WILDTRUST™

SMALL SCALE FISHERS

MODULE 04

SESSION PACK

SESSION PLAN: MUSSEL BIOLOGY

SESSION OBJECTIVES:

The aim of this session is for the learners to understand the biology of marine mussels and their life cycle and to appreciate that they are slow growing and require time and resources to reproduce in order to replenish stocks.

NOTES FOR THE FACILITATOR:

A mussel is a soft body animal, protected by a hard shell which is brown in colour. Like most other animals' mussels have two sexes. The male mussel flesh is light or white in colour and the females' flesh is redder or orange in colour. Mussels reproduce by spawning, which takes place in the winter months. Females release eggs in the water and males release sperm, these mix, creating mussel larvae. These tiny baby mussel larvae are free floating for up to 6 months. Many will not survive due to predation, being washed away, water temperate change and pollution. Anytime between 1-6 months the larvae will attempt to find a suitable home. The best option is to embed amongst other bigger established mussels if possible.

Mussels are slow growing animals when they about 1½ years to 2 years they start to split in sizes, with the males becoming longer than the females. They are also become sexually mature around this age. Depending on the climate of the area mussel can grow up to 120mm reaching around the age of 3 years.

Mussels are found on the rocks in the intertidal zone (between high and low water mark). Because mussels are sedentary with their shells glued to the rocks by strong byssus threads, they rely on the high tide water and waves to wash over them and bring them food. When there is water the mussels will open their shells slightly sucking in water and filtering out tiny particles called plankton to eat. Mussels also filter out dirt and pollution from the water when they are feeding. Mussels are very important for keeping the ocean healthy and clean. Wate clarity is important for many animals to survive.

Mussels have numerous predators including fish, octopus, crayfish, urchin and humans.

INTRODUCTION ACTIVITY:

Ask the learners to tell you what humans require to survive and reproduce – they can shout their answers out and you can write them on the board.

Answers: Food, air, water, shelter. protection, time to grow big enough to reproduce, male and female

Explain that much like humans' mussels require the same things, we will learn this in the next activities.

- Food (they filter feed)
- Air (extract oxygen from the water)
- Water (seawater bring them their food)
- Shelter (mussels need to attach themselves somewhere sheltered from big waves etc)
- Protection (their shell)
- Time to grow (mussels need about 2 years before they are sexually mature)
- Female mussels produce eggs, males' sperm, these mix in the water during spawning season creating mussel larvae.

MAIN ACTIVITY: Mussel Story

1. Read Mpilo the mussel story (see below) to the learners.
2. Then divide the learners into groups of 3 or 4 people.
3. Give each group a piece of blank paper (poster size if possible) and colouring equipment.
4. Have the learners draw their own version of Mpilo the mussel, their drawing should include: mussel biology and life cycle as well as the ecosystem mussels live in and their function.
5. Now re-read the story slowly allowing the learners to draw as you read.
6. Allow them to create their own characters etc.
7. Have each group share their drawing with the class.

CLOSING ACTIVITY:

Play the mussel game with the learners (see below).

MPILO THE MUSSEL STORY

Once upon a time, in the clear blue waters of the sea, lived a little mussel named Mpilo. Mpilo wasn't like most sea creatures that could swim freely in the water. Instead, she lived **attached by strong threads** to a smooth **rock in the intertidal zone**, right between where the high waves crashed, and the low tide left behind treasures. Mpilo was part of a big mussel family that lived all along the rocky shore.

Mpilo's home was a shiny **brown shell**, smooth on the outside, but strong enough to protect her from danger. Inside her shell, Mpilo was **soft,** kind of like a squishy little ball, and she spent most of her time filtering food from the water. She didn't need to go hunting like other animals. Instead, she opened her shell ever so slightly, letting the waves bring tiny bits of food to her, things like plankton and organic particles. She'd strain them out of the water and munch away, happy to live in the peaceful sway of the tide.

Although Mpilo couldn't move, she wasn't alone. Her family lived all around her, and the rocks were covered with many other **creatures too like barnacles, limpets, and even mussel worms**. They all lived together in a busy little community, each doing their part to make the rocky shore a special place.

One bright winters eve when the moon was full, Mpilo, noticed something different in the water. The water around her became busy, it bubbled with tiny creatures all around.

"What's happening, Mama Mussel?" Mpilo asked her mother, who was attached next to her on the same rock.

Her mother smiled and said, "It's that time of year again, Mpilo. It's our ***spawning season***."

"What does that mean?" Mpilo asked, curious.

