

Seaweed 2007 *Marine Bycatch Matters*

Discover Bycatch

Primary K-3 SOSE and Science

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Main Idea

This unit introduces young students to the fisheries issue of bycatch – “when fishers target particular species that they want to catch, they also catch other species by accident, these species are called bycatch”. This might occur when a commercial fishing boat is trawling for prawns and also catches fish, or when a recreational fisher is angling for a snapper and catches a toad fish. Students will obtain an understanding of the types of bycatch, such as marine mammals, seabirds, reptiles and sharks. Further to this they will become familiar with where their seafood comes from, fishing methods and other aspects of bycatch. They will also learn about the groups involved with the use, management, protection and conservation of Australia’s fisheries and marine environment and development of bycatch reduction devices. In examining bycatch, students can also be given a preliminary introduction to fisheries, including the contributions fisheries make (food, economic, cultural, recreational), the issues they are trying to manage (such as overfishing, habitat impacts) and aquaculture.

Background

Every type of food production activity affects the environment. One of the ways that fishing can affect the environment is through accidental take of bycatch. Bycatch can include fish, sharks and rays, marine mammals (sea lions, seals, dolphins), marine reptiles (marine turtles, sea snakes), seabirds (albatross, petrels, pelicans) or invertebrates (crabs, shells etc.). The type of bycatch depends on the type of fishing gear used, where and when the fishing takes place and what species are around at the time. Bycatch can be caught in commercial, recreational and Indigenous fisheries, because most conventional fishing methods can lead to bycatch being caught. Most bycatch is returned to the ocean, depending on the species and fishery it may be returned alive or dead.

Why are Australian fisheries trying to reduce and manage bycatch?

Historically fisheries management has focused on making sure that fishing for the target species is sustainable such as the prawn species targeted by a prawn trawl fishery. Management of commercial fisheries is increasingly focused on the impact of fishing on not just the target species, but also bycatch species, the marine habitats and ecosystems in which fishing occurs. This is called an ‘ecosystem approach’.

The management of bycatch is necessary for several reasons:

- 1) to prevent waste: if the bycatch is not going to be used, catching it should be avoided as much as possible;
- 2) to reduce the work for fishers in sorting their catch and prevent damage to the catch from bycatch species;
- 3) to ensure the catch of a particular species as bycatch does not threaten the long-term survival of a population. This is particularly important for species which are considered vulnerable to local and even global extinction due to declining numbers;
- 4) to minimise impacts on bycatch species that are protected under Australian legislation;
- 5) to ensure the catch of a particular species as bycatch does not adversely affect the marine ecosystem, e.g. through removal of predators or key prey species from a foodweb.

Wildlife bycatch

In recent years, the bycatch of marine mammals, seabirds, marine reptiles and some sharks by fisheries has been of increasing concern both globally and nationally. Most of these species are generally slow growing, late maturing, long-lived, have few offspring and often have small population sizes. For

example, the leatherback turtle, grows to about 1.8m in length, weighing about 500 kg, they don't start breeding until they are 13-14 years old and then only breed every 2 – 3 years, on particular beaches.

Some of these species are considered vulnerable to local and even global extinction because of declining numbers. Depending on the species, these declines can be due to a range of impacts, including human activities and environmental changes. The leatherback turtle is found in all oceans of the world and the populations in the Pacific are regarded as endangered. The population declines are thought to be due to bycatch in fisheries throughout the Pacific, disturbance to nesting beaches, gathering and eating of eggs in some countries, predation of eggs by feral animals, pollution (causing disease), rubbish, boat strike and hunting adults in some countries. Given the declines in populations of some of these species, even though they may seldom be caught in most fisheries, Australian fisheries are trying to reduce their bycatch to assist in the recovery of the populations.

These species are also protected under Australian legislation. Under Commonwealth environmental legislation (the *Environment Protection and Biodiversity Conservation Act 1999*, EPBC Act) species can be listed as protected (e.g. all marine mammals and seabirds, sea snakes), vulnerable (e.g. green turtle, great white shark, Australian sea lion), endangered (e.g. loggerhead turtle, Tristan's albatross, southern giant petrel) or critically endangered (e.g. grey nurse shark on the east coast). This means fisheries are required to avoid and minimise bycatch of these species.

In addition, these species are charismatic wildlife whose fate arouses public concern. While these species may be seldom caught in fisheries, any bycatch may raise public concern which can have adverse social and economic impacts on fisheries. For example, previously the USA implemented a trade embargo on prawns from countries which did not use Turtle Excluder Devices (TEDs) in their fisheries.

Measures to reduce bycatch

Australian fisheries are trying to reduce bycatch to reduce waste and keep marine resources healthy. By working together, fishers, researchers, conservationists and the government have introduced fishing technologies and innovations, including changes to fishing gear and practices that have reduced bycatch.

Approaches to reducing bycatch can involve:

- (i) changing the fishing gear to allow species to escape, avoid catching them or minimise harm to the species if caught;
- (ii) fishing in different places or times where the bycatch species do not occur or are less common;
- (iii) changing how fishing gear is used to avoid catching the species, or if caught minimise harm to the species.

It is not a one size fits all solution to bycatch.

It is important to keep looking for new and better ways of reducing bycatch, to benefit the fishers and the marine environment. As consumers of seafood you should also be aware of how the fisheries operate when you choose your fish. Sharing information on bycatch solutions is an important step toward reducing bycatch on a global scale.

Some examples of what is being done to help reduce bycatch?

Turtles

In Australia, all boats that use trawl nets to target prawns in tropical waters must have Turtle Excluder Devices (TEDs) fitted to their nets. Turtles are occasionally caught as bycatch by prawn trawlers as they occur in the same areas where the fishing occurs. The TEDs are a grid within the net. If a turtle enters the net this grid guides it to an opening at the top of the net so that it can escape. The prawns pass through the grid to the end of the net and are caught. The use of TEDs has dramatically reduced the bycatch of turtles in Australian tropical prawn trawl fisheries. At the same time safe handling procedures for turtles have been developed for fishers, in case a turtle is still caught. These show how to ensure the turtle is safely returned to the water. The TEDs have also benefited larger sharks and stingrays, as they are also able to escape through this device and so fewer are caught as bycatch.

