

4-H Aquatic Science

Keeping Fish Alive

Unit # 1

Project Book

Name: _____

Age: _____

Club Name: _____

Years in 4H: _____

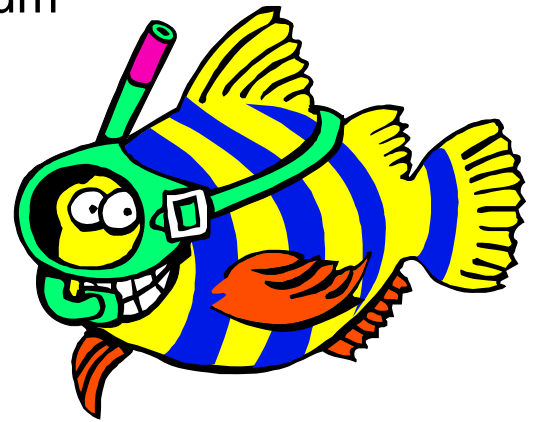
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Available on line at <http://lake.ifas.ufl.edu/4-H/Projects.htm>



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Welcome beginning hobbyist,

Keeping tropical and marine fish is the ideal hobby. I know, because I've been doing it for 45 years. The fish are beautiful and it's fun to watch how they behave. Things you learn from the hobby can help you with citizenship activities. There is lots to learn about: the growth of living organisms, interaction of live forms in an ecosystem (living things and the place they live), some things about water pollution and how nature deals with the problem, how scientists work.

And you'll have fun learning. The aquarium is a world you create and control. You can make it look the way you want. You can compare results with your friends. And you'll have the chance to compete in 4-H competitions and local Aquarium Society shows.

Aquatic Science is the study of fish, the water they live in, and other living things in the water. The world has lots of water, which people need to live and which we use in many ways. We need to understand as much as we can about water and fish.

One problem you'll have is with parents who want to be part of the fun. Parents love fish. Fish don't bark in the night or bite the postman. They don't leave surprises on the rug, or scratch the furniture. You may have to insist that they get their own aquarium, to keep them from overfeeding your fish.

My first aquarium, many winters ago, had a stainless steel frame with glass cemented together with what looked like roofing tar. I couldn't afford a stand, so I asked mother if I could put it on her coffee table. "Aquariums leak and it will ruin the table," was her immediate response. "Aquariums don't leak," I insisted. After all, what do mothers know, anyway. I learned much from that first aquarium. I learned how mollies spawn (have babies), I learned about water quality, I learned that mother was right, aquariums do leak, and I learned how to refinish coffee tables.

45 years later aquariums are much improved. They seldom leak. But parents are still the same. They're always ready to help, but they expect you to do your best to finish projects and clean up the mess. Tell them where you plan to put the aquarium, remind them that water is heavy, be careful with electricity around water, and ask them before using things from the kitchen or tools from the garage or work shop.

Many people will tell you that keeping tropical fish is difficult. Actually, give them what they need and they thrive. This manual explains what they need and gives you the "secret to success". As you read the book you'll find that "secret" everywhere. It's, regularly change the water, feed them a quality flake food, and don't put the wrong fish together. That's it. Simple. But the manual explains more about each.

In the manual I list the equipment you will need. Of course 4-H does not endorse any products. But I've used brand names to suggest a quality level of equipment you should use.

Good luck, Paul Speice The Aquatic Maestro

Member's Project Guide

This beginning level manual is designed for use with a 4-H group or as a self study project for 8-18 year old members. However, it is recommended that 8-12 year old members find an adult who is willing to work with them. This project should take between four and six months to complete. Older members may be able to complete this project sooner and then advance to the next unit. This project manual can be used in group teaching settings.

Check your county's project guidelines for additional requirements, especially if you choose to participate in county project judging or prepare an exhibit for the fair. Members who complete this project are encouraged to continue their exploration of Aquatic Science. Check with your 4-H leader for additional 4-H projects in this area.

Project Guidelines:

1. Complete the Planning Section of this guide, steps 1-4.
2. Explore all twelve Interest Areas, which are listed below.
3. Complete all of the "Things to Do" in each Interest Area.
4. Take part in at least two Learning Experiences.
5. Become involved in at least two Citizenship/Leadership activities. Some of the choices are listed below. Parents or 4-H Leaders can help you decide.
6. Complete the project record at the end of the book.
7. Complete Project Summary

Activity check list.

Explore all twelve of the Interest Areas listed below. Record the date you began work.

Date Started:	Interest Area
_____	Equipment
_____	The Set Up
_____	Water
_____	Putting Fish in the Aquarium
_____	Water Quality
_____	How to Change Water
_____	Other Equipment
_____	Food and Feeding
_____	Stress and Disease
_____	The Fish
_____	Aquarium Fish
_____	Live Plants

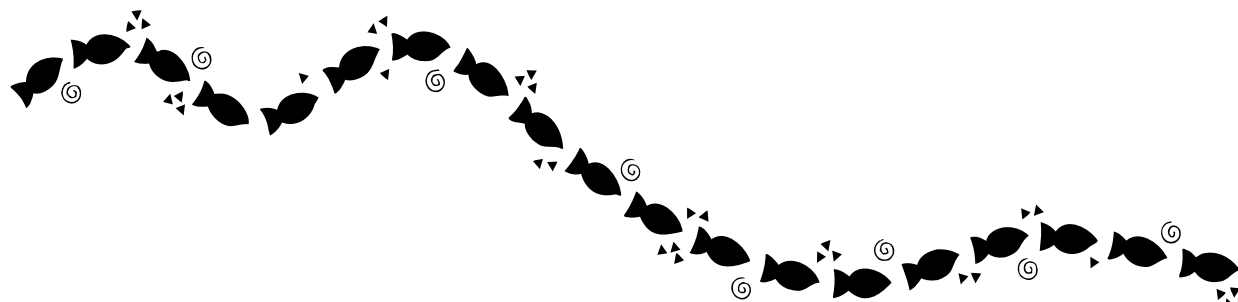
Leadership/Citizenship Activities

Check off the activities you wish to do or plan your own in the space provided. Do at least two. Keep track of your progress by writing in the date you complete activities. Leadership/Citizenship activities may be added or changed at any time.

<i>What I plan to do</i>	<i>When I finished</i>	
		Get your friends to join you in an aquarium project.
		Help someone with their project.
		Organize a bowl show in your community.
		Invite an experienced hobbyist to speak to the club.
		Tell others about aquariums as a healthy, entertaining hobby.
		Teach someone something you learned about aquariums.
		Start an aquarium club in your community.
		Ask someone to join 4-H.
		Use something you learned about aquariums to benefit your family.
		Help set up and keep clean an aquarium for the disabled or elderly.
		Help a 4-H member prepare an aquarium project for judging.
		Help prepare an aquarium exhibit for the county fair.
		Provide a free check up of aquariums in the neighborhood.

Or, plan your own activities.

