

# Combined effect of temperature and soil on prawn physiology: Preliminary results

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## Introduction

Delgado *et al.* (2003) have showed an effect of sediment on prawn physiology.

Lemonnier *et al.* (2003) showed that the evolution of sediment quality in semi-intensive pond was partly related to the initial soil characteristics.

The aim of this study was to investigate relationship between soil and prawn physiology. The experiment was conducted in St Vincent research facility (Figure 1).



Figure 1: Aerial view of LAC St Vincent

## Materials and methods

Three types of soil: Schist, Clay and mix Clay-silt were randomly distributed in 2 m<sup>2</sup> outdoor tanks (three replicants each). Control tanks were without any substrat (n=3).

Tanks were filled with water with a daily renewal of 30 %. Temperature probes were installed into 4 tanks.

After 2 weeks, each tank received 60 prawns (30/m<sup>2</sup>).

Prawns were fed with artificial food (1 % fresh weight per day).



Figure 2: Schematic representation of soil repartition

After 72 h, prawns in stages C and D2 were sampled and hemolymph was collected for physiological parameters analysis: Magnesium (Mg); total proteins; Glucose; Lactate; Osmoregulatory capacity (O.C.); Hemocyanin.

Water was sampled for pH, O<sub>2</sub>, temperature, chlorophyll-a and turbidity measures.

Soils were sampled for redox, water content, organic matter, ammonia and nitrite concentration analysis.

Results for the water analysis are showed in table 1.

Tab.1: Average of principle water variables of three samples at 24, 48 and 72 h respectively. Each sample was done at 3 tanks in triplicate.

| Day | Température (°C) | Oxygène (mg/l) | Turbidité (Nephelometric turbidity unit) | pH  |
|-----|------------------|----------------|--|-----|
| 24  | 24.0             | 1.20           | 15.0                                     | 7.5 |
| 48  | 24.5             | 1.15           | 16.0                                     | 7.6 |
| 72  | 25.8             | 1.10           | 17.0                                     | 7.7 |

A multifactorial analysis showed that amongst the environmental parameters (Tab.1), temperature plays an important effect. Two groups of tanks are distinguished: one with a minimum temperature < 23 °C (tank 3, 4, 5, 6, 9 and 10) and the other one > 23 °C over the 72 h period (figure 3). The average temperatures for each group are 24 °C and 25.8 °C respectively.

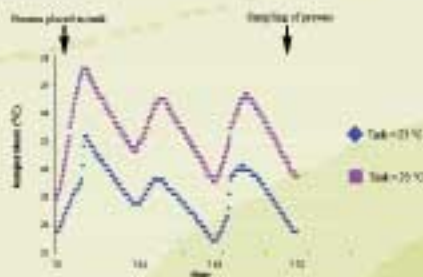


Figure 3: Temperature evolution of temperature during probe

## Results

For the analysis, replicate tanks within same temperature group were pooled.

In intermolt prawns, we observed (Tab.2):

- an effect of temperature on Mg, O.C., lactate and total proteins.
- an effect of soil on lactate and total proteins.
- a combined effect of temperature and soil on O.C., lactate, total proteins, glucose and Mg.

Results are not molt stage dependent.

Tab.2: P value of Temperature effect, Soil effect and interaction Temperature \* soil effect for each molt stage (C and D2) and multi-factorial parameters. P value in grey cell is significant.

| Parameters              | Temperature effect | Soil effect | C molt stage (n=12) |         |
|-------------------------|--------------------|-------------|---------------------|---------|
|                         |                    |             | P value             | P value |
| Hemocyanin              | 0.0001             | 0.0001      | 0.0001              | 0.0001  |
| Osmoregulatory capacity | 0.0001             | 0.0001      | 0.0001              | 0.0001  |
| Lactate concentration   | 0.0001             | 0.0001      | 0.0001              | 0.0001  |
| Protein concentration   | 0.0001             | 0.0001      | 0.0001              | 0.0001  |
| Glucose concentration   | 0.0001             | 0.0001      | 0.0001              | 0.0001  |
| Magnesium concentration | 0.0001             | 0.0001      | 0.0001              | 0.0001  |

The effect on magnesium, total proteins and lactate concentrations are showed in figure 4 for C molt stage:

- magnesium level is significant higher in the < 23 °C group compared to the control one and also in the soil clay and mix clay - silt. No effect was observed with schist soil.
- total proteins increase in the < 23 °C prawn groups submitted to clay and mix clay-silt soil. There was no effect of temperature with schist soil and control.

We have an effect of soil and temperature on the plasmatic lactate level in prawns. The combined effect is even more significant.

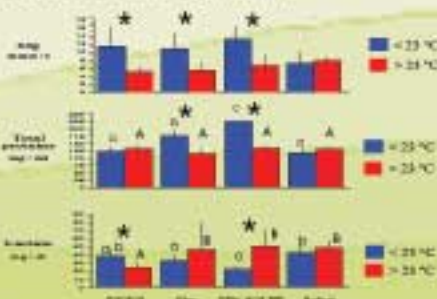


Figure 4: Prawn levels of hemocyanin, total protein and lactate by C molt stage. The letters describe the difference within a temperature group between soil type. The one specific significance difference between temperature group within soil type.

## Conclusions

The principal effect is due to temperature (level or magnitude) which may cause a stress in prawn.

Secondary effect: the type of the soil lead to a different physiological response. Prawns reared on schist soils do not respond in the same way.

The results suggest that soil characteristics could have an importance on the stress of prawns during winter season.

## References

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