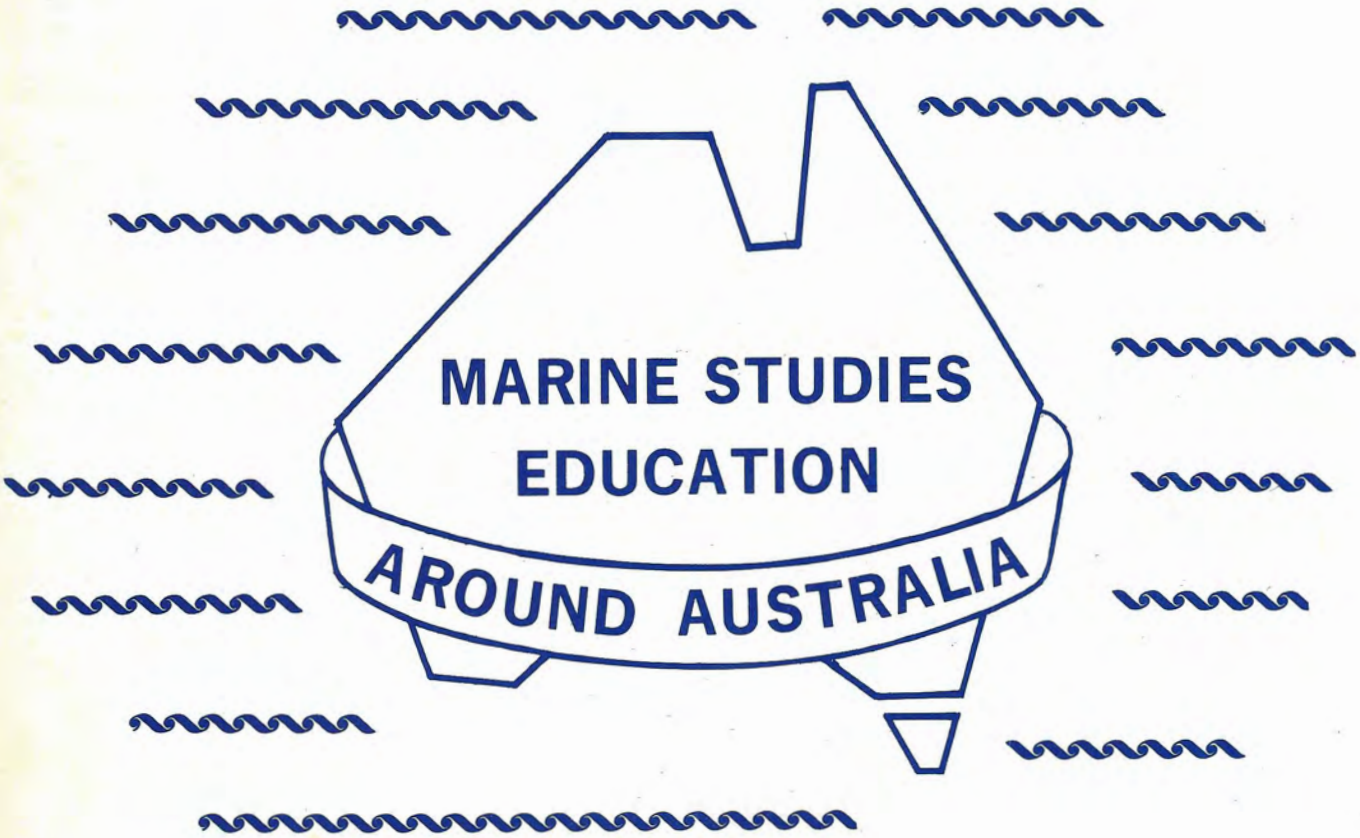

National Marine Educators Conference Proceedings

November 29th – December 1st 1985 Gold Coast Queensland 1985

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MARINE STUDIES EDUCATION AROUND AUSTRALIA

complied by

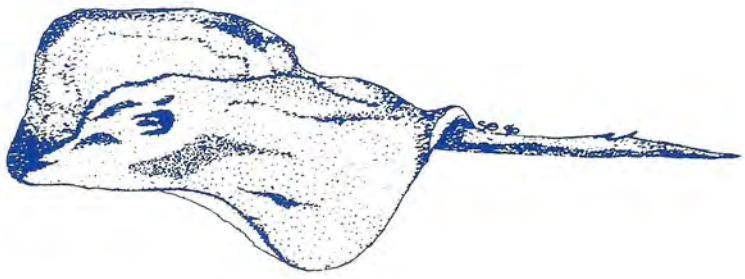
Bob Moffatt
Project Co-ordinator
Brisbane South Marine Studies Project

NATIONAL MARINE EDUCATORS CONFERENCE PROCEEDINGS

November 29 - December 1, 1985, Gold Coast Queensland.

CONTENTS

CONFERENCE PROCEEDINGS



ACKNOWLEDGEMENTS

The conference committee would like to thank the following for their contributions

Conference Speakers: (In order of presentation)

Laurie Hammond, Graham Saunders, Peter McGovern, Russel Synnot, Keith Wood, John Mathias, Boris Daniljchenko, Mary Marsh, Bob Moffatt, John Tomkin, Geoff Bayly, Tony Bergin, Ann Byrnes, Toni O'Neill, Janet Oliver, Kirk Petersen, David Kopelke, Fabian Fay, Julie Swartz, Peter Kinchington, Kris Kristensen, Peter Holm, George Stubbs, Derek Foster, Rob Fraser, Wayne Fossey, Clive Allen, Cyril Connell

Group Chairpersons:

Laurie Hammond - (Organisation), Peter Kinchington - (Resources), Peter Holm - (Safety), Len Zell - (Community Development), Meg Kennedy - (Curriculum), Terry Balsom - (Teacher Development)

Printing and data management:

The Brisbane Education Centre

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Illustrations:

Sue Oats

Conference Committee:

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Ken Gilbert	(Planning)
Clive Allen	(Evaluation)
Gwen Lane	(Secretary/ Treasurer)
Sue Oats	(Production)
Kelvin Rodgers	(Technical)
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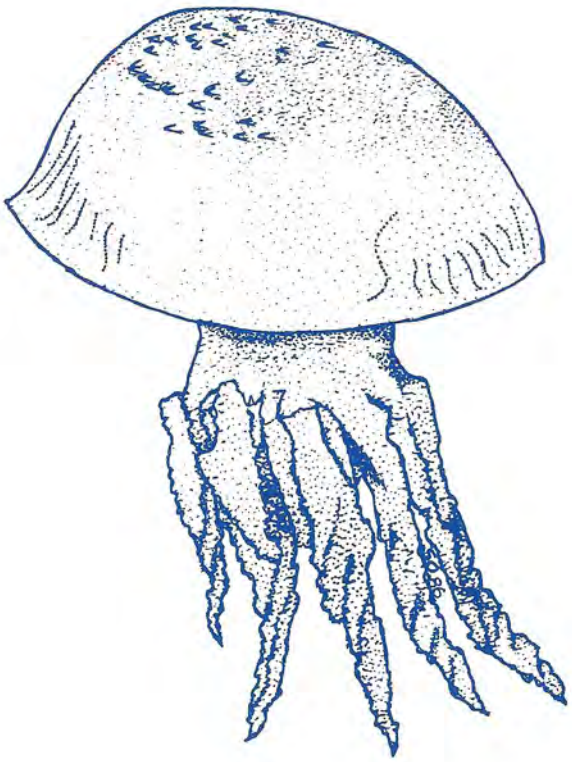


PROGRAMME

FRIDAY 29th November 1985

3.30pm WELCOME AND OPENING ADDRESS
Dr. Laurie Hammond - Director of the Victorian Institute of Marine Science
Dr. Graham Saunders - Director of the Queensland National Parks & Wildlife Service

4.00pm KEYNOTE PRESENTATIONS
Dr.Peter McGovern Head of School of Nautical Studies - The Aust. Maritime College, Launceston, Tas.
Dr.Russel Synnot Editor, "Careers in Marine Science" - Broadening your mind to Marine Science, Victoria.
Mr.Keith Wood Instructor South Brisbane College of TAFE - "TAFE/Secondary interfaces", Qld

7.30 pm PLENARY DISCUSSION & PROBLEM ANALYSIS - "Marine Studies: What are the problems ?"
Mr. R. Moffatt Conference convenor

SATURDAY 30th November 1985

9.00am DATA COLLECTION "Marine Studies: Where are we at ? - a 1985 update"

Workshop 1	Curriculum Development Navy Style	ACT	Lt.Cmd Mathias
Workshop 2	The Jacobs Well Community Boat Project	Qld	Mr. B. Daniljchenko
Workshop 3	Brisbane South Marine Studies Project	Qld	Mr. R. Moffatt
Workshop 4	Developments in Marine Centres	TAS	Ms. M. Marsh
Workshop 5	Marine Studies Community Education (Vic)		Mr. J. Tomkin
Workshop 6	Marine Studies Education (South Aust.)		Mr. G. Bayly
Workshop 7	The Australian Centre for Maritime Studies		Mr. A. Bergin
Workshop 8	Project Reef Ed (NSW & QLD)		Ms. T. O'Neill and Ms. J. Oliver

1.45 MINI WORKSHOPS

1. Great Barrier Reef Wonderland	Mr. K. Petersen	G.B.R.M.P.A
2. Marine Studies outside the school	Mr. D. Kopelke	B.I.F.S.C.
3. Project Neptune	Dr. F. Fay	Sea world
4. Community Education at Queenscliff	Ms. J. Swa rt:	V.I.M.S.
5. Teacher Inservicing at Queenscliff	Mr. P. Kinchington	V.I.M.S.
6. A revegetation project with school groups	Ms. K. Kristensen	V.I.M.S.
7. Ocean Venturer Experiences	Mr. P. Holm	M.O.E.C.
8. Safety Awareness in Marine Studies	Mr. G. Stubbs	B.S.H.S.
9. Planning for a Marine Studies Course	Mr. D. Foster	B.S.H.S.
10. School Marine Studies Programmes	Mr. R. Fraser	NSW
11. School Marine Studies Programmes	Mr. W. Fossey	B.S.H.S

SUNDAY 1 st. December 1985

9.00 REACTORS COMMENTS: Mr. Clive Allen, Inspector of Schools, Queensland.
9.30 am Address by Mr. C. Connell Deputy Director of Secondary Education
9.45 Developing a model for change. Participants to work in groups evaluating what they heard on Saturday in terms of the problems identified on Friday night.
10.15 To be followed by group reports till morning tea.
11.15 WORKING ON THE MODEL FOR CHANGE
11.30 New groups form to work on solutions to problems identified. Participants choose to become involved in a working party group to establish action plans.
1.00 pm WORKING LUNCH "Formalising the Model" - Group leaders to give reports.
Dr. Laurie Hammond, Director V.I.M.S. Chairman

MEETING OF M.E.S.A. "Marine Education Association of Australasia"

MEETING OF STATE ASSOCIATIONS "Elections of office bearers"

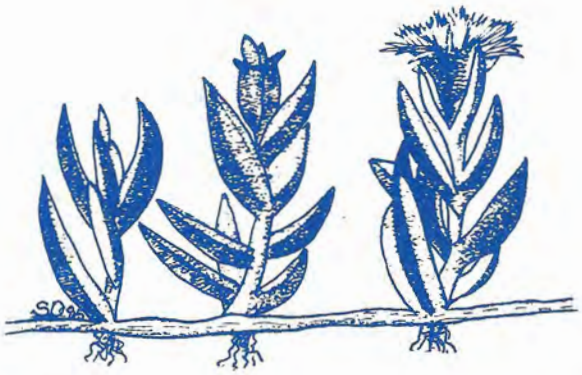
LIST OF DELEGATES

The following is a list of names and addresses of meeting delegates that attended the 2nd Marine Educators meeting at the Broadbeach International Hotel, November 29 - December 1st 1985. Included also is the list of apologies received.

For the record, 77 registered and with apologies and new members to M.E.A.Q. [Our State Association], over 100 Marine Educators were identified.

A breakdown is as follows:

A.C.T.	1
Victoria	7
Tasmania	2
South Australia	1
Queensland:	57
New South Wales:	9
Apologies	27
TOTAL	104



AUSTRALIAN CAPITAL TERRITORY

Mr. Anthony Bergin Royal Naval College Jervis Bay ACT 2540

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Dr. Laurie Hammond 14 Parliament Place Melbourne VIC 3002
Dr. Russel Synnot 6 Foam Street Hampton VIC 3188
Mr. John Tomkin 18 Fellows Road Point Lonsdale VIC 3225
Ms. Kris Kristensen Marine Studies Centre Queenscliff VIC 3225
Ms. Julie Schwartz Marine Studies Centre Queenscliff VIC 3225
Mr. Peter Kinchington Marine Studies Centre Queenscliff VIC 3225

TASMANIA

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Dr. Peter McGovern, Australian Maritime Academy Launceston TAS 7250

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Ms. Beth Cummings 15 Upolu Esplanade Clifton Beach 4871 [Marine Consultant]

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Mr. Norm Newell PO Box 659 Hermit Park Q Townsville 4812
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Mr. Ian Stewart 11 Holt St Currimundi 4551 Q
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Mr. Don Fee 29 Phillip St Mt Pleasant 4740 Q
Mr. Bill Keid 9 Coral Drive Blacks Beach 4741 Q
Mr. Mark Haig 17 Manooka Drive Cannonvale 4802 Q
Mr. Greg McGarvie 69 Bedford Road Mackay 4740 Q
Mrs. Meg Kennedy 6 Queen St North Mackay 4740 Q

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Brisbane North

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Mr. Keith Wells Dakabin SHS Marsden Road Kallangur 4503 Q
Mr. Bill Wilson 33 Melinda Court Kallangur 4503
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Mr. Len Zell N.P.& W.L.S. MLC Court 239 George St Brisbane Q 4000
Mr. Keith Wood Sth Brisbane TAFE South Brisbane Q 4101

Brisbane West

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Mrs. Dianne Hempenstall Benowa SHS PO Box 5733 Gold Coast M.C. Bundall Q 4217
Mr. Boris Danijchenko Jacobs Well FSC PO Box 33 Beenleigh Qld
Mr. W. Fossey PO Box 143 Beenleigh 4207
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Mr. Clive Allen Mail Bag 250 Mt. Gravatt Q 4122
Mr. George Stubbs, Brisbane SHS Musgrave Park South Brisbane 4101 Q
Mr. Terry Balsom 23 Jenifer Avenue Runaway Bay 4216 Q
Ms. Carol Fiffer 32 Provincial Road Holland Park 4121 Q
Mr. Steve Hall 19 Allawah Avenue Palm Beach 4221 Q
Mr. Mike Halpin 16 Florence Street Tweed Heads NSW 2485
Mr. Graham Cox Keebra park SHS Ann St Southport 4215 Q
Ms. Gail Mayes 11 Elmira St Indooroopilly 4068 Q
Mr. Bob Mann Gold Coast TAFE Heeb St Benowa Q 4217 Q
Mr. Norm Love 25 Hendersen St Bulimba 4171

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L.C.D.R. John Mathias 8 College Rd Jervis Bay NSW 2540
Ms. Mary Mathias 8 College Rd Jervis Bay NSW 2540
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The Regional Director, Brisbane North Region, PO Box 153 Windsor 4030 Q
The Regional Director, Brisbane West Region
The Regional Director, Wide Bay Region PO Box 142 Maryborough Q 4650
The Regional Director, Central Region, PO Box 138 Rockhampton 4700 Q
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Mr. Peter Laurence SEA WORLD The Spit Southport Qld
Mr. Ralp Hickling 110 Scott St Stafford 4053 Qld

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Mr. B. McAllistar Department of Education PO Box 33 North Quay Brisbane 4000
Mr. R. Herschell Department of Education PO Box 33 North Quay Brisbane 4000
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Mr. Jonathan Shepherd Queenscliffe High School Queen St Queenscliffe VIC 3225
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Ms. Myriam Preker Heron Is Research Station via Gladstone Qld 4680
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Ms. Heather Angus 47 Munroe St Auchenflower 4066
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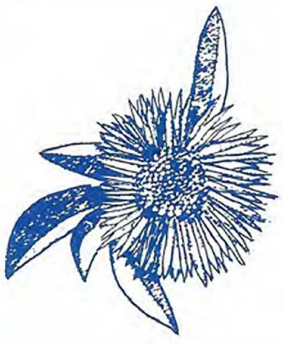
Mr. Tom Perrogo Kingston Environmental Eduation Centre Rottnest Island 6161 SA
Mr. Ian Warfield Maritime Safety Division PO Box 594 Canberra City 2601

ADDRESS UNKNOWN (Please help if you can) Ms. Sue Gordon



WELCOMING ADDRESS

by

Dr L. S. Hammond
Director
Victorian Institute of Marine Sciences

This address, delivered at the kind invitation of Bob Moffatt represents an opportunity for you to commence this meeting with a sense of the recent history of marine education in Australia, and of the events leading up to this meeting.

A workshop at this time last year, organized by the Victorian Institute of Marine Sciences at its Marine Studies Centre at Queenscliff, was the first time marine educators from around Australia had come together to discuss their work. That workshop showed us that there was a need for marine educators to get together, to talk and enthuse, and to exchange information and assist one another.

The Queenscliff gathering was altogether a very cathartic and very productive time, and though very much smaller than the meeting we will have over the next two days, it showed us the way and gave us the confidence to push on to greater things. I'm sure that, at this meeting, we'll again capture that same enthusiasm and excitement.

Several characteristics of marine education in Australia were evident at the previous workshop. Most striking was the diversity of activities, of motivations, and of organizations. Programmes were being run by state bodies, federal bodies, private organizations and a few quangos as well. Some were school-based, others were conducted at special field centres or even on ocean-going vessels. They were aimed at schools, at special interest groups and at the general community. They sought to impart formal knowledge about the sea, to promote an awareness and appreciation of the marine environment, and to teach special maritime skills. Some were vocationally oriented, others were value-oriented. We will experience this diversity again during the next two days, but to help us focus on issues, the organizers have given a "vocational" theme to much of the present meeting. This will not be to the exclusion of other aspects of marine studies, for we probably all recognize that the diversity of our endeavours is perhaps their major strength.

There were no grand recommendations the last time we met. Rather, the participants in the Queenscliff Workshop resolved to continue to communicate, to exchange materials and resources, to publicize marine education, to meet again, and to form some sort of national grouping. The first four of these resolutions were met during 1985 in various ways: by the publication of an occasional newsletter by VIM's Marine Studies Centre at Queenscliff, by the development of an embryonic resource bank at that Centre, by the publication of various articles and reports on marine education, and by the convening of this meeting by Bob Moffatt. We hope that the fifth resolution may be met at the conclusion of this meeting.

I commend to you the programme that has been devised by the organizers for the next two days. We will be asked to progress from setting the scene, to reviewing the present status of marine education, to identifying problems, to proposing solutions. I look forward to it, and in welcoming you here, exhort you to participate fully and enthusiastically.

Welcome, and thank you.

OPENING ADDRESS

by

Dr Graham Saunders
Director
Queensland National Parks and Wildlife Service

History recorded this country as Terra Australis - the great south land. While it was discovered and its shores charted by men in ships, the emphasis since has always been on the land. Most of us live relatively close to the sea, but we have considered our wealth to be in greater population, expanded settlement inland, in crops and livestock and our minerals. We forget we would be worthless without trade in ships across the seas.

The country's extensive maritime history is more chronicled in books and memories than as a topic of everyday discussion. I predict a new volume is starting here today. When a writer looks back, he will see this workshop as worthy of a mention as a catalyst for Marine Education in this country. The fact this assembly is taking place reflects a number of changed attitudes.

One is in education itself, particularly in Queensland has there been an awareness of the subject, not surprisingly, as the state has 7400km of coastline. Teachers have been encouraged to look for ways to prepare their students for the future.

Another is in pressure from within the maritime field itself - very diverse but including fishing, tourism, State and Federal Government services and authorities, research, supply and service industries, and organizations like Surf Life Saving Clubs and the Volunteer Coast Guard.

Unfortunately, no stastics are compiled to group maritime related employment to indicate its real significance in the community. More importantly, perhaps, has been the upsurge in the community of maritime related tourism, and of boating and sailing, particularly in the last 10 years. This has brought with it a general acceptance that such activity is a part of modern life. It deserves as well as demands attention.

Most importantly, it is recognised by politicians as a sector of our economic life both generating money and activity and is therefore a responsible area in which to spend taxpayers money. Just as there are pastoral and agricultural colleges catering for the education of young people intending going on the land, so should there be some institution and system to cater for the growing number that will spend much of their working lives on the water, particularly inshore.

The bottom line in so many discussions in government and industry these days is jobs - how many positions can be created with a fixed amount of funds? Students contemplating working in the maritime environment can take heart where Queensland is concerned. Two recent publications by the Australian National Parks and Wildlife Service indicate this. They cover the 37 million hectares given protection under various marine and estuarine protected area categories. Almost the whole of one 220 page book is taken up with the reserves in Queensland totalling a massive 34.7 million hectares. The other book is sufficient to cover the rest of Australia.

The Queensland National Parks and Wildlife Service has the task of day to day management of the Great Barrier Reef Marine Park which takes up most of the declared areas. Now there are 38 staff in the Maritime Estate Branch, and a total approaching 100 is feasible by the time all sections of the reef come into full control as envisaged. While a number of these jobs are for management officers requiring tertiary qualifications, many are for Marine Park Rangers, the maritime equivalant of that conservation figure, the National Park Ranger.

He or she is often the self motivated nuts and bolts person to keep the visitors and the office happy, and the engine running. My service has discussed changes to the present ranger course to cater specially for the person who wishes to become a Marine Park Ranger. The person with a school level Marine Studies qualification have a definite advantage.

Multiply our needs by a factor of say 10 or 20 and there is a major need emerging in the 1990's and beyond. While there will always be a need for the general practical person like the deckhand, there will be many opportunities for specialists. I think of the Boating and Fisheries Patrol Officers, those who tend the navigation marks and lights, Water Police, Servicemen for Marine Instruments and engines, Marine Research Assistants, and Tour Guides for above and below the water.

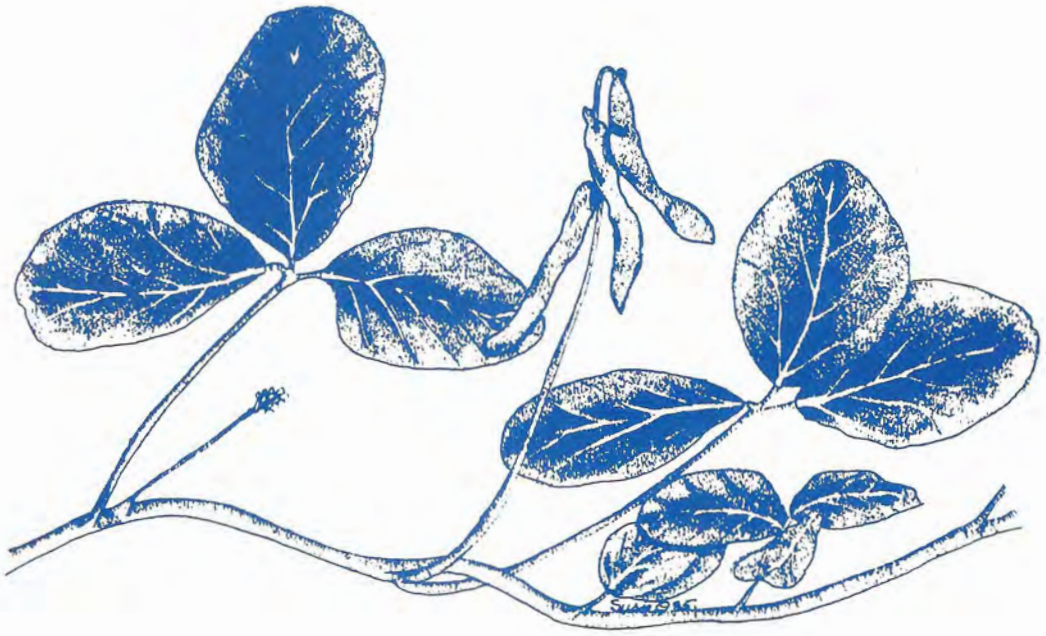
Mr Bob Moffatt and the Benowa State High School P & C Association are to be congratulated for their foresight in preparing a Marine Studies Programme for students to attend the Marine Studies Centre at the school. Honest people in this room will regret not having such an opportunity in their days at school.

The task to be considered is - What's next? How can a Marine Studies programme be made available to the students in Cairns, or Thursday Island, or Perth, or Hobart ? Is the task an urgent one, needed for preparation for jobs in the next few years? Can or need it be modified to suit certain State and other organization requirements? The opportunity is here this weekend to consider such problems. Very few of us are teachers in the strict sense. The organizations we represent, however, do have a very important role to play in education, and in Marine Education in particular.

One weekend is not much time to consider all the implications the deliberations could have. I wish you well in your discussions for the sake of a new style new generation of Australians.

I have much pleasure in declaring this Marine Educators Workshop officially open.

Thank you.



CAREERS AT THE AUSTRALIAN MARITIME COLLEGE

by

Peter McGovern
Head of the School of Nautical Studies
Australian Maritime College, Launceston, Tasmania

Australia's marine and maritime activities are substantial in scope and number. They encompass merchant shipping, fishing and recreational boating to name but three. It is not surprising therefore that there is substantial employment in this field. To this end the Australian Maritime College offers education and training for students who are seeking careers in specific areas of the maritime industries.

The College as an Educational Institution

The AMC is an Institution of Education established under the Australian Maritime College Act 1978. The functions of the college are:

> (a) to conduct an institution for the provision of such maritime and maritime-related education and training as the Council, with the approval of the Minister, determined, or as the Minister requires, being principally tertiary education for persons who wish to become, or are, officers on merchant or fishing vessels or who wish to become, or are, otherwise engaged in connection with shipping or the fishing industry;
>
> (b) to use the facilities and resources of the College to advance and develop knowledge and skills in the fields with which the College is concerned
>
> (c) to award such degrees, diplomas and certificates in relation to the passing of examinations or otherwise in relation to the education and training provided by the College as are provided for by the Statutes
>
> (d) to consult and maintain liaison with other institutions and authorities in Australia that are concerned with the provision of maritime education and training
>
> (e) to do anything incidental or conducive to the performance of any of the preceding functions.

During 1985, there will have been 635 students on campus pursuing courses leading to awards, and the College will have serviced 1,000 other students on short courses. Some of these courses will have been conducted off-campus at venues dictated by student or industry requirements. At the moment we have a full-time staff of about 130 including staff associated with ships and residences, and about 50 are teaching staff.

The shipping and fishing industries are diverse, as are most other industries; however options are correspondingly varied. Young people have an inherent interest in ships and the sea, and the breadth of activities in this sector offer an exciting chance for career development.

The AMC is conscious of its role as a cross-sectoral institution. Entry standards are flexible, applicants are considered on an individual basis. Maximum credit is given for previous studies, whether those studies have been pursued with the AMC or at some other college or university.

Courses and awards offered by AMC

School of Engineering

Bachelor of Engineering (Maritime); Bachelor of Applied Science (Marine Engineering); Associate Diploma in Marine Radiocommunication; Associate Diploma in Maritime Electronics; Certificate of Competency Preparatory Studies ; Radar Maintenance

School of Fisheries

Graduate Diploma in Fisheries Technology; Bachelor of Applied Science (Fisheries Technology); Certificate of Technology in Fisheries Operation; Certificate of Competency Preparatory Studies

School of Nautical Studies

Graduate Diploma in Hydrographic Surveying; Graduate Diploma in Business (Shipping); Bachelor of Applied Science (Nautical Studies); Diploma of Applied Science (Nautical Science); Certificate of Competency Preparatory Studies; Deck Boys; Engine Room Wipers; Stewards/Cooks (Safety Training)

Short Courses

Advanced Fire Prevention and Control on Board Ship; Advanced Navigation and ARPA Simulator; Advanced Petroleum Tanker safety; Automatic Radar Plotting Aids; Barge Handling for Antarctic Expeditioners; Basic Fire Fighting; Basic Petroleum Tanker Safety; Basic Radar; Bridge Teamwork; Business Management for Fishermen; Cargo Loading for ANARE; Chemical/Gas Tanker Safety; Communications Procedures - Antarctic Expeditioners; Elements of Shipboard Safety; Fire Fighting Command; Fire Fighting for ANARE; Fire Prevention and Control; First Aid at Sea; Fishery Officers; Fish Handling and Processing; Fishing Technology (Trawl); Fishing Vessel Hydraulics; Fishing Vessel Refrigeration; Grain Loading; Hazardous Goods; Human Relations and Management for Ships' Officers; Hydroacoustic Fish Detection; Inert Gas/Crude Oil Washing; Instrumentation and Control; Introductory Fisheries; Liquefied Gas Tanker Safety; Liquefied Gas Tanker Safety Familiarisation; Longitudinal Strength; Magnetic Compass Compensation (full); Magnetic compass Compensation (restricted); Management for Offshore Industry; Marine Diesel Operation Refresher Course; Marine Automatic Radar Plotting Aid Surveying; Marine Electronics; Marine Radar Surveying; Medical Safety for Abalone Divers; Medical Training for Shipmasters; Morse Communication; Net Making and Mending; Net Repair and Maintenance; Petroleum Tanker Discharge Safety; Petroleum Tanker Familiarisation; Petroleum Tanker Safety; Pilotage with Radar; Prawn Trawl Gear Design & Operation; Proficiency in Seamanship; Proficiency in Survival Craft; Radar and Sonar; Radar maintenance; Radar Observer; Radar Refresher; Radar Simulator; Radiotelephony Refresher/familiarisation; Radiotelephone Operators General Certificate; Radiotelephone Operators Restricted Certificate; Ratings Training; Safety for Fishermen; Sea Survival for ANARE; Shipwright Retraining; Small Boat Radar Operator; Stability Refresher; Stability Techniques; Trawl Gear Design & Operation; Unmanned Machinery Spaces Operation.

CAREERS IN MARINE SCIENCE

by

Dr. Russell Synnot
Head Technologist, Melbourne Department of Works & Editor of "Careers in Marine Science"

This talk will concentrate on the analysis of

- career opportunities in marine science;
- the description of the new edition of the booklet "Careers in Marine Science";
- a discussion of several career areas
- and a discussion of future directions and opportunities.

Career opportunities

A major problem in the analysis of career opportunities in marine science in Australia is the lack of information concerning the numbers of persons employed as marine scientists. The Graduate Careers Council of Australia does not maintain records for any of the marine science disciplines.

The Commonwealth Employment Service has recently funded research on the crown of thorns starfish on the basis of the numbers of registered unemployed "marine biologists" at the Townsville offices. The only accurate data concerning the numbers of marine scientists in Australia has been accumulated in the Department of Immigration and Ethnic Affairs, when overseas scientists have been employed in positions where no Australian was deemed suitably qualified or experienced.

This lack of suitable data has implications for the future directions of marine science in Australia:

-Planning for future training and facilities can be misleading or wrong;
-No political weight can be applied when lobbying decision makers
-Without due recognition, some fields of marine science are taught as "add-on s" or afterthoughts to established courses.

Even without employment data for marine sciences, it is felt that with a broad based economic recovery, the declaration of the 200 mile fishing zone, the adoption of the London convention, a surge in the recreational usage of coastal marine resources and the emergence of a promising commercial mariculture industry, that career opportunities in marine science in Australia are increasing.

Booklet - "Careers in Marine Science"

The Association of Marine Sciences of Australia promotes and encourages the development of marine science. As part of that philosophy, the Association publishes a booklet entitled **Careers in Marine Science**. The fourth edition of this booklet will be published early in 1986.

The text will include:

-descriptions of research
-applied, education and technical careers
-summary of career opportunities, training and qualifications required
-directions for further advice and information

Career Areas

Maritime Archaeology is a relatively new marine science in Australia. A 12 month post-graduate course is taught at the Western Australian Institute of Technology, in conjunction with the Western Australian Museum. Very few full-time maritime archaeologists are currently employed in Australia and career opportunities are very limited. Further expansion is heavily dependant on external funding.

Food Technology is an expanding field and several courses are offered at colleges in N.S.W. and Victoria. So far most graduates from these courses have found little difficulty in finding employment.

Marine Mariculture career opportunities are expanding as developments in mussel, oyster, fish and prawn culture and farming take place in most states of Australia. Courses in mariculture are available at several colleges in Tasmania and cater for a range of entry qualifications.

Marine Botany and Zoologyhave very limited career opportunities as a situation of oversupply has existed for many years. Most graduates are employed in the government sector, generally doing routine laboratory work and teaching.

Future directions

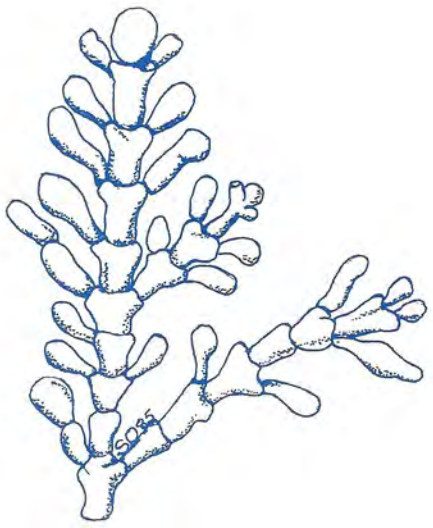
Future training requirements for marine science students should include the following:

-An increased teaching of communication skills - the end product of all scientific research is some form of communication.

-Management skills need to be included in the teaching at some stage to alleviate the problems of trained scientists being pushed into management positions on the basis of their scientific performance, not management abilities.

-Equal opportunity should be emphasised as after a decade of positive action by government little impact is observable in the numbers of women employed in marine science institutions in Australia.

-A few traditional views about marine science should be dispelled. Care should be taken in the description of careers in marine science - the proportion of time spent at sea is usually very small compared to the time spent in the office and laboratory performing less glamorous routine tasks.



T.A.F.E. INPUT SUGGESTIONS

by

Mr. Keith Wood
Marine Studies Teacher
South Brisbane College of TAFE

Suggestions:

- Establish a professional association capable of attracting a broad range of marine educators, under the umbrella of an existing Union/Industrial Association of Educators.

- Develop an effective political lobby

- Work to avoid competition between colleges and between colleges and schools

- Establish standards of teaching expertise

- Establish staff development programs

- Establish co-operative ventures:

  * equipment gathering
  * joint programs
  * 'contracted out' programs
  * fund raising
  * course design
  * equipment design
  * teaching mechodology design

CONFERENCE DESIGN - PLANNED CHANGE AND PROBLEM SOLVING STRATEGIES

was developed by
Mr. Ken Gilbert (Utah)
and presented by
Mr. R. Moffatt (Conference convenor)

The model is a refinement of the Dewey,Miles, Chin, Lewin, Lippit and White, "Planned Change and Problem Solving Strategies". The sessions will aquaint you with a number of steps that are involved in problem solving

*

The model

Motivate to change				Develop need for change. Establish consultant relationship
Identify problem	What is the apparent problem?	Dissatisfaction leads to seeing problem	Identify the problem	Clarify client problem
Analyse	What is the real problem?	"	See forces in balance (FFA)	"
Data collection	What information is relevant?		See feelings, emotional reactions too	
Invention	What are the possible solutions?	Consider the alternatives, choose one	Think of poss alterations own conduct	Examine alternative goals and solutions
Plan strategy	What is the best solution How do we implement it?		Consider action possibilities, feelings about action	Transform intentions into change efforts
Take action	Take action	Take action	Action here or after more analysis	Take action
Feedback evaluation	Evaluate	Analysis	Analyse process to this point	
Generalise		Generalise, integrate	Reflect on process and its possibilities	Generalise and stabilise
Phase out				Achieve terminal relationship
Recycle	Repeat cycle for other problems which emerged in the course of working on this or on other issues.			

* From: John Dewey, Mathew Miles, Robert Chin, Lewin, Lippit and White

Note: The above summary is an attempt to draw out as full as possible a statement of steps in the process. The order of steps is only a rough indication and it is expected that there will be movement back and forwards to earlier and later steps as the procedure warrants it.

The design

STEP 1: Friday's information input - "The Marine Studies Scene"

The Broad Perspective, What about the students and their life in the Marine World, What are Career/Job/Recreation/Leadership prospects

STEP 2: Friday night session - "Exploring the Problem of Marine Studies in Australia"

Aims to aquaint all participants with the issues/problems/questions facing Marine Education in Australia, discuss the Perceptions of Youth in their International Year, explain the purpose of this Workshop, and collate other perceptions seen by the group

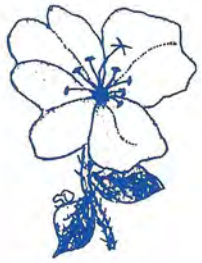
i.e. MARINE STUDIES -----> ? --------> ? ---------> ?

Group Discussions/Refining Solutions/Working on most important/Working Parties, National/State Associations.

Marine Education has a wide spectrum. Consider the following and some possible desired goals as perceived by a humble "trained educator". Among many other things:

Firstly the "Non Teacher Trained" organisations have a stake in the Education of Australians. There is a need for all involved to recognise this at this meeting.

Organisation	Possible goal
Navy,	Well trained people for defence
Fishing Industry,	Successful businesspeople
Tourism,	Educated tourists
Department of Transport,	Safe operators
Water Police,	Law abiding citizens
Surf Lifesavers,	Safe participators
Coast Guard,	Ditto
Air Sea Rescue	Ditto
National Parks and Wildlife,	Educated users of resources
Great Barrier Reef Marine Park Authority	Ditto
Scientists	Increase wise use and knowledge
Conservationalists	Educated wise users
Dept of trade	Educated businesspeople and wharf workers



Secondly, consider the "Trained educational institutions"

What are the relationships between: PEP and Marine Studies, Projects/Field Study Centres, Curriculum Initiatives, Students lack of knowledge-what they can do with the courses, Teachers/Community lack of knowledge of links School/TAFE/Community/Tertiary, The traditional pathways are clear but the new ones are not ? Primary schools, Secondary Schools, TAFE colleges, Colleges of Advanced Education, Universities, Colleges of Maritime Studies

Queensland is the first State to develop a formal syllabus in Marine Studies and classroom ready materials for Upper Primary/Lower/Upper Secondary. The materials are in their infancy and need inputs from all Australians involved in Marine Education to improve.

2. So where does Marine Education begin and end ?

Here are some Problems/Issues; Is there community partricipation, how much money is spent, how many communication problems exist between people, what is the nature of marine studies, is it a subject/philosophy/part of environmental ed, do community groups fall into Marine Ed Surf Lifesaving/Coast Guard, where do our defence forces (eg:Navy) fit in, are they environmental Ed or Marine Ed, should the subject be practical/theoretical or environmental, who should it be taught to, students who are tertiary bound, TAFE bound, Community bound, what is the community involvement, where do parents fit in, does a boat licence course come into Marine Ed, what about fishing clubs, outdoor educators, Marine Park rangers, Harbours and Marine Officers, who should develop the Syllabi Secondary/TAFE/Community, what standards should the syllabus set, do we become involved, Who should become involved, What right have they anyway to be involved and how much notice should we/they take.

STEP 3: Saturdays Workshops - "Collecting the Information"

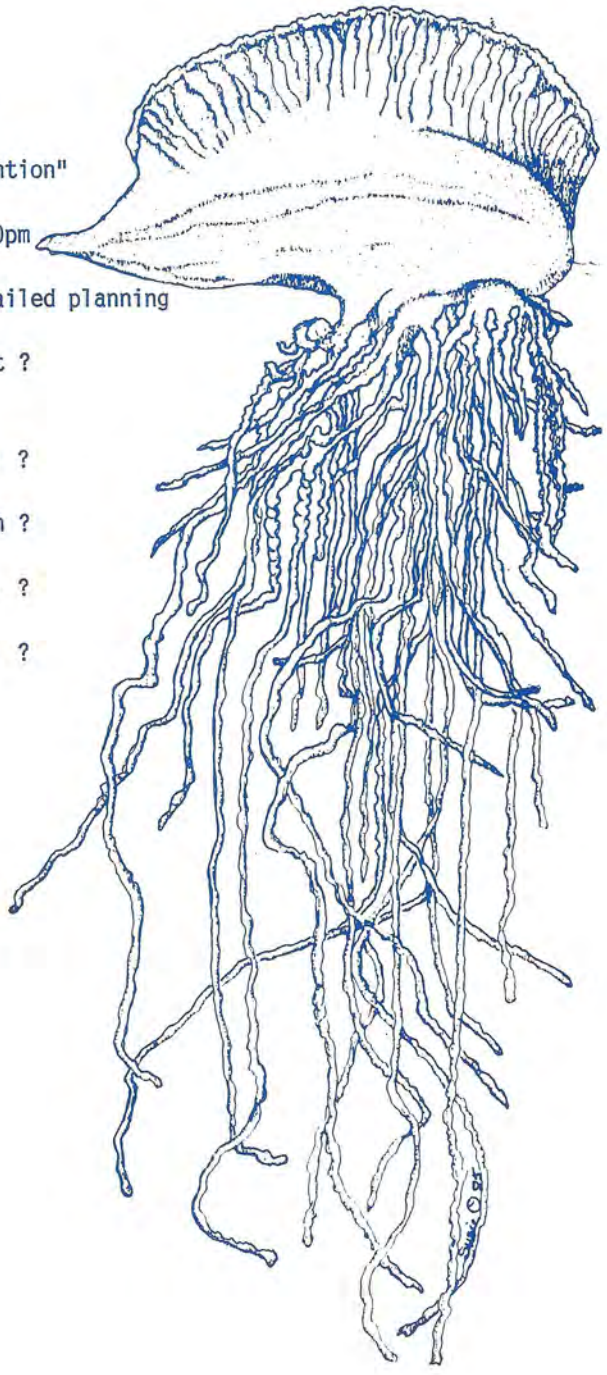
Workshops/Miniworkshops/Informal Discussions/Keynotes

STEP 4: Sunday - Finding possible solutions: "Planned Intervention"

9.00 am ----------> 11.00am ----------> 2.00pm

What needs to be done -----> How should it be done ------> Detailed planning

Mixed groups	Perceived working parties participants choose	What ?
Brainstorming	A.....	How ?
Refining	B.....	When ?
	Could be	
Plenary Reporting	C.....	Who ?
On OHP + Photocopies to all as reports are complete	D.....	Why ?



THE AUSTRALIAN MARITIME COLLEGE

by

Peter McGovern
Head School of Nautical Studies AMC Tasmania

About the College

The College is sited in Northern Tasmania, the main campus at Launceston; the School of Fisheries and the practical training facilities at Beauty Point, some 30 miles downriver from Launceston. Campus development began at the start of 1979 and the physical facilities are substantially complete. Some of the more interesting features of the college are:

(a) Fisheries Flume Tank

This is a circulating water channel 31 m long, 5 m deep and 5 m wide. The working and observation section of the tank is 15 m long, 5 m wide and 2.4 m deep. Model nets are streamed in the moving water and their performance is evaluated. Nets are scaled 1:5 to 1:30 dependent upon type; maximum water speed is 1.5 m/sec.

(b) Ship Model Towing Tank

This is a concrete tank of length 60 m, width 3.5m and depth 1.8 m used for examining the performance of model hulls in calm water or waves. Models can be towed at a speed of up to 4.5 m/sec.

(c) Wyuna

This is a navigation and seamanship training vessel. The ship is 64 m long with diesel electric propulsion. Up to 40 students can be accommodated at any time, using the most modern equipment.

