



**GCSE**

4781/03



W15-4781-03-R1

**SCIENCE B**

**UNIT 1: Space, Energy and Life**

**Pre-Release Article for use in the following examinations on 15 January 2015:**

**GCSE Science B Foundation Tier (4781/01)**

**GCSE Science B Higher Tier (4781/02)**

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### Information for Teachers

The pre-release sets the scene for the questions in **Section B** of the Foundation Tier and **Section A** of the Higher Tier. Questions will be based around pre-release and related specification content. There will be an emphasis on data handling/analysis in this section. The questions on the pre-release will be common between the two tiers. These questions will be worth 24 marks.

No recall or terminology is required over and above that in the specification.

Students will be expected to have discussed and studied the article together with relevant specification content prior to the examination. However, they will not be expected to memorise any part of it as a copy will be provided in the examination paper.

## Pre-Release Article – Dissolved oxygen and aquatic life

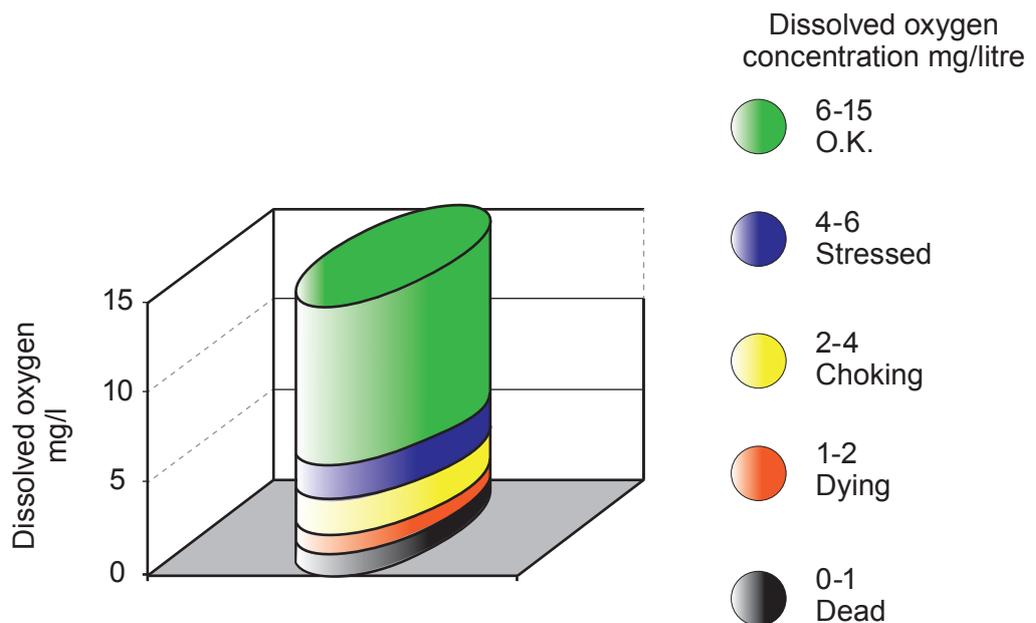
In the 1970s, Chesapeake Bay, USA was discovered to contain one of the planet's first identified marine dead zones. The waters were so depleted of oxygen (hypoxic) that they were unable to support life, resulting in the death of massive numbers of fish.

### Where does dissolved oxygen come from?

There are two main sources of dissolved oxygen: air and photosynthesis. Both phytoplankton and plants can be found in water. These organisms are net producers of oxygen in the daytime, but at night become net consumers of oxygen. At the surface of the water, oxygen from the air **equilibrates** with oxygen dissolved in the water. Moving water has a rougher surface than still water. With more surface area in contact with air, moving water will equilibrate with air more quickly.

**Oxygen depletion** occurs as dissolved oxygen (**DO**) becomes reduced in concentration. **DO** is measured in milligrams per litre (mg/l).

