THE EFFECTS OF TANK COLOURS ON GROWTH AND SURVIVAL OF CUTTLEFISH (*Sepia officinalis*) HATCHLINGS AND JUVENILES

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Research Questions:

- How does tank colours influences cuttlefish hatchlings and juveniles growth and survival?
- Which is the better colour: black, yellow-sandy or white?

Conclusions:

- In white and sand colours, the 300 lux light intensity might have promoted blindness or interfere with prey contrast and prey capture;
- Black tanks should be used to diminish the problem with slow and fast growers;
- Further knowledge regarding the effects of light intensities is required.

Material and Methods

Adult *Artemia* sp. + *Mesopodopsis slaberi*

Fed

3x 20 hatchlings 1DAH = 180 cuttlefish

3x 35 hatchlings 30 DAH = 210 cuttlefish

Fed

Palaemonetes varians

Experiment I - Hatchlings

Black Yellow-sandy White

Experiment II - Juveniles

White Black

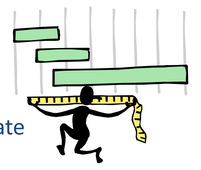
Table 1 – Experimental Conditions for both trials.

Tank colour	Black	Sand	White
Experiment I			
Temperature (all)	19.3±0.5ºC		
Salinity (all)	36.7±0.9gL^{-1}		
Dissolved Oxygen (all)	7.4±0.1 mg/L (98.2±1.3%)		
Incident Light Intensity (all)	320.00±30.00 lux		
Reflective Light Intensity	10.63±1.27 lux [a]	124.03±11.89 lux [b]	130.77±4.18 lux [b]
Experiment II			
Temperature (all)	20.5±1.0ºC		
Salinity (all)	38.2±1.0gL^{-1}		
Dissolved Oxygen (all)	7.0±0.4 mg/L (95.0±5.2%)		
Incident Light Intensity (all)	320.00±30.00 lux		
Reflective Light Intensity	3.80±0.62 lux [a]	-	46.53±9.00 lux [b]

Superscript letters represent grouping of differences within the same row for P<0.001.

50 days

Sampling every 10 days:



Growth:

- Mean Wet Weight
- Instantaneous Growth Rate
- Biomass
- Mean Biomass Increase
- Feeding Rate
- Food Conversion

Mortality:

- Total Absolute
- Mean Cumulative

Results

Table 2 - Mean wet weight (MWW), Mean Absolute IGR (MAIGR), Mean Cumulative Mortality (MCM), Total Absolute Mortality (TAM), Biomass (B), and Mean Biomass Increase (MB%) values for cuttlefish hatchlings and juveniles at the end of both experiments.

Tank colour	Black	Sand	White
Experiment I			
MWW (g)	0.532 ± 0.129[a]	0.436 ± 0.140[b]	0.474 ± 0.147[ab]
MAIGR (%BWW/d)	4.62 ± 0.161	4.16 ± 0.684	4.34 ± 0.572
MCM (%)	21.7 ± 5.8	30.0 ± 13.2	36.7 ± 7.6
TAM (cuttlefish)	13	18	23
B (g)	25.04	18.40	17.63
B% (%BWW/d)	9.74 ± 0.93	6.78 ± 2.57	6.22 ± 1.74
Experiment II			
MWW (g)	3.03 ± 1.10[a]	-	2.35 ± 0.82[b]
MAIGR (%BWW/d)	3.66 ± 0.08	-	3.13 ± 0.21
TAM (cuttlefish)	0	-	2
B (g)	318.3	-	242.2
B% (%BWW/d)	10.48 ± 0.52	-	7.43 ± 1.26

Superscript letters represent differences within the same row for P<0.05.

