

## Grain 3: The main past and current fish farming systems

**Responsible: Olivier Mikolasek, Cirad**

### The concept of fish farming system

A fish farming system can be defined as a set of elements in dynamic interactions, organised by humans in function of their objectives, with the goal of making one or several fish population reproduce and grow, while valorising and renewing several resources.

There is a huge diversity of fish farming systems, because human resources and production factors can be mobilized according to a large number of combinations in time and space. For past and current fish farming systems to become perennial, they must satisfy their promoters, be profitable and attend the present and future challenges of societies.

This diversity can be analysed according to several point of views, leading to the development of typologies, of which one of the most common relates to the level of inputs' intensification.

In the most extensive systems, such as the very old Hawaiian coastal ponds, or Venetian valliculture that appeared as early as the 17th century, wild fry freely enter the ponds where they get trapped by a grid after growing out.

Over the centuries, human societies have conceived and developed semi-intensive systems integrated in their surrounding environment. Some are particularly complex and efficient, like for example, the Chinese carp polyculture that associates fish species with supplementary diets in order to make a better use of all the trophic resources that can be found in a pond, the Vietnamese VAC system that combines a garden with a fish pond and livestock, or the integrated pig-fish, chicken-fish, duck fish farming systems. Although traditional, they are remarkable by their capacity to recycle locally available bio-resources.

In the most intensive systems, most of which appeared during the 20th century, feed must be distributed as pellets that are converted into fish flesh in tanks, raceways or floating cages. Water is a fluid that brings in oxygen and evacuates wastes.

### Quantitative contribution of the different fish farming systems

As of today, fish farming ponds remain the dominant production system. In 2008, 80% of the global fish production was originating from freshwater (70%) or coastal ponds (10%). The remaining 20% was mostly produced in pens or cages. Approximately one fourth of the fish grew in extensive unfed systems; half in semi-intensive fertilized systems with or without additional feeding; and the remaining, in intensive systems fed using commercial pellets (Waite and al., 2014).

Family fish farms well integrated in their rural territory still dominate the production, particularly in Asia, although industrial fish farms growingly emerge in many countries.

### Current trends of small-scale and agro-industrial systems

The trend is towards an increase of the fed species but, paradoxically, also towards an intensification of agricultural land through fish farming.

Those dynamics of horizontal integration where fish farming contributes to intensification of agricultural production systems is a reality, certainly very old, but still relevant as shown by the example of the rice-fish culture in China, where the surfaces were multiplied by 13 over the last two decades (FAO, 2012).

This horizontal integration is also developing successfully around the world to supply local markets: it is for example the case in Forestry areas of Guinea with lowland rice-fish culture, or in the Southern states of Brazil with swine-fish associations in aerated ponds, etc.

In parallel, the dynamic of vertical integration, supported by industrial groups, produces large quantities of fish in floating cages to satisfy the lucrative markets of the developed countries or the large cities of the developing countries: one can cite the example of Norwegian or Chilean salmon, or the Vietnamese panga etc.

### The need to assess the economic, social and environmental impacts

The relative contribution of the different farming systems, whether they are small-scale, employer or capitalistic, to food and nutritional security of human populations is still under debate. Indeed, although more than 70 per cent of Asian aquaculture production come from small semi-intensive and 'traditional' farms, some scientists argue that medium and large-scale aquaculture enterprises based on feed would contribute more effectively to poverty alleviation and food security improvement. They would even be the only way of developing African aquaculture. The studies on which they base their analysis remain however too limited to allow for such a generalization. More generally speaking, the impacts of different types of fish farming on sustainable development of territories remain insufficiently documented to respond to other global issues such as the water resources management or the recycling of effluents and waste. But this is another story that will be presented in another topic.

To learn more on FS, aquaculture typologies and current debates

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