Wave Experiments

Level

5-6

Key question

How do we use a stream tray to model waves?

Key outcome

Describe and monitor wave action.

Three wave experiments using a stream tray

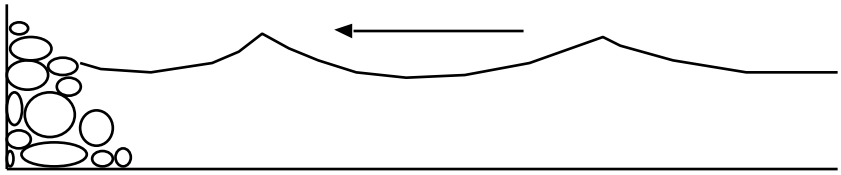
What you need

A small group is preferable so that all participants can do the experiments; otherwise, the leader/teacher would use the experiments to demonstrate, with the students gathered around the tray.

Stream tray
Bucket of sand
Bucket of stones
Two different lengths of wood
Electric fan

Key questions accompany each of the three experiments.

Figure 1. Set-up with stones



Key question

How do different surfaces reflect waves.

Investigating the Effect of Beach Materials on the Reflecting Waves

What you do

1. Fill the stream tray to a depth of 4 cm.
2. Place a board (on a slight angle) at the end of the tray
3. Create a wave that will be reflected off the board and count how many times the wave moves back and forth across the tank before it disappears.
4. Replace the reflecting board with stones. Place a pile of stones at one end of the tray. These stones should be piled up to a level just below the top of the tray. Ensure that there is a seaward slope with the pile of stones and it is even across the width of the tank (Figure 1).
5. Create a wave that will be reflected off the stones and count how many times the wave moves back and forth across the tank before it disappears.

by Dr Bill MacIntyre, Massey University, New Zealand.

6. Replace the stones with a pile of sand. Ensure that the sand is higher than the water level and that there is a seaward slope on the sand.

7. Create a wave that will be reflected off the sand and count how many times the wave moves back and forth across the tank before it disappears.

If there are differences, can you explain them? What would happen if there was island in the centre of the stream tray?

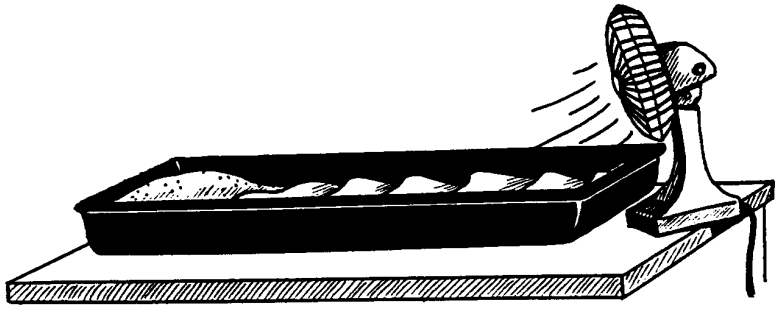


Figure 2. Set-up with fan

Investigating The Relationship Between Wind And Wave Size

Key question

How does wind effect waves?

Construct a "beach' at one end of the tank/stream tray with sand or pebbles. Slowly fill the stream tray with water to a depth of 3 cm. Position a fan (or hair dryer) at one end of the stream tray -opposite to the sand end. Aim the fan so that the air will hit the water at a 45• angle as shown in Figure 2. Never let the fan or hair dryer touch the water or electric shock could occur.

Before you begin, read the steps below and make a table to record your observations and predictions.

1. Using the 'low' speed on the fan, turn it on for 3 minutes. Record your observations of the water in the form of a table (see next page). Allow the water to become calm.

2. Using the 'high' speed on the fan, turn it on for 3 minutes. Record your observations of the water on the table. Allow the water to become calm.

3. Write a prediction that describes what you think will happen to the water when you turn the fan on for 5 seconds at 'high' speed. Turn it on for 5 seconds and record your observations next to the prediction.

4. Now that you have your prediction and observation recorded in the table, predict what will happen to the water when the fan stays on for 10 seconds at 'high' speed.

Using your observations what can you say about the link between wave size and wind. What would happen to the water:

- if the stream tray was longer
- if the angle of the fan was different.

Lost At Sea: Investigating the Relationship between Wave Speed and Water Depth

Key question

How does water depth effect wave speed?

1. Fill the stream tray to a depth of 1 cm. Use the longer piece of wood to act as a reflector at one end of the tank.

2. Practice making a wave pulse by ‘dropping’ or ‘pushing’ the shorter piece of wood into the water at one end. Don’t make a wave too big or you will have problems with the depth. Time how fast the wave travels the distance of the tray.

3. Record the distance and time taken in the table below.

4. Repeat this for depths of 2 cm, 3 cm, 4 cm, and 5 cm.

- Do you see any patterns or trends?
- What will happen if there is sand on the bottom?

Extension

1 Additional activities using stream trays:

- Use Condy’s Crystals in the water and observe the currents.
- Join stream trays together to show catchment ecology.
- Sprinkle green KOOL-AID cordial crystals on land, water, and let it percolate it through the water table.
- Made a sand cliff with igneous bits (including pumice) inside it and show wave cut.

2. Consider all three experiments: what implications do the results have for the real life situation along our coastlines?

3. Repeat appropriate experiments in the sea (refer to other activity units).

Example of recording table for investigating relationship between wave speed and water depth

Depth (cm)	Distance (m)	Time (sec)	Velocity (m/sec)
1 cm		(i) (i) (ii) average	
2 cm		(i) (ii) (iii) average	
3 cm		(i) (ii) (iii) average	
4 cm		(i) (ii) (iii) average	
5 cm		(i) (ii) (iii) average	