

# Lagoon water quality and shrimp farming: a state of knowledge

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# Shrimp aquaculture in New Caledonia

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- About 2000 tons annually (*Litopenaeus stylirostris*)
  - Provides 1000 jobs (300 permanents)
  - More jobs in rural areas
  - second New-Caledonian exportation product, right after nickel
  - 75% of the production is exported (Europe, Japan, USA, Australia)
  - Small producer: < 0.05% of the world production



# Shrimp aquaculture in New Caledonia

- High production costs (small producer, high labour price, high energy price, far from customers)
- Requires specific markets
- **Requires high quality products**
- With certification quality
- Consumer safety
- Environmental preservation



# Shrimp aquaculture in New Caledonia





# Shrimp aquaculture in New Caledonia

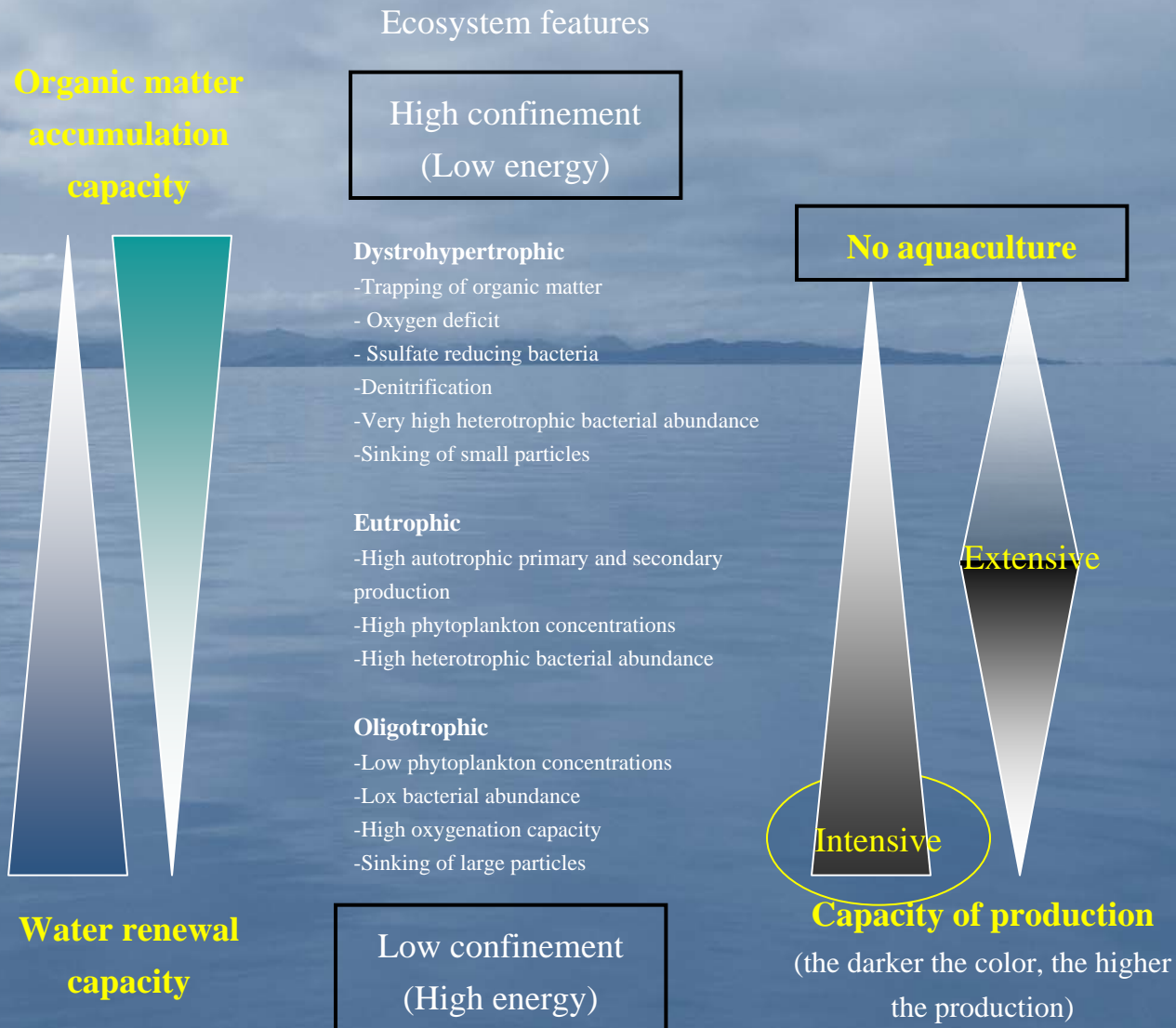
- ponds range between 3 and 11 ha
- Shrimp density: 15 to 35 /m<sup>2</sup>
- from 30 mg to 30 g
- Input: feed (FCR = 2), Fertilizer (Urea, without Phosphates) sea water (5% to 30%) and aeration
- Duration: about 200 days

Water exchange is used:

- to flush nutrients and phytoplankton
- to remove toxic metabolite wastes
- to dilute pond water to avoid high salinity