(d) Bluefin

Bluefin is a 34.5 m stern trawler. Fourteen students can be accommodated and they can practise bottom and mid-water trawling, prawn trawling, long lining, squid- jugging and other fishing methods. The ship is fully equipped with fish finding gear and with fish handling equipment.

(e) Investigator

This is a 10 metre inshore trawler of wooden construction. In addition to its role as a fishing boat, the vessel is used for compass adjusting, boat handling and maintenance training.

(f) Pinduro

This is a 13 metre fibreglass launch full fitted for Hydrographic Surveying and also used for compass adjusting and maintenance training.

(g) Diesel Engine Simulator

This is a computer-controlled device which simulates the operation of the engine-room of a 120,000 tanker propelled by a slow speed diesel producing over 20,000 kw. The instructor can test the training responses of students by feeding in faults. The simulator will respond in the same manner as a real engine; the students' action must be the same as that which he would take in real life.

(h) Ship Handling Simulator

This consists of a fully operational ship's wheelhouse, the windows display a computer-generated scene of sea, harbour surroundings, other ships etc. The visual scene covers an arc of 200 degrees and up to 20 different traffic ships can be programmed to appear. The simulated scene can be viewed in daylight, or darkness, with rain or fog. There are eight different own-ship types, and the simulators produce the characteristics of each one faithfully

MARINE SCIENCE EDUCATION IN THE RAN

by

Lt Commander John Mathias
Oceanography Lecturer Royal Australian Naval College

Abstract

A presentation outlining the development of Marine Science Education in the RAN from the early 60's to the present. This includes the development of a first-year university course at the Royal Australian Naval College and three courses in Oceanography in the Diploma of Applied Science. The progression from these courses to 1st, 2nd, and 3rd year degree courses in Oceanography at the Australian Defence Force Academy, due to open in January, 1986, is then outlined. Careers in Marine Science in the RAN are examined as are the uses to which the RAN puts Marine Science.

Courses offered at the RAN

Oceanography I

The Oceans and Ocean Basins: (general properties of sea water, submarine topography, changes in sea level), Waves and Tides: (origin types and properties), Oceanic and Atmospheric Circulation: (surface currents, deep circulation upwelling and methods of investigation), Structure of the Earth's Crust Beneath the Oceans: (benthic topography, geophysical properties, sea floor spreading and continental drift), Sediments: (benthic, pelagic, mapping, sampling, profiling and properties Chemical, Acoustical and Optical Properties of Sea Water: pH, Eh, salinity variation, sonar, radio penetration, absorption of light and methods of measurement)

Oceanography II

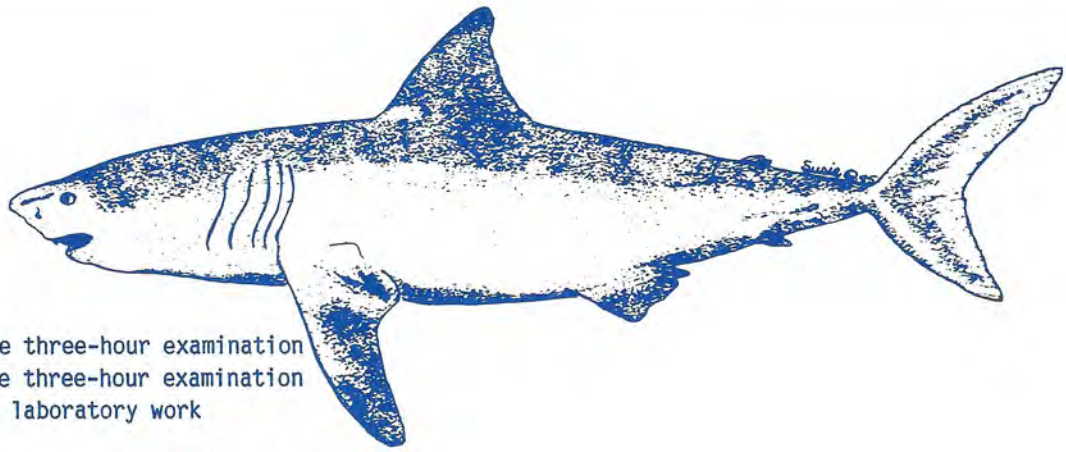
History of Ocean Exploration: (sounding techniques, use of acoustic devices, present state of the art), Morphology of the Oceans: coasts and estuaries, continental shelf, coral reefs, continental slope, plateaus, submarine cables, abyssal plains, mid ocean ridges, seamounts and ocean deeps, Rocks and minerals of the oceans - to be covered in practical classes, Geological processes in the oceans. The principles of sea floor spread, Scientific techniques: ship positioning, sampling; geological, hydrological and biological; tide, current and wave measurement, precision depth recording, sea beam, sub-bottom profiling, side scan sonar.

Oceanography III

Wave Motion: basic wave theory, shallow and deep water waves, forecasting curves, near shore waves, tsunamis, internal waves, energy wave spectrum, Tides: basic tidal theory, secondary tidal features, amphidromic systems.Winds and currents: oceanic current systems, forces affecting winds and currents, types of ocean currents, wind patterns.Salinity and temperature: salinity and chlorinity, temperature and thermoclines, density and T-S diagrams, global heat distribution Communication layers: sound, light, lasers, satellites, Meteorology: basic meteorology, synoptic charts, weather forecasting, operational forecasting, Marine Biology: brief history of life on Earth, evolution, principal marine organisms, organisms harmful to ships and shore installation dangerous marine life, food chains, Marine Chemistry: nutrients in the sea; cycles for carbon, nitrogen, phosphorus; oxygen content of waters; pollution

Oceanography IV

Marine Geophysics: gravity and magnetic patterns in the oceans, palaeomagnetism and magnetic reversals, ocean seismic techniques. Marine acoustics: sea noise (biological and wind generated), sonar ranging, Marine technology: ocean resources, exploitation the catalyst for technological advance, Mineral resources: hydrocarbons, minerals, resources, Fishing industry: pelagic and benthic fishing and equipment used, Marine installations: oil rigs, pipelines, deep sea drilling, energy from sea, marine acoustic communication, Man in the sea: diving limitations, underwater habitats, research submersibles, marine salvage



Additional Information:

Oceanography I

ASSESSMENT: session one - one three-hour examination
session two - one three-hour examination
credit given for laboratory work

TEXTBOOKS: Gross, M. G. - OCEANOGRAPHY - A VIEW OF THE EARTH
Prentice-Hall (1977)
Pickard, G. L. - DESCRIPTIVE PHYSICAL OCEANOGRAPHY
Pergamon (1979)

(UNSW reference 25,601) Lectures 3 hrs/wk
Laboratory 2 hrs/wk

Oceanography II

Prerequisite Physical Science I Lectures/Tutorials 4 hrs/wk
Laboratory 2 hrs/wk

ASSESSMENT: One three-hour examination
Credit given for assignments

TEXTBOOKS: Weihaupt, J. G. - EXPLORATION OF THE OCEANS, AN INTRODUCTION TO OCEANOGRAPHY, Collier Macmillan Publishers London (1979)

Oceanography III

Prerequisite Oceanography II Lectures/Tutorials 4 hrs/wk
Laboratory 2 hrs/wk

ASSESSMENT: one three-hour examination.
credit is given for assignments, laboratory and field work

TEXTBOOKS: Weihaupt, J. G. - EXPLORATION OF THE OCEANS, AN INTRODUCTION TO OCEANOGRAPHY, London (1979)
Williams et al. - SEA AND AIR, Annapolis, Maryland: Naval Institute Press (1973)

Oceanography IV

Prerequisite Physical Science II Lectures/Tutorials 4 hrs/wk
Oceanography II desirable Laboratory 2 hrs/wk

ASSESSMENT: One three-hour paper
Credit is given for assignments

TEXTBOOKS: Williams et al - SEA AND AIR, Annapolis, Maryland Naval Institute Press 1973
Gross, M.G. - OCEANOGRAPHY: A VIEW OF THE EARTH, 2nd ed. Englewood Cliffs, New Jersey, Prentice-Hall (1977)
Gores, Joseph N. - MARINE-SALVAGE, David and Charles, (1971)
Weihaupt, J. G. - EXPLORATION OF THE OCEANS, AN INTRODUCTION TO OCEANOGRAPHY, London

INTERPRETING THE GREAT BARRIER REEF - THE FUTURE ROLE OF GREAT BARRIER REEF WONDERLAND

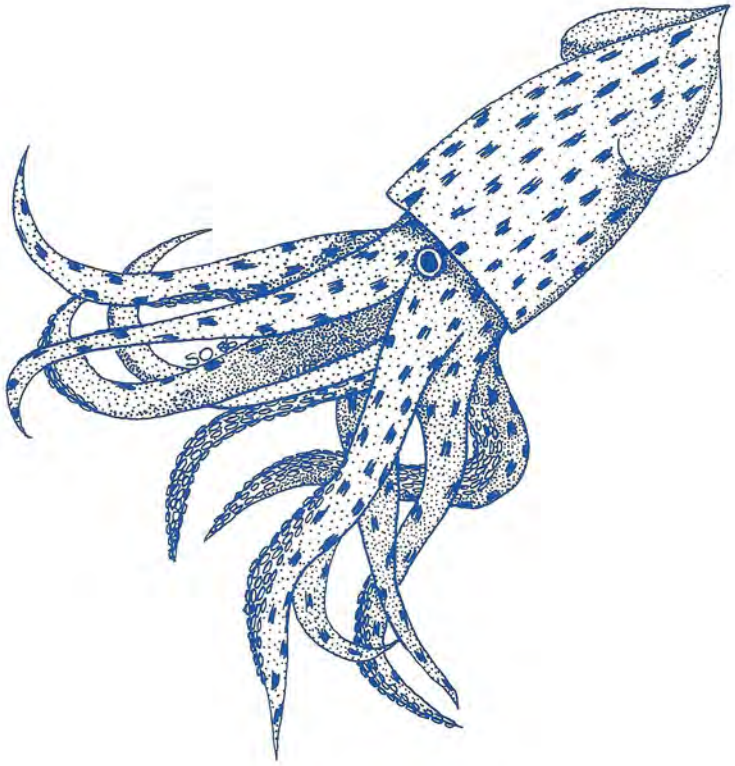
by

Kirk Petersen
Senior Extension Officer, Great Barrier Reef Marine Park Authority

Information on the concept

The Great Barrier Reef Marine Park Authority has long recognised that user education and interpretation are vital components of the Great Barrier Reef Marine Park management system. Consistent with this philosophy, the Authority has played a leading role in planning the development of the Great Barrier Reef Wonderland Bicentennial project.

The project will provide unique interpretive facilities and opportunities through the combination of scientific research, technological development, marketing and interpretive planning involving both public and private sector support. This talk describes the project components and planning undertaken to date.



THE VICTORIAN INSTITUTE OF MARINE SCIENCE'S MARINE STUDIES CENTRE

by

Dr. Laurie Hammond (Director)

The Marine Studies Centre is an educational resource centre operated by the Victorian Institute of Marine Sciences, an independent statutory authority which has responsibilities in marine research and education. The general educational objectives of the Institute include developing within students and other members of the community an appreciation of man's relationship to the sea and a sense of responsibility for the sea and its resources, as well as providing systematic knowledge about marine environments and marine organisms. To meet these objectives, the Marine Studies Centre provides programmes for school students at all levels, as well as for tertiary students and community groups. These activities emphasize field experience and a "hands-on" approach to learning.

The Centre is situated on the Queenscliff foreshore at the southern end of Port Phillip Bay, sharing a site with the Marine Science Laboratories belonging to the Department of Conservation, Forests and Lands. There is ready access to a wide variety of marine environments, including wave-cut rocky platforms, sandstone bluffs, saltmarshes, mangrove forests, seagrass meadows, mudflats, sandy shores and coastal dunes, so that the Centre is ideally situated as a base for environmental studies. The nearby Harold Holt Marine Reserves provide sanctuary for a great diversity of marine life, including many species of local and migratory birds. The township of Queenscliff has great significance in Victoria's maritime history, and provides many sites of historical interest, particularly the old pier and Maritime Museum

Inside the Centre a stimulating learning environment has been created. Large aquaria and a "touch-tank" allow visitors to become familiar with underwater life at close quarters. There are displays of shells, birds and other preserved animals and plants, as well as many informative posters and examples of studies done by previous visitors to the Centre. Microscopes and similar equipment are available for special studies.

The Marine Studies Centre is available for groups of up to 30 students from schools, for part- or full-day sessions. The Centre also provides courses for adult education and other community groups, and a summer holiday programme open to the general public. Universities and other tertiary education institutions may use the facilities of the Centre for their own teaching purposes.

MARINE STUDIES IN QUEENSLAND SCHOOLS

by
Mr. Bob Moffatt

Current situation: Department of Education.

At present schools in Queensland can undertake marine studies education in the following institutions:

(a) Primary and Special Schools:

Teachers have great freedom to select the appropiate content for their students. Some schools choose to teach the subject through a theme eg: the great barrier reef, rocky shore, swimming in the sea. Some schools have a well developed sailing programme eg: Gladstone Special School built with their students a series of sailing dingies and trailers. A workshop was set up and the teacher assisted the students build the boats. At Cooloongatta special school a surfing programme operates where students are taught surf survival and surf lifesaving skills. Other schools in the Brisbane area assisited with the building of the Jacobs Well community boat project.

(b) Secondary Schools:

At present a syllabus outline exists for students who wish to study marine studies to a board registered stage. This means, the board of secondary school studies approves a sample school marine studies workprogramme and the relative achievements of the students appear on their senior certificate. The results do not count for tertiary entry. Schools can study from the following syllabus topics: Navigation, Snorkelling and Diving, Camping, Boating, Sailing, Fishing - commercial and recreational, marine history, oceanography, marine technology or managing marine resources. Teachers have the freedom to allocate hours and units. The following is a list of schools offering marine studies programmes:

Benowa SHS PO Box 4733 Benowa, **Keebra Park SHS** Ann St Keebra Park, **Merrimac SHS**, Merrimac 4226, **The** Southport School Winchester St Southport Q 4215, **Wynnumn SHS** Peel Street, Manly 4179 Qld, **Woodridge SHS** Wembly Road, Woodridge 4114 Q, **Maroon Outdoor School**, Boonah Qld, **Brisbane SHS**, Brisbane Qld, **Dalby SHS** PO Box 608, Dalby Q 4405, **Lockyer District SHS**, PO Box 266 bGatton Qld 4342, **Burnside SHS**, Burnside, **Caloundra SHS**, Caloundra, **Caboolture SHS**, Lee St Caboolture Q 4510, **Maroochydore SHS**, Marchooydoore Qld, **Gympie SHS** PO Box 22, Gympie 4570 Q, **Maryborough SHS** Kent St Maryborough Q 4650, **Eidsvold** Secondary Department Eidsvold 4627 Q, **Bundaberg SHS**, Bundaberg, **Gladstone SHS** P.O. Box 260 Gladstone Q 4680, **Toolooa SHS** Phillip St, South Gladstone Q 4680, **Yeppoon SHS** Rawlings St Yeppoon 4703 Q, **Gladstone** Catholic High School, Gladstone, **Pimlico SHS** PO Box 310 Hermit Park, Townsville Q 4812, **Proserpine SHS** Ruge Street, Proserpine Q 4800, **Mackay North SHS**, North Mackay, **Ayr SHS** PO Box 961, Ayr 4807 Q, Christian Brothers College St Patricks PO Box 252, Mackay Q 4740, **Mirani SHS**, Mirani Qld 4741, **Heatley** SHS PO Box 64, Aitkenvale Townsville Qld 4814, **Bowen SHS** Bowen Qld 4805, **Home Hill SHS**, Home Hill Qld 4806, **Townsville SHS** Box 5439 M.S.O.,Townsville Q 4810, **Pioneer SHS**, PO Box 124 North Mackay 4742, Mossman SHS PO Box 178, Mossman Q 4873, **Smithfield SHS** PO Box 400 Smithfield 4871 Qld, **Trinity Bay** SHS Hoare St Manunda, Cairns 4870 Qld, **Thursday Is SHS** Thursday Island, **Bamaga SHS** Bamaga, **Wiepa SHS** Central Avenue, Wiepa 4874

The board of secondary school studies has convened a group to write a syllabus in marine studies. It is hoped the first trial will occur in 6 schools in 1988.

(c) Special Marine Centres

Some field study centres and special schools offer marine studies. These are; **Darling Point Special** School,cnr Upper and Lower esplanade, Manly Qld, **Jacobs Well Field Study Centre**, Jacobs Well Qld,**Boyne** Island Field Centre Boyne Island via Gladstone, **Cairns Marine Centre**, c/- PEP Office Cairns Department of Education

(d) TAFE/Secondary schools:

Some TAFE/Sec courses operate within the state. Examples of these can be found at Benowa, Keebra Park, Merrimac, Southport, Burnside and Townsville SHS's. TAFE/Sec course development is embyronic at this stage.

MARINE STUDIES AT BURNSIDE STATE HIGH SCHOOL - QLD

by

D. Foster, P. Bradford, K. Hall, R. Townsend and K. Barnett
Teachers Burnside State High School, Sunshine Coast TAFE

Philosophy

The Marine Studies course has been designed to take advantage of the educational facilities and expertise existing within Burnside State High School, Sunshine Coast TAFE course and community organizations to provide students with experience and knowledge in aquatic and marine activities. A major goal underlying the course objectives is to ultimately develop a generous and sensitive philosophy toward the coastal marine environment which will enhance the quality of the recreational area for the future. Through an examination of the practical, legal, and responsible approaches to fishing, and boating, participants will develop a rich awareness into their value for all ages. The students will be exposed to practical and theoretical components of many different marine activities. All of these activities will lead to certificates of achievement from such bodies as Burnside State High School, Sunshine Coast TAFE College, Australian Yachting Federation, Department Harbours and Marine and Volunteer Coast Guard. The course will be socially, recreationally and prevocationally orientated. This will equip students with sound knowledge of safety and skills for successful and safe leisure pursuits as well as giving them exposure to various career paths.

The completion of certificates, whilst not directly related to any specific vocation will make the student a very attractive candidate for career positions. There will be a minimum 50% practical aspect to Marine Studies. The practical components will be performed mostly in the Maroochy and Mooloolah Rivers and numerous locations on the Sunshine Coast. Marine Studies is a school subject and should not be confused with TAFE courses being offered. Marine Studies will be available to almost any student in grade 11 to complement their other subjects. Because of the lack of facilities available at the moment the course must be restricted to 28 students. These students will be selected from applications received. This is an exciting and unique course which will grow, as facilities become available, to develop able young mariners and fishermen for the maritime workforce.

Course outline

The course is divided into four sections: Boating (55 hrs) and commercial and recreational uses of the marine environment (55 hrs) are studied in year 11. Advanced seamanship and certification (110 hrs) are studied in year 12.

Boating

This includes boat types, boat building, safety and emergency proceedures, rules of load, buoyage systems, launch procedures, engines, maintenance, use, boat handling, knots, ropes, securing and anchoring. Certification is a school certificate, harbours and marine boat licence, AYF TL1 and TL3 certificates.

Commercial and recreational uses of the marine environment

This includes fishing techniques both commercial and recreational, fish management, fishing regulations, practical fishing, preparation of catch, cooking and storage. Certification is a school certificate, work experience statement and reference from the employer.

Advanced seamanship and certification

This includes nautical terms, ropework, anchorage, safety, sailing theory, navigation, charts, publications, chartwork, compass work, position fixing, tides, tidal streams, lighthouses, beacons, passage planning, marine meteorology and first aid. This theory will be complimented by a minimum of 60% practical work which will involve advanced boating skills developed in grade 11 as well as specific activities related to topics in the theory units. The course will culminate with an ocean sail aboard the OYC clubs, "Ocean Venturer". Certification includes, school certificate, CNC48 TAFE/Sec certificate, AYF TL1,TL4, TL5. Additional certificates may include, St. Johns Ambulance First Aid, SCUBA and volunteer coastguards radio operators certificate.

MARINE STUDIES AT BENOWA STATE HIGH SCHOOL

by

R. Moffatt, M. Evans, D. Read, S. Cerato, T. Failes, D. Hempenstall, S. McCabe and D. Gorwyn
Science Teachers Benowa State High School, Gold Coast, Queensland

About the courses

This course introduced the applied school subject, Marine Studies into the school curriculum two years ago for students in years 11 and 12 students who wished to study a relevant subject based on local conditions. Students can study either a course with 80% practical (Marine Studies) or a course with 50% practical (Multistrand Science). Benowa High is situated on Queensland Gold Coast and both courses are designed using the sea as a theme. Content, process, skills and attitudes are all based on this thematic approach. Students from grades 8 - 10, can also do marine studies units in the schools sports and recreation programme.

Course description:

Students enrol in either Grade 11 Marine Studies or Multistrand Science. Students study a combination of the following units: Teachers either select a course which is practical or theoretically oriented. The multistrand course tends towards the theory while marine studies is largely practical.

Units with a practical emphasis (Marine Studies) are:

Unit 1: Navigation: Coastal features, Navigation Methods, Excursion, Weather, Pilotage, Tides.
Unit 2: Snorkelling: Physiology, Techniques, First Aid, Dangerous Marine Animals, Safety, Certificate.
Unit 3: Radio: Components, Features, Discipline, Types, Practice Exercises, Certificate.
Unit 4: Boating: Buying a Boat, Safety, Seamanship Skills, Handling, Maintenance, Licence.
Unit 5: Camping: Types of, Equipment for Camping with a boat, Campsites, Practical Conservation.
Unit 13: Advanced boathandling: TAFE/Sec subject TAFE syllabus: Advanced speed boat handling in association with the air/sea rescue
Unit 14: Radio/Radar: TAFE/Sec subject TAFE syllabus: Taught by Tafe college staff.
Unit 15: Marine Petrol and diesel engines: TAFE/Sec subject TAFE syllabus: Taught by Tafe college staff using the marine studies resources of the school.
Unit 16: Introduction to sailing: Sailing theory and practice: A introduction to the theory and practice of sailing. Includes ocean sailing with Maroon Outdoor Education Staff.

Units with a more theoretical (Multistrand Science) emphasis:

Unit 6: Fisheries Biology: Plankton, Nekton, Benthos, Fishing Methods Protected Species, Fisheries Management and Technology, Trawler base excursion and project.
Unit 7: Estuarine Chemistry: Theoretical underpinnings (formula, composition of matter, changes in chemical reactions),Laboratory Methods, Pollution, Salinity, Temperature, Ph, and other parameters.
Unit 8: Coastal Physics: Waves, Tides, Beach Erosion, Beach Management Protection Coastal Management.
Unit 9: Diving Science: Boyles Law, Charles Law, Effects of Pressure on Diver, Marine Medicine.
Unit 10: Sampling Methods: Marine Technology in Scientific sampling apparatus, student project, Field Work.
Unit 11: Oceanography: History and Scope, Oceanographic Methods, geological and geographical theories,
Unit 12: Chemical Properties of seawater: Classical Chemistry applied to a realistic subject.

Outcomes/results:

390 students have graduated so far with either:
(a) Board accreditation, also counting towards TE score (Multistrand Science)
(b) Board registered credit on senior certificate (Marine Studies)
(c) TAFE/Sec Marine Subject accreditation (appears on senior certificate)

MARINE STUDIES AT BRISBANE STATE HIGH SCHOOL

by

Mr. George D Stubbs
Manual Arts Subject Master (Brisbane State High School)

Brief description:

The course outlined below is what our school proposes to do in 1986/87. A core of 132 hours has been selected from a total of 200 hours. Twelve units are envisaged, five of which supply the underpinnings of the course, four are extensions of core and three are electives: These are:

Core units:

Unit 1: Basic seamanship. This includes;general boat orientation, safety afloat, cordage, line handling, dingy operation, trailer operation, rules of the road, anchoring, practical steering, boat handling and dingy sailing) 26 hours.

Unit 2: Boat construction and maintenance This includes engine servicing, general maintenance, repairs, boat types, materials, metal vessels, GRP vessels, Ferro construction, principles of internal combustion engines, outboard motors, servicing, fault finding and sailing boats) 26 hours.

Unit 3: Pilotage This includes chart symbols, nautical distance, course setting, tides, solar cycle, phases of the moon, tide tables, caculations and buoyage system. 10 hours.

Unit 4: Communications: Introduction to visual signalling, radio communications and voice procedure. 7 hours

Unit 5: Safety on board small craft Includes safety equipment, requirements, legalities, survival at sea, first aid, resuscitation, fire prevention, appliances and procedures. 10 hours

Extensions of Core units:

Unit 6: Advanced seamanship Includes customs, courtesies, rules of the road, deck work, mooring, vessel handling, stability, stowage, theory of sailing, control mechanisms, practical sailing, marine catering and provisioning. 23 hours

Unit 7: Marine mechanics: Includes internal combustion engines, principles of operation, systems, servicing and practical excercises in fault finding. 10 hours

Unit 8: Coastal Navigation Includes navigation instruments, compass, course corrections, course settings, set, drift, three bearing fixes, running fix, angle off the bow, chartwork, barometer, weather maps, wind, clouds, tidal calculations, buoyage and practice. 20 hours

Unit 9: Marine industries: Shipping, terminal operations, port management, fishing industries and maritime research. 5 hours

Elective studies:

Unit 10: First elective. Includes celestial, electronic navigation, marine engineering, marine and littoral studies.

Unit 11: Second elective. Includes shipping and terminal operations, maritime insurance, fisheries and boat building.

Unit 12: Certification. Power boat licence, limited hf radio operators licence, AUF day skippers certificate.

Note: Units on advanced seamanship, marine mechanics and pilotage may be re-designed in elective studies. Also a changing emphasis towards more "classroom oriented" studies could develop as the course proceeds. Studies in Barrier Reef Ecology and Maritime History could well emerge.

Aim/need/rationale

The emphasis of this course has been aimed at enhancing employment opportunities within the maritime industry rather than education for life skills. This has been done because of the central location of the school and its proximity to the marine wing of the South Brisbane College of TAFE. Strong emphasis has been placed on, "on board" skills both in craft operation and boat construction and maintenance.

MARINE STUDIES AT GOROKIN STATE HIGH

by

Mr. Rob Fraser
Gorokan High School, New South Wales

Information

The "Marine Environment" course has been running at Gorokan High (N.S.W) for five years. It is an O.A.S. course (other approved study) taught to the senior years 11 and 12. The course is designed to give a general overview of the whole marine environment and has been broken into 4 main topic areas:

1. The Oceans
2. The Shore to Continental Shelf
3. Man and the Sea
4. The Future of the Marine Environment

Each of these areas is further broken into topics that range through areas such as:
- the physiology of the oceans
- dangerous marine life
- man's effect on the marine environment
- marine archeology

In the first year of the course it was found that there was little resource material and money to back up the course. A lot of pupil interest was lost in "dry" areas of writing and reading. In the following years a collection of videos, slides and pamphlets were compiled to supplement the course. Much of the resource material has come from government bodies, magazine and newspaper articles. All these provide a good focus for class discussion. This work is supplemented with a sport unit called MARINE ENVIRONMENT SPORT. In a nine week sport unit they spend time sailing; scuba and skin diving (in a pool) and walking on the local seashore rock platforms. As well there are two excursions held in this time, one to Sydney Maritime Museum and Manly Marineland and the other to Newcastle Maritime Museum. The main limitations on the course are time and money. The content of the course if taught in depth would take at least 3 years.

Units of work studied:

Unit 1: General oceanography: The nature of the seas and oceans, chemical and physical properties of seawater, plate theory, configuration of the seas, upwellings, tides, currents. weather, hadal zone, animals and plants therof, web of life.

Unit 2: The shore to the continental shelf: Taxanomy of animal and plant life, seaweeds and angiosperms, invertebrates (sponges, coelenterates, marine worms, crustaceans, molluscs, echinoderms, chordates), other marine animals, marine fish, tropical, cold water, warm water, marine animal behaviour, reproduction, symbiosis, attach and defence, motion and moving, instinct, migration, protection of the young, eating out of the sea.

Unit 3: Man and the sea: Diving, snorkelling, SCUBA theory and practice, commercial, cave diving, marine professions, shipbuilding, dredging and construction work, mining, fishing, the sciences of the sea, icthology, mammalogy uses of the marine environment, safety in small craft, boating, meterology, sailing, navigation, underwater photography, marine archeology, ship wrecks, important wrecks.

Unit 4: Future of the Marine Environment: Mans effects, shipping, transport, building, recreation, food supply, pollution, mans colonisation of the sea, overfishing, who owns the seas ?

MARINE EDUCATION IN SOUTH AUSTRALIA

by

Mr. Geoff Bayly
Teacher, Port Lincon State High School South Australia

Information

An outline of the Education Department's OSTP document and where Marine Education fits in is available on writing to me at the below address.

Schools:

Port Augusta High	- Year 9 Mangrove Unit
Kingston Area	- 20 week semester
Westminster	- adult course
Victor Harbour High	- revamped Year 11 Biology course.
Port Lincoln High	- alternative to other science courses

Tafe courses:

-mainly navigation certificates
-coxain ticket, masters ticket

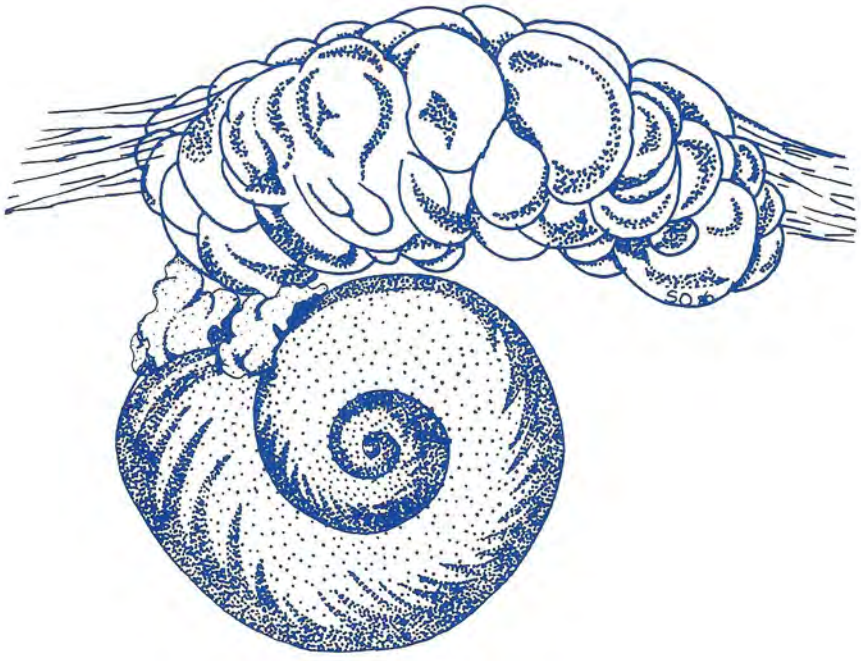
Tertiary courses

-Adelaide & Flinders University

Contact Person:

Geoff Bayly
Pt Lincon High School
PO Box 375
Port Lincon SA 5606

Phone: (086) 823677 (Work)
(086) 825916 (Home)



PROJECT REEF-EDUCATION

by

A. Byrnes, T. O'Neill, J. Oliver, P. King, J. Marsh and R. Moffatt
Great Barrier Reef Marine Park Authority Project Reef Ed Team

Aims of the project

AIM I:

To assist students to acquire an increased sense of self-awareness and to be more conscious of, and sensitive to, their surroundings.

AIM II:

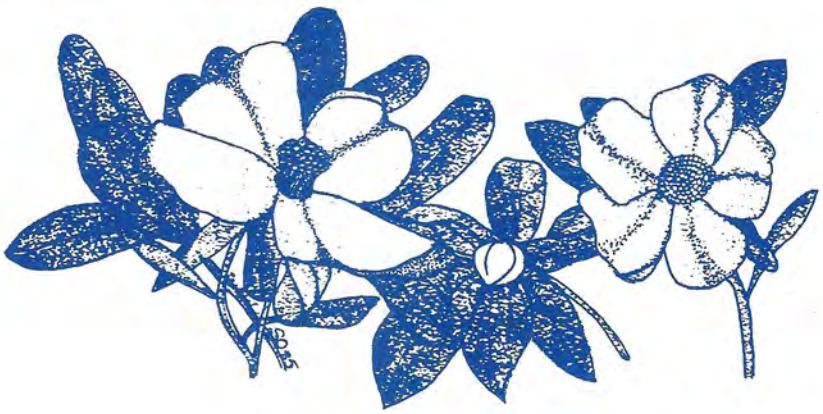
To enable students to develop greater knowledge and understanding of natural phenomena which occur in their environments and of various processes and outcomes of human/environment interaction.

Listed below are some areas in which knowledge might be extended.

-Distribution, structure and origin of reefs as landform features
-Interactions between materials of the ocean's atmosphere and earth
-Ecosystem structure and function
-Distinctive characteristics of the Great Barrier Reef system
-Natural environments as resources for humans
-Human impact on natural environments
-Influence of natural environments in human affairs and history
-Human well-being in natural environments
-Creative responses to natural environments
-Human perceptions, perspectives, values and ethics in relation to natural environments
-Management, conservation and preservation of natural environments
-Scientific investigation of natural environments

AIM III:

To provide opportunities for students to develop the skills and abilities needed to increase their environmental awareness, to identify and investigate problems in their environment, to function effectively in outdoor settings, to communicate with, and relate successfully to, other people, to respond creatively to their environments and to engage in outdoor leisure activities.



Both physical and intellectual development are involved here. In many learning activities, motor and cognitive components go hand in hand and are interdependent. Physical skills may be considered as those having a substantial motor component. Thinking skills (or cognitive processes) involve intellectual activities which are more complex than recall. Some thinking and physical skills which can readily be fostered through Great Barrier Reef studies are listed below. Items on the list are not mutually exclusive: some embrace, or are included within, other categories on the list.

- -observing
- -recording and organizing information
- -interpreting and analyzing information
- -identifying problems and issues
- -experimenting
- -inferring
- -making conclusions
- -thinking critically and evaluating information
- -relating to others
- -handling biological and geological material
- -functioning efficiently outdoors
- -participating in recreational activities
- -collecting second-hand data
- -synthesizing information
- -applying information
- -hypothesizing
- -controlling variables
- -predicting
- -devising explanatory models
- -valuing
- -communicating
- -using equipment
- -living in remote locations
- -surviving in emergencies
- -expressing creatively

AIM IV:

To assist students to develop feelings, interests, attitudes and values which are inherent in deriving enjoyment from encounters with natural environments, in acting responsibly and relating effectively to others in a group situation, in carrying out environmental investigations in a scientific manner and in being concerned for, and prepared to act in the cause of, maintenance and improvement of environmental quality.

Some interests, feelings, attitudes and values which can be fostered through Great Barrier Reef studies are listed below. Some of these are behavioural or procedural attitudes for which there is widespread encouragement within present education systems. Others are substantive attitudes which are more controversial or problematical. There is a strong link between affective and cognitive areas of learning and a rigid separation between them cannot be maintained.

- -curiosity
- -acceptance of responsibility for own actions
- -awareness of the importance of health and safety procedures
- -interest in, and enjoyment of the company of others
- -willingness to be convinced by evidence and change one's mind
- -willingness to work with precision
- -appreciations of the limitations of science
- -awareness of and sensitivity to natural environments
- -a sense of national identity
- -willingness to co-operate with others
- -self-reliance and self-discipline
- -persistence and perseverence in carrying out a task
- -tolerance and respect for the rights of others
- -intellectual honesty
- -desire to question and seek evidence for claims
- -willingness to suspend judgment if evidence is lacking
- -interest in the methods and products of scientific enquiry
- -enjoyment of outdoor experiences
- -appreciation of the value of skills in outdoor pursuits (for development of physical fitness and for recreation)

-pride in the heritage value of the Great Barrier Reef
-interest in social and and environmental issues
-concern for the maintenance and improvement of environmental quality
-willingness to initiate and become involved if action on behalf of maintenance or improvement of environmental quality.

-appreciation of the inter-relatedness of people and their environment
-concern for the magnitude of changes made by humans to their environment
-appreciation of the need for wise management of natural resources
-appreciation of the contribution scientific enquiry can make to the solution of environmental and social problems

About the project:

The project has produced in draft form materials for teaching about the Great Barrier Reef. The project when finally typeset, illustrated and printed will emerge in a series of booklets bound in two, or three hard covered plastic binders. The project has been gradually emerging over the past few years and has involved many thousand of hours assembling, trialling, rewriting and editing barrier reef curriculum materials for students and teachers.

The following materials will be sold by the Great Barrier Reef Marine Park Authority:

Why Reef Education ? An indepth examination of the reasons why reef education is important and why students should be taken to the Barrier Reef. This section will enable teachers think about reef education in order that they might develop a school rationale and aims for a reef trip. It explains to schools how and to introduce reef education into their school curriculum. This section is effectionately known as Section A.

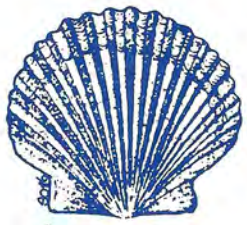
How to get to the Reef ? The "nuts and bolts" of how to get there. Everything from what students should take, to handy hints on how to raise money to get there, safety, first aid, menus for deserted islands, radio contacts, types of equipment to take, how to make inexpensive gear, camping hints, dangerous marine creatures and ways to avoid being bitten and much more. Section B - Logistics.

What student activities can be done on the reef ?Once you are there, what can you do ? This section gives one hundred and one different things to do on the reef. Hug a tree, cuddle a cucumber or old favorites like the line transect are there. Nothing like this has ever been done before and the project team has spent many years trialling these activities on the reef. The activities are divided into two types: The "natural world" activities cover the animals and plants that make up the natural world of the reef. The other type is the "Human Dimension" which challenges students to reach out into the world of environmental education, to imagine and think, create, design and hopefully achieve all those other things you have read in the aims above. Each activity will be on an easily reproducable sheet so that masters can be made onto water proof paper or student booklets. The teacher will be able to pick and choose, design student projects or direct students to specific learning tasks. Section C.

What about the islands and reef ? This Section will provide background information for teachers who know little about how the reef formed, why it formed, what is on it, what special relationships exist on the reef. Called section D, it should prove to be an invaluable resource to any teacher interested in reef education.

The island booklets. Four have been written on Lady Musgrave, Lady Elliott, Heron and North West Islands. Each booklet describes in detail the educational value of the island and special features that relate to the island. Interesting pieces of information like the history of the island, reef walks, safe snorkelling areas can also be found.

THE BRISBANE SOUTH REGIONAL MARINE STUDIES PROJECT



by

Mr Bob Moffatt (Project Co-ordinator)

The aims of the project:

This project aims to provide to any interested organisation or individual: Marine Studies notes suitable for students to use in the classroom, Specific Objectives that students can use to study from at night, Workbooks that teachers can use in the classroom on which to focus learning, Examination papers that match specific objectives and work programmes, Excursion ideas that link workbook sections together and make learning more meaningful, practical programmes to suit extended timetabling, Sample work programmes that match these notes and of which the Board of Secondary School Studies approves, A Syllabus document that can act as a "springboard" for other ideas, Information on TAFE / Sec Marine Studies programmes, The resources necessary to conduct Marine Studies programmes for local schools, Additional curriculum materials specific to our region, Information on other Marine Studies Projects in Australia and Overseas and Professional assistance and inservice education in the fields of Marine Studies Curriculum Development and Resource Management.

Information about the project:

The Brisbane South Marine Studies Project is supported by the Education Department Regional Office with a full time salaried officer. The Project was started under the Secondary Transition to Work Education Scheme, [S.T.E.P.] with establishment grants for equipment and a building which was to serve as a model for other schools wishing to begin Marine studies programmes. A further grant from the Education Department Secondary Division will enable the model building to aquire internal fittings for water, sewage and electricity as well as providing some floor coverings and extending the building either end to cater for increased usage. The Parents and Citizens Association and the Science Department at the Benowa State High school also contributed financially. To defray costs of publication, a charge is made to schools interested in purchasing curriculum materials. The P & C Marine Studies Committee uses the sales and production sections as part of the it's Grade 11 Small Business Management and Community Based Learning courses. A Community Employment Project [C.E.P.] has greatly assisted in the development of the Marine Studies Centre within the school grounds, (Sewage, Water, Landscaping, Roadway, Retaining Walls and Electrical connections have been made by the employees of this project.

Programmes developed:

Three programmes have been operating since the project started in 1984.

The Curriculum Development Programme seeks to put low cost booklets into student's hands. Practical teacher resource manuals are used to explain the booklets and to assist the teacher by providing sample specific objectives, examination papers and excursion ideas.

The Building and Resources Programme has built a model Marine Studies Centre at Benowa State High School, with S.T.E.P. and local community funds. A trailer of boats, motors, snorkelling, navigating, marine communications and Marine Science equipment is housed at that centre which is shared with Keebra Park, Merrimac, Southport, Miami State High School's, the local TAFE college and community. Keebra Park is setting up a fishing and marine communications unit and Merrimac High, a "Surf Survival"programme. All equipment is shared on a "User Contributes" basis to generate sufficient funds to keep the programme going. Other schools in Queensland are developing Resources and programmes based on this model.

The Teacher Development Programme seeks to motivate and inspire teachers to begin a Marine Studies subject at their school as well as making them environmentally aware of the Marine Environment. This programme has made three intiatives: **Firstly** a State Association of Marine Educators has been formed to promote Marine Studies in schools and to run in-service programmes. **Secondly,** Regional Workshops were conducted in Central, Northern and Peninsula Regions in Queensland and **finally** we are hosted a gathering of Marine Educators from around Australia on the Gold Coast from November 29th - December 2nd. At this workshop we hope to lay the foundations for Marine Education in this country.

Curriculum materials developed:

The following materials are those published to date and are represetitive of what schools in Queensland are using in the classroom.

Classroom notes:

These are classroom ready and are suitable for a wide range of ages and backgrounds depending on how the teacher wishes to approach the topic. 10 Units are available.

Practical Notes

Unit 1:	Navigation:	Coastal features, Navigation Methods, Excursion, Weather, Pilotage, Tides,
Unit 2:	Snorkelling:	Physiology, Techniques, First Aid, Dangerous Marine Animals, Safety, Certificate.
Unit 3:	Radio	Components, Features, Discipline, Types, Practice Exercises, Certificate.
Unit 4:	Boating:	Buying a Boat, Safety, Seamanship Skills, Handling, Maintenance, Licence.
Unit 5:	Camping:	Types of, Equipment for Camping with a boat, Campsites, Practical Conservation, Safety, Leadership Skills.

Applied Notes:

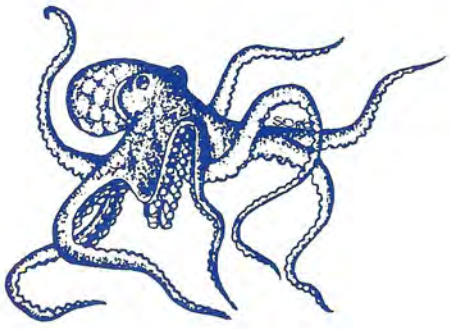
Unit 6:	Fisheries Biology:	Plankton, Nekton, Benthos, Fishing Methods Protected Species, Fisheries Management
Unit 7:	Estuarine Chemistry:	Laboratory Methods, Pollution, Salinity, Temperature, Ph, and other parameters.
Unit 8:	Coastal Physics:	Waves, Tides, Beach Erosion, Beach Management Protection Coastal Management.
Unit 9:	Diving Science:	Boyles Law, Charles Law, Effects of Pressure on Diver, Marine Medicine.
Unit 10:	Sampling Methods:	Marine Technology in Scientific sampling apparatus, student project, Field Work.

