The Sea Star

Newsletter of the Utah -Wasatch Marine Aquarium Society **Founded 1995 Issue 43 January 2002**

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Inside this Issue

Welcome New Members

Dave Cook
Neil Callister
Steve Cutler
Lynn Deutschmann
Bonnie Hart
Calvin Johnson
Arjen Jonkhart
Becky Merlo
Roger Prows
Dan & Angi Sheppard
Parker Smith
Phyllis Smith
Kirk Talbot
Jared VanderMeyden
Gene Warner
Arthur Whittaker

News and Events

Meetings held since the last issue have had great participation in some question and answer discussion and coral propagation. We started out with some discussion of some interesting topics regarding nutrition of some reef animals and ended with talk about filtration piping and lighting. The bulk of the meetings was spent propagating several different coral species, including acropora, montipora capricornis, and sarcophyton. The coral were donated by Jake Pehrson, Joe and Cindy Jones and Randy Olsen. They showed us how to cut the coral into fragments and attach them to rocks so they can grow to an adult coral. Every Member was able to take home a piece of coral for their own tank.

Julian Sprung, the hobby's foremost author and lecturer, has rescheduled his visit, which was rendered impossible by the air-travel ban following the terrible September 11th terrorist atrocities. Leading up to Julian's lecture in July will be a series of guest speakers.

Steve Tyree - Thursday, March 7

Ron Shimek - Friday, April 5

Eric Borneman - Friday, June 7

Julian Sprung - Friday, July 13

Beginning with the March meeting, a change in venue is necessary to accommodate the increased attendance. Brent Anderson, President of The Living Planet Aquarium (TLP), has offered their new facility at the Salt Lake Community College. If parking is acceptable, the WMAS and TLP may soon set out on a symbiotic journey through the ocean realm! For more information on symbiotic relationships, read about the Deep Sea Anglerfish in a story by former WMAS member Monique Turner, in the October 2000 issue of the Sea Star. (Hard copies available by request to Mark Peterson)

The Marine & Freshwater Institute

The Living Planet (TLP) has, this month, established the Marine & Freshwater Science Institute (MFSI) at the Salt Lake Community College main campus on Redwood Road. The MFSI will showcase the wonders of the watery world and be a learning center for thousands of Utah students and invited visitors. In addition to offering mini displays previewing TLP's marine and freshwater exhibits, coral propagation areas allow the study and development of techniques to grow a reef. Yes, TLP volunteers will grow much of the coral used in its aquariums, rather than taking it from the wild.

Many WMAS members helped with the renovation of the 10,000-square-foot meeting hall which is the MFSI. Thanks to all who have helped and that continue to assist TLP to become a reality. If you have been growing a coral to donate to TLP, the time is near where you can place it in the new MFSI facility. It is located on the south central area of the SLCC campus in a completely cleaned and renovated auto shop bay.

Membership Renewal

WMAS membership is encouraged but not required to attend meetings. Please renew your yearly membership by donating $20 to the WMAS at the next meeting or by mailing your check payable to "WMAS" to the Treasurer, Rick Malin, at 510 Ash St., Tooele UT 84074.

GFCI – Your Best Friend

Jim Perry, Editor

Of all the gadgets and equipment available in the aquarium hobby, none is more essential than the GFCI. This is perhaps the only piece of equipment that all experts agree on - no other piece of equipment is as important.

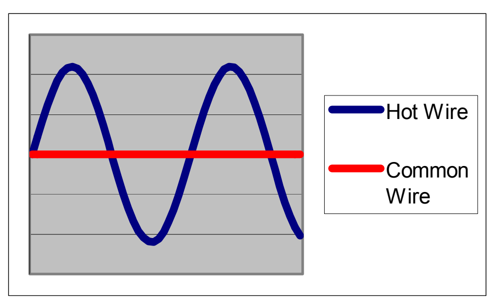
The GFCI, or Ground Fault Circuit Interrupter, is an electrical device designed to protect you and your aquarium from problems with electrical equipment. The GFCI, sometimes called a GFI, can literally save your life. It is cheap, can be bought at any hardware store for around $10, and is easy to install and use.

