Aquarium Set-up

Urban Ecology

Estuary Systems

(1) An estuary i ne
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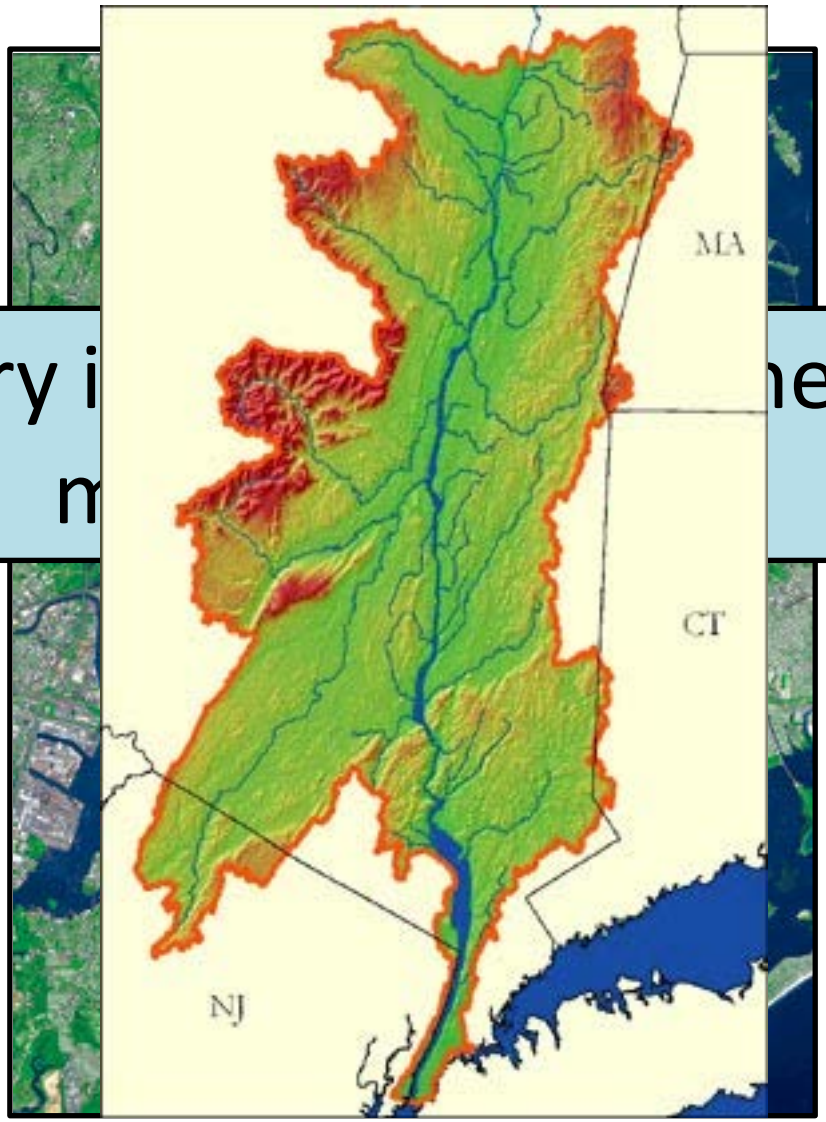
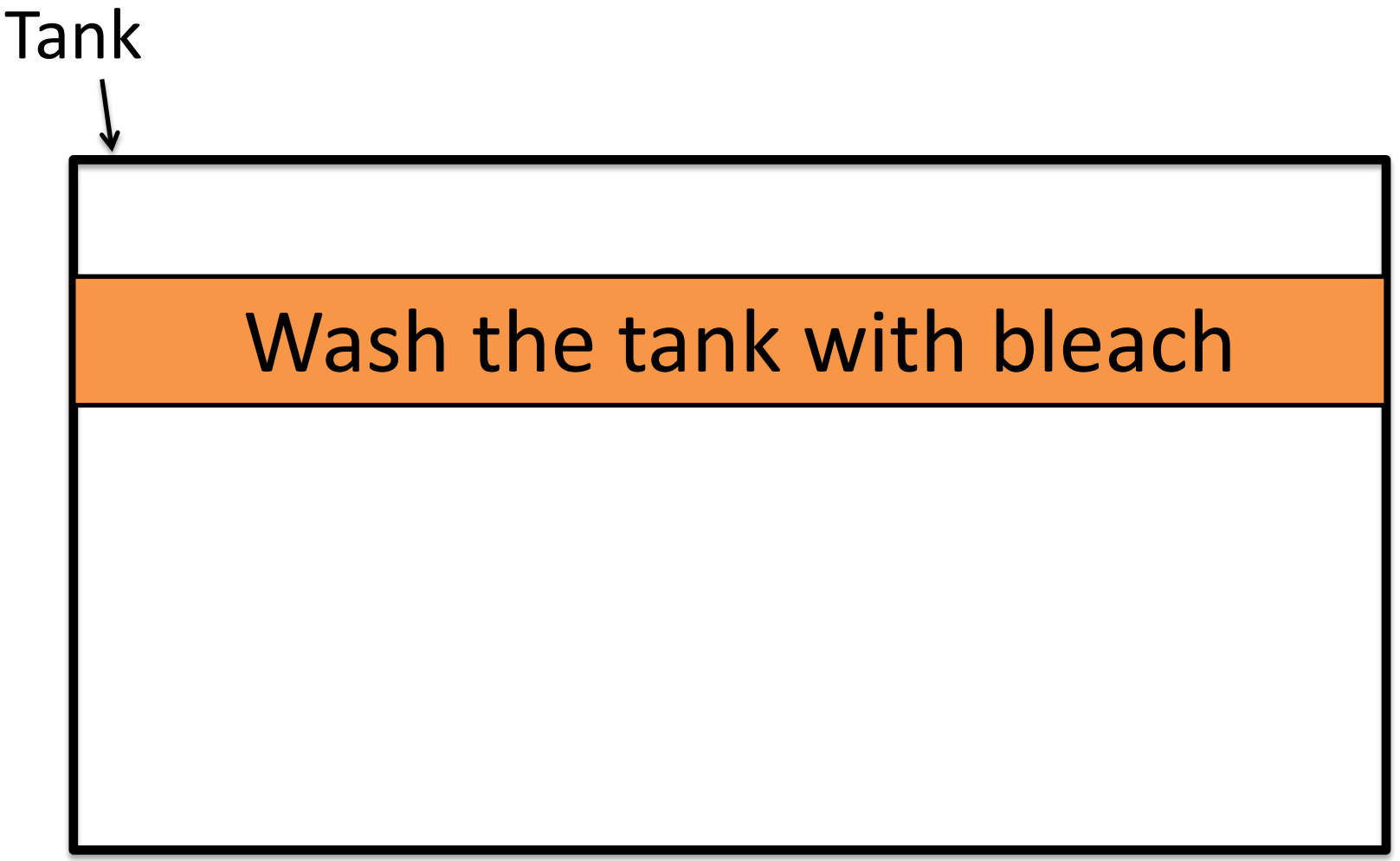
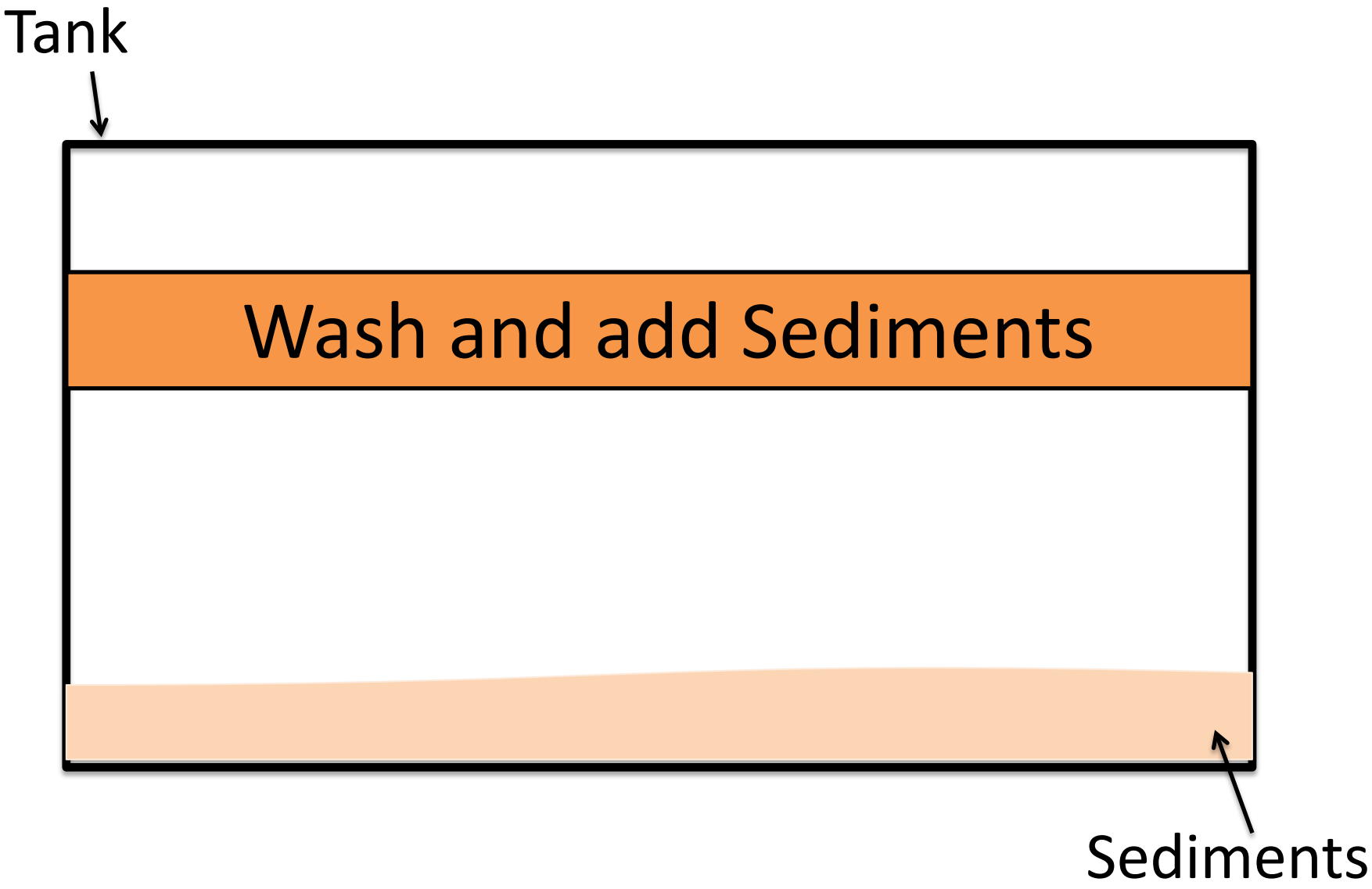


