

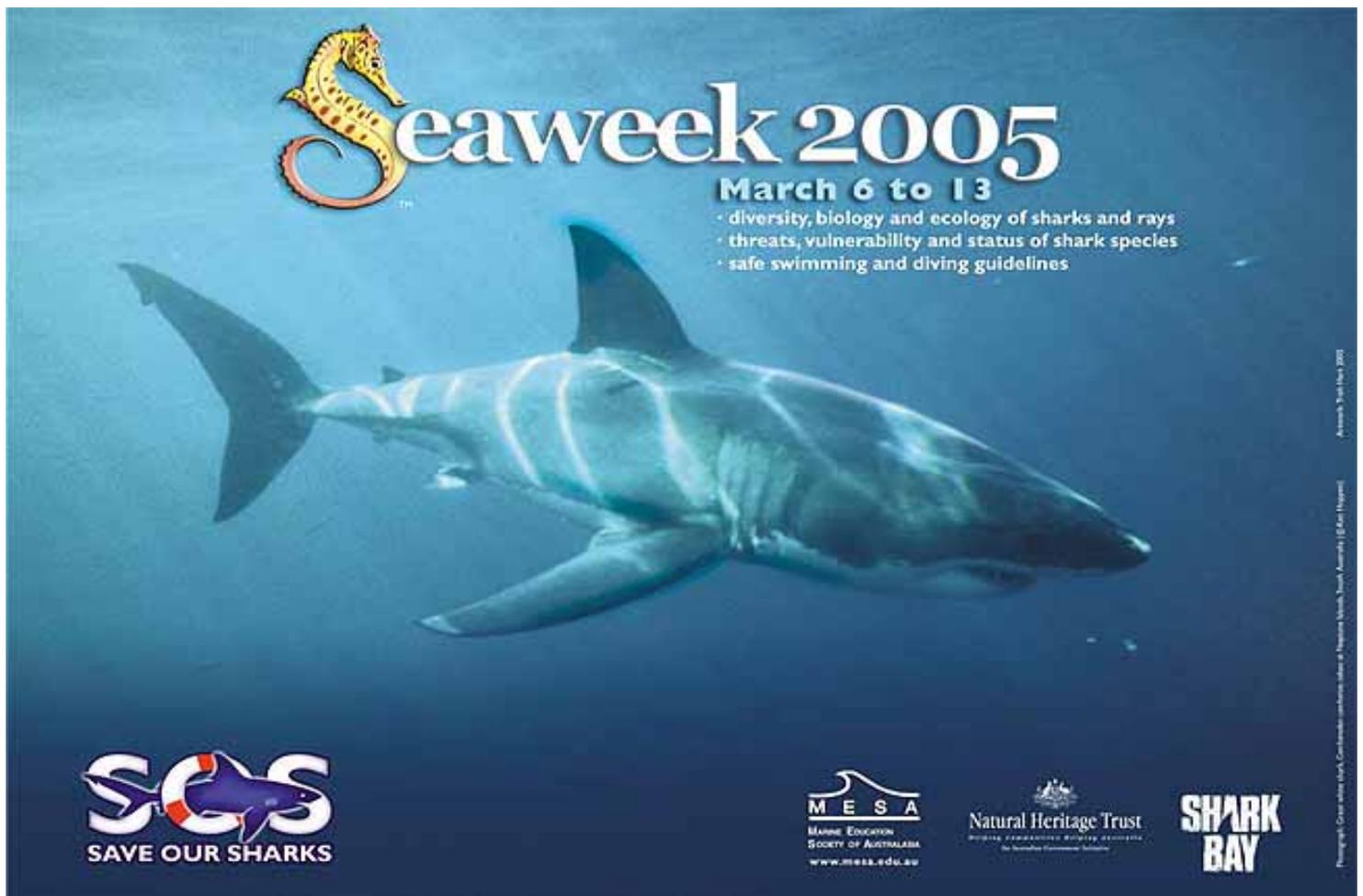
SEAWEEK 2005: SAVE OUR SHARKS

Activities Booklet

For students of all ages

SHARKS AND SUSTAINABILITY

An online publication provided by MESA
for teachers, students and the community



Seaweed 2005
March 6 to 13

- diversity, biology and ecology of sharks and rays
- threats, vulnerability and status of shark species
- safe swimming and diving guidelines

SOS
SAVE OUR SHARKS

MESA
Marine Education
Society of Australasia
www.mesa.edu.au

Natural Heritage Trust
PROTECT. PROMOTE. PRESERVE. PROGRESS.
AN AUSTRALIAN GOVERNMENT DEPARTMENT

SHARK BAY

Photograph: Great White Shark Conservation Centre; Shark Bay Marine Park Authority; [E] [G] [H] [I] [J] [K] [L] [M] [N] [O] [P] [Q] [R] [S] [T] [U] [V] [W] [X] [Y] [Z] [AA] [AB] [AC] [AD] [AE] [AF] [AG] [AH] [AI] [AJ] [AK] [AL] [AM] [AN] [AO] [AP] [AQ] [AR] [AS] [AT] [AU] [AV] [AW] [AX] [AY] [AZ] [BA] [BB] [BC] [BD] [BE] [BF] [BG] [BH] [BI] [BJ] [BK] [BL] [BM] [BN] [BO] [BP] [BQ] [BR] [BS] [BT] [BU] [BV] [BW] [BX] [BY] [BZ] [CA] [CB] [CC] [CD] [CE] [CF] [CG] [CH] [CI] [CJ] [CK] [CL] [CM] [CN] [CO] [CP] [CQ] [CR] [CS] [CT] [CU] [CV] [CW] [CX] [CY] [CZ] [DA] [DB] [DC] [DD] [DE] [DF] [DG] [DH] [DI] [DJ] [DK] [DL] [DM] [DN] [DO] [DP] [DQ] [DR] [DS] [DT] [DU] [DV] [DW] [DX] [DY] [DZ] [EA] [EB] [EC] [ED] [EE] [EF] [EG] [EH] [EI] [EJ] [EK] [EL] [EM] [EN] [EO] [EP] [EQ] [ER] [ES] [ET] [EU] [EV] [EW] [EX] [EY] [EZ] [FA] [FB] [FC] [FD] [FE] [FF] [FG] [FH] [FI] [FJ] [FK] [FL] [FM] [FN] [FO] [FP] [FQ] [FR] [FS] [FT] [FU] [FV] [FW] [FX] [FY] [FZ] [GA] [GB] [GC] [GD] [GE] [GF] [GG] [GH] [GI] [GJ] [GK] [GL] [GM] [GN] [GO] [GP] [GQ] [GR] [GS] [GT] [GU] [GV] [GW] [GX] [GY] [GZ] [HA] [HB] [HC] [HD] [HE] [HF] [HG] [HH] [HI] [HJ] [HK] [HL] [HM] [HN] [HO] [HP] [HQ] [HR] [HS] [HT] [HU] [HV] [HW] [HX] [HY] [HZ] [IA] [IB] [IC] [ID] [IE] [IF] [IG] [IH] [II] [IJ] [IK] [IL] [IM] [IN] [IO] [IP] [IQ] [IR] [IS] [IT] [IU] [IV] [IW] [IX] [IY] [IZ] [JA] [JB] [JC] [JD] [JE] [JF] [JG] [JH] [JI] [JJ] [JK] [JL] [JM] [JN] [JO] [JP] [JQ] [JR] [JS] [JT] [JU] [JV] [JW] [JX] [JY] [JZ] [KA] [KB] [KC] [KD] [KE] [KF] [KG] [KH] [KI] [KJ] [KK] [KL] [KM] [KN] [KO] [KP] [KQ] [KR] [KS] [KT] [KU] [KV] [KW] [KX] [KY] [KZ] [LA] [LB] [LC] [LD] [LE] [LF] [LG] [LH] [LI] [LJ] [LK] [LL] [LM] [LN] [LO] [LP] [LQ] [LR] [LS] [LT] [LU] [LV] [LW] [LX] [LY] [LZ] [MA] [MB] [MC] [MD] [ME] [MF] [MG] [MH] [MI] [MJ] [MK] [ML] [MM] [MN] [MO] [MP] [MQ] [MR] [MS] [MT] [MU] [MV] [MW] [MX] [MY] [MZ] [NA] [NB] [NC] [ND] [NE] [NF] [NG] [NH] [NI] [NJ] [NK] [NL] [NM] [NN] [NO] [NP] [NQ] [NR] [NS] [NT] [NU] [NV] [NW] [NX] [NY] [NZ] [OA] [OB] [OC] [OD] [OE] [OF] [OG] [OH] [OI] [OJ] [OK] [OL] [OM] [ON] [OO] [OP] [OQ] [OR] [OS] [OT] [OU] [OV] [OW] [OX] [OY] [OZ] [PA] [PB] [PC] [PD] [PE] [PF] [PG] [PH] [PI] [PJ] [PK] [PL] [PM] [PN] [PO] [PP] [PQ] [PR] [PS] [PT] [PU] [PV] [PW] [PX] [PY] [PZ] [QA] [QB] [QC] [QD] [QE] [QF] [QG] [QH] [QI] [QJ] [QK] [QL] [QM] [QN] [QO] [QP] [QQ] [QR] [QS] [QT] [QU] [QV] [QW] [QX] [QY] [QZ] [RA] [RB] [RC] [RD] [RE] [RF] [RG] [RH] [RI] [RJ] [RK] [RL] [RM] [RN] [RO] [RP] [RQ] [RR] [RS] [RT] [RU] [RV] [RW] [RX] [RY] [RZ] [SA] [SB] [SC] [SD] [SE] [SF] [SG] [SH] [SI] [SJ] [SK] [SL] [SM] [SN] [SO] [SP] [SQ] [SR] [SS] [ST] [SU] [SV] [SW] [SX] [SY] [SZ] [TA] [TB] [TC] [TD] [TE] [TF] [TG] [TH] [TI] [TJ] [TK] [TL] [TM] [TN] [TO] [TP] [TQ] [TR] [TS] [TT] [TU] [TV] [TW] [TX] [TY] [TZ] [UA] [UB] [UC] [UD] [UE] [UF] [UG] [UH] [UI] [UJ] [UK] [UL] [UM] [UN] [UO] [UP] [UQ] [UR] [US] [UT] [UU] [UV] [UW] [UX] [UY] [UZ] [VA] [VB] [VC] [VD] [VE] [VF] [VG] [VH] [VI] [VJ] [VK] [VL] [VM] [VN] [VO] [VP] [VQ] [VR] [VS] [VT] [VU] [VV] [VW] [VX] [VY] [VZ] [WA] [WB] [WC] [WD] [WE] [WF] [WG] [WH] [WI] [WJ] [WK] [WL] [WM] [WN] [WO] [WP] [WQ] [WR] [WS] [WT] [WU] [WV] [WW] [WX] [WY] [WZ] [XA] [XB] [XC] [XD] [XE] [XF] [XG] [XH] [XI] [XJ] [XK] [XL] [XM] [XN] [XO] [XP] [XQ] [XR] [XS] [XT] [XU] [XV] [XW] [XX] [XY] [XZ] [YA] [YB] [YC] [YD] [YE] [YF] [YG] [YH] [YI] [YJ] [YK] [YL] [YM] [YN] [YO] [YP] [YQ] [YR] [YS] [YT] [YU] [YV] [YW] [YX] [YY] [YZ] [ZA] [ZB] [ZC] [ZD] [ZE] [ZF] [ZG] [ZH] [ZI] [ZJ] [ZK] [ZL] [ZM] [ZN] [ZO] [ZP] [ZQ] [ZR] [ZS] [ZT] [ZU] [ZV] [ZW] [ZX] [ZY] [ZZ]

Marine Education Society of Australasia Inc

SEAWEEK 2005: SAVE OUR SHARKS ACTIVITIES BOOKLET

Preface

The intent of this online booklet is to offer ideas and inspiration with, we hope, enough information help you to push off from the shore on your shark adventure. The material was drawn together from the imagination and practical expertise of marine educators across Australia.

We ask that you refer to the table of contents for guidance on the age level of delivery for activities and to the excellent fact sheets, website references and bibliography developed for Seaweeek.

The activities in this booklet are not tied to particular curricula as this differs from state to state, country to country. Enjoy.

Acknowledgements

Australian Geographic
City of Greater Geelong
CSIRO, Science in Salamanca
Marine Discovery Centre, SA
Marine Life Society of South Australia
Monterey Bay Aquarium, USA
Pelagic Shark Research Foundation, USA
Sunshine Coast Grammar School Qld
UnderwaterWorld, Mooloolaba Qld
Wetpaper Qld

Special thanks to

Brian Robinson
Ken Thaiday Sr
Paul Curnow
Trish Hart
Peter Biro

**SEAWEEK 2005: SAVE OUR SHARKS
ACTIVITIES BOOKLET**

Activities Booklet Team

Jody Plecas

Jody believes that life is the sea and her job is to help people understand their connection to it. She is currently working with the EPA to assist councils to clean up stormwater. The sea should not be our garbage bin or trash can, after all, there is only one ocean.



Julie Swartz

Julie was one of the founding members of MESA, living now in far north Queensland. Julie has contributed greatly to the north with her Living Safely with Crocodiles Teachers' kit and her cultural contributions.



Bob Moffatt

Wet Paper Publishers, Queensland
Bob is a long time marine education advocate. WetPaper is known around Australia and the world for ground-breaking marine curriculum for schools. Retired now, his hand is still seen in places like this activity book.



Bob Winters

Bob has worked for the Gould League in Victoria for most of his life. The result has been fun and educational programs and publications for the rest of us to enjoy. We are thankful for his guidance in setting out the format of this activity book.



Kerrie Trees

Kerrie has taken on the challenge of the MESA office while also working as a brilliant education officer at the Hastings Point Marine Environments Field Study and Resource Centre. Her delight is delivering high quality marine experiences to students.



Phil Arnold

Phil is a particularly modest gentleman and retired school principal. He is renowned along the west coast of Victoria for bringing marine education and the performing arts together for schools in the region.

No photo available

Tim Hoile

It was Tim's dream to set up a Marine Discovery Centre and with support from the Star of the Sea School at Henley Beach, South Australia, he did. Tim's primary activities are seen throughout.



Tony Isaacson

Currently teaching at Sunshine Coast Grammar in Queensland, has spent many years sharing the joy of sharks and shark hatchings with students. He worked closely with Underwater World so we now have a Sharkcam to witness a birth.



Hing Ang

Hing is the Education Manager at UnderWater World on Queensland's Sunshine Coast. Hing worked with Tony Isaacson to ensure that no matter where you live you'll be able to watch a shark hatch out of its egg (if you're lucky).



Mark Rodrigue

Mark Rodrigue has been a cornerstone for marine education locally, across Victoria and nationally. His ability to communicate and passionate resolve helped to make this booklet come to life.



**SEAWEEK 2005: SAVE OUR SHARKS
ACTIVITIES BOOKLET**

Contents

Preface, Acknowledgements & Activities Booklet Team

Table of Contents

- 1. Sharks in time (P Arnold, J Plecas, M Rodrigue)**
 - 1.1 Geological Time (Primary/Secondary)
 - 1.2 Shark Researchers (Primary/Secondary)

- 2. Tuning in on sharks (Aust. Geographic, K Trees)**
 - 2.1 Monsters or misunderstood survey (Primary)
 - 2.2 Save Our Sharks Poster Crossword (Primary/Secondary)
 - 2.3 Shark Species Unscramble (Secondary)

- 3. Cultural shark (J Swartz)**
 - 3.1 Creation Story
 - 3.2 Bark Painting (Primary)
 - 3.3 Shark Symphony (Primary)
 - 3.4 Shark Astronomy (Secondary)
 - 3.5 Dance mask (Secondary)

- 4. Stormwater – an issue for sharks (B Winters, J Plecas)**
 - 4.1 Mutant pollutants (Primary and Secondary)
 - 4.2 Keep it clean (Primary)
 - 4.3 It's a matter of concentration (Secondary)

- 5. Researching sharks (J Plecas)**
 - 5.1 Find out more about a particular shark (Primary)
 - 5.2 Investigate what issues surround sharks (Secondary)
 - 5.3 Understanding the different species (Primary)

- 6. Biology of sharks (T Isaacson, H Ang, T Hoile, J Plecas, B Moffatt)**
 - 6.1 Shark eggs (Primary)
 - 6.2 Ocean torpedos (Secondary)
 - 6.3 Shark Key (Secondary)

- 7. Shark art (T Hoile, P Arnold, J Plecas, K McElroy)**
 - 7.1 Sidewalk sharks (Primary)
 - 7.2 Posters (Primary)
 - 7.3 Designing a shark (Secondary)
 - 7.4 Octopus chart (Secondary)

- 8. Great debate (T Hoile, J Plecas)**
 - 8.1 Debate (Primary)
 - 8.2 Debate (Secondary)
 - 8.3 Role Play (Extension Secondary)

- 9. Why sharks are important (T Hoile, J Plecas)**
 - 9.1 Shark products (Primary/Secondary)
 - 9.2 True or false (Primary)
 - 9.3 Test your knowledge (Secondary)

Appendix 1. Frequently Asked Questions (MLSSA)

Appendix 2. Funky Shark Facts (K Trees)

Appendix 3. Fact Sheet – Seaweeek 2005 -Shark Conservation

From the Australian Marine Conservation Society (AMCS) – www.amcs.org.au

**SHARKS AND SUSTAINABILITY
Activities Booklet**

1. Sharks in time

This activity will help to develop understandings of how sharks have evolved over time and encourage students to use the library and the Internet to research sharks and their relatives.



