Physiological and metabolic effects of nutrient enrichment on adult *Artemia franciscana*

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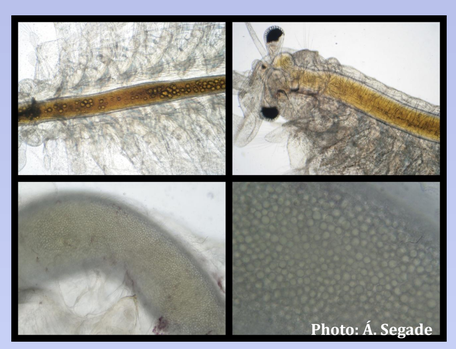
INTRODUCTION

Brine shrimp nauplii (*Artemia sp.*) are used in aquaculture as the major food source for many cultured marine larvae, and also used in the adult phase for many fish. One artemia species, *Artemia franciscana* is preferred, due to the availability of its cysts and to its ease in hatching and biomass production. The problem with *A. franciscana* is that its nutritional quality is relatively poor in essential fatty acids, so that it is common practice to enrich it with emulsions like SELCO and ORIGO ("bioencapsulation"). The bioencapsulation is done just prior to feeding the artemia to a predator organism. This allows the delivery of different substances, not only for nutrient enrichment, but also for changing pigmentation and administering medicine. This is especially useful in culturing ornamental seahorses and tropical fish in marine aquaria. In this study the objectives were to determine the relative nutrient value of ORIGO and SELCO as well as the optimal exposure to these supplements prior to their use as food-organisms.

MATERIAL AND METHODS

ENRICHMENT

- **ORIGO emulsion: mixture of natural algae, protein, phospholipids and HUFAs enriched marine oil**
- **SELCO emulsion: mixture of lipids, vitamins and HUFAs**



Starved organisms (EXP)

Stock culture (ORIGO emulsion) → 24h of starvation → Incubation in SELCO emulsion (6h)

Well-fed organisms (MAX)

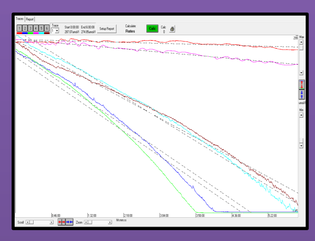
Stock culture (ORIGO emulsion) → Incubation in ORIGO emulsion (6h)

Stock culture (ORIGO emulsion) → Incubation in SELCO emulsion (6h)

PART I:

Organisms monitored for respiration during 6h.

After incubation, final measurements of respiration (R), potential respiration (Φ) and biomass (M) were taked



PART II:

Organisms taken, each half-hour during 6h, for potential respiration and biomass timeline measurements

