The Tahitian Black Pearl Industry and Climate Change: Prospects and Adaptations.

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Introduction: IFREMER - Film

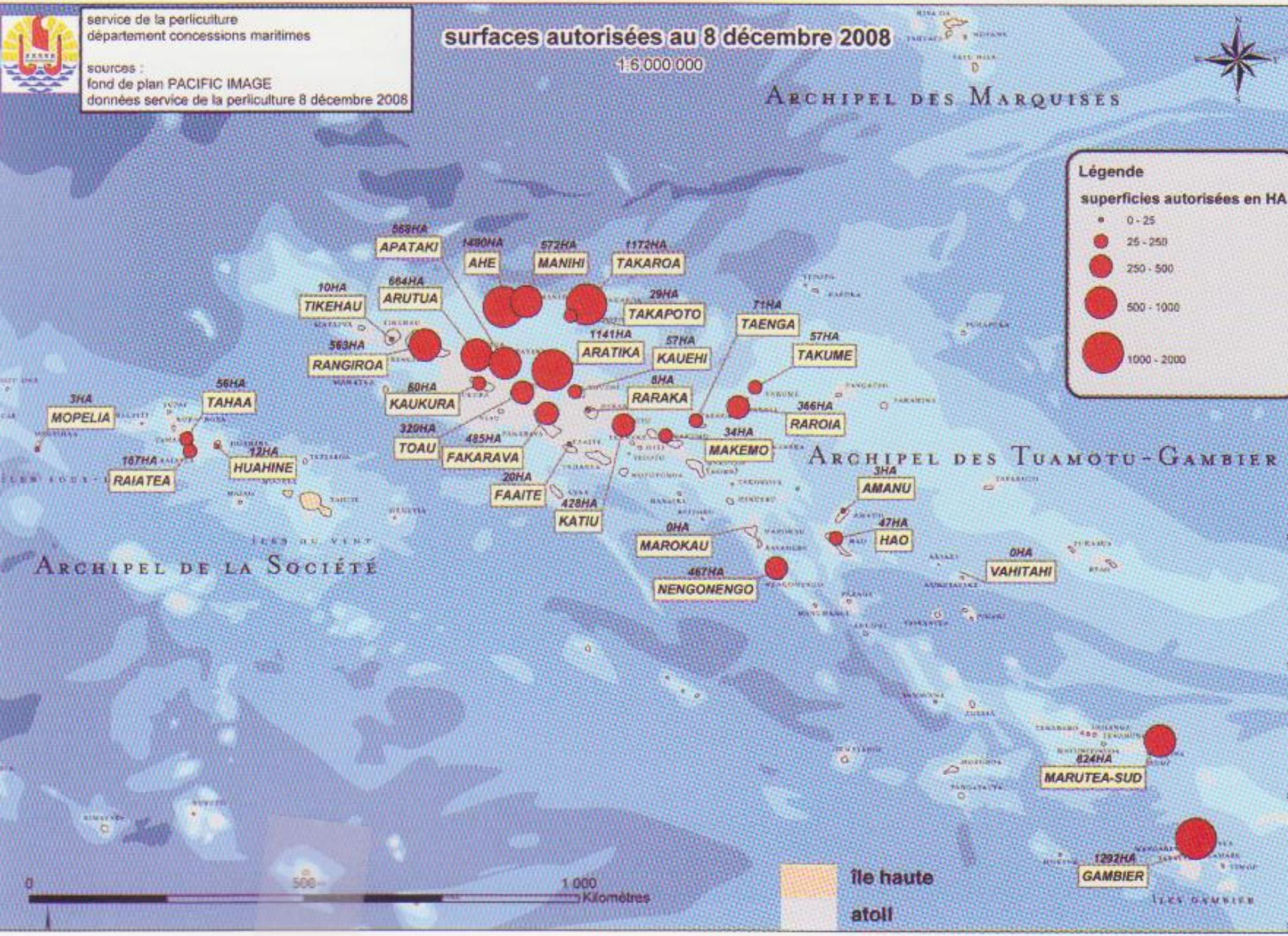
Plan:

I. The black pearl industry: a « pillar » of French Polynesia economy

II. The impacts of climate change on the black pearl industry

III. Economic damages

IV. Prospects of adaptation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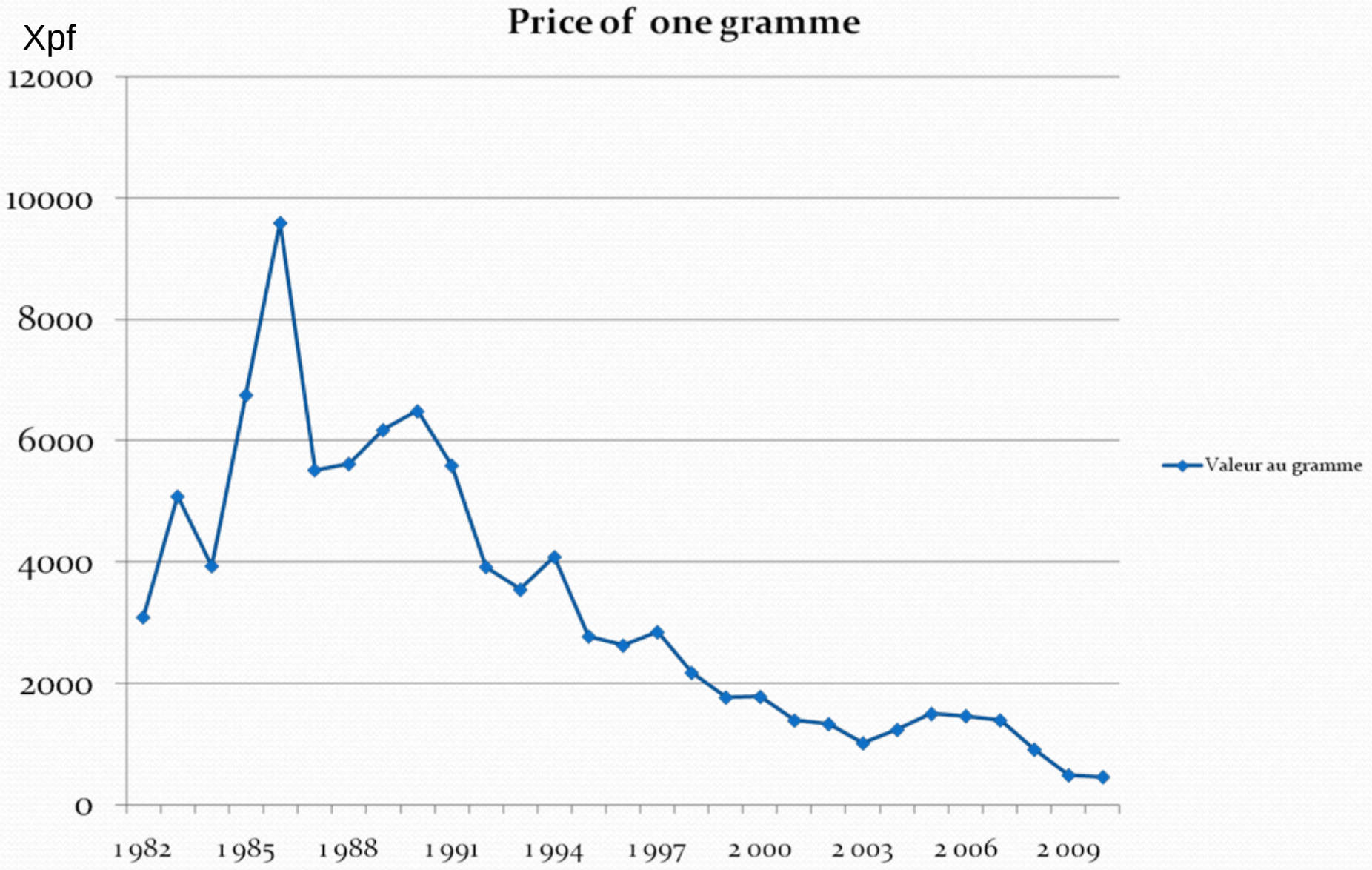
I. The black pearl industry, a « pillar» of the French Polynesia economy

