



# AQUAPONICS NEW ZEALAND

Sustainable Urban Farming

Years 1 - 2

## ECOSTATION CURRICULUM



# What is the Aquaponics Ecostation?



The Aquaponics Ecostation provides opportunity to enrich the curriculum for students and teachers with an interactive, hands-on tool for learning. The system may be used to demonstrate concepts such as:

- 🌱 **Plant and animal anatomy**
- 🌱 **Photosynthesis and respiration**
- 🌱 **Living systems**
- 🌱 **The Nitrogen Cycle**
- 🌱 **The role of bacteria in ecology**
- 🌱 **The function of water in ecology**
- 🌱 **The science of sustainable agriculture**
- 🌱 **Climate change and ecological issues**

and many others, all while caring for fish and plants, germinating seeds, and harvesting vegetables.

The curriculum is designed around the Aquaponic Ecostation. Once it is assembled and running (see assembly instructions included with the kit), the following lessons may be implemented.

# Years 1 - 2 Lesson Plans

## OVERVIEW:

Students will learn about and observe how plants and animals (fish) live in different environments and how their physical features help them to live and grow. Students will compare/contrast plants growing in their natural environment to plants growing in an aquaponic environment, through observation.

## OBJECTIVES:

- Students will observe how the plants and fish live together and help each other exist in their aquaponic habitat.
- Students will observe the behavior of fish and identify how the different parts of the fish help them to move and grow.
- Students will identify the parts of the plant and how each part helps the plant grow.
- Students will learn that both plants and animals need water and food to survive.

## Part 1

### What Plants Need to Grow and Live

#### ACCESSING PRIOR KNOWLEDGE:

- Teacher asks students what people need to live (water, food, and sunlight).
- Teacher asks what plants need and charts ideas.

#### IF NEEDED:

- ❓ What items are needed to care for a houseplant?
- ❓ Why do we water plants?
- ❓ What will happen if the plant is placed in a dark area without any care?







**Plan and Conduct an investigation to determine if plants need sunlight and water to grow.**

### **MATERIALS:**

- ☐ Four common houseplants (*Pothos Epipremnum sp.* and *Philodendron* species work well)
- ☐ Soil for three houseplants and one Ecostation plant
- ☐ Calendar
- ☐ Student/Class recording notebook

**STEP 1:** One plant is watered, given nutrient dense soil, and placed in a well-lit area. Another plant is watered but placed in a dark area (closed box). The third plant is placed in a well-lit area with no water. The fourth plant is planted in the Ecostation, watered and with light. Use cuttings from the houseplants (including roots) with the clay pellets and place those in the Ecostation for comparison.

**STEP 2:** Students predict what will happen to each of the plants. Students will record in their science notebooks their predictions either as a whole class, in small groups.

**The following sentence frames can be provided:**

- I predict that the plant with light, water, and soil will...
- I predict that the plant without light will...
- I predict that the plant without water will...
- I predict that the plant in the Ecostation with water, light, and nutrients from the fish will...

**STEP 3:** Have the students check each plant every other day and mark these days on the calendar. They can record the observations in their science notebook. Do this for a couple of weeks.

**The following sentence frame can be provided:**

- I observe that...

**STEP 4:** Compare/contrast the current observation with the original prediction. Students evaluate their prediction.

**STEP 5:** Final evaluation - Students observe which plants grew and lived and which plants did not. In the science notebook students record their conclusion that plants need water, light, and food to live and grow.

## Part 2

# Anatomy of a Plant and How Each Part Helps

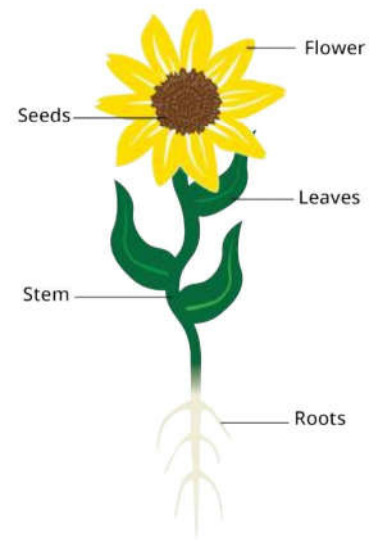
Learning area: ??

