



Aquaculture Systems

Aquaculture

Aquaculture involves cultivating freshwater and saltwater populations under controlled conditions, and can be contrasted with commercial fishing, which is the harvesting of wild fish.

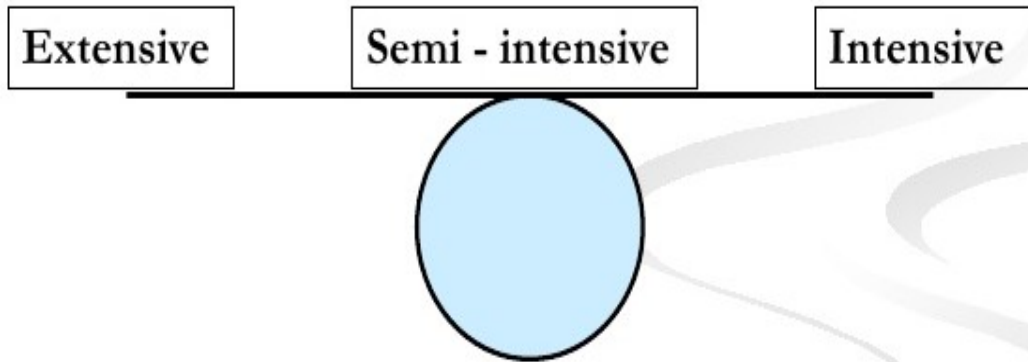
Pisciculture

Fish farming or pisci-culture is the principal form of aquaculture that involves raising fish commercially in tanks or enclosures, usually for food.

