

Soil under mining influence: a potential development for shrimp farming in New Caledonia ?

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Introduction

Second export activity after the nickel industry, shrimp farming produced 1840 tons of *Litopenaeus stylirostris* in 2002 on 472 ha of ponds (GFA, 2002).

Shrimp farming in New Caledonia is a developing industry with a potential estimated at 4000 tons corresponding to a surface of 900 ha (GFA, 2002).

Ponds are built behind the mangrove and potential sites for new farms are limited.



Figure 1: Aerial view of Niponi site. The red color indicates the presence of metals. (Photo B. Kikou)

Metals in soils exploited today and shrimp

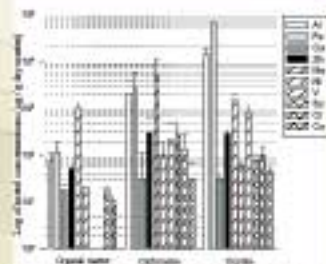


Figure 2: Metal concentrations (µg/g dry matter) in the phases of the organic matter, carbonates and oxides of the soil (sampled in a pond of zone A). Means ± SE (n = 6)

Preliminary data about metal concentrations in soils for shrimp pond are presented on fig. 2 (Mugnier *et al.*, 2001).

Figure 3 shows some preliminary data on metal concentrations in shrimp (different parts of the body) (Mugnier *et al.*, 2001).

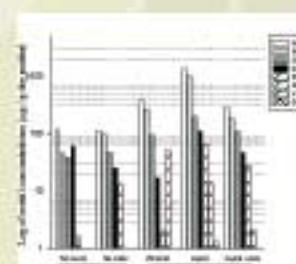


Figure 3: Metal concentrations (µg/g dry weight) in *L. stylirostris* sampled in zone A and in IFREMER (Capital - Capricornien).

Concentrations observed in this study do not show any critical values compared to similar studies in unpolluted area (Horowitz and Presley, 1977; Darmono and Denton, 1990; Paez-Osuna and Ruiz-Fernandez, 1995).

Potential area available for shrimp farming

The inventory of potential sites for shrimp farming in NC (Anonymous, 2002) has recorded a maximum area of 1746 ha suitable for shrimp farming. Among them 505 ha in the "Province Nord" and 210 ha in the "Province Sud" do not qualify at the moment because of flood risk, acid soil, proximity from another farm and mining influence. On this last point, no study has demonstrated so far, whether it could be possible to farm shrimp on this type of soil.



Figure 4: Potential area for shrimp farming including soils with mining influence (red spots).

Soils under mining influence (Fig. 4) are rich in transition metals, especially Chromium (Cr), Cobalt, Iron (Fe) and Nickel (Ni) (Mugnier *et al.*, 2001). They represent a total surface of 315 ha and a potential production of about 2000 tons (approximatively an increase of 30 % of New Caledonia shrimp export if this type of soils could be exploited).

Metals and aquatic life

Not all metals are toxic for living organisms, and even more so for human being. Many metals, as trace elements, are natural components of living tissues, and in some cases their absence can cause deficiencies.

Essential metallic trace elements include Zinc (Zn), copper (Cu), Nickel (Ni), Chrome (Cr), Cobalt (Co), Iron (Fe) and fluorine (F). For instance, hemocyanin, which is the breathing pigment in many molluscs and crustaceans, contains important amounts of copper.

Metallic elements, in relation with organisms, can be classified into three groups:

1° - Not harmful for human safety, present into a majority of the organisms: Sodium (Na), Potassium (K) (alkalins), Calcium (Ca) (alcalino-terreux) and Aluminium (Al).

2° - Essential metals for metabolism, but potentially toxic at high concentrations: Fe, Cu, Co, and Manganese (Mn).

3° - Heavy metal or metalloids, not used by organisms, present a risk even at low dose: Mercury (Hg), Plomb (Pb), Selenium (Se), Arsenic (As), Cadmium (Cd).

Toxicity is function of both the bioavailable concentration of the metal and the exposure time. The toxic effect may lead to mortality but can also be bioresponsible of slow growth, disrupted reproduction, pathology, physiological changes, ... It is also dependant on the development stage and age.

Questions about Shrimp farming and soils under mining and natural erosion influence

What metals are present and in what amount?
Are they bioavailable ?

Are they toxic for shrimp and can they accumulate in shrimp product ?

A lot of questions need answers before New Caledonia considers shrimp farming on this type of soil.
It is important for New Caledonia to explore this potential as a way to increase the shrimp export market.