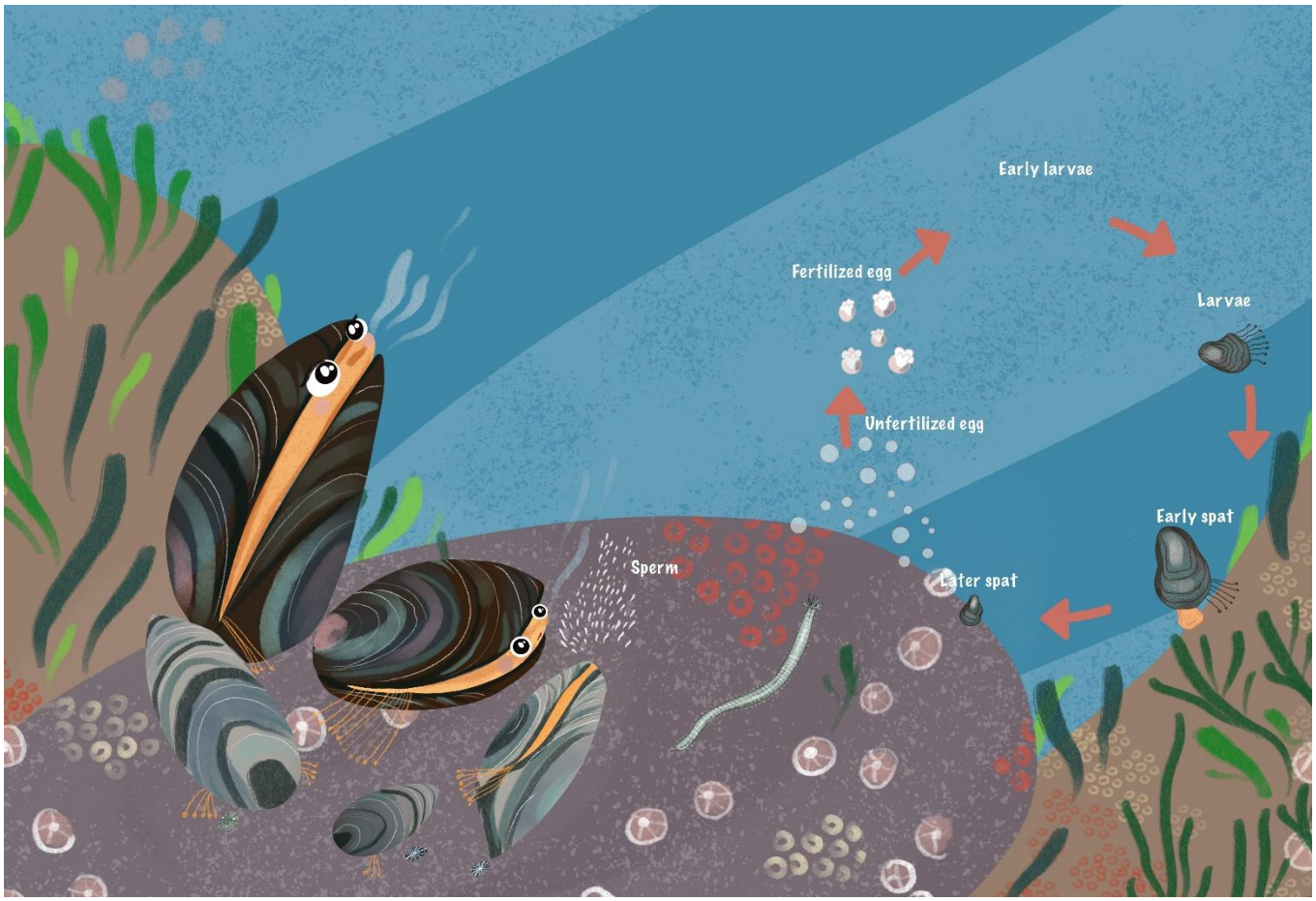
"Well," her mother explained, "during spawning season, female mussels like me release many **eggs i**nto the water, and the male mussels release **sperm**. The eggs and sperm mix in the water, and that's how tiny **new mussels, called larvae**, are created."

Mpilo's eyes widened. "Tiny new mussels? How do they grow?"

"Not all of them make it," her mother continued. "Many larvae get eaten by fish or swept away by the strong waves. But those that survive float in the water until they find a good place to attach, like we did."

Mpilo was amazed. "Wow, so we start as tiny floating larvae babies?"

