

# **Ornamental/Tropical Aquaculture**

## **AQUACULTURE CURRICULUM GUIDE**

### **YEAR TWO SPECIES MODULE**

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- Description:** The module consists of the following four problem areas:
- Module:** Ornamental/Tropical Fish
- Problem Areas:** Determining Opportunities in Ornamental/Tropical Fish Aquaculture  
Determining Requirements for Raising Ornamental/Tropical Fish  
Reproducing Ornamental/Tropical Fish in Tanks  
Identifying Ornamental/Tropical Fish Disease Prevention and Health Care
- Objectives:** The objectives for each problem area are given below.

- A. Determining Opportunities in Ornamental/Tropical Fish Aquaculture
- describe scope and economic importance of tropical fish industry
  - locate major tropical fish producing regions of the world
  - identify occupational opportunities in tropical fish industry
  - locate more information about tropical fish aquaculture
- B. Determining Requirements for Raising Ornamental/Tropical Fish
- describe different habitats and systems of ornamental fish
  - identify equipment to establish aquarium for tropical fish
  - use tropical fish characteristics to select species
  - identify environmental requirements for producing and managing tropical fish
  - identify food requirements and sources for selected tropical fish
- C. Reproducing Ornamental/Tropical Fish in Tanks
- identify species for breeding ornamental fish
  - identify breeding procedures for specific species of tropical fish
  - list tank requirements for breeding tropical fish
  - perform procedures to insure success in breeding
  - care and feed young to insure their survivability
- D. Identifying Ornamental/Tropical Fish Disease Prevention and Health Care
- identify conditions that cause disease in tropical fish
  - identify management practices that prevent disease in tropical fish
  - identify symptoms of disease in tropical fish
  - determine treatments for specific diseases of tropical fish

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### **Teaching Plan:**

**Module:** Ornamental/Tropical Fish - Section A

**Problem Area:** Determining Opportunities in Ornamental/Tropical Fish Aquaculture

**Estimated Time:** 1-2 hours

**Goal:** The goal of this problem area is to learn the status of tropical fish aquaculture and occupational opportunities.

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

describe scope and economic importance of tropical fish industry  
locate major tropical fish producing regions of the world  
identify occupational opportunities available in the tropical fish industry  
locate more information about tropical fish aquaculture

**Resources:** The following resources are needed to complete this problem area:

### **Essential:**

Transparencies, world map or globe.

**Aquarium Fish**, by Ulrich Schliewen, Barron's Educational Series, Inc., 250 Wireless Boulevard, Hauppauge, NY, 1992.

### **Additional:**

**Aquarium Fish Magazine**; see references on page 158 and compare how these sources are similar to the more traditional animal production enterprises.

**Practical Fishkeeping Magazine.**

Any general reference on tropical fish aquaculture.

**Content and Procedures**

**Preparation (Interest Approach):**

**Use TM A1 to present objectives.**

To develop student interest in this module, lead students into thinking about the importance of the tropical fish industry. Ask if any of them have pets. Ask students to identify what type of pets they have. Record on board. You should end up with dogs, cats, tropical fish, hamsters, etc. For those who don't have pets, ask them to think about a friend or relative who does. Have students tell what was their first pet. This is often tropical fish. Why? The reasons may be ease of care, relative low cost to start and maintain, low risk - no dog bites, accidents on carpets, or animal running away. Because of these reasons, tropical fish are very popular and demand is high. Lead discussion into the objectives for the problem area.

**Presentation**

**A. What is ornamental/tropical fish aquaculture?**

**Use TM A2 to give a definition of tropical fish aquaculture.**

1. Ornamental aquaculture, or tropical fish raising, is the culture and management of fish for purposes other than for food. Fish are kept in a tank, aquarium, or sometimes an outdoor pond.
2. The purposes of raising or having tropical fish are similar to other hobbies, i.e., for productive use of leisure time, ability to work with nature, and to provide a pleasant scene.

**B. What is the history of ornamental aquaculture?**

**Review with students the history of aquaculture that was presented earlier in the course.**

1. Raising fish for ornamental purposes follows the development of aquaculture for food purposes.
2. Additional species of fish were kept not because of their food quality, but because of unusual characteristics such as size, shape, and most importantly color.
3. Raising and keeping tropical fish in this country has long been a popular hobby and the interest the general public has in aquatic animals can be illustrated by the popularity of large aquariums such as the Shedd Aquarium in Chicago, Illinois, and aquatic theme parks such as Sea World.
4. Today, raising tropical fish is as popular as ever as evidenced by the abundance of pet stores that sell tropical fish and specialty stores that cater solely to tropical fish enthusiasts.

**C. Where are tropical fish produced?**

**Show TM A3 to show sources of tropical fish in the world or use a globe or large flat world map.**

1. Either they are caught in the wild or they are farmed.
2. The major producers of tropical fish include the Pacific Rim countries of southeast Asia (Philippines, Thailand, Hong Kong), the United States, and some European countries like Germany and Holland.
3. The major sources of tropical fish are Africa, Central and South America, and the Southeast Pacific.

**D. Where are tropical fish produced in the United States?**

**Ask students to describe the climate and topography that must be present in Florida to make it ideal for outdoor tropical fish production .**

1. Florida is major producer of tropical fish in the United States.
2. Climate and topography are very favorable to outdoor pond culture.

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3. As culture of fish moves to indoor recirculating systems, tropical fish will be able to be grown anywhere.
4. First-time survey in 1987 by the Agricultural Statistics Service of tropical fish production in Florida revealed 193 growers; sales of \$21.7 million; centered in Hillsborough and Polk counties.
5. Half of tropical fish bought in United States are imported.

### **E. What occupations are related to the tropical fish industry?**

**Use TM A4 to list the occupations related to tropical fish aquaculture.**

1. Producers/breeders.
2. Importers/brokers.
3. Pet store/tropical fish specialty store owners/employees.
4. Wholesalers who get fish from brokers/importers to retailers.
5. Supplies and service for both the producers/breeders and retailers, including supplies and services for aquarium hobbyists.
6. Specialty areas:
  - a. Aquascaping (the use of aquariums for interior decorating, especially offices and restaurants) for indoor and outdoor settings.
  - b. Veterinarian specializing in aquatic animals.

