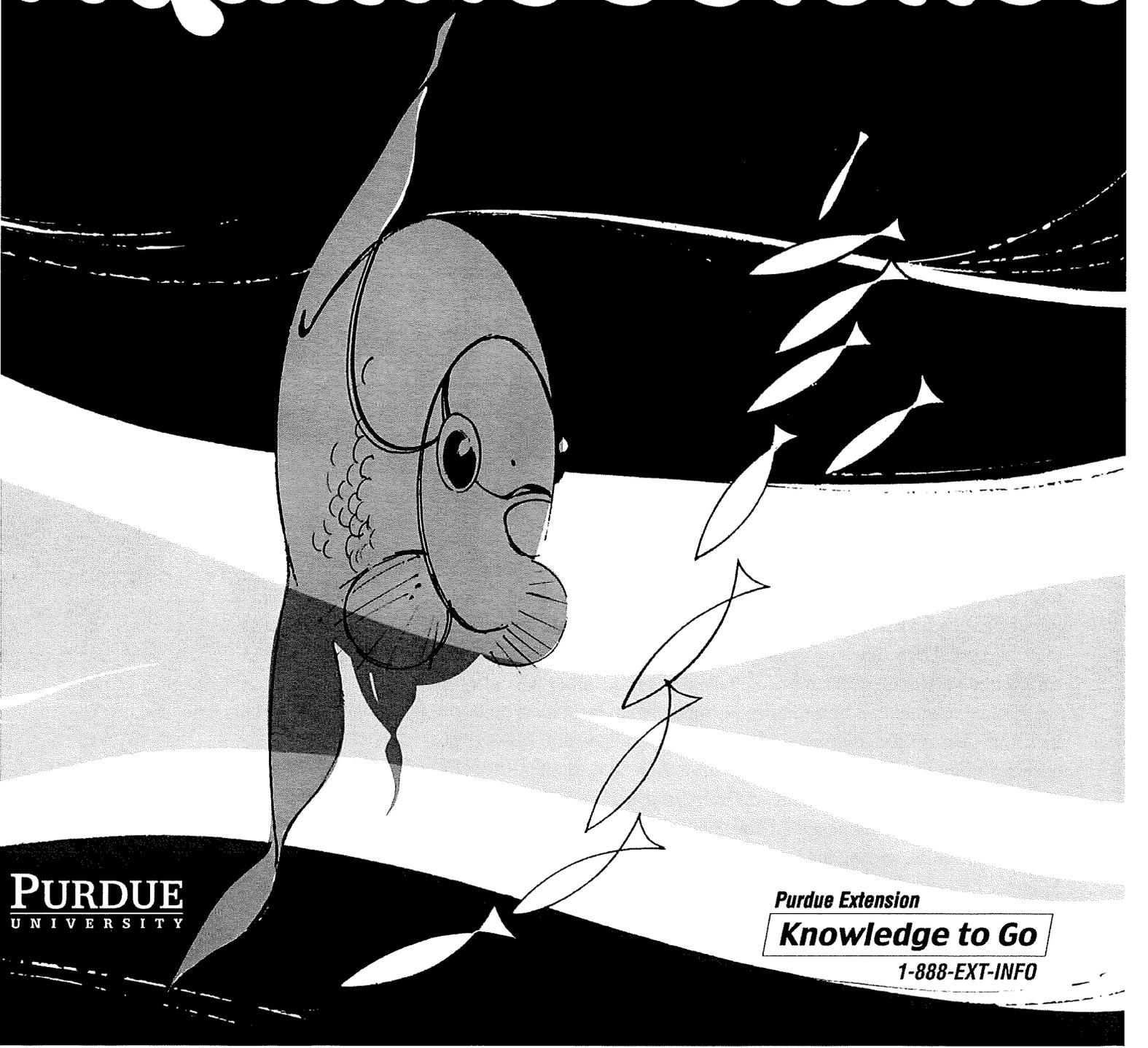


4-H-447-W

\$2.00

Aquatics Science



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Knowledge to Go

1-888-EXT-INFO

Note to Parents and Volunteer Leaders

Welcome to 4-H aquatic science project. Raising fish can be an exciting, enlightening, and challenging experience.

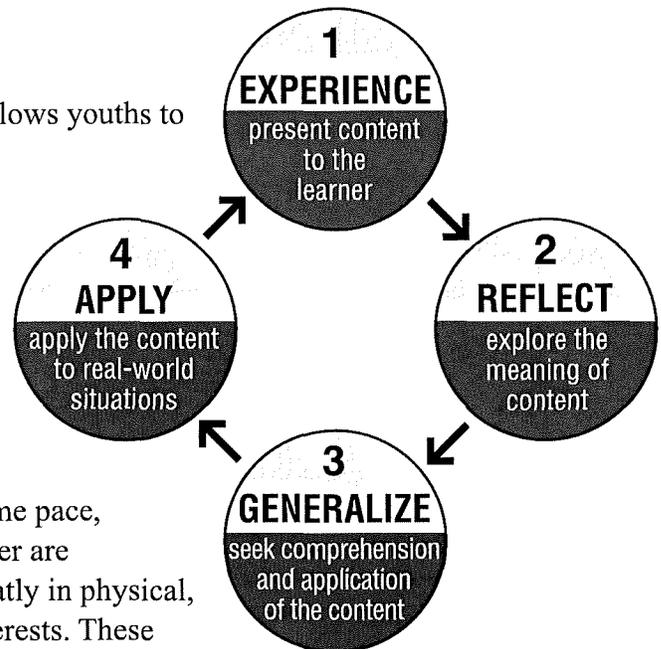
The activities in this project manual allow young people to choose the depth of their involvement and the amount of money they will spend. The Aquatic Science 4-H Project requires a small investment if a youth raises goldfish, or a much larger investment if they choose to raise tropical fish. Tropical fish can be a very expensive, especially if a large aquarium is desired.