Teachers workbook:

This is called the S.E.A. Note pack. Over 200 pages of non-copyright material for your subject master or co-ordinator to devise workprogrammes from. It contains specific learning outcomes, stated in a form that students can take home and study from at night, excursions that can be adapted to your school area and examination papers that are developmental but still something to give you a start. Produced each year.

Syllabus:

This 30 page document provides the framework by which Marine Studies can be introduced into the school. It considers the level to which the content should be taught, a rationale, Global Aims, Organisational Notes General objectives for 10 possible topics, Learning Experiences and Assessment proceedures for students and teachers, possible resources necessary to implement the programme and some aspects of Maritime Safety with school students.



DEVELOPMENTS AT THE WOODBRIDGE MARINE STUDIES CENTRE

(with particular emphasis on the Primary Area)

by

Mary Marsh (Centre Officer in Charge)

Brief histroy

The Marine Studies Centre at Woodbridge was established in 1979 as the result of a science teacher gazing out of his classroom window at an empty shed on the foreshore and wondering what could be done with it. A submission and $90 000 later allowed the scallop splitting shed to be transformed into a laboratory and aquarium room for secondary students with the emphasis on marine topics. Other acquisitions followed - the ex-Fisheries Research Vessel PENGHANA which allows the older students to continue their studies afloat, a new classroom for Primary children, a pool with a variety of specimens waiting to be fed and now a van equipped with a range of gear to teach country children who live within easy access of the coasts.

Staffing

The Centre is staffed by three teachers, one sailing master and backup staff. We also have a goup of docents - volunteers who give us their time and expertise. They are able to do things such as teach rowing to Grade Sixes, clssify specimens, repair equipment, collate items for our news file, build models and generally will turn their hand to any task that we ask of them.

Use of facilities

The Centre caters for students from K - Year 12 and 6,000 students visit Woodbridge annually. These groups are our raison d'etre but other groups also use the Centre on a less frequent basis. They include:

1. University of Tasmania
   The Zoology Deparment and the Centre of Education use the Centre's staff and facilities for undergraduate students

2. Hobart Technical College
   Unemployed youth are able to undertake Deckhands Courses

3. Adult Education
   Marine Studies at Sea attracts the public and provides excellent public relations for the Centre.

4. Department of Sea Fisheries
   All scientific data is available for the Department's use. We are also available to assist in Search and Rescue operations.

5. Rivers and Water Supply Commission
   The electronic tide gauge supplied by the R.W.S.C. allows secondary students to record accurate data as well as assisting the Commission

6. Community Groups
   a. Diving Education Jan Pope, one of our Primary teachers, is also a FAUI instructor and conducts Underwater Naturalist classes at weekends during the year b. Scouts: Activities are conducted at the Centre and the Scouts use the Centre's longboat as their main rowing boat

7. General
   Private groups, tourists, educationalists from overseas and interstate, CSIRO, Tasmanian Amateur Fishermen's Association, dive clubs, etc. make regular use of the Centre

Curriculum

Presently 15 units are being offered in the infant area, 33 units in the primary and 25 units in the secondary.

Infant Area

Language development through experiences, is of prime importance in the Infant area and experiences linked with a Polaroid photographic record allows for instant feedback. The use of videos and tape recordings is also very popular and assists teachers back in the classroom. Teachers may choose to spend the day using a creative interpretation of the environment through drama; puppets; hunting for colours, textures, shapes and sizes on the exposed rocky foreshore; modelling; plaster casting, marine rubbings; making mobiles; weaving with found objects, drawing from live specimens in tabletop tanks, ink and quill sketching as well as the regular touchtank and marine pond exposure. One of the most popular activities for Infants is ring-netting from the jetty and the children are involved handling small leatherjackets. In fact, the leather jackets are now so used to finding bait in the ringnet that often they will rush into an empty net.

Special Children

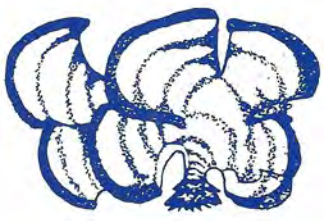
We cater for a wide range of handicapped children which is challenging. The majority of them have a low mental age and are usually catered for with a modified Infant programme. We add a short row in one of the Centre's dinghies for small groups and this is usually the highlight of the day for these children.

Primary Activities

Thirty two units are offered in this area with further development in the maths and survival units. The older children observe ship's watches and the ship's bell is rung every half hour. The profiliferation of motor boats and mishaps prompted us to develop a basic survival lesson not only related to what to do in the water but how to survive on our inhospitable coastline while waiting for rescue. Hyperthermia can be a very real problem anywhere in Tasmania. A popular approach for children who have visited the Centre before is the theme day "Shipwrecked Pirates". The day is spent role-playing, in costume, and the Centre becomes a pirate camp in the middle of unexplored territory. The local township becomes a Wild native Village and the track to the lunch area is highly dangerous with unknown ferocious animals lurking (gentle goats), quaking swamps waiting to trap the unwary and a treasure needs to be safely hidden among the tall English trees in the tiny beach reserve or in the small sand-dunes. Because they have been shipwrecked, the children are searching for ways to feed themselves without the benefits of fishing lines and shops. This is a focus point for the normal day's programme and the children discover mussels, oysters, small bivalves and ulva could be used if necessary. Children receive a pirate chart of the area and another one showing the many actual shipwrecks around Bruny Island. These charts are used in creative writing back at school. By tapping the children's natural gift for imaginative play, the programme becomes very real as we see from the children's reports returned to us.

Secondary area

Units in this area are continually being refined. The new units include 'Island Ecology' which is conducted on a small island and allows groups to camp in a sheltered area. The Sail Experience Programme and Power Boating has continued with assistance from the Division of Recreation.



COMMUNITY EDUCATION AT THE QUEENSCLIFF MARINE STUDIES CENTRE

by

Ms Julie Swartz
Marine Education Officer
Queenscliff Marine Studies Centre, Victoria

and
Mr John Tomkin
Information Officer, Department of Conservation, Forests & Lands
Queenscliff Marine Science Laboratories, Victoria

About the centre (see also the Paper by Dr. Laurie Hammond on the Centre)

It is widely accepted that the marine environment is a valuable resource and that wise use of such a resource is necessary. Marine education has an important role in fostering this awareness and furthering understanding in the general community about issues today and in the future.

The Marine Studies Centre in Queenscliff , Victoria, deals with two areas of education - schools and the community. The goals of our community education program are:

- To build a wider community awareness of marine issues, allowing informed public participation in working for the environment.
- To enhance people's enjoyment of the marine environment by promoting their sensory awareness and understanding of their surroundings.
- To generate appropriate behaviour patterns amongst user groups (identified as recreational visitors, commercial users and local residents).

The target audience for community education is not one group but a large number of specialised groups each with their own amount of awareness of the marine environment. These range from marine scientists with an extremely high level of awareness through non-professionals with a special interest in the marine environment and therefore with awareness to the general public most of whom have a very low level of awareness.

There are a number of methods of communicating this information (and especially marine research). They include the media, lectures, open days and information centres.

As marine educators we have many advantages over other educators. Most Australians (75% - 80%) live on the coastal plains representing 3.3% of the total Australian land area. Yet the public know little about it but are fascinated by it. There is a strong trend to overestimate the knowledge of your audience particularly if it is an adult group.

Community education at the Marine Studies Centre involves the display Centre, educational programs and materials development.

Display

The Centre is used as a display where the public may observe a variety of underwater life in large aquaria and handle intertidal organisms in the touch tank. Poster displays covering a wide range of topics (shipwrecks, beachcombing, marine flora and fauna, fishing et.) contain simple information directed at children, therefore adults find it readable, interesting and understandable.

The interactive nature of the display is enhanced by the use of 'feely boxes', microscopes and marine trails (quizzes which direct attention to particular aspects of the display).

Visiting a museum or zoo may become a collection of passive experiences and people quickly become bored. However, the Centre provides experiences that certainly are not passive and usually are enjoyable.

Programs

Community educational programs at the Marine Studies Centre are of two types:

- weekend worshops
- summer holiday programs

Workshops are organised around a theme such as the types of marine environments in the local area. Some workshops emphasise ecological concepts such as the diversity of marine organisms; others emphasise aesthetic appreciation of the environment such as the Nature Printing Workshops. Participants are usually people who already have an interest in the marine environment and who want to increase their understanding.

The annual summer holiday program held during the January holidays appeals to a wider cross-section of the community including the 'environmentally-unaware' public.

The program provides enjoyable education for everyone on all aspects of the marine environment. The Centre is open for display, and activities are scheduled throughout the day and evening, focussing upon developing awareness of the marine environment.

Rockpool rambling (or spotlighting) are very popular with family groups who will happily spend hours discovering 'new' animals, edible seaweeds and so on, all the while learning to minimise their impact upon the shore. Birdwatching expeditions to nearby seagrass shallows or a cruise to Mud Island (a marine reserve) to observe waders and ocean birds provide a 'wilderness experience' for many participants.

Craft activities (plastercasting, seaweed pressing), practical skills (rope work, seine netting) and evening films or slideshows are also offered.

Thus, in drawing upon local interests and local experts, we are able to provide a comprehensive community education program which focuses upon recreational pursuits.

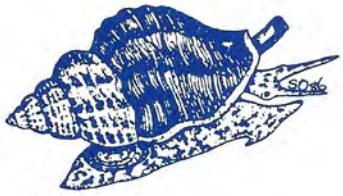
Materials

The other aspect of the Marine Studies Centre's community education program is that of materials production. The publications, in the form of small inexpensive booklets, are aimed at all ages from young children to adults and focus on aspects of the marine environment such as the Marine Reserves, Lighthouses, Navigation and Tides as well as guides to the rockpools, mudflats, and sand dune environments.

Conclusion

It has been noted that in environmental education, closer links are needed between schools and the community e.g. VAEE Annual Conference, October 1985. School educators tend to become locked into frame-works and jargon; conversely community educators need to gain educational expertise.

An important element of the Marine Studies Centre's community education success is that the programs are run in the same way and in the same place and by the same staff as the school programs, providing the link between school and community education in the marine environment.



JACOBS WELL COMMUNITY BOAT PROJECT

by

Mr. Boris Daniljchenko (Officer in charge)

This project operates over two stages within the Brisbane South and North Education Regions through Transition School and Regionally based activities organised by interested schools and the Field study Centre, Jacobs Well. The aim is to build and operate a vessel for students wishing to conduct marine studies programmes.

Stage 1

This involved the purchase and transport of the vessel from the Ithaca TAFE college to Jacobs Well, completion of the superstructure to suit its usage, with regard to Marine board specifications and Education Department guidelines. The work was done on a continuous contract price basis. Because of the nature of the tasks involved, some requiring very specialised skills (e.g. caulking of the hull), specific programs were not offered, but rather a continuous series of units of essentially practical nature. These units were conducted progressively and enabled students and schools to choose these units that were most applicable to their current transition programs.

Stage two:

Schools are circularised regarding potential involvement which could be on an 'at school' at Jacobs Well Field Study Centre basis, or a combination of the two. Some jobs will require students to be present at the Centre whereas other jobs are subcontracted out to schools e.g. making of dories. The numbers involved at any one stage depends on the nature of the task and range between 5-30 students at a time at the Centre. As an example of potential involvement in the home economics/art area, students are involved in the making of curtains, mattress covers, flag and sail. To effectively complete these tasks the students need to:

research the suitability of fabrics for uses proposed, choose style and design most suited to anticipated use considering economical uses of chosen fabrics measuring - estimating amount of fabric used, applied decoration of fabric e.g. screen printing etc., sewing of items, care and laundering, interior decorating aspects

All the above activities have a much wider application for each student. For students staying at the Centre for a week or so, practical experience in catering programs gives students a good opportunity to "have a go" at looking after themselves the way they would have to after leaving home, e.g:

Aspects of
- (a) nutrition
- (b) menu planning
- (c) budgeting
- (d) storage of food
- (e) preparation of food in confined areas using limited facilities
- (f) preparation of seafoods caught
- (g) catering for different size groups

Co-operative planning between School and Centre maximises the learning potential of each of the stages of construction. 1. Work observation and care, opportunities in fishing boat building and allied, industries 2. Recreational activities e.g.boating, sailing, fishing, water skiing, rowing 3. Marine biology and/or general science 4. Meteorology and basic seamanship 5. Oceanography/Marine/Ecology 6 Resource management e.g. role of fauna, flora, fishing and study reserves, mangrove ecology/farming fish, crustacean ecology, work of beach protection authority 7. Navigation using modern and traditional instruments 8. Programs in environmental education and awareness 9. Work observation and career opportunities in the tourist and allied industries-operation of charter vessels, venues for tourist resorts, operation of tours, management and economics, public relations and advertising catering 10.Maintenance of a marine vessel.

MARINE STUDIES OUTSIDE THE SCHOOL

By

Mr. D. J. Kopelke, Boyne Island Field Study Centre

While the topic may imply that Marine Studies can be studied outside the school within the Field Study Centre situation in Queensland, Centres provide an extension to the work being done in schools. Marine Studies (at the school level) is transdisciplinary by nature covering such areas as Biology, Physical Education, Geography, Career Education and at Boyne Island programs exist that cater for most of the different areas. If Field Study Centres are an extension of the classroom then how do these programs assist the school?

Firstly they can provide an "experience" for schools not studying Marine Studies.

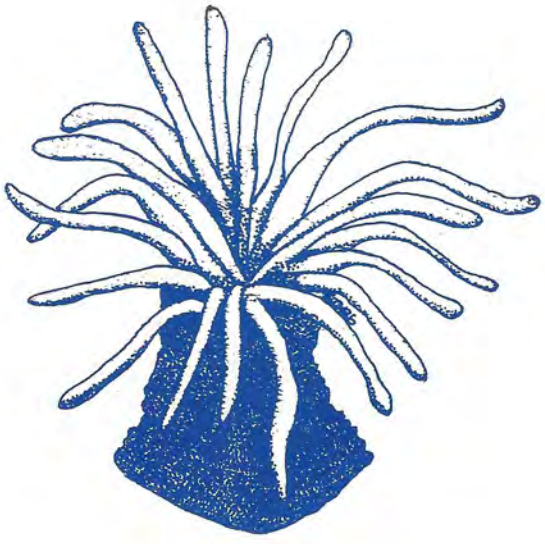
Secondly they can continue the school study situation by providing an opportunity for practical work or for an extended study in a particular area by living in at the Centre on a camp.

Thirdly through the development of Centre facilities they provide an opportunity for enrichment of school programs through their specialist staff and range of equipment.

In conclusion I ask should we set the establishment of Field Study Centes as a goal in Marine Studies in this country, and, if we do what role will they play in programs, equipment, facilities and staff?

Contact Person:

Mr. David Kopelke
Boyne Island Field Study Centre
Boyne Is via **Gladstone 4680**



THE ROLE OF THE PRIVATE RESEARCH CENTRE IN MARINE STUDIES

by

Mr. Anthony Bergin
Lecturer in Politics
Australian Defence Force Academy, Canberra

This paper discusses the history, current activities and future development of the Centre.

The Australian Centre for Maritime Studies has been developed by a group of individuals with a wide variety of connections with the sea, but a common concern at Australia's lack of a maritime tradition. Maritime interests are placed well down the nations's lists of priorities. There is a dearth of research into maritime affairs. Private sector investment is relatively limited. First-hand experience in maritime matters in both private enterprise and Government is scant. For most of our history our maritime requirements have been serviced by others. Though this has allowed impressive economic development over the past 200 years, as a nation we have little involvement or awareness of our maritime interests. This has left us with a serious blind spot in managing and developing our maritime resources and interests.

Internationally, the prospects for greater utilization of the sea are seen to be increasing. Australia's own potential in this regard is under-explored. Indications are that it is significant, but will need careful management and imaginative development. While an informed community may emerge with the passage of time, the rapidity of foreseeable developments in utilization of the sea, and the wealth and diversity of Australia's maritime resources and interests, require urgent and concerted action if our potential is to be realized and wisely managed.

A private, non-profit organization incorporated in the ACT, the Centre is being developed to fulfil the following roles:

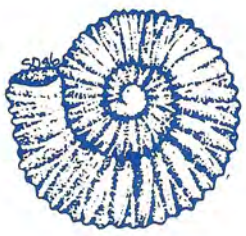
- Disseminate information at all levels within the community and as appropriate overseas in order to increase understanding of maritime affairs with a view to developing the educational and intellectual framework necessary to provide an overall perspective of maritime affairs.

- Promote and facilitate existing research into maritime affairs including the creation of an information centre and specialist library facilities in the area of maritime affairs.

- Undertake where desirable research or consultancy work in maritime affairs either within Australia or overseas.

- Complement existing research and development by promoting contact between disciplines that impinge upon maritime affairs and between relevant governmental academic, and private agencies concerned with maritime affairs.

- Provide a point of contact for discussions, talks and exchanges of information and visitors with relevant bodies whether local or overseas, concerned with maritime affairs.



SEAWORLD AND MARINE EDUCATION

by

Dr. Fabian Fay

Description

Seaworld is Australia's largest and most comprehensive Marine Park. Now in its 14th year of operation, the Park was officially opened in October, 1971 by the then owner and original developer, Mr Keith Williams, who sold it in December 1984. 750 000 persons per year visit Seaworld. The Park is jointly owned by Pivot Investments Pty. Ltd of Perth and Queensland public company, Murphyores Holdings Limited, both of which are under the control of Western Australian businessman, Mr Peter Laurance. Location is just 3 kilometres north of Surfers Paradise, is the Spit at Main Beach. The Park is located at the northern most extremity of Sea World Drive, The Spit.
It may be reached by tour coach or local Surfside bus, or just five minutes by car or taxi from Surfers. Sea World occupies 20.2 hectares (50 acres) of land on the Spit at Main Beach - the site originally was sand dunes and mangrove swamps. Half the total area is a man made lake system, which for our marine life provides as close to a natural environment as is possible. We are open all year (except Christmas Day), from 10.00 am to 5.00 pm. The Admission price covers all six show, exhibits and unlimited use of eleven rides including the "Corkscrew" triple loop roller coaster, and the new Ansett Skyway Gondola ride. Extra charges apply only to purchases from the Restaurant, Snack Bar or Gift Shop. Naturally, helicopter joy flights are not included in our admission. Sea World's permanent staff consists of approximately 260 persons with additional staff in the busy holiday periods.

Educational programmes

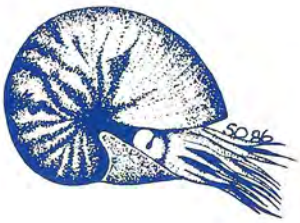
Each day there are 3 underwater Shark and Fish Feeding Shows, 2 Ski Shows, 2 Dolphin and Sea Lion Shows, 3 Petting Pool Shows and 1 Dolphin Pantomime. These shows run continuously throughout the day from 10.15 am to 4.30 pm. One of the most popular exhibits is the Oceanarium. Within the crystal clear tank is a comprehensive collection of sharks, turtles, rays and reef fish - all able to be seen through twenty underwater view windows. The prominent white Besser Lighthouse houses Sea World's resident "Glassblower" who regularly displays his creative skills by turning glass rods into works of art. At Sea World's Petting Pool (adjacent to the Bark Endeavour) visitors will notice North American harbour seals. Other displays include fairy penguins, Australian fur seals (Public feeding 11 am to 5 pm) all of which are located in separate display pools in the "Old Time Adventures" area.

Visits must be pre-arranged by school groups. Aside from the many education styled attractions, the Park offers a comprehensive educational talk on marine life, however, a new "School of the Sea" programme is now available. Special student concessions are available to all pre-booked groups:

Primary Students	$7.00 per head
Secondary Students	$9.00 per head
One teacher for each 20 students	Free of charge
Additional teacher/adults	$11.00 per head

Special discounts are available for all pre-booked groups of twenty or more. All enquiries or booking should be directed to the Public Relations Department.

OCEAN VENTURER - OCEAN YOUTH CLUB OF AUSTRALIA



by

Mr. Peter Holm
Principal Maroon Outdoor Education Centre

About the club.

The Ocean Youth Club of Australia operates at sea much the same as "Outward Bound" does ashore. While sail training is its visible aim, the personal development of young people and the encouragement in them of a sense of responsibility and team effort has high priority. By using a sailing yacht as the means for learning and the sea as the teacher the Club aims to develop also young people's awareness of, and respect for, the marine environment. Challenge and adventure are important ingredients in the overall program. The sail training itself is multi-faceted.

The youngsters on board learn more than just "how to make the boat go". Navigation, seamanship, safety, meteorology, victualling, preparation of food and general maintenance are all part of the experience. The aim is to have the youngsters operate as the crew of the yacht and within the limits of their experience and safety take total responsibility for all the tasks aboard. They should feel after a period onboard that they sailed themselves somewhere and were not just passengers who were given some menial tasks to keep them occupied.

The range of tasks on board include:

1. Sail setting and trimming
2. Navigation and pilotage
3. Course/Passage planning
4. Anchoring and berthing
5. Radio operation
6. Meal planning and preparation
7. Standing watches
8. Operation of Tender Vessels
9. On board maintenance
10. General Seamanship

The vessel

Ocean Venturer, a fifty foot steel ketch is the vessel currently operated by the Club in Queensland. She has berths for up to 17 people and is equipped to provide suitable experiences in all the above fields. The vessel has been used to support a number of school programs.

The first of this nature was in June and July last year when "Ocean Venturer" was still based in Sydney. Since she moved permanently to Brisbane in March of this year more programs and a greater variety of programs have been hosted. In 1985 for example the following school or school related programs have been run:

1. Benowa State High School Marine Studies class, five days in Moreton Bay.
2. Indooroopilly High School 7 days Tin Can Bay to Gladstone via Bundaberg and Lady Musgrave.
3. The Gap High School five days Moreton Bay.
4. Two ALFA programs one from Capalaba and one from Beenleigh each on a five day co-operation exercise.
5. Kelvin Grove trainee teachers conducted a 6 day program mainly in Moreton Bay but concluding with an overnight ocean sail to Tin Can Bay.
6. A living skills group from Bremer High School on a similar exercise to the ALFA PROGRAMS.
7. Brisbane C.A.E. Post Graduate Outdoor Education students combined sail training, navigation, dive and reef study exercise sixteen days Brisbane - Bundaberg - Lady Musgrave - Bundaberg - Brisbane.

Financing

The Club is a non profit organisation where members pay their share of expenses and also provide labour in maintenance periods. There is a membership fee of $15 per year and members contribute $30 per day while on board.

This represents $165 per student for a five day exercise including all food, use of wet weather gear, etc. As the Queensland Director for the Club and the person ultimately responsible for balancing the books I know how little the margin is over costs. On the other hand, as a teacher and parent I realize how significant the sum of $165 is for a student or parent to find. Some funding/subsidy is available for disadvantaged students through a bursary made possible by the Federal Government, but this is limited.

I've been able to arrange a discounted contribution for some groups but I have a responsibility to keep the Club solvent as well. When a group goes out for example the Club arranges a skipper and mate who are capable of running the vessel on their own if the need should arise. The skipper we usually have to pay but sometimes we have suitably qualified senior members who volunteer their services for mate and occasionally skipper. The program can be tailored to suit the group on board so could emphasise night navigation, reef studies, sailing techniques, leadership training or whatever.

The Club's postal address is:

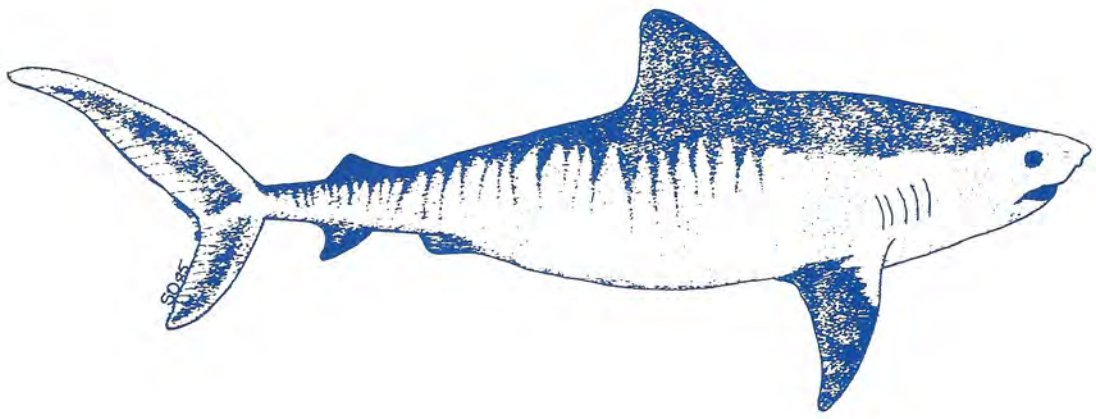
OCEAN YOUTH CLUB OF AUSTRALIA
1 Central Avenue
DEAGON QLD 4017

Phone: (07) 269 9707

or

Peter Holm
Principal
Maroon Outdoor Ed. Centre
Mail Service 488
BOONAH QLD 4310

Phone: (075) 636 164



GROUP 1 REPORT
NATIONAL ORGANISATION WORKING PARTY

by

Dr. Laurie Hammond
Director, Victorian Institute of Marine Science

SUMMARY OF RECOMMENDATIONS

1. That a body be formed to represent the interests of marine education, and that it be called the Marine Education Society of Australasia or M.E.S.A.

2. That the objects of M.E.S.A., shall be inter alia:

   * to promote and publicize marine education in all its apects
   * to facilitate and coordinate initiatives in marine education throughout Australasia.
   * to foster links with other professional and voluntary organizations interested in marine education
   * to represent the interests of marine educators to government bodies an statutory organizations
   * to conduct meetings, conferences, seminars and other teacher inservicing programmes
   * to publish and distribute information about marine education

3. That the structure of MESA shall be:

   A Council, comprising an Executive Committee plus one representative from each state or territory, with allowance for non-Australian representatives.

   The Executive Committee will comprise a President, Secretary, Treasurer & Editor of the Newsletter.

4. That State branches of MESA be formed where possible.

5. That membership of MESA shall be open to all individuals and organizations interested in furthering the objects of the Society, and will include the following classes: ordinary, student, institutional (including libraries) and corresponding (people outside of Australasia).

6. That membership fees shall initially be

Ordinary	$15
Student	$ 5
Institutional	$30
Corresponding	(to be decided)

Twenty percent of each subscription will be returned to the relevant branch.

7. That MESA conduct annual general meetings, no more than 20 months apart.

8. That Mr A. Bergin and Mr J. Mathias be invited to prepare a draft constitution embodying these and other relevant points, for discussion during 1986 and ratification at the first annual meeting of MESA.

These recommendations were ratified by general show of hands. The following office bearers and state representatives were elected:

President	Anne Byrnes	Sydney College of Education
Secretary	Julie Swartz	Marine Studies Centre, Queenscliff
Treasurer	Gwen Lane	Benowa State High School
Editor	Kirk Petersen	GBRMPA, Townsville

Representative from:	Queensland	Bob Moffatt
	New South Wales	Toni O'Neill
	Victoria	John Tompkin
	Tasmania	Mary Marsh
	South Australia	Geoff Bayly
	Western Australia	To be determined
	A.C.T.	John Mathias

In addition, activities for MESA during 1986 were endorsed. These included:

* Preparation of a position paper defining the scope and objectives of marine education, and describing present organizations, structures, activities, resources and needs.

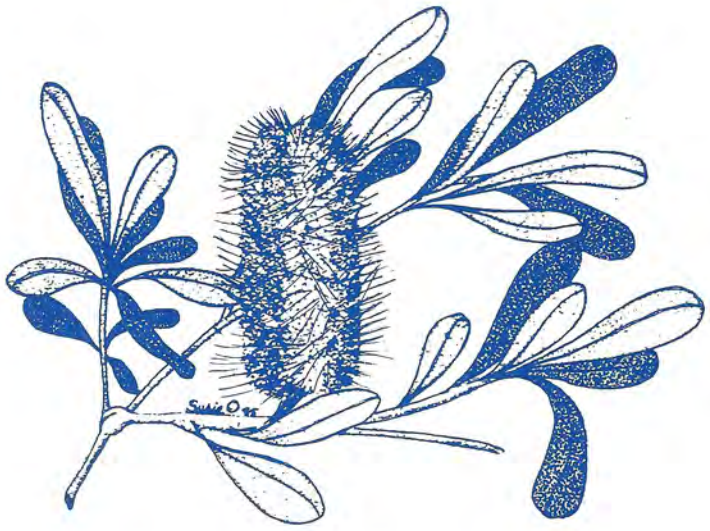
  This will form the basis for future policy.

* Development of a resources inventory and bank

* Development of a database on training and careers in marine and maritime fields in Australia.

Contact Person:

Dr. Laurie Hammond
14 Parliment Place
Melbourne Vic 3000



GROUP 2 REPORT
MARINE RESOURCES WORKING PARTY

by

Mr. Peter Kinchington
Marine Studies Education Officer, Queenscliff Marine Studies Centre, Victoria

Resource ideas:

The members believed the most appropriate way to approach the resources question, was to provide listings of organizations etc. that could prove useful. Some of these were:

1. Printed and audio visual materials.
2. People - Professional / non-professional
3. Physical - Mobile e.g. boats, scuba and sampling equipment
   - immovable e.g. buildings, laboratories, study centres
4. Habitats (the location of rocky platforms, mudflats, dunes, etc., around Australia so that marine educators can see what is within their reach).

To include new sources on the listings, contact addresses and telephone numbers should be sent to the Resource Committee Co-ordinator.

Members of the resource committee:

New South Wales:

Mike Halpin Teacher
16 Florence Street, c/- The Southport School
TWEED HEADS 2485 Ph: (075 36 2304)

Victoria:

Peter Kinchington Marine Education Officer
(Co-ordinator of Resource Committee) Vic. Institute of Marin Sciences,
10 Wharf Street, Marine Studies Centre,
QUEENSCLIFF 3225 Weeroona Parade,
QUEENSCLIFF 3225
PH. (052) 52 0375

Queensland:

David Kopelke Officer-in-Charge,
55 Boyne Island Road, Boyne Island Field Study Centre,
BOYNE ISLAND 4680 BOYNE ISLAND 4680
(079) 73 7312

Paul Sumpter Teacher,
20 O'Reilly Street, c/- Townsville S.H.S.
MUNDINGBURRA 4812

Greg Martin Teacher,
P.O. Box 277, c/- Smithfield S.H.S.
SMITHFIELD 4871

Steve Hall Teacher,
P.O. Box 264, c/- Palm Beach-Currumbin S.H.S.
COOLANGATTA 4225

Carol Fiffer Teacher,
32 Provincial Road, c/- Brigidine College,
HOLLAND PARK 4121 BRISBANE 4000

Beth Cumming Co-ordinator,
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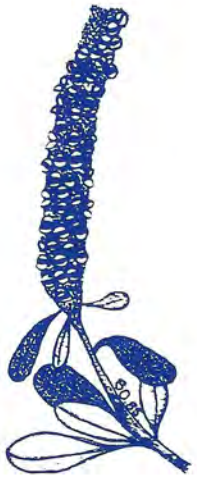
CLIFTON BEACH 4871

Kevin Cousins Teacher,
115 Archer Street, St. Brendans
EMU PARK 4702 YEPPOON 4703



GROUP 4 REPORT
COMMUNITY NEEDS & WANTS WORKING PARTY

by

Mr. Len Zell
Marine Parks Extension Officer
Queensland National Parks & Wildlife Service

A. Who are they:

(Diagram identifying the whole community of Australians including overseas visitors:

FORMAL	NON-FORMAL
primary students	vicarious user
secondary students	media
tertiary students	government (local, state, c'wealth)
adult education	recreational user (passive, extractive)
	commercial (fishermen, tourist, mariculture)
	industrial users

categories to be considered: -age groups
-ethnic groups
-special interests groups, e.g. divers

B. What for:

Motherhood Statement

To develop an informed community (i.e. all Australians) who are then able to ensure reasonable use of the marine environment (reasonable use as defined by GBRMPA).

C. Community Needs/Wants

1. Identified needs - what we determine

   a. to know more about the marine environment

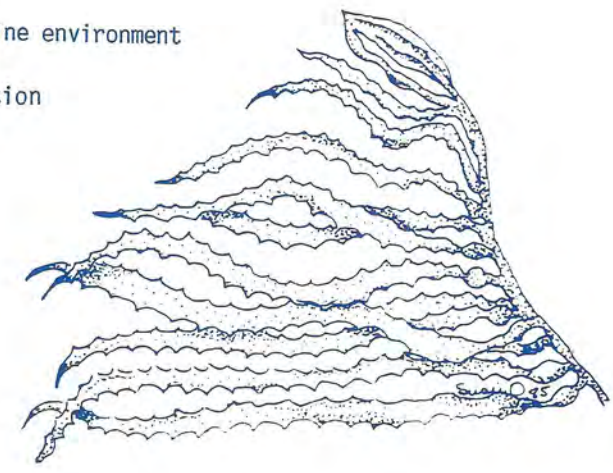
   b. to be better users of the marine environment

   c. safer users of boats and other equipment and the marine environment

   d. skills to experience the marine environment -observation
   -diving

   - what they request

   a. to know more about the marine environment
   -ecology
   -plants/animals
   -greater understanding
   -processes



b. media enquiries - for information
- for talent

c. knowledge/materials enabling an ability to evaluate media reports

d. Government enquiries

e. skills to use, experience and enjoy the marine environment

f. vocational assistance

g. planning visits to marine environment

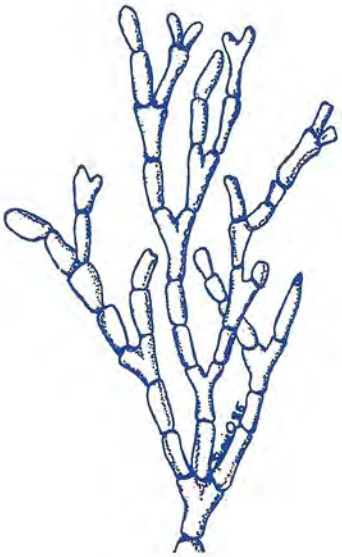
D. How do we involve them

1. Plan and implement projects which are related to the marine environment

2. Publicity - pre-project
- during project
- post-project

(make programs etc. attractive relevant and good value for money)

Media - all
Publications
-guides
-project resources
-reports
-evaluation



3. Programs - formal: schools and tertiary institutions
- informal: clubs, ad hoc groups
- activity/participatory oriented

4. Train and assist tourist operators as marine educators

5. Provide materials to assist in 1-4
- educators
- tourist operators
- guided activities

6. Provide/identify facilities to attract, and inform and involve them:
- field study centres
- natural resources
- 'educational' tourist facilities e.g. aquaria

7. Encourage community participation in marine education - get 'experts' from general community to act as marine educators.

E. Using the Media

1. Use media experts - our own
2. Ensure media well informed and know where to go to get information
3. Provide press releases/photos etc.
4. Provide marine educators with resources and skills to deal with the media.
5. Public relations program to be developed

GROUP 5 REPORT
CURRICULUM WORKING PARTY

by

Mrs Meg Kennedy
Science Teacher, Christian Brothers' College, Mackay, Qld

General statements:

1. It was decided that a curriculum was needed to cover THREE main areas of the education system. The three areas of education were classed as:

(i) Pre-secondary
(ii) Secondary
(iii) Post-secondary

2. The curriculum needs to be broad in scope for the pre-secondary areas, incorporated into Junior Science (years 7, 8, 9, 10) course work, and be catered for in the years 11 and 12 by a separate curriculum, divided into two streams.

3. A consultancy Board needs to be set up in regions (or states) to enable a follow through of ideas, skills and knowledge from Pre-secondary to Secondary to Post-secondary levels. It was envisaged that this board would consist of members who would be able to help individual schools/ teachers set up their own work programmes.

(The people involved would need to be aware of the resources and needs of the school and its students, resources in the local area and relevant areas of the curriculum that would suit the school and region.)

The possibility of existing curricula needs to be investigated.

4. Books with Core Units and Optional or extension units need to be developed for both Junior and Senior courses - particularly the latter (for years 11 and 12), with inputs from schools and regions regarding resources, existing work programmes, and interesting field study trips, etc.

The books should provide guidelines and suggestions for teaching about the marine and aquatic environments for pre-secondary teachers. Both pre-secondary and some secondary teachers need to be encouraged to include information on marine studies and the marine environment - from a recreational and a vocational point of view.

Suggested developments for the three levels:

Pre-secondary

The committee felt that this area should be covered by a multi-disciplinary approach to marine studies, with the major input occurring as part of environmental education programme.

The areas to be covered would include: general awareness and knowledge of the organisms involved and the systems involved in the marine environment; skills such as snorkelling, sampling and identifying major groups of plants and animals; an empathy with the environment; recreational use of the marine environment; and vocational use of the marine environment.

The overall approach would be one of integrated study relating to the total environment, rather than being specific to the marine environment.

More guidelines for pre-secondary school teachers and educators in general is needed to cater for the above areas to be covered.

Secondary

For years 7, 8, 9, 10, the committee felt that marine education should be incorporated into existing Science programmes in schools, and or technical schools and TAFE colleges.

The areas to be covered would include:

-basic chemistry of estuaries
-the impact of local fisheries on the ares
-long-term effects of sand-mining, marinas, artificial reefs etc. on existing plant and animal life
-the effects of pollution and oils spills on reef ecosystems
-the historical significance of our seas/oceans
-the development of possible fish farms to feed future populations

For years 11 and 12 (especially for Q'land schools), it was felt that TWO streams of marine education need to be developed:

-a non-academic stream (Marine Studies)
-an academic stream (Marine Science)

MARINE STUDIES (non-academic)	MARINE SCIENCE (academic)
*Board approved school based subject	*Board subject = Formal syllabus (counts for TE score)
*Applied skills, e.g. boating, navigation, snorkelling, scuba diving, fishing	*Applied and knowledge based - containing some Biology, Chemistry, History, Geography, Geology and Physics
*Recreational and Vocational lines (Tafe involvement?) with recognized community accredition for courses, e.g. navigation & radio operation	*Leading to possible Uni Courses
*Empathy with the environment	*Empathy with the environment
*Transdisciplinary approach	*Transdisciplinary approach with more emphasis on content and process objectives
*Little content/knowledge objectives in the course	*Major part of course based on content knowledge of systems and how to interpret or analyse them

May cause problems in some schools where teacher numbers, and/or student numbers do not allow for this arrangement - these schools could perhaps opt for the CORE and CORE-EXTENSION set up with the core being

made up of the applied side of the course and the extension side being the content-process side of it.)

Post-secondary

The committee felt that more universities, colleges of advanced education, technical colleges etc., need to include some aspects of marine education in their courses (at undergraduate level). The need to develop an awareness of the marine environment was essential, also the recreational use needed to be guided through courses, recognized accredited certificates for approved courses - involves TAFE and other community organizations.

We felt there was a need to involve groups such as GBRMPA, National Parks and Wildlife, Coast Guards, Scuba clubs and Fishing clubs, etc.

COMMITTEE MEMBERS AND ADDRESSES

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c/-Keebra Park State High
SOUTHPORT QLD 4215

Mary Marsh
Marine Studies Centre
WOODBRIDGE TAS 7162

Colin Allen-Waters
Gladstone State High School
GLADSTONE QLD 4680

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Ingham State Primary School
INGHAM QLD 4850

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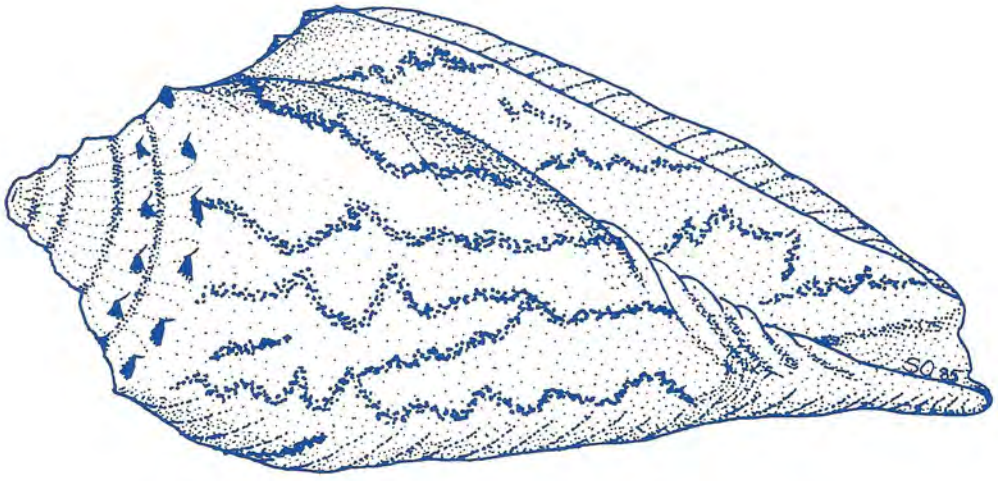

GROUP 6 REPORT
TEACHER DEVELOPMENT WORKING PARTY

by

Mr. Terry Balsom
Marine Studies Teacher, Gold Coast College of Technical and Further Education

Group Task:

To identify the possible parameters of Educator Development in Marine Studies

Task Guidelines from Conference:

1. Support for teachers, educators
2. Who would participate anyway
3. Skills analysis
4. Likely authorities to provide such skills
5. Type of training - inservice, preservice
6. Where and how
7. What type of certification should be sought or required
8. Inservice publication to promote education

Discussion identified the following points for further consideration:

1. (a) No suitable training course exists to satisfy the needs of educators wishing to gain skills in this specialised area of Marine Studies.

(b) Individual subjects available through T.A.F.E. Mariner programmes are not recognised by the Board of Secondary School Studies or the Board of Teacher Education. (Ed. Note: Awards for TAFE subjects appear on the students senior certificate)

(c) Educators presently working in the area have

i. gained their experience through industry, sporting or recreational pursuits; or,
ii. in the main possess little if any formal qualifications in marine related knowledge

2. (a) Interest in a suitable training course would be considerable, based on the attitude of conference participants.

(b) Teachers and educators presently working in the area would be equally likely to participate as those wishing to train toward qualifications for the purpose of gaining teacher appointment to the area.

(c) Trainee teachers would be likely students as suitable courses could be included in the liberal studies component in current Diploma of Education courses.

3. The skills required of educators in marine Studies are diverse and yet specific. They may however be grouped under the following topic headings:

(a) Marine Sciences - including ecology, biology, physics, and chemistry etc.
(b) Mariner Technology - including navigation, marine communications, nautical and ship knowledge etc.
(c) Mariner Shipboard Skills - Shipboard safety, Coxswain Certificate, power and sail, marine engine driver, etc.
(d) Mariner Fishing Skills - including net and gear technology and seafood handling etc.
(e) Aquatic Science and recreational pursuits - including diving (both snorkelling and

scuba), surfing, water safety and board riding, boat handling (sail and motor).

4. Likely Authorities to provide such skills are primarily Technical and Further Education; however, the C.A.E.'s and Universities could also offer suitable courses and it would be seen as desirable that C.A.E.'s offer them in their Social Sciences programmes. It is likely that some existing subject material is available through C.A.E.'s as a search may later reveal.
T.A.F.E. currently offers all or most of those subjects required, however they are available only as individual study units and lead to no specific outcome i.e. Certificate, Diploma etc.

5. It is desirable that both inservice and preservice courses are made available as specific needs will indicate.

6. Course material could be digested in numerous ways including, full time, part time, evening and week-end attendance; also correspondence and mid semester practical workshops.

