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Transparency Masters

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Module I-B — Discovering the Origins and Opportunities in Aquaculture

**Problem Area:** Determining the Origins of Aquaculture

**Estimated Time:** 2-4 hours

**Purpose/Goal:** The goal of this problem area is to help students develop an appreciation of the beginnings of aquaculture.

**Learning Objectives:** Upon completing this problem area, students will be able to:

- name three countries practicing aquaculture more than 200 years ago;
- trace the development of aquaculture;
- compare and contrast the development of aquaculture with agriculture;
- relate the development of aquaculture to fishing practices;
- describe early aquaculture in China, Egypt and the Roman Empire;
- describe the development of aquaculture in the United States;
- list the major aquacrops in the United States;
- explain why aquaculture is expanding.

**Instructional Resources:**

The following instructional resources are needed to complete this problem area:

**Essential:**

- Transparencies made from masters attached to the module.
- World map or globe.

**Additional:** Any general references on aquaculture, such as the following:

**Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms,**
*by Bardach, Ryther and McLarney.*

**Third Report to the Fish Farmers,**
*by Dupree and Huner.*

**Principles of Fishery Science,**
*by Everhard and Youngs.*

**Introduction to Aquaculture,**
*by Landau.*

**Aquaculture: An Introduction,**
*by Lee and Newman.*

**Aquaculture Training Manual,**
*by Swift.*
CONTENT AND PROCEDURES

Preparation
(Interest Approach):

This interest approach spurs students into thinking about history — the record of significant past events.

Suggested Procedure:

1. **Ask students to think** about their community. Have them name things that exist today: highways, airports, supermarkets, hospitals, automobiles, etc.

2. **Now, have them reflect** back 200 years and describe how their community might have appeared at that time. In general, farming was the way of life. Ninety percent of the people lived on farms. There were no stores - no fish markets. People produced a few crops but mostly hunted and fished. Occasionally, extra fish would be traded to a neighbor for something the neighbor had. Ask the students if they would like to have lived in their community 200 years ago.

3. **New technology emerged.** Life changed as a consequence of the new inventions and new ways of earning a living. Populations grew and demanded fish and other aquaculture commodities on a year-round basis. Thus, aquaculture was on its way!

4. **Lead discussion** into the objectives for the problem area.
# Aquaculture

## Presentation

### Key Questions/Summary of Content

*This teaching plan helps learners develop an appreciation for the history and development of aquaculture.*

### Teaching Techniques

*Present the objectives using T I-B-1 or by writing them on the chalkboard.*

## I. Where did aquaculture begin?

A. Historical records don’t give the complete story.

B. Records show the following locations were involved in aquaculture for many years before modern times:
   - China
   - Egypt
   - Europe (several countries)
   - Italy (Rome)
   - Indonesia
   - Hawaii (before becoming a state)

All of these countries practiced aquaculture more than 200 years ago.

## II. How did aquaculture develop?

A. Aquaculture developed in a similar pattern in several areas of the world. These apparently occurred independently.

B. The development grew out of fishing practices.

1. Trapping or fishing led to:
   - trapping and holding live fish for freshness, which ultimately led to:
   - trapping, holding and feeding fish for longer maintenance.

A. Ask students to offer their comments on how aquaculture developed in their local area. (Such involvement might motivate students to appreciate the history of aquaculture.)

B. Describe how a fish could be caught and put in a small pond for holding (storing). Through discovery, it was found that the fish reproduced in the holding ponds.
2. Once people saw fish could be fed while being held, they continued the practice to insure a year-round supply of fish.

III. How does the development of aquaculture compare with agriculture?

A. Aquaculture and agriculture share the following similarities:
   1. Aquaculture involves:
      - Fishing
      - Holding
      - Feeding
      - Husbandry
      - Breeding
      - Domestication (possibly)
   2. Agriculture involves:
      - Hunting
      - Holding
      - Feeding
      - Husbandry
      - Breeding
      - Domestication

B. Aquaculture and agriculture have differences.
   1. Aquaculture involves:
      - Food for the elite (wealthy or ruling families)
      - Recreation (such as sport fishing)
      - Larger efforts to manage
   2. Agriculture involves:
      - Food for the masses
      - Single farmers or small groups

C. In some areas, aquaculture probably developed from fishing practices. In other areas, aquaculture may have developed along with agriculture after discovery of irrigation techniques.

