

# Ecology and the Limiting Factors for Life

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## Ecology and the limiting factors for life.

Q1) What is a limiting factor? (Try a quick search for Limiting Factor or Ecological Limiting Factors)

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Q2) Name two limiting factors for life; ensure that one of them is related to aquatic environments.

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(If you are stuck try limiting factors for life e.g. temperature, carbon dioxide concentration or even nitrogen and phosphorus)

Q3) Take one of the limiting factors above and explain why it limits life.

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Q4) Light availability has always been a limiting factor for plants and phytoplankton. Use the space below to draw a simple chart outlining how increasing depth in the ocean limits light of different wavelengths.

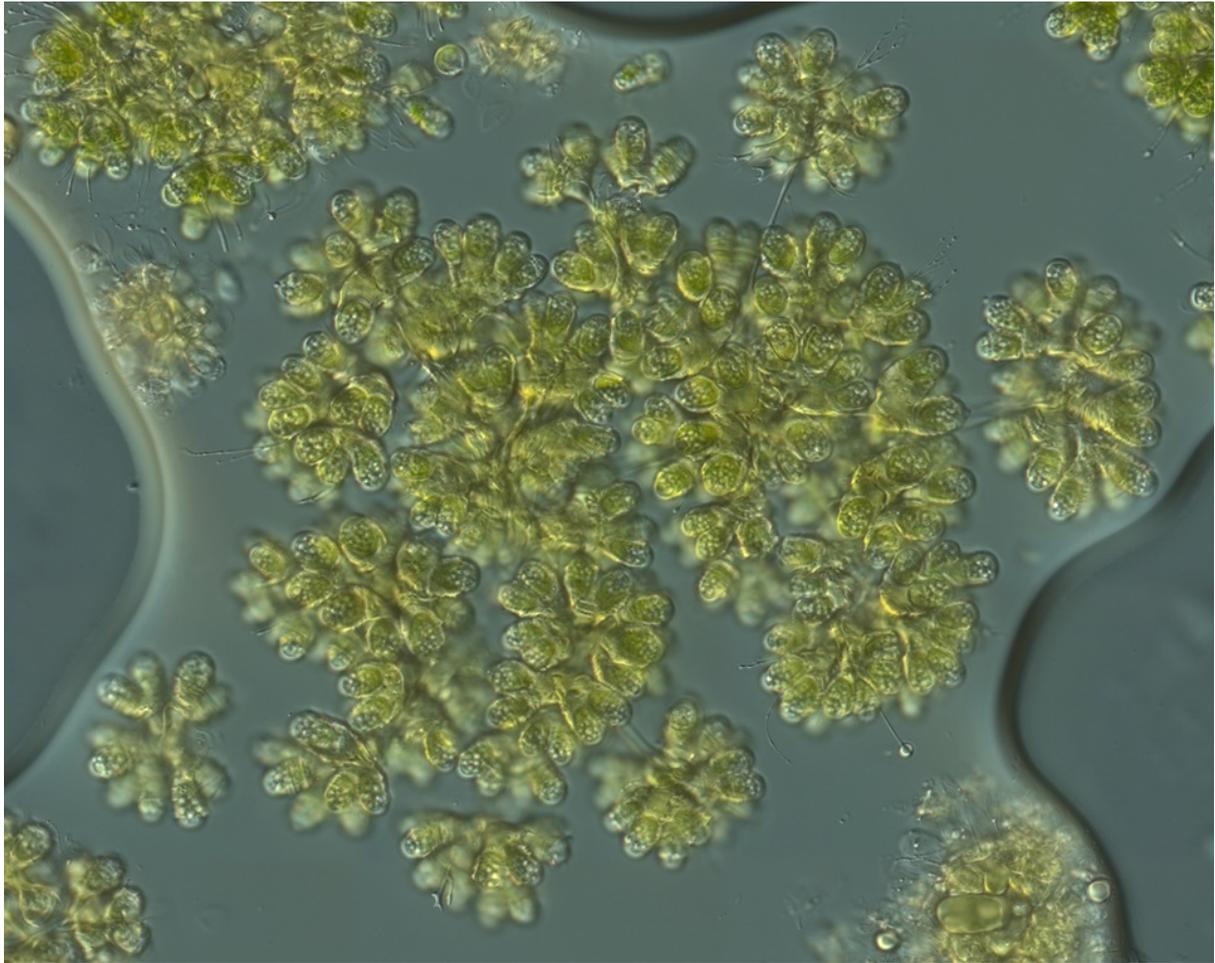


Image 1: A strain of *Botryococcus braunii* cultured by ANACC. Source: CSIRO ANACC.