### Diagram 1 How much oxygen in the water do aquatic creatures need?

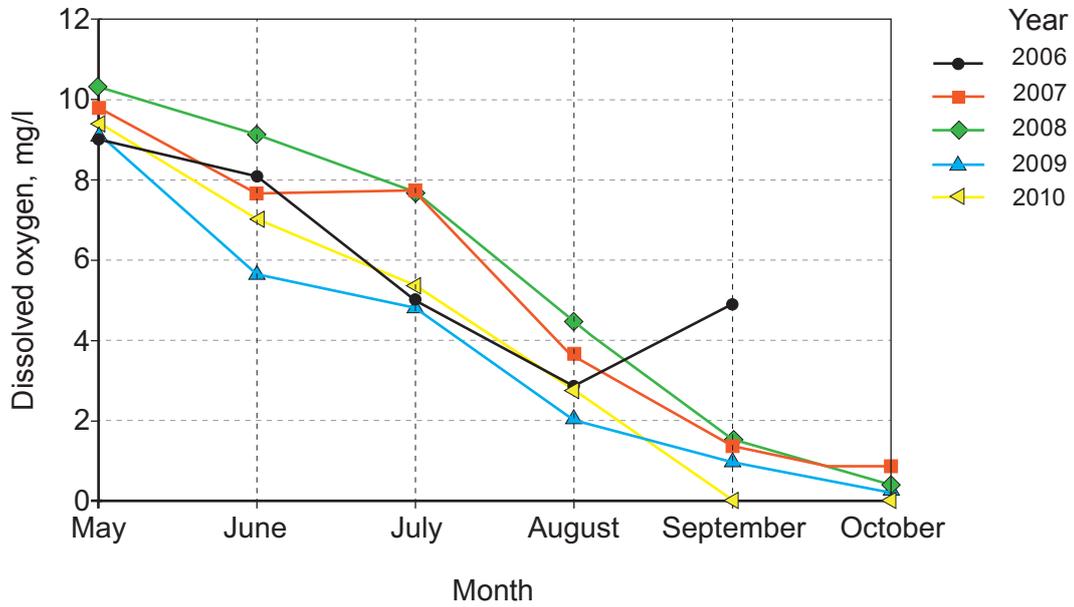
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### What causes dissolved oxygen levels to vary?

The amount of dissolved oxygen will be determined by:

- how much oxygen the water can hold (temperature-dependent)
- the depth of the water
- how much surface area is available for diffusion from the air
- how much oxygen is produced by photosynthesis
- how much oxygen is consumed by respiration.

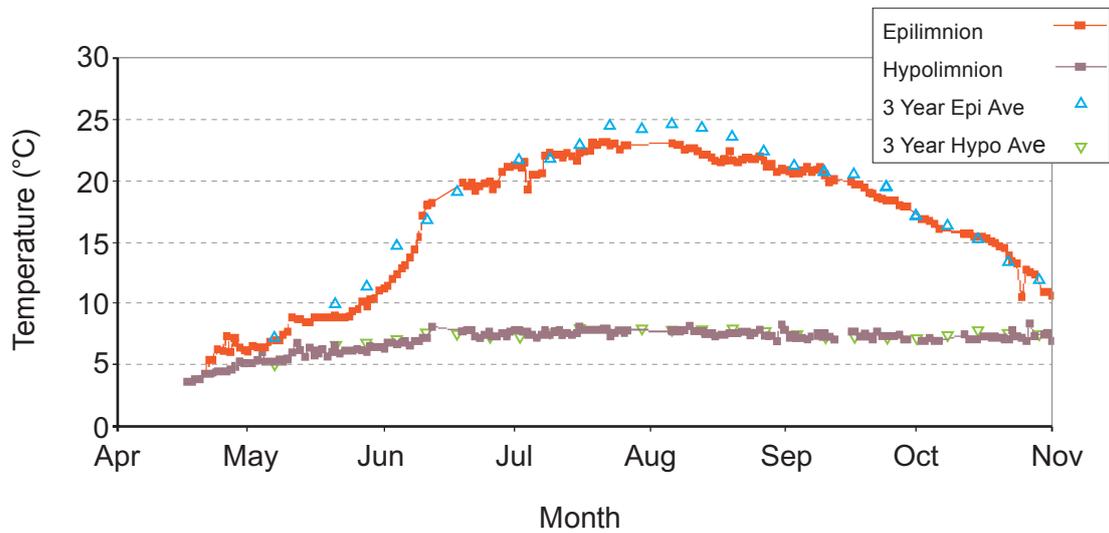
Graph 1. How dissolved oxygen concentration (DO) varies with the month in the year