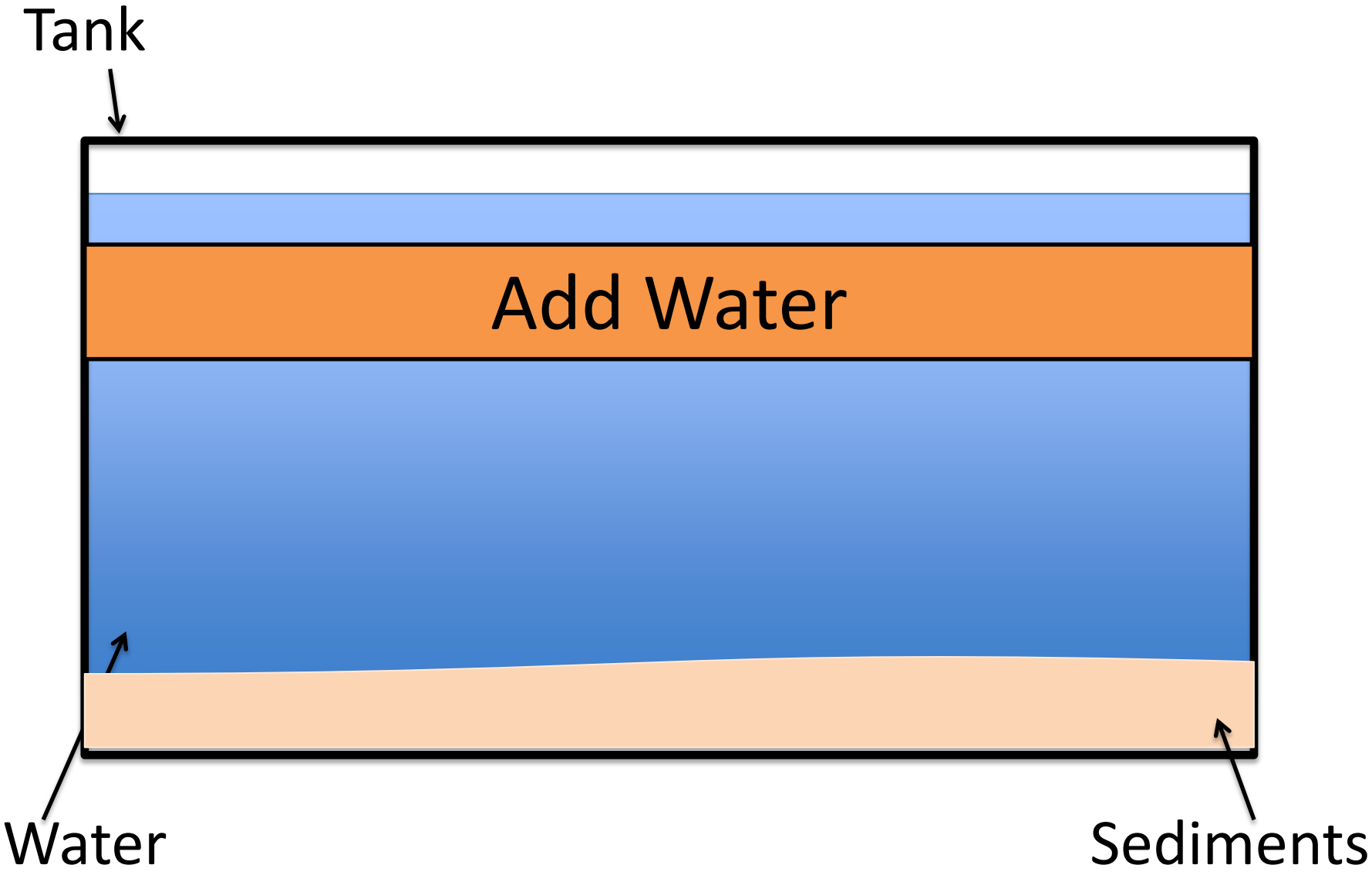
(2) We Live in the **Hudson River** Estuary

