

Birth of a Reef Tank

A Beginner Guide for Setting-up a Reef Aquarium

Part I "Introduction to Reef Tanks"

John J. Geisler

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Prologue

I have been keeping fresh water aquariums for nearly twenty-five years. Like many of the people that enjoy this hobby I started off with one tank and through the years added more and larger tanks. With the addition of the larger tanks came larger and more expensive fish. I would liken this evolution of the hobby to an individual's education process. One starts off in grade school and as time passes so do the grades until high school and then on to college. Same with hobbies. As one becomes more involved in the hobby they learn more and grow with it. In my opinion, I believe one's first small fresh water aquarium is like starting in grade school and the beginning of the education process. Following that education process I feel starting and maintaining a reef aquarium would be compared to the college to post graduate level as this hobby goes. There is much, much more education required to be successful at this level!

I have found that the very first and most important step in making the leap into reef aquariums is **RESEARCH!** Do your research, read, study, ask others in the hobby, do anything and everything you can to know as much about reef tanks as possible before ever making your first actual purchase! Reef tanks are a LOT of work and VERY expensive so education can be invaluable in helping to guarantee your success at starting and maintaining your ecosystem. Understand what your getting into...are you willing to do the work? Can you afford it?

Along with these questions are some more that you may not even be aware of...what type of an aquarium set-up do you want? Do you want a true reef tank or a fish only? (Many fish are not compatible with reefs). What size...a micro-reef or a huge set-up? (Size is money, how big can you afford or fit?) Where can you set up you mini ecosystem so that it will flourish? What type of filtration system is right for the system you want to keep? These are but a few of the questions that need answers before you make the first purchase. It is my strong recommendation that if you want to spend money on a new reef or marine aquarium the first purchase should be for books and magazines!

Sources for Information

Listed below are some recommendations for sources of information anyone can research to help get a better understanding of this hobby and some of the options available:

Books

There are libraries and store shelves full of wonderful books with mountains of information about this hobby! Where to start and which ones? One recommendation for buying is Amazon Books but there are also several online

aquarium suppliers that have good selections at reasonable prices. Here are a few book recommendations:

- **The Reef Aquarium-Volumn I**
Charles Delbeek & Julian Sprung
Often referred to as the bible of reef keeping and usually one of the first books purchased.
- **The Reef Aquarium-Volumn II**
Charles Delbeek & Julian Sprung
- **Guide to the Coral Reef Aquarium**
Ron L. Schimek
Easy to read with basic advice.
- **Natural Reef Aquariums: Simplified Approaches to Creating Living Saltwater Microcosms**
John Tullock, Martin Moe
Excellent book! Written late 1997 this is one of the more recent books out there. Easy to read with sound advice more in line with modern reef keeping.
- **Marine Reef Aquarium Handbook**
Dr. Robert J. Goldstein
- **Corals: A Quick Reference Guide**
Julian Sprung
- **Dr. Burgess Atlas of Marine Aquarium Fishes.**
Dr. Warren E. Burgess
- **The Conscientious Marine Aquarist**
Robert Fenner
- **The Modern Coral Reef Aquarium: Volumn I**
Fossa & Nilsen
- **The Modern Coral Reef Aquarium: Volumn II**
Fossa & Nilsen
- **A Practical Guide to Corals for the Reef Aquarium**
Ed Puterbaugh & Eric Morneman
- **The Captive Reef: A Concise Guide to Reef Aquaria in the Home**
Dana Riddle
- **The New Marine Aquaria: Step-by-Step Setup and Stocking Guide**
Michael S. Paletta
- **Corals for the Mini Reef Aquarium**
Dr. Herbert R. Axelrod

Magazines

While books have massive amounts of detailed information, I sometimes enjoy the more reader friendly version found in some magazines. They contain good information written specifically for the people that actually keep the aquariums.

A few resources are:

- Aquarium Fish Magazine
- Marine Fish and Reef

Internet

The internet is undeniably one of the best resources for obtaining information! The information is out there but one has to know where to look! If you know how to effectively use search engines, go for it! In the mean time here are a few links to help speed the process:

- Aquarium Net www.aquarium.net/flash_index.html
- About Network search.about.com (search for aquariums)

Bulletin Board / Chat Rooms

This is another variation on the Internet as a source of information. There are quite a few avid members of this hobby all over the world and some of the bulletin board and chat rooms are a wonderful way of uniting these people and sharing the information and knowledge they have accumulated.

