4. Coastal processes – wave action

Aim

This activity introduces students to the processes involved in wave action, the action of rips and longshore drift.

Materials

- Resource sheet: Wave action.
- Workbook, drawing pencils and pens.
- Student text book on coastal processes.

Activities

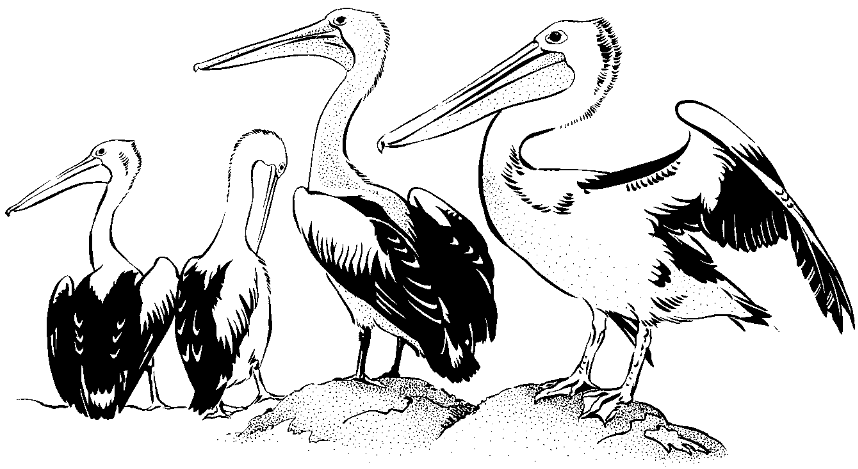
1. Read the resource sheet: Wave action and relevant text book on coastal processes.

2. Explain what a wave is and what determines its size. Include a diagram.

3. Based on the descriptions in the resource sheet and the text book, create individual labelled diagrams to show:

- Waves approaching the shore, cresting and breaking, and creating swash and backwash.
- A plunging wave.
- A spilling wave.
- A rip.
- Wave refraction.

4. Research rips to find out how rips can be recognised. What should people do if they are caught in a rip?



Australian Pelican ©MT

4. Wave action

Waves

The major process operating within any beach system is wave action. Waves are the superficial movement of surface water produced by winds blowing over the sea.

The size of the wave is determined by:
- wind speed,
- the fetch - the extent of open water across which the wind has blown,
- the length of time the wind has been blowing.

When waves are well out to sea the pattern is called a **swell**. When there is no storm the **crests** of the waves may be long distances apart. When a wave finally approaches the shore, changes begin to take place. The waves start to feel the drag of the ocean floor when the depth equals half the **wave length**. The waves slow down as a result of this contact with the sea floor. The other crests crowd in behind it and the waves are forced to peak. This peak leans forward into a curl - finally leaning too far and it topples into a spilling tumbling rush of water. This rush of water is called the **swash**. When the swash drains back down the beach it is called the **backwash**.

The depth of the ocean floor influences the speed at which the wave lengths change. A gradually rising slope on the ocean floor allows the wave longer time to change and break. Such slopes produce 'rollers' or 'surfies curls'. A steeply rising slope only allows the wave a short time to break. These waves usually end up breaking into cliffs.

Types of breaking wave

Constructive waves

There is horizontal movement of the water as the wave breaks. The swash is greater than the backwash and sand is pushed up the beach. These '**spilling waves**' occur where the seafloor has a very gentle slope. The wave keeps its shape and only changes height slowly.

Destructive waves

There is a strong downward movement as the wave breaks. The backwash is greater than the swash and sand is dragged down the beach. These are '**plunging waves**' and occur where the seafloor changes rapidly in depth and has a steep slope. The crest curls over and falls into the trough in front of it.

Currents and rips

Most coasts are influenced to some degree by the tide. The changing water level and the currents that result from this movement shape the coastal landforms. As the tide rises, water is moving towards the land. This landward current is known as a **flood current**. As the tide falls a current develops in a seaward direction. This is known as an **ebb current**. (Note that currents also exist on a world scale. These are called ocean currents and may carry water thousands of kilometres. They can be warm or cold).

When water withdraws from a beach as backwash, it does so either as:

1. **Undertow**. This is strong sheet flow near the seabed and only extends as far as the next oncoming breaker.

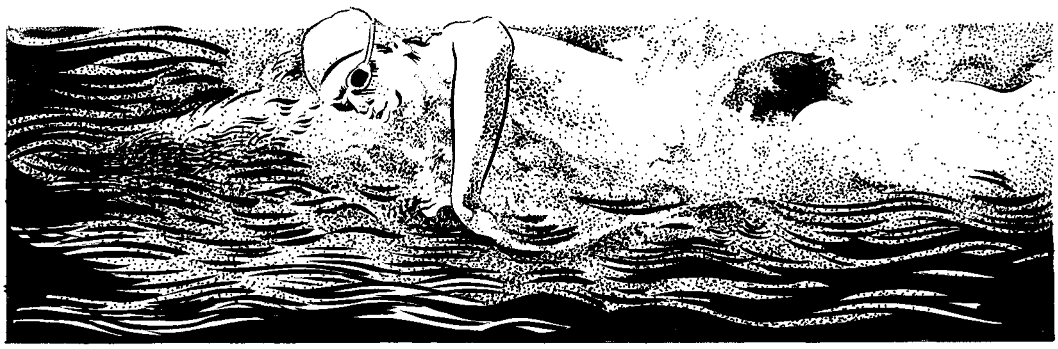
Localised **rip currents** with water flowing back through the breaker line in a flow as wide as 30 metres. Rip currents are defined as localised rapidly flowing currents returning water seaward through the surf zone. On reaching the deeper water the rip slows down, diverging to form a turbulent rip head.

Rip currents are irregularly spaced in position and in time as they depend on factors as submarine contours, configurations along the coast and on the height and frequency of the waves.

Wave refraction

Ocean swell has parallel crests in deep water, but as the waves move to shallower water they become modified by the influence of the sea floor. At first the wave crest pattern is only slightly changed, but as the depth decreases, the drag effects of the sea floor slow down the advancing waves. Sea floor shape therefore influences the pattern of swell approaching the coast, bending the crests until they are parallel to the contours of the sea floor (the submarine contours). This is known as wave refraction.

Where waves enter a broad bay, they become refracted into gently curved patterns, the wave in the middle of the bay moving on in deeper water while towards the sides in shallower water the wave is held back.



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