Project Review ---- Once you complete what you plan, fill in the record section towards the end of this record book. Have your parent or advisor review your project with you. Depending on your county, you could receive a special 4-H project award for you efforts.



Introduction

Keeping Fish Alive:

The purpose of this 4-H adventure is to set up and maintain a beautiful, successful aquarium. Beauty is provided by nature's colorful fish and your creative arrangement of plants and rocks in the aquarium. Success, clear water, long lived fish, stable environment, breeding, will result from your knowledge of the fish and its needs. Beauty and success can both be yours with the help of this 4-H Guide and a little effort.

The two basic needs of fish are proper diet and good aquarium water. A third element must also be remembered, different fish have different habits, fish eat fish. Keep this in mind when you choose what fish you put together as well as when raising baby fish. Some fish are aggressive and constantly chase other fish. To avoid problems, you must know a little about new fish before adding them to your community aquarium.

Your 4-H aquatic science project will get off to a good start, and you can avoid disasters if you locate a good pet shop operator or an experienced aquarist who can offer advice. Your club leader can help you meet these people. If the fish are mixed properly, fed a good diet and if the water quality is good, the fish will live for a long time. You can see that you control all of these things. Success will be yours if you spend the time to learn about the fish and its environment. You're going to have fun, and you'll learn things that have lifelong value.

Things to Do:

1) Visit two or three pet shops. Go to shops that sell only pets and pet supplies. Look at their aquariums. Are they clean? Shop#1_____ Shop #2_____ Shop #3_____. Notice that small fish and large fish are kept in separate aquariums. Watch the fish.

Do they chase? Shop#1_____ Shop #2_____ Shop #3_____. Ask the pet store clerk, which fish can be mixed together. Find out why the Betta is called a fighting fish.

Please explain: _____

2) Compare the list of ingredients on a can of fish food with those on a cereal box. Notice how similar the needs of fish are to our own needs? Fresh ingredients and vacuum sealing is as important for fish as it is for our food. Some ingredients such as vitamin A and C can be lost because of poor packages.

Equipment

Aquariums are made of glass cemented with silicone, a sealer/glue which holds the glass together and makes the aquarium water tight. The plastic frame makes it look nice and makes it easier to handle. Properly assembled aquariums have no sharp edges and are guaranteed not to leak, unless you break the glass. Be careful when adding rocks to your set up. Since size limits the number and types of fish you can keep, larger aquariums are desirable. For this beginning 4-H project, you'll be using a 10 gallon aquarium.

Aquarium covers are needed for many reasons. They keep the fish from jumping out. They keep the cat and little hands out. They prevent dust from entering and reduce evaporation of the aquarium water. A cover can be made from plastic wrap, punch a few holes in it, a sheet of plastic or glass. Tape the edges of glass to avoid cuts. Aquarium manufacturers make combination hoods and lights for their aquariums. These full covers have marked sections which can be removed to allow for the addition of heaters, filter stems, etc. You may save some money by making your own cover, but in the long run a cover or hood made for your aquarium is the best choice.

Lights are important for two reasons. They make it easier to see the fish and you need them to grow plants. More about plants later. Fluorescent light is best but more expensive than incandescent. Incandescent bulbs also produce more heat than the fluorescent bulbs.

The under gravel filter is a molded plastic plate with water lift tubes. The plate is perforated with many slits to let the water flow through. An under gravel filter with the proper size plates and water lift tubes, enable you to use your aquarium gravel as a filter.

An air pump or power head, a small water pump, is used to move water from under the under gravel filter up the lift tubes to the top of the aquarium. This causes the water to circulate through the aquarium. Therefore, water is constantly flowing down through the gravel. When this happens, many bacteria, good ones, will begin to live on the gravel pieces. These bacteria change some of bad chemicals in fish waste material to safe chemicals. It also helps break down excess food but careful feeding is a better way to solve the problem.

Gravel can be bought at the pet shop. It comes in many colors. Darker colors make the fish less nervous and will make their colors brighter. Fish try to blend into the background. Fish kept over white sand or bright red or yellow gravel, will be very pale. You can collect your own gravel from the beach or creek beds, but it must be washed well before using. If the gravel pieces are too large, food particles get between them, the fish can't reach this food, it spoils, and you have one of those disasters we're trying to avoid. If the gravel is too fine (sand) water can't flow through the gravel bed. Later in this guide we'll tell you more about why water movement is important. Gravel about 1/8" in size is about right. Wash with water only. We never use anything but clean water to wash any part of the aquarium or anything we put in it. Cover the under gravel filter with between 2 and 3 inches of gravel. For a 10 gallon aquarium that's between 10 and 15 pounds of gravel.

The air pump produces air to operate the under gravel filter, which as we've said will help clean up the fish wastes. The air pump should use a long lasting rubber for the bellows and valve, operate quietly and be of strong construction.

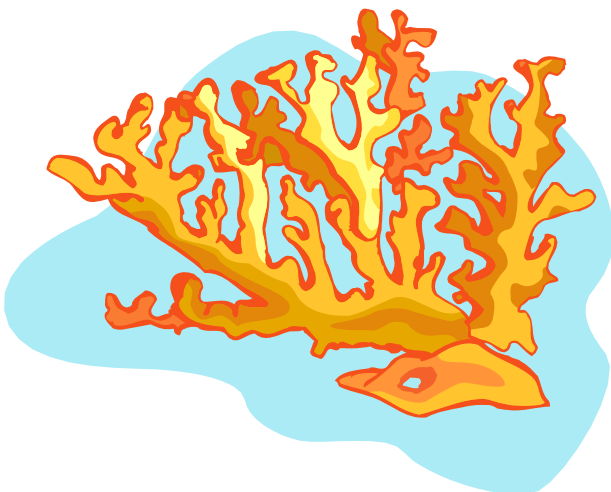
The movement of water has another benefit. The fish, like us, need oxygen and give off carbon dioxide. As oxygen is used by the fish it is replaced at the surface of the water. The carbon dioxide leaves at the same time. Bubbling caused by the air pump makes sure that the oxygen and the carbon dioxide are being exchanged at the water's surface.

Gang valves divide the air stream produced by the pump. Some gang valves are made of brass, others of plastic. They are made with 2, 3, 4 and more outlets. Gang valves allow you to operate several filters or airstones with one air pump.

Power heads are small water pumps that can be placed on the top of the water lift tubes of undergravel filters. They pump water not air, but they operate the undergravel filter the same as air pumps. Air pumps can also be used to operate airstones or ornaments.

A heater is necessary since you will be keeping tropical fish, which come from warm waters. A quality heater with an accurate thermostats, open wound heat coil, should be used. Heaters are made in lengths from 8 to 15 inches, and from 25 to 200 watts in power. Pick the one that matches the size of your aquarium. An 8 inch, 50 watt heater is a good choice for the 10 gallon aquarium for your 4-H project.

A thermometer is needed to measure water temperature. Some stick on the outside of the aquarium and are accurate and easy to read, others float in the water. If you keep goldfish or North American fish, such as sunfish, no heater would be required. In nature they live in cooler water than the tropical fish you'll buy from your pet store.



