**GENERAL INTEGRATED SCIENCE – UNIT 3**

**TASK 1 – ENERGY THROUGH THE ECOSYSTEM ASSESSMENT**

**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ WEIGHTING: 9%**

**DUE DATE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ MARK: \_\_\_\_\_\_ /\_\_ = \_\_\_\_\_\_ %**

**Question: *How does energy flow through an ecosystem?***

**Objectives**

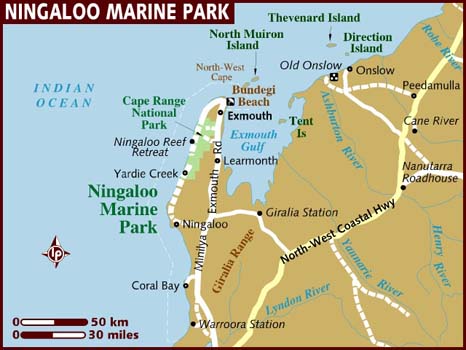
* Communicate scientific ideas and information for a particular purpose, using appropriate scientific language, conventions and representations
* Use appropriate scientific representations, including diagrams of structures and processes, to communicate conceptual understanding, solve problems and make predictions

**Background**

The Ningaloo Coast is a World Heritage Site which protects a 260km fringing reef north of Shark Bay. It is located 100km north of Perth. It is the only fringe coral reef in Western Australia and is the largest in the world.

There are over 500 fish species, 250 species of known coral and 600 species of molluscs. Due to the high biodiversity within the region, it was turned into a marine park in 1987. This was to try bring about ecological and social conservation.

Continual monitoring and surveys are conducted in the region. This is to check on the health and wellbeing of the reef ecosystem. Selections of the monitoring sites are surveyed every three years.



**Food Web**

|  |  |  |
| --- | --- | --- |
| **Phytoplankton** |  | **Whale Shark** |
| https://s-media-cache-ak0.pinimg.com/736x/5a/c5/2e/5ac52eb50c9823d6e74517df47203169.jpg |  | http://new-brunswick.net/new-brunswick/sharks/pics/whaleshark.gif |
| Single-celled plants, similar to terrestrial plants. Contain chlorophyll. Located close to the surface of water |  | Slow-moving filter feeding shark. Consumes phytoplankton, zooplankton and coral. Mostly found in the Ningaloo reef when coral is spawning. |
|  |  |  |
| **Squid** |  | **Macroalgae** |
| http://marinebio.org/upload/_cephs/Sepiadarium-austrinum/Southern-bottletail-squid.gif |  | https://lagill6.files.wordpress.com/2014/02/seaweed-one.jpg |
| Carnivorous squid that eat zooplankton. |  | Also known as seaweed. Photosynthetic marine plant. |
|  |  |  |
| **Zooplankton** |  | **Daisy Parrotfish** |
| https://www.fisherieswiki.org/system/species_image/image_path/417/medium/Antarctic_krill.png?1321637371 |  | http://www.fishing-khaolak.com/images/fish/saltwater_fish/dusky_parrotfish.jpg |
| Small herbivorous organisms that feed on phytoplankton and are preyed upon by whale sharks and squid. |  | Small fish found in the Ningaloo reef. The prey on macroalgae (seaweed) which help keep the population down. |
|  |  |  |
| **Bridled Parrotfish** |  | **Coral** |
| http://www.fishing-khaolak.com/images/fish/saltwater_fish/bridled_parrotfish.jpg |  | http://thegraphicsfairy.com/wp-content/uploads/2011/04/coral+vintage+image-graphicsfairy004bggred.jpg |
| Similar to the Daisy Parrotfish, the Bridled Parrotfish feeds on seaweed found in the coral reef region. |  | Coral consume zooplankton (small animal organisms) and phytoplankton debris. They in turn are preyed upon by whale sharks. |
|  |  |  |
| **Yellow fin Tuna** |  |  |
| http://www.lastwordonnothing.com/wp-content/uploads/2011/01/Thunnus-orientalis_FAO_1.gif |  |  |
| Tuna are large fish found in the Ningaloo reef. The prey on squid, macroalgae, zooplankton and phytoplankton. |  |  |

1. Using the above information on the Ningaloo reef, create a food web showing the feeding habits of the organisms found there.

Food web to be done in four layers. 1 mark per correct layer.

SQUID

CARNIVORE – 1 MARK

OMNIVORE – 1 MARK

HERBIVORE – 1 MARK

AUTOTROPH – 1 MARK

WHALE SHARK TUNA

CORAL

ZOOPLANKTON DAISY PARROTFISH BRIDLED PARROTFISH

PHYTOPLANKTON MACROALGAE (seaweed)

**Keystone Species**

A keystone species is an organism that plays a crucial role in the overall functioning of an ecosystem. If the keystone species were not to inhabit the ecosystem any longer, the ecosystem would drastically change or even cease to exist.