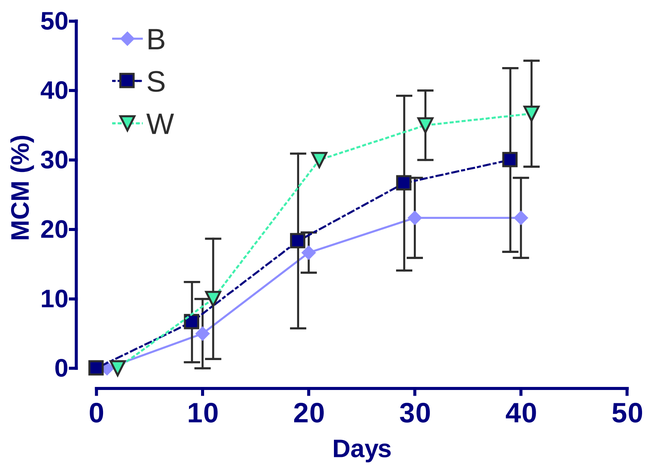


Fig. 1 – Variation of Mean Cumulative Mortality (MCM, %) of hatchlings of different coloured groups (B- black; S- sand and W- white) for experiment I. Data is presented in offset. Vertical lines represent standard deviation.

Table 3 - Statistical analysis of the effect of tank colour on different growth parameters of *Sepia officinalis* in experiments 1 and 2

EXP.	VARIABLE	TEST	SOURCE	SS	df	Statistic	p	Post-Hoc	Homogeneous groups
EXP. 1	$WW_{Day\ 40}$	Nested Anova	Colour	0.206	2.00	5.07	0.145	-	-
			Tank(Col.)	0.230	6.00	1.89	0.088	-	-
	B	RM Anova	Colour	7.990	2.00	2.73	0.144	-	-
			Time	**168.0**	**1.06**[a]	**133.60**	**<0.001**	Tukey	D1, D10, D20 < D30 < D40
			Interact.	7.500	2.12[a]	2.99	0.121	-	-
	MAIGR	Welch test	Colour	n.s.[b]	2.00	3.52	0.173	-	-
		RM Anova	Colour	0.029	2.00	2.72	0.144	-	-
			Time	**0.770**	**1.42**[a]	**48.11**	**<0.001**	Tukey	D10 < D20 < D30, D40
			Interact.	0.180	2.85[a]	0.56	0.650	-	-
	$Arcsin\sqrt{MCM}$	Anova	Colour	0.042	2.00	1.81	0.242	-	-
EXP. 2	$Log\ (WW_{Day\ 50})$	Nested Anova	Colour	**0.592**	**1**	**30.54**	**0.005**	Unequal-N HSD	White < Black
			Tank(Col.)	0.077	4	0.76	0.552		
	B	RM Anova	Colour	**849**	**1**	**41.60**	**0.003**	Tukey	White < Black
			Time	**24827**	**5**	**482.00**	**<0.001**	Tukey	D1 < D10 < D20 < D30 < D40 < D50
			Interact.	**720**	**5**	**14.00**	**<0.001**		
	MAIGR	RM Anova	Colour	**2.18**	**1**	**17.96**	**0.013**	Tukey	White < Black
			Time	**41.76**	**2.23**[a]	**60.09**	**<0.001**	Tukey	D20 > D10 > D30, D 40, D50
			Interact.	0.369	2.23[a]	5.53	0.624	-	-
	B%	RM Anova	Colour	**5.078**	**1**	**14.85**	**0.018**	Tukey	White < Black
			Time	**58.68**	**2.70**[a]	**58.18**	**<0.001**	Tukey	D10, D20 > D30, D50 ≥ D40, D50
			Interact.	1.134	2.70[a]	1.12	0.377	-	-
	$Arcsin\sqrt{MCM}$	t-test	Colour	–	4	-1.00	0.374	-	-

[a]d.f. was calculated after applying the Greenhouse-Geisser correction for sphericity
[b]n.s.: not supplied by the SPSS software.
RM Anova denotes "Repeated Measures Anova"; Tank(Col.) denotes the variable "Tank" nested into the variable "Colour".
Black bold p-values are significant after a stepwise Bonferroni or step-up FDR correction; grey bold p-values are significant after a step-up FDR correction.

- **In Exp. I, black tanks displayed better values of B and TAM;**
- **In Exp. II, black tanks were better than white.**

- **Mortality was only registered in Exp. I;**
- **No statistical differences found due to high standard deviation.**

- **While for Exp. I (hatchling stage) differences were only found for the effect of time on growth (MWW), in Exp. II, growth differences were found (p<0.05) between colours.**
- **The lack of differences found in Exp. I were due to the higher standard deviation of white and sand tanks.**

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