TESTING A MODEL OF ZOOPLANKTON SECONDARY PRODUCTION IN CULTURES OF *Daphnia magna*

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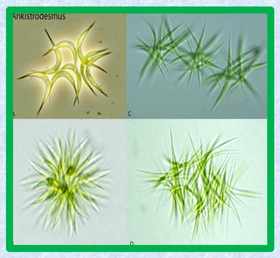
Daphnia magna

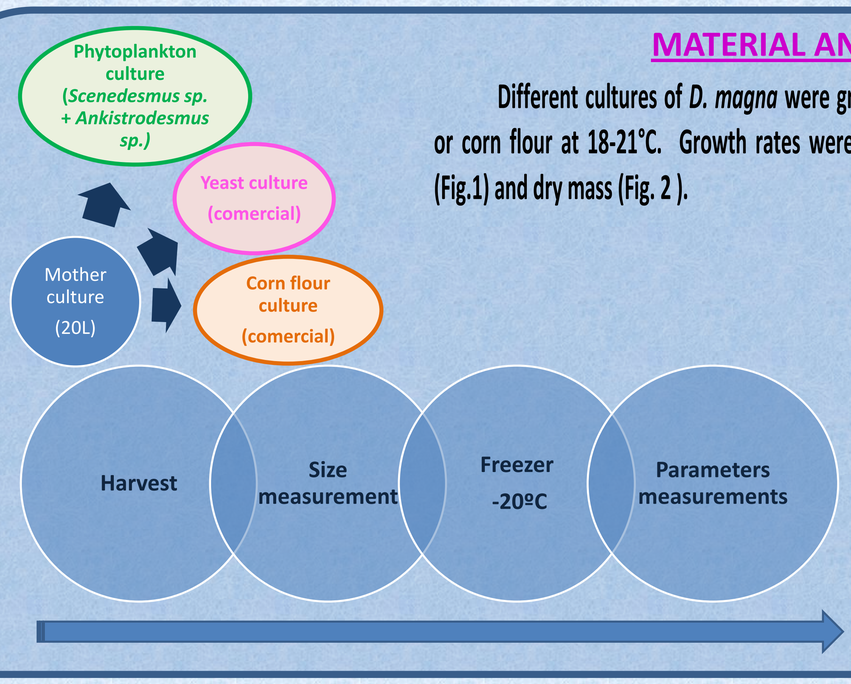
INTRODUCTION

Secondary production is the product of biomass and growth rate. The key to its estimation is a good measurement of growth rate. Principal factors controlling this rate in zooplankton are the amount, and the quality of food (Vijverberg, 1989). Here, we measure the daily and overall growth rate in the Cladoceran, *Daphnia magna,* raised under different food regimes. We then used the measurements as a reference standard to model zooplankton secondary production in natural populations.



Ankistrodesmus sp. mixture

MATERIAL AND METHODS



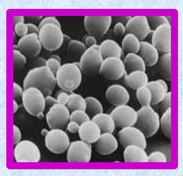
Different cultures of *D. magna* were grown on phytoplankton, baker's yeast, or corn flour at 18-21°C. Growth rates were calculated from time courses of size (Fig.1) and dry mass (Fig. 2).

RESULTS

Table 1. Characteristics of the different *D. magna* cultures

Kind of food	Maximum size L_{max}(mm)	Age of L_{max} (days)	Maximum weight W_{max}(µg)	Age of W_{max} (días)	Gorwth rate (d^{-1})	Condition factor (CF)	Temperature (ºC)
Phytoplankton mixture	1.42 ± 0.19	18	153	13	0.203±0.03 (r^2=0.77)	5.78	20.9 ± 1.1
Yeast	2.01 ± 0.14	17	110	12	0.317±0.03 (r^2=0.94)	1.19	20.1 ± 0.5
Corn Flour	1.38 ± 0.07	19	150	19	0.136±0.01 (r^2=0.72)	4.51	19.2 ± 1.2

