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SCIENCE IN CYCLES

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that support and
endanger humanity

EXCLUSIVE

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A pearl of a partnership

Dr Yannick Gueguen and Professor Nabila Mazouni discuss the efforts of a crucial initiative that aims to assess the sustainability of the pearl farming industry in French Polynesia and potential routes of growth

Pearl farming is essential to the economy of French Polynesia, generating thousands of jobs for the islands. What are the main concerns for the current state of pearl farming in the region?

Pearl culture has a key position in Polynesia on economic, environmental and social levels. This activity, spread over 22 Polynesian islands, contributes not only to slowing down human migration to Tahiti, but also helps with the planning and economic development of these areas. Pearl culture is in fact the second most profitable source of revenue after tourism and is the primary export industry.

As a result of recent economic decline, the pearl industry is now in a very difficult situation: the price of the pearl has collapsed and is still decreasing, and a large number of farms have gone bankrupt or already closed, leading to substantial job losses for the country and resulting in social difficulties. In an attempt to reverse this trend, locals have established regulatory tools and communication methods, the effectiveness of which have not yet been studied due to a lack of robust indicators. In response to this situation, the POLYPERL project was designed to provide some answers by analysing the many aspects of the industry.

Against this context, could you outline the main objectives of POLYPERL?

POLYPERL is an integrated, multidisciplinary and multi-stakeholder study of the pearl farming industry in French Polynesia. The work was proposed in order to analyse its sustainability and development prospects by testing different scenarios of industry evolution.



How does the project aim to support more sustainable pearl production methods and optimise profitability?

Research can make a valuable contribution and help secure and sustain production, while providing tools that will improve pearl product quality, business profitability and the added value of the end product.

Our work consists of assessing the means and levels at which technological and organisational progress can be made, taking into account maintenance of the ecosystem's capacity to provide these services. In addition, this work will consider the political, social and cultural context in which the research is conducted.

The analysis developed in POLYPERL aims to underline the main factors controlling pearl production, the market and the socioeconomic role of this activity. This will help develop a better understanding of oyster reproduction and growth in a changing environment, but will also involve a detailed breakdown of farming practices.

Can you summarise the field missions undertaken by POLYPERL over the course of 2012-13?

Field missions are essential for all aspects of POLYPERL and several have been undertaken since the project began.

Pearl oyster sampling has been carried out on selected islands to allow an inventory of the genetic diversity of pearl oyster populations in French Polynesia. A one-year study of the Ahe and Rikitea islands has been organised to investigate the influence of environmental mechanisms on the development and dispersal of *Pinctada margaritifera* pearl oyster larvae in the lagoon. Several field experiments were also carried out to evaluate the role of biofouling on the performance of oysters in terms of growth and on the fluxes of particulate and dissolved matter in the water column. Moreover, a number of grafting experiments have been organised at different farms (in Rangirao, Rikitea, Tahaa) to improve husbandry practices and study genetic/environment interaction. For the economic analysis of pearl oyster farms, a series of surveys (around 70 farms) have been performed on three archipelagos (Société, Gambier and Tuamotu).

These surveys will help to identify and explain technical and commercial choices, organisation modes, economic performance and other factors impacting the performance of pearl farms.

The project brings together 10 institutional, industrial and NGO partners. How does this collaboration of industries facilitate your work in the long term?

We have a working group of 10 partners offering skills in complementary disciplines and experience of partnerships in the field, ensuring a good understanding of local stakeholders and issues specific to this activity located in an overseas territory. This partnership, federated through POLYPERL, is a great opportunity for French Polynesia to obtain technological, environmental, economic and social solutions that will ensure sustainable pearl production for years to come.

PEARL OYSTERS BEFORE THE GRAFT, SUBJECTED TO BIOFOULING DEVELOPMENT

Pearl farm findings

Using dynamic interdisciplinary research methods, the **POLYPERL** project aims to help reverse the alarming decline of the French Polynesian pearl farming sector, the country's main export industry

PEARL FARMING HAS become increasingly essential to French Polynesia's economy over the last three decades. However, the turn of the millennium marked the start of an extended period of decline for this industry with a range of factors contributing to this downturn, including an increasingly competitive market, poorly organised sales, overproduction and a decline in the quality of the pearls being made available for export. Long dependent on financial support from mainland France, it is vital that industries native to the islands are given the best possible chance of survival.

Due to the country's reliance on the pearl farming industry, this decline could be potentially disastrous for French Polynesia's economy if no action is taken to rejuvenate the market.

The POLYPERL project, led by Yannick Gueguen at the French Research Institute for Exploitation of the Sea (Ifremer), in collaboration with Nabila Mazouni (Deputy Coordinator) at the University of French Polynesia, and funded by the French National Research Agency, was created to address the wide-ranging ramifications of this crisis.

POLYPERL is a truly interdisciplinary project, arising from a sequence of collaborations crossing a range of sectors and backgrounds. The 10 project partners include research institutes (Ifremer, IRD, universities, CNRS), the government service responsible for pearl farming, the pearl farm Gaugin's Pearl, a non-profit association Te mana o te moana and the biotechnology company Skuldtech in France. These partners encompass expert research teams, independent stakeholders and private firms, and it is only by bringing

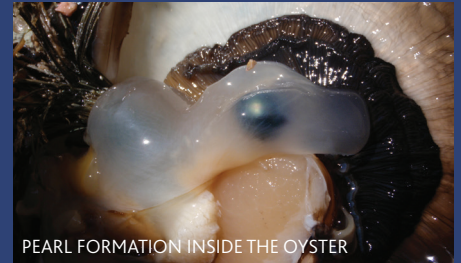
together these diverse parties that a future path for the French Polynesian pearl farming industry can be laid. "The methodology implemented in the POLYPERL framework is to conduct joint research on specific sites or through stakeholder interviews where the questions cut across disciplines. This includes the establishment of focus groups to identify structural axes for the sector," Mazouni explains. The objective of this approach is the development of a co-constructed diagnostic of the situation, from which several management scenarios will be developed.