- Reef Central www.reefcentral.com (Check out the bulletin boards)
- The Reef Tank www.thereeftank.com (Check out the bulletin boards)

LFS (Local Fish Store)

Your LFS can be another good source of information about different types of systems, needs, fish etc but this information can be slightly more difficult to acquire. The availability of a reputable LFS with good marine or coral experience can vary considerably depending on your area. If you live in any of the coastal areas, you're lucky to have some great shops to choose from. If you in "Small Town USA", you may or may not have a shop that carries or knows anything about salt or corals. If you do happen to have a shop in your area that handles corals, look at their tanks and see what condition they're in. If they have nice looking, healthy display tanks they probably know what they're doing. Once you find a shop that knows what it's doing, are they able and willing to help educate you? LFS's can be very busy at times and getting someone that is experienced with corals and such to spend the time to educate you on everything you need to know can be tough. I recommend you do your research ahead of time and use the LFS for specific questions, not *Reef Tank 101*.

Choices

As you do your research into the different types of aquariums available, you will start to develop an idea of what you want for your system. You will need to look at a number of different options available and decide for yourself what your best choices are. Listed below are some of the options that need to be considered as part of the system you start:

Tank Selection

Believe it or not, the purchase of the tank is probably one of the cheaper expenses you will encounter but it can have a substantial impact on other costs. While the larger tanks do cost slightly more initially, the greatest cost impact will be realized in the live rock and sand base that goes into it. The larger tanks will also require more filtration, which can impact the type of system used. In a 55 gallon or smaller tank, a hang on the back (HOB) filter system such as a CPR Bak-Pak or AquaC Remora can be used. Larger than 55 should probably have a separate sump or similar with a skimmer.

It is very common with saltwater systems to have a sump. A sump is a separate tank whether glass, acrylic or even PVC that is used to increase water volume, filtration and usually provide a place for equipment such as a protein skimmer. This sump is located below the main tank, usually inside the base cabinet. If you plan on using a sump, I would highly recommend purchasing a tank that is already pre-drilled with overflows. This is sometimes referred to as reef-ready. A pre-drilled tank will have overflow boxes already installed, either as a full height corner overflow or partial boxes mounted near the top. Corner overflows have many advantages in both aesthetics and function. These overflows, which are partially hidden within the tank, will allow you to position the tank much closer to the wall. These extra few inches can sometimes make a big difference in tight spaces.

When deciding on what tank to buy you again need to consider what you want to collect. If you want to create a reef display with fish and live corals there are several points to consider. One is the depth of the tank from front to back. A fifty-five gallon tank measures 48" long, 13" deep and 20" high. This is a great tank for freshwater fish but with a reef tank the 13" dimension can be a problem. Reef tanks require a substantial amount of live rock as part of the filtration and also to serve as the base for mounting the different corals. This rock takes up quite a bit of the 13" footprint and becomes rather tight. With the addition of the corals, which typically need room to spread out, the 13" dimension becomes even tighter. Now try and work in the tank for maintenance and cleaning and you will very likely wish you had a larger tank. I strongly recommend a minimum of 18" depth front to back when doing a reef tank or even for a fish only with live rock (FOWLR) tank. This will allow more base area for arranging the rock formations and allow some open sand area, which is very important for a variety of reasons.

The second dimension to consider is the height. A good reef tank will typically have a sand bed around 4" deep. That 20" height now becomes 16" remaining. When the live rock is added you will want to create arches, caves and open areas to help with the circulation within the tank and also to provide areas for any fish

to swim through. By the time the rock is arranged in the tank you can easily have an arrangement 8" to 12" high. This doesn't leave a lot of room at the top section for mounting corals. While a 20" tank can work for a reef tank and many people have used them, a 24" high tank can provide additional aqua-scaping options.

The third dimension to consider is the length. This is more of a home decorating issue than a marine issue. How much space do you have available for a tank? This involves questions of location, which will be addressed later.

There are a variety of sizes of tanks that can work well for reef tank systems. A few of these sizes are listed below:

Tank Sizes

Gallons	L	D	H
65	36	18	24
75	48	18	20
90	48	18	24
120	48	24	24
125	72	18	22
150	72	18	28
180	72	24	24

Location

Where will you set-up your system? You do not want to locate your system across from or in front an exterior window if you can avoid it. The direct sunlight can sometimes lead to an algae problem that can get difficult to control. While this is not usually as much of a problem with reef tanks compared to freshwater systems, still one potential problem worth avoiding if possible. Look for heat vents or other heat sources that can affect your system. Try and select a wall area that is clear of heat vents, radiators, direct sunlight etc.