Fossil ray image courtesy of the California Academy of Sciences

Activity 1.1 Geological time

Materials needed

- 100 m tape measure and some markers (eg cones) - your PE teachers may be able to assist here
- Cards to write names of important species
- A large open area on which the timeline can be constructed (e.g. oval, park, schoolyard and pathway).
- Time and species table (below)

Procedure

1. Have students develop an understanding of scales – in this case students will use a scale of 1 metre (m) = 10 million years MY)

Calculate the following:

Distance	Years Represented
100m	
10m	
	10 Million Years
10 cm (0.1m)	1 Million Years
1 cm (0.01m)	
1 mm (0.001m)	

2. Have students mark out 100metres using the tape measure and place a marker at each 10 m interval. This line represents a billion years or 1,000,000,000 years. The present should be marked along with 1 billion years ago.
3. Have selected students make a sign to indicate the species listed in the table below and note when these animals first appeared on their cards.
4. Start the whole class walking at the billion years mark and walk towards the present. As students with the signs reach their time of appearance ask them to stand at that point.
5. All other students should keep walking towards the present.
6. At the end of the activity have students think about where sharks fit into the timeline compared with other modern animals.

SHARKS AND SUSTAINABILITY
Activities Booklet – 1. Sharks in time

Evolution of Species over Time (simplified)

Years Before Present	Name of Period	Animals Appearing	Notes
1,000,000,000 (1 Billion Years)	Pre-Cambrian	Bacteria and protozoans	Simple single celled animals evolve. Simple plants already present in oceans.
540,000,000	Cambrian	Corals, molluscs, brachiopods, trilobites	Many animals with calcified skeletons emerge as the dominant group
450,000,000	Ordovician	Primitive fish	Early fish were armour plated with heavy scales such as modern coelacanths. Life is still dominated by invertebrates.
420,000,000	Silurian	Sharks evolve	First land plants appear.
380,000,000	Devonian	Fish rapidly evolve to many current forms. Ammonites.	Sea are dominated by fish including sharks and squid like ammonites.
300,000,000	Carboniferous	Insects evolve on land.	Many coal deposits formed. Land covered in early forests.
250,000,000	Permian	Reptiles	Mass extinction of many invertebrates in the sea. Reptiles form aquatic, land and flying forms.
200,000,000	Jurassic	Dinosaurs appear. First mammals	Mammals evolve as small rodent like forms.
150,000,000	Cretaceous	Dinosaurs	Dinosaurs dominate but rapidly become extinct.
65,000,000	Paleocene	Mammals dominate land	Mammals rapidly become the major group on land and include grazers and carnivores.
30,000,000	Eocene	Whales and dugongs evolve in the sea from land relatives such as hippos. Early horses, camels, rhinoceros appear.	The coasts are submerged and kelp forests appear. On land, spreading grasslands replace forests over large areas on several continents.
25,000,000	Oligocene	<i>Carcharocles megalodon</i> (ancestor of the Great White Shark) appears.	Modern ocean currents formed.
1,500,000	Pleistocene	First humans appear	The oldest species of <i>Homo</i> — <i>Homo habilis</i> —evolves
50,000	Holocene	Modern humans	Human civilization develops. Activities of mankind begin to affect world climates. The extinction of other species continues.

SHARKS AND SUSTAINABILITY
Activities Booklet – 1. Sharks in time

Activity 2.2 Shark researchers

Use the Internet or library to research information for a short presentation to the class on one of the following topics:

- What were the early ancestors of sharks like – find out about the Megalodon shark – ancestor of the Great White shark?
- What is the largest shark? Where does it live?
- What is counter-shading and how is it useful to sharks?
- What senses do sharks use to track down their prey?
- What products made from parts of sharks are used by people?
- How are skates, rays and chimaeras like sharks? How are they different?
- Why do sharks sink if they stop swimming? What do whale sharks and basking sharks eat? How do they get this food?
- What is the smallest shark and where does it live?
- Do sharks have a good sense of smell?
- Do sharks ever sleep?
- What are the records of shark attack in different parts of the world? Where do most attacks occur?
- What can be done to reduce the risks of shark attack?



SHARKS AND SUSTAINABILITY Activities Booklet

2. Tuning in on sharks

Life is a circle. In order to have a *healthy balanced ocean* there needs to be a balance of nutrients, plants and animals that eat plants as well as the animals that eat animals.

Healthy sharks are a vital element of that life cycle, however, in order to have *healthy sharks* we need to have a healthy sustainable ocean environment for the sharks to live in.

Australian Geographic recently developed a shark survey for students. To participate, students can take the survey themselves to make a record of what they know (or believe) about sharks before surveying other people.

2.1 Survey activity

SHARKS – MONSTERS OR MISUNDERSTOOD? Australian Geographic

YOUR TASK

- o Prepare one survey sheet for each interview by copying the following page twice (double sided copying to save paper) or four individual sheets.
- o Make sure to complete your own details as the Researcher on each sheet before you begin (name, address, contact email at school or home)
- o Fill out one sheet with your own answers then find three people, of different ages and both sexes, and ask them if they would like to take part in our nation-wide shark survey.
- o Ask each person the five questions and write their answer on one of the pages you've copied.
- o Send you results form straight to Shark HQ:

**Attention: Sacha Dench
National Shark Survey
Australian Geographic Society
PO Box 321, Terrey Hills, NSW 2084**

To get your own copy of the Shark! Explorer kit you can order one or multiple copies by telephoning 1300 887 795.

The kits are \$4.95 each and include a poster of 15 Australian sharks, a 16 page colour booklet and online activities that are interesting and fun.



SHARKS AND SUSTAINABILITY
Activities Booklet - 2. Tuning in on sharks

SHARKS – MONSTERS OR MISUNDERSTOOD?
Australian Geographic

SURVEY QUESTIONS:

1. What are the first three words that come to mind when you think of sharks:
 - a _____
 - b _____
 - c _____

2. Each year 150 people world-wide are accidentally killed by falling coconuts. How many humans do you think are killed by shark attacks each year?
 - a. 10
 - b. 100
 - c. 1000

3. How many sharks do you think are killed by humans each year?
 - a. 20,000-100,000
 - b. 200,000-1,000,000
 - c. 20,000,000-100,000,000

4. Do you think we should protect Australia's sharks?
 - a. No. they are dangerous! Well maybe a few in the aquariums is okay.
 - b. Yes, but only the small ones.
 - c. Yes. They are amazing animals and have a right to live in the ocean.

5. Where have you learnt most about sharks?
 - a. From programs on TV
 - b. From things I have read in books, magazines and newspapers
 - c. From visiting aquariums

RESEARCHER _____

NAME OF RESEARCHER (your name): _____

NAME OF SCHOOL: _____

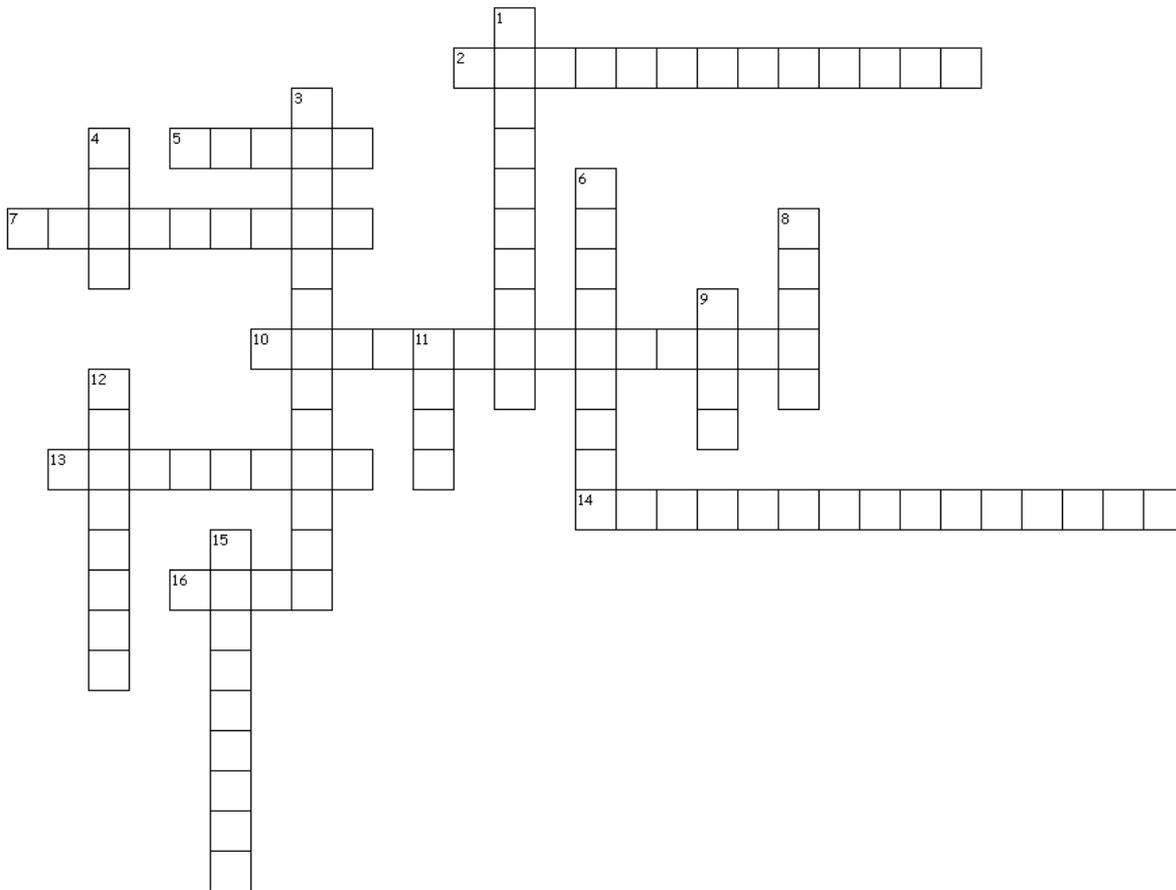
ADDRESS: _____

CONTACT EMAIL: _____

SHARKS AND SUSTAINABILITY
Activities Booklet - 2. Tuning in on sharks

2.2 Save our Sharks poster crossword

The clues are from the SOS poster (see next page). Read the important information about sharks on the back of the poster and you will be able to complete the crossword.



Poster crossword clues

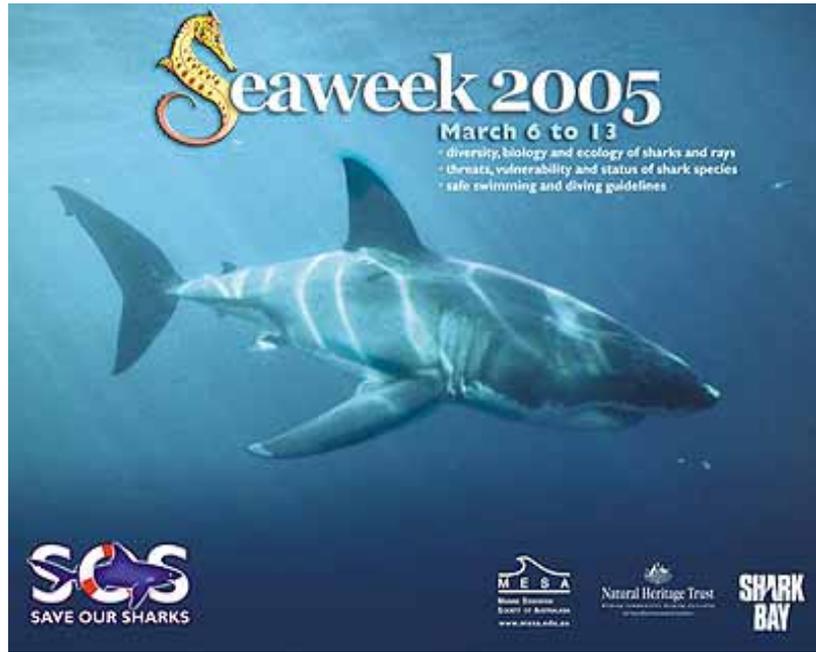
Across

2. Scientific name for the group of animals that includes sharks, rays, and chimaeras.
5. Where most sharks live.
7. Tooth-like scales covering a shark's body.
10. Threatened shark once falsely believed to attack humans. (4, 5, 5)
13. The largest ray which feeds on plankton.
14. Large shark that feeds on mammals and fish. (5, 5, 5)
16. Relatives of sharks with flattened bodies.

Down

1. The largest of all sharks. (5, 5)
3. Theme for Seaweek 2005. (4, 3, 6)
4. Part of shark removed for soup.
6. Australian sharks with beautiful markings and a fringed mouth.
8. Shark is sold under this name in fish and chip shops.
9. Hollywood movie series that caused a lot of fear about sharks.
11. Sharks are mainly caught using these.
12. The food of whale sharks.
15. Shark skeletons are made from this.

SHARKS AND SUSTAINABILITY
Activities Booklet - 2. Tuning in on sharks



Front of Seaweed Poster

Download the Seaweed Poster (pdf) (front and back) from
http://www.mesa.edu.au/Seaweed2005/seaweed_poster.pdf

* Answers are on page 6.

SHARKS AND SUSTAINABILITY
Activities Booklet - 2. Tuning in on sharks

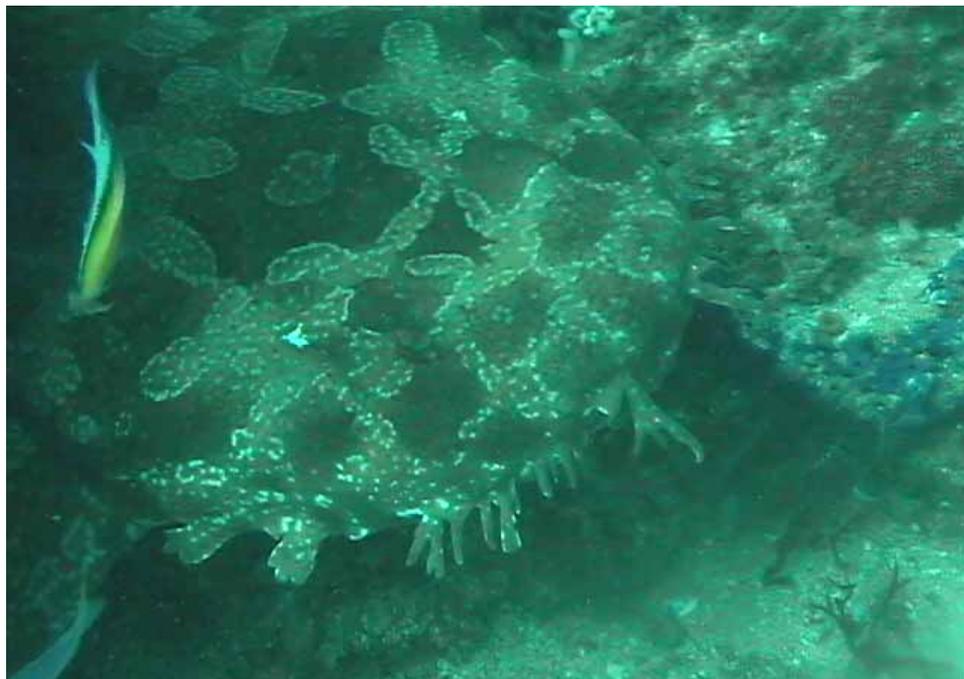
2.3 Shark species unscramble

Several species of sharks are identified on the back of the MESA Seaweed 2005 poster. Can you unscramble the common names listed below?

You may even find surprise shark species not listed on the MESA poster.