### **Review:**

Review by having students demonstrate their knowledge and understanding of the objectives. This can be done by asking key questions such as the following: How does tropical fish aquaculture differ from food aquaculture? How did tropical fish aquaculture develop? Why do people keep tropical fish? How can we tell that raising tropical fish is an important hobby? What types of jobs are available in the tropical fish industry? Is information available about keeping tropical fish?

### **Application Activities:**

Application can be achieved by having students locate pet stores and specialty shops in their area that sell tropical fish. Visit these stores and make an inventory of supplies and services that are available to tropical fish hobbyists. Write to various magazines and specialty societies asking for information and complimentary copies of their literature.

### **Evaluation:**

Evaluations should focus on the extent to which students achieved the objectives of the problem area. Example exam questions are attached.

## **Objectives**

- Describe tropical fish industry.
- Locate major tropical fish producing regions of the world.
- Identify occupational opportunities in tropical fish aquaculture.
- Locate resources for obtaining additional information.

## **Tropical Fish Aquaculture**

- Culture and management of fish for purposes other than for food
- Fish kept in a tank, aquarium, or pool for the enjoyment of viewing
- Purposes are similar to other hobbies:
  - Productive use of leisure time
  - Ability to work with nature
  - Provide a pleasant scene

## **Sources of Tropical Fish**

- **Producers:**
  - Pacific Rim countries
  - United States
  - Europe
- **Sources in the Wild:**
  - Africa
  - Central and South America
  - Southeast Pacific

## **Occupations in the Tropical Fish Industry**

- Producers/breeders
- Importers/brokers
- Pet specialty store owners/employees
- Wholesalers
- Supplies and service
- Aquascaping
- Veterinarian

Quiz for Section A

Name:

Date:

Quiz on Determining Opportunities in Ornamental/Tropical Fish Aquaculture

1. Define tropical fish aquaculture.
2. Explain how raising tropical fish is similar to other hobbies such as gardening or painting.
3. Which state is a major tropical fish producer? a. California b. Texas c. Mississippi d. Florida
4. What percentage of tropical fish bought in the United States is imported? a. 10% b. 25% c. 50% d. 75%
5. Name two Pacific Rim countries that produce tropical fish:  
\_\_\_\_\_ and \_\_\_\_\_.
6. List four occupations related to tropical fish aquaculture:  
\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

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### Key for Quiz - Section A

1. Define tropical fish aquaculture.

**Culture and management of tropical fish for purposes other than for food. Fish are kept most often in an aquarium but can be kept in an outdoor pool or pond for viewing for pleasure.**

2. Explain how raising tropical fish is similar to other hobbies such as gardening or painting.

**Productive use of leisure time, ability to work with nature, provide a pleasant scene or area.**

3. Which state is a major tropical fish producer? **d. Florida**

4. What percentage of tropical fish bought in the United States is imported? **c. 50**

5. Name two Pacific Rim countries that produce tropical fish.

**Philippines, Thailand, Hong Kong**

6. List four occupations related to tropical fish aquaculture:

**Producers/breeders, importers/brokers, retailers/wholesalers  
supplies and services, aquascaping, veterinarian**

**Teaching Plan:**

**Module** Ornamental/Tropical Fish - Section B

**Problem Area:** Determining Requirements for Raising Ornamental/Tropical Fish

**Estimated Time:** 4-5 hours

**Goal:** The goal of this problem area is to understand the requirements necessary for providing a healthy environment for raising and keeping tropical fish.

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

- describe different habitats and systems of ornamental fish
- identify equipment to establish aquarium for tropical fish
- use tropical fish characteristics to select species
- identify environmental requirements for producing and managing tropical fish
- identify food requirements and sources for selected tropical fish

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

**Essential:**

Transparencies, samples of equipment to exhibit, and tropical fish data sheets.

**You and Your Aquarium**, by Dick Mills, Alfred A. Knopf, Random House, Inc., NY, 1986

**Additional:**

References on tropical fish that discuss their characteristics and behaviors.

## **Content and Procedures**

### **Preparation (Interest Approach):**

**Show TM B1 and lead a discussion about the objectives of ornamental/tropical fish aquaculture.**

To develop student interest in this module, lead students into discovering that tropical fish are not all alike and that knowing the differences are important in their production and management. Ask students what requirements a bird might have in order to lay an egg (nest). What about a penguin? (no nest needed) What about woodpeckers? (a nest made in the tree vs. a nest made in branches) They are all birds but have different nesting requirements.

Ask students to describe how different animals are born. Ask if they know of any breed of cow that is born in an egg or any breed of chicken that is born live. Usually, all the animals of a species are born the same way. However, with fish, some lay eggs whereas some bear live. Discuss that even though tropical fish are all fish that doesn't mean they all have the same characteristics and habits. Knowing this is as important to raising tropical fish as knowing that trying to put a cow into a nest in a tree in order to calve is not a good management practice.

### **Presentation**

#### **A. What are the different habitats required by ornamental fish?**

**Show TM B2 and discuss different types of habitats.**

1. Freshwater aquarium.
  - a. Coldwater: oldest used system. Goldfish is most popular. Limited number of species; egg layers.
  - b. Tropical: most popular today with almost unlimited number of species, both egg layers and live bearers.
2. Saltwater aquarium.
  - a. Coldwater: relatively new interest. Limited number of species. Less expensive than tropical saltwater. Fish less brilliantly colored. Breeding is very rare in captivity.
  - b. Tropical: relatively new. Numerous species. Most expensive. Brilliantly colored. Breeding is very rare in captivity, which adds to the expense because most specimens must be caught in the wild.

#### **B. Which is the right system to choose?**

1. The most popular system is the freshwater tropical system. Is easier to maintain than saltwater and offers many species of fish that are in demand by fish hobbyists. These species are also bred much more easily in an aquarium. Most of the saltwater species are not bred in captivity.
2. Because tropical fish species can be bred in captivity, the cost of purchasing and replacing fish is much lower than for other systems.

