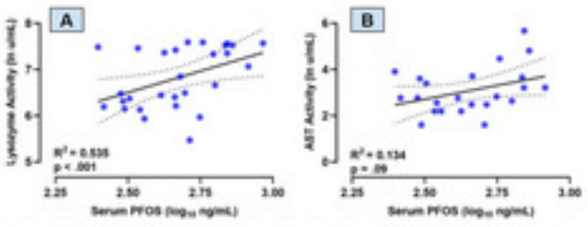
Quiz

Station 1: Part 2

What PFAS chemical, manufactured by the company Chemours in Fayetteville, NC, was released into the Cape Fear River, a major drinking water source for Wilmington, NC?

- Ammonium chloride
- GenX
- Coal ash
- PFBA



For the following questions, use the graphs shown. Scientists studying the effect of perfluorooctanesulfonic acid (PFOS) contamination on Cape Fear River fish measured the concentration of PFOS in their serum. The activity of lysozyme and AST enzymes in these fish were also measured. A scatterplot of lysozyme activity vs serum PFOS is plotted in Figure B, and AST activity vs serum PFOS is plotted in Figure C. The graphs also show trend lines (solid black line) and confidence intervals for the trend line (dotted line). The scientists want to know what their results show. What is the correct interpretation of Figure A?

- Higher levels of serum PFOS are associated with INCREASED lysozyme activity in Cape Fear River fish
- Higher levels of serum PFOS are associated with DECREASED lysozyme activity in Cape Fear River fish
- There is no identifiable relationship between serum PFOS and lysozyme activity in Cape Fear River fish
- Increased lysozyme activity causes higher levels of serum PFOS in Cape Fear River fish

Quiz

Station 1: Part 3

Answer the following questions about potable water treatment to help keep Wilmington's drinking water safe. The figure attached shows one of the steps of potable water treatment. Which step is shown, and what is the physical or chemical basis for this step?

- Coagulation/flocculation, charge
- Coagulation/flocculation, density
- Sedimentation, charge
- Sedimentation, density

In potable water treatment, slow sand filtration is a _____ process, while rapid sand filtration is a _____ process.

- biological, chemical
- biological, physical
- chemical, physical
- physical, biological

Which of the following correctly lists membrane filtration steps in the order of DECREASING pore size?

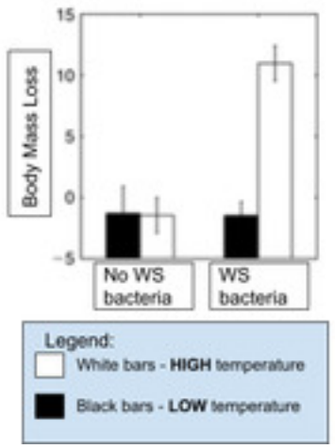
- Ultrafiltration, microfiltration, nanofiltration, reverse osmosis
- Microfiltration, ultrafiltration, nanofiltration, reverse osmosis
- Reverse osmosis, ultrafiltration, nanofiltration, microfiltration
- Reverse osmosis, microfiltration, ultrafiltration, nanofiltration

Which of the following infections is associated with poor water quality and inadequate water treatment?

- COVID-19
- **Cystic fibrosis**
- **Listeria**
- **Giardiasis (Giardia)**

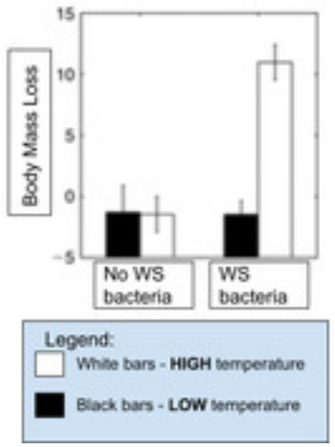
Quiz

Station 2



Abalone are a type of shellfish caught and sold in North Carolina. Over the past ten years, abalone around the world have been suffering from withering syndrome (WS), a bacterial infection that causes the muscular "foot" in abalone to wither away. Scientists studying WS collected data on the amount of body mass lost by abalone both with and without WS bacteria. Data was collected for abalone in high temperature waters and in low temperature waters. The data is graphed in the attached figure. Which of the following is the correct interpretation of this graph?

