

# What is required from the perspective of WP2

Focus:

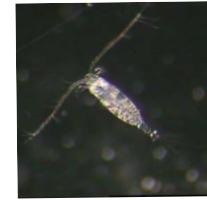
- pollution and Ecotoxicological effects,
- Acidification
- parameterising fishing effects,
- invasive species

## MEECE Environmental factors :

- $T \rightarrow$  global warming, physiological dependence
  - $CO_2 \rightarrow$  Ocean acidification, food quality effect
  - $Cu \rightarrow$  Pollution, heavy metal: leading to cell death and deformation
- 
- What is required is robust parameterizations for inclusion in WP2 modules or the development of modules.

## *Acartia tonsa*

- order Calanoida family Acartiidae
- prosome length<sub>max</sub>=1 mm
- within tropical regions up to 14 generations year<sup>-1</sup>
- high reproduction, overwintering in resting egg stage
- origin subtropical/tropical waters
- omnivorous
- restricted to near shore environments



O'Neill Function:

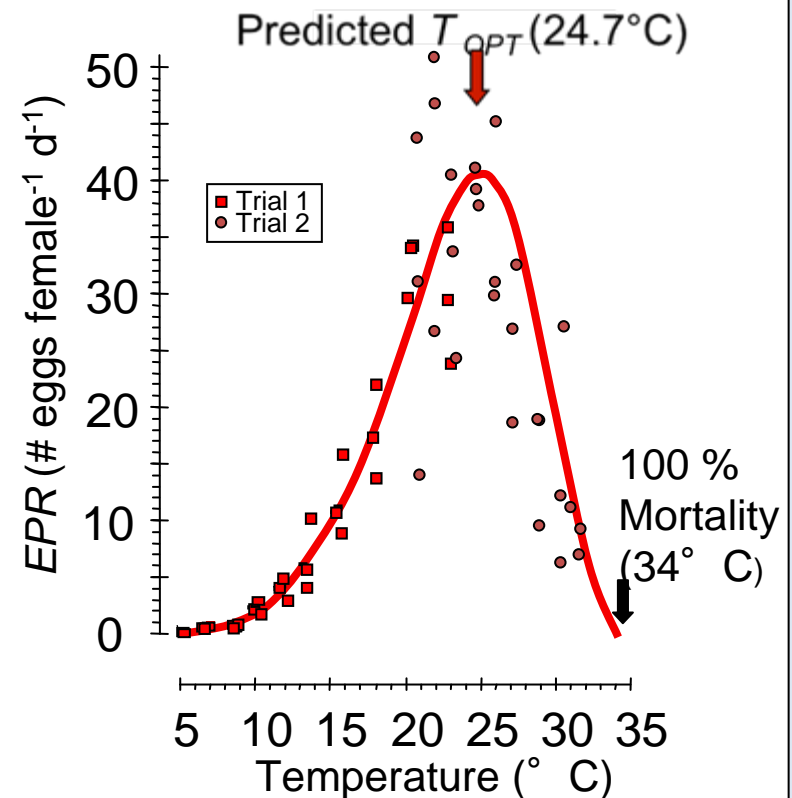
$$EP = EP_{MAX} \frac{(T_{MAX} - T / T_{MAX} - T_{OPT})^{x+1}}{T_{OPT} / T_{MAX} - T_{OPT}} e^{-[x*(T - T_{OPT})]}$$

where

$$x = [W * [1 + \sqrt{1 + 40/W}]^2] / 1000$$

and

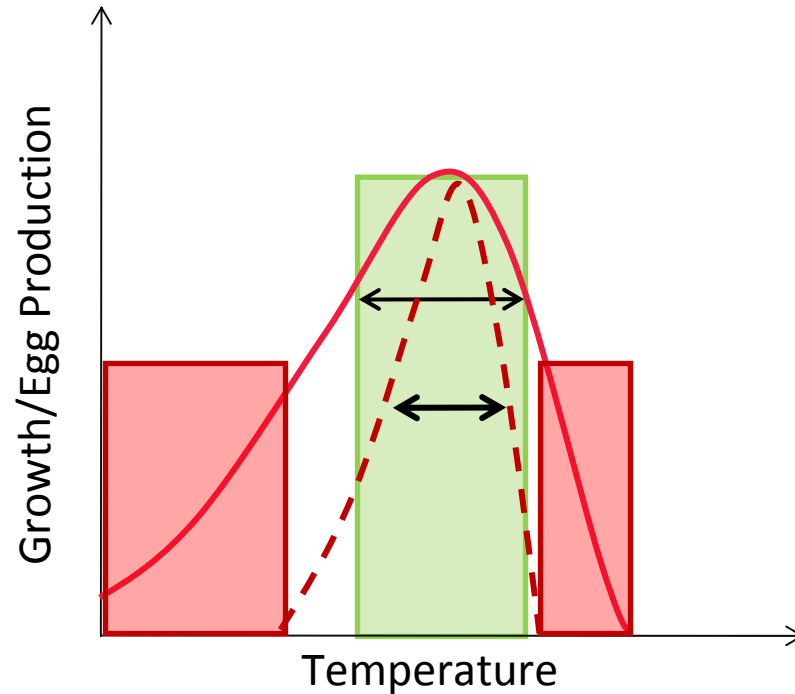
$$W = (Q_{10} * \alpha - 1) * (T_{MAX} - T_{OPT})$$