**C. How is a freshwater tropical aquarium set up?**

**Show TM B3 and review requirements for an aquarium. Explain how oxygen content of water changes with temperature. Have different size fish tanks or dimensions of common sizes and calculate surface areas.**

1. Aquarium size.
  - a. Surface area of tank. Fresh oxygen can reach the fish only through the surface area of the aquarium. The larger the surface area, the larger the surface for oxygen to enter the water.
  - b. Type of fish. Coldwater freshwater ornamentals and coldwater marine ornamentals require more oxygen than freshwater tropicals, with marine tropicals needing the most.
  - c. Rule of thumb: Calculate the surface area of an aquarium then divide by the following factors to determine how many inches of fish the tank will hold: freshwater tropical = 12 square inches; freshwater coldwater = 30 square inches; marine tropicals = 48 square inches. Example: A tank 48 inches long by 18 inches wide has a surface area of 864 square inches. If we want to keep freshwater tropicals in this tank, divide 864 square inches by 12 square inches. Approximately 72 inches of fish can be kept in the aquarium.
2. Bottom material. Most fish will prefer quartz gravel or river sand. Both can be purchased at aquarium stores. Refer to the requirements of the particular species you will be raising. Bottom-dwelling fish prefer sand. Be sure to wash all material before placing in the aquarium.
3. Rocks, plants, roots. Depending on the species of fish living in the aquarium, these materials may be added both to make the tank look more natural and also to afford fish the correct habitat to live and reproduce. Fish species that tend to be shy will need cover, especially if other fish species will be present.
4. Water and water quality. As important to fish as air is to land animals.

**Use TM B4. Discussion should include importance of water to fish, comparing how pollution affects the clean air humans need.**

- a. Water hardness. A measure of the amount of mineral salts in the water. Most aquarium fish can survive in medium hard to hard water.
  - b. Water pH. Is a measure of acids and bases in the water. Most aquarium fish prefer a water pH slightly acidic, 6 to 6.9.
  - c. Water toxins. Ammonia. Produced by decaying animal and plant matter and other organic wastes. When tank pH is below 7.0, ammonia is not a problem. Over 7.0, ammonia in the form of ammonium (harmless) may change to toxic ammonia (harmful). Either lower the water pH or change the water. Sometimes water is contaminated with nitrate. Levels up to 25 ppm are acceptable. For higher levels, water changes are recommended and siphon debris out of tank.
5. Tank filtration. As important as for tropical fish as for food fish. The same principles apply and the results should be the same: clean water with adequate oxygen level for fish to grow and thrive. There are various filter systems for aquariums. They all require maintenance and routine cleaning. Select a filter that has enough capacity to handle the aquarium size.

**If possible, have different types of filters set up or operating. However, good diagrams would also be useful.**

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6. Adding fish to aquarium. Follow procedures that will reduce stress on the fish.
  - a. Float fish in a plastic bag until the temperature equalizes between tank water and transport water.
  - b. Move fish from supplier to aquarium as quickly as possible without sudden or abrupt motion.

### **D. What are the feeding requirements of tropical fish?**

**Show TM B5 and discuss importance of a balanced diet for ornamental fish and compare with food fish. Even though ornamentals do not require big weight gains, health, vigor, coloration, and reproductive efficiency all depend upon a good diet.**

1. Nutritional requirements: proteins, carbohydrates, fats, minerals, and vitamins.
2. Live, natural food. Many sources of food are available in nature and can be easily collected. Mosquito larvae, grasshoppers, crickets, earthworms, and flies are all suitable sources for fish. It may be fun to collect these occasionally, but to maintain a healthy, well-balanced diet everyday may fatigue even the most ardent aquarist, especially if you have many tanks to feed.
3. Advantages of commercially prepared food:

**Show TM B6 and discuss commercially prepared food.**

- a. Stable supply.
  - b. Known nutrition.
  - c. Known quality.
  - d. Easier to maintain a well-balanced diet.
4. Selecting the right food.
    - a. For a bottom-feeder, select a food that sinks.
    - b. If the fish species is vegetarian, don't try to feed it meat.
  5. Vary the diet. There is no one best food type or source. In the wild, fish eat a variety of foodstuffs. Don't be afraid to change feeds and experiment with different food sources.
  6. Do not overfeed fish. Not only does this waste food and money, but it also aids in the buildup of wastes in the tank which can lead to poor water quality and fish death. Only give enough food that the fish will eat in 3 to 5 minutes. Feed 2 to 3 times a day.

**Show TM B7. Have samples of different types of food. Place food in water and compare floating and sinking abilities. Time how long it takes for the food to disintegrate.**

7. Available fish food.
  - a. Manufactured: pellet - floating and sinking; tablet; flake - float initially, then sink; granular - usually sink quickly.
  - b. Freeze-dried feeds: water fleas, tubifex worms, black mosquito larvae, bloodworms, brine shrimp, krill, Pacific shrimp.
  - c. Live foods: crickets, earthworms, flies and maggots, smooth caterpillars, woodlice, grasshoppers.

**E. How should tropical fish be selected?**

**Write on board the reasons the class has for wanting to raise ornamental fish.**

1. There are many species of fish that are suitable for raising in aquaria. Before deciding on which species to raise, the aquarist needs to determine:
  - a. Purpose of raising or keeping fish.
  - b. Skill level needed.
  - c. If breeding is a purpose, determine if it can be done and find out how difficult it will be.
  - d. If fish are to be bred and sold, determine potential market and outlets.
  - e. Special tank, environment, food, handling required.
  
2. Tropical fish data sheet.

**Pass out TM B8, Tropical Fish Data Sheet, and discuss characteristics.**

- a. The more that is known about a specific fish species, the better a decision can be made about whether the species has the desirable characteristics for tropical fish operation.
- b. Many good references have been published and much research has been performed on many of the more popular tropical fish species.
- c. By developing a data bank on different fish species, a better decision on selection can be made.