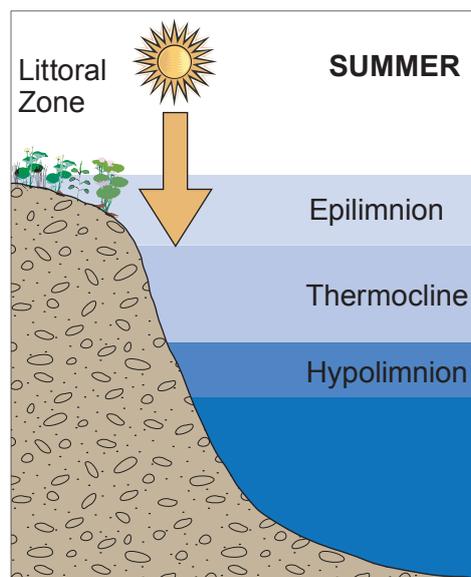
**Table 1. How maximum dissolved oxygen concentration (DO) varies with temperature**

Temperature (°C)	DO (mg/l)	Temperature (°C)	DO (mg/l)
0	14.60	23	8.56
1	14.19	24	8.40
2	13.81	25	8.24
3	13.44	26	8.09
4	13.09	27	7.95
5	12.75	28	7.81
6	12.43	29	7.67
7	12.12	30	7.54
8	11.83	31	7.41
9	11.55	32	7.28
10	11.27	33	7.16
11	11.01	34	7.16
12	10.76	35	6.93
13	10.52	36	6.82
14	10.29	37	6.71
15	10.07	38	6.61
16	9.85	39	6.51
17	9.65	40	6.41
18	9.45	41	6.41
19	9.26	42	6.22
20	9.07	43	6.13
21	8.90	44	6.04
22	8.72	45	5.90

