

Reef scientists: lesson 1 of 3

Why scientists sample

Counting a reef without
counting everything

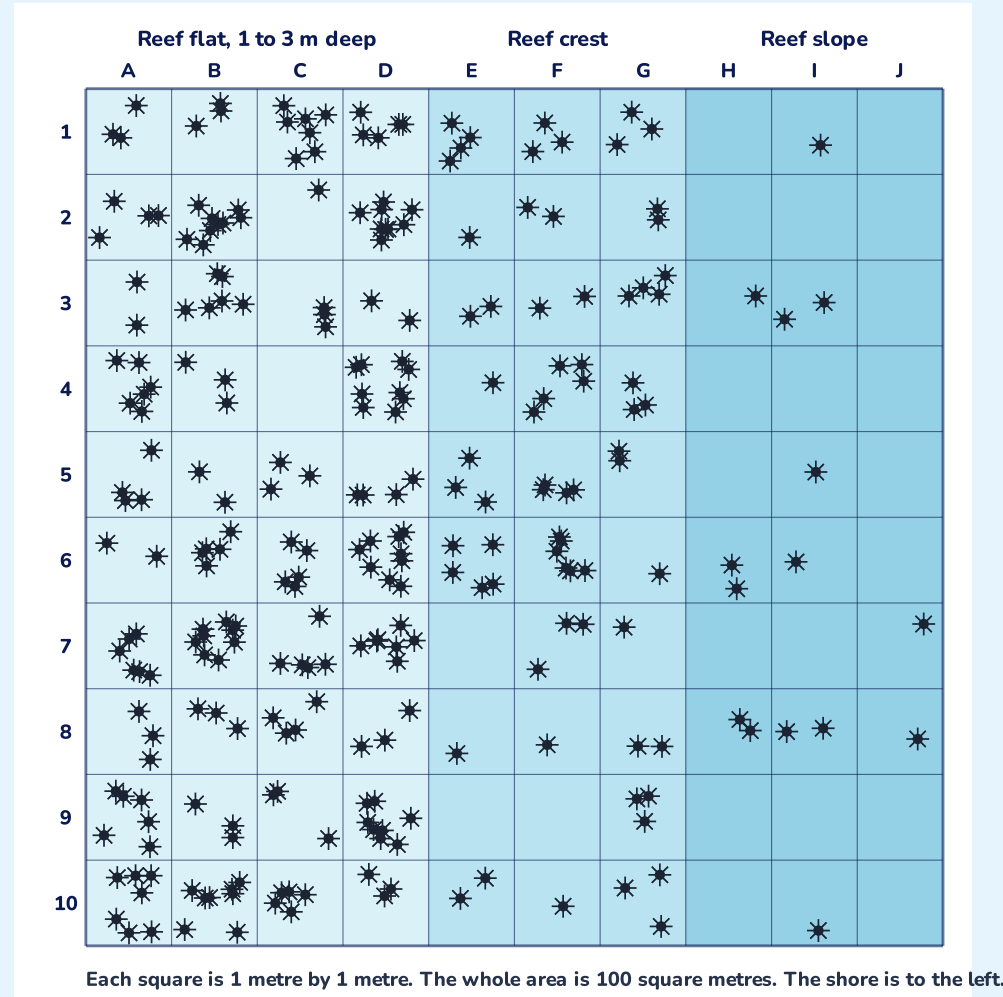


MCP survey divers. Photo: MCP



How many sea urchins?

This is a practice map of 100 square metres of reef. Before you count anything, write down a guess.



Why not just count them all?

MCP divers survey reefs along about 70 km of coast in southern Negros Oriental. Nobody could count every animal on every metre of that.

Divers also have limited air and time underwater. So scientists count a sample, a small part chosen carefully, and use it to estimate the whole.



Laying a survey tape. Photo: MCP

Method 1: random quadrats

1. Use the random number table to pick 10 squares, such as C7 or H2.
2. Count the urchins in each square. An urchin on a line counts only if its centre is inside.
3. Work out the mean number per square.
4. Multiply by 100, the number of squares in the whole area.

Why random?

If you choose the squares yourself, you might pick the busy ones without meaning to. That is called bias.



Method 2: stratified random

1. Notice the map has three zones: reef flat, reef crest and reef slope.
2. Sample each zone separately, in proportion to its size: 4 squares on the flat, 3 on the crest, 3 on the slope.
3. Work out the mean for each zone, then multiply by that zone's number of squares (40, 30 and 30).
4. Add the three zones together.

Why stratify?

Urchins are not spread evenly.
Sampling each zone makes sure no zone is missed or over-counted by chance.



Method 3: your choice

1. Pick 10 squares wherever you like, without the random table.
2. Count, work out the mean and multiply by 100, as before.
3. Keep this estimate. We will compare all three.



Compare the methods

Write each group's estimates on the board. Then your teacher will reveal the real total.



Your guess



Random quadrats



Stratified random



Your choice

Which method got closest? Did every group get the same answer? What would happen with 20 squares instead of 10?



How MCP surveys a reef

MCP uses stratified random sampling, the same idea as Method 2, to monitor fish, invertebrates, corals and the seabed.

30 m

survey tape laid over the reef for each transect

3

depth ranges surveyed at each site

2,016+

surveys a year, repeated every 3 months

Volunteers train for 2 to 4 weeks in species identification and methods before they are allowed to survey.



Words scientists use

Population

every individual in the area you care about

Sample

the part you actually count

Random

every square has the same chance of being chosen

Stratified

sampled zone by zone, in proportion to size

Bias

a pattern of error that pushes results one way

Replicate

a repeat of the same measurement



For exam classes

The same idea appears in GCSE and IGCSE biology practicals: estimated population = (total area ÷ area sampled) × number counted.

In this activity, 10 squares of 1 m² were sampled from 100 m², so the estimate is 10 × the number you counted.

- AQA: required practical, field investigations
- Edexcel: core practical with quadrats and belt transects



Talk about it

Why did stratified sampling work better on this map?

What could make a real underwater survey biased?

How many samples are enough? How would you decide?

Next time: measuring coral cover



Photos and sources

Photos: survey divers and survey tape by MCP, Negros Oriental. All illustrations drawn for this lesson by Marine Conservation Philippines.

Sources:

- Marine Conservation Philippines. Marine Monitoring.
- PMT Education. AQA required practical 9 notes.
- Field Studies Council. GCSE science practical ecology.

Full links are in the teacher reading. Free to use and share for education. Made by Marine Conservation Philippines. More free lessons: marineconservationphilippines.org/resources/teachers-resources/

