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What are the potential routes for the development of ecology-based alternatives for fish production in shallow lakes?

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Fish farming in ponds is the most commonly used rearing system worldwide (FAO, 2014). This is more often polyculture in a variety of environments and with highly diversified methods of management and practices.

DEVELOP POLYCULTURE SYSTEMS

Combining different animals species (e.g. polyculture of Chinese carps)

1. Using of multiple food resources and habitats
2. Rearing fish with different sensitivity levels to environmental change

Rahman *et al.* (2006)
Aquaculture, 257, 359-372.

RECYCLING OF NUTRIENTS BETWEEN FARM COMPONENTS

Combining different animal productions

(e.g. Integrated Agriculture Aquaculture Systems)

Using waste from a production system as input to other production systems

Prein (2002)
Agricultural Systems, 71, 127-146.

Nhan *et al.* (2007)
Agricultural Systems, 94, 445-458.

For fish production in shallow lakes, these few examples highlight opportunities to stimulate and valorize natural processes in order to reduce both inputs and pollution.

5

Increasing diversity within animal production systems to strengthen their resilience

4

Decreasing pollution by optimizing the metabolic functioning of farming system

3

Decreasing the inputs needed for production

STIMULATE THE NATURAL PRODUCTIVITY OF FISHPONDS

Increasing the periphyton development which provides:

1. Natural food for fish (increase of productivity)
2. Shelter and reproduction zones
3. Improvement of water quality

Azim *et al.* (2002)
Aquaculture, 213, 131-149.

Crab *et al.* (2007)
Aquaculture, 270, 1-14.

Different examples are given to illustrate the possible mobilization of the five agroecological principles, proposed by Dumont *et al.* (2013) for the design of sustainable fish production systems.

1

Adopting management practices aiming to improve of animal health

2

Preserving biodiversity in agroecosystems by adapting some management practices

3

MAINTAIN and/or DEVELOP PLANT ZONES ON POND BANKS

Recognition of multiple roles:

1. Biodiversity support (refuge, nesting habitat for waders, amphibians, dragonflies)
2. Food resources
3. Water purification
4. Attractive habitats (fish reproduction)

Bernard (2008)
PhD, ENS, Lyon, France.

Wezel *et al.* (2014)
Limnology, 15, 213-223.

Mobilization of these agro-ecological principles sets an ambitious course for the future. However implementation of suitable solutions should take into account local contexts.