**Graph 2** How the mean daily water temperature varies with the month in the year

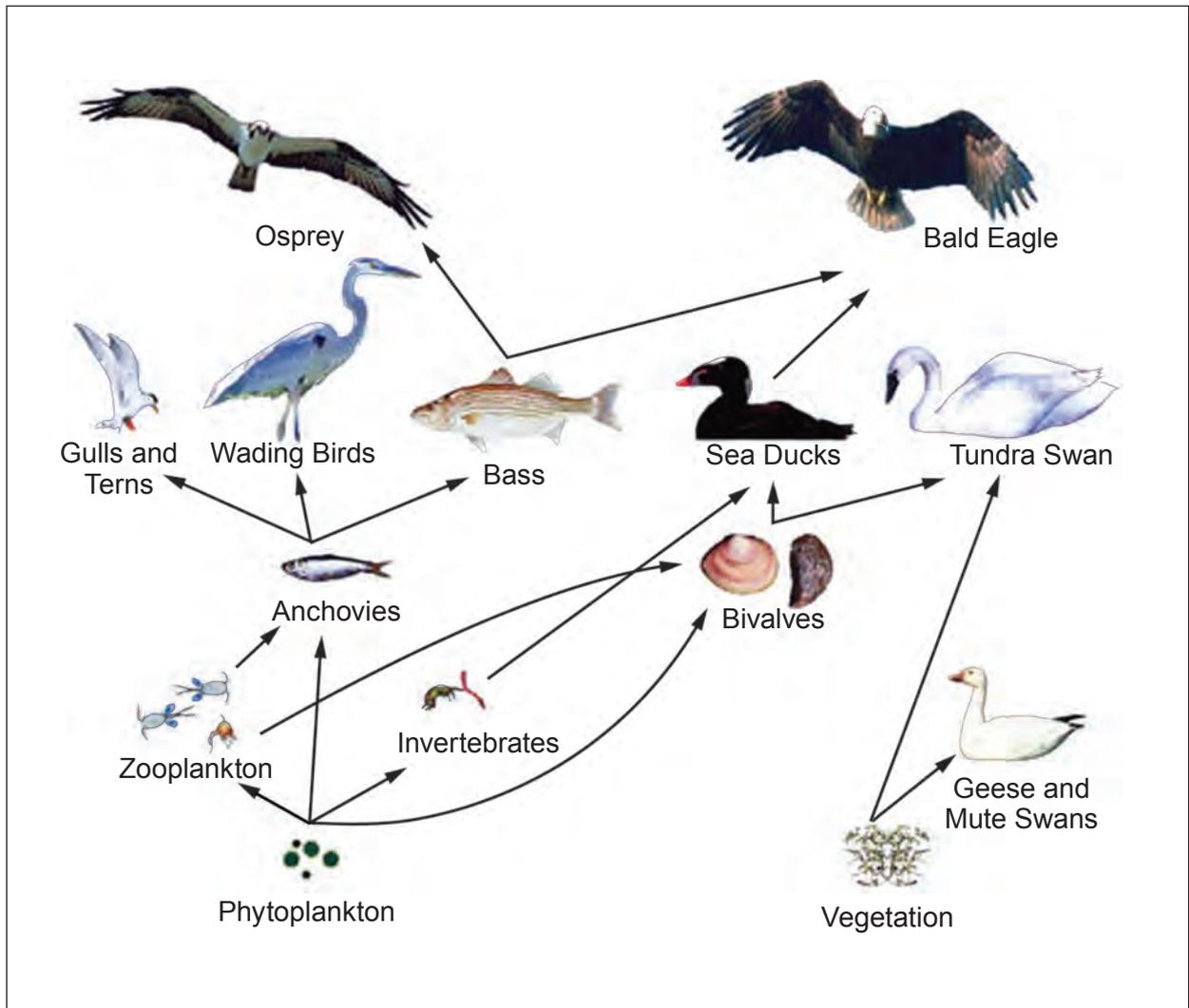


**Diagram 2** How depth affects the dissolved oxygen concentration



The sun heats the top layer of water, the epilimnion, which causes it to become less dense. The bottom layer, the hypolimnion, does not receive sunlight and therefore remains cold. Since the epilimnion is less dense, it floats above the hypolimnion and the two do not mix. The thermocline is the dividing area between the top and bottom layers. The epilimnion is the only part of the lake that sunlight can penetrate.

Diagram 3 Chesapeake foodweb



**Acknowledgements:**

[http://www.epa.gov/glnpo/monitoring/d\\_o/](http://www.epa.gov/glnpo/monitoring/d_o/)

[http://en.wikipedia.org/wiki/Chesapeake\\_Bay](http://en.wikipedia.org/wiki/Chesapeake_Bay)



**GCSE**

4781/03-A



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**SCIENCE B**

**UNIT 1: Space, Energy and Life**

P.M. THURSDAY, 15 January 2015

**Resource Folder (Pre-Release Article)**

For use with:

GCSE Science B (UNIT 1) **SECTION B** of the Foundation Tier

GCSE Science B (UNIT 1) **SECTION A** of the Higher Tier

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## Pre-Release Article – Dissolved oxygen and aquatic life

