



# System Operation Guide for the Freshwater Stingray display

in the traveling exhibit:  
*Amazon Voyage: Vicious Fishes & Other Riches*



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# 1 Introduction

## 1.1 Overview and objectives of this document

The objective of this document is to provide a comprehensive overview of the purpose of aquarium displays and the role they play in the Amazon Voyage traveling exhibit. In addition, it is intended to provide technical information for the caretakers on the live animal collection and their requirements. It provides a detailed description of the life support systems and the maintenance protocols.

It is intended to be used as a reference to facilitate care and maintenance of live animal components to standardize the daily routine, environmental parameters, and husbandry protocols. Additionally it will serve to facilitate transfer for the traveling exhibit from institution to institution.

## 1.2 The role of live aquatic displays in the exhibit

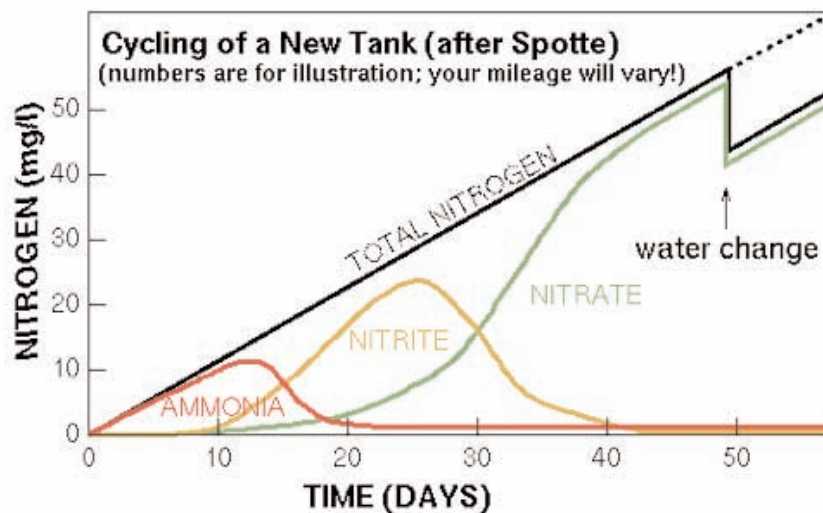
Live animal exhibits augment overall biodiversity message.

## 1.3 Key educational concepts and statements

- Diversity
- Adaptations
- Scientific field research
- Role of the aquarium fish trade

# 2 Overview of a balanced Amazon aquarium environment

## 2.1 Nitrogen cycle



Source: "[The Krib](#)" living aquarium web site [The Nitrogen Cycle](#)

In order to maintain target aesthetic and environmental parameters several types of water filtration and treatment or are used in the components of the life support systems (LSS).

## **2.2 Mechanical filtration**

The term mechanical filtration is used to describe the apparatus to remove debris from the water. Before leaving the aquariums large particles are trapped by mesh strainers. In the tetra tank, there is a mesh strainer inserted in the overflow standpipe. In the stingray tank, the intake fittings are equipped with mesh strainers as well. As the water is drawn through the pump, it is forced through a canister filter containing a pleated paper cartridge that will trap any fine particulate matter.

## **2.3 Biological filtration**

Biological filtration is an aquatic environmental management tool that depends on the use of aerobic bacteria as its key element. Beneficial bacteria 'clean' the water of toxic nitrogenous waste by the use of metabolic processes to convert it to less toxic forms. The basic requirements of bacteria to be used as biological filtration in aquariums is, 1) they need substrate or media to establish on, 2) they must be in an aerobic environment (flowing water), 3) they must have the waste to be converted circulated across them.

The biological filter components in the Amazon Voyage aquariums are contained in canister filters in the in-line filtration. The canisters contain baskets of 'bio balls' which provide the substrate for the aerobic bacteria. As the water is circulated through the biological filters, it comes in contact with the bacteria and waste is treated.

For the initial set up of the displays, the biological filtration units were pre-seeded in an existing established biological filter of similar environmental parameters in order to get inoculated with a beneficial bacteria colony. In addition, mesh bags of biologically established gravel were put into the baskets to further expose the new media to the desirable bacteria.

Wherever possible, the biological filter component should be treated as a living entity that is critical to the environmental maintenance. It should not be allowed to remain in the canister with the circulation stopped, desiccated, or exposed to any shocks that might kill the bacteria.

See section 9 of this document for notes on facilitating transfer of the biological filter for relocating the exhibit.

