Adult Companion Guide

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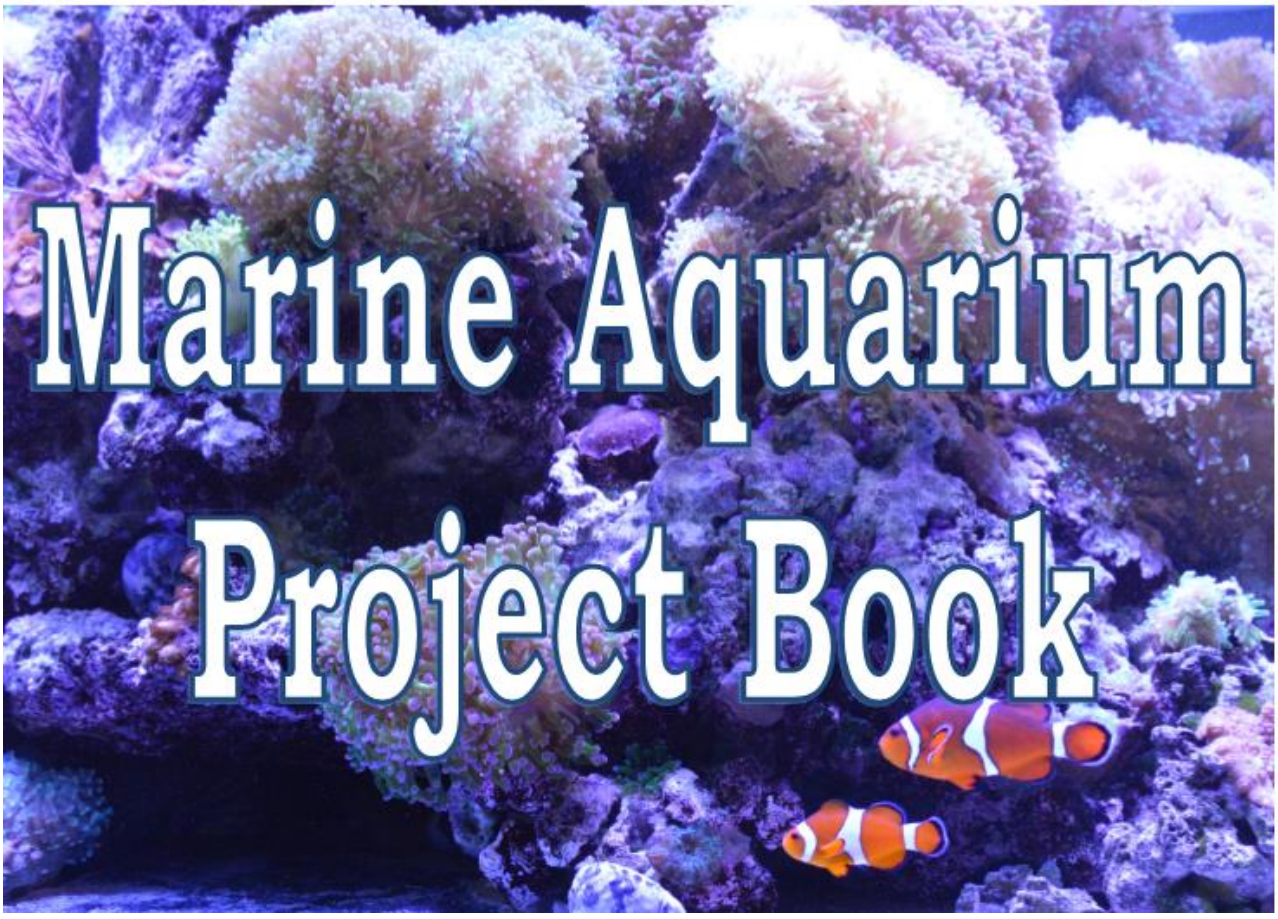

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4-H Marine Aquarium Project Adult Partner's Guide

Introduction

This adult guide is designed to assist the adult partner with a better understanding of the Marine Aquarium Project Book, as well as enhancing youths' learning experiences. The marine aquarium project is an excellent project that will enable youth to explore marine science, chemistry and biology. While cultivating corals and designing their own aquarium layout through Aquascaping, youth will gain empowerment and enjoyment of a hobby that is very rewarding.