Uniform Building Codes now require GFCI devices on all electrical circuits used around water – this certainly applies to aquaria! If you don't have a GFCI, this article will explain why you should, what it does, and how to get one.

First a little background on electrical wiring, which I have to oversimplify a bit to avoid writing a textbook. The simplest electrical devices run from DC (direct current). Battery powered devices (like a flashlight) are a good example of DC – a battery has a positive terminal and a negative terminal. Current flows in one direction as electrons move through the conductor (a wire) and through the device (like the flashlight bulb). As the current flows, the light bulb lights up. But what makes the electrons move through the wire? – electrical potential, or voltage. Voltage is to electricity what water pressure is to your home plumbing. The more pressure there is, the more the water wants to flow, and the more force it has once you open the faucet. The greater the voltage difference, the more the electricity wants to get moving!

We discovered long ago that there is a better way to run electrical service into your house than batteries and DC current. This is called alternating current, or AC. Unlike a DC battery which has a constant voltage across the positive and negative terminal, alternating current switches the positive and negative back and forth very quickly, which causes the electric current to move back and forth in the wire many times each second, instead of flowing constantly in one direction. In the United States, AC circuits are rated at 110 volts and switch the voltage back and forth 60 times per second. The voltage actually changes back and forth in a sine wave – meaning the voltage is continually changing like the diagram above.

Your house wiring consists of a hot wire (usually a black wire), which has the continually alternating voltage, and the common wire (usually white) that has a constant zero-volt potential. When there is a circuit (or electrical path) from the hot wire to the common wire, electricity flows, powering your electrical devices. Your home wiring probably has a third or ground wire (unless you have a very old home). A ground is like a black hole for current, and exists for safety reasons. The ground wire gives the electricity a path of least resistance to follow,



In AC circuits, voltage changes as a sine wave drawing stray current safely away (into the ground) when there is a problem with the wiring.

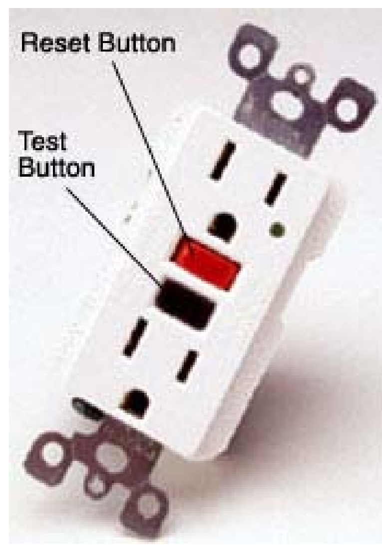
On a three-pronged outlet in the U.S., the common wire is the slightly longer slot on the left, the hot wire is the slot on the right, and the ground is the one below in the center. Now that you know all about home wiring, we can get back to the GFCI!

The voltage difference between the hot wire and the common wire provides the power for all electrical devices. The current flows back and forth between the two wires as the voltage changes . At any given moment, the exact same amount of electric current should be flowing in the hot and the common wire. Think of a garden hose – the same amount of water should be going into one end as is coming out of the other end! If not, the hose must have a hole somewhere. This is true for electric current as well. For example, with a common lamp, current flows from the common wire to the hot wire, lighting the light bulb in between. Now imagine your dog chewed through the lamp cord, and bit into the hot wire. Current will begin to flow from the hot wire through your dog and into the floor (especially if the floor is wet). Since some current is now "leaking" into the dog instead of back to the common wire, there is an imbalance in the amount of current flowing in the hot and the common wire.

This is exactly what a GFCI is for. The GFCI measures the amount of current in the hot and the common wires, and if they are not the same, it shuts off the circuit immediately! In the dog example, our GFCI instantly detects when more current is flowing in the hot wire than the common wire (since some of that current now flows through the dog) and will shut of the power. The GFCI just saved the dogs life!

How much electricity does it really take to hurt you? Let's put this risk into some numbers. When current flows through your body you begin to feel pain at about 0.008 amps. Your muscles begin to spasm (so you can't let go of a wire!) at about 0.015 amps. You can experience heart failure (because it too, spasms) at about 0.1 amps. Your hearts stops outright at about 1 amp. Unfortunately, your circuit breaker won't trip until you reach about 20 amps – long after your heart gave up!! Luckily, a GFCI device will detect a current difference of about 0.005 amps and cut the power before it can do any damage. For this reason, building codes require GFCI protected outlets anywhere close to water, such as a bathroom, or an aquarium.