## Stressor Effects

Type 1: Within the optimal temperature range stress due to other environmental stressors may have a minimal influence on vital rates

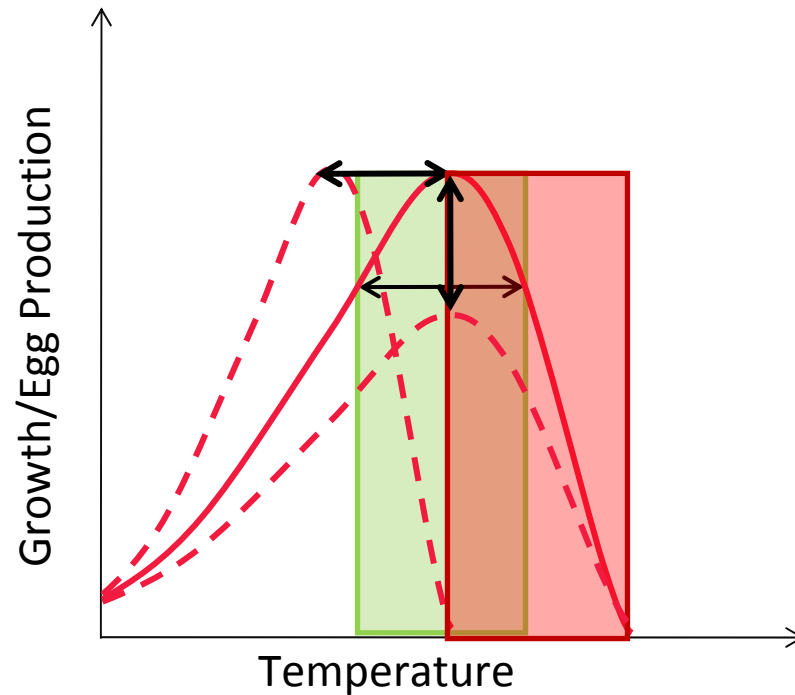
At suboptimal temperatures, stress may result in failure or reduction of reproduction. Due to stress, the range of optimal temperature for growth may be **reduced**.