Key figures:

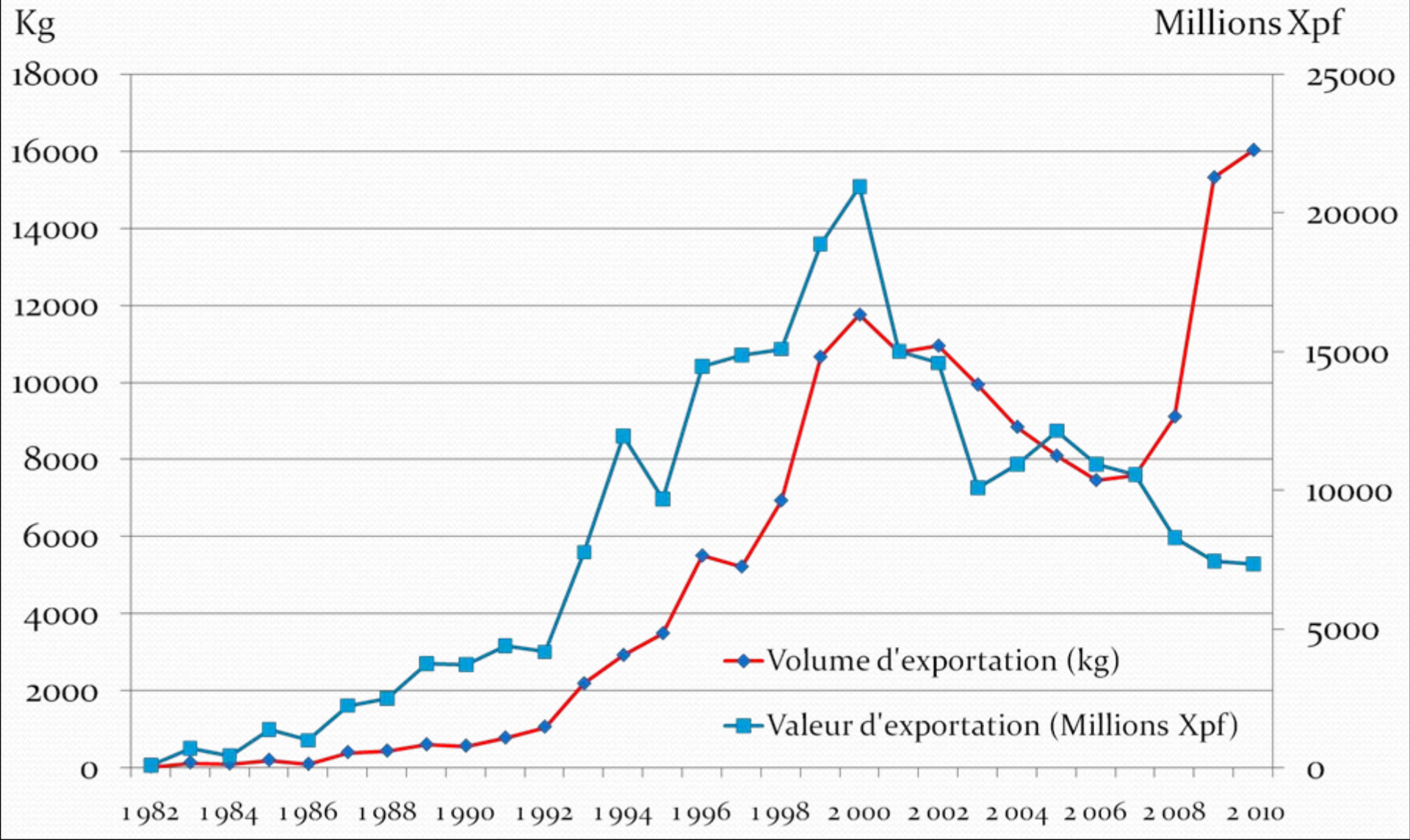
- 9 586 Xpf (111 US$) /gramme in 1986
  480 Xpf (5.55 US$)/gramme in 2010 (ispf)

