Ecosystem and Edible Urchins

Worksheets

Coastcare Victoria School Kit

Coastcare Victoria

VICTORIA State Government | Energy, Environment and Climate Action

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Author
Coastcare Victoria and Ocean Imaging.

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Ocean Imaging.

Contents

Activity 1: Quiz

1. For how many years have Paul and his colleagues been surveying this reef at Williamstown?

a) 2
b) 4
c) 6
d) 12

2. What three things were the divers measuring in the surveys?

a) Urchin diversity, fish densities and kelp cover
b) Kelp cover, seaweed diversity and urchin densities
c) Rock distance, seaweed height and number of urchins removed
d) Distance from shore, ocean temperature, food abundance

3. Which urchin species was being collected on the dive?

a) Long spined sea urchin
b) Short spined sea urchin
c) Black spikey sea urchin
d) Rough edged sea urchin

4. What do sea urchins usually eat?

a) Zooplankton
b) Phytoplankton
c) Drifting seaweed
d) Small starfish

5. What factor caused the seaweeds to grow prolifically in the 1950's and 1960's?

a) Temperature
b) Sunlight
c) Nutrients
d) Currents

6. What helped the urchin populations increase so dramatically?

a) Lack of predators
b) Abundance of food
c) Lack of seaweed
d) Warm temperatures

7. Why did the urchins change from 'couch potato' mode to 'army mode'?

a) Less seaweed around so they needed to fight for it
b) Chemicals in the water
c) Huge appetite brought on by temperature
d) Battle with the other urchin species

8. How many short spined urchins can a recreational fisher with a license catch in a day?

a) 20
b) 30
c) 40
d) 80

9. What part of the sea urchin is eaten?

a) The short spines
b) The mouth muscle
c) The eyes
d) The roe (eggs)

10. What rule needs to be considered when catching urchins?

a) Must be caught below 2m deep
b) Must be caught with gloves
c) Must be cooked within 2 hours
d) Must be taken from a sanctuary zone

Activity 2: What's causing the problem?

As the video plays underline biotic (living) factors and **circle abiotic (non-living) factors**

"What we think has happened over time is a combination of all of the nutrients actually coming into Port Phillip Bay, with all of the sewerage wastewater that's been coming in, in here since the 50s and 60s. And that has basically driven a change in this ecosystem from the bottom up.

And all of those excess nutrients in the water actually drove a whole lot of other weedy seaweed species to massively proliferate. And when you have a whole lot of food, then other species will come along and make the most of that. And so sea urchins love to sit there on a rock and eat whatever drifting bits of seaweed are coming by, and so with all this extra seaweed that was now out there and floating around it built a larger sea urchin population in the bay.

But then what happened, we got to the Millennium drought, which was from the end of the 1990s, and through the 2000s. So, a long period of increased temperatures, but also reduced nutrients that were actually now coming into the bay. And so, now all of a sudden, we had less nutrients in the bay, and less seaweed that was now growing and proliferating because of it.

And that meant we had way more urchins. So, we had really high urchin numbers. And the seaweed populations were down here. So, they switched from couch potato mode to actually active foraging, kind of army mode. And instead (of waiting for food), moving around and eating and clearing all of the seaweeds and the kelps off the reef."

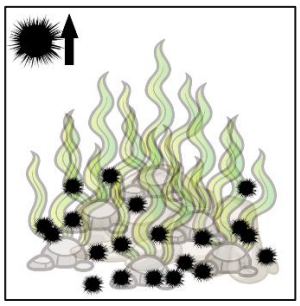
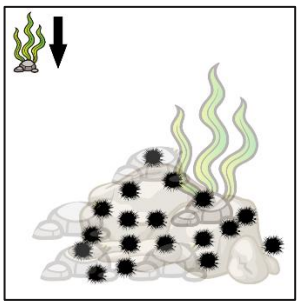
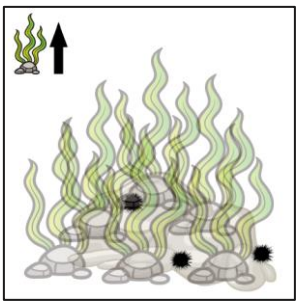
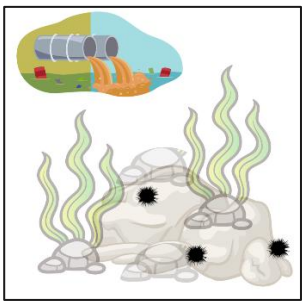
Activity 3: Urchin population - Comic strip

The text of our comic strip is in the correct order but the pictures at the bottom of the page are not. Cut out the pictures and stick them on in the right order.

