Saltmarshes

This education pack was produced by two long standing partnerships, the Pen Llŷn a'r Sarnau SAC and the Llŷn Partnership, with contributions from a wide range of additional partners.

FOR MORE INFORMATION AND EXTRA RESOURCES

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Welcome

Wales could definitely be considered a maritime country. Its huge coastline stretches for 1,680 miles, enveloping the country in its influence, even if in nothing more than the milder wetter weather its proximity brings.

The coastline alone offers a wealth of different habitats and along with them species specifically adapted to thrive there. Muddy river estuaries, long sandy beaches, exposed and violent rocky shores, and cliffs, share as many differences as similarities and all can be found along Wales' shores. As you move offshore you may come across the country's largest inhabitants. Cardigan Bay is home to one of only two resident bottlenose dolphin pods in the UK, and every summer our waters are visited by the world's second largest fish, the basking shark, and the fifth largest, the ocean sunfish, drawn here by the plankton blooms that flourish in spring's lengthening days. Welsh seas provide a home for thousands of species, from the tiniest barnacle to some of the world's largest living creatures.

No matter how far you live from the sea you are dependent on it for every breath you take as over half the world's oxygen is generated by marine organisms. The sea improves people's health and well-being, providing recreation, food and, employment. It also contributes a lot of the Welsh economy, especially through tourism. However, for a long time this has been a one-sided relationship and protection of the sea has been slower to come and harder to enforce. Our seas are under constant pressure and the more people who understand and appreciate the wonder of our seas, the more likely any protection measures are to succeed and the safer the future of our seas will become.

How to use this pack

Each topic begins with a basic introduction and ideas for further study. Every activity within that topic starts with the teachers' guidance sheet and then the learners' worksheets. (These can also be found as separate sheets to be printed directly from the electronic resources).

The symbols below are found in the top right-hand corner of every activity and provide a quick reference guide for preparing and planning:

Booklet type, in this case Sea

Activity takes place outside or inside

Individual, partner or group activity

Time this activity takes to complete

Time of year this activity is suitable for - spring, summer, autumn, winter, or all year

Where to get more information

This printed pack is intended to act as a starting point for a much bigger collection of activities that will regularly be updated. These resources will be made available on **www.tiramor.cymru** as they are created and further physical additions will be issued as and when funding becomes available. All activities are available as separate downloads on the website.

All URLs correct at time of publishing.

Saltmarshes

Saltmarshes lie between the land and the sea, literally bridging the two habitats: between the water on one side and the dry land on the other. They are, therefore, a unique habitat, as tidal water covers the land twice a day.

They are typical of sheltered areas on the coast, namely straits, river estuaries, and ports, where they are protected from the force of the waves.

In them, plants that can resist saltwater grow, as it is a semi-saline habitat, being covered and uncovered by the sea at high and low tide. These plants are important for anchoring and stabilising the habitat by holding mud and sand in their roots.

Fish can use the marshes for shelter, which makes them an important nursery area. Animals that live in the mud offer food to species higher up the food chain, making this an important and biodiverse habitat. For example, waders such as the redshank and the oystercatcher feed on fish, shellfish, and worms in the mud when the tide is out. This biodiversity is why several saltmarshes in Wales, such as Y Fenai, Conwy Bay, and the Glaslyn, Dwyryd, and Artro estuaries, have been designated as Special Areas of Conservation (SACs). Among the notable species in these conservation areas are otters, dolphins, and pintail eels. These habitats are also internationally important as feeding and resting places for migrating birds - a kind of 'fast food' stop for birds to rest and refuel before continuing their journeys.

Although it is such an important habitat, there is little understanding of its value as a blue carbon resource and its role in protecting the coast, especially in the face of climate change, rising sea levels, and more frequent and intense storms. Saltmarshes and the muddy areas known as mudflats offer 'nature-based solutions' to help prevent coastal erosion and flooding. These are often more cost-effective and environmentally friendly than 'hard' defences such as walls, jetties, and concrete breakwaters. In some places, these stronger defences are being removed in favour of 'soft' restoration techniques, including the re-flooding of land that was previously reclaimed from the sea. Examples of this can be seen at Traeth Mawr and the Cob in Porthmadog, and at Malltraeth, Anglesey.
In addition to supporting wildlife, the land is used as pasture for sheep and cattle. Meat from Welsh livestock grazing on saltmarshes is known for its distinctive and unique flavour.