- The black pearl industry is, after tourism, the second endogenous economic resource in French Polynesia (21 Biliions Xpf en 2000) (243 Millions US Dollars).

- Since 1991-1992, we have increased production volumes in order to cover the continuous collapse in prices. (Since 1994, exportations have been multiplied by 5,4 while the pearl price divided by 8,9!)


Price of one gramme
Xpf
12000
10000
8000
6000
4000
2000
0
1 982
1 985
1 988
1 991
1 994
1 997
2 000
2 003
2 006
2 009
Valeur au gramme

Evolution of exportation volumes and values (Source: ispf , 2009 ; Poirine, 2003



II. Impacts of climate change on the black pearl industry

According to IPCC, the main effects of climate change are: Sea Level Rise, Increase in cyclones intensity, air and ocean warming and oceans acidification.

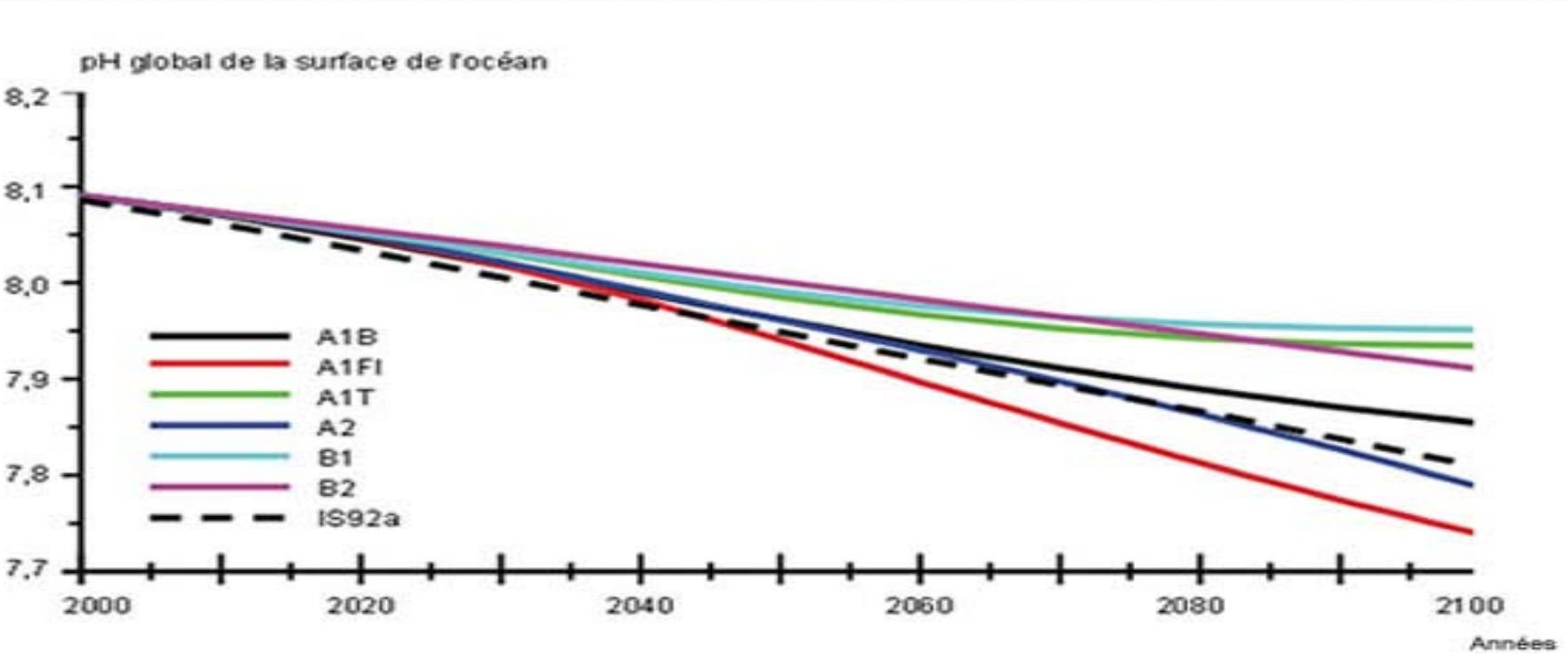
For the largest firms owners, climate change threats are to be ranked in this order :