- WS bacteria INCREASE water temperature around infected abalone
- WS bacteria DECREASE water temperature around infected abalone
- HIGH temperature water makes abalone more susceptible to body mass loss due to WS bacteria
- LOW temperature water makes abalone more susceptible to body mass loss due to WS bacteria



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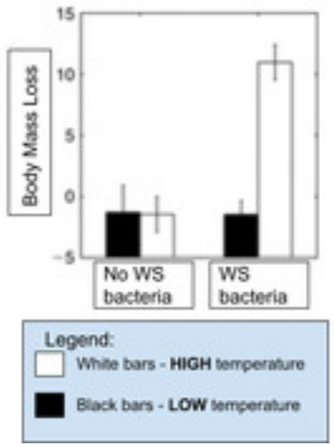
- Increased pH
- Increased aragonite saturation
- Low dissolved oxygen
- Low turbidity



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- Aragonite saturation
- pH
- Fecal coliform
- Temperature

Answer the following questions about measurement techniques for water quality parameters. Ocean (not lake or estuary) turbidity is measured in units of _____ and usually uses a _____.

- Grams per cubic centimeter, conductivity tester
- NTU, nephelometer
- Secchis, hygrometer
- Moles per liter, titrometer

Answer the following questions about measurement techniques for water quality parameters. Which of the following describes dissolved oxygen measurement using the Winkler method?

- The sample is “fixed” using chemical reagents, and then titrated with an iodine-based reagent to measure dissolved oxygen
- **An electrical current is run through the water sample, and the measured conductivity is used to infer dissolved oxygen content**
- **A disk is lowered into the body of water until the black and white pattern on the disk is no longer visible**
- **The sample is reduced using cadmium, and then the presence of a red coloring is used to measure dissolved oxygen**

Answer the following questions about measurement techniques for water quality parameters. Which of the following is NOT a method for measuring pH?

- **Test strips (pH indicators)**
- Ion-sensitive electrodes
- **Titration**
- **Manometers**

Open Ended Question

Now that we're in Bermuda, we hop on a boat in search of the organism in the image. What is the common name of the organism depicted?

Quiz

Station 3: Part 2

A unique feature of this organism is that they create a vacuum in their mouth and consume their prey, which include lobster and smaller fish, in this peculiar way.

- Upside down
- Alive
- Whole
- Cooked

This organism always spawn in December and January during this event and will migrate over 300 km to reach specific spawning places. What is this event that corresponds to Nassau grouper spawning?

- Full moon
- Winter solstice
- Sunset
- Sunrise

The population of this organism has greatly declined over the years and is now an endangered species. Which of the following is not a reason for this population decline?

- Invasive species
- Overfishing
- Habitat loss
- Catch and release

Open Ended Question

While visiting the coral reefs around Bermuda we notice this organism growing on some of the coral. Identify the organism in the image (common name only).

Quiz

Station 3: Part 4

Which of the following is NOT an example of a disturbance to the coral reef that would lead to rapid colonization by this organism?

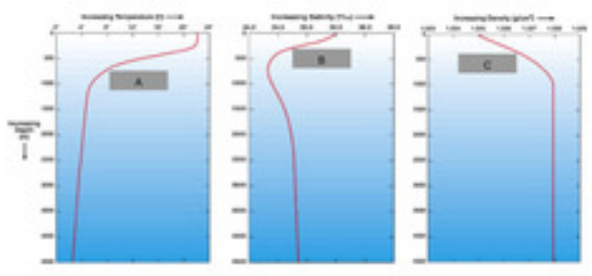
- Coral bleaching
- Crown of thorns starfish outbreaks
- Decreased nutrients
- Extremely low tides

Which of the following methods would be viable in controlling the populations of this organism to prevent coral reef colonization?

- Increasing nutrients
- Increasing herbivore populations
- Overfishing
- Introducing PFAS chemicals to kill algae