Seabirds

The accidental bycatch of seabirds, particularly albatross and petrels, in pelagic longline fisheries is of global and national concern. In Australia it is addressed through Australia's Threat Abatement Plan – Bycatch of Seabirds. Seabirds dive on the baited hooks when the hooks are near the surface during setting or hauling of the longline and can get hooked or entangled. A range of measures have been introduced in fisheries to reduce bycatch of seabirds, these include:

- Setting the longlines at night, as most seabirds are less active at night.
- Using tori-lines, or bird-scaring lines. These are lines attached to a pole at the back of the boat, they extend out above where the hooks are being set or hauled. The tori-lines have streamers on them which stop the birds from trying to get the baits.
- Using weighted swivels on the hooks. These are weights that make the hooks sink faster, so that the birds cannot get them.
- Other things that are being researched include: dyeing the baits so it is harder for the birds to see them and underwater setting chutes so the birds can't get the baits.

Seals and Sea Lions

Seals, mainly the Australian Fur Seal and occasionally the NZ Fur Seal and Australian Sea lion, interact with boats using trawls to catch fish in southern Australian waters and may be accidentally caught. The interactions occur because the seals occur in the same areas as the fisheries, they are inquisitive and their diet includes the fish targeted by the trawlers. Seals can also learn to associate trawlers with food and so may be attracted to fishing boats. These fisheries have been looking at whether Seal Excluder Devices (SEDs), which are very similar to TEDs, are effective at reducing seal bycatch. The Commonwealth-managed South East Scalefish and Shark Trawl Fishery also has a Code of Practice which describes fishing practices aimed at reducing interactions and bycatch of seals. These include:

- Not deploying trawl gear when seals are near the stern of the vessel.
- Rapidly deploying gear to reduce the time the gear is in shallow water where the seals are most likely to be.
- Not turning during trawling if the net mouth is near the surface, to avoid potential trapping of seals in the net.

Fishers, researchers and managers are also working together to collect more information on seal interactions in this fishery to understand the bycatch issue.

A small population of Australian sea lions lives along the mid-west coast of Western Australia. This population overlaps with the western rock lobster fishing grounds, which is both a commercial and recreational fishery. While a rare occurrence, small sea lion pups can become trapped in the rock lobster pots and drown. The industry, researchers and government have worked together to develop Sea Lion Excluder Devices (SLEDs) which are simple, relatively cheap devices, basically an upright bolt fitted to the base of the pot which rises towards the pot opening. It stops the sea lion pups entering the pots but does not affect the catch of lobsters. All rock lobster pots, both commercial and recreational, used in the waters near the sea lion population must have SLEDs.

Sharks

Some sharks are protected species in Australia, such as the grey nurse shark and great white shark. Some other sharks, mainly deepwater species are of concern as they tend to be long-lived, slow growing and can be susceptible to overfishing. Fisheries around Australia have taken steps to reduce shark bycatch:

- In Australia's tuna longline fisheries, the Eastern Tuna and Billfish Fishery and the Western Tuna and Billfish Fishery, sharks are a bycatch that is sometimes retained and sold (by-product). However, this does not include any protected shark species which can not be kept. To manage and reduce shark bycatch these fisheries have a limit on the number of sharks that can be retained in a fishing trip, no more than 20 shark. These fisheries have also banned the use of wire trace. Wire trace is a length of wire used to attach the hook to the fishing line. Without wire trace the sharks have a greater chance of biting through the fishing line and so not being caught.
- In the South East Scalefish and Shark Fishery areas have been closed to reduce the bycatch of school shark and deepwater shark species.
- In the Northern Prawn Fishery the introduction of TEDs has also reduced the bycatch of large sharks and rays.

Fish and Invertebrates

Bycatch includes unwanted fish species and also small individuals (usually juveniles) of the species being targeted. Many commercial fisheries try to reduce and avoid the catch of small individuals through modifications to the gear:

- In fisheries that use trawl gear to target fish, there is usually a minimum mesh size which enables small individuals to pass through the mesh and not be retained in the trawl.
- In hook and line fisheries, the size of the hook and bait used will determine the size of the fish caught. To avoid catching juveniles a larger size of hook can be used.
- In most tropical prawn trawl fisheries there tends to be a lot of bycatch caught, mainly fish and invertebrates (crabs, shells, sponges etc). This is because the trawl nets are relatively unselective and these species live in the same area as the prawns and so are caught by the nets. In recent years there has been a lot of effort in the development of Bycatch Reduction Devices (BRDs) which allow the fish to escape from the net, while still retaining the prawns. These include devices such as "square mesh windows", "fish-eye" and the "fish box". These all work on the fact that fish have better swimming abilities than prawns and so can actively escape if there is a device to let them out.
- In lobster pot fisheries they have escape gaps in the pots for undersized lobsters to crawl out of.

Discover Bycatch

Recreational Fishing

Recreational fishers also catch bycatch. The bycatch of recreational fishing includes catching fish species that they don't want to keep, and the accidental catch of seabirds, marine mammals or marine reptiles, that might try and take the bait from hooks or lobster pots, get tangled in the fishing line or nets.

Volunteer organisations such as Australian Seabird Rescue and Wildlife Rescue groups work to save and rehabilitate injured seabirds, many with fishing-related injuries. Australian Seabird Rescue has found that most seabird fishing tackle injuries happen during fishing, not due to lost equipment. They have developed guidelines for sensible angling to reduce bird injuries, including:

- Being on the lookout for diving birds such as terns, gulls and pelicans which may take a bait when a line is cast;
- Avoid using unattended set lines;
- Do not cut the line if a bird is hooked but try to reel in the trapped bird gently, cover their head and remove the hook. If the hook can't be removed without causing further injury, seek assistance from the local wildlife group.