Also keep in mind cleaning. You will need to do a LOT of cleaning with your system so be sure to have fairly easy access to the kitchen or another area you can do you maintenance. If you have an option of type of floor, smooth waterproof flooring is preferable. It is a guaranteed fact that you will be spilling water so be prepared to mop the floor or clean the carpet occasionally.

Also keep in mind access and view-ability. You will need to be able to get to all sides of you tank during maintenance so you will need clear access. This same clear access can help with view-ability. After you have done all the work and your system is running you will likely spend quite a bit of time sitting and watching your creation. Try and position the systems so you have the best view and other can enjoy also. While going to this effort, room decor and aesthetics can be important to your decisions but this is a mater of taste and decorating so your on your own with this one.

Besides the aesthetics and access issues involved in the tank location, you also need to pay strict attention to structural issues. Big boxes of water are heavy.

One gallon of water weighs eight pounds. Add to this the weight of the tank, stand, hood, sump and any equipment located in the stand and you can have a very substantial amount of weight located in a small area. By following several basic guidelines this additional weight will usually not be a problem.

1. Locate the tank along perimeter walls. This keeps the weight close to the floor joist support.
2. For interior wall locations, make sure there is a load-bearing wall directly below or close to below the tank position.
3. Check the direction of the floor joists. The tank should span multiple joists and preferably not be positioned so the length of the tank runs in the same direction of the joists. By spanning the joist, the complete load of the tank is spread out across several joists.

Base Cabinet

Many factors can impact the selection or style of the base cabinet. The size of the tank can influence several factors as the larger the tank the heavier, therefore a more substantial base is needed. A larger tank will also be more likely to need a sump or other larger filtration system housed inside. Keep in mind what type and size of filtration system will be used. You will also need to allow enough space to access this filtration so plan accordingly. Also keep in mind that you will need a surprising amount of electrical to run your system! You will have a lot of outlets, timers and cords housed in your base cabinet so allow enough space and access for the electrical octopus to come later.

The style of the cabinet is mainly a decorating issue driven by taste and decor. So long as the cabinet meets the necessary criteria for the tank and equipment, what it looks like is a personal preference.

Livestock

While trying to decide on all the other options available one of the most critical decisions that needs to be made is "what do you want to keep in your tank"? Do you want to keep corals? Do you want to keep fish only? If you want to keep corals in your system there are several other substantial factors and cost involved, the most critical being lighting. Most corals are photosynthetic and require a different type and amount of light than a fish only tank. This lighting is VERY expensive so know all the facts before deciding on keeping corals. (I have included a section on cost later in this document to help with some of these decisions). Also impacted by the type of livestock is type and amount of water flow. Many corals require a greater amount of water flow than a fish only system. Along with the greater water flow, the use of wave makers is highly recommended for many systems keeping corals.

Lighting

Your choices in lighting are one of the areas with the most differing opinions as to which system is the best. The one most important factor that will drive this selection is your livestock. A fish only tank can use conventional lighting which will typically consist of SO fluorescent tubes and standard ballast. These are the hoods that will commonly come with the tank when purchased as a kit or system. Corals require a much more intense light and the equipment is more complicated and more expensive. The three main choices for light systems for corals will consist of VHO (Very High Output), PC (Power Compact) or metal halide. The livestock you intend to keep in your tank will determine which type of light and how much will be needed to keep your critters happy.

VHO:

VHO lights are fluorescent lights that look very similar to regular fluorescent light tubes. One visible difference is the rear face of the tubes have a coating that helps direct the light outward. VHO bulbs produce substantially more light and require high powered electronic ballast to operate them. (The most popular ballast for these bulbs is from a company called "Ice Cap" and these ballast are sort of an industry standard). These bulbs come in a variety of light intensities measured in "K" as in 6200K. Different corals require different amount of light at different "K" values so you will need to add this to your research. Most corals will be quite happy with just VHO lighting but some clams and hard corals will require PC or Metal Halide.

PC (Power Compact)

Power compact light fixtures are a type of fluorescent lighting gaining popularity. These bulbs look completely different than a regular fluorescent bulb as the tube is about 5/8" in diameter and doubles around so all four pins are on the same end. The actual length of the bulb will be similar to other fluorescent bulbs but it has twice the length of tube. Typically, the same type of ballast that will power the VHO bulbs can be used for the PC's. Inch for inch, PC bulbs produce more light than VHO.

