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JAMES COOK  
UNIVERSITY

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# Calines

MAGAZINE OF  
THE GREAT BARRIER REEF AQUARIUM



JAMES COOK

21 JUL 1995

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# Coralines

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**Great Barrier Reef Marine Park Authority**

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# E DITORIAL

Recently, I had the opportunity to participate in an Aquarium collecting trip. Working at the Aquarium it is easy to take for granted what is involved in maintaining life on a coral reef. As I collected specimens for the Coral Reef Exhibit ensuring each animal would have a ready made niche in our tank, I thought about all that is involved in sustaining a unique coral reef system on land.

The Aquarium features many stars of the reef environment, from corals to the rare flatback turtles. However, all this is only possible because of the committed group of people behind the scenes. I was reminded of what the Aquarium is all about ... People. A group of dedicated staff and volunteers supported by our Friends, you.

In the world of science you meet many dedicated people. They have an enthusiasm which is contagious. It is nice to share some of their work with you through articles in *Coralines*. In this issue we learn about research on coral's reactions to oils. Some of the Aquarium members will remember seeing research in action when Paul Hough, Aquarium Research Officer conducted late night experiments on corals at the Aquarium Sleepout evenings. Dr Jeff Miller and Margaret Card reveal the secrets of the beginning of life for turtles. We find out how delicate the balance of life is for the turtle. 'The Ins and Outs of Volunteering at the Aquarium' by Alison Ferry provides us with an insight to what volunteering is all about - sharing experiences and information.

In every family there are arrivals and departures, and the Aquarium family is no different. Due to other commitments Alison Ferry is no longer a co-editor on the magazine but will still be busy keeping us in touch with what the volunteers are doing. Her assistance in producing the first two issues was appreciated. The new addition to our family is David Lloyd. David has joined us as Interpretive Manager, leaving the cold southern waters to be captivated by the colourful world of coral reefs. David will be co-editor of *Coralines*, sharing his wealth of experience with us.

Anna Harreboomee



Front Cover: Aquarium volunteer, Gaylene Mackenzie gives a small child the opportunity to touch a rare Australian Flatback turtle. Photo: Doug Drummond

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## DIRECTOR'S MESSAGE

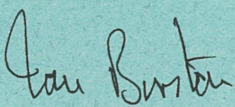
The Great Barrier Reef is a very special place. Even though humans have been using the Reef for thousands of years it is only recently that we have begun to understand the complexity and fragility of this natural wonder. Our mandate is to protect it for future generations to use and enjoy.

The Great Barrier Reef Aquarium is also a very special place. While our displays will never match the size and natural beauty of the Great Barrier Reef we make up for this by providing an environment for learning and a level of visitor services and education not possible at the Reef itself.

It is the people that work at the Aquarium that make it so successful in achieving its goals. Not only our very competent and dedicated staff but also our growing corp of volunteers. In the past twelve months over 110 active volunteers put in nearly 10 000 hours of service. Imagine for a few seconds the implications of this - 10 000 hours of enthusiastic unselfish and caring service to the public in the interests of saving the Great Barrier Reef. Money can't buy this sort of dedication and commitment!