When our comic is in the correct order, are the sea urchins in the ecosystem experiencing top-down, or bottom-up control?

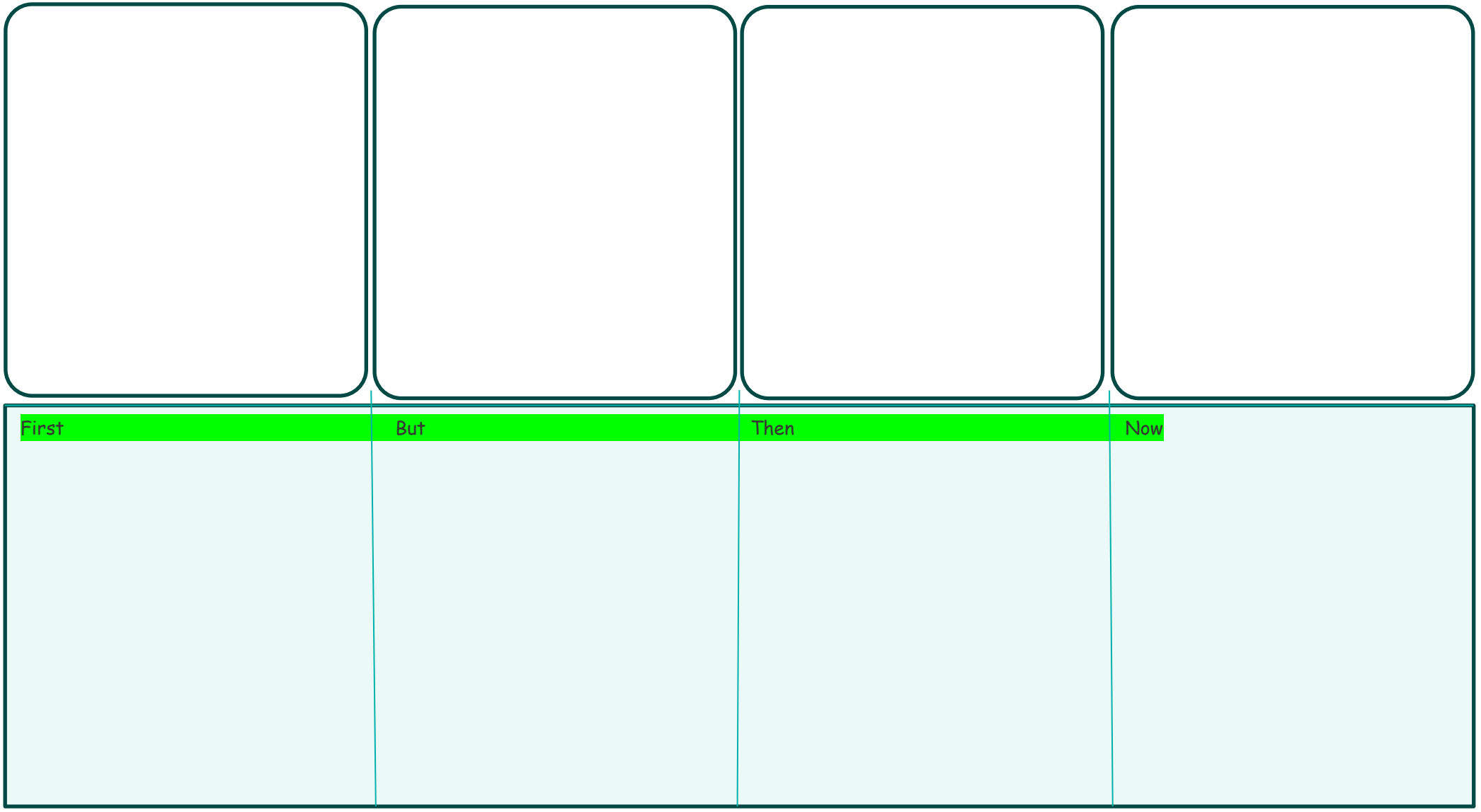
What we think has happened over time is a combination of all of the nutrients actually coming into Port Phillip Bay, with all of the sewerage wastewater that's been coming in here since the 50s and 60s. And that has basically driven a change in this ecosystem from the bottom up	All of those excess nutrients in the water actually drove a whole lot of other weedy seaweed species to massively proliferate.	And when you have a whole lot of food, then other species will come along and make the most of that. And so sea urchins love to sit there on a rock and eat whatever drifting bits of seaweed are coming by, and so with all this extra seaweed that was now out there and floating around it built a larger sea urchin population in the bay	Then what happened, we got to the Millennium drought, which was from the end of the 1990s, and through the 2000s. So a long period of increased temperatures but also reduced nutrients that were actually now coming into the bay. And so, now all of a sudden, we had less nutrients in the bay, and less seaweed that was now growing and proliferating because of it.