The program can be completed by urban, suburban, and rural youths. Young people may begin and end the program any time during the year or continue it for several years. They can learn on their own, or the program may be used for classroom enrichment or as a special activity in a church group or club.

Record sheets are intended to teach scientific recording and initiate good data collection practices. Activities are designed to help the 4-H'er acquire responsibilities, make decisions, and care for living things.

Experiential Learning

4-H uses an “experiential learning” format that allows youths to “Learn by Doing.” Experiential learning distinguishes 4-H youth development education from many other educational methods. The activities in this manual allow youths to learn as they build an aquarium or select a goldfish container and purchase fish, food, plants, etc.



Ages and Stages of Youth Development

Keep in mind that people don't develop at the same pace, and transitions from one developmental stage to another are generally gradual. Youth of the same age can vary greatly in physical, mental, social, and emotional growth and personal interests. These differences are even more marked between age groups. A youth may seem very responsible and mature at one meeting and may be bored and noisy at the next meeting. Accept the members at their current development stage and offer challenging opportunities to help them make the transition into the next developmental stage. With patience and commitment, you can help your 4-H members to grow and mature and help make 4-H a rewarding and fulfilling experience. You can learn more about the common physical, mental, social, and emotional development of youth from the publication *Ages and Stages of Child and Youth Development, A Guide for 4-H Volunteers* (NCR 292). This publication is available on the Web or from the Extension office in your county.



You, as a parent or volunteer leader, are a valuable asset to your community and to the individual members of your 4-H club. Youth benefit greatly from working on projects that they are interested in and from interacting with caring adults.

Resources

An excellent 4-H Aquatic Science curriculum is available from The Ohio State University. You can order it online at <http://ohioline.osu.edu/~buckpubs/>. This site gives publications listings by categories. Scroll down to 4-H and look for the following publications under the Aquariums section. (You can access the OSU 4-H catalog directly at <http://ohioline.osu.edu/4-H/fguide00/index.html>.)

625GPM *Fishy Science* (Note: GPM stands for “Group Project Manual”)

Recommended for project advisers and third- through fifth-grade teachers.

Explore the unique features and abilities of fish in four easy-to-use lessons. Includes activities on how fish breathe, float, drink, and swim.

626 *Keeping Fish Alive*

Know more about a healthy environment by designing a functional aquarium for your fish. Ten-gallon aquarium needed for this project.

627 *Special Aquarium Setups*

Plan and study how to raise four types of fish in an artificial environment that will keep them alive. Twenty-gallon aquarium needed for this project.

628 *Aquatic Plants*

Design a natural environment by growing plants in an aquarium to keep your fish healthy in the tank.

Another useful publication is *Exploration Activities in Aquaculture*, from Interstate Publishers Inc., Danville, IL (800) 843-4774 or e-mail info-ipp@IPPINC.com ISBN 0-8134-3105-0 (\$14.95 for 4-H clubs, as of July, '01)

Additional information for advanced study is available from many sources. Your local library, bookstore, hobby store, or the Internet will offer a wealth of information on raising fish.

Credits

This publication was adapted and revised from the 4-H Aquatic Science project manual by Natalie Carroll, Extension Specialist. The original manual was written by William E. Caldwell, Purdue University.

Thanks to Mrs. Mary Oberthur and Dr. Don Schuder for their help with the original 4-H Aquatic Science project manual text.



Raising Fish

Fish are fun and relaxing to watch. With a little planning they can be inexpensive, easy, interesting, soothing, and educational. Of course, they can be expensive, troublesome, and messy to care for ... It's all up to you!

Your fish will be completely dependent on you for their food and living conditions. If you develop regular fish-care habits, your fish will thrive. They tolerate occasional neglect if they are in good condition, but continual neglect will show clearly. Remember: They are living creatures! If you select this project, plan to give your fish regular meals, clean water, and interesting surroundings. Think of how you would feel if you were a hungry fish living in a bare bowl of dirty water, not knowing when, or if, you would be fed. Your fish will be a reflection of the real you ... careful and caring, or careless and cold.

Study your fish and you will find they have personalities. Even in a large aquarium, individuals will stand out and earn names for themselves such as Baby, Grandma, Head Wife, Grumpy, Scardey Cat, and Big Papa.

Types of Fish

The type of fish that you decide to raise will make a big difference in the amount of time and the cost of this project.

Suggestions for the Beginner

Goldfish are a good choice for the beginner. They are widely available, can be kept in a bowl, and do not require expensive accessories. Raise at least two fish. If you are using livebearers, you will need three fish (two females and one male).

Suggestions for the Advanced Project

The advanced member can continue with goldfish, as outlined above, with the addition of a planned program, definite goals, and a statement of results. Or you may choose to raise tropical fish. There are nearly endless choices in the types of tropical fish, aquariums, and accessories. If you enjoy the challenge, it can become a life-long hobby. Since goldfish do best in cold, unheated water, they should not be placed with tropical fish. Most tropical fish require warm, heated water in the range of 72° to 85° Fahrenheit.

Planning Ahead

Before you purchase your fish, you will need to prepare their "home" (bowl or aquarium) and purchase the equipment that you will need. Plan to allow one or two days to prepare for the fish and to allow the tank to "season." Seasoning the tank makes the water healthier for your fish:

- Dissolved chemicals (chlorine and fluoride) that are present in city tap water will evaporate. There are chemicals available from your aquarium supplier to treat city tap water to season it more quickly. No treatment is necessary for well water unless your well system adds chlorine. If your water is safe for you to drink, and contains no chlorine, it is safe for your fish. You can get chlorine test strips from an aquarium supplier so you can check your own water.
- Bacteria will have time to break down any detergents that may have been present in the water or in the tank.
- Plants can get their roots settled.
- Rock dust (from the gravel you will use to cover the bottom of the tank) has time to settle.
- Seasoning allows the water to come to the proper temperature for your fish.