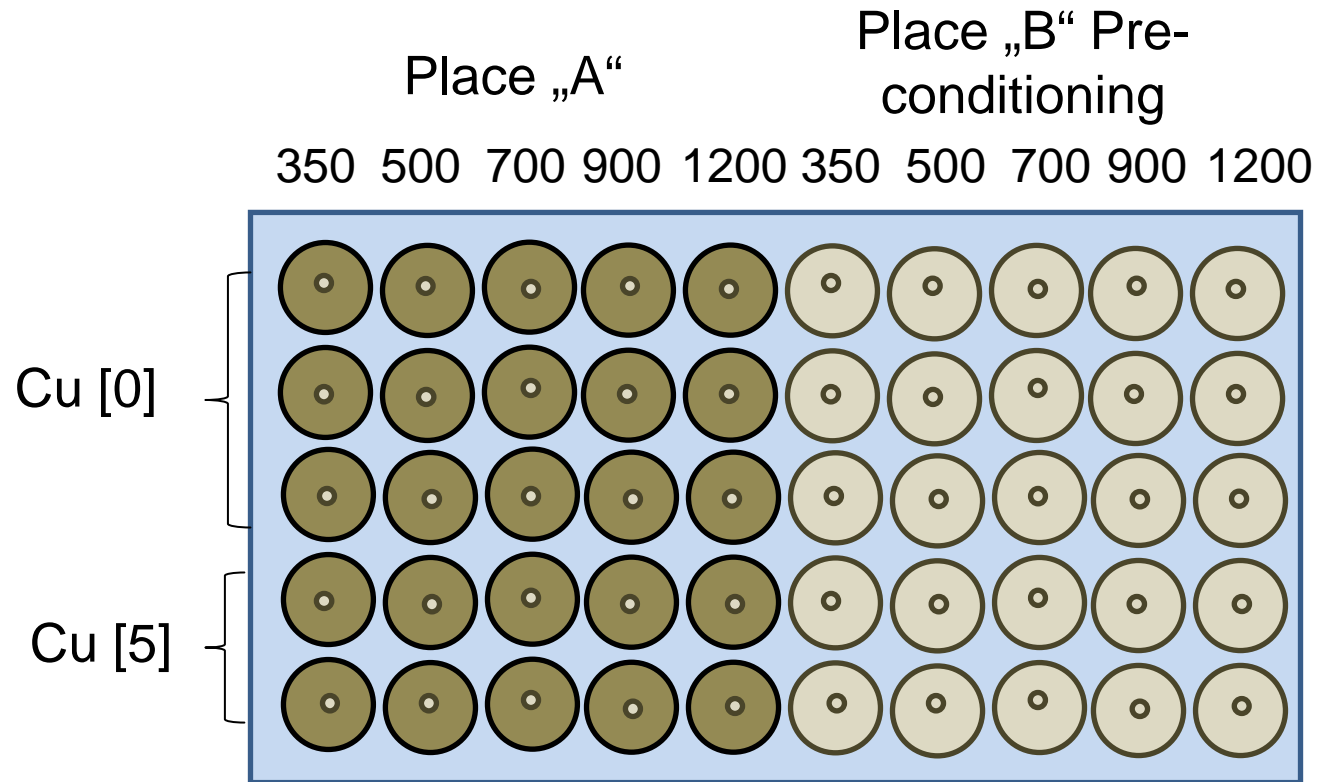
## Stressor Effects

Type 2) Environmental stress may **shift** temperature optimum, leading to a **netto lack** of reproduction