# Effect of ecosystem characteristics on shrimp production



# Effluent composition and nitrogen budget

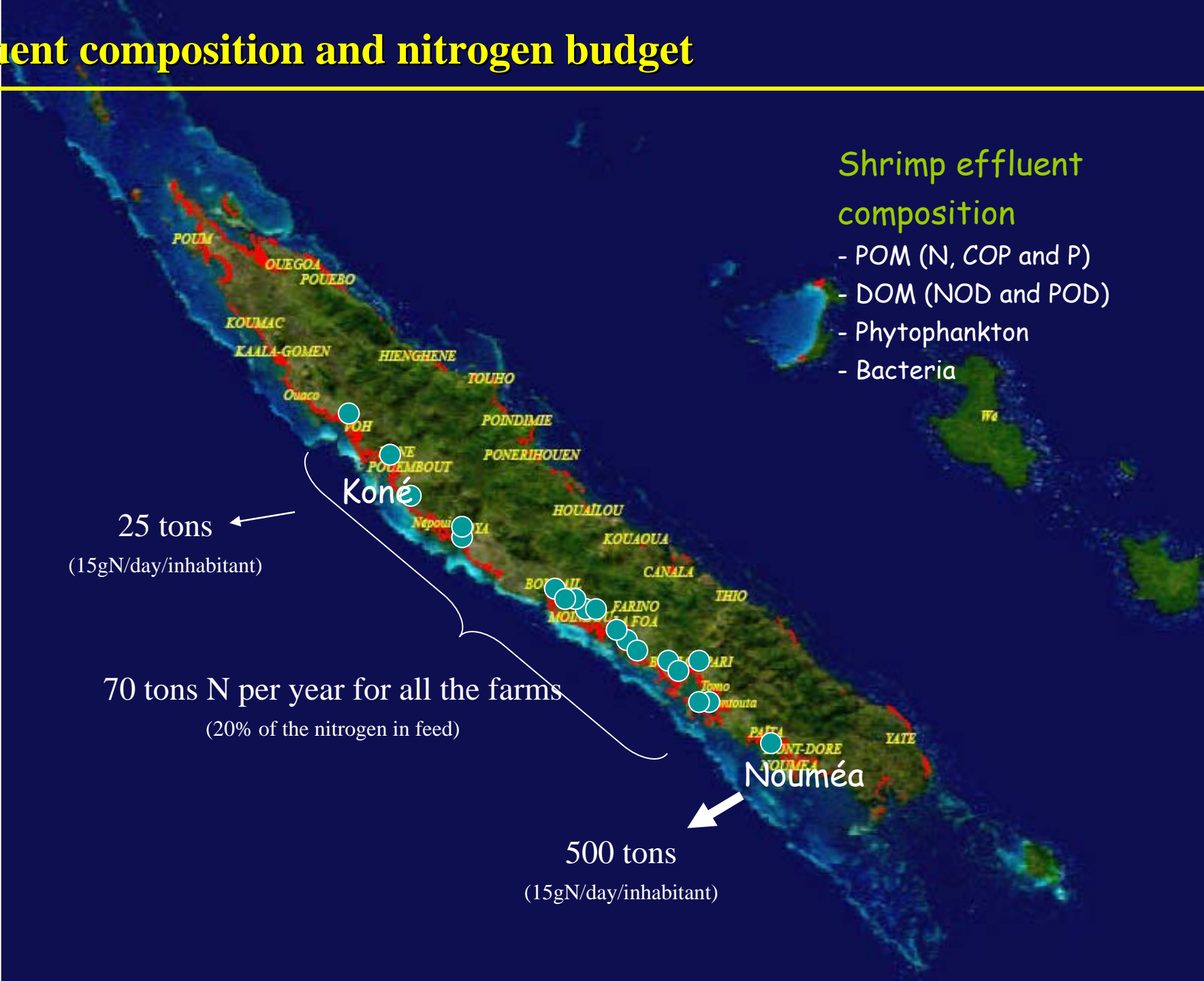
## Shrimp effluent composition

- POM (N, COP and P)
- DOM (NOD and POD)
- Phytoplankton
- Bacteria

25 tons  
(15gN/day/inhabitant)

