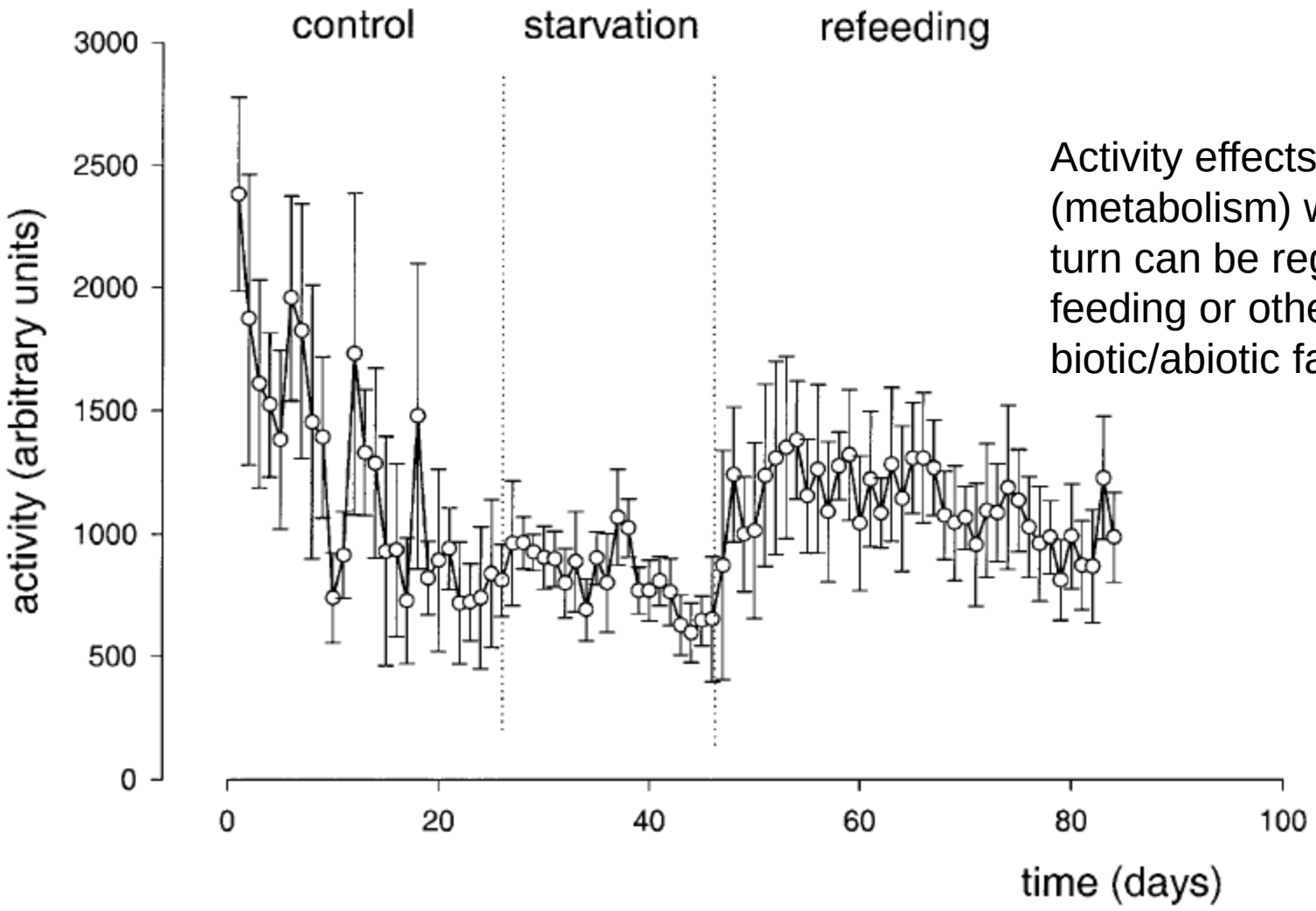

Activity effects cost terms (metabolism) which in turn can be regulated by feeding or other biotic/abiotic factors.