Type 3) Environmental stress may **reduce or stop** reproduction

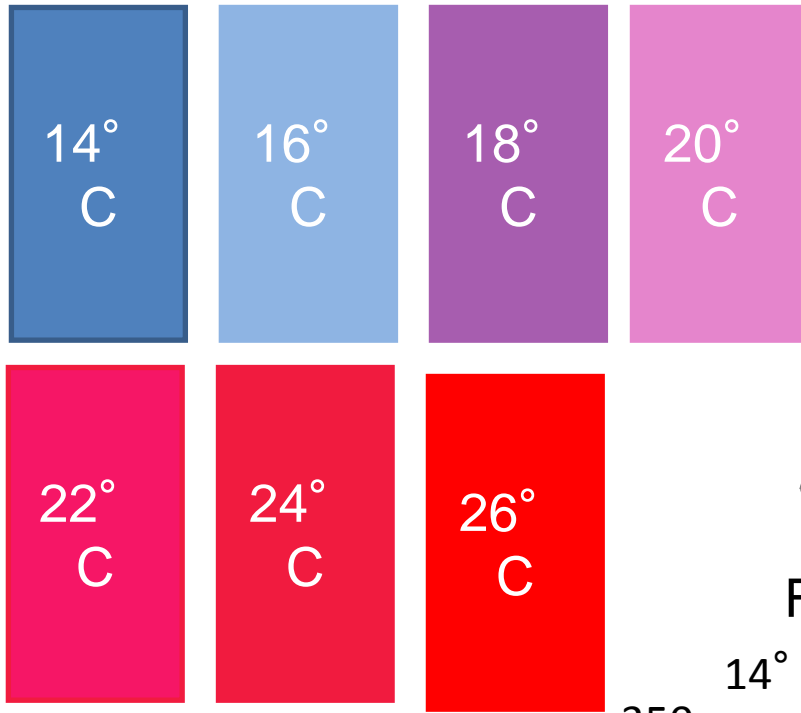


*Interactive Effects on Egg Production: CO<sub>2</sub>, Cu and T*

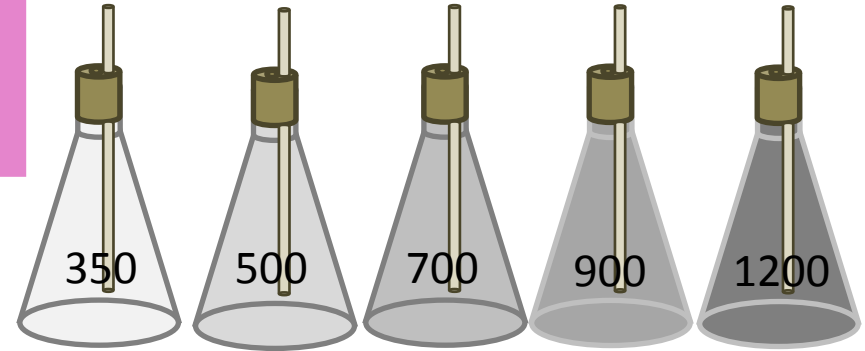


Every table of 7 at one single temperature

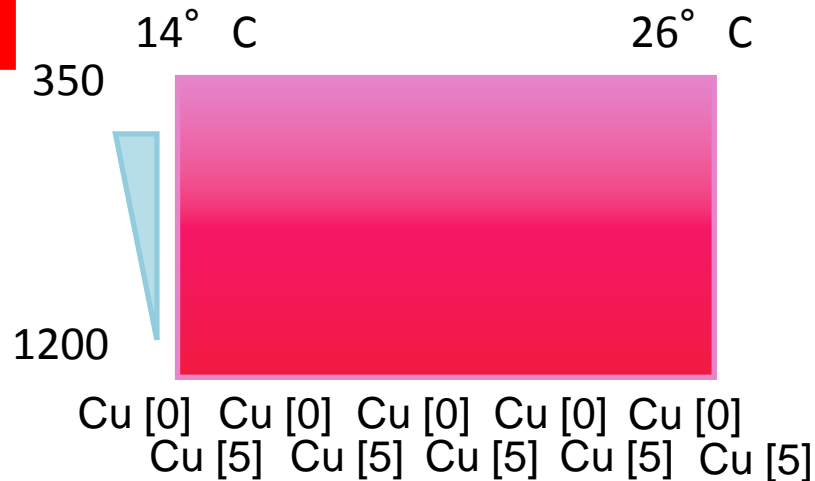
# Multi stressor experiment



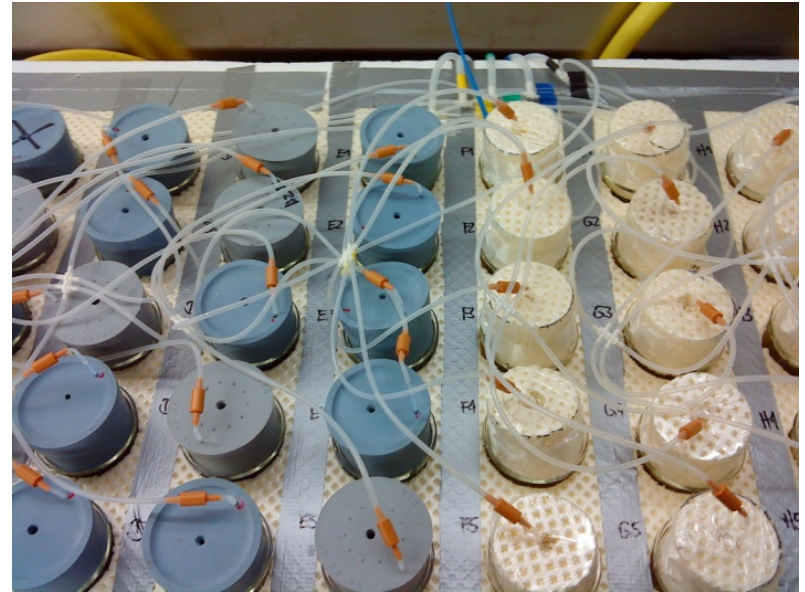
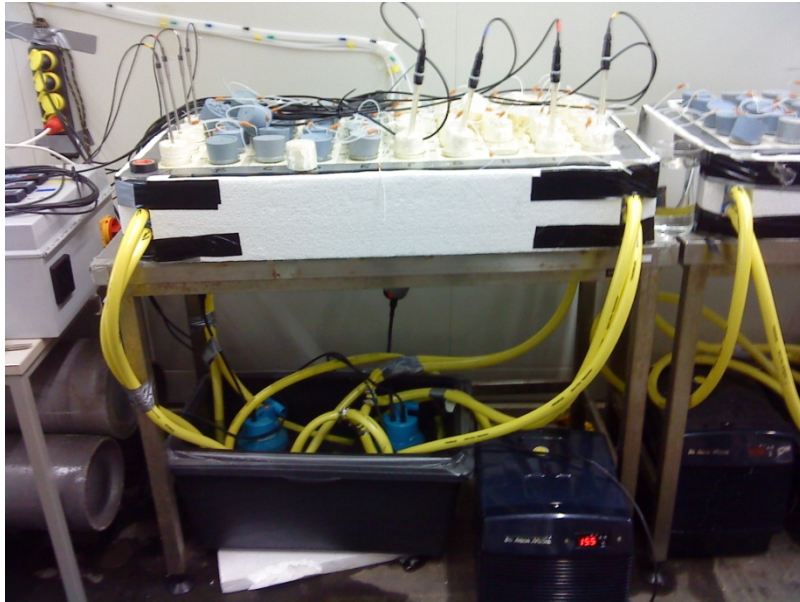
Algae incubation at different CO<sub>2</sub> levels:  
1. High density for feeding  
2. Low density for stoichiometry



