UNIT 14 LEARNING OBJECTIVES

See the Bio 183 Unit 14 webpage for the learning objectives.

UNIT 14 ACTIVITIES

Step 1: Read Chapters 15 and 16 in your textbook (*Marine Biology*, 9th ed., by Castro and Huber) and answer the questions in these worksheets. For hints or to double-check your answers, go to the Biology 183 website.

Step 2: For lab points, do the lab activity entitled “Primary Productivity.” There are worksheets for this activity later in this packet. Directions are on the Biology 183 website. This lab can be completed anywhere that you have internet access. When you have completed the lab activity, take your results to the front desk in the Biology Learning Center to receive lab points.

Step 3: Optional: Check out the “Open Ocean” and “The Deep” DVDs from the front desk at the Biology Learning Center and watch it on one of the computers in the Center. The DVD cannot be taken out of the BLC. The show is a little less than an hour long and you can watch as little or as much of it as you want. Be sure to use headphones while watching so as not to disturb your neighbors! The program is part of an 8-episode series created by the British Broadcasting Service in 2002 called “The Blue Planet.”

Step 4: Optional: Read “Ocean Drifters,” a short article from Audubon Magazine with some absolutely amazing photos of planktonic organisms. Article and photos are available on the Unit 14, step 4 web page.

Step 5: Prepare for the Unit 14 exam. The exam will consist of 37 multiple-choice questions. The questions will be “factual” in nature (to assess whether you learned the facts in this unit). Some of these 37 questions may come from material you learned during your lab activities. To prepare for the 37 “factual” questions, try the multiple-choice practice quiz for Unit 14. Go to the Biology 183 website for the link to this practice quiz. The answers are at the end of the practice quiz. The last 3 questions will be geography-related questions.

Step 6: Come in to the Biology Learning Center to take your Unit 14 exam. The exam will consist of 40 multiple-choice questions.
STEP 1: TEXTBOOK WORKSHEETS

Chapter 15
1. Review: What is the pelagic realm? (Chapter 10)

2. How do pelagic organisms live?

3. Describe the epipelagic zone and relate it to the photic zone.

4. What are the two subdivisions of the epipelagic zone?
   1
   2

5. Briefly describe the neritic subdivision of the epipelagic zone.

6. Briefly describe the oceanic subdivision of the epipelagic zone.

The Organisms of the Epipelagic
7. How do epipelagic ecosystems differ from coastal ecosystems?

8. What types of feeding strategies dominate the epipelagic zone?

9. Review: What are the plankton? (Chapter 10, Fig. 10.11)
The Organisms of the Epipelagic: The Plankton: A New Understanding

10. What are two ways that plankton are categorized? (Fig. 15.2)

1

2

The Organisms of the Epipelagic: The Phytoplankton

11. Describe the most common primary producers in the epipelagic realm.

12. Discuss the importance of the primary production that occurs in the epipelagic zone to the earth as a whole.

13. What are two important types of net phytoplankton in the epipelagic zone?

1

2

14. Review: What is diatom? (Chapter 5) What is a dinoflagellate? (Chapter 5)

15. What is a phytoplankton bloom?

The Organisms of the Epipelagic: The Zooplankton

16. Briefly describe the typical epipelagic food chain.

17. What is the importance of protozoan zooplankton?

18. Review: What are protozoans? (Chapter 5)
19. Review: What is a foraminiferan? What is a radiolarian? (Chapter 5)

20. Review: What are copepods? (Chapter 7)


22. Why are large animals, like jellies and siphonophores and even some fishes, considered to be part of the zooplankton?

The Organisms of the Epipelagic: The Nekton

23. List at least six members of the epipelagic nekton.
   1
   2
   3
   4
   5
   6

24. Describe the planktivorous nekton.

25. Describe how size relates to food choice among the nekton.
Living in the Epipelagic

26. What are two challenges faced by epipelagic organisms?
   1. 
   2. 

Living in the Epipelagic: Staying Afloat

27. How do organisms in the epipelagic zone avoid sinking?

28. Name two ways that epipelagic organisms increase their drag (or water resistance).
   1. 
   2. 

29. Briefly describe three ways that epipelagic organisms increase their buoyancy.
   1. 
   2. 
   3. 

30. Review: What is a swim bladder? (Chapter 8, Fig. 8.12)

31. Name three types of marine organisms that store lipids in order to increase buoyancy.
   1. 
   2. 
   3. 

32. What is a drawback of using a swim bladder to control buoyancy?

33. What is the neuston?

34. What is the pleuston?
35. What is the most common way that the neuston and pleuston float?

36. Use the by-the-wind sailor (*Velella*) as an example of how the pleuston are adapted to life at the sea surface. (Fig. 15.14)

*Living in the Epipelagic: Predators and Their Prey*

37. What are four areas of adaptation related to predator/prey strategies that are important in the epipelagic?
   1. 
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   4. 

