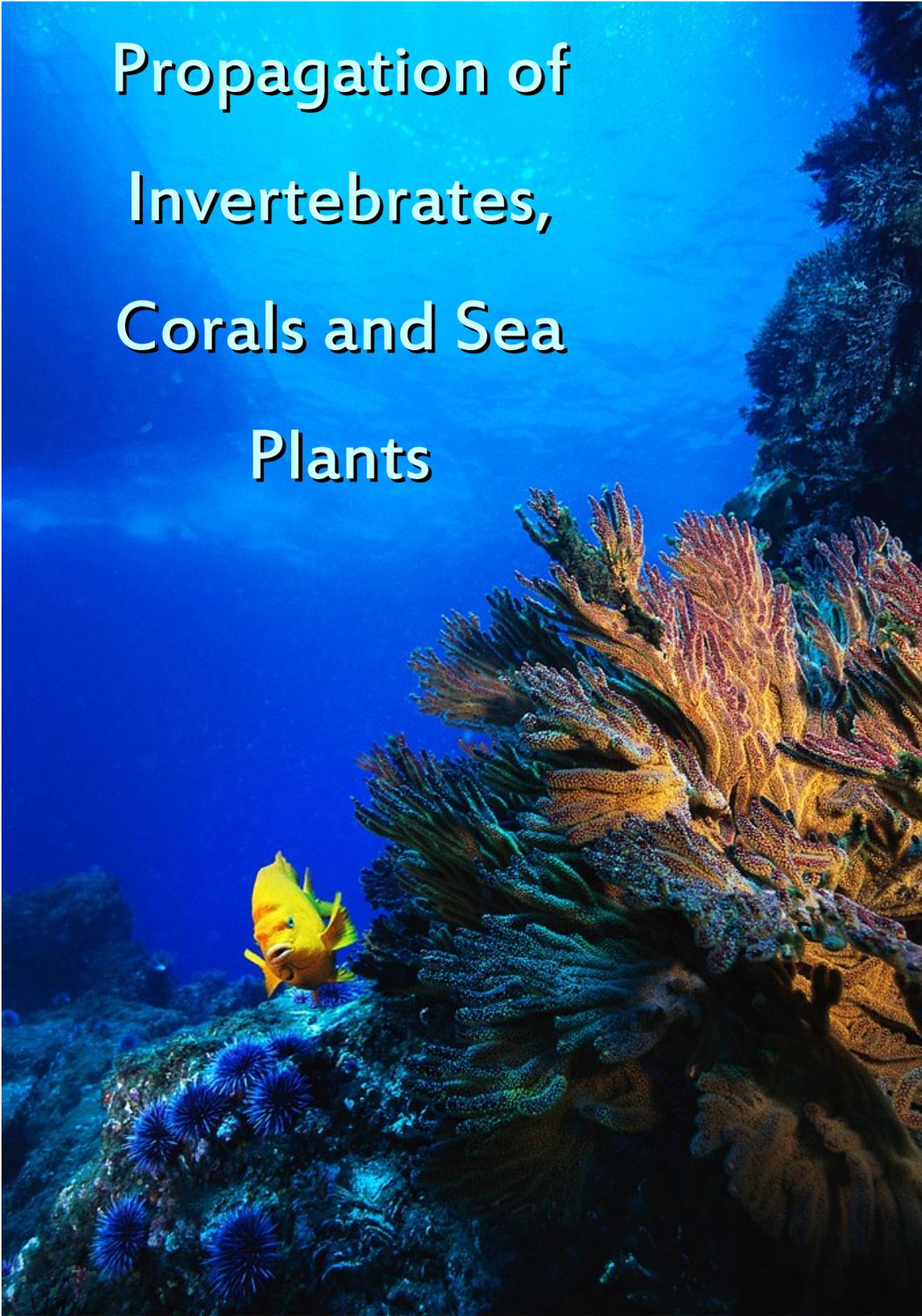


# Propagation of Invertebrates, Corals and Sea Plants



## ***Overview of Propagation***

Propagation can be one of the most inexpensive methods of stocking your aquarium. Hobbyists can either reuse newly formed corals, plants and invertebrates in another area of the tank, trade fragments of coral or sea plants with other hobbyists or sell propagated species to other hobbyists, aquarium shops and the general public.