Fishers often catch finfish, sharks or stingrays they don't want to keep. This can be because it is a species they didn't want to catch, or because of bag limits and legal sizes. Catch and release fishing has also become an increasingly popular practice among many anglers. It is quite common for fishers to release fish they could legally keep, and while this isn't bycatch, similar principles apply in terms of ensuring these fish survive. The Gently does it initiative, is part of the National Strategy for the Survival of Released Line Caught Fish (<http://www.info-fish.net/releasefish>) is an initiative of the Fisheries Research and Development Corporation (FRDC) in conjunction with the Australian National Sportfishing Association (ANSA) and Recfish Australia. The strategy aims to improve the understanding of and increase the survival rates of released line caught fish.

To help these animals survive fishers can:

- Always throw back undersized, unwanted or inedible animals alive;
- Remove mouth hooks, if possible, or cut the line if the hook has been swallowed;
- Try to release the fish as fast as possible and avoid handling them too much;
- Hold the fish upright, where possible, until it has recovered sufficiently to swim away.

Key Understandings

- Every type of food production activity, including fishing, has an impact on the environment
- Bycatch is a local, national and global issue
- Bycatch affects more than just fish
- Reducing bycatch reduces waste and keeps marine resources healthy
- Different fishing techniques have different types of bycatch
- Bycatch reduction methods/technologies are vital to improving Australia's fisheries and the environment
- Management of bycatch is important to all involved in the fishing industry, fishers, animals, environment, and the consumers of seafood.

Focus Questions

- What sort of impacts does food production have on the environment?
- What is bycatch?
- What animals are impacted by bycatch?
- Why is reducing bycatch important?
- How does bycatch affect you? How does bycatch affect different groups of people?
- How can we reduce bycatch in Australian fisheries (commercial, recreational and Indigenous)?
- What can we do and why is it important to get involved?
- Why is it important to keep looking for new and better ways of reducing bycatch?

Key Terms

alternatives, animals, Aquaculture, bag limits, behaviour, birds, Best Environmental Practices (BEP's), biodiversity, boating, bycatch, Bycatch Reduction Device (BRD), care, colours, commercial fishing, conflict issue, conflict resolution, conserve, conservation, cultural values, dolphin, dugong, ecosystem, endangered, enforcement, environment, environmental values, equipment, ethics, evaluation criteria, facilities, features, fields, fish, fishing, government, human-made, impacts, implementation, Indigenous peoples, interest group, legislation, leisure, local, look after, maintenance, management plans, multiple-use resource, nature, ocean, permits, political values, pollution, protect, ranger, rare, recreational fishing, resource, restrictions, safety, sailing, sea, signs, stakeholder/user group, technology, threatened, tourism, trawlers, Turtle Exclusion Device (TED), Vessel Monitoring Systems (VMS), zoning, water, work.

Key Learning Areas

- Society and Environment;
- Science;
- English;
- Mathematics; and
- The Arts.

Outcomes

The unit focuses on the following core learning outcomes from the Years P-3 SOSE and Science Syllabuses:

In Place and Space:

- 1.1 Students match relationships between themselves and an environment.
- 1.2 Students make simple connections between elements of simple ecosystems.
- 1.4 Students organise and present information about why the ocean is important to them.
- 1.5 Students describe the relationships between personal actions and environmentally friendly strategies in the ocean and fishing (recreational or commercial).
- 1.7 Students design a game to match animals, people or plants to the ocean and fishing .

In Culture and Identity:

- 1.3 Students share an understanding of how diverse families meet human needs of food, clothing and shelter.
- 1.4 Students gather information and record information about fishing techniques, types of fish and where the seafood they eat comes from.
- 1.5 Students describe, draw or enact how an important event might be perceived from another's perspective.

In Systems, Resources and Power

- 1.1 Students understand that the environment provides resources that meet our needs and individuals can conserve resources.
- 1.6 Students enact consequences of following and not following rules and regulations of familiar seaside places.

In Life and Living:

- 1.2 Students group living things in different ways based on fishing techniques.
- 1.6 Students observe and describe components of different marine environments and bycatch.

Key Competencies

- Collecting, analysing and organising information;
- Communicating ideas and information;
- Planning and organising activities;
- Working with others in teams;
- Using mathematical ideas and techniques;
- Solving problems; and
- Using technology.

Planning Considerations

Some tips to help the unit run smoothly:

- Read through the unit thoroughly and highlight activities you think are most relevant to your students;
- Consider which of the key learning outcomes from your State Syllabus are most likely to “come out” of the unit;
- Gather together key resources used in the unit, eg. photographs, picture books, activity sheets etc. (see resources page);
- Contact your local fishing company or fisheries management agency, which may be kind enough to loan a Bycatch reduction device, such as a Turtle excluder device. If so hang it up in your class room;
- You may wish to write to parents informing them of the topic, sharing the understandings for the unit and inviting any assistance and resources;

- Organise an excursion to a public aquarium, Marine Discovery Centre or Fish market; and
- Organise a learning log for each student.

Sample Unit Sequence and Activity Ideas

Tuning In: Sample activities

Photo Gallery

Students bring photographs, pictures and drawings of marine animals, plants or fishing activities. In groups talk about the importance of fishing sustainably such as:

- Different types of fishing (recreational, commercial, Indigenous, different gear types);
- What animals are attracted to fishing vessels;
- Why animals are attracted to fishing vessels;
- Types of animals caught as bycatch;
- Types of animals found in the ocean;
- Types of plants found in the oceans;
- Areas for boating, fishing, visiting and other recreational activities; and
- Ways (technologies or practices) to reduce bycatch.

Shared Book Approach

Read picture books about the Fishing, Ocean, and seas as open places to use and enjoy.

Bailey, D. *Fishing*, London : Heinemann, 1990. or

Baker, J. *Where the Forest Meets the Sea*, Julia McRae, 1987.