7. The degree of qualification is an area of discussion which requires further investigation. However,
if Marine Studies is to be observed in its appropriate status, educators should appreciate the need for appropriate higher certification in line with the degree of responsibility applied to the Marine Board of Queensland Certificates of Competency, the Australian Yachting Federation and the professional Diving Authorities etc.

Lesser qualifications will result in lower overall status for Marine Studies as a school subject, or a programme as a means toward employment.

8. It was generally agreed than any organisation is only as good as its communication network. M.E.S.A.
will grow through the efforts of individuals and centres around Australia and Tasmania by news correspondence and monthly news letters. The Conference has been the greatest single innovation, by demonstrating to all, the enormous amount of progress already achieved in Marine Studies. By sharing experiences and facilities wherever possible, we will grow and develop together.

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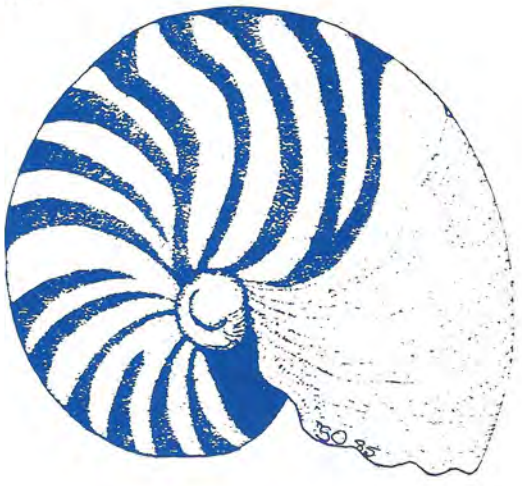


EVALUATORS COMMENTS

by

Mr. Clive Allen
Inspector of Schools, Queensland Department of Education

A reaction to the "workshops" held on Saturday (Ed.)

While acknowledging its great importance Australia-wide, I have a rather parochial view of Marine Studies. I think Marine Studies is an ideal subject in Queensland as the vast majority of our population lives within easy access of the sea. On our doorstep we have the Great Barrier Reef, and I don't need to expound the virtues and beauties of that particular attraction. There is certainly increasing development and use of reef tourist resorts and also increasing recreational use of the sea. Recreational and commercial fishing is also very important in the state.

When you put all of these together you realise that there are very strong reasons for Queensland developing Marine Studies. The only way of coping with this increase in pressure on the Marine Environment so that this environment stays usable by generations to come, is to have an educated public, who are sufficiently understanding of the problems to see the need for strong support for conservation measures.

I read, with considerable concern, that a Senate Select Committee had recommended the closing of all Marine Parks and a ban on the collecting of dolphins. If you consider what Marine Parks have done for the general public's understanding and appreciation of dolphins and other marine mammals, you would realise that these parks have played a major role and would continue to play a major role in public awareness of the need for conservation measures to save all marine mammals. I really feel that it is a rather shortsighted viewpoint to say that because you have got a number of these animals in captivity, that they should be freed because they are taught to do unfamiliar tricks. I do however, strongly support the need to monitor the quality of these parks.

I think that much more must be done to familiarise the public with the problems of conservation and the environment. But I really feel that we will formalize the public's education if we can introduce widely, a Marine Studies course.

Just to home in on one or two points which were made by the speakers yesterday. Bob (Moffatt) told of his visit to Bamaga and Thursday Island where the Marine Studies course would have incredible relevance to the students of both of those high schools. I strongly emphasise that relevance should be the keystone on which we should be building any Marine Studies course.

I was very impressed with what was being done in South Australia by Geoff Bayly. I think he has a very down to earth approach to the subject, but it is obviously a subject for better students. Having said that, I must say I was dismayed to hear that in South Australia, the Student has to pass Year 10 Science to be able to do the Marine Studies course. If these conditions were used in Queensland, then Bob's first classes of Marine Studies students would never have started the subject. They would have certainly been deprived of one of their most interesting and most relevant subjects. So use caution when establishing pre-requisites. In fact I was appalled by the ripple of approval that went around the room at the thought of saying that Year 10 Science should be a pre-requisite.

I was also most impressed by the work being done by Kris Kristensen. I think to involve students in a practical conservation project serves two purposes, possibly even three. It uses normally unused student labour. These students are participating in something which is particularily worthwhile and because they have become involved, they will be more concerned about that particular area. I think this project was one of the highlights of yesterday's information. It was significant that Kris said the students were solving practical problems. I highly commend that particular activity.

In regard to Rob Fraser's course, I consider the teaching SCUBA diving is something which has to be given a tremendous amount of thought. I think it is an activity that can be done too early. But having

listened further, to what Rob had to say, I realized that the course wasn't just SCUBA diving, and that he was using that as a jumping off point for the rest of his course.

My major comment in regard to the format of yesterday is that the workshops were not workshops. Now having said that I realize two things. Firstly, the difficulty in trying to get through the host of information that was available in the time that was available and that this precluded the workshop approach. There's a second constraint too. What we have here is probably the beginning of a subject which is going to have a very wide influence on the whole of the nation. Workshops usually work best if there is a pool of basic experience in the group and perhaps there are many people here who haven't yet jumped in off the deep end. That may have made workshops a less than successful method of operation.

I was overwhelmed yesterday by the diversity of the information which was placed before you. I'm sure that you have benefited from this wealth of information and from the large number of references to resources which will enable you to go back and operate effectively in your schools.

Looking at what Marine Studies should be doing.

We are faced at the present time, and it will continue into the future with a retention rate from year 10 to year 11 which is approaching 70% at the beginning of this year. This was an 8% increase over last year, which was an increase over the previous year. I can see nothing but a continued increase in our retention rate for years to come. The largely academic population in years 11 and 12 are no longer with us. We do have a significant percentage of students who do not require, nor are they capable of coping with an academic education. Therefore, we are looking for subjects that they can cope with, which they are interested in and which have relevance in their life. Marine Studies fits all of those requirements. When you are devising a Marine Studies course, you must keep those people in mind.

I will acknowledge also, that there are students who wish to make a career out of areas of Marine Studies and that they are tertiary oriented. There is a component of Marine Studies which is necessary to cater for those academically oriented and academically able students. This of course creates a problem. If you make the subject for one group, the others are either bored or can't cope. What you have to do is either develop two streams, or two subjects, or you have to develop an approach where you have a core which all students take with enrichment material which only the better students do. I can see nothing wrong with all students doing the course on Navigation, Boat handling and so on then; have other components which your low ability students would not even attempt, with your better ones moving on into that area. So any consideration you have given to the production of a Marine Studies course must keep in mind both groups.

If you are interesting and educating both these groups of students, the resulting educated, receptive public will be interested and able to respond intelligently to conservation issues.

I have a note here which says: "Beware of overemphasis on your own pet activity." It's really very easy to develop your Marine Studies course into an extension of your activities at the weekend. A Marine Studies course has to range over a wide range of topics and that's why I was concerned when I saw the emphasis placed on SCUBA in one course.

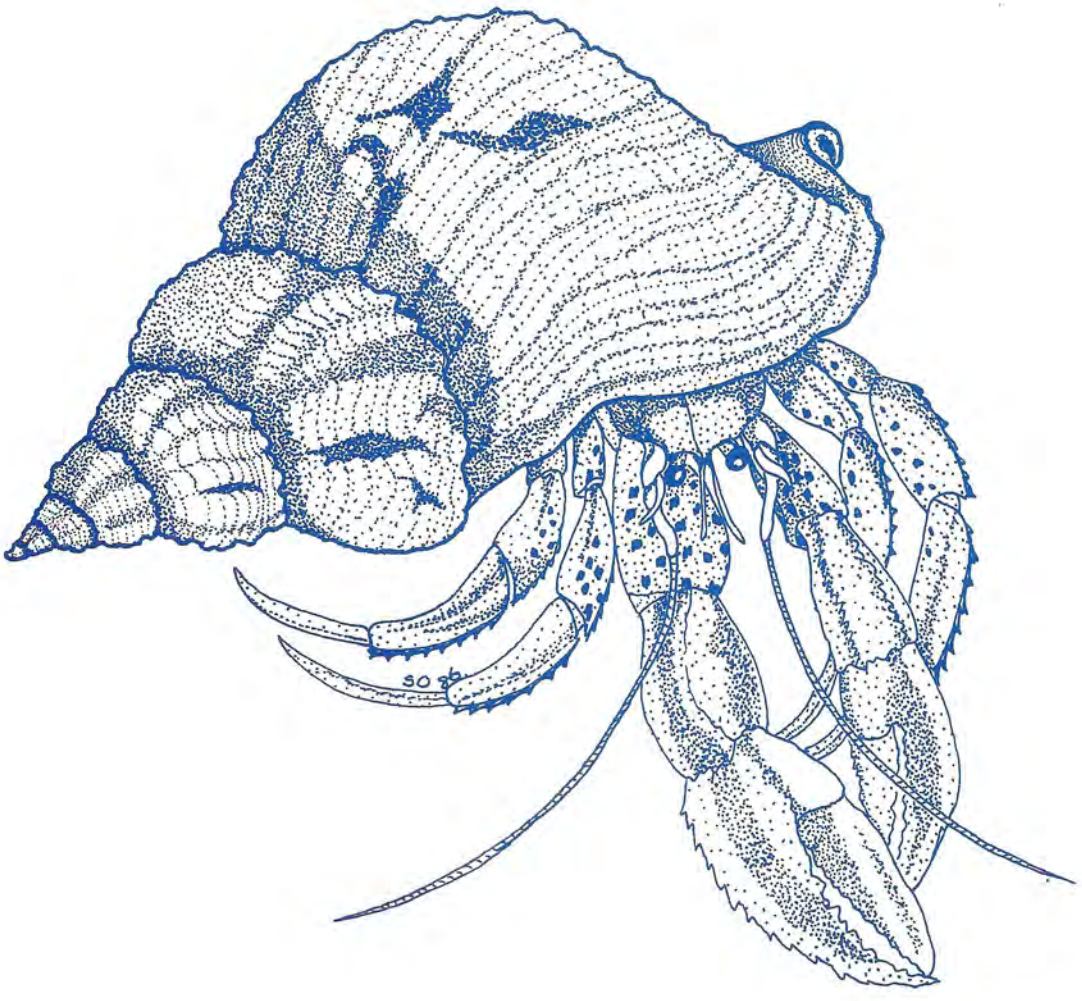
I might add that I am a reformed spear fisherman. I first went spear fishing in 1949. I had to use a home made mask and gun as they were not commercially available. I spearfished for two or three years before I realized that it was not the way to go. I have also been a SCUBA diver for more time than I like to remember so I speak about "Don't jump into SCUBA too soon" from personal experience. I feel that some students are not physically capable of manipulating that 70 odd pound tank on their back in a boat which is rocking in a chop and those students should not be doing a SCUBA course. Leave it until they mature physically and they can do it through a commercial course - there are many of them around which are well organized with well trained instructors. When I say don't start too soon, I don't mean don't start in secondary school, but I would shudder to think of some of "the knee high to grasshopper" students trying to cope with the problems of SCUBA.

There was one other point that George Stubbs brought up yesterday. The **legal problem** is one which always raises its head. I always refer back to the term "due care and concern". My personal opinion, NOT

the departmental one, is that I would dread to see certification of teachers a pre-requisite for your teaching various components of a Marine Studies course.

I would like to finish by quoting Fabian Fay yesterday. He said "There is a hell of a lot of material out there". I would like to re-emphasize what he said. There IS indeed a tremendous amount of material out there so make sure you don't put yourself into a course which straight-jackets you. Make sure that your course caters for both level of students we are going to have from now onwards, and make sure that you just don't follow one narrow little pathway.

A Marine Studies course has to be a very wide ranging one.



STUDENT AND TEACHER EDUCATION

by

Peter Kinchington

Marine Studies Centre,
Victorian Institute of Marine Sciences

Knowledge cannot be imposed on a student; at the marine Studies Centre, Queenscliff we aim to stimulate a person's natural modes of learning, that is, their curiosity and interest. This is achieved through a variety of strategies.

1. Interactive Displays

Students are encouraged to handle the displays which include dried sponges, starfish, shells, beachcombing objects and a wide range of living marine organisms.

2. Stories

"Telling stories" is one of the most ignored strategies in educational literature, yet it is one of the most valuable. Stories can be used to involve an otherwise unreceptive audience. Scientists constantly avoid anthropomorphic approaches, but teachers should not overlook the advantages of being anthropomorphic, because if you are trying to capture the attention of a novice audience, scientific language will alienate them. By using anthropomorphic language, students can be helped to immediately relate to the situation or theory being described. Once the students feel comfortable with the topics, scientific terms and concepts may be interspersed and they are more likely to be comprehended than if presented in a dry and unpalatable manner.

3. Spectacular Demonstrations

To be effective demonstrations should 'grab' the attention of the students. One example of this type is used to demonstrate the feeding behaviour of coelenterates. This entails placing a Eleuthuria medusa and some copepods (see Fig. 1 and 2) into a drop of seawater on a cavity slide. Then, bu using equipment available in most schools, a projections system can be set up (Fig. 3). This enables the students to see Eleuthuria capture the copepods as they swim past by stunning them with stinging cells (nematocysts) and then using its tentacles to place the hapless prey in its mouth (manubrium). Prior to running this demonstration the students have been 'primed' through stories thast explain about stinging animals (coelenterates) and their nematocysts which are describes as tiny poisonous harpoons. The students are spellbound by this demonstration and frequently allude to 'star-wars'.

4. On-site Activities

The Centre is located on the Queenscliff foreshore on the southern end of Port Phillip and provides ready access to a wide variety of marine environments, e.g. mudflats, rocky platforms, saltmarshes and coastal dune systems. Programmes have been developed to fully utilize these environments for teaching purposes. A marine education officer accompanies the group to provide support to the teacher and also to answer questions of a specific or general nature that may arise during field work.

Teacher inservice

The best way to motivate students is to have a motivated teacher. Consequently, at the Centre emphasis is not placed upon appropriate jargon, but on effective demonstrations, practicals and desplays designed to stimulate students and teachers alike. we use strategies (1) and (4) on the teachers themselves so that they can experience the Centre from a student's perspective an adapt it to their own classroom needs.

Conclusion

Students and teachers both need to be stimulated by a subject to truly appreciate it and to successfully convey any knowledge or concepts acquired. At the Centre we aim to achieve this to further the access of people to marine studies.

TOORADIN MARINE AND FIELD STUDIES CENTRE PROGRESS REPORT

by

Mr. Harry Briedahl
Officer in Charge, Tooradin Centre

Project Funding

In July 1985 a project proposal for the development of a marine and field studies centre at the Torradin Education Support Centre was submitted to the Westernport Region of the Victorian Education Department. This proposal was well received by the Regional Office and has the Region's full support. (A summary of the project is included in this report). In November 1985 Westernport Region used the July project as the basis of a major budget initiative submission to the Victorian Education Department for funding in 1986-87 financial year. The results of this submission should be known early in 1986.

Appointment of a regional consultant

In August 1985 Westernport Region appointed a science and evironmental education consultant to be based at the Tooradin Education Support Centre. This position will be occupied by Harry Breidahl until the end of 1986. The establishment of this position has allowed for some early work to begin on the development of the marine studies centre program at Tooradin.

Summary of proposal

The Tooradin Education Support Centre is located in the old Tooradin Primary School building, approximately 60km from Melbourne on the South Gippsland Highway. The Centre has direct access to Sawtells Inlet and Westernport Bay, and the surrounding district offers a wide range of both natural and man-modified environments. It has been recognized for some years that this site has great potential for the establishment of field studies centre and since it opened in 1980, a range of field studies programs have been conducted at the Education Support Centre. Experience gained during this time, indicates that the key to success of a field studies centre at Tooradin lies in the provision of professional staff on a full-time basis. We therefore propose that a field studies centre, called the Tooradin Marine and Field Stu dies Centre, should be established at the Tooradin Education Support Centre. The most important aspect of this proposal is the call for appointment of two teachers to the new Centre. The proposal also calls for the sharing of a clerical assistant with the Education Support Centre and the provision of $12,000, over the first three years, for the establishment of field studies and other related programs. The proposed field studies centre would be based in the existing environmental studies room and two additional rooms at the Tooradin Education Support Centre. The development of primary and postprimary programs would be based on four main aims: the development of displays and collection of resources that relate to the major environments of the Westernport region, with a special emphasis on the marine environment; the development of a range of marine studies and research programs for schools and in-service programs for teachers, again with a special emphasis on the marine environment; the development of a range of marine studies curriculum programs and support materials; and, the establishment of a network of links with similar centres and organizations, at the state, national and international level. Our enthusiasm for this proposal is shared by a number of other organizations, which will help to ensure the success of this proposal. The Tooradin Marine and Field Studies Centre Committee, July 1985.

The centre at Tooradin

The concept of a field studies centre at Tooradin evolved late in 1979 when the old Tooradin Primary School was vacated and the school population moved to a new site. At that stage the old school buildings were seen as providing an ideal site for both a field studies centre and a teachers centre. Since 1980, when the Tooradin Education Support Centre began operation, a small field centre has occupied the central classroom of the old school. Although the centre offered great potential as a site for a field studies centre it has always been limited by the lack of consistent staffing. In the period 1980 to 1983 an environmental studies program was established and run by a part-time environmental studies consultant based

at the Centre. Although this program ended with the unfortunate cut-backs in consultancy in 1983, it clearly demonstrated the need for such a program in the region. The environmental studies programs that were developed in the 1980 to 1984 period catered for both primary and postprimary students. The programs covered a wide range of topics but the marine studies program was of special interest. Now that the Westernport Region's science and environmental studies consultant is again based at Tooradin, marine studies programs are again receiving some support. The old Tooradin Education Support Centre, which would house the project is already funded. As a result the costs of providing and maintaining the buildings and associated facilities have already been met. Secondly, the central room of the old school building is already partly set up as a resource and display area. This room should be further developed as a resource and display area for the new marine and field studies centre. Special emphasis should be placed on the continued development of aquaria and other displays relating to marine environment. Since the old school residence is available for use by the Tooradin Education Support Centre, a number of other rooms will be available for use by any future field studies centre programs. Detyails of the lay-out of extra rooms will depend upon what rooms are available, but it is expected that there will be a second classroom available as marine science laboratory and smaller rooms will be available for staff office space and a resources room and library.

In summary

The proposed Tooradin Marine and Field Studies Centre should be housed in the existing buildings of the Tooradin Education Support Centre. These rooms will be required:

* The central room of the old Tooradin Primary School building (presently the environmental studies room), that will be occupied by a wide range of displays.
* A marine science laboratory that will occupy a second classroom in the old school building.
* A resources room and library, that will occupy a room in the old school residence.

The site of the centre at Tooradin offers a great deal of potential for a wide range of environmental studies programs, specially those that focus upon the marine environment. The immediate locality offers the following:

1. Seagrass Meadows: There are extensive areas of seagrass in Westernport Bay. Seagrass dieback and related problems of a decline in fisheries, erosion of mudflats and foreshores and destruction of dependent marine life is an important issue which may be used to demonstrate the complex inter-relationships involved in environmental problems.

2. Other Marine Communities: The Centre has easy access to a great variety of marine communities. As well as the seagrass meadows mentioned above, there both are intertidal mudflats and rocky shores which offer great potential for a wide range of studies. Subtidal communities could be made accessible through the use of boats and a range of sampling equipment, such as dredges. Some areas of intertidal mudflats are major feeding areas for a wide range of wading birds, including a number of rare species.

3. Mangrove and Saltmarsh Communities: Westernport Bay offers one of the most southerly examples of a mangrove community. It also offers fine examples of the saltmarsh communities more typically associated with temperate climates. Together with the associated mudflats and seagrass meadows, there is a great deal of potential for a wide range of studies of these communities and the many problems that they are now facing. Of special note are the saltmarsh areas on French Island. These remote saltmarshes are one of the few remaining areas where the rare Orange-bellied Parrot has been observed.

4. Terrestrial Communities: As well as the marine environment, the Tooradin Centre has access to a range of terrestrial environments. Of special note is the Cranbourne Annexe of the Botanic Gardens. The natural vegetation here contains a great diversity of plant types. The area is the largest remaining area of acid sand heathland close to Melbourne. Over 300 species of native plants have been established in the Annexe and national collections of Acacias, Banksias and Casaurinas are to be established as well. The Annex is also noted for its wealth of wildlife, including such rare animals as the New Holland Mouse.

5. Industry and Agriculture: The Westernport area also provides the opportunity for study of a number of major industries, for example Lysarts at Hastings. As a major deep-water port, Westernport Bay and its associated industries also offer many opportunities for a wide range of studies. Of particular note is the chance to study programs that focus on the relationship between development and conservation. The number of smaller industries in the area also provides a diverse source of activities and study projects. Of particular note are - ICI Glass at Lang Lang, a number of small commercial fishing operations and the boat repair facilities at Hastings. Tourism adds a further area of study. Especially with the South Gippsland Highway, which carries the bulk of traffic to Phillip Island (Australia's third biggest tourist attraction), running past the Centre's door. Finally the Tooradin Centre is ideally situated to take advantage of the varied farming activities in the region. Of particular note are potato and asparagus farms and the Bales onion processing factory.

6. Historical: The area surrounding the Tooradin Centre offers a range of well established historical attractions. Of special note are the Tooradin Fisherman's Cottage and the Coolart Reserve. Local historical societies, especially the Hastings Historical Society and the Koo-wee-rup Historical Society, are available to assist with the development of study programs.

7. The Tooradin Education Support Centre: The central room of the old Tooradin School has already been used as a display area, resource room and base for environmental studies programs. As a result a number of resources are already present at Tooradin. For example two large marine aquaria and stands already occupy the environmental studies room of the Centre. The materials and equipment for a range of displays such as - bee hive, "touchy" aquaria and indoor sand dunes and swamps - are also present. A great deal of finished and unfinished material relating to field studies is also available. Finally, the Tooradin Centre offers the advantage of having access to the personnel and equipment already established at the Education Support Centre. The Education Support Centre, visiting regional consultants and advisers and the associated Pakenham Special Education Unit already attract a wide range of teachers and pupils to the Centre.

National conference

I am very disappointed that I will be unable to attend the National Workshop of Marine Educators in Queensland this November. As a result I should like to take this opportunity to explain why I am unable to attend. Firstly, The Education Department Region that employs me has been very supportive, but their in-service budget for 1985 is fully accounted for and my only other sources of funding were either from a very small operating budget that I might have access to in 1986 or from my own funds. Neither of these alternatives was acceptable. Secondly, this is the second time the rather touchy subject of interstate travel has presented problems for me. Based on my own experience of past events and on advice received, I believe that attending this workshop as a respresentative of the Victorian Education Department was out of the question. As a result, I strongly recommend that all future national workshop organizers should take account of the restrictions that organizations, such as the Victorian Education Department, put on their employees (no matter how strange these restrictions may seem). As a result of the problems with the 1985 workshops, I should like to propose that the (soon to be formed) National Association of Marine Educators takes advantage of the next Australian Association for Environmental Education conference - to be held at Lorne from September 1 to 5, 1986. As this conference is being supported by the Victorian Education Department, teachers and other education department employees should have no problems obtaining leave to attend. It is also far enough ahead to allow everyone to organize funding for travel. Finally, the conference itself should be relevant to all marine educators and there is the chance to organize special meeting times either during the conference or before or after it. Finally, I hope that you all have a great time and that the workshop is as productive as the first one was in 1984. I hope that NAME has a safe and trouble free birth and I only ask one thing - if you get as far as deciding on a logo, please avoid the temptation to use a diver!

[Ed note: The diver was voted unamiously by members for the Queensland chapter!]

MARINE PERSPECTIVES IN OUTDOOR EDUCATION

(The Beenleigh State High School Study)

by

Mr. Wayne Fossey
Deputy Principal, Benowa State High School

Background

Beenleigh State High School offered the opportunity to intergrate unique physical advantages and school demands into a marine oriented outdoor programme. A flexible physical education and social science programme was able to utilize Beenleigh's locational advantages in offering this course. Beenleigh is adjacent to both the Albert and Logan rivers; close to island land masses, namely Stradbroke and Moreton Islands; to Field Study Centres - Jacob's Well and Maroon Dam' and to Jumpinpin Bar.

Proceedures and rationale

The goals of the outdoor education programme were included within the frame-work outline at the end of this paper. The Staff of the Beenleigh High School after considerable discussion decided upon the justification and development of programmes which could be loosely titled "Outdoor Education." The need to justify the expenditure on equipment was the original reason for staff being asked to make their contribution towards an integrated programme. After initial discussions it was easily realized that the need, interest and skills within the school provided ample justification. This paper outlines our rationale for Outdoor Education programmes; the aspects of integration; the submission to purchase, repair and develop equipment; our Maroon experiences and what the teachers perceive as the advantages and problems with such programs.

This paper is an attempt to put in practical terms one school's programs. It must be noted that the programs were developed by teachers with no formal outdoor education training but interest, enthusiasm and experience - background and experience include urban-rural experiences, Scouting, Army and adventure in outdoor interests e.g. rock climbing, bush walking, Kayaking and sailing.

Outdoor education was defined as learning experiences in the natural environment where the individual meets the challenge of resolving real life problems learning skills of a practical creative value and attains insights about human and natural resources. The distinctive feature of outdoor education is that it takes place in the natural environment generally away from the School.

Living and learning out of doors may embrace a multiplicity of activities including environmental study programs, conservation projects, field studies, adventure pursuits. As a practical element in the Health and Physical Education Syllabus outdoor education focuses upon areas of activity concerned with motor fitness, physical skills (survival, recreational), interdependence of people and their environment, social development and adventure activities which present a challenge to the individual. Also there are many opportunities within the scope of this element for interdisciplinary integration.

If values are considered as central to behaviour, the programs of environment are aiming to change behaviour, then programs must be centred upon values and attitudes. Teachers cannot dictate the values relating to the environment but should help the students achieve a balance in environmental concern by practical experiences outdoors. In order to develop attitudes and values environmental education should not be considered as a separate subject nor a subject centred upon one discipline, because the aims of environmental education can only be realized by a new awareness and concern by all teachers who contribute to the curriculum of the school.

Why an outdoor education program at Beenleigh State High School?

The following needs were perceived by staff and the aim is to overcome these needs: a) need for practical activities because of the difficulties some students were experiencing with programs of a more

academic nature, and these programs heightened student interest and discipline; b) need to encourage environment concern by involvement and help encourage respect for the environmental ethic; c) need to aid in future leisure activities; d) need to help students become involved in activities including challenge and adventure with limited risk and danger; e) demand for students to learn outdoor skills e.g., canoeing, kayaking, rock climbing, and f) the alternative view; (the social, emotional advantages).

The overall educational advantages which accrue to students through outdoor education; the need to establish a stock of equipment suitable for an outdoor education course. Education should endeavour to provide as wide a range of "life" experiences as possible. In an increasing complex technological world where cultural, social, and moral attitudes are in a constant state of flux, it is important that students gain experience which teach them to be self reliant, to accept responsibility and to exercise that responsibility wisely, to be able to co-operate with others and to show consideration for others and their opinions. These objectives are not easily attainable and it is difficult to measure the extent to which they are attained by students. However, by both objective and subjective means, some indication of the achievement of these qualities can be gained throughout a student's school career. It is important therefore that educators look at the whole system of education, and specifically the objectives, structure, method and content of the particular subject areas. I believe that outdoor Education as a subject and a course has enormous potential as far as the attainment of the afore-mentioned qualities is concerned. It is unique in its application to these goals in that not only does it provide students with specific knowledge and skills, it also provides for the overall development of the student in terms of the qualities I have already mentioned. From the point of view of specific Outdoor Education "Subjects" it can be readily seen how students can develop their staff reliance, can accept responsibility and co-operate with others. Most of the activities (canoeing, kayaking, camping) will develop not only those qualities, but also an appreciation of nature, the need to protect that which is part of our heritage. The social advantages which also become evident are a direct outcome of the group aspect which becomes an integral part of the outdoor education course. Students who are introspective and reserved, have opportunities through this course, to become more outgoing and conscious that they, as individuals, have talents and qualities which can be shared with others. Students who have socially undesirable tendencies are pressured, by virtue of the group expectations, to co-operate with the group and become an active member of that group.

To summarize:

The qualities produced by an Outdoor Education course which I believe are basic and essential are: Self reliance, Leadership - the acceptance of responsibility, Justice - responsibility which can be exercised wisely, Co-operation - The benefits of group work - an integral part of Outdoor Education, Consideration for others

Beenleigh staff met to decide the program for the activities, review past experiences, organise student preparation and public relations, and all students are asked to make suggestions for the type of program and food. Some difficulties have been experienced and a constant review of programs and equipment is necessary.

a) Staffing changes often mean a change in areas of expertise but this can be overcome by inservice training. b) Costs of equipment, storage and repair are high. Damage and losses do occur but can be limited by detailed stocktake of the equipment before/after each project. Busing costs are often considerable. c) Time involvement by staff is heavy and includes equipment checks, arrangement e.g. for food, bus and finance. Delegation of tasks has helped to reduce the individual logistics however an overall command role needs to be assumed by one individual. d) Resentment from staff not involved. Mathematics-Science staff have objected to the time for excursion-camping and often have shown no interest in programs or integrating their activities.

The integrated elements of an Outdoor Education program are working well and positive response has come from staff and students, however programs and equipment are under constant review. The interest and enthusiasm shown by most staff and students has ensured the future survival of the programs.

LINKING SCHOOLS IN PROJECTS

by

Ms Kris Kristensen
Education Officer, Queenscliff Marine Studies Centre

Summary

The dune stabilisation program performed by school students in the Barwon South Western region is an example of how schools can co-ordinate to participate in projects of high conservation and educational value.

Over a period of two weeks, two hundred students were involved in a range of restoration activities which resulted in a considerable improvement to the environment, and which were directly relevant to their school studies.

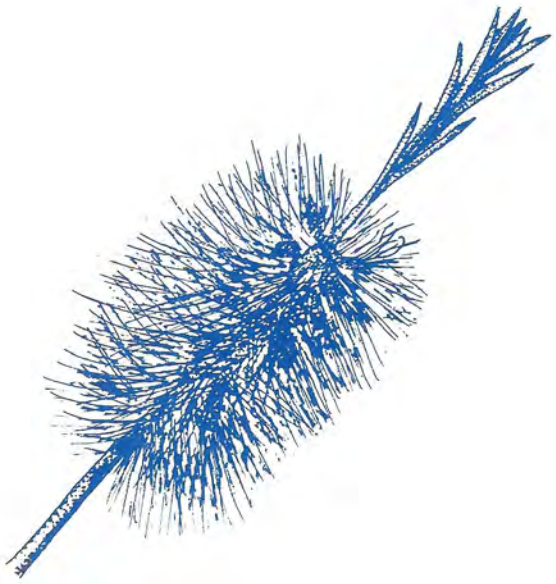
General objectives

-To reduce the impact of erosive forces on a section of coastal dune by creating an environment in which plants may flourish and form stabilising vegetative cover.

-To provide students with a practical project of edcucational, environmental and social significance which directly relates their academic studies to a "real world" situation.

-To create an awareness in the student of their personal ability to effect a positive change in the environment and to feel pride in their achievement.

[This talk was supported by a series of 35mm slides showing the stages of student invilvement. It could be clearly seen that the project achieved marked changes in what seemed to be an impossible situation. Ed note.]



THE CASE FOR THE EXHIBITION OF DOLPHINS AND WHALES

by

The Seaworld Staff

Learning to care

As man enters his planet's last ecological preserve, the ocean, it is imperative to his own survival that he learn to understand, manage and conserve its precious resources.

Sea World and other marine parks in Australia contribute substantially to the collection of scientific information and research on mammal biology, behaviour, communication and intelligence.

Sea World often provides life-giving assistance at stranding sites and in the transport and care of stranded animals.

Professor Kenneth Norris, Professor of Natural history at the University of California, and one of the founders of the Society of Marine Mammology, the world body of scientific authority, says, "I disagree with the contention that closing exhibits will assist the conservation efforts for marine mammals. History teaches exactly the opposite. People care about the things they know, things that lie close to the emotional heart. A trip to a marine park is a safari for the rank and file of society, and has done perhaps more than anything else to keep public awareness high."

"The memory of people is distressingly short. There needs to be constant re-education. What counts is the emotional touching of a person and an animal. A visitor watching a dolphin respond to a trainer, or a little boy who seeks to pet it, is where the public caring begins."

"We must continue to learn, to educate, and to share new understandings about the lives of dolphins with the public if we really want to protect them."

Sea World has an envied reputation for the keeping and raising of dolphins. It wants to keep doing this for the reasons that Professor Norris outlines.

There is a move by some followers of the Greenpeace movement to close down every Marine Zoological park in the world, claiming that the mammals in the parks are mistreated, and that there is no need to exhibit mammals in order to ensure their survival. The weight of legitimate scientific opinion is strongly opposed to that view.

Throughout the world, there are only 500 or so dolphins and whales exhibited in marine parks. As an animal species, they are the most pampered and cared-for group on earth. High technology has been developed in the major parks such as Sea World on the Gold Coast, ensuring an animal husbandry programme of the highest order.

-The world is full of animal cruelty. Tens of thousands of domestic pets are senselessly tortured and killed every year in Australia.
-Thousands of dolphins are killed annually by fishermen who claim that the mammals are in competition for their food supply.

There would appear to be so many other deserving causes for Greenpeace, but they have chosen to attack the marine parks of the world because such attacks will gain them the most publicity. Considering the pressures on our world, it is not valid to follow their idealistic view.

MARINE EDUCATION IS THE WORLD'S ONLY HOPE.

HOW EXPENSIVE IS MARINE STUDIES FOR QUEENSLAND SCHOOLS

by

Mr. R. D. Moffatt

Extracts from a paper presented at the conference

Abstract:

This paper discusses four possible funding models for the introduction of marine studies education in our state

Model 1: Marine Studies for under $1000

Let me assume that you are a school like Mossman - far from regional office or other schools and living in a small regional community. Your PEP co-ordinator is mad keen on agriculture and you don't even get a look in at the money. However you have a few members on the P&C who own boats and whose students are in grade 9 or 10 (not academically brilliant, but nice and well mannered). You are planning to introduce marine studies into your school in grade 11 for 24 students next year and have received regional office approval and permission from your principal.

You approach the P&C for their support and get a grant of $600.00 for equipment and approval to charge a $15 book loan system fee which gives you a budget of $950. You have a reasonable but not over stocked science storeroom, access to the manual arts, physical education, geography and home ecconomics departments.

Lets see what units you can do and equipment you can use:

Books: Of course you will buy some Brisbane South Notes: For about $360, you can buy 12 Navigation, Radio, Boating, Camping, Snorkelling and 6 Biology, Physics and Chemistry plus Postage , which is your collections from your textbook scheme. If you look after them you should get three years use from them. Write to the regional office and borrow the teachers guide for planning. The students will have to share the books, but you are just starting.

Equipment: With the $600 P&C grant you can buy 6 Parallel rules, Local charts, compasses and photocopying for Navigation. For snorkelling you should get away with 6 sets gear of snorkels, masks and fins with the rest made up from asking the students to bring their own. For marine communications a 27 mkz radio can be purchased with you communicating with the air sea rescue for the other. Finally if you offer parents to pay for the petrol, you should be able to run your boating unit by having parents take the students out on their boats on the weekend. You will need to borrow: A parents boat for demonstration, a ships compass, log, sextant, dividers, additional snorkelling gear, (or students take turns in the pool), fishing rods and reals, charts. If the local air sea rescue or coastguard helps, then other equipment can be borrowed. You will need to use gear from other subject departments eg; Globes, charts, instruments (Geography), motors and tools (Manual arts), cooking gear - for fishing (Home Ecconomics) and geometry - (Mathematics). This will require good public relations and a willingness to share equipment.

With this gear you should be able to do the following units of work in Grade 11: Navigation, Snorkelling, Boating, Fisheries biology and fishing. Next year you have a new budget. The P and C is estatic, the president's son enrols in your course, the PEP co-ordinator gets her promotion to Cairns and you take over. By following the sample programmes in the regional office copy, you start :oceanography, maritime history, boat licence, excursion, camping, sailing and marine chemistry.

This model relies on your public relations with the P&C and the other subject departments of your school. It relies on good, honest students, who are able to borrow equipment and look after it. It cannot stand on its own without a large amount of community support, but lets face it, Mossman is a lovely place to live and you don't mind putting the time in and building the course up slowly. You may be able to organise yourself to the local field study centre near Cairns for an excursion involving boats. This will allow you

to get the students a hands on experience in small boats. Similar situations apply in the Central (Boyne Is) and Brisbane South (Jacobs Well) regions.

I think also of Woodridge SHS, who had their PEP marine studies programme slashed to under $1000 in 1985. For the boating unit, the school organised a car pool with parents to a local boat hire place on Moreton Bay. Students paid $15 for a 7 week course for students to get their boat licence. The hire boat manager gave up his time in association with the Beenleigh Air Sea Rescue, to show the students how to operate correctly his boats. He showed them also how to clean and maintain the motors, how to lauch them and gave them a lot of handy hints associated with boating. The school organised a local petrol station to donate some fuel for his business, which cut costs further. This is an example of - time and effort. If you are prepared to put the time and effort into organising, then you can save large amounts of money.

Model 2: Marine Studies for under $5000

Burnside SHS on the Sunshine Coast is a good example of this. Earlier in this set of proceedings you should have heard what Derek Foster had developed.

Burnside SHS decided on Marine Studies with the local community and TAFE, with the option of "going it alone" if things went wrong. They purchased boats and equipment as part of a share in the school PEP funding. I can think of Maryborough, Pimlico, Townsville, Home Hill, Trinity Bay, Bundaberg, Caloundra and at least half a dozen other schools who did the same in 1985. The school programme involves working with the community, who can supply the expertise and in some cases where TAFE is involved, equipment and staff. Excursions to the local river and a deputy principal who timetabled a sizable part of Thursday, assists the course in the practical elements. Keebra Park has timetabled Thurs and Friday afternoons to marine studies, but when you consider over 200 students lining up, the administrators didn't have much choice.

The cost of marine studies courses ranges with this model. A big factor is equipment - should I buy or hire? Whatever the case, you want students to get hands on experience. By hands on I mean time to practice and master the skills inherent in the marine studies philosophy that is making this subject so popular. If you want to bring students back to grade 11 and 12, then they must be given the time to master what they learn. In simple terms, all students should get their boat licence, their radio operators ticket or pass their AUF snorkelling exam. These exams are externally set and students are able to get certificates that are readily accepted by employers who work in the maritime field. As educators you will realise that if you want anyone to master skills, they must have time to make mistakes, be shown where they went wrong and have time to correct them. Students and teachers don't seem to mind working after school because the students are actively involved, motivated and are interested in what they are doing. But I am digressing.

Pimlico spent just under $4.000 on boats, trailer and equipment. They spent a further $1,000 on snorkelling, navigation and radio equipment. Keebra are still spending, but going second hand. My guess is that they will invest a little over $2,000 but they are tied into the 4th Model which I shall explain soon. Merrimac has placed their emphasis on surf survival and will spend about $5,000 by the time they are finished on surfcraft, books and storage. Caloundra's P&C allocated over $5,000 for boats, navigation and snorkelling equipment, radios, and classroom notes.

I feel confident that schools who go it alone to give their students experiences in the units of navigation, snorkelling, camping, marine communications, fisheries biology and fishing, marine science and oceanography will spend about $4,000 to set up their courses and then about $1,000 a year to maintain them. This would put marine studies on a par with many other subjects beginning their courses in grade 11. When I stared at Benowa State High School as Science Subject Master, I can well remember the establishment grants given to Biology, Chemistry, Physics and Multistrand Science in the order of $2 - $3,000. In fact one year I remember a cheque for $7,500 as an establishment grant for Science equipment. I am sure that if you looked at other practical subjects like manual arts or home ecconomics, you will find substantial establishment grants as well.

Model 3: Marine Studies for under $15,000

This is the model that has been set up at the Gold Coast, and has been adapted in the Gladstone, Mackay and Cairns districts. It involves a number of schools in an area getting together to form a cluster to share a trailer load of small outboard dingies, motors, radios, navigation, fishing and snorkelling equipment. Usually a staff member from a school is seconded to a temporary advisory position or works in a field study centre, to assist the schools communicate effectively.

The Gold Coast Model works for Keebra Park, Merrimac, TAFE and Benowa State High Schools and colleges. Schools meet late in the year to plan courses for their students and book equipment for days. Eg: Keebra has the boats - Thurs, Fri; Benowa Tues, Wed and Merrimac Monday. The boats are used all year, each day, and schools arrange for a motor service and fuel fee to be paid to the Benowa State High School P&C association. This is based on the formula of $1 per student per day with school's opting to pay labour or supply their own. From time to time, the P&C employs a part time teacher aide to assist in the periodic maintenance of the equipment or arranges a swap of lab assistants or technical staff to help. This cuts labour costs and helps the maintain the equipment. In 1985 schools used Commonwealth funds for Non-Target schools for this purpose. If this is not forthcomming in 1986 then schools will charge the students a "hire fee", just as they pay a "hire fee" to use the Southport pool for snorkelling. Over 1000 students used the boats in 1985 with 300 boat licences issued. This was done in conjunction with the Harbours and Marine who also helped by granting the Benowa State High School P&C exemption for all time, from boat registration fees.

Each school in the cluster also purchased its own equipment to specialise in its own field. For example, Merrimac purchased surfcraft: each school in the cluster can pay a service fee for the surfcraft, Keebra purchased fishing and radio equipment and a similar sharing arrangement operates. The idea that no school in the cluster should duplicate resources was agreed on from the start and to this date no school or college has. The programme has now been operating just over 2 years and is looking good. In 1986 students from Keebra and Benowa will do a TAFE/sec powerboat handling course run at the Air Sea Rescue. $3,000 of TAFE/Sec moneys have been allocated for this purpose. In second semester a further $3,000 will be allocated and students from the 3 schools will do either a petrol and diesel engine course or a surf certificate course.

It should be pointed out that all equipment is shared amongst the 4 schools and colleges and when you divide by 4 you still end up under $5,000, which is the same as the third model.

Model 4: Marine Studies for under $120,000

This model has been set up at the Jacobs Well Field Study centre where a vessel has been built using STEP and PEP funds. The vessel, the "E.R. DUKE", named after the former regional director for Brisbane South, is surveyed for 45 students but can realistically take about 14. Two other vessels have been built that the students can either row or sail and student programs are planned to operate over two stages within the Brisbane South and North Education Regions.

Stage 1:

This involved the transport of the hull of a vessel purchased from the Ithica TAFE section, to Jacobs Well, completion of the superstructure to suit its usage, with regard to Marine board specifications and Education Department guidelines. The work was done on a continuous contract price basis with local schools. Because of the nature of the tasks involved, some requiring very specialised skills (e.g. caulking of the hull), specific programs are not offered, but rather a continuous series of units of essentially practical nature. These units were conducted progressively and enabled students and schools to choose these units that were most applicable to their current transition programs. Depending on the interests and skills of available teaching staff involved in these units, extension/parallel acitivities are:

1. Production of A/V material showing the progress of the project starting with the transport of the vessel from Ithaca T.A.F.E. to the launching at Jacobs Well. As well as providing a record of the whole project it was used during the construction/fitting stage to bring prospective students

up to date with what has been done so far. 2. Small boat handling and safety, 3. Canoeing and other recreational pursuits, 4. Campcraft - cooking skills, 5. Social interaction, 6. Environmental studies

Co-operative planning between School and Centre maximised the learning potential of each of the stages of construction.