By definition propagation means to simply multiply the number of individuals, it is also referred to as “fragging” (short for fragmenting). In the aquarium this can be done for corals, sea plants and some invertebrates. The basic principle involves cutting up the organism and getting each cutting to grow into an entire new organism. This regeneration ability only occurs in some invertebrate species, all plants and most corals.

In terms of coral this technique is very important to reduce the demand for species collected from the reefs of the world. Much damage is occurring to coral reefs from tourist activity, pollution and collection of corals for the aquarium trade, in fact some countries have made collection of species from coral reefs illegal. So by fragging your own corals you can actually make money, trade species for new ones and help save the reefs.

There are different techniques for propagation and each is dependent on the type of coral, plant, or invertebrate that is going to be propagated.

## ***How to Propagate Invertebrates***

Not much is known about the propagation of marine aquarium invertebrates as this technique is still relatively new to home aquariums. However many species of invertebrates can simply be cut into pieces with a clean sterile razor blade and each piece when left to regenerate in stress free conditions will become a complete new specimen. An easy invertebrate to do this with is a starfish by cutting off the legs and having each one turn into a new starfish in a few months. The best thing you can do is to experiment with your invertebrates and see what works best. It is quite probable that sea slugs, sea cucumbers and sponges can be propagated relatively easily in this fashion.

Always keep the water quality as high as possible and make sure the frags are well fed and kept in a stress free environment. It is also a good idea to use activated carbon in the water for a few weeks after fragging to eliminate anything in the water that may harm your new organisms.

For some invertebrates like snails, clams and shrimp propagation has not yet seen any successes. Species like these can instead be multiplied by breeding. To do this you simply ensure you have a number of individuals in a stress free environment and let nature take its course. For snails and shrimp in no time at all you will see reproduction occurring, and as with fragging new individuals can be

sold or traded. It is often a good idea if you have fish to grow up shrimp in a refugium (a safe haven for species that would ordinarily be eaten by the main tank population) either in the main tank or attached to it (sharing the same water but preventing main tank inhabitants from entering) for live food for the fish. This will be a well-received, healthy dietary supplement and will save you money on buying food. Snails on the other hand can be bred for tank cleaning purposes; this will save you time cleaning!

### ***How to Propagate Coral***

For home saltwater aquariums, coral is not only a beautiful addition to the tank; they also benefit the fish. Fish enjoy the spaces provided by the coral and makes your aquarium as close to the actual undersea environment as possible. Growing and propagating coral reefs is more difficult than growing fish and plants. With a lot of care and remaining diligent, you will soon begin to see the coral grow and the branches extend. As mentioned previously propagating coral can not only benefit you but also relieve pressure on the reefs themselves by reducing demand for collected coral. Tank reared coral has also been observed to better withstand slight water quality fluctuations and grow faster than wild species. Sick corals can also be propagated to help save a sick or dying organism, basically you are removing the healthy tissue to regenerate and discarding the rest.

Coral are invertebrates, meaning they do not have a spine or any internal organs. Reefs are mostly made up of tiny animals known as polyps and millions of them work together to form the skeleton of the coral reefs. In order to successfully propagate coral, four elements must be present:

- ***Proper lighting***
- ***Water flow***
- ***Good quality of water***
- ***Proper food***

## **LIGHTING**

The proper lighting is most likely the most important element needed to propagate coral reefs. Coral are photosynthetic and require the correct amount of lighting in order to grow and thrive. Many corals also feed off of the nutrition provided by the by-products of photosynthesis (produced by symbiotic zooanthellae). When planning to grow and propagate coral reefs on your own, you need to decide what types of coral you wish to grow. Different types of coral require different types of lighting.