### ACCESSING PRIOR KNOWLEDGE:

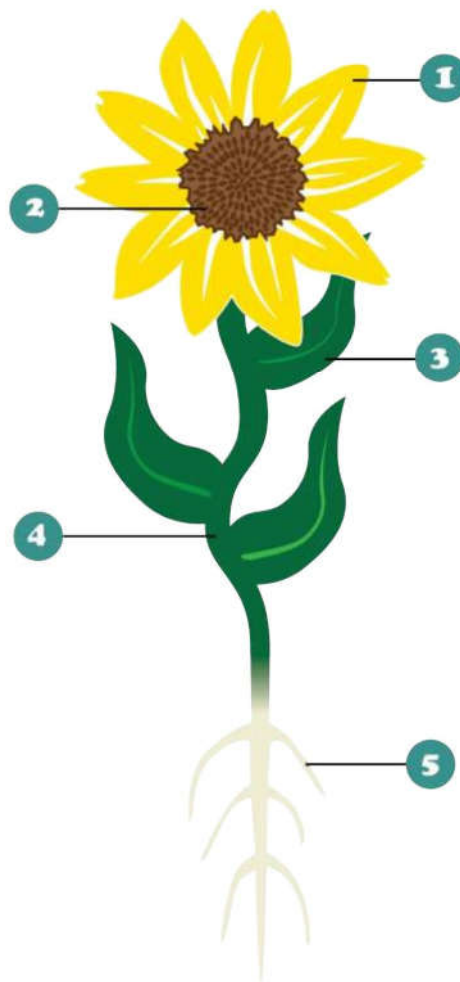
Teacher takes a plant out of the Ecostation and asks students to observe the parts. The instructor leads a discussion on the parts that were observed and their functions. Students recall what plants need to grow and live.

### KEY VOCABULARY:

- Flower    ? Stem    ? Leaves
- Seeds    ? Roots



Students are provided labels and draw their own plants.





### Leaves.

#### MATERIALS:

- ☐ Plants growing in the Ecystation to observe
- ☐ Black paper, cut in 50mm by 75mm rectangles
- ☐ Two paper clips per paper rectangle

**STEP 1:** Take a picture of a healthy, large-leafed plant in the Ecystation

**STEP 2:** Attach black paper to two or three leaves of the plant using the paper clips. Leave these in place for one week.

**STEP 3:** Students predict what will happen to the covered leaves and record this in their science notebook. Students can write or illustrate their prediction.

**STEP 4:** Students will mark the beginning date on the calendar and calculate the ending date of one week.

**STEP 5:** Students will uncover the leaves and compare it to the picture of the plant. Students record their observations in their science notebook.

**Evaluation:** Students will answer, what happened to the leaves and why?

Review what happened to the leaves of the plant without light. Tell students that just like we collect energy from the sun, plants collect energy from sun/light through their leaves.



### Activity 3: Learning area -

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#### STEMS & ROOTS

Roots absorb the water and plant food. The stem carries nutrients throughout the plant to the tips of the leaves and flowers.

#### ACCESSING PRIOR KNOWLEDGE:

Ask students if they know what stems and roots do.

#### MATERIALS:

- ☐ Celery stalks with leaves or cabbage
- ☐ Food coloring
- ☐ Clear jar

**STEP 1:** Grow celery in your Ecostation and show students the full root structure. Fill a jar half full of water and add a few drops of food coloring, stir. Cut and place a freshly trimmed celery stalk in the jar of colored water.

**STEP 2:** Ask the students to record their predictions as to what will happen.

**STEP 3:** Leave the celery stalk in the jar overnight.

**STEP 4:** Students observe and record their observations in their science notebook.

**NOTE:** If you leave the roots of the celery in the color it will not change. Talk to students about how plant roots act as a filter and only take up nutrients and water.



### Activity 3:

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#### MATERIALS:

- |                           |                 |
|---------------------------|-----------------|
| ☐ Large potato            | ☐ Knife, spoon  |
| ☐ 200 x 200mm baking dish | ☐ Measuring cup |
| ☐ Water                   | ☐ ruler         |

**STEP 1:** Cut the end of the potato to make a flat surface on which it can balance. On the other end, the widest part of the potato. Hollow out a cup or a small bowl with the spoon. Be careful not to go through the bottom.

**STEP 2:** Place the flat bottom of the potato in the middle of the plate. Using the measuring cup, fill the plate with water. Note the amount of water used. Measure the depth of the water on the plate using the ruler.