Cut the pictures out and stick them on in the right order.

Make your own comic about populations.

Title:



Activity 4: Urchin population sampling

It's your turn to collect data on urchin populations, just like Paul and the other marine biologists. You have five different paper reefs to sample.

Counting every urchin on a reef is very difficult – so scientists use a 1m square, called a quadrat, to help them count a sub-set of the total population. Research shows that if we sample 10% of our population, we can correctly estimate the total population.

Calculate the total area of the reef so that we can calculate 10% of the area.

- Each small grid square is 20cm x 20cm (a 20cm square)
- How many grid squares together make a 1m square? ____
- How many meters square is each reef? ____ m long X ____ m wide = ____ m^2
- Calculate 10% of the 80m^2 reef sheet: ____ m^2 ÷ ____ = ____ m^2
- We need to count the urchins in ____ x 1m^2 quadrats to estimate our population

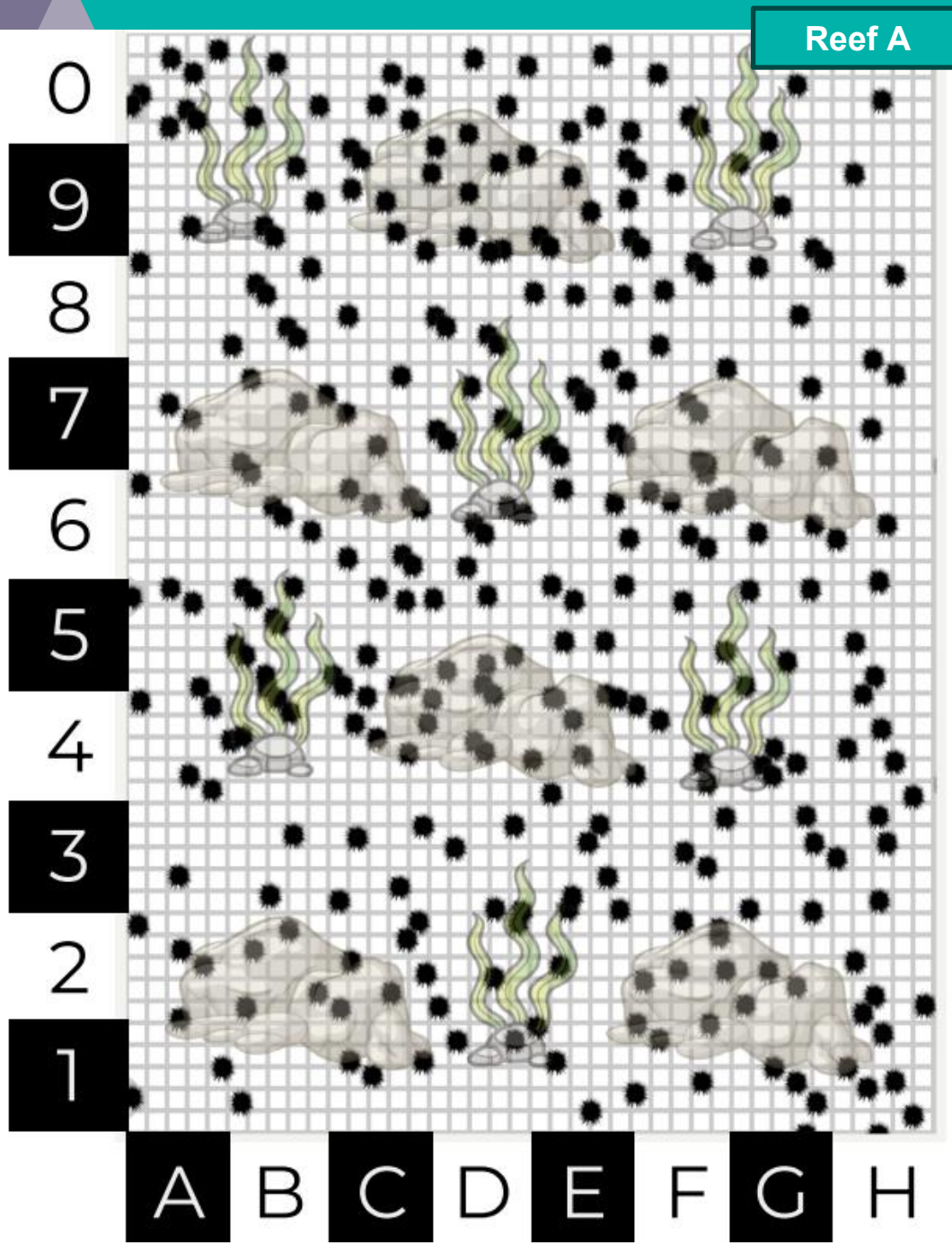
Random sampling

If we choose where to put our survey squares, we might pick the 'best looking' locations. This will make our data biased and create inaccurate results. It is impossible not to be biased, it's just how the human brain works. Therefore, scientists use a random number generator.