1. Work observation and care, opportunities in fishing boat building and allied, industries, 2. Recreational activities e.g.boating, sailing, fishing, water skiing, rowing, 3. Marine biology and/or general science, 4. Meteorology and basic seamanship, 5. Oceanography/Marine/Ecology, 6 Resource management e.g. role of fauna, flora, fishing and study reserves, mangrove ecology/farming fish, crustacean ecology, work of beach protection authority, 7. Navigation using modern and traditional instruments, 8. Programs in environmental education and awareness, 9. Work observation and career opportunities in the tourist and allied industries-operation of charter vessels, venues for tourist resorts, operation of tours, management and economics, public relations and catering, 10.Maintenance of a marine vessel

This model relies almost exclusively on the management of the Field Study Centre, the budget of the Queensland Agricultural Project Club Branch and the availablility of the centre to schools. Planning from year to year is at the discretion of centre and schools do their marine studies programme on a "one off" basis. There is no possibility of the centre running a course for students because the philosophy of the centre makes no provision for long term courses at this stage.

Conclusion

The board of secondary school studies marine studies syllabus committee has been formed. Set up under the Science advisory committee, the task before it is to come up with a proposal for a pilot in 1988. This should co-incide with a bicentennial project which will give the students the necessary curriculum materials for the course. A surveying of national and international audiences both technical and educational is underway. Contributions for the syllabus will come from large areas of the marine community in this state to give it a local flavour and the syllabus design will tackle the problem of having to convince the board curriculum committee of the need for a large practical element incorporated in the design.

The committee has representitives from the Science, Social Science and Physical Education advisory committees, and it must pass through all these committees before going finally to the board for adoption to pilot and trial. Whatever the case, at least 50 schools by the 1990's will be offering marine studies in some form or another.

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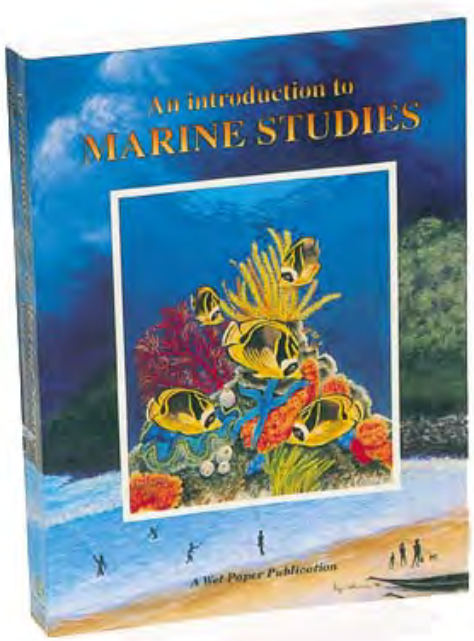
www.wetpaper.com.au

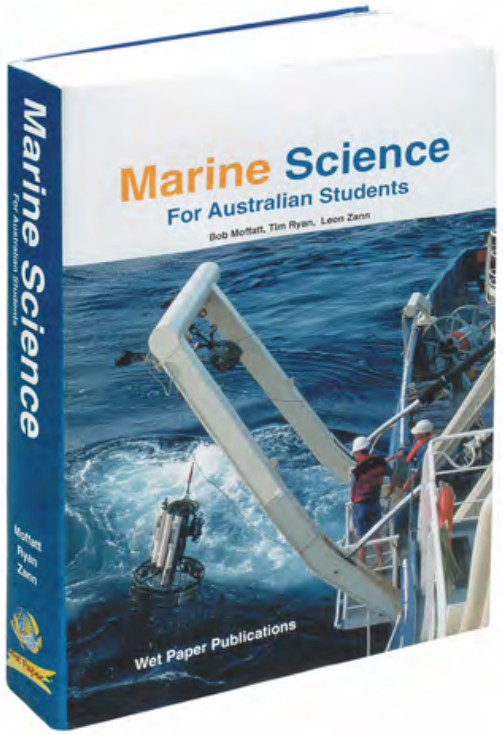
KIDS AND WATER

It's about safety and conservation

Years 1 - 6



Years 7 - 10



Years 11 - 12

KIDS AND WATER

It's about safety and conservation

- **Primary School marine program**
- **Years 1 - 6**

Wet Paper

18 books, 16 pages, full colour called readers

Level 1 Kit


Felt background
Marine Reader Series
Everyone Likes the Sea
Jim Grant
Marine Reader Series
At the Beach
Sheree Marris
Marine Reader Series
Sea Creatures
Bob Winters
Level 1
Teacher Resource Book
Barbara Jensen
Marine creature felts
Teacher resource book

Level 1 Reader

Surfers ride their boards on waves in the sea.

We ride our boards too.

Reading recovery level information

Method

Books 1-18 were read with a small sample of children (about 150) from a Primary School during March - June of 2001. Sample ages ranged from 5-10 years and were both boys and girls.

Results

The following reading recovery levels are only to be used as a guide until a more extensive sample size and test is conducted. The comments are from the reading specialist who has volunteered her time to Wet Paper

Level 1 Readers

Book 1 Everyone likes the sea:	Minimum level 10/11
Book 2 Sea Creatures:	Approximate level 13
Book 3 At the beach:	Minimum level 10 - 12

Level 2 Readers

Book 4 Fun by the sea:	Minimum level 12/13
Book 5 Working at Sea:	Approximate level 15
Book 6 Be safe at the beach:	Minimum level 12/13

Level 3 Readers

Book 7 Tourists and the Sea:	Approximate level 24/25
Book 8 All Kinds of Boats:	Approximate level 19
Book 9 Rock Pool Life:	Approximate level 30
Book 10 Creatures of the Deep:	Approximate level 20
Book 11 Shipwrecks:	Minimum level 26/27
Book 12 Our Day on a Research Boat:	Approximate level 28 Δ

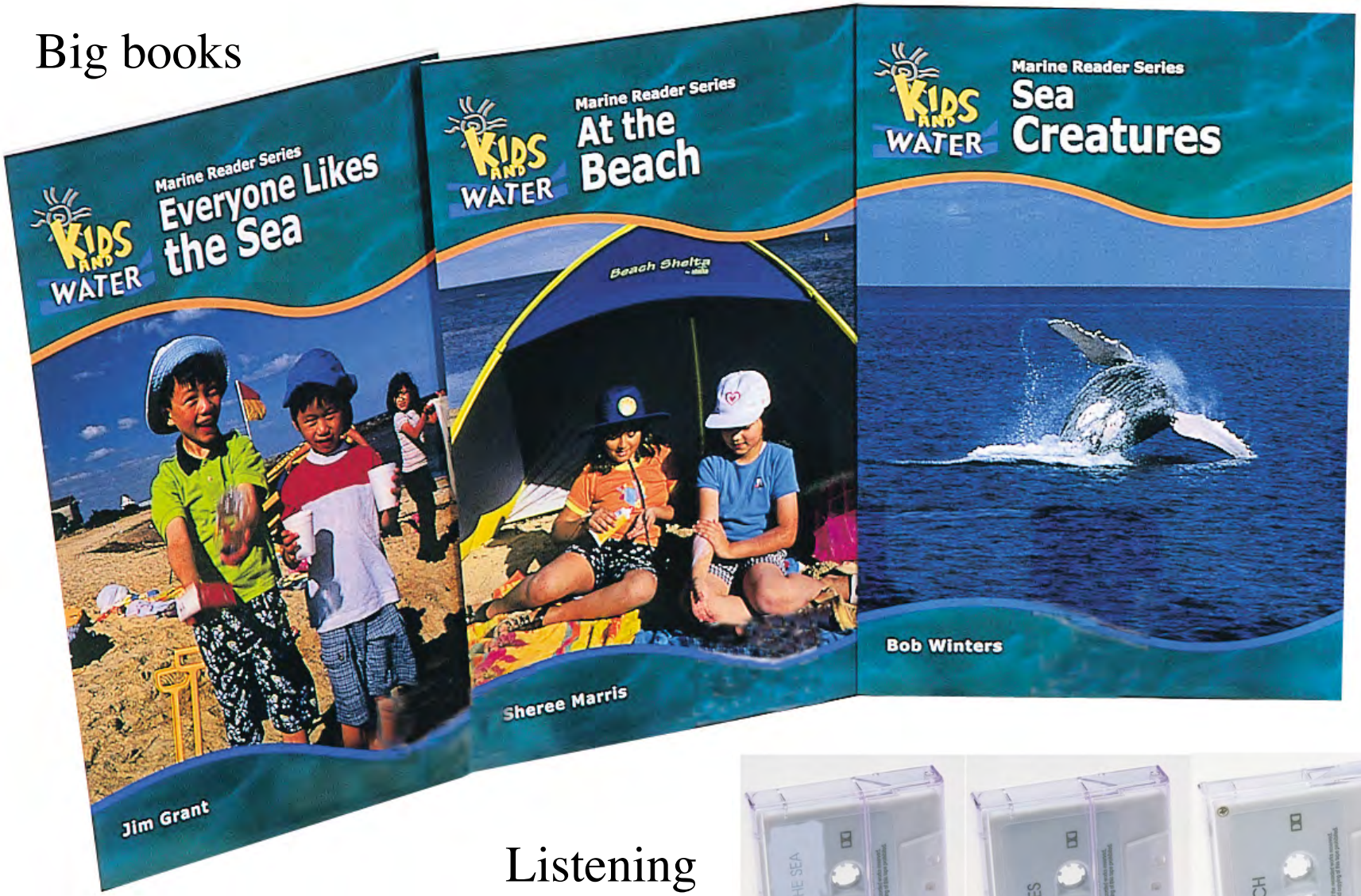
Level 4 Readers

Book 13 Let's Go Sailing:	Approximate level 20
Book 14 Food from the Sea:	Minimum level 26/27
Book 15 Classification and Survival:	Approximate level 30
Book 16 Sea Creatures at Risk:	Approximate level 29
Book 17 Better Boating Behaviour:	Minimum level 21
Book 18 Don't Mess with the Sea:	Approximate level 28/29 Δ

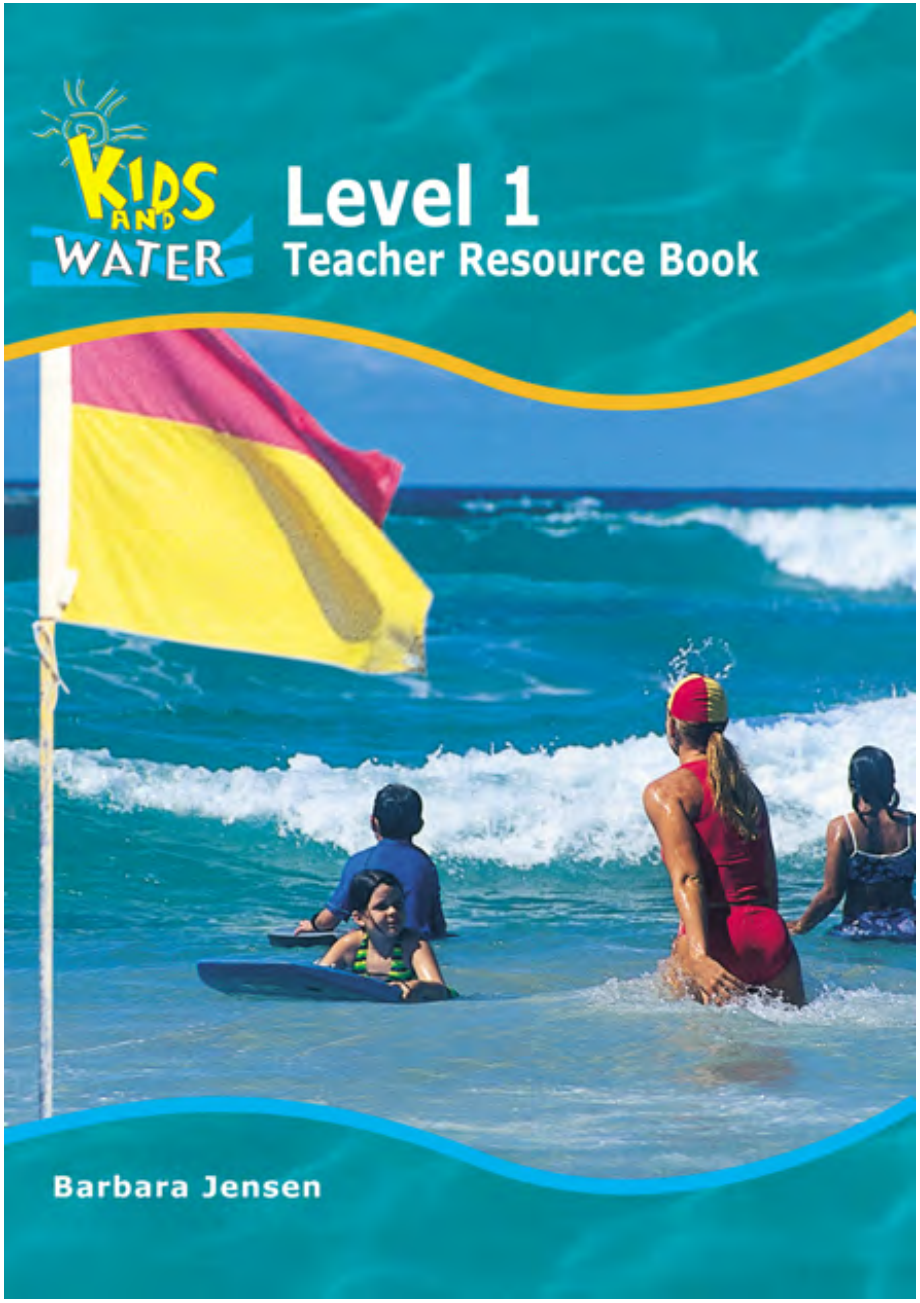
Some comments

- The book contains lots of text changes with some complex vocabulary and a lot of visual analysis of unknown words is required, For example book 1.
- Language is easily accessible, however vocabulary makes it harder. For example book 2
- Although the pictures are good and give some support, they do not assist in working out with some complex vocabulary - Example: Many children may have difficulty with "squarking". For example book 3

Big books



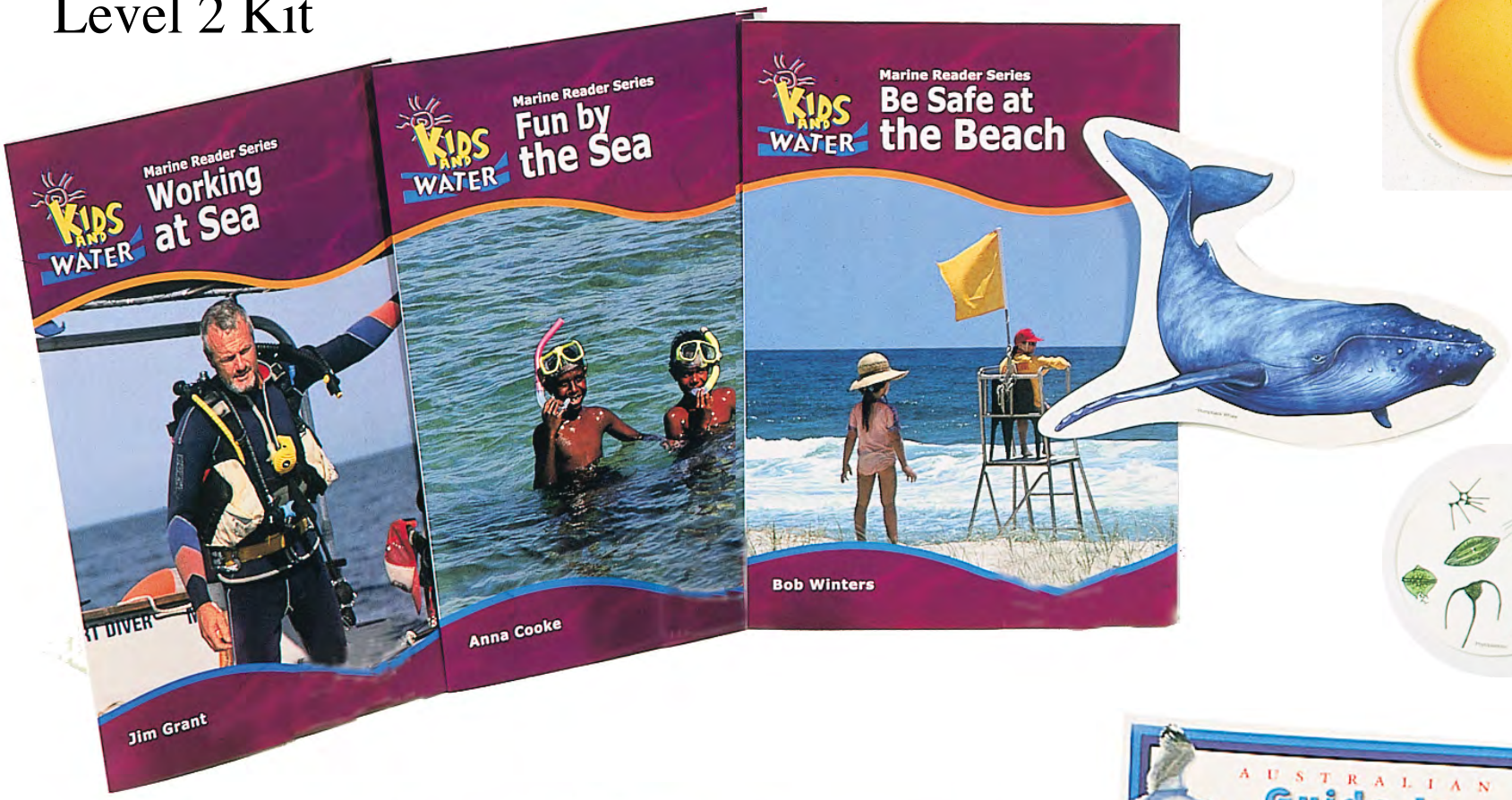
Listening post tapes



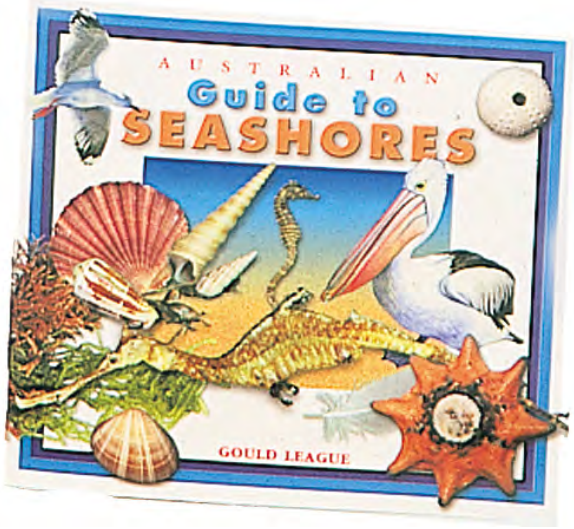
Learning outcomes

	Activity	KLA	Outcome
1	Risky rock pools - p23	English Health & PE	WRITING — 2.9 Writes brief imaginative and factual texts which include some related ideas about familiar topics. SAFETY — 2.12 Explains and demonstrates options to improve personal safety and the safety of others.
2	Beach detectives - p24	Mathematics Health & PE	MEASUREMENT — 2.21 Locates and sequences events in time, beginning to read familiar clocks and calendars. SAFETY — 2.12 Explains and demonstrates options to improve personal safety and the safety of others.
3	Mixed messages - p25	English Health & PE	READING AND VIEWING — 2.5 Constructs and retells meanings from visual texts with predictable narrative structures. SAFETY — 2.12 Explains and demonstrates options to improve personal safety and the safety of others.
4	Guess what happened - p26	Health & PE The Arts	SAFETY — 2.12 Explains and demonstrates options to improve personal safety and the safety of others. DRAMA — 2.6 Uses experience and imagination to make drama. 2.7 Makes choices about drama elements and organises them in expressive ways.
5	Safe sentences - p27	English Health & PE	WRITING — 2.9 Writes brief imaginative and factual texts which include some related ideas about familiar topics. SAFETY — 2.12 Explains and demonstrates options to improve personal safety and the safety of others.
6	Why? - p28	English Health & PE	WRITING — 2.9 Writes brief imaginative and factual texts which include some related ideas about familiar topics. SAFETY — 2.12 Explains and demonstrates options to improve personal safety and the safety of others.
7	My ocean pledge - p29	English SOSE	WRITING — 2.9 Writes brief imaginative and factual texts which include some related ideas about familiar topics. PLACE AND SPACE — 2.6 Identifies how people can cooperate to care for places in a community.
8	Learn how to read the beach! - p30	Health & PE SOSE	SAFETY — 2.12 Explains and demonstrates options to improve personal safety and the safety of others. PLACE AND SPACE - 2.5 Describes choices people make in their use of places.

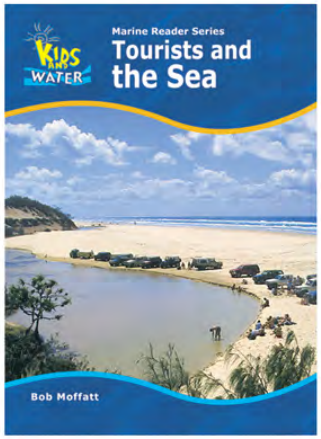
Level 2 Kit

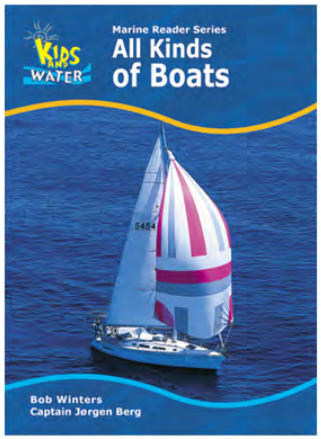

Marine Reader Series
Working at Sea
Jim Grant
Marine Reader Series
Fun by the Sea
Anna Cooke
Marine Reader Series
Be Safe at the Beach
Bob Winters

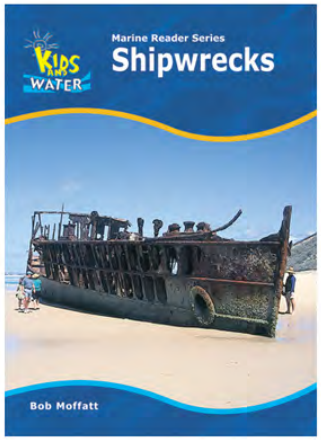

Fun by the Sea
Anna Cooke

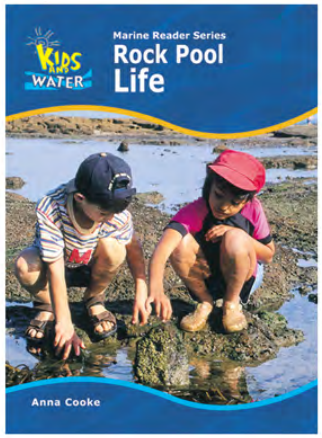

AUSTRALIAN
Guide to
SEASHORES
GOULD LEAGUE

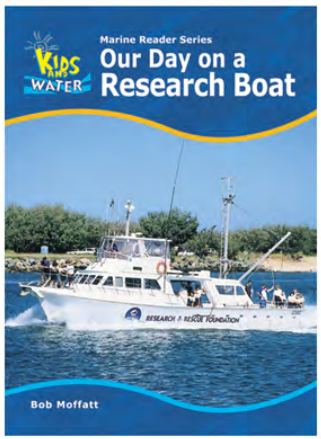
Level 3











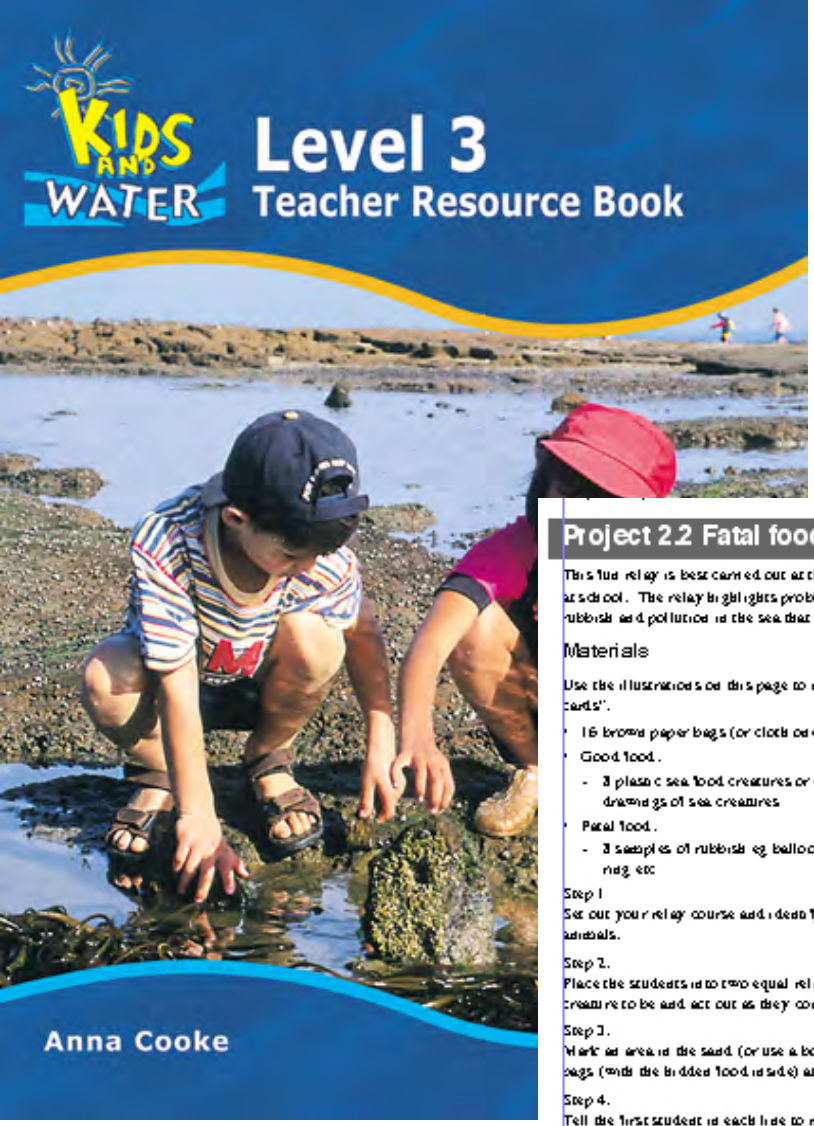
Sea anemones

Sea anemones can be found stuck to rocks or in the sand. Sticky tentacles surround a sea anemone's mouth. That is what a sea anemone uses to catch food.

These tentacles also have stinging cells that can paralyse small creatures.

The stinging cells protect the sea anemones from animals that want to eat them.

What happens to sea anemones when water in the rock pool dries up?



Level 3 Activities

Project 2.2 Fatal food relay

This fatal relay is best carried out at the beach but can also be done at school. The relay highlights problems associated with rubbish and pollution in the sea that harms the sea creatures.

Materials

Use the illustrations on this page to make the "food cards".

- 16 brown paper bags (or cloth ones)
- Good food.
  - 8 plastic sea food creatures or cards with names/drawings of sea creatures
- Fatal food.
  - 8 samples of rubbish eg balloons, plastic bags, foam, six-pack ring, etc

Step 1
Set out your relay course and identify a separate area for sick and dying animals.

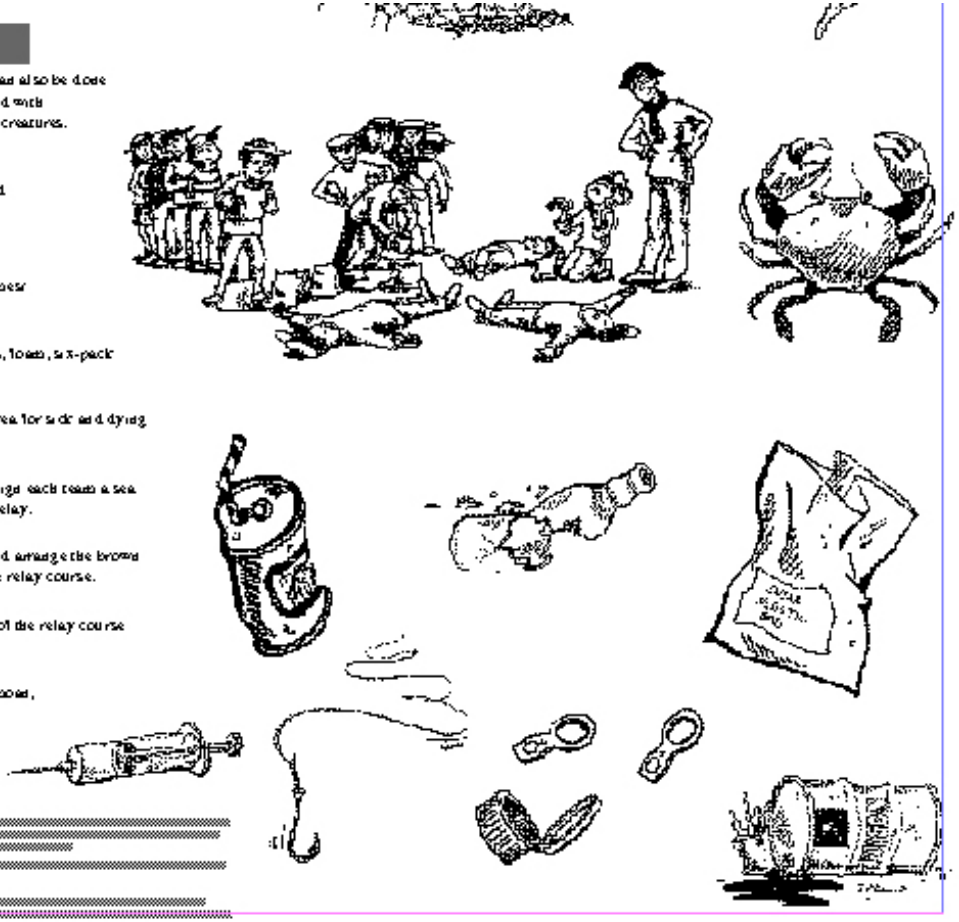
Step 2.
Place the students into two equal relay teams. Assign each team a sea creature to be and act out as they complete the relay.

Step 3.
Mark an area in the sand (or use a box if inside) and arrange the brown bags (with the hidden food inside) at the end of the relay course.

Step 4.
Tell the first student in each line to run to the end of the relay course and select a bag.

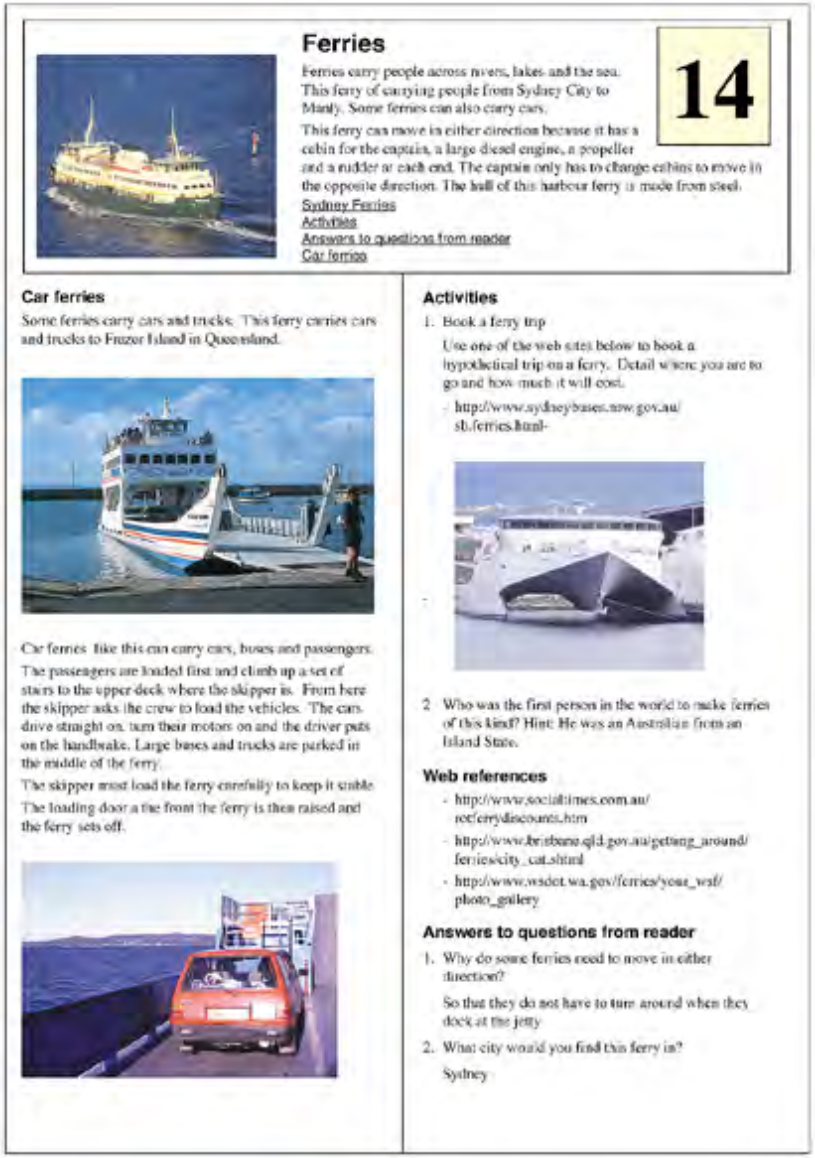
Step 5.
If the bag has fatal food in it, the students should shout, groan then go to the sick and dying section.

If the bag has good food in it the student will go back to their relay team.



Level 3 extension pack

Web pages



14

Ferries

Ferries carry people across rivers, lakes and the sea. This ferry of carrying people from Sydney City to Manly. Some ferries can also carry cars.

This ferry can move in either direction because it has a cabin for the captain, a large diesel engine, a propeller and a rudder at each end. The captain only has to change cabins to move in the opposite direction. The hull of this harbour ferry is made from steel.

Sydney Ferries
Activities
Answers to questions from reader
Car ferries

Car ferries

Some ferries carry cars and trucks. This ferry carries cars and trucks to Fraser Island in Queensland.

Car ferries like this can carry cars, buses and passengers.

The passengers are loaded first and climb up a set of stairs to the upper deck where the skipper is. From here the skipper asks the crew to load the vehicles. The cars drive straight on, turn their motors on and the driver puts on the handbrake. Large buses and trucks are parked in the middle of the ferry.

The skipper must load the ferry carefully to keep it stable.

The loading door at the front the ferry is then raised and the ferry sets off.

Activities

1. Book a ferry trip

   Use one of the web sites below to book a hypothetical trip on a ferry. Detail where you are to go and how much it will cost.

   - http://www.sydneybuses.nsw.gov.au/sb_ferries.html

2. Who was the first person in the world to make ferries of this kind? Hint: He was an Australian from an Island State.

Web references

- http://www.socialtimes.com.au/ref/ferrydiscounts.htm
- http://www.brisbane.qld.gov.au/getting_around/ferries/city_cat.shtml
- http://www.wsdot.wa.gov/ferries/your_wsf/photo_gallery

Answers to questions from reader

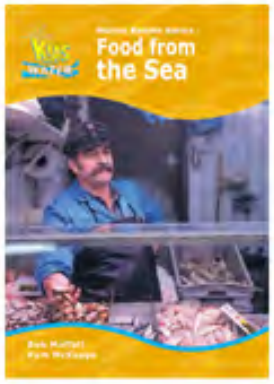
1. Why do some ferries need to move in either direction?

   So that they do not have to turn around when they dock at the jetty

2. What city would you find this ferry in?

   Sydney

Level 4



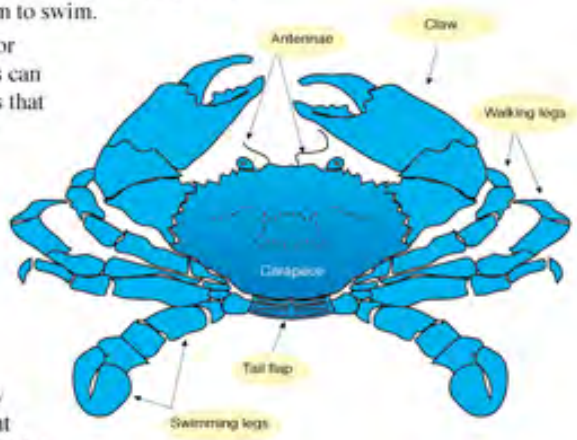
Crabs

Crabs are crustaceans with 10 legs but the front pair are usually very powerful nippers. A crab's tail is very small and tucked under its body. Its antennae are short and many crabs have eyes on long stalks. Most crabs prefer to walk rather than swim. Some do have legs that look like paddles that help them to swim.

Crabs often hide under rocks for protection. Many smaller crabs can bury themselves in sand. Crabs that live along the beach and mudflats sometimes feed on dead and rotting animals.

All crabs have gills to get oxygen from water. As long as they are damp, many can survive out of the water for hours.

Some male crabs have interesting mating rituals. They wave their large nippers to fight other male crabs and attract females.



Mud crab

Glossary

anchor	heavy object tied to a boat that stops it from drifting
cable	a metal rope
chart	a special map used on a boat or ship, used to mark a position or course at sea
crew	the people who work on a boat
earmuffs	equipment placed on the ears to protect them from loud sounds
engineer	person who designs and fixes equipment
fog	clouds touching the ground
marine biologist	person who studies the life in the sea
marine radio	a radio that can be used to speak to other radios on other boats
PFD	Personal flotation device. Safety equipment people wear to help them float in water.
plankton	tiny plants and animals that float in the water
pollution	things that make the air, soil or water unhealthy for people, plants and animals
radar	a way of bouncing sound waves off things so you know their location
research	investigating interesting things about our world
safety equipment	things that help us remain safe
scientist	person who studies interesting things about our world
skipper	person in charge of a boat
sunscreen	a cream that protects the skin from the sun
ultraviolet	one of the rays of sunlight that damages the skin
wharf	a place where boats can tie up and people can get on and off a platform
wheelhouse	an enclosed place on some boats where the skipper can control the boat
water sampler bottle	special bottle that lets water into it at the depth it is wanted
weather	changing pattern of temperature, cloud, wind and rain
weather forecast	prediction of how the weather is going to change

Preventing litter and pollution

To keep our cities healthy for people all our waste must be properly disposed of.

Oil from the car can be taken to recycling stations and other household items can be recycled in household rubbish bins.

Plastics, glass, paper, cardboard, newspapers and cans are all able to be recycled.

We can prevent much litter at the beach by placing rubbish in bins that are bird proof.

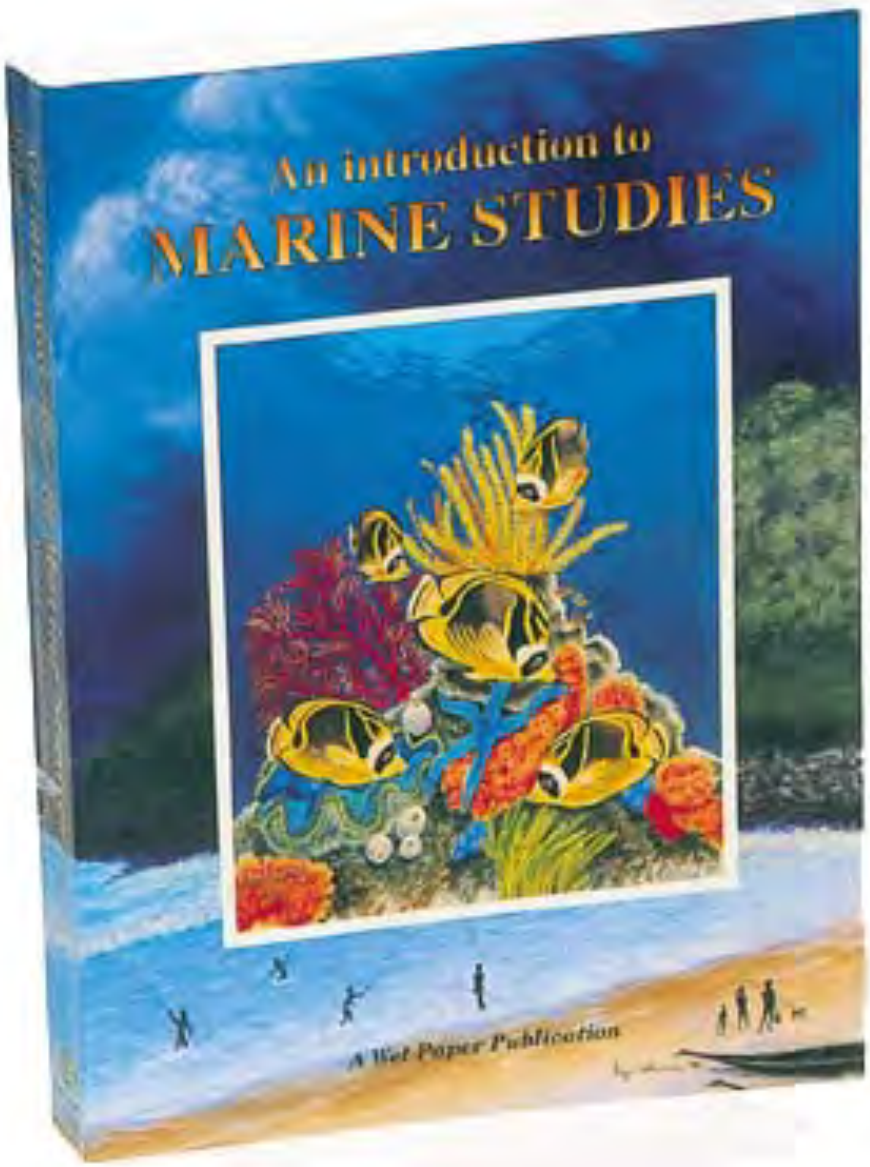
The best way to prevent litter is to reduce what we use. Can you think of ways to do this?

Oil can be recycled at the rubbish tip

Ibis

Why are wheelie bins better than garbage bins at busy city beaches?

Can oil be recycled in your city or town? If so, where?

