

SI Environmental Science - Full Discipline Demo

Oceans and Coasts

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Environmental Science - Full Discipline Demo
Course	SI Environmental Science - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Match each term to the best description.

Terms to match:

- ⌘ Aphotic zone
- ⌘ Littoral zone
- ⌘ Gyre
- ⌘ Neritic zone
- ⌘ Thermohaline circulation

Descriptions to match:

- 1 Large area of circular surface currents
- 2 Movement of deep-ocean currents
- 3 Shoreline area between high and low tide levels
- 4 Horizontal area stretching from low tide mark seaward to the edge of the continental shelf
- 5 Vertical area ranging from a depth of 200 m to the ocean floor

Correct answers:

- 1 Gyre 2 Thermohaline circulation 3 Littoral zone 4 Neritic zone
5 Aphotic zone

Classify each statement as true or false.

⚡ Rocky coastlines located inside lagoons are more at risk to erosion than sandy, barrier island coastlines.	
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Correct answers:

1

Coastlines with higher overall CVI values are more susceptible to erosion and flooding than coastlines with lower values.

The Coastal Vulnerability Index is a rating system used to assess the risks of coastlines from rising sea levels.

2

Only coastlines in the tropics are threatened by coastal erosion.

Rocky coastlines located inside lagoons are more at risk to erosion than sandy, barrier island coastlines.

Exploration

Deep-ocean currents are driven by differences in ____.

- ☐ wind speeds
- ☒ water density ✓
- ☐ rotational forces
- ☐ air temperatures

The Coastal Vulnerability Index evaluates undeveloped coastlines based on ____ variables.

- ☐ four
- ☐ five
- ☒ six ✓
- ☐ seven

Many species in the ocean reside permanently in the ____ zone or visit it to obtain food or sunlight energy.

- ☐ aphotic
- ☐ littoral
- ☐ intertidal
- ☒ epipelagic ✓

Exercise 1

What type of surface ocean currents are Assateague Island and Goosefare Bay exposed to and in what direction do they flow? Reference the location of each site in your explanation.

Assateague Island and Goosefare Bay are exposed to warm surface currents from the North Atlantic gyre. Both sites are located on the Atlantic coast of North America. The currents flow in a clockwise, northerly direction, transferring heat from the tropics to each location.

Which study site from this exercise experienced the highest rate of coastal erosion? How is the coastal erosion rate related to Coastal Vulnerability rankings? Reference Data Table 1 in your explanation.

Assateague Island has experienced more coastal erosion in the past than Goosefare Bay as recorded in Data Table 1. Higher erosion rates result in the assignment of higher coastal vulnerability ranking values. Assateague Island has a CVI ranking value of 5 for coastal erosion rate whereas Goosefare Bay has a value of 3 as recorded in Data Table 1.

Based on the calculated overall Coastal Vulnerability Index, is Assateague Island or Goosefare Bay predicated to be at a higher risk of future coastal flooding? Reference Data Table 2 in your explanation.

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Data Table 1: Coastal Vulnerability Variables and Rankings
(SAMPLE ANSWER BELOW)

Variable	Assateague Island value	Assateague Island ranking	Goosefare Bay value	Goosefare Bay ranking
(a) Coastline type	Barrier island	5	Indented coast	2
(b) Coastal slope (%)	0.13	2	0.39	1
(c) Mean wave height (m)	1.2	4	1.1	4
(d) Mean tide range (m)	0.64	5	2.78	3
(e) Relative sea level change (mm/yr)	5.15	5	1.87	2
(f) Erosion/accretion rate (m/yr)	-4.1	5	0.19	3

Data Table 2: Assateague Island and Goosefare Bay CVI
(SAMPLE ANSWER BELOW)

Location	CVI
Assateague Island	28.9
Goosefare Bag	4.9

Exercise 2

Based on the mapped tracking data, would each of the organisms tracked in this exercise be classified as residing primarily in the littoral, neritic, or oceanic zones during the tracking period? Reference the definitions of each zone in your explanation.

Each of the organisms tracked in this exercise would be classified as residing primarily in the oceanic zone during the tracking period because the majority of each organism's tracks occurred in the open North Pacific Ocean between the west coast of North America and the Hawaiian Islands. The littoral zone includes the distance between low and high tides, the neritic zone occurs above the continental shelf, and the oceanic zone stretches across the open ocean beyond the continental shelves.

Based on depth data, would each of the organisms tracked in this exercise be classified as vertically migrating primarily through the epipelagic or aphotic zones? Reference the definitions of each zone and Data Table 3 in your explanation.

The great white shark migrated primarily within the epipelagic zone, which extends from the ocean surface to a depth of -200 m. The average tracking depths for the white shark were -179 m. The bluefin tuna and elephant seal migrated primarily in the aphotic zone, which extends from a depth of -200 m to the ocean floor. The average depth for the tuna was -311 m and the average depth for the seal was -342 m as recorded in Data Table 3. The Laysan albatross was tracked mostly above the water surface with a positive average depth of 7.85 m, as recorded in Data Table 3, and was not tracked within either the epipelagic or aphotic zones.

Data Table 3: Marine Animal Migrations
(SAMPLE ANSWER BELOW)

Animal	Maximum daily depth range (m)	Average depth (m)
Elephant seal	-125 to -715	-341.79
Bluefin tuna	-60 to -480	-310.85
Laysan albatross	0 to 30	7.85
Great white shark	0 to -730	-179.40

Competency Review

Surface currents are driven by ____ and the earth's rotation.

- ☐ heat
- ☒ winds ✓
- ☐ water density
- ☐ sound waves

Gyres rotate clockwise in the Northern Hemisphere.

- ☒ True ✓
- ☐ False

Coastal erosion is caused by ____.

- ☐ strong waves
- ☐ high tides
- ☐ storm surges
- ☒ All of the above ✓

Coastal slope (%) is a variable in the Coastal Vulnerability Index.

- ☒ True ✓
- ☐ False

The ____ zone contains shoreline that is sometimes under water and sometimes exposed.

- ☐ aphotic
- ☐ neritic
- ☒ littoral ✓
- ☐ oceanic

The highest diversity of marine life occurs in the neritic zone that overlays the continental shelf.

- ☒ True ✓
- ☐ False

Assateague Island has a lower overall CVI value than Goosefare Bay.

- ☐ True
- ☒ False ✓

Tracking data suggests that _____ migrate through the oceanic zone of the North Pacific Ocean.

- ☐ great white sharks
- ☐ bluefin tuna
- ☐ elephant seals
- ☒ All of the above ✓

Extension Questions

A developer is searching for a location to build a coastal resort that will offer guests year-round snorkeling, swimming, and beach activities with a low risk of flooding and erosion. **Apply your knowledge of oceans and coasts to provide the developer with location suggestions to meet their goals. Include the parameters of water currents, coast exposure, and water depth in your explanation.** (SAMPLE ANSWER BELOW)

The developer should select a location that receives warm surface currents that transport heat from the tropics to allow for year-round water access for guests. The coastline should be protected from open ocean waves by being located in a bay or lagoon to both reduce the chances of flooding and result in calmer water conditions for guests to swim and snorkel. A beach consisting of sand or small gravel will promote a variety of beach activities compared to a rocky coastline. A location should also be chosen that is outside the path of tropical storms, which frequently result in erosion and flooding. The location should have a gentle-sloping continental shelf that will create an expansive neritic zone rich in ocean life, including numerous fish and coral species, for guests to observe while snorkeling.