Q5) Explain why marine plants are not found deeper than a few hundred metres.

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Q6) Some marine algae use a pigment called phycoerythrin in their tissues. This tends to reflect the red spectrum of light so they look red and are therefore a type of red algae. These algae are often also found deeper than many others, the typically green or brown alga. Outline the adaptation most likely to explain why red algae are often found deeper than other algae.

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An ongoing study conducted on-board RV *Investigator* titled **Natural iron fertilisation of oceans around Australia: linking terrestrial dust and bushfires to marine biogeochemistry**, involved scientists sampling marine air and water samples to find the tiniest traces of iron. Iron is used by life for a multitude of reasons.



Image 2: Associate Professor Andrew Bowie and PhD Candidate Morgane Perron with an automated rainwater sampler aboard *RV Investigator*. ©ABC / Ann Jones

Q7) As we understand it iron is used by life in a multitude of ways. We know iron is an essential nutrient in our diet.

Detail how iron is used in the human body? (hint: look up myoglobin and haemoglobin)

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Q8) Plants use iron too, it is not the same as in the human body. Phytoplankton or algae, as simple plants (really many belong to the Protista), will use iron as well.

Describe two ways iron is used in phytoplankton. (you will need to search online for the information)

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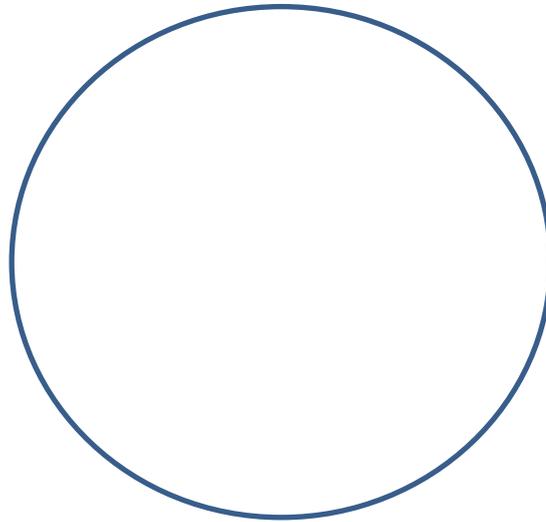
2

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Q9) Use the pie chart to outline what the composition of seawater is. (Again, a simple image search for composition of seawater will work). Note how iron does not get a mention!



Iron is a trace element in ocean water. Part of the issue is that the oceans are oxic or oxygen rich. This means that any iron ions or the electrically charged particles of iron that make it into water very quickly react with the oxygen and form stable iron oxides or rust. These are pretty heavy and tend to sink and they are also very stable, and life finds it hard to break it down to use it.

So what are the sources of iron in our oceans?

Q10) Use the CSIRO video at <https://www.youtube.com/watch?v=7DI0qhdkfT8> or the video transcript at <http://www.csiro.au/Youtube/Iron-in-the-Southern-Ocean/video-transcript> to describe where some sources of iron are found in the southern ocean.

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Q11) From the video, why is the TMR unit (Trace Metal Rosette) made from plastics and titanium?

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Q12) The scientists in the on-board lab are in clean suits. Explain the need for this type of care with your sample analysis.

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Q13) Using a wider search, detail other sources of iron that make it into the oceans. (Hint, look towards the northern hemisphere rather than the southern oceans)

<https://www.researchgate.net/publication/285753943> The Importance of Atmospheric Deposition for Ocean Productivity

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Q14) Let us bring this all together.

Analyse why iron in the oceans is an important limiting factor for oceanic phytoplankton.

Identify what a limiting factor is

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Describe what iron is used for in phytoplankton

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Explain why iron is a limiting factor in the oceans and where it might come from

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Analyse the importance of iron in the oceans; that is what might occur if there is too much or too little iron?

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Image 2 CSIRO. 2020. Natural iron fertilisation of oceans. [ONLINE] Available at: <https://mnf.csiro.au/en/Voyages/Multi-voyage-projects/Ocean-iron-fertilisation>. [Accessed 9 February 2020].

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## Extension

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