



How do Ships Transport Cargo and Protect the Marine Environment? Middle Years Sustainability Unit

NB These teacher curriculum notes are accompanied by a second PDF file of activity sheets.

This unit of work is designed for middle year students. It has a student learning focus and anticipates that you the teacher will coordinate your students' learning and there is little need for instruction.

The activities require students to use the accompanying web pages. These pages have been developed using the following criteria:

- Designed to engage students who are reluctant to read. Each page is kept to less than 200 words.
- A core set of potentially new key words are introduced to students. There are not too many new technical words for your students to remember.
- The pages have an appropriate literacy design with a suitably sized text, the illustrations support the text and there are no gimmicks.
- The website is designed to be handled by school networks.
- Your students are provided with recommended websites for those who are motivated to go deeper.

The topic will enable your students to learn at a deeper level. They will make many links in their understandings and insights. They will learn and discover links between the following:

- While shipping is the most efficient method for moving goods the volume being shipped between Australian ports has been declining.
- Science, maths and the stability of ships.
- What ships must and must not do to protect the marine environment and avoid polluting the sea.
- How the majority of the world's goods are efficiently and safely moved by ships around the world.
- Shipping is the most efficient form of transport.
- Why we all benefit from the activities of shipping.
- How does the transport of goods compare with our personal transport needs?

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1. Classroom preparation

How can your classroom be organised to provide a stimulating learning environment about shipping? Will you want to set up the class before your students start the unit? Some ideas could include:

- Ask your students to contribute ideas to the classroom setup.
- Locate maps of the world and Australia, also posters, including AUSMEPA posters and place them on walls.
- Make sure you have access to computers that are connected to the Internet.
- Find out what resources are available in the library. Will you borrow some of these books?
- Locate suitable videos, DVDs and CD-ROMs.
- As a prior learning activity, each student could contribute a piece of artwork. They could make an image of a large ship and include a range of wildlife including dolphins, seals, turtles, birds, fish, sharks etc.
- Load a marine screen saver onto computer screens.
- Identify a location where students' work will be displayed.

2. Activities - Prior learning

Materials: Art and craft materials, colour pencils, A4 paper

Background: Prior learning activities enable students to value what they already know about a topic. It provides their teacher with some insight into what their students know and think.

Activities: Choose one or more of the following activities or provide an activity of your own.

Ideas for prior learning:

1. Using art and craft materials, ask each student to make an animal (dolphins, seals, turtles, birds, fish, sharks etc.) that they think might be encountered out at sea. Make an image of a large ship on a wall in the classroom and place the images in the sea around the ship.
2. Use activity sheet 1. It has four aspects of shipping for students to write about. They are:
 - What does shipping do?
 - Where would you find ships?
 - Why is shipping important?
 - How can ships impact on the environment?
3. Individuals draw an environmental postcard or sticker providing a message about the importance of the marine environment. They each have a maximum of 30 seconds to present their product to the class.

3. Student goals and assessment

Materials: Copy of "Student goal setting" activity sheet

Goals background: Goals assist students to be more involved in self-directed learning, to remain on track and meet their learning objectives.



Activity: Student goals can be developed using the following three areas:

1. Goals developed from the above authentic learning question “How should ships protect the marine environment?” The goals can include:
 - Understanding the role of ships in the transport of goods around the Australian coast as well as to and from ports around the world.
 - Investigate how goods get from one place to another.
 - Investigate the precautions required to prevent shipping from impacting on the marine environment.
 - Create experiments to determine how steel ships remain stable in the sea.
 - Develop a communication product that links the better transport options to a more sustainable environment, including the marine environment.
2. Goals can relate to the Learning Outcomes or Standards you will be assessing during this unit of work.
3. Individualised student goals can also be developed. These personal goals are aimed at improving individual’s learning needs. For example each student will have reflected on their last unit of work. They should be able to identify two aspects where their learning can or should be improved.

Assessment background: Education systems have greater expectations concerning assessment. Having assessment processes in place throughout a unit of work and involving students in their assessment will assist teachers meet these expectations:

- **Assessment for learning** will help teachers respond to students’ learning needs during the unit of work.
- **Assessment as learning** occurs when students monitor their own progress and make learning choices.
- **Assessment of learning** occurs when teachers use evidence of what students have achieved. Teachers are often obliged to measure this against Learning Outcomes or Standards.