1. Oceans acidification
2. increase in cyclones intensity
3. Lagoons warming
4. Sea Level Rise

This rating is different from the one observed in other industries (Tourism, fishing and construction)

II.1. Oceans Acidification

- When the atmospheric carbon dioxide is in contact with the sea, it reacts to become carbonic acid.
- Oceans will be much more acid in 2100(IPCC, 2007)



Some undoubtable consequences on every species processing calcification

There three **possible** impacts of acidification on the black pearl industry:

- Feeding threat (Acts on the oxygen and nutriments concentration).
- Dissolution of the mother of pearl shell made out of calcium carbonate.
- Prevent shell making at the larval stage

II.2. Intensification of cyclones

2 types of impacts:

- Material loss (Infrastructures, production outlets)
  - Depends on the geographic location, the type of firm and the quality of building materials .
  - Avoid saturation of culture outlets (risks of chocks, and/or get into a tangle – i.e. fraud problem).

- Mortality of pinctada *margaritifera* :
  - Suffocation risk due to excess of sediment brought by waves
  - Plausible indirect effects (differed). Example of the 1985 high mortality rate in Takapoto.

II.3. Lagoon Warming

A. Diagnostic and expectations

- The average temperature in the studied lagoons (community of Fakarava) lays in between 26.5°C and 29.5°C depending of the season (Service de la Perliculture, 2009).

- During « el niño » years, 1°C has to be added to these temperatures.

- In 2025, the average temperature should increase to 31.5°C in these lagoons.

- In 2100, average temperature should rise to 32.8°C.

B. Potential consequences

- According to what we know today, the survival of the industry **is not** threatened
  - P. *margaritifera* had been cultivated on Sudanese coasts by temperature up to 34°C (Reed, 1966).
- The optimum temperature for the culture of P. *margatitifera* lays between 23°C et 28°C (Yukihira *et al., 2000)*
- Above30°C, P. *margaritifera* develops over its optimal temperature (Yukihira *et al., 2000)* .
  - Then, noticeable effects on the animal
- Repetition risk of algae bloom(green tie).
  - Takapoto
  - Manihi

III. Economic Damages

- Impacts are physical effects of climate change actions.
- Damages are the direct and indirect costs resulting of the impacts
  - Economic damages due to loss of materials
  - Loss of productivity

III.1. Economic damage due to loss of materials

- Examples of sales and abandons of firms following cyclones in 1983.

- Cost of equipment lost is not high compared to loss of productivity due to animal weakening. (Most of capital is under water…).