In addition to supporting wildlife, the land is used as pasture for sheep and cattle. Meat from Welsh livestock grazing on saltmarshes is known for its distinctive and unique flavour. Glastraeth Lamb from the Dwyryd is a well-known example. There is a need for careful management of livestock to avoid overgrazing and the degradation of this fragile habitat.

Due to pressure for land to be used for agriculture or housing, many saltmarshes have been lost, either through drainage or coastal erosion. Continuous monitoring is required to prevent the complete loss of this fragile habitat, especially as coastal ecosystems come under growing pressure from development and efforts to 'improve' wetlands. Without strong conservation and restoration efforts, the rare species that depend on saltmarshes face a very uncertain future.

Further research keywords
Anthropogenic, biodiversity, biogeochemistry, carbon and carbon sequestration, ecosystem services, greenhouse effect, greenhouse gas, invasive species, photon, vegetation, wetlands.

Activities Overview

ACTIVITY 1
Saltmarsh Scramble!

FOLLOWING THIS ACTIVITY, LEARNERS SHOULD:

1. Understand the role of Special Areas of Conservation

2. Be able to identify the basic needs of animals for survival

3. Understand how environmental factors affect wildlife populations

SKILLS THAT WILL BE DEVELOPED

- Communicating ideas
- Critical thinking
- Making decisions
- Collaborating in a team
- Handling data and numeracy

ACTIVITY 2
Saltmarsh Connections

FOLLOWING THIS ACTIVITY, LEARNERS SHOULD:

1. Understand how species, habitats and natural processes are interconnected in the saltmarsh ecosystem

2. Understand how saltmarshes provide important ecosystem services that support both wildlife and people

SKILLS THAT WILL BE DEVELOPED

- Critical thinking
- Communicating effectively
- Collaborating and discussing ideas
- Reasoning and making connections

ACTIVITY 3
Saltmarsh Nurseries

FOLLOWING THIS ACTIVITY, LEARNERS SHOULD:

1. Understand why saltmarshes provide ideal nursery habitats for young fish

2. Be able to describe how fish grow and change through different life cycle stages

SKILLS THAT WILL BE DEVELOPED

- Observing carefully
- Ordering events
- Communicating ideas
- Explaining processes

ACTIVITY 4
Living with the Tide

FOLLOWING THIS ACTIVITY, LEARNERS SHOULD:

1. Understand the different zones of a saltmarsh and the plants and animals found in each

2. Be able to explain how tidal changes shape the saltmarsh environment and affect living things

SKILLS THAT WILL BE DEVELOPED

- Observing and interpreting
- Modelling and labelling
- Communicating clearly
- Creating and presenting a video
- Collaborating as a team

45 MINS

12

Activity 1

Saltmarsh Scramble!

Equipment required:

- Copy of 'Presentation 1: Saltmarsh Scramble!' and device to share with learners
- Large open outdoor area, e.g. school field or playground
- Large piece of paper and pencil or pen
- Clipboard (optional)
- Something to mark two lines (e.g. chalk/cones)

To complete the activity:

1. (Slide 4) In pairs, ask learners to discuss:
    - What is a Special Area of Conservation (SAC)?

After discussion, share the definition on the slide to clarify and confirm understanding.

2. (Slide 5) Share the concept cartoon and encourage learners to read each character's opinion carefully and discuss their ideas in pairs. Ask:
    - Who do you think is right?
    - Could more than one person be correct?
    - Why do you think we protect these areas?
    - What might happen if these areas weren't protected?

All statements are true: Special Areas of Conservation (SACs) are conservation sites that safeguard species and protect habitats. Marine SACs help protect habitats such as saltmarshes and reefs that are important for wildlife, including otters, wading birds and plants.

3. (Slide 6) Support learners to identify a local marine SAC and consider features that it protects, such as saltmarshes, mudflats, estuaries and seagrass beds.

4. (Slide 7-8) Encourage learners to describe what they can see and to discuss why saltmarshes may be protected. Support learners to explore the location of the nearest saltmarsh.

