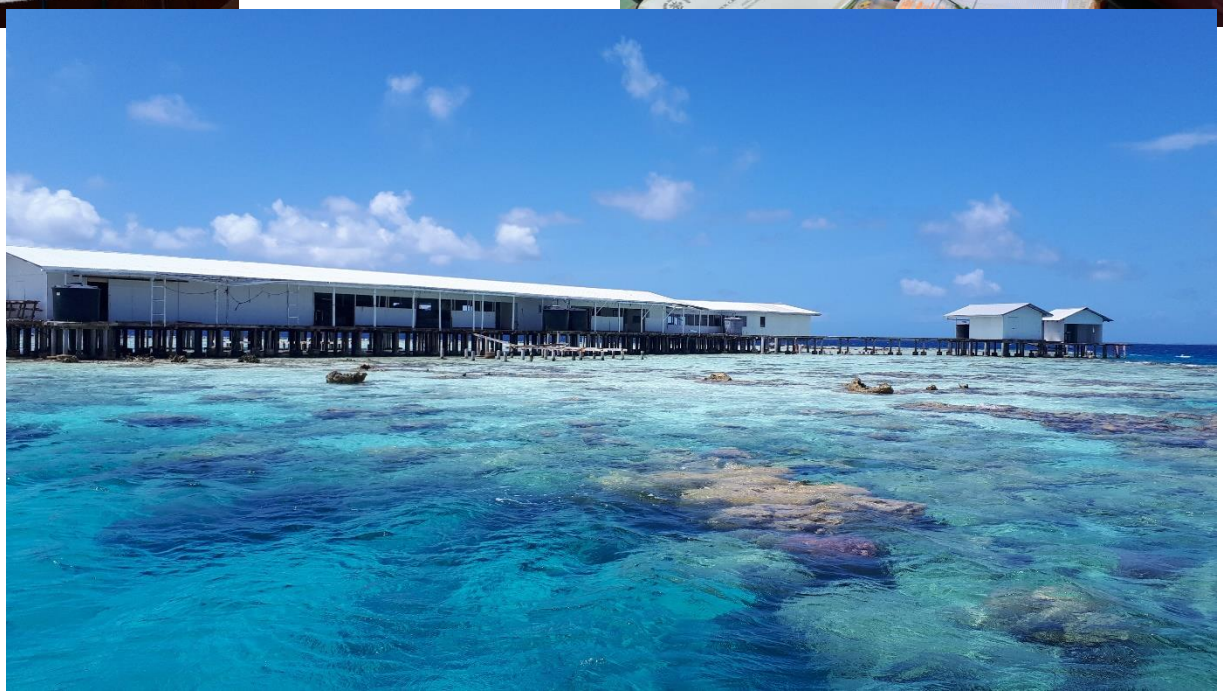

Impact of climate change on French Polynesian pearl oyster farming: Risk perception and adaptation strategies

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Funding: MSH du Pacifique

Place: French Polynesia

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Title of the project: Impact of climate change on French Polynesian pearl oyster farming: Risk perception and adaptation strategies

1. Dissemination

Two articles:
First: risk perception/risk assessment of the impact of climate change on pearl oyster farming in French Polynesia
Second: climate change adaptation strategies/resilience of French Polynesia pearl oyster farming. A policy analysis.

2. State of art

Assessing the resilience of people, places, and systems to climate-change hazards is essential for understanding how to reduce disaster risks. Globally, a number of resilience assessment methodologies have been developed and implemented at several levels, local, regional and national, through the adoption of a wide range of criteria and indicators (Hoque et al., 2019).
Since the first developments, early 1970s, in the French Polynesia pearl oyster farming sector has been investigated in its environmental, social and economic dimension. The results of these studies suggest that the sector and associated communities are threatened by oyster mass mortality, mismanagement practices, and climate change related impacts. Pearl oysters health related issue (e.g. mass mortality outbreaks related to pathogens) has received great attention given the negative consequences on the sector and on the Polynesian economy (Grizel et al., 1986; Dauphin and Denis, 1987; Berthe et Prou, 2007). On the other hand, Blanchet (2000) discusses the place and role of pearl oyster farming on the local economy and society of the archipelago; while others express concerns over the social-economic change determined by the development of this activity (Robineau and Garanger, 1997). Recent projects, for instance POLYPERL[1] and RESCCUE[2], carried out an integrated assessment of the impact of climate change on local communities' well-being, including the oyster farming sector.
Nonetheless, there is a little understanding of the vulnerability, risk exposition and resilience of the sector and associated local communities to climate change as well as how they will be affected by adaptation and mitigation measures.