Esutary Video

How can we set up an Estuary System in our classroom?




Tank
Wash and add Sediments
Sediments

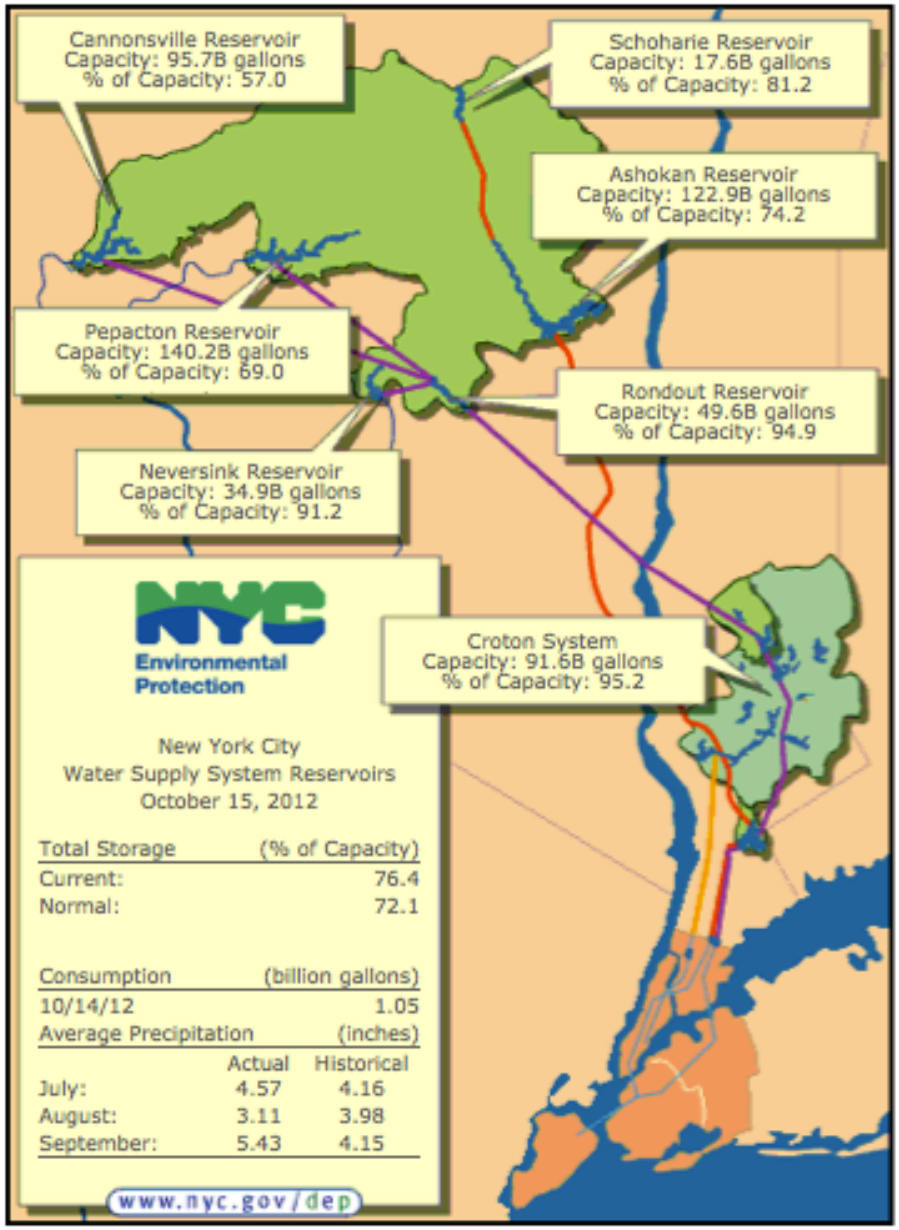

Tank
Add Water
Water
Sediments

(3) It is in …er because …that live in the tar…

(4) Ocean… …**2-36ppt**, while fre…

(5) The sa… …**pt**

Current Reservoir Levels



For additional near real-time information on surface water conditions in the New York City Watersheds, go to the USGS for New York State.

Concentration ppt

Salinity is expressed as a concentration: **a mass of chemical per unit volume of water**. Most of the total dissolved solid content of water consists of common salts.

Salinity of an Estuary is between 20-30 ppt. We are also saying the concentration is 20-30 grams of salts per liter of water.

$$\frac{\text{1 gram of salt}}{\text{1000 grams of water (1 Liter)}} = \text{1 part per thousand}$$

An Estuary Soda Bottle

How much salt do we need if we want to create an estuary (25 grams/Liter) in this soda bottle?