38. What are three strategies used for epipelagic organisms to aid in sensing their environment? (Fig. 15.17 and 15.18)
   1. 
   2. 
   3. 

39. Review: What is the lateral line in fishes? (Chapter 8, Fig. 8.19)

40. What are three types of protective coloration used by epipelagic organisms? (Fig. 15.18)
   1. 
   2. 
   3. 

41. Describe countershading.

42. Why does the epipelagic contain the world’s most powerful swimmers?
43. What adaptations do epipelagic fishes have for fast swimming?

44. How does vertical migration help some epipelagic organisms avoid predation?

*Epipelagic Food Webs*

45. Why are epipelagic food webs important to understand?

*Epipelagic Food Webs: Trophic Levels and Energy Flow*

46. What are three reasons that epipelagic food webs are difficult to understand?
   (Fig. 15.24)
   1
   2
   3

47. Describe briefly the length of epipelagic food chains.

48. How is the efficiency of energy transfer between steps in epipelagic food chains typically different from that of other ecosystems?

49. Briefly describe dissolved organic matter (DOM).
Epipelagic Food Webs: The Microbial Loop

50. What is the role of DOM in the microbial loop? (Fig. 15.25)

51. Briefly describe the microbial loop. (Fig. 15.25)

Epipelagic Food Webs: Patterns of Production

52. What is the base of epipelagic food webs?

53. What two factors influence primary production in the epipelagic zone?
   1
   2

54. Briefly discuss two cases when light may limit photosynthesis in the epipelagic zone.
   1
   2

55. Compare nutrient levels in the epipelagic with those in deep waters. (Figs. 15.27 and 15.28)

56. Why are coastal epipelagic areas often not nutrient limited?

57. Why are oceanic waters at high latitudes highly productive?
58. Describe the seasonal cycle of primary production at high latitudes. (Fig. 15.29)

59. What is upwelling? How does it affect nutrient levels and primary production? (Figs. 15.30, 15.31, 15.32, and 15.33)

60. Describe productivity in epipelagic coastal waters.

61. Describe productivity in epipelagic equatorial waters.

62. Describe productivity in epipelagic polar and cold temperate regions.

63. Describe productivity in the epipelagic central gyres of the oceans.

We are going to skip the last few pages of Chapter 15—It’s long enough as it is!  

Chapter 16  
1. Briefly describe the mesopelagic zone and the deep ocean.

2. What feature does the communities of the mesopelagic and deep ocean share?
3. Compare the abundance of life in the mesopelagic, deep sea, and surface layers of the ocean. (Fig. 16.1)

4. What is the source of oxygen in the mesopelagic zone and the deep sea?

5. Review: What is the thermohaline circulation? (Chapter 3, Fig. 3.25)

The Twilight World
6. Describe how light changes with depth in the mesopelagic zone.

7. Review: What is the thermocline? (Chapter 3, Figure 3.22)

The Twilight World: The Animals of the Mesopelagic
8. What are mid-water animals?

9. What are five common types of zooplankton in the mesopelagic zone? (Figs. 16.2, and 16.3)
   
   1  3  5
   2  4

10. Briefly describe mid-water (mesopelagic) fishes. (Fig. 16.6)

11. What are the two most common types of mid-water fishes?
   
   1
   2

12. Briefly describe bristlemouths. (Fig. 16.6)
13. Briefly describe lanternfishes. (Fig. 16.6)

**The Twilight World: Adaptations of Mid-water Animals**

14. List the five most common adaptations to limited food supply that are shared by mid-water fishes.

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   2  
   3  
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15. Describe food availability in the mesopelagic zone.

16. Mesopelagic animals can be divided into two groups based on what characteristic?

17. What are some of the non-migrating animals?

18. On what do the non-migrating zooplankton feed?

19. What do the non-migrating fishes, squid, and shrimps eat?

20. What is the advantage of not having a swim bladder to a non-migrating fish?

21. Besides not having a swim bladder, what 4 other characteristics do non-migrating fishes share?

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   2  
   3  
   4

22. Review: What is vertical migration? (Chapter 15)

23. Describe migrating fishes, in comparison to non-migrating fishes. (Fig. 16.9)
24. What is the Deep Scattering Layer (DSL) and how does it relate to vertical migration?