3. Aim

The aim of the project is to assess the risk exposure of the French Polynesian pearl oyster farming to climate change and identify adaptation measures to understand the resilience of the sector and associated local community. Information is gathered through 1) an in-depth analysis of the scientific literature and policy documents related to climate change impact on Pacific islands; 2) review of the national statistics on demographic, social and economic criteria 3) semi-structured face-to-face interviews to all relevant stakeholders.
This study will integrated local knowledge and perception with scientific knowledge to improve the understanding of the impact of climate change on local conditions and local assets, and to increase capacity for planning for adaptation behaviour to their changing world.

[1] Gestion Intégrée et Adaptation de la Perliculture en Polynésie Française dans le Contexte du Changement Global : Approche Environnementale, Économique et Sociale
[2] Restauration des services écosystémiques et adaptation au changement climatique

4. Methodology

Scientific literature

Relevant scientific publications on the issue are identified with the systematic search of the following words in Google scholar: Black pearl oyster farming, French Polynesia, climate change pacific islands, climate change risk exposure, local community risk perception, vulnerability to climate change, resilience criteria/indicators etc….

Statistics

Statistics on social and demographic situation and trend and economic variables from 1970 till today. Data will be gathered from the https://www.ispf.pf/ to integrate the information obtained in the interviews about the criteria and indicators of risk exposure/vulnerability and resilience/adaptation (*Annex A*)

Questionnaire

The questionnaire is a mix of yes/no, multiple-choice and open answers. Face-to-face interviews were performed with the two categories of interviewees: 1) experts (including academics of 6 different disciplines, representatives of the sector, administration at different level) and 2) producers/local communities. When it was not possible to meet the participant in person, an online questionnaire was sent from September to November 2020.
The questionnaire is divided into four to address the following issues: background information, level of knowledge, vulnerability/risk perception, and adaptation capability/measures (*Annex B* – questionnaire scheme Experts; *Annex C* questionnaire scheme sector/communities)

1. Knowledge **(**Vision of experts and vision of sector/communities)
   Description of the current/past situation of the pearl oyster farming sector. Level of knowledge about the sector and the climate change.
2. Vulnerability (vision from the expert); risk perception (vision from sector/communities):
   - Which are/will be the consequences of climate change for the sector and associated communities?
   - Which are the segments of the sector that will be mostly affected/exposed by the climate change related impacts? (e.g. producers (small, big, medium), sellers, tourism, local communities);
   - Which are the areas/atolls most exposed?
3. Level of Resilience: adaptation measures
   Which are the adaptation strategies (for scientists and government)? Do farmers think they will be able to adapt to new conditions? What other alternatives they have (tourism, agriculture, fishing etc.)? Ability to develop a new activity?

5. Study site

French Polynesia is composed by 118 islands in the South Pacific Ocean, 67 of which are populated by 268 000 people. The entire area is highly exposed to sea level rise and some islands are likely to disappear in the near future. For example, the Tuamotu Archipelago hosting around 15 000 people emerge 1 or 2 meters from the sea level while 84 out of 118 islands do not pass 3m (Jamme, et *al.*, 2015).

This study covers the geographic area of the Tuamotu-Gambier Archipelago that are considered the most important pearl oyster producers (Figure 1). It is expected that communities and business living in these areas will be impacted in a different way by climate change and also the adaptation strategies could be different.

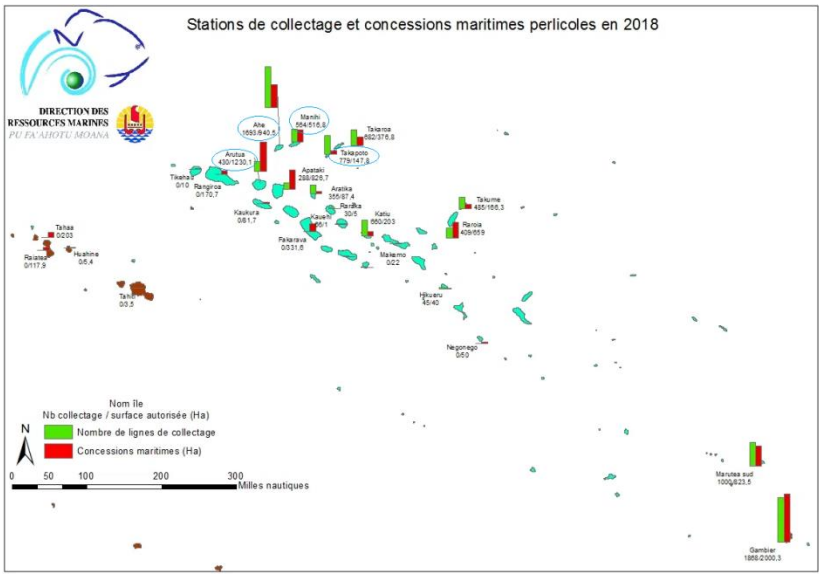

Figure 1. Spatial distribution of production sites in the Tuamotu-Gambier archipelago for the year 2018 (*source*: Direction de Ressources Marines)