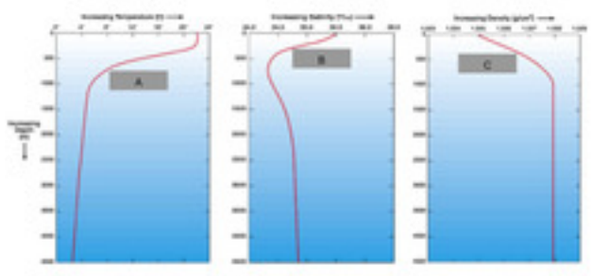
Quiz

Station 4: Part 1



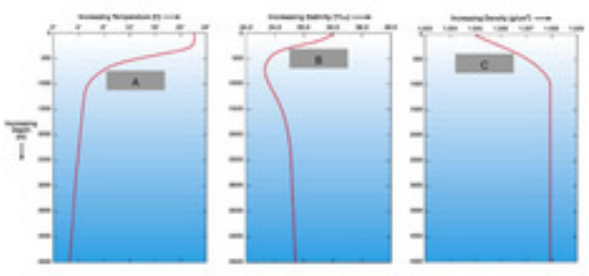
While we are taking water quality measurements out in the Rio de la Plata, we notice that there are strong gradients of certain water quality parameters. Use the attached graphs to answer the following questions. What is the appropriate name for the gradient indicated by A?

- Halocline
- Pycnocline
- Thermocline
- Chemocline



While we are taking water quality measurements out in the Rio de la Plata, we notice that there are strong gradients of certain water quality parameters. Use the attached graphs to answer the following questions. What is the appropriate name for the gradient indicated by B?

- Halocline
- Pycnocline
- Thermocline
- Chemocline

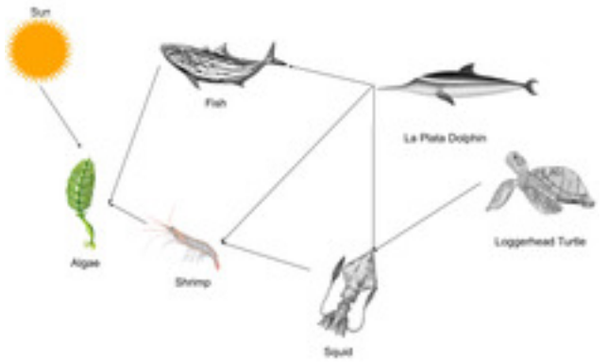


While we are taking water quality measurements out in the Rio de la Plata, we notice that there are strong gradients of certain water quality parameters. Use the attached graphs to answer the following questions. What is the appropriate name for the gradient indicated by C?

- Halocline
- Pycnocline
- Thermocline
- Chemocline

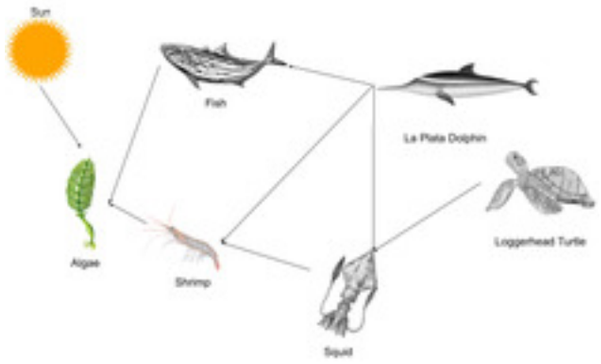
Quiz

Station 4: Part 2



Attached is an example food web of the Río de la Plata estuary. Use the the diagram to answer the following questions. In the recent months, there has been an increase in the La Plata dolphin population. What impact might this have on the loggerhead turtle population?

- Increase
- Decrease
- Stay the same
- Extinction



Attached is an example food web of the Río de la Plata estuary. Use the the diagram to answer the following questions. The Rio de la Plata is home to the La Plata River Dolphin, the only species of river dolphin that lives in the ocean and saltwater estuaries. The La Plata River Dolphin feeds on shrimp who in turn feed on algae. What percent of the energy in the algae is transferred to the La Plata River Dolphin?

- 0.1%
- 1.0%
- 10.0%
- 100.0%

The Rio de la Plata drainage basin is the second largest in South America taking up almost ¼ of the continent's surface area. Due to precipitation, over 57 million cubic meters of this material are carried into the Rio de la Plata every year. This material contributes to turbidity and requires dredging in the estuary to keep shipping lines open.

- Plastic waste
- Silt
- Animal waste
- PFAS and other chemicals

Off the eastern coast is one of the 5 ocean garbage patches in the world. The garbage patches correspond to ocean gyres which are caused by what natural phenomenon?

- Coriolis Effect
- El Nino
- Eutrophication
- Solar flares

Open Ended Question

As you and your partner swim through the reef, a researcher points out this organism to you. Identify the organism in the image above (common name only).