5. (Slide 9) Reinforce key habitat needs with learners: food, water, shelter and space.
Ask learners to come up with motions to represent food, water and shelter (e.g. food = hands on mouth; water = hands making waves; and shelter = hands clasped over their head).
Explain to learners that wildlife populations in saltmarshes continuously fluctuate in response to a variety of (limiting) factors, e.g. not enough food, water or shelter.

6. (Slide 10) Ask all learners to count off aloud in sequence: "1, 2, 3, 4,1, 2, 3, 4..." until everyone has a number. Ask all learners who said "1" to line up behind the 'crab line' with all the "2s," "3s," and "4s" behind the 'habitat line'. The two lines should be set approximately 10 meters apart. Learners behind the crab line will be 'shore crabs', whilst learners behind the habitat line will represent the three essential components of a habitat (food, water and shelter).
The crabs will need to find food, water and shelter in order to survive.

7. Record the number of crabs at the start of the activity on a large piece of paper. Continue to record the crab population at the end of each round, for approximately 12 rounds.

8. At the beginning of each round, both groups (crabs and habitat components) should face away from each other. Ask all learners to choose one habitat component, and on signal, ("One, two, three, crabs!"), each crab and habitat component will turn to face the opposite group, clearly showing one habitat need sign. When crabs see the habitat component they need (another learner whose sign matches theirs), they run to that learner and bring the 'food,' 'water,' or 'shelter' back to the crab line. 'Capturing' a habitat component represents the crab successfully meeting its needs and reproducing as a result. Any crab that fails to find its chosen habitat component is considered unable to survive and must move to the habitat line. Remind learners that they cannot change what they are looking for during the round.

9. After the learners have played 6 rounds, introduce a predator, such as a heron into the simulation. The predator can tag crabs only when they are going towards their habitat component. Once tagged, the crab is escorted back into the den and will change role and become a predator for the next round.

10. In the final round, you may wish to ask all learners on the habitat component line to turn around without making any habitat component sign. This may represent environmental pollution or habitat destruction.

11. At the end of the 12 rounds, bring all learners together to discuss the activity.
    - What did they notice?
    - What do animals need to survive?
    - What happened to the crab population over time?
    - What are the 'limiting factors' that affect the survival of animals?
    - How did the number of crabs fluctuate?
    - How did introducing a predator affect the crab population?
    - Why is a good habitat important for animals?

ADDITIONAL TASK Optional

(Slide 11) Encourage learners to use the data gathered during the activity to create a graph to show how the shore crab population has changed over time. Then, ask learners to analyse any trends they observe.

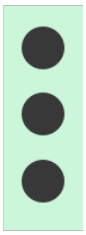
RESEARCH TASK Optional

Challenge learners to visit the North Wales Wildlife Trust website www.tiramor.cymru/saltmarshes (Resource 1) to find out what shore crabs look like, where they live, what they eat, and how they survive in their habitat.

Saltmarsh Scramble!

CRAB LINE

APPROX 10M



PREDATOR DEN

HABITAT COMPONENT
FOOD/WATER/SHELTER

30 MINS

Activity 2

Saltmarsh Connections

Equipment required:

- Copy of 'Presentation 2: Saltmarsh Connections' and device to share with learners
- Print out of the hexagonal cards on S_SM_1(1-2), one per group
- Scissors
- Internet enabled devices and internet access
- Something to record points and notes (e.g. paper and pencil)

To complete the activity:

1. (Slide 4-6) In pairs, ask learners to discuss possible links between the photos on each slide. Encourage them to look closely and think broadly. For example:
    - "Curlews and saltmarshes connect as curlews feed on worms and invertebrates in saltmarsh mud at low tides."
    - "Saltmarshes provide a safe nursery for young fish to feed and grow."
    - "Saltmarshes store large amounts of blue carbon in their muddy soils, which helps reduce the effects of climate change by keeping carbon dioxide out of the atmosphere."

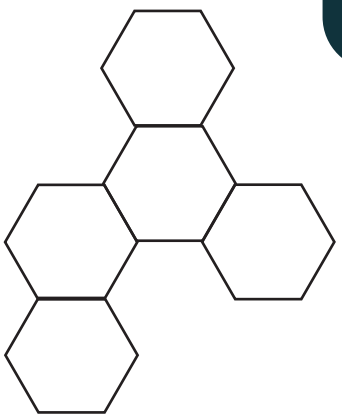
2. (Slide 7) Challenge learners to create more than one connection using the photos on the slide. Can any pairs connect all photos? For example:
    - "Climate change can cause sea level rise, leading to habitat loss, coastal erosion and saltmarsh habitat loss."