2 Liters X 25 ppt of Salts = **50 grams**

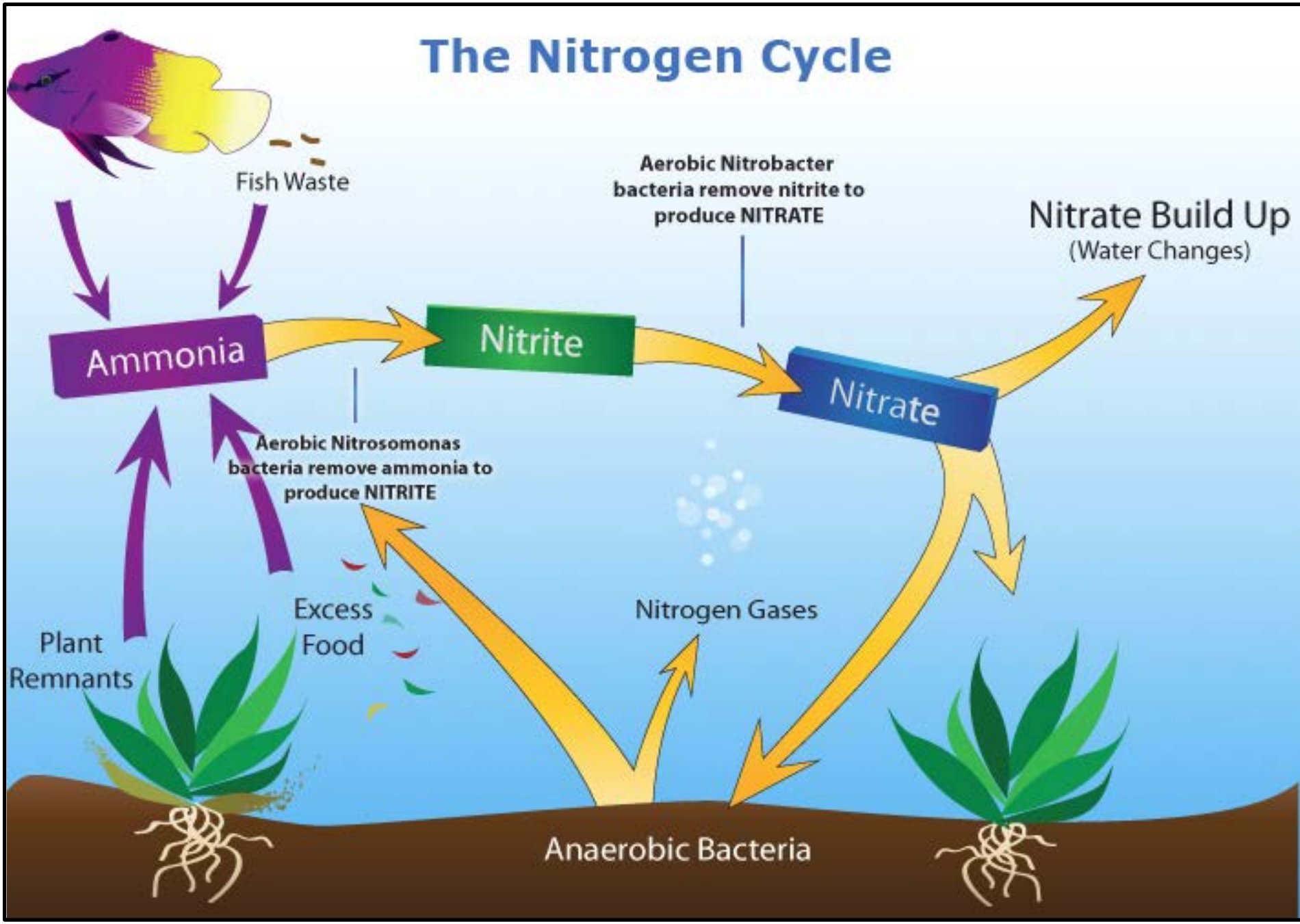
25 grams of salts per liter of water

(3) It is important to **dechlorinate** water because chlorine is toxic to organisms that live in the tank.

(4) Oceans typically have a salinity of **32-36ppt**, while freshwater has a salinity of **0ppt**

(5) The salinity of an estuary is **20-31ppt**

(6) The most toxic nutrient to fish is **Ammonia,** which must be monitored to prevent aquarium die-off


The Nitrogen Cycle
Fish Waste
Aerobic Nitrobacter bacteria remove nitrite to produce NITRATE
Nitrate Build Up
(Water Changes)
Ammonia
Nitrite
Nitrate
Aerobic Nitrosomonas bacteria remove ammonia to produce NITRITE
Excess Food
Plant Remnants
Nitrogen Gases
Anaerobic Bacteria

Equipment

Tank

Add Equipment

Water

Sediments

Equipment

Tank

(7) An **<u>Aquarium Habitat</u>** is essential for organism survival because it decreases stress by creating a safe place away from predators

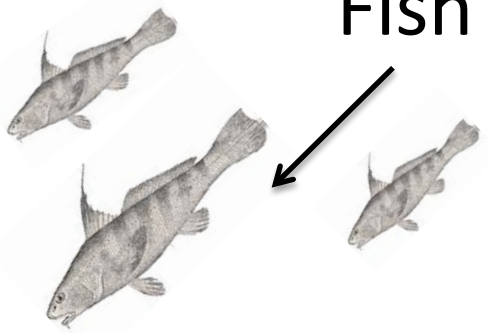
Water

Habitat

Sediments

Equipment

Fish



Tank

(8) Our fish will come from **Jamaica Bay**.

Water

Habitat

Sediments

Tasks: Class 1

1. Rinse Tank with bleach and water
2. Rinse Sediments
3. Test tap water for nutrients
4. Rinse shells and aquarium plants
5. De-chlorinate water and add salt

Tasks: Class 2

1. Clean and set up filter, heater, aeration
2. Test tap water for nutrients
3. De-chlorinate water/ Add Salt
   - Add water to Aquarium
4. Rinse shells and aquarium plants
   - Add to aquarium

Aquarium Maintenance Guide

Academy of Urban Planning
Aquarium Club

Table of contents

Aquarium Basics -Tests

- Water quality tests need to be completed at least once/week
- Make sure to log all results on the proper sheet

Test: Temperature

Fish like a constant temperature, any sudden changes may shock them

- There is a thermometer attached to the wall of each aquarium
- Record the temperature in °F on the proper log sheet
- If the temperature is below or above normal range, check the heater (picture shown) to make sure it is working and set at the correct temp. Never take the heater out of water for a long period of time and it should always be completely submerged.

What levels should we expect? Temperature Range 65-75 F

When should we worry? Avoid sudden changes in Temperature

What do we do if there is a problem? Check the heater, is it working? Is the dial set to 70F? This normally should not be a problem in the tank, but something to keep in mind when performing a water change.

Test: Nitrate

High levels of Nitrites can be toxic to Fish, we do this test to make sure the levels are safe

- This Test is located in the **BLACK BOX**
  - Find the **PURPLE BAG** labeled **NITRATE**
- Steps:
  - Fill the test chamber with water from the aquarium
  - Empty ONE reagent packet into the test chamber
  - Shake until well mixed (about 60 seconds)
  - Wait 3 minutes
  - Compare to Nitrate Color Scale (orange)
  - Rinse kit with clean water

What levels should we expect? 10 mg/L or below
When should we worry? When Levels are above 70mg/L
What do we do if there is a problem? A 30% water Change (explained later in booklet) and maintenance filtration system.

Test: Nitrite

High levels of Nitrates can be toxic to Fish, we do this test to make sure the levels are safe

- This Test is located in the **BLACK BOX**
  - Find the **PURPLE BAG** labeled **NITRITE**
- Steps:
  - Fill the test chamber with water from the aquarium
  - Empty ONE reagent packet into the test chamber
  - Shake until well mixed (about 60 seconds)
  - Wait 10 min.
  - Compare to Nitrite Color Scale (red)
  - Rinse kit with clean water

What levels should we expect? 0.4 mg/L or below
When should we worry? When Levels are above 0.6mg/L
What do we do if there is a problem? A 30% water Change (explained later in booklet) and maintenance filtration system.