Quiz

Station 5: Part 2

Answer the following questions about the organism you identified. Why are these organisms a threat to coral reefs including the Great Barrier Reef?

- They tend to outcompete native sea star species
- They secrete toxic compounds that kill coral
- They replace fleshy macroalgae in the reef environment
- They rapidly eat large swaths of coral

Answer the following questions about the organism you identified. As you climb back onto the dive boat, the researchers fill you in on their investigation of this species. According to your Australian friends, laboratory research has demonstrated that the larvae of this species are more likely to survive when the abundance of phytoplankton in the reef environment is high. What phenomenon might create this abundance of phytoplankton in the reef environment, and what activities on land might cause it?

- Predation, overfishing
- Eutrophication, fertilizer runoff
- Hypoxia, sedimentation pollution
- PFAS contamination, leakage from landfills

Answer the following questions about the organism you identified. Your Aussie pals want your recommendation for how to deal with this problem. Which of the following is NOT an appropriate strategy for combating the spread of this organism in threatened reefs?

- **Injection with toxic chemicals, such as bile salts**
- **Physical removal of the organism from the reef by divers**
- Reduce overfishing of the organism's predators
- **Cutting the organism into pieces**

Open Ended Question

On your second dive, you come across this organism. Identify the organism in the image above. (Common Name only)

Quiz

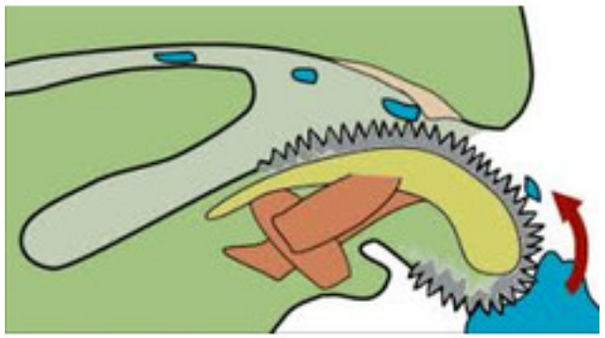
Station 5: Part 4

Answer the following questions about the organsim you identified. What is the relationship between this organism, and the previous organism you found on the Great Barrier Reef?

- This organism is closely related to the previous organism, as revealed by genetic analysis
- This organism is a prey species for the previous organism
- This organism is one of the only natural predators of the previous organism
- This organism provides the source of the venom present in the spines of the previous organism

Answer the following questions about the organsim you identified. The research team tells you that they are investigating the possibility of breeding this organism in captivity. Which of the following factors contributes most strongly to the difficulty in captive breeding of this species?

- **Incomplete understanding of triggers of larval metamorphosis**
- The organisms' use of internal fertilization
- **Lack of availability of food sources for the organism**
- **Difficulty collecting enough organisms to establish a breeding population**

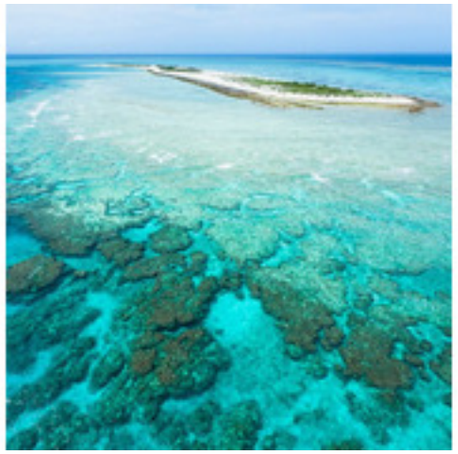


Answer the following questions about the organsim you identified. One of your scientist friends drops their research notes, and you find this sketch. What is the name of the structure shown in the diagram? It has many tiny teeth (denticles) used to tear through the skin of prey before releasing paralyzing saliva.

- Cilia
- Proboscis
- Odontophore
- Radula

Quiz

Station 6: Okinawa, Japan



Okinawa is an island surrounded by abundant coral reefs. It's particularly famous for rare blue coral. Unfortunately, Okinawa's coral reefs are under threat. Your job here is to learn more about these problems and analyze how the local government is responding to them. As you fly into Okinawa, you pass over Nagannu Island off the coast of the main island. What type of coral reef is seen in this aerial view?

- Barrier
- Fringing
- Atoll
- Estuary

The structure of a coral reef is composed of many coral polyps. Coral that form reefs are known as _____ and usually _____ contain zooxanthellae.