Plants, rocks and driftwood will complete the set up. Lifelike plastic plants will be used for this project. Some of the rocks that you find in creeks and on lake shores, such as granite or slate are safe to use if you wash them well, remember water only for washing. You can be sure of rocks obtained from pet shops. The same is true of driftwood. Never use sea shells or coral in the freshwater tropical aquarium. They slowly dissolve and make the water unsafe. Other items, such as nets, siphon tubes, air tubing, air stones, algae scrapers, etc will also be needed. Any, yes, fish need food. More on all that later. Now you're ready to begin the set up.

Things to Do

1) Compare the cost and quality of equipment, for example, an air pump. There are a variety of makes, models and prices. Ask the store clerk, which ones last longer. Of course the better the quality the higher the price. Check the guarantee. Ask if they sell replacement parts for the equipment they sell. Pet stores prices may be higher than those at discount stores. But pet store operators know the hobby and can help with your problems.

<i>Pump 1</i>	<i>Model</i>	<i>Price</i>	<i>Guarantee</i>	<i>Parts</i>
_____	_____	_____	_____	_____

<i>Pump 2</i>	<i>Model</i>	<i>Price</i>	<i>Guarantee</i>	<i>Parts</i>
_____	_____	_____	_____	_____

2) Check the different books available at the pet shop. Don't shop at any pet store that does not sell a good variety of books. Everything you need to know to have a successful 4-H project is in this guide book, but as you expand your activities in the hobby, there are many books about different topics. Give titles of a few books that you have looked at.

The Set Up

Fish will be purchased after your aquarium has been set up and operating for one or more days. First let's be sure you create a home for them that meets their needs and is attractive. Begin by rinsing the aquarium with warm clean water and a clean cloth or sponge, no soap or any other cleaner.

Of course you'll want to put your aquarium where it's easy to see. Most aquarium manufacturers build attractive metal and wood stands that match aquariums. They are ideal for supporting an aquarium, but you can save money by using a table or dresser. However, the surface you pick must be sturdy, level and flat. Be sure that your parents agree with your choice.

All corners of the aquarium must touch the table, bookshelf, dresser, or stand you choose to use. Put the aquarium where you plan to have it. Press down on each of the top corners of the aquarium. If you can make it rock back and forth, it is not flat. When you fill the aquarium it may leak, you won't be able to fill it completely. Don't use a card table, or any table with small legs, or that is shaky, for your stand. Water weighs more than 8 pounds per gallon. A 10 gallon aquarium with gravel will weigh about 90 pounds. Don't ever try to move it while it is filled with water.

Do not set the aquarium in front of a window. The sun will over heat it. It will also cause a heavy growth of algae. Algae will quickly cover the glass as well as the plants and rocks with green mat, like moss growing on a log. This is not unhealthy for the fish, but it looks bad. Some aquarists allow the algae to grow on the back wall of the aquarium and keep the other sides clean so they can see the fish. There are some ideas about how to remove algae at the end of this section.

Rinse the gravel well. A kitchen colander is a good way to do this, but ask your parents first. You can also place the gravel in a bucket, fill it with water, stir the gravel, and then pour off the water and any dirt that has washed off the gravel. Do not use a bucket that has held soapy water, household cleaners, or anything but water. When the gravel is free of any dust the water being used to rinse it will be clear. Put the gravel in the aquarium and spread evenly.

Stick the thermometer on the outside of the aquarium. Place it on either side where you can read the temperature without having it block the view of the fish. Some heaters are glass and float in the water. Now we're ready to put some of the water in the aquarium. The temperature of the water should be 76 to 78 degrees. Mix the water so that the temperature is close to 76 to 78, before putting it in the aquarium. Place a saucer or small plate on top of the gravel. As you pour water in be sure it hits the plate, that will keep the water from stirring up the gravel. Fill the aquarium to within 2-3 inches of the top. You'll add the rest of the water after you add rocks, plastic plants and other decorations. That way water doesn't overflow when you place the other items in it.



Place the plastic plants in an arrangement that looks nice to you and provides open spaces where the fish can be seen. Fish will swim in the open areas, but they also like to swim through the plants and find places to hide. If you wish, add some rocks, or pieces of driftwood. Once the aquarium looks good to you, add the water to complete the filling of the aquarium.

A TIP: No water in nature is free of salt (minerals). Add one teaspoon of non-iodized salt per gallon of water in the aquarium. Pet shops have special salt available for freshwater aquariums. This will help the fish fight off disease. It's easiest to mix the salt in the water before adding the water to the aquarium. If you add it directly the water gets cloudy, as it dissolves the water will clear.

Hang the heater on the back of the aquarium, clamping it to the top. Only the glass tube goes in the water. Do not plug it in at this time.

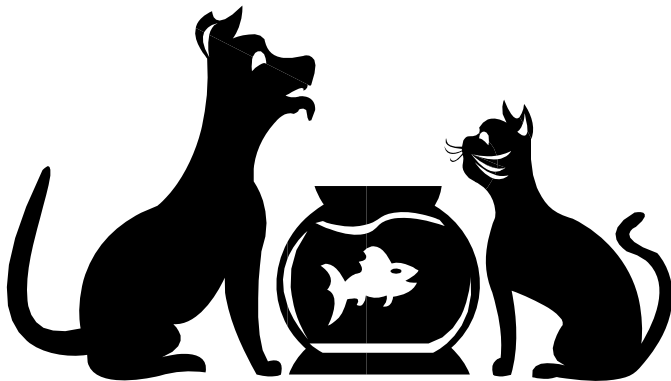
Place a piece of air tubing between the pump and the gang valve. Using a rubber band make a small loop in the air hose where it connects to the gang valve. Arrange this loop so it sticks above the level of water in the aquarium. This will prevent any accidental siphoning of water from the aquarium into the pump. Connect the gang valve to the air stems in the filter's water lift tubes, using the tubing that comes with the undergravel filter.

Plug the air pump into the electrical outlet. Do this with dry hands. Electricity can be dangerous; water increases the danger. Adjust the knobs on the gang valve so that air flow in both lift tubes is the same. The bubbles should be moving up the tube fast enough that you can't count them. The air stones inside the air lift tubes must be set near the bottom of the lift tube.

Plug in the heater after it has been in the water for 30 minutes or more. Even though the heater is plugged in the heating coil will not be on all the time. A thermostat in the heater turns it on and off. A time bulb inside the heater will light up when the heating coil is on. Adjust the control knob so that by turning it slightly you can get this small indicator light to blink on and off.

The heater will now keep the water in the aquarium at its present temperature. If the water you place in the aquarium is between 76 to 78 degrees and you let the heater sit in the water for fifteen minutes or more before plugging in, this first setting of the heater will be close to what you need. Further adjustments may be needed to bring the temperature to 78 degrees.

CAUTION: If you need to adjust the heater wait one full day between changes in the heater setting. Make small changes in the setting over a period of days to get the temperature right. It takes the heater several hours, after you change the setting, to change the temperature of the water. A safe range for tropical fish is between 72 and 80 degrees.