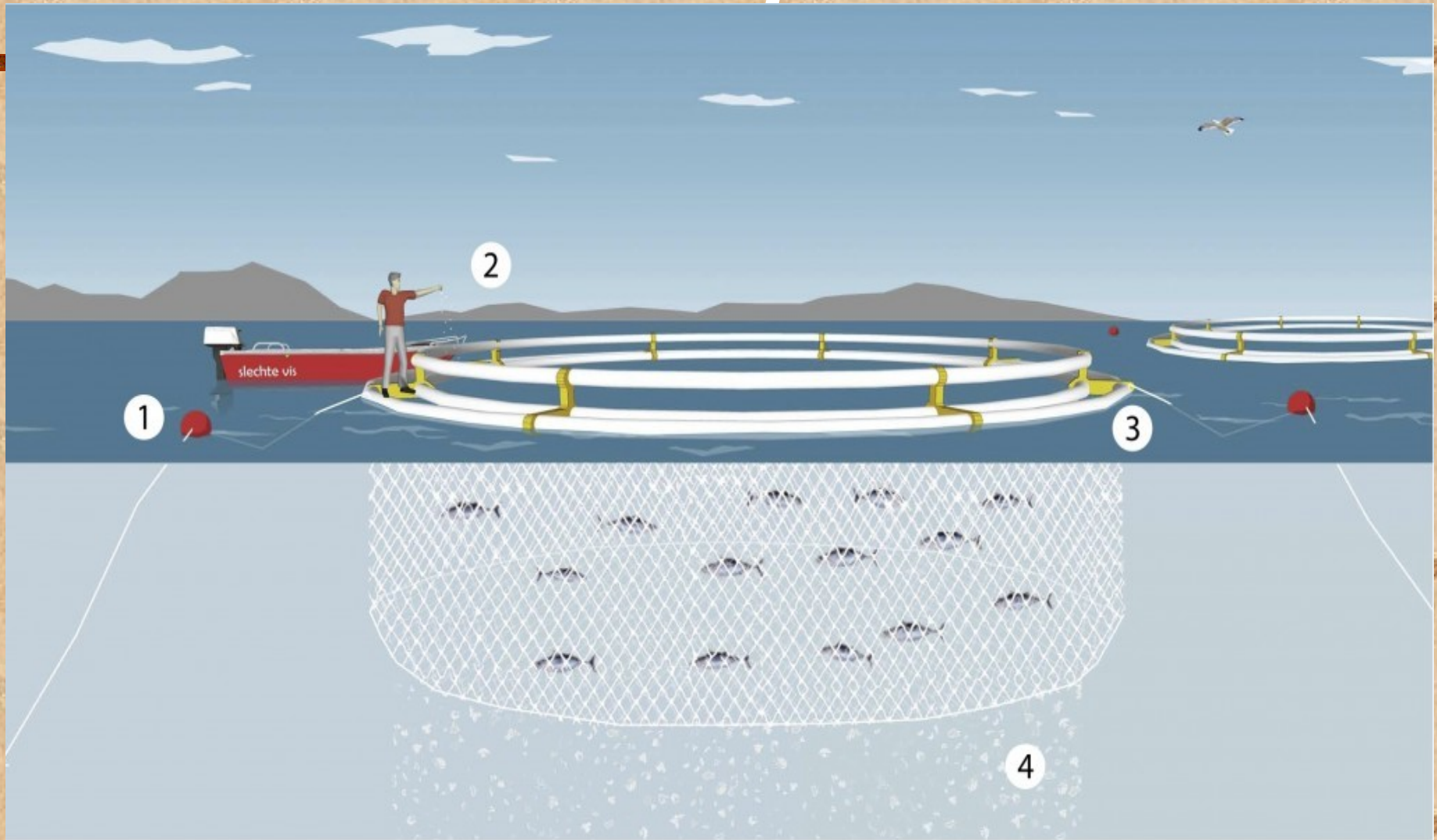
Steps in the Culture

1. Pond Preparation
2. Water Culture
3. Stocking
4. Feeding Management
5. Water Quality Management
6. Sampling
7. Harvest

Types of Fish Culture



Extensive Aquaculture



1. The cage is moored to the ocean floor
2. Fishmeal based feeds are added to the cages
3. Buoyant tubes keep the cages afloat
4. Fish faeces and waste fall through the cages

Extensive Aquaculture

- ✓ Extensive systems use low stocking densities (e.g., 5000-10000 shrimp post larvae (PL)/ha/crop)
- ✓ No supplemental feeding is done
- ✓ Fertilization may be done to stimulate the growth and production of natural food in the water.
- ✓ Water management is totally dependent on tidal fluctuation.
- ✓ Production is generally low at less than 1 t/ha/y.
- ✓ The stock is left to grow on its own, utilizing natural food sources.
- ✓ No or less predation control in this type of aquaculture
- ✓ It is qualified as 'fish production'
- ✓ Prawns, muscles, seaweed, carp, tilapia, tuna and salmon are cultured mostly by this method.

Design of Extensive Culture System

Place excavated material above waterline, and slope to drain.