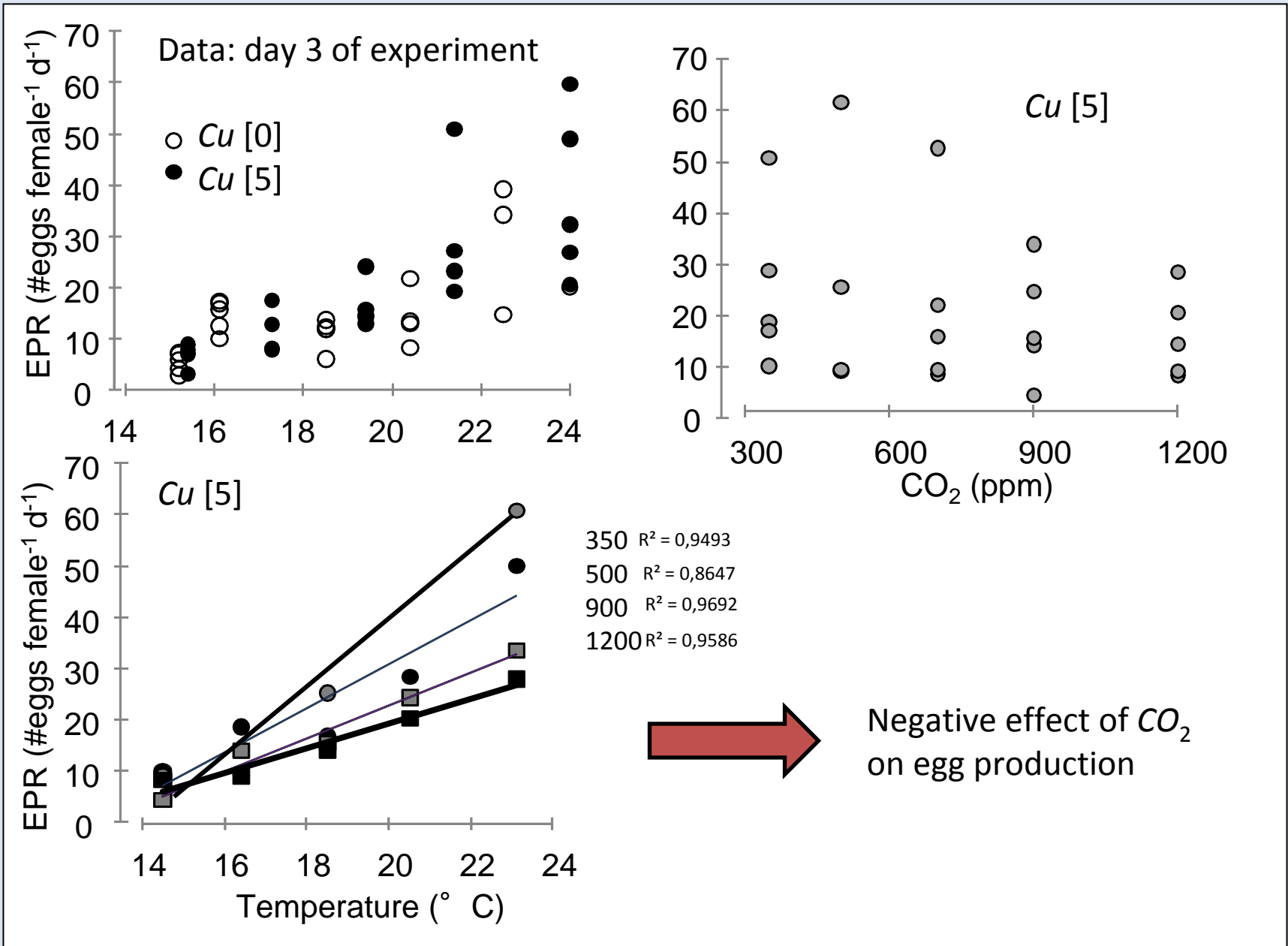
Food Quality Table



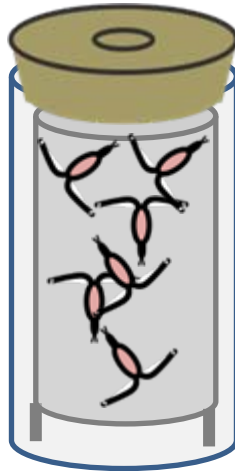
# Multi stressor experiment



# Multi stressor experiment Results

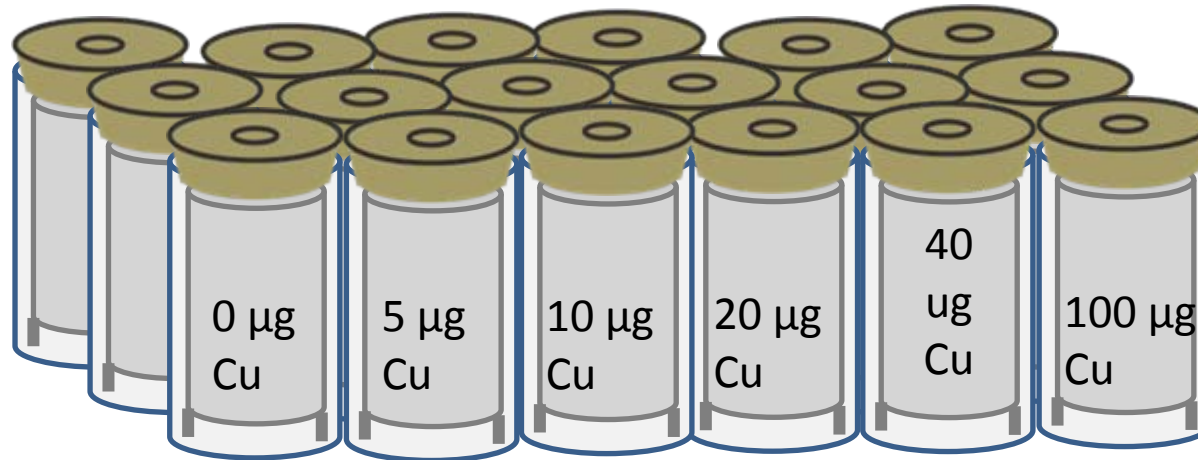