**Review:**

Review by having students demonstrate their knowledge and understanding of the objectives by having them answer review questions such as the following: What are the different types of ornamental fish aquarium systems? How is tank capacity determined for ornamental aquaria? What purpose do rocks, plants, and roots have in an aquarium? What level of hardness and pH do most ornamental fish prefer? What are the advantages of commercially prepared fish food? What are some factors to consider when selecting a species of ornamental fish to raise?

**Application Activities:**

Application can be addressed by having students complete a tropical fish data sheet for several species of ornamental fish. Through group discussion and consensus, decide on the purpose of ornamental fish programs and on what species of ornamental fish the program will raise and maintain. Have students set up and establish aquaria for the selected fish species.

**Evaluation:**

Evaluation should focus on the extent to which students achieved the objectives of the problem area. Examples exam questions are attached.

## **Learning Objectives**

- Describe different habitats and systems of ornamental fish.
- Identify equipment to establish an aquarium for tropical fish.
- Use tropical fish characteristics to select species.
- Identify environmental requirements for producing and managing tropical fish.
- Identify food requirements and sources for selected tropical fish.

## **Habitats**

- Freshwater
- Coldwater
- Warmwater or tropical
- Saltwater or marine
- Coldwater
- Warmwater or tropical

## **Setting Up a Freshwater Aquarium**

- Surface area important for oxygen exchange
- Type of fish
- Coldwater vs. warmwater oxygen capacity
- Species demand
- Freshwater tropicals need 12 square inches
- Freshwater coldwater need 30 square inches
- Marine tropicals need 48 square inches

## **Water Quality**

- **Water hardness:**  
The amount of mineral salts in the water. Medium hard to hard water preferred.
- **Water pH:**  
A measure of acids and bases in the water scale of 1 to 14. pH 6 to 6.9 preferred

## **Nutrient Requirements**

- Same nutrient requirements as other animals
- Balanced diet equally important as for catfish or tilapia
- Required nutrients:
  - Proteins
  - Carbohydrates
  - Fats
  - Minerals
  - Vitamins

## **Advantages of Commercial Feeds**

- Stable supply
- Known nutritional content
- Known ingredient quality
- Easier to maintain a balanced diet

## **Available Fish Food**

- **Manufactured:**
  - Pellets
  - Tablets
  - Flakes
  - Granular
  
- **Freeze-Dried:**
  - Water fleas
  - Tubifex worms
  - Black mosquito larvae
  - Bloodworms
  - Brine shrimp
  - Krill
  - Pacific shrimp
  
- **Live:**
  - Crickets
  - Earthworms
  - Woodlice
  - Smooth caterpillars
  - Flies and maggots
  - Grasshoppers

## Tropical Fish Data Sheet

Scientific Name:

Common Name:

Size:

Typical Marking and Coloration:

Origin:

Biotype:

Social Habits:

Compatible Fish Species:

Captive Breeder: Yes No

Captive Breeding Difficulty Level:

High Medium Low

Live Bearer or Egg-Laying Brooding Habits:

Water Requirements:

Salt or Fresh: Recommended pH: Temperature Range:

Tank Requirements:

Size: Plants: Bottom material:

Food Requirements:

Adults:

Young:

Is it sold in the community: Yes No

Source(s) of information:

Quiz for Section B

Name:

Date:

Quiz on Determining Requirements for Raising Ornamental/Tropical Fish

Matching - Identify which ornamental fish habitat or system characteristic is described by writing the correct letters: FC = freshwater coldwater, FT= freshwater tropical, SC = saltwater coldwater, ST=saltwater tropical.

1. \_\_\_\_\_ oldest system of four
2. \_\_\_\_\_ most popular today
3. \_\_\_\_\_ most expensive fish specimen
4. \_\_\_\_\_ most brilliantly colored specimen
5. \_\_\_\_\_ unlimited number of species available
6. \_\_\_\_\_ egg layers and live bearers
7. \_\_\_\_\_ breeding is rare in captivity

For questions 8-12, circle a T for True statements or an F for False statements.

8.    T      F      Freshwater aquariums are easier to maintain than saltwater aquariums.
9.    T      F      Saltwater species are less expensive than freshwater species.
10.   T      F      Saltwater tropicals need the most aquarium space.
11.   T      F      Most ornamental fish species prefer acidic water.
12.   T      F      When water pH is below 7.0, ammonia is not a problem.

Short answers:

13.    Overfeeding fish can cause which of the following conditions? a. Overgrown fish b. Poor water quality c. Cannibalism between species d. Water hardness to change
14.    Describe the process of floating fish and explain why it is practiced.
15.    Identify 3 advantages of commercially prepared fish feed.
16.    An aquarium measures 54 inches long by 20 inches wide. How many inches of freshwater tropicals can be kept in the aquarium.

**Module:** Ornamental/Tropical Fish - Section C

**Problem Area:** Reproducing Tropical Fish in Tanks

**Estimated Time:** 4-5 hours

**Goal:** The goal of this problem area is to learn the necessary conditions and requirements for reproducing tropical fish in tanks or aquariums.

**Learning Objectives:** Upon completing this problem area, students will be able to:  
identify species for breeding ornamental fish  
identify breeding procedures for specific species of tropical fish  
list tank requirements for breeding tropical fish  
perform procedures to insure success in breeding  
care and feed young to insure their survivability

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

**Essential:**

Transparencies, assorted tanks, and aquaria set up for breeding tropical fish.

**Additional:**

**You and Your Aquarium**, by Dick Mills, Alfred A. Knopf, Inc., Random House, Inc., NY, 1986.

**Aquarium Fish**, by Ulrich Schliewen., Barron's Educational Series, Inc., 250 Wireless Blvd., Hauppauge, NY, 1992.

**Show TM C3 and discuss how live-bearing fish spawn.**

- a. Viviparous species. Eggs are nourished inside the female's body through her bloodstream. Fry are born free-swimming.
- b. Ovoviviparous species. Eggs are nourished by a yolk sac. Fry are born free-swimming but with a yolk sac.