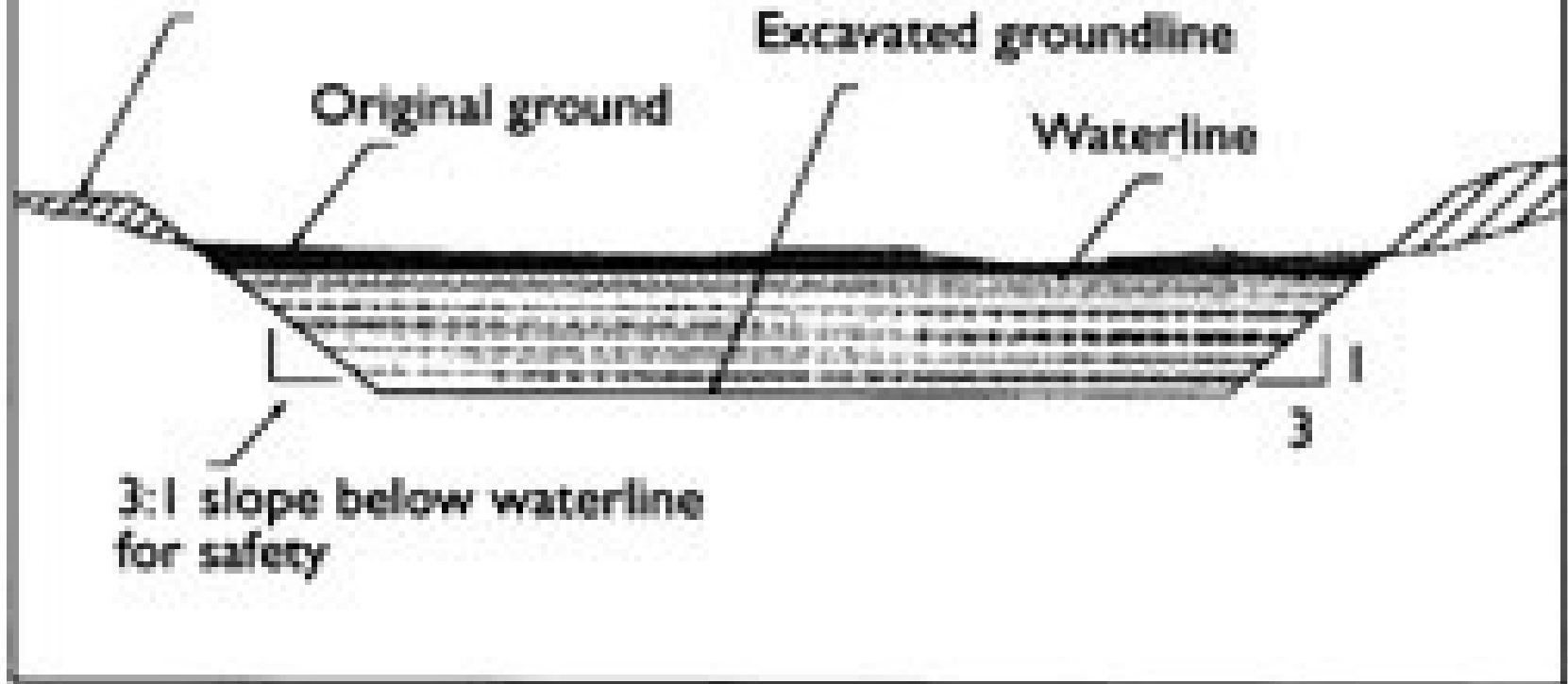


Figure 3. Typical section of an excavated pond (not to scale)