It is a good idea to take pictures of your tank setup and the first day that you place your new fish in your tank. Pictures help you remember your first (or second, third, etc.) aquarium and document your project work. These are especially useful if your fish die so that you are still able to make a poster exhibit of the records that you kept, what you learned, and what your fish looked like.

You will need the following items to care for your fish in a bowl project.

- Salt (non-iodized)
- Gravel
- Nylon net or cover for the tank
- Plants
- Siphon
- Snails
- Thermometer
- Food
- Net

You will need additional items for an aquarium, particularly if you are raising tropical fish. These include a light, pump, and filter.

Tank Size

The size of the tank determines the number of fish you may keep, because it fixes both the amount of water and the surface area of the water. Fish need oxygen, just like you, but they take it from the water as it passes through their gills. Oxygen enters the water at the surface, so you should fill bowls only to their widest point, because that allows the largest surface area to absorb oxygen from the air. If you do not have a cover on your tank or bowl, you must allow at least two inches above the water line to keep fish from jumping out. Live plants and air pumps increase the amount of oxygen available to your fish.



In general, a gallon of water will hold six to eight neon tetras (a small, slender fish), two pair of guppies (small fish), two barbs, or two medium goldfish (medium). A pair of fish totaling one inch in length requires a gallon of water (not more than two inches of fish per gallon if you have a pump and filter). A five-gallon tank will house six pairs of fish together with plants and other animals. The Labyrinth fishes, which swallow surface air, can take more crowding. Male Siamese fighting fish are always kept alone in quart jars. They will kill one another if they are in the same container. It is best to allow fish plenty of room until you have gained experience, because overcrowding is usually detrimental. Remember: fish grow and multiply!

You can measure how much water will be available for your fish by using a gallon jug to fill your bowl or tank to three inches from the top. This leaves two inches top space and one inch for gravel.



Getting Started

Once you have determined how many fish you will start with and have found or purchased a bowl or tank, it is a good idea to sterilize your tank and check for leaks.

Sterilizing Your Tank

Wash the bowl or tank and any accessories you have (castles, marbles, etc.) in clear tap water. Do not use any soap or detergent. They can leave residues that might harm your fish. Be sure that any accessories are colorfast and insoluble. Put the accessories into the bowl/tank and fill to the top with hot water. Add as much non-iodized salt as will dissolve when you stir it into the hot water. Let the water sit for about one hour. Remove the salt water: You can pour the water out of a bowl, but you must dip or siphon off the water if you have a tank, to prevent springing the sides. Rinse with clean water and set the tank up for your fish.

Gravel

A bag of colored gravel will be enough for up to six one-gallon bowls. Solid-colored gravel is better than multi-colored because you can spot dirt and uneaten food more easily. Use care if you choose to pick up your own rocks to add to the bottom of your tank. Many Indiana rocks are limestone, which will make the water too alkaline. Some blue and green rocks have compounds that are poisonous to fish. Marbles may be used. Slant the gravel so it is deepest in the rear of the tank or bowl, so the dirt will collect at the front where it is easily removed.

Plants

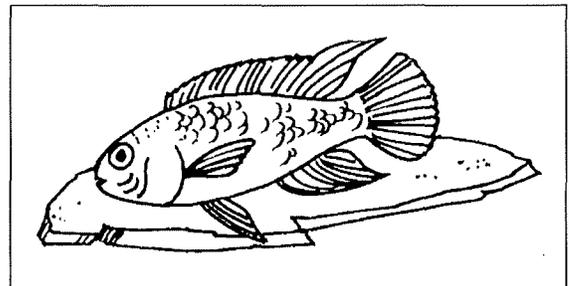
Plants increase the available oxygen in the water. Choose healthy plants with good color, clean odor, and no slime. Rooted plants will need one to two inches of gravel. Place plants in the rear for background. Do not crowd plants as they, too, take water space and get food caught on their leaves. If plants are placed on the side with the most light, baby livebearers will swim into them for protection. A bunch of floating water plants will be enough for two to four bowls. While there are several plants that can be used, we recommend Anacharis, Cabomba, or Vallisneria, since these seem to be the hardiest plants. Advanced members may want to use Lemna, Anacharis (elodea), Cabomba, Myriophyllum, Ludwigia, Potamogeton, Chrysosplonium, Herpestis, Utricularia, and Cryptocoryne.

Net

Do not handle fish with your hands. Buy or make a small net that you can use when moving your fish.

Cover

A cover will keep hands, cat paws, and foreign objects out of your bowl or tank. Fine-mesh nylon netting can be used to make a tank cover. A wad of extra nylon net makes a fine cleaning cloth, and a narrow piece can be pulled through dirty tubing with a piece of fine wire. Glass or Plexiglas can also be used for a top on tanks that have an air pump.



Food

There are many varieties of food. Some fish are top feeders, some eat only from the bottom, some prefer sinking pieces, and others don't care. Ask the clerk for recommendations when you buy your fish, and look the foods over carefully when you make your purchase. A small package of food goes a long way. If you and your friends buy several kinds and share them, you can have a variety of food without spending too much. Feed goldfish once a day. Tropical fish can be fed two to four times a day. You may feed them up to every two hours if you want quick growth, but you must keep the feedings small. Be sure they clean up every bit in five minutes. Overfeeding is easy to do and dangerous to your fish.

Salt

Buy a box of plain non-iodized table salt to use in cleaning your equipment. Never use detergent, since it is harmful to fish. Salt sprinkled on a clean cloth or wad of nylon net does an excellent job of cleaning. Sick fish can sometimes be helped by putting them in a solution of two quarts of seasoned water and one teaspoon of plain salt for a half-hour daily until the fish seem better. Plants can be rinsed in this solution when you clean the tank to get rid of food particles and algae growth. Finish by rinsing them in clear tap water.