Explain to students how they will be assessed. To assist you with assessing your students throughout the unit of work:

- A grid of suggested assessment tasks has been provided.
- A rubric (that you may wish to modify) is available in the activity sheets.

Theme	Examples of assessment tasks
Activities – Prior learning	<ul style="list-style-type: none"> ● Participation and contribution to a class activity. ● A well-considered input relating to their prior knowledge.
Student goals and assessment	<ul style="list-style-type: none"> ● Able to record the required goals for the unit of work. ● Shows an understanding of their personal learning needs by setting personal learning goals.
Finding out	<ul style="list-style-type: none"> ● Organising work in a team. Working cooperatively with others. ● The team takes control of the research.



	<ul style="list-style-type: none"> • Sharing information. • Working independently. • Completing tasks on time. • Using different sources to obtain information and solve problems. • Using technology effectively to obtain information. • Providing evidence of how and where they found information. • Extracting and making notes of the appropriate information to answer their questions. • Present ideas and information using a range of formats and media. • Appropriate use of media in preparing a report. • Creating simulations and using experimental procedures to demonstrate how processes can work. • Presentation demonstrates that students answered their questions.
Drawing conclusions, finding solutions	<ul style="list-style-type: none"> • Organising work in a team. Working cooperatively with others. • Able to weigh up a number of options. • Use creative strategies to solve problems and prepared to take learning risks. • Shows an understanding of how people's activities link to marine pollution. • Presentation of their solutions.
Considering Social Action: Communication project	<ul style="list-style-type: none"> • The content of the communication product demonstrates their understanding of the unit of work. • An appropriate medium has been chosen and justified for a specific audience. • The communication package is engaging to the chosen audience. • The medium has been used in an appropriate way. • The communication product demonstrates creativity.

4. Tuning in

4.1 How big is a ship?

Find out on the internet the basic dimensions of a ship, its length, width, molded depth (height from the bottom of the ship to its main deck) and weight. Using large tape measures map out a ship on the school oval and have students stand on the perimeter of the imaginary vessel. Take a digital photo with the school building in the background to obtain a sense of scale.

Example: The **Helix** is an Australian owned tanker. Its dimensions are:

www.ausmepa.org.au



Length:	183 metres
Width (Breadth)	32 metres
Molded depth	18 metres
Weight when loaded	45,000 tonnes

Titanic

Length:	269 metres
Width (Breadth)	28 metres
Molded depth	20 metres
Weight when loaded	52,000 tonnes

4.2 Virtual tour

Take a virtual tour of a ship. The virtual tour can be found on the *Ships and the Marine Environment* student pages. Students can click on various parts of the ship to find out what is going on in that section.

Students can take a tour of the Royal Australian Navy ships on www.navy.gov.au/vf/ Make sure they click on view tour to see inside the ship.

Move around the SS Jeremiah O'Brien in San Francisco harbour by clicking on the direction you want to go in. www.virtuar.com/ysf2/ap-Jeremiah.htm (Warning, this historic naval ship has a simple mascot painting of a cartoon style girl with exposed breasts.)

Other virtual shipping sites:

www-odp.tamu.edu/drillship/index.html

www.seagoing.narod.ru/tanker/tanker.html

5. Finding out - web research

5.1 Authentic learning question

How do Ships Transport Cargo and Protect the Marine Environment?

Class discussion

Use a thinking tool that students are familiar with to examine the question. The tool should be able to relate ideas. Examples of tools include a mind map, tree chart, a word web or put each idea into a bubble and link it to other ideas.

As a class examine the authentic learning question: **How do ships transport cargo and protect the marine environment?**

What do we think this question means?

If the sea needs protection, does that mean the sea is under threat?

What might some of the threats be?

Why are ships needed?

What do ships carry?



Are ships the best form of transport?