## **WATER FLOW**

The flow of the water is also an important element for propagation. Most corals will need a strong and turbulent motion in order to be effective. It is important that the path of water movement be changed

and deflected. Linear flows of water can damage most types of coral, except for the fan variety which survive well in these conditions.

## **WATER QUALITY**

While lighting is considered to be the most important factor, the illumination is only as good as the quality of the water. Light will not properly penetrate the water if dirt, yellowing agents, and other tank wastes are present and floating around in the water. Water quality must be monitored and maintained at all times. Sudden changes in the quality of water, whether good or bad, can shock the corals and cause discoloration.

In order to ensure good water quality, you need:

- ***Effective filtration***
- ***Protein skimming***
- ***Partial water changes***

## **NUTRITION**

One of the most common causes of the sudden death of coral is improper nutrition and inadequate feeding. Not feeding coral correctly is also one of the most common mistakes made when growing coral. Most coral require weekly feedings; some need daily feeding. Food provided needs to always be fresh. Stale food loses essential nutrients. Airtight containers are the best method for storing the food

in the refrigerator. Any food that is frozen or opened should be thrown away after a 5-6 month period.

Another important food factor to consider when feeding coral is the size of the prey. Generally the size of the polyp will indicate the size of the prey. Small-sized polyps will not respond to food that is too large and using liquid or bottled feed can be useful for provided proper nutrients. Large polyps can digest larger foods like zooplankton and sometimes tolerate chunks of minced meats.

### **PROPAGATION TANKS**

It is possible to propagate corals in your display tank, however many people simply do not have the room to do this. So it makes sense to get a propagation tank, the best tank to get to maximize surface area for you new corals would be a 20-40 gallon shallow wide tank. A separate tank will give you the room you need and ensure a stress free coral-optimised environment for your new corals to grow. A separate tank can also prevent your other marine creatures being adversely affected by excessive mucus production that can occur as a result of corals being cut up, this mucus can be especially damaging to other species of coral. It is recommended to cover the base of the propagation tank with a good natural rocky substrate that the corals will adhere to.

A single metal halide light should be enough for your propagation tank. If you don't want to go through the bother and cost of getting a completely separate tank you can simply plumb into the main display

tank with easily available plumbing supplies. This saves on filtration, protein skimming and water maintenance costs. However you will still need sufficient pumps for enough water movement for the corals. You can even supply additional filtration to the main tank by adding live rock or live sand. A propagation tank can even also be used as a refugium for beneficial micro-organisms and invertebrates that will assist the water quality and environment of the main tank.

### **CORAL PROPAGATION**

The underlying principle of propagating or “fragging” corals is simply to cut off a healthy apical (growing tip) piece of coral 3-10 cm long and get it to attach to a piece of substrate by gluing, tying or attaching with rubber band until the coral attaches itself (usually in a few weeks). Then like magic a few months later you have a new mini coral.

**Soft corals:** Can be fragged with sharp scissors then attached to a piece of substrate by loosely holding in place with a rubber band until they have attached themselves. You must be very gentle as it is easy to damage the soft, slimy tissue. Alternatively the coral fragment can simply be stuffed into a hole in the rock and will eventually attach itself. The coral fragments can also be simply dropped into the tank and allowed to attach to the rubble by themselves. To do this there must be a delicate balance in water movement; too much making the fragments move around a lot and too little which may cause to corals to become sick or even die.

**Stony corals:** Fall into 2 groups;

1. Small polyped stony corals (SPS) e.g. Acropora species, these corals are easy to frag and very fast to regenerate.
2. Large polyped stony corals (LPS) e.g. brain corals, these corals are hard to frag because of large polyps and shape of dense skeleton. However it is possible to frag them by putting them on a hard surface and split off bits with a chisel and hammer, this method can easily damage them however. LPS corals are traditionally slow to regenerate.

