

PART A Station 1 Division C

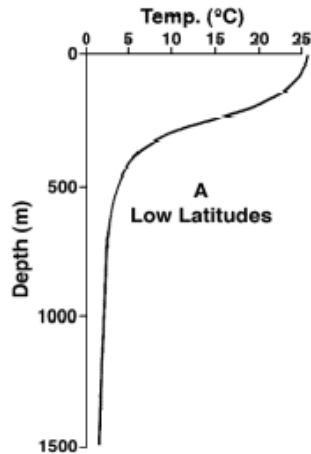
Choose the best answer and mark it on your answer sheet. 1 point each question
DO NOT WRITE ON THE TEST

1. In general, in the ocean, the most highly-exploited and longest-lived organisms are found at the _____ trophic levels, whereas on land it is the _____ that are longer-lived and more widely harvested.
 - a. Bottom, heterotrophs
 - b. Bottom, autotrophs
 - c. Middle, heterotrophs
 - d. Top, heterotrophs
 - e. Top, autotrophs
2. Consider the following generalized oceanic food chain: phytoplankton → zooplankton → planktivores → piscivores. If overfishing occurs, which type(s) of species will increase in abundance?
 - a. Planktivores
 - b. Phytoplankton and planktivores
 - c. Phytoplankton, zooplankton, planktivores
 - d. Piscivores
 - e. Phytoplankton, zooplankton, planktivores, piscivores
3. Overfishing can artificially introduce _____ into a food web.
 - a. Top-down control
 - b. Pollution
 - c. Trophic cascades
 - d. Nutrient spiraling
 - e. None of the above
4. A smaller mean predator: prey mass ratio (PPMR) results in
 - a. Overfishing
 - b. Shorter food chains
 - c. Longer food chains
 - d. Meta-population formation
 - e. None of the above
5. Which of the following are difficulties involved in constructing and examining a marine food web?
 - a. Populations are dispersed over a very large area
 - b. A shift in PDO or NAO can shift the distributions of species
 - c. Individuals of species often undergo substantial changes in their body size over their lifetime
 - d. A and B only are relevant difficulties
 - e. All of the above are relevant difficulties
6. _____ is a strategy used by zooplankton to avoid predation. They generally move to the _____ of the ocean during the _____.
 - a. Dispersion, warmer areas, night
 - b. Hibernation, deeper areas, winter
 - c. Hibernation, warmer areas, winter
 - d. Diel vertical migration, surface, day
 - e. Diel vertical migration, deeper areas, day
7. In general, _____ is the limiting nutrient in estuarine and marine waters.
 - a. Phosphorus
 - b. Nitrogen
 - c. Silicon
 - d. Sulfur
 - e. Carbon

PART A Station 2 Division C

Choose the best answer and mark it on your answer sheet. 1 point each question
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Questions 8-13 refer to Figure 1, shown below.



http://earthguide.ucsd.edu/virtualmuseum/Glossary_Climate/gencircocean.html

8. What is the name given to the abrupt change in temperature seen on the graph above?
9. A zone of abrupt change in salinity accompanies your answer to #9. What is this zone called?
10. How does salinity change with depth?
11. Your answers to 8 and 9 can combine to produce a zone of rapid change of one other property of water. What is this zone called?
12. What is this other property of water?
13. At high latitudes, what dramatic change might you see in Figure 1?

PART A Station 3 Division C

Choose the best answer and mark it on your answer sheet. 1 point each question
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14. In general, estuaries may have a more _____ food web than a _____ food web. The latter type generally dominates in the ocean.
- a. Grazing-focused, microbial
 - b. Microbial-focused, detritus
 - c. Grazing-focused, detritus
 - d. Detritus-focused, grazing
 - e. There are no major differences.
15. Canals can produce which of the following effects on estuaries?
- a. Restoration of sheet flow
 - b. Saltwater intrusion
 - c. Development of anoxic waters
 - d. Facilitation of spread of non-native species.
 - e. Three of the choices can happen.
16. Elasmobranch fishes accomplish _____ by retaining highly concentrated urea.
- a. Hypotonicity
 - b. Osmosis
 - c. Osmoregulation
 - d. Filtration
 - e. Both a and c

Questions 17–20 refer to Figures 2 and 3, shown below.