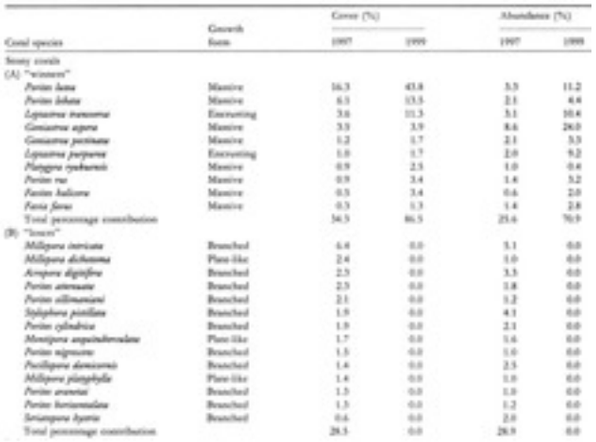
- Ahermatypic, do
- Ahermatypic, do not
- Hermatypic, do
- Hermatypic, do not

Which of the following correctly orders the four steps in the settlement of the scleractinian coral?

- Searching, recruitment, metamorphosis, asexual reproduction
- Asexual reproduction, searching, metamorphosis, recruitment
- Recruitment, searching, asexual reproduction, metamorphosis
- Metamorphosis, asexual reproduction, recruitment, searching

After landing in the city of Naha, you learn about threats to Okinawa's coral reefs. In 1998, unusually warm water temperatures in the water around Okinawa caused a thermal stress event that killed 85% of the coral around Sesoko Island. What did the thermal stress event cause?

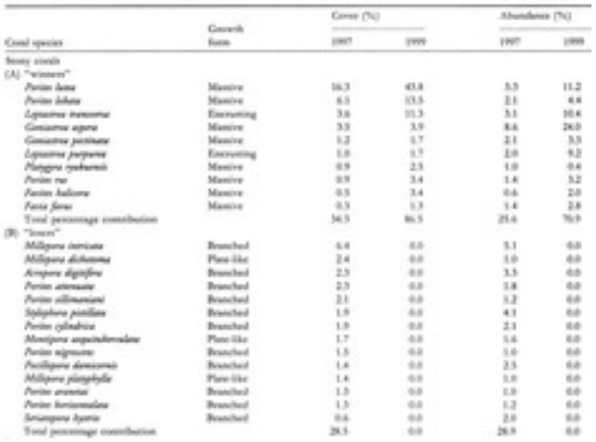
- Sedimentation pollution
- Eutrophication
- El Nino
- Coral bleaching



Coral species	Growth form	Cover (%) 1997	Cover (%) 1999	Abundance (%) 1997	Abundance (%) 1999
Stony corals					
(A) "winners"					
Porites lutea	Massive	16.3	43.8	3.3	11.2
Porites lobata	Massive	6.1	13.5	2.1	4.4
Leptastrea transversa	Encrusting	3.6	11.3	3.1	10.4
Goniastrea aspera	Massive	3.3	3.9	8.6	24.0
Goniastrea pectinata	Massive	1.2	1.7	2.1	3.3
Leptastrea purpurea	Encrusting	1.0	1.7	2.0	5.2
Platygyra sinensis	Massive	0.9	2.5	1.0	0.4
Porites rus	Massive	0.9	3.4	1.4	5.2
Faviids Indicone	Massive	0.5	3.4	0.6	2.0
Favia favus	Massive	0.3	1.3	1.4	2.8
Total percentage contribution		34.3	86.5	25.6	70.9
(B) "losers"					
Millepora intricata	Branched	6.4	0.0	5.1	0.0
Millepora dichotoma	Plate-like	2.4	0.0	1.0	0.0
Acropora digitifera	Branched	2.3	0.0	3.3	0.0
Porites attenuata	Branched	2.3	0.0	1.8	0.0
Porites nilimaniai	Branched	2.1	0.0	1.2	0.0
Stylophora pistillata	Branched	1.9	0.0	4.1	0.0
Porites cylindrica	Branched	1.9	0.0	2.1	0.0
Montipora angulatruncata	Plate-like	1.7	0.0	1.6	0.0
Porites nigrescens	Branched	1.5	0.0	1.0	0.0
Pocillopora damicornis	Branched	1.4	0.0	2.5	0.0
Millepora platyphylla	Plate-like	1.4	0.0	1.0	0.0
Porites aranetai	Branched	1.3	0.0	1.0	0.0
Porites horizontalata	Branched	1.3	0.0	1.2	0.0
Seriatopora hystrix	Branched	0.6	0.0	2.0	0.0
Total percentage contribution		28.5	0.0	28.9	0.0

