

Seaweeek 2007 *Marine Bycatch Matters*

Explore Bycatch and the Technologies to Reduce It

Upper Primary 4 - 7 SOSE and Science

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Main Idea

This unit introduces students to the issue of bycatch in fisheries – “when fishers target particular species that they want to catch, they also catch other species accidentally. These species are called bycatch”. This might occur when a commercial fishing boat is trawling for prawns and also catches fish they don’t want, or when a recreational fisher is angling for a snapper and catches a toad fish. Students will explore the different types of bycatch, such as marine mammals, fish, seabirds, marine reptiles and sharks. Further to this they will explore and obtain a strong understanding of where their seafood comes from, fishing methods and technologies in reducing bycatch. They will also learn about the groups involved with the use, management 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 advancements in fisheries technologies.

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, 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; and
- 5) to ensure the catch of a particular species as bycatch does not adversely affect the marine ecosystem, eg 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. These species are generally slow growing, late maturing, long-lived, have few offspring and often have small population sizes. For example, leatherback turtles grow to about 1.8m in length, weigh about 500 kg, 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 of adults in some countries. Even though these species 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 (eg all marine mammals, seabirds and sea snakes), vulnerable (eg green turtle, great white shark, Australian sea lion), endangered (e.g. loggerhead turtle, Tristan's albatross, southern giant petrel) or critically endangered (eg 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, the USA implemented a trade embargo on prawns from countries which did not use Turtle Excluder Devices (TEDs) in their fisheries. More information about TEDs is provided below.

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, which 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; and
- (iii) changing how fishing gear is used to avoid catching the species, or if caught minimise harm to the species.

There 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 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, that 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 of 20 on the number of sharks that can be retained in a fishing trip. 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 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 through which undersized lobsters can crawl out.

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/releasedfish>) 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 is very diverse and affects more than just fish.
- Australian fisheries are trying to reduce bycatch to reduce waste and keep marine resources healthy.
- Bycatch reduction devices and technologies differ throughout the fishing industry.
- Different fishing techniques have different types of bycatch.
- Bycatch reduction methods/technologies are part of the sustainable management of Australia's fisheries and the marine environment.
- Humans, plants and animals co-exist on the planet.
- Improving bycatch technology is just one way that we can help protect and preserve our oceans.
- Management of bycatch is important to all involved in the fishing industry, fishers, animals, environment and the consumers of seafood.
- Fishers, researchers and the Australian government are continually developing and improving technologies that reduce the amount of bycatch, including changes to fishing gear and practices.
- It's important to keep improving and developing bycatch reduction technologies, to benefit the fishing industry and the marine environment.

Focus Questions

- What sort of impacts does food production have on the environment?
- What do we mean by bycatch?
- What are Bycatch Reduction Devices?
- Why are Bycatch Reduction Devices important?
- How can technology help improve the marine environment and Australia's fishing industry?
- Why is the biodiversity of Australia's oceans important and what threats does it face?
- Why are some animals more likely than others to become bycatch?

- How can current bycatch technologies be improved?
- How can people become involved in bycatch reduction and improving Australia's Fisheries?
- 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?
- What can we do when we are fishing with friends and families to reduce bycatch?

Key Terms

alternatives, animals, Aquaculture, bag limits, behaviour, birds, Best Environmental Practices (BEP's), biodiversity, boating, bycatch, Bycatch Reduction Devise (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

- Studies of Society and Environment;
- Science;

Sample Unit Sequence and Activity Ideas

Tuning In: Sample Activities

Shared Book Approach

Read books about the ocean, fishing and the plants and animals that live there.

For example: the ballad '*We take so much for granted*' or Bailey, D. *Fishing*, London : Heinemann, 1990. or Lister, A. *Magic Beach*, Allen & Unwin, 1990.

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 different types of fishing.