Steel Made Cages



Plastic Made Cages



<http://fish-farming.net/fish-farming>

Circular Cages



Rectangular Cages



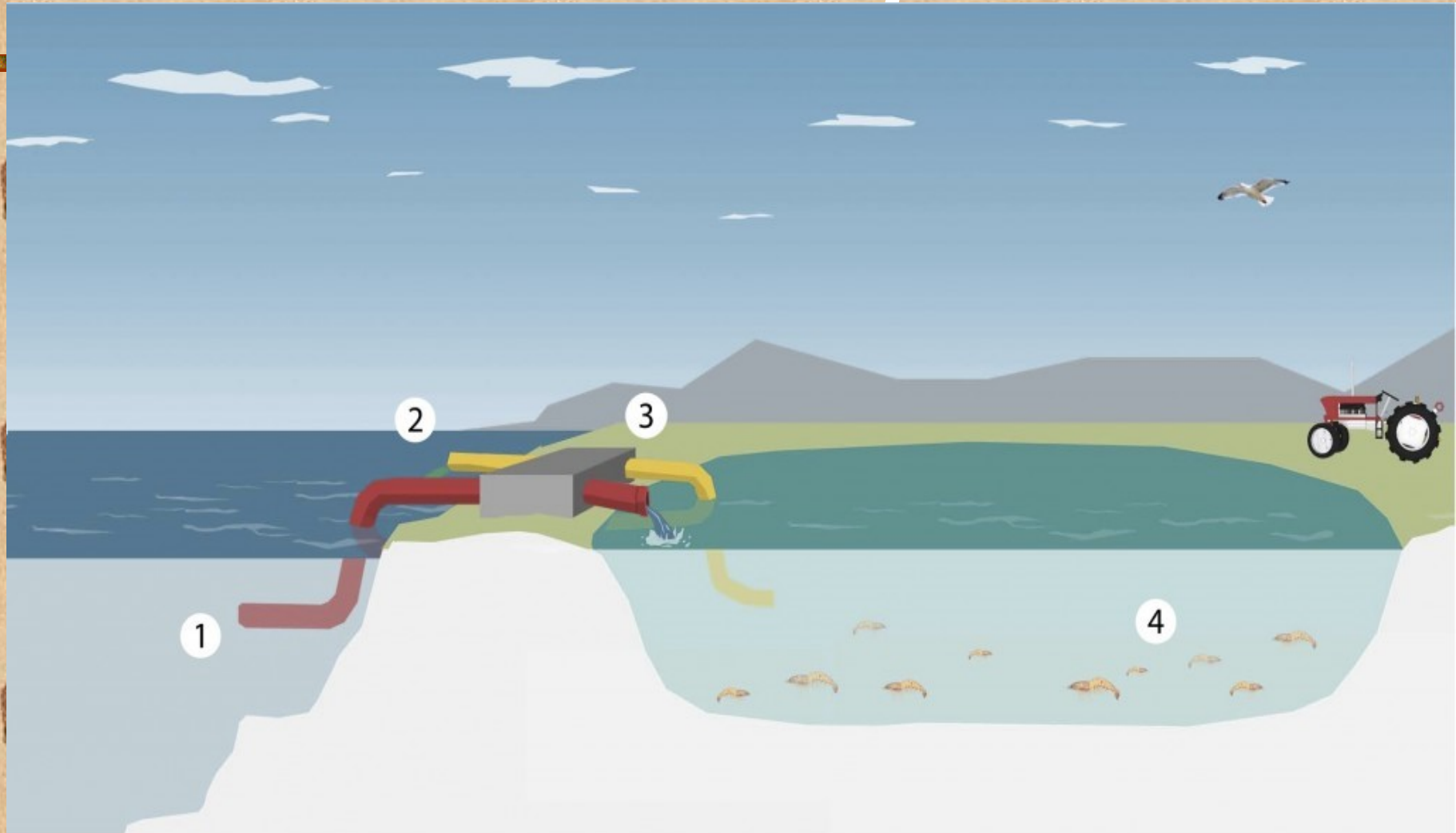
Advantages of Extensive Aquaculture

1. It can be undertaken in existing farm dams.
2. It negates the need for costly built structures.
3. It lowers overheads and production costs due to no feeding and aeration requirements.
4. Lowers the labor costs.
 - ✓ low stocking densities
 - ✓ Less attention to water quality issues and
 - ✓ stock monitoring
5. Many other uses of the waterway, such as recreational boating and fishing, occur simultaneously

Disadvantages of Extensive Aquaculture

1. Natural habitat destruction (Example: Philippines, shrimp aquaculture, destruction of thousands of acres of mangrove fields)
2. The introduction of invasive species into ecosystems
3. Foreign fish upset the genetic variability of the species, more prone to disease and infection.
4. Some farmers protect their stocks from predatorily birds such as pelicans and albatross by shooting sometimes endangered creature
5. Diseases and Parasites (Example: "black gill" diseased caused by fungus, bacteria or detritus. Necrosis and browning of exoskeleton)
6. A non-reliable water supply (e.g. drought)

