



Counting fish and measuring diversity

Lesson plan: count fish on practice belt transects, calculate density and Simpson's diversity index, then plan a real field survey



Ages	13 to 18 (grades 8 to 12)
Time	60 minutes
Group	Up to 35 students, in pairs
Where	Any classroom. No internet needed.
You need	The slides, one fish belt worksheet (A4 landscape, colour) and one survey planner per pair, calculators

What students learn

- How belt transects are used to count fish, and the observer effects that make it hard.
- How to calculate fish density so surveys of different sizes can be compared.
- How to calculate and interpret Simpson's diversity index.
- How to plan a fair, safe field survey of their own.

Before the lesson

1. Print one **fish belt worksheet** in colour and one **survey planner** per pair.
2. Calculators.

The lesson

- 1 The belt transect 8 minutes, slides 1 to 3.** Explain the method and the diver rules. Discuss why fish counts are harder than coral counts.
- 2 Count the fish 15 minutes, slide 4.** Pairs count each species on both belts. Compare counts between pairs: small differences show observer error.
- 3 Density and diversity 20 minutes, slides 5 to 7.** Work through the density formula and the Simpson's worked example, then pairs calculate both for each site.
- 4 Plan a survey 12 minutes, slide 8.** Pairs start the survey planner. It works well as homework or a project.
- 5 Wrap up 5 minutes, slide 9.** Discuss one or two questions.

Answers and what to listen for

Answer key: protected site Parrotfish 9, Surgeonfish 8, Butterflyfish 6, Damselfish 14, Grouper 3, Snapper 4; total 44 fish, density 29.3 per 100 m², Simpson's D = 0.81. Fished site Parrotfish 4, Surgeonfish 5, Butterflyfish 5, Damselfish 18, Grouper 0, Snapper 1; total 33 fish, density 22.0 per 100 m², Simpson's D = 0.66. Groupers are missing at the fished site: large, tasty predators are often the first fish removed by fishing.

Making it easier or harder

- **Younger groups:** skip Simpson's index and compare species counts and totals only.
- **Older groups:** discuss why damselfish can be more common at a fished site, and what dominance by one species does to D.
- **Projects:** the survey planner suits senior high school research tasks and extended essays.

Safety and good practice

- Any field survey needs adult supervision, a check of tides and weather, and a rule that nobody collects or disturbs animals.

Curriculum links

- **Science:** sampling, biodiversity, human impact (GCSE, IGCSE and IB ecology).
- **Maths:** formulas, density, indices.
- **Philippine senior high school:** General Science, General Mathematics and research skills.
- **Ocean Literacy Principle 5:** the ocean supports a great diversity of life and ecosystems.

The teacher reading has the science behind every slide, with links to the sources.

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