Toxic Algae STEM Investigation

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This resource was developed as a result of participation in CSIRO's teacher professional learning program, Educator on Board.

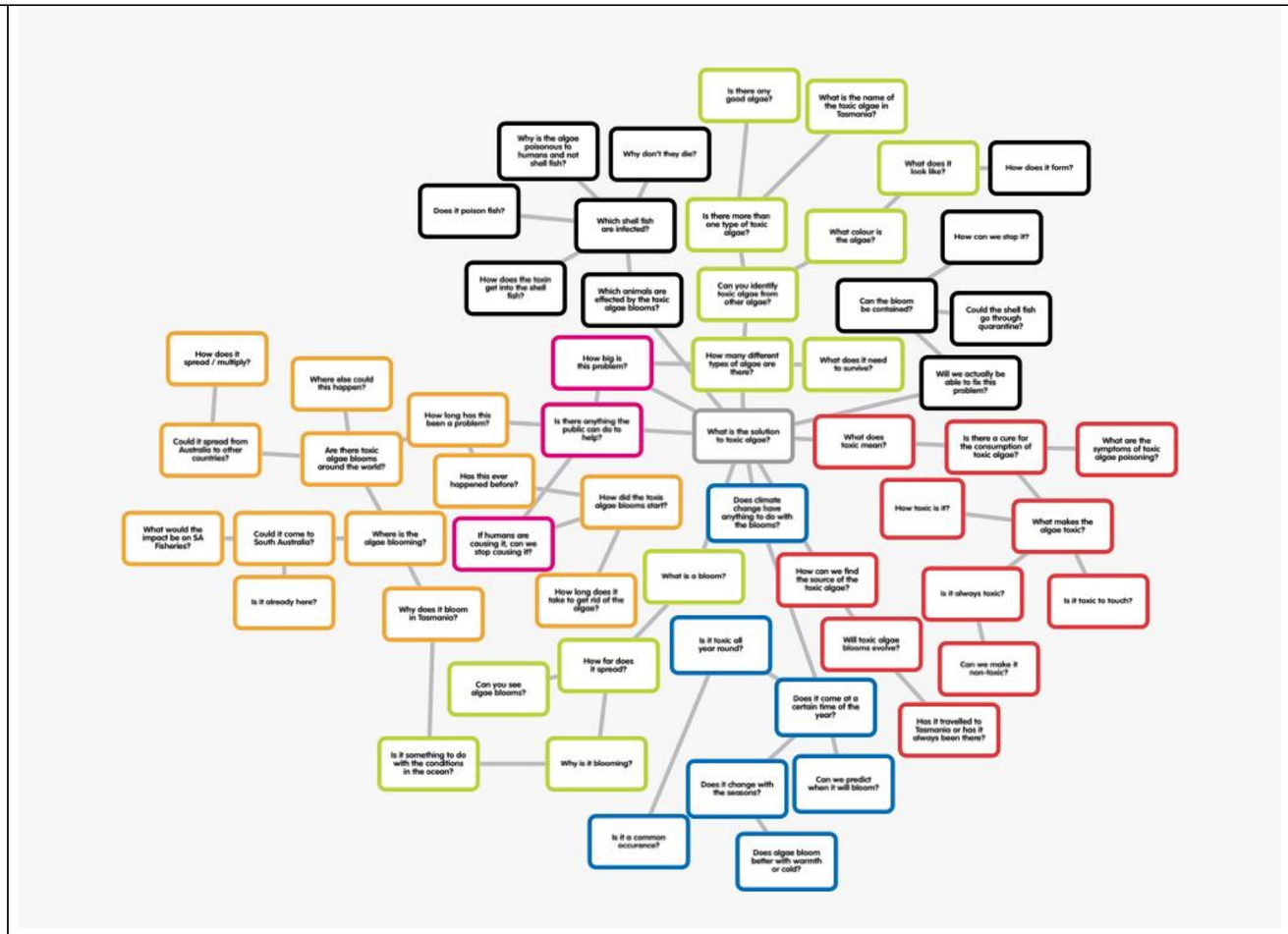
STEM Planning Template: Year _____6/7___CSIRO Toxic Algae Investigation_____

