

# Introduction to Aquaculture

## Introduction to Aquaculture

Key concepts, benefits, challenges, and basic practices

### 1. What Is Aquaculture?

| Definition                                                                                                                                                                             | Scope                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>Aquaculture</b> – the controlled cultivation of aquatic organisms (fish, crustaceans, mollusks, algae, and aquatic plants) for food, restoration, research, or ornamental purposes. | Encompasses <b>freshwater</b> and <b>marine</b> systems, ranging from small-scale ponds to large offshore cages. |

### 2. Historical Perspective

| Period              | Milestones                                                                         |
|---------------------|------------------------------------------------------------------------------------|
| Pre-historic        | Evidence of fish ponds in ancient China (~ 4000 BC) and Egypt.                     |
| Classical antiquity | Roman and Greek texts describe fish tanks and sea-weed farms.                      |
| 19th-century        | First modern fish hatcheries (e.g., U.S. <i>Umatilla</i> hatchery, 1888).          |
| Mid-20th-century    | Rapid expansion of intensive systems (e.g., shrimp ponds in Southeast Asia).       |
| 21st-century        | Integration of biotechnology, recirculating systems, and offshore cage technology. |

### 3. Types of Aquaculture Systems

| System          | Environment                                 | Typical Species        | Key Features                                         |
|-----------------|---------------------------------------------|------------------------|------------------------------------------------------|
| Extensive ponds | Shallow earthen or liner ponds (freshwater) | Tilapia, carp, catfish | Low input, natural productivity, large surface area. |

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| System                                                             | Environment                                          | Typical Species                             | Key Features                                                                                          |
|--------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Intensive tanks /<br>Recirculating<br>Aquaculture Systems<br>(RAS) | Closed-loop tanks<br>(indoor or greenhouse)          | Salmon, trout,<br>barramundi                | High stocking density, water<br>reuse, precise control of<br>temperature, O <sub>2</sub> , and waste. |
| Cage culture                                                       | Floating cages in<br>lakes, rivers, or oceans        | Salmon, sea<br>bass, tuna                   | Utilizes natural water flow;<br>moderate-to-high density.                                             |
| Integrated Multi-<br>Trophic Aquaculture<br>(IMTA)                 | Combines species<br>from different trophic<br>levels | Fish + mussels<br>+ seaweed                 | Waste from one species<br>serves as feed/nutrients for<br>another, enhancing<br>sustainability.       |
| Algal farms                                                        | Open ponds,<br>photobioreactors                      | Spirulina, micro<br>algae                   | Produces feed, nutraceuticals,<br>biofuels.                                                           |
| Hatcheries                                                         | Controlled incubators<br>& rearing tanks             | All major<br>species (early<br>life stages) | Produces seedstock for grow-<br>out operations.                                                       |

## 4. Major Species Groups

| Group                     | Representative Species                                          | Economic Importance                                            |
|---------------------------|-----------------------------------------------------------------|----------------------------------------------------------------|
| Finfish                   | Atlantic salmon, Nile tilapia, Pacific<br>white shrimp, catfish | Primary source of global aquaculture<br>protein.               |
| Crustaceans               | Pacific white shrimp, giant river<br>prawn, crayfish            | High market value, especially in Asia.                         |
| Mollusks                  | Pacific oyster, Manila clam, abalone                            | Low feed conversion; ecosystem<br>services (water filtration). |
| Aquatic plants &<br>algae | Seaweed (kelp, nori), Spirulina                                 | Food, feed additive, bioactive<br>compounds.                   |

## 5. Benefits of Aquaculture

# Introduction to Aquaculture

## 1. Food Security

- Supplies >50% of the world's fish for human consumption.
- Provides high-quality protein, essential fatty acids (EPA/DHA), vitamins, and minerals.

## 2. Economic Growth

- Generates employment (farm workers, processing, logistics).
- Supports rural development and export earnings.

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