Yeast



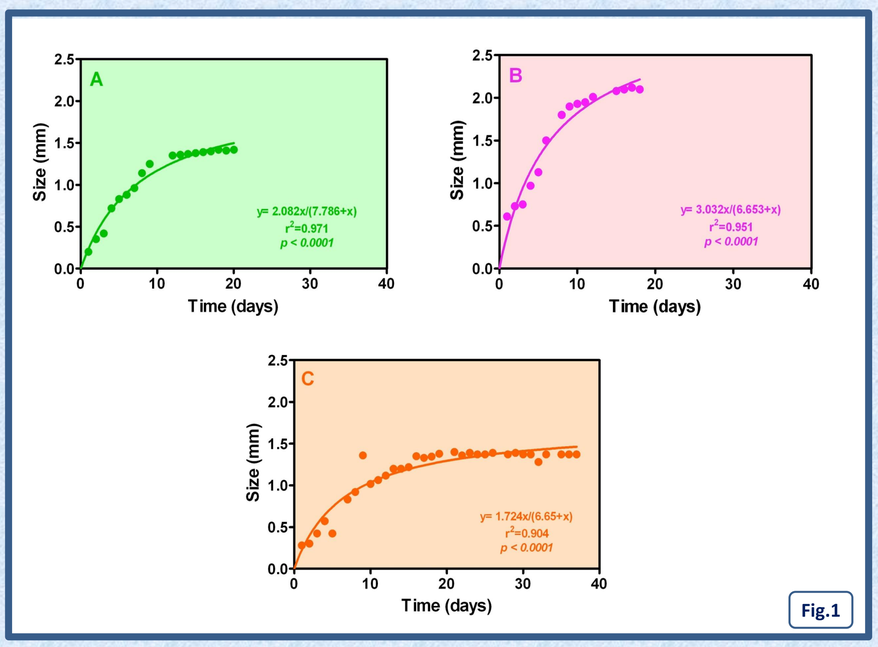


Fig.1

Fig.1 .- *D. magna* growth illustrated by the size time-course. A: Fed on phytoplankton mixture; B: Fed on yeast; C: Fed on corn flour.

Table 2. Regression analysis for size and dry-mass.

W=dry-mass, in µg; L=size, in mm (*) *p<0.0001*

Kind of food	Equation	r^2
Phytoplankton mixture	Ln W = 1.39 Ln L + 4.51	0.92 (*)
Yeast	Ln W = 2.68 Ln L + 2.67	0.98 (*)
Corn flour	Ln W = 1.02 Ln L + 4.46	0.93 (*)