Explain the scoring system: 1 card = 1 point, 2 connected cards = 2 points, and so on. Each card must be meaningfully connected. If learners cannot make a connection, they may place a single card down and explain what is shown in the photo or the meaning of word (1 point). Learners may use internet-enabled devices to research unfamiliar terms, species, or ideas to help them make stronger, evidence-based connections.

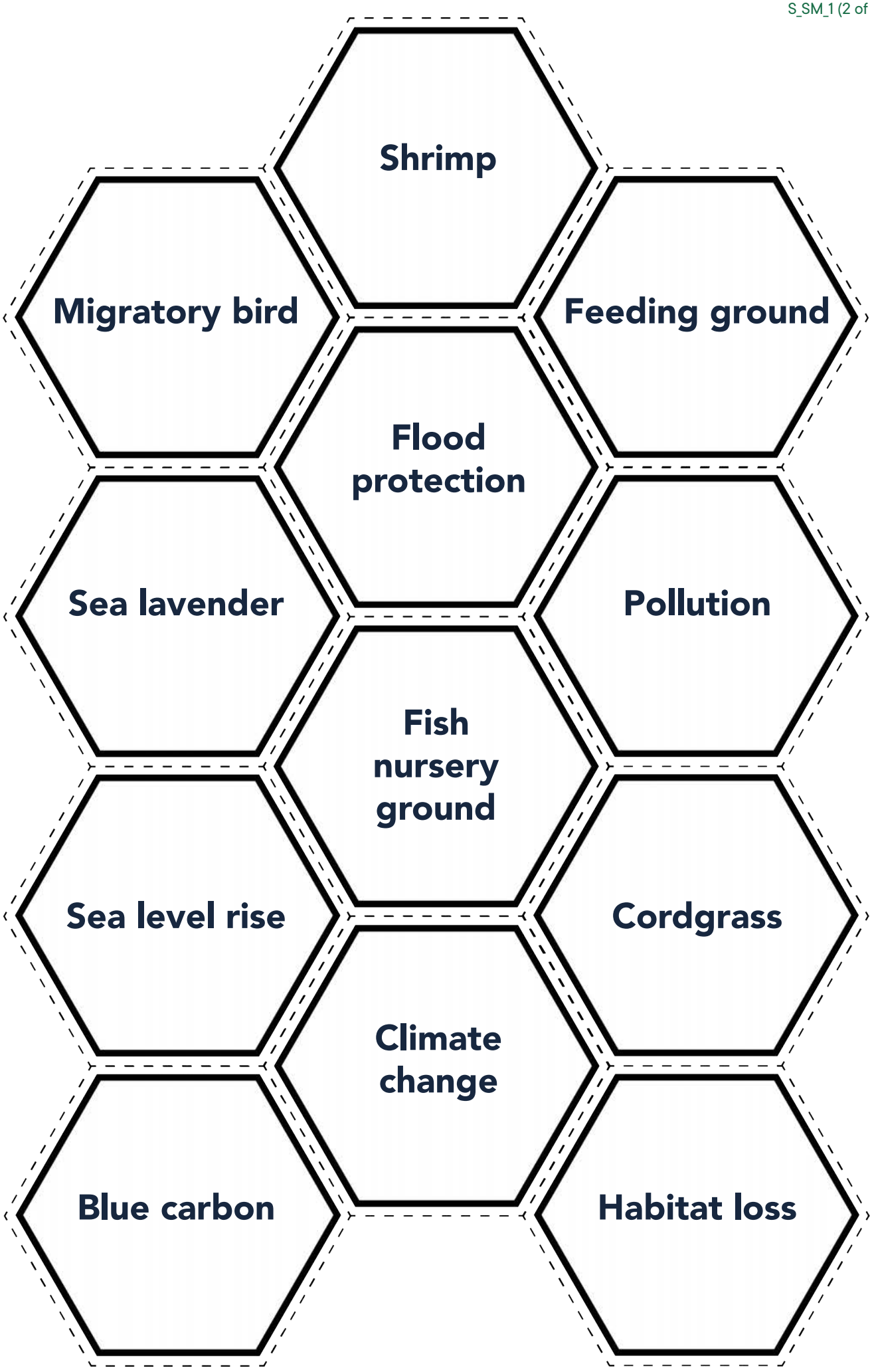
3. (Slide 8) Organise the class into small groups and provide each group with a copy of S_SM_1 and a pair of scissors. Ask learners to carefully cut out the photo cards, and to share them equally across the group. These will be the cards learners use to build their hexagonal grid. Use page 1 only for an easier version of the task. Include page 2 (word-only cards) for a more challenging version, encouraging deeper connections and explanation.