Stony corals can simply be cut and superglued (gel) to a piece of substrate. It is a good idea to cover the entire cut surface with glue as amazingly this helps to prevent infection and help the healing process! Areas of high water flow also help with the healing process. Fixing stony corals to natural, saltwater cured substrates has higher success rates, as does cooler water temperatures and upright orientation of the attached cutting.

### **HOW TO PROPAGATE YOUR CORAL**

This example is for stony corals, for soft corals simply attach to substrate as above.

1. Select a healthy coral to frag, as an unhealthy specimen may further degrade from the stress of being propagated.

2. Choose a healthy growing branch to cut off, remembering that more branching may occur from the cut site (so if you want an aesthetically pleasing coral, choose your branch to cut off wisely). Growing tips (apical) seem to have better survival than sub-apical or branch segments.
3. Get a clean bucket filled with tank water just before you begin (so temperature is the same as display tank). This will be used to rinse the mother colony and frags before placing them in tanks.
4. Put safety glasses on and with clean hands remove the mother colony from the tank. Hold firmly by the base, being careful you don't damage the delicate sclerites (use tweezers if delicate specimen of coral).
5. Quickly cut off the bits you are selected to frag with clean (wipe with rubbing alcohol before process to help prevent infection) scissors / razor blade / garden secateurs depending on the hardness of coral. Ensure the coral is pointing towards the water so that the piece being cut off won't go anywhere but there. Some corals can be difficult to cut, so be careful.
6. Put cuttings in the bucket of tank water, then rinse and replace the fragmented mother stock coral. Ensure you replace it where it came from to minimize stress. A high water flow around the coral will assist with the healing process and help dissipate any excess mucous production that can be damaging to other corals.

7. Remove cuttings, rinse in tank water. Dry the freshly cut base with a clean paper-towel and add a liberal amount of super-glue (gel) to the piece of substrate you want to attach the coral to. Firmly attach frag to substrate in an upright orientation. Try to ensure the entire cut surface is coated with super-glue as remarkably this has been reported to assist with the healing process. Hold the coral to the substrate firmly for about 30 seconds to get a good bond. NB: high water flow may break the bond between the coral and the substrate.
8. Rinse the frag and substrate in the bucket and place into your propagation tank or display tank. Ensure there is adequate water movement and lighting. You can epoxy the rock that the frag is glued to into place in your tank. NB: epoxy is damaging to coral tissue.
9. After fragging a number of cuttings it is recommended to use activated carbon to soak up anything in the water that may damage your cuttings for a few weeks. Try to keep them as stress-free as possible until they re-establish (heal themselves and begin branching) after a month or so.
10. The key to successful fragging is to prepare before hand, work quickly to minimize stress, and look after mother stock and cuttings well after propagation.
11. Ensure that while the fragments and motherstock are healing, attaching then “basing out” you provide good water quality and

keep smothering filamentous algae at bay. Then you should have minimal problems.

### ***How to Grow, Propagate and Breed Sea Plants***

Most aquarium sea plants come from captive propagation, seaweeds have been successfully commercially cultured for centuries. These techniques have since been adapted for aquarium species. Most commercial techniques however are trade secrets, so it can be hard to figure out exactly what works best for different species.

Sea plants can be hard crust-like species that are calcereous, leafy species that resemble plants on the land or actual seaweeds that anchor themselves to the sea bed by holdfasts.

Sea plants are a healthy, natural looking, interesting addition to an aquarium that can help supplement your fishes diet and also provide additional filtration for the water by using up waste products from the marine animals. They actually improve the general health of the aquarium, especially macro-algae which very effectively filter the water to gain vital nutrients for growth. All marine plants recycle the biological waste products of your other marine life, namely nitrates, phosphates and ammonia that they use for growth. These elements if left unchecked in your aquarium can easily build up to toxic levels that will harm your other marine life. Marine plants also increase the

oxygen levels in water, which is healthy for fish. So as you can see marine plants play a vital role in biological filtration in your aquarium. They usually require only abundant light and decent water quality.