Reef scientists in Okinawa measured the percent cover of hard corals in the reefs around Okinawa both before and after the thermal stress event. Their data, divided into “winning” and “losing” coral species, is tabulated below. Based on this data, what coral growth form appears to be most susceptible to thermal stress events?

- Branched
- Encrusting
- Massive
- Algae



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Goniastrea aspera	Massive	3.3	3.9	8.6	24.5
Goniastrea pectinata	Massive	1.2	1.7	2.1	3.3
Leptastrea purpurea	Encrusting	1.0	1.7	2.0	5.2
Platygyra yaeyamaensis	Massive	0.9	2.5	1.0	0.4
Porites rus	Massive	0.9	3.4	1.4	5.2
Faviids Indicone	Massive	0.5	3.4	0.6	2.0
Favia favus	Massive	0.3	1.3	1.4	2.8
Total percentage contribution		34.3	86.5	25.6	70.9
(B) "losers"					
Millepora intricata	Branched	6.4	0.0	5.1	0.0
Millepora dichotoma	Plate-like	2.4	0.0	1.0	0.0
Acropora digitifera	Branched	2.3	0.0	3.3	0.0
Porites attenuata	Branched	2.3	0.0	1.8	0.0
Porites nilimanni	Branched	2.1	0.0	1.2	0.0
Stylophora pistillata	Branched	1.9	0.0	4.1	0.0
Porites cylindrica	Branched	1.9	0.0	2.1	0.0
Montipora angulatruncata	Plate-like	1.7	0.0	1.6	0.0
Porites nigrescens	Branched	1.5	0.0	1.0	0.0
Pocillopora damicornis	Branched	1.4	0.0	2.3	0.0
Millepora platyphylla	Plate-like	1.4	0.0	1.0	0.0
Porites evermai	Branched	1.3	0.0	1.0	0.0
Porites horizontalata	Branched	1.3	0.0	1.2	0.0
Seriatopora hystrix	Branched	0.6	0.0	2.0	0.0
Total percentage contribution		28.5	0.0	28.9	0.0

Followup studies decades after the event determined that despite their local extinction in 1998, some species of coral (such as Acropora) had returned to the reef and become the dominant species at several locations around Okinawa. What is the most reasonable explanation for this?

- Acropora has a lower reef recruitment rate than competitor species
- Acropora exhibits faster growth than other species
- Predators of acropora went extinct in Okinawa following the 1998 event
- A few surviving members of Acropora developed heat tolerance

In 1994, the local government passed the Okinawa Prefecture Red Soil Erosion Prevention Ordinance, a set of laws designed to prevent the situation in the image. What threat to Okinawa's coral reefs does this law address? What is the main way that this threat harms coral?

- Eutrophication, cause algal bloom
- Eutrophication, prevent photosynthesis
- Sedimentation pollution, cause algal bloom
- Sedimentation pollution, prevent photosynthesis

Open Ended Question

While scuba diving, we find this organism. Indonesia is one of the largest exporters of this organism. Give the common name of this organism.

Quiz

Station 7: Indonesia Part 1

This organism performs a function similar to earthworms where they take in the ocean sediment and excrete it out in a process known as _____.

- Biotilling
- Aeration
- Bioturbation
- Perturbation

This organism is capable of defending itself through a process where it releases clusters of fine tubes that are released through the anus. These tubes that become longer and adhesive when in contact with the saltwater are known as _____.

- Cuverian tubules
- Fallopian tubes
- Eustachian tubes
- Cathode ray tubules

Open Ended Question

The largest one of these organisms ever discovered was found off the coast of Sumatra, Indonesia weighing more than 500 lbs. Indonesia may also be the only place in the world with all 11 species of this genus. Give the common name of this organism.

Quiz

Station 7: Indonesia Part 2

On the surface of the organism, what are the names of the dark spots? An example can be seen in the red circle.