Yes, Mama replied, but now you are a juvenile mussel attached to this rock with me. Here you will grow to be an adult.



Mpilo couldn't wait to grow up, but she knew it wouldn't happen quickly. Mussels, after all**, grow slowly.** As the days turned into months, Mpilo noticed she was getting bigger. By the time she was about **6 months old**, she was about the size of a small pebble—between **30 and 40 mm**. Over the next few years, Mpilo grew larger and larger. By the time she was **2 years old**, she had reached about **60 mm** in size, and something interesting happened. Mpilo noticed the males around her where **white in colour and started to grow a little longer than the females which where more pink in colour.**

"Why are the boys getting longer?" Mpilo asked her mother.

"That's just how we mussels grow," her mother replied. "Males tend to get longer as they grow older. But we all have our own pace. You're growing just fine."

As Mpilo grew older, she realized just how important it was to protect the ocean and its creatures. She noticed the fishermen who came to the shore, collecting mussels from the rocks. Sometimes they took what seemed like a lot to her, and this worried Mpilo.

"Mama, what will happen if too many mussels are taken?" a concerned Mpilo asked.

“If there aren’t enough mussels, Mama explained, then animals that feed on mussels like fish, octopuses, and even seabirds, won’t have enough to eat. We form a part of what is called a **food web.**

“We also have an important job of helping keep the ocean clean “Mama stated,

“How do we keep the ocean clean?”, Mpilo asked. “Were so small!”

Mama smiled and explained mussels are like tiny vacuum cleaners, every time we open our shells, we suck in water from around us. As the water flows through we filter out tiny food particles—like little bits of plankton and tiny plants to eat. But the best part is that when we filter out all that food, we also get rid of little bits of pollution, dirt, and waste that is floating in the water. So we make the water cleaner by eating and filtering out the yucky stuff and the cleaner the water is, the healthier all the animals are.”

Mussels might seem small, but we have a BIG job! A single mussel can **filter** about **25 liters of water every day**. When there are lots of us in one place, we work together to clean huge amounts of water, making the ocean a better place for all creatures.

“Wow,” said Mpilo. “I feel like a tiny ocean superhero!”

Mama giggled and spoke. “We may not wear capes, but we sure do help the ocean stay clean! But we need help from everyone to keep the oceans healthy, it’s important that people do not take too many mussels from the ocean, or else we won’t be able to do our job.”

After a long day of filtering and cleaning, Mpilo looked out over the sparkling ocean. “We may be small,” she said, “but we mussels are mighty when we work together!”

And so, Mpilo the Mussel continued to live peacefully on her rock, filtering the water, growing slowly, she still wasn't fully grown, but she had become **sexually mature,** which meant she could start **making eggs** of her own.

Mpilo closed her shell tight for the day as the tide was going out, hoping that one day, everyone would understand how important it was to care for the ocean, so that the waves would continue to carry tiny mussel larvae, and there would always be enough mussels for future generations.

MUSSEL GAME

The aim of the game is for the mussel larvae to find suitable places to attach, survive and grow big enough to reproduce.

Learner outcomes:

- to describe and appreciate the life cycle of marine mussels
- identify mortality factors related to marine mussels
- describe marine mussel habitat

Explore:

- Ask the learners to tell you anything they know about the marine mussel lifecycle
- Where do mussels live
- Check if the learners know what mortality means and if they know any of the mortality factors that affect mussels.

Materials required:

- Rope to mark the playing area – or you can draw lines in the sand if you are playing on the beach.
- Mortality factors labels / cards / stickers (see below) – instead of printing these you can upcycle cardboard such as cereal boxes and use a marker to make labels that can hang around the players neck using some string.
- Box / container with toothpicks in – break 1/3 of the toothpicks in half so that box contains both full and halved toothpicks. These will represent male and female mussels. The players must not be able see in this box, they must blindly / randomly pick one out.

Game set up:

Mark off the playing area with rope or drawing in the sand (see diagram below)

Demark the playing zones within the rocky shores intertidal zone:

- Safe zone 1 - Starting point – Free floating larvae
- Ocean zone
- Safe zone 2 – Mussel larvae land on substrate
- Substrate zone
- Safe zone 3 – Juvenile mussels attach – in this zone the players collect a toothpick
- Attached zone

- Safe zone 4: Mussels are now mature and able to spawn. Males release sperm into the water, females release eggs, these mix and new mussel larvae is created.