Test: Ammonia

High levels of Nitrates are very toxic to Fish, we do this test to make sure the levels are safe

- This Test is located in the **BLACK BOX**
  - Find the **PURPLE BAGS** labeled **Ammonia** and **Ammonia 2**
- Steps:
  - Fill the test chamber with water from the aquarium
  - Empty ONE reagent packet into the test chamber
  - Shake until well mixed (about 60 seconds)
  - Compare to Ammonia Color Scale (green)
  - Rinse kit with clean water

What levels should we expect? 0.4 mg/L or below
When should we worry? When Levels are above 0.6mg/L
What do we do if there is a problem? A 30% water Change (explained later in booklet) and maintenance filtration system.

Test: pH

A pH that is too high or too low can be harmful to the fish, we do this test to make sure the pH levels are safe

- This Test is located in the **BLACK BOX**
  - Find the **PURPLE BAG** labeled **pH**
- Steps:
  - Fill the test chamber with water from the aquarium
  - Empty ONE reagent packet from the **pH** package into the test chamber
  - Shake until well mixed (about 60 seconds)
  - Compare to pH Color Scale (purple)
  - Rinse kit with clean water

What levels should we expect? pH range 8.1 – 8.4

When should we worry? When pH is below 7.5 or above 8.5

What do we do if there is a problem? A 30% water Change (explained later in booklet)

Test: Alkalinity

Alkalinity measures how strongly the water can "hold on" to it's pH. If the alkalinity is too low, the pH could drop off rapidly at any point.

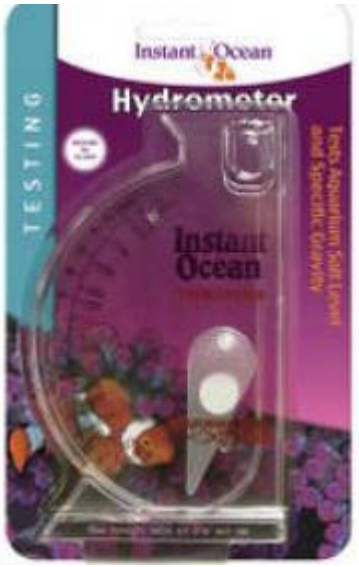
- This Test is located in the Clear Container labeled **Alkalinity**
  - Find the **test chamber** (looks like a tiny muffin tin) and the **Alkalinity reagent** (small jar with yellow liquid)
- Steps:
  - Fill one hole in the chamber with water from the aquarium
  - Add one drop of Alkalinity reagent (water should turn blue)
  - Keep adding drops until the water turns yellow
  - The Alkalinity is equal to the *number of drops added ÷ 2*
  - Rinse kit with clean water

What levels should we expect? Alkalinity range 2-3 mq/L
When should we worry? When Alkalinity is below 2 mq/L
What do we do if there is a problem? A 30% water Change (explained later in booklet)

Test: Salinity

Our fish are from a brackish system; therefore, salinity levels that are too high or too low will stress them

- We test for salinity using a **Hydrometer** (clear plastic device with a moving arrow)
- Steps:
  - Fill the hydrometer with water from the aquarium
  - Wait for the arrow to settle (about 5-10 sec.)
  - Record the salinity (outside row of numbers)
  - Rinse the hydrometer with clean water

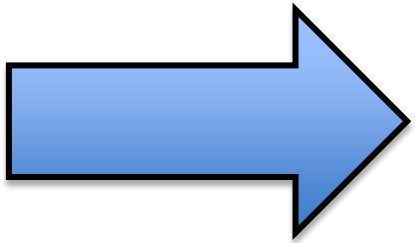


What levels should we expect? Salinity Range: 26-29ppt
When should we worry? When Salinity is below 25 or above 30
What do we do if there is a problem? Too salty? Add freshwater; Too fresh? Add salt (explained later in booklet)

We Have A Problem!!

- Most problems in the tank can be solved by changing the water and keeping the filtration system in good working order:
  - Getting rid of the “problem” water and adding new, clean water.
  - Rinsing the blue filter cartridges in the filtration system.

How to Perform a Water Change



Water Change:

- We never want to change all the water at once, because it will shock the fish and get rid of helpful organisms that convert ammonia to nitrate
- We change only 30% of the water at a time

Water Change – Remove Dirty Water

- Empty about 30% of the water from the aquarium using a bucket and the siphon.
- Start by putting the large piece into the tank.
- Pump the siphon until the water starts flowing without pumping (3-4 pumps). Make sure the bucket is lower than the tank (on the floor).
- Put the head on the sediments to clean them, pinch the tubing and release to pulse flow.
- Stop siphon by pulling head out of water. Dump dirty water in bucket down the sink.

Water Change – Add Clean Salt Water

- Mix new salt water in a clean bucket:
  - Add 1 ¼ cup salt per 5 gal. tap water (large white buckets are 5 gallons)
  - Add a 1/4 cap full of dechlorination liquid (yellow bottle)
  - Mix well
  - Allow to sit for at least 5 hrs to bring temperature up
  - Do not add the new water until the temp is within 2°F of the aquarium water
    - You may need to use a spare heater to warm the water
- When the temperature is OK, slowly add the new water to the tank
- Be careful not to put weight on the frame of the tank when adding water

Filtration Maintenance:

This instrument is the most important item attached to the tank. If it is not cleaned at least once a month the tank's water quality will be bad because of decreased filtration.

