Basic Principles of Aquaculture I

Species Choice
Economics
Water Sources and Systems
Non-Conservative Aspects Water Quality
Conservative Aspects Water Quality
Basic Principles of Aquaculture II

Feeds Nutrition & Growth
Reproduction, Selective Breeding, Genetics
Disease Predation Cannibalism
Harvesting Hauling Processing
Environmental Concerns
Aquaculture

The Cultivation of Aquatic Animals.

Compared with Agriculture

Both Involve Husbandry of Food Animals

No Commercial Hunts for Big Mammals

“Origins” in China more than 1,500 BC

Annual River Floods Recede, Carp Remain

Fed Nymphs and Silkworm Feces
Fish Life History Strategies

Generalized

Embryo, Blastula, Gastrula, Hatch, Larva, (Metamorphosis), Juvenile, Adult, Reproduction

Fish: Metamorphosis Usually Reduced Except in Flatfish
Aquaculture Requirements

Source of Young to Raise

Appropriate Feeds - Nutrients & Amounts

Protection from Predators
  Mammals, Birds, Reptiles, Fish

Protection from Disease
  Stress & Immune System, Virus, Microbes

Protection of Environment
  Water Quality, Waste Removal, O₂ Content
Aquaculture Species

#1 Aquacultured Fish: Carp ~ 28 Species
Family Ponds - Not Large Operations
Eastern Europe Eastward to China and India

US: #1 Aquaculture Import: Penaeid Shrimp

Aquacultured Finfish Species:
FW: Carp, Tilapia, Catfish, Trout
SW: Salmon, Grouper, Bream, Striped Bass
Others: Shellfish, Snails, Sea Cucumbers
Aquaculture Species Choice I

Finfish - More Than 200 potential species
a. Farmed For Sale as Food
b. For Sale as Bait
c. For Sale as Ornamentals (Aquarium Fish)
d. For Sale as Potential Sports Fish
Aquaculture Species Choice II

Molluscs – Bivalves, Snails, Octopus, Pearls

Crustaceans - Shrimp, Crabs, Crayfish, Krill

Echinoderms - Sea Cucumbers, Sea Urchins

Plants - Nori, Dulce, Nostoc, Watercress

Algae for Biofuel with Sequestered CO₂
Basic Economics

This is a Business

It Must Be Profitable or it Will Close

Need Knowledge of Market Forces

What Do Buyers Want? - Specifications?
What Do They Pay?
What Would Be Your Competition?
How Stable has This Market Been?

You Must Develop a Business Plan
Business Plan I

Fixed Costs Include:

- Land
- Pond Construction
- Water Supply
- Feeding System
- Disease & Weed Control
- Other Equipment
  - Boats, Tractors, Trucks, Haul Tank
  - Shop, Aeration, & Emergency Equip.
Business Plan II

Include Operating Costs
Depreciation, Interest, Taxes & Insurance
Repairs, Maintenance, Energy, Chemicals
Fingerlings, Feed & Various Supplies
Harvesting, Hauling, Processing

Marketing Issues

Major Contingencies

Such as Crop Failure
Species Choice - Considerations

1. Know the Biology of Your Species

2. Is This Species Commonly Cultured?
   a. Is the Life Cycle Closed?
   b. What are the Sources for “Seed”? 
   c. Life History Stage Specific Needs?
   d. Species Diseases, Parasites, Predators

3. Feed Conversion Ratio & Feed Sources

4. Species Specific Environmental Concerns
Choosing Potential Sites

1. Marine vs Freshwater Locale
2. Available & Appropriate Water Sources
   Temperature, O$_2$, pH, Salinity
3. Legal Ownership - Protect Investment
4. Location Unpolluted - Thermal, Toxins etc
5. Enclosure/Containment Decisions
   Rafts, Ponds, Raceways, Cages etc.
Water Sources & Systems I

Water Sources & Pretreatment
Municipal, Well, Surface Water
Foreign Species - Predators - Foulers
Aquatic, Terrestrial, Airborne
Suspended Sediments - Mechanical Filtration
Recirculating Water Systems
Components, Treatments, Back-up Systems
Semi-Closed Water Systems
Water Sources & Systems II

Flow-Through Raceway Systems
Cages & Net Pen Systems
Ponds
  Site Survey, Toxic Soils, Leakage, Size,
  Levees, Drains & Inflow Lines,
Other Considerations
Other Types of Systems
  Pole, Raft, String, Tray
Non-Conservative Aspects of Water Quality

Photosynthesis & Primary Production
  Measuring Primary Productivity
Plant Nutrients
Fertilization
Control Aquatic Vegetation
The Carbonate Buffer System
Dissolved Oxygen
Conservative Aspects of Water Quality
Physical Aspects - Culture & Environment

Temperature
  Physiological Responses to Temperature Flux
Salinity
  Tolerance, Osmoregulation, Smoltification
Light, Suspended Solids, Alkalinity, Hardness
Substrate Requirements, Density, Pesticides
Herbicides, Trace Metals
Disposal of Aquaculture Effluent
Feeds, Nutrition & Growth I

Feeding Strategies & Food Requirements
Natural Foods for Larvae & Fry
Prepared Feeds
  Weaning, Purified Feeds
Types Practical Feeds
  Microencapsulated Diets, Moist &
  Semi-Moist Feeds, Dry Feeds
Feed Storage - Dry Feed Manufacture