The aquarium now needs to sit at least 24 hours before adding fish. This will give you time to adjust the heater and make sure the chlorine is gone. You can also use this time to rearrange the plants, rocks and wood until you're satisfied with your beautiful slice of the bottom. Be sure to siphon out a little water before doing this, to avoid an overflow.

Things to Do

1) How big is your aquarium? _____. Try this easy way to calculate the volume of any aquarium.

One gallon of water is 231 cubic inches.. Think of a cubic inch as a block, one inch long, one inch wide and one inch high. If you can figure out the number of cubic inches in your aquarium this will tell you how many gallons of water it will hold. Do this by multiplying the length times the width times the height of your aquarium, you will have the volume in cubic inches. A standard 15 gallon aquarium measures 12" x 12" x 24".

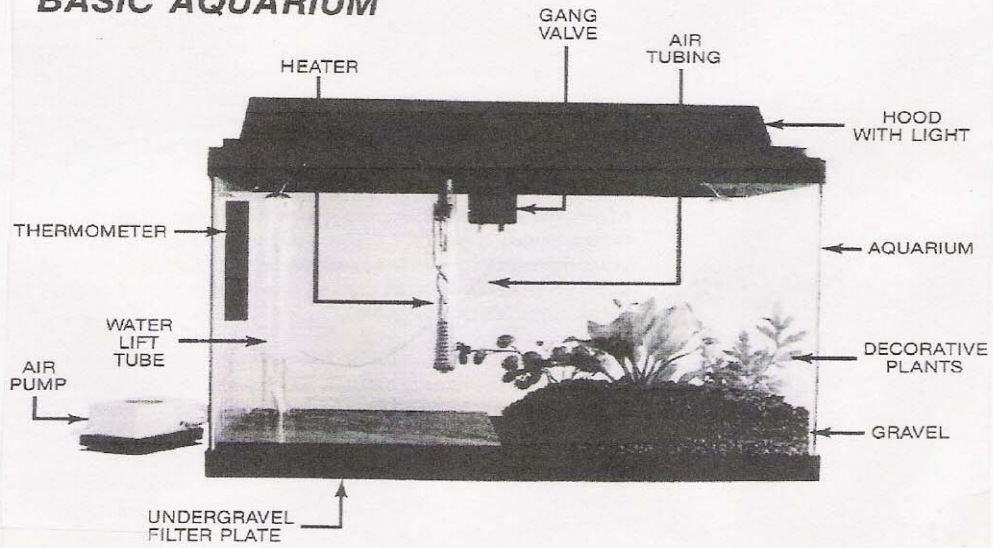
Figure here

12" x 12" x 24" = cubic inches. If you divide the volume in cubic inches by 231 you will have the volume in gallons. $3,456/231 = 15$ gallons. Check the volume of your aquarium following the above instructions.

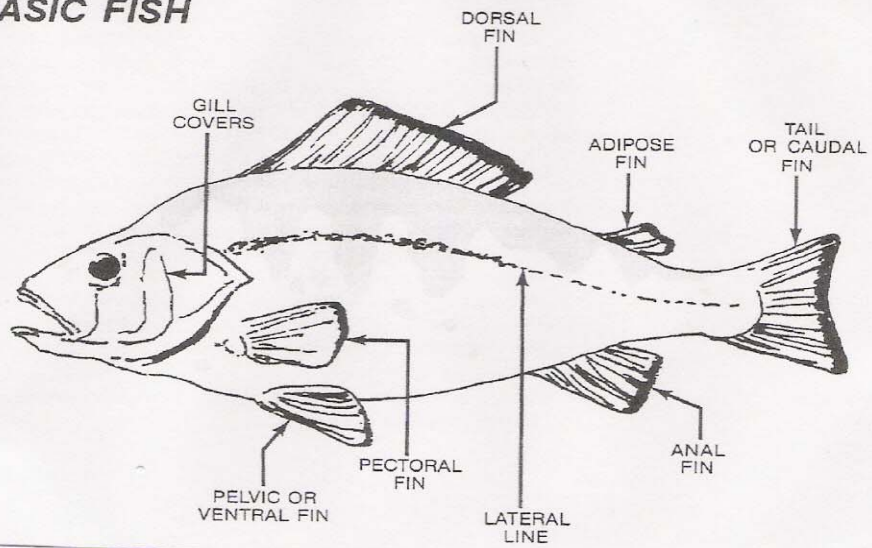
2) What makes the final set up beautiful? The fish are the main attraction but what can be done to make your aquarium a beautiful slice of the bottom. That is a set up that looks like what you think the bottom of a river or lake looks like. Each aquarist's approach will differ. You can get some ideas by looking at other people's aquariums. Check those at the pet shop. See how they use rocks and driftwood. Visit a public aquarium or a place like Sea World. Many doctors offices and restaurants have aquariums. Starting with ideas you can sculpt your own slice of the bottom.

Write some of your ideas here:

BASIC AQUARIUM



BASIC FISH



Water

Water from the faucet at your home comes from a central supply, or from a well. Water from a central supply is not suitable for fish. Your city or town or the water company puts chlorine or chlorine products in the water. The chlorine kills bacteria which could make us sick, but the chlorine can also kill your fish and must be removed. Fortunately, this is easy to do.

If pure chlorine, which is a gas, is used for treatment it will pass out of the water. Collecting tap water that is chlorinated in any container, letting it sit for 24 hours before using it to change water in your aquarium, results in safe water for the fish. And when filling a new aquarium, we wait two or three days before adding fish, to insure the chlorine is gone. A water treatment, can be used to remove the chlorine instantly. It is called a de-chlorinator. Read the instructions on the bottle. If you have well water, no treatment is necessary unless your well system adds chlorine. If the well water contains no chlorine and is safe for humans, it will be safe for your fish.

Things to Do

- 1) Fill a glass of water from the tap. Notice the bubbles that form on the inside of the glass. The same thing happens when you first fill an aquarium. This is air forced into the water by the pumping equipment that the city uses, or by the pump in your well. How long does it take for the bubbles in the glass to disappear? Since the fish live in the water and it actually passes through their skin, primarily in the gills, these bubbles can cause problems for fish. Some bubbles may appear on the fish. Letting the water in a new aquarium age for at least 24 hours, especially with the under gravel filter circulating the water, eliminates this source of trouble.
- 2) A good pet store will test your aquarium water. Take a jar of your tap water to the pet store. Ask them to test it for chlorine. Using a chlorine measuring kit, it is a simple test. Ask them to test water from one of their aquariums. Compare the two tests. If you wish, buy your own test strips and do some experiments at home.

Store aquarium _____ *Home aquarium* _____

Putting Fish in the Aquarium

Once the chlorine is gone, the water treated, if necessary, and the temperature set to 76-78 degrees, we can buy some fish. After all, that's what we've been waiting for. Before you add the fish, read the section on water quality on page 19. When you bring fish home from a pet shop, they will be in a few cups of water in a plastic bag. A rubber band holds the bag shut and air or oxygen has been trapped inside, it is like a balloon partially filled with water.