- 1) GETRA HTWEI KSHRA
- 2) LEAHW ASRHK
- 3) YGER SNREU AKSRH
- 4) HAMGUMEOT HKASR
- 5) DSEBOARNO VSEEN LGLDEI RHSAK
- 6) GTEIR ARKHS
- 7) LLUB ARKHS
- 8) BBWGNOEG RSAHK

* Answers are on the following page.



Shark camouflage - Can you find the shark in this photograph?
Answer on the following page.

SHARKS AND SUSTAINABILITY
Activities Booklet - 2. Tuning in on sharks

POSTER CROSSWORD ANSWERS

Across

2. Chondrichthyes
5. Ocean
7. Denticles
10. Grey Nurse Shark
13. Manta Ray
14. Great White Shark
16. Rays

Down

1. Whale Shark
3. Save Our Sharks
4. Fins
6. Wobbegong
8. Flake
9. Jaws
11. Nets
12. Plankton
15. Cartilage

SHARK SPECIES UNSCRAMBLE ANSWERS

1. GREAT WHITE SHARK
2. WHALE SHARK
3. GREY NURSE SHARK
4. MEGAMOUTH SHARK
5. SEVEN GILLED SHARK
6. TIGER SHARK
7. BULL SHARK
8. WOBBOGONG SHARK



This is a wobbegong. It can rest in as little as 50 cm of water under ledges.



SHARKS AND SUSTAINABILITY Activities Booklet

3. Cultural perspectives

As for many coastal Indigenous peoples around the world, the shark is an important symbol for many Aboriginal and Torres Strait Islander cultures. The shark appears in numerous stories, dance and paintings from different groups around Australia.

3.1 Shark dreaming story

The shark is an important ancestor spirit of the Yolngu Aboriginal people from Arnhem Land in northern Australia. The Yolngu people believe that the world was made during the Dreaming (before the first morning) by ancestor spirits. Several Yolngu clans have shark totems and Dreaming stories about the Ancestor Shark *mana*. Dreaming stories usually explain how the land came to be shaped and inhabited; how people should behave and why; where to find certain foods; and how to navigate around the country.

The Yolngu believe that during the Dreaming, the Ancestor Shark travelled around the land and sea, creating and naming features of the land as he went. In some stories, he was injured or killed, and his many shark children were attracted to the saltwater. These shark Dreaming stories explain how the coast came to be shaped like it is and why there are many sharks in the sea. Telling Dreaming stories to children is a very important way that they learn.

Activity

You need:

Writing paper
Ruler and pencils

Discuss the structure of a story - a story has a beginning, a middle in which one or more events take place and an ending.

Explain that the Shark Dreaming stories of the Yolngu tell why their landscape is like it is:

- why the saltwater is choppy and rough (injured Shark thrashed around)
- why there are many little sharks in the bay (Shark's children attracted to blood)
- why there are two round boulders on a beach (Shark's eyes)
- why the Pandanus trees have leaves like spines (Shark's teeth)
- why the rocks on some beaches are red (Shark's blood)

(The information in brackets relates to actual stories; children do not have to follow these and should come up with their own ideas.)

Ask children to choose one aspect of the Yolngu landscape (or make up their own) and write a story to explain how the Ancestor Shark created it. Ask children to rule three boxes onto their sheet of paper. The middle box should be larger than the other two. Children should write their stories in the boxes.

SHARKS AND SUSTAINABILITY

Activities Booklet – 3. Cultural perspectives

Box 1. The beginning should introduce the Ancestor Shark and where he is. Discuss how to begin a creation story (“In the Dreamtime..”, ‘Before the first morning...’, “When Ancestor Spirits travelled the land...”)

Box 2. The middle should describe an adventure of the Shark. Discuss the characteristics, good or bad, that the Ancestor Shark might have (large, powerful, brave, mean, fearsome...), other characters (turtles, fish, stingrays, men...) and possible events that might form the story (a fight, a hunt, a chase, an encounter, an accident, a friendship, a love, a parting...)

Box 3. The ending should link the action to the landscape. Discuss possible endings (“That is why today....”, “To this day....”, “This place is the”)

Extension

Read or listen to other Aboriginal creation stories. Discuss what these stories are explaining about the landscape or the animals that live there.

More information on storytelling: <http://www.dreamtime.net.au/index.cfm>

3.2 Bark Painting

Yolngu Dreaming stories are also told through ceremonial song and dance and by traditional designs painted onto bark. The Ancestor Shark *Mana* is usually painted in X-ray style showing the liver. The liver represents ‘the child within’ or future generations of shark clan people. He is also sometimes shown with his many shark children, travelling across the saltwater. Look at Yolgnu bark paintings of the shark using references such as ‘Saltwater. Yirrkala Bark Paintings of Sea Country’.

(Reference: *Saltwater. Yirrkala Bark Paintings of Sea Country* 1999. Buku-Larrngay Mulka Centre in assoc with Jennifer Issacs Publishing. ISBN 0 646 37702 7)

Activity

You need:

Bark suitable for painting – stringybark, paperbark
Sticks and feather quill or similar
Paint or ochre (traditional colours - yellow, red, tan, brown, white, black)
Clear lacquer
String
Pictures of Aboriginal bark paintings

Show children a few examples of traditional Aboriginal bark paintings. Explain that such paintings are designed to tell a story such as the Dreaming story in the previous activity. Ask children to suggest the story behind each painting.

Examine the style of painting that is typical of the Yolngu bark paintings from northern Australia. Explain that ‘X-ray style’ is the name given to paintings where the animal’s internal organs can be seen. Point out that lines and cross-hatching as well as blocks of solid colour are used to fill the entire space of the painting.

Ask children to think of a design that will illustrate their story about Mana, the Ancestor Shark. Consider how you will show the Shark, his shark children, the saltwater, any rocks, islands or other features in the Shark’s country and whether there are other characters in the story that should appear.

SHARKS AND SUSTAINABILITY

Activities Booklet – 3. Cultural perspectives

Help children to smooth the surface of the bark ready for painting. Draw your design onto the bark using pencil. Use a stick or feather quill to colour in your design with ochre or paint. Experiment with lines and cross-hatching.

When dry, spray clear lacquer over your painting and attach string to hang. More information on bark painting techniques:

http://www.mbayaq.org/efc/efc_smm/smm_gallery_au_art.asp

3.3 Shark symphony

As sharks are important symbols to Aboriginal and Torres Strait cultures, it is not surprising that they appear in many traditional songs and dances. Traditional instruments of Indigenous peoples include the yidaki (didjeridu), clapsticks, boomerangs, clubs, large conch shells, seed rattles, hollow logs and reptile skin drums. Hand clapping and lap/thigh slapping were also used.

Activity

You need:

CD: Songs from the Northern Territory 4: Aboriginal Music from North-Eastern Arnhem Land Including Groote Eylandt. (Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS): AIAS 4 CD).

Materials to make simple instruments: shakers, clapsticks, drums, lengths of pipe as *didgeridoos*, etc

Talk about how music is used to convey feelings and ideas; give some examples that children are familiar with. Explain that the music you are about to play is made by Aboriginal people in the Northern Territory and 'describes' how sharks move.

Listen to Track 12 b.

"Shark sung with didjeridu - an account is given of the smooth, gliding movements of several sharks, their fins, their teeth and their steering tails."

Ask if the children recognise any instruments on the track. Discuss the tempo, tone and feel of the music. What 'picture' of sharks does this music portray? What story does the music tell about the sharks? Why might Aboriginal people of northern Australia think about sharks in this way?

Make a list of traditional Aboriginal instruments – didgeridus, clapsticks from different wood, shell 'rattles', boomerangs slapped together, lizard skin drums...

Ask children to make their own simple instruments from items in the classroom. They could also bring in any instruments from home.

Hold a music circle, taking turns to play your instruments as individuals, groups and all together to 'tell a story' about the shark. You could also use body percussion – slapping different parts of your body to make various sounds. Try different tempos, volumes and kinds of sounds to suggest specific moods and actions of the shark.

More information: <http://www.manikay.com/albums/sfnt4.shtml>

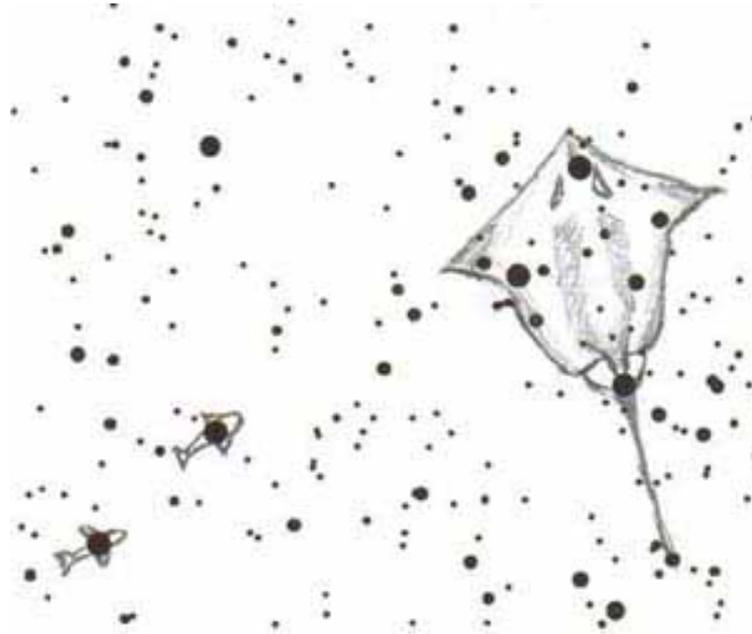
<http://aboriginalart.com.au/didgeridoo/instruments.html>

SHARKS AND SUSTAINABILITY
Activities Booklet – 3. Cultural perspectives

3.4 Shark astronomy

Sharks also feature in Aboriginal astronomy. Astronomy is the study of the stars and planets. Star patterns are usually linked to Dreaming stories which are used for finding direction. Aboriginal people, even young children, traditionally found their way by knowing the positions of the sun, moon and stars.

Aboriginal peoples have their own stories and names for stars. To the Ngarrindjeri people in coastal South Australia, the Southern Cross is a stingray, *Nunganari*, being chased by two sharks *Ngarakani* (the two pointer stars, Alpha and Beta Centauri) across the night sky. Only their fins can be seen.



Aboriginal Skies

Source: <http://ching.apana.org.au/~paulc/loreaussie.html>

Reproduced with permission from Paul Curnow

Activity

You need:

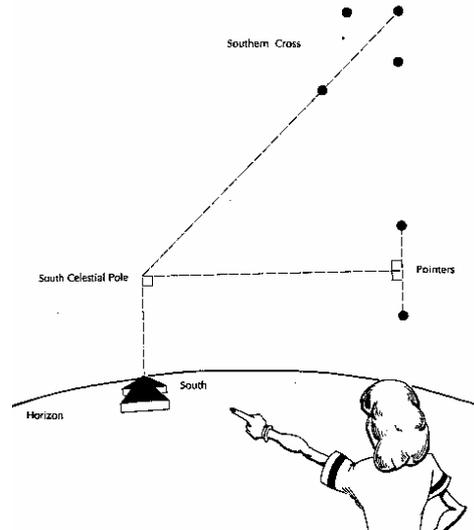
Star chart
Sheet of paper and pencil
Map of Australia

Look at the star chart and identify the Southern Cross. Make your own celestial chart showing the stingray being chased by two sharks (pointers).

Show students how to use the Southern Cross to find south.

SHARKS AND SUSTAINABILITY

Activities Booklet – 3. Cultural perspectives



Source: ReefEd, Great Barrier Reef Marine Park Authority, 1988. ISBN 0 642 12040 4

Discuss how knowing the story about sharks and a stingray might have helped people to find their way at night.

Identify other well-known star groups – the Saucepan, the Milky Way, the Pleiades, etc. These stars are also known differently by Aboriginal people. Consider the animals and objects that would have been familiar to traditional Aboriginal people and using your imagination, draw how Aboriginal people may have seen these star groups.

In small groups, discuss the reasons night skies were important to Aboriginal peoples in the past. Discuss the statement “The earth and sky is like a book for illustrating teaching stories.” In your group, make up one or several supporting statements that explain the first statement. Begin your supporting statement with “This is because... ”

Extension

Other groups of Aboriginal people have different stories associated with the Southern Cross – in Arnhem Land it is a friendly crocodile, in Central Australia it is an eagle hawk and in northern Victoria it is a ring tailed possum. In small groups, study a map of Australia and discuss why different groups might know the same stars by different names and stories. Report your ideas back to the class.

Source: <http://www.assa.org.au/nacaa/aaaip.pdf>

SHARKS AND SUSTAINABILITY
Activities Booklet – 3. Cultural perspectives

3.4 Torres Strait Island shark mask

Sharks are totems for some Torres Strait Islander people. Totems are animals that are very special - they are respected and revered. Shark totems are an important part of Torres Strait Islander culture and are represented in their traditional dances.

People from each island group have their own special dances which are performed at cultural events around the region. Each dance has a different costume which includes spectacular and distinctive head dresses. The traditional head-dress, *dari*, made of feathers, bamboo, string and paint, has become a symbol of Torres Strait Islander culture and features on their flag. Islanders continue to make dance costumes today – they still use traditional methods but use a wide range of materials. As well as natural local materials such as woods, fibres, leaves, feathers and shells, they often use plywood, tin and plastic and finish the work with bright enamel paint.

Hammerhead shark dance head-dresses, such as the ones illustrated here, are contemporary versions of traditional shark head-dress designs. Ken Thaiday, a Torres Strait Islander who lives in Cairns, made these head-dresses from black bamboo, plywood, string, plastic and resin. The white plumes around the jaws represent the foam breaking around the shark's mouth as it surfaces to swallow a school of baitfish.

More information:

<http://www.abc.net.au/arts/artok/craft/s197254.htm>

<http://www.cairnsregionalgallery.com.au/ianpasin/edukit.pdf>



Ken Thaiday Sr. *Beizam [Hammerhead shark] dance mask* 1994 black bamboo, plywood, wire, string, plastic, resin, nails, enamel paint
Collection of the artist. Image and reproduction courtesy of the artist and Cairns Regional Gallery.



Performance of the shark dance by Ken Thaiday Sr. and the Loza Dancers at a Cairns Regional Gallery exhibition opening in February 1996. Photography by David Campbell. Image and reproduction courtesy of the Cairns Regional Gallery.

