NAME:	DATE:	CLASS:

Unit 9225

Ocean Zones Worksheet

Learning Objectives
By the end of this exercise you should be able to:

- Describe the distribution of organisms to the abiotic components of the environment
- Describe zonation
- Describe the abiotic factors that determine zonation
- Describe vertical structure underwater

Student Instructions
Use the information provided on the following pages and knowledge gained in class to answer the following questions.

Questions

1. What is meant by the two terms: abiotic factors and biotic factors. Give examples of each.

2. Compare the abiotic factors occurring in the neritic zone and the abyssal zone. List three organisms that you know of that live within each of these zones?

3. Define the following terms:
   - Benthic
   - Photic zone
   - Littoral zone
   - Sub-littoral zone

4. Give an example of an organism that lives within the neritic zone. Using abiotic factors as a basis for your answer explain why this organism is not found in the abyssal zone.

5. Give an example of an organism that lives within the abyssal zone. Using abiotic factors as a basis for your answer explain why this organism is not found in the pelagic zone.

6. Explain the difference between plankton and nekton

7. What abiotic factors characterise the pelagic zone and list three organisms that you know that live within this zone.

8. What is zonation and how do abiotic factors affect zonation?

Ocean Zones

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Why study the sea in New Zealand?
The ocean currently covers 71% of the earth's surface. Around two thirds of earths land area is found in the Northern Hemisphere which means the Northern Hemisphere is about 61% ocean. Oceans cover 80% of the Southern Hemisphere (Castro & Huber, 2003). New Zealand is surrounded by sea and is often described as a maritime nation!

Life in the oceans surrounding New Zealand is diverse due to the wide range in latitude covered by New Zealand. New Zealand covers 30 degrees of latitude. Our sea waters range from sub-Antarctic to sub-tropical making study of the New Zealand oceans particularly fascinating. The study of marine organisms and their ocean environment is the study of marine ecology.

What is ecology?
There are two commonly accepted definitions of ecology. The first states that ecology is concerned with the interaction between organisms and their environment; the second says that ecologists are trying to understand the **distribution** and **abundance** of organisms (Cotgreave & Forseth, 2002). The first definition is broader and perhaps more widely accepted than the second. Taking the wider definition of the two: Marine ecology therefore, is the study of the interaction between marine organisms and their environment.

Life in the sea – Abiotic factors
In order to understand and study the interaction between marine organisms and their environment we need to consider the nature of the marine environment. Some of the concepts used by terrestrial (land) ecologists are relevant to marine ecology. But there are many aspects of the marine environment that make it totally unique and unlike environments above water. In studying the marine ecology then, one of the first things to think about is: what is it like to live in the sea?

The most obvious difference for organisms living in the sea to deal with is that the oceans are wet! Organisms living in the sea live in a three dimensional world. Their bodies are supported by water and not subject to the forces of gravity. In water, sound travels faster than in air. In the sea there is often less light from the sun and colours are lost rapidly becoming blue once a few meters below the surface. Marine organisms of the deep sea have to deal with extreme pressure exerted on them from the weight of vast amounts of water above and around them. The oceans are a salty place but not uniformly so. This creates a challenge for marine organisms that swim through different areas to deal with differing levels of salinity in their surrounding environment. Heat is conducted much faster in water than in air, which makes the oceans a much colder place for the organisms that live there.

Each of these factors such as salinity, temperature, sunlight, sound, pressure etc are all known as **abiotic factors.** Abiotic factors can be physical or climatic conditions. In contrast **biotic factors** are due to the effects of other species living in the environment. For example, biotic factors might relate to food supply, predation, grazing, competition and human activities.

Zones
Some **abiotic factors** such as light and depth play a big part of determining different **zones** within the ocean. The distribution of organisms in the sea is controlled by the interaction of water depth, latitude and distance from shore (Cotgreave & Forseth, 2002). Most species are found in shallow water near continents, although this represents only about 8% of the total ocean area (Cotgreave & Forseth, 2002).

There are three major ocean habitats or zones, each with its own sub-habitats. The three major zones or habitats are: the **neritic zone**, the **pelagic zone** and the **abyssal zone**.

The neritic zone
The neritic zone is sometimes defined as the area above the continental shelf. It is the area made up of the shallow ocean waters along the coasts and inhabited by a large number of species. It encompasses depths from 0m to 200m and is characterised by the interaction of land and sea. This zone is influenced by wave action and receives high amounts of nutrients from land surfaces. These nutrients help support the great fisheries of the world. Coral reefs occur in neritic zones in tropical regions and are one of the most complex ecosystems and biologically diverse marine ecosystems. There is more sunlight penetrating the upper parts of the neritic zone than in deeper waters and pressure is not as great as in the deepest parts of the ocean.