The fish will be fine if they're not kept in the bag for more than a couple of hours. But don't let them get hot or cold. Don't leave them in your car while you go shopping with mom and dad. In winter they'll freeze. In the summer the sun might cook them. When you get home, remove the rubber band and float the bag in the aquarium with the open end folded over the outside of the aquarium. The water in the bag will slowly become the same temperature as the water in the aquarium. After waiting about 5 minutes pour a little water from the aquarium into the bag, 1/4 to 1/3 of the volume of water in the bag is about right. Repeat this step twice more at 5 minute intervals. After about 15 minutes the fish can be released. By slowly mixing the water, as indicated above, the fish will adjust to the aquarium water with little or no stress.

When you add the first fish to the new aquarium, do not feed them until they've been in the aquarium for a full day. They'll be nervous due to the handling and may not eat well. As soon as you put fish in the aquarium, the fish will begin polluting the water. More about that later. Notice that when you release the different kinds of fish in your new aquarium some will chase others. Some will hide in the plants or behind or under the rocks. Some will be active and some will seem to lie around. Three things account for these differences.

- 1) All of the fish are frightened by the new environment.
- 2) Some fish prefer to hide, to stay out of sight unless its dark.
- 3) A few of your fish may be over stressed or have some disease.

The first few weeks after you set up your aquarium spend time each day carefully watching fish behavior. Take notes on how it changes. Try to determine what is natural behavior for each fish.

Write notes here:



Adding fish to your new aquarium starts a chemical cycle. The fish's body functions like ours. They eat and they give off waste material, and, this is done in the aquarium water. Excess food and the fish's waste pollutes the water, which is the fish's environment. The solid waste will collect in and on the gravel. We'll learn how to take care of that problem when we learn about water changes.

A more serious problem results from the ammonia that the fish discharge, which we can't see. Ammonia is very toxic. Fortunately nature has evolved a nice means of removing it and that involves the undergravel filter. We'll cover this in the next section which is on water quality. Later when you add more fish to your collection, you'll notice that the fish already in the aquarium seem very interested in the fish floating in the bag. When you release the new fish those already in the aquarium may chase and bully the newcomers. Since these new fish are already slightly stressed from all the netting and handling, we should try to avoid more stress.

- Tips:
1. The additional stress of bullying or chasing can be minimized by feeding the fish when you release the new ones. Fish would rather eat than chase.
 2. If a fish jumps out of the aquarium, pick it up with a wet net or your wet hand. Dry materials against the fish's skin remove the slime that covers its body. The slime layer keeps bacteria and parasites off the skin and scales. Always take the time to dip the net or your hand in the aquarium water before saving that fish that jumped on the floor.

Things to Do

1) Every living thing has a scientific name. Man's scientific name is *Homo sapiens*. *Homo* means man; *sapiens* means thinking. The first name is called the genus, the second the species. How does a person tell if two fish are of the same genus or species? It isn't as simple as shape or color or size. For instance the time blue Neon Tetra which you'll see in every pet store, has an African cousin, the Tigerfish, which grows to be five feet long. The important differences have to do with the fins, scales and teeth. Many times a microscope is needed. But the key is observation.

Neon Tetra



2) Make a chart or list of the separate species of fish you think are in your aquarium. Use the chart on the next page. You'll need help finding some of these answers. Don't try to do this all at once. Work on it over a period of time. Missing information can be accumulated as you read, visit the pet shop and talk to other hobbyists.

Water Quality - H²OQ

H²O is the chemical formula

for water. It is a combination of hydrogen and oxygen. Putting the Q on the end reminds us of the need to maintain good water quality - H²OQ. Fish food and fish waste are two big polluters of aquarium water. Ammonia is expelled by the fish as waste material, ammonia is bad, it kills fish. Fortunately ammonia is food for certain bacteria. These are the good guy bacteria. In order to prevent the bad guys, ammonia, from killing our fish we need to be sure we have good guys, bacteria, in our aquarium.

The bacteria we want, live on the surface of plastic and real plants, on the sides of the aquarium, and on rocks and gravel particles. These bacteria need oxygen. That's why undergravel filter plates were invented. When water is pulled up the waterlift tube by the air bubbles, it first flows down through the gravel and this provides the bacteria with oxygen. A small number of good guy bacteria will be introduced with your new fish when you first start your aquarium. Every half hour they reproduce by splitting in half. Each half becomes a new bacteria. In five hours one bacterium becomes over one thousand bacteria. These bacteria start eating the ammonia. Soon there are enough good guy bacteria present on the gravel to change any ammonia as it appears.

Think about this. If you tried to measure how much ammonia was in your aquarium two weeks after you put the fish in, you wouldn't find any. Why? Because the bacteria eat it as fast as it appears. But remember when you first put fish in there aren't many good guy bacteria. The build up of ammonia in the first six days reaches high levels. The ammonia stresses and kills your fish. To prevent this we remove about one quarter of the water from the aquarium on the fourth day. It is replaced by new water. Remember, the replacement water should sit over night to remove the chlorine, or you can use a water treatment. This water change keeps the water fresh, and gives the good guy bacteria time to start doing their job. This is your first step on the road to keeping good water quality.

This water change is very important, but it is only the first of several water changes you will make. Water changes are the key to good H²OQ. Make another change (1/4 of the volume) on the 7th or 8th day. For the first two weeks change 1/4 of the water every 3rd or 4th day. Then, for the next month, make a water change once a week. After this six week start up period regular water changes of 1/4 of the volume should be done at least every other week, twice a month. In aquariums where you want to keep larger numbers of fish, some big fish, or hundreds of fry, baby fish, water should be changed more often, perhaps once a week. But never change more than 1/4 of the water at a time.

This is the start of what we call the Nitrogen Cycle because of the presence of nitrogen in the various chemicals the bacteria produce. After about six weeks all of the good guy bacteria we need will be present and with the help of our water changes they keep the aquarium naturally healthy. You can't change water too often. After all in the flowing streams where most fresh water fish live it is continuously changing. Remember, removing two gallons of water during a water change removes two teaspoons of dissolved salt. Salt should be added to the water you use for water changes just as was done when first filling the aquarium. Pour the water in gently so as not to disturb the gravel or your plants.

Things to do:

1. We mentioned the Nitrogen Cycle, you can also go online to: <http://faq.thekrib.com/begin-cycling.html> (Beginner FAQ: The Nitrogen Cycle, and "New Tank Syndrome" What is Nitrogen Cycle?) The fish produce ammonia. The chemist writes ammonia as NH_3 - nitrogen and hydrogen. Some of the good guy bacteria change the ammonia from NH_3 to NO_2 - called nitrite. Both ammonia and nitrite are toxic. Nitrite is easy to detect and measure using test strips sold in pet stores. A different good guy bacteria converts the nitrite to nitrate. Nitrate is safe except in large amounts. When you make regular water changes, every two weeks, the nitrates are removed, diluted, during the change. Notice that as the chemical changes progress more oxygen appears and attaches to the nitrogen. These steps are nature's way of eliminating the toxic waste products. Nitrates are good food for plants. The water you remove from the aquarium during a water change can be used to water and fertilize house plants. Check with your parents to insure you don't over water their favorite plants.

