Modelling A Marine Eco-system: The Undersea World

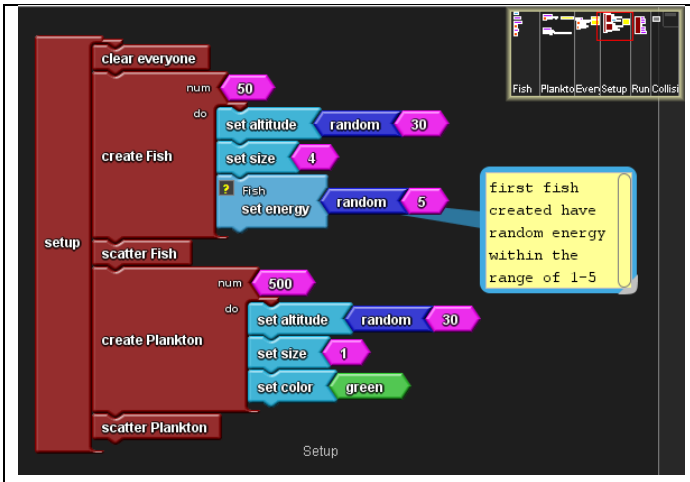
DECOMPOSE into smaller parts

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, paste a screengrab of the code in the box at the end of the document, and explain how it works in as precise fashion as you can.

For each procedure, an explanation is given to help you get started.

First complete the move Fish procedure.

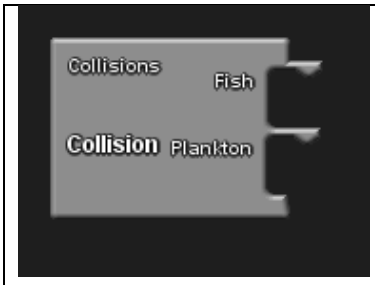
Fish should move 1 step in a random direction, turning up to 10 degrees, either left or right, on each step.

Swimming takes energy, so each step uses up .1 of their energy.

The energy variable has been created for you.

	If the fish run out of energy they will die. Complete the Fish die? Procedure to test for energy level. Fish die when it falls below zero. You will need a conditional 'IF' block as part of your solution.

Our fish need to eat to keep their energy levels up. Use a collision to simulate this.

	When Fish and Plankton collide: Fish energy increases by 0.5 Plankton die

If Plankton are eaten, we need to ensure they can also replenish and reproduce.

	There is a 2% chance that Plankton may reproduce. If the random number generated is 1 then: If the Count of Plankton is less than 550 Hatch a new Plankton: Set it heading in a random direction. Move it up to 5 (random) steps away.

Similarly Fish need to be able to reproduce.

	Fish will reproduce when they have enough energy (try over 5). When they do reproduce, their energy reduces by 2. The hatched fish head in a random direction and move up to 3 (random) steps away from their parent. They need an initial energy level set (try 2).

Test your model at each stage to make sure it works properly.

Each time you run it, different species of fish may come to dominate, or possibly all become extinct.

Try experimenting with different numbers of Fish and Plankton.

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 overleaf, and explain 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?