Metal Halide

Metal halide lighting is totally different from the previous two fluorescent lights. Metal halide is a type of High Intensity Discharge (HID) light bulb that produces a very intense light and with that light comes heat. Extra precautions need to be taken when using metal halide to protect the tank and people from the heat of the bulbs. On the plus side for metal halide, these bulbs tend to create a shimmer effect in the aquarium that can be quite beautiful and is part of their popularity. On the negative side, the bulbs are VERY expensive, often costing in the \$90 or more each range. Like the VHO and PC bulbs, these bulbs also require a special ballast to operate and the ballast is also expensive.

The most common wattage for the Metal Halide bulbs are 150w, 175w, 250w and 400w although other watt sizes are available. The 175w and 250w are

arguably the most popular wattage sizes but larger and deeper tanks can take advantage of the 400watt bulbs. More watts equals more heat so this is another factor to consider when making your choice.

Metal Halide bulbs also come in a variety of K values. Common ranges are 6500K, 10000K and even 20000K. 6500K is a very common and popular choice but this can sometimes appear slightly more yellow in color. If using the 6500K metal halide, it is sometimes recommended to use a combination of halide and VHO Super Actinic lighting to reproduce the full spectrum needed for the corals. Add this to your research list.

Energy consumption with the different types of lighting can vary but that gets into a depth of data that will not be covered at this point. Suffice to say, if you have a reef tank, you will be paying more for your electric usage.

Timers

As part of your lighting system it is strongly recommended to incorporate electronic timers. (See link to Ice Cap timers). You should have your lights configured to turn on and off at selected times each day to provide a balanced amount of light for your corals. It is also recommended that the VHO Super Actinic bulbs have their own ballast and timer. This allows controlling this light independent of the other bulbs. The Super Actinic bulbs will create a blue glow in your tank, which can be rather pleasant by it's self. The light spectrum produced by the Super Actinic bulbs also will generate different colors in your corals and cause them to fluoresce when used by itself for some added variety. Some people advocate setting the timers so the Super Actinic comes on for a period of about 1 hour before the other lighting and stays on about 1 hour after the other lighting is shut off. This represents the dawn and dusk effect for your livestock.

With larger tanks it is fairly common to have several different lights such as a bank of VHO actinic bulbs and multiple Metal Halide (MH) bulbs to cover the larger area. Part of that larger tank, more money equation again. When using multiple MH bulbs it is recommended that each ballast (one ballast per bulb) be on a separate timer. This can offer several advantages but the most important one is to stagger the ignition of the MH bulbs. MH bulbs draw a much larger amount of power during ignition. If your electrical circuit is anywhere close to it's limit, the extra load of several MH bulbs igniting at the same time will likely push your circuit to overload. Burnt fuses or tripped breakers and if your not home to reset or replace, this is bad. Spend the money for lots of timers.

There are lots of timer options available. The basic Intermatic version that uses little plastic tabs inserted in the dial will work but personally I dislike them. If the timers are anywhere close to where they can be bumped the dial can be moved and your timer setting are shot. Worth the money to upgrade to the electronic version. Intermatic has a very nice fully programmable, digital timer that works great. This is a very good choice. For the VHO lighting, Ice

Cap has a digital timer that is wired directly to the ballast but this timer is a little more expensive, usually around \$50.

For the next level of teckies, X10 has a series of programmable remote control modules than can be run by handheld RF remote and even controlled by computer programming. These same timer modules can be used by some of the higher end monitors and controls available. This can become important as your system evolves and you start dealing with lighting effects, temperature monitoring, heat and cooling control, pH monitoring and control etc. That subject is for a little further along in the process and deeper into the checkbook.

Water

Ever notice that most people are drinking bottled water and fewer people are drinking tap water? Tap water is a great thing for showers, washing clothes and daily usage but not necessarily always the best thing for drinking. While most cities have water that is perfectly fine for drinking, there are quite a few cities that the people definitely should NOT be drinking the water. Along with contaminates in the pipes and other nasties in the water, most cities are treating the water with chemicals. There are articles available with a lot of information regarding the stuff in many major cities water, add that to the research list if you get bored. The summarized version is.... tap water is not acceptable water for a reef tank.