Ultimately, the project partners are striving to holistically investigate the current state of pearl farming in the country, with the aim of identifying sustainable solutions to issues that have contributed to the industry's decline. The outcomes of this collaboration will increase the wider scientific community's understanding of pearl production and benefit French Polynesia's intellectual capital, economy and people.

A MULTI-PRONGED APPROACH

Since the factors that led to the decline of the pearl farming industry are manifold and complex, the diversity of the partners involved in POLYPERL has proven valuable. Project partners have targeted many areas that impact on the industry, from the natural biological production of pearls in French Polynesia to farming practices and the wider socioeconomic context in which pearls are traded.

The work comprises 14 tasks, each of which can be associated with POLYPERL's interconnected aims: to outline the characteristics of the resource (the pearl oyster *Pinctada margaritifera*)



PEARL FORMATION INSIDE THE OYSTER

and guarantee the viability of its production; improve the eco-efficiency of the pearl farming industry by refining tools and methods; promote durability and efficient governance; and disseminate, transfer and promote knowledge gained through the research.

As part of the project, the French oceanographic vessel *ALIS* spent over a month studying the hydrobiological and hydrodynamic features of the lagoon in the Ahe atoll. This research was conducted with the aim of developing a pilot system capable of forecasting larval dispersal in pearl oysters. This will allow increased planning around the harvesting of pearl oysters, making pearl farming far more sustainable in the long term.

NATURE'S BOUNTY

French Polynesia is renowned for its black pearls, and they are the product around which the pearl farming crisis has hinged. There are three factors that impact heavily on the potential financial returns from pearl farming: surface quality, colour and growth potential. Consequently, much of the group's research has considered how these factors are influenced and how they can be optimised.

One important influence on the growth of *P. margaritifera* is climate change. Climate affects many aspects of *P. margaritifera*'s development, and understanding the precise impacts of current localised climate changes could lead to the identification of optimal rearing sites and the modelling of suitable habitats.

Climate change has so far resulted in rising sea levels, warming lagoons, ocean acidification and increasingly violent cyclones in the region. These changes present various threats to *P. margaritifera* harvesting, and can result in both the loss of pearl farming infrastructure and damage to the oysters themselves. Ocean acidification is a particularly serious threat, since it can prevent shell formation at the larval stage. Climate change can lead to poor quality pearls or, in some cases, no pearls being produced at all. These are the sorts of threats POLYPERL is tasked with confronting.

Creating high quality pearls in large quantities over a sustained period of time is crucial if the industry is to survive. In particular, improving the processes bound up with pearl culture may help to produce a better quality product. Cultured pearls are created through the interaction of the biological products of two molluscs. This involves the implantation of a bead nucleus and a piece of mantle tissue from a donor oyster into the gonad of a host oyster: "The donor strongly influences some cultured pearl quality traits," Gueguen points out. "Generation of selected donor lines from these stocks through hatchery production would be one way to increase the quality of cultured pearl farming of *P. margaritifera* in French Polynesia."

FORGING A PATH

POLYPERL still has plenty of work to complete and is projected to continue into 2014. The Second Annual Meeting of the project is due to take place in the spring of 2014, and is sure to feature a stimulating



assembly of research, expert knowledge and new insights into the French Polynesian pearl farming industry.

The project's results are due to be exploited in numerous ways: findings are expected to feature at conferences and in scientific journals; strategies for boosting the pearl farming industry are to be passed onto stakeholders; recommendations for those involved in the pearl farming industry are to be collated and disseminated to pearl farmers, politicians and other relevant parties; and the project's researchers will deliver training and lessons at the Centre des Métiers de la Nacre et de la Perliculture, French Polynesia, where Polynesian students are trained in pearl farming.

The project is undoubtedly an excellent example of how a number of interconnected goals can be met by bringing together partners with distinct but complementary backgrounds and expertise. As a result, POLYPERL is now set to provide the French Polynesian pearl farming industry with tools for a more sustainable future.

Ultimately, the project partners are striving to holistically investigate the current state of pearl farming in the country, with the aim of identifying sustainable solutions to issues that have contributed to the industry's decline

INTELLIGENCE

POLYPERL

OBJECTIVES

To improve knowledge of the pearl oysters species and its culture and to provide innovations and decision-making tools in view of sustainable and integrated management of pearl culture. POLYPERL will enlarge the range of technological, economic and social solutions in order to guarantee viable pearl culture in French Polynesia.

PARTNERS

Ifremer, France and French Polynesia • **Direction des Ressources Marines**, French Polynesia • **CRIOBE**, USR 3278 CNRS EPHE, France and French Polynesia • **Institut de recherche pour le développement (IRD)**, New Caledonia and French Polynesia • **University of French Polynesia**, French Polynesia • **Te mana o te moana**, French Polynesia • **LAMETA, UMR CNRS, University of Montpellier, INRA and SupAgro**, France • **AMURE, UMR Ifremer, UBO**, France • **Gauguin's Pearl**, French Polynesia • **Skuldtech**, France

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Ifremer