A salt-water aquarium is an especially dangerous thing with electricity. Because salt water is such an excellent conductor, and because we tend to have electrical devices such as powerheads and heaters submerged in the water, we run a much higher risk than is typical with home wiring. Over time, the power cords may wear out, get eaten, become brittle, or just crack, exposing the aquarium water to the wires beneath. Once the aquarium water contacts a wire, the highly-conductive salt water becomes an extension of the wire itself with voltage potential rising and falling 60 times per second. If there is any connection to common (or to ground), current will start to flow through the tank water, including your coral and fish.



Trust me, they don't like this! If the current is small enough, you may not notice it at first. Leaky heaters and powerheads tend to start with very small current leaks, which gradually get bigger, until one day, when you stick your hands into the water -- ZZZZAAP!

On the other hand, if you use the GFCI, the circuit will be broken the minute current starts to flow through your body.

Now another point – ground your tank! If your tank is grounded, your GFCI will trip the instant your heater or powerhead goes bad, and while current is still very small, because the grounded tank has a path for current to flow. If your tank is not grounded, the GFCI won't trip until some other path to ground comes along – like when you stick your hands in the water! You can purchase commercially available grounding probes for aquariums, which are made of titanium (which will not corrode in salt water). Never use copper or any metal which can rust. Even stainless steel will usually rust when exposed to salt water. Connect your grounding probe to the ground wire of your electrical system. If you live in an old home without a ground wire, connect the ground to the screw in the plate covering your outlets, or your metal plumbing pipes (which are a perfect ground).

Adding a GFCI

You can get GFCI devices in several forms. You can replace your circuit breakers in your breaker box with a GFCI breaker. This is more expensive, and usually requires an electrician to install, but it has the benefit of protecting an entire circuit. You can also purchase a power-strip that has GFCI protection. This is less expensive, and certainly requires no electrician, but may require you to purchase a good number of these devices. It also requires you to have the discipline to plug things only into the power-strip. My favorite GFCI device is the GFCI outlet. Simply purchase one at any hardware store and replace your existing outlet with the GFCI outlet.

Replacing a standard outlet with a GFCI outlet is very easy. There are instructions available on the web at www.homestore.com/HowToGuides The GFCI outlets cost around $10.

Debugging a ground fault problem

Once you have a GFCI installed, you may one day have your GFCI tripped. When this happens, unplug all your electrical devices, then reset the GFCI. Plug your devices back in, one at a time,

Did you know?

While we're on the topic of electricity, do you know how much your aquarium costs for electricity every month? This is actually very easy to figure out!

Electric *power* is measured in watts. Electric *current* is measured in amps. Most devices tell you how much power they use somewhere on the device. For example, you may have a powerhead that uses 30 watts. Some devices, such as larger pumps, give this information in terms of current (amps) instead of power (watts). For example, your pump may draw 1.3 amps. Fortunately, there is a simple equation to relate these: Power = voltage times current. Since our devices work at 110 volts, it is simple to figure out that a pump that draws 1.3 amps uses:

1.3 amps * 110 volts = 143 watts.

The electric company bills you with a unit called a kilowatt hour (kwh), or 1000 watts for one hour. The cost (shown on your electric bill) is about 6.3 cents per kilowatt hour.

So, if you have a powerhead (30 watts) and a pump (1.3 amps) you can easily figure the cost. First, the pump is 143 watts (see above) and the powerhead is 30 watts, for a total of 173 watts. If you run these 24 hours per day for a month, that would be:

0.173 kilowatts * 24 hours * 30 days = 124.56 kwh

At 6.3 cents per kwh, that's 124.56 kwh * 6.3 cents = $7.85

For devices that run part time, you may have to get creative to measure how long they are on. For example, my heaters run on a temperature controller – I plugged a simple light timer in with the heaters, and observed how much the timer advanced during a 24 hour period – this told me how long the heaters were on!

until the GFCI flips again. Once you identify the culprit, you can replace that piece of equipment or possibly have it repaired.