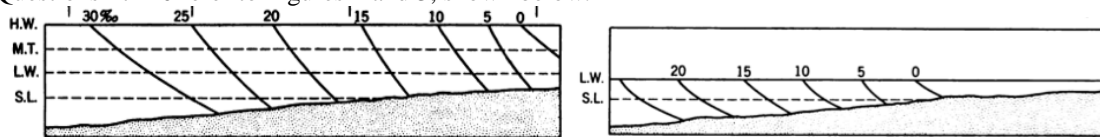


Figure 2: Hypothetical estuary. Percentages refer to salinity. HW= High water, MT= Midtide, LW= Low water, SL= Sublittoral

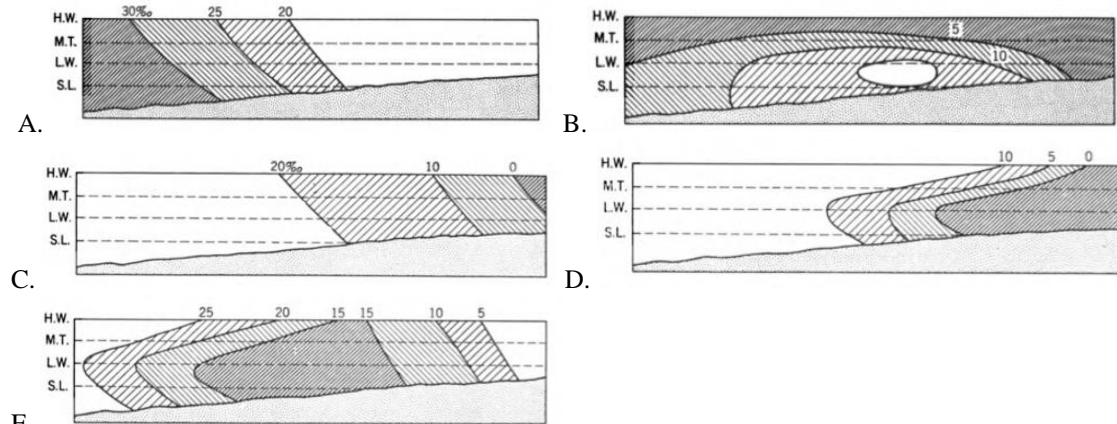


Figure 3: Distribution in hypothetical estuary (Fig. 2) of organisms having different types of salinity limitations. Darkest shading represents most favorable conditions.

Marine Ecology, by Hilary B. Moore

17. Which of the diagrams in Figure 3 represents the distribution of a marine organism limited by the availability of water above a certain salinity at some part of the tidal cycle?
18. Which of the diagrams in Figure 3 represents the distribution of a brackish-water organism limited toward the upper part of the estuary by the occurrence of water of high salinity and toward the ocean by the occurrence of water of low salinity?
19. Which of the diagrams in Figure 3 represents the distribution of an organism limited only by the range of salinities encountered during the tidal cycle?
20. Which of the diagrams in Figure 3 represents the distribution of a fresh-water organism limited by the occurrence at some stage of the tidal cycle by water of sufficiently low salinity?

PART A Station 4 Division C

Choose the best answer and mark it on your answer sheet.

DO NOT WRITE ON THE TEST

1 point each question

21. Which of the following characteristics is true of coastal plain estuaries?
 - a. They are narrow
 - b. They are shallow (<30 m)
 - c. They have weak tides
 - d. They have strong stratification
 - e. An example is Puget Sound
22. Which of the following is the best example of an r-selected species?
 - a. Herring Gull
 - b. Great Blue Heron
 - c. Salmon
 - d. Diatoms
 - e. All of the above are r-selected species.
23. Sediment pollution in an estuary can be caused by
 - a. Fires
 - b. Cattle
 - c. Loss of floodplains
 - d. Two of the above can cause sediment pollution
 - e. All of the above can cause sediment pollution
24. Which of the following is not true of point sources of pollution?
 - a. Include combined sewer systems and concentrated animal feeding operations
 - b. Require NPDES permits
 - c. Include effluent from oil refineries
 - d. Include salt from irrigation practices and toxic chemicals from urban runoff
 - e. All of the above are characteristics of point sources.
25. An important process in anaerobic sediments occurs when bacteria take up and reduce _____, leading to the end product of H₂S.
26. The most strongly saline areas of an estuary are referred to by the term _____.
27. The least saline areas of an estuary are referred to by the term _____.