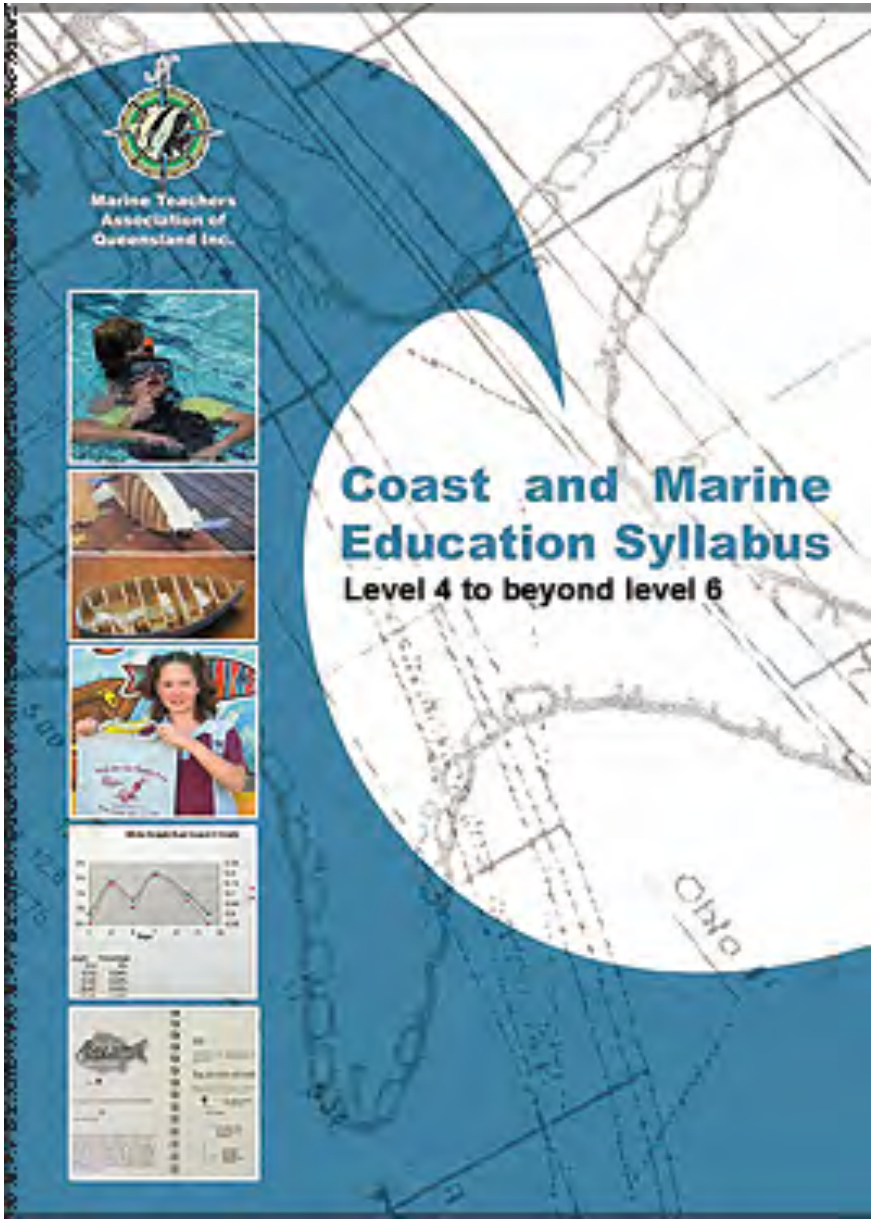


Wet Paper

Middle School Resources

Years 8 - 10

We have written a syllabus with the Qld Marine Studies Teachers for the book



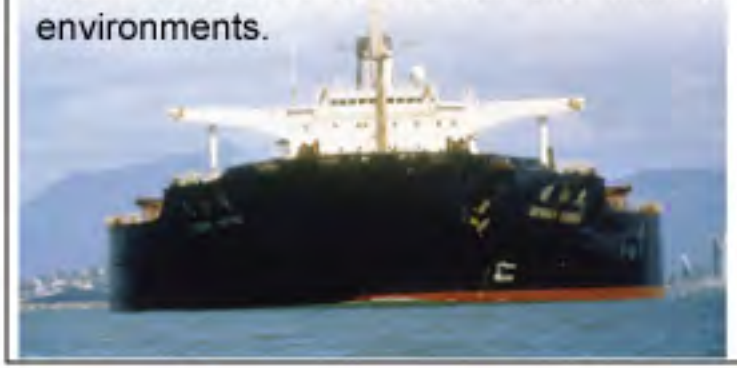
Practices and skills:

that allow people to use marine and coastal environments

identify situations that are potentially dangerous to humans.

Industry :

that are related to coastal and marine environments.



Oceanography:

the physical and chemical interactions between the ocean and the coast.

Coast and Marine Education

Conservation:

the sustainability of coastal and marine systems

Ecology :

the biological interactions that occur between the ocean and the coast.

Contents

Snorkelling is a great way to learn about marine studies.

Chapter 2

Dangerous creatures

Figure 16.1 Great white – a potentially dangerous marine creature

The saying, 'what we don't understand we fear and what we fear we fight' can best describe the purpose of this chapter.

Over the years many marine creatures have gained a dangerous reputation. Until recently, morayeels were thought to lurk in crevices in order to dart out and attack passing snorkellers. However, by understanding the marine world better, we are slowly coming to accept that many of these so-called monsters of the deep are, in most situations, quite harmless. If we learn to treat all marine life with respect and learn the behaviours of potentially dangerous marine creatures, we will be able to enjoy our marine world.

Although people have few problems with marine life overall, Australian waters contain a large share of marine animals with the potential to cause us discomfort, serious injury and, in some cases, death and there are a few of these **predators** in New Zealand.

Figure 16.2 A shark continually looses its teeth.

There are two main types of potentially dangerous marine creatures: **aggressors** which will attack us to defend their territory or simply consider us as part of their diet; and **retaliators** that would much prefer to ignore us and only cause harm when deliberately or accidentally provoked or disturbed.

We will look at some of the animals in each category to learn about their lives and how to reduce the risk of being hurt.

Figure 16.3 Shark in non-aggressive mood

Aggressors

Fortunately, few marine animals take the first aggressive step when attacking people. Generally, only saltwater crocodiles and a few shark species attack people without being provoked. They have been responsible for about 50 fatal

Sharks

There are about 350 different species of sharks, ranging in size from less than a metre to the giant whale sharks with average length of over 12 m – longer than two school buses. The whale shark, despite its large size, is non-aggressive and feeds only on plankton.

Only two species, the great white and, to a lesser extent, the tiger shark are responsible for nearly all attacks on humans resulting in death or serious injury. However, take care whenever any species of shark is close by.

Aggressive moods

It is not easy to determine the mood of any animal, however with sharks there are some warning signs. Figure 16.3 shows a shark in a non-aggressive mood. The pectoral (side) fins are raised and the shark is cruising along. Figure 17.1 shows a shark with the pectoral fins down and in an aggressive mood.

Sharks have a keen sense of smell for blood, feed at dawn and dusk and can chase schools of fish. So one way to avoid a shark attack would be not to surf at dusk, when fishermen are cleaning their fish from boats anchored nearby.

Great white sharks

These large, efficient predators are responsible for most fatal attacks on humans throughout the world. Also called white pointers due to their cone-shaped heads and pointed snouts, as shown in Figures 16.1 and 17.2. These creatures fully deserve our utmost respect.

Most adult great white sharks are about 5 m long, the same length as the average family car. There have been recorded sightings of these sharks up to 10 m long.

They have a large girth up to 1.3 m and are capable of very fast speeds. A diver in waters off South Australia who saw his buddy taken by a great white said that the attack resembled being hit by a train in both speed and intensity.

Great whites live worldwide from the warm waters of the tropics to the almost-frozen ocean near the poles.

Great whites, like most sharks, have excellent eyesight and can see much better in water that humans can. They spend considerable time circling and studying prey before attacking. The great white is the only shark that can hold its head vertically out of the water. This enables them to observe prey on the surface or on shore, such as seals on rocks. These creatures are not mindless eating machines. Their mouths and teeth are perfectly adapted for their role as predator as shown in Figure 17.3.

Figure 17.1 When a shark drops its pectoral fins, it's time to become concerned.

Figure 17.2 Great white shark

Figure 17.3 Great white's mouth and teeth

Education has recently begun to persuade people that sharks have important roles at the top of many food chains in marine ecosystems.

Diving deeper

1. Go to the library and see if you can view the CD-ROM: *Dangerous Marine Animals*.
2. If a stonefish only uses its venom for defence, how does it catch prey?
3. Select and name two other species of shark that although not aggressive, have the potential to be harmful to humans.
   a. Using a sketch describe their physical structure, their usual diet and how they obtain food or prey.
   b. Explain the extent to which they may be harmful.
4. Research how different cultures view dangerous marine creatures.
   a. Find out about totems.
   b. Research the role sharks and crocodiles play in different cultural beliefs.
5. Research the role sharks played in Aboriginal or Pacific Island cultures.

Figure 18.1 Tiger shark

During attacks, their entire head changes shape. Both jaws extend to the front and the snout bends upwards and out of the way. They have rows of sharp, triangular teeth which bite with a sawing action. Their jaws open to give them a large bite radius of up to 0.5 m which would enclose two adult humans.

Great whites are one-bite specialists, putting all their energy into one strike then quickly losing interest and swimming away.

The diet of great whites varies from pelagic fish to young whales. They prefer seals and have often attacked surfers and divers near seal colonies.

Tiger sharks

These sharks prefer the warmer subtropical waters of northern Australia, Hawaii and California.

Tiger sharks are shorter than great whites, averaging 3 to 4 m. Nor are they as aggressive. Most tiger shark attacks on humans have been non-fatal, usually occurring in murky waters close to shore where sharks may have mistaken the victims for other prey.

In addition to eating their favourite turtles and sea-snakes, these sharks are scavengers, preferring to prey on young or sick animals.

They have, for example, attacked struggling fish on the ends of divers' spears. Stomach contents of tiger sharks have contained tyres, tin cans, bottles and wood showing that they are not fussy eaters and confirming their tendency to **scavenge**.

The only recorded fatal attacks by tiger sharks have occurred after shipwrecks when there would have been a lot of injured and bleeding survivors in the water. Large schools of tiger and blue mako sharks were reported to have attacked shipwrecked sailors following sea battles in the Pacific Ocean during the Second World War.

What do you do if a shark attacks?

Although the risk of shark attack is very remote, you may reduce the risk even further by following this advice.

Try to remain calm. If you see the shark before it attacks, be aggressive and attempt to beat it off. Many sharks, even large great whites, have been discouraged and driven off by beating fists in the water or on their snouts.

If your buddy is attacked and there is no boat available for a rescue, it is possible to jump in the water and attempt to get him or her away from the shark. This may sound risky, but as mentioned, some sharks are one-bite specialists and there has never been a recorded attack on a person attempting a rescue.

Once a victim is rescued, wrap them in a blanket, apply a pressure bandage to any wounds and get them to a medical practitioner or hospital as fast as possible.

Saltwater crocodiles

Saltwater crocodiles, which can grow to 8 m, live in the tropical waters of northern Australia and Papua New Guinea. They can live for 100 years. They are highly dangerous and will attack without provocation. In fact, they have a greater strike rate for killing humans than do sharks.

Questions

Use your textbook to find the answers

1. Why are sharks and saltwater crocodiles called aggressors?
2. Describe a great white shark using your own words and a sketch diagram.
3. What features of the great white shark make it an efficient predator?
4. Why is the tiger shark called a scavenger?
5. Describe how you can reduce the risk of shark attack.
6. Explain, in step form, what you would do if your nearby diving or surfing buddy was attacked by a shark.
7. What is the size and lifespan of a saltwater crocodile?

Figure 19.1 Saltwater crocodile

Figure 22.1 Stonefish

Stonefish

The stonefish is not known for its attractive appearance. It is, in fact, very hard to see at all, because its camouflage blends in perfectly with its surroundings, as shown in Figure 22.1. Stonefish, found on reefs in tropical and subtropical waters, contain a deadly venom which can kill humans. This venom is contained at the base of 13 sharp spines. These spines are contained in sheaths which remain folded and hidden if undisturbed. They become erect upon the slightest contact and immediately puncture the unfortunate victim, releasing the deadly venom.

To avoid stonefish, be very observant when diving on reefs. Fortunately they only use their weapons for defence and contacts with humans are rare.

Figure 22.2 Box jellyfish

Jellyfish

Jellyfish (or sea jellies) belong to a group called the Cnidarians which catch their prey by using long tentacles containing large numbers of barbed stinging cells called **nematocysts** (Figure 23.1). On contact, the nematocysts either release a paralysing toxin into the victim or ensnare it with complex, sticky threads. Most species of jellyfish are only a nuisance to humans, producing only mild stings. Two notable exceptions, however, are the box jellyfish (shown in Figure 22.2) and the bluebottle.

Box jellyfish

Box jellyfish, also known as sea wasps, are the deadliest stinging jellyfish in the world and have killed many swimmers, particularly children, off northern Australian beaches. They have large, transparent, bell-shaped bodies up to 30 cm across, each with a large, trailing clump of tentacles up to 4 m long, containing millions of nematocysts.

Preferring warmer waters, they are found only in the tropical waters of Australia's far northern beaches between December and March. Beaches from Cairns around to Broome are closed for swimming during this period.

Victims, especially children, usually die within minutes of being stung after suffering intense pain followed by paralysis (caused by the poison shocking the heart) followed by breathing failure. The poison also attacks the red blood cells in the victim's skin upon contact and produces large, purple, whip-like marks.

Figure 22.3 Bluebottle

Bluebottle

Bluebottles, also called the Portuguese man o'war, are found in all oceans except the colder regions near the poles.

Although more widespread, they are not as deadly as box jellyfish and have only caused death when the victims were particularly allergic to its toxin.

The bluebottle, as shown in Figure 22.3, gets its name from the colour and shape of its body which looks like a blue, sail-shaped balloon up to 25 cm long.

The trailing tentacles are up to 10 m long (over 30 feet), which makes them hard to avoid especially in strong currents or large waves. Although not fatal in most cases, the sting causes severe pain and welts on the skin.

Sea-snakes

Sea-snakes are found in coral reefs in warm tropical and subtropical waters. There are about 30 species, all highly venomous, that use their venom to kill prey and for defence. Figure 23.2 shows a banded coral sea-snake.

Although their venom is toxic enough to kill humans, they are not generally aggressive. Many of the smaller sea-snake species have very small mouths and short fangs and do not release venom with every bite.

However, the larger species (over 2.5 m long) have long fangs and mouths large enough to go round a human bicep. Most sea-snakes will not try to bite unless deliberately squeezed.

Sea-snakes are very curious and have worried snorkellers and divers by winding themselves around air hoses and flippers.

In the mating season, they often mistake their mirror image in a diver's mask for a potential mate and attempt to court the nearest air and pressure hose or snorkel.

To avoid contact with sea-snakes, gently repel them with flippers or a gloved hand.

Blue-ringed octopuses

These small, beautiful creatures as shown in Figure 23.3, are highly **venomous** and have been responsible for many human deaths throughout the world.

They are usually found in shallow rock pools at low tides or in reef pools and areas with high concentrations of shellfish, such as mussels.

This is the smallest species of octopus. Its body is smaller than a human hand and it has tentacles from 15–20 cm long.

They normally feed on crabs and shellfish and have only bitten humans when picked up (usually by curious children) or when accidentally disturbed while feeding.

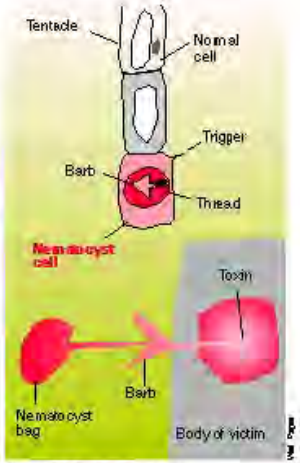


Figure 23.1 Anematocyst

Figure 23.2 The banded coral sea-snake

Figure 23.3 Blue-ringed octopus

12. Describe ways to avoid crocodile attack.
13. What are the disadvantages of laying shark nets off popular beaches?
14. Why don't we destroy all great white sharks and saltwater crocodiles to avoid fatal attacks on humans?
15. Describe how a stingray defends itself.
16. How can you avoid being stung by a box jellyfish?
17. Why is it often necessary to perform CPR on a victim of a jellyfish or blue-ringed octopus sting?
18. Give two reasons why the stonefish is potentially dangerous to humans.
19. Explain why sea-snakes are not regarded as a serious threat to humans.
20. Describe how a cone shell catches its prey or defends itself from attack.
21. Why don't victims of the blue-ringed octopus realise they have been bitten?
22. Give two reasons why it is difficult to avoid being stung by blue bottle jellyfish.
23. How can you tell if a blue-ringed octopus is upset?

When they bite, they release highly toxic venom through a parrot-like beak in the centre of their eight tentacles.

Victims often do not realise they have been bitten because anaesthetic saliva is released with the venom.

This often proves fatal because the venom affects the nervous system with paralysis occurring within 30 minutes.

When these octopuses are disturbed, brilliant, almost fluorescent, blue rings appear on their arms and bodies, giving plenty of warning to potential predators.

This sends a message to other animals indicating that the blue-ringed octopus is poisonous and if eaten will cause severe discomfort or death.

Many marine animals use signals such as this to warn off predators.

Key words

Aggressors, nematocysts, predators, retaliators, scavenger, territorial, venomous.

Summary questions

Fill in the gaps in these sentences. The missing words can be found in this chapter.

a. If we learn to treat all marine life with [1] ___ and learn the behaviours of the potentially dangerous marine creatures, we will be able to [2] ___ in our marine world.

b. The [3] ___ shark, despite its large size, is non-aggressive and feeds on [4] ___ .

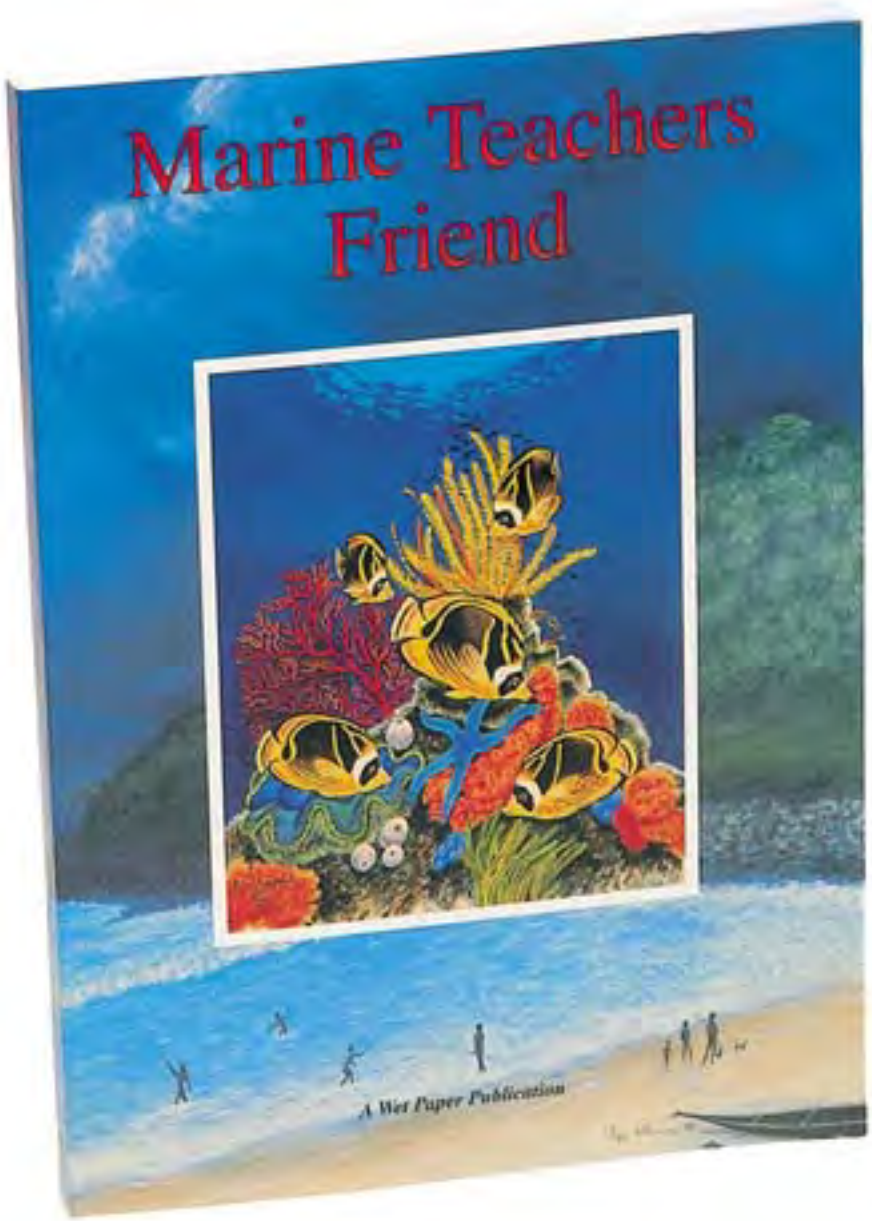
c. The [5] ___ shark is not as large or as [6] ___ as the great white, with an average length of 3 to 4 m.

d. [7] ___ are highly intelligent, often observing the habits of their [8] ___ from a safe distance for [9] ___ before [10] ___ .

e. To avoid contact with [11] ___, they will quickly [12] ___ if you splash heavily when wading into the water.

   Swim at least a [13] ___ off the bottom.

f. To avoid contact with sea-snakes, gently [14] ___ them with [15] ___ or a [16] ___ hand.



Junior Marine Studies

To design your course

The Teachers Friend

Chapter 2
Dangerous creatures

Suggested workprogram

The following program for approximately 3 weeks is based on 4 contact hours (240 minutes) per week. Contact your state's Marine Teachers Association for other resources (videos, worksheets, etc.).

Chapter topics

The hierarchy of topics used in the chapter is given below. Many teachers find this useful when helping their students organise their class-notebooks. In many states, this also assists in LTLTR programs (Learning to learn through reading).

1. Introduction
2. Aggressors
   - 2.1 Sharks
     - 2.1.1 Aggressive moods
     - 2.1.2 Great white sharks
     - 2.1.3 Tiger sharks
     - 2.1.4 What do you do if a shark attacks?
   - 2.2 Saltwater crocodiles
   - 2.3 The future for sharks and saltwater crocodiles
3. The restrainers
   - 3.1 Stingrays
   - 3.2 Cone shells
   - 3.3 Stonefish
   - 3.4 Jellyfish
     - 3.4.1 Box jellyfish
     - 3.4.2 Bluebottle
   - 3.5 Sea-snakes
   - 3.6 Blue-ringed octopuses

Week 1

1. Introduction
   - Read page 16.
   - Discuss the statement 'What we don't understand we fear and what we fear we fight,' and give an example.
   - Define the terms 'aggressor' and 'restrainer'.
2. Aggressors
   - Read pages 16–21.
   - Recall the number of fatal attacks by sharks in the past 25 years.
   - Complete Activity 2.1 Dangerous marine animal poster
   - 2.1 Sharks
     - 2.1.1 Aggressive moods
       - Outline the behaviour differences between an aggressive mood and a not-aggressive mood in a shark.
     - 2.1.2 Great white sharks
       - Describe the features of this shark and ways to avoid attack.
     - 2.1.3 Tiger sharks
       - Describe the features of this shark and ways to avoid attack.
     - 2.1.4 What do you do if a shark attacks?
       - Debate methods used by rescuers when a shark attacks a victim.
   - 2.2 Saltwater crocodiles
     - Describe places where crocodiles live.
     - Recall the speed at which crocodiles can move and the hunting features of crocodiles.
     - Outline how territory affects a crocodile's behaviour.
     - Describe the external features of a saltwater crocodile.
   - 2.3 The future for sharks and saltwater crocodiles
     - Outline how to act if attacked by sharks and crocodiles and suggest possible treatments for each
     - Read page 191 and explain the importance of higher order predators in the food chain.

Evaluation options

1. Class discussion
2. Answer questions 1–11.
3. Hold class group discussion on sharks.
4. Set library assignment from Diving deeper on page 13.

Extension

Research how sharks may have played a role in Aboriginal, Maori or Pacific Islander culture.

Weeks 2–3

3. The restrainers
   - Complete Activity 2.2 Locations of dangerous marine animals.
   - Complete Activity 2.3 Library research.
   - Read pages 21–24.
   - Define the term 'restrainers' and give two examples.
   - 3.1 Stingrays
     - Explain how people are accidentally stung by stingrays.
     - Describe how a stingray responds to being prodded on.
     - Recall the voltage produced by a electric ray.
     - Describe how to avoid being stung by a stingray.
   - 3.2 Cone shells
     - Describe how a cone shell protects itself.
     - Describe how to avoid being stung by a cone shell.
   - 3.3 Stonefish
     - Identify a stonefish from a photograph.
     - Turn to Figure 36.2 and identify the sheaths on the stonefish from a photograph.
     - Describe how fish spines inject venom.
   - 3.4 Jellyfish
     - Complete Activity 2.4 *Australian jellyfish stings* video. (This is the name of the video)
     - Recall the names of the stinging cells in jellyfish.
     - Draw a diagram of how a stinging cell fires.
     - 3.4.1 Box jellyfish
       - Describe the appearance of the box jellyfish.
       - Describe the effects of box jellyfish stings on humans.
     - 3.4.2 Bluebottles
       - Give an alternative name for a bluebottle
       - Read page 183 and identify the different cell colonies in a bluebottle.
       - Complete Activity 2.5 Stings
   - 3.5 Sea-snakes
     - Describe how a sea-snake injects its poison.
     - Recall how to avoid sea-snakes and the condition under which they will attack humans.
   - 3.6 Blue-ringed octopus
     - Recall the places where blue-ringed octopus are found and the conditions under which they bite humans.
     - Describe the appearance of the blue-ringed octopus when it is disturbed.

Evaluation options

1. Answer questions 12–23 on page 24.
2. Answer the summary questions.
3. Mark library assignment.
4. Mark group wall chart.
5. Mark summary questions answers.
6. Complete chapter test.

Activity 2.1 Invent a dangerous marine creature

Outcome

Students use knowledge of dangerous marine creatures to design and build a papier-mache model of a dangerous marine creature.

Performance criteria

1. A clear pencil sketch identifying parts of the creature that are dangerous and a corresponding table that shows how the feature can either harm, kill, stun or otherwise make unattractive to another animal.
2. Free standing or suspended from ceiling papier-mache model that has been constructed from design.

Activity 2.2 Dangerous marine animal poster

Outcome

Students design and complete a classroom poster of dangerous marine life for display in a surf club or local beach.

Method A

1. In class, design a poster which warns the public about a group of potentially dangerous marine animals. Select your group from the following.
   a. aggressors—sharks and crocodiles
   b. stingers—jellyfish, blue-ringed octopus, fire coral or Portuguese man o' war
   c. spiny ones—sea urchins, stingrays, stonefish, cone shells, cobbler and lion fish

   Your design should contain text outlines of the major dangerous features, how to avoid the creatures and treat wounds from at least three species of animals in your chosen group.
2. At home, either cut out pictures or draw coloured diagrams of your chosen animals then put them together with the text outlines under large bold headings on a blank A3 size paper sheet.

Method B

1. Complete Exercise 134 Handling marine creatures in *Marine Skills Student Manual*, Wet Paper Publications, 1993.
2. Note that the answers to the questions can be found on page 68, *Suggested Answers to Marine Skills Student Manual*, Wet Paper Publications.

Activity 2.3 Locations of dangerous marine animals

Aim

To sketch a map showing places where dangerous marine life can be found.

Method

Sketch a map of Australia or New Zealand and key in locations of the habitats of: sea wasps, blue bottles, tiger and great white sharks, blue-ringed octopus, saltwater crocodiles, stonefish and sea-snakes.

Activity 2.4 Library research

Aim

To complete a term report on a topic dealing with dangerous marine life

Method A

Use source for books is the Surf Life Saving Association, PO Box 2136 Portside Valley Q 4006, for reference books on dangerous marine life.

Chose one of the following for a term report.

Assignment 11

- Treatment for victims of attacks by or stings by marine animals often will require a basic knowledge of first aid involving applying pressure bandages, mouth-to-mouth resuscitation and cardiopulmonary resuscitation (CPR).

  Using diagrams, describe the steps of how to obtain the 3 types of treatment and explain the circumstances where each of them would be used.

Assignment 12

- Select and name 2 other species of shark that, although not aggressive, have the potential to be harmful to people.

  Using a sketch, describe their physical structure, their usual diet and how they obtain food or prey.

  Explain the extent to which they may harm humans.

Assignment 13

- Find the correct first aid treatment for:
  a. bluebottle stings
  b. fire coral or stinging hydroids stings

Method B

Complete Exercise 167 Dangerous marine organisms on page 321, *Marine Skills Student Manual*, Wet Paper Publications, 1993.

Activity 2.5 Australian jellyfish stings video

Aim

To identify potentially dangerous jellyfish and record the various treatments available for their stings.

Method

1. Watch the video *Australian jellyfish stings* available from Specialized Video Productions, 111 Paradise St, Mackay Q 4740. Costs approx. $33 ($3 donated to the Surf Life Saving Association).
2. Make a note of the various jellyfish shown and treatments for stings.

Activity 2.6 Excursion activity

Aim

To visit a licensed reptile attraction or aquarium to see a selection of dangerous marine life.

Method

Visit the dangerous marine animals section of your local marine centre, such as Kelly Tarlton's Underwater World in Auckland, Underwater World in Perth, Sea World in Sydney and the Gold Coast, and marine exhibits in the other states.

Observe the range of live animals or specimens and draw up a table showing how the animals feed, move and adaptations to living in the sea.

Activity 2.7 Stings

Aim

To complete a worksheet on the stinging cells of jellyfish.

Method

1. Complete Exercise 16A *Stings* on page 312, *Marshall's Skills Student Assistant*, Wet Paper Publications, 1993.
2. Note that the answers to the questions can be found on page 74, *Suggested Answers to Marshall's Skills Student Assistant*, Wet Paper Publications.

Textbook questions: suggested answers

This information is also published for students on the web site http://www.wetpaper.com.au.

1. Why are sharks and saltwater crocodiles called aggressors?
   Ans. Both will attack humans without provocation.
2. Describe a great white shark using your own words and a sketch diagram.
   Ans. Student's own words and diagram drawn from Figure 16.1.
3. What features of the great white shark make it an efficient predator?
   Ans. Streamlining, speed, size, mouth structure, sight, intelligence
4. Why is the tiger shark called a scavenger?
   Ans. Prefers the easier food-gathering method.
5. Describe how you can reduce the risk of shark attack.
   Ans. Do not enter the water alone, or at dusk or dawn, when the location is isolated and murky, near river mouths or seal colonies or where sharks have been seen previously, or with bleeding cuts.
   Do not clean fish close to shore, look around carefully while surfacing from a dive and stay in groups if ship-wrecked.
6. Explain, in steps/ons, what you would do if your nearby diving or surfing buddy was attacked by a shark.
   Ans. Remove from the water from the water, apply pressure bandage for any wounds, keep them warm and get medical assistance as soon as possible.
7. What is the size and life span of a saltwater crocodile?
   Ans. Up to 8 m and 100 years.
8. How is a crocodile able to open its mouth underwater?
   Ans. A special valve closes to stop water from entering the gullet.
9. Describe the features which make the crocodile such an efficient predator.
   Ans. Size, speed, intelligence, mouth structure
10. Why don't crocodiles make good pets?
    Ans. They are very territorial and will regard humanity as an increasing threat.
11. How can you tell when a shark is in an aggressive mood or a non-aggressive mood?
    Ans. When a shark is in an aggressive mood, its pectoral fins will point down.
12. Describe ways to avoid crocodile attack.
    Ans. Do not enter the water in their areas, do not visit the same spot near a river's edge on a regular basis and suspend a rope contender from a steep bank when collecting water.
13. What are the disadvantages of laying shark nets off popular beaches?
    Ans. (Not a specific method — kill too many harmless sharks and other species
14. Why don't we destroy all great white sharks and saltwater crocodiles to avoid fatal attacks on humans?
    Ans. These predators are important to ocean food chains, our right to destroy them is questionable. They keep other predator numbers down to allow increased numbers of lower order food chain members. See Chapters 13 and 19.
15. Describe how a stingray defends itself.
    Ans. Raises its barbed tail vertically
16. How can you avoid being stung by a box jellyfish?
    Ans. Do not enter the water, especially during the wet season, wear a wetsuit or pantihose on exposed parts.
17. Why is it often necessary to perform CPR on a victim of a jellyfish or blue-ringed octopus sting?
    Ans. Paralysis causes circulatory and breathing failure.
18. Give two reasons why the stonefish is potentially dangerous to humans.
    Ans. Is very well camouflaged and has highly toxic venom
19. Explain why sea-snakes are not regarded as a serious threat to humans.
    Ans. (Not-aggressive towards us and most are limited by small mouth size
20. Describe how a cone shell catches its prey or defends itself from attack.
    Ans. Releases a venomous harpoon
21. Why don't victims of the blue-ringed octopus realise they have been bitten?
    Ans. Pain killing anaesthetic is released with the venom.
22. Give two reasons why it is difficult to avoid being stung by bluebottle jellyfish.
    Ans. Long trailing tentacles, the creature is shifted around rapidly by currents and wave action.
23. How can you tell if a blue-ringed octopus is upset?
    Ans. Blue rings become predominant.

Diving deeper: suggested responses

This information is also published for students on the web site http://www.wetpaper.com.au.

1. Go to the library and see if you can locate and view the CD-ROM, *Dangerous marine animals*.
   Suggestions.
   Ask your librarian to find the CD-ROM.
2. If a stonefish only uses its venom for defence, how does it catch prey?
   Suggestions.
   Because the prey dies quickly from the poison, it will end up close by. The stonefish will then feed off the dead remains.
3. Select and name 2 other species of shark that, although not aggressive, have the potential to be harmful to humans.
   a. Using a sketch, describe their physical structure, their usual diet and how they obtain food or prey
   Suggestions.
   Locate a book on sharks and find the hammerhead and whaler sharks.
   b. Explain the extent to which they may be harmful.
   Suggestions.
   See information in book
4. Research how different cultures view dangerous marine creatures.
   a. Find out about totems.
   Suggestions.
   Many books on Pacific Island people contain traditions and customs.
   b. Research the role sharks and crocodiles play in different cultural beliefs.
   Suggestions.
   The shark was often considered good luck by some Islander people.
   Use your research to see if this is true.
5. Research the role sharks played in Aboriginal or Pacific Island cultures.
   Suggestions.
   Try looking up initiation ceremonies. Look at the video on *Salt Water People* from Wet Paper.

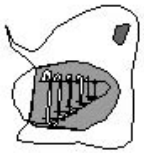
Summary questions: answers

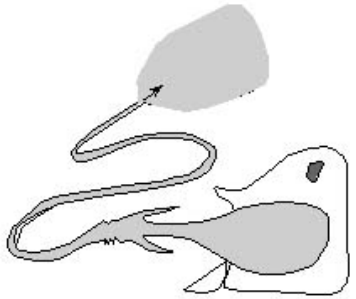
This information is also published for students on the web site. http://www.wetpaper.com.au.

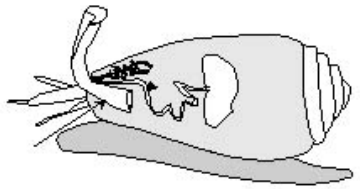
1. respect
2. enjoy
3. whale
4. plankton
5. tiger
6. aggressive
7. Crocodiles
8. prey
9. days
10. attacking
11. rays
12. flee
13. stalker
14. repel
15. flippers
16. gloved

Revision sheet

1. Define the following terms
   a. aggressors
   b. renaissance
   c. habitat
   d. territorial
   e. predator
   f. scavenger
   g. toxic
   h. dermatocyst
   i. camouflage
2. Explain why saltwater crocodiles have a greater reputation than sharks as a threat to humans.
3. Write down the steps you would take if attacked by a shark.
4. Sketch a dermatocyst in the space below and describe how it functions.
5. Outline how to avoid being attacked by the following.
   a. stingray
   b. saltwater crocodile
   c. stonefish
   d. box jellyfish
6. Briefly describe how to treat stings from the following.
   a. bluebottles
   b. cone shells
   c. blue-ringed octopus
7. Explain why great white sharks should not be regarded as mindless eating machines.

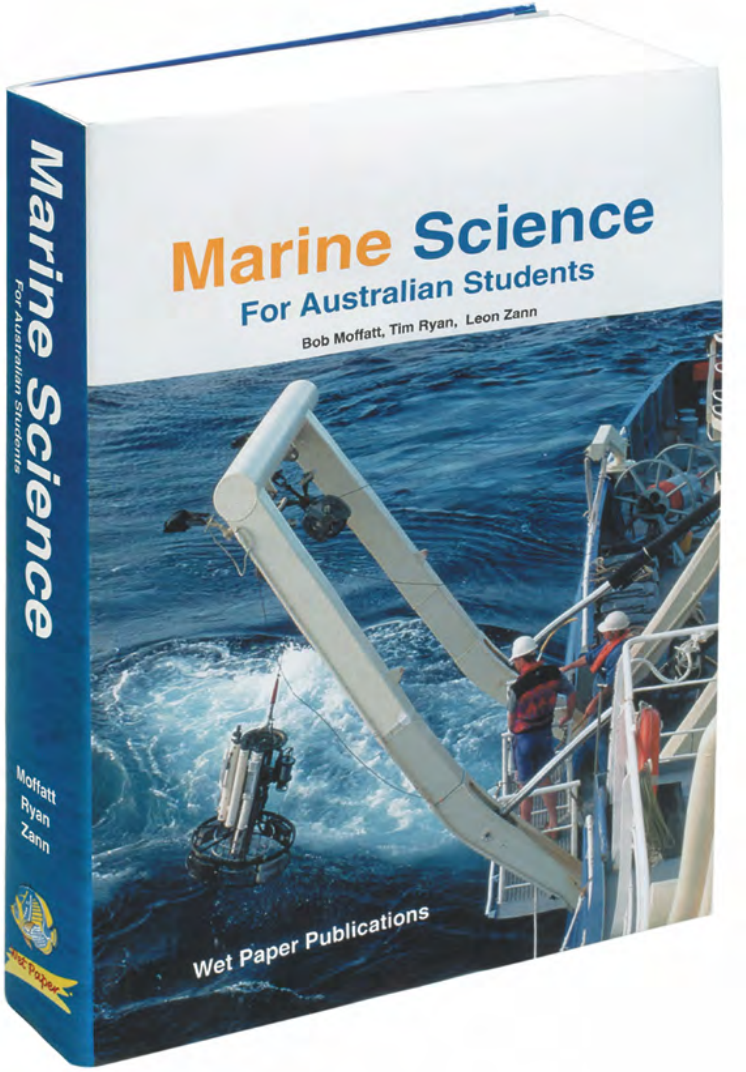






Senior School Resources

Years 11 - 12



Designed for

- ✓ Senior Science or Marine Studies courses in Tas, Qld, NSW and WA
- ✓ First year university marine science units

Contents

Three Parts

Introducing the chapter

Chapter hooks

- Watch the National Oceans Office sea floor video Available from www.oceans.gov.au
- Read *the beginning of life - another view* on page 27 and invite an Aboriginal elder to class to discuss the significance of the *Rainbow Serpent* and local aboriginal marine stories in class.
- Discuss the implications of The Law of the Sea convention (read page 13).
- Begin Exercise 1.1 — *A matter of time*

Why study this chapter

Plate tectonics helps us understand the shape of our coastline and lays the foundation for the chapters on coastlines and oceans.

It is also important for us to understand the significance of the Rainbow Serpent in Aboriginal culture.

Exciting new discoveries are being made by the Commonwealth Scientific and Industrial Research Organisation — CSIRO. These are essential if we are to claim our nationals Exclusive Economic Zone as discussed on page 13.

A knowledge of our ocean's topography also has enormous military significance. Deep oceans trenches near East Timor make it possible for submarines to travel between the Pacific and Indian Oceans.

Chapter overview

Key concepts

1. Scientists believe the earth was formed by the dust cloud hypothesis and that it is over 3,000 million years old.
2. Aboriginal people believe the earth was formed by the Rainbow Serpent who made laws for all animals to obey. She created humans from those who obeyed these laws and gave them the land and seas to manage.
3. The oceans lie on a thin layer of crust which is subject to enormous forces from within the earth.
4. The crust of the earth has different densities and can move around causing earthquakes and volcanoes. Earthquakes and volcanoes are caused by moving plates on the earth.
5. Australia was once part of a huge super continent which drifted apart due to plate movements.

   About 200 million years ago Australia was part of a super-continent called Pangaea.

   Pangaea broke up into two continents Laurasia and Gondwanaland.

   Laurasia was made up of North America and Asia. Gondwanaland comprised South America, Africa, India, Australia and Antarctica.
6. There are no lions and tigers in Australia because Gondwanaland split up before they had evolved.
7. Marine dinosaurs existed in Queensland because it was once a shallow inland sea.
8. Our coastline was given its unique features based on this movement. Some examples of this are:
   - Western Australia is flat and geologically very old.
   - The Great Australian Bight was formed as we split from Antarctica.
   - The East coast has the great dividing range with fast flowing rivers creating huge volumes of sand.
   - The tropical reefs have only formed in recent times and are a thin veneer on ancient reefs.
9. Modern oceanographic methods have established that the sea floor has mountains, plains, valleys and hills on a much grander scale that on land.
10. Using computer technology and advanced echo sounding, Australian marine scientists have began to map our oceans with a high degree of accuracy.

Essential reference

Law of the Sea -Teacher Notes by Cindy Hann, Geoscience Australia, GPO Box 378, Canberra, ACT, 2601.

Earth and its oceans

Our galaxy

For centuries we have gazed into the night sky and seen a wispy path of white that crosses from one horizon to another.

This is the milky way which is a band of stars that makes up the edge of our galaxy.

Our **solar system** (within the milky way), is very small compared with the milky way (Figure 7.2). Its centre is occupied by the sun, with nine planets orbiting.

The earth is the only planet in our solar system to have oceans. From space our planet appears blue and white because almost 3/4 of it is covered by water, and clouds encircle our atmosphere.

The earth's three major oceans are the Pacific, Atlantic and Indian Oceans. The Pacific is about the same size as the Atlantic and Indian. The Arctic Ocean is almost completely covered by ice. Nine seas are enclosed in these oceans.

Figure 7.1 The night sky

Our solar system

Today water continues to be added to the earth's atmosphere by volcanoes above and below the earth's surface. In fact that's how water was added to the seas and our atmosphere in the dawn of time. The discussion which follows is a theory and should be regarded as such.

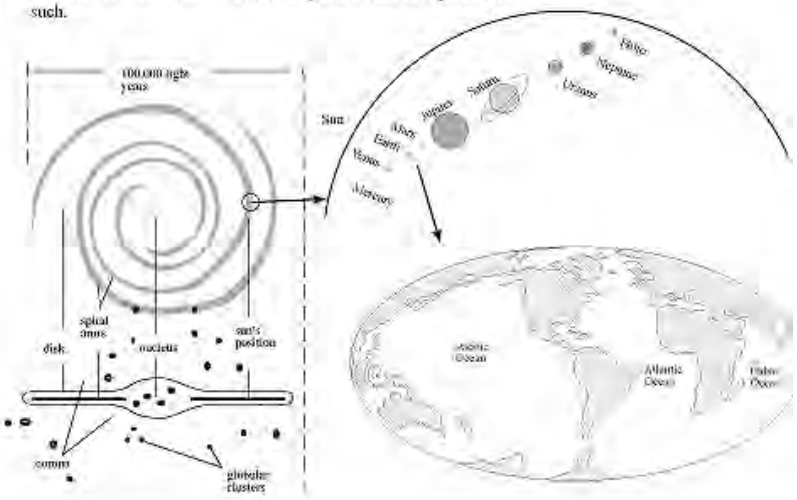


Figure 7.2 An idealised representation of our Milky Way Galaxy and solar system (After Weinhaupt 1979)

Introducing Chapter 1

Oceans and coastline formation

Bathymetry Video

By

Geoscience Australia

Exercise 3.2 Current experiments

Experiment A:

Aim

To determine if warm water will rise or fall.

You will need

- A small aquarium full of water (Figure 68.1), ice block, test tube and stopper, food colouring

What to do

1. Fill the vial with hot water and place a few drops of food colouring in it.
2. Now stopper it and place at the bottom of an aquarium filled with water.
3. Place an ice cube on the surface and add a few drops of food colouring. Observe what happens.
4. Now open the vial and observe what happens.
5. Write a conclusion and predict what happens to water at the poles and equator.

Questions

1. What happens to water as it cools down from the tropics to the poles?
2. What happens to water as it moves into the tropics?