Ask students:

- How many different types of fishing can you think of? (recreational, commercial, fishing for crabs, fish, crayfish, tuna etc)
- Do fishers use different types of boats to catch different seafood?
- Why do fishers need different equipment to catch different seafood?
- What do you take with you when you go fishing?
- What are some places to go fishing? (freshwater, creek, rivers, lakes, dams, estuaries, ocean, beach, reef, rocky shore, boat etc)
- What places have you been fishing?
- Do different fish eat different bait?
- Does all our seafood come from the ocean?
- Is all our seafood caught in nets?
- Where do you think prawns come from or how are they caught?
- Do different animals live in different parts of the ocean?

Predict and list students' answers.

Sharing Fiction, Non-fiction and Maps

Students browse books and view videos about Australia's coastline and fishing.

Display a map of Australia's coastline. Use brainstorming to list places where certain types of seafood are caught. For example, tuna is mainly caught in the waters off Port Lincoln, in South Australia. Talk about reasons why. The national atlas of marine fishing and coastal communities (<http://adl.brs.gov.au/mapserv/fishcoast/>) may help with this, it shows where different types of seafood are caught and where different fishing gear are used.

Prepare a large floor or wall map of Australia's coastline. Students identify locations on Australia's coastline and use maps and other reference material to identify key fishing locations, areas for catching freshwater fish, river fish, commercial fishing, prawn fishing, aquaculture, tuna fishing, and other areas of particular importance to Australia's fisheries. Get students to draw or write the names of the different fishing types, and place them on the appropriate location on the map.

What is Bycatch?

Ask students the question "What is Bycatch?"

Complete the sentence, "When I hear the term, Bycatch, I think of....."

Picture Clues

Bring in pictures, and books, fishing books and guides of fish found in your local area (your local fishing store may be able to assist you). In groups talk about the different features of the many varieties of seafood caught in your area:

- Size, colour;
- Where some of these animals or fish live and what lives near them ;
- Areas for fishing, mooring, swimming, surfing, visiting, observing seabirds and other wildlife and boating.

Download a collection of photographs and display. Ask students to select one image each and individually write words and phrases that describe the fish, or animal, what it provides to the marine environment and what it is used for. Then, in pairs, share responses. Focus on similarities and differences in responses.

Bycatch

Discuss the questions:

- What does 'Bycatch' mean?
- Have you every caught bycatch?
- How did you feel?
- What did you do with your bycatch?

Encourage students to think of themselves as a species that has been caught by mistake as bycatch and to describe how fishing, people's everyday actions, purchasing choices, and other animals might affect them. Encourage students to describe how they could avoid being caught as bycatch.

What do we mean by bycatch and bycatch reduction devices?

Use brainstorming to list all the options that might be used by fishers to reduce bycatch. The list should include bycatch reduction device/s, nets, bag limits, commercial fishing, license and bycatch. As a class, devise a definition for each word.

In small groups, compile lists of marine animals the students think could become bycatch and the reason for this.

Complete summaries of each group's suggestions.

Preparing to Find Out: Sample Activities

Assessing Prior knowledge

On paper strips, students record facts, feelings and opinions about bycatch.

The teacher can place five hoops in a circle on the floor, each one with the following statements written on a card:

- Things we know about Australia's fishing industry;
- Things we like about Australia's fisheries and seafood;
- Things that concern us bycatch;
- Things about Australia's fisheries which are interesting and intriguing; and
- Things we would like to know about reducing bycatch.

Students sort their responses into the categories, and discuss the results. Bundle the responses and paste them onto a class chart.

Introducing the importance of improving technologies to reduce bycatch

- Discuss and identify animals that are commonly caught as bycatch.
- Discuss species importance and unique features. Talk about why that animal is caught as part of bycatch. What things might help to prevent it being part of bycatch in the future?
- Share lists and make a collective one. Consider whether the list can be classified in any way. (One way to categorise the items is to ask which bycatch reduction device can be

implemented for which animals). In groups, use reference material to clarify and modify lists, and report to the class group.