### **Common types of marine plant:**

**Macro-algae** This group of plants includes Halimeda (money plant), Caulerpa and maidens hair (also known as Turtle grass).

Macro-algae can be a very valuable addition to a marine tank as they provide excellent filtration (primarily nitrates, nitrites, phosphates and heavy metals) and can be a healthy food source for Angels, Tangs and other Herbivores. Grown in the display tank these plants provide interest, hiding places for marine creatures, food for herbivores as well as filtration.

### **Algal filtration**

People often increasingly use natural algal filtration for their tanks. The most common way to do this is to grow your macro-algal species in a lit sump under the main aquarium, or in a refugiums beside the main aquarium. Here the plants can grow unhindered in 18-24 hours of light (less dark hours are recommended as tank pH is reduced when plants are no longer photosynthesizing) providing oxygen and high levels of biological filtration. Live sand and/or rock is also

recommended to keep in a refugium, you can even breed invertebrate food species in here too, such as shrimp. And the consequent removal of pollutants will keep your tank healthy and reduce the incidence of pest algae in the main tank.

## **Caulerpa**

This is the best known macro-algae and is the easiest marine plant to propagate and grow. It is easy to maintain and shouldn't become too dominant in the tank. Caulerpa provides food and shelter for invertebrates, which in turn provide food for your fish. It is also said that this plant has an ability to buffer pH changes and even provides chemicals which are beneficial for fish health! Caulerpa prefers medium light levels (about 10 hours daily) and can need regular pruning.

This plant grows by using a runner (stolon) to link individual plants, propagation can be done by simply cutting the runner and relocating individual plants which will again grow into groups if planted in good sediment. Try to avoid cutting up too many leaves as the plants energy source comes from here, just aim for the runner of the plant. Some species are very invasive in the wild, so mind this plant in your tank!

## **Halimeda**

This plant is known as the money plant because it grows as a series of calcareous “coins” chained together. Halimeda is a hardy, slow growing plant that may require calcium supplements for good growth of its calcium carbonate skeleton. This plant is difficult to propagate, as it dislikes pruning. Fish will nibble at Halimeda but do no real damage.

### **Flowering plants:**

There are 2 types of flowering plant commonly found in marine aquariums; Red mangrove (*Rhizophora mangle*) is a species that needs a fair bit of air space above water to grow leaves and shoots (only the base of the stem and body of the roots are submerged) the tips of the roots are also above water to breath.

The other flowering plant is Turtle grass (*Thalassia*), this plant is harder to grow and needs a fair bit of light and a lot of soft substrate for its roots. This can be grown and individual plants can be separated to form new “colonies”.

## **Thalassia**

Also known as Maidens hair or Turtle grass. It usually comes attached to rock and resembles a very vivid green matting of grass. Splitting the rock the plant is growing on up then encouraging the plant to spread onto new rock/substrate can most easily propagate it. It prefers medium light levels and water flow. Fish will not eat this plant as it is toxic if ingested.

## **Red mangrove**

Mangroves can grow in freshwater, brackish or marine aquarium setups.

Mangroves have yellow flowers and are pollinated by wind, if you grow a number of them it is easy to get them to breed. They are unique in the fact that seeds germinate while still attached to the mother plant, when the seeds finally drop they are already mini-plantlets (called propagules) that can float for up to a year before suitable substrate is found upon which to grow.

Growing mangroves requires that you have a fair bit of open space between the water line and the top of the tank, as this is where the stem, shoots and leaves grow. Most of the root system remains submerged.

Mangrove propagules can be planted into the substrate (sand, gravel or live rock) or simply tied to an area where the shoot and leaves are above water, mangroves can even be trained to grow out of the plumbing opening in the back of the aquarium where the shoots and leaves can then grow above the aquarium itself! Mangroves require only minimal light, so if space inside the tank is an issue this can be a good idea.