PART B Station 5 Division C

Choose the best answer and mark it on your answer sheet.

DO NOT WRITE ON THE TEST

1 point each question

1. Corals, like all cnidaria, have
 - a. A gastrovascular cavity with only one opening
 - b. Medusa
 - c. A circle of tentacles
 - d. a and c
2. These cells contain toxins which are used for catching prey.
 - a. Mesoglea
 - b. Nematocysts
 - c. Coenosarcs
 - d. Theca
3. The highest point of a reef is the
 - a. Algal ridge
 - b. Reef flat zone
 - c. Fore reef zone
 - d. Buttress zone
4. Which of the following is in the correct order from youngest to oldest?
 - a. Barrier reef, fringing reef, atoll
 - b. Atoll, barrier reef, fringing reef
 - c. Atoll, fringing reef, barrier reef
 - d. Fringing reef, barrier reef, atoll
5. Planulae show
 - a. Positive phototaxis
 - b. Negative phototaxis
 - c. Positive geotaxis
 - d. None of the choices
6. Slow growing corals use aggressive behaviors while fast growing coral use
 - a. Direct interaction
 - b. Overtopping
 - c. a and b
 - d. None of the choices

PART B Station 6 Division C

1 point each question

Choose the best answer and mark it on your answer sheet.

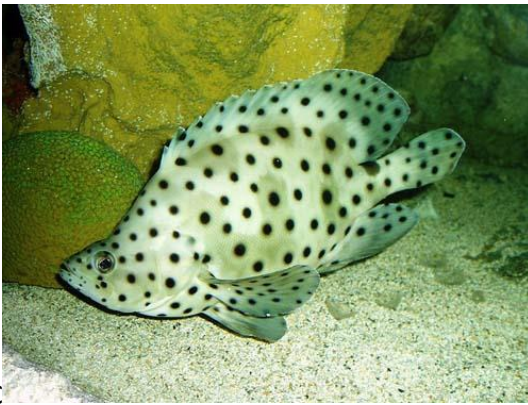
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A



B



C



D



E



F

7. Which of the pictured organisms spawns at aggregation sites?
 - a. A, C and D
 - b. C, D, E and F
 - c. C, E and F
 - d. A, C, D and F
8. Which of the pictured organisms has symbionts living on its mouthparts?
9. Which of the pictured organisms are listed as species of concern?
 - a. C, D, E and F
 - b. D, E and F
 - c. D and F
 - d. E and F
10. Which of the pictured organisms is listed as endangered?
11. Which of the pictured organisms is related to starfish?
12. Which of the pictured organisms is sequentially hermaphroditic with most individuals starting as males?

PART B Station 7 Division C

1 point each question

Choose the best answer and mark it on your answer sheet.

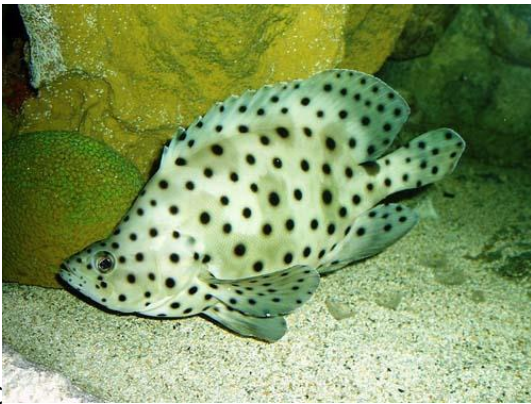
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A



B



C



D



E



F

13. Which of the pictured organisms uses the cardioid escape reaction?
14. Males of this organism must migrate to find females.
15. This organism occasionally preys on the crown of thorns starfish.
16. This organism has a larval stage known as the echinopluteus.
17. Individuals of this species may live for up to 40 years.
18. When a female of this type of organism is carrying eggs she is referred to as “berried.”