A. Use T I-B-2 or the chalkboard to show similarities between aquaculture and agriculture. Ask students to describe what they think occurred with each. For example, how are fishing and hunting related?

B. Use T I-B-3 or the chalkboard to show differences in the emergence of aquaculture and agriculture. Ask students to explain who they think the “elite” were.
IV. How did aquaculture develop from fishing practices?

A. Different systems of culture emerged as a result of various experiences.

B. Cage culture likely developed when fishers realized, if they held their surplus catch in baskets in the water, the fish could be kept fresh and grown if food was provided.
   - Fish held in cages were easy to harvest.
   - Cages could be used in large bodies of water or streams.
   - Primitive cage culture was practiced in Indonesia with carp.

C. Pond culture likely developed from temporary pools of water that remained when flooded streams receded.
   - Some fish were trapped in the pools of water when the flood subsided.
   - Natural supplies of food were in some of the ponds and the fish grew when there was enough water for their survival.
   - In Europe, moats and small dug ponds (known as stew ponds) were used to store fish.

D. Integrated development with agriculture possibly occurred in some locations.
   - Agricultural processes produced an environment where aquaculture spontaneously occurred.
   - Hawaii had a system of aquatic and terrestrial organisms in the same water structure.
   - Indonesia had abandoned rice fields where shrimp grew. (The fields had to be abandoned when salt water went into them and made them too salty for rice.)

B. Explain that a cage is a net container that floats in the water. Baskets of some type were likely used in the early years of cage culture. These confined fish in water, much as a bird cage prevents birds from flying away.

C. Ask a student to describe a pond or pond systems. (A pond is an earthen structure that holds water. They are widely used in aquaculture today.)
   - Mention the meaning of “natural supplies of food.” Ask students to describe what they think it might be. Examples: algae, plants larger than algae, insects and small fish.

D. Explain that integrated systems are used with some crops today. An example is rice that also includes crawfish farming.
   - Review the meaning of “aquatic” and “terrestrial” by asking students to explain the terms.
V. What was the nature of aquaculture in early developments in China, Egypt and Rome?

A. Aquaculture in China began around 3500 B.C.

1. Common carp was the first fish cultured.
   - Carp are hardy and grow in freshwater.
   - By 1000 B.C., carp were extensively cultured and were apparently the only fish cultured at the time.
   - Large broodstock were caught from rivers during breeding season, with mature male and female fish stocked in ponds.
   - The emperor expected to have fish for food year round. (In order to keep their heads, the servants learned ways to “get” fish. This may have led to the building of fish gardens.)
   - Fish held a valued place among ancient Chinese. (The word “fish” means “surplus” in Chinese. Fish were equated with “bountiful harvests.”)

2. Because fish were an important part of life in China, cultivation developed very early.

3. Overfishing may have spurred the development of aquaculture. (Yu Wang, a Chinese ruler in 2000 B.C., issued a ban on fishing during spawning season.)

4. Fish Breeding, the oldest document on fish farming, was written by Fan-Li during the fifth century B.C. (Fan-Li was a politician and administrator who became renowned for his self-taught expertise in carp culture.)
   - The document described methods for pond construction, broodstock selection, stocking and management of ponds. (Pond size was one acre with small islands in it. The fish would swim around the islands and feel that they were in rivers or lakes and not in small ponds.)

A. Use T I-B-4 or the chalkboard to outline the history of Chinese aquaculture. Discuss each of the milestones.
   - Show a picture or specimen of a carp.

3. Have students discuss the meaning of overfishing. Ask them to explain how fishing during spawning season reduces the fish population very rapidly.

4. Ask students to name examples of aquaculture publications available today. Have them bring some to class and review examples of articles they contain. Are the subjects similar to those included in the book by Fan-Li? (Copies of the publications will likely be available in the classroom. The school library should subscribe to the appropriate aquaculture publications.)
• The document advocated putting turtles in ponds. (Fan-Li indicated turtles acted as guardians and prevented spirits from carrying off fish. Though Fan-Li may not have understood, his advice was sound. The turtles ate some of the fish thus reducing the population and stunting. Fan-Li thought that the presence of only small fish in an overpopulated pond was due to evil spirits carrying off the large fish.)

5. Emperor Li of the Tang Dynasty (618-906 A.D.) banned the culture of common carp because the word for carp was Li.

• The Emperor was sacred and apparently thought anything that shared his name was sacred as well and should not be eaten.

