# Modelling A Marine Eco-system:
The Undersea World

> **DECOMPOSE into smaller parts**
>
> **DEFINE each part as a block**
>
> **CALL the blocks in correct order**

Remember, the key thing about handling complexity is breaking things down into smaller parts, then creating procedures for each small sequence.

Once defined, procedures can be called at runtime. You have been given a part complete model. It creates an undersea world, with 50 fish and 500 plankton. The names of all the procedures have been created for you, but most are 'stubs'. They have been named but the code they run hasn't been defined.
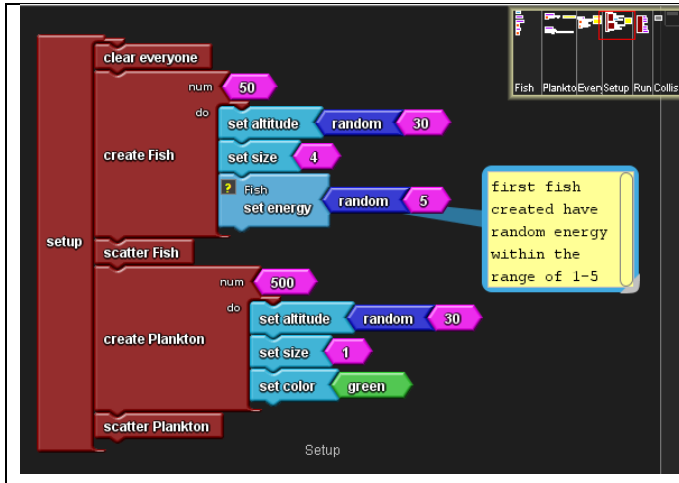

Start by explaining precisely what happens when the Setup procedure is called.

When you set the model running the Forever loop runs (see right). Only two of the procedures in this loop called are functioning. Both the Fish and Plankton move up and down, because this procedure is defined for Everyone, and called by both Breeds.

The Plankton also move very slowly. You should recognise how that happens from previous models we've studied.

Your task is to complete the other procedures, in the order shown below. For each one, when you have completed it, paste a screengrab of your code into the box at the end of the document, and explain how it works in as precise fashion as you can.
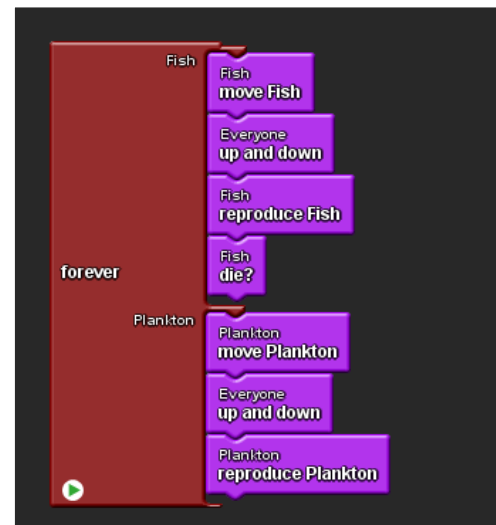
First complete the move Fish procedure. Fish should move 1 step in a random direction, turning up to 10 degrees, either left or right, on each step. Swimming takes energy, so each step uses up .1 of their energy. If they run out of energy, they will die.

Here are a few other relevant facts:

Eating Plankton boosts energy by .5. If their energy exceeds 5 they can reproduce.

Plankton will reproduce if there are less than 550 in the world.

Both fish and plankton need to move away from their mother when they hatch.

Armed with that knowledge, decide on the best sequence for solving the problems. Test your model at each stage to make sure it works properly.

Each time you run your model, different species of fish may come to dominate, or possibly all become extinct. Try experimenting with different numbers of Fish and Plankton. Also try altering the amounts of energy gained from eating, or lost through moving.

When you are happy everything works, copy each of your procedures into the boxes below, and explain clearly how they work.

Fish Procedures (Screengrabs)	Explanation
Fish Move	
Fish Eat Plankton	
Fish Die?	
Fish Reproduce	

Plankton Procedures	Explanation
Plankton Move	
Plankton Reproduce	

Collision Code	Explanation

Thinking about improvements:

Now that you have a simple eco-system, think about ways to make it more real.

- Add another breed – a predator like a Shark.
- At Setup, create one or more Sharks.
- Ensure the Shark(s) can move around at Runtime, losing a little energy like the Fish.
- When they eat Fish they gain energy.
- If they have enough energy they can reproduce like Fish.
- And if they run out of energy, they die.

Once you have a working model with a predator.

- Monitor the numbers of fish and sharks.
- Experiment with different values for energy and reproduction to develop a stable eco-system.

Can you think of further modifications you can make to improve your model?