To maintain a healthy, thriving ecosystem in your aquarium requires healthy, clean water. To achieve the healthy water you will need to first start with RO (Reverse Osmosis) filtered water for your saltwater solution. This gets us back to bigger tank equation again but bigger tanks require more water...duuhh. Most people when they start out usually don't have their own RO System so you will need to carry your water home (ever hear of Gunga Din)? This can be a pain but this also brings us back to the part about "lots of work" and it's just starting. There are two common sources for obtaining your RO water; the first being the LFS. Nearly all LFS's that handle marine (saltwater) livestock will sell RO water. Be prepared as most of the shops don't supply any water jugs so you will need to bring you own five gallon water jugs and have them fill them for you. Also be prepared for the fact that these shops tend to charge from \$0.50 to \$0.75 per gallon for plain water and about \$1 per gallon (or more) for RO/salt mix. The second choice if you want to make LOTS of trips is the grocery store. Many of the larger stores now have RO dispenser units where you can get water refills, again remember to bring you own water jugs. Most of the dispensers will fit a maximum size of 2 1/2 gallon jugs but the cost per gallon is usually about \$0.35 per gallon. Time verses Money...your choice.

When it comes time to mix your saltwater mix you will need a hydrometer, as this is the only way to know you have the right amount of salt in your water. Even if you buy your water already mixed you will need this meter to monitor the specific gravity of your "seawater".

Filtration

Filtration is another area I recommend a lot more research! Once you start with clean health seawater you need to keep it that way! There are two main types of filtration you will likely use, mechanical and biological.

Mechanical

Mechanical filtration will essentially consist of any type of device that circulates water through a filtration medium. For saltwater and reef tanks this will usually consist of a foam fractionation device called a protein skimmer. (I won't go into the details here of how a skimmer works, add that to the research list). Skimmers can come in a variety of different styles but the volume of water that needs to be filtered will usually determine which style is best. As mentioned earlier, for tanks in the 55 gallon and under size a hang on the back (HOB) style such as the CPR Bak-Pak or AquaC Remora can work just fine. For larger tanks you will likely need a refugium or sump which are separate tanks other than the main tank that water is pumped into, filtered and then returned to the main tank. These systems require a LOT more plumbing, pumps, work and space so study this area carefully when making your decision regarding the type of aquarium and system you plan to build.

Biological

Biological filtration is Nature's way of keeping the water clean and balanced. In closed to semi-closed systems such as aquariums this is mainly accomplished by a variety of "critters". These critters usually consist of bacteria, worms, snails, crabs and different types of detritus eating scavengers. For a balanced ecosystem the two most important elements you will be starting with are your liverrock and livesand.

Liverock

Liverock is the term used for chunks and pieces of the base calcification of tropical reefs. This is the cumulated build-up of the materials created by stony corals and the other animals that inhabit the reef. The rock itself is not actually alive but is home to multitudes of small critters, algae and bacteria (the good stuff).

Liverock is usually very porous and the combination of critters, bacteria and open space acts as a natural filter to balance the water. Even if you plan on keeping a fish only system (no corals) the use of liverrock is very beneficial. If you ever encounter the initials, FOWLR, this stands for **Fish Only With Live Rock**.

The recommended amount of liverrock for your aquarium is between 1.25 to 2.5 pounds per gallon of tank. This can vary depending on how porous the rock and how much you want in the tank (or how deep the wallet). This gets us back to the bigger tank versus smaller size quandary as you can expect to

pay at least \$4.60 per pound up to \$12.00 per pound for your live rock. (I don't recommend paying \$12.00 per pound). I do recommend going for around 1.5 pounds per gallon if you intend to place corals as they usually come on a small piece of live rock so more corals adds more rock.

Deep Sand Base (Livesand)

For any of you that have been keeping freshwater aquariums before wanting to make the jump into salt (hopefully) you have probably been using undergravel filters as part of your filtration system. This is one of the big differences in keeping saltwater and corals. Most experts do not recommend the undergravel method and instead advocate the natural deep sand base method. Most experts recommend a minimum depth of 4" as a sand base. A deep sand base typically consists of three different layers of sand.

The base layer consist of Aragonite reef sand in the 1.0-1.7 mm size. This should measure approximately 1 - 1 1/2" deep.

The second layer consist of Oolitic Aragonite sand which has a grain size of 0.5 - 1.2mm. This layer should measure approximately 1 1/2" - 2 1/2" deep.

The top layer consist of "livesand". Live sand is typically shipped in sealed plastic bags with a minimum amount of seawater included so the sand is wet. This sand is loaded with bacteria (the good stuff), small worms and other critters that are beneficial to your system. The bacteria and critters eat the detris (garbage) that settles to the bottom of the tank and converts it to more inert compounds. The livesand comes in 20# bags so you get what you get unless you can share.

How Much Sand?