The Basics of Plenums

*Editor's note: In the past several years the use of a plenum has become very popular for reef tanks. Nevertheless, there are a number of people who argue against plenums (most notably Dr. Ron Shimek, a noted marine aquarist and invertibrate zoologist). Like most important issues, there are two sides to the argument, and we at the WMAS encourage sharing of ideas and different points of view. This article from **Joe Jones** of Mountain Corals, who has personally found success with plenums, describes the basics of plenums and how to construct them.*

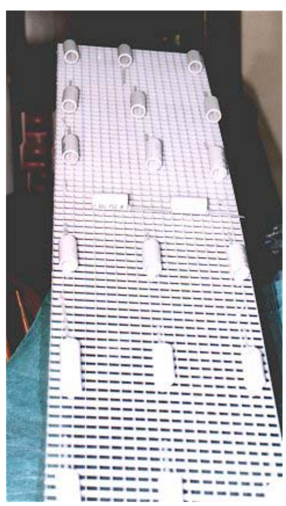
The term plenum, as referred to by aquarists, is the open space under the gravel which is an area of reduced water movement and reduced oxygen content.

It has been known for many years that there were beneficial bacteria that helped to reduce aquarium wastes. Recent research has shown that there is a progression of types of bacteria in the natural environment - in both fresh and salt water depending upon the amount of available oxygen. These layers, or strata, can be successfully generated in any aquarium.

The first stratum of bacteria are found in the oxygen rich water and upper ½ inch or so of bottom, (sand, gravel, mud or whatever). These bacteria break down the ammonia into nitrite.

The second stratum of bacteria is immediately below the first and continues for about one to two inches. These bacteria are in a somewhat reduced oxygen environment and break the nitrite down into nitrate.

The third stratum is made up of bacteria that only survive in areas of greatly reduced oxygen content, (very low but not totally absent oxygen concentration). These bacteria break the nitrates down into nitrogen and oxygen gases. If there is a total lack of oxygen, the bacteria mutate into a type that produces deadly hydrogen-sulfide gas.



Many plenum systems are made with plastic egg-crate to create the void-space under the sand. (Photo by Cindy Jones)

The closer that we can get to the ways of Nature, the better we will be able to care for our favorite animals.

How to acquire a plenum

You basically have two choices: Purchase a commercially available product or make your own.

Commercial plenum products are available in almost all aquarium stores and come in many sizes to fit almost any tank.

There are excellent products that have many advantages over the home made variety, i.e. less labor involved, less chance of your substrate compacting, and it keeps the larger digging creatures from getting into the plenum. Such products are almost imperative if you want to keep some of the more aggressive diggers such as some of the gobies and wrasses, and keep them out of your plenum.

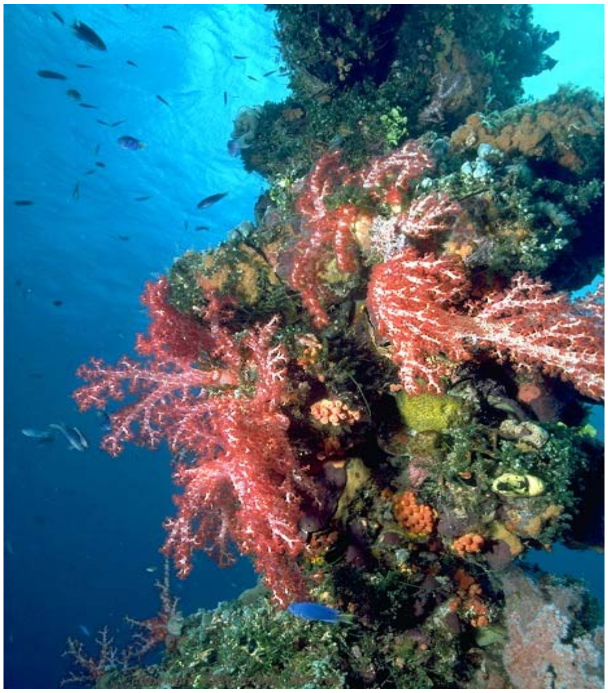
On the other hand, you can make your own. The primary advantage to this approach is the reduced cost, and the satisfaction of building it yourself. The items that you will need are: PVC tubing of an appropriate size; plastic eggcrate; and plastic or plastic coated fiberglass screening.