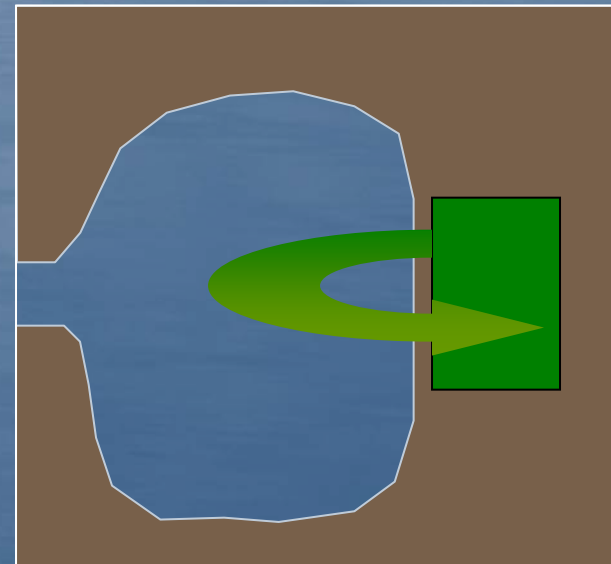
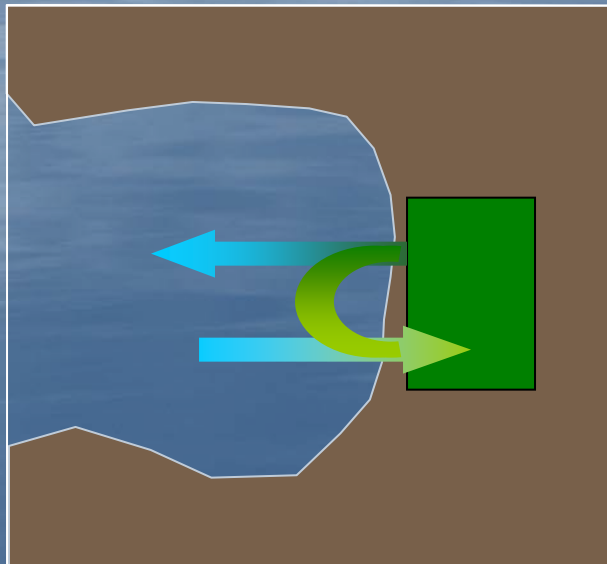
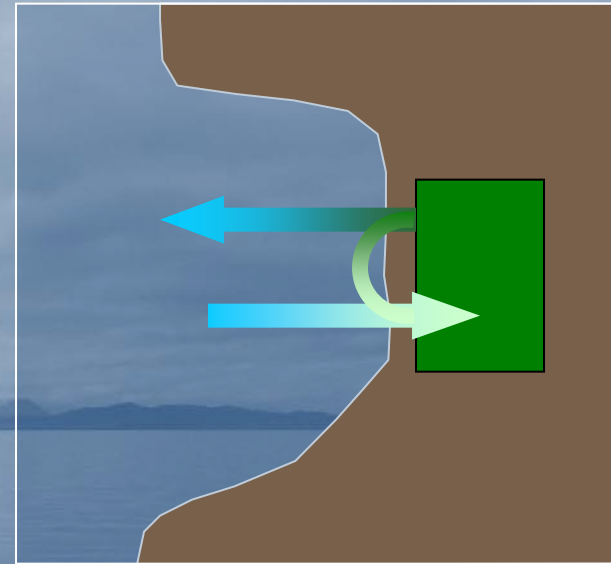
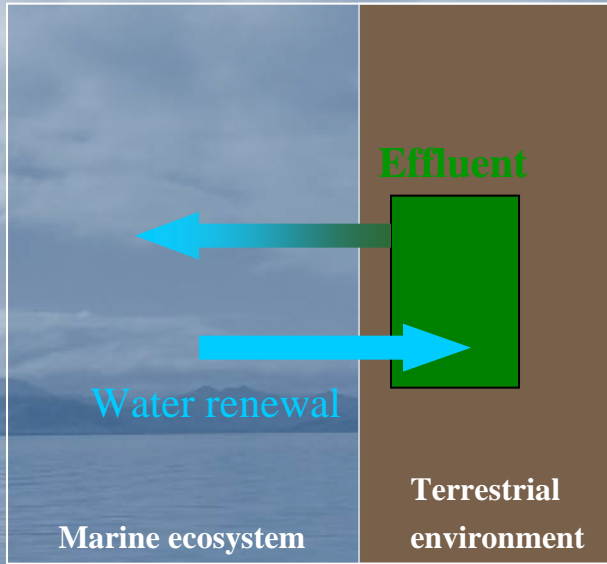
70 tons N per year for all the farms  
(20% of the nitrogen in feed)

500 tons  
(15gN/day/inhabitant)