## **2.4 UV sterilization**

Ultraviolet light (UV) sterilization is used to kill undesirable waterborne organisms. A powerful UV lamp (fluorescent light bulb) is contained in a canister component of the in-line life support system. The lamp is isolated within the canister in a quartz sleeve to separate it from the water but to allow the water to be exposed to the killing ultraviolet light waves. Waterborne organisms (protozoans, bacteria, viruses, and algae) that are circulated through the unit and when exposed to the UV, are killed and the water is sterilized.

## 3 Environmental guidelines and target parameters

Target environmental parameters are established based on those that occur in the Amazon, adapted for practical aquarium applications.

### 3.1 pH

6.0 - 6.8, priority consideration given to a value that can be maintained at a stable level.

### 3.2 Ammonia

Maintain the lowest levels possible. Action should be taken: water changes and assessment of LSS status, feeding routine, and stocking density; if testing indicates the presence of ammonia.

### 3.3 Temperature

78° – 82°F (25.5° – 27.7°C) Avoid fluctuations.

## 4 Life support systems description

### 4.1 “Stingray tank”

Water Route:

Water leaves and returns to the system in two locations. Reference to these locations will be made as if one is standing behind the aquarium with the access doors opened. Arrows on all the plumbing on both sides indicates the direction of water flow through the pipes and equipment.

To the right, there is a circulation loop with virtually no life support apparatus. The **Pump** pulls water through the high-surface area, large mesh, black screen tube that runs horizontal near the bottom of the tank below the lighting window in the back of the tank. The water passed through the pump and then returns to the aquarium through a ribbed flex tube that terminates at a 90 degree elbow that provides directionality to the return flow.

To the left, water is pumped from the aquarium in the same fashion that it is on the right side. On this side, however, the water passes through several pieces of equipment. The operation and maintenance of the equipment is in an upcoming section. This section simply offers descriptions of the function of the devices. Key words are highlighted in bold.

As with the right side, the water first reaches the **Pump Basket Strainer**. This feature removes medium-sized debris and fish waste.

The second device that water reaches is the **Pump** which provides the circulation flow to the life support system.

The third device that water reaches is the **Bio-Ball Canister**. It is the black, barrel-shaped object furthest from you on the second shelf of the life support rack. This feature provides a high surface area cartridge for **Biological Filtration** (or **Denitrification**) with little to no entrapment of debris or fish waste.

The fourth device that water reaches is the **Filter Canister**. It is the black barrel like object closest to you on the second shelf of the life support rack. This feature removes fine debris and fish waste.

The fifth, and final device that water passes through is the **Ultra Violet (UV) Sterilizer**. It uses an ultra violet lamp to kill bacteria and other microorganisms that are too small to be caught by any of the filtration devices.

After leaving the UV Sterilizer, the water is returned to the aquarium through a ribbed flex tube that terminates at a 90 degree elbow that provides directionality to the return flow.

## 5 Exhibit maintenance protocol

### 5.1 “Check-in/check out” procedure

Every day, the live animals and all critical systems need be closely monitored. A routine procedure needs to be developed and carried out to systematically assess the status of animals and the life support systems. The procedure should be conducted by the assigned caretaker first thing in the morning (“check-in”) and the last thing before going home (“check-out”).

See Appendix I for the preliminary draft checklist for animal welfare and life support system status checklist.

### 5.2 Instructions for Specific Tasks

#### 5.2.1 How to change out a canister filter or bio-ball cartridge:

The filter cartridge (the black barrel-shaped object closest to you on the right of the aquarium when standing behind the display) will need to be changed out for a fresh cartridge at a TBD frequency. Refer to the pressure gauge on the top of canister as the indicator for when the canister should be changed out. **When the pressure reaches 15 PSI, change out the canister.** The procedure below is the same for both the filter and bio-ball cartridges, but the need to access and/or maintain the bio-ball cartridge will be much more infrequent than the filter cartridge unit.

Step 1: Turn off the pump by unplugging it (unplug the UV sterilizer at the same time the pump is unplugged to avoid over-heating the UV unit – the plugs of both devices are zip-tied together to help remind the user to do this).

Step 2: Reach under the grey plastic rack that the canisters are mounted on and open the red valve handle all the way (there is only one red valve handle). **Make sure that the end of the 10' clear plastic tube is placed into a bucket or drain before opening valve.**

Step 3: Using fingers only, open the yellow air-bleeder port on the top of that canister. A hissing sound of air being pulled in should be heard and water should be exiting the drain line.