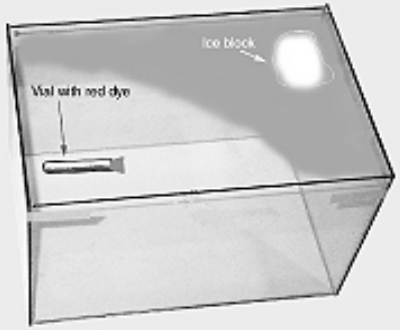


Figure 68.1 Experiment A: set up
(Photo Bob Moffat)

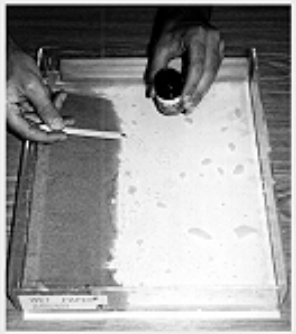


Figure 68.2 Experiment B: set up
(Photo Bob Moffat)

Experiment B:

Aim

To study longshore drift.

You will need

- A small tray filled with sand and water as shown in Figure 68.2, condys crystals, wave generator (Block of wood - see Figure 68.2).

What to do

1. Make a beach as shown in Figure 68.2 .
2. Generate some waves with the block of wood and have a partner add a few drops of Condys crystals as shown.
3. Keep generating the waves and observe what happens.

Questions

1. What happens to the dye in the tray?
2. Design an experiment to test the hypothesis that longshore drift is determined by depth.
3. Design an experiment to demonstrate refraction and diffraction (See Chapter 2).

Long shore drift field study

(Based on an original idea by Mary Lou Cady)

You will need

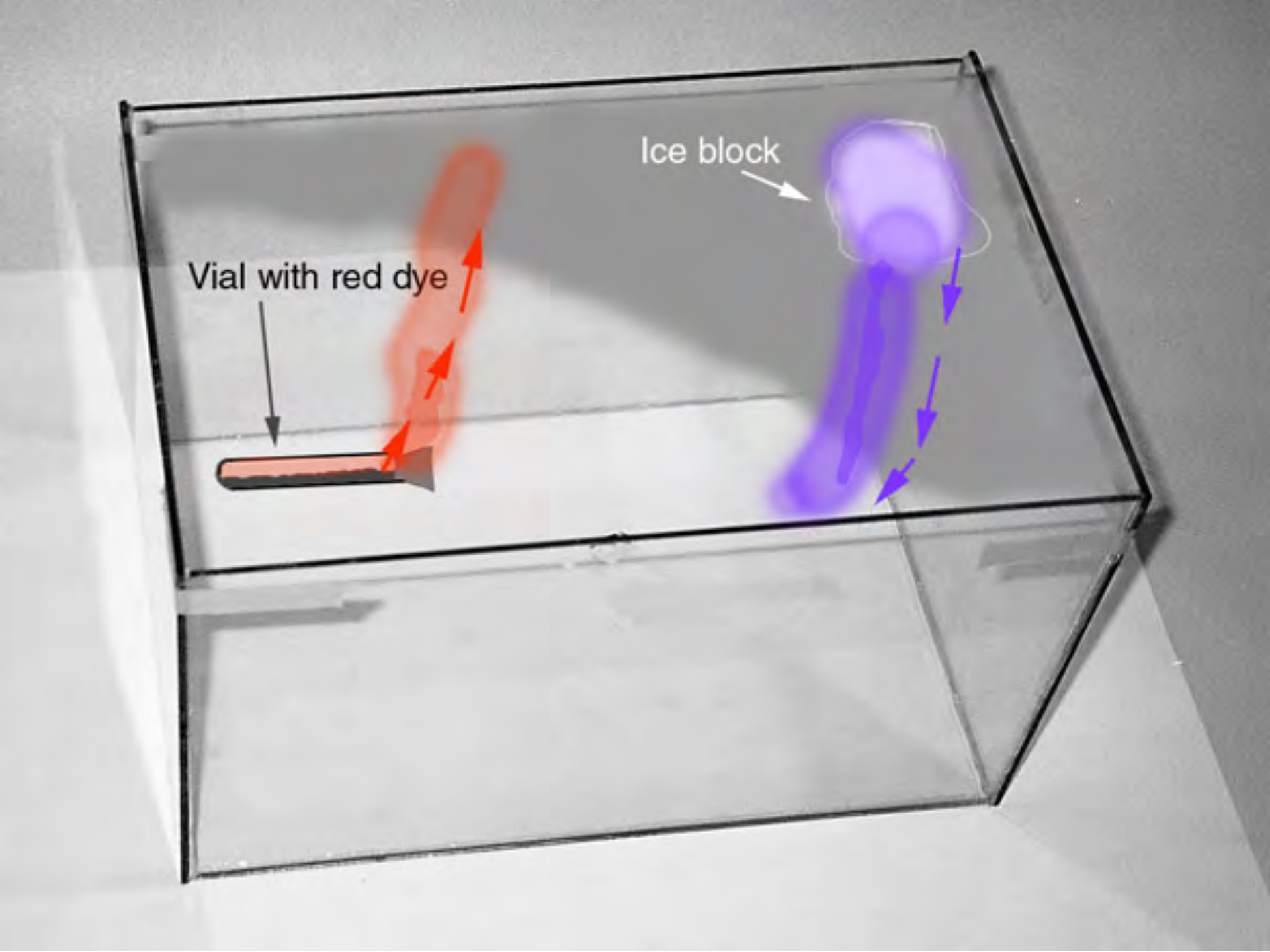
A straight stretch of beach, two oranges, data sheet, pencil, hard surface to write on and a watch with second hand.

What to do

1. Pace out 5 stations, 15 metres apart on the beach.
2. At a prearranged signal you cast your oranges into the sea - one close in the other as far out as you can throw and the timekeeper starts the watch. You then follow your oranges and any variations. If the orange comes in, you should throw it out again.
3. After one minute the timekeeper signals and you are to mark the position of your orange in the sand opposite where the orange is. After two, three, four and five minutes, record data accurately in the tables developed in class.
4. Draw up a data table and write a short report on your results.

Easy experiments

Pressure


Ice block
Vial with red dye

Exercise 3.3 Local currents

Method

Part A Making a drogue

1. Attach the plastic bottle to the broom stick with lots of tape and cord as shown in Figure 72.1.
2. Drill a hole in the bottom of the broom stick and tie the weight on with another piece of cord.
3. Test your drogue in a swimming pool or wheelie bin.
4. Make adjustments so that the drogue floats and add a flag.

Part B Field work

1. Tie 10 metres of cord to the drink bottle.
2. Select a place such as a jetty where the current is running and you can launch your drogue.
3. Lower the drogue into the water and tell your partner to time how long it takes for the drogue to run out to the full length of the 10 metres of rope on a prearranged signal.
4. When your partner is ready, release the drogue and observe what happens.
5. Use the hand bearing compass to determine the direction of the current.
6. Using the formula:

   Speed = distance / time

   calculate the speed of the current and record it.
7. Repeat your experiment twice and average your results.
8. Make a summary detailing how fast the current was, which direction it was flowing, the possible cause of the current and how the current may change during the day.

Extension

You may like to try to see if the current speed changes at different times in the day.

Figure 72.1 A home made drogue
(Photograph Bob Moffett)

Figure 72.2 Tracking drogue
(Photograph Bob Moffett)

Materials and equipment (per group)

Equipment required

- electrical tape
- empty plastic bottle
- old broom stick
- divers weight
- 11 metres venetian blind cord
- coloured materials (for flag)
- watch with second hand
- handbearing compass

Inexpensive equipment

Exercise 2.2 The heights of waves

PART A

This wave height data was recorded at the O'Connor Reef wave-rider buoy (Figure 43.1) located 7 kilometres east south east of Wiley Island at a water depth of 68 metres.

This location is shown in Figure 43.2. Observations were made at 6 hourly intervals. The 4 readings per day were each of 20 minute duration and the analogue magnetic tape recordings produced were digitized for subsequent computer analysis.

Figure 43.3 shows the percentage wave height frequency distribution for a 12-month period.

QUESTIONS

1. What was the percentage of wave height recordings that ranged between 1 – 2 metres?
2. A total of 1102 observations were recorded. What should have been the total number of observations made and how many observations were not recorded? Suggest an explanation to account for the difference.
3. Identify the variables that the oceanographers need to consider in this experiment.
4. How many days were the wave height recordings over 4 metres?
5. On how many days were the sea conditions ideal for boating? (0 –0.5m waves)

   Express this as a percentage of the year.

Figure 43.1 O'Connor Reef tracker buoy
(Photograph CSIRO Marine Division)

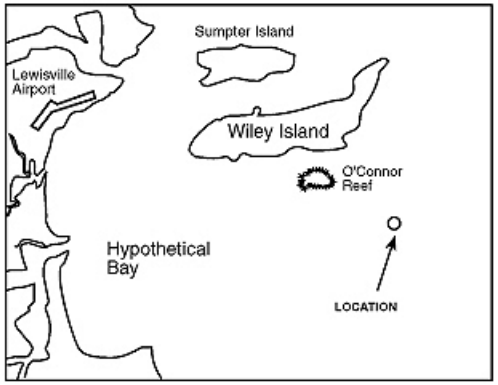


Figure 43.2 Tracker buoy location
(Illustration Bob Moffatt)

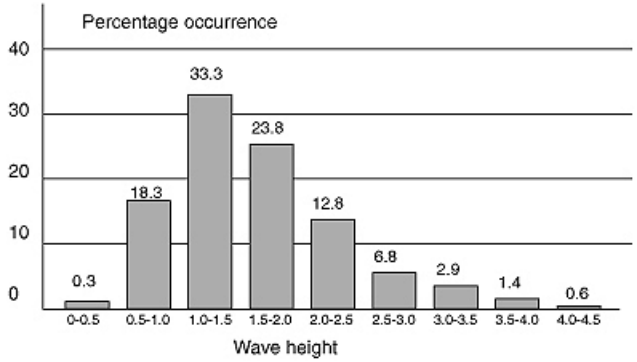


Figure 43.3 Wave data
(Illustration Bob Moffatt)

Self contained exercises with all the data available

Exercise 4.1 Beach profiling

Based on an original exercise by Ann Coopersmith and the Marine Lab at University of Hawaii

Aim

To draw a profile of the beach

Method

1. Make a profile metre rule like the one shown in Figure 99.1 and practise on a slope at school to record the change in heights down a slope or bank. Start at the top of the bank — call this your datum point. Position the metre rule so that it becomes level as shown in Figure 99.1. Pull the tape down to the ground and take a firm grip of the tape at the point it touches the sand. Then, without altering your grip, bring the tape up so that you can measure the distance from the end of the ruler and the point the tape touched the sand. This distance represents the fall over one metre. Record this in your notebook.
2. Place a stick or pencil at the place where your hand touched the sand and move the metre ruler to begin the next reading. Repeat this procedure as you go down each metre of the beach. Record ups as + and downs as –, noting distinguishing features on the beach such as dominant plants, grazing by animals, droppings, fences, walkways, erosion scarps, low or high tide marks, areas of microridges, sand waves, moving sand particles. When you get to the swash zone (that's the area where water runs up the beach), measure it. Back in class recalculate all your measurements so that you can see how far each station is below the datum point. Now plot a profile of the beach slope.

Questions

1. Is the beach eroding or accreting? How can you tell from your graph?
2. How wide was the swash zone? How will this change over time?
3. Make a prediction of how this profile will change over the year.
4. Work out the profile angle and compare it with others in your class. Are they all the same?

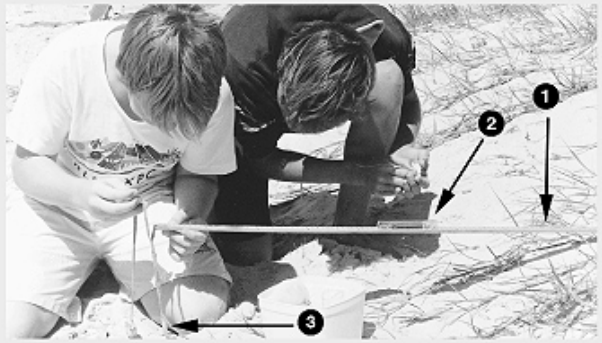


Figure 99.1 A beach profile stick
(Photo Bob Moffatt)

Sand grain analysis

Based on an original exercise by John Maloney, St Augustines College, Cairns

Purpose

To identify the types of particles that make up sand.

You will need

- handful of sand
- sieves of various sizes
- sticky tape
- magnifying glass or microscope with slides

What to do

Carefully sieve the sand and separate out the particles. Now look carefully for shells, minerals and other materials.

Questions to answer

1. Look at the classification of particles on page 91. What types does your sand sample contain?
2. Draw the different materials in your sample.
3. Name any non-carbonate component and say where it came from.
4. Can you see any minerals in the sample? What do they look like?
5. Use pieces of sticky tape to collect a sample of your sieved sand and stick it into the space below giving them names.
6. Attempt to grind up your sample. How hard is your sample?
7. Design an experiment that will allow you to test chemically if a sample contains calcium carbonate.

Small group field work

Exercise 4.2 Sand per cent composition

Based on an original exercise by Bob Moffat

In this experiment you are going to work out where the big sand grains are on the beach that you collected in Exercise 4.1

Materials and equipment (per group)

- Sieves — Note:

  For beaches with fine sand grains

  - sieves of sizes, 300 µ metres, 250 µ metres, 200µ metres (See Figure 100.1A)

  For beaches with larger grain sizes

  - sieves of sizes, 600 µ metres, 400 µ metres, 200µ metres
  - or larger sieves as shown in Figure 100.1B
- aluminium pie dishes labelled as follows:

  - subsample, >300 µm, 250 µm, 200 µm, < 200 µm
- 2 ice cream containers
- completely dry sand samples from top, middle and bottom of beach in plastic zip top bags
- lab balance
- 4 aluminium pie dishes or plastic jars as shown in Figure 100.2.

A. For beaches with fine sand grains

B. For beaches with larger grain sizes

Figure 100.1 Materials necessary to make sieves
(Photos Bob Moffat - A. Geoff Jensen B)

Field work hints

1. Often it is impractical to take a balance into the field.

   In this case the use of small plastic containers as shown in Figure 100.2A may be of assistance.
2. You will need a labelled container for each sieve as shown and use a rough estimation as shown in Figure 100.2B to work out the percent.
3. Use zip-top plastic bags to collect other sand samples that can be taken back to the lab and analysed if time permits.

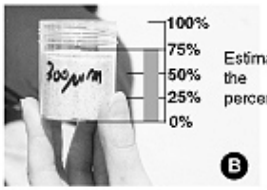


Figure 100.2 Field analysis
(Photos Bob Moffat)

To make sieves

1. Mesh of very fine mesh sizes is available from Swiss Screens, Randall St, Slacks Creek, Q'ld, 4127. Plastic sieves as shown are available from Hardie Iplex, in a trades pack of 10, and are called a weathering apron, 50mm, product code is VO 7450. The silk comes in widths ranging from 900 - 1200mm and a 125mm long strip will make 9 sieves of the sizes mentioned above. If you use the 50mm weathering apron, then cut the 125mm strip into nine equal squares.
2. Use a rubber band to hold down the mesh and then add bondcrete glue around the rubber band. Take the all weathering tape and bind the mesh to the sieve. Pull down the tape as you bind to make a strong seal. Allow to dry for 24 hours. Make sure you mark the sieve with the correct size.

Detailed field work

Method

1. Take four pieces of filter paper or plastic bottles and label them as shown in Figure 101.1.
2. Now weigh each and record its weight in Figure 101.2.
3. Arrange the sieves in order from 300 µm, 250 µm, 200 µm as shown in Figure 101.1 and place the ice cream container underneath.
4. Now add three level teaspoons of sand from sample A to the top sieve.
5. Carefully swirl the sieves for two minutes so that the sand moves through each sieve.
6. Separate out the sieves and carefully pour the sand from each sieve on top of its corresponding piece of filter paper or use the bottle.
7. Weigh each piece of filter paper and record the new weight.
8. Total the weights and record them at the bottom of the column.
9. Calculate the percentages using the formula:

   $$\text{Per cent} = \frac{\text{weight of sample}}{\text{total weight of sand}} \times 100$$

10. Record these in the table.

Extension exercises

- Try sand grains from different parts of the beaches and graph the differences. You will need to dry the sand first.

Figure 101.1 Sieving the sand
(Photo Bob Moffat)

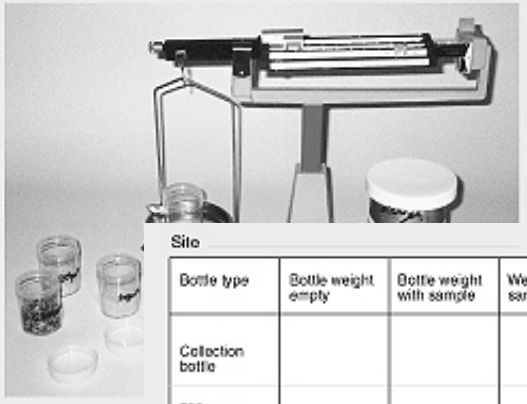


Figure 101.2 L
sand compositi
(Photo Bob Moffat)

Involving complex calculations

Site

Bottle type	Bottle weight empty	Bottle weight with sample	Weight of sample	Fraction of total weight	% of total weight
Collection bottle					
300 µ m					
250 µ m					
200 µ m					
< 200 µ m					
Error					

Figure 101.3 Data table
(Illustration Bob Moffat)

Hint:

Use an electronic balance if available as triple beam balances may be a bit dated.

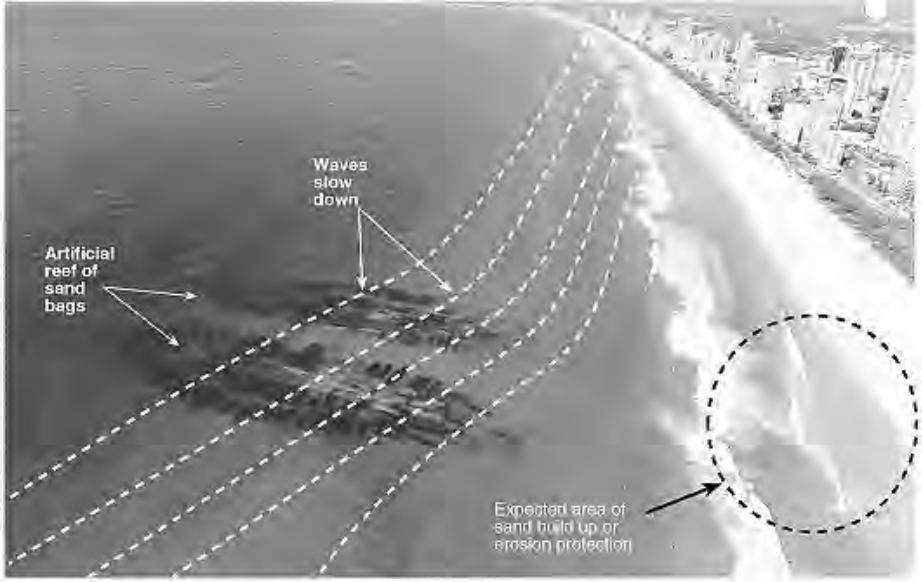


Figure 119.1 Artificial reef in high energy shore Queensland
(Photo courtesy Gold Coast City Council)

The long term effects of this reef are still being monitored as it has been placed on a shore of sheltered by an island with infrequent storm wave impact. Hard reefs however provide a great place for SCUBA diving and fishing as they allow places for fish to grow and reproduce.

Soft reefs

Artificial reefs are a new innovation in coastal engineering based on world's best practice. The reef shown above was constructed underwater to avoid the unsightly rocks of a groyne.

The problem

Incoming storm waves were causing severe erosion on the beach and threatened to damage the main highway that carried telecommunications cables and sewage pipes.

The solution

The reef was designed to slow down storm waves causing them to break further out at sea. This would slow the eroding beach cycle (see Chapter 4).

During calm weather sand could build up as shown in Figure 119.1 much the same way the groyne shown on Page 114.

The problems of unsightly rocks and permanent environmental damage was solved by having the reef made from geotextile mega bags. This meant that if the engineers were wrong or there were any problems that could not be solved, the bags could be cut open, the sand allowed to fall free and the bags removed by a dredge.

You can read more about this project on Pages 120 and 121 over.

Further information about this project can be found at:

www.coastalwatch.com

www.onthenet.com.au/~jackson/asrn/narrowneck/Index.html

www.asrltd.co.nz/projectsgoldcoast.html

Figure 119.2 Surfing on the artificial reef
(Photo Gold Coast City Council)

Odd fact

1 million cubic metres would fill a football field to a depth of 220m.

Case studies from most Australian States

Extensive web references that should stay

New keys

Exercise 8.3 Shark classification

(Based on an original exercise by Mike Sugden, Hobart College, Tasmania)

Figure 205.1 shows photographs of 8 different sharks representing major shark groups (Orders).
Table 204.1 shows two ways of classifying these sharks to the order level. One is a dichotomous key, the other a chart.
Use Table 204.1 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.

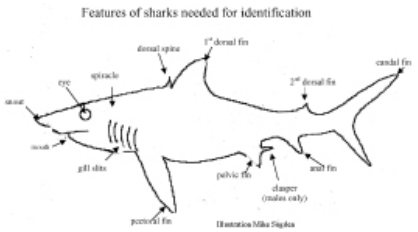


Table 204.1 Dichotomous Key for shark orders

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 ... ... *Squatiniformes* (Angel Shark)
   b. Sharks with body not raylike and mouth on bottom side of head ... 3

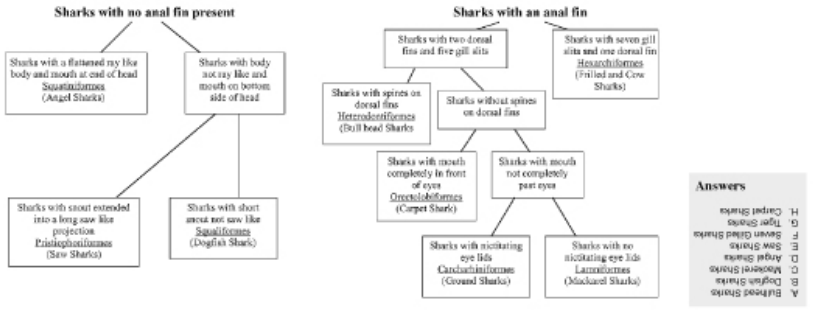
3. a. Sharks with snout extended into a long saw like projection ... ... *Pristiophoriformes* (Saw Shark)
   b. Sharks with short snout not saw like ... ... *Squaliformes* (Dogfish Shark)

4. a. Sharks with 6 or 7 gill slits and one dorsal fin ... ... *Hexanchiformes* (Seven gilled Sharks)
   b. Sharks with two dorsal fins and five gill slits 5

5. a. Sharks with spines on dorsal fins ... ... *Heterodontiformes* (Bullhead Shark)
   b. Sharks without spines on dorsal fins 6

6. a. Sharks with mouth completely in front of eyes ... ... *Orectolobiformes* (Carpet Shark)
   b. Sharks with mouth not completely past eyes 7

7. a. Sharks with nictitating eye lids ... ... *Carcharhiniformes* (Tiger Shark)
   b. Sharks without nictitating eye lids ... ... *Lamniformes* (Mackerel Sharks)



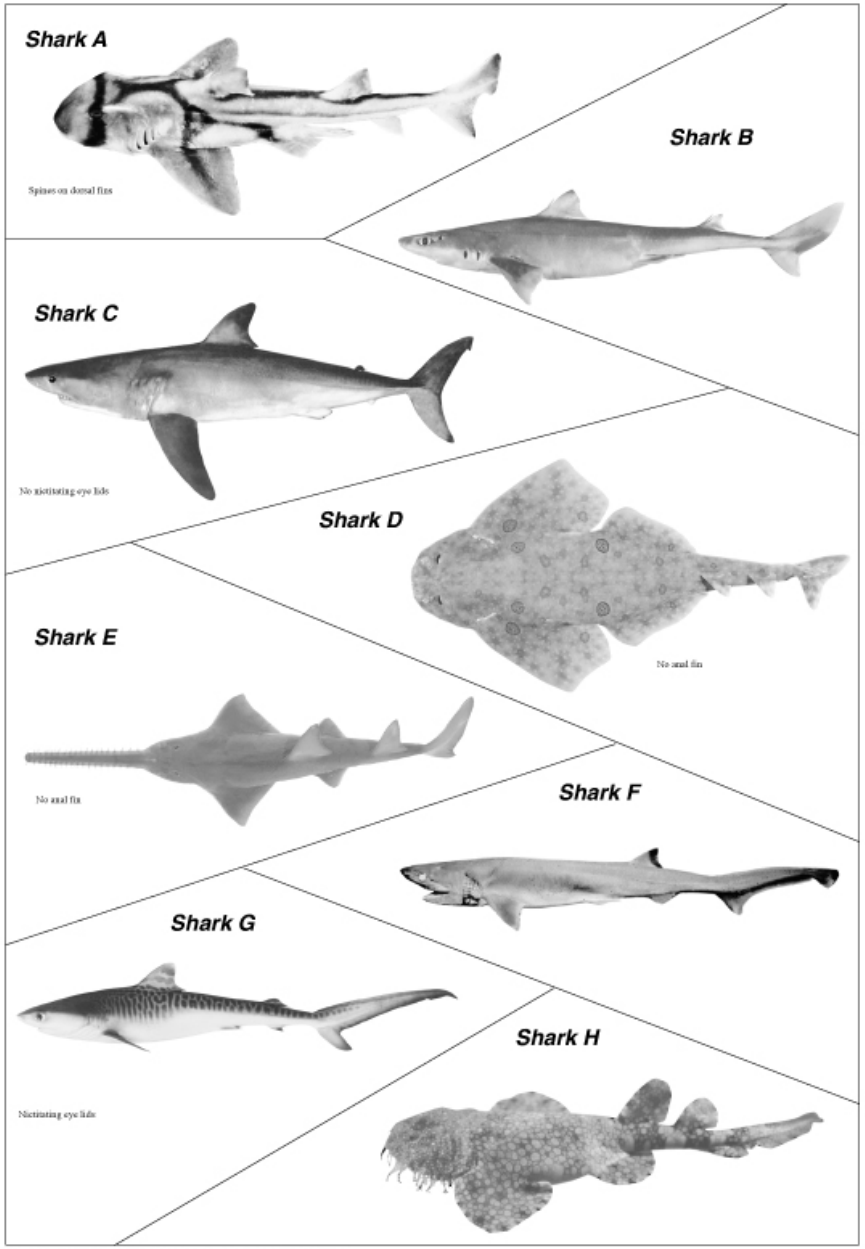


Figure 205.1 Shark photographs for Exercise 8.2
(Photographs courtesy Dr. Peter Last CSIRO)

Marine biodiversity

- Genetic diversity - refers to the genetic variety and variability within each species. Genes vary between individuals within a species. It is this variation which is genetic diversity.
- Species diversity - the number of different species living on earth. At present almost 1.8 million species have been discovered and described by scientists. It is the total variety of all the species in an area that makes the diversity.
- Ecosystem diversity - refers to variety in the combination of species that form ecosystems such as ponds, coral reefs, forests or grasslands. It is the variety of ecosystem types that is ecosystem diversity.

Genetic diversity is an investment in the survival of a species.

It involves all the past evolutionary selection processes.

New terms and concepts explained

Large Marine Ecosystem

Large Marine Ecosystems (LMEs) are relatively large regions, of the order of 200,000 km^2 or more, characterised by distinct

- *bathymetry*
- *hydrography*
- *productivity*
- *species composition and*
- *trophically inter-dependent populations*

(Sherman and Alexander, 1986).

New concepts in Marine Management

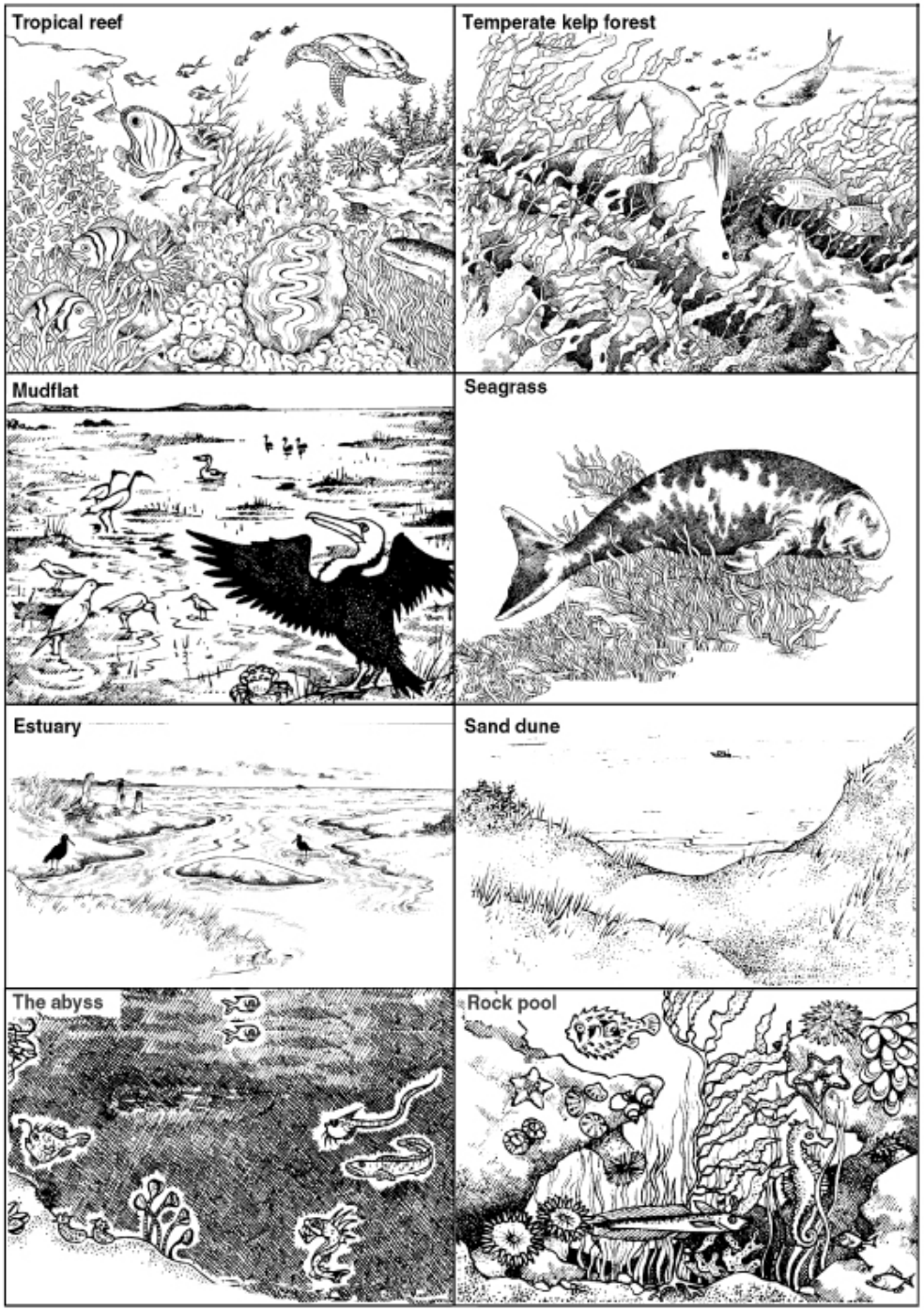


Figure 219.1 Concept by Nancy Tsernjavski, Illustration by Sharyn Madder, copyright MESA, reproduced with permission.

Exercise 8.4 Diversity

What to do

Form groups of about 5-6 and use the poster on Page 213 as a discussion starter to answer the questions below.

Questions

1. The poster depicts a range of marine organisms in various habitats spanning coastal dune to intertidal zone, rock pool, reef and open ocean, through the zone of light and into the zone of perpetual darkness.

   What does your group think of the graphic, its characteristics and setting in attempting to explain species diversity?

   a. Make a list of the types of animals and plants you can identify.
   b. Classify them as best you can using the tree of marine life (Page 207).
   c. Make a list of the external features for each organism.
   d. Make suggestions on ways to improve the graphic.
2. What is the difference between genetic, species and ecosystem diversity? Use the illustrations in the graphic to give an example of each.
3. Use the key on page 202 to devise a new key for the vertebrates shown in the graphic.
4. Draw up a two column table with temperate and tropical as headings. Now list under each heading where you think the animals and plants in the graphic would be found.
5. Study the images on pages 214 - 215.
   a. Make a copy of each illustration and draw food webs for each.
   b. Using the tree of marine life, classify into animal and plant groups each of the marine organisms shown.
   c. Draw up a table to distinguish between the four different ecosystems shown.
   d. For each ecosystem, make a list of at least 4 individuals not shown.

Figure 212.1 MESA's ABSea has a simplified version of biodiversity and is available from Wet Paper at PO Box 540 Coolangatta 4225.

7. What are the five kingdoms of marine life depicted and what characteristic/s separates them from each other?
8. Name one or more animals from the following groups in the illustration
   - Mammalia
   - Reptilia
   - Osteichthyes
   - Chondrichthyes
   - Amphibia
   - Mollusca

Excellent references

You can check out MESA's web site at:

- www.mesa.edu.au

Other sites to see biodiversity of marine are:

- www.gbrmpa.gov.au
- local marine aquaria
- snorkelling in your local rock pools
- beach combing or rock pool rambling

Simple illustrations

Extensive MESA plugs

Exercise 9.1 Phytoplankton ID

Algal culture

Take some aquarium water or fresh seawater and place it in a large jar in the sun for a few days.

Collect the green algae which forms on the inside of the jar. For this exercise, make a slide and view it under the monocular microscope.

Laboratory methods

1. The steromicroscope as shown in Figure 237.1 has two eyepieces, A and B.
2. Carefully remove the microscope from the case (not shown) and carry it with the stainless carry handle D to a place with light coming through a window. Place the base E, on a firm desk.
3. To focus the microscope, take some plankton (I) from your sample with an eye dropper (H) and place in a petri dish (F) that has been placed on a white stage fixed with a screw (G). Note, if you are using live plankton, you may get a better view by unscrewing G and using the black side of the stage disc.
4. Locate the fixed eye piece B and the adjustable eyepiece A. Move A_1 and B_1 apart or closer to fit your eyes.
5. Now close one eye, look through B and use the focus knob (C) to focus on your plankton. Now open your other eye and use eyepiece A to bring your plankton into perfect focus.
6. Use the identification illustrations below to identify the plankton in your sample as either diatoms or dinoflagellates.

   Use the Wet Paper book – *Mangroves in Focus*, Pages 88- 89 to help you identify them further.

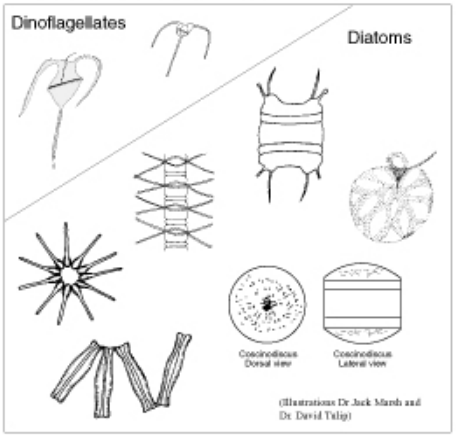


Figure 237.2 Common diatoms and dinoflagellates.

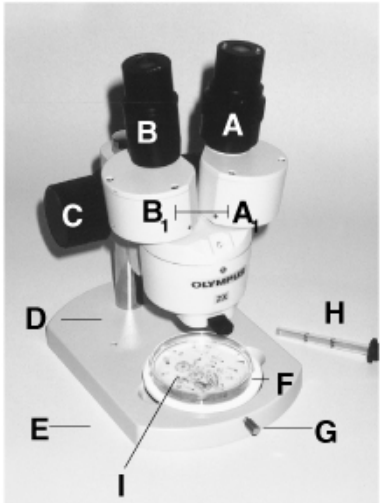


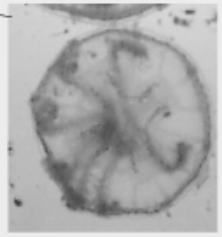
Figure 237.1 Steromicroscope for viewing live plankton
(Photo Bob Moffatt)

Digital Plankton

Digital microscopes are now available from:
Southern Biological
PO Box 57 Nunawading
Vic 3131

A digital microscope transfers the image direct to your computer just like your digital camera.

This shot of a medusa was taken by a QX3 Intel students microscope at 100x. File size ended up at 26mb jpeg and was converted to 300dpi gray scale for commercial printing.
(Information – Southern Biological supplies)



New technology and the address where you can get it from

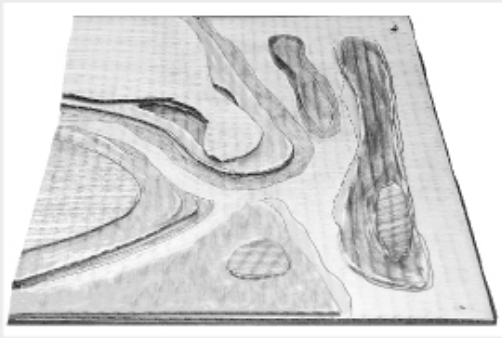
Exercise 9.2 A model for where plants live

What to do

You are going to make a model wetland similar to the map over, to investigate the different forces in nature that shape our coastline.

The model is made up of a number of different layers of cardboard each representing different land levels. For example the bottom layer will be the sea bed, the next the mud flats and so on. Each layer will have to be cut out separately and stuck onto the next.

Now complete the following steps to make your model.



1. Take the A4 sheet of paper and design your wetland. You need to have at least areas where mangroves can grow, a melaleuca swamp, an offshore island (so that the waves from the sea don't wash away the mangroves), as well as sea and sand banks where marine animals can live.
2. Once you have your design check it is possible to cut it out into layers.
3. Cut two pieces of cardboard to A4 size. The first will be the bottom of the sea.
4. Now take a second and place it on the desk and lay the piece of carbon paper over the cardboard. Take your design and place it on top.

   Now with a pen, draw over seagrass beds, the sandbanks, the creek and the layers you think are at the same level. Ask your teacher to check.
5. Remove the carbon paper and you will see a pattern on your cardboard that you can use to cut out the first layer.

   Use the scissors to cut out the layers.
6. Now use the glue to carefully position the seagrass beds, sandbanks and foreshores on the seabed.
7. Continue cutting and gluing until your model is finished.
8. Add a compass point and label north. Add a grid and some latitude and longitude marks and then ask students to identify places on the model (eg what is the latitude and longitude of the river mouth?)
9. Optional - you may like to paint your model, and then coat it with clear varnish. You could then pour water down it to simulate water flow.

Questions

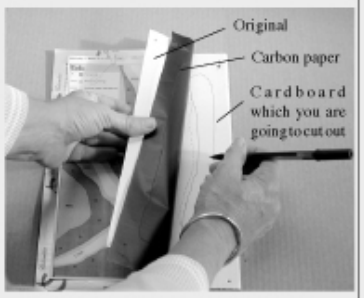
1. Scientists use the words high and low energy areas to indicate forces in nature caused by waves. On your model, what forces of nature would cause high energy areas and where would they occur?

   How does the island protect the mangroves from these high energy areas?
2. What types of weather would cause increased silting of mangrove areas?

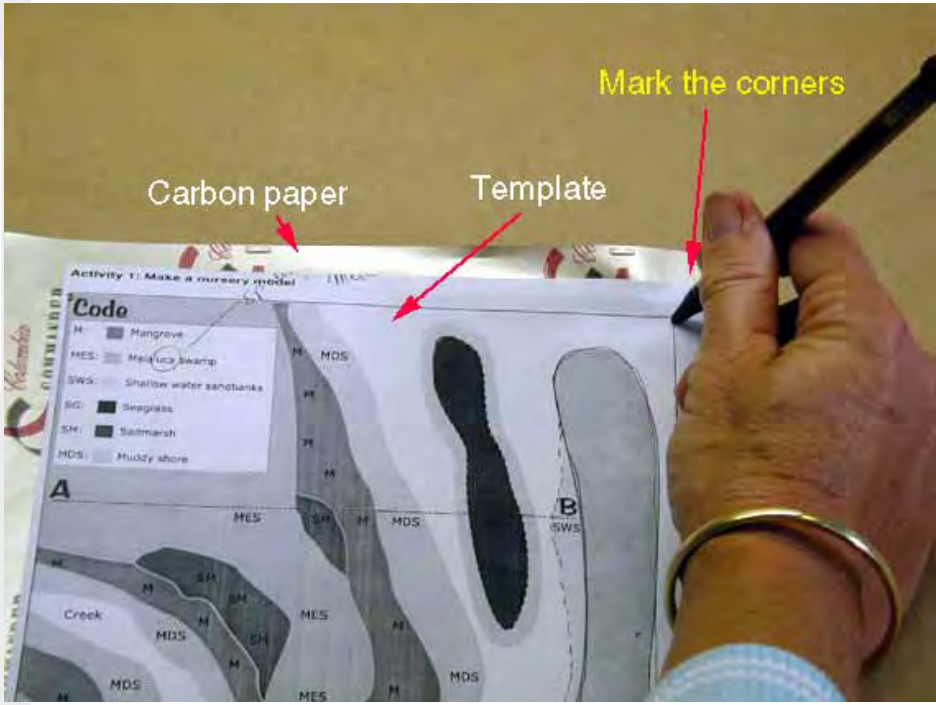
Equipment list

- A4 sheet of paper
- Scissors
- Cardboard sheets
- Carbon paper
- Glue
- Pen
- Paints (optional)

Note: Use stanley knives with extreme care under the direction of your teacher.