RESULTS

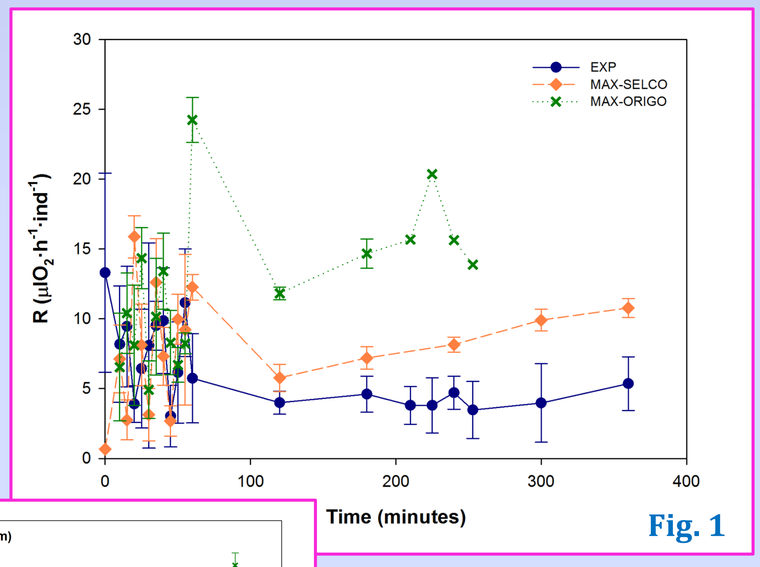


Fig. 1

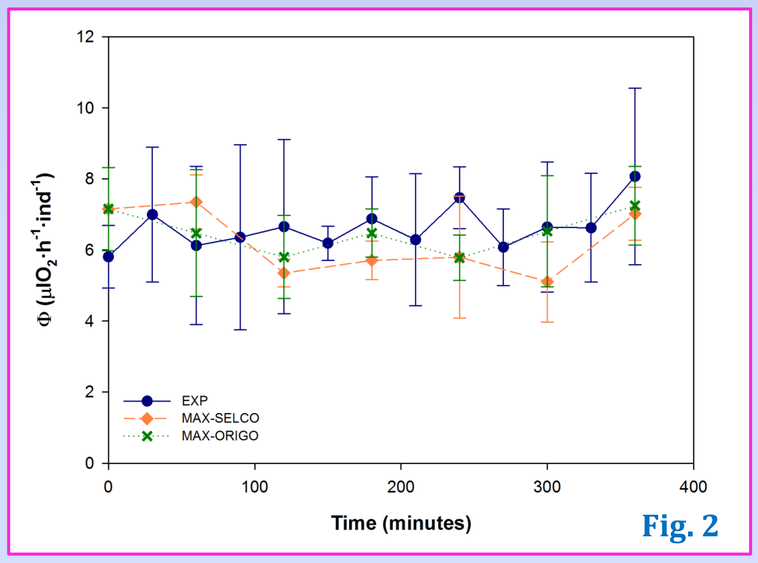


Fig. 2

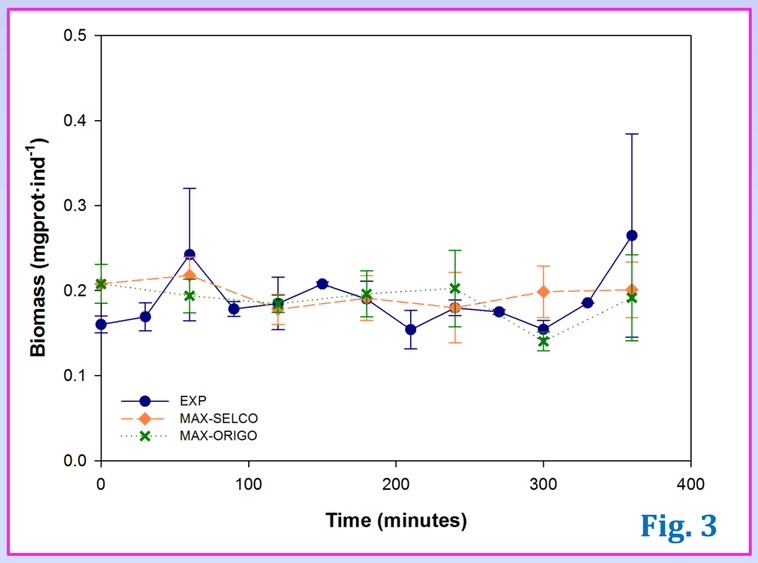
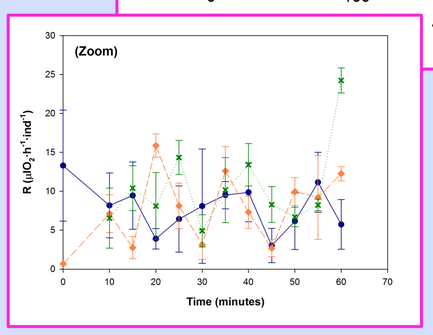


Fig. 3

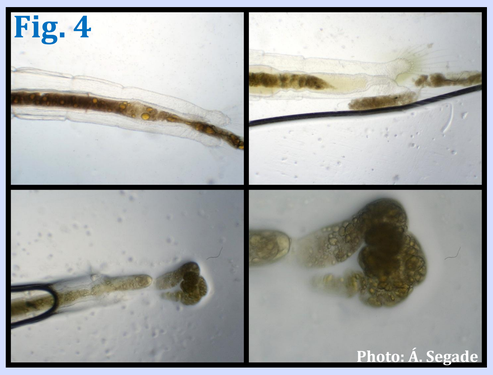


The results show that ORIGO stimulates respiration more than SELCO (Fig. 1, $p < 0.05$), which could be due to the differences in their biochemical composition. ORIGO emulsion has a protein base that not occur in SELCO, an emulsion composed mainly of fatty acids. The organisms may not assimilate these fatty acids (SELCO) or SELCO may not cause a physiological response, as no differences were found between fed and starved adult organisms (Fig.1 , $p > 0.05$). Furthermore, both Φ (Fig. 2) and M (Fig. 3), displayed no differences ($p > 0.05$) between well-fed conditions and 24 hours of starvation, nor between enrichings in fed-adults. This suggests that SELCO is not assimilated. In addition, we observed the direct excretion of SELCO (Fig. 4).

References	T(ºC)	Sample	Respiration ($\mu lO_2 \cdot mgDM^{-1} \cdot h^{-1}$)	Potential respiration ($\mu lO_2 \cdot mgDM^{-1} \cdot h^{-1}$)	Type of food
EXP	22	*Artemia franciscana*	11.78±2.39 (8.62-16.03)	22.19±3.50 (17.81-28.41)	SELCO emulsion
MAX-ORIGO	22	"	26.27±4.14 (23.34-29.19)	23.49±2.42 (21.78-25.20)	ORI-GREEN emulsion
MAX-SELCO	22	"	15.04±1.44 (14.03-16.06)	24.00±1.98 (22.60-25.40)	SELCO emulsion
Martinez et al. (2010)	22	*Artemia salina*	12.74 ±9.10 (3.87-45.87)	10.02 ±9.00 (1.32-35.90)	*Dunaliella salina*
Varó et al. (1993)	25	*Artemia sp.*	7.05±6.81 (2.24–11.87)	--	Yolk sac
Varó et al. (2000)	24	*Artemia parthenogenetica*	3.87±3.16 (1.63–6.09)	--	Dunaliella sp.
Irwin et al. (2007)	25	*Artemia franciscana*	10.41±4.28 (7.39–13.44)	--	Yolk sac

Table 2. Dry-mass specific respiration and potential respiration ranges as found in the literature. Means, standard deviations and ranges corrected to 25 °C are given. T is the incubation temperature.

Fig. 4



	R/Φ
MAX-ORIGO	1.13 ± 0.29
MAX-SELCO	0.62 ± 0.01
EXP	0.54 ± 0.15

Table 1. Variability of the R/Φ ratio. This ratio reflects the scope of metabolic activity in zooplankton. A value of 0.5 is expected when Φ is measured at K_m where cells respire at ~50% of their capacity (Packard, 1985). We foul this with SELCO. The increase in this ratio on ORIGO argues the great influence of high quality food. Hernández-León and Gómez made a similar observation in 1996.

References and Acknowledgements :

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