Semi-intensive Aquaculture



1. Inlet for ocean water 2. Outlet for waste water 3. Pump 4. Prawns are often cultivated using this method.

Advantages of Semi-Intensive Aquaculture

1. The amount of harvested fish can be planned.
2. Average 5 cubic meter water is used per kg fish.
3. The fish can grow faster and to a larger size.
4. Supplementary feed is given at least two times per week

Disadvantages of Semi-Intensive Aquaculture

1. Natural habitat destruction

Example: Philippines, shrimp aquaculture, destruction of thousands of acres of mangrove fields

1. Constant outflow of water may also reduce surrounding water quality if not treated adequately.
2. Food safety is medium level and customer preference is high.
3. The oxygen amount is effected by the fertilization in the ponds, reduced oxygen can affect the fish health/welfare (in negative way).
4. It is having more stocking density as compared to extensive aquaculture (1-5 kg/cubic meter)

Intensive Aqua culture





Advantages of Intensive Aquaculture

1. Through this system, many draw backs of aquaculture are minimized.
2. Introduction of pollutants and toxicants is minimized.
3. Creates many employment opportunities.
4. It is fully controlled by farmer.
5. More fish can be produced from short place.

Disadvantages of Intensive Aquaculture

1. Water has to be continuously recycled and monitored.
2. To prevent deterioration of water quality, water has to be treated mechanically.
3. More expensive cost of maintenance and a non-natural environment for fish growth.
4. More expenditure of labor.
5. Cost of input per unit of fish weight is higher than extensive farming.
6. It is not possible to make fish big sized in system.

Parameter	Extensive	Semi-Intensive	Intensive
Species Used	Monoculture or Polyculture	Monoculture	Monoculture
Stocking Rate	Moderate	Higher than extensive culture	Maximum
Engineering Design and Layout	May or may not be well laid-out	With provisions for effective water management	Very well engineered system with pumps and aerators to control water quality and quantity
	Very big ponds	Manageable-sized units (up to 2 ha each)	Small ponds, usually 0.5-1 ha each
	Ponds may or may not be fully cleaned	Fully cleaned ponds	Fully cleaned ponds
Food and Feeding Regimen	None	Regular feeding of high quality feeds	Full feeding of high-quality feeds
Cropping Frequency (crops/y)	2	2.5	2.5
Quality of Product	Good quality	Good quality	Good quality
	Variable sizes	Uniform sizes	Uniform sizes
Disease outbreak	More disease outbreaks can occur and can not be controlled	Disease outbreak can be controlled	Disease outbreak can be controlled

