



Caring for your Seaquarium: A Technical Guide

Aquarium preparation

The Seaquarium currently is provided as a complete unit with a custom-built cabinet (see photos and diagram). At the moment, most of these are set up for you by *Seaquarium* staff. If this is not the case:

- 1) Place aquarium, with cover & light fixture, on cabinet towards the back of the table-top.
- 2) If screen-covered false bottom has not already been installed in the tank, insert this now and attach vertical pipes (stand-pipes).
- 3) Add bottom gravel and spread evenly over the screen. This gravel should have a large content of broken shells or barnacles to help buffer the acidity of the seawater.
- 4) Attach the clear pipes from the cabinet (see diagram).
- 5) Attach airline from cabinet to check valve from aquarium.

Aquarium filling

Use clean natural saltwater or dechlorinated artificial saltwater.

- 1) Close Tap C (after pump) and open taps B (Drain) & A (in-coming Flow).
- 2) Attach hose to drain outlet.
- 3) Carefully add water to aquarium with small bucket (a bit of dirt stirred up from the gravel is normal) to about 3 cm from the top.
- 4) Start siphon to fill plumbing. There are several ways to do this:
 - a) Suck on the hose until water starts flowing (organic, but don't forget to spit!)
 - b) Close the drain pipe valve B and fill the siphon filler pipe with a small container (see schematic). Once water is visible in the filler pipe, close plug securely and open drain tap to allow water to start flowing.
 - c) Fill the hose to the drain pipe with water from the aquarium and fill the plumbing in reverse with this siphon (method still under development).
- 5) Once flow through the drain pipe is good, close Tap B and open Tap C. Water should fill up both filter cartridges and the cooling unit.
- 6) Once filter cartridges are full, start pump with main power switch.€
- 7) Ensure water is flowing and check for leaks – fix problems before continuing
- 8) Continue filling the aquarium with water: either with continued small bucket bailing, OR through the drain pipe by suction or pumping.
- 9) Fill to about 3 cm from the top if tank is to be stationary, about 10 cm from the top if it will be wheeled around (regular wheeling around is not recommended).
- 10) Ensure that drain tap is closed, that there is a good water flow, and that there are no leaks.
- 11) Ensure bubbler/air lift is operating (if supplied).
- 12) Check for fine bubbles in water flow: if these are present there may be a leak somewhere or a loose fitting. To find these, unplug pump and wait for water to leak out somewhere, then tighten &/or re-seal those joints.
- 13) Close lids.
- 14) Monitor temperature (acceptable cooling rate to 10°C from room temp is 1-2 hours).

Aquarium start-up

With recently used gravel & natural seawater: allow to run several hours before adding hardy animals

With unused gravel & artificial seawater: run about a day before adding animals, then run with some anemones and other small hardy organisms (fed twice daily) for about a week before adding more organisms and fish

Aquarium operation

The aquarium should be monitored regularly for temperature and flow. Salinity can also be easily monitored. Dissolved oxygen, nitrates and ammonia are also of interest, but more complicated to monitor exactly – biological indicators are useful tools for monitoring these. Acceptable ranges of these variables are:

- Temperature: 6 – 14 °C, 11 °C is good for normal marine operation on our coast.
- Salinity: 28-32 parts per thousand (assuming coastal marine critters). This is at the lower end of the green band on pet-store floating hydrometers (these can vary quite a bit, so it is interesting to standardize yours with a refractometer, known solution, or other hydrometer, at some point).
- Oxygen: 9 – 11 ppm, = 90-100% saturation. This can be tricky to diagnose with bio-indicators. The water may look extra-clear, tube worms and echinoderms initially appear fine. Hermit crabs and fish are early victims (as they have a high oxygen demand), while other organisms aren't affected as early.
- Ammonia should not be detectable. This would generally only be a problem for a short period after a tank is freshly set up or if the tank is being over-fed. In the second case, the water will start looking faintly cloudy from an over-production of bacteria and an oily sheen develops on the surface of the water. You might also notice a rotten smell. No feeding for about a month helps clear this up. Spawning can also produce ammonia problems – this is indicated by a sudden extreme cloudiness of the water. A coagulant, such as minced up *aloe vera*, helps trap the milt in the gravel, where it is chewed up by the bacteria, or in a supplementary 1 micron filter cartridge, but a water change may be necessary.
- Nitrites should not be detectable. It is very unusual for nitrites to build up. Fish are good indicators – they start “breathing” hard.
- Nitrates build up gradually, but rarely get to toxic levels. However, once water gets too brownish and substantial foam is on the surface it is time to change the water. The material that provides these indicators are mostly other organic compounds that build up in parallel with nitrates. Sea urchins and starfish respond to these conditions with lethargy, and anemones may not spread out as much as usual.

