**Notes: Ocean Environments and Food Webs**

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| What lives in the ocean? | * \_\_\_\_\_\_\_% of ocean is unexplored!
* Known organisms are put into \_\_\_\_\_ groups:
	+ \_\_\_\_\_\_\_\_\_\_\_\_ dwellers—live on the sea \_\_\_\_\_\_\_\_\_/bottom (seaweed, \_\_\_\_\_\_, coral)
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_—swim in the ocean (fish, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, whales)
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_—float at or near the ocean \_\_\_\_\_\_\_\_\_\_\_ (jellyfish, protists, bacteria)
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| Habitats: Intertidal Zone | * Intertidal zone: habitat at edge of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Between high and low \_\_\_\_\_\_\_\_\_\_\_\_ marks
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ conditions
	+ At \_\_\_\_\_\_\_\_\_\_ tide
		- \_\_\_\_\_\_\_\_\_\_, direct \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Organisms must be able to live out of \_\_\_\_\_\_\_\_\_\_\_ & tolerate \_\_\_\_\_\_\_ temp!
	+ At \_\_\_\_\_\_\_\_\_ tide
		- Covered in \_\_\_\_\_\_\_\_\_\_\_\_
		- Organisms must be able to live \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ & tolerate water temp
	+ Tidal \_\_\_\_\_\_\_\_\_\_\_\_: areas along the shore where \_\_\_\_\_\_\_\_\_\_ remains at low tide.
		- Plants and animals that live here must be able to survive huge \_\_\_\_\_\_\_\_\_\_\_\_ in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (evaporation🡪salinity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; water comes back🡪salinity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
	+ Organisms have ways to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the changing conditions (mussels close shells to keep from \_\_\_\_\_\_\_\_\_\_\_\_ out , crabs \_\_\_\_\_\_\_\_\_\_\_\_ or burrow to find shelter, etc).
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| Habitats: Estuaries | * Estuaries: where fresh water and \_\_\_\_\_\_\_\_\_\_ water mix (where \_\_\_\_\_\_\_\_\_\_\_ meet the ocean)
	+ Not very \_\_\_\_\_\_\_\_\_\_; salinity \_\_\_\_\_\_\_\_\_\_\_\_\_ with tides
	+ LOTS of \_\_\_\_\_\_\_\_\_\_: extremely \_\_\_\_\_\_\_\_\_\_\_\_\_
		- All must be able to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to changing conditions
		- Very good “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” for fish: allow eggs to \_\_\_\_\_\_\_\_\_\_\_ and grow safely before migrating out to sea
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ washed in from the ocean by \_\_\_\_\_\_\_\_\_\_, sediment rich in nutrients washes out from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- These nutrients are constantly mixed by the \_\_\_\_\_\_\_\_, creating very \_\_\_\_\_\_\_\_ conditions for plants and animals
	+ Estuaries are one of the most \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ecosystems on Earth.
	+ Estuary waters are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (less than 30ft deep), so \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reaches the bottom, allowing \_\_\_\_\_\_\_\_\_\_\_\_\_ to grow.
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| Estuaries in North Carolina | * There are a lot of Estuaries in NC
* The \_\_\_\_\_\_\_\_\_\_\_ estuary in NC is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Sound.
	+ \_\_\_\_\_\_\_\_\_\_ drains into here from a variety of places in both \_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_
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| Why are estuaries important? | * They help control \_\_\_\_\_\_\_\_\_\_\_\_\_ (the washing away of land/beach) and reduce \_\_\_\_\_\_\_\_\_\_\_
	+ Sandbars buffer the impact of \_\_\_\_\_\_\_\_\_\_\_, while plants and shellfish \_\_\_\_\_\_\_\_\_\_\_ the shore against tides.
* Act as an environmental \_\_\_\_\_\_\_\_\_\_\_\_: plants and animals here filter out \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the water.
