

Introduction to Aquaculture

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Key concepts, benefits, challenges, and basic practices

1. What Is Aquaculture?

Definition	Scope
The cultivation of aquatic organisms (fish, crustaceans, mollusks, algae, and aquatic plants) under controlled conditions.	Includes freshwater, brackish, and marine environments; covers hatcheries, grow-out farms, and integrated multi-trophic systems.
- Often called “fish farming”, but the term encompasses a much broader range of species and production methods. - Complements wild capture fisheries by providing a reliable, year-round supply of seafood.	

2. Historical Perspective

Era	Milestones
Pre-modern (ancient times)	Carp ponds in China (~2000 BC), tilapia in Egypt, oyster beds in the Roman Empire.
19th-century	First scientific fish hatcheries (e.g., U.S. Fish Commission, 1872).
Mid-20th-century	Expansion of intensive marine cage culture (salmon, tuna).
Late 20th–21st-century	Rapid growth in Asia; emergence of recirculating aquaculture systems (RAS) and offshore platforms.

3. Why Aquaculture Matters

3.1 Food Security

- Supplies ~52% of the global fish consumption (FAO, 2022).
- Provides high-quality protein, essential fatty acids (EPA/DHA), vitamins, and minerals.

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3.2 Economic Benefits

- Generates employment: ~**207million** jobs worldwide (direct & indirect).
- Supports rural livelihoods and export markets, especially in Southeast Asia, Latin America, and Africa.

3.3 Environmental Advantages (when well?managed)

- Reduces pressure on over?exploited wild stocks.
 - Can be integrated with agriculture (e.g., rice?fish systems) to recycle nutrients.
 - Offers potential for **carbon sequestration** through seaweed and bivalve culture.
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4. Core Components of an Aquaculture System

1. Species Selection

- Biological suitability (temperature, salinity, growth rate).
- Market demand and price.
- Environmental impact (e.g., invasive potential).

2. Production System Types

- **Extensive**: Low input, large ponds/lakes, natural productivity.
- **Semi?intensive**: Supplemental feeding, moderate stocking density.
- **Intensive**: High stocking density, formulated feeds, water treatment (e.g., RAS).
- **Integrated Multi?Trophic Aquaculture (IMTA)**: Combines species from different trophic levels to recycle waste.

3. Water Management

- Source (river, groundwater, seawater).
- Quality parameters: temperature, dissolved oxygen, pH, ammonia, nitrite, salinity.
- Flow regime: static, flow?through, recirculating.

4. Feeding & Nutrition

- Commercial formulated feeds (protein, lipid, carbohydrate, vitamins, minerals).

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- Alternative ingredients: insect meal, algae, plant proteins.
- Feeding strategies: demand?feeders, automated dosing, feeding frequency.

5. Health Management

- Biosecurity (screening, quarantine).
- Disease monitoring (clinical signs, lab diagnostics).
- Prophylaxis: vaccines, probiotics, water quality control.

6. **Harvest