**C. What are the necessary conditions for breeding?**

1. Selecting a breeding pair. Select only healthy fish that are free from any deformities. Fish should exhibit desired color patterns.
2. Sexing fish. Sexing fish can be accomplished on some species by examining the anal fin. The male's is more rodlike, while the female's is fan-shaped. In some species the male is more brilliantly colored. In still others, the female becomes enlarged and wider due to stored eggs.
3. Nutrition. It is very important that breeding fish receive a well-balanced diet to encourage spawning. Live food should be given to breeding pairs.
4. Separate fish. Separate male and female fish for 2 weeks. This encourages spawning activities when the fish are reunited. Separation can be accomplished by putting a clear barrier (glass or plastic) in the tank.

**D. What are the necessary conditions for various breeding tanks?**

**Show TM 4 and TM 5 and exhibit different breeding tank arrangements and materials needed by the different spawning methods.**

1. Egg scatterers. The purpose of this tank is to provide protection for the eggs. This can be done by placing layers of glass marbles on the bottom of the tank for the eggs to fall into, out of reach of the parents. A curtain of nylon draped across the tank will also work.
2. Egg buriers. A 2-inch layer of sterile peat fiber on the tank bottom will provide a good substrate for fish to bury their eggs.
3. Egg depositors. Provide different types of surfaces and protected areas for fish to lay their eggs.
4. Mouthbrooders. A gravel layer at least 2 inches deep in order for fish to make a depression to lay and fertilize eggs.
5. Nest builders. Plants and plant material needed for nest building.
6. Breeding tank for live bearers. A tank with many plants to provide cover for fry or use a breeding trap.

**E. What post spawning care is required?**

Depending on the species of fish, it may be necessary to remove one or both parents or remove the fry. This needs to be determined before the spawning takes place so the necessary tanks are available and set up.

**F. What are the feeding requirements for fry?**

Have samples of food to exhibit. Ask students to prepare cultures of live food. Discuss the relative merits of each type of food.

## **Learning Objectives**

- Identify and select appropriate species of ornamental fish for breeding.
- Identify breeding procedures for specific species of tropical fish.
- List the tank conditions necessary for breeding tropical fish in tanks.
- Perform the necessary procedures to insure success in breeding.
- Care for young, including feeding.

## **Reproduction Methods of Egg-Laying Fish**

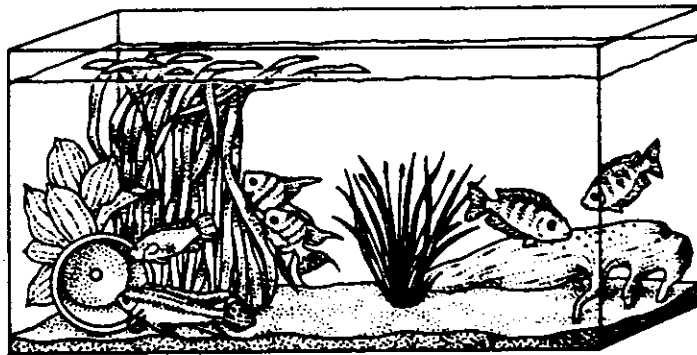
- **Egg Scatterers:**  
Fish spawn spontaneously and often  
Egg-saving devices should be used  
No parental nurturing  
Examples: Barbs, Danios, Goldfish
- **Egg Buriers:**  
Fish bury eggs to avoid dry season  
In aquarium, eggs are buried in peat  
Examples: Killifish
- **Egg Depositors:**  
Fish select breeding partners  
Eggs are laid on various surfaces  
Parent fish care for eggs and fry  
Examples: Cichlids
- **Mouthbrooders:**  
Fish carry eggs and fry in their mouth  
Eggs are laid in a depression on bottom of tank  
Examples: Some Cichlids and some Bettas
- **Nest Builders:**  
Fish builds a nest; eggs laid in nest; male fish  
guards eggs. Examples: Gouramis, some  
Sunfishes, some Cichlids

## **Reproduction Methods of Live-Bearing Fish**

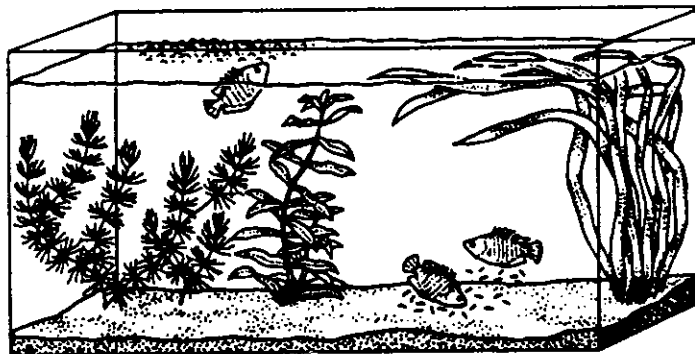
- Viviparous eggs are nourished inside the female's body through her bloodstream. Fry are born free-swimming.
- Ovoviviparous eggs are nourished by a yolk sac. Fry are born free-swimming, but with a yolk sac.

## Breeding Tank Requirements

- For egg depositors: Provide many different types of surfaces and protected areas for fish to lay their eggs.

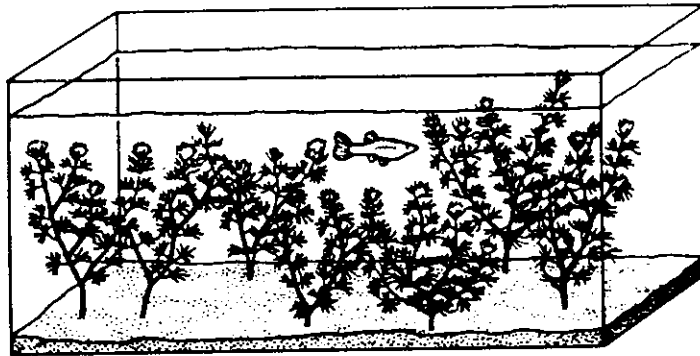


- For mouthbrooders: A 2-inch gravel layer to allow fish to make depressions in which to lay eggs.