PART B Station 8 Division C

Choose the best answer and mark it on your answer sheet. 1 point each question
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Specimen	Species	Length (in)	Biomass (g)
1	A	5	95
2	A	5	100
3	A	6	120
4	A	7	125
5	B	8	130
6	B	8	135
7	B	9	135
8	C	8	130
9	C	7	125
10	C	9	140
11	C	10	140
12	C	9	135
13	C	7	120
14	C	12	160
15	C	8	130
16	C	10	150
17	D	2	75
18	D	3	80

19. Eighteen fish were caught at Cool Coral Reef. The data collected is presented in the above table. What is the species richness?
20. What is the median catch length?
21. What is the abundance?
22. What is the biomass range?
23. The three stages of coral reef formation in order are
24. _____ involves dragging a fishing net along the sea bottom and can damage coral reefs.
25. The chemical _____ is sometimes used to stun and capture live fish and can kill coral reefs.
26. _____ is caused primarily by cyanobacteria and appears to consume coral tissue until only a skeleton remains.
27. The US Coral Reef Task Force aims to understand coral reef ecosystems and _____.

PART C Station 9 Division C

Answer the following questions using the given information. 1 point each question
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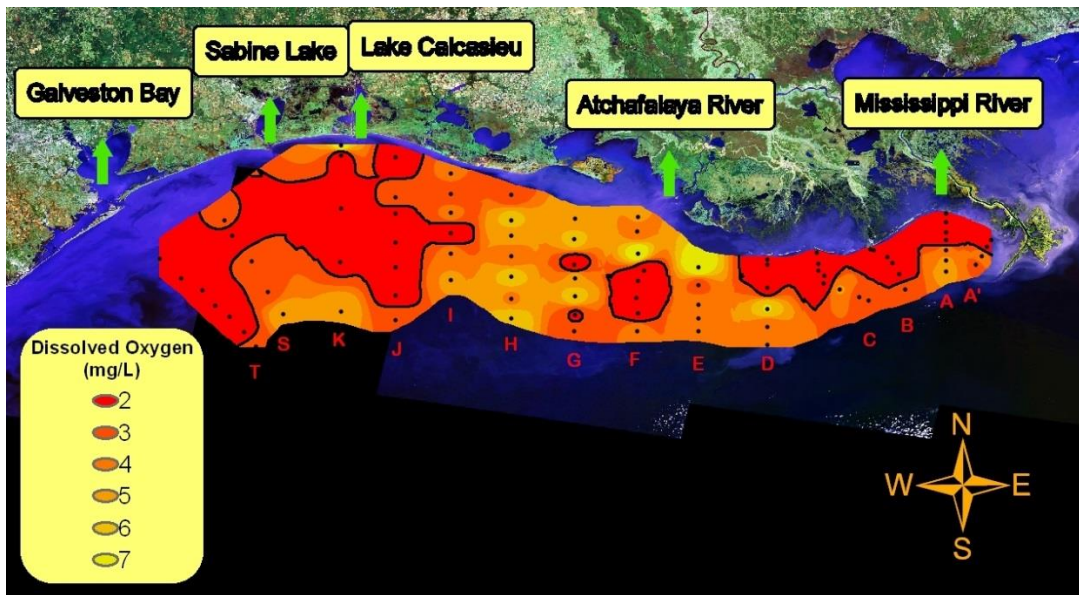


Figure 1

1. Referring to figure 1, which of the following is true?
 - a. The DO levels in the Gulf of Mexico are good.
 - b. The DO levels in the Gulf of Mexico are mainly good, with a few areas showing mild hypoxia.
 - c. The DO levels in the Gulf of Mexico are not good, with most areas showing mild hypoxia.
 - d. The DO levels in the Gulf of Mexico are not good, with most areas showing moderate to severe hypoxia.
2. Which of the transects, B, F, I or T, shows the most severe hypoxia?
3. Aragonite saturation levels are
 - a. Highest at low altitudes
 - b. Highest at high altitudes
 - c. Optimal when around a value of 1
 - d. Optimal when around a value of 10
4. Aragonite saturation
 - a. Falls with increasing CO₂ levels
 - b. Rises with increasing CO₂ levels
 - c. Is not affected by CO₂ levels
5. Looking at the test tubes 1-4, which has the highest salinity? Hint- 2uS/cm is the same as 1 mg/L.
6. What is the reading of salinity for tube 1 in mg/L?
7. A series of dilutions were prepared in 300ml BOD bottles. What is the BOD for bottle 1? Show your work.