Websites

Fish and Kids (British)

http://www.fishandkids.org/staff_resources.php

*various web pages on bycatch

Get hooked: it's fun to fish (NSW DPI Fisheries)

www.fisheries.nsw.gov.au/recreational/general/get_hooked

For more websites and book ideas see References

Discuss the fishing industry, including people involved, fishing methods, types of fish and different animals that live in the sea.

Ask students:

- What is fishing?
- What how many different types of fishing are there?

- How many seas and oceans are there in the world?
- What is bycatch?
- How many different sea mammals, birds, reptiles and fish can they think of?
- What animals might become bycatch?
- When did they last swim in the sea? Did they see any fish? What types?
- How many different fish or seafood have you eaten e.g. flake, snapper, prawns, oysters?
- Can you think of any other fish you can eat or can buy at the grocery store?
- Have they been fishing, if so, when, and where did they go, what did they catch, what did they use for bait?
- Where do they think their bait came from?

Predict and list features students think would be the most common. Test these by counting the number of times the feature occurs. Make a class graph of results.

Read and discuss stories, show videos or documentaries of the Ocean and fishing, draw students' attention to the variety of settings, features and uses of the Ocean, its animals and plants.

Resource 1.1

Preparing to find out: Sample activities

Photo files

See: Seaweek 2007 Image Gallery on MESA website www.mesa.edu.au and
www.deh.gov.au
www.afma.gov.au
www.gbrmpa.gov.au

Collect/download photographs of the ocean, fishing, fishing equipment and ocean animals, reptiles, birds and fish. Students share these and talk about features and activities and animals they recognise. Identify things that are associated with fishing.

Ask students:

- What do we mean by fishing?
- Why is it important?
- What does it support?
- What fish do we collect to eat?
- What is bycatch?
- How many different types of fishing can they think of?
- Can anyone fish for anything anywhere any time?
- What animals make up bycatch?
- What is being done to reduce bycatch? Who is responsible for this?
- What can the photos tell us about fishing? What don't the photos tell us about fishing?

Make charts of student responses and use these to develop focus questions for the unit.

Class Chart

With the class, prepare a class chart of things students know about fishing, the ocean, bycatch and animals of the ocean. Students could draw pictures and explain them while the teacher scribes. Prepare a list of questions students want to investigate. Ask students to offer possible answers to these.

Magic Circle

Place incomplete statements on cards and place them in a box:

- Bycatch is...
- Reducing bycatch, benefits the
- Bycatch reduction technologies include.....
- Dolphins depend on fish for...
- Fishers provide us with.....
- Seabirds feed on.....

Students can sit in groups of 5 or 7 and take turns to select a card. Read these and ask students to discuss the statement in groups. Students report back some of the information gained.

(Adapted from Hill, S. *Games that work – cooperative Games and Activities for the Primary School Classroom*, Eleanor Curtin, 1992).

Finding Out: Sample Activities

Fishing in the ocean

Prior to this activity, read picture books about fishing, view photos or suitable videos.

Students mime various activities that make up Australia's fishing industry. Ideas may include fishing, conservation, developing fishing technologies or animals that can make up bycatch. Photograph these or ask students to draw them. Place photographs/drawings on to a painted mural of the ocean.

Tips

- Turn your classroom into the ocean, covered in the fishing industry (commercial, recreational and Indigenous activity).
- Decorate the entire classroom to look like the ocean and the fishing community as much as possible. Don't forget signs, facilities, special places, as well as the boats, bycatch, bycatch reduction devices, nets, hooks (fake), sinkers, fishing floats, fish, birds, plants and animals. Consider the work and recreational activities undertaken on and in the waters of the ocean/waterway nearest you.
- You may like to make up an information sheet about the ocean and fishing to tell other classes in your school about it. They may like to visit your "Ocean".

Establish students' prior knowledge by asking questions such as:

- What things would you expect to find in a fishing net?
- Who works in the fishing industry?
- How many ocean animals eat fish?
- How many ocean animals can you think of?

Resource 1.2

In a Public Aquarium, Marine Discovery Centre students can do the following:

- Observe, touch specimens and see fish and animals of their local area;
- Locate and describe different ocean animals, birds and fish;
- Discover what (fish and chip) "Flake" is;
- Locate and identify big fish eg. groupers, trevally, and other fish common to our dinner table;
- Locate and identify sea turtles, sharks and rays;
- Identify different swimming patterns of fish, turtles and sharks;
- Locate different hiding places and camouflage techniques of animals; and
- Identify different habitats of Marine Animals.

Resource 1.3

Ask students to decide what purpose each feature or use serves.

Tip

File the checklist of words and symbols as evidence of students' skill in applying the concepts "natural" and "human-made".

Sorting out: Sample activities

What makes up the fishing industry?

In the earlier activity, students found things using their senses. Ask them to recall things seen, heard, or touched. They share ideas with a partner and draw responses. Brainstorm words and record on a chart. Invite students to illustrate these, then group words on a class chart.

For example:

Things found in bycatch

To see	To hear
To touch	When seeing the ocean I feel

Concept maps

Create a concept map showing what Australia's fishing industry consists of and then sort and classify descriptions into categories (eg natural objects (fish, animals, etc and human-made objects (boats, nets, markets etc). Repeat the activity to illustrate the ways the ocean is used for work and recreation.

Classifying information

Students place a picture/name card of an object from the fishing industry on their chest. They then move around the class to find one or more students with cards that might belong in a group similar to theirs. Students justify their groupings.

What am I?

Play "What am I?". Each student states something known about bycatch. Record and illustrate responses. Make a class big book.

Six Hat Thinking

Introduce Edward de Bonos's *Six Thinking Hats*.