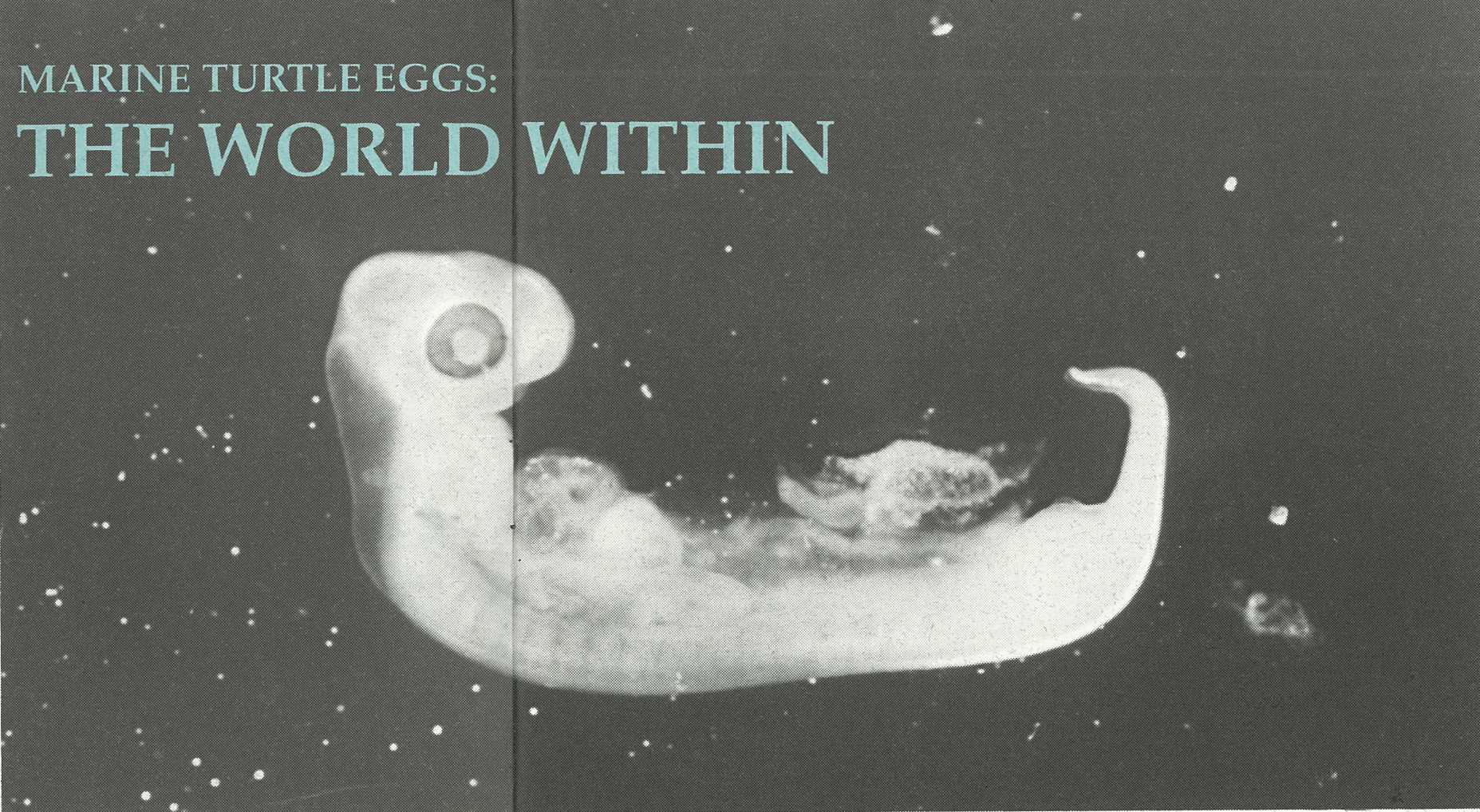
Who knows what primeval instinct or greater power draws people so strongly towards looking after one of Nature's greatest gifts? All I know is that these people, staff and volunteers alike, are helping to achieve our vision of making this the best Aquarium in the world and in doing so are helping to protect the Great Barrier Reef forever.

Though you may not be able to visit the Aquarium or the Reef I hope you will be able to share in a small part of this vision by reading and enjoying *Coralines*.



Ian Burston  
Director

# MARINE TURTLE EGGS: THE WORLD WITHIN



Jeff Miller & Margaret Card

Each year, only a handful of fortunate people witness hatchling sea turtles as they emerge from the sand and scramble toward the sea. However, there is a fascinating sequence of events that occur inside the eggs with no witnesses.

Like that of a bird, development of the embryo of a sea turtle takes place within the egg. However, unlike birds, which are incubated in a nest above ground, sea turtles lay their eggs in a pear-shaped chamber dug into the beach by the female. Inside the egg chamber and then inside each egg the embryo develops from a single cell into a hatchling, ready to take its chances in the wild world. With good luck a hatchling will survive to breed in about 40 or more years.

Different species of sea turtles lay different sized eggs. The process of development of the embryo (embryogenesis) is the same, however, regardless of size.

The egg of a marine turtle is a specialised package that protects the embryo during development and provides its requirements

*A middle phase embryo before the carapace (shell) has formed with pigmented eye, limb buds and tail visible. Photo: J. Miller*

for food, water and respiration. The package consists of three major parts: the shell, the albumen, and the yolk. Each part plays a critical role in the protection and nurturing of the developing embryonic turtle.

### HOW IT ALL BEGINS

Female sea turtles do not lay eggs every year. They spend several years between nesting seasons living in a feeding area. There they must eat enough food to provide the energy for the next reproductive effort. As a female prepares to breed, the follicles (early egg yolks) in her ovaries grow from about 3 mm in diameter to 2 cm or more (depending on the species of turtle). After the follicles have developed to nearly full size, the female migrates to her nesting site. This migration may be only a few hundred kilometres or it may be 2 or 3 thousand kilometres.

The female mates with a number of males about a month before she begins laying eggs for the season. Once inside, the sperm are stored in a myriad of folds at the top end of the oviduct.