Temperature Control – Thermometer

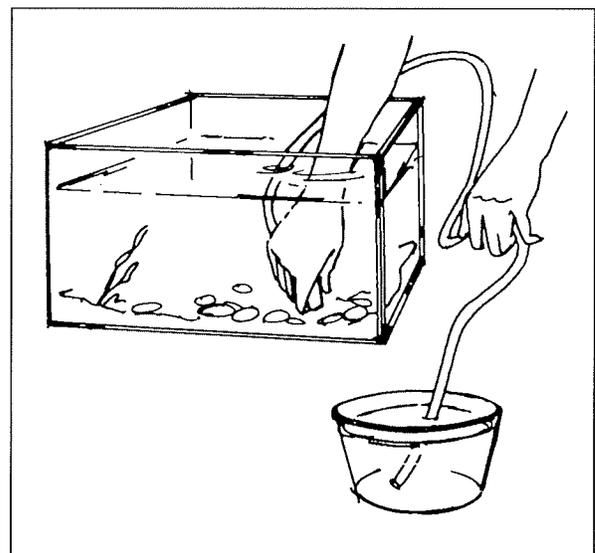
An indoor or outdoor thermometer that you already have will do to check water temperature when you change or add water. You may want to purchase a small aquarium thermometer in order to keep a constant check.

Depending upon the kind of fish you raise, the temperature of the water can be a critical factor. Sudden temperature fluctuations may

easily harm or kill your fish. If you are raising tropical fish, the temperature should be kept between 70° and 85° F. The ideal is about 75°. Don't put tropical fish in water below 75° F. Goldfish do not need such careful attention to temperature conditions as they may live in water from 50° to 75° or slightly colder.

Cleaning – Siphon

Plastic tubing to make a simple siphon can be purchased at most hardware stores. If you wish to purchase plastic tubing with a suction attachment, you will need to spend more. Siphon as much as a third of the water from the bottom of the tank once a week. Replace the water that you removed with seasoned water. You will not have to change all of the water in the tank unless you overfeed. The tubing must be full of water to work. Fill the tubing at the sink or by slowly lowering it into the water. The waste end must be lower than the intake end, and the intake end must be under water at all times. Pinch the tubing by folding it sharply when you move the siphon. If the siphon is working properly, dirt will be quickly sucked into the tube. Extend your finger below the end of the intake end to guide the tube and stir up the dirt, especially if your gravel is fine enough to be picked up. Keep the tube slightly above



the bottom. If gravel or a snail is pulled into the end, they will often drop free if the tubing is pinched to stop the water flow. If they get into the tubing and stop the flow, you may be able to flush them out by raising the intake end or by using the faucet. If this does not work, hold one end of the tube with one hand and use the other hand to push the rock or snail out of the tube. You can attach a piece of nylon net to the end of the tube with a rubber band to keep from picking up unwanted items.

Snails

Snails come large and small. You may find some on the plants that you buy. Baby snails look and feel like a fine grain of sand but grow quickly. They eat the food the fish leave and help clean the tank by removing the algae that forms on the side of the glass. Snail eggs should be allowed only in large tanks. Although a few snails can be beneficial, they will become a nuisance if you do not control the number in your aquarium and get rid of the excess. You can use two small snails per gallon of water. If large snails are used, you should not have more than three in a five-gallon tank. Large snails are a good choice for large tanks since they do not eat plants and do not reproduce rapidly.

Locating the Aquarium

Put your aquarium in a place where it receives a medium amount of light. Strong light encourages the growth of algae, which turns the water green. In general, a northern or western exposure of light is most suitable — north being the best of the two. If you must place your bowl or tank where it will face the sun (southern window), fasten a sheet of green cellophane to the portion facing the direct rays of the sun.

If algae turn the water green, you may add daphnia (waterfleas). After the water is cleared, the fish will feed upon the daphnia. If there are several fish in the tank, you may need to put some of them in another tank so they won't eat the daphnia before the daphnia can clean out the algae. If sufficient light is not available and plants begin to lose their green color, place an electric lamp with a 70- or 100-watt bulb over the aquarium a few hours each day. Do not keep an aquarium close to a radiator.

Example materials for a simple bowl of fish

Snail
1 pair guppies (fancy)
1 peppered corydoras (catfish)
2 or 3 plain guppies
Book
Bowl
Gravel
Plants
Food
Thermometer
Plastic tubing
Plain salt
Nylon netting to cover bowl
Net

How to Fill Your Tank

1. Assemble the materials one or two days before getting your fish.
2. Put gravel in a pan or large strainer and run tap water over it until the water runs clear. All gravels have some dust and even after washing may cloud water until it settles.
3. Place the gravel in the bottom of the tank.
4. Sterilize your tank as described previously.
5. Place your bowl or tank in the location that you have decided upon.



6. Arrange the gravel in your tank. Put more gravel in the back of the tank and less in the front. This will bring dirt to the front for siphoning and allow deeper gravel for background planting. In round bowls with floating plants, cover the bottom evenly with gravel.

7. Put a piece of paper or a saucer on the bottom of the tank and pour water onto it. This will lessen the disturbance of the gravel. Fill the tank one-third to one-half full.

8. Place the plants and accessories. Fill the tank to two or three inches from the top.

9. Let the water season for a day or two if you did not add seasoned water in step 7.

An Alternate Method for Adding Gravel

Follow steps 1, 2, 4, and 5 listed above. Then fill your tank one-third to one-half full of water before adding the gravel. Put the gravel in a cup or jar. Holding the cup under water, pour the gravel slowly into place in the tank and shape it with your fingers. Then place the plants and accessories where you want them and complete filling the tank with water by placing your hand in the tank so your fingers touch the side of the tank and your palm is facing upward. Pour the water onto the palm of your hand so that it runs down your fingers and onto the walls of the tank without disturbing the gravel.