Discover Bycatch

<p>Red Hat = feelings</p> <p>What are my feelings about bycatch?</p>	<p>White Hat = Information</p> <p>What are some facts we have learned about the bycatch?</p>
<p>Blue Hat = what thinking is needed</p> <p>Can we think of ways to reduce bycatch in our oceans?</p>	<p>Green Hat = new ideas</p> <p>What is possible for us to do as consumers of fish, recreational fishers and the fishing industry?</p>
<p>Black Hat = weaknesses</p> <p>What questions or issues does our learning about bycatch uncover?</p>	<p>Yellow Hat = strengths</p> <p>What are the good points we have learnt about bycatch and the fishing industry?</p>

Place cut out hats on the floor and group responses as a class. Use the Blue Hat to determine major areas and focus questions for future investigation.

Class Database

Prepare a wall grid to record information collected by students for future investigations. The left-hand column might indicate names of different methods or types of fishing eg trawling, prawn fishing, aquaculture, long lining, commercial, recreational, line fishing, crayfish or lobster fishing, spear fishing, gill netting, or others identified by students.

Columns across the top might indicate the types of information collected and suggested by students, for example:

- Type of target animals caught;
- Number of target animals caught;
- Equipment used;
- Non-target animals caught (bycatch); and
- Bycatch reduction devices implemented or ways to reduce bycatch.

Tip

Assessment idea: use checklist to record student contributions to the database. This might include their capacity to suggest categories as well as provide information. This will indicate a student's skill in following a task through to completion and capacity to collect and record information appropriate to the task.

Family Snapshot

To assist with this activity, ask families to help students complete a survey. Students ask parents about fish they have eaten, including its name, what it tasted like, how it might have been caught. Or students ask parents about how often they fish, what they try to catch, what they have caught that was not what they intended to catch. With the help of family members, students complete Resource 1.4. On another page students draw other activities they and their families might do to help reduce bycatch to later share with the class.

Resource 1.4**Graphing**

At school students cut up their survey sheets, sort responses and use these to make a class graph of the fish eaten. Students make statements from the graphed data.

Tip

Assessment idea. Ask students to identify:

- The most popular eaten fish;
- The least popular eaten fish; and
- Consumed fish with the same level of popularity.

OR

- How often most people fish;
- What is the most popular fish to catch; and
- What is the most common bycatch.

This will indicate a student's capacity to interpret visual information.

Categorising Pictures

Using photographs collected during earlier activities, divide them into categories. Ask students:

- Can we put all the photographs in groups?
- What might we do if some are in more than one group?

Students write or dictate captions for photographs, eg what fish they are fishing for; why they are trying to avoid bycatch etc. In groups, make a collage, paint a mural or make a class big book.

Modelling

In groups or individually, students construct models of animals that are particularly threatened by bycatch. Use plasticine, play dough, construction kits, paddle pop sticks, blocks and natural materials to make something chosen by the students to show how it is connected to the fishing industry. Display under appropriate labels. Invite other students and/or parents to view and hear about the models.

Design a game

In pairs or individually, students design a game matching animals, plants and fish to a fishing method.

Going further: Sample Activities

What was here before?

The purpose of this activity is to increase student awareness of the idea of change, and to consider traditional fishing methods used by Indigenous groups.

Tips

Contact the Aboriginal & Torres Strait Islander Education Unit or Aboriginal and Torres Strait Islander parents to find out about suitable excursions which include hands-on sessions on Aboriginal & Torres Strait Islander food, shelter and arts and crafts to complement learning activities in “What was here before?”.

Read *Window* by Jeannie Baker to the class, then ask students what they think might have been on the land where their house or school is now. Ask similar questions in relation to the ocean.

Arrange a visit to an area of importance to local Indigenous groups. Seek advice about places to visit. During the visit draw students’ attention to the ways Indigenous people used:

- Areas along the Australian coastline;
- Animals from different regions of the ocean and shoreline;
- Plants and animals from our ocean and waterways for medicines;
- Natural objects to make tools, hunting weapons and other equipment;
- Plants, soils and seeds for ceremonial purposes, rock and cave painting and decorative art work; and
- What areas of the Australian coastline mean to their culture and traditions.

At school, organise a program of indigenous arts and crafts. These could include:

- Using different coloured soils and clays.
- Making paint or dye using grasses, pine needles etc.
- Building models of shelters using natural products.

Making Connections: Sample Activities

A fishy problem

Ask students to identify problems they think could occur as a result of not reducing the amount of bycatch. Group those together that relate to caring for the marine environment, fisheries and technology. Generate possible solutions for these problems.

Prepare a chart to record student findings

Problem	Example	Solution
Caring for the marine environment		
Fisheries		
Technology		

Role-Plays

Role-play the following scenarios:

You want to go fishing in a local estuary (river by the sea). A family is just leaving the spot where you want to fish and has left behind their empty bait bags and other rubbish. What might you do?

You want to purchase some fish to eat for dinner, but are not sure if it has been caught sustainably or with the use of a bycatch reduction device. What might you do?

The fish you want to purchase for dinner has been caught sustainably, but is \$3 more expensive than the other fish at the market. What might you do?

You notice people fishing offshore (using your binoculars), but they leave behind a damaged net, and drop it into the ocean. What might you do?

You are down at the wharf and notice a fishing boat on which all nets are fully equipped with bycatch reduction devices. What might you do?

A friend of your parents is going to start up their own fishing company, the friend ask you what is your favourite fish to eat? What might you say?

The friend asks your opinion on fishing and how to fish sustainably. What might you tell them?

Sign-making

Students design labels to go on fish tags or labels in fish markets and grocery stores or wherever fish is sold, to help buyers identify fish which have been caught in a fishery making use of bycatch reduction devices, or sustainable fishing practices. Paint, draw or write about the various locations that the signs or labels could be placed.

Students design signs or information sheets to be located where recreational fishers fish, to help them reduce bycatch or safely release bycatch. Paint, draw or write about where these signs might be located and what they would show.

Who looks after our fisheries?