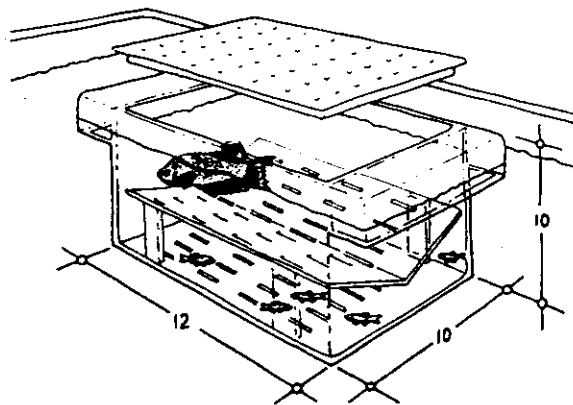


## Breeding Tank Requirements

- For nest builders: Provide plenty of plants for material to make nests.



- For live bearers: Provide plenty of plants for cover or use a breeding trap.



Quiz for Section C

Name:

Date:

Quiz on Reproducing Ornamental /Tropical Fish in Tanks

Match the following reproduction methods with the correct description or characteristics by writing the correct letter in the space provided. Please note: There may be more than one answer for to the question.

- |          |                |    |   |
|----------|----------------|----|---|
| 1. _____ | Egg scatterers | A. | Must wait until dry season is over before hatching    |
| 2. _____ | Nest builders  | B. | Parent fish remain with eggs and fry                  |
| 3. _____ | Mouthbrooders  | C. | Fish spawn spontaneously and no nurturing occurs.     |
| 4. _____ | Egg buriers    | D. | Male usually guards the eggs                          |
| 5. _____ | Egg depositors | E. | Female fish incubates eggs in her throat              |
| 6. _____ | Live bearers   | F. | 2-inch layer of peat                                  |
|          |                | G. | Plant material for building                           |
|          |                | H. | Different types of surfaces including protected areas |
|          |                | I. | Glass marble layers on tank bottom                    |
|          |                | J. | 2-inch layer of gravel                                |
|          |                | K. | Many plants or a breeding trap                        |

Circle a T for True statements or an F for False statements.

- |     |   |   |   |
|-----|---|---|---|
| 7.  | T | F | Viviparous fish species are born with a yolk sac.                 |
| 8.  | T | F | The anal fin on a male fish is usually fan-shaped.                |
| 9.  | T | F | Spawning can be encouraged by first separating the breeding pair. |
| 10. | T | F | Feeding live food to breeding pairs can aid the spawning process. |

## ***Aquaculture Curriculum Guide***

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### Key for Quiz - Section C

- |     |      |   |    |   |
|-----|------|---|----|---|
| 1.  | C, I | Egg scatterers  | A. | Must wait until dry season is over before hatching    |
| 2.  | D, G | Nest builders   | B. | Parent fish remain with eggs and fry                  |
| 3.  | E, J | Mouthbrooders   | C. | Fish spawn spontaneously and no nurturing occurs      |
| 4.  | A, F | Egg buriers   | D. | Male usually guards the eggs                          |
| 5.  | B, H | Egg depositors  | E. | Female fish incubates eggs in her throat              |
| 6.  | K    | Live bearers  | F. | 2-inch layer of peat                                  |
|     |      |   | G. | Plant material for building                           |
|     |      |   | H. | Different types of surfaces including protected areas |
|     |      |   | I. | Glass marble layers on tank bottom                    |
|     |      |   | J. | 2-inch layer of gravel                                |
|     |      |   | K. | Many plants or a breeding trap                        |
| 9   | F    | Viviparous fish species are born with a yolk sac.                 |    |   |
| 10. | F    | The anal fin on a male fish is usually fan-shaped.                |    |   |
| 11. | T    | Spawning can be encouraged by first separating the breeding pair. |    |   |
| 12. | T    | Feeding live food to breeding pairs can aid the spawning process. |    |   |

**Teaching Plan:**

**Module:** Ornamental/Tropical Fish - Section D

**Problem Area:** Identifying Ornamental/Tropical Fish Disease Prevention and Health Care

**Estimated Time:** 4-5 hours

**Goal:** The goal of this problem area is to gain experience in management techniques required to keep tropical fish healthy.

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

- identify conditions that cause disease in tropical fish
- identify management practices that prevent disease in tropical fish
- identify symptoms of disease of tropical fish
- determine treatments for specific diseases of tropical fish

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

**Essential:**

Transparencies.

**You and Your Aquarium**, by Dick Mills, Alfred A. Knopf, Inc., Random House, Inc., NY, 1986.

**Additional:**

Any tropical fish resources related to fish health.

Tropical fish exhibiting signs of distress or disease. Sick fish may be obtained from pet stores who receive a shipment with sick fish or from customer returns. These fish may be obtained if you have a good relationship with the store owner and the owner understands the nature of your aquaculture program.

### **Content and Procedures**

#### **Preparation (Interest Approach):**

**Show TM D1 and discuss learning objectives.**

To develop student interest in this module, ask a student to explain why if one person in a class gets a cold or flu, then it is likely that others will get it also. (Organisms travel through air.) Ask another student to explain why if this situation occurs, some students will get sick and others will not. (Some people have higher resistance.) What makes for high resistance? (rest, good eating habits, being healthy to begin with, staying away from adverse environmental conditions) Have students discuss merits of prevention vs. treatment of colds and flus. Ask them to relate these ideas to a fish tank. If there is one sick fish in the tank, what is the chance of others getting sick also?