Partnering with Youth

Working with youth in 4-H allows for both the adult and the youth to build on a relationship that can last a lifetime. It is vital to ensure that both the youth and the adult are valuing each other's opinions during interactions. Build trust with each other and allow for the youth to feel comfortable expressing their opinion in the project area. Allow the youth to be in a position to make decisions in the project area. This will create satisfaction and pride in a completed project.

Understanding Youth Needs

In the follow pages, we will discuss the Life Skills that can be acquired while working with youth in the Marine Aquarium Project. It is important to keep in mind that the youth that you will partner with have their own expectations with this project. After establishing a relationship with the youth, it is important to determine their expectations and needs to help them reach their goals. One youth may have the desire to only grow and breed corals, while another youth might only want to have fish and no coral in their marine tank.

Establishing an open line of communication and allowing the youth to feel comfortable with self-expression in their project will allow the project to excel. Youth need to feel comfortable with experimenting with the project and their own expression through the project.

Youth also respond more quickly to instant results in many projects. It is important to express to the youth that this project will take some time to show tangible results. Much like watching a garden grow, that marine aquarium can take some time to establish. Assure the youth the results will exhibit themselves in the long term.

Youth also have a need to belong. Their 4-H club will allow for a belonging environment. There also may be the opportunity in your area for a local reef club. Ask at your local aquarium store if there is a group of local aquarists. Youth should also be encouraged to join the Marine Aquarium Society of North America (masna.org).

Enhancing the Experience

Consider helping your youth have an enhanced experience with this project by participating in some of the following activities:

- Visiting local aquarium stores
- Accompanying youth to aquariums
- Snorkeling in nearby areas
- Virtual tours of aquariums are available online

Experiential Learning Model

Adult partners learn to assist youth with their project by applying the experiential learning model by Kolb (1984). By keeping youth involved and actively engaged in the learning marine aquarium project, youth will complete specific steps, learn techniques and how to set and reach goals.

Steps

The steps of the experiential learning process are clarified.

1. Do—adults assist youth with completing tasks in the project book.
2. Reflect—adults can discuss successes with youth as well as what they would like to improve upon. Ask the youth what they learned from the experience, how they would change their approach or how they could improve upon a technique they have learned.
3. Apply—adults can support youth with implementing enhancements in the future.

Techniques

Each area of the experiential learning process is expounded upon and connected to the marine aquarium project.

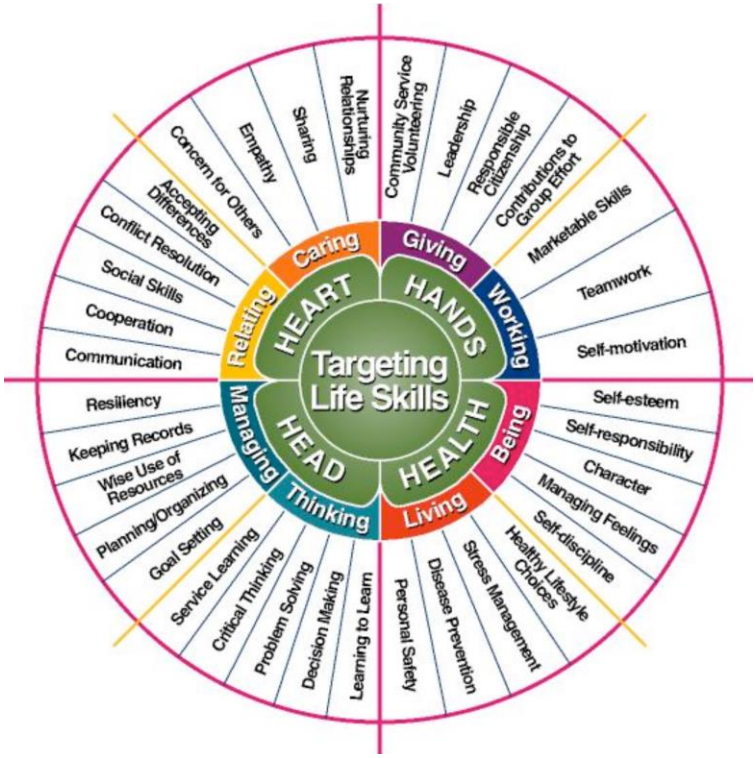
1. Experience—this action is carried out by the youth. The adult's role is support at this time.
2. Share—youth can share their experiences through illustrated talks at the club, county, district and state levels. Illustrated talks are a great way for youth to share their experience and sharpen their public speaking skills. In a five to ten minute talk, youth will teach others what they have learned from their project. For example, a youth would explain with pictures in a slide show or on a poster board how to complete a water change in a marine aquarium.