5.2 It's only words

Small group activity and report back to the class

Use the glossary to distinguish between the following words:

Ballast water

Bilge

Harbour master

Pollution

Quarantine

Skimmer

5.3 Research using the web – Protecting the marine environment

Students should start their research with the AUSMEPA website www.ausmepa.org.au and locate the Ships and the Marine Environment program. Students will find many other websites of interest. As a class ask them what they may need to find out about shipping and the marine environment. These are some of the questions that could be asked:

- Why are ships needed?
- Why are there different kinds of ships?
- How do ships transport different kinds of cargo?
- Why is shipping and rail more energy efficient than road transport?
- What needs to be done to keep ships safe?
- Why does the marine environment need protection?
- How can the marine environment be affected if a ship has an accident?
- How must the marine environment be protected when cleaning of ships, removing ballast water and the disposal of oily waste from bilges are done?
- What kinds of precautions are needed to keep ships and the marine environment safe?
- What impact does our personal transport have on the environment?

You may want students to record how they went about finding their information when using a search engine. This format could include:

1. Question they are answering.
2. The search engine they have chosen (provide a reason for choosing it).
3. The key words they have used for their search.
4. The information they have found to answer the question.
5. How reliable they rate the source of information.

This documentation could be used as their report. You may like to provide students with a short period of time to give a report on what they found to be the most interesting, surprising or disturbing information.

5.4 Research using the web – Goods on the move?

Background



Most of our international trade is moved by sea. However over the years there has been a steady decline in shipping goods between major Australian ports even though the amount of goods being transported has been increasing.

Students use the internet to research their questions. They should start by using www.ausmepa.org.au Students with higher reading skills might refer to Wikipedia, <http://en.wikipedia.org> and find references about shipping using the search engine. There is a lot of information about protecting the marine environment on the internet including the AUSMEPA website. Students should compare the fuel efficiency of ships, rail and using the road.

6. Finding out - experimenting

Small group activity

The 6.1 Floating activities should be done by all students. If time is limited some can be done as demonstrations. The other activities could be done by different groups and then demonstrated by students to the rest of the class. In most of these activities, students will need a model ship and a container of water.

- A model ship can be made by cutting down the length of a one litre milk carton so that the half carton resembles the shape of a ship.
- The perfect size water container is the rectangular plastic tub used in libraries and sometimes in science labs. They are about 20cm deep.

6.1 Floating

6.1.1 Forces: This activity can be done as a class demonstration:

- Fill a bucket full of water
- Ask several students to lift the bucket.
- Discuss lifting the bucket as using a lifting **force against gravity**.
- Ask students what happens when they try and push a ball under the water.
- Then what will happen if they try and push a smaller, **empty** bucket under the water if they don't allow water to flow in?
- What **force** would be needed to **push** the bucket into the water?
- The **force to lift** a volume of water is the same as the force needed to **push** the same volume of water away.

6.1.2 How do heavy things float: Students experiment with a range of objects to see if they can make them float. Once they have made them float, they find out what can be done to make them sink.

- Can they make a plate float?
- Will a mug float?
- How will a plastic cup float?
- Will a metal knife float?

6.1.3 My floating theory: Students develop their own theory using their own words to explain why some objects float on water while other objects sink.



6.2 Stability

6.2.1 My floating mug: Use weights attached to a mug so it will float in a more stable way. What different solutions did students develop to make their mugs float? Which provided the best stability?

6.2.2 Top heavy or bottom heavy: Using the model ship compare how stable the model is when it has weight in the bottom or a weight attached high above the ship (could make a small tower). Where is the best place to put weights to make the model stable?

6.2.3 Water or a solid weight: How is the stability of the model ship affected when some solid weights are placed in the bottom? Test with a few waves from the side. What happens when the solid weights are replaced by the same weight of water in the bottom of the boat?

6.2.4 My stability theory: Students develop their own theory using their own words to explain what makes ships most stable and what makes ships less stable. Why would water moving freely inside a ship make it very unstable?

6.3 Stacking a ship

Students in this activity will need some 'heavy cargo'. This should be things that can be stacked in the model ship and moved around like steel bolts, large nails or metal blocks from the science laboratory. If metal materials can't be found, use rice in many small sealable plastic bags. In this activity, students could have two model ships side by side in their tub and compare how the models behave as they stack them up.

6.3.1 Top heavy vs bottom heavy: Compare how stable the model is when the model has a tall heavy load compared with the same load distributed evenly across the boat.

6.3.2 Weight distribution across the width of the ship: What happens to the stability of the model when all of the weight is stacked towards one side of the ship?

6.3.3 Weight distribution from the front to the back of the ship: What happens to the stability of the model ship when most of the weight is stacked at the front or the back of the model.