	+ Salt marsh plants trap some of the \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ carried by rivers and move them into the soil where they are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ Oysters filter \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ out of water as they \_\_\_\_\_\_\_\_, collecting the contaminants in their bodies (Fun fact: oysters can filter \_\_\_\_\_ gallons of water a day)
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ eat organic matter found in sediment and release carbon dioxide and \_\_\_\_\_\_\_\_\_\_\_\_\_\_, preventing these gases from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the estuary
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| How are humans harming estuaries? | * \_\_\_\_\_\_% of people live within 50 miles of the sea; big \_\_\_\_\_\_\_\_\_\_\_ are often near where rivers meet the sea.
	+ We harm estuaries: \_\_\_\_\_\_\_\_\_\_\_\_\_ farms, estuaries filled in for raising \_\_\_\_\_\_\_\_\_\_ or housing, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_\_\_ can build up, causing environmental and \_\_\_\_\_\_\_\_\_\_ problems
	+ Protection from government (make \_\_\_\_\_\_\_) and local organizations and individuals (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
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| Habitats: Wetlands | * Wetlands form along \_\_\_\_\_\_\_\_\_\_\_\_\_ of estuaries; \_\_\_\_\_\_\_\_\_\_\_\_\_\_ areas
* \_\_\_\_\_ kinds:
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: away from equator, in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ areas; protect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- rich \_\_\_\_\_\_\_\_\_, grasses provide important \_\_\_\_\_\_\_\_\_\_\_\_\_\_ for fish, birds, etc.
		- marsh \_\_\_\_\_\_\_\_\_\_\_\_ are important: have thick \_\_\_\_\_\_\_\_\_\_ systems that help hold the muddy soil together; many small \_\_\_\_\_\_\_\_\_\_\_ and other animals live in the grass
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: found in \_\_\_\_\_\_\_\_\_\_\_\_\_ areas (Florida), lots of trees and shrubs, protect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Swamps and marshes take the initial impact of high \_\_\_\_\_\_\_\_\_\_\_ from the ocean, soak up heavy \_\_\_\_\_\_\_\_\_\_ and storm surges, and release the extra \_\_\_\_\_\_\_\_\_\_\_\_ gradually into rivers and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ supplies.
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| What are conditions like near shore? | * Near shore🡪 \_\_\_\_\_\_\_\_ water, \_\_\_\_\_\_\_\_\_\_\_, temperature and salinity \_\_\_\_\_\_\_\_\_\_\_, nutrients
* Waters near shore support many \_\_\_\_\_\_\_\_ forms.
	+ \_\_\_\_\_\_\_\_\_\_ life in water lives near shore
	+ \_\_\_\_\_\_ important habitats: Coral Reefs and Kelp Forests
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| Habitats: Coral Reefs | * Found in \_\_\_\_\_\_\_\_\_\_\_\_\_\_, tropical areas
* limestone deposits formed by \_\_\_\_\_\_\_\_\_\_\_ (ant-sized organisms that produce a hard \_\_\_\_\_\_\_\_\_\_\_\_\_ covering that remains after they die—new corals then grow on top of the \_\_\_\_\_\_\_\_\_\_\_\_ of dead ones)
* coral rely on \_\_\_\_\_\_\_\_\_\_\_\_ for food: algae live \_\_\_\_\_\_\_\_\_\_\_\_\_\_ coral & make \_\_\_\_\_\_\_\_\_
* only in nutrient-rich, \_\_\_\_\_\_\_\_\_\_\_\_\_ waters (algae need sunlight to make \_\_\_\_\_\_\_\_\_\_\_)
* LOTS of life (\_\_\_\_\_\_% of ocean species): Some species use reef for \_\_\_\_\_\_\_\_\_\_, some \_\_\_\_\_\_\_ corals or seaweed that grow on corals
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ habitats due to pollution
	+ Coral \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: pollution or extreme \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (too hot or too cold) kill the \_\_\_\_\_\_\_\_\_\_\_ that live in the coral—coral turns \_\_\_\_\_\_\_\_\_\_\_\_)
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| Habitats: Kelp Forests | * Found in \_\_\_\_\_\_\_\_\_ water
* Kelp (\_\_\_\_\_\_\_\_\_\_\_) attaches to the ocean \_\_\_\_\_\_\_\_\_\_ & grows upwards (can be \_\_\_\_\_\_ meters tall!); have \_\_\_\_\_\_\_\_ bulbs on the stalks to help it float up towards the surface
* Use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to produce food
* Found near shore (need \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
* Provide \_\_\_\_\_\_\_\_\_\_\_\_\_\_ for many organisms
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| Habitats: Open Ocean | * Oceanographers (scientists who study the \_\_\_\_\_\_\_\_\_\_\_\_\_) divide the ocean into \_\_\_\_\_\_\_\_\_\_ according to how far down \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ penetrates
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_ zone: also known as the sunlit on; the part of the ocean that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can penetrate. All marine \_\_\_\_\_\_\_\_\_\_\_\_\_ live here because they need sunlight for photosynthesis. Almost all life in the ocean is dependent on \_\_\_\_\_\_\_\_\_\_\_\_\_ (remember: Circle of Life)
	+ \_\_\_\_\_\_\_\_\_ zone: deep ocean; completely \_\_\_\_\_\_\_\_\_\_\_\_.