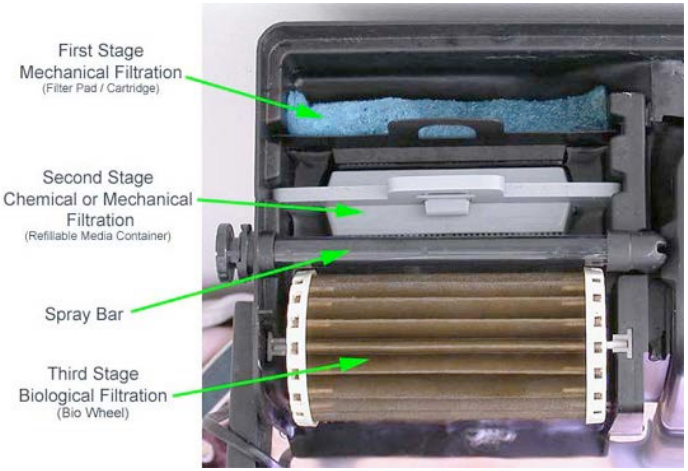
The filter pumps the tank water through the blue carbon filters and and over the bio-wheels to

1. filter large particles
2. create surface area for beneficial bacteria rid toxic ammonia.

The entire filtration system should be removed from the tank, taken completely apart, cleaned and tubing scrubbed. Cleaning once a month will keep the filters clean and pump tubes free of gunk.

Filtration Maintenance Continued:

How to Perform Filter Maintenance



- Unplug filter from the power outlet
- Remove completely from tank and bring to sink
- Remove the biofilter wheels and place in a safe area. Do not rinse or get the biofilter wheels wet.
- Take apart the components of the filter, rinse/scrub with test tube brush. The are several parts that must be taken off, including
  - 1. the blue filters (Rinse them)
  - 2. the tan carbon filters (Rinse them)
  - 3. the spray bar tubes that stream the water over the biofilter wheels. (use small scrubber and rinse them, carbon pieces get stuck in the tubing and prevent flow) By pulling out, away from the center you can remove both spray bars.
  - 4. the long tubing that extends into the tank (use large scrubber to clean gunk inside of tube)
  - 5. the pump that is located in the bottom of the filtration system (scrub it and rinse well)
  - 6. rinse and scrub inside the filtration system with everything mentioned above removed
- Once everything is scrubbed and rinsed, put everything back into filtration system. Put it back on the tank. Fill the chambers with water from the tank.
- Plug in the filter, wait for pump to start working and biofilter wheels to start turning. You may need to add more water to chambers to get pump sucking water. This is easy if the water level in tank is full.
- Note: if you didn't put the pump in correctly the water will not be sucked up into the filters. Take off filtration system and fix pump.
- Rinse and put the filter lid back over the filtration system.

The Pump

The blue filter

The Scrubber

Adjusting Salinity –Too Salty

- Because water evaporates and leaves salt behind, it is common that the tank will get too salty.
- We solve this problem by adding fresh water
- Steps:
  - Mix some fresh water with 1/4 cap of dechlorination liquid and allow the temperature to adjust (just like with the water change)
  - When the temperature is OK, slowly add a little bit of freshwater at a time, checking the salinity with the hydrometer after each addition
  - Stop adding fresh water when salinity is back down to the desired range (26- 29 ppt)

Adjusting Salinity- Too Fresh

- Sometimes, the water in the tank may be too fresh
- We solve this problem by adding salt
- Steps:
  - Add a small about of salt (1/4 cup) at a time to about a ½ gallon of water, add a few drops of dechlorinator and mix well. Add to tank and mix inside tank to create a mixed solution.
  - Check the salinity after each addition using the hydrometer
  - Stop adding salt when the salinity is back up to the desired range (26-29ppt)

Feeding the Fish

- In general only feed fish once per day
- Only feed fish amount of food they can eat in a 2 minute period (a small pinch).
- If more than one person is responsible for feeding, avoid confusion and create a feeding chart, documenting every time the fish eat.
- DO NOT OVER FEED. Over feeding will cause serious water quality issues.
  - Overfeeding will clog up filtration system
  - Cause cloudiness
  - Raise nutrients
  - May result in fish death

Check Air Pumps

- Air pumps give fish plenty of oxygen. Make sure they are working properly.
- Air pump should be plugged into an outlet
- Air tubing should be plugged into pump at one end and plugged into air stone (submerged) at the other end.

Air Pump and Tubing

Air Stone

Cleaning Aquarium Glass

- Use algae scrubber often. If you don't have the scrubber a brown paper towel can be used
- Remove light/lid and scrub all sides of tank
- Rinse the scrubber and put away

Aquarium Lighting

To Operate Timer

- The light is plugged into a timer that comes on in the morning and shuts off after school.
- To set time light is on, push in the segments on the dial.
- Make sure the switch at the side is slid to timer mode.
- Plug in Light to timer.