- With the class prepare a class chart of things students know about bycatch reduction technologies. Include a list of questions students want to investigate. Ask students to offer possible answers to these.
- Encourage students to design their own bycatch reduction device, by either sketching one, or making a model using paddle pop sticks, string, playdough, clay, tape or glue.

Setting the Inquiry

Explain to the class that in pairs or groups their task is to prepare either a play, multi-media presentation, a report or a brochure which conveys detailed information about the:

- Importance of Australia's fisheries;
- Why it is important to keep looking for new and better ways of reducing bycatch.
- Species common to bycatch;
- How technology can help improve Australia's fisheries and marine environment; and
- What bycatch reduction devices might be like in the future, in 2027.

Display these details as an ongoing reference for students to use. Use brainstorming to guide the investigation and suggestions as to where relevant information might be found. Students work in groups to prepare for their investigation.

Finding Out: Sample Activities

Small Group Investigations

Students work in groups. Each group is to locate relevant information on bycatch reduction devices and compile a pros and cons list for using them, from the fishers' point of view, the bycatch species point of view and the students' point of view.

Investigate Marine Species

Using illustrations provided in this resource, picture books, brochures or the world wide web, ask students to find and cut out important (economically, socially, culturally, etc) marine species.

Collect and ask students to sort these into groups (eg target and non-target commercial species, plants, animals etc).

Encourage students to justify their groupings and to discuss how they came to their conclusion.

On the pictures place a "T" for target species and an "NT" for non-target species. Get students place the image on the map of Australia's coastline, where the animals are usually caught or found to live.

Visit a Marine Discovery Centre

Explain to the students that they will be visiting a local Marine Discovery Centre to help undertake research so that they can experience some of the animals which are important to Australia's fisheries.

While visiting, observe some of the biodiversity of the local area. Make a close study of animals that are commercially important and some which are caught as bycatch. (eg. unwanted fish, marine mammals, seabirds, reptiles and sharks).

Prepare a list of questions to investigate. For example:

- Which species are commercially important?
- Where are these species normally found?
- What does each species need to survive?
- What non-target animals are usually caught as bycatch when trying to catch the above target species?
- Does this non-target species have adaptations to enable it to avoid being part of bycatch? If so, describe them.
- Why is this non-target species part of bycatch?
- What bycatch reduction devices and fisheries management plans are in place to protect/manage this species?
- What is the role of communities, governments, fishers and others in the management of this non-target species?

Identify and categorise dynamic interactions of Australia's marine environment eg turtles feeding on algae, or creatures that shelter in the body of others or under rocky structures.

During the investigation students could also:

- Observe living examples of fish they have eaten, eg snapper, flake (shark), flathead, tuna. Draw simple sketches of species and label parts.
- Stand in one spot and collect evidence on how certain animals move, how long they live for and what they feed on.
- Collect evidence of the activities of specific species or examples of species dependent on other plants and animals (don't forget about seabirds, which may not be on display at your marine centre).

Which species are caught by fishing nets?

Use the ideas from the ballad *We take so much for granted* to identify non-target species that are caught by fishing nets. Discuss ways to avoid catching these non-target species.

Scribe, write slogans or poems to convey these messages.

Create species masks to identify species that are non-target species. Play the Yes/No game. To do this, pin the mask outline of a non-target species to each student's back. They then wander around the room asking questions about their species requiring a yes/no answer only. When they have guessed the answer, then remove the mask and put it on their chest.

Talk about the species and what technology could be used to avoid being caught as bycatch (eg a Turtle Excluder Device for a turtle). Students then become guardians of that species and bycatch reduction technology. Note information about it, sketch it, or build a small model of the animal and the BRD and note things about a BRD that helped the animal go free. Exhibit this work for others to see.

Predictions

In pairs, students list the things they know and would like to know about their 'non-target species and bycatch reduction devices' (identified in the activity above).

Students illustrate the species in or near the bycatch reduction devices that prevented it becoming bycatch.