Bottle #	mL Seed	Initial DO	Final DO	Depletion
1	3	7.95	5.20	2.75
2	6	7.95	3.85	4.10
3	9	7.90	2.40	5.50
4	12	7.85	1.35	6.50

8. What is the BOD for bottle 4? Show your work.

PART C Station 10 Division C

Answer the following questions using the given information. 1 point each question
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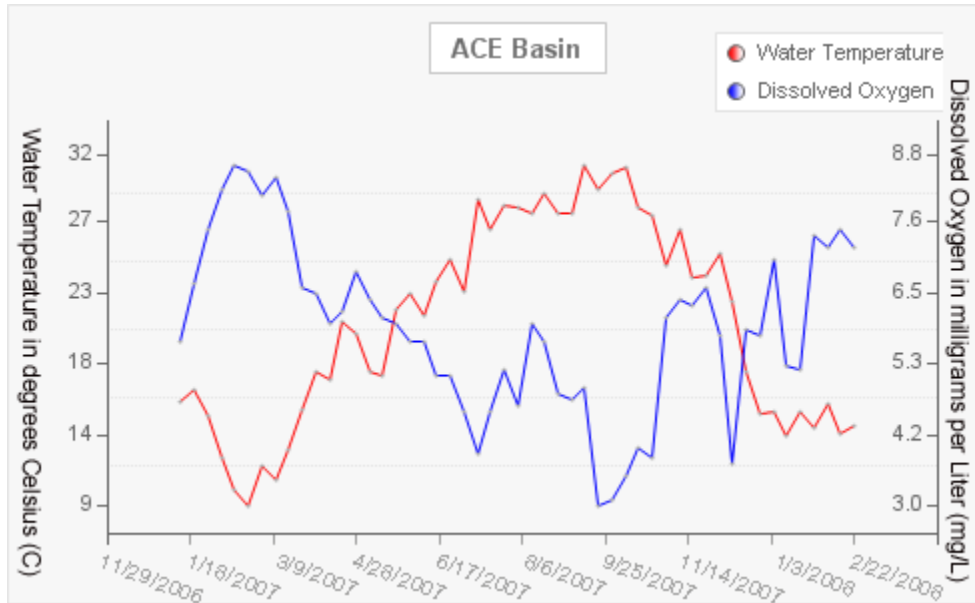


Figure 2

9. Referring to Figure 2 above **in your answer**, what is the relationship between water temperature and dissolved oxygen?
10. What is the range for water temperature in Figure 2?
11. _____ brings nitrate rich water to the surface in coastal areas.
12. The presence of high amounts of nitrate salts can affect _____ readings.
13. The primary sink for phosphorus in the ocean is
 - a. Sediment
 - b. Organisms
 - c. Coral reefs
 - d. All of the above.
14. Phosphorus is limiting in marine ecosystems because
 - a. It tends to evaporate
 - b. It tends to oxidize
 - c. It tends to absorb to sediments
 - d. None of the above.
15. Estuaries usually have _____ levels of phosphorus compared to freshwater systems.
 - a. Higher
 - b. Lower
 - c. The same
16. Nitrate availability in the ocean sets the limit for _____ growth, and therefore primary productivity.
 - a. Benthic macroinvertebrate
 - b. Phytoplankton
 - c. Fish
 - d. Coral reef