Australian Curriculum Science Content		
Science Understanding	**Science as a Human Endeavour**	**Science Inquiry Skills**
Classification helps organise the diverse group of organisms Interactions between organisms, including the effects of human activities can be represented by food chains and food webs	Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical contributions. People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity	• Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge. • Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.
Key concepts/Big ideas		
When organisms are organised through classification, that knowledge enables us to make scientific decisions than benefits communities. Human activity impacts all organisms. There are ways of representing the interdependence of organisms.		• Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence. • Use scientific knowledge and findings from investigations to evaluate claims based on evidence. • Communicate ideas, findings and evidence based solutions to problems.
Learning Intentions		
• What do you want them to know, understand and be able to do? Know – The classification hierarchy and use the appropriate scientific language. The difference between and the purpose of a food web and food chain. Students need to know what a microorganism is and their role in an ecosystem. Understand - That we, as human beings, have an important role to play in ensuring the health and viability of micro-organisms. Students need to understand that there are ways that we can all contribute to solving problems that are occurring globally. Able to do – Sort and classify unknown microorganisms in terms of zooplankton and phytoplankton. Be able to represent the data in a table and create appropriate graphical representations. Interpret data sets from a primary resource and compare data from different regions.		

Australian Curriculum Mathematics Content	**Australian Curriculum Design and Digital Technologies Content**	**Other content areas**
Interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables Interpret secondary data presented in digital media and elsewhere (ACMSP148) Identify and investigate issues involving numerical data collected from primary and secondary sources Investigate and calculate percentage discounts of 10%, 25% and 50% with and without digital technologies. Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies. Recognise and solve problems involving simple ratios.	Acquire data from a range of sources and evaluate authenticity, accuracy and timeliness Analyse and visualise data using a range of software to create information, and use structured data to model objects or events Define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints Evaluate how student solutions and existing information systems meet needs, are innovative, and take account of future risks and sustainability.	• Scientific vocabulary • Analytical Reading • Report Writing • Spelling of technical language • Oral language • Research and comparison • Comprehension – multi level groups
General Capabilities		
Numeracy Students solve problems in authentic contexts that involve collecting, recording, displaying, comparing and evaluating the effectiveness of data displays of various types. They use appropriate language and numerical representations when explaining the outcomes of chance events. In developing and acting with numeracy, students: • interpret data displays	Literacy Students develop strategies and skills for acquiring a wide topic vocabulary in the learning areas and the capacity to spell the relevant words accurately. In developing and acting with literacy, students: • understand learning area vocabulary Students navigate, read and view texts using applied topic knowledge, vocabulary, word and visual knowledge. They listen and respond to spoken	Critical and Creative thinking Students pose questions and identify and clarify information and ideas, and then organise and process information. They use questioning to investigate and analyse ideas and issues, make sense of and assess information and ideas, and collect, compare and evaluate information from a range of sources. In developing and acting with critical and creative thinking, students: • pose questions

• Interpret chance events.	audio and multimodal texts, including listening for information, listening to carry out tasks and listening as part of participating in classroom activities and discussions. Students use a range of strategies to comprehend, interpret and analyse these texts, including retrieving and organising literal information, making and supporting inferences and evaluating information and points of view. In developing and acting with literacy, students: • navigate, read and view learning area texts • listen and respond to learning area texts • interpret and analyse learning area texts.	• identify and clarify information and ideas • organise and process information. Students imagine possibilities and connect ideas through considering alternatives, seeking solutions and putting ideas into action. They explore situations and generate alternatives to guide actions and experiment with and assess options and actions when seeking solutions. In developing and acting with critical and creative thinking, students: • imagine possibilities and connect ideas • consider alternatives • seek solutions and put ideas into action. Students identify, consider and assess the logic and reasoning behind choices. They differentiate components of decisions made and actions taken and assess ideas, methods and outcomes against criteria. In developing and acting with critical and creative thinking, students: • apply logic and reasoning • draw conclusions and design a course of action • evaluate procedures and outcomes.

Design Challenge Ideas	
The BIG Question: What is the solution to toxic algae blooms?	
Define the problem	
• **Engage** the students in the topic. • **Set the scene** by giving them background information to the problem and linking this to prior learning. • As you **define the problem**, make sure you answer these questions: • What is the problem to solve? • What do we want to design? • What is it for? • How does the target audience impact the design? • What are the project requirements **(criteria**)? • What are the limitations (**constraints**)? • What is our goal? **Criteria** identify the ways students will **define success** for their designs. What will the device need to accomplish to solve or to simulate a successful solution to the problem? **Constraints** refer to the **limitations** that students must observe when designing their solution. They may have to consider materials, size or weight or the device. They may need to consider safety factors or environmental impact.	Stimulated by the CSIRO Educator on board program. https://research.csiro.au/educator-on-board/category/in2018-t02/ http://www.abc.net.au/news/2018-05-22/breakthrough-science-on-algal-blooms/9784200 Success Criteria – Make a recommendation to CSIRO to contribute to the Toxic Algae solution in Tasmania. Make connections to local ocean conditions and plankton species to advise SA Fisheries – Interdependence Reviewing solutions in light of feedback adding to the skill set of scientific investigation and engineering design. Constraints – Tasmanian Fisheries need to continue operating and meeting quarantine / hygiene regulations in Australia and overseas when exporting shell fish. Location and Technological understanding. We can only make recommendations rather than physically contribute which can be frustrating.