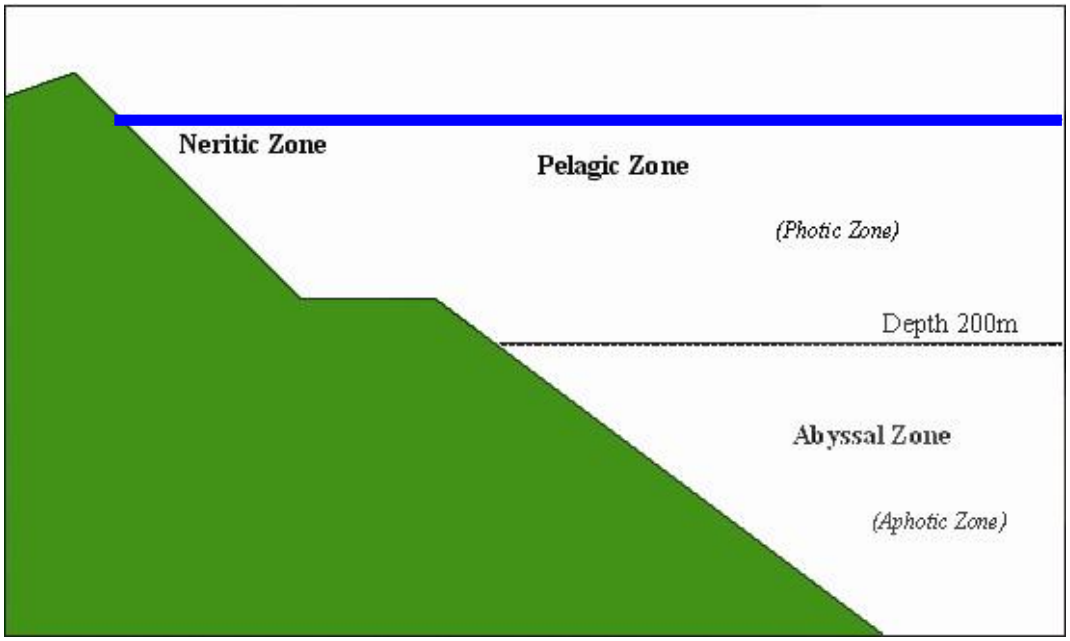
Within the neritic zone there are other identified zones including the **littoral zone** and the **sub-littoral zone**. The littoral zone is made up of the area between high and low tide, otherwise known as the intertidal zone. The sub-littoral zone is the sub-tidal zone that covers the continental shelf beyond the intertidal zone.

The pelagic zone
The pelagic zone is the open water region of oceans. The surface area is known as the Photic zone. The photic zone has sufficient light penetration to allow photosynthesis and extends to roughly 100m depth. Organisms in this surface of photic zones make up the microscopic **plankton** and macroscopic **nekton**. Plankton may adjust their depth but cannot determine their direction and float along at the mercy of currents. Photosynthetic plankton account for about 40% of the Earths photosynthesis (Cotgreave & Forseth, 2002). Nekton are made up of organisms that can swim. More sunlight penetrates the pelagic zone than deeper waters. This affects temperature and productivity. There is less pressure exerted on organisms in this zone than in the deeper ocean zones.

The abyssal zone
The abyssal plane is the area below 100m in depth. The **benthic region** is that part of the abyssal zone that is made up of the sea floor. You might also hear people using the term **benthic** in relation to other zones. For example, scientists call organisms that inhabit the seafloor, benthic organisms. Benthic therefore, refers to anything related to the seafloor.

The abyssal zone was initially thought to contain little life because of high pressures, low temperatures and low light conditions. In the last 25 years however, scientists have discovered that there are a huge variety of living organisms that inhabit the abyssal zone (Cotgreave & Forseth, 2002). Life in the abyssal zone is dependent on organic matter making its way into the depths from the surface zone.

Sometimes the abyssal zone is divided into three areas: the **Bathyl zone** which is the area between slope edge and 4000m, the **Abyssal zone** which is the area between 4-6000m and the **Hadal zone**, which is the area deeper than 6000m.



Zonation
As indicated above, different organisms are found in different ocean zones. For example, limpets (*Cellana sp*) are found in the neritic zone and not the abyssal or pelagic zone. By the wind sailors (*Velella* sp) are found in the pelagic zone and not the abyssal zone.

However it is not only the type of organisms that alter according to different zones but the **abundance** (number of individuals) and **distribution** (where they are situated) alters. The abundance and distribution of organisms differs according to depth and for intertidal communities, distance from the low tide line. This concept is known as **zonation**. **Zonation** is the term used to describe changes in the composition of a **community** across an area which occur in response to an environmental gradient. Because physical and chemical conditions change from place to place, different parts of the ocean harbour very distinct communities.

Communities and Zonation
Because physical and chemical conditions change from place to place, different parts of the ocean harbour very distinct communities. These communities form zones which are the basis of zonation studies. **Communities** are an interacting collection of species found in a common environment or habitat.

The intertidal or littoral zone is an excellent place to study zonation. Here the distribution of organisms is affected by the amount of time the community is exposed to air. Below the high tide line different zones are also evident.

Discussion question
What abiotic factors characterise each of the three major ocean zones?

Discussion question
What adaptations do you think organisms of the abyssal zone might make to survive given the abiotic factors that occur in there?

Discussion question
Consider the abiotic factors that characterise the neritic zone, pelagic zone and abyssal zone and determine in which zone (and why) the greatest biodiversity might be found?

Discussion question from the worksheet questions
Consider the characteristics of organisms (that you identified in questions 3 and 6) that enable them to survive in the pelagic, neritic or abyssal zone. EG if you identified an tuna as a pelagic zone resident, what characteristics does this animal have that make it suited to survive in this zone?

References and additional reading:

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