4. (Slide 9) Support learners to build a hexagonal grid by connecting ideas about saltmarshes. Each connection must make sense and be something the learners can explain to others. Cards are placed in a honeycomb-style grid, with each edge representing a connection. Learners will receive points for each meaningful connection they can explain. Ask learners to take turns and to keep track of their points as a team.

5. (Slide 10) Finally, ask learners to share their most interesting or surprising connections with the class. Did any connections surprise them? What did this activity help them to realise about saltmarshes?




Saltmarsh
High tide
Low tide
Mudflat
Estuary
Coastal erosion
Special Area of Conservation
Samphire
Otter
Curlew
Young fish
Crab


Shrimp
Migratory bird
Feeding ground
Flood protection
Sea lavender
Pollution
Fish nursery ground
Sea level rise
Cordgrass
Climate change
Blue carbon
Habitat loss

30 MINS

Activity 3

Saltmarsh Nurseries

Equipment required:

- Copy of 'Presentation 3: Saltmarsh Nurseries' and device to share with learners
- Print out of S_SM_2, one per pair
- Scissors
- Glue
- Paper or notebooks for recording ideas
- Internet enabled devices and internet access

To complete the activity:

1. (Slide 4) As a whole class, discuss whether a saltmarsh would make a good nursery for young fish. Why do learners think this?
Make a note of key features on the board or a shared screen. Suggestions may include:
    - Shallow water
    - Invertebrates to feed on
    - Hiding places between grasses
    - Other young fish or birds nearby

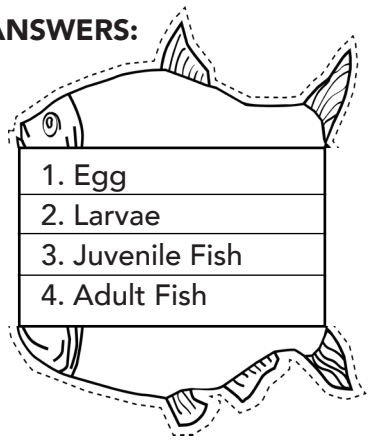
2. (Slide 5) In pairs, ask learners to imagine they are a young fish living in a saltmarsh.
Give them 3 minutes to draw or jot down their ideas. They can include things like:
    - What can they see?
    - What would they eat?
    - Where would they hide?
    - Who might be nearby – a friend or a threat?

3. (Slide 6) Give each pair of learners a copy of S_SM_2.
This includes a fish template, its life cycle stages, and matching descriptions.

4. Ask learners to cut out the fish, life cycle stages and their descriptions. Support them to put the stages in the correct order, discussing changes in size, location, diet, or threats over time.

5. Encourage learners to glue the life cycle stages onto the fish template.
Support them to fold along the lines to create their finished life cycle foldout.

ANSWERS:



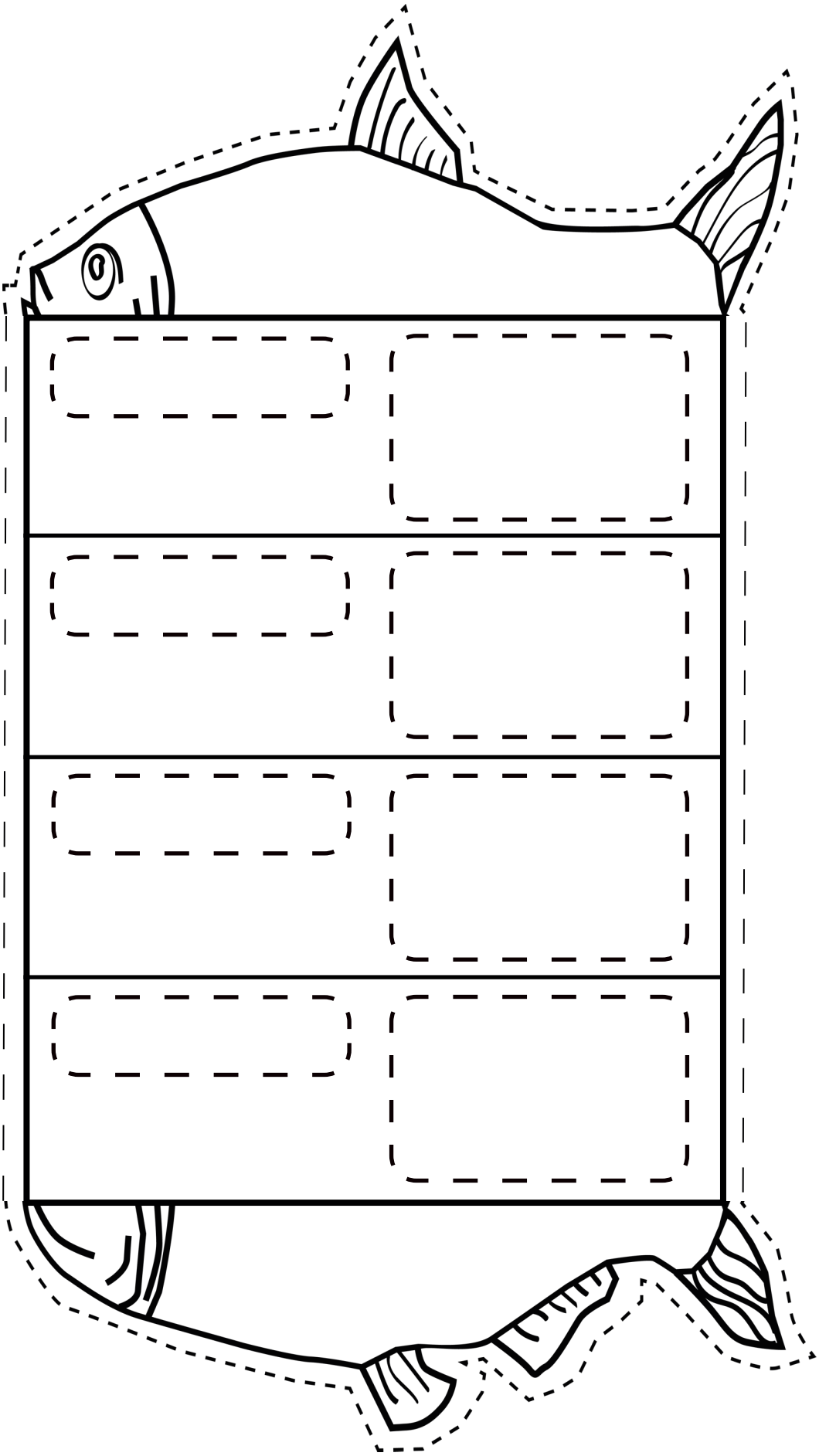
ADDITIONAL TASK Optional

(Slide 7) Challenge learners to design a perfect saltmarsh nursery for young fish.

They can draw and label their habitat or create a simple 3D model.

Encourage them to include features like food sources, safe hiding places, shallow water, and ways the habitat protects the fish from danger. Encourage learners to present their designs and explain how each part helps the fish survive.

Saltmarsh Nurseries



Egg

Adult Fish

Larvae

Juvenile Fish

Tiny, drifting larvae hatch from eggs. They feed on plankton and are very vulnerable to predators.

Small fish grow quickly, feeding on small invertebrates and hide amongst plants.

Fully grown fish live in deeper waters. They migrate, feed and return to spawn.

Fish eggs are laid in shallow coastal waters or estuaries. They are sticky and attach to seaweed or gravel.