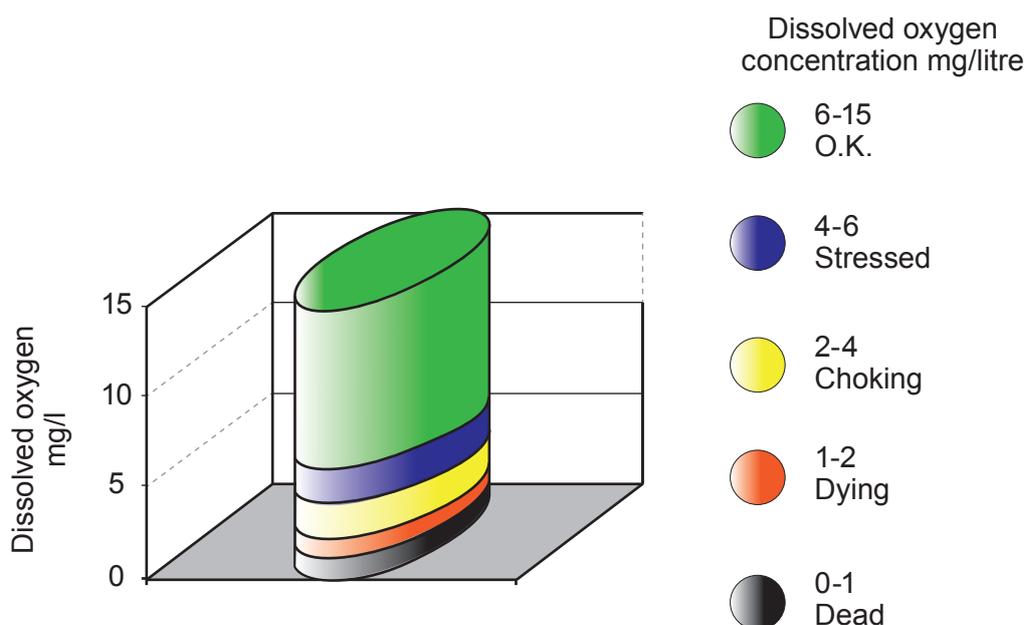
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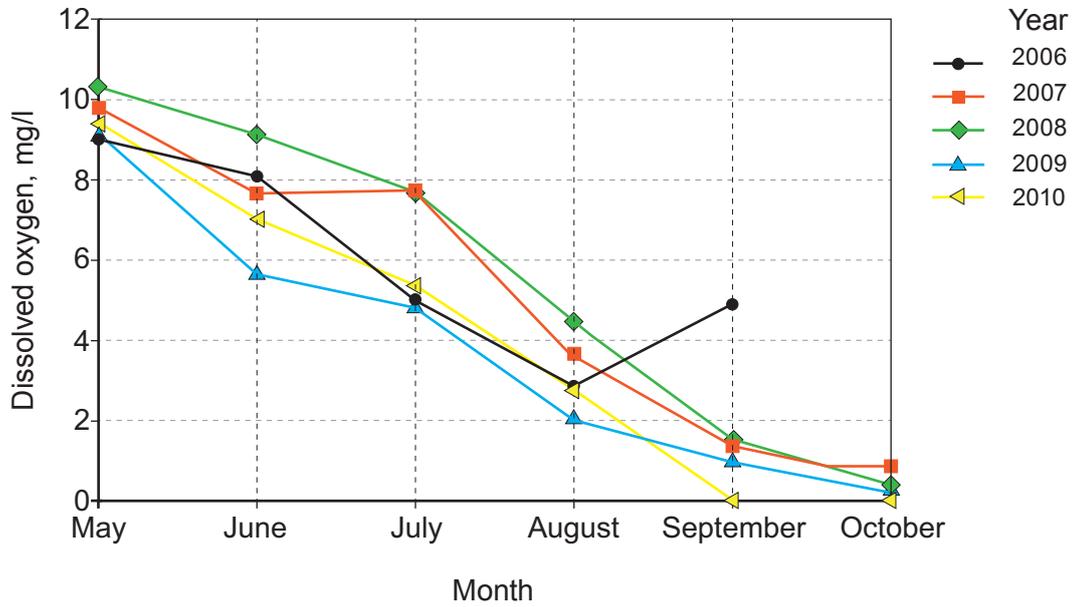
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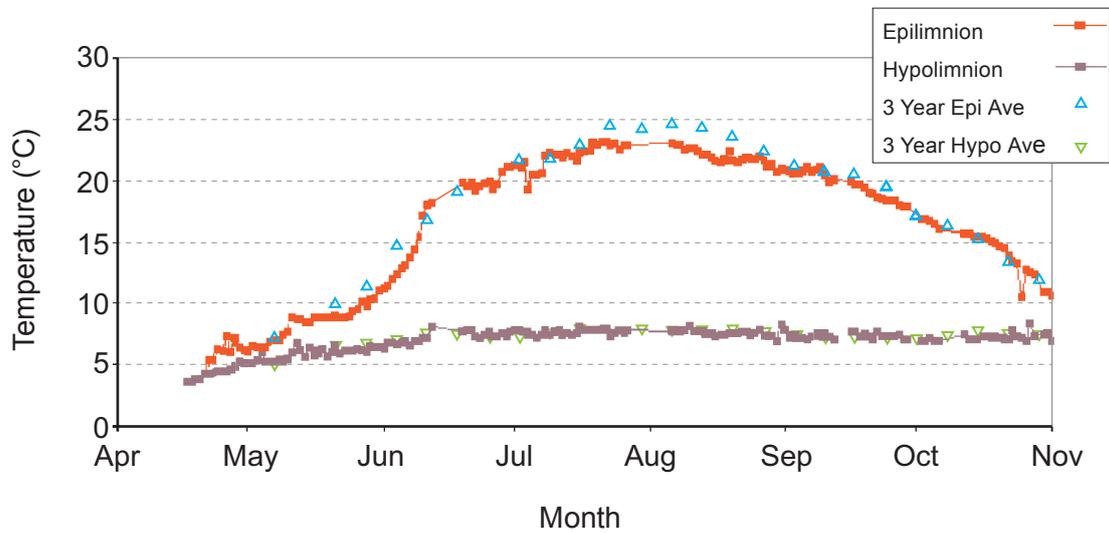