3. Process—adults can help youth think about what they did and how they learned from it. The youth can also explore any life skills they may have learned from the experience.
4. Generalize—this step constitutes adults assisting the youth to zero in on what they learned from the activity. Upcoming plans can be taken into consideration at this point as well. Youth may consider what they may want to do differently in the future.
5. Apply—youth and adults can make notes on the lessons learned and knowledge gained from the involvement in the project.

Targeting Life Skills

Youth learn life skills through nearly all 4-H projects. When youth develop new abilities that they can carry with them throughout their lives, we call these "life skills". The ability to problem solve and relate to others as well as managing a project are a few examples. The marine aquarium project allows youth to learn working, thinking, managing and caring. 4-H emphasizes "learn by doing" and a marine aquarium projects is one of the best ways to learn by doing through a variety of tasks over several months.

In the center of the life skills wheel, it is easy to see our 4-H's. Heart, hands, Head and health are each separated into two main components. These components are then further segmented into three to five additional skills per area. The key to reading the life skills wheel is to start from the center and work your way to the outermost ring.



Hendricks, P. (1998) "Developing Youth Curriculum Using the Targeting Life Skills Model"

Working

Youth will work during set and maintenance of the aquarium. Chores will include feeding fish and checking temperature. One a weekly basis, salinity should be checked and the top cleaned of any salt residue. Every other week youth can test their system for the first couple of months. This is an excellent way to monitor the progress of the nitrogen cycle. Youth laboring to clean their aquarium will gain self-esteem through the type of hard work which is not learned in a classroom.

Thinking

Youth learn preparation, organization and goal setting while planning the aquarium design. Adult partners can assist youth with problem solving should an error occur while testing or if the project aquarium encounters a problem.

Managing

Youth will learn to keep records and monitor the aquarium. Adults can support youth with testing and establishing a testing schedule. Proper feeding of marine life will need to be practiced. Assisting youth with best management practices will be an additional way adults can partner with youth in this project area.

Caring

Youth exercise caring by sustaining a healthy environment for their marine life. As their aquarium grows and develops over time youth may even have corals that they can harvest and swap. Adults can help with cutting and gluing these frags.

Materials Needed

Below is a simplified list of materials needed to enjoy the marine aquarium project:

- ✓ "Reef Ready" tank that includes stand, tank, lights with a 3-chamber filter system
- ✓ Live sand and rock
- ✓ Reverse Osmosis (RO) water
- ✓ Thermometer
- ✓ Heater
- ✓ Protein skimmer
- ✓ Test kit
- ✓ Refractometer
- ✓ Glass scraper
- ✓ Fish (optional)
- ✓ Net

Understanding the Science Behind it All.

Reverse osmosis (or RO) freshwater and saltwater is the only water youth should use in their tanks. This water has been purified to the point where there are essentially zero total dissolved solids. This means there is nothing in this water to grow nuisance algae or cyanobacteria. Many pet stores offer RO water for sale. At around $1 a gallon, it is far more affordable than buying an RO filter and mixing the water yourself. Never allow youth to use water from the ocean, bay or sound.

The nitrogen cycle is the natural process through which nitrogen is incorporated into food by photosynthetic organisms. These organisms are consumed directly or indirectly by other organisms and subsequently excreted, acted upon by bacteria and made available again for plant nutrition. Below is the answer key to the Nitrogen Cycle activity.