	+ ­\_\_\_\_\_\_\_\_\_\_\_\_\_ zone: ocean floor
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| Habitats: Surface Zone | * Sunlight penetrates here: top \_\_\_\_\_\_\_\_\_\_ meters
* contains phytoplankton (tiny \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ protists that change CO🡪O): they make most of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in our atmosphere, and are also an important \_\_\_\_\_\_\_\_\_ source in ocean food chains. They are the most \_\_\_\_\_\_\_\_\_\_\_\_\_ “plants” in the ocean.
	+ zooplankton—tiny floating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that eat phytoplankton
	+ zooplankton and phytoplankton get \_\_\_\_\_\_\_\_\_\_\_\_\_ by fish, squid, and other animals, like whales.
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| Habitats: Deep Ocean | * \_\_\_\_\_\_\_\_\_\_\_\_ surface zone
* \_\_\_\_\_ sunlight = no \_\_\_\_\_\_\_\_\_\_\_\_ (cold and dark)
* We used to think that no \_\_\_\_\_\_\_\_\_\_ could exist in the deep ocean, but it contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, including some fish, squid, shrimp, crabs
	+ Extremophiles: organisms that can live in areas with \_\_\_\_\_\_\_\_\_\_\_\_\_\_ pressure, temperature, complete \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_ chemicals
	+ No plants for \_\_\_\_\_\_\_\_\_\_—deep-sea animals eat \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or rely on food drifting down from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Bioluminescence: when animals \_\_\_\_\_\_\_\_\_\_\_ in the dark—many deep-sea animals do this (fireflies do too).
* Discovering life in the deep ocean revised our thinking about what organisms need to \_\_\_\_\_\_\_; it expanded our understanding of how life \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and how life might exist on other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* most of deep zone is unexplored due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_, darkness, & size
 |
| Habitats: Hydrothermal Vents | * lots of organisms live near hydrothermal vents
	+ Driven by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ under the ocean
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in Earth’s crust🡪water seeps into cracks, \_\_\_\_\_\_\_\_\_\_ up, rises back up, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ out of cracks
		- The water coming back up from the cracks contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ animals that live near vents depend on a special \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_—make food from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ released by the vents (like \_\_\_\_\_\_\_\_\_\_\_\_\_)
	+ Vents and the organisms that live there are created and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as volcanic activity in the area \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (may be a few decades, or hundreds of \_\_\_\_\_\_\_\_\_)
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| Habitats: Cold Seeps | * Cracks in the Earth from which \_\_\_\_\_\_\_\_\_\_\_\_ fluids come out
	+ Fluid usually composed of natural gas (\_\_\_\_\_\_\_\_\_\_\_\_\_) and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can process methane to make \_\_\_\_\_\_\_\_\_\_\_; base of the food chain at cold seeps
	+ Fluid comes out at \_\_\_\_\_\_\_\_\_\_\_\_\_ rate than hot fluid at hydrothermal vents
		- lasts for \_\_\_\_\_\_\_\_\_\_\_\_\_ periods of time; some seeps may be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of years old
 |
| How can scientists study the deep ocean? | * From ships:
	+ Photograph the bottom: use \_\_\_\_\_\_\_\_\_\_\_\_\_—sound waves that map the ocean floor
	+ Drop \_\_\_\_\_\_\_\_\_\_\_\_ into currents to map \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Collect samples of \_\_\_\_\_\_\_\_\_\_\_, rock, and marine life
* New technology:
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (submarines), remote-controlled vehicles, \_\_\_\_\_\_\_\_\_\_\_\_\_
 |
| What is a food chain/web? | * Food Chain: how \_\_\_\_\_\_\_\_\_\_\_\_\_ travels through an ecosystem—shows what organisms \_\_\_\_\_
* Food Web: a more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ food chain; animals usually don’t eat only \_\_\_\_\_\_\_\_ thing, and most things are eaten by more than one type of animal.