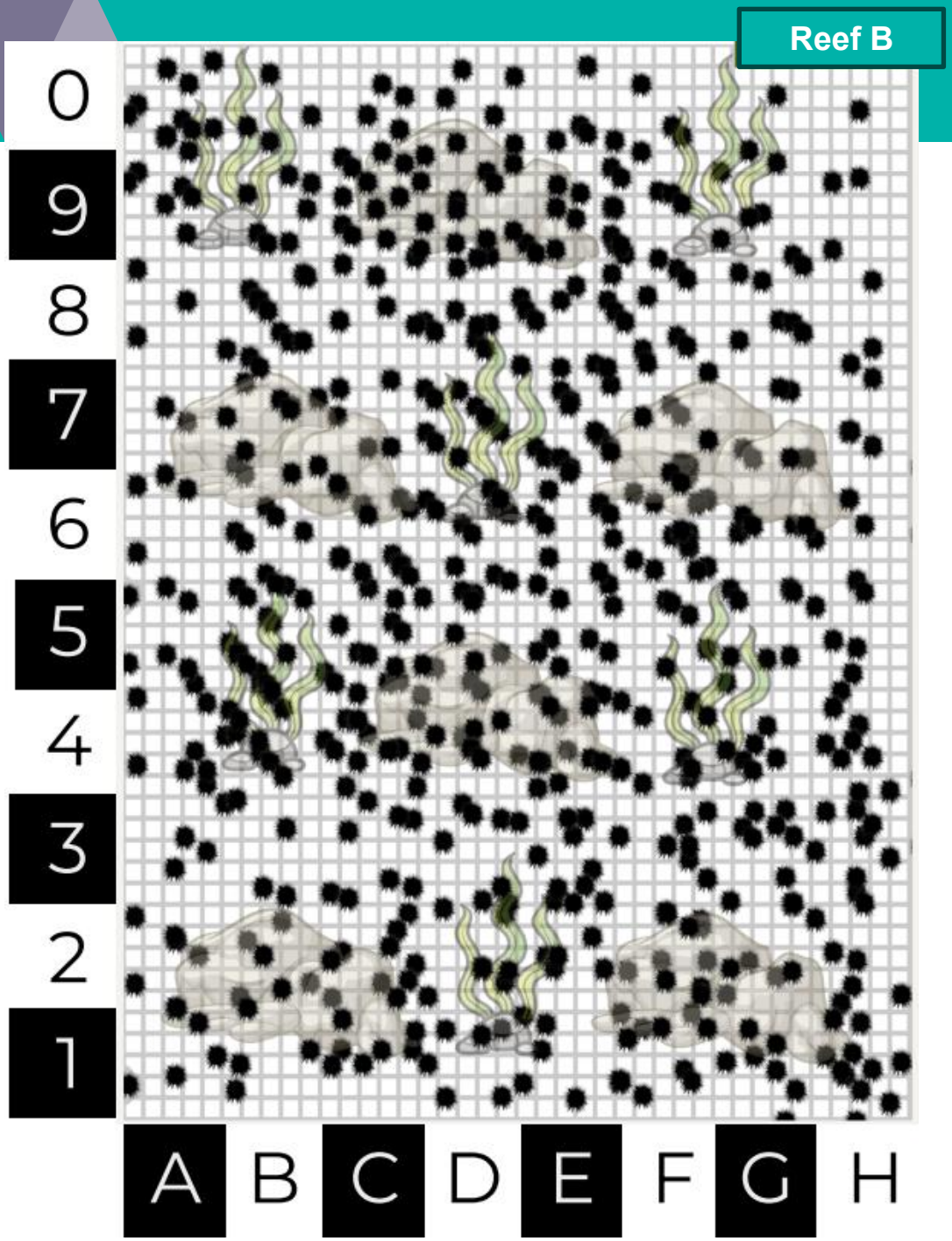
- Random coordinates have been generated to help you place your quadrats on your paper reefs.
- Use your ruler to outline the quadrats you are going to sample.
- Count the urchins inside each quadrat and record them next to your coordinates.