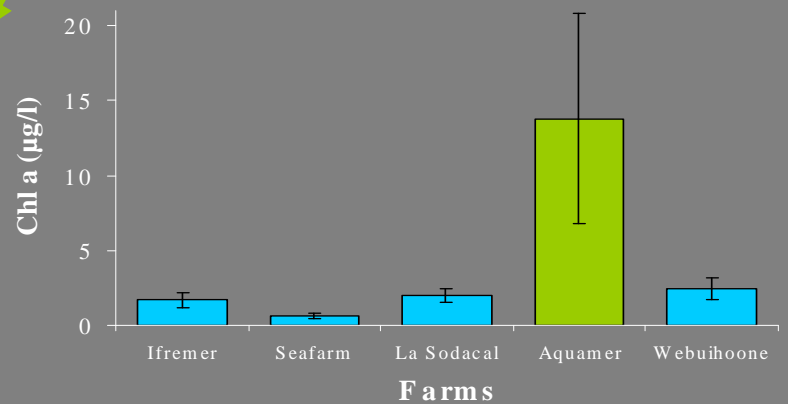
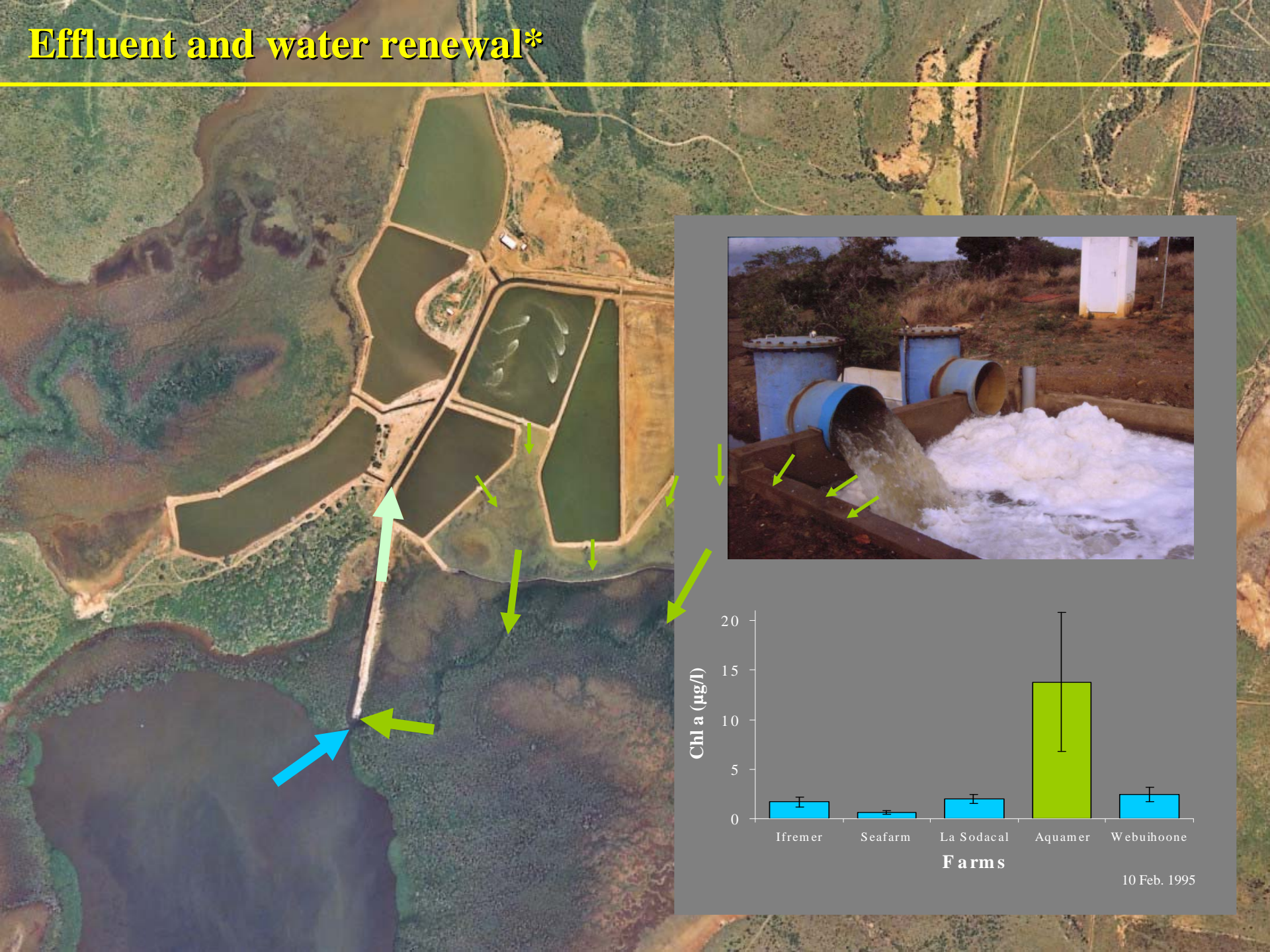


# Effluent and water renewal\*





# Effluent and water renewal\*



10 Feb. 1995



# Effluent surveys in the lagoon

ZoNéCo Program: « traceurs de effluents »