A fun activity is to make 'thaumatropes'. On a small piece of card, draw the bycatch reduction device. On the other side of the card, draw the animal. Attach string to both ends, twist it, and then pull. The card spins around as the string unravels. The species will appear to be 'in' the bycatch reduction device.

Research bycatch reduction devices and technologies

Using the information located in the *Background information*, as well as other sources of information (eg Resource list and the internet), encourage student to research and describe the various bycatch reduction devices in use within Australia's fisheries. Encourage student to describe how the bycatch reduction devices work and what animals they exclude or reduce becoming bycatch.

Sorting Out: Sample Activities

Deciding on 'what' to present and how to do so

Re-state the purposes of the bycatch investigation, and ask students to consider how they are going to bring their information together and present it so that the main points come across clearly.

As a class, list the main issues affecting marine turtles, marine mammals, fish seabirds, reptiles and sharks. Decide on ways to present this information.

Flow chart

Students draw two different flow charts or posters. The first explains how seafood makes its way to our dinner table with the use of bycatch reduction devices. A second flow chart or poster could show the impacts of bycatch and what effects occur in our marine environment if bycatch reduction technologies are not used.

Masks

Students use face masks created earlier of their favorite non-target species. These masks will be used in drama activities and in the final, reflective sharing circle.

Plays, multi-media presentations, reports or brochures

Model the construction of the genres above. Students now use the information they have gathered to construct a piece of work of their choice.

If they have been working in pairs, encourage students to conference each other.

If they are working individually, they can be encouraged to team up with others and to talk about their plans.

Information Chart

When plays, presentations, reports and brochures are finalised, a class retrieval chart could be developed on which to show collected data. This is important as students will begin to see patterns emerging.

Going Further: Sample Activities

Sharing Circle

A good prop for this activity is the mask made earlier by the students. This will help students get into roles quickly and feel less inhibited about sharing.

Sitting in a circle, ask students to imagine they have become an animal that sometimes gets caught up as part of bycatch. They should think about why they are an important part of the ecosystem and what makes them special.

Ask someone to speak for that species as it cannot speak for itself, and to sit inside the middle of the circle, eg 'I speak for the Seal'. The other students represent humankind.

Students on the outer circle ask questions of the species, eg 'Tell us about yourself Seal. Where do you live? Why are you special?' The student in the middle talks about the species it represents.

Ask additional questions, eg 'What troubles you Seal?' The seal tells the humans of its plight and may ask them questions: 'Why don't you all use bycatch or seal excluder devices, I barely escaped a net the other day and many of my turtle friends have been caught up in nets?' The humans listen and respond if they wish.

Another student then enters the circle to speak on behalf of a species common to bycatch and the process continues.

Afterwards, debrief by talking about the way the students felt as the bycatch species and as the humans.

Making Connections: Sample Activities

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 that have been caught in a fishery that uses 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 cares about bycatch?

Students draw posters which show how different people are concerned about, affected by or involved with the reduction of bycatch such as fishers, families, bycatch reduction device designers, scientists, governments, grocery stores.

In this activity students begin to understand that reducing bycatch and caring for Australia's fisheries is the joint responsibility of those who work in the industry and those who use the marine environment for fishing or other leisure activities such as bird watching.

Concept Mapping

Draw conclusions about what has been learned. Develop concept maps using key words. Students draw connecting lines between words and indicate how they believe their words relate to each other. From the concept maps, students come up with one statement about bycatch. Share and prioritise statements.

Consequences

As a class, consider the consequences of not increasing involvement in, and appreciation of, bycatch reduction. Use a consequence wheel to examine first, second and third order consequences.

Culture Creation

Examine the ways in which a particular aspect of popular culture (eg television program, movie, toy or fashion item) has been marketed by advertising companies.

Ask students:

- What is the marketing attempting to do?
- What is the role of advertising in this process?
- Who or what benefits from this marketing?