Population calculation

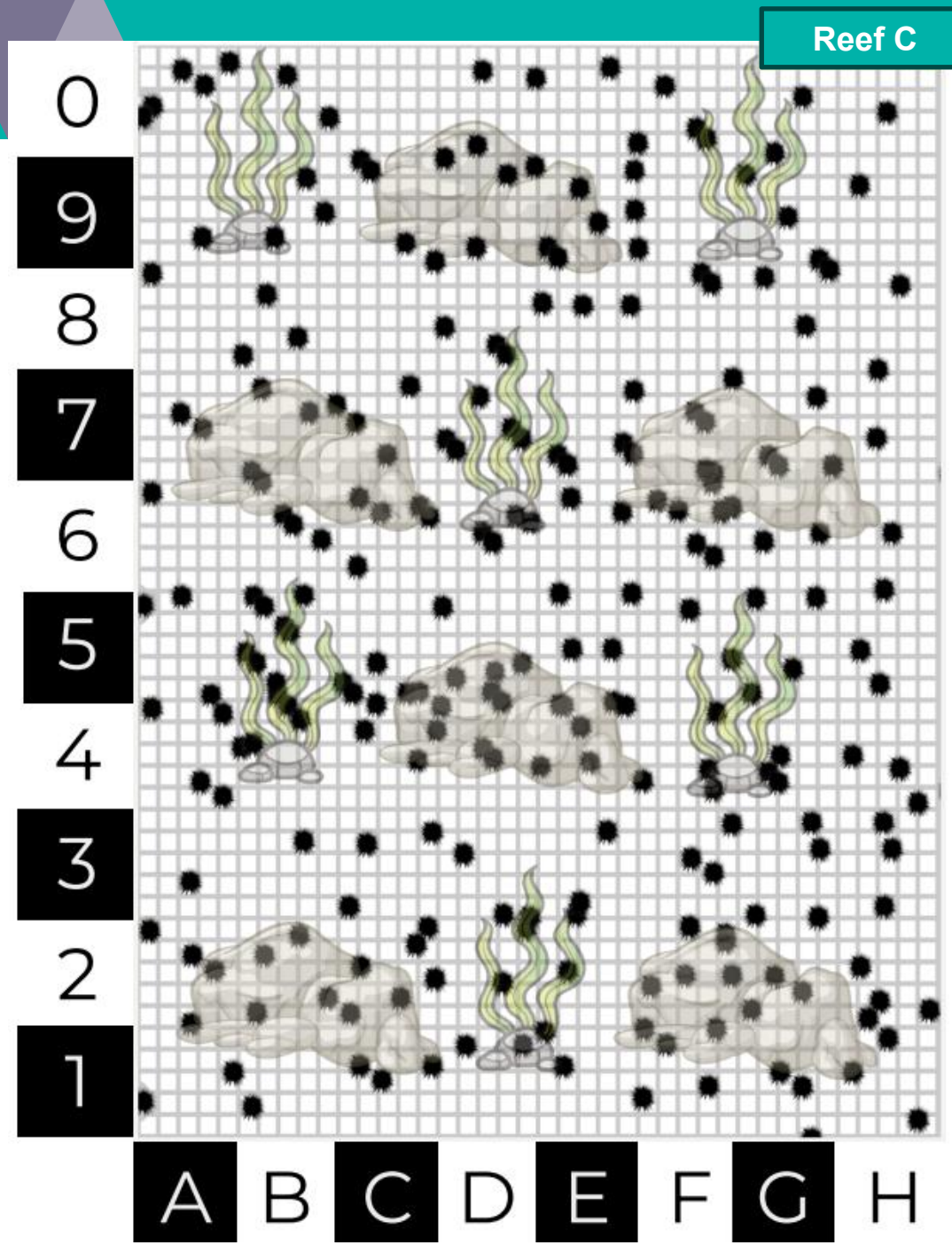
- Calculate the average of your eight quadrat counts – this tells you how many urchins are living on an average 1m^2 of this reef.
- Multiply the urchin average by the total area of the reef – this is an estimate of how many urchins are living on the reef.