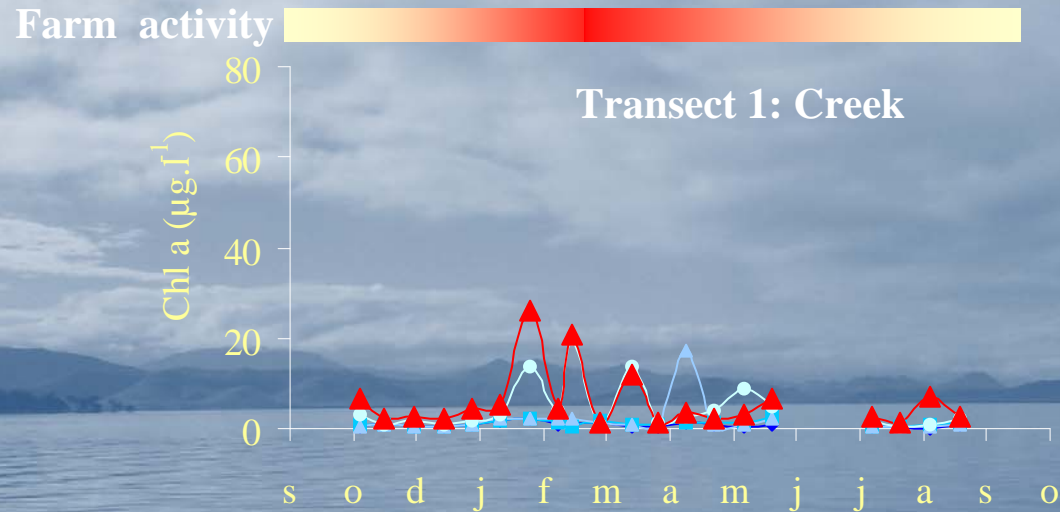


Transect 1: creek

Transect 2: bay



# Effluent surveys in the lagoon



Lagoon water quality

Chl a  $< 0.5 \mu\text{g.l}^{-1}$

Oligotrophic system

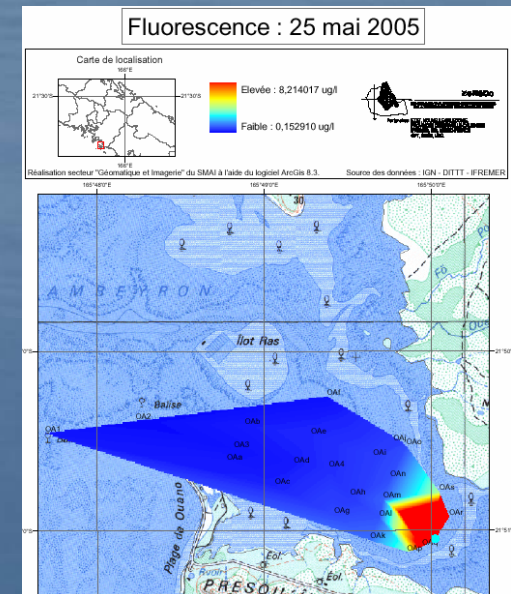
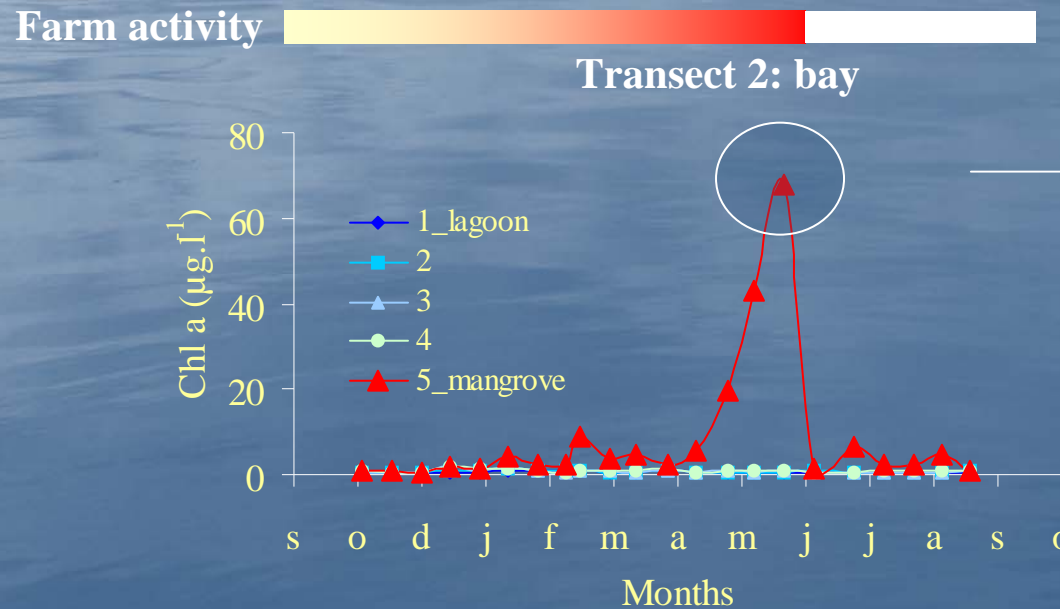
Bay water quality

