Influence of sediment characteristics on prawn physiology : pH as principal effect

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Introduction

Effect of sediment quality on prawn production has been demonstrated (Delgado *et al.*, 2003) and pond bottom degradation with time is highly suspected to explain a decrease in production of shrimp farms in New Caledonia (Lemonnier *et al.*, 2002). However, relations between prawn physiology and sediment are poorly documented.

The aim of this study was to demonstrate an effect of pond sediment quality on prawn physiology.

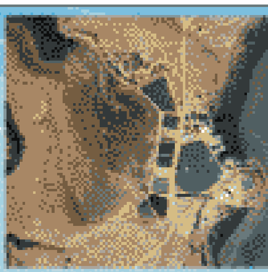

Figure 1 : Aerial view of the LAC SV

Materials and methods

30 prawns (average weight : 13.2 ± 1.9 g) were placed in 100 x 50 x 15 cm cages which were placed at random on the bottom in 12 stations in a one Ha pond.

After 24 hr exposure to sediment, hemolymph of prawn in C stage (intermolt) was sampled for osmotic pressure (O.P.) measure as an indicator of stress (Lignot *et al.*, 2000).

The experiment was repeated 4 times. Each time, 2 groups of free prawns were sampled as control once in the morning and then in the afternoon.

Each soil station was sampled for pH, redox potential, water content, loss by ignition at 550°C and ammonia concentration (in the first upper cm).

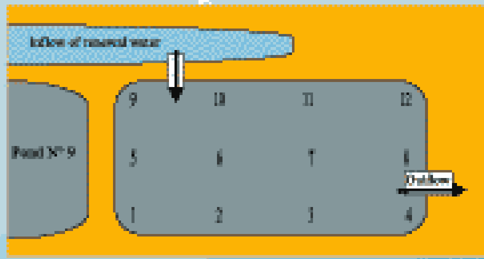

Figure 2 : Position of sampled stations

Sediment characteristics

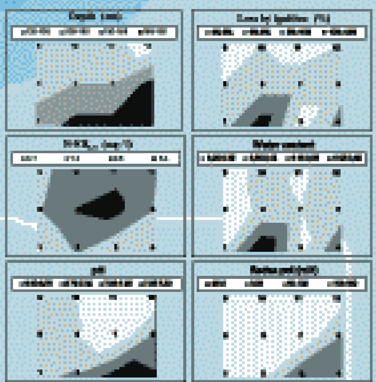

Figure 3 : Schematic presentation of physic and chimic variables

Depth was marked (average : 1.7 meter) for point 2, 3, 4 and 8. Other stations varied between 1.4 to 1.5 meter depth except station 12 with 1.25 m.

The loss by ignition was most important in stations 2 and 4, which were characterised by a fluid sediment (higher water content).

The total ammonia concentration was maximum in the center of the pond. It did not seem to be related to the loss by ignition.

Varitions of redox potential and pH were concomittant with depth. The highest redox potential and pH were found at the deepest point of the pond.

Osmotic pressure variations

The osmotic pressure of the prawn was related to water inflow circulation. Osmotic pressure increases with distance from the inflow water flux.

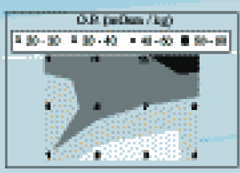

Figure 4 : Schematic representation of osmotic pressure repartition

Correlations between prawn O.P. and sediment characteristics

All stations — Without stations 2, 5 and 7

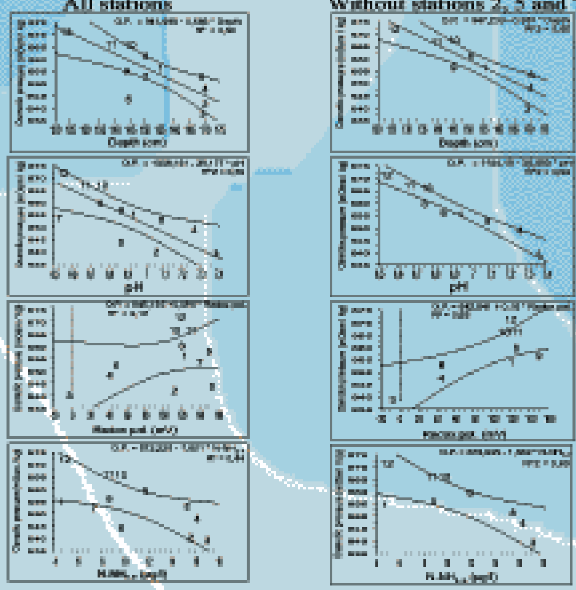

Figure 5 : Significant correlation graphics between prawn osmotic pressure and physic and chimic variables (In right graphics, station 2, 5 and 7 were excluded).

The correlation analysis shows a significant correlation between prawn osmotic pressure and depth, pH and ammonia concentration in the sediment.

Points 2, 5 and 7 seem to be different from the other stations. Prawns sampled at those stations seem to be less stressed as their osmotic pressure is lower. When data from those stations are discarded from the analysis, the significant correlation described before is reinforced and Redox potential becomes correlated to prawns osmotic pressure.

Conclusion

The main results of this study show a correlation between pH, redox potential, ammonia concentration of soils and prawn osmotic pressure. Correlation between pH and osmotic pressure follows a linear model. pH influence on prawn physiology is poorly documented. However, its implication in respiration and acido-basis balance for instance is very important.

References

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