Guiding questions developed through brain storming in groups.

Research

Teams gather needed information about the problem.

- Investigations that help set up the criteria and goals of the design.
- Learning from other disciplines - What maths skills are needed? How can you incorporate the use or development of technology?

Group Tasmanian Dinoflagellate images collected form the RV Investigator – Success criteria; microorganisms grouped based on common identifying features i.e. physical.

Develop research teams to find answers to the guiding questions. Share information with the whole group in a filmed presentation. Recorded information stored on a common drive for all to access during the investigation.

Collect local plankton samples using scientific processes and equipment.

Analyse samples using microscopes 600 x magnification. Record images using the digital microscope.

Compare local to Tasmanian plankton samples in groups.
Record repeated species and generate a visual representation individually. Analyse own data and explain VR representation. What does it mean? (Formative Assessment)

Remind students of concept of Interdependence, what does this means in terms of the toxic algae problem? Make connections to those impacted.

Assessment Task for *What is the solution to toxic algae blooms?*

For this assignment you will begin in your groups but will complete the mathematical component by yourself.

In your group, find the website that we began to use to find out which dinoflagellates are found in South Australian waters. There are lots to check through, so what strategies can your group use to make the task easier?

As you find one, look carefully among the photos you used to group the plankton to see if it is also found in the waters near Tasmania. If it is there, put an orange spot in the corner of the photo.
Write the scientific name of the dinoflagellate on the paper that is on the whiteboard in the common area. Make sure it hasn't already been written on the paper.

Image credit: Dr Richard Kirby

You must find out how different species of dinoflagellate are in the collection given by Dr Ruth Erikson and how many of those species you have discovered are also in South Australia.

So that we have more data, write your results on the table created and displayed in the common area.

Individually, copy the table of data into your maths book. Use the data to work out what percentage are found in South Australian waters and what percentage are found in Tasmanian waters.

Your task now is to find two different ways to graph the information. You can use Excel to create them.

Paste these graphs into your maths book next to your table of data.

Under the graphs explain :

- What the graphs are about.
- How you think scientists might use this information that we have gathered.

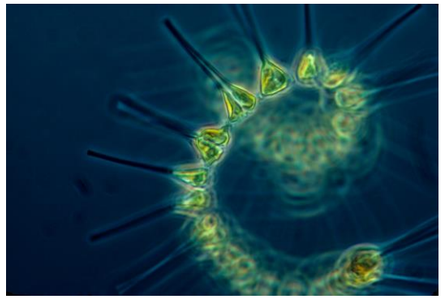


Image credit: NOAA MESA Project

Rubric for Assessment Task on Toxic Algae Blooms Name: _____

Table of data	Able to create table of data for South Australian and Tasmanian dinoflagellates with assistance	Able to create table of data for South Australian and Tasmanian dinoflagellates with limited assistance	Able to create table of data for South Australian and Tasmanian dinoflagellates with no assistance
Pen and paper graph	Able to create appropriate graph with assistance	Able to create appropriate graph with limited assistance	Able to create appropriate graph with no assistance
Digitally produced graph	Able to create appropriate graph with assistance	Able to create appropriate graph with limited assistance	Able to create appropriate graph with no assistance
Explanation of the purpose of the graphs	Unable to explain the purpose of the graphs	Able to explain the purpose of the graphs to some degree	Able to explain the purpose of the graphs to a high degree
Explanation of how CSIRO scientists may make use of the data supplied by SDPS	Unable to offer a reasonable idea of how the data may be useful	Able to offer a reasonable idea of how the data may be useful	Able to offer more than one reasonable idea of how the data may be useful

Bibliography

Resource:

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Image 1: credit to Dr Richard Kirby, 2015, The Importance of plankton. [ONLINE] Available at: http://blueplanetsociety.org/2015/03/the-importance-of-plankton/. [Accessed 27 August 2019].

Image 2: credit to NOAA MESA Project, 2009, Phytoplankton – the foundation of the oceanic food chain.jpg. [ONLINE] Available at: https://en.wikipedia.org/wiki/File:Phytoplankton_-_the_foundation_of_the_oceanic_food_chain.jpg. [Accessed 27 August 2019].