I don't want to panic anyone here but we're about to get into "math"! There is a mathematical formula that works pretty well for figuring out how much sand it will take to achieve the proper depth for the size tank you are using.

To calculate the amount of sand you will need you can use the formula shown below:

$$(\text{Tank width}) \times (\text{Tank length}) / 1,728 \times 70$$

This will give you the number of pounds per one inch of sand base. As an example, a 55 gallon tank typically has a base measurement of 13" x 48". For the formula this equals $13 \times 48 = 624 / 1,728 = 0.36 \times 70 = 25.2$. It will take 25.2 pounds of sand to achieve 1" of sand base in a 55 gallon tank. This will help you determine how much sand you will need per layer to achieve the desired depth. Since many of the different types of sand come in premeasured bags such as 20# or 40# this formula also helps you determine how deep or how many bags you will need. Using this same formula you can determine that one 40# bag of sand will achieve 1.58 inches of sand base in the above 55 gallon tank. ($40 / 25.2 = 1.58$).

And you though once you graduated you wouldn't need that stuff any more!

Cost

Now we get to the hard part...the soul searching and searching the wallet. How much can you or do you want to spend? Reef tanks aren't cheap. Nor are they easy. It is not likely that you will be able to assemble a successful reef tank for under \$1,500.00 and for a maximum....there is no maximum! Realistically, one can anticipate an average of from \$2,000 to \$3,000 to set up a reef tank. Larger tanks will cost even more (back to that bigger cost more part again). Before I ever made my first purchase to start my tank I did my research....lots of it. As part of that research I created an Excel spreadsheet to use while designing my system and calculated the cost that went with it. By the time I had listed the parts I would need to start the system I was over \$2,000 excluding one single piece of livestock, just hardware alone!

To help you with figuring out some of the anticipated cost involve I have included a sample of a spreadsheet I did for a 90 gallon system as mentioned above. I am also including a blank form you can use to start your own list if you so desire. You can use this a reference to help calculate the anticipated cost for the system you wish to set-up. I have also included a blank form for calculating electrical usage if you serious about wanting to know how much your new system will add to bottom line on the montly utility bill.

OK....so you've added up the numbers and thought ...hummm I can afford that. A little damage to the checkbook, maybe some more damage to the credit card or maybe a LOT more damage to the credit card but you went ahead and bought the stuff for your reef tank. Don't put your wallet away yet. Fish, corals and an assortment of livestock yet to come. The tank is just the empty home, now you have to furnish it and populate it. There is no limit to how much you can spend in this area, just how much you are willing to spend.

Oh boy....now you have some corals and some fish in your new reef tank. Don't forget they have to eat. You have now added some new pets to the household and they like to be fed also. But don't forget about the corals. Yes they actually do need to be fed but at least they are less demanding than the fish. The corals will need some supplements but this is more of a weekly to few weeks effort, not usually daily.

Ok, you've left the fish store, the tank is up and running, the critters are fed and happy, the lights come on and go off when they're suppose to, time to put the wallet away. Well...sort of. Utility bill just showed up. Upps. Went up a little bit. Back to the bigger cost more again. A little tank, a couple of lights and a Hob skimmer and you probably won't notice a difference in your electric bill. Not to bad. How about that 90 gallon or 180 gallon set-up? Several MH lights, VHO lights, several pumps, multiple powerheads, multiple heaters, etc. They all use electricity. Each motor has an amp rating, each light and heater has a watt rating and these can all be added up and totaled. For every 1000 watts you have one kWh (Killowatt/hour) which is what your utility company is charging you for. Different states have different rates for the electrical usage but \$0.0635 per kWh is a working average. To give you an idea, one 100 watt light bulb burning for ten hours straight uses 1 kWh (10 x 100 = 1,000) Simple math so far. The burning light bulb at the above rate just cost about 6 1/2 cents. Big deal. OK....all those little pumps and powerheads are running all the time, the lights are running 10 to 15 hours per day and you just piled up a bunch of pennies. Still not a big deal. Every day. If you're counting

pennies that one could hurt. Depending on how big and how elaborate the system, all that stuff can add an extra \$20- \$50 every month to the electric bill. This might not be a big deal at all but again, bigger cost more and a tight budget is not a good fit with a reef tank.