• Subsequently, other species of carp were cultivated as a replacement for the common carp.

• This led to Chinese polyculture — growing more than one species in the same water structure.

6. In Chinese polyculture, it is important to realize water is a three-dimensional habitat in contrast to soil, which is treated as having one dimension.

• Fish of one species use only one portion of a pond and often feed on only one kind of food. (All of the productive portions of a pond will not be used if a single species of fish is in the pond.)

• The basis of aquaculture was demonstrated by the Chinese. Different organisms occupy a different niche (niche refers to the different positions and functions organisms occupy in an environment). Each niche is defined by its location and food supply.

7. Four species of carp were grown.

• Ask students to explain the problem with Fan-Li’s reasoning about small fish in a pond and no large fish.

• Write the definition of polyculture on the chalkboard.

6. Ask students about the food preferences of people. Do all people eat the same food? This can be used to explain why polyculture works — different species eat different foods.

7. Use T I-B-5 or the chalkboard to illustrate how four species of carp may be polycultured. You may want to draw the location of each species of fish in a pond.
Module I-B

- Grass carp (Ctenopharyngodon idellus) — a topwater fish which feeds on littoral (near shore) macrovegetation (large vegetation or larger than algae).
- Big head carp (Aristichthys nobilis) — a midwater fish which feeds on zooplankton.
- Silver carp (Hypophthalmichthys molitrix) — midwater fish which eats phytoplankton.
- Mud carp (Cirrhina molitorella) — bottom fish which feeds on a wide variety of plants and animals.

8. China is generally considered the cradle of aquaculture.
   - This may not be true.
   - Common carp are not native to China and may have been introduced from the Caspian and Black Seas.
   - Chinese aquaculture evolved from being exclusively for the elite to a staple food for common people.

B. Early aquaculture in Egypt focused on the tilapia fish.
   - Developments paralleled carp in China.
   - No early written documents are known to exist, but early drawings in tombs dated about 2000 B.C. show tilapia. (The depiction shows a person fishing with a hook-and-line in an aquarium. It appears that the fishing was more for recreation than food.)
   - Early aquaculture was likely a part of irrigation systems.
   - Egyptians had developed lake systems with flowing water.
   - Egyptian developments were related to terrestrial agriculture.

B. Use T I-B-6 or the chalkboard to outline the history of aquaculture in Egypt.

C. Early aquaculture in Rome focused on mullet and trout.
   - Pliny the Elder, who wrote a history of Rome, recorded that saltwater and freshwater fish culture was practiced in Rome in the first century B.C.

C. Use T I-B-7 or the chalkboard to outline the history of aquaculture in Rome.

- Explain that zooplankton are microscopic animals that live in water and serve as food for some fish.
- Explain that phytoplankton are microscopic plants that live in water and serve as food for some fish.
- Have students use a microscope to view slides of zooplankton and phytoplankton.
• It is believed the freshwater culture was for food and sold for profit.
• The saltwater systems were thought to be for the amusement of the nobility.
• The culture of molluscs was practiced in the Mediterranean region as early as 800 B.C.

VI. How did aquaculture develop in the United States?

A. Aquaculture development can be placed into four phases:
   • Ocean Native Americans
   • Continental Native Americans
   • European American
   • Current day developments

B. Ocean Native American culture occurred in Hawaii.
   • An organized system of aquaculture existed 400 years A.D. in Hawaii.
   • Hawaiian society centered around the ocean, agriculture and aquaculture.
   • Extensive pond systems were developed. (Hawaiian chiefs controlled aquaculture by leasing tracts of land to lesser governors who saw to it that the ponds were well cared for and fish were produced.)
   • Fish ponds were a symbol of wealth and were carefully attended.
   • Hawaiian integrated aquaculture was carried out until the Europeans arrived in 1778 A.D. (The contact destroyed the ancient religion which removed the chiefs from ruling the ponds and land. The economy changed from barter to money.)
   • A few of the old ponds are still used today.

1. Four types of agriculture/aquaculture were used in Hawaii.
   • Freshwater fish ponds — fed water by canals from streams.