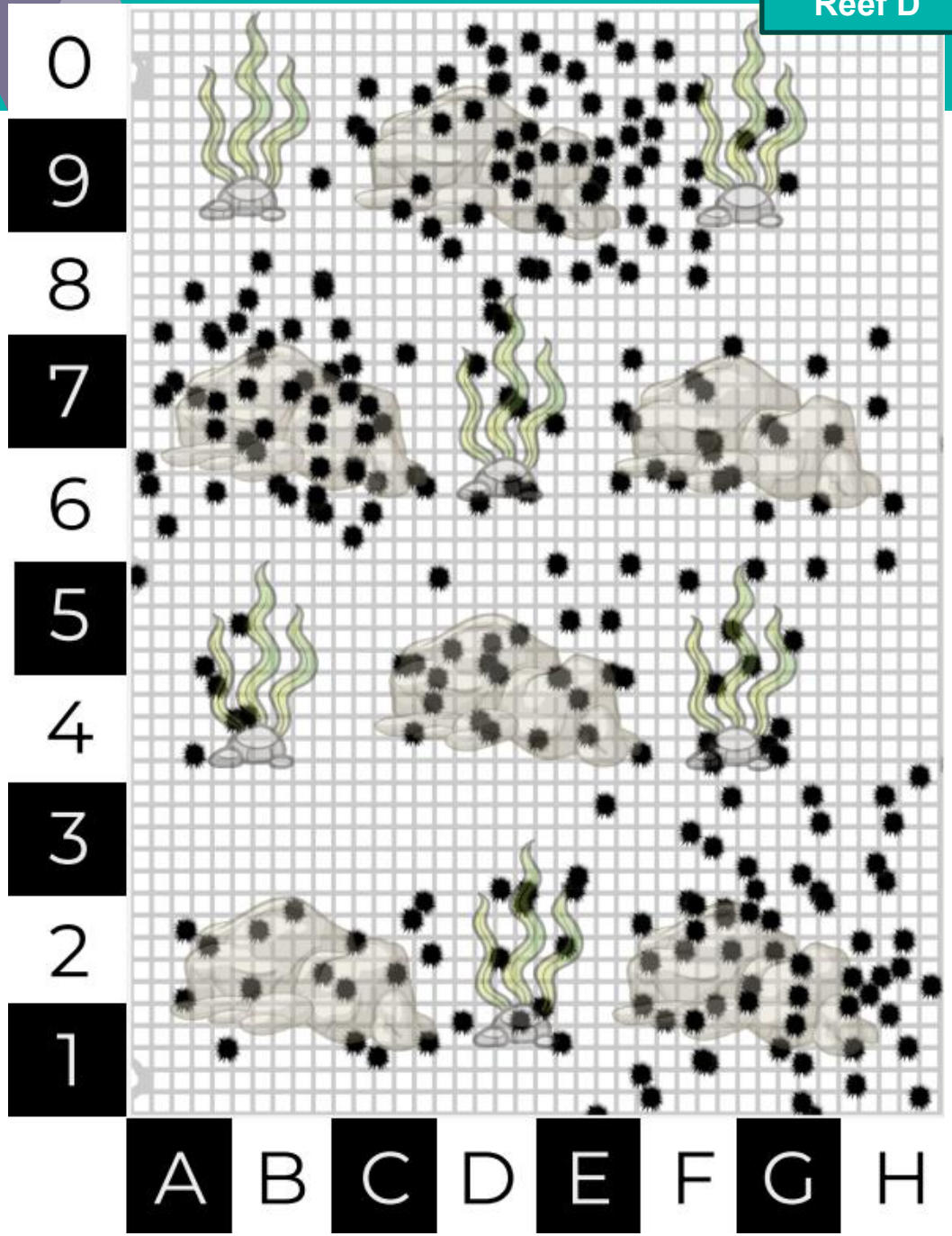
Random Coordinate	Urchin population count
H8	
D8	
G7	
E6	
F4	
5A	
A7	
9C	
AVERAGE	
POPULATION ESTIMATE	