From the class database, select people connected to the Australian fishing industry. Students draw pictures, which show how different people such as rangers, scientists, biologists, fish market people, fishers, conservationists, families, government workers, cleaners etc. In this activity students begin to understand that care of Australia's fisheries is a joint responsibility of those who work there, those who eat fish and those who care for the marine environment.

Introduce students to the various government organisations that have a role in sustainable fisheries management, such as:

The Department of Agriculture, Fisheries and Forestry, the Australian Fisheries Management Authority (or their State/Territory Fisheries management agency), Environmental Protection Agency, Department of Environment and Heritage, the Fisheries Research and Development Corporation, fishing associations and organisations that work together to sustainably manage Australia's fisheries.

Locate information from the following web-sites about the way fisheries in Australia and around the world are managed, including how the plants and animals of our marine environment are looked after.

Bycatch rules

Students refer back to the grid made to classify problems. Students suggest a rule for some of these problems to reduce bycatch and make fishing more efficient and sustainable.

Taking Action: Sample Activities

As a class, suggest how we can make sure people could help reduce bycatch and make fishing more sustainable.

Students could:

- Contribute to a class article for the school newsletter.
- Prepare a display of models of the various bycatch reduction devices and invite other classes or parents to view it and ask questions.

- Speak to other classes about the use and care of our oceans.
- Prepare letters to newspaper editors.
- Invite a knowledgeable people to speak in class.
- Make a poster to advertise the use of bycatch reduction devices.
- Create a calendar illustrated with the various animals and plants of our oceans.
- Make a poster about recreational fishing and how to manage bycatch.

Reflection: Sample Activities

Ask students to complete a self-assessment and reflection activity using the following questions:

- What is the most important thing I have learned about bycatch?
- What have I learned about myself and how I might treat ocean environments?
- What would I still like to find out about bycatch?
- What piece of work am I most satisfied with? Why?

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- Winters, B. *Be safe at the Beach*, Wetpaper, 2001.
- Winters, B. *Sea Creatures*, Wetpaper, 2001.

Websites

The websites have been organised as:

- Key websites
- Teaching resources and school kits related to fisheries and marine environment
- Fisheries - Fishing gear, management and research
- Bycatch and environmental management in fisheries
- Protected Marine Species, General
- Turtles
- Seabirds
- Seals and Sea Lions
- Bycatch Reduction Devices (BRDs) for fish
- Recreational fishing and bycatch

Key websites

MESA - Seaweek 2007

Department of Agriculture Fisheries & Forestry - Fisheries

<http://www.daffa.gov.au/fisheries>

Bureau of Rural Sciences - Fisheries and Marine Sciences

http://www.daff.gov.au/fisheries_marine

Department of the Environment and Heritage - Coasts and Oceans

<http://www.deh.gov.au/coasts/index.html>

CSIRO Marine and Atmospheric Research

<http://www.cmar.csiro.au/>

Oceanwatch - SeaNet

<http://www.oceanwatch.org.au/>

Fisheries Research and Development Corporation

<http://www.frdc.org.au/>

Great Barrier Reef Marine Park Authority

<http://www.gbrmpa.gov.au/>

Australian Fisheries Management Authority

<http://www.afma.gov.au>

Department of Primary Industries, New South Wales - Fishing and aquaculture

<http://www.dpi.nsw.gov.au/fisheries>

Department of Primary Industries and Fisheries, Queensland - Fisheries

http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/28_ENA_HTML.htm

Department of Primary Industries, Victoria – Fishing and aquaculture

<http://www.dpi.vic.gov.au/dpi/nrenfaq.nsf>

Primary Industries and Resources, South Australia – Fisheries

<http://www.pir.sa.gov.au/sector7.shtml>

Department of Primary Industries and Water, Tasmania – Sea Fishing and aquaculture

<http://www.dpiw.tas.gov.au/inter.nsf/>

Department of Fisheries, West Australia

<http://www.fish.wa.gov.au/index.php>

Department of Primary Industries, Fisheries and Mines, Northern Territory - Fisheries

<http://www.nt.gov.au/dpifm/Fisheries/>

Teaching resources and school kits related to fisheries and marine environment

Australian Fisheries Management Authority (AFMA) - Resources for teachers and students:

www.afma.gov.au/information/publications/education/pdfs/fs07_bycatch.pdf

www.afma.gov.au/information/students/methods/brd.htm

www.afma.gov.au/information/students/methods/docs/brd.pdf

Oceanwatch – links to fisheries related resources for kids

<http://www.oceanwatch.org.au/kids.htm>

Fisheries Western Australia - Kids resources, including games and activities:

<http://www.fish.wa.gov.au/fishtales/index.php>

Get hooked: it's fun to fish (Primary Industries and Resources, SA):

<http://www.pir.sa.gov.au/dhtml/ss/section.php?sectID=1998&tempID=16>

includes:

- Activities around throwing small fish back and how to return them to the water

http://www.pir.sa.gov.au/byteserve/fisheries/get_hooked/pdf/code/13_code1.pdf

http://www.pir.sa.gov.au/byteserve/fisheries/get_hooked/pdf/code/16_code4.pdf

- Not leaving fishing gear unattended

http://www.pir.sa.gov.au/byteserve/fisheries/get_hooked/pdf/code/17_code5.pdf

Get hooked: it's fun to fish (NSW DPI Fisheries)

www.fisheries.nsw.gov.au/recreational/general/get_hooked

Get hooked: it's fun to fish: national junior fishing codes education kit (Fisheries Victoria)

[www.dpi.vic.gov.au/dpi/nrenfaq.nsf/646e9b4bba1afb2bca256c420053b5ce/178183686128f34bca256eb4001b6f76/\\$FILE/ATT22AI9/intro.pdf](http://www.dpi.vic.gov.au/dpi/nrenfaq.nsf/646e9b4bba1afb2bca256c420053b5ce/178183686128f34bca256eb4001b6f76/$FILE/ATT22AI9/intro.pdf)

Fisheries Research and Development Corporation – Educational products

One in a Thousand the miraculous life of the sea turtle, Education kit:

<http://www.frdc.com.au/research/online%5Fresources/turtle.php>

The Workboot Series: The story of seafood in Australia

http://bookshop.frdc.com.au/miva/merchant.mv?Screen=PROD&Product_Code=PUB-001&Category_Code=pubcat&Store_Code=B

Environment Protection Agency, Queensland - CyberRangers
http://www.epa.qld.gov.au/nature_conservation/cyberangers/

ProjectNet for Schools (AIMS)
www.aims.gov.au/pages/research/project-net/apnet-alpha.html

ReefED (GBRMPA - middle years)
www.reefed.edu.au/teaching/middle_schooling/index.html

Schools for wildlife - WWF (video)
www.wwf.ca/satellite/wwfkids/S4W/0512.asp

Teach Engineering resources for K-12
www.teachengineering.org/index.php

Fish and Kids (British)
http://www.fishandkids.org/staff_resources.php
*various web pages on bycatch

Fisheries - Fishing gear, management and research

Department of Agriculture Fisheries & Forestry - Fisheries
<http://www.daffa.gov.au/fisheries>

Bureau of Rural Sciences
Fisheries and Marine Sciences
http://www.daff.gov.au/fisheries_marine
Marine Matters National: Atlas of Australian Marine Fishing and Coastal Communities - online mapping tool
<http://adl.brs.gov.au/mapserv/fishcoast/index.html>

Australian Fisheries Management Authority (AFMA)
Descriptions and pictures of the different fishing methods and devices used
<http://www.afma.gov.au/information/students/methods/default.htm>
Fishery maps
<http://www.afma.gov.au/information/maps/default.htm>

Fisheries Research and Development Corporation - Information on species, where caught, gear used etc -
<http://www.frdc.com.au/species.php>

Department of Primary Industries, Victoria: Fishing gear types:
<http://www.dpi.vic.gov.au/dpi/nreninf.nsf/childdocs/-B1F754E6F182011F4A2568B30006520E-CE8BD18640C97753CA256BC80006E3AA-433E45DA0FDD5EF44A256DEA0029043D-E2641142B408F7ECCA256BED000A0711?open>

Department of Primary Industries and Fisheries, Queensland: Fishing methods and target species
<http://www2.dpi.qld.gov.au/fishweb/12540.html>

Fisheries Research and Development Corporation (FRDC)
<http://www.frdc.com.au>

Bycatch and environmental management in fisheries

Australian Fisheries Management Authority
Managing bycatch:

<http://www.afma.gov.au/environment/bycatch/default.htm>

Ecosystem Based Fisheries Management:

http://www.afma.gov.au/environment/eco_based/default.htm

Reducing bycatch (fact sheet):

http://www.afma.gov.au/information/publications/education/pdfs/fs07_bycatch.pdf

Bycatch action plans:

<http://www.afma.gov.au/information/publications/fishery/baps/default.htm>

Ecologically Sustainable Development in Commonwealth fisheries:

<http://www.afma.gov.au/environment/esd/default.htm>

Department of the Environment and Heritage

Fisheries and the Environment

<http://www.deh.gov.au/coasts/fisheries/index.html>

50 ways to care for our coast

<http://www.nht.gov.au/nht1/programs/coastcare/50-ways.html>

Oceanwatch

Bycatch mitigation extension and research

<http://www.oceanwatch.org.au/>

Department of Fisheries, Western Australia

Bycatch management: <http://www.fish.wa.gov.au/docs/pub/CommercialBycatch/index.php?0605>

Primary Industries and Resources, South Australia

Fisheries plans and bycatch policy:

<http://www.pir.sa.gov.au/dhtml/ss/section.php?sectID=502&tempID=10>

Department of Primary Industries, New South Wales

Bycatch and its reduction

http://www.fisheries.nsw.gov.au/commercial/commercial2/bycatch_and_its_reduction

Protected Marine Species, General

Australian Fisheries Management Authority - Protected species interactions with Commonwealth fisheries:

http://www.afma.gov.au/environment/eco_based/protected.htm

Department of the Environment and Heritage - Protected and threatened species

<http://www.deh.gov.au/biodiversity/threatened/index.html>

Primary Industries and Resources, South Australia – Protected species interactions with fisheries

http://www.pir.sa.gov.au/pages/fisheries/environmental/protected_species.htm:sectID=1983&tempID=1

Department of Primary Industries, New South Wales

Threatened species interactions with fisheries

http://www.fisheries.nsw.gov.au/threatened_species

Threatened species guide for fishers

http://www.fisheries.nsw.gov.au/__data/assets/pdf_file/24275/Threatened_species_guide_for_fishers.pdf

Department of Primary Industries and Fisheries, Queensland - Protected marine species

<http://www2.dpi.qld.gov.au/fishweb/2772.html>

Turtles

Australian Fisheries Management Authority - Turtle excluder devices (TEDs)

<http://www.afma.gov.au/information/students/methods/ted.htm>

Department of the Environment and Heritage

Marine turtles

<http://www.deh.gov.au/coasts/species/turtles/index.html>

How to help with marine turtle conservation and management

<http://www.deh.gov.au/coasts/species/turtles/conservation.html>

Department of Primary Industries and Fisheries, Queensland: Turtle excluder devices (TEDs), information, descriptions and pictures:

<http://www2.dpi.qld.gov.au/fishweb/10559.html>

Environmental Protection Agency, Queensland: turtle information

http://www.epa.qld.gov.au/nature_conservation/wildlife/watching_wildlife/turtles/

Footage of turtles

http://www.epa.qld.gov.au/nature_conservation/wildlife/watching_wildlife/turtles/turtle_tracking/