Explain how to play the game:

- Tell the learners that they are going to play the role of either a mussel or one of the mortality factors.
- Players who start out as mussel larvae must try move from safe zone 1, the start, across the ocean zone to safe zone 2 without being tagged by a mortality factor player. If they are tagged, they die and must leave the game (playing area). If they reach safe zone 2, they can rest before moving on.
- Players that make it to safe zone 2 are now tiny baby mussels 1-2 months old, known as recruits. These babies need to find somewhere safe and suitable to attach themselves like in a crevasse in the rocky shore or the best and safest place for them to attach themselves is amongst established mussel beds with other bigger mussels on the rocky shores. When they this small they can use their tiny foot to move around and find a good spot before becoming permanently attached by their threads.
- Players then move from safe zone 2 to safe zone 3 crossing the substrate zone, again trying not to be tagged by the mortality factors in this zone. During this phase of the game the mussels have grown into juvenile mussels about 6 months of age.
- At safe zone 3 players collect a toothpick from the box hold onto it until the end.
- The players then move from safe zone 3 to safe zone 4 across the attached zone during this phase the mussels need to mature from juvenile (6 months) to adults (2 years).
- The players that make it safely to safe zone 4 have become mature mussels and able to reproduce by spawning. Males release sperm into the water, females release eggs, these mix and new mussel larvae is created. The players who have a full toothpick (long stick) are males and the players who have half a toothpick (short stick) are female. Make a note of how many of each sex made to reproduction age safely.
- Explain each of the mortality factors for each of the zones.
    - In the Ocean zone: Predator = fish who eat larvae, water temp – if the larvae hit a cold patch they can die and big waves who can wash the tiny larvae away.
    - In the Substrate zone: Predators = seastar, urchins and crabs who eat them, water pollution, and incorrect substrate like landing on the sandy shore instead of rocky shore or exposed area of the rocks without protection of others, or no space on the rocks to attach due to algae.

    - In the Attached zone: Predators = Octopus, lobsters and harvesters (humans) consume them. A sandstorm can smother mussels to death and an oil spill can destroy entire mussel beds.
- Give the learners who will represent mortality factors their labels and stand these players in their zone depending on which factor they represent. These players can only tag mussels in their zone and only one mussel at a time.
- All players must play within the playing area – if they step out the playing area they die

Evaluate:

- Ask the learners what happened in the game? Did all the mussels survive? How many made it to the age where they can reproduce? How many of these where male and how many females, if only one sex survives will the mussels be able to reproduce?
- Explore what would happen if all the mussel larvae where to survive – would there be enough resources them? Like space and food?
- Look at the mortality factors and discuss how they differ at the different mussel life stages – what would happen if the harvester was introduced at an earlier life cycle stage / zone?
- Discuss the monitoring programme
- Ask the learners to tell you about the life cycle of mussels,

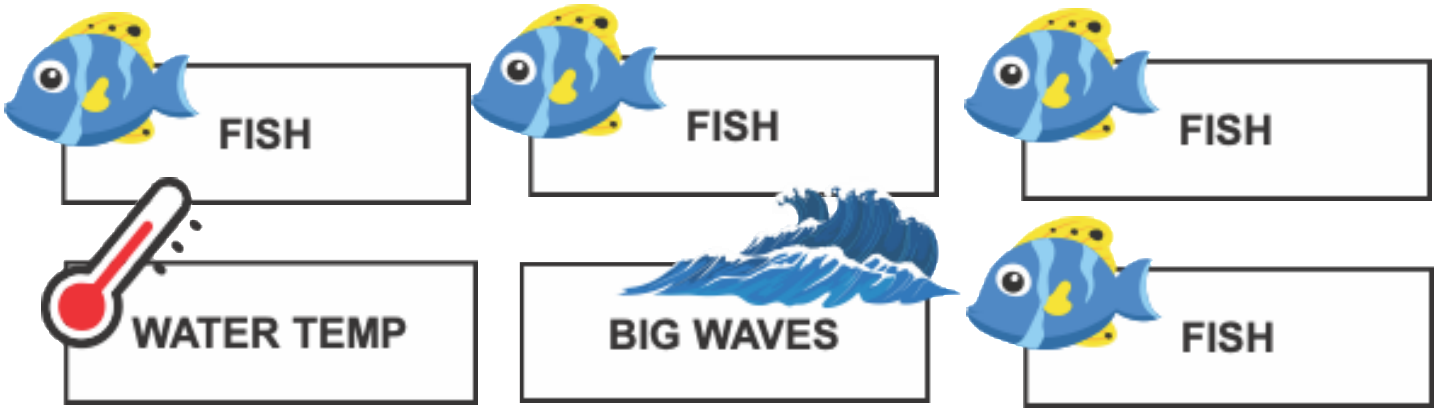
Elaborate:

What would happen if the ratio of mortality factors was changed?