2. Ask some one to help you understand oxidation. Draw a chart of the nitrogen cycle showing the oxidation that occurs.

How to Change Water;

It's obvious that water can be removed by dipping any container into the aquarium. It can also be changed by siphoning using a garden hose or large plastic tube, which discharges into a bucket or sink. The recommended method is to use a special siphon with an enlarged plastic tube on one end. The large end is pushed into the gravel and moved around. This device removes dirt and water without sucking out any of the gravel this keeps the gravel from plugging up with dirt. If the gravel plugs up, oxygen won't get to the bacteria, they will die, and ammonia will build up. This can be easily avoided by following the water changing plans.

A siphon can be started by sucking hard on the hose and then quickly putting the discharge end below the water level in the aquarium. Water will flow until the big end is removed from the aquarium or the small end is raised higher than the level of the water in the aquarium. It may take a little practice to start the siphon and not get water in your mouth. If you do get water in your mouth, spit it out. It won't hurt you, but don't drink it. Here is another way to start the siphon. Put the entire siphon tube in the aquarium starting with the big end. Make sure the tube fills with water. Be sure no air pockets form in the tube. When the siphon tube is filled with water put your thumb tightly over the small end, while it is under water. Keep the big end under water in the aquarium. Pull the small end out of the aquarium and place it in the bucket you use for water changes. Remove your thumb and the water will start flowing.

Things to do:

1) Set two small jars or glasses of water on a window sill or on the dresser in your room. Cover one of them. Check them occasionally. What is happening? _____

_____. Where is the water going? _____

2) Read about evaporation, during evaporation only water leaves the aquarium. Look at the inside of the uncovered glass. The gray film is the chemicals that were in the tap water and which were left in the glass during evaporation. Replacing water that has evaporated is not the same as making water changes. If you don't remove water from the aquarium, replacing evaporated water continually adds small amounts of minerals. Over time they will accumulate to an unhealthy level. Think about this, will there be more or less evaporation during the summer when the temperature goes up? _____

Other Equipment

In addition to undergravel filters, there are two other filters for small aquariums. Their water lift tubes are smaller than those on the undergravel filter. The sponge filter is just that, a one inch thick sponge as big as a slice of bread. They are of various shapes. The air draws water through the sponge which becomes the home for the good guy bacteria. The box filter is a plastic box which contains a layer of cotton and a layer of carbon, charcoal. The cotton material catches dirt in the water, the carbon removes color and odor from aquarium water. The box filter is placed in one of the back corners of the aquarium, which is why it's sometimes called a corner filter.

Power and canister filters are motor driven. They move large amounts of water through a variety of filter materials. They do a very good job of keeping the water clear. If you don't overfeed the fish. A power filter is usually a plastic box that hangs outside the aquarium. Water is pumped from the aquarium, filtered through cottony floss and charcoal and returned to the aquarium. Some filters have adjustable flow rates.

A TIP: When feeding your fish, turn the flow rate on the power filter to slow. This will keep the filter from pulling in food which reduces the life of the filter material and the effectiveness of the filter.

Canister filters, are large plastic canisters filled with different kinds of filter material. They sit on the floor beneath the aquarium. These filters have large amounts of filter material from coarse to fine. They work like both the gravel with the undergravel filter, and the power filter. They are very efficient and result in sparkling clear water that is safe for the fish. Canister and power filters are used on large aquariums or when you want to keep a larger number of fish in a smaller aquarium. Your local pet store can show you the various sizes of these filters and explain how they work and the filter materials available.

A TIP: As we said earlier algae is not harmful to the aquarium, but it takes away from the beauty of your set up. Algae attaches itself to surfaces of the aquarium. If you scrape it from the sides of your aquarium the filters can remove it. A piece of nylon netting, which can be purchased in a fabric store, held in a ball by a rubber band works well for this purpose. You can also buy algae removing tools in pet shops. Some fish eat algae. The most common of these is called a Plecostomus, or Pleco, for short.

Books are the most important equipment for success in the hobby. Every serious aquatic science hobbyist has a library of fish books. Books are available on equipment, breeding, types of fish, nutrition, and water quality. They vary considerably in cost and material covered. World Wide Web has become a wonderful source of information. Check out different web sites with your parents permission.

Things to Do:

1) On your next visit to the pet store, take time to examine all the additional equipment to help you with the hobby. Ask to see a sponge filter. Find out about the uses of a breeding trap. Please explain _____

2) Visit your public and school library. Ask if they have any books on fish or aquariums. List the books that you have read or looked through.

3) List the web sites you visited and tell what you learned. _____

Food & Feeding

In nature, fish eat when they're hungry and they eat live food. Both things change when they are kept in the aquarium. Fish need the same basic food as we do, proteins, vitamins, minerals, carbohydrates and fats. The source of this good diet is not important.

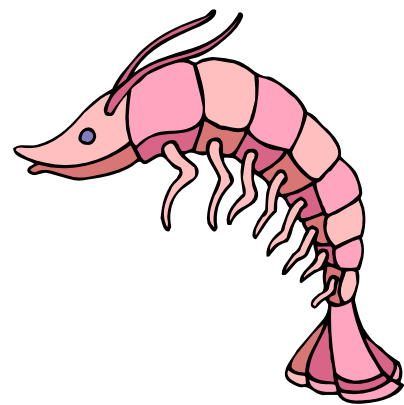
Fish will eat what tastes good to them. But not every food that tastes good to the fish will be the best diet. A good flake food is made with fresh ingredients and packaged to preserve the nutritional elements. A good flake food is convenient to use. There is no mess. And since it has been blended to contain all those ingredients necessary for your fish's health, you can be sure your fish get a balanced diet. Feed the fish once or twice a day. The food you place in the aquarium should be completely eaten within ten minutes. Overfeeding is the cause of cloudy water. The food that is left over decays and pollutes the water. Feeding is a good time to check the condition of your fish. Watch each fish carefully. Make sure they are all eating. Observe their color and behavior. A change in either is a warning signal that something is wrong.

If you notice changes in the fish's color or behavior, make a water change. If the problem is one of water quality, the water change will lessen it. If you go away for two or three days, don't worry about feeding the fish. In fact, if you leave on a week's vacation, it's better to let the fish get hungry than take the risk that a friend or neighbor will overfeed them. If you have good water quality and the temperature stays in the proper range, not eating for a week will not seriously harm a fish.

Things to Do:

1) Although a good flake food will provide all the nutritional needs of your fish, they will relish live food. You can provide them with an occasional treat by feeding some live food. Find a pet shop that sells live brine shrimp or small worms called trout worms or tubifex worms. Find some frozen food and try that.