Choosing Your Fish

If you have an unheated and un aerated bowl, you will have to use care in choosing the variety of fish for your project. There are many fish that will do well, but there are many that will not adapt to the lower temperatures or that are particularly hard to care for. Remember: The water temperature will be a few degrees lower than the temperature of your home. Water temperature changes more slowly than the air's,

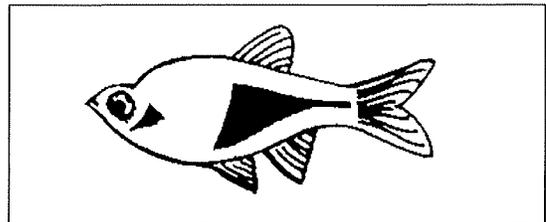
but if the tank is in a draft, the water temperature will be cooler than usual. Tanks that are covered and electric lighted will be several degrees warmer than the room. Guppies prefer 74° to 84° F and will survive in 68° water, but they will not breed at lower temperatures. If possible, take a picture of your new fish the day you bring them home.

Fish Disease

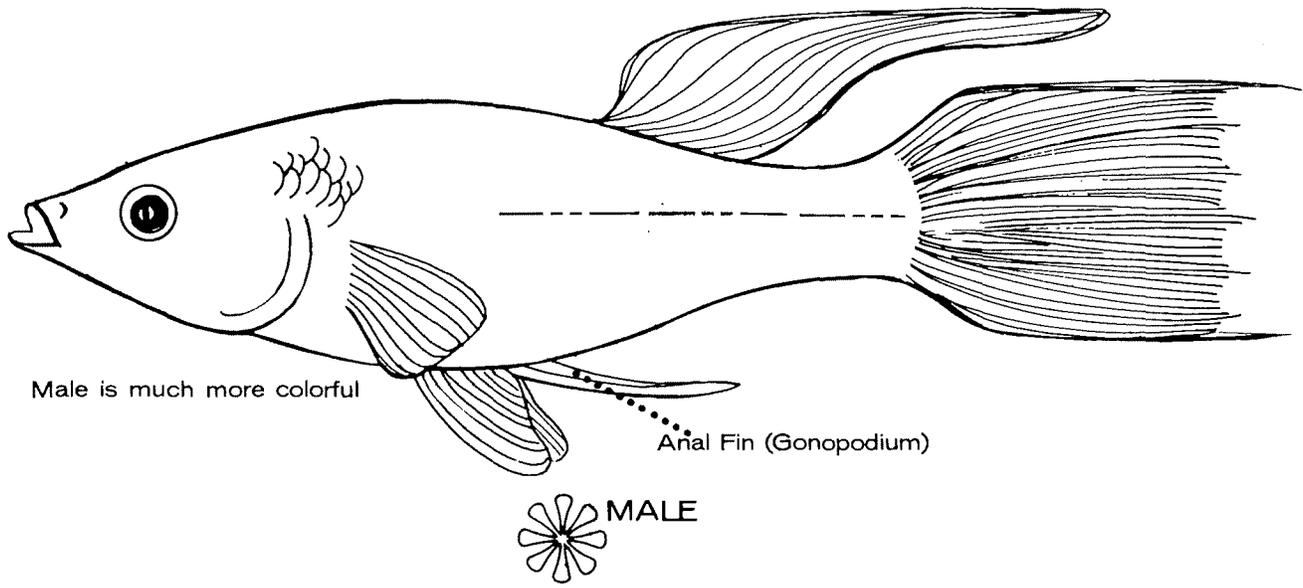
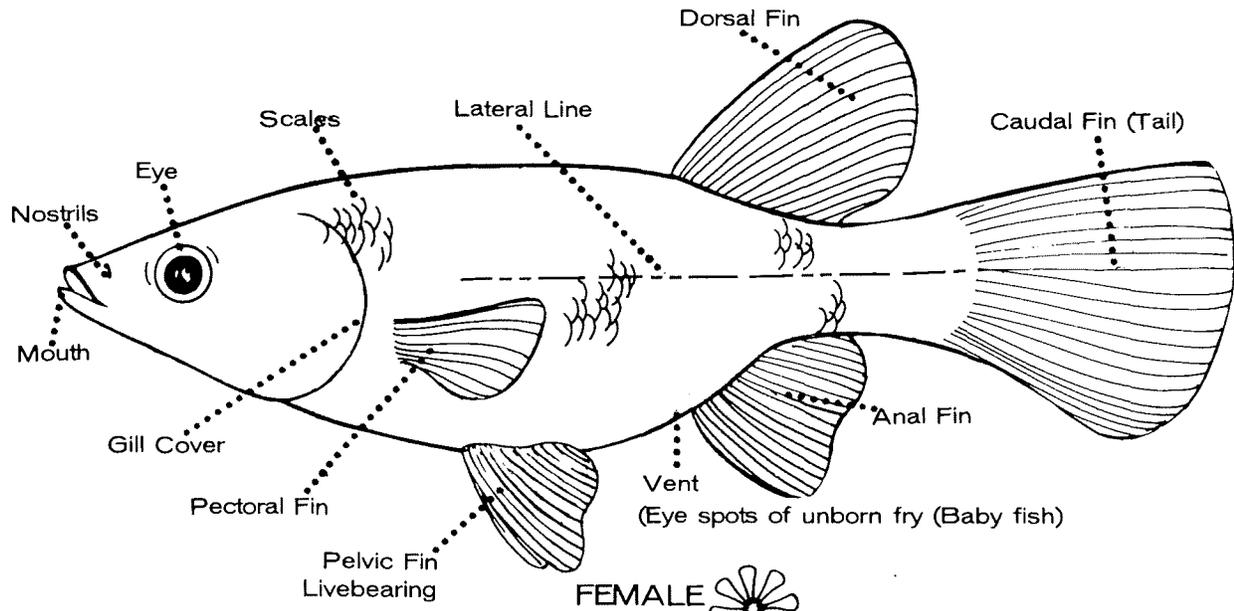
Fungi, such as water mold (*Saprolegnia*), and a protozoan called water itch are two of many parasites that bother fish. Fish with these conditions may show gray patches or scales on their fins and should be isolated quickly. You may wish to try immersing the diseased fish in a 10 percent solution of non-iodized salt as described previously. Remove it after one half hour and rinse in seasoned water. Usually the patches disappear after this treatment. Another treatment that may help is to put your fish in a 0.5 percent solution of potassium permanganate for 15 minutes. Quarantine the fish in a separate tank of seasoned water and watch it for a possible reoccurrence of the condition. If your fish does not recover, it should not be returned to your aquarium as it may transfer the disease to your other fish.