## Cu affecting Egg Production

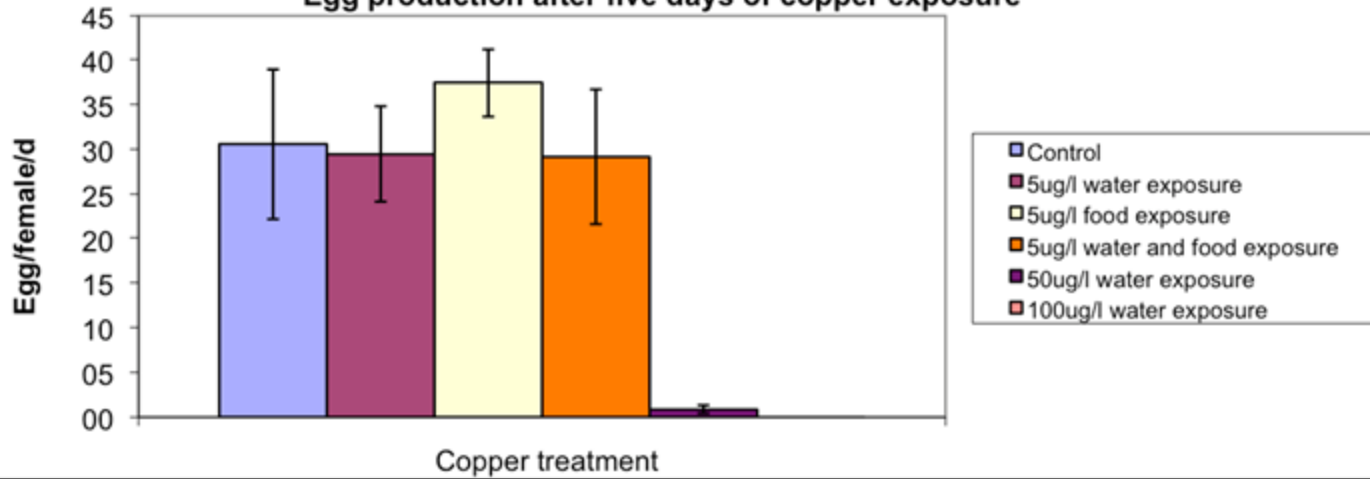


Simple experimental design:

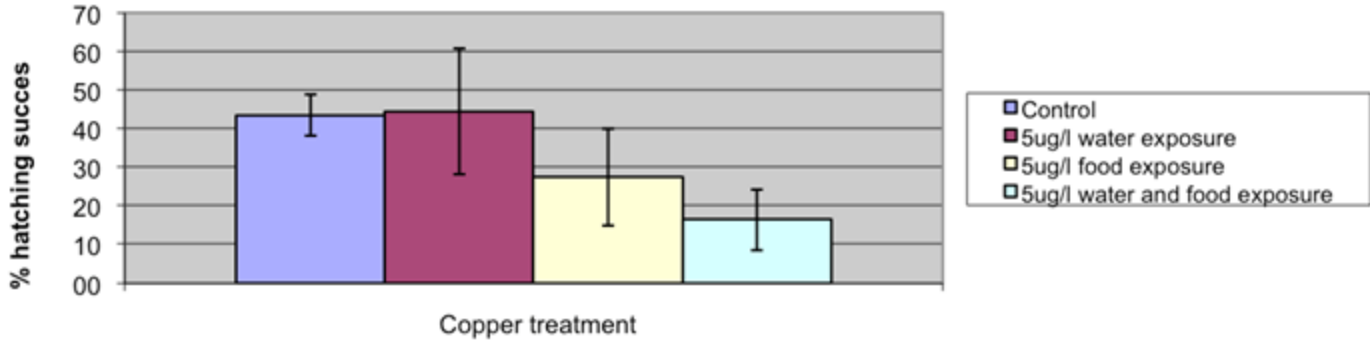
- 250 ml beakers
- Sieves with mesh bottom
- 5 females, one male
- plug
- incubated at 20 ° C
- 3 replicates at each Cu level