Chl a  $< 2 \mu\text{g.l}^{-1}$

Mesotrophic system

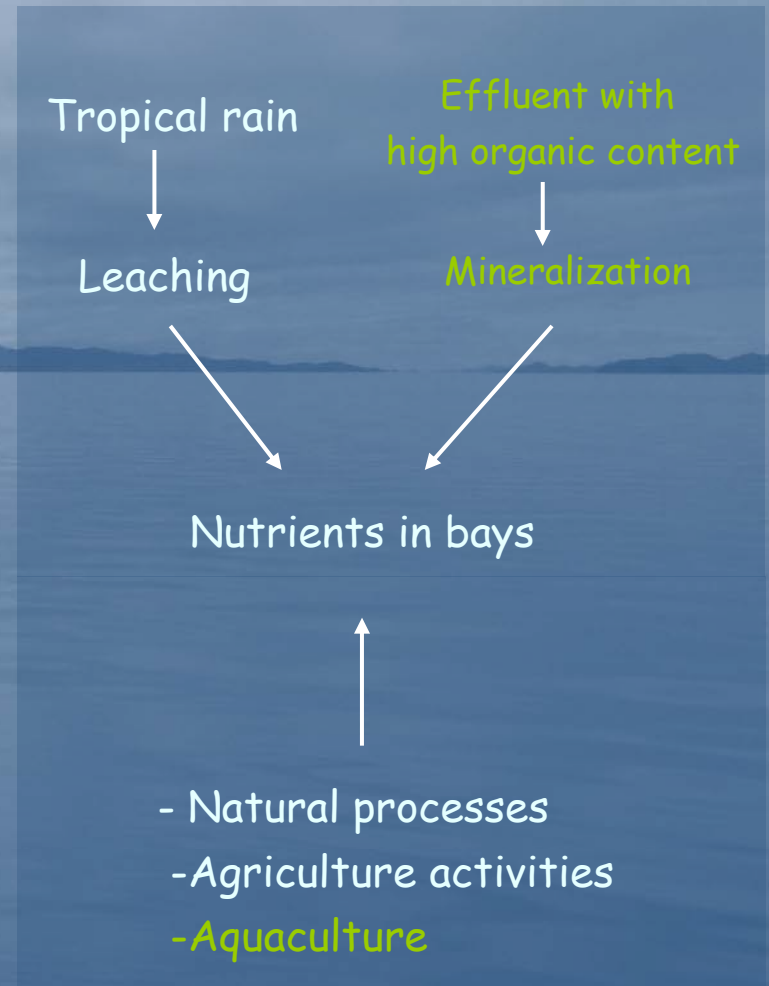
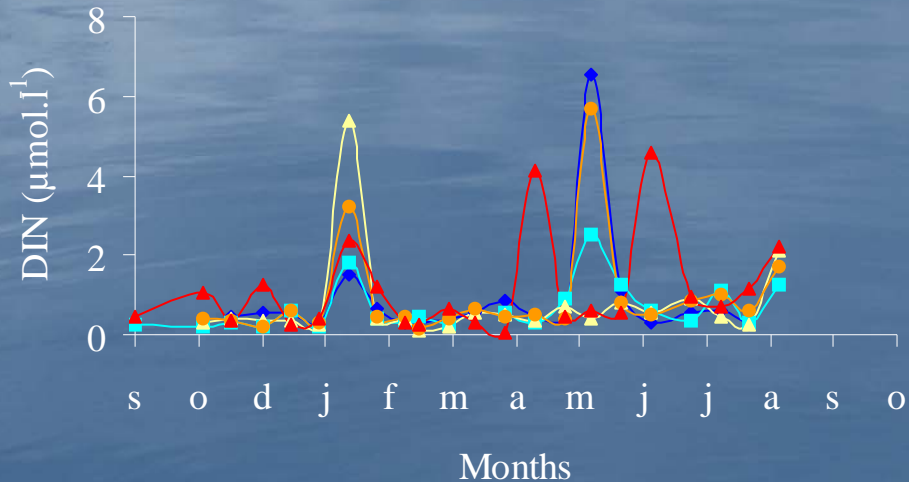
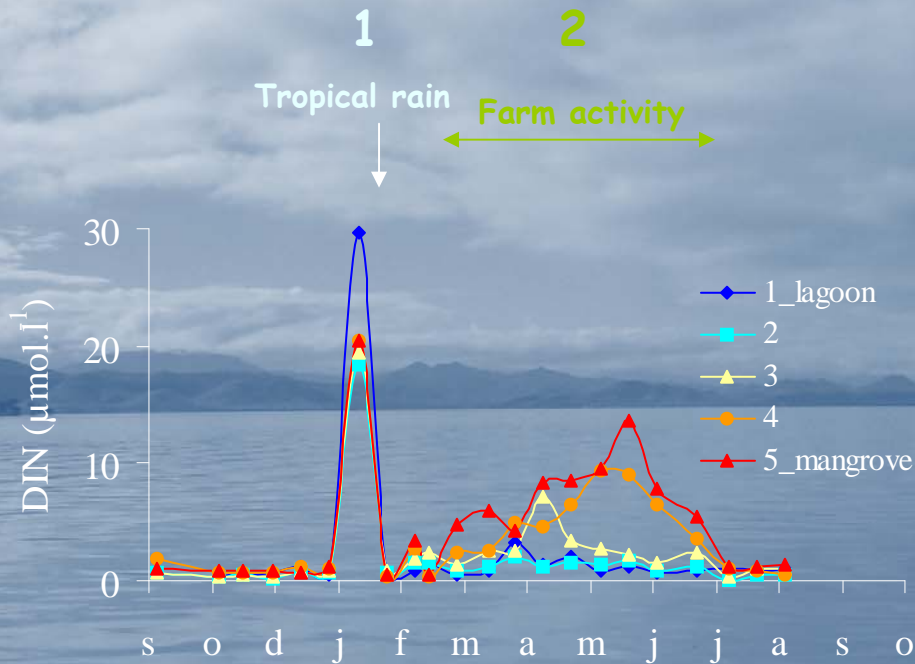
Bay near Nouméa