**STEP 3:** Ask the students to record what will happen to the water and the potato in their science notebook. Observe and record the condition of the potato and water.

**STEP 4:** Leave the potato in the pan for several hours or overnight.

**STEP 5:** Record the amount of water in the potato and compare/contrast with the prediction.

**EVALUATION:** Depending on year level, students will use a combination of drawing, dictating, and/or writing sentences or paragraphs to recall information, use facts and definitions, and provide a concluding statement.

### Activity 5:

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#### STEMS & ROOTS



#### MATERIALS:

- ☐ Plants growing in the Ecostation
- ☐ Scissors

**STEP 1:** Students trim the roots of one or two of the plants in the Ecostation.

**STEP 2:** Students predict and record what will happen to the plants with trimmed roots.

**STEP 3:** Leave the plants for two days.

**STEP 4:** Students observe and record their observations in their science notebook.



## Part 3

# The External Parts of the Fish and How They Help the Fish Grow and Move

### ACCESSING PRIOR KNOWLEDGE:

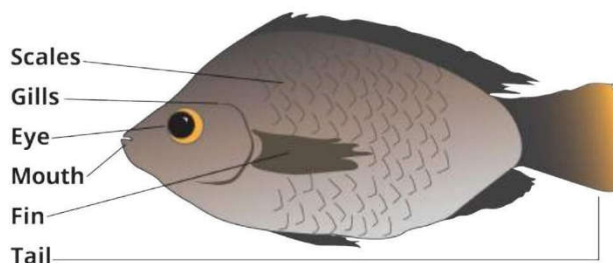
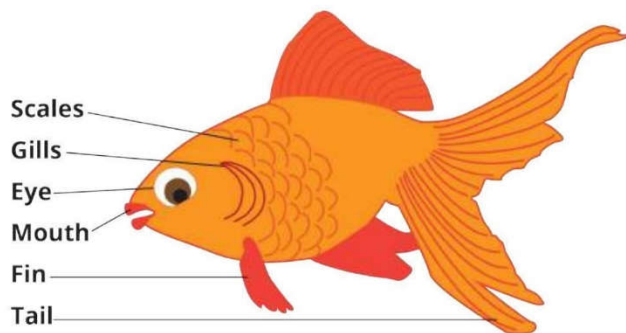
Students share and the teacher records what students know and have experienced about fish. Encourage the discussion by asking questions such as:

- What kind of environment do fish live in?
- Who has fish at home?
- How does a fish get its food?

### Activity 6: Understanding fishparts

#### MATERIALS:

- Diagram of the anatomy of a fish
- Fish parts and their use-glossary
- Fish to observe

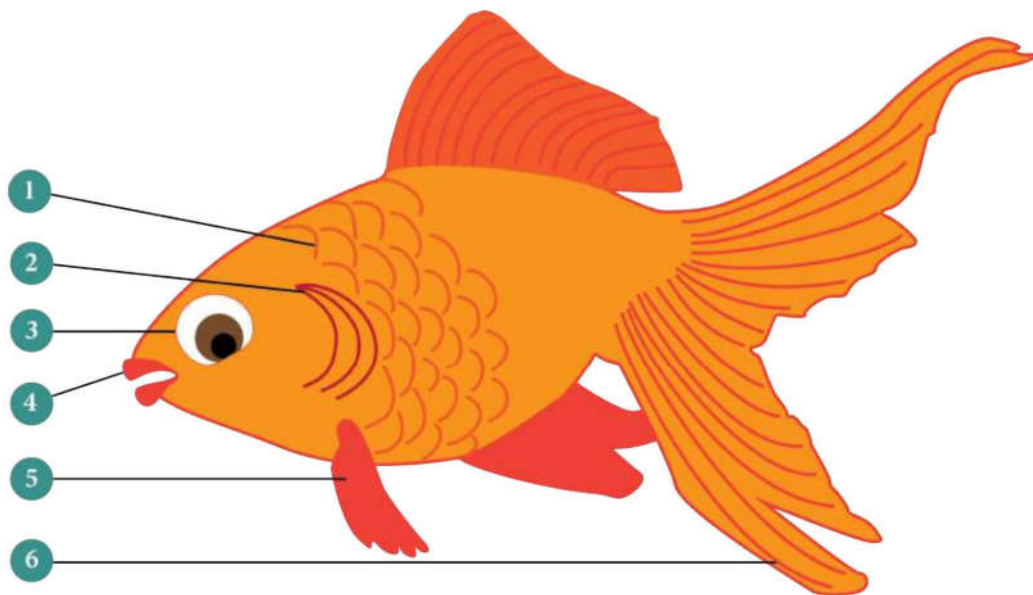


**STEP 1:** Students count and describe the fish in the fish tank. Students can describe the position of a fish in relationship to other objects using position words such as: above, below, behind, in front of, to the right/left of, etc.

