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Integrated management of pearl culture in French Polynesia in the context of global change: Synopsis of existing results

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ABSTRACT

The paper presents a state of the art on knowledge of the black pearl oyster aquaculture at the scale of French Polynesia. It also introduces the main results obtained throughout the multi-partners POLYPERL project. The goal of this project was to develop an integrated and participative action-research of the pearl oyster culture system, focusing on the environmental, technological, economical and societal dimensions impacting the industry. The research proposed ranges from the understanding of biological phenomena of the production system to socio-economic aspects and governance of the industry, taking into account the management of anthropogenic, climate and health risks. We introduce here the different papers from the POLYPERL project that are compiled in this volume of ECSS dealing with recent scientific work that can contribute to sustainability of the pearl industry in French Polynesia.

1. Introduction

Close to thirty million people worldwide depend on coral reefs. Most live from fishing, tourism or aquaculture activity. If coral reefs are not protected in time, these populations and eventually small island countries will be condemned to disappear. So, worldwide, the conservation of these ecosystem services is considered as a management priority (Millennium Assessment, 2005). This situation is particularly striking with pearl farming industry in French Polynesia.

Indeed, in 30 years, the aquaculture of black pearl culture has become one of the most important industries (second rank for exportation values) in French Polynesia (Talvard, 2015; Le Pennec et al., 2010; Andréfouët et al., 2012; Gueguen and Mazouni, 2014). However, this industry, based on the exploitation of the pearl oyster *Pinctada margaritifera*, is currently undergoing an unprecedented crisis. As a result of the economic decline that the industry has experienced since 2001, the pearl culture industry is in a very difficult situation. The price of the pearl has collapsed (price per pearl was divided by a factor of 8) and is still decreasing. Consequently, a large number of farms have gone bankrupt or already closed, leading to substantial job losses for the country and resulting in a resumption of migration to Tahiti. While this serious crisis is partially due to internal causes (increase of the pearl production, disorganization of the sector, significant decrease in the average quality of the pearls exported), external factors have also a great influence (evolution of the market, economic crisis, etc …). In an attempt to reverse this trend, local authorities have established regulatory tools, promoted communication events, etc., whose effectiveness in the medium term have not yet been studied, due to the lack of robust indicators.

It is in response to this situation that the project POLYPERL was designed. By making a comprehensive analysis of the different components of the industry (technical, biological, economic, health and governance), we aimed to co-construct proposals for the management strategy of the sector. For that, POLYPERL project was split into complementary working packages, to embrace the different components of the pearl farming industry while maintaining between them a permanent interaction (Fig. 1). Project work consisted of assessing the means and levels at which technological and organizational progress can be made, taking into account maintenance of marine ecosystem capacity to provide these services. In addition, this work took into account the political, social and cultural context in which this research was conducted. Indeed, with this approach, different disciplines in the scientific

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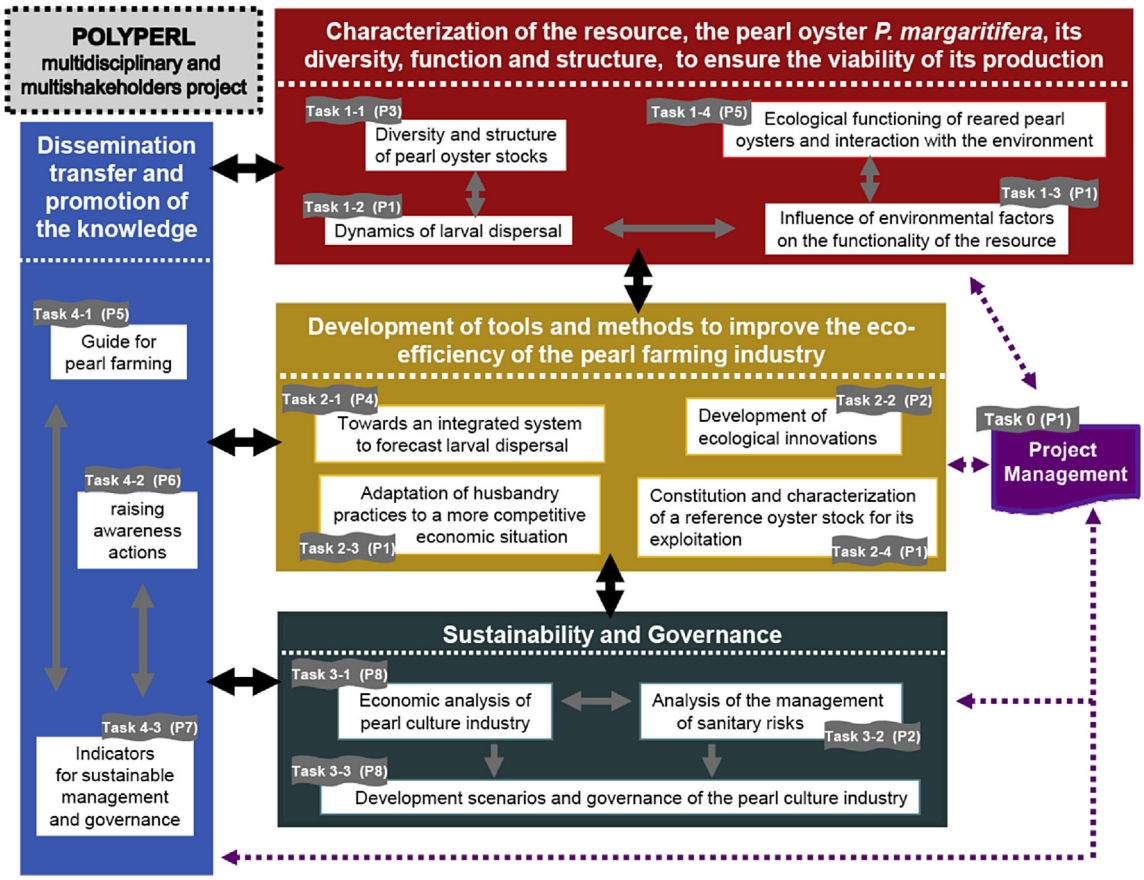