6.3.4 How much weight: If there is a lot of weight in the ship, what happens when there are a few waves? How deep can the ship be loaded into the water and remain safe from waves?

6.3.5 My weight distribution theory: Students develop their own theory using their own words to explain how weight distribution of cargo affects the stability of a ship.

6.4 Friction

These activities will be challenging and may take time and several attempts.



6.4.1 Is friction in water and on land different? Students use their models to compare the force needed to move their model in water compared with the force needed to move it on land (may need some toy wheels). They also investigate the implications of stopping in water.

6.5 Steering

Rudder: Students attach a crude rudder to their model and investigate how effective it is at turning their model. (The model must be moving for the rudder to turn the direction of the boat.)

6.6 Propeller

Propeller: Students attempt to make a working propeller that is turned by a twisted elastic band. Suggest the workings of the propeller are attached under the model. Does the propeller work as effectively when it is partly out of the water compared to when it is fully submerged?

7. Drawing conclusions, finding solutions

7.1 Thinking

Whole class discussion

As a class, use these different ways of thinking to explore and expand what students have learnt.

What students know – What do you know about the protection of the marine environment? How are ships used? What do ships transport? What must ships do to protect the marine environment? What is the most fuel efficient way to move goods? What kinds of transport do I use?

How students feel – How do you feel about the conservation of marine life? Should we be using the most fuel efficient transport available? Do you feel that shipping is a better way of transporting goods? Should we be trying to reduce the number of trucks using the highways? Should we be trying to use less fuel to transport ourselves around?

Students are critical thinkers – How difficult is it to prevent the sea being polluted? What are some risks to our marine environment? How can ships prevent the pollution of the sea? Why aren't ships used more to transport goods around Australia? Are ships a safe form of transport? Are ships and rail safer than trucks? Can we use smaller cars or use cars less often?

Students find the benefits – How is the sea important to people? Compared with road transport, how does shipping benefit the environment? What are the advantages of carrying large volumes of goods on a ship? What are the benefits of smaller cars?

Students are creative, find solutions and make recommendations – How can we get more goods that require long distance travel to be carried by ships and by rail instead of being carried in trucks which cause more pollution and damage to our roads? How can governments influence the use of ships and rail instead of trucks? How can we use less fuel for personal transport?

Where do students go from here? – How has your way of thinking about transport of goods changed? Should we encourage a greater use of shipping and rail? Should we change the people use transport?



7.2 Daily news

Write a short news report about the purchase of a new ship to transport goods between Australian ports. Explain between which ports the ship will be operating, and what its cargo will be. Explain to the reader how the ship will have environmental benefits.

7.3 Issues

7.3.1 Should shipping (and rail) be encouraged to move more goods?

As a class develop a list of advantages in using ships and rail to move more goods, particularly between major Australian cities.

7.3.2 Why can't authorities be doing more?

Students start developing a set of solutions that reduces the use of interstate highways for the transport of goods in favour of ships and rail. They identify what authorities need to be influenced to generate change.

7.3.3 What should I do?

Imagine you are 21 years old and you are about to move interstate to another city to start a new job. Explain what you could do when choosing a new home and transport options to reduce the amount of fuel you will need.

8. Considering social action and communication

Introduction

Students will complete a communication project related to transport.

- They could choose to influence an authority's or political party's policies to encourage goods to be transported using the most fuel efficient methods and those that have the least impact on people and the environment.
- Alternatively students may wish to develop a more general communication package directed at using more fuel efficient methods and changing driving behaviour when transporting ourselves about.

8.1 Influencing decision makers

8.1.1 What needs changing?

Develop a very clear written statement that explains:

1. The problem that is occurring
2. What needs to be changed
3. What the benefits of the change will be to the environment and to people and their communities.

8.1.2 Who needs influencing?

What authorities or political influences can help solve the problem? Brainstorm ideas. Which groups or individuals might be easiest to target?

8.1.3 What media will have an impact?



Once students have identified their targets to influence, they need to brainstorm different ways they might communicate with their target group. Some methods are more achievable by students than other methods. Students will need to be advised very early in their planning if the school agrees to their method of communication. When corresponding with politicians, always ask questions that require a response. Examples of communication media can include:

- Letter to politicians
- Email to politicians
- Media release explaining concerns students have
- Petition
- Surveys of opinions
- Web materials
- Email letters to the community about the issue
- Web conference with other concerned students
- Articles for publication in local newspapers.