**STEP 2:** Students observe the fish in the tank and draw what they see. Students describe the parts they see and what they are used for.

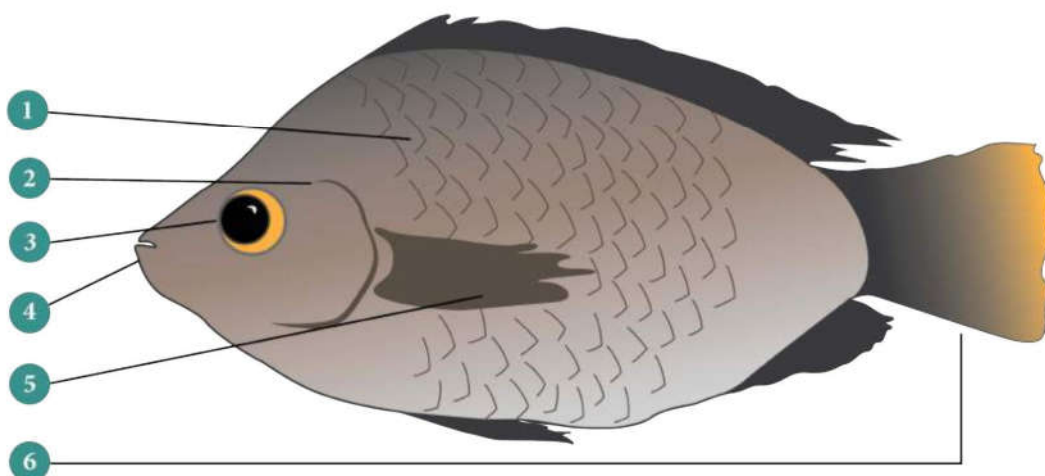
**STEP 3:** Students record their observations in their science notebook.

**EVALUATION:** Depending on the year level of the students, students will use a combination of drawing, dictating, and/or writing sentences or paragraphs to recall information, use facts and definitions, and provide a concluding statement.



- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
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## Part 4 Putting It All Together

Students observe the habitat of the Ecostation system. Students should identify how the plants receive water, light, and nutrition. The students will identify how humans feed the fish and the fish waste is food for the plants.

### Activity 7:



#### Learning area:

**STEP 1:** Students will identify and list what plants and fish need to live and grow in their natural environment. What do they have in common and what is specific to the plant or fish?

**STEP 2:** Students will compare/contrast the sources of light, water, and food in the natural environment and the aquaponics system.

**EVALUATION:** Students will complete a Venn Diagram to show the similarities and differences of the two ecosystems, in nature and in the Ecostation kit. Teacher will chart the diagram on the board.

Depending on the year level of the students, students will use a combination of drawing, dictating, and/or writing sentences or paragraphs to compare/contrast the aquaponic system and the natural environment, using facts and definitions, and providing a concluding statement.

## Glossary

**Aquaponics** – The system or the development of a system that is beneficial to both plants and aquatic animals and bacteria in a recirculating environment where all can thrive and grow; a sustainable food production system that combines a traditional aquaculture (raising aquatic animals such as fish in tanks) with hydroponics (growing plants in water) in a symbiotic environment

**Biome** - A place with certain kinds of living and nonliving things **Ecosystem**—All the

living and nonliving things working together in an area **Environment**—All the living

things and nonliving things in a place

**Fresh water** – An environment that has water with little or no salt in it

**Habitat** – The place where a living thing makes its home

**Nutrients**— A substance that provides nourishment essential for growth and the maintenance of life

**Recycle** – To turn an old thing into something new

**Reduce** – To use less of something

**Reuse** – To use something again

**Seed** – An undeveloped plant with stored food inside a protective coat