A. Nitrates are naturally removed by changing the water.

B. Waste from fish create ammonia (NH3).

C. Larger fish eat smaller fish and produce waste.

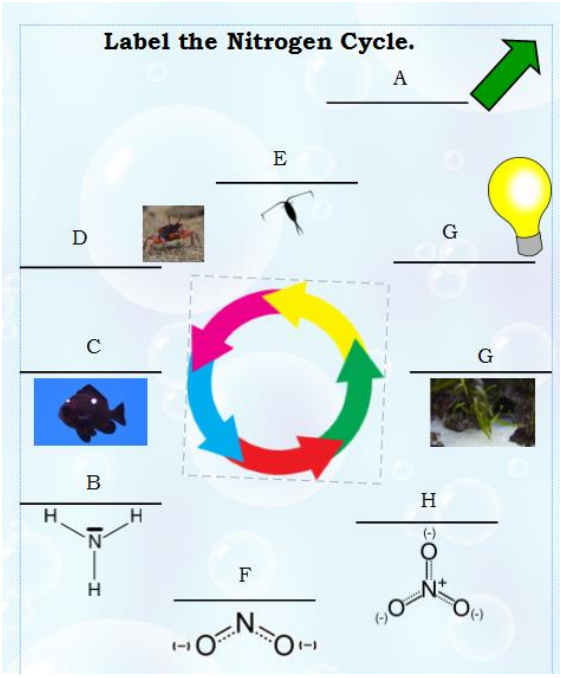
D. Smaller fish and other livestock eat microorganisms in your tank and are known as the cleaner crew.

E. Phytoplankton and other microscopic organisms eat waste.

F. Bacteria eats the Nitrites (NO2) and they become Nitrates.

G. Plants and phytoplankton use light to sustain life.

H. Nitrates (NO3) are created from ammonia by good bacteria on live rocks.



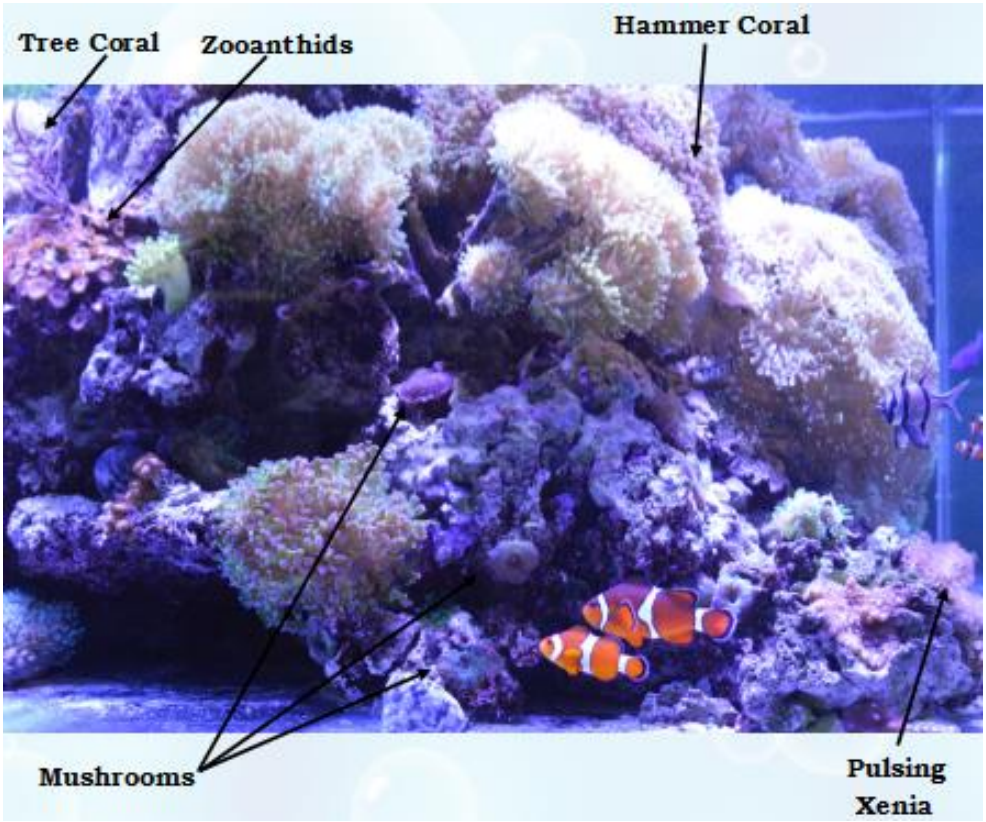
Corals

Corals for Beginners

Below is a list of corals proven to be unchallenging, resilient, and well-suited for the beginning hobbyist. These are all soft corals that do not require additional lighting and are not aggressive.