45 MINS

12

Activity 4

Living with the Tide

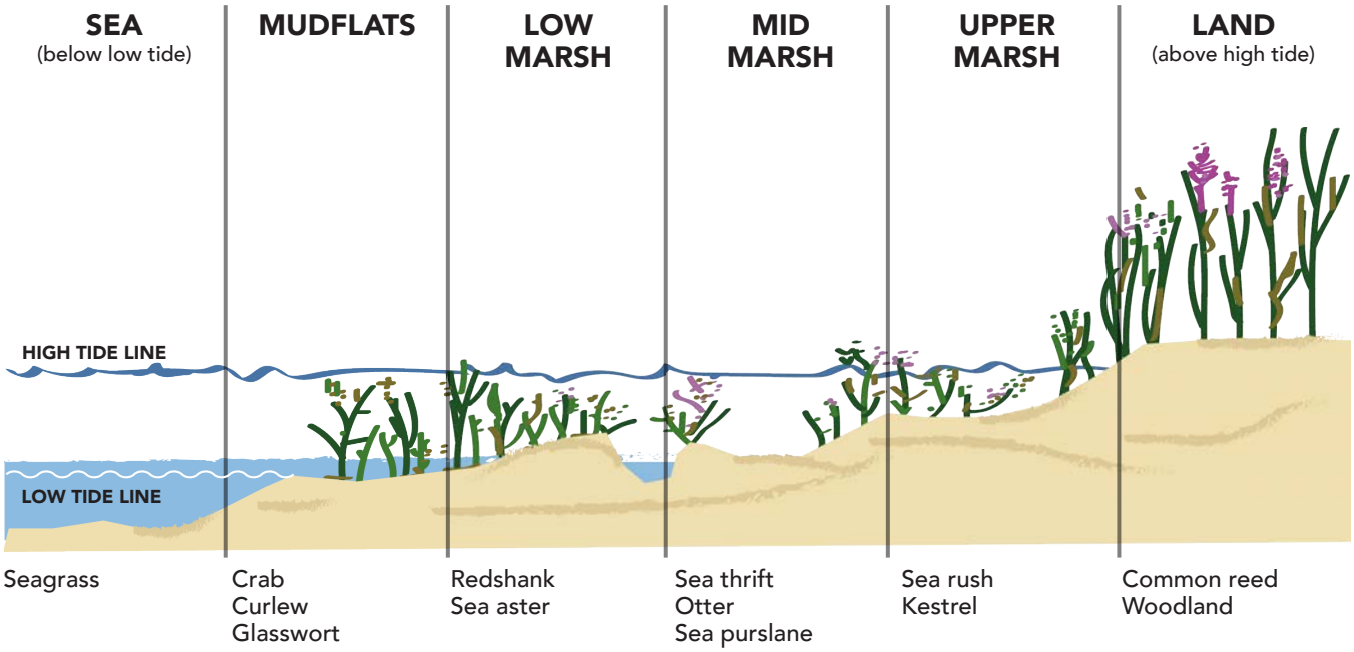
Equipment required:

- Copy of 'Presentation 4: Living with the Tide' and device to share with learners
- Print out of the 'Saltmarsh Zones and Tides' worksheet, one per learner
- Internet enabled devices and internet access
- A clear tray, tub or shallow box (e.g. plastic storage box, plant tray, or baking dish)
- Something to create the levels of saltmarsh, e.g. modelling clay, recycled card, craft materials or LEGO bricks in various colours
- Craft materials to represent marsh vegetation, e.g. sponges, scrunched tissue, or- green paper
- Paper, card, or small labels to mark areas and name species
- Glue, scissors, tape, and pens/pencils
- Blue ribbon or strips of paper to show how far the tide reaches
- Tablet, camera or phone (optional)

To complete the activity:

1. (Slide 4) Share drone video with learners www.tiramor.cymru/saltmarshes (Resource 2).
Ask learners to share what they notice as the drone travels from the mudflats to the upper marsh.
    - How do the plants change? (Do they get taller? Denser? Change colour?)
    - Where do you think the tide reaches at high tide? Why do you think that?

2. (Slide 5) Introduce the key features of a saltmarsh. Support learners to identify the various zones, from mudflat to land. Support learners to identify where various species live:
    - Where would you most likely find a crab?
    - Which bird species are you likely to find in the lower marsh?



3. (Slide 6) Show the time-lapse video of a saltmarsh during a tidal cycle: www.tiramor.cymru/saltmarshes (Resource 3), and ask learners to describe:

- What changes?
- Is the tide coming in or going out?
- What disappears or reappears?
- How might this affect plants and animals?

Explain that tides shape saltmarsh life and that saltmarshes protect our coasts by acting as soft coastal defences, absorbing wave energy, trapping sediment, and reducing erosion.