The main longer term maintenance activities generally needed, other than feeding, are partial renewal of the water and cleaning of the filter gravel. The frequency of these necessities will vary, depending on the size of the tank and quantity of animals and plants in the aquarium. Small tanks (up to 33 gal) may need water changes once a month or more frequently, while larger tanks may run for 6 months or longer with the same water, depending on the contents. Water losses to evaporation should be made up by adding de-chlorinated tap water, but some seawater is ok as well. (Remember, only the fresh water evaporates, leaving higher density seawater behind.) To dechlorinate Victoria tap-water, just let it sit in a container for about a week.

In general, changes of 20-30% of the volume every 3 months is advisable. Occasional filtration with a one-micron “rust” cartridge or a charcoal cartridge may be used to deal with temporary perturbations (such as spawning or overfeeding) or to extend the usability of the water. Gravel generally needs cleaning only once every 6-8 months, with greater frequency for smaller tanks.

The tank will automatically re-start after power outages, with no risk of overflowing. If a power outage is prolonged, ice in sealed plastic bags or clean, sealed ice packs should be floated in the aquarium to keep the temperature below 14°C.

Thermostat

The thermostat will help regulate the temperature of the aquarium. Most set-ups are equipped with a Johnson control electronic thermostat, and an instruction sheet is supplied with these. We provide the aquaria with these pre-set for about 11° C (52° F), with a minimal difference between the upper and lower cut-offs. Sometimes these operate in Fahrenheit to reduce the temperature differential. The actual temperature of the aquarium may vary a bit, depending on the heat of the room and air circulation in the cabinet. If the aquarium is too cold relative to the school temperature, it starts building up condensation. To change the temperature, you push the menu button until “SP” shows up on the screen, then the up or down arrows to select a new temperature, and finally the menu button again to register the new setting.

The thermostat also regulates how soon the refrigeration unit will start up after it is plugged in – this is to avoid overloading electrical circuits. We generally pre-set this for about 1 minute.

Air pump

We install air pumps with dual air supply for eventual retro-fitting of aquaria with a protein skimmer. At the moment, both supplies are fed to a single airlift in the aquarium that provides extra circulation and aeration in the tank, and this also acts as a back-up if the water pump or water flow breaks down. During servicing when water flow is temporarily stopped, the air pump can be plugged into an independent electrical outlet to keep air exchange going on an emergency basis. The model of air pump currently being used appears to be very sturdy and quiet. Unfortunately, it doesn't have repair kits, so if it breaks we generally replace it with a new pump.

Water Pump maintenance

Our systems have two styles of water pump: blue-coloured & very quiet “Poseidon” pumps or noisier but sturdier “Little Giant” pumps. The Little Giants are indicated in situations where the aquarium has shown a history of un-noticed power failures or flow problems; otherwise we are now using the Poseidons exclusively. However, these are more easily damaged if run without water, and are expensive to fix.

Poseidon pumps need no regular maintenance.

Little Giant Pumps should be oiled every 4-6 months of operation. Use light-weight machine oil, such as 3-1 brand. There are two oiling channels at either end of the motor (black cylinder part of pump). These are small semi-circular holes right next to the ends of the motor, usually on the side

with the labels or the topside of the pump. Squeeze oil into these holes until they are full. This can be done while the pump is running.

Feeding

Care should be taken not to over-feed the aquarium to avoid rapidly deteriorating water quality. It is important to recognize what needs feeding, to select appropriate food types and to avoid feeding too frequently (i.e. no left-over food hanging around). Frozen zooplankton is the best food for fish, large-tentacled anemones and crabs; Kent microfeed is the best for filter feeders, and lettuce, carrots, or seaweed are good for sea urchins. Other organisms, such as sea cucumbers, many snails, and some starfish live well on the detritus from other animals or encrusting algae and animals. Stirring up the gravel a bit once a week suspends good recycled food for filter feeders such as scallops and mussels.