- ✓ Button Polyps
- ✓ Cauliflower Colt Coral
- ✓ Colony Polyps
- ✓ Leather Coral
- ✓ Mushrooms
- ✓ Tree Coral
- ✓ Zoanthids

Answer key to page 17



LPS Hard Corals—advanced

Large Polyp Stony (LPS) Corals are generally larger calcareous corals with large fleshy polyps. These corals have stinging tentacles and can be more aggressive. In a small tank, they would not be recommended. These examples include:

- ✓ Acan Brain Coral
- ✓ Brain Coral
- ✓ Button Coral
- ✓ Candy Cane Coral
- ✓ Donut Coral
- ✓ Elegance Coral
- ✓ Frogspawn Coral
- ✓ Hammer Coral
- ✓ Lordhowensis Coral
- ✓ Plate Coral
- ✓ Torch Coral

SPS Hard Corals—advanced

The Small Polyp Stony (SPS) corals have small polyps on a calcareous skeleton. These corals traditionally are branching or plated. SPS hard corals are more difficult to keep than the LPS or soft corals and are not recommended for beginners. Some examples include:

- ✓ Acropora
- ✓ Birdsnest Coral
- ✓ Blue Ridge Coral
- ✓ Capricornis
- ✓ Horn Coral
- ✓ Pavona
- ✓ Porites

Fish

The selection of fish is vital to the success of your aquarium hobby. As tempting as it is to buy more expensive fish, it is best to begin with Damsels or Blue Green Chromis. Clownfish are also very popular, but can cost $20 each. Always ask for assistance at your local fish stores when selecting new fish. Some fish are considered “loners” and should not be placed with other fish. In addition, some fish should be paired with other animals. The pistol shrimp and watchman goby are an example of a symbiotic pairing. That is, both organisms benefit from the relationship, where the shrimp’s home is guarded by the watchman goby and the shrimp builds a home for the goby.

Below is a list of great fish for beginners:

- ✓ Bicolor Dottyback
- ✓ Blenny
- ✓ Cardinalfish
- ✓ Clownfish
- ✓ Blue/Green Reef Chromis
- ✓ Damselfish
- ✓ Basslet
- ✓ Firefish Goby
- ✓ Flame Hawkfish

Testing

Most fish stores will test your water for little or no cost until you can get your own kit. It is recommended for the youth to obtain an essential test kit that will be able to test for Ammonia, Nitrates, Nitrites and the pH of the aquarium. This kit will retail for $25-$30. A hydrometer will cost around $10 and is essential for testing the salinity of the water. Too much salt in the water will have detrimental results, as will too little salt in the water. A hydrometer is key to keeping an eye on the salinity of a tank's water.

The Sera aqua-test box is an example of an advanced testing kit. This kit will test for pH, Ammonia (NH3), Nitrites (NO2), Nitrates (NO3), Iron (Fe), Phosphates (PO4), Copper (Cu), Carbonate Hardness (kH), and Calcium (Ca). You will commonly only test for the last four on the list if a problem arises. This complete kit retails for about $100. Each kit comes with complete instructions. It is important to work with youth for their first few initial tests. Correct measurement of reagent drops is vital. Work closely with youth until they are comfortable with the testing kit.

Resources

There are a lot of resources available to obtain great information about marine aquariums and the hobby. Here is a list of some great online resources for your youth:

- Reef2Reef is an online community of saltwater aquarium hobbyists. Their goal is to provide a friendly place to discuss and ask questions pertaining to the marine and reef aquarium hobby. This site has free membership and will assist with identification and has a great database of articles. http://www.reef2reef.com/
- Marine Aquarium Societies of North America (MASNA) is an organization dedicated to the education, assistance, support and encouragement of those in the marine aquarium hobby. Membership is $20 per year for an individual or $35 per year for a family. http://masna.org/

- Another great resource is your local aquarium store. They will assist you with finding out where the local reef club meets and how to join. These local resources are a great way to find frag swaps and obtain frags that are close by.

Glossary

Algae Growths of plant-like organisms. Some algae may look like plants but they are not plants. There are many different types, shapes and colors of algae.

Alkaline

Refers to the pH of water. Water with a pH higher than 7 is said to be an alkaline.

Ammonia

Chemically known as NH_3 and is a toxin that can build up in an aquarium. It is released naturally by fish. Ammonia is step one in the nitrogen cycle and is removed by bacterial action where it is transformed into nitrite. It can also be removed by mechanical filtration.