If a fish got sick because of low resistance, chances are good it was caused by poor conditions in the tank. All the other fish in the tank were subjected to the same conditions in the tank too. Who controls the conditions in the tank or aquarium? (The aquarist does.) Is it better to prevent or treat illnesses and diseases? (prevent)

#### **Presentation:**

##### **A. Why is prevention the best medicine?**

**Show TM D2 and start class discussion by having students identify situations that cause them stress and do not allow them to function normally. Also discuss consequences of prolonged stress. Have students imagine what it must be like to be a fish and have someone chase it with a net through its house.**

1. Prevention through proper aquarium management practices. Health depends upon the environment in which the fish have to live. The environment is under the control of the aquarist.
  - a. Stress. Any type of stress may cause fish to succumb to disease or illness. Always be considerate of the fish when handling or netting. Hitting the tank, sudden or loud noises, constant moving of fish from tank to tank cause extreme stress.
  - b. Water quality. Because fish are surrounded by water, any detrimental change in the water will directly affect the fish. Keep water quality high by not overfeeding fish, controlling algae growth, maintaining the filtration and aeration systems, and regularly changing about 20% of the tank's water (every 3 to 4 weeks).
  - c. Water temperature. Maintain a constant water temperature. Use aquarium heaters. Insure the aquarium heater is adequate for the size aquarium. Two heaters in one large tank may be necessary. Determine what the optimum temperature range is for the specific fish species, then maintain it.
  - d. Food quality. Feed fish only high quality, nutritious food. Commercially prepared food usually causes no problems. Be very careful when feeding live food. Any illness or disease that the live food brings into the tank will attack fish.
  - e. Quarantine newcomers. New fish must be in a separate tank for a few weeks to insure they are healthy and disease free. After this period they can be added with the rest of the fish.
  - f. Daily tank inspections. Inspect fish every day. Get to know their habits and special behavior characteristics. A change in their behavior, such as eating and swimming habits, is an early sign that something is wrong.

**B. What causes disorders in tropical fish?**

**Show TM D3. Mention that these organisms are usually always present in aquarium water waiting for a fish to become susceptible by being weakened from some type of stress.**

1. Parasites.
  - a. Feed on skin and gills; may penetrate skin.
  - b. Easily treated by adding chemicals to water.
  - c. Examples: Ichthyophthirius (Ich), velvet disease, and skin flukes.
  
2. Bacteria and fungi.
  - a. Can be caused by poor tank.
  - b. Important to keep tank clean.
  - c. Treated with drugs.
  - d. Examples: dropsy, fin and tail rot.
  
3. Diseases.
  - a. Tuberculosis.
  - b. Cancer.

**C. How can these diseases be diagnosed?**

**Refer to TM D4, Mardel Fish Disease Chart.**

1. Most fish illnesses can be diagnosed and treated without consulting a veterinarian.
2. Companies manufacturing treatments for fish diseases often will have diagnostic charts to guide the aquarist in determining disease and treatment. If after referring to one of these charts the disease and or treatment cannot be confidently determined, then call in a specialist.

**D. What treatment is available?**

**Show TM D5.**

1. Heat therapy.
  - a. For treatment of external parasites (Ich, Oodinium).
  - b. Raise water temperature to 86°F for 10 days for Ich, 92°F for about 30 hours for Oodinium.
  - c. Raise temperature slowly (2°F per hour).
  - d. Discontinue treatment if fish exhibit undesirable side effects.
  
2. Salt bath.
  - a. For treatment of fungus, gill and skin flukes.
  - b. One-half oz table salt per quart of water.
  - c. Bathe fish for 20 minutes.
  - d. Repeat bath two times at 48-hour intervals.
  
3. Formalin bath.
  - a. For treatment of external parasites.
  - b. 3 ml of 35% formalin to 10 quarts of water.

## ***Aquaculture Curriculum Guide***

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- c. Bathe fish for approximately 30 minutes.
  - d. Discontinue treatment if fish exhibits undesirable side effects.
4. Treatment with chemicals and drugs. Several companies manufacture and distribute chemicals and drugs for aquarium use that can be found at your local pet shop. As with all animals and the administration of chemicals or drugs, the correct diagnosis is important to selecting the right treatment.

### **Review:**

Review by having students demonstrate their knowledge and understanding of the objectives. This can be accomplished by having students respond to and discuss the following questions: What are major causes of stress for fish? Other than stress, what are additional factors that can weaken fish and make them susceptible to disease? What are the major causes of disease and illness in fish? How are heat treatments, salt baths, and formalin baths administered? What is essential before deciding on a particular treatment for a sick fish?

### **Application Activities:**

Have students correctly diagnose sick fish. If sick fish are not available, teacher can describe a set of symptoms, and students can diagnose the disease or illness described. Students can develop a data bank of medicines and treatments available in the community at local pet and specialty stores. They can treat sick fish using approved practices.

## **Learning Objectives**

- Identify conditions that cause disease and illness in tropical fish.
- Identify management practices that prevent disease and illness in tropical fish.
- Identify symptoms of diseases and illnesses of fish.
- Determine treatments for specific diseases and illnesses of tropical fish.