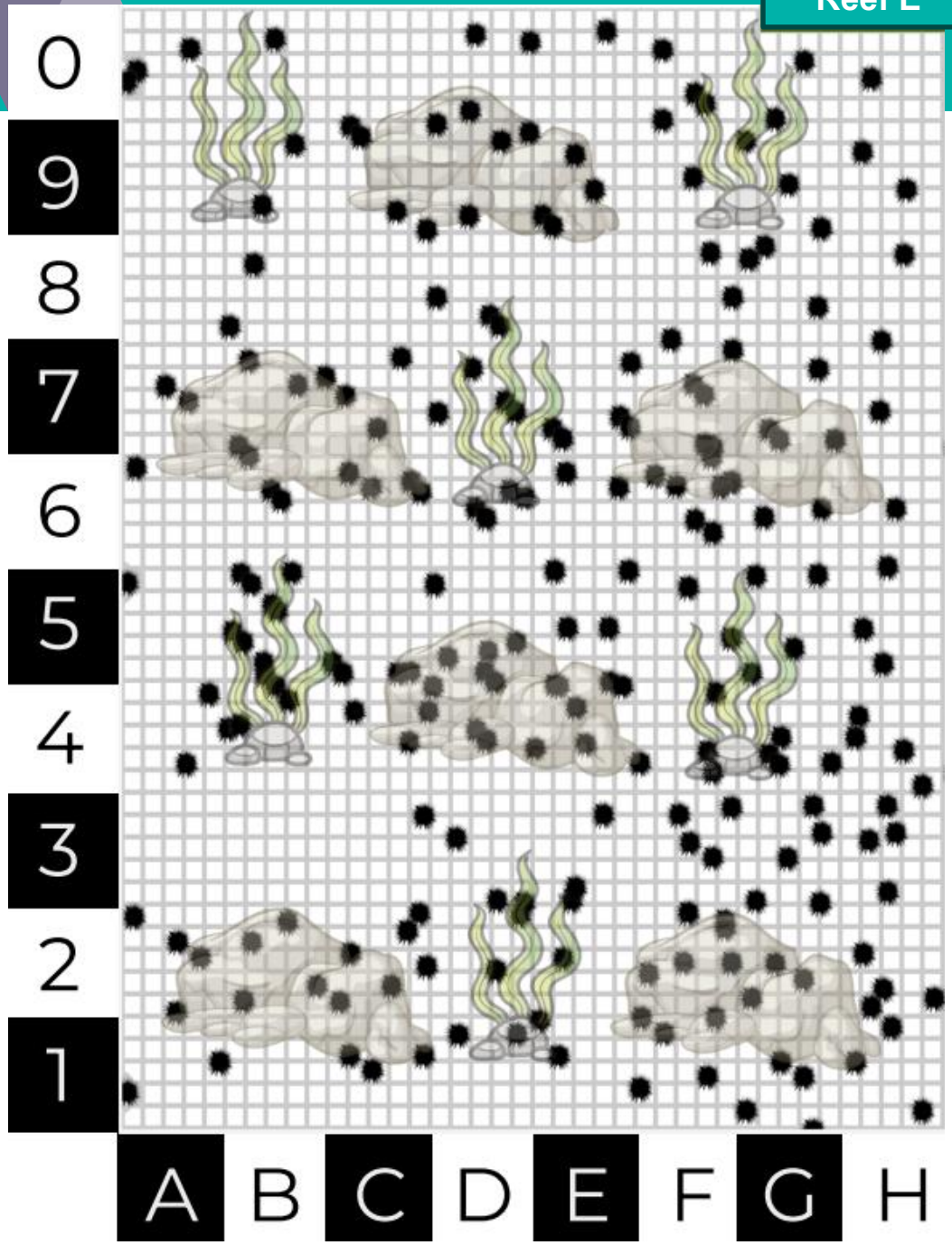
Random Coordinate	Urchin population count
A6	
F2	
7B	
46	
7A	
8C	
F4	
3D	
AVERAGE	
POPULATION ESTIMATE	



Random Coordinate	Urchin population count
A4	
B7	
4D	
G3	
0C	
5D	
1E	
1F	
AVERAGE	
POPULATION ESTIMATE	



Random Coordinate	Urchin population count
A5	
3D	
6C	
A8	
F9	
F6	
4B	
7F	
AVERAGE	
POPULATION ESTIMATE	



Random Coordinate	Urchin population count
A5	
F6	
G0	
B1	
A2	
6G	
D3	
6E	
AVERAGE	
POPULATION ESTIMATE	

Investigation 1: Urchin adaptations

Circle the category(s) of adaptation in the space below: Note some adaptations may have multiple categories.

1. They can survive in low food environments by shrinking their shell size (if you are smaller, you need less food).

   Behavioural Physiological Structural

2. They put less investment in reproduction in low food environments. Less energy in the roe (eggs and gonads).

   Behavioural Physiological Structural

3. Spines - protects them from predators and they can also use them to catch bits of seaweed as they float past. They also use the spines to pass food to the underneath side where their mouth is.

   Behavioural Physiological Structural

4. Mouth on the bottom - this means they can graze along the rock and eat anything that's attached there. The mouth is called an Aristotle's lantern and looks a bit like a beak.

   Behavioural Physiological Structural

5. Sea urchins walk using their many flexible tube feet, meaning that they can find food.

   Behavioural Physiological Structural

6. Investigate another ocean animal. Record some of their adaptations:

- Structural

- Behavioural

- Physiological

Use the internet to research the following questions.