A. Use T I-B-8 or the chalkboard to list the four phases.

B. Use T I-B-9 or the chalkboard to outline culture in Hawaii.

• Ask students to offer their thoughts on how the arrival of the Europeans, who brought new religious beliefs, changed aquaculture in Hawaii.
- Taro ponds — irrigated agricultural plots primarily for growing taro. (These areas had connections with freshwater streams for the irrigation of taro, but the stream was often near saltwater.)
- Brackish water fish ponds — located near the shoreline but were only used for culture of fish.
- Seawall fish ponds — not really ponds as much as they were areas off the shoreline which were walled off from the rest of the sea by a human-made wall.

2. Hawaii maintains a prominent role in aquaculture today.

C. Continental Native Americans practiced aquaculture in several locations.
- Southern California, near the Salton Sea, had fish ponds built by the Palm Springs or Cahuilla peoples.
- Native Americans are known for the use of wild fish in agriculture to enrich the soil. (An example is the use of fish to fertilize corn by placing a fish in the soil near the corn kernels as they are planted.)
- The extent of involvement on the continent is not as well documented as it is in Hawaii.

D. The European-American phase of aquaculture developed after the middle of the 19th century when overfishing and industrial pollution had drastically reduced the wild stocks of species.
- Early emphasis was on restocking depleted streams and lakes, not on the culture of food crops.
- Scotland and Norway led the effort in salmonid culture — trout and salmon.
- In the early 1800s, the American Fish Cultural Association was founded. The organization changed its name in 1885 to the American Fisheries Society. (Until recent years, the Society emphasized fisheries biology rather than aquaculture.)

- Explain taro is a food crop grown for its roots. Ask students if they have eaten taro. (Taro is used to make taro chips and poi, a paste-like food made by pounding the roots.)

C. Use T I-B-10 or the chalkboard to outline aquaculture among Continental Native Americans. (Be sure students understand the meaning of “Continental Native Americans” — individuals native to the continent of the United States.)

D. Use T I-B-11 or the chalkboard to outline aquaculture in the European-American phase.
In the South, farmers have managed farm ponds to produce catfish, sunfish and bass for food and recreation. This is a long-standing practice. The fish are used by the farmer or sold through fee fishing.

E. Current developments in the United States have focused on four species.
   - trout
   - catfish
   - atlantic salmon
   - crawfish

   In addition, several species are showing much promise for culture. These include tilapia, hybrid striped bass and prawns.

   Several species are also grown for baitfish or as ornamentals and pets.

1. Trout have received considerable attention in the 1900s. Trout culture provides over 75% of the quantity consumed in the United States. Some areas suited for trout culture have productive and profitable farms.
   - Trout are grown in cool waters in the northern United States.

2. Catfish is by far the largest aquaculture crop in the United States.
   - In 1960, there were fewer than 600 acres in catfish production.
   - In the early 1990s, there were 150,000 acres in catfish.
   - Catfish are primarily grown in the warm waters of the southern United States.

3. There is considerable interest in the expansion of aquaculture in the United States.
   - New species are being studied, including tilapia and hybrid striped bass.
   - New approaches to production are being investigated.

E. Use T I-B-12 or the chalkboard to present the four major aquaculture species. Ask students if they have eaten any of these fish. Set up a tasting session with cooked samples.

1. Ask if students have been fishing. If so, ask them to name the species they caught and describe its characteristics.

2. Ask students to name a distinct characteristic of catfish — barbels. (The growth about the mouth that reminds people of the whiskers on a house cat.)

   - Show pictures or specimens of tilapia and hybrid striped bass.
• New industry infrastructures (feed mills, processing plants, distribution networks, etc.) are being established to meet the needs of producers and get the product to consumers in the desired forms.

VII. Why is aquaculture expanding?

A. Aquaculture is expanding because of consumer demand for aquaculture foods and other products.
   • Health-conscious people are learning about the benefits of fish in the human diet.
   • Cultured aquafoods are more likely to be free of harmful pollution than wild foods.
   • Increased income makes it possible for people to buy more fish and other foods that were unaffordable a few years ago.

B. Aquaculture is expanding because of a diminishing world supply of fish and other aquatic products.
   • Overfishing in some waters has removed all desirable fish.
   • As human population increases, demand for aquafoods will outstrip the ability of natural waters to produce the desired amounts.

C. Pollution has destroyed some wild stocks.
   • Populations of the fish have been exterminated.
   • Those available may be unfit for human consumption.

