

Redundancy in our Reef Systems.

By David Grigor

There are a number of things that should be at least considered when planning a reef tank. With not only loss of life potential but also the amount invested, we need to put a lot of thought into the design and planning of our systems.

Below are bullet items that should be considered. Many of these items are lessons learned from TCMAS members that have caused tank crashes.

1. **Electricity.** When planning a tank. It is advisable to use more than 1 electrical circuit. You may have some restrictions such as living in an apartment but whenever possible need to consider it. Either case you want to think of the worst case scenario and make sure you have an action plan.
 - a. **Single Circuits** – when you have only one circuit, if something were to trip the circuit. For example: lighting sometimes will cause a GFCI to trip unexpectedly and all your circulation devices are on the same circuit. Gone unnoticed while away from the house could be disastrous in as little as 8 hours if you have a high fish load.
 - b. **Multiple circuits** – Best to place at least 1 circulation device on each circuit. That way if one of the circuits were to trip there at least is some circulation in the tank.
2. **Overflows.** It is strongly suggested especially when you have time to plan out your system to use drilled overflows or purchase a reef ready tank. While siphon overflows can work flawlessly for years but remember it only takes 1 failure to become a catastrophe. Some have tried to use the point that getting a tank drilled cost too much. Really the difference is negligible. Probably the biggest reason people use siphon overflows is because they don't want to take the time or trouble of drilling or getting it drilled.
 - a. **Overflows in general** – with the recent advances in circulation methods, it really isn't necessary to push large amounts of flow through your overflows. The more you tax your overflows the more chance of something to go wrong.
 - b. **Single Overflows** – when using single overflows a clog or partial clog can be disastrous. Not only potentially ruining floors, walls, ceilings, but also loss of livestock. If you decide to use a single overflow be sure to use strainers on them to prevent large pieces from clogging.
 - c. **Multiple Overflows** – for redundancy it is best to use more than one overflow. Optimally, each overflow should be large enough that if one was totally clogged the other one can handle the full load. When using larger return pumps this may not be possible. Always be sure to use strainers on the overflows to prevent clogging or partial clogging.
3. **Circulation** – There are many ways to provide circulation in a reef tank. Powerheads, closed loops, sea-swirls, propeller type powerheads such as Tunze streams and Seio pumps, wave2k machines, Tunze waveboxes to name a few.

- a. **Returns** – Back when sea-swirls were first introduced when there weren't as many circulation options available. There was a trend to use a large return pump and sea-swirls to provide all of your circulation. One of the main reasons people stated for doing so is to keep powerheads and other bulky items out of the show tank for aesthetic reasons. From a redundancy standpoint this is not a very good solution. Usually the large amounts of flow required causes your overflows to work hard. A clog or partial clog can be an issue. In the event of return pump failure, this could also become a serious issue because all of your circulation is stopped.
 - b. **Multiple circulation devices** - It is always advisable to use more than 1 device for your circulation needs. That way if a pump failure occurs, you have at least some circulation for gas exchange. Ideally they should be arranged on different electrical circuits as well so if something were to trip a circuit you would have at least some circulation in the tank. Sometimes power heads and other more bulky devices are a necessary evil, and one must sacrifice aesthetics in an effort to prevent catastrophes.
4. **Heaters** – Unfortunately here in MN, heaters are pretty much a necessity. One of the leading heater malfunctions is the built in thermostats
- a. Never trust the built in thermostats. They have been known to stick on. We push the temperature limits with our lighting.
 - i. **Using multiple smaller heaters** – Some people use philosophy is that two smaller heaters is better than using one large heater. Since many really push the upper temperatures with lighting systems (particularly MH). Even a smaller heater can produce enough heat if stuck on to cook our tanks. Also, having two heaters increases your risk of a heater failure.
 - ii. **Temperature controller** – It is highly advisable to use an additional temperature controller with any heater. Typically you set the built in thermostat slightly above what the temperature controller is set to. If for some reason the temperature controller malfunctions or is set incorrectly, the hope is that the built in thermostat will turn it off.
 - 1. There are several types of temperature controllers. You can use single stage for just your heater, dual stage. Usually the dual stage is the better option because it can also be used to control your fans or a chiller. This is nice because it will ensure that both the fan/chiller and the heater will never be working at the same time. With evaporation rates being high in the winter this is a good advantage to only run your fans when they are needed.
 - 2. Aquarium Controllers such as Reefkeeper I & II, and the Neptune Systems Jr , III, and the pro. A lot of times particularly in a new setup, it is probably wiser to buy one of these controllers vs. a specific temperature controller. With the reefkeeper and the Neptune Jr. costing less than \$100 additional. You do get other features such a