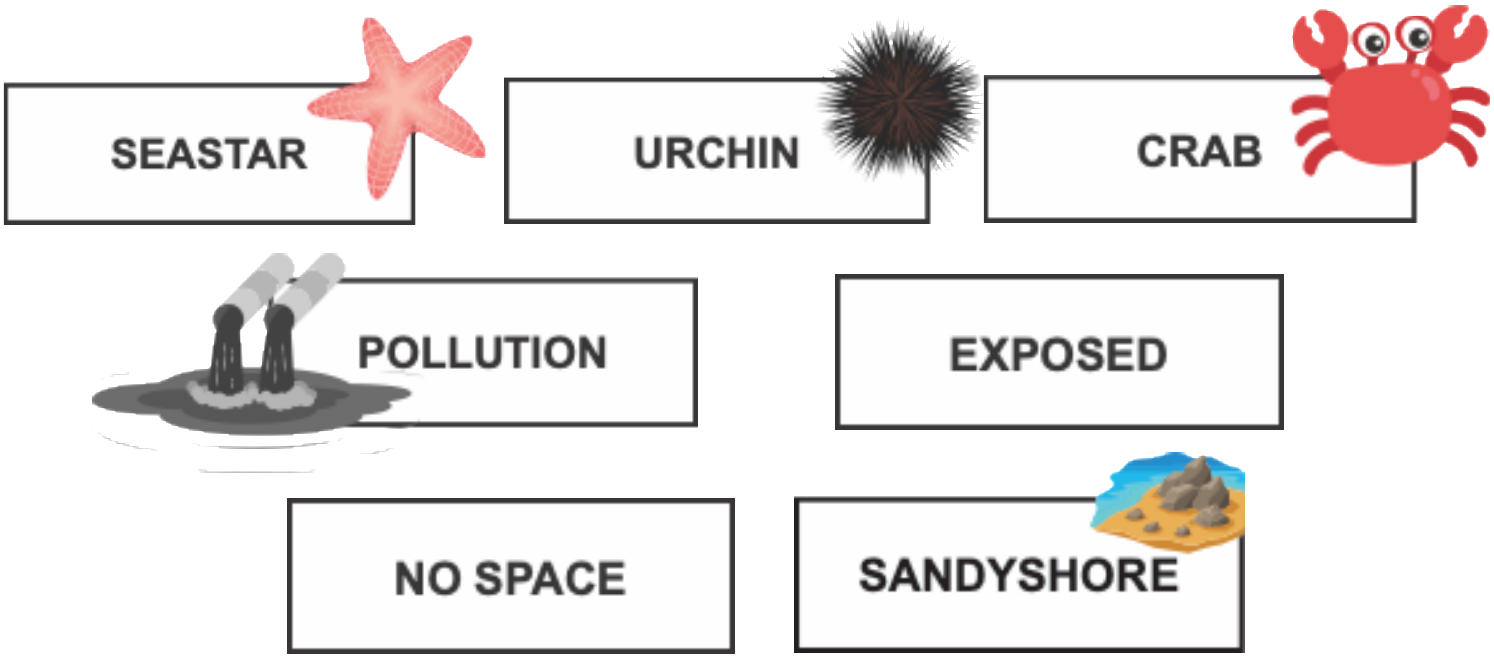
What would happen if the human factors were removed, or you added monitors to the game? (You can replay the game to find out).

Mortality labels:

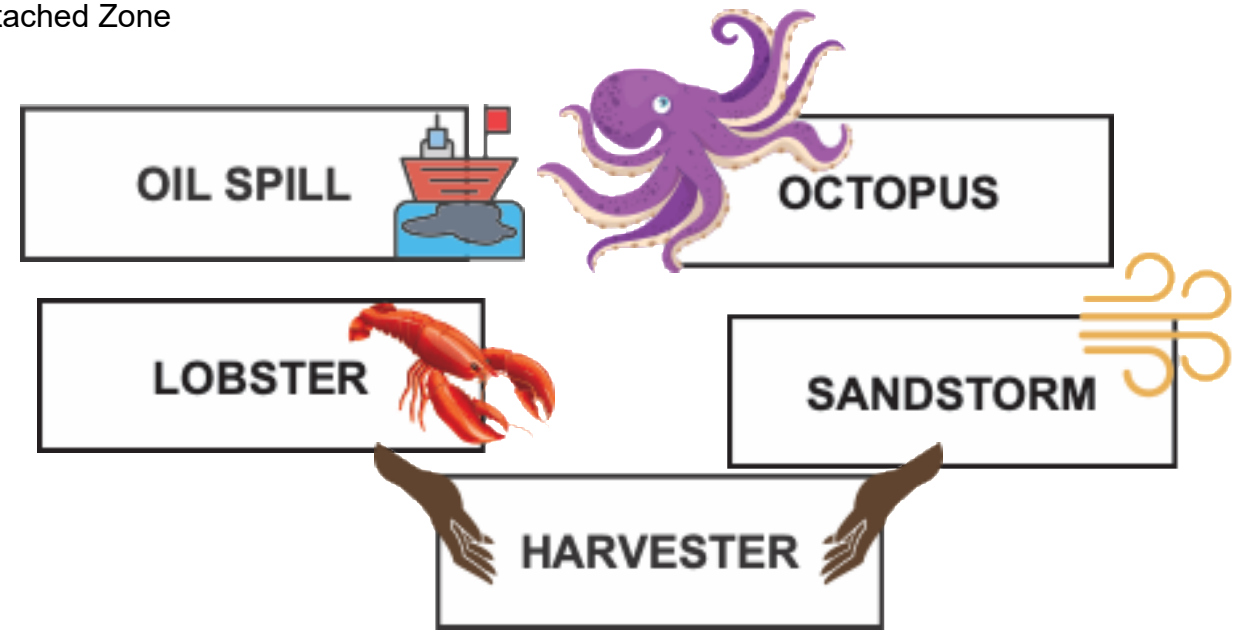
Ocean Zone



Substrate Zone



Attached Zone



PLAYING AREA

Curriculum and Assessment Policy Statement Alignment

SSF Modules				Module - CAPS Alignments							
Module	**Topic**	**Objective**	**Activity**	**Section**	**Grade**	**Subject**	**Strand**	**Topic**	**Content & Concepts**	**Tasks**	**Term**
1	Rocky shores ecosystem interactions	The aim of this session is to demonstrate the relationship between living and non-living organisms in the rocky shore ecosystem as well as a basic food web and the relationship between harvesters and the ecosystem.	Rock pool activity	Senior Phase	Grade 7	Social Sciences	Geography	Natural resources and conservation in South Africa	Natural resources: on earth – including water, air, forests, soil, animal and marine life- Use and abuse of selected examples	Matching, Making connections bettwen causes and effects	4
2	Sustainable utilization (harvesting)	The aim of this session is to illustrate the concept of sustainable utilization (harvesting) by using the worm model.	Worm model	Senior Phase	Grade 7	Social Sciences	Geography	Natural resources and conservation in South Africa	Natural resources: Use and abuse of selected examples	Writing, short answers Making connections bettwen causes and effects	4
3	Stock limits	Learners are exposed to what stock control is and how and why bag limits are determined as well as an appreciation for the fact that some elements cannot be controlled in the process.	Bean game	Senior Phase	Grade 7	Social Sciences	Geography	Natural resources and conservation in South Africa	Management of resources: Concept of conservation – including reasons for conservation as well as Conservation areas (including marine reserves)	Answering questions, Working with data (graphs and tables)	4
4	Mussel biology	The aim of this session is for the learners to understand the mussels biology and life cycle and to appreciate that they are slow growing and require time and resources to reproduce in order to replenish stocks.	Mussel story and game	Senior Phase	Grade 7	Natural Science	Live & Living	Biodiversity	Basic differences in processes such as movement, nutrition and reproduction, distinguishes plants from animals		1
				Senior Phase	Grade 7	Natural Science	Live & Living	Variation	individuals of the same species can reproduce to make more individuals of the same species		1
				Senior Phase	Grade 7	Natural Science	Live & Living	The biosphere	*Living things need energy, gases, water, soil (rocks) and favourable tempratures. *Living things are suited to the environment in which they live		1
5	Cooperative resources use and stewardship	The aim of this session is for the learners to understand the need for cooperative use and stewardship over finite resources	Commons dilemma lake fishing game	Senior Phase	Grade 7	Social Sciences	Geography	Natural resources and conservation in South Africa	Management of resources: Concept of conservation – including reasons for conservation as well as Conservation areas (including marine reserves)	Itentifying and discussing issues, evaluating ideas and actions writing paragraphs	4