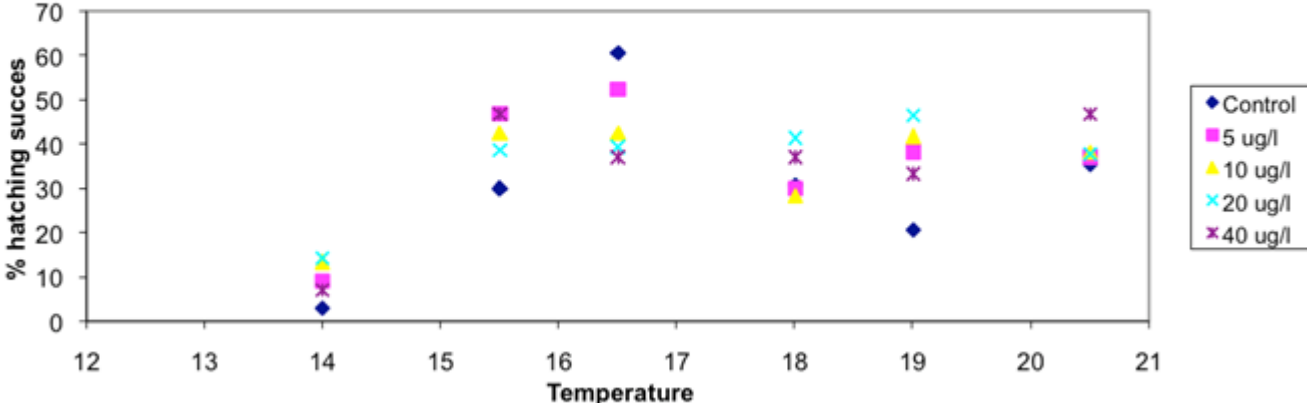
**Egg production after five days of copper exposure**



**48 hour hatching success of egg produced by females after five days of copper exposure**



### 48 hour hatching success of eggs produced by females with no copper exposure



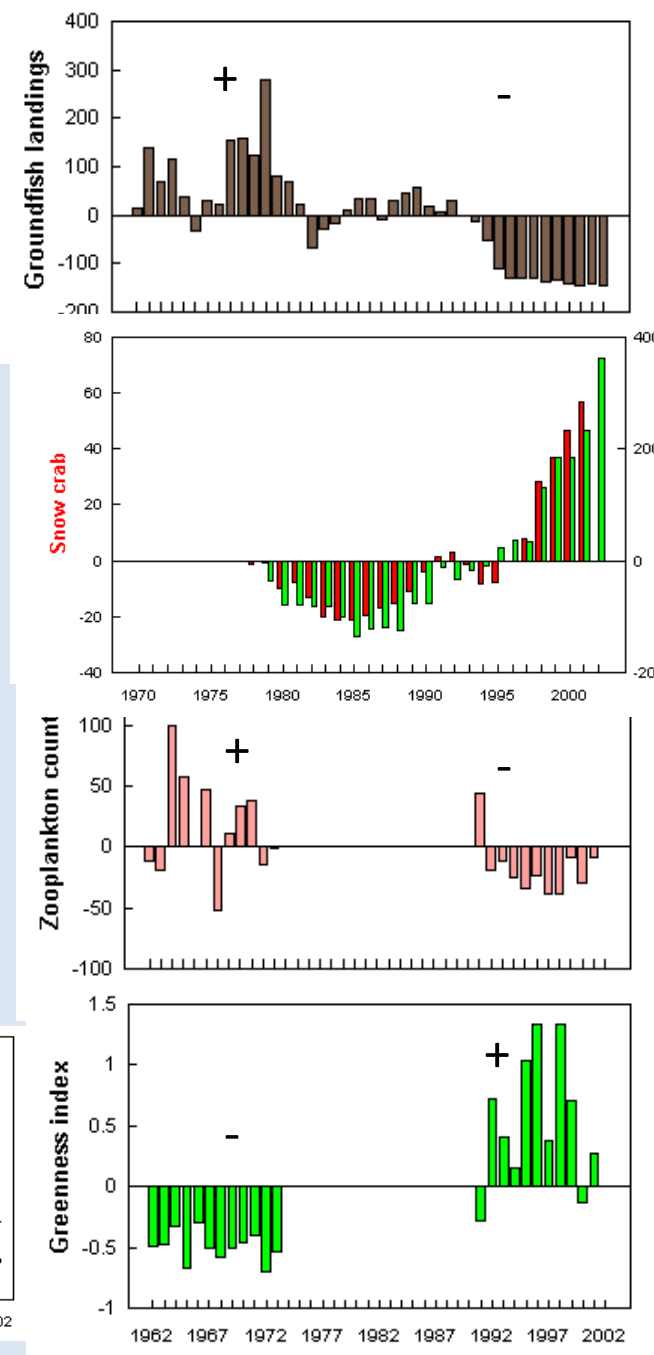
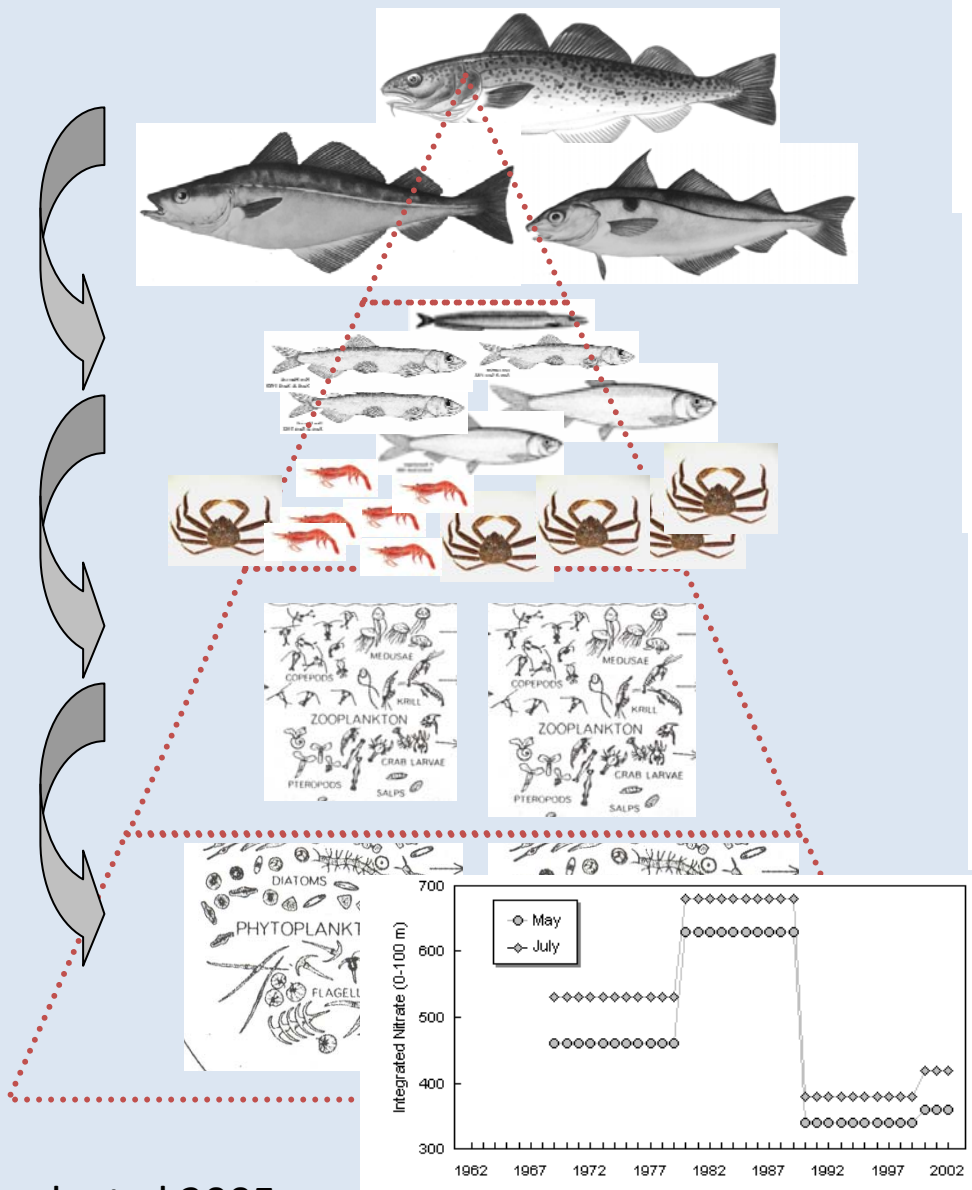
**Pollution impacts: (organisers UNIBO and UPiedmont) aiming to develop process descriptions of the impacts of pollution on organism health and population dynamics. We will focus on the impact of pollutants and endocrine disruptors based on existing data sets (e.g. TOXNET, DART, MBT and Aquire), data from the ICES database and former research projects as well as experimental results from T1.3.**  
**Deliverable at M24**