- b. **Time based** – A timer or a dosing pump where no matter what condition happens it will only dispense X amount of water at a time. The trouble with water level only systems without a timer is that if there is a plumbing issue, clog in a overflow line or something else that could be causing the sump levels to lower other than evaporation can spell trouble. Most times if you do have a limited water supply a time based system is not required.
 - c. **Kalkwasser considerations** – Using Kalkwasser with your topoff water does have pros. However, you must be very careful to ensure that Kalkwasser is not overdosed or added to quickly. Dosing pump for Kalkwasser is highly recommended. However providing you insure a limited supply of water along with very small diameter tubing so that it will not dispense too quickly will provide enough redundancy for the worst case scenerios.
7. **Power outages.** Planning is so HUGE when it comes to power outages. While many of the solutions may not be cheap, keep in consideration your entire investment in livestock. For short power outages, your main focus should be oxygen levels. While temperate can also be an issue, usually corals and fish are more metoblism slows down and if temps drop slowly usually are not fatal.
- a. **Battery powered air pumps** - When on a budget this may be a possible solution. Ideally one that would turn on automatically during a power outage, however I don't know if that exists. There are some inexpensive ones powered by D sized batteries. Downside you have to be home when power failure occurs to turn it on.
 - b. **AC/DC converter** – If a pinch a ac/dc power can be used along with a car or marine battery. Downside again is you have to be home to hook it up to your battery.
 - c. **Small UPS** – Typically UPS built for Computer uses will not run long enough to provide much power. However, they are relatively inexpensive and if a small powerhead (5watt or less) is hooked up to it. The main positive is it should work unattended.
 - d. **Triplite UPS or larger** – Triplite makes a 500W inverter (about \$300) that you can marine batteries to it (about \$80) to achieve your desired runtime based on the power consumed. This is usually a good option for a 24 hour of less power outage and makes for a very good first line of defense when you're a work or asleep where the tank is unattended. Depending on how many batteries you add, it might be possible to also add a heater. However this will have a severe impact on the runtime.
 - e. **Power Generator** – This is ideal for long power outages. Downside is that most portable generators you have to be home to hook them up. So this is a real good used in conjunction with UPS for those hours when you may not be at home.
 - f. **Notify via a controller** – I know Neptune III and the Pro can be used in conjunction with a modem or email if computer has power to notify you via a pager when power outage occurs. There is also a separate phone dialer you can purchase that will notify via phone when temps reach a

certain or power outage. However, it is pretty costly (over \$200) and may make getting the higher end controllers worth while.

8. **Hardware Redundancy** – Unfortunately over time most equipment does fail. Should be prepared for such an occasion. All too often you hear people making a mad dash to find a replacement or looking to borrow something after the fact.
 - a. **Return pumps** – Have a replacement pump available. Ideally it would be an identical pump but depending on the cost of the pump, perhaps a lesser or older pump can be used for backup until a new one can be purchased. Also in your plumbing design best to add unions and/or adapters so that it can be easily swapped without making a mess. With smaller submersible pumps it's a good idea to have an extra and can always be used for water changes or mixing water during the meantime.
 - b. **Heaters** – Can always use it for mixing saltwater and can be used as a backup.
 - c. **Bulbs** – Because many bulbs are special order and not always available locally, I like to keep an new bulb as a spare. Worst case keep an old bulb that you could use until the new one arrives.
 - d. **Ballasts** – While for cost reasons it may not always be possible, I do like to keep a spare ballast available so that if I do have to send in for repair or replacement I am not without light for a week or more. Worst case, have some sort of spare lighting available to use such as an old PC fixture or lesser wattage MH fixture that you upgraded from.
9. **Miscellaneous points** that aren't necessarily redundancy related:
 - a. Use clamps on all barbed fittings. Unfortunately you hear far too often where a tubing comes about on a return pump or overflow draining causing water spills or depending on how long gone unnoticed can be even worse.
 - b. Siphon overflow failures.
 - c. Make sure sump has enough volume to handle water in a power outage condition. You can drill a small hole just above the water line on the return line to help break the back siphon in a power outage.