Hydroponic Culture

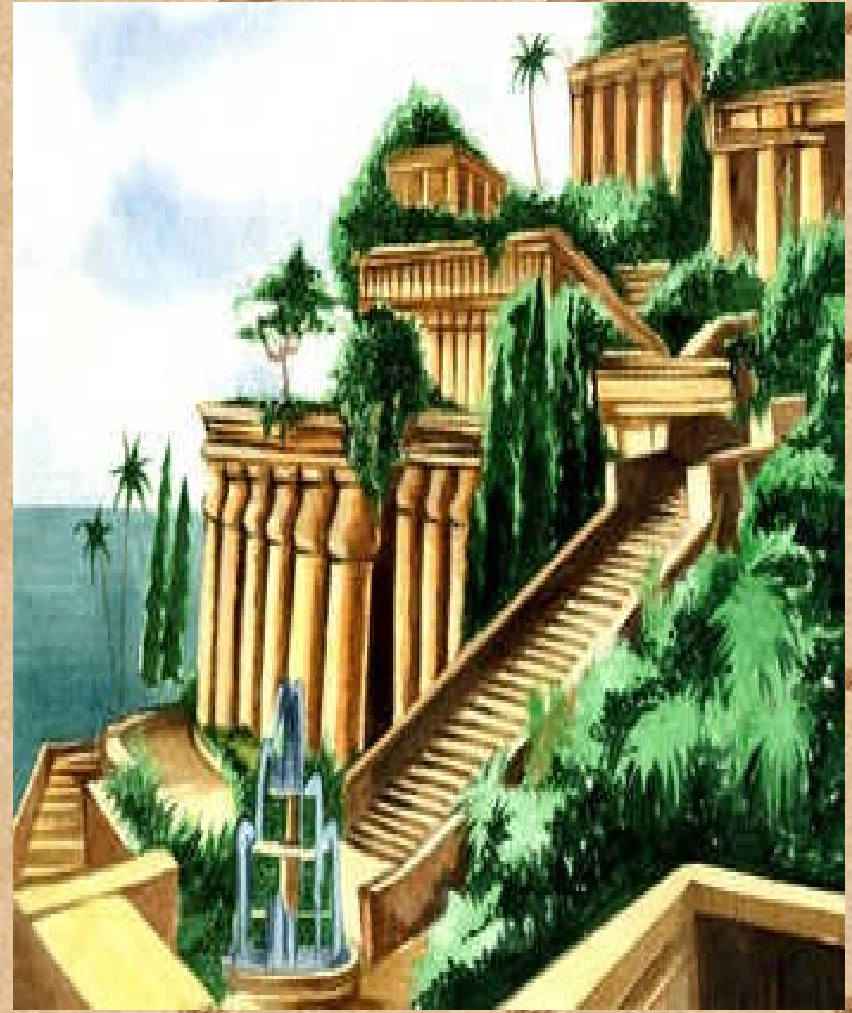
Hydroponics is a subset of hydroculture and is a method of growing plants using mineral nutrient solutions, in water, without soil. Terrestrial plants may be grown with their roots in the mineral nutrient solution only.

1. It is an eco-friendly method
2. It minimizes use of water and potentially harmful chemicals.



History

1. Many different civilizations have utilized hydroponic growing techniques throughout history.
2. Hanging gardens of Babylon, somewhere in (Iraq)



History

3. Egyptian hieroglyphic records date back several hundred years B.C. describe the growing of plants in water.

4. Floating gardens of the Aztecs of Mexico



NUTRIENTS NEEDED FOR PLANT LIFE

- Nitrogen
- Phosphorous
- Potassium
- Sulphur, Calcium, Magnesium
- Copper, Boron, Zinc, Manganese

IS PH IMPORTANT IN HYDROPONICS?

1. The control of pH is extremely important, not only in hydroponics but in soil as well.
2. Plants lose the ability to absorb different nutrients when the pH varies.
3. The ability to quickly and easily test and control pH in hydroponics is a major advantage over dirt gardening, where testing and adjusting the pH is much more complicated and time consuming.

ADVANTAGES OF HYDROPONIC


1. Superior taste, quality, appearance, uniformity, and extended shelf life of hydroponic vegetables.
2. No sterilization of growing media required.
3. No cultivation, no soil borne diseases or insects. Allows uniform water availability to plants.
4. Closer plant spacing is possible
5. Less water required and less fertilizer needed

DISADVANTAGES OF HYDROPONICS

1. Limited production in comparison to field conditions. Initial setup cost is high.
2. As the necessary equipment are expensive.
3. Hydroponic gardens are influenced by power cut.
4. Water borne diseases can quickly spread right through the hydroponic gardens
5. If the hydroponic system fails it can leads to rapid plant death and losses.



There are 4 basic types of hydroponic systems;