2) Experiment with small earth worms. Rinse them well first. Try house flies that have been killed by swatting. Do not use anything killed with a spray. Beetles and ants are not a good food. Their exoskeletons, outside shell, are too hard. What did your fish seem to like? _____



Stress & Disease

Stress is a problem for all living things. You've probably heard a friend, teacher, or parent say they were "stressed out". Stress occurs when we're forced to do something, or have forced ourselves to try too hard. A pulled or strained muscle has been asked to do more than it can. It has been stressed. If a person is jumpy, upset, feeling blue, their brain and nerves have been asked to handle more pressure than normal. We call that stress.

In the aquarium stress in anything that makes the fish do something they don't normally do. For instance, if the oxygen content is low, the fish will have to work extra hard to breathe. That's a stress. If your little brother or sister pounds on the side of the aquarium that's a stress for the fish. If you forget to change water regularly, you're stressing the fish.

Stress kills fish. A prolonged stress makes the fish, run down. When this happens the disease, bugs, have a better change to take over. What are these bugs? There are a number of different kinds. Fish always have parasites on and in them. And the aquarium always has some bad guy bacteria just waiting around for a chance to infect a fish. If the water is good, if we feed the fish properly, if we don't put fish together that are natural enemies, the stress will be low. Most of the time, unless fish are stressed, they can deal with the parasites and bacteria. Here is the formula for success.

$$H\ 2OQ + \text{no stress} + \text{healthy fish} = \text{success}$$

Things to Do:

1) Although our approach to fish keeping is to avoid stress by feeding right and maintaining good water quality, disease may show up. Spend some time at the pet store medicine rack. Don't be alarmed by the variety of medicines, each for its own type of parasite or infection. Read the instructions on several different medicines. Ask the owner to tell you about different diseases. List the disease & cure below.

2) Observation of your fish is important. Obviously it will help you learn about them. More important, you will get to know the natural behavior of your fish when they are healthy. If a fish gets sick you will notice changes in its behavior. It will swim differently. It will avoid other fish. It will probably quit eating. You will see these behavioral changes two or three days before there is any sign of disease. You can then help immediately by making two or three daily partial water changes and continue observing them. In most cases they will return to normal. If you are keeping a diary or log of dates of water changes and temperature checks, record the behavior changes, temperature checks and the increased number of water changes. Record keeping helps us know where to start if the same thing happens again. This is the way a scientist learns. Below list the water changes you have made and the date.

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

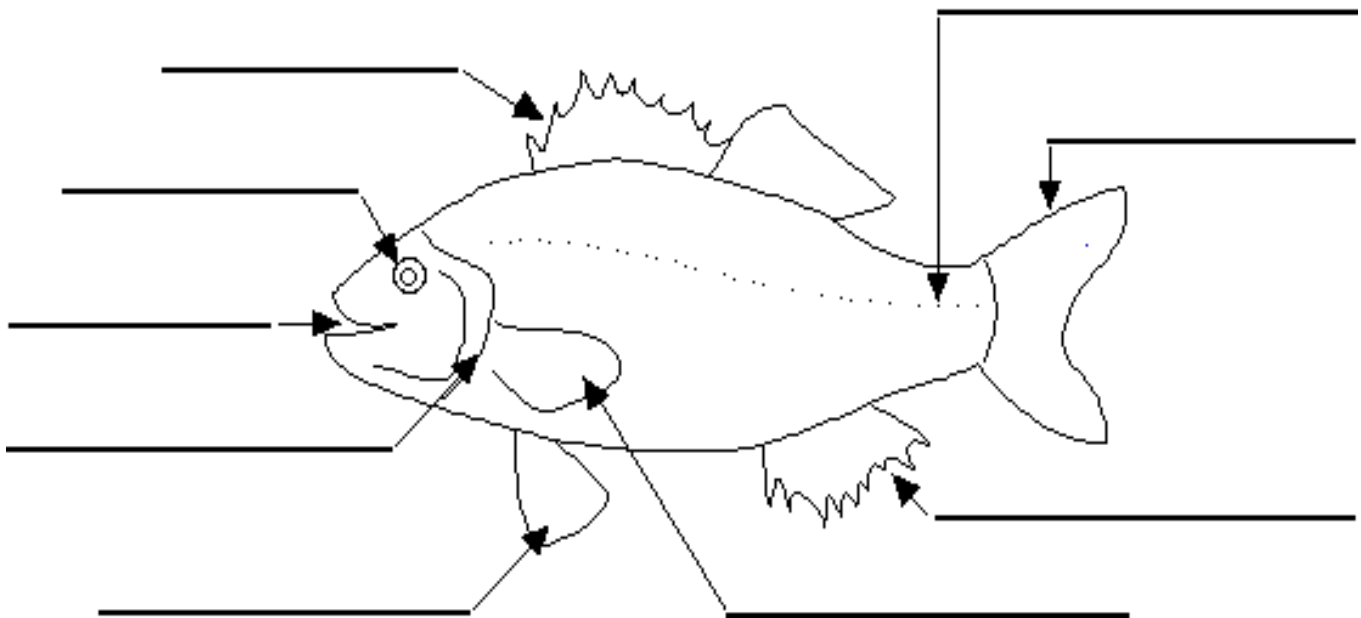


The Fish

The way biologists look at living things, all animals are divided into 9 or 10 different groups. One of these groups is **CHORDATA**, from chordate. Chordate is another word for backbone. All animals with backbones are divided into 5 different classes. One of these is the fish.

Fish are aquatic. They extract oxygen through their gills. Gills are feather like and are located on either side of the head. The gills lie under the gill covers. Some fish which live in warm waters with low oxygen content have evolved the ability to swallow surface air and take oxygen from it while it's in their bodies. Some Asian fish, called Gouramis, hold the swallowed air in a sponge like structure in their heads. Many South American catfish, primarily the Corydoras and sucker mouth types, store it in their intestines. Small blood vessels in these organs collect the oxygen. Most fish have seven fins, single and paired. The single fin on the back is called dorsal fin. The tail or caudal fin is also single, as is the fin just below and in front of the tail fin, the anal fin. On the belly of the fish there are two pairs of fins. Those nearest the head are the pectoral fins. The pair behind these are the pelvic or ventral fins.

Read the definitions, then label the fish diagram below, not all fish have all of the fins defined below.



anal fin - the fin on the lower side of the body near the tail

caudal fin - the tail fin

dorsal fin - the fin on the upper side of the body

eye - sight organs located on the head

gills - fleshy organs that are used for breathing - they are located on the side of the head

lateral line - a series of sensory pores (small openings) that are located along the sides of fish - they sense vibrations in the water

mouth - the part of the body which the fish uses to catch food - it is located at the front of the body

pectoral fin - each of the paired fins on either side of the body, near the head

pelvic fin - each of the paired fins on the lower side of the body, near the head

lateral

Some fish have a small single fin on the back between the dorsal and the tail fins called the adipose fin. You'll see this little fin on tetras and catfish. Some fish have two dorsal fins, some more. Some fish have only one fin on their belly, running the length of the fish. These are called knife fish. Some fins are short and stubby, others long and flowing. Through controlled breeding man has created many long fin and high fin varieties of the common fish.