Partial water changes

- 1) Turn off pump with main switch.
- 2) Turn off tap C that leads to the chiller.
- 3) Attach drain hose or place bucket under drain pipe.
- 4) Open drain - tap B
- 5) After draining approx. 1/3 of tank, close tap B and re-start pump. Then gradually (carefully) refill the aquarium with fresh seawater, using a small bucket

Cartridge Filter use

Filter cartridges are used only in the holder on the pressurized side of the pump, and generally are only needed for occasional use. The problem with continual use is that they get plugged up and stop flow. The cartridges are available in most hardware stores. Rust filters (1 um) are used to clear fine milky water, “string” filters (500 um) can be used to clear larger dirt, and charcoal filters are used to remove yellow colour and possible toxins.

To insert cartridge into filter canister:

- 1) Turn off flow and pump valves (taps A and C)
- 2) Place small bucket under cartridge holder to catch spilled water
- 3) Unthread holder; blue wrench may be needed
- 4) Insert cartridge and replace holder, tightening snugly but by hand only.
- 5) Open taps
- 6) Restart pump
- 7) If pump has air trapped in it (runs but doesn't pump water), push down red purge button on the after-pump filter holder for a moment until a small amount of water bubbles out.

Once water is clear or flow begins to diminish due to clogged (discoloured) filter cartridge, remove the cartridge. ****When a filter is inserted, the water flow of the tank should be checked regularly (several times a day daily) because water flow can be obstructed very quickly, which will result in a temperature spike in the aquarium and ultimately death of specimens in the aquarium.****

Charcoal and string filters can sometimes be used several times.

To remove cartridge:

Follow the same process as putting one in (explanation above).

Gravel cleaning

Minor cleaning can be done with a siphon-based gravel cleaner or stirring up the gravel while there is a string filter in the cartridge holder. *More serious cleaning* involves removing the gravel and cleaning it outside of the tank. This is generally done together with a water change and general cleaning of tank and/or if tank is being shut down seasonally.

Gravel removal and cleaning:

- 1) Drain some of the water out of the aquarium through drain hose (as described above) into buckets to hold the animals and organisms. These are taken out of the aquarium and can be kept cool in a cooler or with sealed bags of ice floating in the bucket.
- 2) Drain water to about 5 cm depth through the drain hose. This can be done with the pump assisting. Close valve.
- 3) Remove large rocks and other items and scrape out as much of the gravel as is readily feasible with a small bucket &/or dustpan, leaving as much water behind as possible;
- 4) Remove remaining gravel by carefully rolling up screen from the sides and using the screen to lift it out of the aquarium (not possible in most recent models).
- 5) Re-open drain valve to drain dirty water, while replenishing with tap water to rinse tank. In the case of seasonal storage continue this process until there is clean freshwater throughout the system.
- 6) When siphon from drain pipe stops, remove the screen bottom and drain last bits of water with a hose, then wash out remaining dirt either by tipping the tank (smaller tanks) or with a supplementary siphon hose or waterproof vacuum cleaner.
- 7) Gravel can be rinsed with tap water, either in a bucket and/or in smaller portions using the screen as a sock. Watch for small crabs or worms that can be rescued during this process. Gravel needs to be drained before re-use, but not necessarily dried.
- 8) Check screen for serious tears or holes, and replace if necessary. Use the old one as a model for cutting a new one from mosquito screen (available at most hardware stores).
- 9) Follow instructions on aquarium set-up and starting as above to re-start aquarium, or as below for preparing tank for storage.

Tank storage

- 10) To store tank, everything should be first rinsed with clean fresh tap water (as above for gravel cleaning). The water can be left in the tank during storage, but it is better to drain it out of the tank and system. Drain the filter holders as per instructions on changing filter cartridges, but leaving all taps open; the drain pipe, by opening the drain tap; and the chiller unit. The drain hose for the chiller unit (1/4 in. clear tubing) is tucked under the chilling exchanger (the large diameter white pipe next to the fridge). This has a plug in its end that is removed to drain the exchanger and any remaining water in the system. Don't forget to replace the plug after draining.

11) Re-start aquarium after storage as per instructions above.

Chiller Maintenance

A critical consideration for the chiller (refrigeration unit) is that air flow is not obstructed. Make sure that no furniture or walls are closer than 4 inches from the intake screen on the side of the cabinet. Dust should be vacuumed out of the condenser at least once a month (or more often, depending on how quickly it collects dirt). A symptom that too much dust has accumulated (or the air path is obstructed) is that temperature in the aquarium rises slowly, even though flow is still good, and that the chiller runs continuously or more often than usual.