Reproduced with permission from Ken Thaiday and the Cairns Regional Gallery

SHARKS AND SUSTAINABILITY
Activities Booklet – 3. Cultural perspectives

Activity

You need:

Two A4 sheets of thick white paper or card (160 gsm)
Sticky tape or stapler
Two straws (bendy straws work best)
Cotton wool
Collage materials (optional)
Paints
Scissors
Glue

On one sheet of card, trace or photocopy the shark mask outline. Fold in half as shown and cut out the shape. On the other sheet of card cut out a strip 4cm wide along the longest side of the sheet. This is the head band. Paint the shark mask and head band and allow to dry. When dry, decorate the shark mask and head band by glueing on cotton wool or other textured collage materials (dried seaweed, sand, tiny shells, etc)

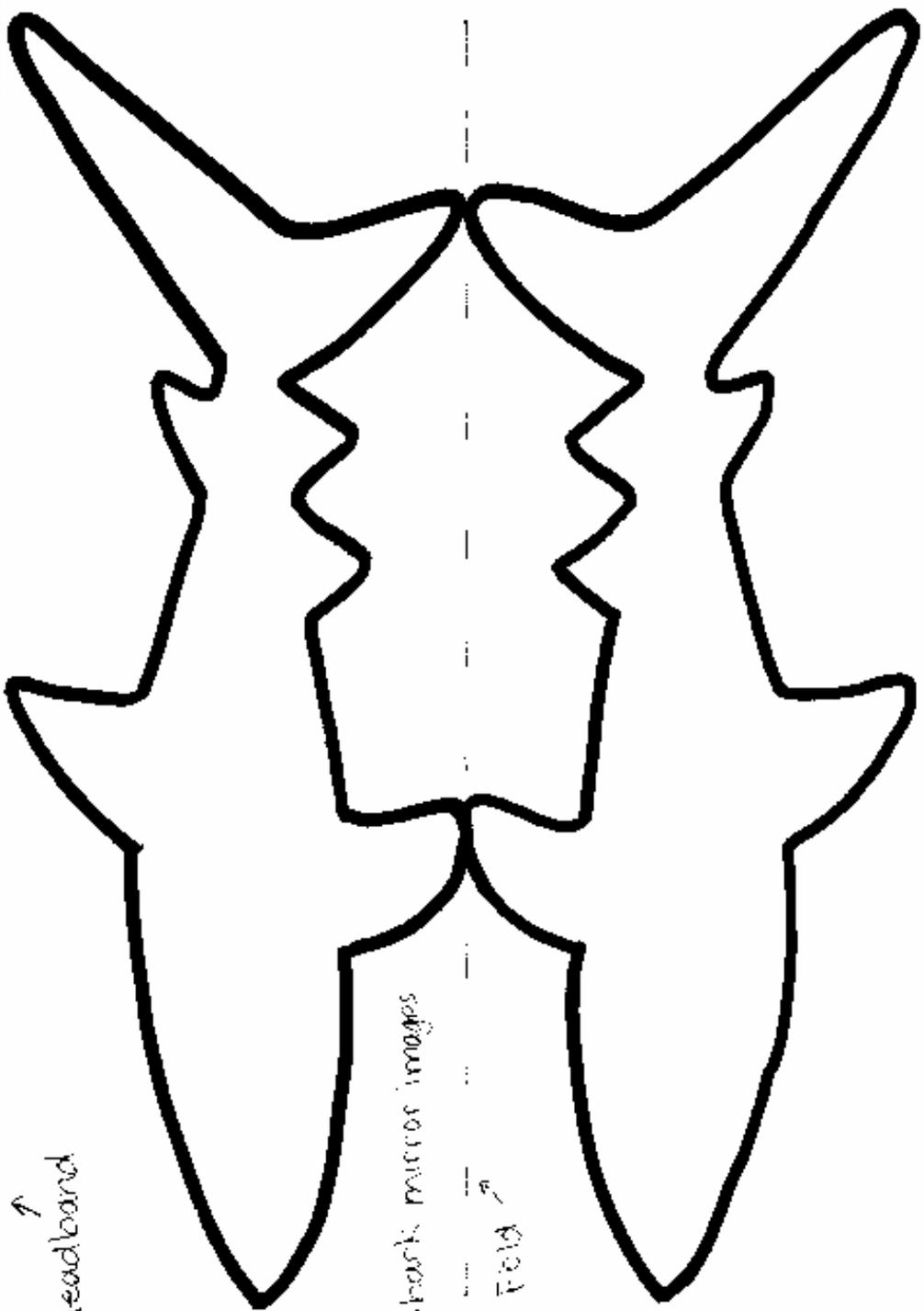
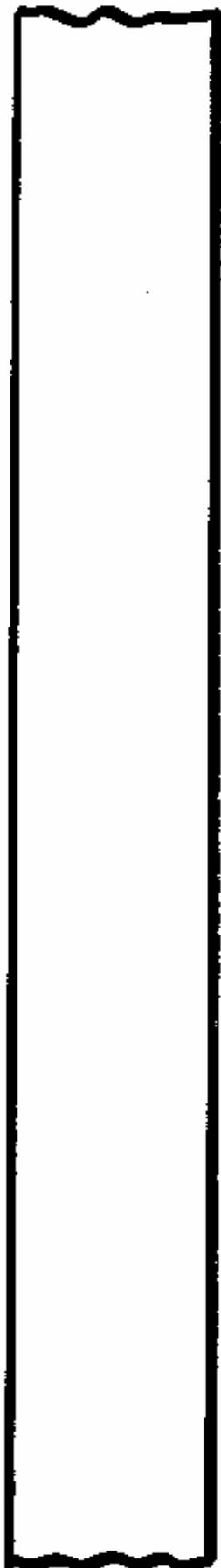
Take the remaining piece of card and fold it in half lengthways. Draw your own shark, taking up most of the card, and cut it out. (A shark shape in mirror image is provided for photocopying if required). You should have two mirror images of a shark. Glue the shapes together, inserting a straw between the shapes at both the head and tail ends, so that your shark is held up by the straws. You may also need to staple the straws to the card for extra strength. Paint your shark in bright colours.

To assemble, use sticky tape or a stapler to attach the head band to the mask, adjusting to fit. (The mask covers the entire face; you look out between the 'jaws'). Then tape or staple the straw holding the shark's tail to the back of the headband, adjusting the length of the straw so that the shark sits above your head. Lastly, attach the straw holding the shark's head to the front of your mask, and trim the straw so that the shark sits horizontally.

Now you are ready to do the shark dance!

Extension:

Research and write a report on shark totems and what they mean to people of the Torres Strait. Include in your report a definition of totems, some of the rules relating to totem animals and your ideas on how these rules may have influenced the conservation or otherwise of these animals in the past.

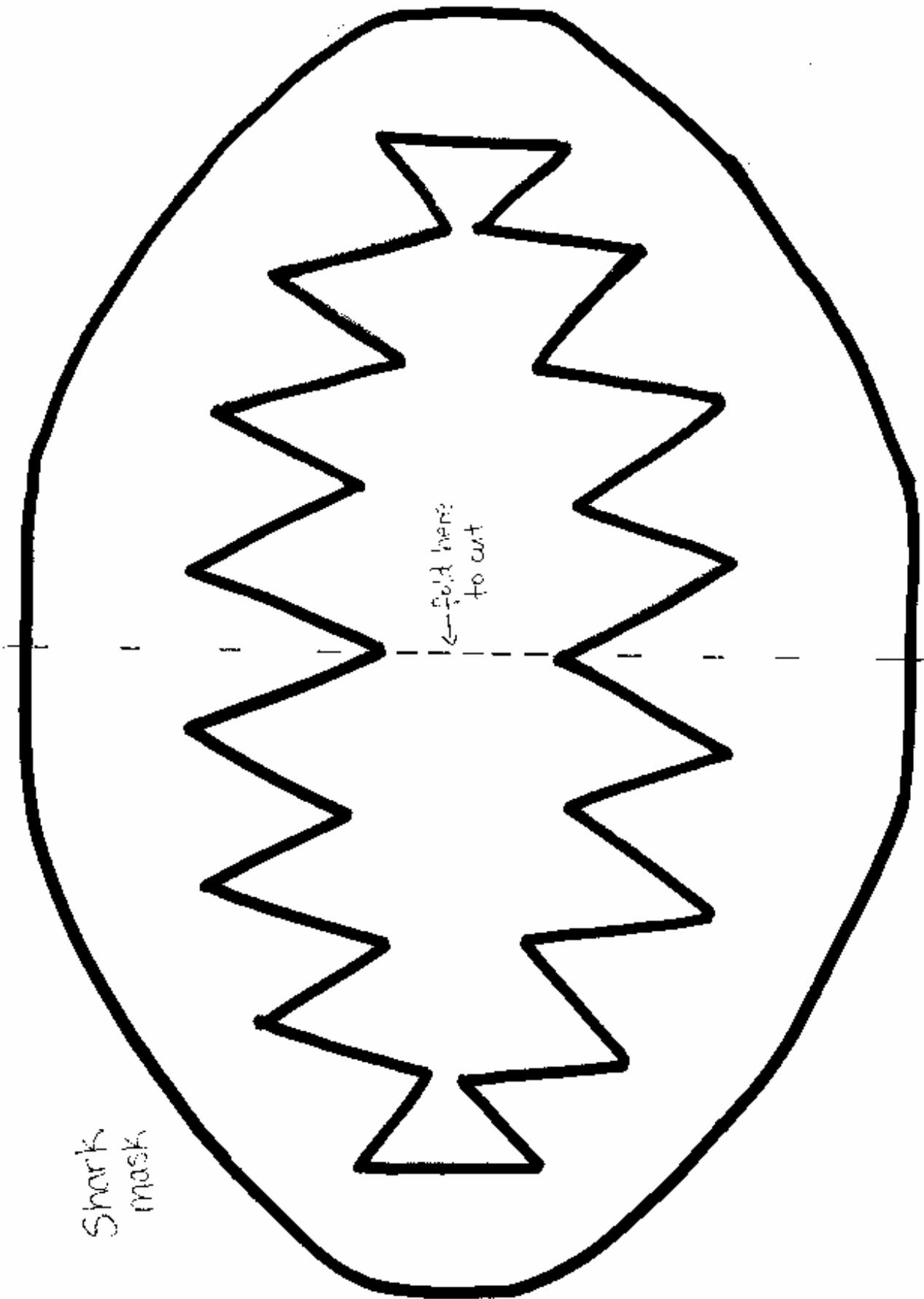


↑
Headband

Shark mirror images

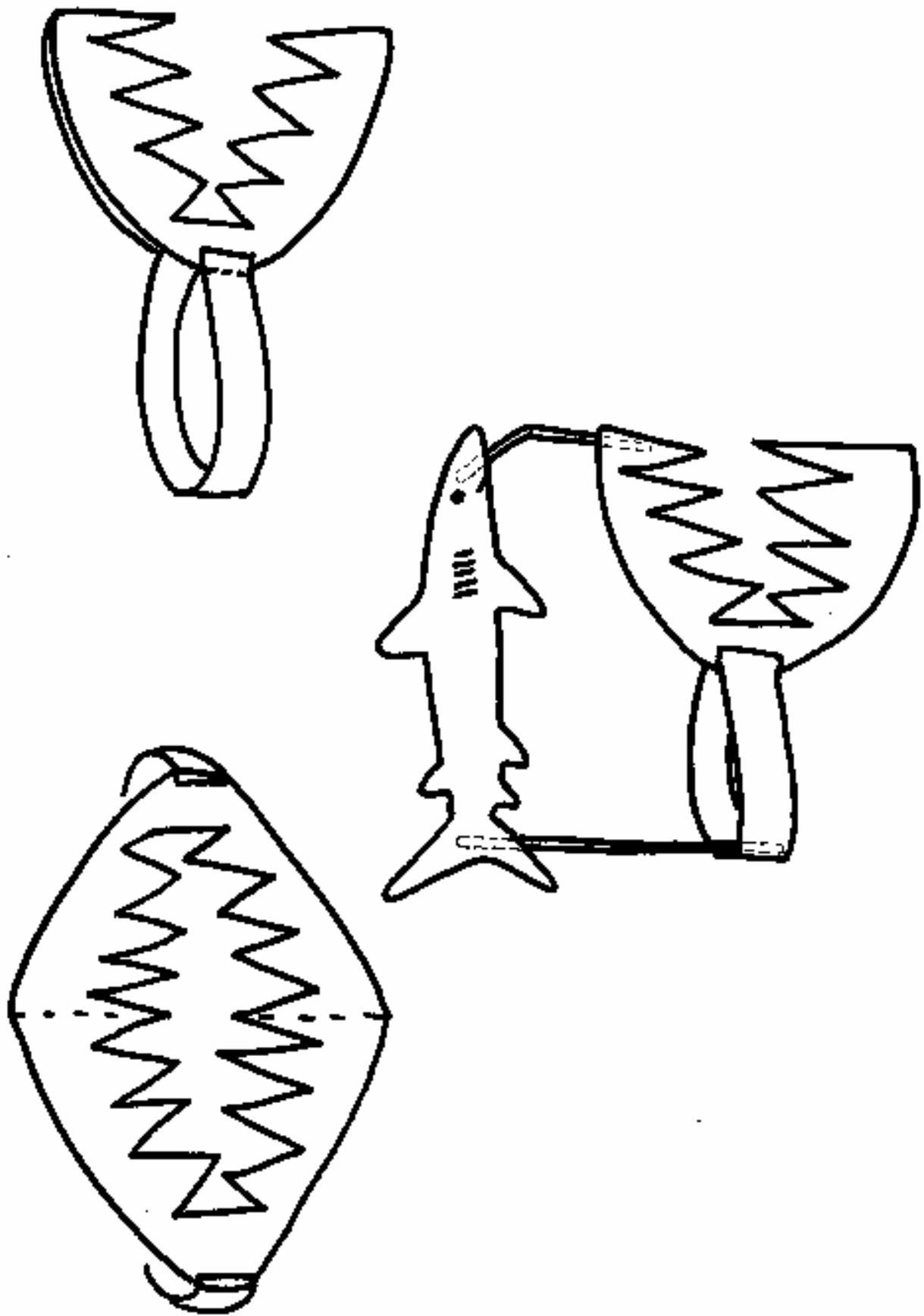
Fold →

Shark body outline



Shark
mask

Shark jaw blackline



Shark Mask Construction

SHARKS AND SUSTAINABILITY
Activities Booklet – 3. Cultural perspectives

3.5 Shark prints

The shark, Baidam, is one of eight totems for Mer (Murray Island) in the Torres Strait. (Mer is well-known as the island home of Eddie Mabo and his long struggle for land rights). Sharks are well-respected throughout the Torres Strait and seen as a symbol of law and order. They are revered as excellent hunters of the deep. Baidam is also the name of the traditional head-dress worn by initiated men of a feared cult from eastern Torres Strait, renowned for shark masks made of turtle shell.

Brian Robinson, a Torres Strait Islander artist, has created a linocut print of the shark, called *Lurking Baidam*. A linocut is made by cutting a design into lino (similar to the stuff on the kitchen floor). Ink is then placed onto the lino and when a sheet of paper is placed on the lino, it comes away with the design printed on it. In this linocut print, Brian has shown the shark as it is often seen underwater – mysterious, fragmented in the dappled light filtering down from the sea's surface, an image that is half-seen, half-imagined. He says, "Sharks are one of the most mysterious and misunderstood creatures in the sea". Do you agree with this?



Brian Robinson *Lurking baidam* 1999 linocut, hand coloured
Collection of the artist. Image and reproduction courtesy of the artist.
Reproduced with permission from Brian Robinson

SHARKS AND SUSTAINABILITY
Activities Booklet – 3. Cultural perspectives

Activity

You need:

Paper and pencil
Lino or similar suitable material for printing
Cutting tools
Newspaper
Paint or ink in various colours

In small groups, brainstorm words and ideas that describe how you feel and think about sharks. Look at Lurking Baizam and list the ways that Brian has made the shark seem mysterious and misunderstood.

Sketch a design of a shark that shows your ideas and feelings about sharks. Draw your design onto the lino. Use a simple outline for the shark and add some texture or lines inside the shape. Fill in the background as well. Place your lino onto thick newspaper and carefully cut or carve your design into the lino.

Roll or dab paint or ink onto the linocut. Place a sheet of paper carefully over the linocut and pull away. Your design will be printed onto the sheet of paper.

Experiment with different colours and textures by using different applications of paint or ink. In this way you can make different prints from the same linocut. Do some colours and textures convey your ideas better than others?

Extension:

Use brainstorming or small group discussion and reporting techniques to explore these points:

How were sharks viewed by Torres Strait Islanders in traditional times? How do you know? How were these views about sharks incorporated into traditional culture? What does contemporary artwork such as Brian's linocut say about sharks today? Does Brian try to combine both traditional and present-day views about sharks in his work? How do you know?

Create a survey to find out what students in your class think about sharks. Can you find out if sharks have different meanings for people from different cultural backgrounds? Can you find out whether people who are familiar with swimming, surfing and diving in the sea have different views from those who don't have such experiences? What other information can you find? Present your findings as a wall chart or graph.

SHARKS AND SUSTAINABILITY
Activities Booklet

4. Stormwater – an issue for sharks

It is often beyond our comprehension to discover that everyday things done on the land can affect life far out in the ocean including sharks. It has a lot to do with the nature of water itself.

CITY OF GREATER GEELONG
Geelong businesses - working together for healthy waterways

All stormwater that enters our drains needs to be kept free of pollutants from industry and businesses.

By managing your workplace to prevent stormwater from becoming polluted you are assisting in the protection of Geelong's unique waterways.

Contact Council to find out more about ways you can improve the quality of stormwater draining from your site.

Polluted water coming from the land has a profound affect on the marine environment in the coastal zone.

The run-off water picks up and transports all kinds of suspended matter and litter which then moves with increasing speed into the nearest receiving waterway; creek, river, lake and sooner or later to its final destination, the ocean.

As it hits the earth each raindrop creates like a tiny explosion. Rain showers dislodge and sometimes dissolve pollutants that have collected on hard surfaces like roofs, roads and car parks.

Some of the pollutants that come from people or business in cities and towns are:

Nutrients: (Nitrogen and phosphorus)

- Garden fertilizer
- Carwash detergent
- Grass clippings

Poisons (toxicants)

- Paint and turpentine

Hydrocarbons (oil and petrol)

- Engine degreaser
- Two stroke oil

Sediments

- Sand and gravel
- Plaster
- Cement

Permission for use of this poster was given by the City of Greater Geelong in Victoria.

SHARKS AND SUSTAINABILITY
Activities Booklet - 4. Stormwater – an issue for sharks

4.1 Mutant pollutants

Ring your local council to find out the name of the company that cleans out the cities gross pollutant traps (GPTs). Arrange a visit to view the clean out of a local GPT.