Though all organisms work interdependently within a habitat, keystone species have an even greater impact on all other organisms. They can be responsible for fixing nutrient quality, controlling the distribution of other organisms which could change the ecosystem from one type to another or prevent the overpopulation of an organism. They can even help maintain the stability of ecosystem or help it to be resilient to disturbances by outside abiotic factors (such as storms or human interference).

The removal of a keystone species can be catastrophic. It can create a domino effect within the ecosystem where pests could take over or nutrients may not be cycled back in or other species may disappear.

In the Ningaloo reef, herbivorous fish are the keystone species. Herbivorous fish, such as the Daisy Parrotfish and the Bridled Parrotfish, feed on macroalgae (seaweed). The removal of the seaweed by the Parrotfish allows coral, in the reef, to flourish. In areas high in herbivorous fish population, then one would find coral-dominated reefs. Whale Sharks migrate through coral-dominated reefs during the months that they spawn as they are an abundant food source.

Under normal circumstances, seaweed and coral would compete for the same resources.

1. How does the coral reef flourish when seaweed is present in the ecosystem?

Consume – 1 MARK : Herbivoroous fish consume seaweed  
Control – 1 MARK : causes population to be kept under control

Competition – 1 MARK : coral flourish as no competition for resources (space).

1. Imagine a tsunami moves through the Ningaloo reef. As it moves, it brings along water that is much cooler than the herbivorous fish (Daisy and Bridled Parrotfish) can tolerate. This results in the fish dying out and removal of the coral, due to the rough conditions. Explain what would happen to the distribution of seaweed, coral and whale sharks within the reef. Include why it would happen in your response. You may use information used in question 1 to support your response.

Number/population of coral would DECREASE and seaweed would INCREASE – 1 MARK  
Cold water 🡪 bleaching and removal of coral. More space in reef for seaweed to grow – 1 MARK  
Consumers of seaweed are killed – 1 MARK  
Natural predator no longer control population – 1 MARK  
whale sharks less abundant as seen only when coral are spawning – 1 MARK

1. Draw a new food web (with organisms from question 1) showing what you described in question 3.

CARNIVORE – 1 MARK

OMNIVORE – 1 MARK

HERBIVORE – 1 MARK

AUTOTROPH – 1 MARK

SQUID

WHALE SHARK TUNA

ZOOPLANKTON

PHYTOPLANKTON MACROALGAE (seaweed)

**Monitoring Techniques and Ecological Pyramids**

Consider the scenario below.

Scientists from a number of Western Australian universities are conducting research and surveys in the Ningaloo reef area. One group of scientists are looking at the density or abundance of organisms in given areas. By using transects throughout the reef ecosystem they can count the number of organisms.

1. State why it is important to collect data from different areas within the ecosystem.

Remove anomalies – 1 MARK  
Results are valid and reliable – 1 MARK  
Scientists use the average – 1 MARK

Below is a table showing the number of Crown of Thorns starfish that scientists found at 17 survey sites within the Ningaloo reef. These organisms consume coral.

|  |  |  |  |
| --- | --- | --- | --- |
| **Site** | **Number of organisms/m2** | **Site** | **Number of organisms/m2** |
| 1 | 24 | 10 | 53 |
| 2 | 30 | 11 | 41 |
| 3 | 12 | 12 | 36 |
| 4 | 42 | 13 | 25 |
| 5 | 89 | 14 | 14 |
| 6 | 36 | 15 | 15 |
| 7 | 10 | 16 | 32 |
| 8 | 15 | 17 | 23 |
| 9 | 79 | 18 | 31 |

1. Determine the average number of Crown of Thorns starfish per m2 based on the information from the previous table. Ensure to show all working out.

Add numbers together – 1 MARK  
divide by 18 – 1 MARK  
607 ÷ 18 = 33.7/m2

The averages of other organisms within the same food chain were also determined.

|  |  |
| --- | --- |
| **Organism** | **Average number of organisms/m2** |
| Phytoplankton | 24,109 |
| Zooplankton | 1,263 |
| Coral | 562 |

1. What kind of ecological pyramid would the scientists use to present this data?  
   Number pyramid - 1 MARK
2. Create this pyramid with all the organisms from the table and the average number of Crown of Thorns starfish that you determined. In the food chain, the coral is eaten by the Crown of Thorns starfish. Make sure to include the name of the organism, average number of organisms/m2, the trophic level and the type of organism on the pyramid.

ORDER – 1 MARK

AUTO/HETEROTROPH – 1 MARK

TROPHIC LEVEL – 1 MARK

#/m2 – 1 MARK

Crown of Thorns  
33.7/m2  
  
Tertiary Consumer  
HETEROTROPH  
  
  
Coral  
562/m2Secondary Consumer - HETEROTROPH  
  
  
Zooplankton  
1,263/m2  
  
Primary Consumer - HETEROTROPH  
  
  
  
Phytoplankton   
24,109/ m2Producer - AUTOTROPH