Aquascaping

The art of designing your aquarium. It involves arranging aquatic plants, rocks, stones or driftwood. The design is up to the individual and can have unlimited possibilities.

Aragonite

A mineral that contains calcium which is found in rock, gravel or sand. Aragonite is commonly used in marine and saltwater aquariums.

Bacteria

Bacteria are single-celled, microscopic organisms. Some beneficial bacteria can be used to filter the water by breaking down and consuming waste in an aquarium system.

Ballast

A power source required for aquarium lights. These are located in the hood.

Bio-Balls

Plastic balls of various sizes which have complex designs. They are used as part of the biological filtration in an aquarium. The more surface area they have, the more area the beneficial bacteria has to grow.

Biological Filtration

Natural filtration for an aquarium that uses bacteria to break down waste as part of the nitrogen cycle.

Bivalve

A shelled animal whose shell is comprised of two halves usually connected by a flexible hinge. Scallops and clams are examples of bivalves.

Blue Green Algae

Cyanobacteria that forms a blue-green slime that can cover surfaces in an aquarium. This can easily be removed by syphoning during water changes.

Bryopsis Algae

This is a hair type algae that can come to your tank as a hitchhiker. Be careful where you buy your livestock. Never bring home something from the wild.

Calcareous

Anything containing calcium carbonate. Calcium carbonate is used to help maintain a high pH in aquarium water.

Calcification

The extracting of calcium from the seawater by corals and coralline algae. Calcium is then deposited in the form of calcium carbonate.

Calcium

(Ca) A mineral that makes up most corals and other calcareous organisms. In your reef tank, maintain calcium levels between 380 and 480 mg/l (miligrams per liter). This can be achieved through regular water changes and by using calcium additives.

Calcium Carbonate

($CaCO_3$) a chemical compound often used as a calcium supplement. It can be added to aquariums to increase the general hardness (GH) of the water.

Carbon

A substance used for filtration in an aquarium. It is ideal for removing large numbers of toxins in the water as well as maintaining the clarity of the water.

Chemical Filtration

Filtering the water with chemicals such as carbon and protein skimmers is the chemical filtration in the overall filtering system.

Chromatophores

Color pigmentation cells in the skin of marine animals. They are used by some fish and invertebrates to change colors which allows them to hide from predators.

Compatibility

This refers to how well fish and other animals are likely to get along. Damsels for instance can be very aggressive and should not be overcrowded in a tank. Remember, big fish eat little fish. Use caution when additional animals are introduced to your aquarium.

Copepods

Tiny crustaceans found in marine aquariums. Copepods can reproduce in an aquarium system and make a great source of live food for your fish.

Coral

Marine invertebrates in the class Anthozoa of phylum Cnidaria. Corals commonly live in small colonies of many identical distinct polyps. Some corals secrete calcium carbonate to create a hard skeleton, while others are called soft bodied corals.

Coralline Algae

A form of algae that creates a calcareous crust like coral. Coralline algae is colorful and can occur in bright pink, purple and red colors. It is sought after in a reef tank, and can be made to grow on rocks and desired surfaces by maintaining correct levels of alkalinity, pH and calcium levels. Because it will

also grow on the glass, it can be a struggle to clean. Regular scraping can keep coralline algae under control.

Coral Sand

A white to light colored sand made up of crushed coral. It can also be called live sand if microorganisms are present.

Crustaceans

Hard-shelled invertebrates including crabs, lobsters, shrimps and barnacles.

Cyanobacteria

Type of microscopic, photosynthetic organisms that can form large colored mats in an aquarium. Traditionally blue-green in color, they sometimes are red, brown, dark green or black. Easily removed by syphon during a water change. Testing can determine the cause and additives can be used to correct the problem.

Diatoms

A single-celled organism that forms brown algae on aquarium glass or rocks. Their shells are formed from silicate, which can be found in non-purified water. Always use reverse osmosis (RO) purified water in your aquarium. Never add water from the ocean to a reef tank. There are microscopic diatoms present that will ruin your ecosystem.

Detritus

Waste from aquarium inhabitants. This will accumulate in gray piles in the tank. While syphoning during a water change, detritus can easily be removed. Bumblebee Snails are also great for cleaning up detritus.