You can even use Mangroves as an aquarium filtration system, it will require 1 mangrove plant for every 2 gallons of water (depending on mangrove size; if the plants are large you need fewer of them), this will provide adequate biological filtration for your aquarium.

Mangroves require magnesium supplements to keep the leaves from senescing (yellowing) from salt stress. As mangroves have a “salt pump” which removes excess salt through their leaves, leaves should be wiped free of salt every so often to keep the plant in optimal health. They can be trained in growth formation much like a bonsai. In the wild they grow large so trimming is important if you only have limited space.

All other common saltwater plants come from the Chlorophyta group and are seaweed like. Many of these species have complex lifecycles but can be propagated using commercial techniques, for example Nori cultivation in Japan. The hardest plants to grow successfully are the calcereous algae plants.

Propagation of sea plants is often done to improve the health of the plant. New growth is stimulated when the plants are divided up and replanted.

There are two common types of propagation when dealing with plants.

- ***Vegetative Propagation*** – happens when a part of the plant is used to propagate the plant. It includes cutting the stem or tuber, or any other part of the plant.
- ***Seed (or Sexual) Propagation*** – happens when a plant is produced using a seed or spore of the original plant.

Cuttings are the easiest way to propagate sea plants. Different types of plants require different propagation and pruning techniques. Long-stemmed plants need to be trimmed and maintained in order to bring balance to the plant. Long, sharp scissors should be used for these tasks. Generally the plants will grow 2-3 new leaves and often make the plants very top-heavy, causing the branches to break off due to the extra weight.

Some examples of freshwater aquarium plants requiring a maintenance routine of trimming include:

***Cambona*** – a fast-growing plant that works great as an oxygenator in the tank. Due to the tendencies to grow so quickly, pruning needs to

happen regularly. Propagation of Cambona happens when the lower leaves are replanted.

**American Cress** – a beautiful plant which is easy to grow and maintain. The plant flowers easily and propagation happens when the aerial stems, located near the base of the plant, are replanted after a clipping.

**Wisteria** – an easy plant to grow and maintain. Propagation occurs when the stems of the plant are replanted, from which new plants will grow.

**Anubias** – these plants are not fast-growing and generally do not grow in abundance. Remove old leaves as soon as they appear to weaken. This type of plant also succumbs often to an influx of algae in the tank.

**Floating Fern** – an easy plant to maintain and grow. Propagation takes place when the buds of matured plants are replanted.

Foreground and Sword plants typically generate runners which take care of propagating the new plants. Those sea plants that produce side shoots should have their rhizomes cut away gently, as well as a few leaves. They can then be planted along the surface of the substrate.

## **SUBSTRATE**

There are some aquarium plants that need to be planted in the substrate or in a pot in order to grow. Other plants can survive by attaching themselves to rocks, driftwood, or other objects. Additionally, there are plants which live floating around the tank.

When dealing with substrate, ideally particles should range between 1.5 – 3.0 mm. Finer substrates are not always tolerated by the roots of the plants. With larger particles, the water circulates easily and allows for better circulation. The depth of substrate will also vary based on the plant chosen to grow and should be determined after the plant species have been decided.

## **LIGHTING**

Depending on the species of plant, there will be different requirements for lighting. It is important that you do adequate research on the lighting when you have determined which types of plants you want to grow. It takes effort to grow and maintain healthy aquatic plants but it is not impossible to achieve an aquarium of healthy plants.

While lighting does vary depending on the plant life you want to sustain, there is a simple rule to follow that will point you in the right direction. Aquatic plants typically require .5 – 1.0 watts of fluorescent lighting for every liter of water (.5 x water liter = wattage). Incandescent lights are still commonly used in tanks; however, these

lights tend to get very warm and adversely affect the temperature of the water. They also use a lot of energy and, compared to fluorescent lights, do not have a very long working life and need replacement more often.