1. What characteristics do all sea urchins have in common?

2. What sea creatures are sea urchins closely related to?

3. How do sea urchins move?

4. How do sea urchins reproduce?

5. In the space below, draw a labelled diagram of a sea urchin.

Investigation 2: Sustainable seafood

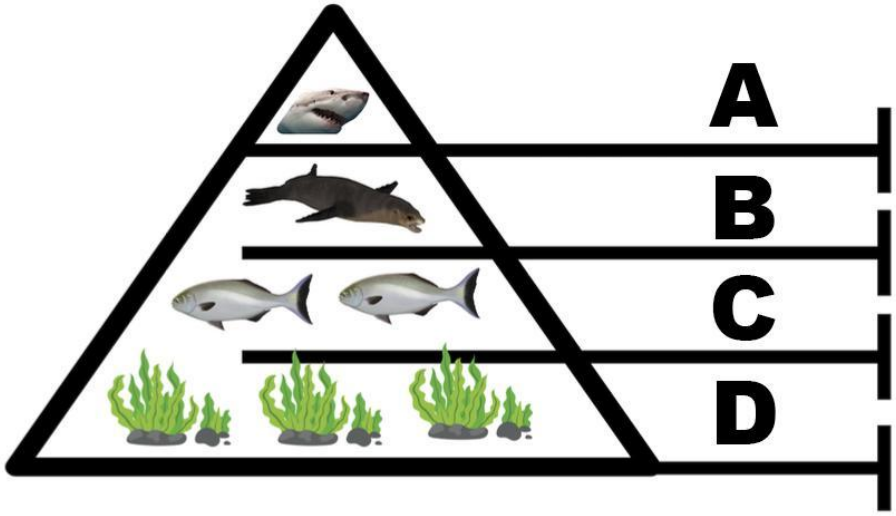
Marine species	**Species name**	**Diet**	**Prey size**	**Pyramid Level**	**Sustainability prediction**	**Sustainability** (green, orange or red)
Blacklip abalone	*Haliotis rubra*					
Sea Urchin	*Heliocidaris erythrogramma*					
Bluethroat wrasse	*Notolabrus tetricus*					
Blue Mussel	*Mytilus planulatus*					
Oysters	*Saccostrea glomerata*					
Luderick	*Girella tricuspidata*					
Australian Sardine	*Sardinops sagax*					
Southern Calamari	*Sepioteuthis australia*					
King George Whiting	*Siliagnodes punctata*					

Australian Salmon	*Arripis trutta*					
Southern Rock Lobster	*Jasus edwardsii*					
Snapper	*Pagrus auratus*					
Yellowfin Tuna	*Thunnus albacares*					
Gummy Shark	*Mustelus antarcticus*					
Swordfish	*Xiphias gladius*					

Review questions

1. Match the labels with the correct letter in the population pyramid:

   primary consumer, primary producer, secondary consumer, tertiary consumer



A =

B =

C =

D =

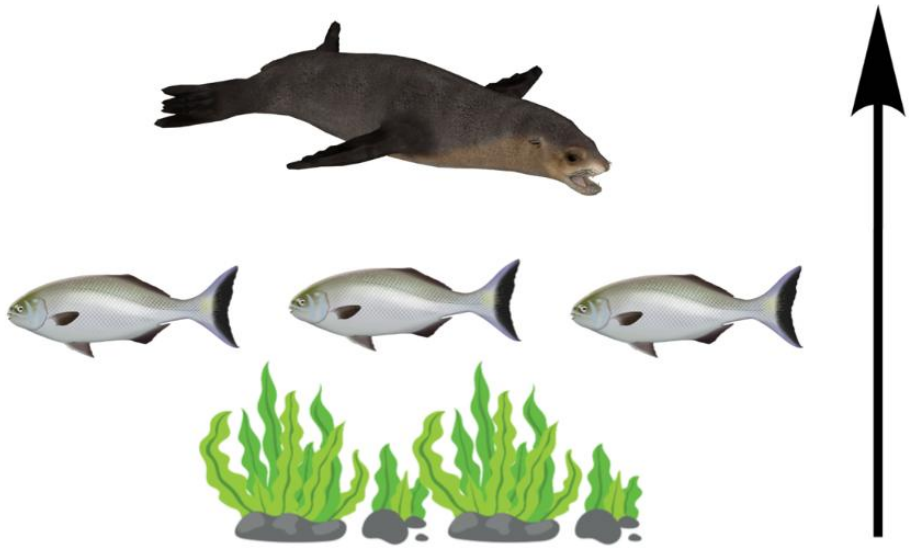
(4 marks)

2. The above diagram shows a top-down control. Which species control the sea lion population numbers? (1 mark)

3. In a top-down ecosystem, what may happen if there were not enough sea lions? (2 marks)

4. Finish this sentence: (1 mark)

In the diagram below, the ecosystem is controlled from



5. What is likely to control the number of fish that may be able to live in this ecosystem? (1 mark)

6. Name one factor that may impact the amount of seaweed that is able to grow in this ecosystem. (1 marks)

7. What might happen if the amount of seaweed was reduced in this ecosystem? (1 mark)