- Wick,
 - Water Culture,
 - Ebb and Flow (Flood & Drain),
 - Aeroponic.
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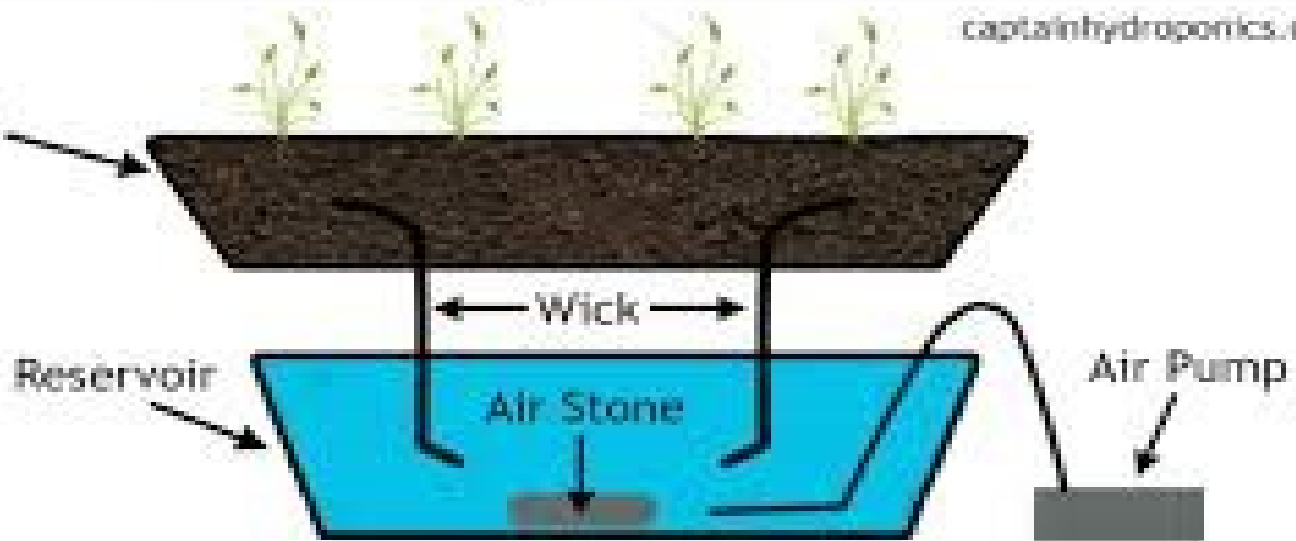
WICK SYSTEM

The Wick system is by far the simplest type of hydroponic system. This is a passive system, which means there are no moving parts. The nutrient solution is drawn into the growing medium from the reservoir with a wick.

Wick System

captainhydroponics.com

Grow tray and growing medium



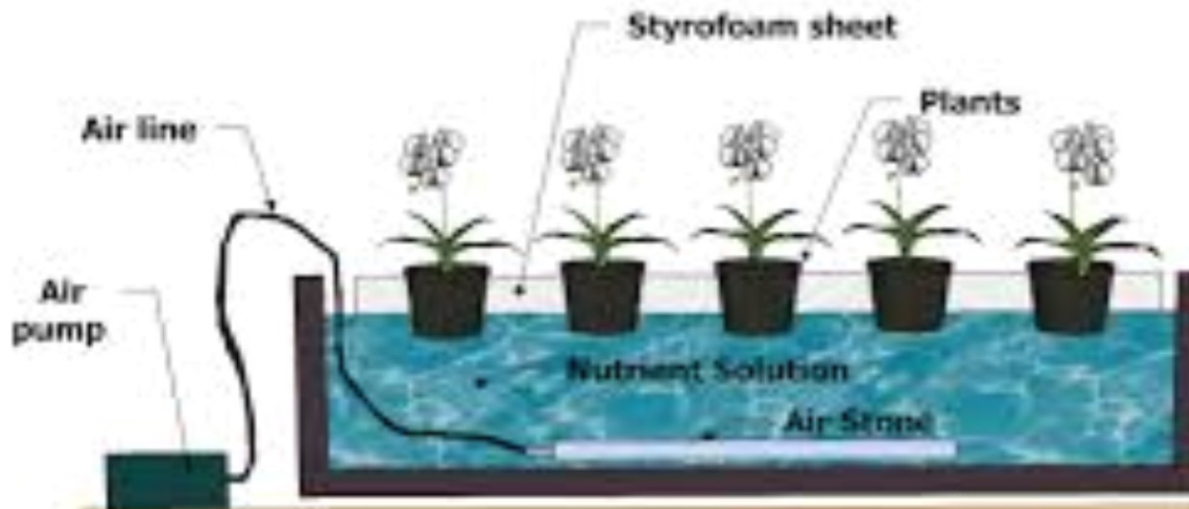
Pros:

- 1) Simple
- 2) Passive
- 3) No Timer Required

WATER CULTURE

The water culture system is the simplest of all active hydroponic systems. The platform that holds the plants is usually made of Styrofoam and floats directly on the nutrient solution. An air pump supplies air to the air stone that bubbles the nutrient solution and supplies oxygen to the roots of the plants.

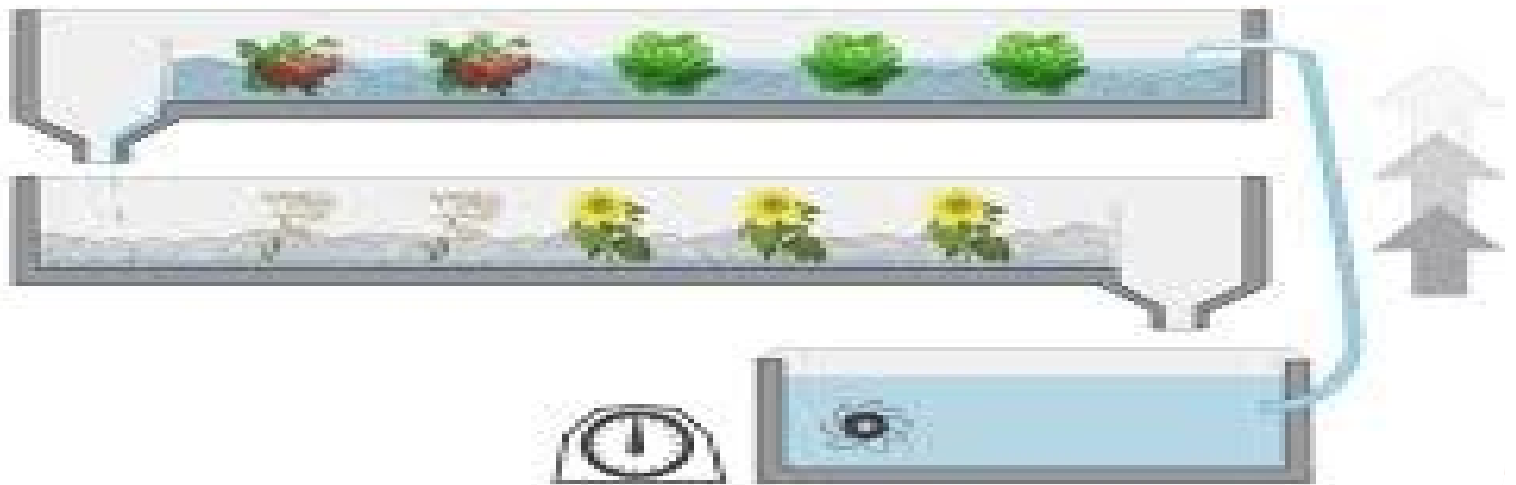
Typical Water Culture System



EBB & FLOW

- The Ebb and Flow system works by temporarily flooding the grow tray with nutrient solution and then draining the solution back into the reservoir. This action is normally done with a submersed pump that is connected to a timer.
- When the timer turns the pump on nutrient solution is pumped into the grow tray. When the timer shuts the pump off the nutrient solution flows back into the reservoir.

ebb and flow



AEROPONIC

The aeroponic system is probably the most high-tech type of hydroponic gardening. The roots hang in the air and are misted with nutrient solution. The misting are usually done every few minutes. Because the roots are exposed to the air, the roots will dry out rapidly if the misting cycles are interrupted

Aeroponics system