Other symptoms of disease are discovered by watching the behavior of your fish. Watch for the following symptoms:

- Hiding in the plants.
- Lying on the bottom.
- Holding fins close to their body.
- Gasping for air at the top.



PARTS OF THE FISH



GUPPY



Kinds of Fish

Barbs and Similar Fish

Cherry Barb, †Checker Barb, *Gold Barb, †Pear Danio, †Zebra Danio, †Goldfish, †White Cloud Mountain (the last two prefer a water temperature from below 64° to 74° F)

Tetras

*Neon, Cardinal, Red-eyed, Black-lined, †Buenos Aires, †Tetra from Rio (similar fish is a †Bloodfin)

Livebearers

(can be sexed by anal fin – gonopodium)

*Guppy, *Molly, *Swordtail, *Platy

Labyrinth Fishes

(take extra air at surface)

Betta or Siamese Fighting Fish (keep male in individual bowl), *†Three-spotted Gourami, †Blue Gourami, †Opaline Gourami, Dwarf Gourami

Assorted Families

*Peppered Corydoras (catfish), Egyptian Mouthbreeder, Glass fish, †Australian Rainbow fish

*Fish that may be cared for in a one-gallon bowl.

†Fish that tolerate temperatures as low as 64 degrees.

Fish Care Habits

Bowl Check

Learn to automatically check these items each time you look at your fish:

- Are all fish alive and visible? Do they look healthy? Are there any torn fins, etc?
- Is there any uneaten food on the top or bottom of the bowl?

- Is the equipment working properly?
- Is the water temperature correct? Are there any drafts or full midday sunlight?
- Are the plants healthy and in place?
- Is the water level where it should be? Is it clear, with no foul smell?
- Is the tank covered? Are there any foreign objects in the tank?

General Management

- Isolate new or sick fish in a separate, small bowl.
- Keep everything but known safe objects out of water.
- Guard against sudden changes in the water temperature.
- Turn the light off at night and on in the morning (constant light makes fish infertile and may cause algae problems).
- Do not tease fish by splashing water or tapping on the glass. Goldfish, however, may be trained to come to the side of the bowl by tapping softly.
- Be sure that all members of your family understand the safety rules.

Feeding

- Feed regularly; goldfish once a day, tropicals two times or more if you can.
- Feed no more than they can eat in five minutes; remove food promptly.
- Feed fish yourself. In an emergency, leave written instructions or have another hobby member do the feeding.
- Give a variety of food.
- Keep your food out of reach of others, especially young children.



Cleaning

- Wash hands before and after caring for fish. Rinse thoroughly before working with your fish to avoid transferring any detergent to your tank.

- Dump waste water in toilet, not in sink.

- Rinse any dishes or pans carefully before using. Don't use metal pans.

- Season (condition) water by aging or with chemicals available for this purpose from your aquarium supply house. Well water does not require seasoning.

- Clean the bottom of the tank by siphoning about a third of the water once a week.

- Replace siphoned and evaporated water with seasoned or conditioned water.

- Check water temperature before adding it to the tank. Warm the water if needed by heating a small amount. Add the water by pouring against your palm and down your fingers onto the side of the bowl.

- When changing all the water in the bowl, save the top one-third to one-half of water to place fish in while you are cleaning your tank and add it to the new water later.

- When changing the water in the entire bowl (fish out), use salt, not soap, to clean the bowl.

- Scrape the water evaporation mark off the bowl regularly to prevent an accumulation.

- Use a nylon net scrap to clean the sides of the bowl.

- Keep all chemicals on a high shelf ... they will kill fish if they are not used according to the instructions on the container.

- Never touch fish with your hands. Use a net.

- Wash any dishes or pans thoroughly after use and put them away.

Safety Rules (for your family and friends)

Fish need specific kinds of care. Do not leave small children alone with fish until you have supervised their first viewings and carefully explained that they should not try to care for or play with the fish. Anyone who does not know how to care for fish should not do the following things.

- Put anything in the water.

- Feed.

- Tap on glass or splash water.

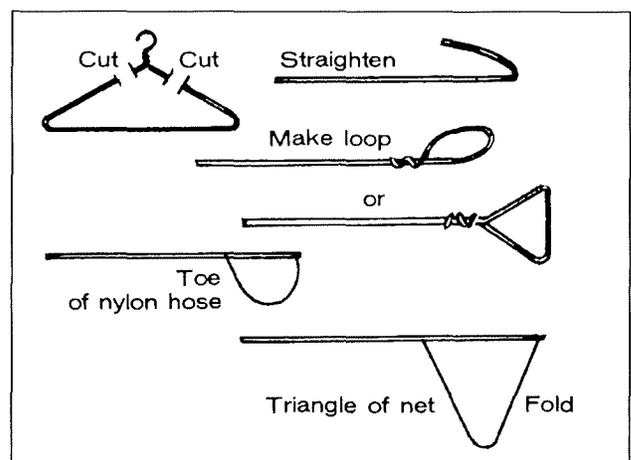
- Mess with the equipment.