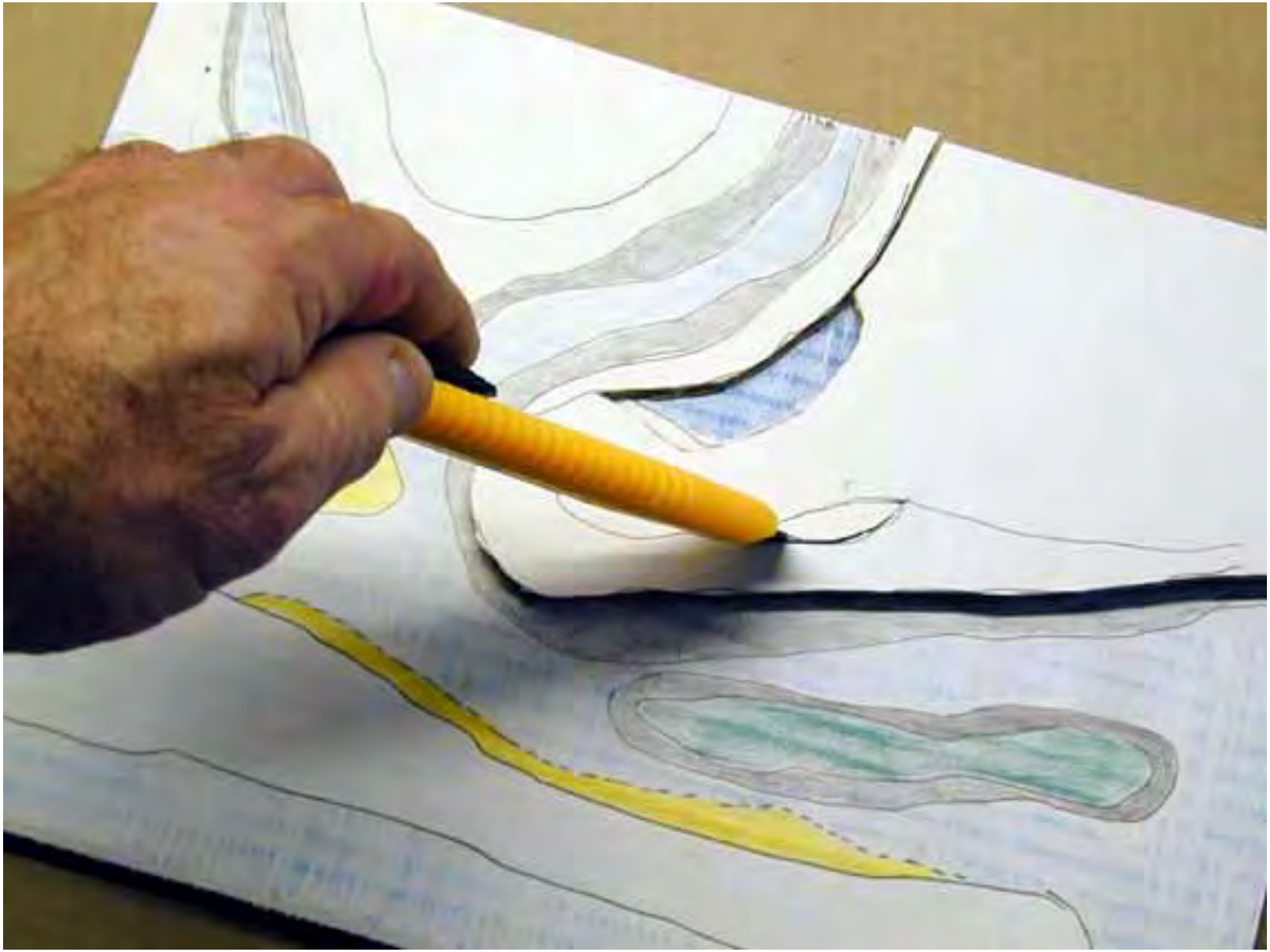


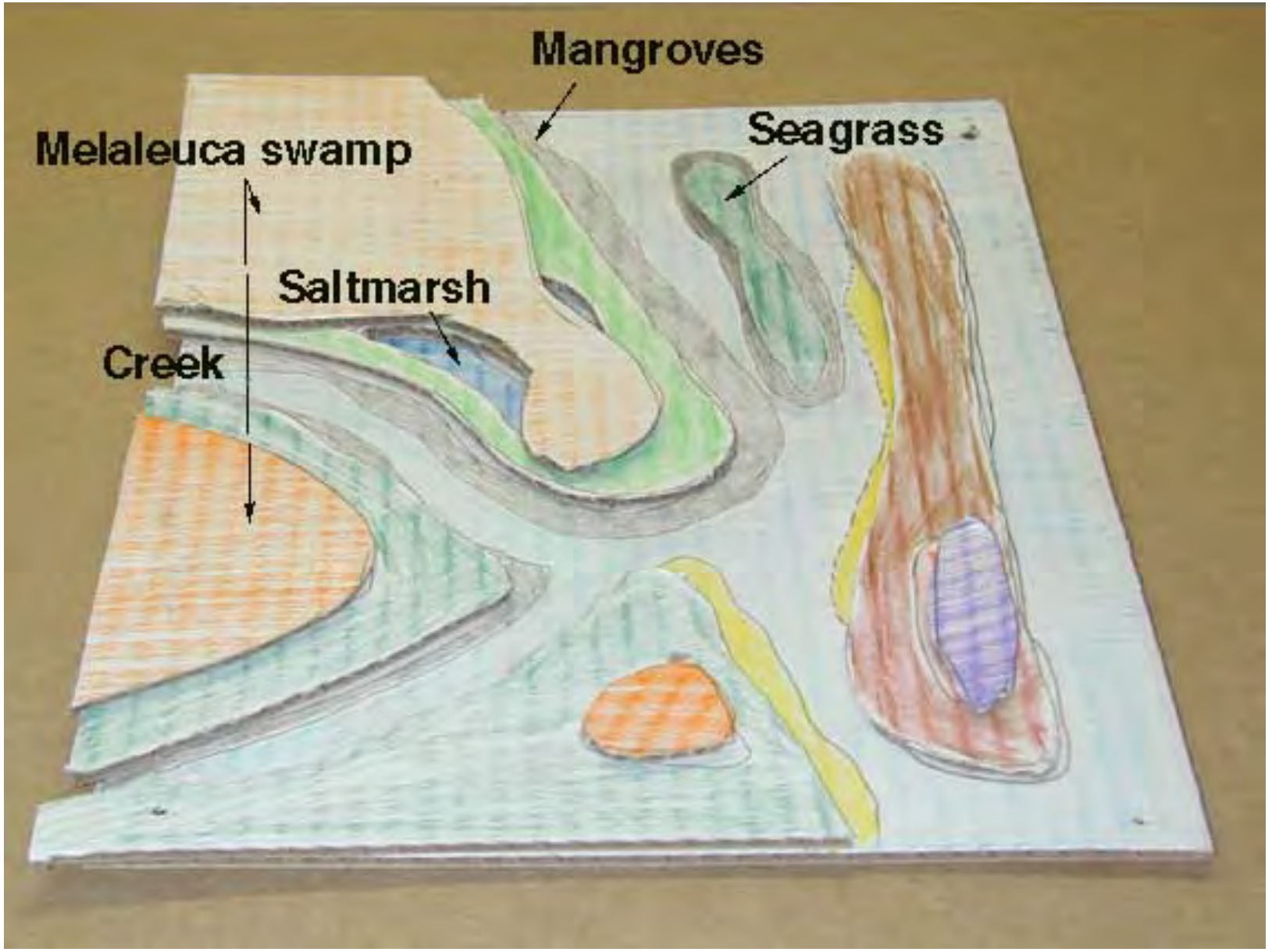
Using carbon paper to mark out your cardboard

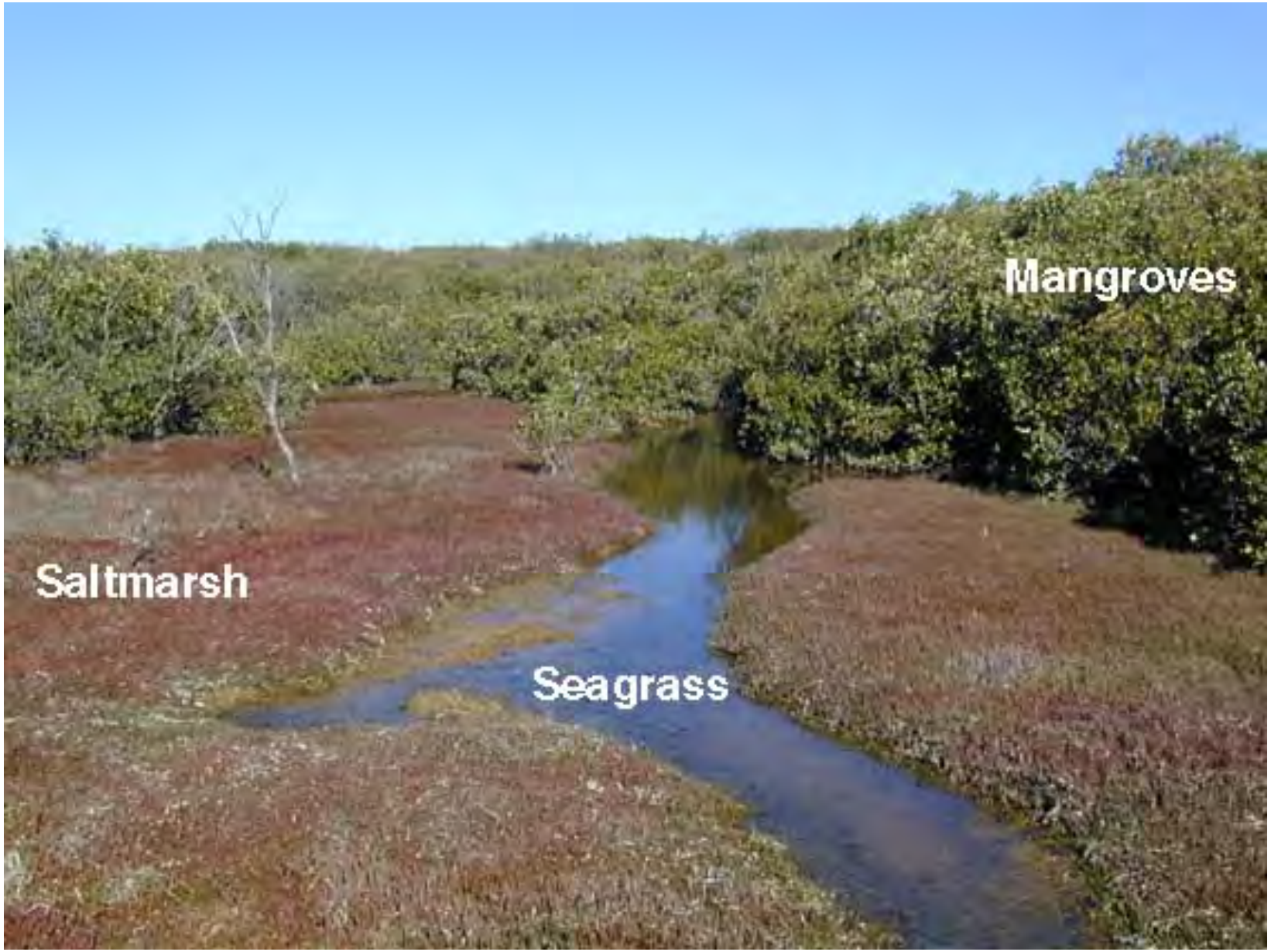


New activities


Code




Mangroves
Seagrass
Melaleuca swamp
Saltmarsh
Creek


Mangroves
Saltmarsh
Seagrass

It's time for the school report. How does our marine environment rate?

Report Card

Subject: Water quality in the marine environment

(A: excellent, to D: poor)*

Pollution	Sources and Effects	Level
Coastal rivers (developed)	Moderate to serious sedimentation; elevated nutrients from land use, sewage; pollutants from developed and industrial discharges; acid sulphate soil run-off.	C-D
Coastal rivers (undeveloped)	Increased sedimentation; elevated nutrients.(1,6,42)	A-B
Estuaries, coastal lakes (developed)	Many estuaries eutrophic. Coastal lakes moderately to seriously eutrophic.	B-D
Estuaries, coastal lakes (undeveloped)	Possible minor sedimentation; elevated nutrients.(6,42,51-57)	A-
Nearshore coastal waters, bays (developed)	Elevated nutrients (e.g. SA Gulfs; Victorian Bays; NSW Bays; Moreton Bay; possibly Great Barrier Reef lagoon).	B-C
Nearshore coastal waters, bays (undeveloped)	Possible increases in sediments and nutrients.(6,42,51-57)	A
Ocean (developed)	Trace levels of chlorinated compounds etc (much lower than northern hemisphere, but increasing towards coast).(42-45)	A-
Ocean (undeveloped)	As above	A

*Scores
A: No detectable problems, or trace levels of contaminants
B: Some problems or low levels of contaminants
(or widespread low levels, or few sites with moderate levels)
C: Moderate problems or moderate levels of contaminants
(or widespread moderate levels, or some sites with high levels)
D: Serious problems or high levels of contaminants
(or widespread high levels, or many sites with very high levels)

Figure 443.1 SOMER Report Card of marine habitats, in developed and undeveloped parts of Australia. (Note: like your school report card, 'A' is excellent and 'D' is poor.)
(Reproduced with permission Environment Australia)

Clear summary diagrams

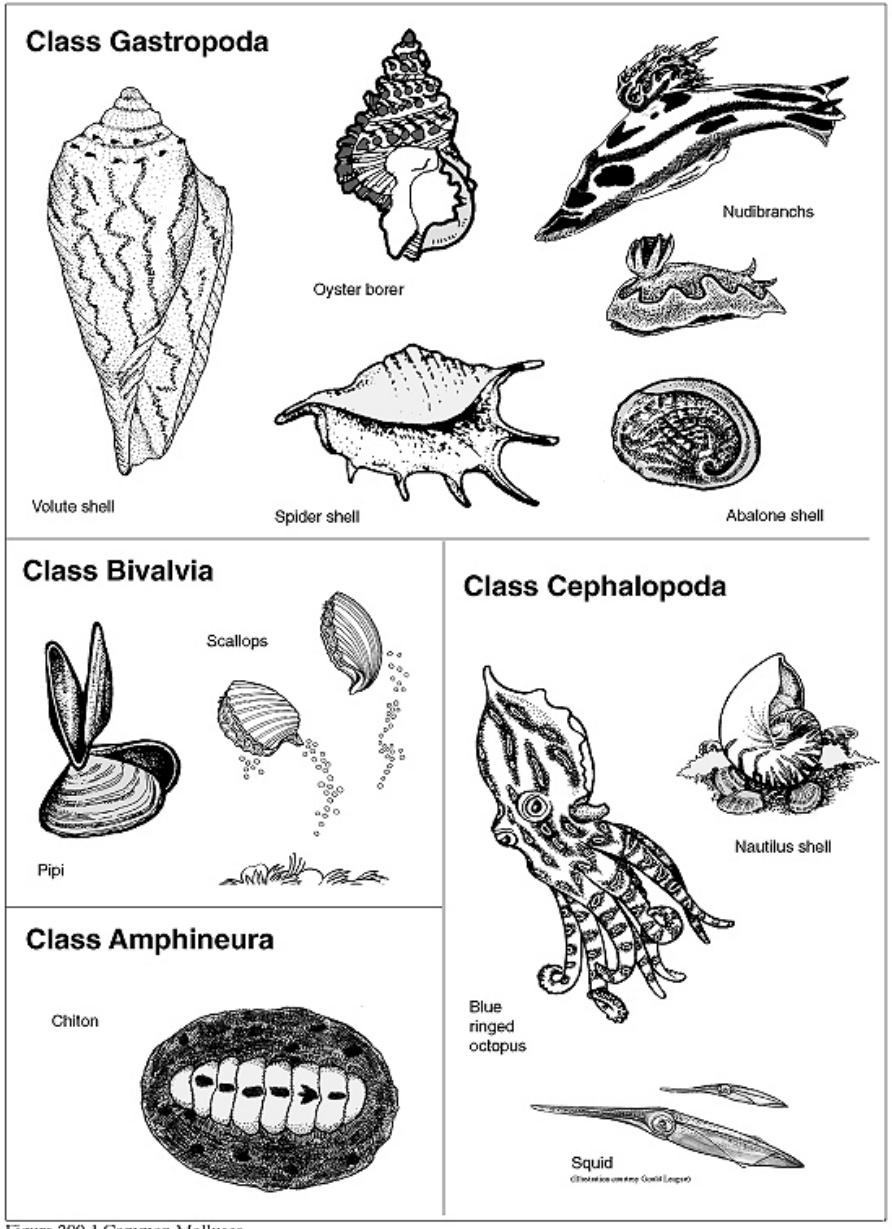


Figure 290.1 Common Molluscs

(Illustrations by Steven Byers, Sue Oats, Rose Bedford, Sharon Madder)

Clear illustrations

Phylum Mollusca

Characteristics: Most have a soft skin, bilateral symmetry, mantle with gills, most types protected by a shell, no segmentation. Most have a large foot and some posses a specialized feeding organ known as a radula.

External features

Molluscs have a soft body, usually covered with a hard outer shell or shells and have a strong foot to fix themselves to rocks for protection (Figure 289.1). The limpet in Figure 289.3 is a good example of this phylum because if we carefully prize it off the rocks and turn it over we can see the head, foot and mantle cavity.

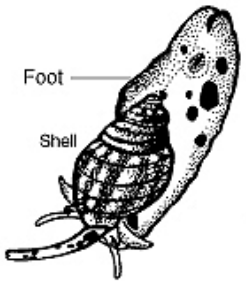


Figure 289.1 Most molluscs have a foot and a shell.
(Illustration Gould League)

Feeding

Some molluscs also have a modified mouth piece called a **radula** which scrapes food off rocks (Figure 289.2). Food is then passed to a digestive tract and anus. This radula can be modified further in carnivorous molluscs to bore into other animals such as the oyster borer (Figure 290.1). Other molluscs such as clams, filter feed by drawing water into their bodies through a series of siphons.

Breathing

Molluscs breathe through gills located in a mantle cavity located on top of the foot. Water is sucked in by muscular contractions and is drawn over the gills' surfaces where oxygen is extracted and carbon dioxide released. (Figure 291.1, shows the gills under the mantle cavity.)

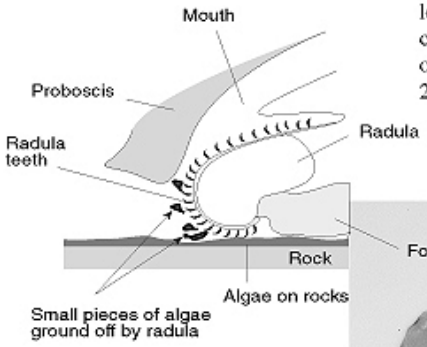
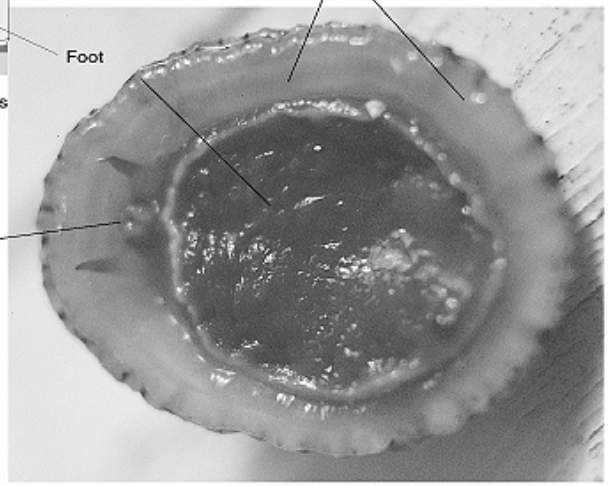


Figure 289.2 Limpet radula
(Illustration Bob Mellor, after Lemon)

Figure 289.3 Limpet — a Gastropod
(Illustration and photo Bob Mellor)



Clear layout

What the teachers wanted was

- ✓ Questions on knowledge and understanding
- ✓ Information processing and reasoning

For

- ✓ Each chapter and exercise
- ✓ Based on Blooms Taxanomy

Knowledge

Verbs

- Describe
- Find
- List
- Locate
- Name
- Relate
- State
- Tell
- Write

Questions

- Can you name the
- Describe the appearance of
- Find the meaning of the following terms
- How many
- What happened after
- What is the name of
- Who was the person that
- Which is the right answer

Instructions/activities

- List all the stages of
- Make a time line of the events
- Prepare a chart showing
- Recite a poem
- Write the formula for photosynthesis
- Describe the events leading up to
- Locate a place that
- Name the animals in the
- State the formula for
- Tell the story about
- What is the scientific name for, the common name for

Understanding

Verbs

- Convert
- Draw
- Describe
- Distinguish
- Express
- Interpret
- Match
- Outline
- Restate
- Translate

Questions

- Write the formula for photosynthesis in your own words
- Give a definition of species
- Provide an example of a
- Write a brief outline for
- What differences exist between
- What do you think could have happened next?
- What was the main idea of the article?
- Match the ... with the description

Instructions/activities

- Draw pictures to show
- Convert this ..... into a statement
- Describe/express in your own words/restate the
- Give an example of a
- Illustrate the main ideas of the article
- Prepare a flow chart of the steps involved in
- Outline the main reasons for
- Distinguish between

Applying

Verbs

- Calculate
- Classify
- Construct
- Complete
- Examine
- Illustrate
- Record
- Report
- Show
- Solve
- Use

Questions

- Calculate the number of ... in the square
- Classify the following into the phyla
- Construct a diagram to show
- Plan and conduct an experiment to show that

Instructions/activities

- Calculate the number of .. per minute
  Calculate the number of
- Classify the following
- Construct a food chain from the following
- Complete the sentence
- Examine the illustration and
- Draw a diagram/map/plan and label it correctly
- Use a collection of plants to show that
- Make a model to show that
- Record your results in the table below
- Use your knowledge to show that
- Plan an experiment to show that
- Explain the procedure for
- Illustrate your answer with a

Analysing

Verbs

- Analyse
- Arrange
- Categorise
- Compare
- Contrast
- Distinguish
- Examine
- Explain
- Identify
- Investigate
- Separate
- Survey

Questions

- Which events could not have happened and why?
- How is this similar to or different from
- What was the main theme?
- Distinguish between
- What was the turning point in the development?
- Explain what must have happened when
- Are there any other possible outcomes?
- What were some of the motives behind
- Write a number of questions that could be used in the interview
- Write ... similarities and ... differences between ...

Instructions/activities

- Design a questionnaire to gather data
- Write a commercial for a coast care add
- Make a flow chart to show the reproductive cycle of a
- Construct a graph to illustrate the relationship between
- Which events could not have happened and why
- Write a number of questions that could be used to
- Explain the difference between the following words
- Identify the following animals from the illustrations below
- Investigate the effects of
- Carry out a survey to
- Prepare a scientific report of

Creating

Verbs

- Compose
- Research
- Create
- Design
- Devise
- Estimate
- Formulate
- Imagine
- Improve
- Invent
- Plan
- Predict
- Propose
- Conduct

Questions

- Create new uses for ...
- If you had access to all the necessary resources, how could you stop ships hitting the reef
- Invent a solution to ...
- Can you develop a proposal which will ..?
- How may ways can you ...
- Propose how we could improve this experiment/
- Predict what will happen if ....

Instructions/activities

- Create a new product (fish) and plan a marketing campaign
- Devise a number of ways to improve
- Write and perform a play to illustrate a barnacle feeding
- Invent a machine to
- Design a cover for a brochure
- Compose a rhythm and or add new words to a well known tune
- Devise an experiment that will extract more ..... from tidal energy
- Construct a model of a (copepod)
- Design a wave power house
- Suggest ways to improve the management of
- Choose music to reflect the movement of ...

Evaluating

Verbs

- Argue
- Assess
- Choose
- Debate
- Decide
- Determine
- Evaluate
- Discuss
- Judge
- Justify
- Prioritise
- Rate
- Recommend
- Verify

Questions

- Plan and conduct an experiment to justify your answer/
- How would you defend your position in relation to ...?
- Assess and choose a better solution to .....
- How would you have handled ..... ?
- What changes would you recommend to... ? Why?
- Do you believe that ....
- How would you feel if
- How ineffective are
- What is the most valuable

Instructions/activities

- Prepare a list to be used by .... to judge a
- Organise and conduct a debate about a controversial issue
- Prepare a booklet that could be used by tour operators to
- Write a letter to the editor of the local newspaper advising on changes needed to
- Prepare a report in which you evaluate the research on
- Recommend new strategies to be adopted by the ..... based on your strategic plan and group's analysis

Exercise 15.1 Rocky shore transect

(Based on an original exercise by Bob Moffatt)

A low tide rocky shore profile from Moffatt Headland in Hypothetical Bay (Chapter 2, page 55) was drawn using the methods described in Exercise 4.1, Chapter 4, and biotic data was taken from 8 stations as shown in figure 391.1 below. The students counted the animals and plants at each station and then made a decision on how to graph their results based on the criteria in the legend box in Figure 391.1. They then collected and graphed the abiotic data as shown on the next page. Study this data and answer the questions on page 393.

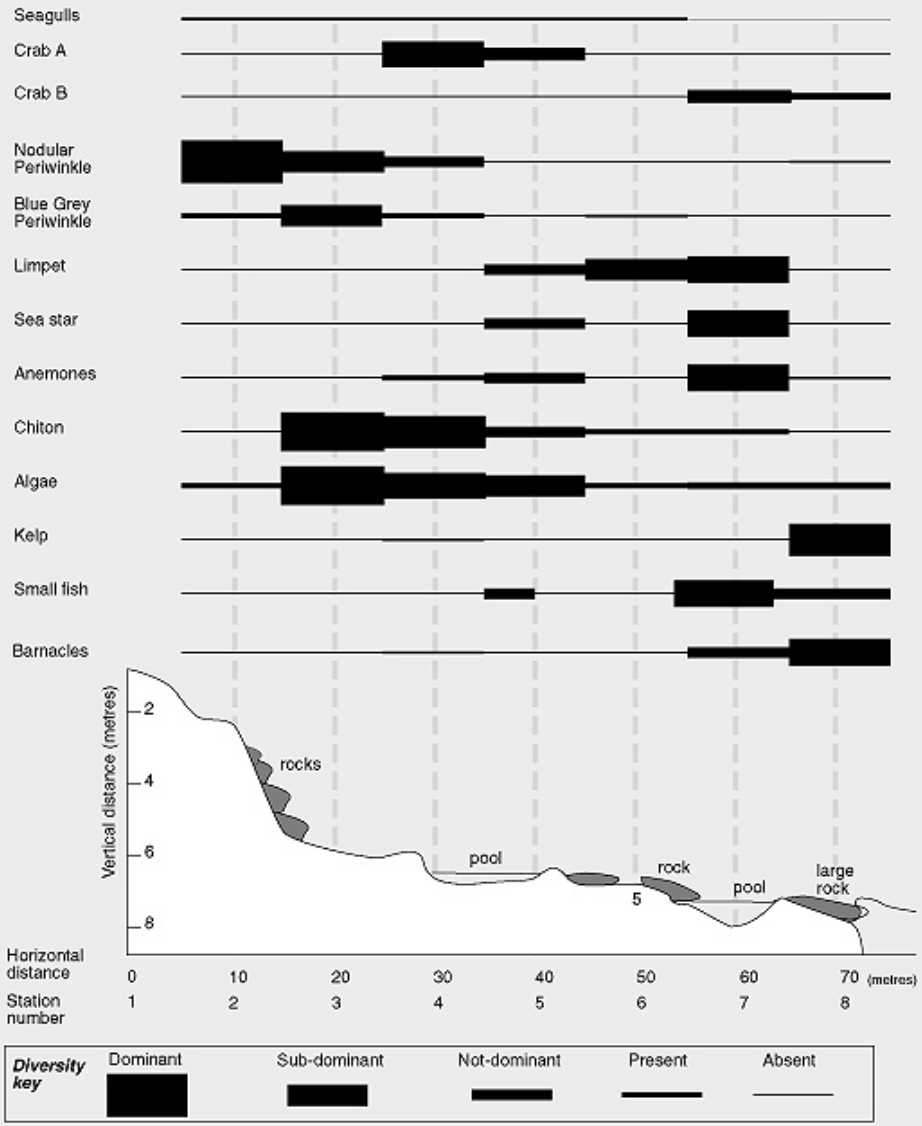


Figure 391.1 Biotic data for rocky shore

(illustration Bob Moffatt)

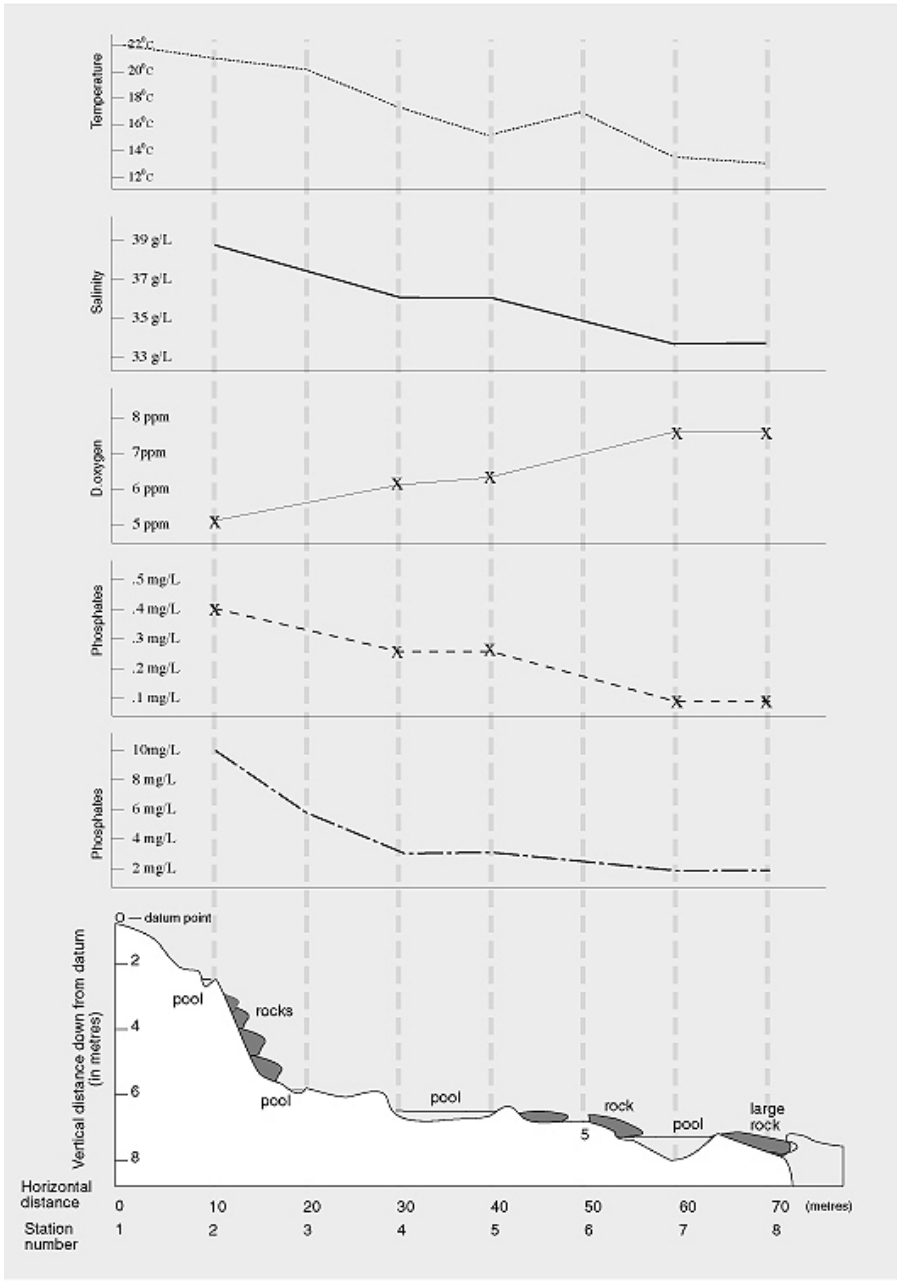


Figure 392.1 Abiotic data

Questions: Exercise 15.1

Knowledge

1. Describe the number of stations measured, the distance covered and the animals and plants in the data presented.
2. Define the words *habitat, limits of tolerance, buoyancy.*
3. Describe the features of the shore at stations 2, 4, 5 and 7.
4. Define the terms *abiotic* and *biotic* giving examples of each from the data presented.

Understanding

5. Describe possible methods for determining the abiotic data and biotic data.
6. Provide an example of a herbivore.
7. What do you think could have happened to the data when the tide came in?
8. Draw pictures to show you know the difference between a barnacle and a chiton.
9. Give an example of an echinoderm and an cnidarian.
10. Prepare a flow chart of the steps involved in drawing the rocky shore profile.
11. Outline the main reasons for the collection of data of this type.
12. Make a list of all the biotic and abiotic factors that were studied.
13. Which animals and plants would be affected by buoyancy?
14. Which animals and plants would be affected by wave action? When and why?
15. Where would temperature pose the greatest problems for rocky shore organisms and why?
16. Name one predator from the data.
17. What could cause the salinity in a pool to drop?

Applying

18. Calculate average temperature on the rocky shore.
19. Classify the blue grey periwinkle into kingdom, phylum and class.
20. Construct a food web for the pool at station 7.
21. A metre square with 100 mm divisions was used to

Analysing

23. Examine all the data and answer questions a-c below.
    a. Explain what happens to the nitrate levels as you go from the sea to the top of the headland.
    b. Identify the least favourable habitat.
    c. Where are barnacles most dominant? Suggest a reason for this.
24. Analyse the data from stations 3 and 7 and answer questions a-e below.
    a. Which are the dominant species?
    b. What abiotic feature affects them the most?
    c. Which is the hottest, saltiest station?
    d. Compare the phosphate and nitrate readings at each and suggest reasons for the differences.
    e. Describe the changes in dissolved oxygen levels and suggest a possible reason for the difference.

Creating

25. From the data presented, create an animal that could live in every station.

Evaluating

26. Analyse both sets of data for station 3 and answer questions a-c below.
    a. Which are the dominant species
    b. Which species are not present and why?
    c. Identity the most favourable habitat justifying your answer using biotic and abiotic data.
27. Why are chitons only found in some places on the rocky shore?
28. Determine which abiotic factor and biotic factor would have the greatest and least effect on the organisms mentioned in the study.
29. A housing development was planned for the headland. Geologists identified acid sulfate soils in the area, but the developers said they would excavate these soils and replace them with environmentally friendly soil.

    As councillor reviewing the submission, make a list of all the environmental factors that would impact on the animals.

    Determine the levels of tolerance of each and determine which would be most affected

Knowledge and understanding

Information processing and reasoning

for exercises

Questions: Chapter 16

Knowledge

1. Describe a natural ecosystem and name their four requirements/criteria.
2. Name any five communities that may exist in an estuarine ecosystem.
3. Write a definition for *biomass* and give an example.
4. Define the terms – community, autrotroph, acid rain, denitrifying bacteria, hydrological cycle.

Understanding

5. Draw a diagram to show you can distinguish between the terms community, population and individual, in a biotic environment.
6. Draw the phosphorus cycle using sand dune plants as an example.
7. Draw diagrams of the carbon and nitrogen cycles to show you can identify the major components for each.
8. What is the greenhouse effect and how might this affect sea conditions around the world?
9. Distinguish between the terms *producer, consumer, scavenger and decomposer.*
10. Redraw Figure 414.2 as a food chain.
11. Restate the pyramid of numbers as shown in Figure 416.1 in 3-4 sentences.

Applying

12. Calculate the percentage of bioaccumulation of DDT for each of the trophic levels in Figure 417.2.
13. Redraw Figure 428.1 below and construct a food web for the marine organisms shown.
14. Complete an energy pyramid of the food web as constructed in the previous question.

Analysing

15. Explain the role plants of the sea play in the carbon cycle and the nitrogen cycle.
16. Identify the form in which carbon is taken up by phytoplankton from their surroundings. How do fish obtain their carbon?
17. 79% of air is nitrogen gas yet some plants growing on the sand dunes grow poorly because of shortage of nitrogen. Explain this phenomena.
18. Explain why the sulphur cycle is not balanced.
19. Explain the statement — *An ecosystem contains organisms capable of capturing (this) energy to manufacture organic molecules.*

Creating

20. Use the map of Hypothetical Bay on Page 55, Chapter 2, to estimate some of the number and types of communities that may exist within the bay ecosystem.

Evaluating

21. Argue a case in 2 paragraphs for the ban of DDT giving an example.
22. Evaluate the statement — *the higher levels of a food chain will contain smaller amounts of biomass.*
23. Why is there a need for a definition of large marine ecosystems?

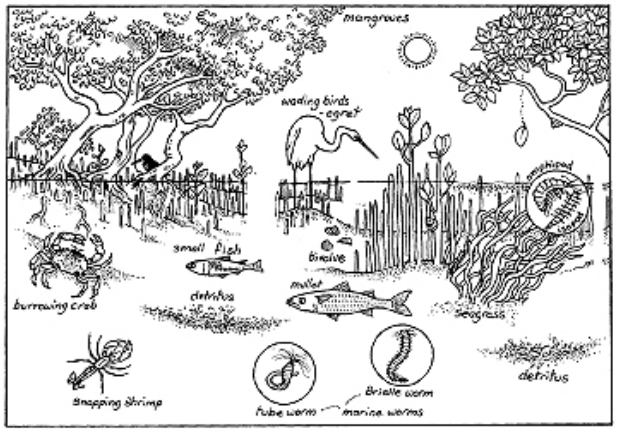


Figure 428.1 Mangrove food web

(Illustration by Shanya Madder, based on concepts by Nancy Tsenjiwski from ABSea, copyright MESA, reproduced with permission)

End of chapter

Knowledge and understanding

Information processing and reasoning

Appendix 3 Planning a unit of work (assignment contracts)

To plan a unit, you could set a learning contract which can have a number of different options.

- Option A — Choose a minimum of 2 activities from each column —> 14 activities
- Option B — Choose a minimum of 2 activities from each row —> 12 activities
- Option C — Complete all activities that have been shaded (see examples) —> 15 minimum activities

Assessment options

Select 12 or more tasks from Columns 1, 2, 3 etc, then assign points and set criteria (Knowledge and understanding)

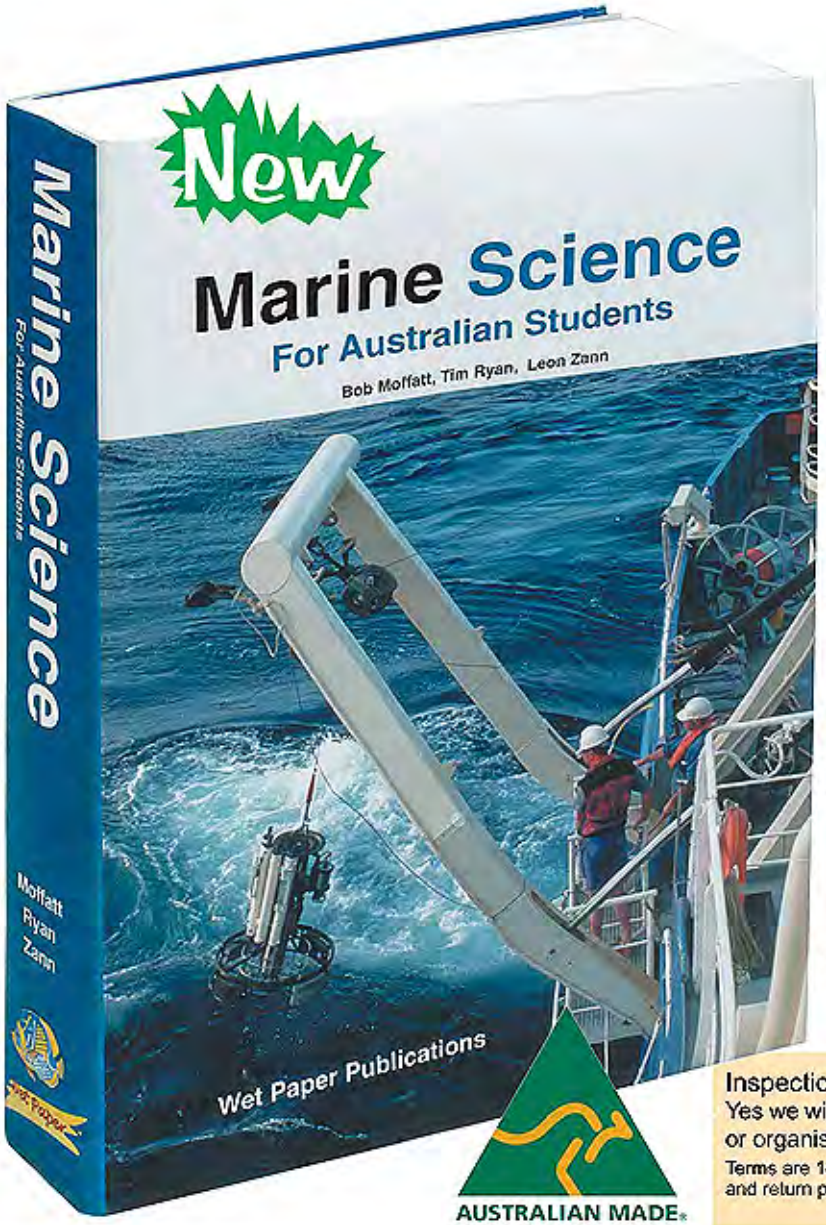
Example: Chapters 11 and 12 Choose an invertebrate

Gardner's intelligences Seven ways to complete this unit	Knowing Describe, find, list, locate, name. relate, state, tell, write 1 point	Understanding Convert, draw, describe, distinguish, express, interpret, match, outline, restate, translate, apply 2 points	Applying Calculate, classify, construct, complete, examine, illustrate, record, report, show, solve, use 3 points	Analysing Analyse, arrange, categorise, compare, contrast, distinguish, examine, explain, identify, investigate, separate, survey 4 points	Creating Compose, research, create, design, devise, estimate, formulate, imagine, improve, invent, plan, predict, propose, conduct 5 points	Evaluating Argue, assess, choose, debate, decide, determine, evaluate, discuss, judge, justify, prioritise, rate, recommend, verify 6 points
1. Verbal/linguistic (I enjoy reading, writing and speaking)	Locate the animal you want to study in Chapter 11 or 12 and state why you have chosen it.	Draw your selected animal and describe its external appearance.	From the animals in the hat provided by your teacher, draw one and classify it to species level.	Write 6 similarities and 6 differences between two animals in the same phylum in one A4 page.	Write a poem/ brief skit to describe how this animal feeds or reproduces.	Write 4 of the animals adaptations and rate it's chances of survival from pollution.
2. Maths/logical (I enjoy working with numbers and science)	Count the number of external features on the animal.	Construct a food web showing the trophic relationships of the animal and possible predator-prey relationships.	Explain in clear logical steps how the animal moves .	Decide if the animal is radially or bilaterally symmetrical or another form.	Design another way the animal could defend itself from predators using chemicals. Explain how they may work.	Decide if the animal lives in a population and determine the carrying capacity for a specified habitat size.
3. Visual/spatial (I enjoy painting drawing and visualising)	Paint a colour illustration of the animal showing clearly its external features.	Use a map of hypothetical bay to show where the animal would live. Explain your reasoning.	Prepare a map of Australia to show the distribution of the animal.	Compare the external features of the animal with one from a different phylum.	Make a model of the animal and paint it explaining your choices.	Prepare a map of the continental shelf and decide and label the distribution of the animal.
4. Body/kinaesthetic (I enjoy doing hands on activities)	Mime the movements of how the animal could defend itself from a possible predator.	Describe what could be in an invertebrate board game.	Prepare a museum mount of the animal (microscopic, embedded or preserved).	Analyse the pleopod of a mantis shrimp and work out how it can move at the speed of a .22 calibre bullet.	Make a diorama of the animals habitat to show parts of the food chain.	Evaluate the performance of a group members poem/rhyme/song/ rap.
5. Music/rhythmic (I enjoy making and listening to music)	Recall a song about a marine animal, record it and play it in class.	Make a chant using invertebrates with the same name eg 1,2,3 we love the sea, sea star, sea urchin, sea cucumber.	Convert the words from a song into a story board interpreting the lyrics.	Select some music for a play on the octopuses garden.	Write a song/rap to describe how an invertebrate moves or reproduces.	Review the music of any students work prior to presentation and make a written report.
6. Interpersonal (I enjoy working with others)	In a pair, present a power point or story board/flip card presentation on the life history of a marine invertebrate.	As a group, select any marine invertebrate discussed and make a summary chart.	As a group, select any marine invertebrate discussed and explain using visuals, its role in its habitat.	Make a summary chart comparing an arthropod and a mollusc.	Make a set of back labels for the Who am I game in Chapter 11, page 270.	In a pair evaluate the author's interpretation of any marine invertebrate from Chapters 11 and 12.
7. Intrapersonal (I enjoy working by myself)	Copy and colour in the tree of marine life in Chapter 8.	Make a drawing of a prawn labelling all parts.	Examine any of the case studies and report on their intended purpose.	Analyse all of the appendages of a crab and explain their functions.	Create a model of an echinoderms tubed foot so you can show how the animal uses it.	Find a brochure, museum model or aquarium display and evaluate how the information has been communicated.

Two philosophies

Not everyone learns in the same way or at the same rate

Not everyone has to do the same thing at the same time or in the same way.



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Thanks for
the memories