Step 4: After several minutes and after several gallons of water have left the canister, close the red valve handle. Leave the yellow air-bleeder port in the current, open position.

Step 5: Push the small yellow ‘catch tab’ on the back collar of the canister down to free the threaded collar on the canister. Turn the collar counter clock-wise until it can be lifted off.

- Step 6: Using the finger hold on the back of the canister cap, dislodge it from its o-ring seal by firmly, but smoothly pulling up.
- Step 7: Remove filter cartridge and move immediately to the black tray or a bucket and insert replacement filter cartridge into the canister.
- Step 8: Inspect the condition of the o-ring and re-apply Vaseline if o-ring is not moist around the entire circumference of the top. Replace canister top by seating it securely and snugly on the o-ring seal. Spin the collar back onto the threads clock-wise until it is stopped by the small yellow 'catch-tab' on the back of the canister. **(Do not attempt to over tighten beyond the 'catch tab')**.
- Step 9: Place a rag around the yellow air-bleeder port on the top of the canister. Air should be hissing out of this port. When water starts to squirt out, turn the yellow port clockwise until snug **(do not over tighten)**.
- Step 10: Inspect the over all system and observe for a few minutes until everything is assured as stable and running properly with no drips or spills.
- Step 11: Take soiled filter cartridge to rinse area and use hose-pressure to clean the pleats as much as possible. Then, place the canister in bleach-water for at least 24 hours. Remove, spray with hose again and let air-dry in preparation for the next rotation of cartridges.

#### 5.2.2 How to maintain the basket strainer:

This device is designed so that a basket can be removed for cleaning without interrupting the flow of water to the system (the pump does not have to be shut off for this procedure). The basket should be checked once per day until the frequency is determined through observing the system over time. It may need to be cleaned more frequently than once a day. At any given time one of the two canisters is 'active' and straining and the other is clean and 'at rest.'

Arrows on the orange handle between the gray strainer canisters show the direction of the water flowing through the unit. Turn the orange handle 180 degrees to the arrow points the opposite canister that it was originally pointing to. At this point water is now flowing through the new, previously 'at rest' strainer and water is isolated for the previously 'active' strainer.

Now the previously 'active', but now 'at rest' canister can be cleaned. Rotate the lid off counter-clockwise by grasping the long turn-handle on the lid. Clean the basket and replace it and the lid. Now the strainer is clean, 'at rest' and ready for use when the newly 'activated' strainer needs to be cleaned.



The basket strainers are the blue-topped, gray canisters in the center left of the picture. The orange handle is obscured by the turn-handle on the strainer lid in the foreground.

### 5.2.3 How to clean the inside (wet side) windows:

For general wipe-downs, which ideally occur daily, of the intern acrylic surface of the ray aquarium, use the white 3M “Doodle bug” pad covered with the soft nylon mesh covering. It is secured to the orange 3M “Doodle bug” pad holder with a Velcro-like attachment. Make sure the pad surface is free of any grit, sand or pebbles. Acrylic scratches easily!

While standing behind the tank, start at the part of the window closest to you at either the far right or far left side of the slanted window. Slide the pad to the opposite side while applying firm, upward pressure of the wind, then down one pad length and return to the opposing side. Repeat until the entire window had been wiped.

For more ‘intense’ scraping of any problem areas that may develop, use the “Kent Pro Scrapers.” They have a slender black handle with a 3” wide scraper holder at the opposite end of the handle. The scraper itself is red plastic and should only be used if the leading edge is smooth, even and free of any nicks or burrs.

For any window cleaning of the ray aquarium, try to arrange for a co-worker to be positioned on the visitor-side of the aquarium. They can verbally help direct your efforts. If no one is available, the florescent light behind the tank can be lifted up and a view through the light port window can be used for helping locate areas that need to be cleaned.

### 5.2.4 How to clean the outside (dry side) windows:

Use only a clean, cotton cloth (cotton baby diapers are ideal) and Brillianize. There is debate on the use of isopropyl alcohol on acrylic. It may lead to crazing – especially at acrylic bond locations, so be safe and use Brillianize.

### 5.2.5 How to gravel wash:

The ray system has a dedicated gravel-washer. It is a clear, ridged plastic cylinder which is attached to a flexible, clear hose. Before gravel washing, make sure that there is enough seasoned replacement water available for the replenishing the water that will be lost to gravel washing, (see “How to do a water change” section below).