What you will need:

- Some tongs & long sticks
- Gum boots
- A note book
- A map of the local run-off catchment or watershed

Your job, should you choose to accept it, is to take note of the kinds of rubbish observed. Record the numbers of each kind of litter using tongs. Collate your information.

Look at the list of some pollutants that can contaminate the ocean then choose one you have observed. Consider what set of circumstances might cause that pollutant to find its way into the sea.

Primary students: Prepare a chart of the pollutants you have observed and illustrate it.

Secondary students:

- Prepare a graph of the pollutants observed. Did the GPT collect all of the pollutants?
- Develop a strategy for educating, regulating and then enforcing stormwater quality improvements.
- Research and write either a media release for a newspaper or design a public service announcement to be aired on television.

SHARKS AND SUSTAINABILITY
Activities Booklet - 4. Stormwater – an issue for sharks

4.2 Keep it clean

Sharks are super-predators, that is they eat other predators. Pollution from stormwater including heavy metals and other toxicants are concentrated predatory fish. These chemicals may affect both the sharks and those that prey on sharks. What other animals prey on sharks?

If we think of the ocean as a vast bowl, it shouldn't be too hard to create an ocean simulation and to show a stormwater outfall feeding into it.

You will need

- Wet area and a bucket or two
- Large glass bowl or small fish tank (no fish)
- Plastic shark or other sea creature (optional)
- Pollutants:-
 - grass clippings (or garden leaves)
 - soap flakes (or dish soap)
 - car oil (you can use soy sauce)
 - dirt (you can use cocoa powder)
 - toxicants (you might choose to use food colouring or glitter for heavy metals).
 - One length of plastic PVC pipe
- A fish net
- Tongs

Task 1: Create an ocean and an outfall.

Hold the PVC pipe position it so that water pouring in at the top fills a large bowl or tank with clean fresh water. Observe water carefully, are there bubbles on the glass. What might this be? If you have a plastic shark put it in the tank.

Gather together samples of pollutants and one by one explain what the pollutant is and tip it into the PVC pipe (still aimed at the inside of the bowl). Add more water to simulate a rain shower which washes the pollutant down. Repeat with each of the pollutants.

The result is very likely what you expected it to be. Can you still see your plastic shark. Do you think he'll be able to live in this ocean?

Task 2: Clean it up

If your bowl is an ocean you can't just tip it out. What can you do to clean up the polluted water?

If you have used a toy shark, take it out and have a look at it.

Can you draw any conclusions about keeping the stormwater clean? Do you think it is easier to keep it clean or to try to clean it up before it escapes into the receiving water?

The Rays and Sharks fact sheet makes reference to the effects of coastal development. How can this affect inshore habitats?

SHARKS AND SUSTAINABILITY
Activities Booklet - 4. Stormwater – an issue for sharks

4. 3 It's a matter of concentration

You will need:

- Commercial fishing fact sheet
- Internet access
- Telephone access

We know that sharks are one of the fish that people eat. But what hidden substances are we eating when we eat shark? If we tried to make a comparison with things we know better (land animals), the comparison suffers.



The contents of a GPT

Land predators, like people, mostly eat animals that are plant eaters. In the ocean it is a bit different.

The little plant plankton are eaten by other tiny animal plankton, then larger animals are eaten in turn by larger fish and again by larger fish and so on to the high level predators, the sharks. There is no equivalent predator on the land.

Each time an animal is eaten by another you could almost say that the elements of that animal are condensed and concentrated in the one that consumed it. A toxic element, mercury for example, becomes increasingly concentrated in higher ocean predators like tuna, swordfish and sharks.

Take some time to research which government bodies are responsible for the quality of the stormwater run-off into the rivers, lakes and ocean. Is it the same organisation(s) for both the urban and rural areas?

- Locate the stormwater drain nearest to your school. Arrange a visit from a local WaterWatch or water monitoring group and ask them to demonstrate water testing at the drain outlet.
- Determine a regime for continued testing and a protocol for raising the alert if findings are considered outside of norms.
- Design a communication strategy to make relevant stakeholders (who are they?) aware of any problems or good news reports.
- Present your findings and recommendations to the class and write an article for the school news.

HINT: You will find a high school VCE Environmental Science study design that includes **Mercury**. It can be found at www.vcaa.vic.edu.au/vce/studies/envscience/envscindex.html (pages 47 and 48).

SHARKS AND SUSTAINABILITY Activities Booklet

5. Researching shark topics

Media reports on shark related topics can be quite interesting to follow and often result in more questions. Anyone who is interested in sharks needs to know how to find out more about them. One way of doing that is through 'desktop' research.

To learn more about sharks to increase your knowledge it might be useful to employ the shark links provided in the Seaweek website list to do some of your own research on sharks. Decide what sort of shark or shark topic you'd like to research, whether it is an issue or just knowledge about a particular shark. Here are some suggestions:

You will need:

- Diversity, Biology, Commercial Fishing and Roles of sharks fact sheets from the MESA Seaweek 2005 website.

5.1 Find out more about a particular shark

A few common names of shark or rays:

- Angel
- Bat Ray
- Grey Nurse
- Gummy
- Port Jackson
- Shark Ray
- Whale
- White



Courtesy of Sean Van Sommeran
Pelagic Shark Research Foundation

5.2 Investigate what issues surround sharks

Some relevant topics might be:

- Shark protection
- Medical discoveries made from sharks
- Shark tagging
- Shark habitats
- Shark laws
- Threats to sharks
- Principles of sustainability

Use your computer (at school or the library or at home) to search the web for your topic. Use the shark links provided to get a head start.

HINT: Sometimes you may need to use inverted commas on each side of the key words to get your best result from search engines on the Internet.

SHARKS AND SUSTAINABILITY
Activities Booklet - 5. Researching shark topics

- 1) List the key information about your shark topic that
 - a) you didn't know before (where they live, what they do, how they move, what they eat, who eats them) or
 - b) things that might indicate why sharks are important to a healthy ocean.

- 2) See if you can find answers to some of the questions that scientists and ocean managers might ask in relation to sharks:
 - 1) How & where sharks might contribute to a clean healthy ocean?
 - 2) How sharks do contribute to biodiversity, why do we need sharks?
 - 3) How are sharks important to people and culture?
 - 4) How long have sharks been around and why have they lasted so long?
 - 5) How we can help sharks to continue to do their job?
 - 6) How can we live with them while they do it?

Refer to Appendix 1

SHARKS AND SUSTAINABILITY
Activities Booklet - 5. Researching shark topics

FUNKY FACTS WORKSHEET		
Match each description in Column B with one of the names of the sharks in Column A. Write the number from Column B next to the matching shark name.		
Column A	Column B	
BLUE WHALER	1.	This shark is a huge 5-6 metre long deep ocean giant with a huge 1 metre wide mouth designed to filter plankton and small fish.
WHITE TIPS	2.	This is one of the fastest sharks in the world which can leap repeatedly out of the water by reaching a velocity of up to 35 km/hour.
BOTTOM DWELLERS	3.	The largest shark actually captured weighed 3130 kg (7302 lbs) and was 6.5 metres (21 feet).
WHITE SPOTTED DOGFISH	4.	This shark's tail is over 40% the length of its body. It is used to thrash into schools of fish stunning many of them before they are devoured.
MAKO SHARK	5.	One species of shark has reflective crystals set in the retina of the eye arranged to reflect light back onto the light receptor cells enabling them to see extremely well at night.
LEMON SHARKS	6.	This shark can live in less than 1 metre of water as close as 1 metre from the rocks you may be sitting on near the coast.
GREY NURSE	7.	This shark has a high density set of cones (colour receptor cells) in the retina of their eyes enabling them to see in colour.
GUMMY SHARK	8.	The smallest shark measures a maximum size of 15 cm.
MEGAMOUTH SHARK	9.	Some sharks, having eaten fully, need 4 days for them to be hungry again.
THRASHER SHARK	10.	Almost half of all Australian sharks live in this habitat.
GREAT WHITE SHARK	11.	This shark can swivel 180 degrees over the hiding spots of their prey to flush them out of the sand.
COOKIE CUTTER SHARK	12.	These babies eat each other in the womb. Only the strongest one is born.
PORT JACKSON SHARK	13.	This is the biggest shark in the world.
HAMMERHEAD	14.	This is one of the species of shark that has 5 claspers.
CHIMERAS	15.	This shark can live approx 70 years.
GREY NURSE SHARK	16.	This shark species which is potentially dangerous to humans can travel over 100 km up rivers to fresh water.
GREY WHALER	17.	These reach maturity at 2-3 years and live for 10-15 years.
WHALE SHARK	18.	This shark's stomach secretes strong hydrochloric acid to help stimulate digestion of protein and dissolve bones.

SHARKS AND SUSTAINABILITY
Activities Booklet - 5. Researching shark topics

TIGER SHARK	19.	This shark is one of the species that have the fastest growth rates of 30 cm/year until maturity.
GREAT WHITE SHARK	20.	This shark may weigh up to 5 tonnes and have a liver that alone may weigh over 1 tonne (25% of its body weight).
WOBEGONG SHARK	21.	The mother's uterus of this kind of shark also secretes a kind of milk, which is absorbed through the skin of the baby sharks.
BULL SHARK	22.	A strange spiral like egg case is often found washed up on the beach of this well known shark.
BASKING SHARK	23.	This shark can float motionless mid water.
DWARF DOG SHARK	24.	This small shark has the biggest and most frightening set of teeth for a shark of its 30 cm size.

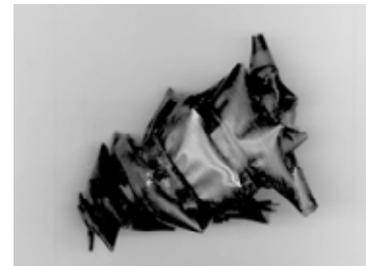
SHARKS AND SUSTAINABILITY
Activities Booklet

6. Biology of sharks

We are fascinated by the shapes of shark eggs some of which look like corkscrews while others are whimsically referred to as mermaid's purses.

BIRTH OF A SHARK

In this activity you may want to observe a live shark egg. UnderwaterWorld at Mooloolaba and the Sunshine Coast Grammar School have created an opportunity for you to be able to view a live shark egg on-line at <http://www.scgs.qld.edu.au/webcam/index.php>



Port Jackson egg case
courtesy of J Plecas



Mermaid's purse with egg yolk and hidden embryo.
Courtesy of George Perina www.seapix.com/merpurse.htm



Stages in the development
of a shark embryo.

Note: Youngest shark to bite a human? A marine biologist, while probing the uterus of a pregnant Grey Nurse (or Sand Tiger Shark in USA), was bitten by an unborn pup!

SHARKS AND SUSTAINABILITY
Activities Booklet – 6. Biology of sharks

6.1 Shark egg activity

You will need:

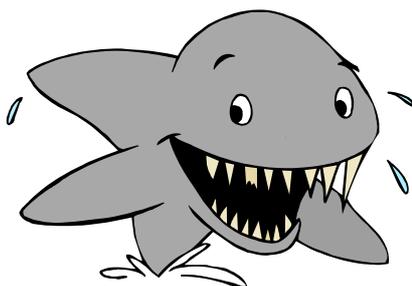
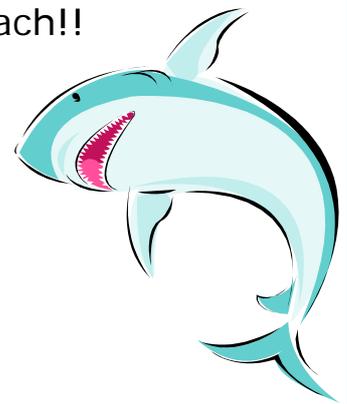
- Worksheet
- Pens or pencils



Shark, skate and ray eggs

Shark, skate and ray eggs are often found washed up on the beach.

Draw and label as many as you can find. You may use resource books, the Internet or even the beach!!



View the online slide show at www.marinediscoverycentre.com.au/Downloads/Sharks.pdf

© Marine Discovery Centre, SA www.marinediscoverycentre.com.au

SHARKS AND SUSTAINABILITY Activities Booklet

6.2 OCEAN TORPEDOS

You will need:

- One piece of clean dry shark skin
- Microscope or magnifying lens
- Transport to fish market / museum
- Permission slips

Sharks are amazing, even their skins are masterpieces of engineering. The nature of shark skins is such that a turbulence layer of water is created around their bodies allowing them to slide through the water much the way jet planes cut through the air.

Visit to fish market:

If your class has the opportunity it might be interesting to see what happens in the city before daybreak by visiting the fish market. Where you are able to arrange it beforehand there is a good chance you can leave the market with a shark skin to use for class research. Clean and dry the skin thoroughly.

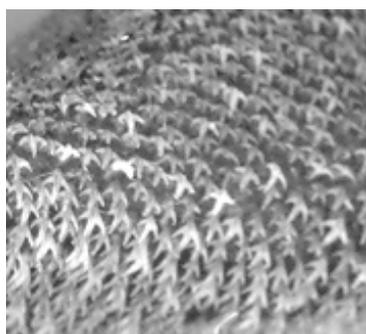
Visit to museum

Make a call to the museum or aquarium to see if they have any shark skins that you can investigate.

Once you have a piece of shark skin to view look at it under microscope or magnifying lens to see its visual characteristics.

If possible, touch the shark skin, first running your hand with the grain and then very, very carefully against the grain.

Record your observations for use in other exercises.



This is a sample of a Pearl Shark skin obtained from a fish sellers stall on a visit to the Queen Victoria Market in Melbourne. The sellers were most surprised at the request. This type of shark was being sold as 'flake' (usually gummy shark). Notice the grappling hook denticles. The denticles act just like Velcro when they come in contact with clothing!



This animal was found washed up on a beach near the heads of Port Phillip Bay.

Trivia: Shark is the most popular fish for the takeaway food trade in south eastern Australia giving rise to the nickname 'Shark Eaters' for people specifically living in the state of Victoria.

Classification Activity Answers

A Bullhead Shark **B** Dogfish Shark **C** Mackerel Shark **D** Angel Shark
E Saw Shark **F** Seven gilled Shark **G** Tiger Shark **H** Carpet Shark

SHARKS AND SUSTAINABILITY
Activities Booklet – 6. Biology of sharks

6.3 Shark Classification Key

Courtesy of Wet Paper Publications

Table 1 shows two ways of classifying these sharks to the order level. One is a dichotomous key, the other a chart.

Figure 1 shows the major features of sharks and Figure 2 contains photographs of 8 different sharks representing major shark groups (Orders).

Use Table 1 to classify each of the sharks to order level. When you have finished summarise your answer in your notebook. Try and find examples from at least three different orders.