	+ Example: \_\_\_\_\_\_\_\_\_\_\_🡪Sea Urchins, Fish🡪\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, Sea Lions🡪Killer Whales, \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Most marine creatures eat a \_\_\_\_\_\_\_\_\_\_\_\_\_ of foods. If one link in a food chain is gone, there are alternate \_\_\_\_\_\_\_\_\_\_ sources
* Ocean food chains/webs are also connected to \_\_\_\_\_\_\_\_\_\_ organisms (bears may eat \_\_\_\_\_\_\_, dead things on \_\_\_\_\_\_\_\_\_\_\_\_\_, raccoons may eat \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, etc.)
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| What do food chains look like in the deep ocean? | * Because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ doesn’t reach the deep ocean (including hydrothermal vents and cold seeps), microbes have evolved chemosynthetic (using \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to make food) processes that create \_\_\_\_\_\_\_\_\_\_ by reacting oxygen with \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (like sulfur and methane) in the water around hydrothermal vents and cold seeps.
	+ Some animals (like \_\_\_\_\_\_\_\_\_\_\_\_\_\_) allow these chemosynthetic microbes to live \_\_\_\_\_\_\_\_\_\_\_ them, providing a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the microbes in exchange for their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Some animals (like clams, \_\_\_\_\_\_\_\_\_\_\_\_\_\_, snails, and shrimp) eat the \_\_\_\_\_\_\_\_\_\_\_.
* Most animals that live in the deep are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and they eat other \_\_\_\_\_\_\_\_\_\_\_\_ or dead things that sink to the bottom from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
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| What is a keystone species? | * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Species: a species that has a greater-than-expected effect on an ecosystem; if it is \_\_\_\_\_\_\_\_\_\_\_\_\_ from the environment, the entire ecosystem is affected \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (sometimes, it completely “collapses”).
	+ Many keystone species are \_\_\_\_\_\_\_ predators (killer whales, starfish, \_\_\_\_\_\_\_\_\_, bears)
	+ Example: In the food web above, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are the keystone species. If they are removed from the environment, there will be too many \_\_\_\_\_\_\_\_\_\_\_, which will provide more food for the \_\_\_\_\_\_\_\_\_ and sea lions who’s population will increase, then seals and sea lions along with salmon will eat all of the \_\_\_\_\_\_\_\_\_\_\_\_, which will lead to too many zooplankton, which will eat all of the phytoplankton, which will lead to not enough \_\_\_\_\_\_\_\_\_\_\_\_\_ for the baleen whale (and less \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).
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**Questions:**

1. Where are coral reefs found? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kelp forests? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. How are wetlands related to estuaries?
3. Why are estuaries important?
4. What adaptations do organisms need in order to float in the open ocean?
5. Why is it challenging to live in the intertidal zone?
6. How did extremophiles affect the way we view the possibility of life on other planets?
7. What do you think is the best way to study the deep ocean?
8. Why is it challenging for organisms to live in the deep ocean?
9. What is bioluminescence?
10. How are cold seeps and hydrothermal vents similar?
11. Explain how a food chain relates to a food web.
12. Write your own example of a food web.
13. Why is a keystone species important?