**Acidification: (organisers UiB, NERC-NOCS) will analyse data sets from T1.1 to develop parameterisations of ecosystem responses to acidification induced changes in stoichiometry, calcification, succession, primary production acidification experiments response experiments. A particular focus will be placed on the results of large scale mesocosm experiments.**  
**Deliverable at M24**

**T1.5 Fishing: (organiser HCMR) meta analysis of existing fish stock abundance and fisheries datasets to** parameterise the fishing impacts in ecosystem models, such as fishing mortality on target and non-target species, fishing impact on population dynamic traits, fishing impact zooplankton, fish and benthic invertebrate community. It is envisaged that these processes will feed directly into existing models as perturbations experiments.

**Deliverable at M24**

**Key: parameterizing the cascading effects of fishing on ecosystem and biogeochemical processes. Mortality, consumption rates.**



Frank et al 2005

## **Invasives:**

We cannot model the invasion of a specific species but we can model the susceptibility of a system to be invaded

In order to do so we need to be able to

- parameterize the qualities of a species that makes them a successful invader e.g. Fitness, resilience, growth rate, predator avoidance strategies .
- The characteristics of habitats which are invaded. Stressed vs non stressed

**T1.5 Alien invasive species: (organisers KU CORPI and SAHFOS) to statistically analyse the invasive alien species data bases to deliver key parameterisations and scenarios including invasive species relevant for the biogeochemical model framework and modelling the ecosystem response to spreading invasive alien species.**