8.1.4 Planning how to influence change in improving transport of goods

Complete a summary of the plan and submit it to the teacher in case there are issues that students had not considered. Once students have teacher feedback, students can complete their plan.

8.1.5 Implementing change in transporting goods and protection of the marine environment

Teachers will need to provide guidance as students implement their plan. Students should not feel disempowered by not being adults. Often sincere younger people will be more noticed than experienced campaigners. However the communication project is developed, try and build in feedback. This can be done by asking some probing questions that require answers.

8.2 Influencing road users to be more fuel efficient

8.2.1 Brainstorming

Develop a list of ideas about how road users can use less fuel. The list can include these adult solutions:

- Drive a smaller car.
- Next time you buy a car, purchase a more fuel efficient car.
- Plan ahead so you need to do less trips.
- When driving, avoid accelerating quickly.
- Use public transport when you can.
- Walk or use a bicycle when you can.

These student solutions:

- Sometimes, use the phone, Facebook, etc instead of being driven to friends.
- Use public transport when you can.
- Walk or use a bicycle when you can.

8.2.2 Planning



Small group activity

Small groups each choose one solution to use to plan a communication project. They will need help to be sure all aspects of their planning are covered. Because some of their solutions could be unique, it is not possible to list every contingency in the list below, so it is important that their teacher carefully goes through each plan making necessary modifications, before students implement their plans.

Before students start their plan they should answer the following about their solution:

- What will be achieved by this solution?
- What are the benefits that will result from the solution?
- Why is this solution important to the health of the environment?
- How might the solution benefit people?

Criteria students may need to consider when making their plan:

- Start by organising all the steps needed to implement the plan.
- Identify who will need to approve and comment on the plan.
- What tasks are going to be done to put the plan into operation?
- What resources will be needed to do the tasks?
- Who will do the tasks?
- How will students remain safe?
- How much time will be needed to complete the solution?
- How will the group measure how successful their solution was?

Produce a first draft of the plan and submit it for comment. When the comments have been received, make the necessary changes. To make sure students are clear about the comments, it may be helpful to also provide verbal feedback.

Choosing an audience

Students will be developing a communication product for an audience. The communication product explains to an audience something they can do to reduce their impact on transport methods that causes pollution of the marine environment. Students will need to:

1. Choose an audience e.g.
 - a. Other students
 - b. School administration
 - c. Families
 - d. Council
 - e. Car drivers
 - f. Shoppers etc
 - g. People in authority
 - h. etc.
2. Identify the main interests of their audience.
3. Identify the kind of media their audience encounters each day.

Analysing their audience

Ask students to analyse their audience by:



1. Linking the interest of their audience to the message they wish to communicate.
2. Identifying appropriate media that link the message and the interest of their audience (the media are often restricted by the budget available). Communication products can include:
 - a. Posters
 - b. Billboards
 - c. Radio commercials
 - d. TV commercials
 - e. Newspaper advertisements
 - f. Press releases
 - g. Musical jingles
 - h. PowerPoint presentations
 - i. Webpage
 - j. Newsletter
 - k. Email letter
 - l. Competition

Develop the communication product

Allow groups or individuals to design and develop their communication product. Students should write attached notes explaining how their product should work.

8.2.3 Implementing the plan

Teachers will want to review with students relevant aspects of the school's code of behaviour and OH&S procedures that will protect students. As most students will be working with a large degree of independence, they will need to report back to their teacher on their progress.

Once students are ready, they should implement their solutions.

9 Student evaluation of communication project

PMI student assessment

Use the "PMI" activity sheet. PMI stands for plus – minus – interesting. In this activity students look at another student's work and write down what they think the pluses and minuses are and describe what they found interesting. Ask students to complete a PMI so that each piece of work has at least two or more assessments. The PMI assessment should not be written on the other students' work.

10. Reflection

Materials: Reflection activity sheet

Background: Reflection time provides students with an opportunity to value what they have learnt and the learning processes they have been involved in.



Activity 1. Reflection activity sheet

Your students may have preferred reflection strategies, so they should use these. The reflection activity sheet in this unit of work can be used to provide some structure while reflecting.