Is it worth it? Each person will need to make that determination for themselves. If you're tight on cash I would not recommend dumping money into a reef tank as they can become addictive. Once the system is established and you start adding live stock and paying that little extra on the monthly bill, you will very likely be constantly hang'n out at the LFS and finding new critters you want to add. *"Gee honey, it was only \$100, it was a DEAL!"*

Effort

This is the part where I include another warning.....REEF TANKS ARE A LOT OF WORK! If you are by nature a lazy person (not many like to admit this if they are) you will likely not be willing to maintain the effort required to keep your tank and ecosystem healthy! After the initial effort of setting up the system there is the ongoing maintenance and feeding that is required on a daily or at least a weekly basis to keep the tank looking good and water healthy! Just a few of the typical maintenance functions you can expect to deal with are:

- Water Testing - Nitrite, Nitrate, Ammonia, PH and other test every 3-7 days whe the system is new, less frequently once it is established.
- Algae cleaning - Snails and other cleaners don't get it all, you still get to scrape, pluck and clean.
- Water transportation - You'll need to carry all that RO water until you buy your own system.
- Water mixing - Every couple weeks or so you'll need to do a partial water change, this means mixing batches of seawater.
- Pump cleaning - Periodically the pumps need to be disassembled, cleaned and maintained.
- Feeding - This can range from daily flakes, brine shrimp to custom formulated protein feedings with eye droppers or basters to Kalkwasser drip for the corals (More info on that one later). Even corals need to be fed!
- Mopping the floor - I guarantee you'll be making a mess while doing the other stuff!

Now that the warning part is out of the way, the good new is that if you do all your work assignments diligently your reward is an attractive, healthy ecosystem (hopefully)! As I mentioned earlier, aquariums and reef tanks are addictive and you will probably find yourself spending hours with the room lights off, tank lights on and gazing into your aquatic ecosystem!

Anything worth having is usually a lot of effort, whether this effort is worth while for you.....well, you will need to make these decisions for your self!

REEF AQUARIUM COST GUIDELINE FORM

#		TANK	MODEL	UNITS	PRICE		NOTES
Subtotal							

#		LIGHTING	MODEL	UNITS	PRICE		NOTES
Subtotal							

#		CABINET & HOOD	MODEL	UNITS	PRICE		NOTES
Subtotal							

#		FILTERS & PUMPS	MODEL	UNITS	PRICE		NOTES
Subtotal							

#	SUMP & PUMPS	MODEL	UNITS	PRICE	NOTES
Subtotal				<input type="text"/>	

#	LIVE ROCK & SAND	MODEL	UNITS	PRICE	NOTES
Subtotal				<input type="text"/>	

#	MISCELLANEOUS	MODEL	UNITS	PRICE	NOTES
Subtotal				<input type="text"/>	

TOTALS

Tank, hood and base cabinet subtotal	
Lighting subtotal	
Filters and pumps subtotal	
Sump and pumps subtotal	
Live rock and sand subtotal	
Miscellaneous accessories subtotal	
TOTAL	

ELECTRICAL USAGE CALCULATION FORM

LIGHTING

#		DESCRIPTION	WATTS	AMPS	HRS	Kwh	D-TOTAL
Subtotal							

PUMPS AND POWERHEADS

#		DESCRIPTION	WATTS	AMPS	HRS	Kwh	D-TOTAL
Subtotal							

HEATERS

#		DESCRIPTION	WATTS	AMPS	HRS	Kwh	D-TOTAL
Subtotal							

OTHER

#		DESCRIPTION	WATTS	AMPS	HRS	Kwh	D-TOTAL
Subtotal							

Utility company electric rate per kWh	
Subtotal cost per day	
Average cost per month	
TOTAL COST PER YEAR	

90 GALLON REEF AQUARIUM BUDGET SUMMARY

	TANK	MODEL	UNIT\$	PRICE	NOTES
1	90 gallon, predrilled tank	All Glass #	\$230.00	\$220.00	
1	Overflow kit	All Glass #	\$40.00	\$40.00	
1	Tax and misc		\$30.00	\$30.00	
Subtotal				\$300.00	