## **Controlling Aquarium Environment to Prevent Health Problems**

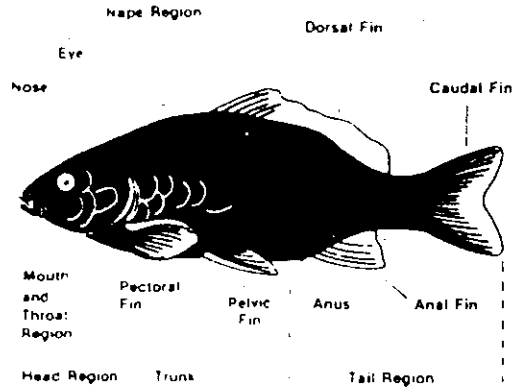
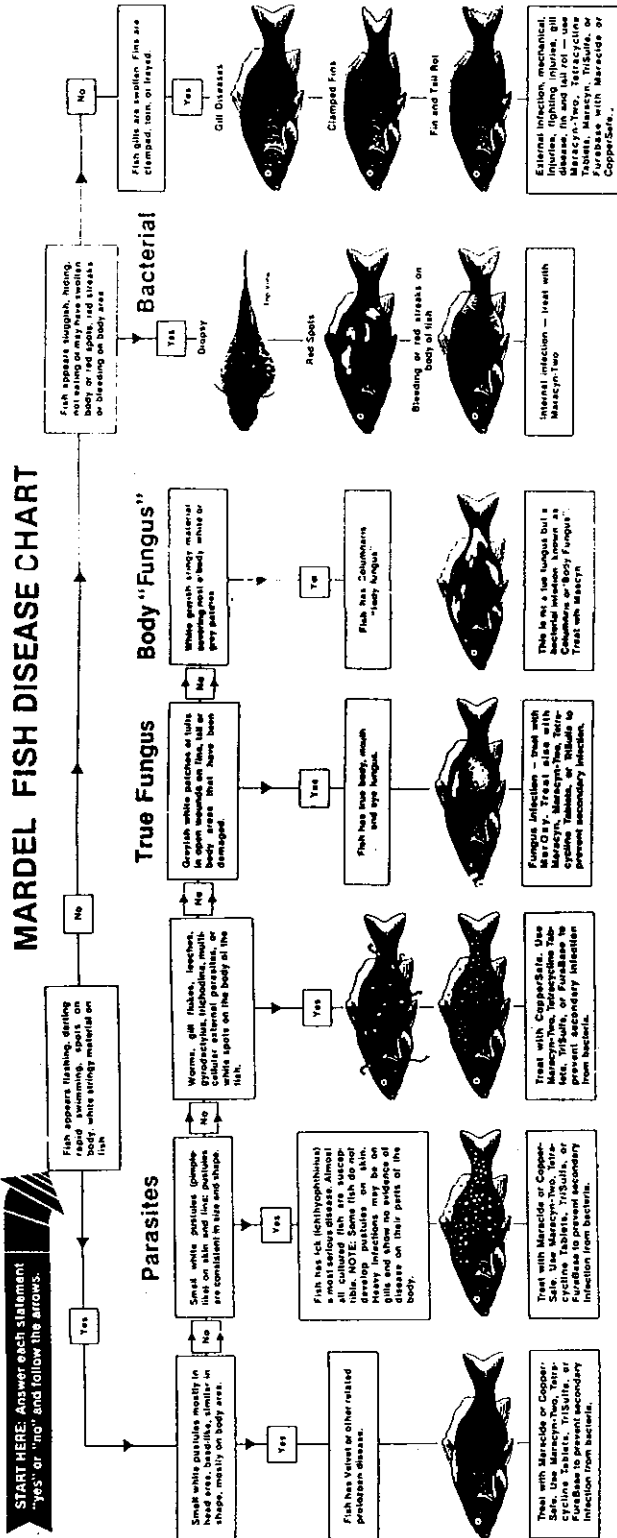
- Stress
- Water quality
- Water temperature
- Food quality
- Quarantine new fish
- Daily tank inspections

## **Causes of Disorders in Tropical Fish**

- Parasites: Internal and external
- Bacteria
- Fungi
- Diseases: tuberculosis and cancer

# Mardel Fish Disease Chart

## MARDEL FISH DISEASE CHART



### Maracyn®

Broad spectrum antibiotic tablet treatment against Gram-positive bacterial and "fungal" diseases of both fresh and salt water fish.



### Maracyn-Two®

Antibiotic for controlling Gram-negative bacterial infections. Treat sick fish that won't eat.



### Tetracycline Tablets

Fast dissolving Gram-negative antibiotic tablets for controlling bacterial infections in fish.



### Maracide®

Concentrated drops to control "ick" and other common parasites in fresh water aquaria. No tank adjustments necessary.



### MarOxy™

Anti-fungal solution. True fungus is easily controlled. Also effective against bacteria.

## **Treatments**

- **Heat Therapy for External Parasites:**

Raise water temperature to 86°F for 10 days for treating Ich.

Raise to 92°F for 30 hours for Oodinium.

Discontinue treatments if fish exhibit undesirable side effects.

- **Salt Bath for Fungus, Gill and Skin Flukes:**

Add .5 oz of table salt per quart of water.

Bathe fish for 30 minutes. Repeat baths twice, 2-day intervals.

Discontinue if fish exhibits undesirable side effects.

- **Formalin Bath for External Parasites:**

Mix 3 ml of 35% formalin to 10 quarts of water.

Bathe fish for 30 minutes.

Discontinue treatment immediately if fish exhibits undesirable side effects.

- **Chemical and Drugs**

Quiz for Section D

Name:

Date:

Quiz on Identifying Ornamental/Tropical Fish Disease Prevention and Health Care

In the space provided, write the correct response to each question.

1. Explain why the aquarium manager is the best defense against disease for tropical fish.

2. Briefly explain how the following factors affect fish health:

Water quality:

Water temperature:

Food quality:

3. Fill in the blanks:

Heat therapy is good for treating \_\_\_\_\_. For treating Ich, aquarium water should be increased to \_\_\_\_\_°F for \_\_\_\_\_ days. When raising the water temperature, raise it \_\_\_\_\_°F per hour until the desired temperature is reached.

A salt bath is good for treating \_\_\_\_\_ and \_\_\_\_\_. Add table salt at the rate \_\_\_\_\_ oz per quart of water. Bathe fish for \_\_\_\_\_ minutes. The baths needs to be repeated \_\_\_\_\_ times at \_\_\_\_\_ hour intervals.

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### Key for Quiz - Section D

1. Explain why the aquarium manager is the best defense against disease for tropical fish.

**Fish health is very dependent upon the environment in which the fish live. This environment is under the direct control of the aquarist. Good management practices by the aquarist will prevent diseases and keep the fish healthy and resistant to succumbing to illnesses.**

2. Briefly explain how the following factors affect fish health:

**Water quality: Fish are surrounded by water; any detrimental change to the water will directly affect the fish.**

**Water temperature: Fluctuations in water temperatures put stress on fish. This increases their susceptibility to disease and illness.**

**Food quality: Good nutrition keeps a fish healthy. A well-balanced diet is essential for keeping fish disease resistant. For live food, an undesirable organism on the live food will also try to infect aquarium fish.**

3. Fill in the blanks.

**Heat therapy is good for treating external parasites. For treating Ich aquarium water should be increased to 86°F for 10 days. When raising the water temperature, raise it 2°F per hour until the desired temperature is reached.**

**A salt bath is good for treating fungus and gill and skin flukes. Add table salt at the rate .5 oz per quart of water. Bathe fish for 20 minutes. The baths needs to be repeated 2 times at 48-hour intervals.**