D. Habitats have been destroyed by construction projects, such as for hotels and housing projects.
   • Coastlines that were once good marshes that provided breeding grounds for some species have been destroyed.
   • When breeding grounds are destroyed, wild populations diminish.

VII. Use T I-B-13 or the chalkboard to list reasons why aquaculture is expanding in the United States and in other countries around the world.

• Ask students to give examples of foods eaten by “health conscious” people.

C. Ask students to name examples of streams, lakes, or oceans where pollution has caused fish kills and/or destroyed wild stocks.
Review

Review by having students demonstrate their understanding of the objectives. This can be done by asking key questions, such as:

- Where did aquaculture begin? How did it develop?
- How are aquaculture and agriculture similar? Different?
- How did aquaculture develop from fishing? How did cages, ponds and other systems emerge?
- What species of fish were first cultured in China and Egypt?
- What is polyculture? How did the Chinese use four species of carp in polyculture?
- How did aquaculture develop in the United States? What phases were involved?
- What species of aquacrops are most widely grown in the United States?
- Interest is very high in aquaculture in the 1990s. Why?

(It may be helpful to students to construct a timeline and include important dates of aquaculture development.)

Application

Application can be achieved by having students investigate the history of any aquaculture that exists in the local area. When did it begin? How did it get started? What people were leaders in starting aquaculture?

Students enrolled in a history class can relate their studies to the role and development of aquaculture. (Note: Discuss with the history teacher the possibility of having additional information on the history of aquaculture included in the history classes.)

Have students research the climates, topography, social customs, food habits, economic system, lifestyle and coastal characteristics of the different areas where aquaculture has developed. Have them discuss how these factors contributed to the types of aquatic animals and aquaculture methods used in each area. Students could be organized into groups or pairs to present a report on each different region.

Evaluation

Evaluate how well the students have achieved the specific learning objectives by:

- Asking the students questions relevant to the objectives.
- Observing how students respond to the study of later modules. Do they show an understanding and appreciation for the origins of aquaculture?
- Giving a written test (example included).
Discovering the Origins and Opportunities in Aquaculture

Problem Area: Determining the Origins of Aquaculture

Instructions: Answer the following questions. Be sure to spell correctly and provide complete information to answer each question. Name______________________________

1. Name three countries that practiced aquaculture over 200 years ago.____________________________________

2. Indicate which of the following are similarities and differences in aquaculture and agriculture. Use an “S” to indicate similarities; a “D” to indicate differences.
   a. ______ feeding
   b. ______ food for the masses
   c. ______ breeding
   d. ______ holding
   e. ______ recreation
   f. ______ husbandry

3. What was the role of the following in the development of aquaculture from fishing?
   Cages ______________________________________
   ____________________________________________
   ____________________________________________
   Ponds ______________________________________
   ____________________________________________
   ____________________________________________

4. What are two important events in the development of Chinese aquaculture?
   a. ______________________________________
   b. ______________________________________

5. What is polyculture? How is it beneficial? __________________________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________
6. Match the following events/developments with the phases in U.S. aquaculture. Use these symbols in the blanks: \( H = \) Ocean Native Americans \( C = \) Continental Native Americans \( E = \) European American \( M = \) Current day developments

a. _______ fish ponds were a symbol of wealth

b. _______ had fish ponds in Southern California

c. _______ early emphasis on restocking depleted streams and lakes with fish

d. _______ used taro ponds

e. _______ catfish is leading crop

f. _______ industry infrastructure is being developed

g. _______ seawall ponds

7. Why is there a great interest in aquaculture today? Place an “X” in the blank by the reasons for high interest in aquaculture.

a. _______ health benefits of fish in the human diet

b. _______ cultured aquafoods are more likely to be free of pollution

c. _______ overfishing has reduced supplies of wild fish

d. _______ consumers are not interested in fish as a food

e. _______ human population is growing faster than aquatic foods can be naturally produced in streams and lakes

f. _______ wild stocks of fish are plentiful
1. China  Egypt  Italy

2. a. _____ feeding  c. _____ breeding  e. _____ recreation
   b. _____ food for the masses  d. _____ holding  f. _____ husbandry

3. **Cages**: Caged fish were easier to harvest, could be used in large bodies of water, realization that caged fish could be kept alive and grown.

   **Ponds**: Fish were trapped in pools of water when flooded streams receded, natural supplies of food were in some ponds and the fish grew.

4. a. Overfishing and subsequent ban on fishing during spawning.
   
b. The document FISH BREEDING, describing aspects of aquaculture.