Filter

There are three main types of filters: biological, chemical or mechanical. They work differently to remove unwanted particles or compounds from your aquarium's water.

Filter Medium

Any substance used in water filtration systems to remove impurities or organic wastes from the water. Sponges and Bio-Balls are a couple of examples.

Foam Fractionation

A process of skimming or removing proteins from water through the use of foam. This is the filtration method used by protein skimmers. Many people call it protein skimming; however, foam fractionation is the correct term.

"Frag"

Slang for a coral fragment. A "frag" is a small piece of coral. Sometimes this can often include small colonies of several polyps or a single polyp. Frags are usually mounted on a small piece of metal, plastic or other material called a frag plug. Frags are a great way to start out in the hobby. New coral can be added to a tank for a relatively inexpensive price. Frag Swaps are held throughout the country which is an excellent way to add new and exotic corals to your system.

General Hardness (GH)

An overall measurement of the concentration of calcium, magnesium and other ions. It is measured in degrees and the desired range is between 5˚ to 10˚. The higher the degree, the harder water will be.

Gills

Membranes fish use to absorb dissolved oxygen from the water during respiration.

Heater

A standard piece of equipment used to heat the water in an aquarium. Heaters vary in size, wattage and style. Heaters are an excellent way to maintain the temperature in you aquarium system.

Herbivore

An animal that eats plants. Herbivores are vital to your healthy aquarium because they can assist with keeping algae controlled.

Hydrometer

A device used to measure the specific gravity or salinity of your aquarium.

Impeller

Small fan that is located inside the motor of the pump.

Invertebrate

An animal with no skeleton or backbone.. Many animals that live on coral reefs are invertebrates. This includes mollusks, crustaceans, worms and corals.

Krill

Tiny, shrimp-like marine invertebrates. Krill is regularly sold in aquarium stores either as live food, frozen or freeze-dried.

Live Rock

Rocks cultivated from farms that usually have a variety of sea life attached or living in them. Including nitrifying bacteria, sponges, algae, coralline algae, worms, and starfish. Live rock is commonly used in reef aquariums because it contains beneficial bacteria that can help filter the water through nitrification.

Live Sand

Sand that contains beneficial bacteria and other sea organisms. Live sand is used in reef aquariums because it contains bacteria that can help filter the water through nitrification.

Marine Aquarium

An aquarium that keeps marine plants and animals in a contained environment. Also known as a saltwater aquarium, a marine aquarium is usually set up to reproduce a marine environment such as a coral reef.

Magnesium

An elemental metal that plays a critical role in the chemical and biological processes in the marine aquarium. Magnesium is important for the skeleton forming process of stony corals and other invertebrates.

Mechanical Filtration

A water filtration method that uses filtering medium to remove particles from the water.

Microalgae

Small microscopic types of algae such as the green algae and hair algae often present in marine aquariums.

Nano Reef

A small marine aquarium that is typically less than 20 gallons. Nano reefs can be more challenging to keep because of the small water volume.

Nitrate

NO_3 the final product in the nitrogen cycle. There should be no nitrates in the water after the nitrogen cycle is complete.

Nitrification

The progression by which bacteria changes ammonia into nitrite and then nitrite into nitrate. This is the basis of the nitrogen cycle.

Nitrifying Bacteria

Naturally occurring bacteria that change ammonia or ammonium into nitrite or change nitrite into nitrate as part of the nitrogen cycle. Nitrifying bacteria are a key component of a biological filter for an aquarium.

Nitrite

(NO_2) Nitrites should have a zero reading after the nitrogen cycle is complete. Nitrites are the bacteria that consumes the ammonia that comes from the waste.

Nitrogen Cycle

The nitrogen cycle is the natural process through which nitrogen is incorporated into food by photosynthetic organisms. These organisms are consumed directly or indirectly by other organisms and subsequently excreted, acted upon by bacteria and made available again for plant nutrition.

Oxygen Reduction Potential (ORP)

This is a simple measurement of the water's ability to cleanse itself.

Parasite

An organism that nourishes itself with the tissues of another organism. Parasites are one of the main reasons aquariums have disease.

pH

This is a measurement of how acidic or base your water is. Monitoring the pH is important if you have animals in your tank that require a more acidic or a more base environment.