Chl a  $< 3 \mu\text{g.l}^{-1}$

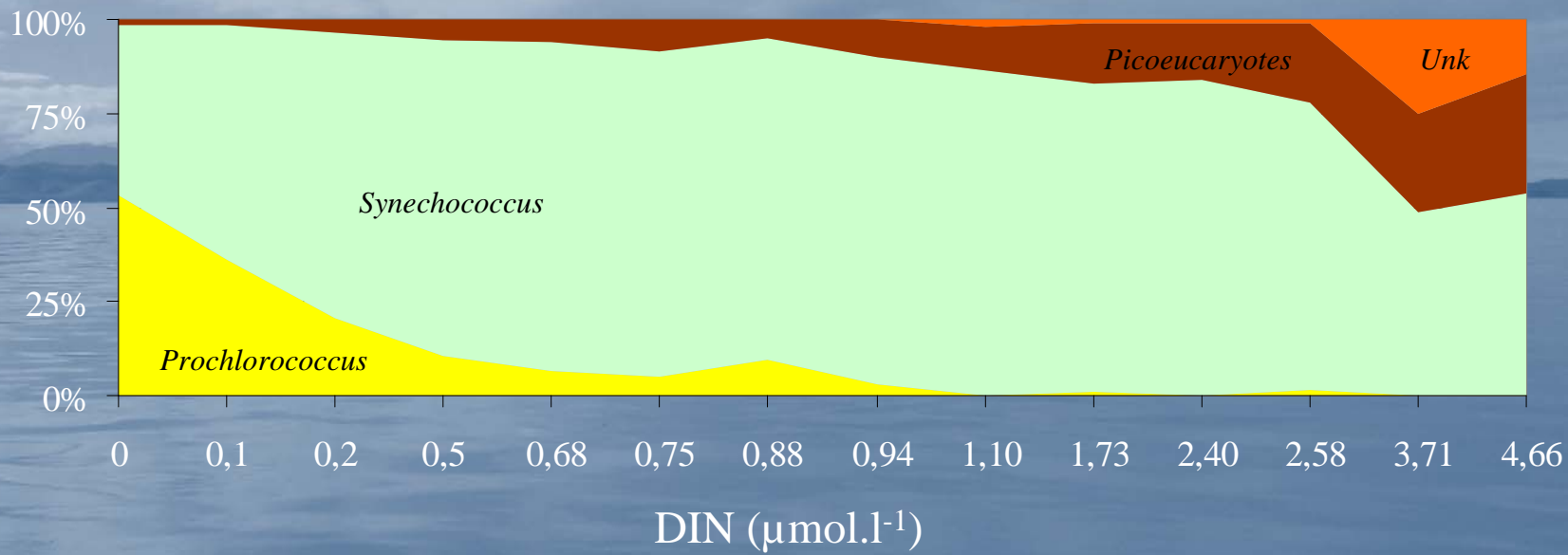




# Effluent surveys in the lagoon

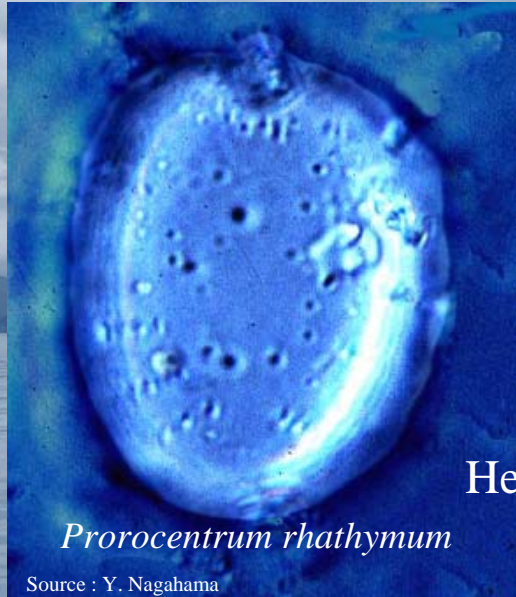


# Effect of nutrients on phytoplankton communities



Sea      Lagoon      bay      End of the bay      Creek

# Red tide



Hemolytic toxins

*Prorocentrum rhathymum*

Source : Y. Nagahama

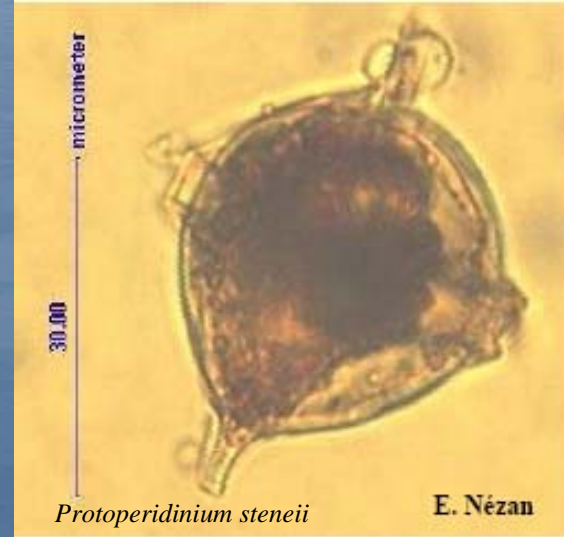


Source : Ifremer / J. Herlin

Red tide in a pond at the beginning of the rearing (Sept. 2003)