5. The growing of more than one species in the same water structure. Each species prefers different water location and food, thereby utilizing the entire water structure.

6. a. _____ fish ponds were a symbol of wealth
   b. _____ had fish ponds in Southern California
   c. _____ early emphasis on restocking depleted streams and lakes with fish
   d. _____ used taro ponds
   e. _____ catfish is leading crop
   f. _____ industry infrastructure is being developed
   g. _____ seawall ponds

7. a. _____ health benefits of fish in the human diet
   b. _____ cultured aquafoods are more likely to be free of pollution
   c. _____ overfishing has reduced supplies of wild fish
   d. _____ consumers are not interested in fish as a food
   e. _____ human population is growing faster than aquatic foods can be naturally produced in streams and lakes
   f. _____ wild stocks of fish are plentiful
Discovering the Origins and Opportunities in Aquaculture
Determining the Origins of Aquaculture

OBJECTIVES

• Name three countries having aquaculture more than 200 years ago
• Trace the development of aquaculture
• Compare the development of aquaculture with agriculture development
• Relate the development of aquaculture to fishing practices
• Describe early aquaculture in China, Egypt and Italy
• Describe the development of aquaculture in the United States
• Explain why aquaculture is expanding
• List the major aquacrops in the United States today
Similarities Between Aquaculture and Agriculture

AQUACULTURE INVOLVES:
• Fishing
• Holding
• Feeding
• Husbandry
• Breeding
• Domestication (possibly)

AGRICULTURE INVOLVES:
• Hunting
• Holding
• Feeding
• Husbandry
• Breeding
• Domestication
AQUACULTURE

Differences in Aquaculture and Agriculture

AQUACULTURE INVOLVES:
- Food for the elite people
- Recreation
- Larger efforts to manage

AGRICULTURE INVOLVES:
- Food for the masses
- Single farmer or small groups
History of Chinese Aquaculture

- Began 3500 years B.C.
- Common carp was first cultured fish
- Chinese valued fish
- Overfishing and wisdom of leaders
- *Fish Breeding* written 5th Century B.C.
- Common carp banned by Emperor Li (about 600 A.D.)
- Polyculture developed
Carp and Polyculture

- Four species of carp grown in same pond
- Each species prefers different:
  - Water location
  - Food
- Species and preferences are:
  - Grass carp - prefers topwater and feeds on macrovegetation near shore
  - Big head carp - prefers midwater and feeds on zooplankton
  - Silver carp - prefers midwater and feeds on phytoplankton
  - Mud carp - prefers bottom and wide range of food
History of Egyptian Aquaculture

- Developments paralleled China
- Early recordings show aquaculture in 2000 B.C.
- Tilapia was predominant species
- Likely emerged as part of irrigation systems
History of Roman Aquaculture

- First records of aquaculture were 100 B.C.
- Species included trout and mullet
- Used both freshwater and saltwater
- Freshwater was for commerce and food
- Saltwater was for amusement of nobility
United States Aquaculture Development

FOUR PHASES:
- Ocean Native Americans
- Continental Native Americans
- European American
- Current
Ocean Native Americans

- Occurred in Hawaii 400 A.D.
- Extensive pond systems developed
- Ponds were symbol of wealth
- Types of ponds:
  - Freshwater fishponds
  - Taro fishponds
  - Brackish water fishponds
  - Seawall fishponds
- Declined with arrival of Europeans in 1778
Continental Native Americans

- Some involvement in aquaculture
- Not as well documented as in Hawaii
- Constructed fish ponds in California
- Used fish and aquacrops throughout North America
European American Phase

- Developed in mid 1800s
- Early emphasis on restocking streams and lakes
- Scotland and Norway prominent in trout and salmon culture
- Emphasis of associations was on fishery biology—not on aquaculture
Major Aquacrops in United States Today

- Trout – north, cold water
- Catfish* – south, warm water
- Atlantic salmon – northern lakes and oceans
- Crawfish – primarily in south

CROPS WITH POTENTIAL
- Tilapia
- Hybrid striped bass

*Largest aquacrop in United States
Reasons Aquaculture is Expanding in the United States

- Increased demand for certain aquafoods
- Health benefits of aquafoods
- Freedom from possible pollution of wild species
- Increased income
- Diminishing species in natural waters
- Human population increasing