Climate change will accelerate outlets wear and tear

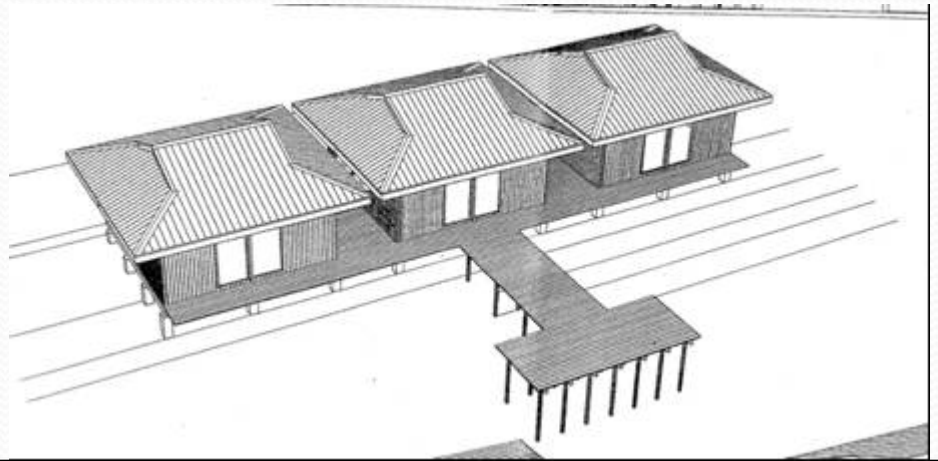
- A more frequent renewal of outlets park
- A more frequent specialization in oyster brood collecting . Total investment is cheaper than other farms (200 000 Xpf).

III.1. Economic damages due to loss of materials

For farmers, the main concern is resistance of infrastructures to winds and swells (Use of bamboo, leave space in between floor laths).

Adaptation measures:

- ✓ Prohibition of building farms in the middle of the lagoon
- ✓ Rise and strengthening of farms foundations
- ✓ Standardization of "Fare greffes" (grafting house)



Tahiti Etude Coordination andSPRL, 2002)

III.1. Economic damages due to loss of materials

Tableau : building costs of a « Fare Greffe » (Service de la Perliculture, 2005)

	Small farm	Average farm
Area	24 m², 30m²	110m², 200m²
Cost of materials (Price in Tahiti)	2 Millions Xpf (23 256 US $)	4 Millions Xpf (46 512 US $)
Cost of building by a construction firm (materials and freight included)	5 Millions Xpf (58 140 US $)	9 Millions Xpf (104 651 US $)
Electricity intallation	0,5 Millions Xpf (5 814 US $)	1 Million Xpf (104 651 US $)

III.2. Other consequences of global climate change

- Independently of geographic location, climate change will impact small firms first. (less flexibility, less adaptation capacity (integration, specialization, differentiation)).

- The black pearl industry is a perfect example of how vulnerable small island states or territories are to erratic chocks (earthquake in Kobe).

- The black pearl industry is still a mono-activity in most of Tuamotu

  - Abandon of certain isles. Climate refugees or economic refugees?

  - Worsening of the asphyxia situation of Papeete due to the "flexion effect" (increase of unemployment rate) .

  - In a medium term, climate change may play a "moderator role" and finally solve the production problem.

IV. Some adaptation paths to non-material damages of climate change (not exhaustive)

- More knowledge is needed on the capacity of P. *margaritifera* to acclimatize to climate change as well as on its resilience. To continue research on physiology, biology and the eco-physiology of *P. margaritifera* and on the process of the pearl bio-mineralisation. Crucial interest of integrating this models to economic models in order to anticipate the consequences of global climate change on the industry on a medium and long run.

- Improve controls.

- Climate change will exacerbate the negative effects of an inappropriate management of supply and demand (Need for one selling station).

- Uses of decision tool for professionals (oyster health monitoring by the government's department of the pearl culture)

conclusion

- An industry relying on a stable and healthy environment.
- Today, we have few certitudes on what will be the impacts of climate change on the black pearl industry. This a crucial sector for the economy with social stakes in French Polynesia.
- Material damages of climate change are trivial compared to potential loss of productivity.
- The industry as well as the firms composing it, will fall in prey to deep modifications initiated by the new challenges of climate change (Firm strategy, innovation, technical progress).
- Important advanced researches on the eco-physiology and the physiology of P. *margaritifera* have been realized. However, certain physiological limits are still unknown. In this uncertain environmental context, it is essential to pursue scientific research to better master the determinism of the pearl quality and its management. A multidisciplinary approach would undoubtedly help the decision making process to adapt to climate change.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