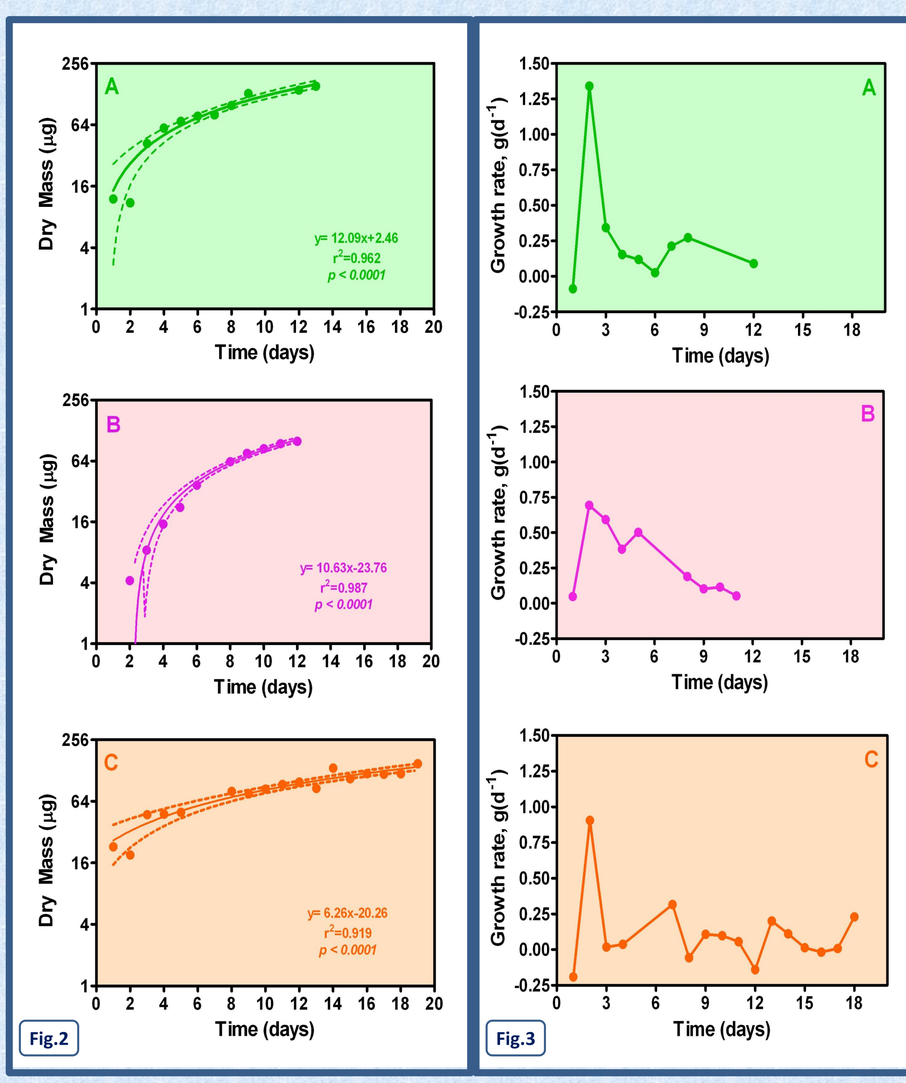
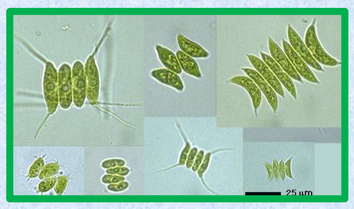


Fig.2 Fig.3

Fig. 2 and Fig. 3 .- *D. magna* growth illustrated by the dry-mass time-course and daily growth rate, respectively. A: Fed on phytoplankton mixture; B: Fed on yeast; C: Fed on corn flour. Dashed lines represent the 95% confidence intervals.



Mixture of Scenedesmus sp.

CONCLUSIONS

- Although the highest global growth rates were obtained with yeast (0.317d^{-1}), the highest values of the condition factor (5.778) and secondary production (508 µg dry mass·d^{-1}) as well as the maximum weight were found in daphnia fed on phytoplankton. This mixture seems to be the optimal food for culturing *Daphnia*.
- The Huntley and López (1992) model overestimates the secondary production by 174%.
- On a utilitarian basis, because size is such a good index of biomass, it provides a simple and more reliable measure of growth-rate than dry-mass.

Secondary production values (period of 12 days)

Phytoplankton culture (µg dry mass·d^{-1})	Yeast culture (µg dry mass·d^{-1})	Corn flour culture (µg dry mass·d^{-1})
508.88	307.46	328.26

Using the expression P = B 0.0455 $e^{0.111T}$ (Huntley and López, 1992)

Phytoplankton culture (µg dry mass·d^{-1})	Yeast culture (µg dry mass·d^{-1})	Corn flour culture (µg dry mass·d^{-1})
1379.32	776.75	943.16

(B = biomass, T = temperature)

In comparison, our measurements are approximately 60% lower than the Huntley-López model predict. Its seems that their equation may overestimate the secondary production in our culture system.

Corn flour

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