Materials List

Item	Order #	Price	Website
Algae scruber	APN-437755	$8.49	www.drsfostersmith.com
Tetra marine Feed granules	APN-119415	$7.49	www.drsfostersmith.com
Air pump for 20 gallon Tank	997579	$20.99	www.petco.com
Acrylic Aquarium, 30 gallons, 36" x 12" x 16"	AT30	$233.28	www.aquaticeco.com
Emperor 400 filter system	CD-25878	$36.39	www.drsfostersmith.com
Corkscrew Plastic Aquarium Plant small	1285521	$2.54	www.petco.com
Corkscrew Plastic Aquarium Plant large	1285416	$4.24	www.petco.com
crused coral sediment 40 lbs	CC5	$24.35	www.aquaticeco.com
Instant Ocean seasalt	IS160	$49.95	www.aquaticeco.com
Ammonia Test kit	731452	$29.99	www.thatpetplace.com
Alkalinity Test kit	198590	$12.99	www.thatpetplace.com
Tetra aqua safe dechlorinator	APN-437755	$8.49	www.drsfostersmith.com
saltwater test kit	APN-26077	$35.69	www.drsfostersmith.com
Tetra Marine Feed flakes	APN-119427	7.29	www.drsfostersmith.com
Aqua-timer for light	671534	8	www.carolina.com
Bulb for tank 24" T8, 17 W	BL24	19.29	www.aquaticeco.com
20 lb Black Beach Reef Sand	CD-33959	29.99	www.drsfostersmith.com
Aqueon Siphon with Bulb Vacuum Aquarium Gravel Cleaner	1384295	12.74	www.petco.com
Submersible Heater 100 watts	1081721	36.99	www.petco.com
Air line tubing 8'	1446614	$3.99	www.petco.com
air stone	196870	$2.50	www.thatpetplace.com

Urban Ecology: Estuary in the Classroom - Aquarium Setup

Name: _____ **Date:** _____

Video Activity: ***Write 5 facts from the video about estuaries***

1. _____
2. _____
3. _____
4. _____
5. _____

Discussion Questions

Follow along with the speaker to fill in the blanks below

(1) An estuary is a water body where _____ water meets _____water.

(2) We live in the _____ estuary.

(3) It is important to _____ aquarium water because chlorine is toxic to organisms that live in the tank.

(4) Oceans typically have a salinity of _____ where fresh water bodies have a salinity of _____.

(5) The salinity of an estuary is _____.

(6) The most toxic nutrient to fish is _____ which must be monitored to prevent aquarium die-off.

(7) An _____ is essential for organism survival because it decreases stress by creating a safe place away from predators.

(8) Our fish for the aquarium are coming from _____.

Below is a list of tasks necessary to set up the aquarium; check all that you helped out with.

Remember: This is YOUR aquarium!!

- ❑ Cleaning Tank with Bleach
- ❑ Washing Sediments
- ❑ De-Chlorinating Water
- ❑ Adding Salt to Water
- ❑ Testing Tap Water for Nutrients
- ❑ Adding Water to Tank
- ❑ Washing Shells and Plants
- ❑ Setting up Aquarium Equipment
- ❑ Setting up Aquarium Habitat
- ❑ Other _____

_____

_____

Circle one:

I am interested in aquarium club YES NO

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Urban Ecology

<u>Optimal Aquarium Conditions:</u>
Temperature: (75-80F)
Nitrate (NO3): less than 30 mg/L
Nitrite (NO2): 0 mg/L
Ammonia (NH3): 0 mg/L
Phosphate (PO4): less than 1 mg/L
pH: (8.0-8.5)
Alkalinity: (8-12 dKH)
Salinity: (29 g/L) (specific gravity) 1.021

Log Sheet Aquarium 1

Date	Class Period	Name(s)	Temp (°F)	Nitrate (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	Phosphate (mg/L)	pH	Alkalinity (dKH)	Salinity (mg/L)

What is pH?

pH, one of the most common analyses in soil and water testing, is the standard measure of how acidic or alkaline a solution is. It is measured on a scale from 0 – 14. pH of 7 is neutral, pH less than 7 is acidic, and pH greater than 7 is basic. The closer pH gets to 1, the more acidic. The closer pH gets to 14, the more basic.

The pH scale is logarithmic, which means that a unit *decrease* in pH equals a ten fold *increase* in acidity. For instance, tomato juice (pH 4) is ten times more acidic than black coffee (pH 5). Hydrogen (H^+) ions (ions are atoms or groups of atoms with negative or positive charge) control acidity levels. pH measures the concentration of H^+ and hydroxide (OH^-) ions which make up water (H_2O): $H^+ + OH^- = H_2O$

When the two ions are in equal concentration, the water is neutral, whereas the water is acidic if $H^+ > OH^-$ and basic when $OH^- > H^+$.

Why is pH important?

Aquatic organisms need the pH of their water body to be within a certain range for optimal growth and survival. Although each organism has an ideal pH, most aquatic organisms prefer pH of 6.5 – 8.0. Outside of this range, organisms become physio- logically stressed. Reproduction can be impacted by out-of-range pH, and organisms may even die if the pH gets too far from their optimal range.

What is Alkalinity?

Alkalinity is the buffering capacity of a water body. It measures the ability of water bodies to neutralize acids and bases thereby maintaining a fairly stable pH. Water that is a good buffer contains compounds, such as bicarbonates, carbonates, and hydroxides, which combine with H^+ ions from the water thereby raising the pH (more basic) of the water. Without this buffering capacity, any acid added to a lake would immediately change its pH.

Why is alkalinity important?

Aquatic organisms benefit from a stable pH value in their optimal range. To maintain a fairly constant pH in a water body, a higher alkalinity is preferable. High alkalinity means that the water body has the ability to neutralize acidic pollution from rainfall or basic inputs from wastewater. A well buffered lake also means that daily fluctuations of CO_2 concentrations (discussed above) result in only minor changes in pH throughout the course of a day.

What affects alkalinity?

Alkalinity comes from rocks and soils, salts, certain plant activities, and certain industrial wastewater discharges (detergents and soap- based products are alkaline). If an area's geology contains large quantities of calcium carbonate ($CaCO_3$, limestone), water bodies tend to be more alkaline. Granite bedrock (much of RI) is deficient in alkaline materials to buffer acidic inputs. Addition of lime as a soil amendment to decrease acidity in home lawns can runoff into surface waters and increase alkalinity.