To remove dust, take off the protective screen for the condenser (if present) and vacuum accumulated dust from the outside. Once every year, it is also good to blow the dust out with compressed air. Other maintenance of the chiller should not be necessary.

Q & A Technical Tidbits

Aquarium size: a tank volume of 50 – 75 gallons is ideal for creation of a stable functioning ecosystem, requiring less maintenance and fewer water changes than smaller tanks (every 3-6 months should be adequate). Larger tanks are also stable but become harder to manage.

Temperature – between 10°C and 12°C is ideal; over 15°C the problems become complex as water chemistry changes (also stressful for the animals); lower than 10°C can cause condensation on the glass. What is this in Fahrenheit? Ask a student?

Keep the radiator (air intake) on the chiller clean and dust-free by vacuuming regularly. Yearly servicing and cleaning by a refrigeration specialist is advantageous and recommended.

Water Flow: Good water flow is essential to keep oxygen levels adequate in the seawater. Water flow is maintained by attending to possible obstructions (see Filtration). Clogged lines can also cause a decrease in water flow – a visual check with a flashlight is useful to see if pipes need cleaning. After many months the crushed layer of shells at the bottom of the tank (see filtration) become clogged with fine sediment which slows down the water flow. The standpipe in the tank at the opposite end from the siphon has an airlift in it to help maintain proper water circulation. The flow from this airlift is also an indicator of how clogged the gravel may be, and excess foaming is an indicator that water needs to be changed.

Oxygen: Maintaining a good flow of water across the surface of the tank is crucial for allowing oxygen from the air to dissolve into the seawater. If the surface of the aquarium has an oily sheen (from over-feeding, or too little disturbance) oxygen has trouble getting into the water. Paper towels carefully placed on the surface of the water can soak up the film. These are then carefully lifted out and discarded. Then the water inflow pipe may need to be turned a bit to be out of the water and/or the level of water in the aquarium needs to be lowered to make some splashes. Also check that the aquarium is not over-stocked with animals.

Supersaturation: Water in some seaquaria gets readily supersaturated with air if there is a leaky fitting in the plumbing somewhere, particularly on the suction side of the pump. Air gets sucked in through tiny spaces in these loose fittings, forms tiny bubbles and is forced into solution beyond the actual carrying capacity of the water (supersaturation). The tiny bubbles get washed into the aquarium and attach to a variety of things, either causing them to float or damaging them, whereas the supersaturated gas comes out of solution in soft tissues, not unlike the bends of divers. A small amount of this can be beneficial, particularly if there is low oxygen, you wish to

aggregate milt from spawning, or you wish to clear excess organic compounds from the water. However, the small bubbles are particularly bad for tunicates, sponges, and jellyfish where they damage soft tissues. In excess amounts they are bad for fish and clams when they get caught on the gills or even come out of solution in the eyes. An early indicator of supersaturation is the formation of excess small bubbles on the silicone caulking in the joints of the tank, or on some of the animals (e.g. the anemones and sea cucumbers). To find the loose or leaky fitting, the water pump should be turned off and, after waiting a while, look for small water leaks. If the fitting is accessible, they should be tightened or re-done with Teflon tape. As a temporary fix, stretchy plumbers tape or silicone cement may resolve the problem.

Filtration:

Biological filtration of natural metabolic products (pee and poop) is provided by bacteria and algae that build up in the gravel and nooks and crannies of the aquarium. This also provides an opportunity for recycling wastes through other animals. However, the process does not actually eliminate metabolic waste – it mostly converts it to nitrates and other organic compounds that accumulate in the aquarium and eventually need to be reduced by water changes. The gravel also gradually gets silted up and needs to be cleaned on occasion. More modern increased efficiency filtration systems are available, but as long as the temperature of the aquarium remains cold, we get used to slightly coloured water, and are prepared for annual cleaning. Biological filtration of this kind remains the simplest and most practical process.

