Socio-economical needs and Tridacna maxima giant clam fishery development at Tatakoto atoll, Tuamotu archipelago

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Socio-economical needs and *Tridacna maxima* giant clam fishery development at Tatakoto atoll, Tuamotu archipelago.

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Several lagoons of the atolls of Tuamotu Archipelago and volcanic islands of the Australes Archipelago (French Polynesia) are characterized by enormous populations of the clam *Tridacna maxima,* a species endangered in many locations worldwide. The growing harvesting pressure combined with the relatively small size of these lagoons call for management action to sustain these fisheries. The French Polynesia Fishery Service funded in 2002 a multi-disciplinary research program to assess the natural clam stocks size, its dynamics and to test the feasibility of spat collecting, especially at Tatakoto atoll, the main clam flesh exporter of the Tuamotu Archipelago.

Natural clam stocks and community structures were first assessed. A combination of remote sensing and *in situ* data collection provided an estimate of the natural clam stocks and its community structure. The legally harvestable stock (>12cm) present in the shallower water (<1.5m) yield 307 ± 69 t of commercial clam flesh.

Invertebrate fishery management models are still in their infancy. Classically, overfishing has been divided into "yield overfishing" in which high fishing intensity reduces the potential yield, and "recruitment overfishing" in which the depletion of the reproductive population results in poor recruitment. Yield per Recruit *(Y/R)* and Spawning unit Per Recruit *(SPR)* approaches have been developed for finfish applications and have no explicit consideration of spatial structures that are critical for invertebrates. The instantaneous rate of total (Z) and natural mortality (M) are critical parameters for model parameterisation but estimating total (Z) and fishing (F) mortality require strong assumptions, especially stability of growth, mortality and recruitment in space and time. For a first diagnostic regarding overfishing, we monitored *in situ* giant clams population dynamic (growth, mortality) and fishery data (export, number of fishers, catch per unit of effort, size structure of the catch). With respect to yield overfishing, Tatakoto is below the fishing level of yield maximisation and therefore fishing effort could theoretically increase. However, numerous case study of invertebrate fishery collapses call for a precautionary approach and for different modelling strategy and parameterization. An adaptative co-management is therefore proposed to allow sustainable economical incomes and data acquisition for management. Indicators that measure key aspects of the resource and fishery are needed in the perspective of their incorporation in a decision-making framework.

If management actions are too constraining for fisheries, spat collection offers alternative solutions that could also result in fishing effort reduction. Successful experiments of spat collecting, grow-out systems, transports and restocking were prerequisite to any technology transfer towards local villagers and private parties. With an average density superior to 450 ind/m², and an overall settlement rate of 78.9 %, spat collecting was very successful. Transport trials between islands provided average survival rate of 96 %. This giant clam production scheme proves to be competitive with classic hatchery/nursery-based production schemes. It provides exciting perspectives for restocking and stock enhancement, ecotourism and restoration for a variety of locations.

Technology transfer is possible as soon as new policies ruling these activities are established, especially the implementation of a tracking and labelling system. Within this framework, balanced efforts between fishery and spat collections will provide a path for sustainable development for several remote and forgotten islands.