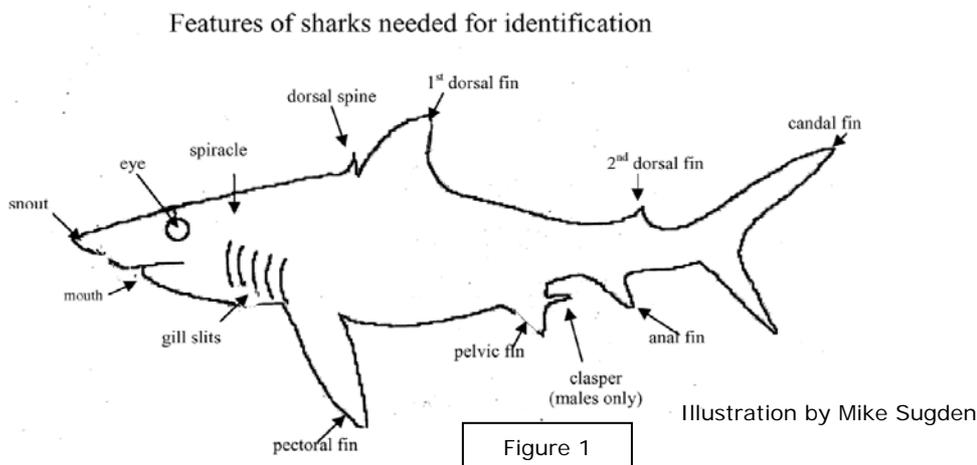


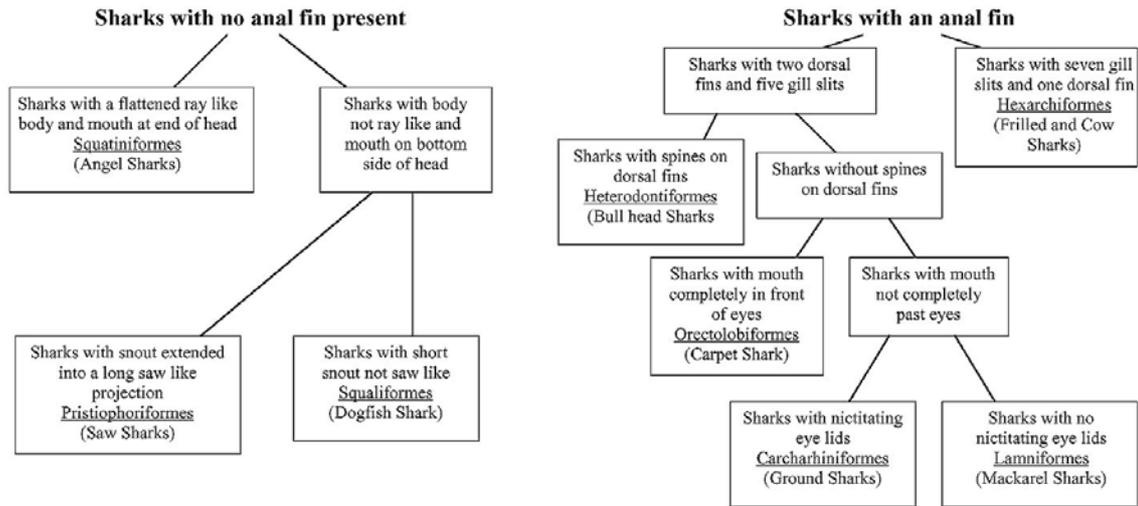
Table 1. Dichotomous key for shark orders

1. a. Sharks with anal fin 4	
b. Sharks with no anal fin 2	
2. a. Sharks with flattened raylike body and mouth at end of head <i>Squatiniiformes</i> (Angel Shark)	
b. Sharks with body not raylike and mouth on bottom side of head 3	
3. a. Sharks with snout extended into a long saw like projection <i>Pristiophoriformes</i> (Saw Shark)	
b. Sharks with short snout not saw like <i>Squaliformes</i> (Dogfish Shark)	
4. a. Sharks with 6 or 7 gill slits and one dorsal fin <i>Hexanchiformes</i> (Seven gilled Sharks)	
b. Sharks with two dorsal fins and five gill slits 5	
5. a. Sharks with spines on dorsal fins <i>Heterodontiformes</i> (Bullhead Shark)	
b. Sharks without spines on dorsal fins 6	
6. a. Sharks with mouth completely in front of eyes <i>Orectolobiformes</i> (Carpet Shark)	
b. Sharks with mouth not completely past eyes 7	
7. a. Sharks with nictitating eye lids <i>Carcharhiniformes</i> (Tiger Shark)	
b. Sharks without nictitating eye lids <i>Lamniformes</i> (Mackerel Sharks)	

Answers for the classification activity at end of page 3.

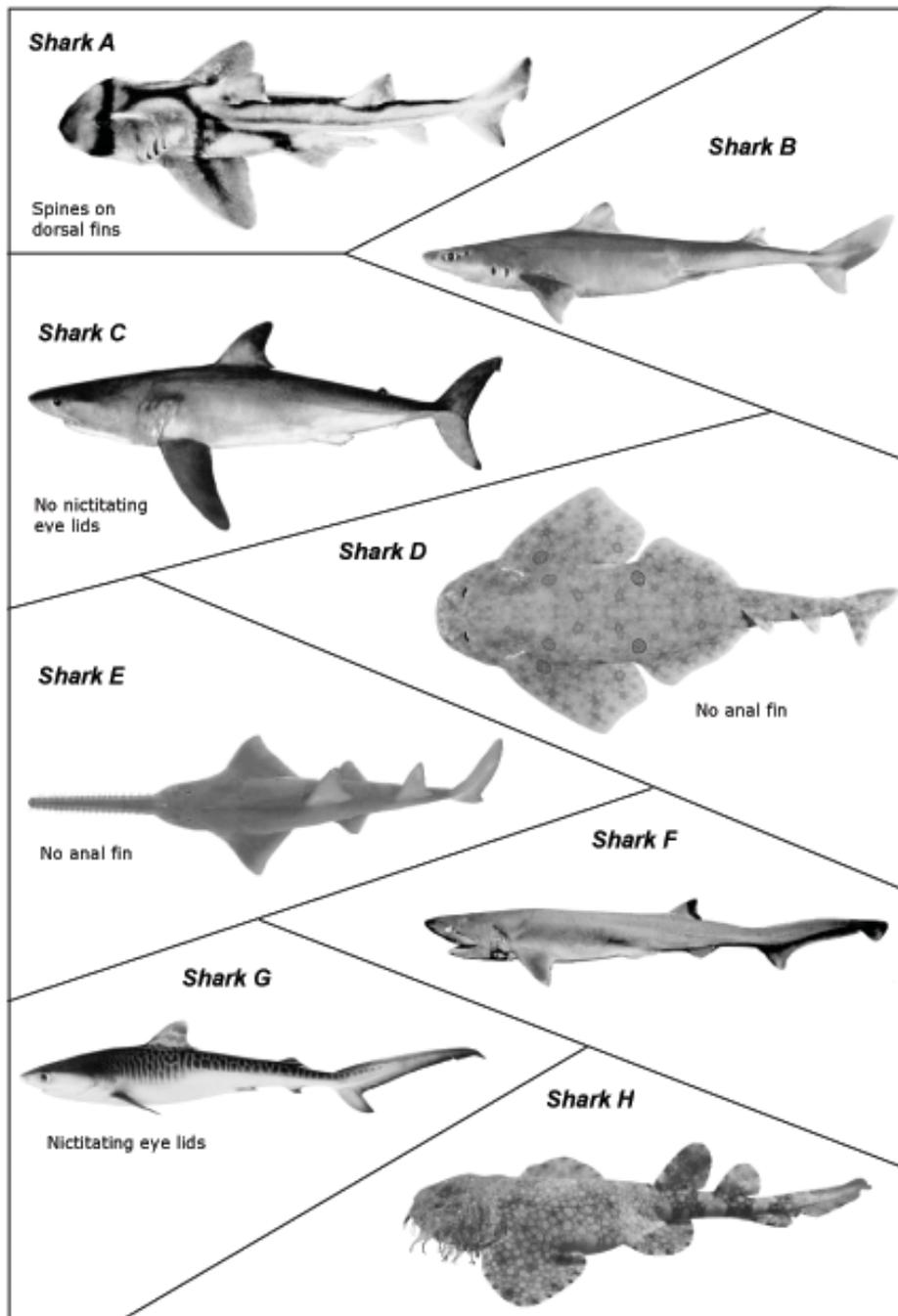
SHARKS AND SUSTAINABILITY
Activities Booklet – 6. Biology of sharks

Table 1. continued



SHARKS AND SUSTAINABILITY
Activities Booklet – 6. Biology of sharks

Figure 2. Shark photographs



Shark photographs
(Photographs courtesy
Dr. Peter Last CSIRO)

SHARKS AND SUSTAINABILITY Activities Booklet

7. Shark art

To get a better mental picture of some of the issues and concerns regarding sharks it is sometimes helpful to express your understanding in different ways. Visual arts are one way to do this.

7.1 Sidewalk sharks

Concept contributed by Monterey Bay Aquarium

After you have done research on your favourite shark (see 5.1) you are ready to try it on for size.



You will need:

- Large sealed floor/footpath/sidewalk or long sheet of brown paper
- Chalk if you use the footpath/sidewalk or pencil and texta/magic marker

HINT: If using brown paper you might draw in pencil, finishing with texta or paint

Find a comfortable floor or footpath.

Draw the shark you have chosen using the dimensions and shape researched.

Make sure the drawing is as long and as wide as your research indicates. When it is complete lie down beside your drawing with feet level to the end of the sharks tail. Mark your height to see how closely you measure up to the shark.

7.2 Posters

You will need:

- Fact sheets on Commercial fishing, Roles in the ecosystem, Shark attack, Sharks and Rays, Whale sharks
- Paper and pens/pencils/paint

“Healthy Oceans” Poster

Make your own Healthy Oceans poster in two parts.

Mark a halfway point in a poster then create a different story for each side:

- What a healthy ocean would have in it
- One that demonstrates an ocean without sharks

When completed ask the school newsletter to run an article on the project with photos of the artwork.

SHARKS AND SUSTAINABILITY Activities Booklet - 7. Shark art

“Save our Sharks” Poster

You could include some interesting facts and captions

- e.g. More people die from coconuts falling than from shark attacks
- More people die from lightning than from shark attacks
- More people die from bee stings than from shark attacks
- People kill up to 70 million sharks per year yet only 5 to 15 people world wide die from shark attacks.

© Marine Discovery Centre, SA www.marinediscoverycentre.com.au

7.3 Design a shark

You will need:

- Shark facts on Diversity, Biology, Grey Nurse and Whale, Sharks and rays
- Internet access and/or library card
- Whiteboard or paper

Create a graphically designed shark as if you were an engineer or create a three dimensional shark of your own design



Foundation

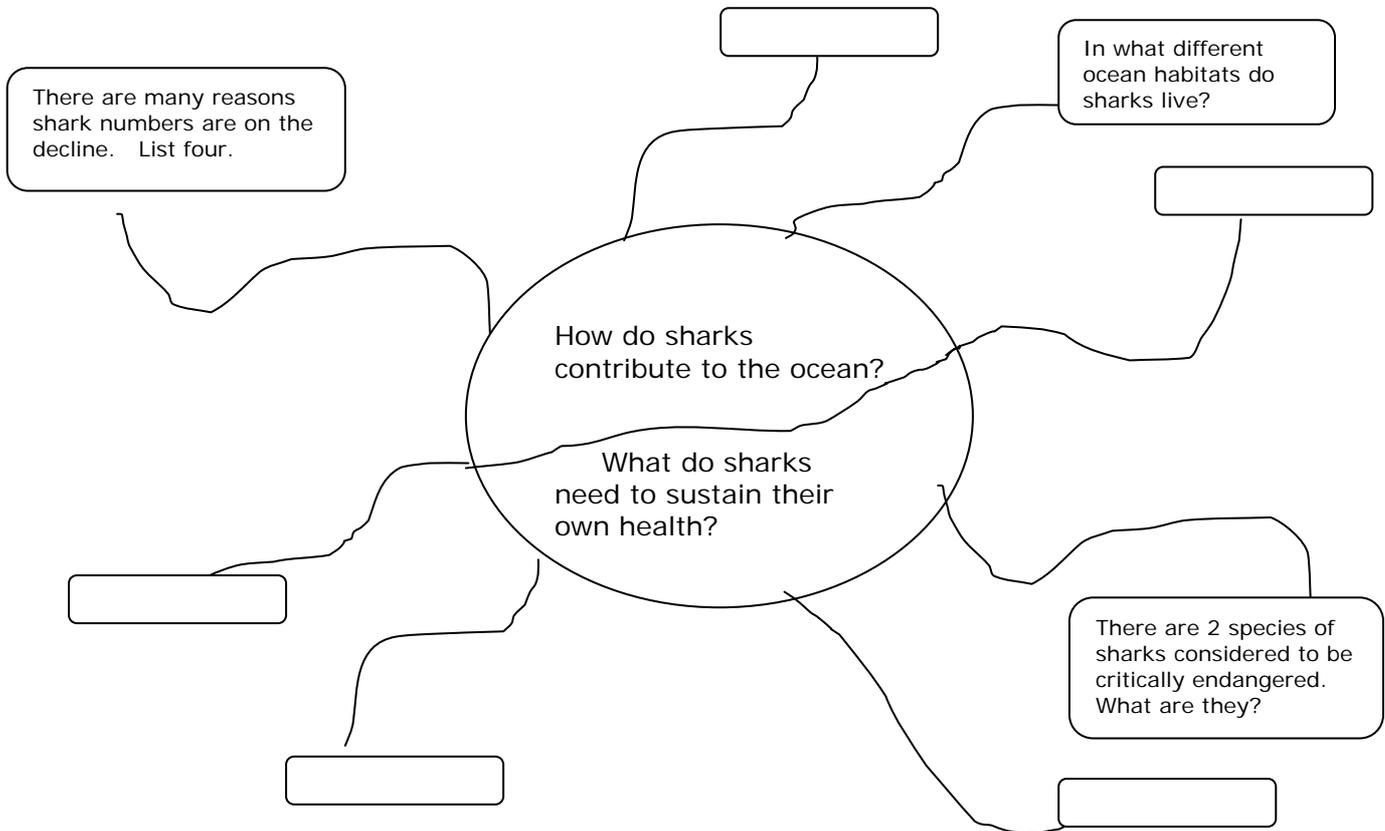
Remember to keep in mind:

- Characteristics of sharks bodies
- Different materials have different weights and characteristics too
- Trial the model in tank or bucket of water

SHARKS AND SUSTAINABILITY
Activities Booklet - 7. Shark art

7.4 Octopus chart

Using an octopus style chart try to tease out reasons why sharks are important to the ocean and what sharks need to stay healthy. Below find an example of how you might begin. Add more tentacles issues if they are identified.



What similarities or differences can you see appear in each half of the diagram?

HINT: The Seaweek Shark Fact Sheets and Appendix 1 may be useful resources.

SHARKS AND SUSTAINABILITY Activities Booklet

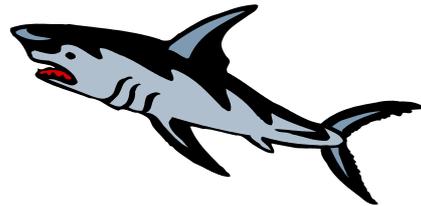
8. Great debate

One thing is certain, sharks are controversial. A great challenge to unravel the controversy is to create a forum for a debate where the speakers speak on a topic from opposing viewpoints.

8.1 Primary Activity

You will need:

- Teams of 3
- Shark fact sheets on:
 - Cultural significance of sharks and rays
 - Grey Nurse shark
 - Great White shark
 - Whale shark
 - Release of sharks
 - Rays and Sharks,
 - Role of rays in the ecosystem,
 - Role of sharks in the ecosystem
 - Australian shark attacks
 - Shark and ray conservation
 - Recreational fisheries for shark



Find information to support your topic (For and Against)

1. All sharks should be killed.
2. Shops should tell consumers when they are purchasing shark products.
3. Sharks should be kept in aquaria for study and education.
4. Shark nets should be compulsory for all metropolitan beaches.
5. It should be compulsory for surfers and divers to wear shark pods.

SHARKS AND SUSTAINABILITY
Activities Booklet – 8. Great debate

8.2 Secondary activity

Using the Reuters article below plus Seaweeek 2005 shark information sheets, useful websites links, and bibliography, form debating teams in either the positive or negative aspects of one of the following suggested topics:

- Zone causes shark bite?
- Triple bottom line: do sharks fit?
- Swim with sharks, I don't think so!
- Sharks: friend or foe?

8.3 Role Play activity

To develop the argument further, design and deliver a role play against one of the topics that has already been debated.

You will need:

- 5 groups (i.e. fishermen, conservationists, beach goers, scientists, farmers)
- An arguable position in each theme area
- A moderator to assist in issue arbitration

Annual 'Dead Zone' Spreads Across Gulf of Mexico

Wed 4 August, 2004 00:43

By Jeff Franks

HOUSTON (Reuters) - A huge "dead zone" of water so devoid of oxygen that sea life cannot live in it has spread across 5,800 square miles of the Gulf of Mexico this summer in what has become an annual occurrence caused by pollution.

The extensive area of uninhabitable water may be contributing indirectly to an unusual spate of shark bites along the Texas coast, experts said.

A scientist at the Louisiana Universities Marine Consortium said on Tuesday measurements showed the dead zone extended from the mouth of the Mississippi River in south eastern Louisiana 250 miles west to near the Texas border and was closer to shore than usual because winds and currents.

"Fish and swimming crabs escape (from the dead zone)," said Nancy Rabalais, the consortium's chief scientist for hypoxia, or low oxygen, research. "Anything else dies."

In the last 30 years, the dead zone has become an annual summer phenomenon, fed by rising use of nitrate-based fertilizers by farmers in the Mississippi watershed, Rabalais told Reuters.

The nitrates, carried into the gulf's warm summer waters by the river, feed algae blooms that use up oxygen and make the water uninhabitable.

The dead zone's size has varied each year depending on weather conditions, but averages about 5,000 square miles and remains in place until late September or early October.

Virtually nothing is being done to stop the flow of nitrates into the river, meaning the dead zone will reappear every year, Rabalais said.