Mechanical filtration beyond that of the gravel is provided by two things in the aquarium set-ups:

- a pre-pump coarse stainless screen traps gravel and escapees to prevent these from going into the pump. This custom-built screen is installed in a standard filter housing before the pump; if there are animals in this canister, it can be removed for emptying.
- a post-pump pressurized filter canister. This holds standard drinking water filter cartridges available in hardware stores, but generally we only put cartridges in for one or two days when more intense filtering is desired. A charcoal filter can help clear up the colour of water and a particulate filter can help clear up turbid water (adding a bit of aloe vera can help aggregate turbidity to make it filterable).

Spawning: Several of the species that we use in the aquaria get quite happy during certain times of the year and start spawning. In particular, scallops may spawn in the fall and tubeworms and urchins spawn in the spring. Immediate action: remove the culprits and begin aloe treatment (Mary had a great story about taking her worms home to the garage for the weekend until they got over their friskiness!)

Yogi's Secret Aloe Remedy: This is a novel solution to clear the tank of the cloudy "reproductive material". You will need a blender and approx. 6" piece of Aloe Vera plant and a cup of seawater. Blend and pour the viscous mixture into the tank ensuring that the air pump is working well (to help bring all of the particulates to the surface of the water). The water usually clears up within two to three days, thus avoiding the extra work of a water change. The kids also love grinding up the Aloe Vera and the opportunity they have to (be allowed to?) teach the rest of the school about sex!

Troubleshooting and maintenance should be a collaborative work between students, teachers, Seaquaria staff and volunteers. Use digital photos of the tank to assist in diagnosing problems. Get students to e-mail photos to the troubleshooting team. This can save a trip to the school by Seaquaria staff. This worked really well recently with a spawning episode at Willows School; and can be especially helpful for people like Mary who are in other parts of the province. Maintain an up-to-date diagram of your particular aquarium and maintenance activities. The apparatus configuration is slightly different in each of the schools, so set a student the task of drawing your configuration and numbering the shut-off valves. Keep a copy for yourself and send one to Cathy.

Troubleshooting list:

Principal Symptom(s)	Supplementary Symptom	Probable Cause	Action
Water cloudy white or brown	Very milky opaque white or brown and foaming, often in spring-time	Someone has spawned	Remove culprit; add coagulator, operate protein skimmer or fine air stone. May have to change water
Water cloudy white	Transparent white; food left-overs may be found in stirred up gravel. May have oily film on surface.	Overfeeding & over-production of bacteria	As above, but probably no need to change water; no feeding for 1 month; reduce feeding afterwards. Oily film should be removed with a paper towel.
Water cloudy white	Lots of small air bubbles in water and on silicone of aquarium	Small leak before pump drawing in air; super-saturation of water	Turn off pump and watch for location of leak; tighten fixture or fix in other ways
Water yellowish	Growth on walls when examined closely	Algae on glass. Natural, but may mean too much light or nutrients.	Scrape algae off with magnetic scraper (glass tanks only), try adding some macro-algae to the aquarium (surfgrass or <i>Gracilaria</i>)
Water yellowish	Walls clean, flow good	Normal waste by-products accumulating	Insert carbon cartridge or change some of the water if you want to, but a bit of yellowish colour is fine (even beneficial)
Flow reduced, temperature may rise	Filter cartridge installed	Filter clogged	Remove cartridge
Flow reduced, temperature may rise	Gradual reduction in flow, no filter cartridge	Gravel clogged	Siphon dirt out of gravel or clean out whole tank (annual)
Flow reduced, temperature may rise	Sudden, pump noisy, air bubbles in line	Pump with air – air being drawn in from a loose fitting	Turn pump off for a few minutes, then restart. Check where air is starting to show up; tighten fittings as needed.
Flow reduced, temperature may rise	Sudden, pump noisy, no air bubbles; pre-pump filter holder may have gravel	Gravel or other bits or animals in pump	Shut off pump, remove from pump head and check for something stuck. Also check gravel catcher for detritus. Check for missing blades on the impeller. Re-assemble, replacing impeller if needed, remembering all the washers and to check for leaks.
Pump with high-pitched squeal	Flow reduced	Siphon broken or something lodged in pump	Turn off pump immediately. Check for air in filter holders. Re-prime siphon and diagnose reasons for loss of flow.
Temperature rising slowly	Flow not reduced	Chiller condenser blocked	Check for furniture or walls blocking condenser, clean off dust
Crabs and fish dying	Tubeworms fine, algae growing well, water super clear	Low oxygen	Make sure incoming water pipe splashes into water rather than being submerged; add air-stone