Maintaining a Marine Tank

Filling and maintaining a saltwater aquarium.

By Richard Harker

Fill ’er Up

In maintaining a marine tank, sometimes the simplest tasks can be the most annoying. For example, topping off the tank. We know it is best to maintain a stable salinity in both reef and saltwater fish-only aquariums. This means adding freshwater to the tank as water evaporates, changing its salinity. Ideally, one would add a small amount of water after only a small amount has evaporated.

Unfortunately, doing this manually means regular trips from the source of the water (say a reverse-osmosis [RO] unit at the other end of the house) to the tank. A conscientious hobbyist with little else to do can easily complete the task many times a day. But, most of us have other responsibilities and interests, so the tank might get topped off once a day and sometimes even less frequently. To ensure the greatest stability in salinity, a better option is to at least semi-automate the process, so that while you may still be hauling water, the actual process of adding water to the tank takes place at more frequent intervals.

For instances, you can store top-off water near the tank in a large garbage can. A pump in the container can then continually or periodically add water to the aquarium. A diaphragm or peristaltic pump can add small amounts of water, continually replacing water as it evaporates.

One problem with this approach is that one must preset the pump to add water at the same rate it evaporates. Otherwise, the pump might add too little or too much water. Careful monitoring of the water level in the tank or sump while gradually adjusting the pump will help match the pumping rate to the evaporation rate. However, changing temperatures or humidity in the home, as well as other variables, will force the hobbyist to frequently fine-tune any adjustments.

A better solution is to use a water level sensing device to detect when the water level in the tank or sump drops. In this month’s column I will look at several devices — from the simplest to the very complex — that will automatically top off the aquarium.

For those who are handy at "putting together" their own equipment, a "float switch" can be built. A float switch consists of a pair of switch contacts that open or close when a magnet comes near. The contacts are wired in series with the power to a pump, so closure of the contacts activates the pump. The magnet is attached to a float that falls as the water level drops. The contacts are at or slightly below the surface of the water, so that as the water level falls, the magnet moves further from them, finally allowing them to close.

The contacts and magnets are available from a number of sources and cost very little. The challenge is waterproofing the switch contacts, as they have to be very near the surface of the water. Unless you are very confident in your ability to work with electrical equipment, avoid this option.

Another option is to use a float switch designed to work in water. The most inexpensive are designed to actuate bilge pumps on boats. Figure 1 is an example of an inexpensive float switch available from boat shops and Wal-Mart. The switch contacts and magnet assembly are waterproof and safe for use in saltwater. The hobbyist must still wire the switch to an appropriate pump, but at least waterproofing is not a concern.

One way to do this is to wire the float switch to a fused power strip by placing the wires in series with the “hot” side of the power strip. While this is easier than wiring a float switch completely from scratch, some understanding of electricity and experience working with electrical systems is advisable. Remember, saltwater and electricity don’t mix.

For hobbyists looking for a more complete float switch, Ultralife produces a complete unit (see Figure 2). The switch contacts are in a long white tube. At the end of the tube is a small white float that contains the magnet. A remote box has what appears to be an extension cord connected to it with a standard 110-volt male plug at one end and a female plug at the other. The box is plugged into a 110-volt outlet and the pump is plugged into the female plug. The white tube with the switch is mounted in the tank or sump at the desired water level.

As the water level drops, the magnet in the float moves away from the contacts, closing them. The float switch magnet can be reversed so that as the water drops the switch opens. This is generally used as a means of turning off a pump before it runs dry.

One maintenance challenge in using a float switch like the Ultralife is that the float gradually gets heavier as it accumulates algae and other debris, including calcium deposits. If the float gains too much weight, it won't float. It remains on even when there is plenty of water, and it will continue to pump water until its source is dry. On more than one occasion I've had a float switch stick on and add 30 gallons of RO water to a 20-gallon sump.

The float can also stick in the open position if "gunk" clogs the spindle on which the float sits. When it sticks in this position, the water level drops, but the float does not change position.

The key to preventing both possibilities is to periodically disassemble the float assembly and clean it thoroughly. This is particularly true in reef tanks dosing calcium in the sump, as calcium deposits on the float will quickly disable the float switch.

Another problem using a simple float switch is that the switch opens and closes at the slightest change in water level. In a tank or sump with rapidly changing water levels, the switch will open and close rapidly and repeatedly. The engineering term for this is "low hysteresis." Some pumps cannot handle this rapid switching off and on.

If the source of the turbulence is water flowing into the sump from the overflow return, a simple solution is to place the switch in a quiet corner of the sump away from the return. Often this is enough to prevent rapid switching. For tanks with surge devices or that have other conditions that cause the water level to vary significantly, there are better top-off devices.

One alternative is the Tsunami AT-1 (see Figure 3). This unit uses pressure changes in a sealed cylinder to control the pump. The hollow cylinder is placed in the water at the appropriate depth and the pump is plugged into the outlet on the remote box. As the water level declines, the pressure in the cylinder stops actuating the switch and turning on the pump. The unit has a great deal of hysteresis built into it. The water level has to change by almost an inch for the pump to turn on, so minor fluctuations in water level won't "fool" the AT-1 into switching the pump on.

Perhaps the most sophisticated water level detector is the AquaSense, a new unit that uses an infrared optical sensor to detect water level changes. AquaSense is manufactured by Natural Cycles. As Figure 4 shows, there are a number of components with the AquaSense. The infrared sensor is in a small black cylinder. It is mounted 2 to 3 inches above the surface of the water using a bracket that is provided. It determines a change in water level by bouncing an infrared light beam off the water surface.

The sensor connects to a proprietary controller that in turn is connected to a standard X-10 interface. The X-10 interface is a device that can turn on or off any X-10 power module. A pump is plugged into an X-10 power module that is also provided. As the water level drops, the sensor actuates the X-10 interface, which then turns on the X-10 power module.

The design of the AquaSense gives the hobbyist a great deal of flexibility in designing his or her water top-off system. There are no wires running between the water level sensor and the top-off pump controller, so the pump can be some distance from the sensor. The X-10 units use household current to communicate. Because standard X-10 units are used, replacements can be found at many hardware stores and Radio Shack.

There are many other X-10 modules that include alarms that can be used in conjunction with the AquaSense. The designer has also built in a safety feature to prevent overfilling the tank. The sensor will run the pump a maximum of two minutes. Then the sensor must be reset. This is to avoid the potential of a false signal running the pump continuously, potentially overfilling the tank.

The AquaSense has been designed with a degree of hysteresis, so some turbulence will not impair the performance of the unit. Even surge devices will not confuse the AquaSense. Light is of greater concern than water motion. Bright light can fool the infrared sensor, so its best application is in a sump rather than a tank.

A hobbyist contemplating the use of a water level sensing device like those described above can take some precautions to prevent over- or underfilling the tank. First, while they are all relatively trouble-free, regular maintenance is advised with all

of these devices. Check their operation on a regular basis, particularly if you are going to be away from the tank for any length of time.

If you are using a float switch, make sure it moves freely and has not built up any gunk, and also make sure not to run a larger pump than necessary on any filler system.