The dead zone forces fish to seek better water, which may be a reason for the recent shark bites on Texas beaches.

Three people have been bitten by sharks along the upper Texas coast this year -- a high number for a state that has recorded only 18 shark attacks since 1980.

Terry Stelly, an ecosystem biologist with the Texas Parks and Wildlife Department, said increasing numbers of sharks have been found in recent years in the waters along the Texas-Louisiana border, near the edge of the dead zone.

Along with other factors, "chances are good they (sharks) were looking for higher dissolved oxygen in the water," he said.

Rabalais agreed, saying "The higher number of sharks in shallow waters may very likely be due to the low oxygen being close to the shore at the time of the attacks."

"The available habitat for the sharks is definitely less when the low oxygen is so widespread," she said.

SHARKS AND SUSTAINABILITY Activities Booklet

9. Why sharks are important

People in Australia use products that come from the ocean on average about 10 to 15 times per day.

Here are some products that rely on resources from our oceans:

- Toothpaste
- Ice cream
- Rubber tyres/tires
- Pudding
- Medicines, i.e. antibiotics, wound dressings
- Photographic film
- Chocolate milk
- Hand lotion
- Paint
- Beer
- Purifying sewerage at the treatment plant
- Oxygen
- Insulation
- Matting
- Denture powder



Shark gillnet vessel – storing the catch
(Image Copyright T. Walker)

SHARKS AND SUSTAINABILITY
Activities Booklet - 9. Why sharks are important

9.1 Shark products (primary or secondary)

You will need:

- Seaweeek shark fact sheets

Sharks are one source of products from the sea. Using the facts sheets and your research, how many more products can you name?

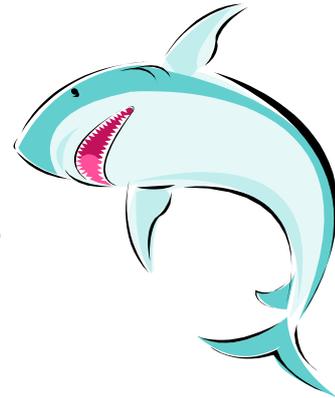


Six paintings were interpreted from the work of the CSIRO **Marine Oils Team**. Scientist **Peter Nichols** assisted artists **Andrew Dewhurst** and **Celeste Chandler**. The exhibit was one of many at the SYNERGY public art exhibit, from the 2002 Tasmanian **Science in Salamanca** project. The gallery of artworks can be viewed at www.science-in-salamanca.tas.csiro.au/gallery/synergy/

Answers can be found at the bottom of the page. Just hold a mirror up to reveal them.

meat, soup, oil, leather, sandpaper, tinkers, medicine

9.2 Sharks, true or false



S H A R K S
TRUE or FALSE

Are the following statements TRUE or FALSE?

Australian waters contain 165 living species of sharks. _____

We have a skeleton made from cartilage. _____

We are a fish with scales. _____

Our average lifespan is between 20 and 30 years. _____

We live from the surface to the ocean depths. _____

We must swim constantly to breathe. _____

When we lose a tooth we cannot replace it. _____

Whale sharks eat only plankton. _____

We have poor eyesight. _____

SHARKS AND SUSTAINABILITY
Activities Booklet - 9. Why sharks are important

9.3 Test your knowledge: What do you know about sharks?

Read one or more of the information sheets on sharks available from the MESA Seaweed 2005 website and answer the relevant questions.

Q1. General biology of Chondrichthyan fishes by Terry Walker

What are the major characteristics that place sharks and rays together as Chondrichthyans and what distinguished them from bony fish?

Q2. The diversity of sharks, rays and chimaeras by Terry Walker

When did the earliest sharks appear on Earth, and how many living shark species have been described worldwide?

Q3. The role of rays in the ecosystem by Simon Pierce

Rays are present in most marine ecosystems worldwide, and have a vital role in maintaining the health and function of these ecosystems. They are high-level predators within the ecosystem, and as such have few predators. Their low natural rate of mortality has allowed them to adopt a life history strategy focussed on producing a few, large young. What characteristics make rays highly vulnerable to human-induced pressures, such as fishing, habitat degradation and pollution?

Q4. The role of sharks in the ecosystem by Mike Bennett

To understand the role of sharks in the ecosystem it is fundamentally important to know what they feed on. Are all sharks true apex predators?

Q5. The whale shark by Brad Norman

Whale sharks have internal fertilisation and produce live young. The eggs hatch in the uterus prior to birth, i.e., ovoviviparity. They have more young than any other shark. How many pups are in a litter, and what is the average length of pups at birth?

Q6. The great white shark by Brad Norman

Satellite tracking has provided information on the extent of movements of great white sharks in Australian waters. Two sharks nicknamed 'Heather' and 'Neale' were tracked from their initial tagging location (within Victorian state waters) by scientists at CSIRO. How many kilometres did Heather migrate over 46 days in 2000?

Q7. The grey nurse by Brad Norman

The grey nurse shark is one of Australia's most endangered marine species. Name four human activities that threaten the grey nurse shark and describe ways that management agencies have minimised these threats?

SHARKS AND SUSTAINABILITY
Activities Booklet - 9. Why sharks are important

Q8. The cultural significance of sharks and rays in Aboriginal societies across Australia's Top End by Matthew McDavitt

For the Yolngu peoples of northeast Arnhem Land, certain ancestors who created potent sacred sites are known as 'power totems'. These ancestors are central to the identity of the clans descended from them, and clansmen draw spiritual and physical strength by accessing their power through sacred designs, songs, and dances. Several Yolngu clans trace their identity to the ancestral whaler shark *Māna* (pronounced: MAR-na). What is the public version of this story?

Q9. Commercial fishing for sharks by Kevin McLoughlin

Sharks have been fished for thousands of years. In Australia, what methods are used to catch sharks and which shark species are important to commercial fisheries?

Q10. Release of sharks in recreational fisheries by Julian Pepperell

Sharks are intentionally caught, tagged and released. Why do recreational fishers tag sharks, and how do they release the tagged sharks?

Q11. Recreational fisheries for sharks by Julian Pepperell

As recreational fisheries are being monitored more closely, it is becoming increasingly important to include accurate fishing effort data as well as accurate catch data. Why?

Q12. Australian shark attacks by John West

On average, how many people die from shark attack in Australian waters each year?

<p>HINT: To learn more about these topics, visit the list of shark websites and shark bibliography on the MESA Seaweek 2005 website.</p>



SHARKS AND SUSTAINABILITY Activities Booklet

Appendix 1.

Frequently asked questions about sharks

*Source: Jewels of The Sea: A marine education resource guide,
Marine Life Society of South Australia Inc. Dec 2001*

Q1. What is a shark?

A. A shark is a fish. It breathes through its gills, has a backbone and lives in sea water. However, unlike all other fish, its skeleton is made from cartilage, not bone and they do not have scales but denticles (tiny teeth-like projections). Also, they have five to seven gill slits rather than one each side as in bony fish. Shark tails are always uneven – the upper lobe is always larger than the bottom lobe.

Their fins are rigid unlike the soft fins of fish which are supported by rays or spines. Buoyancy is provided by an oily liver compared with many fish that have a gas filled swim bladder. The mouths of fish are generally on the front of their heads whereas sharks and rays have their teeth under their head. Fertilisation of eggs in sharks takes place inside the mother's body compared with most fish where fertilisation occurs outside of the parents' bodies.

Q2. Which is the fastest shark?

A. The Mako is the fastest shark in the ocean, able to swim at up to 35 kph. Also known as the Blue Pointer, it feeds on salmon and it is regarded as "a fine sporting fish which fights gamely".

Q3. How long do sharks live?

A. Life span varies from species to species. The Whale shark is thought to live over 100 years but the average life span of a shark is 25 years.

Q4. Which is the biggest shark?

A. The Whale Shark can grow up to 14 metres long, although the average length is 7.6 metres. Its mouth can be up to 1.2 metres wide. These sharks swim with their mouths open to catch plankton and shrimp in the water, which they filter from the water through their gills. The largest shark in SA is the Basking Shark which grows to 11 metres. The SA Museum has an excellent cast from a male Basking Shark. Like the Whale Shark, it feeds on plankton.

Q5. Which shark is the smallest?

A. The Spined Pygmy shark, found in the deep oceans, is the smallest known shark at only 25 centimetres long.

Q6. How many species of sharks are there?

A. Worldwide, there are over 350 species of sharks and 400 species of rays. Despite this diversity, you know when you're looking at a shark or a ray because of their distinct body forms. Some adaptations enable sharks and rays to specialise in new ways of getting around, hunting, and feeding. These kinds of changes can increase the odds of survival, reproduction, and passing on those traits to the next generation, as well as enable species to use resources within a habitat differently, reducing competition.

SHARKS AND SUSTAINABILITY

Activities Booklet - Appendix 1. Frequently asked questions about sharks

Q7. How many teeth do great white sharks have?

A. They can have up to 300 teeth at a time, arranged in 5 rows which act as a "conveyor belt" to replace the front teeth as they are lost. Sharks constantly lose and replace teeth in this way throughout their life.

Q8. Why do we need sharks?

A. Sharks are not just magnificent creatures but also play a vital role in our oceans. If they were to disappear, the whole balance of the sea would be upset. Like other large predators, sharks play an important role both as scavengers, eating the carcasses of dead animals. Large sharks also help the ecosystem by keeping the population numbers of their prey in check, as well as maintaining the "genetic fitness" of populations of other species by selecting out sick or weak individual animals.

Q9. Which are the most dangerous sharks?

A. The most dangerous sharks to man are the Great White, Tiger and Bull sharks. Other species are considered dangerous but most sharks only attack if provoked.

Q10. How long have sharks been around?

A. Sharks have been around for 350-400 million years and are one of the most successful vertebrates on the planet.

Q11. Are sharks warm or cold blooded?

A. Like other fish, most sharks are "cold-blooded". However certain species, such as the Great White and Porbeagle sharks, can raise their body temperature above that of the surrounding water.

Q12. Do sharks eat a lot?

A. A shark eats about 2 percent of its body weight per day which is less than a human eats. They are "cold-blooded" and don't eat as much as humans, storing energy in their large livers until it is needed. They can go for long periods of time between feeding and can keep prey in their stomachs until they wish to digest it.

Q13. Do sharks have a good sense of smell?

A. Yes, sharks can detect one part of blood per ten billion parts of water – that means they could detect one drop of blood in an Olympic swimming pool.

Q14. Why do people kill sharks?

A. Shark meat is used for human consumption, the skin for leather and the liver for oil. Large numbers of sharks are caught in southern Australia where their meat is sold as flake in fish and chip shops. Shark fin soup is popular in Asia and sharks are caught for sport trophies.

Q15. Are there any freshwater sharks?

A. The Bull shark can survive in freshwater and has been seen thousands of kilometres up rivers in Africa and South America.

Q16. How do sharks reproduce?

A. In many different ways. Some sharks, such as the Port Jackson Shark, lay eggs and the young shark hatches out. Great Whites give birth to live young which are fully developed miniatures of the adult. In other species, such as the Mako Shark, the baby sharks hatch from the egg inside the mother before being born.

SHARKS AND SUSTAINABILITY

Activities Booklet - Appendix 1. Frequently asked questions about sharks

The mothers do not care for the young after birth. In some species like the Grey Nurse the fittest pup eats its brothers and sisters before they are born to increase its own chance of survival from the moment of birth [intra-uterine cannibalism]. It is thought that Great White pups do not actually eat other young, but might eat the undeveloped eggs before birth.

Q17. Which shark has the longest tail?

A. The Thresher Shark has the longest tail, with the upper lobe being the same length as the body of the shark.

Q18. Which shark has the strongest bite?

A. The Dusky shark can exert over 60 kilograms of pressure when it closes its jaws.

Q19. Do sharks have good eyesight?

A. Most sharks have good eyesight and can even see in colour. They can detect a light that is ten times dimmer than the dimmest light a human can see.

Q20. Are sharks intelligent?

A. Sharks are much more intelligent than people originally thought. They have a large, complex brain which is relative in size to that of birds. They are also able to be trained to perform tasks, such as pushing a bell in order to get food.

Q21. Do sharks have to swim all the time?

A. Some sharks have to swim all the time in order to breathe, but some can lie motionless on the bottom and breathe by pumping water over their gills. Port Jackson sharks, Wobblygong, Catsharks, Sawtail shark and Draughtboard sharks can all do this.

Q22. What is a shark's favourite food?

A. Sharks eat all sorts of food depending on the species. Great Whites eat seals, dolphins and tuna whilst whale sharks and basking sharks eat small shrimp and plankton. The Tiger shark normally eats turtles and fish, but has been found with tyres, coal, shoes, license plates and even a suit of armour in its stomach. Many sharks will scavenge.

Q23. Are there any predators of sharks?

A. Generally, the only predators of sharks are bigger sharks or humans – we kill over 30 million sharks every year. An Orca [Killer] Whale was filmed attacking and killing a Great White. Sharks have a number of internal and external parasites.

Q24. Do sharks have more senses than us?

A. Yes, as well as the five senses humans have, they also have a "sixth sense". They can sense electrical and magnetic fields, which help detect struggling fish and navigate using the earth's magnetic fields. They do this using jelly-filled canals located in their snouts. This sense is so powerful they could detect a battery in the middle of the ocean.

Q25. Do sharks make sounds?

A. Sharks do not have any special organs for making sounds. They cannot make noise apart from the gnashing of their teeth.

SHARKS AND SUSTAINABILITY

Activities Booklet - Appendix 1. Frequently asked questions about sharks

Q26. Can sharks feel pain?

A. In some cases, sharks seem to feel pain, such as when tags are injected into them. They have a violent lifestyle where territorial disputes and even mating involves biting. Sharks are quite used to injury. They seem to heal extremely quickly. However, sometimes sharks have been seen to continue feeding even when they are badly injured e.g. eating their own intestines and stomach during a feeding frenzy.

Q27. Why are some sharks endangered?

A. Overfishing is the major cause of sharks becoming endangered. The Great White is now a threatened species due to the sports fishing that has taken place over the past decades. In Australian waters the Great White and the Grey Nurse sharks have some forms of protection because their numbers are very low compared to their original populations. Both species have small numbers of babies and do not start breeding until they are relatively old. White sharks are protected in most Australian states.

Q28. How big are baby sharks?

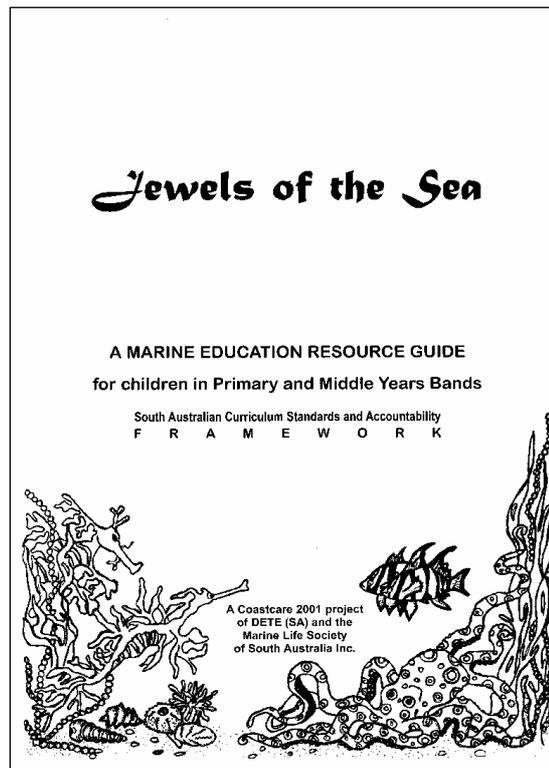
A. This varies from species to species. Spurdog pups are only about 30 cm long, Makos about 60 cm. When Great Whites are born they are about 120 cm long whereas Basking shark pups can be as big as 180 cm.

Q29. How dangerous are sharks to humans?

A. Sharks kill about 100 people in the world each year. However, elephants kill 200 people per year and in Africa, hippos are the number one cause of deaths and accidents. You are more likely to be hit by lightning or killed by bees.

Q30. How many fatal attacks in South Australia?

A. There have been 29 shark attacks in South Australia, 15 of which were fatal. Of these, 13 were due to Great White sharks and 10 of those people died from their injuries.



This page reproduced from the booklet *Jewels of the Sea* with permission from the Marine Life Society of Australasia.

Copies are still available for \$20 plus postage. Contact: www.mlssa.asn.au/



SHARKS AND SUSTAINABILITY Activities Booklet

Appendix 2.