Fig. 1. Technical diagram of the ANR-POLYPERL Project (www.polyperl.org). POLYPERL is a global project taking into account an ensemble of research topics applied to "pearl farming" in French Polynesia and integrating risk management (anthropic, sanitary, social, economic and climatic). The objectives are to enable knowledge of the species and its culture and to provide innovations and decision-making tools in view of sustainable and integrated management of pearl culture in French Polynesia. The POLYPERL project is organised in 14 Tasks that are grouped in 4 Themes: (1) Characterization of the resource, the pearl oyster *Pinctadamargaritifera*, its genetic diversity, function and structure, so as to ensure the viability of its production; (2): Development of tools and methods to improve the eco-efficiency of the pearl farming industry, (3) Durability and governance and (4): Dissemination, transfer and promotion of the knowledge.

community were mobilized in close association with all the industry stakeholders: producers, managers and traders.

In this context, we show in this paper an overwiew of the pearl culture industry in French Polynesia. The main research programms of these last years on pearl oyster culture are presented with a focus on the influence of global change. The importance of the socio-economic aspects of this industry is also highlighted. In the conclusion part, we introduce the different papers form the POLYPERL project compiles in this special issue of ECCS.

2. French Polynesia and pearl culture

French Polynesia is made up of five socio-cultural archipelagos (Société, Tuamotu, Gambier, Marquises and Australes) and comprises 118 islands and atolls. Its total area is 5.03 million km^2 but the land area only accounts for 3500 km^2. Located in the South Pacific, French Polynesia is an isolated region with a population of 285 000 inhabitants. Pearl culture (Fig. 2) indeed has a key position in Polynesia on economic, environmental and social levels. This activity, spread over 25 Polynesian islands, contributes not only to slowing down the human migration from the other islands to Tahiti, but also helps planning and economic development of these areas. Pearl culture, which is directly dependent on the health of the lagoon ecosystem, is in fact the second source of revenue after tourism and is the first export industry (Talvard, 2015).

Pearl culture began to develop in French Polynesia in the early 1970s. The main advantage of this region, compared with other countries where the species *P. margaritifera* is present, is the spontaneous and virtually unlimited natural supply of spat (juveniles) in atoll lagoons. Rapid progress in terms of rearing and informed commercial policy succeeded in making the "Tahitian Black Pearl" a recognised luxury product that exported well to a responsive international market. High mortality of pearl oysters, which started in the mid 1980s, contributed to a scarcity of the product and thus to a significant increase in the gem price per gram. In 1986, the gem price per gram peaked at 80 € (Fig. 3). The epidemic was quickly contained by the implementation of appropriate regulations, and by rapid advances in farming and spat collecting techniques. These advances, in turn, led to the overproduction of pearls, often at the expense of quality. Moreover, the very rapid increase in the number of rearing concessions further boosted this overproduction. In 2000, production exceeded 11 tons with a price per gram of only 15 €. This greatly increased production and has contributed to increase in the volumes of gems exported at the expense of quality. A socio-economic analysis notes that this downward trend now appears to be stabilizing, but also reports that the situation remains fragile and at risk from another fall.

Yet, over the last 3 decades, this activity has become essential to the economy of French Polynesia. Pearls are the top export resource, with a value of 73.7 million euros in 2014 (Fig. 3). The