Phosphate

A nutrient that can cause uncontrolled growth of algae in the aquarium. It can also be toxic in high concentrations and must be kept to a minimum in coral reef aquariums. Phosphate can be easily removed by a number of commercially available filter media.

Photo period

The amount of time each day that the aquarium lights are turned on.

Phytoplankton

Microscopic plants found drifting in saltwater. Phytoplankton embody the bottom of the food chain in the ocean.

Plankton

A general term used to denote both phytoplankton and zooplankton.

Powerhead

A small pump that is fully submersible. It is used inside an aquarium to provide water movement to simulate wave movement.

Protein Skimmer

An additional filtering device that uses bubbles to create foam and remove organic wastes from the aquarium. This is an essential piece of equipment for maintaining good water quality in a reef tank.

Quarantine Tank

Often called a hospital tank. This is a separate tank which allows for sick or injured fish to be placed away from the rest of the healthy fish. This allows the injured or sick fish time to heal without spreading disease or becoming the victim of more aggressive fish.

Reverse Osmosis (RO)

An advanced procedure for filtering water for use in an aquarium. This technique works by pushing water under pressure through a special membrane. Reverse Osmosis (RO) can produce very pure water, but it is a slow process and can only filter small amounts at a time. Many aquarium stores make RO water available for purchase. RO water can be fresh for topping off after evaporation or ready to add RO saltwater.

Salinity

A amount of salt in seawater, measured in parts per thousand (ppt). Natural seawater has a salinity of about 35 ppt.

Specific Gravity

The proportion of concentration of salt in a given liquid to that of pure water. Specific gravity is used to measure the salinity of seawater as compared to distilled water. Distilled water has a specific gravity of 1.000 while natural seawater has a S.G. of about 1.025. Marine aquariums should have a specific gravity of 1.026.

Sponge Filters

A type of filter that provides both mechanical and biological filtration. Particles are removed from the water as it passes through the sponge. Microorganisms growing on the surface of the sponge also eradicate toxic substances from the water.

Sweeper Tentacles

Extended stinging appendages used by some aggressive hard corals to sting other nearby corals in order to gain territory and growing space.

Syphon

A length of tube that can use gravity to move water from one location to another. This is the best way to remove water from your marine aquarium during a water change. The syphon hose can be used to target and remove nuisance algae during a water change.

Symbiotic

A phenomenon where two different organisms live together in a mutually beneficial relationship. Both creatures provide each other with food, protection or some other survival need. An excellent example in the wild is an anemone and clownfish. The anemone offers protection to the clownfish within its stinging tentacles and the clownfish delivers the anemone with scraps of food. In the marine aquarium clownfish often do not pair with anemones. The main cause is due to the fact that clownfish are raised in captivity and are not exposed to anemones at an early age.

Trace Elements

Elements that naturally occur in trivial quantities in your aquarium. These are required for survival by many reef organisms and include barium, calcium, iodine, lithium, molybdenum, and strontium.

Trickle Filters

A purification system where water is dripped over filter medium that is exposed to the air. The air aids to improve the nitrification process. The filter medium usually consists of small plastic balls or strips of plastic. Bio-Balls are used in the systems we discuss in this project book.

Turnover

The amount of water that is filtered by a system. The higher the turnover rate the more beneficial it is for reef tanks.

Vertebrate

Animals that have a backbone and a skeleton. For our purposes this will include fish, sharks and jawless fish.

Water Change

The practice of swapping a portion of aquarium water with a fresh saltwater mix. It is suggested that 20 to 25 percent of the water be changed each month in a reef tank. Remember to only add reverse osmosis or RO water back to the system at this time. This is an excellent way to remove a large amount of impurities in a short amount of time.

Wet/Dry Filter

Part of the biological filtration system that is exposed to the air to aid in the nitrification process. This system is contained in chamber 2 of our aquarium system. Water flows down into the filter and over a filter medium where microorganisms remove pollutants. The water is then pumped back up into the tank. A mechanical filtration medium may also be used in a wet/dry filter.

Zooplankton

Tiny microscopic animals often present in seawater. The larval stages of many fishes and invertebrates are included in this category.

Zooxanthellae

Tiny plants that live in a symbiotic relationship with certain corals, clams and some sponges. They receive nutrients from their host and provide a food source in return. They are the reason for the brilliant colors in corals and clams.

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