Turtle research featured on Catalyst

<http://www.abc.net.au/catalyst/stories/s1408913.htm>

IOSEA Year of the turtle

<http://www.ioseaturtles.org/yot2006/index.php>

Seabirds

Department of the Environment and Heritage

Seabirds

<http://www.deh.gov.au/coasts/species/seabirds/index.html>

Threat abatement plan – Seabird Bycatch

<http://www.aad.gov.au/default.asp?casid=20587>

Save our Shorebirds, Save our Seabirds

<http://www.nht.gov.au/nht1/programs/coastcare/shorebirds/index.html>

Agreement on the Conservation of Albatross and Petrels

http://www.cms.int/species/acap/acap_bkrd.htm

International Plan of Action for reducing incidental catch of seabirds in longline fisheries

http://www.fao.org/figis/servlet/static?dom=org&xml=ipoa_seabirds.xml

Seals and Sea Lions

Australian Fisheries Management Authority - Seal exclusion devices (SEDs)

<http://www.afma.gov.au/information/students/methods/sed.htm>

Department of Fisheries, WA - Sea Lion Exclusion Devices

<http://www.fish.wa.gov.au/docs/pub/SeaLionExclusionDevices/index.php?0200>

Department of the Environment and Heritage

Seals

<http://www.deh.gov.au/coasts/species/seals/index.html>

Sharks

Department of the Environment and Heritage

Sharks

<http://www.deh.gov.au/coasts/species/sharks/index.html>

Grey nurse sharks

<http://www.deh.gov.au/biodiversity/threatened/publications/grey-nurse.html#download>

Department of Fisheries, Western Australia - Sharks

<http://www.fish.wa.gov.au/docs/pub/SharkFactSheet/index.php?0000>

Department of Primary Industries, New South Wales - Grey nurse sharks

http://www.fisheries.nsw.gov.au/threatened_species/general/species/?a=698

Department of Primary Industries and Fisheries, Queensland - Grey nurse sharks

<http://www2.dpi.qld.gov.au/fishweb/13789.html>

Bycatch Reduction Devices (BRDs) for fish

Department of Primary Industries and Fisheries, Queensland - BRDs:

<http://www2.dpi.qld.gov.au/fishweb/18560.html>

<http://www2.dpi.qld.gov.au/fishweb/12545.html#12>

Department of Primary Industries, NSW

Estuary prawn trawl and BRDs

http://www.fisheries.nsw.gov.au/commercial/commercial2/estuary_prawn_trawl_fishery

Reducing bycatch in fish traps

http://www.fisheries.nsw.gov.au/__data/assets/pdf_file/4816/by-catch.pdf

Recreational fishing and bycatch

Gently does it: Release fish survival, Fisheries Research and Development Corporation

<http://www.info-fish.net/releasefish/>

Department of Primary Industries, Victoria: Recreational fishing

<http://www.dpi.vic.gov.au/dpi/nreninf.nsf/childdocs/-B1F754E6F182011F4A2568B30006520E-9ED2C7F8E7207ABFCA256BC80006E51C-625CB431B01891D34A256DEA00291665-ED91740895D57DAACA256C400009D380?open>

Australian Seabird Rescue

<http://www.seabirdrescue.org/>

Department of Primary Industries, Fisheries:

Responsible fishing to reduce wildlife injuries

http://www.fisheries.nsw.gov.au/__data/assets/pdf_file/4834/Responsible-fishing-to-reduce-wildlife-injuries.pdf

Catch and release fishing

http://www.fisheries.nsw.gov.au/recreational/saltwater/saltwater/catch-and-release_fishing

Resource 1.1

Setting of the Story

- Title of the story:

- Time of the story:
(When)

- a day:
- year:
- season:

- Time period:
 - past
 - now
 - future

- The place
(Where)

Tell us about the story

- Title: _____

Settings:

Characters:

Problem:

Solution:

Resource 1.2**Card Game – Spot the fishing features.**

Which ones are human-made and which ones are natural features? Which ones are resources that we need and want?

- Signs
- Buoys
- Nets
- Boats
- Trawler
- Hook
- Fishing rod
- Fishing line
- Gaff
- Bycatch reduction device
- Fish
- Albatross
- Islands
- Rangers
- Wharf
- Fish market
- Fisher people
- Infocentre
- Cultural heritage site
- Trees on island
- Sea Stars
- Dugong
- Dolphin
- Boobies
- Turtle
- Sea snake
- Shark
- Sea Cucumber
- Crab
- Cuttlefish
- Octopus
- Clam
- Jellyfish
- Algae
- Moorings
- Boat platforms
- Shipwrecks
- Pontoons
- Boats
- Tankers

Resource 1.3**Did you see...?**

While “visiting” the aquarium, count and record the number of times you see items listed below. (Your visit might be via video or videoconference or even from books or a documentary).

Fishing checklist

Date: _____

How many things can you find?

(pics to come)

- Signs
- Buoys
- Nets
- Boats
- Trawler
- Hook
- Fishing rod
- Fishing line
- Gaff
- Bycatch reduction device
- Fish
- Albatross
- Islands
- Rangers
- Wharf
- Fish market
- Fisher people
- Infocentre
- Cultural heritage site
- Trees on island
- Sea Stars
- Dugong
- Dolphin
- Boobies

Discover Bycatch

- Turtle
- Sea snake
- Shark
- Sea Cucumber
- Crab
- Cuttlefish
- Octopus
- Clam
- Jellyfish
- Algae
- Moorings
- Boat platforms
- Shipwrecks
- pontoons
- Boats
- Tankers

Draw three things you can see that are natural.

Draw three things you can see that people have made.

Resource 1.4

Family Snapshot

Things my family can do on or by the sea, the beach, by the sea or while on a boat.

Talk to members of your family and then draw a picture for each activity your family has done on or around the ocean, or would like to do.

Areas of Australia's coastline my family has visited.

An area of Australia's coastline my family has visited is called

The area is in _____

The area is near _____

Describe the area _____

We did _____

_____ by the sea or beach.

- Go fishing
- Ride a Jet Ski
- Have a picnic
- Look at fish and other animals
- Go sailing
- Play ball games
- Have a boat ride
- Other ideas