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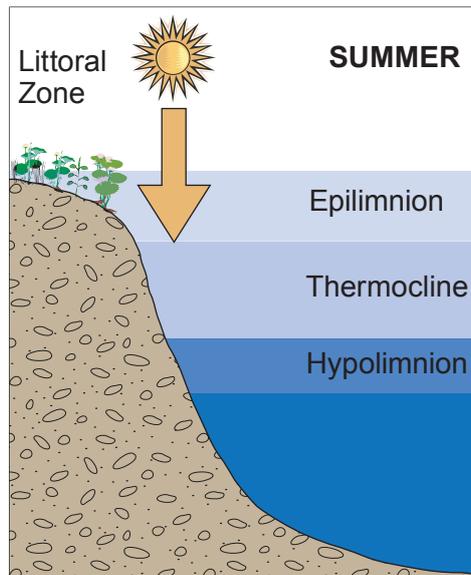
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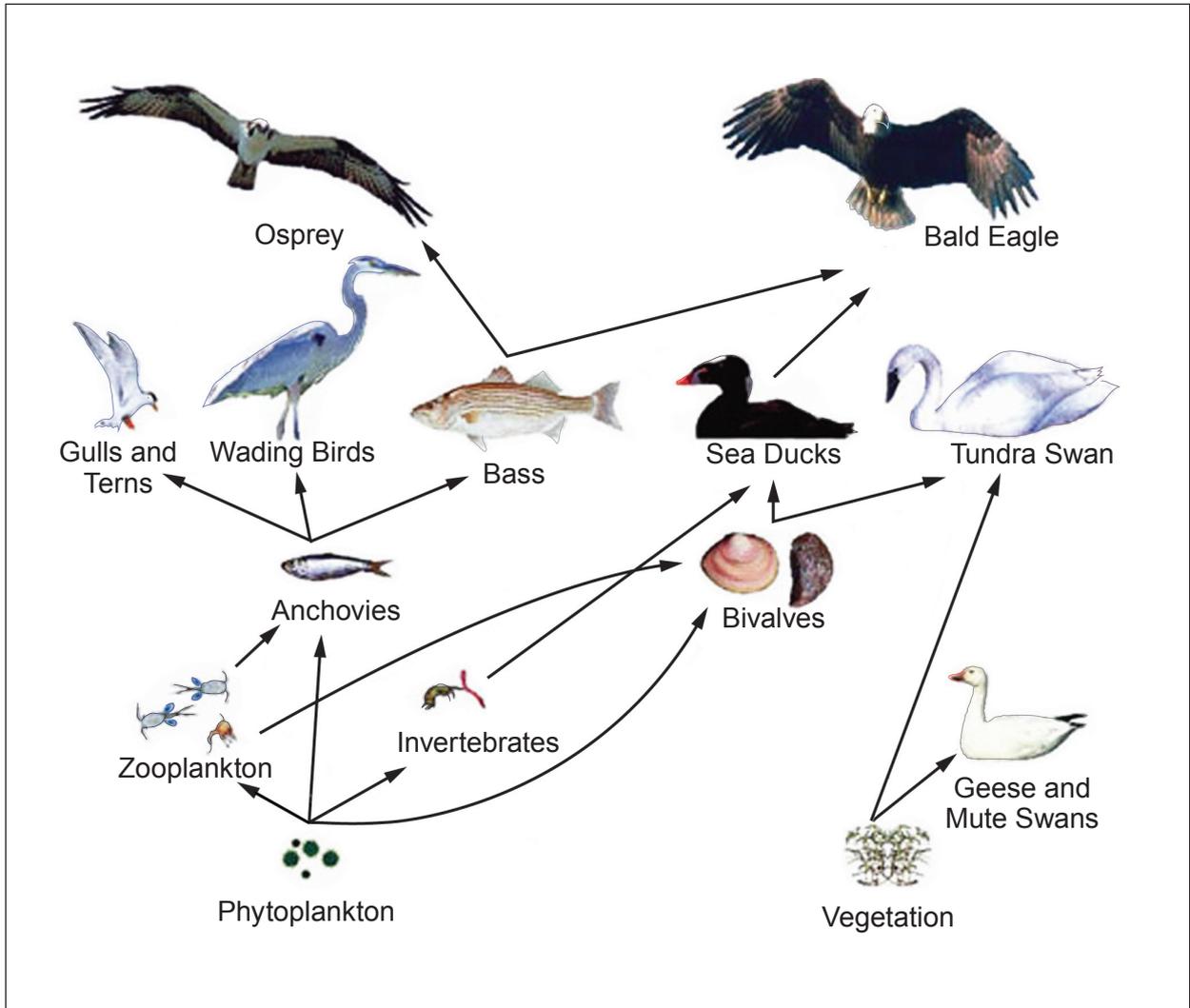


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