Introduction
Since 10 years development of shrimp culture in New Caledonia have been restricted by vibriosis inducing significant shrimp mortalities. Triggering of diseases is the result of loss of equilibrium induced by a lot of environmental parameters including rearing practices. Minimizing impact of disease by improving health of shrimp could be a satisfactory solution. Nevertheless, this way requires a good knowledge and control of biogeochemical parameters at water-sediment boundary and their inter site variability and also development of reliable and simple bio indicators.

Results
Foraminiferal colonization patterns and behaviour in shrimp ponds. 51 species were identified at 10 stations from 8 shrimp ponds of 3 shrimp farms in New Caledonia (figure 1). Two species, Ammonia tepida and Quinqueloculina seminula, dominated assemblages. A few days after the filling of the ponds, the pioneering species A. tepida and Q. seminula grew, A. tepida being the more powerful colonizer at the very beginning. Their high reproduction rates led to increasing number of living specimens and accumulations of empty tests during the first ten weeks. This initial growing stage is followed by stabilization, related to higher oxygen demand (and drop of redox) and/or consumption of living foraminifera by the shrimps. Consistently with previous studies, A. tepida appeared as the most tolerant species to organic accumulations, but its relative abundance dropped when the settlement of lab-lab created low-oxygen conditions. Conversely, Q. seminula was able to climb inside the lab-lab up to the oxygenated layer, and its relative abundance increased (figure 2).

Foraminifer abnormalities as tools of assessment of reduced conditions in shrimp ponds bottom. A number of studies mention increased abnormalities in foraminifera tests from polluted environments (named Foraminiferal Abnormality Index [FAI]), but the observations, generally based on a relatively small proportion of abnormal tests, are somewhat contradictory. Moreover similar features, with equivalent proportions of abnormal tests may be observed in areas subjected to natural ecological stress. The proportion of abnormal tests (figure 3) could exceed 80%, and was often higher than 50% in shrimp ponds. FAI appeared to be positively related to the quantity of Easily Oxidized Material (EOM), native, reactive, organic matter associated with reduced inorganic species sensu Avnimelech et al. (2004) deposited on the bottom of the ponds and to the Sediment Oxygen Demand, and negatively related to Redox (figure 4).

Conclusion
These studies were carried out in shrimp ponds with extreme characteristics from oligo to hyper eutrophic conditions from the western coast of New Caledonia. Although a total of 170 samples only 51 species were found in shrimp pond bottom showing that adverse conditions prevailed comparing the higher species richness in inlet channel and/or tidal salt marsh. The assemblages were dominated by two pioneering species Ammonia tepida and Quinqueloculina seminula. A. tepida appeared as the most tolerant species to organic accumulations, but its relative abundance dropped when the settlement of lab-lab created low-oxygen conditions. Conversely, Q. seminula was able to climb inside the lab-lab up to the oxygenated layer, surviving in good conditions and increasing its relative abundance.

The results allow us to infer that a very high proportion of abnormal tests is a potential indicator of a high accumulation of native organic matter, leading to a high Sediment Oxygen Demand. These studies suggest that foraminifera should help to better management of aquaculture ponds.

References