Further light modifications will be required based on the species of plant you choose. Also, take in to consideration how many plants are growing in the aquarium environment and how deep the tank is when figuring out the strength of the lighting wattage you need to be using.

In addition to the wattage of the fluorescent light bulbs, there should also be a consideration for the color temperatures of a light bulb. There are different temperatures for different reasons. To be on the safe side, less experienced tank owners should use the lamps that are bluish (white) and yellow (warm) types. Lighting should be used in conjunction with the natural timetable of light based on the environment from where the plant originates. Since many of the plants are tropical, 12 hours of light each day is common. More temperate plants may require an additional two hours of light during the summer and only 10 hours during the winter months. If you leave the lights shining all day, everyday, you will be enabling algae to grow faster. Additionally, the constant light will bother your fish.

## **NUTRITION**

Proper nutrition is essential in order for sea plants to survive. Without the proper nutrition, plants will suffer stunted growth, yellowed leaves,

and potentially will die off. There are two basic types of nutrients used to feed aquarium plants.

- **Macro Nutrients – Phosphate, Potassium, and Nitrogen**
- **Other Nutrients – Nickel, Iron, Boron, and Zinc**

There are also other elements need to help plants thrive, which can be incorporated into the tank in several ways.

There are nutrients present in fish food and once excreted by fish, will feed the plants (nitrates, nitrites and phosphates).

There are nutrients available from the tap and well water used in the tank.

There are important nutrients found in the potting soil and other aquarium substrate.

Fertilizers can also be purchased specifically for use in an aquarium. Regular fertilizers for other non-aquatic plants contain too much nitrogen and could be dangerous to the fish. It is important to note that just adding fertilizer to the tank will not help plants to grow unless the other elements are used as well.

## **PHOTOSYNTHESIS**

Plants turn light energy into an energy they can use in the form of sugars. Plants need the carbon dioxide to complete the photosynthesis process and many of the plant species survive well

utilizing the CO<sub>2</sub> provided by aquarium fish and other species in the tank. When plants are photosynthesizing they take in CO<sub>2</sub> and excrete O<sub>2</sub>, which is good for your marine creatures. However, some of the plants will need additional supplies of CO<sub>2</sub> and even the plants who do not require the additional CO<sub>2</sub> will thrive and grow faster with it.

Some aquarium owners can supplement the CO<sub>2</sub> using a gas filled cylinder, while others use a fermentation process to achieve the production of CO<sub>2</sub>. The process of fermentation is not difficult or expensive. Here are the steps one can take to initiate the fermentation process.

- 1. Using a 1.5-2.0 liter plastic bottle, poke a hole through the cap in the top. Run an air line tube into the bottle and make sure it is air-tight, with a non-return valve attached.***
- 2. Fill half of the bottle with water and pour in ½ cup of sugar with a ½ teaspoon of baking yeast.***
- 3. Put the top back onto the bottle and allow the process of fermentation to begin.***
- 4. As the gas starts to evaporate in to the air line, attach an air stone to the tube and carefully place the stone into the tank. This process will fill the tank with enough CO<sub>2</sub> for approximately two weeks.***

## **DISEASE PREVENTION**

There are several measures to take to keep disease at bay when propagating sea plants.

- Do not purchase plants from venues where the aquatic life does not appear healthy. Plants can contain microorganisms that can harm your fish. Quarantine is a must.
- Choose only healthy looking plants and remove any dead or damaged leaves prior to planting into your tank otherwise your tank water could become polluted.
- It is okay to remove a lot of leaves in order to keep the tank clean. There is also the possibility that repotted plants will lose additional leaves after replanting due to shock and the change of environments.
- Self-sterilize the plants before putting them into your tank.
  - ***Dilute a solution of potassium permanganate and soak your new plants for up to 15 to kill off any harmful microorganisms. Only use this method for tanks that contain fish and plants which can deal with the solution.***