6. Results

A total of 48 people took part to the survey covering the most important oyster farming production sites and all relevant stakeholders. In addition, a meeting with 11 producers was organised in Ahe to collect producers and collectors' views (Table 1).

Place	category of stakeholder (number)	Type of expertise
Society Islands	Administration (7)	Pearl oyster farming
		aquaculture
		fisheries
		others
	Research (12)	Oceanography/meteorology
		Biology/Ecology
		Law
		Anthropology/sociology
	Producer (4)	Representatives of associations/Union
		Producer/ex producer
Tuamotu	Producer (15)	Pearl oyster/nacre
		Collectors
		Business management
Gambier	Producer (21)	Pearl oyster/nacre
		Collectors
		Business management
	Community (6)	Several activities

6.1 Knowledge

The survey was addressed to producers of all ages, sex and years of experience. In the Tuamotu Archipelago the interviewers were mostly involved in collecting spat since most of the existing pearl oyster farms were dismissed on in stand-by. When asked about the development of the sector during the last 10 years, all the interviewed describe a deep crisis in the price of pearl in the market that gets worst every year and it reached minimum with the Covid-19 international crisis.
Another problems that is common to the all areas, is the increasing contamination by plastics from the farms and from the ocean. This was the second element of concern after the economic crises of the sector.
Almost all interviewers have identified environmental impacts related to climate change but with differences among areas. In general, there is the perception that something is changing but that is difficult to perceive. In the Tuamotu, an increase of intensity and frequency of meteorological depression has been identified with consequences for public structures and farms. The shift in the ocean/air temperature has been observed which has an impact on the time and effectiveness of spat collection.
Communities and farms in the Gambier Islands seems to be less impacted by the increase of temperature even if a change has been observed by most of the people.

6.2 Vulnerability

The Tuamotu islands seem to be more heavily impacted by extreme weather conditions which are never described as hurricanes but rather as depressions where the water enters the lagoon and causes some inundations and longlines displacement. In this archipelago the most perceived climate change related impact is the change in ocean temperature which was never described as an increase but rather as a shifts of dry and wet seasons. As most of the interviewees in Tuamotu are collectors, predicting the time of the change in ocean temperature is essential to identify the reproduction period of oysters and thus to collect spats. Little increase of sea level and erosion was noticed and the atolls are described as highly dynamics and resilient.
In the Gambier Archipelago, all interviewers agree that extreme weather conditions are not a problem in this area and no changes were noticed during the last 50 years. On the other hand, an increase of sea level has been observer in the main island and coastal erosion is evident in the surrounding atoll. Almost all producers/collectors and local communities observed a shift in seasons and extreme hot temperature which has an impact on the collection of spat, oyster survival, surrounding environment (fish and corals) and on the fruits/vegetable they depend on.

A second round of questions concerns the future changes in environmental conditions and the well-being of the sector and local community. People leaving closer to the seaside have already noticed the increase of sea level and houses and farms have been destroyed and rebuilt. The change in ocean temperature will lead to the decrease of pearl quality and oyster survival if the increase will happen too fast.
The lack of availability of food and water in the future is seen as a possible consequence of climate change but is not a major source of concern.
The socio-economic consequences to climate change related impact are the economic decline and migration since there are few other economic alternatives as profitable as pearl oyster farming in the islands.

6.3 Resilience

When asked about the ability of their community and the pearl oyster farming sector to adapt to climate change, there was a positive vision of the future. They describe themselves as resilient people with high capability to react and to adapt to changes. Only rapid and permanent changes will lead them to leave and to change activity.

According to them, adaptation strategies should be focused on facilitate the inclusion of the sector in the development and implementation of risk plan and disaster response plan, to increase public awareness about the impact of climate change, strength research/society collaboration, diversify economy/create new employment opportunities (integrate fishery, tourism or agriculture in communities) and most importantly better economic strategies for the sector to keep the production and having a higher quality and price.