Once the replacement water has been confirmed as ready, and the quantity is noted, start by placing a bucket nearby for receiving the dirty water.

Submerge the clear, ridged plastic cylinder in the aquarium water. Make sure the flexible end is lower than the level of the water in the aquarium. Place your mouth on the end of the clear, flexible tubing and provide a quick, brisk suck to the tubing. Then quickly move the tube away from your mouth and orient it towards the bucket. A siphon should have been started at this point.

While watching the water level of the aquarium, work deliberately and efficiently through the gravel bed of the aquarium. Allow the siphon suction to pull a few inches of gravel up into the ridged cylinder while keeping the cylinder end totally submerged, then crimp the flex tubing to momentarily stop the siphon flow. The gravel will fall back out of the cylinder to the bottom of the tank. Fish waste and any other debris will stay in the water in the cylinder. Once all the gravel has fallen back out, release the crimp to resume the siphon flow. Allow the flow to remove the fish waste and debris to the bucket and repeat in a new area.

When finished, perform task #7 in the “How to do a water change” section below.

Anytime work is done on a system, observe all the parameters for several minutes to make sure no steps were missed and that the system is operating properly.

#### 5.2.6 How to do a water change:

Step 1: Fill a large, wheeled Rubbermaid barrel with tap water to the highest level that is can be moved comfortably & safely – you'll need to find a place to store the barrel of water. The storage area will ideally be near a source of water and have an electrical outlet that can provide power for an air pump and a submersible aquarium heater. The barrel should be clearly labeled that it is to be used for fish only.

Step 2: Dechlorinate to water in the barrel. Novaqua is one of many products available to dechlorinate tap water. Aerate the water with an air stone and put in a submersible heater set for the target temperature (same as the tanks). Aerate the water for at least several hours or overnight if possible.

Step 3: Test the water for pH and adjust accordingly to lower the pH to 6.0 – 6.8. There are a number of products available to lower pH (“pH Down” for example). Muriatic acid may also be used and may be more cost effective, however, it is dangerous to use and store.

Step 4: With a second large, wheeled Rubbermaid barrel remove water from the display, equal to or less than the volume of water that has been prepared & is ready for use. When siphoning water from the tetra tank, care must be taken to not suck up any fish up. The life support system will need to be shut down, as the volume removed would be greater than the amount of water that the sump can spare & keep the pump from sucking air. It's important that the UV sterilizer gets unplugged as well when the life support pump is shut off as the UV module could heat up & possibly become damaged if it is running without water being circulated through it. The ray tank will not have to be shut down for the partial water changes (as long as the pumps don't suck air when the water level is lowered).

Step 5: After the water is removed from the tank, the new water can be added. It would be very helpful to have a small submersible pump with a hose of appropriate length attached (also labeled “fish only” & to be used exclusively for the Amazon Voyage exhibit aquariums). The conditioned/temperature matched water can be pumped for the barrel into the exhibit.

Note: If water changes are done between the high and low level taped markers on the back of the tank, shutting the pumps off is not necessary.

#### 5.2.7 How to prime the pump if flow circulation stops:

Unplug the pump. Locate the white PVC reducer bushing labeled “pump primer.” Unscrew the fitting that holds the black screen tube on the suction plumbing near the bottom of the inside of the tank. Attach a garden hose to the male threads on the “pump primer” bushing. Thread the bushing to the PVC threads that were left bare when the black screen tube was removed. Pressurize the garden with the water change sump pump while it is submerged in a bucket of conditioned water. Plug pump. Quickly unscrew “pump primer” bushing as soon as pump becomes primed and unplug sump pump. Replace black screen tube.

#### 5.2.8 How to change out the UV lamp:

Unplug the UV lamp and let cool down for several minutes. Open housing and take out light. Put in new UV light. **DO NOT TOUCH LAMP WITH HANDS OR FINGERS – ALWAYS HOLD LAMP WITH A CLEAN DRY CLOTH. OILS ON SKIN CAN CAUSE LAMP TO BURST WHEN IT IS ON AND HOT.** Close housing and plug back in. Overheating UVs – The UV lights should not be allowed to overheat. They will overheat and burst if left on with no water flow to the UV unit.

### 5.3 Feeding and nutrition

Stingrays: Silversides, Night Crawlers, Blood Worms

Stingrays should be fed with long thongs towards the front of the tank to encourage visual opportunities for the visitors. The rays will place themselves where their food is given.