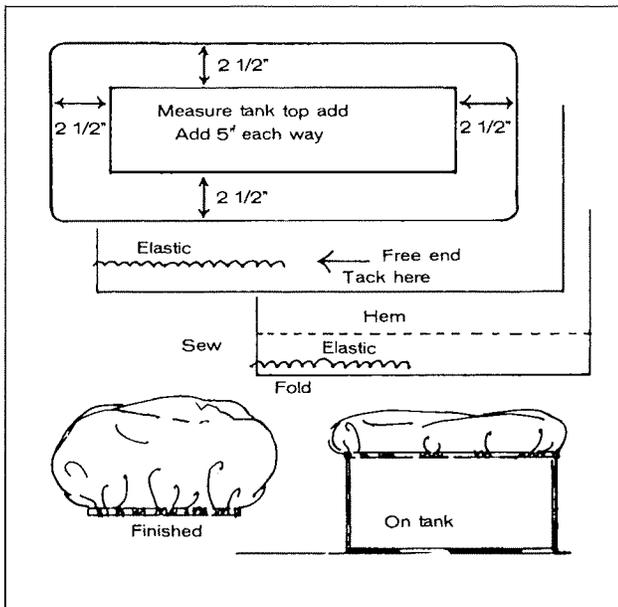
- Try to catch fish.

Simple Equipment to Make Yourself

Net

You can make a net using a wire clothes hanger and a lady's nylon hose (no holes or runs) or nylon netting. You also will need duct tape or a file, a needle and thread, and pliers with wire cutter, or pliers and a wire cutter. Cut the hanger as shown in the picture below. Straighten one of the ends. Bend the short end into a loop and twist around the straight end (handle). Smooth any rough edges with the file, or cover with duct tape. Cut about 3 1/2 inches from the toe of hose (or shape nylon netting into a net) and sew it onto the loop of wire.





Tank Cover

You will need a piece of nylon netting, a narrow elastic band, and a needle and thread. Cut the nylon netting five inches wide and five inches longer than the tank measurements. Cut elastic long enough to reach around tank. Leaving one inch of elastic free, sew it firmly to the netting at that end, then fold the netting over the elastic and sew a casing for it. Pull the end of the elastic forward as you sew, gathering net. The elastic must pull freely through the casing except where the one end is tacked. When you have sewn the casing around all of the netting, overlap the end of the elastic (one inch free at beginning) and sew it firmly.

Bowl Cover

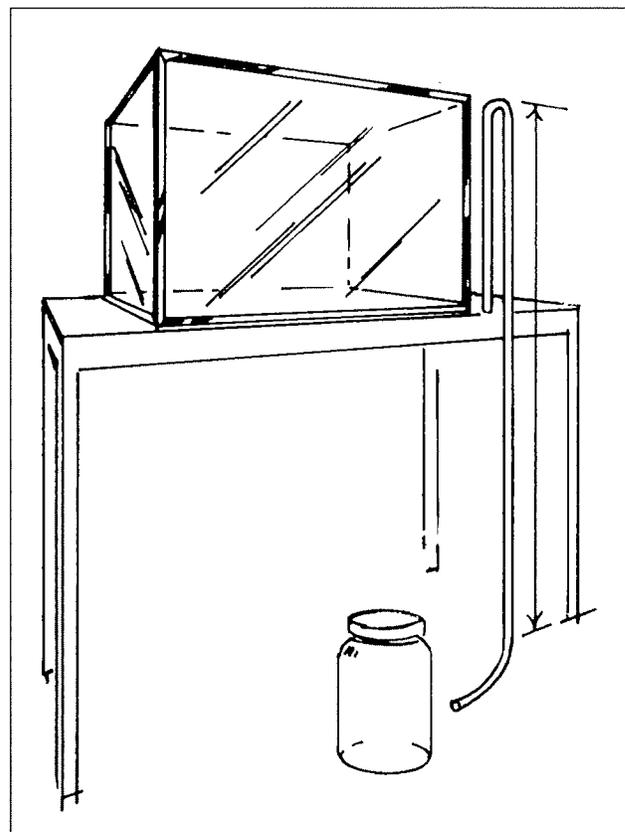
For a round top, you may use a square of netting and secure it with a large rubber band.

Siphon

For small jobs, use two large plastic straws and duct, freezer, or masking tape. Pinch the end of the first straw slightly to insert into second straw. Tape the two straws together to make an airtight seal. Dampen your finger and place it

over the upper end while lowering the straw into the water. Remove your finger and replace it immediately (tap the top of the straw). This sucks any dirt immediately below the straw into the straw. Keep your finger firmly over the end of the straw while removing the dirty water to a waste jar. When you have moved the straw to the waste jar, remove your finger to let the dirty water run into jar.

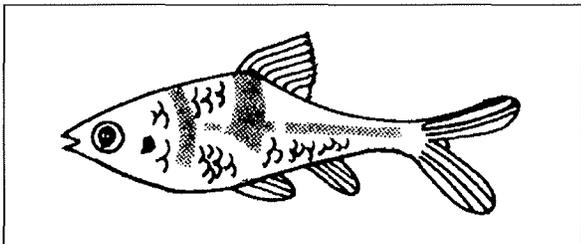
For large jobs, you can purchase plastic tubing to remove water from the bottom of your tank. To determine the length of tubing you will need, add the height of your tank (h) and the distance from the top of your tank to the floor (f) plus 6 inches ($L = h + f + 6$ inches). This will give you enough tubing to drain dirty tank water to a waste jar on the floor. A gallon jar or bucket works well to put the dirty water in, depending upon how much water you will be removing.



Fish Bowls

A single fish may be isolated in a clean, wide-mouth glass quart jar. Cover with netting and keep the water level down two inches from top. A better bowl for many babies or up to six small fish may be made from a one-gallon glass jar. You may be able to find these in your grocery store (if your family likes a lot of pickles!) or one may be available from a local restaurant. Clean these jars carefully and rinse with salt water, then rinse several times with seasoned, treated, or well water. (Or rinse with tap water, fill jar and allow water to season for two days in jar before adding fish.) Fill the jar to about three inches from the top and cover it with netting. Do not use a solid lid, because it will limit the amount of oxygen available to your fish.