As a class, decide on how best to market fish which have been caught using environmentally friendly methods, including the use of bycatch reduction technology. The marketing campaign

should heighten community awareness and appreciation of the importance of reducing bycatch and explain what bycatch is.

Decide on how the class could introduce the idea that there are many and varied ways communities can become involved in reducing bycatch or in raising community appreciation for the importance of sustainable fishing practices.

Taking Action: Sample Activities

Doing Something

Encourage students to choose one local issue associated with reducing bycatch. Read the background information, utilise the resource lists and research the internet for ideas. As a class, brainstorm possible solutions and talk about why something should be done about each of these issues. Discuss what the class can do.

Suggestions might include:

- Raising public awareness by speaking at school assembly, writing an article for the school newsletter, or writing a letter to the editor of a newspaper.
- Developing stickers, pamphlets or an action-chart showing how students and their families can contribute by purchasing seafood that has been caught using sustainable methods or with the aid of bycatch reduction devices.
- Talking to fishers who use bycatch reduction devices or researchers or liaison officers involved in testing them (see Seaweek 2007 website for ways to contact relevant people).
- Writing to Members of Parliament, Government Departments and Environmental Agencies about issues that concern them.
- Develop a sustainable seafood guide for your local area.

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 Australia's Fisheries, bycatch and bycatch reduction technologies?
- What is one thing I have learned about myself, and how I might help to improve the management of Australia's Fisheries?
- What have I learnt about how to avoid bycatch when I go fishing with my family and friends?
- What would I still like to find out about Australia's fisheries, bycatch, and bycatch reduction technologies?
- What piece of work am I most satisfied with?

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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 – Seaweed 2007

<http://www.mesa.edu.au/seaweed2007>

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>

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.ems.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

Explore Bycatch and Technologies to Reduce it

<http://www.fish.wa.gov.au/docs/pub/SeaLoinExclusionDevices/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 Ballad

We take so much for granted

We take so much for granted
It's almost beyond belief,
We think that all will stay the same
Even our precious reef.

Mel's thoughts just kept on wandering
As she stared out to sea,
Her desire to help the ecosystem
Is just how it should be?

"I want to do my share", she thought,
"And protect this precious place,
Save the threatened species".
Then confusion changed her face.

"How can I do my bit to save?
The dugong becoming extinct?
What is it that these creatures need?"
Mel began to think

"I know the sea grass is their home
So that's a place to start,
If I become a volunteer
I can play my part.

Then there are the Coral Trout,
They're also under threat,
From rubbish in the run-off
And small ones in the nets.

We can't forget the turtles,
The Loggerhead for sure.
Disease and nets endanger them,
It can't happen anymore.

The Manta Rays that glide with grace
Often look quite mean
But our reef without these wondrous rays
Would be an awful scene.

And then of course the Mud Crabs
That scurries across the floor,
Are often not found on the reef
But through the kitchen door.

If we just took the big ones
And left the females free,
The crabs would last forever
Not just for you and me.

Pollution affects our dolphins,
Gillnets do the same
Pacific Humpbacks are in decline
But we can play the game,

By buying tuna that's 'dolphin safe'
We keep their numbers high.
But how can we help the Boobies
Those birds that fly so high?

When diving to get their daily food
They must avoid the fishing gear
And even yucky discarded oil
That covers them in smear.

And there they can flounder
And suffer so.
We have to take it seriously
And act as though

It's more our home than just a reef
It's our future that's at stake.
We must protect these species
It's all our choice to make.

Mel then stood up
Tall and proud,
"I will help",
She yelled aloud,

"I'll learn all the things I need to
To make the reef a place
Where all the creatures survive in peace,
And freely live with grace.

I'll get my mates to join me
My family and their friends
We'll work on doing what we can
Until the message ends

Up creeping 'cross the land,
So everyone who comes
To see this wondrous place of ours
That glistens in the sun

Can stand and look in wonder
At creatures living free,
For no more threatened species
Its up to you and me."