Source : Ifremer / J. Herlin



*Protoperidinium steneii*

E. Nézan

Red tide in a pond at the end of the rearing (January 2002)



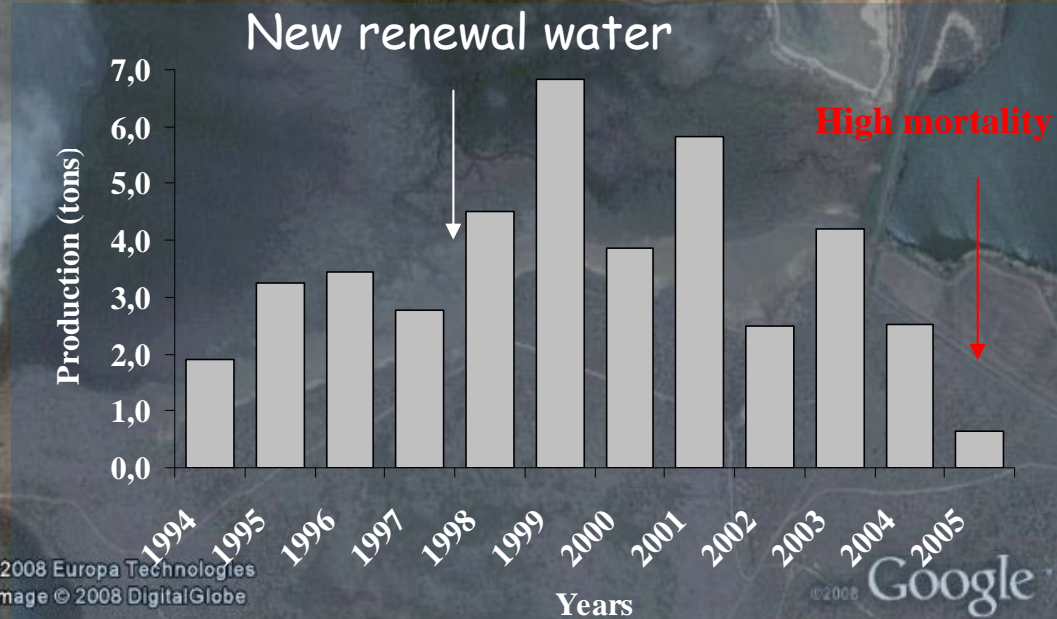
# Pesticides

Freshwater

Freshwater

Moindou river

Salt water



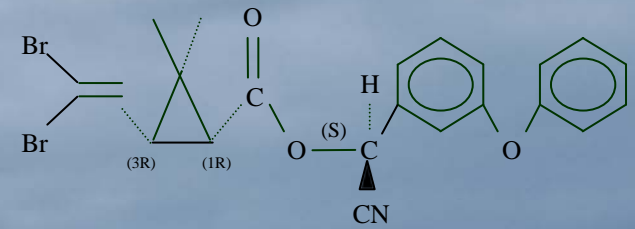
# Pesticides

Deltamethrin: Used by agriculture against insects

37 µg/l measured in the input water



- No mortality in ponds without water exchange
- Probably a toxicity problem
- The farm was closed in 2005



Deltamethrin (µg/l)  
<http://www.epa.gov/ceqtoxic/>

<i>Americamysis bahia</i>	0.016-0.037
<i>Crangon septem.</i>	nd
<i>Gammarus pulex</i>	0,03
<i>Penaeus duorarum</i>	0.35





# Metal and aquaculture



**Pond surface = 640 ha (production is about 2000 tons per year)**

**“Polluted” areas > about 500 ha**



# Metal and aquaculture



**1 - Bioaccumulation of metal and metalloid in shrimp** (Metian *et al.*, in prep)

→ **Effect on the farm products**

**2 – Effect of metal and metalloid on shrimp survival**

→ **Productivity of the farms built on these areas?**

**Metal in the environment (soil and coastal water): a drawback to development ?**

**Need of more research on this topic**

# Conclusions

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Necessity of monitoring, integrating the various components of the hydroystem, in view of preventing possible future conflict of uses.

The objective could be the comprehension of the processes and construction of tools of observation and representation, allowing a monitoring and a forecast of the quality of water, resources and coastal biotopes in interaction with the coastal environment and human activities.

**RNO (Water quality surveillance)**

**REPHY (algal toxin surveillance)**

**Quadrige**

**<http://www.ifremer.fr/envlit/surveillance/>**



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**Thank you for your attention**