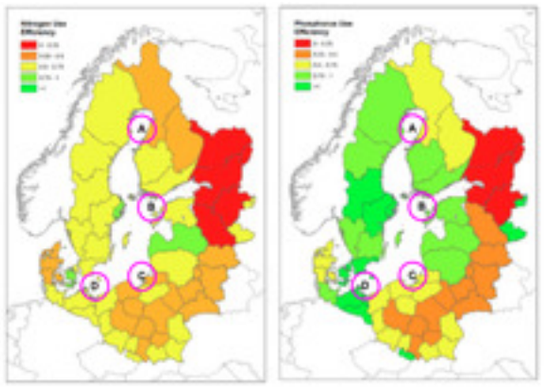
- Oculi
- Eyeballs
- Photonics
- Apertures

Which of the following is NOT a reason for the bright coloration and patterns of this organism.

- Prevent UV light damage
- Warn predators about poison
- Improve photosynthesis of zooxanthellae
- Camouflage

Quiz

Station 8: Baltic Sea Part 1

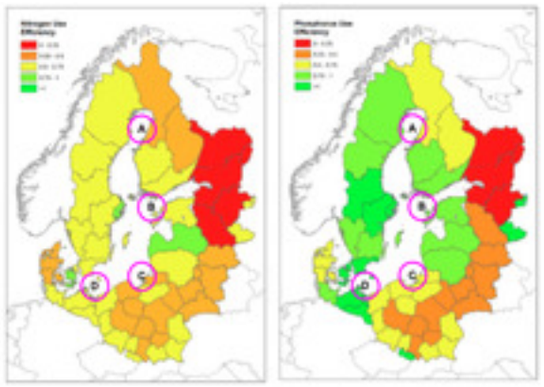


Nitrogen

Phosphorus

Use the maps to answer questions 1-2. In which area might we expect the highest levels of nutrients and eutrophication?

- A
- B
- C
- D



Nitrogen

Phosphorus

Compared to other places we've visited so far, which of the following is NOT a reason that eutrophication is particularly bad in the Baltic Sea?

- Surrounded by land
- Limited water exchange with the North Sea
- Large amounts of agriculture
- Higher latitudes naturally have more nutrients in the water

In the photic zone, the concentration of nitrogen and phosphorus are generally low. Why?

- Organisms take up the nutrients
- Not enough runoff
- Lots of rainfall
- Absorbed into the soil

Open Ended Question

As a result of eutrophication, this event shown in the image happens semiannually, once in the spring and once in the summer. Identify this event.

Quiz

Station 8: Baltic Sea Part 2

What type of organism forms this event?

- Dinoflagellates
- Diatoms
- Fleshy Algae
- Cyanobacteria

Which of the following is NOT an effect this event will have on the environment?

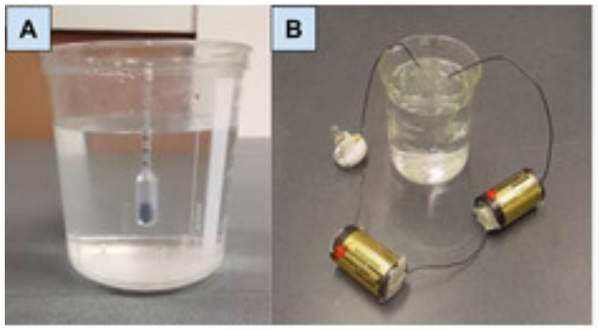
- Depleted oxygen
- Increased nutrients
- Decreased sunlight penetration
- Toxins released into the water

Quiz

Station 9: Dead Sea

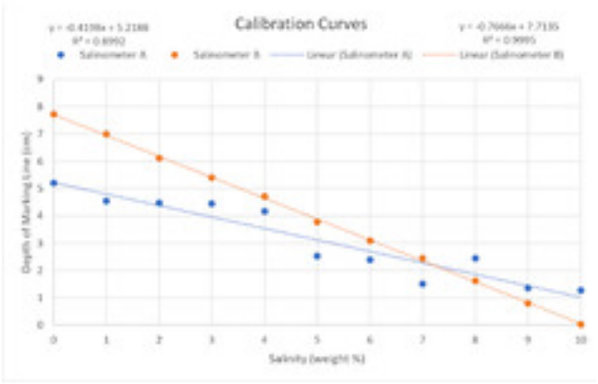
The water of the Dead Sea is extremely salty--34.2% to be exact! This salinity is so high that it's very easy to float (and even difficult to stand on two feet for some people). The same principle that causes this floating effect also explains how many salinometers work. Complete the explanation: Higher salinity increases the _____ of the water, thereby _____ the buoyant force and causing objects to float.