**Should be fed daily.**

### 5.4 Water quality testing

Water should be tested twice a day for the first two weeks. Once stabilized, the pH levels and temperature should be logged in daily.

Parameters: pH levels between 6.0-6.5 and Temperature should be between 78° – 82°F (25.5° – 27.7°C).

It is very important to keep daily continuous records not only with the water quality but also with the visual inspection of the fish. Any unusual behavior should be noted. Their feeding habits, when and how much should also be a part of the daily log.

Dramatic temperature fluctuations could result in specimen death.

## 6 Staff and animal safety concerns

Do not handle the rays directly. Always use a net with a handle. The stingrays are venomous and are capable of rendering a painful wound and toxic venom. The venom is mild and would require only soaking the wound in a bucket with the hottest possible water to neutralize the venom. Any systematic effects will need to be seen by a doctor immediately.

Water should be kept away from all outlets and floors should have a mat where water can drain. Looking directly at the UV bulb can cause eye damage.

Always wash hands after maintenance of the fish. If you have any open cuts on hands or fingers, the cuts should be bandaged and latex gloves should be worn.

## 7 List of appropriate species and sourcing

Ruinimans Aquarium Inc.  
Arie de Zwart-President  
11345 SW 95 Street  
Miami, FL 33176  
Phone: 305-279-2349  
Fax: 305-274-8562  
Email: ruinemansmiami@earthlink.net

### 7.1 Considerations for specimen acquisition and acclimation

Potomotrygon Motoro (Ocellated River Stingray) is the species on display. They are fragile at first, but after tank is stabilized they become hardy. All specimens should be professionally shipped by Ruinimans Aquarium. Otherwise, US Fish and Wildlife requires a transporting permit. Any permitting process could take up to 4 weeks or longer to acquire.

## 8 Special considerations for relocating the aquatic exhibits

### **Staff training**

Staff should have basic knowledge on fresh water fish.

### **Replacement UV bulbs (need to purchase)**

UV lights should be changed when exhibit is received.

### **Animal disposition/acquisition**

Animals that have died for whatever reasons should be kept in a freezer and disposed of properly. US Fish and Wildlife should be notified when transferring animals from state to state, a Captive Wildlife Transport Permit is required. Regulations vary from state to state.

### **Minimizing animal stress for transfer**

Keep in dark cooler where water temperature stays constant.  
Retaining viability of the biological LLS component.

# Appendix I

## “Check-in/Check-out” Daily rounds procedure and checklist

To be conducted by animal husbandry staff first thing in the morning and last thing in the day.

### Visual checks for rounds:

- Animal behavior and well-being (take a few minutes to really watch them)
  - Indications of stress:
    - Unusual posture
    - Heavy respiration
    - Unusually oriented towards the surface
    - Cloudy eyes
    - Heavy mucous
- Water & environment
  - Cloudy water
  - Suspended solids in the water
  - Excessive waste on the bottom of the tank
  - Slime or lingering bubbles on the surface
  - Micro bubbles in the water
- Pumps running and flow occurring
- Suction and standpipe overflow screens free of debris
- All display lighting **on** (when open to public) and **off** (when not open to public)  
timers should be set to control lights for standardized day lengths (10 – 14 hr. days)
- UV indicator light on
- Temp between 78° – 82°F (25.5° – 27.7°C) Avoid fluctuations.
- Pressure gauges PSI: Less than 15 PSI
- Check for water (even small droplets) on life support racks or floor. If present, wipe down and trace to the source.

Note any concerns on tank charts.

## Appendix II

### List of tools and back up equipment:

**There are two sets of tools. One set is dedicated to each system and includes:**

- Gravel washer/siphon
- 3M doodlebug holder and acrylic-friendly white pad
- Kent Pro scrapers on handles of two lengths
- Plastic 'reach-extender' forceps
- Yellow sponges
- Various nets

### **Back-up equipment:**

- Extra Kent Pro Scraper blades in closet
- Back up pump in the tetra service corridor
- 2 large Rubbermaid barrels with wheels
- Air pump
- Air line
- Airstones (have extras - they break when dropped)
- Submersible aquarium heater
- Submersible pump
- "J" tube w/strainer to hook the siphon hose over the side of the tank
- pH test kit
- pH down - chemical to lower pH
- Thermometer
- Dechlorinator (novaqua or similar)
- Floor squeegee & wet vac