	LIGHTING	MODEL	UNIT\$	PRICE	NOTES
1	VHO ballast	Ice Cap 430	\$159.90	\$159.90	Champion Lighting Systems
1	Dual MH ballast, 250W	PFO dual ballast	\$159.90	\$159.90	Champion Lighting Systems
2	Super Actinic VHO 46 1/2"	URI Actinic 03	\$22.90	\$45.80	Champion Lighting Systems
2	Metal Halide 250 watt	Iwasaki 6,500 250w	\$59.90	\$119.80	Upgrade price CLS
1	Lighting timers	Ice Cap	\$50.00	\$50.00	Champion Lighting Systems
2	Lighting timers	Intermatic digital	\$22.00	\$44.00	Hardware
2	MH socket	Mogel	\$19.90	\$39.80	Champion Lighting Systems
2	End Caps	Ice Cap 430	\$12.00	\$24.00	
1	Ventilation fan	Ice Cap	\$45.90	\$45.90	
2	Ventilation fan with guards	Axil fan 1750 RPM	\$25.00	\$50.00	Grainger
2	Aluminum reflector		\$39.90	\$79.80	
1	UPS	Standard ground	\$25.00	\$25.00	Shipping-UPS
1	Miscellaneous wiring supplies	Lot	\$40.00	\$40.00	Hardware
Subtotal				\$883.90	

#	BASE CABINET & HOOD	MODEL	UNIT\$	PRICE	NOTES
1	Oak base cabinet	Custom	\$450.00	\$450.00	
1	Oak hood	Custom	\$150.00	\$150.00	
1	Electrical allowance	N/A	\$50.00	\$50.00	
1	Miscellaneous allowance		\$30.00	\$30.00	
Subtotal				\$680.00	

#	FILTERS & PUMPS	MODEL	UNIT\$	PRICE	NOTES
1	Protein skimmer	Red Sea Berlin	\$150.00	\$130.00	
1	Pump for skimmer	Mag7	\$55.00	\$55.00	
2	True union ball valves		\$20.00	\$40.00	
1	Hoses and clamps-lot allow		\$45.00	\$45.00	
1	UPS charges		\$10.00	\$10.00	Shipping
3	Powerheads	Maxi-Jet 1200	\$20.00	\$60.00	
Subtotal				\$300.00	

#	SUMP & PUMPS	MODEL	UNIT\$	PRICE	NOTES
1	Sump tank	Allowance	\$250.00	\$250.00	budget allowance
1	Circulating pump (main return)	WMD Iwaki 30 RLT	\$130.00	\$130.00	
1	Hoses and clamps-lot allow		\$35.00	\$35.00	
1	Misc, valves, PVC, etc	Lot N/A	\$45.00	\$45.00	Lot allowance
Subtotal				\$460.00	

Birth of a Reef Tank

#	LIVE ROCK & SAND	MODEL	UNIT\$	PRICE	NOTES
1	Aragonite base sand 30#	reef special grade	\$30.00	\$30.00	
2	Oolitic aragonite sand	Sugar sand	\$30.00	\$60.00	
1	Live sand, 20#		\$50.00	\$50.00	
2	Live rock, 40# case	Uncured, Fiji	\$120.00	\$240.00	
90	Shipping	Airport direct pick-up	\$0.55	\$49.50	
				\$0.00	
Subtotal				\$429.50	

#	MISCELLANEOUS	MODEL	UNIT\$	PRICE	NOTES
1	Nitrite test kit	Salifert	\$13.00	\$13.00	
1	Nitrate test kit	Salifert	\$16.00	\$16.00	
1	Ammonia test kit	Salifert	\$15.00	\$15.00	
1	Calcium test kit	Salifert	\$19.00	\$19.00	
1	pH test kit	Salifert	\$11.00	\$11.00	
1	Alkalinity/Hardness test kit	Salifert	\$12.00	\$12.00	
1	Digital thermometer	Rainbow Lifeguard	\$20.00	\$20.00	
1	Floating magnetic glass cleaner	Mag-Float #125	\$16.00	\$15.00	
1	Glass scraper	Various models	\$7.00	\$14.00	
3	Water jugs	5 or 7 gallon	\$8.00	\$24.00	
1	Hydrometer	Swing arm or better	\$10.00	\$10.00	
1	Bastor (turkey bastor-new)	Bulb style	\$2.00	\$2.00	
2	Heater 250 watt	Ebo-Jager 250	\$20.00	\$40.00	
1	Fish food	Various allowance	\$25.00	\$25.00	
1	Buckets and other supplies	N/A	\$25.00	\$25.00	
1	Lots of books	N/A	\$100.00	\$100.00	
1	Miscellaneous allowance	N/A	\$100.00	\$100.00	
Subtotal				\$455.00	

HARDWARE

Tank, Hood and base cabinet subtotal	\$980.00	
Lighting subtotal	\$883.90	
Filters and pumps subtotal	\$300.00	
Sump and pumps subtotal	\$460.00	
Live rock and sand subtotal	\$429.50	
Miscellaneous accessories subtotal	\$455.00	
TOTAL OF HARDWARE		\$3,508.40