- weight, increasing
- weight, decreasing
- specific gravity, increasing
- specific gravity, decreasing



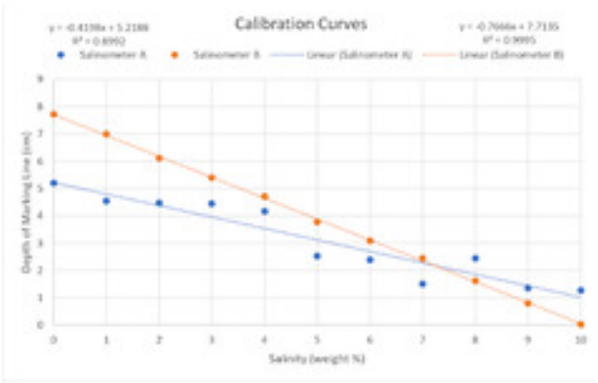
Examine the two devices for measuring salinity pictured above. Which of the following is true?

- Both A and B are salinometers, but only A is a hydrometer
- Both A and B are salinometers, but only B is a hydrometer
- Both A and B are salinometers, but only A is a salinometer
- Both A and B are salinometers, but only B is a salinometer



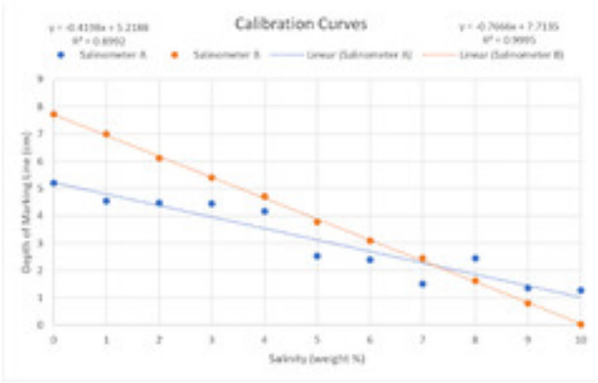
Your last task on this Amazing Water Quality Race is to measure the salinity of an unknown water sample. But wait... it looks like you and your partner forgot your salinometer! Oh no! Luckily, two tourists brought spare salinometers with them on their trip to the Dead Sea (always good to be prepared). They agree to let you borrow them, and helpfully provide you with the following calibration data, which includes trend lines generated by linear regression. Answer the following questions based on the calibration data provided. Based on its salinity, this sample most likely came from which water source?

- The Dea Sea
- The Mediterranean Sea, which is connected to the Atlantic
- The upper Jordan River, a freshwater portion of the river
- Drinking water from Amman, Jordan (a nearby city)



Assume you calculated a salinity of 10% (weight percent). What is this value in ppt (parts per trillion)?

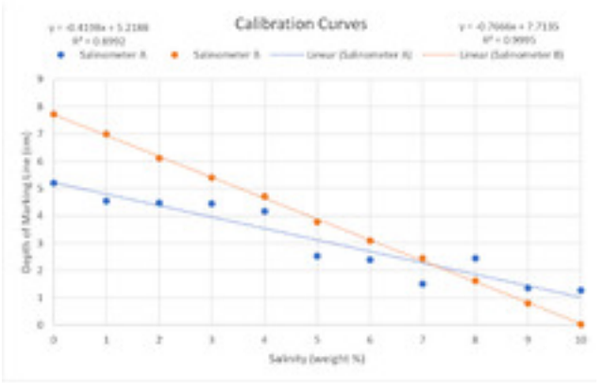
- 1 ppt
- 10ppt
- 100ppt
- 1,000 ppt



Which salinometer appears to be more precise on average?

- A
- B
- Both are perfectly 100% precise--these tourists really know their salinometers!
- Neither salinometer is precise! Why are we using these random peoples' salinometers???

Open Ended Question



You measure a depth of the marking line of 3.9 cm for Salinometer A, and 5.0 cm for Salinometer B. To the nearest tenth of a percent, estimate the salinity of the sample. You will receive credit for being within 0.5%.