Effect of mussel size on the toxicity of Fluoranthene

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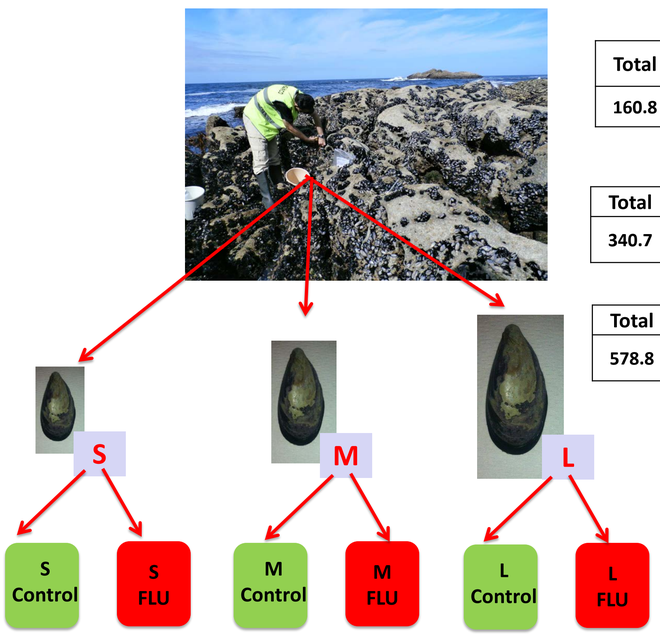
1. Introduction

There are several endogenous and exogenous variables that act as **confounding factors** making the environmental assessment harder. Among these endogenous factors, **body size** has been considered as a variable which influences pollutant bioaccumulation and biomarker responses. The size of animals with unlimited growth as mussels, is closely related with their **age**, therefore the size-dependence of these biological processes could also be related to age.

OBJECTIVE

Evaluate the effect of mussel size on the toxicity of the polycyclic aromatic hydrocarbon (PAH) fluoranthene (FLU), measured by means of the physiological rates integrated in the energy balance equation used for the SFG (scope for growth) estimation.

2. Materials and Methods



S-Small (30 mm)

Total	Gill	Mantle	Gland	Rest
160.8	17.9	15.4	30.2	94.3

M-Medium (40 mm)

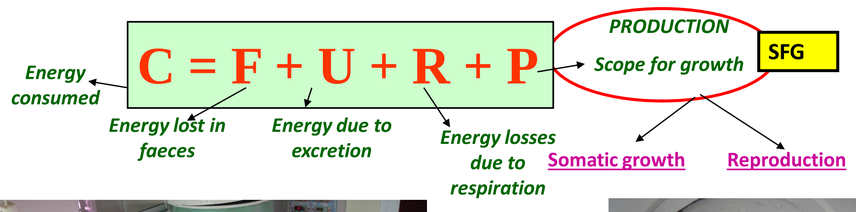
Total	Gill	Mantle	Gland	Rest
340.7	44.9	51.7	58.5	179.3

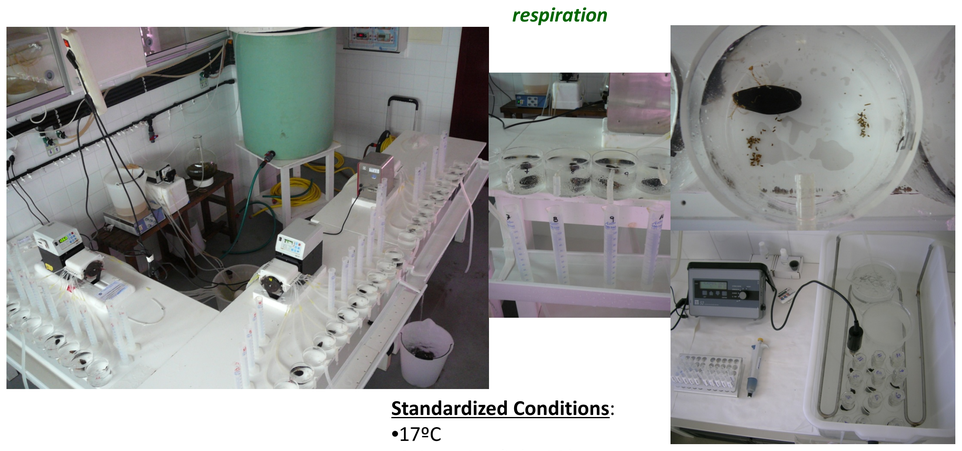
L-Large (50 mm)

Total	Gill	Mantle	Gland	Rest
578.8	89.3	103.3	97.4	277.4

Exposure Conditions:
•30 µg FLU/L daily
•3 weeks
•Daily food ration (t-ISO) 0.15 % mussel live weight
•17ºC