PART C Station 11 Division C

Answer the following questions using the given information. 1 point each question
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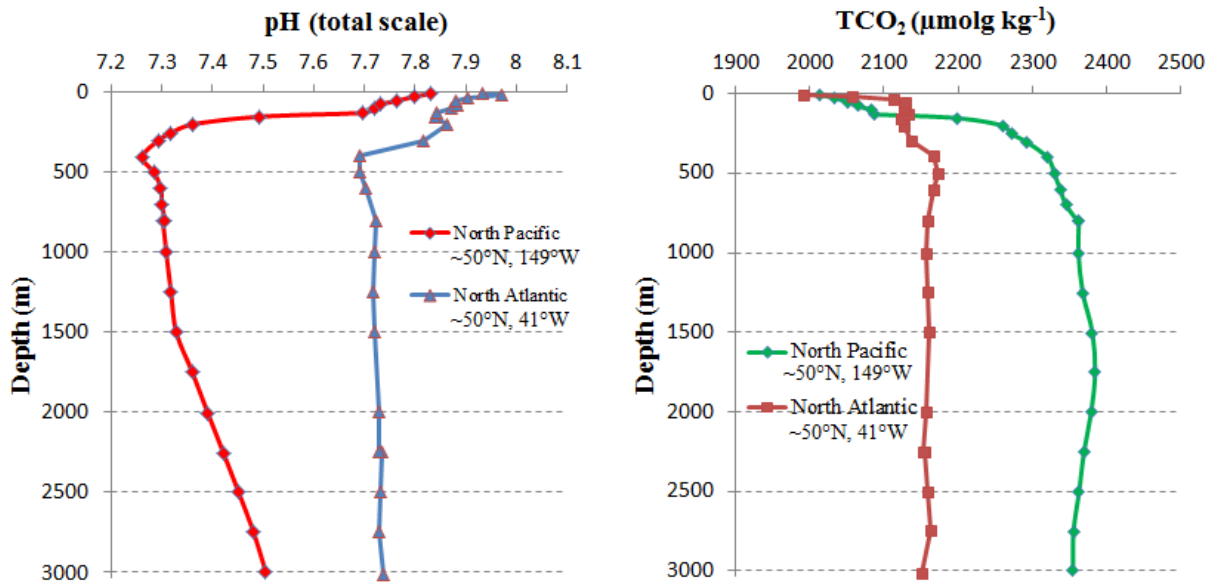


Figure 3

17. Which of the following is true according to figure 3?
 - a. As water depth increases, pH decreases and TCO₂ increases.
 - b. As water depth increases, pH increases and TCO₂ increases.
 - c. Until around 500m pH decreases and TCO₂ increases.
 - d. Until around 500m pH decreases and TCO₂ decreases.
18. Which of the following is true according to figure 3?
 - a. CO₂ when dissolved in water forms a weak base, causing pH to rise.
 - b. CO₂ when dissolved in water forms a weak acid, causing pH to rise.
 - c. CO₂ when dissolved in water forms a weak base, causing pH to fall.
 - d. CO₂ when dissolved in water forms a weak acid, causing pH to fall.
19. Total solids takes into account
 - a. Suspended solids
 - b. Dissolved solids
 - c. Mineralized solids
 - d. a and b
20. Suppose from a sample of 500 mls you obtain 100 mg of dried residue. How many mg of total solids per liter are in the sample? Show your work.
21. A Secchi disc is dropped into an estuary to a depth of 4 feet. Approximately how deep will photosynthesis be able to occur? Explain your answer.
22. A turbidity measurement is often recorded instead of a _____ measurement due to the fact that is it easier to perform.
23. A fecal coliform measurement above _____ is considered unsafe.

PART C Station 12 Division C

24. The last question requires you to demonstrate the use of your homemade salinometer. (4 points possible)
- a. Show your salinometer to the event supervisor or designated volunteer and have them initial your answer sheet. (1 point)
 - b. You may wish to calibrate your salinometer prior to testing the unknown solution.
 - c. Record the concentration of solution A to the nearest tenth of a percent, for example, 8.5%. (3 points)

Tie Breaker Questions- Will only be graded in the event of a tie.

1. A grouper performs head shaking in the presence of a morey eel. What is likely to happen?
2. What is the chemical formula for aragonite?
3. Estuary names typically do not contain the word estuary. Estuaries are instead known by many other names. List as many common terms used to “name” an estuary as you can think of.