4. After exploring the time-lapse video and discussing how the tide changes the saltmarsh, encourage learners to complete the 'Saltmarsh Zones and Tides' worksheet to consolidate their understanding. Support them to label the zones of a saltmarsh and draw an example of an animal that might live in each zone. To link with real-world data, encourage learners to look at 'BBC Tide Times' - www.tiramor.cymru/saltmarshes (Resource 4) for their nearest coastal location and record the times of the next high and low tides. Encourage them to think about how often high and low tides occur in a day and what this means for saltmarsh plants and animals. Ask learners to calculate the time difference between high and low tides and to compare tidal heights.

5. (Slide 7) In small groups, support learners to build a cross-section of a saltmarsh in a tray or box using modelling materials, natural items, clay or LEGO. The goal is to understand the different zones of a saltmarsh and learn which plants and animals live in each one.

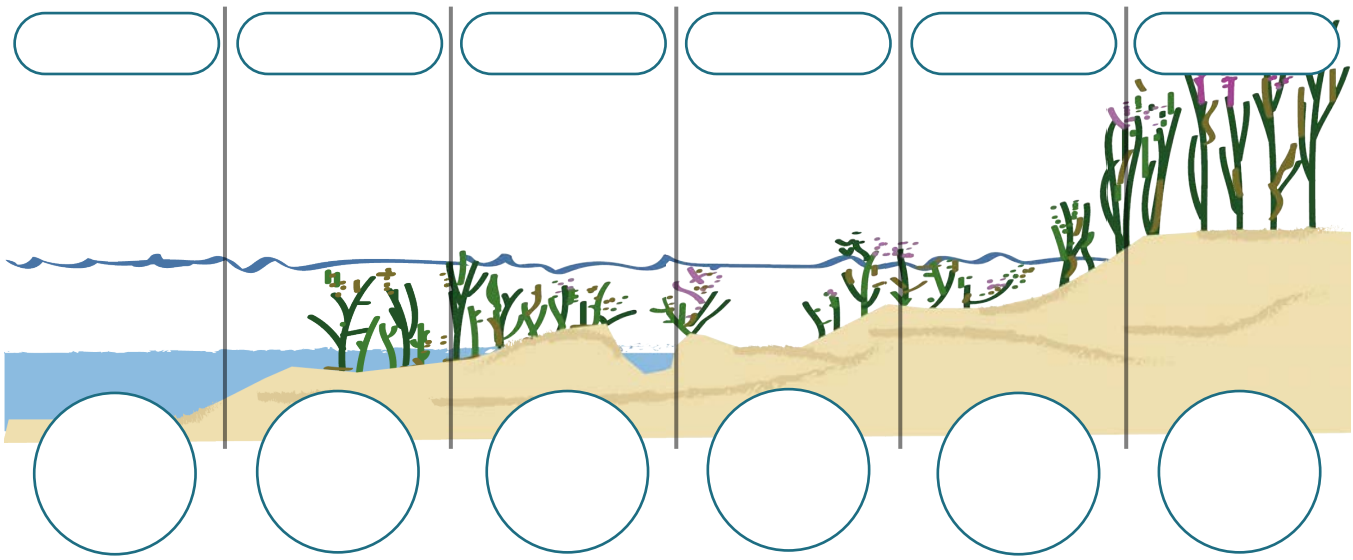
ADDITIONAL TASK Optional

(Slide 8) Invite learners to make a short video presentation of their saltmarsh model. In their recording, they could describe the different zones, point out the animals and plants they included, and explain how tides affect the habitat. They might also like to explain how living things are adapted to survive in the changing conditions of the saltmarsh.

Saltmarsh Zones and Tides

Using the word bank, can you label the saltmarsh's key features? In each circle, draw an animal or plant that you may find there.

Mid Marsh	Land	Mudflat
Upper Marsh	Sea	Lower Marsh



Go to BBC Tide Times - www.tiramor.cymru/saltmarshes (Resource 4) to find your nearest coast. Write down:

- Next high tide: time _____ height _____
- Next low tide: time _____ height _____
- How many hours apart are the high and low tides? _____
- What is the difference in height between them? _____
- How many high tides happen in one day? _____

A hectare of saltmarsh can capture two tonnes of carbon a year and lock it into sediments for centuries.