Fish have the same senses we have. They see, taste, hear, feel, and perhaps smell. They have eyes for their life style. Many have eyes that are big and they have good vision.

Nocturnal fish, those active at night, have small, weak eyes. They can feel by using their lateral line system. The lateral line feels sound vibrations in the water. In fish the taste and smell senses are linked to give them a strong sense for finding food. The best taste sense is found in catfish and other fish with barbels, whiskers. Nocturnal fish all have excellent taste sense. Fish have a sense of touch in the fins and barbels. The lateral line senses pressure changes.



Things to Do:

1) Can you name some fish that have barbels? _____

Which fish have an adipose fin? _____

2) Visit the pet shop. Look at the variety of fish. Do you know what these fish are, elephant nose, knife fish, mud skipper, upside down catfish, loach, arrow nose eel? _____

Aquarium Fish

There are some 22,000 different fish in the world. Many of them live in salt water. Others live in the mouths of rivers and in the coastal swamps. This water is salty but not like the oceans.

It is called brackish water. The fresh water fish include cold water fish. Gold fish are cold water fish. They should not be kept with tropical fish. Salt water fish, brackish water fish, fresh water fish. Cold water fish and warm water fish. An enormous variety to choose from and to learn about. Fresh water tropical, warm, fish vary considerably in size. Be careful what you put together in the same aquarium. A four inch long Jack Dempsey or Oscar will eat your beautiful swordtails and platies in one overnight picnic.

But there are thousands of different species of fish which grow to only two or three inches in length and can live together in an aquarium. There are also fish, like the silver dollar, and the plecostomus which get very large but don't eat other fish. There's lots to learn. Remember, a fish will eat any other fish they can get in their mouth.

About 5% of the fish have live babies; the rest lay eggs. the live bearing fish include several small beautiful fish species. These include guppies, mollies, swordtails, platies and variatus. All livebearers should be kept in trios, groups of three, of one male and two females. You can tell the difference between male and female quite easily. On the belly of the female, in front of the tail, are three fins, a pair closer to the front called the ventral fins and a single fin behind them called the anal fin. On the male the ventrals are the same but behind them the single anal fin which is of a different shape, being long and slender. This fin is called the gonopodium.

When born, the live babies are about 1/4 inch long. Remember, the adult fish will eat them. To prevent this from happening put many plastic plants in the aquarium. You can also float some plastic plants of strand type live plants. You can buy these in bunches and pet stores often sell them as "bunchplants". There are so many different egg laying fish that we can only discuss them in general. They include families of fish called Tetras, Barbs, Rasboras, Danios, Gouramis and Catfish of the size we want to mix. There are other fish which are suitable for the small fish tropical community aquarium but the above types plus the livebearers include most of what we keep.

Things to Do:

1) There are some general families of fish that include most of our aquarium beauties. Do some research at the pet store and in fish books. Learn to identify various live bearers, Tetras, Barbs, Rasboras, Danios, Naked Catfish, Armored Catfish, Suckermouth Catfish, Cichlids and Gouramis. List those that you can identify and draw a picture of one.

_____	_____	_____
_____	_____	_____
_____	_____	_____

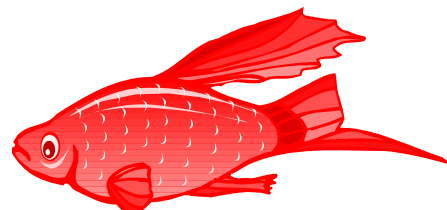
Draw your picture here

2) Check your state's Fish or Wildlife Commission regulations about keeping native fish in aquariums. Where it is legal to do so many people keep native fish.

Lebistes reticulatus



Xiphophorus helleri



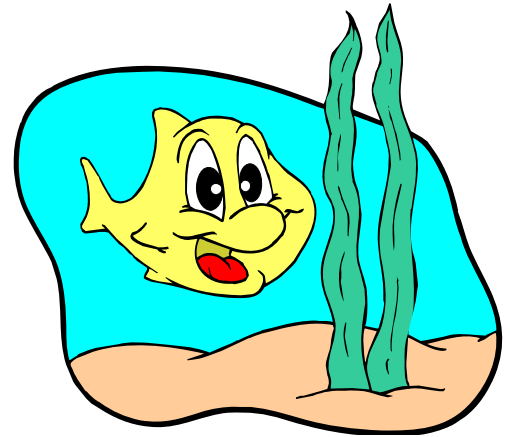
Live Plants

Live plants are a beautiful addition to the aquarium. In the beginning we urge the use of natural looking plastic plants. They are good copies of the real thing, and they provide most of the benefits of live plants, such as beauty, cover, a home for good buy bacteria, and hiding places for baby fish. After you've gained experience you may want to use live plants.

Things to Do:

1) The pet shop will have a variety of live plants. Try a few. Plants need lots of light. In your 10 gallon aquarium the fluorescent light should be used twelve hours a day if you want healthy plants. Some plants need even more light. Don't be discouraged if some plants don't do well. You'll have to learn the special needs of plants. Some fish eat plants. Most Cichlids and Silver Dollar fish eat plants. Ask the pet shop operator to introduce you to someone who knows about plants.

Tell how you keep your fish healthy: _____



Equipment and supplies I own:

Did you enjoy your 4-H aquarium project experiences this year? _____ YES _____ NO

Did you plant to enroll in an aquarium project again next year? _____ YES _____ NO

Why? _____

What did you learn in the 4-H Aquarium Project? _____

Comments by club leader: _____

Date: _____

Signed: _____



Project Summary

LEADERSHIP

List your accomplishments both in this project and as a member of your club, county council, etc.

Ex: participate in TLC as the delegate to District VIII meetings.

Date	Please Describe

COMMUNITY SERVICE

List in detail your individual or club community service accomplishments and the purpose for the service.

Ex: Our 4-H Club saw a need for a food drive & collected 200 items that were delivered to the needy.

Date	Activities and Events

PRESENTATIONS

List in *detail* the demonstrations, speeches, exhibits, workshops where you presented. Also list the topic of your presentation & the level at which you participated at.

Ex: County Events Demonstration - "How to prepare your Rabbit for Show" Check County

Date	Activity	Topic	Please check level				
			Individual	Club	Cnty	District	State

CLUB ACTIVITIES

What activities did you participate in with your 4-H Club.

Ex: Workshops, fair, field trips, judging trips

Date	Activities

NEWSPAPER Articles and/or Pictures of your 4-H Project

NEWSPAPER Articles are extra and will not be deducted.

If you or your 4-H club was in the newspaper please attach the article here.

For project pictures, be sure to include captions describing each photograph. If possible show ☺
The Beginning of your project ☺ work being done and ☺ your completed project.

(Minimum of 3 pictures). You may insert pages as needed.