Funky shark questions and facts

Why are some baby sharks so aggressive and big when they are born?

Some sharks like the Grey Nurse Sharks whose single baby is born fat and half the size of its mother is big and healthy because it has eaten all its younger brothers and sisters whilst still unborn in the uterus

How close can sharks live or come to the shore?

Many sharks like Banded wobbegong with long sharp teeth and are over 2 metres long like the Saddled occasionally live in caves and overhangs no more than 1 metre below the water and less than a metre from the rocks or ledges you may be sitting on enjoying a view of the sea.

Can sharks lay eggs?

Strange looking spiral shaped objects washed up on the beach are the egg cases of Port Jackson sharks. When still in the sea they contain a baby shark attached by a stalk to a huge yolk sac like the yolk inside a chicken egg. When the embryo shark uses up all the yolk it is ready to hatch at about 8 months after it was laid.

Do sharks only live in salt water?

Bull sharks which are potentially dangerous to human can travel over 100 km up rivers to fresh water. They often give birth to live young in these fresh water environments, it is believed to protect them from being eaten by other sharks restricted to living in salt water environments. They are called bull sharks because of their unusually big body.

Are only the large sharks dangerous?

Cookie Cutter sharks are a kind of deep ocean dog fish with the biggest and most frightening set of teeth for a shark of its 30cm size Cookie Cutters huge tail gives it a short acceleration of over 50 km/hr, enabling the little shark to catch the sides of its prey with thick suction lips. It then uses throat muscles to suck up a lump of skin and flesh which it holds onto with sharp hook like upper teeth whilst sinking its massive White Pointer like bottom teeth into the flesh. It does not attack humans.

Can sharks weigh as much as elephants?

A Basking shark, some of which travel around the Southern coast of Australia may weigh up to 5 tonnes and have a liver that alone may weigh over 1 tonne (25% of its body weight). Such a liver may yield over 500 litres of valuable squaline or shark oil rich in vitamin A and unfortunately one of the best oils to use as machine lubricant. Human livers are 3-4% of their body weight.

SHARKS AND SUSTAINABILITY

Activities Booklet - Appendix 2. Funky shark questions and facts

How big is the biggest shark ever captured?

The largest Great white shark actually captured weighed 3130 kg (7302lbs) and was 21 feet 6.5M. Such a shark would be as long as a truck and as wide as a station wagon. Great White teeth over 5 "long have been found belonging to sharks less than 11,000 years old. This means that our not too distant ancestors may have witnessed White Pointers over 12 metres long

Are sharks killed throughout the world just to eat?

It is a fact that sharks are exploited for these reasons:

- For a cheap fish meat called Flake.
- As a preparation for a meal called Buundhaar consisting of shark liver, shark meat boiled, minced and mixed together.
- Shark fins up to \$100/kg for shark fin soup and as an aphrodisiac in Asia
- Shark liver which is a rich source of vitamin A and squalene oil used in cosmetics and as high grade machine oil.
- Shark cartilage extract as a treatment to reduce cancerous tumours
- Chondroitin used as an artificial skin for burn victims.
- Shark bile for the treatment of acne
- Shark corneas for human transplants
- Shark skin for leather and shagreen a fine sand paper used by cabinet makers
- Wobbegong skin is sought after for its elaborate design features)
- Teeth and jaws for jewellery and trophies
- Aquarium exhibits and school dissection resources
- Sport fishing

Does Australia have more sharks than other countries?

Australia with approx 300 known species has one the richest diversities of sharks and rays in the world. Compared to Australia, South Africa has 152 species, 174 species from Japan, 130 species from the Eastern North Atlantic and Mediterranean 83 species from New Zealand.

Where do most sharks live?

Some interesting statistics:

- Australia with approx 300 known species has one the richest diversities of sharks and rays in the world. Compared to Australia, South Africa has 182 species, 174 species from Japan, 130 species from the Eastern North Atlantic and Mediterranean 83 species from New Zealand.
- Almost half of all Australian sharks are bottom dwellers restricted to a lightless zone between 200 and 2000 metres in depth on the continental slope
- 20% of the rest are bottom dwellers on the continental shelf less than 200 metres in depth
- 15% of Australian sharks are pelagic in the neritic waters of the continental shelf (between the shore and the edge of the continental shelf)
- 8% of Australian sharks are oceanic (outside the continental shelf)
- About 50% of all Australian sharks are found only in Australian waters and of these 89% live as bottom dwellers on the continental slope or shelf
- Most shark species live between 20-30 years and take 6-7 years to reach sexual maturity.
- Gummy sharks and Whalers reach maturity at 2-3 years and live for 10-15 years
- The White Spotted Spurdog reaches sexual maturity at 20 years and lives for at least 70 years.

SHARKS AND SUSTAINABILITY

Activities Booklet - Appendix 2. Funky shark questions and facts

Does Australia have the same sharks as other countries?

About 50% of all Australian sharks are found only in Australia and no where else in the world.

How old can sharks grow?

Most shark species live between 20-30 years and take 6-7 years to reach sexual maturity. Gummy sharks and Whalers reach maturity at 2-3 years and live for 10-15 years. White Spotted Dogfish reach sexual maturity at 20 years and lives for at least 70 years.

How fast can sharks grow?

Large oceanic sharks like the Blue Whaler, the Short Fin Mako and the White shark have the fastest growth rates of 30cm/year until maturity.

How fast can sharks swim and do they make any noise?

The sand papery skin of sharks is due to the presence of scale like denticles that look like sharks teeth. Each of these in fast swimming oceanic sharks are designed in such a way to channel water passing over them, cut down turbulence and reduce drag (streamlining). This enables them to cruise without effort at 2-5 km/hour with short sprints of over 30 km /hour. These features make the shark hydro dynamically quiet, a huge advantage when stalking prey.

How can a female shark tolerate being bitten by a male shark?

Because the male Blue shark bites the female to establish a close physical bond to allow insertion of his clasper during mating, the female skin is twice as thick as the males.

Which shark is the biggest shark in the world?

The biggest shark in the world is the Whale shark; it grows to over 12 metres and weighs up to 20 tonnes.

Which shark is the biggest and most powerful hunter?

The biggest predatory shark is the White Pointer. It can grow to 8 metres (or as big as jaws) and weighs over 3 tonnes. It eats seals and other marine mammals such as whale pups, dolphins and turtles.

Which sharks are the fastest?

The fastest sharks in the world are the Mako sharks which leap repeatedly out of the water. To do this it must have a starting velocity up to 35 km/hour – without fins you swim at less than 1 km/hour. The difference in speed is the same as a car doing 60 km/hour being passed by and the car doing 2100 km per hour.

Which shark is the smallest?

The smallest shark is a Deep water dwarf dog shark belonging to the family Squalidae and measures a maximum size of 15 cm. Our own pygmy shark reaches a maximum size of 27 cm.

Which is the strangest shark?

The strange head of a Hammer Head shark acts as a hydrofoil giving it great manoeuvrability enabling it to catch agile prey like squid. Its array of electro receptors arranged horizontally on its snout enable it to detect like a metal detector the electric field of fish buried in the sand. The hydrofoil shape of its head enables the Hammer Head to swivel 180 degrees over the hiding spots of their prey so as to flush them out of the sand.

SHARKS AND SUSTAINABILITY

Activities Booklet - Appendix 2. Funky shark questions and facts

Which shark has the longest tail?

The tail of the Thresher Shark is over 40% the length of its body. It is used to thrash into schools of fish stunning many of them before they are devoured. Here the tail takes the place of the mouth as the chief method of catching prey.

Can sharks see at night?

The eyes of White Pointer sharks and White Tips and Lemon sharks contain reflectors. These consist of plates of reflective guanine crystals set in the retina of hunting sharks eyes, They are arranged to reflect all light coming into the eyes back onto the light receptor cells (rods and cones), enabling such sharks to see extremely well at night.

Can sharks see colour?

White Pointers have a high density set of cones (colour receptor cells) in the retina of their eyes enabling them to see in colour.

Do sharks digest food like humans do?

Although the digestive tract of a 2 metre human is about 9 metres long that of a 3 metre shark does not exceed 2.7 metres. A shark's abdomen must conserve space for its large liver, many embryos and its huge stomach.

Do sharks need to eat every day?

Some sharks like the Lemon shark, once it has eaten fully, needs 4 days to become hungry again. The presence of an unknown preservative, secreted by the stomach lining, enables sharks to eat large prey and keep the food intact for a prolonged digestive process which may take up to 5 days to complete.

Do sharks need to keep moving?

Sharks like White Pointers and Makos require a highly efficient respiratory exchange which take place better the faster water moves across the gills in a front to back direction. These oceanic sharks will die from suffocation if they stop moving or are dragged backwards in the water.

Are sharks just lying on the bottom still alive?

Bottom dwelling sharks like Wobbegongs can pump water through their gill systems by contracting the muscles that control the inlet and outlet of the gill system. Such sharks can lie immobile on the sand or in caves for days without moving.

How do sharks remain motionless in mid water?

Grey Nurse sharks can breathe through both the swimming oxygen exchange process as well as the gill pumping process. Their oily livers and the air they swallow and hold in their gut enable them to sit perfectly still whilst neutrally buoyant. This dual method of breathing makes them to be real energy savers.

Does a large shark have large internal organs to match?

A White Pointer shark at 2 tonnes will only have a 4 kg heart. This means that they do not have exceptional stamina in prolonged and sustained exertion even though they are capable of huge exertion in small bursts.

Are some sharks tempted to eat their own babies?

Pregnant sharks lose their appetite before birth to prevent them from eating their own babies when they are born.

SHARKS AND SUSTAINABILITY

Activities Booklet - Appendix 2. Funky shark questions and facts

Do some male sharks have more than one reproductive organ?

Most male sharks have 2 mating organs or penises called claspers one from each pelvic fin. Only one is used at a time for fertilising the female. The male of the strange elephant fish and Chimeras have 5 claspers. One on the head for holding the female still and 4 claspers associated with the pelvic fin for mating with the female.

Can sharks shed their skin or moult like other creatures do?

During winter when plankton of the North seas populations drop in numbers, Basking sharks do not have enough food to keep their large bodies actively swimming, so they sink to the sea floor open their mouths, face the deep ocean currents to allow for water to flow over their gills for respiration and then hibernate. During this time they shed their gill filters (rakers) and regenerate new ones for the coming spring. Basking sharks are therefore the only sharks that have an annual moulting of any sort.

Does food rot inside a shark's stomach?

Tiger sharks' stomachs secrete strong hydrochloric acid to help stimulate digestion of protein and dissolve bones, tin cans and other objects. The stomach also secretes a tissue preservative substance that keeps food in it fresh for the 4-5 days it takes to digest its prey.

Do sharks produce milk for their young?

The yolk sac of the embryo Grey Whaler, Hammerhead sharks and Blue sharks form placenta like attachments to out grow in the mother's uterus (ovisacs) to carry extra nutrients from her blood to the baby shark via blood vessels that travel up the long yolk stalk which is like our own umbilical cord. The mother's uterus also secretes a kind of milk which is absorbed through the skin of the baby sharks.

How do sharks find their way around in the ocean?

The tiny pores like ampullae of Lorenzani in the heads of migrating sharks are very numerous. These pores can detect electric fields present in their prey. Since these travelling sharks swimming through the earth's magnetic field induces its own local electric field with a voltage that varies with its compass heading it is thought to be able to navigate with its own built in electric magnetic compass.



SHARKS AND SUSTAINABILITY Activities Booklet

Appendix 3: FACT SHEET – SEAWEEK 2005

SHARK CONSERVATION

Fact sheet prepared by the Australian Marine Conservation Society (AMCS) – www.amcs.org.au

Australia is home to over 300 species of sharks, rays, skates and chimeras (called the *Elasmobranchs*)¹. Virtually all species pose absolutely no threat to humans at all, yet we indiscriminately kill millions of them every year. Commercial and recreational fishing are by far the greatest known killers of sharks, though global warming and habitat loss may also be significant contributors.

Our Threatened Sharks

Australia's threatened sharks include²:

- spartooth shark (critically endangered)
- east coast population of the grey nurse shark (critically endangered)
- northern rivers shark (endangered)
- whale shark (vulnerable)
- great white shark (vulnerable)
- west coast population of the grey nurse shark (vulnerable)

Many other sharks however are also of conservation concern. The World Conservation Union (IUCN) lists 77 species of sharks from our region as 'threatened' or 'near threatened' with extinction³.

Why are sharks so special?

- Sharks are like whales and dolphins – they are long lived, mature late in life and produce few young.
- Most sharks are at the top of their food chains and play an important role in keeping marine ecosystems healthy³.
- Sharks appear to have complex social structures which may be severely disrupted by fishing.
- Sharks provide us with inspiration and add to the sense of mystery and wildness of the sea.

SHARKS AND SUSTAINABILITY

Activities Booklet – Appendix 3: Shark Conservation Fact Sheet

- Sharks are our living dinosaurs, and offer us a window into the ancient past.
- We are only now beginning to see the beauty of our sharks, as we see it in other large predators, such as tigers and lions.

Threats to Sharks

Commercial fishing, in particular, is severely impacting the world's sharks⁴. Australia has several shark-specific commercial fisheries, and sharks are killed as 'bycatch' in at least 70 other commercial fisheries as well¹. It is concerning that many fisheries catch sharks from the same populations, yet there are few management arrangements in place to manage the cumulative impacts of fishing on shark populations⁵.

Some commercial fisheries have banned the landing (or keeping) of sharks as part of their contribution to shark protection, while others have strict bycatch limits. However, commercial shark fishing is still extensive across Australia, and shark fin fishing is expanding in some areas.

Shark finning is a form of fishing where sharks are hunted because of the high value of their fins. Shark fins can fetch over \$100/kg when exported to Asian markets⁶. However, the rest of the animal is often sold cheap because it has comparatively little value. Many conservationists and scientists are deeply concerned about shark fin fishing and believe that it is unsustainable and unethical.

Recreational fishing in Australia also kills many thousands of sharks. Large sharks are sometimes killed in fishing competitions and are still regarded by some as hunting trophies. Shark fishing is one of the last big game hunting activities still permitted in Australia.

Shark nets and baited drumlines are used in beach meshing programs in eastern Australia to cull sharks. This is done in the belief that sharks pose a major threat to swimmers. However, the chance of shark attack is negligible compared to other threats and numerous sharks as well as turtles, dugongs and dolphins are killed by these nets. Only three places in the world use shark nets – New South Wales, Queensland and South Africa.

Shark fishing by our northern neighbours in their own territorial waters and in Australia's waters is a major threat to Australia's northern sharks. Most shark populations found throughout South East Asia have been heavily overfished. Australia must expand its work with our northern neighbours to resolve this issue.

What is being done to protect sharks?

Australia's *National Shark Plan* is helping guide research and action to better protect Australia's sharks. We do not know much about most species of shark, so shark research has a very long way to go. Fisheries managers are also beginning to understand that sharks need protection and are working with fishing sectors in most areas to scale back fishing pressure. But are these efforts enough?

Conservationists, like the Australian Marine Conservation Society (AMCS), fear that these efforts may be too little too late for many species. AMCS recommends that we begin caring for our sharks like our whales and dolphins because like these marine mammals, sharks cannot sustain fishing pressure.

SHARKS AND SUSTAINABILITY
Activities Booklet – Appendix 3: Shark Conservation Fact Sheet

AMCS also questions whether we should keep killing sharks because of the essential role they play in the ecosystem and the wonder and mystery they bring to children and adults alike.

References

1. Rose, C and SAG (2001). *Australian shark assessment report for the Australian National Plan of Action for the Conservation and Management of Sharks*, Canberra.
2. EPBC Act
3. Watts, S (2001). *The End of the Line: global threats to sharks*. A report by WildAid, San Francisco, California.
4. Cananagh, Rachel, D. (ed); Kynde, Peter M. (ed); Fowler, Sarha L. (ed); Musick, John A. (ed); Bennett, Michael B. (ed). *The Conservatoin Status of Australian Chondrichthyans: Report of the IUCN Shark Specialist Group Australia and Oceania Regional Red List Workshop*. The University of Queensland, School of Biomedical Sciences, Brisbane, Australia.
5. Lack, M and SAG (2004). *National Plan of Action for the Conservation and Management of Sharks (Shark-plan)*. Australian Government Department of Agriculture, Fisheries and Forestry. Commonwealth of Australia.
6. Borg, J and McAuley, R (2004). *Future Management Arrangements for Western Australia's Temperate Shark Fisheries*. Fisheries Management Paper No. 180. A Discussion Paper. Western Australian Department of Fisheries, Perth.