25. How does vertical migration affect the overall food supply in the mesopelagic?

26. Describe how mid-water animals have adapted to low-light conditions. (Fig. 16.11, 16.12, 16.13, and 16.14)

27. Describe how mid-water animals use coloration and body shape for camouflage from predators.

28. Describe how mid-water animals use bioluminescence to mask their silhouettes. What is counterillumination? (Fig. 16.15 and 16.16)

29. How common is bioluminescence in the mesopelagic?

30. Besides use as counterillumination, what are other uses of bioluminescence in mid-water animals?
31. What is the oxygen minimum layer? How does it develop? (Fig. 16.18)

32. Describe oxygen levels below the oxygen minimum layer. (Fig. 16.18)

33. How do mid-water animals deal with depleted oxygen levels?

The World of Perpetual Darkness
34. Describe the deep sea. List the zones of the deep sea. How deep are they?

35. Just for some additional perspective: How deep are these zones in miles? [5280 ft = 1 mile]

36. Describe the temperature conditions of the deep sea.

37. Why is coloration not important for organisms in the deep sea?

38. What are the primary uses of bioluminescence in the deep sea?
39. Describe eyes and vision in deep-sea animals.

**The World of Perpetual Darkness: The Lack of Food**

40. Describe the food supply in the deep sea.

41. Describe the most common deep-sea fishes. (Fig. 16.19 and 16.21)

42. Why are deep-sea fishes typically larger than their mesopelagic counterparts?

**The World of Perpetual Darkness: Sex in the Deep Sea**

43. Review: What is a hermaphrodite? (Chapter 7)

44. What is the advantage of being a hermaphrodite in the deep sea?

45. What are some ways that deep-sea animals attract mates?

46. What is male parasitism? How is it a strategy for reproduction in the deep sea?
The World of Perpetual Darkness: Living under Pressure
47. How does living under extreme pressure affect deep-sea animals?

48. Review: What is hydrostatic pressure? (Chapter 3)

The Deep-Ocean Floor
49. Review: What is the benthos? (Chapter 4)

The Deep-Ocean Floor: Feeding in the Deep-Sea Benthos
50. How does food availability on the sea floor differ from food availability within the deep-sea water column?

51. What types of organisms dominate the deep-sea benthos?

52. Review: What are meiofauna? (Chapter 11)

53. What is deep-sea gigantism? (Fig. 16.24)

54. How do most deep-sea benthic organisms locate food?

The Deep-Ocean Floor: The Nature of Life in the Deep-Sea Benthos
55. Describe the life of deep-sea benthic organisms.
56. Compare epipelagic, mesopelagic and pelagic animals. (Fig. 16.27)

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The Deep-Ocean Floor: Microbes in the Deep Sea

57. How does pressure and cold temperatures in the deep sea affect bacteria?

58. What are chemosynthetic prokaryotes?

Box: Biodiversity in the Deep Sea

59. Describe biodiversity and abundance of organisms in the deep sea.

Hot Springs, Cold Seeps, and Dead Bodies

60. Review: What is a hydrothermal vent? (Chapter 2)
61. What is the source of primary production at hydrothermal vents?

62. What minerals are used as an energy source by chemosynthetic prokaryotes at hydrothermal vents?

63. What are cold seeps?

64. Describe how dead organisms are similar to hydrothermal vents and cold seeps.

65. How do the organisms at hydrothermal vents, cold seeds, and dead bodies differ from those in the rest of the deep sea?

66. **Geographic literacy is a component of this class.** You need to be able to locate and identify the following ocean regions and locations (all of which are discussed in Chapter 14) on a map of the world for your Unit 13 test and you also are responsible for all geographic terms from past units: **Mexico, Somalia, Perú, Cuba, Great Barrier Reef, Florida Reef Tract, Maldives Islands, Belize Barrier Reef, Marshall Islands, Florida, the Baltic Sea, Saint Lawrence River Estuary, Norway, Chile, Washington, Oregon, California, New England, Nova Scotia, Iceland, Hong Kong, Papua New Guinea, the Philippines, the Caribbean Sea, North America, South America, Southern Ocean, Hawaiian Islands, Aleutian Islands, Marianas Trench, Galápagos Islands, Central America, Indian Ocean, Antarctica, Africa, Pacific Ocean, Bering Sea, Arctic Ocean, Atlantic Ocean, Greenland, Sargasso Sea, Indonesia, Bahamas, Japan, Bermuda, Gulf of Mexico, Gulf of California, Alaska, New Zealand, Polar, Temperate, Subtropical, and Tropical, Australia, Mediterranean Sea, Red Sea, Black Sea, Europe, Marine Biology Laboratory, Woods Hole, Massachusetts (approximate location), and Scripps Institution of Oceanography, La Jolla, California (approximate location).

   There is a foldout map at the back of your textbook to help you, plus there are maps in the BLC.