To transport or introduce fish to water of a slightly different temperature, use a heavy gauge, watertight plastic bag. Test the bag first to make sure it is watertight. Fill the bag half full with water and fish (at least a pint of water) and close it with a rubber band. Carry the bag in a large purse, cardboard container, or foam box to protect the fish from chills or overheating and jolts that might rupture the bag. Do not leave the fish in the bag any longer than necessary. To introduce the fish into different water, hang the bag in the new water for at least 15 minutes, then rupture the side of the bag carefully to let the fish swim free.



When Preparing Fish for Exhibit

- If you have several fish, choose the two largest, healthiest specimens for your exhibit.
- Carry the fish to the show in a small bowl with a plastic cover. Put the bowl in a box and firmly hold it in place by putting foam rubber or tightly wadded paper around it to protect it from spilling and temperature changes.
 - The bowl you use to exhibit your fish should not contain rocks or plants. At a show, these detract from the fish.
 - Check to make sure that the pair of fish you exhibit is one male and one female.
 - The exception to exhibiting pairs is when Bettas are to be shown. These fish attack each other, so they should be shown separately.
 - The fish bowl or jar that is used in the exhibit should have at least one flat side. This way people can see what the fish really look like.

Sometimes it is not possible to exhibit your live fish. Some counties prefer that 4-H'ers in the Aquatic Science Project do a poster presentation. Sometimes members do not want to subject their fish to the move and conditions at the fairgrounds, or they may not want to move the fish because their livebearing female is close to giving birth (note: Guppies are fairly hardy, but Mollies often lose their babies if moved). If your fish died, from a cause other than neglect, you may be able to get permission from your 4-H leader to do a poster presentation that includes your record sheets, what you learned in the project, and any pictures that you have of your fish.

Exhibits

Check your county exhibit requirements, as they take precedence over the suggestions in this manual. Most counties allow youths



enrolled in the Aquatic Science Project to exhibit at the county fair a specimen or pair that they have taken care of for at least four weeks. Poster exhibits should be displayed horizontally, 22" X 28", and mounted on a firm backing and covered in clear plastic or other transparent material. Be sure to include your exhibit label with your name, grade, and county. There is no state fair exhibit for the Aquatic Science Project.

Complete the record pages in the back of this manual. They can be copied, or you may make your own on a typewriter or computer, or you may download them from the 4-H Web site at <http://www.four-h.purdue.edu/> (click on "Search" on the left side of the page, then select "Aquatic Science" from the pulldown menu that says "Project. "). Beginners should complete the following record sheets: 4-H-447A-W, Aquatic Science Fish Record; 4-H-447B-W, Aquatic Science Equipment and Supplies; and 4-H-447C-W, Aquatic Science Food and Feeding Practices. You may need to complete other record sheets (4-H-447D-W, Aquatic Science Losses; 4-H-447E-W, Aquatic Science Breeding Records; 4-H-447F-W, Aquatic Science Problems; and 4-H-447G-W, Aquatic Science Experiment Record), depending on what happens with your fish and your depth of involvement in this project. Advanced members should complete the basic record sheets, other sheets as appropriate, and a notebook with program plans, records, and results.

Advanced Programs

The advanced project requires a planned program. You may develop your own program or choose from one of the ideas given below. All the suggested programs take a relatively short time to complete except the breeding program, which will take a year or more.

Feeding Experiment

The feeding experiment requires two groups of fish that are fed differently. You will need to keep careful records of what you feed, when you feed, and the reactions of your fish. You can adapt the Food and Feeding Practices Record Sheet for your particular experiment. When doing these experiments, observe fish responses as well as tank conditions (cleanliness). Ideas for feeding experiments include feeding live food (daphnia, tubifex worms, enchytrae, brine shrimp, etc.) versus regular dry food, recommended feeding amounts versus overfeeding, or feeding once a day versus feeding three times each day (use the same amount of food daily). Note: Do not conduct feeding experiments that deprive your fish of food or inflict any other deliberate mistreatment. Your fish are living animals and should be treated carefully and with respect.

Balanced Aquarium

Set up "balanced" tank of fish and plants. A balanced aquarium reflects a natural setting as closely as possible. Exhibit two fish of different species and a picture of your tank, or present what you did and learned on a poster, with photographs.

Live Food Raising

Raise live food (white worms, daphnia, and brine shrimp) for your fish. Exhibit your fish that have been fed your live food and samples of the live food, or show what you did and learned on a poster, with photographs.



Simple Breeding

The simple breeding program is a good choice for a 4-H'er for an initial breeding program. The breeding habits of fish vary greatly from one type to another. Some bear their young alive, and some lay eggs in the sand, in plants, or in a nest of bubbles. Others never reproduce in captivity. Some require special attention, while others require no effort at all. You will need to research the breeding habits and needs of your fish. Your local library, bookstore, hobby store, or the Internet are good places to look for information. Be sure to complete the following record sheets: 4-H-447E-W, Aquatic Science Breeding Records; 4-H-447F-W, Aquatic Science Problems; and 4-H-447G-W, Aquatic Science Experiment Record. You can exhibit the parents and selected young fish or present what you did and learned on a poster with photographs.

Advanced Breeding (a year or more)

Breed your fish for a specific color or conformation trait. Exhibit selected young fish or present what you did and learned on a poster, with photographs.

Record Sheets

The following pages contain the record sheets that you are to use with this project. They can be copied, or you may make your own on a typewriter or computer, or you may download them from the 4-H Web site at <http://www.four-h.purdue.edu/> (click on "Search" on the left side of the page, then select "Aquatic Science" from the pulldown menu that says "Project.>"). Having multiple clean copies of the record sheet will allow you to copy your notes for a neater presentation and to use them in successive years.