Eggcrate is available from most hardware and/or electrical supply stores. Eggcrate is a lighting diffuser for fluorescent lighting, and is made of white plastic in ½ by ½ inch squares.

Cut the eggcrate to about 2 inches shorter and narrower than the inside bottom of your tank. (If you have a large tank, or one with structures across the top, you might find it helpful to cut the eggcrate into sections that would be easier to handle.)

Depending on the size of your tank you will need from about ½ inch to 1 ½ inch PVC cut into 2" to 3" sections. (The usual guide is to provide about 1 inch of plenum for every 100 gallons of tank

Though now unrecognizable, this ship's mast is host to an almost incredible array of sea creatures. Sunk in 1944 during World War II, the Japanese freighter **Kansho Maru** is sitting upright on the bottom of Chuuk lagoon, its mast tip nearly exposed at the water's surface. Chuuk is part of the Federated States of Micronesia, and is located about 950 kilometers southeast of Guam. Photo by Jeff Jeffords.



capacity.) You will need enough PVC to support your eggcrate and all of the sand and rock that you will be putting in your tank. (Usually if you space the PVC about 3" to 4" apart in all directions you will be okay.)

Cut the plastic screening so that it will completely cover the eggcrate, and hangs down far enough to cover the PVC. You want it big enough so that you can keep the stronger burrowers from getting into your plenum. Please be careful that you buy untreated screening, as there are some products that are coated with mildewcides, fungicides and other preservatives that can AND WILL leach out and destroy every living thing in your tank. If you are in doubt please ask one of the more experienced club members. A product that my wife and I use is Phifer sunscreen and is sold under the label Sunscreening.

Arrange the PVC pieces either loose in the bottom of your tank, (or as I prefer to do fasten them to the bottom of the eggcrate with plastic or nylon ties or a bit of silicone).

Cover this bottom layer of screen with about 1½" to 2" of coarse aragonite sand or crushed coral. Then place another layer of screening over this.

On top of this second layer of screening place the bottom layer of base rock, and then fill in the rest of the area with about 1 ½ to 2 inches of fine aragonite sand mixed with some live sand.

If you have done all this you are ready to fill your tank with water and start the cycling process. You cycle the tank through the ammonia, nitrite and nitrate cycles until the tank is safe for adding live specimens. This can take anywhere from a few days to several weeks depending on how much live sand you initially added, and whether or not you added extra live bacteria. I like to add CoralLife bacteria pillows. By doing this I have been able to have a safe tank almost immediately. The usual cycle is first an ammonia spike which will generally start to fall within a few days if you have enough bacteria. As the ammonia level starts to fall you will have an increase in nitrites (these are deadly to most aquatic animals), these will start to fall within a short while; third, as the nitrite level falls you will get an increase in nitrates. When your plenum starts to function you will notice a dramatic decrease in the nitrate level. When the nitrate level has dropped to below about 20 ppm it is generally okay to slowly begin adding livestock (start with a damsel or two or some other inexpensive fish which will slowly add to the bio-load.) When the nitrate level is below 0.5 ppm you can go ahead with adding other specimens, slowly so as not to overload your system. When you have got your system in balance regular small (about 5%) water changes and top off with RO. water should be all you need to enjoy a great tank. Regular tank maintenance which includes vacuuming a portion of the sand bed should not be overlooked.

Well there you have it! I hope that this will answer some of your questions. If you have more questions, ask any club member and we will gladly try to help you find the answers. And remember : "SAVE A REEF! Culture your own!". Have fun!

A solitary common moon wrasse (***Thalassoma lunare***) swims above a typical Philippine reef, with dozens of basslets facing into the current, hovering near the safety of the intricately branched hard corals. At night, wrasses hide themselves by burying in the sand or wedging themselves in hidden crevices in the reef. Nearly all species of wrasse have a completely different coloration pattern as adults compared to their juvenile version. Photo courtesy of Jeff Jeffords (http://www.divegallery.com/)

Joseph S. Jones (Rev. 11/13/01)