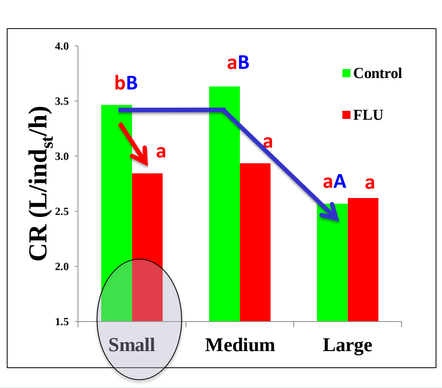
PHYSIOLOGICAL BIOMARKERS

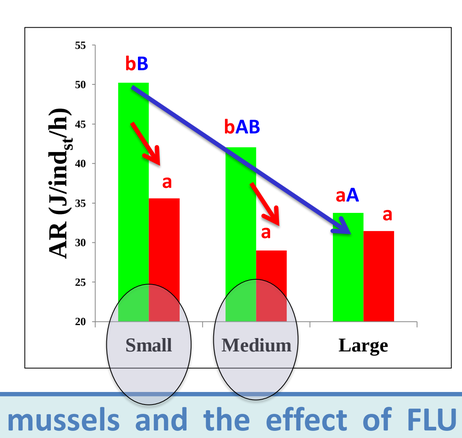




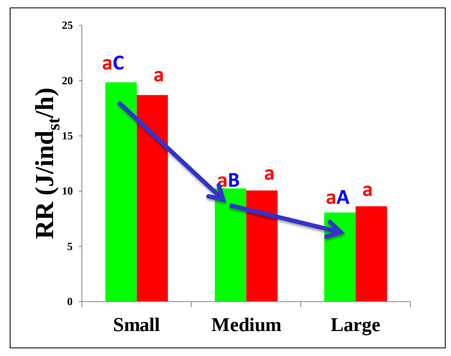
Standardized Conditions:
•17ºC
•0.6 mg OM/L (t-ISO)
•0.4 mg IM/L (ashed silt)

3. Results and Discussion

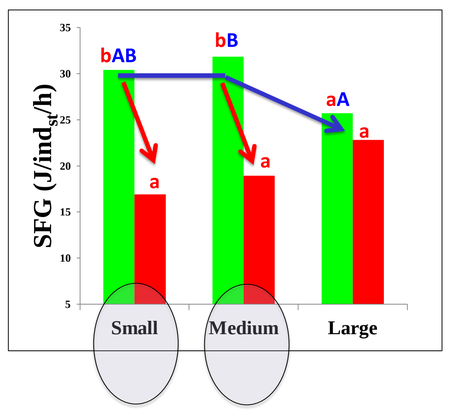




•Clearance rates (CR) were higher in S and M mussels and the effect of FLU was only evident in S mussels.
•Absorption rates (AR) were clearly affected by size (higher in smallest mussels) and by FLU: in S and M mussel, ARs were reduced by exposure whereas no difference was detected in L mussels.



•Respiration rates (RR) were only affected by size, with higher values in smallest mussels, whereas FLU exposure did not alter RRs.



•The integration of all these parameters in the SFG showed that S and M mussels were impacted by FLU exposure whereas L mussels were not.

Two-way ANOVA

	F_{size}	F_{FLU}	$F_{size*FLU}$
Clearance	5.52 (p<0.01)	8.02 (p<0.01)	1.55 (p>0.05)
Absorption	7.52 (p<0.01)	15.68 (p<0.01)	4.51 (p<0.01)
Respiration	271.67 (p<0.01)	1.34 (p>0.05)	0.64 (p>0.05)
Growth	0.20 (p>0.05)	15.41 (p<0.01)	4.55 (p<0.01)

•All the physiological rates were clearly influenced by size , showing decreases in clearance, absorption and respiration (standardized to a common size) as size increases.

•Respiration was the physiological parameter most affected by size.

•The integration of energy inputs and outputs into the SFG, removes the effect of size on physiological rates.

•FLU exposure reduces clearance and absorption rates.

•FLU exposure does not affect respiration rates.

•FLU exposure reduces mussel growth but only in S and M mussels.

4. Conclusions

- Physiological rates (*standardized to a common size*) were size-dependent with decreases at higher mussel sizes.
- Higher feeding/absorption rates in smaller mussels were compensated with higher respiration rates, thus estimated growth is independent of size.
- Smaller mussels (S & M) were more sensitive to FLU than large mussels.
- The effect of FLU exposure was the reduction of the energy available for growth
- Endogenous factors, such as body size, need to be considered in toxicological studies and biomonitoring programs.

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