### DOWN THE TUBES

The follicles for one clutch of eggs are released from the ovary and make their way into the top end of the oviduct where they are fertilised by the stored sperm. Embryonic development begins almost immediately after fertilisation. The fertilised follicle is now the yolk of the egg. The yolk is the food source for the developing embryo. It provides all the essential energy to support the growing embryo, except calcium. The calcium necessary for making bone is supplied principally by the shell of the egg.

As the yolk moves down the oviduct, special cells in the wall of the oviduct secrete albumen (egg white) which surrounds the yolk with a gelatinous covering. The albumen is a watery protein mixture which provides essential moisture and insulation for the embryo.

Then other cells begin to lay down the inner shell membrane that will support the shell itself. This all happens within the first 36 hours after the follicles leave the ovary.

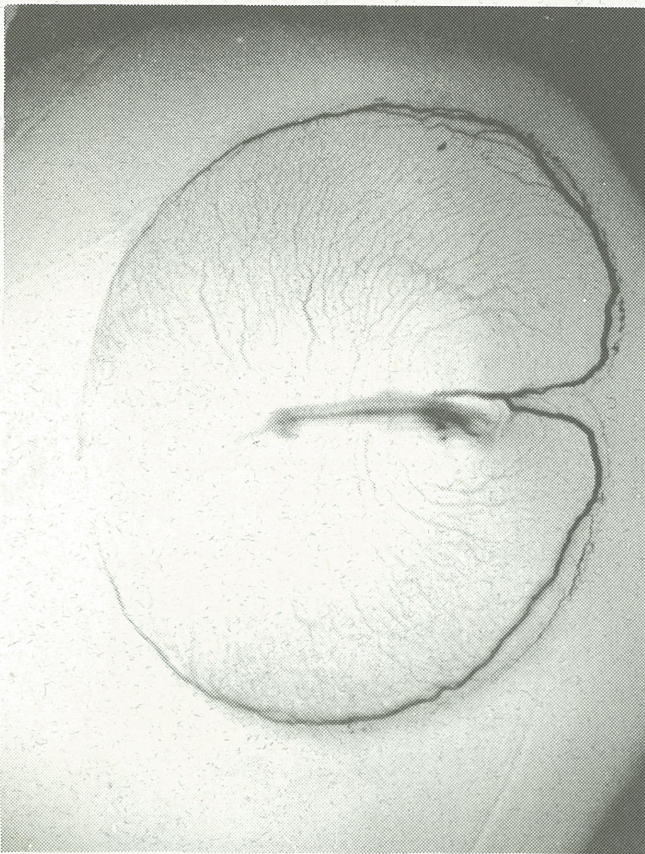


The egg shell is produced by different cells in the oviduct and it requires about 7 to 9 days to be fully formed. The shell of the egg is comprised of an inner membranous layer and an outer calcium layer. Together they form the wrapping around the contents of the egg. Unlike the egg shell of birds, the shell of a marine turtle egg is soft and pliable, but both bird and turtle egg shells protect the embryo and allow respiratory gases (oxygen and carbon dioxide) and moisture to pass into and out of the egg.

During the passage down the oviduct the embryonic cells are undergoing division (making many cells from the one that was formed at fertilisation). When the eggs are finally laid, about 14 days after fertilisation, the embryonic mass is about 4 mm in diameter and contains many hundreds of cells.

#### LIFE'S LITTLE ESSENTIALS

Once the eggs are laid in the egg chamber in the sand, the embryo continues to develop, but temperature, moisture and the availability of oxygen impact greatly on the hatching success of the clutch.



*An early phase embryo with heart and blood vessels of the yolk membrane visible. Photo: J. Miller*

For proper development, sea turtle eggs require temperatures between 23° and 33°C. Temperatures towards the higher end of the range cause changes in the embryo that result in a female hatchling whilst cooler temperatures during incubation result in a male hatchling. The temperature during incubation also slows or accelerates the rate of development. Incubation is shorter when the temperature is towards the warmer end of the acceptable range. If the temperature is too high or too low for too long the embryo does not develop normally and usually dies before hatching. Temperature therefore plays a crucial role in determining the hatching success of the clutch and the ratio between males and females.

The egg of a sea turtle gains weight during incubation by absorbing water through the egg shell into the embryonic world within the egg. If external water is not available, the egg loses weight and the hatchling (if it survives) is usually not as energetic as those that had access to extra water during development. On the other hand, too much water in the sand surrounding the eggs can cause other problems for the developing embryo. If the nest area is flooded by a storm surge, especially towards the end of incubation when the embryo needs more oxygen, the embryo may literally drown inside its egg.

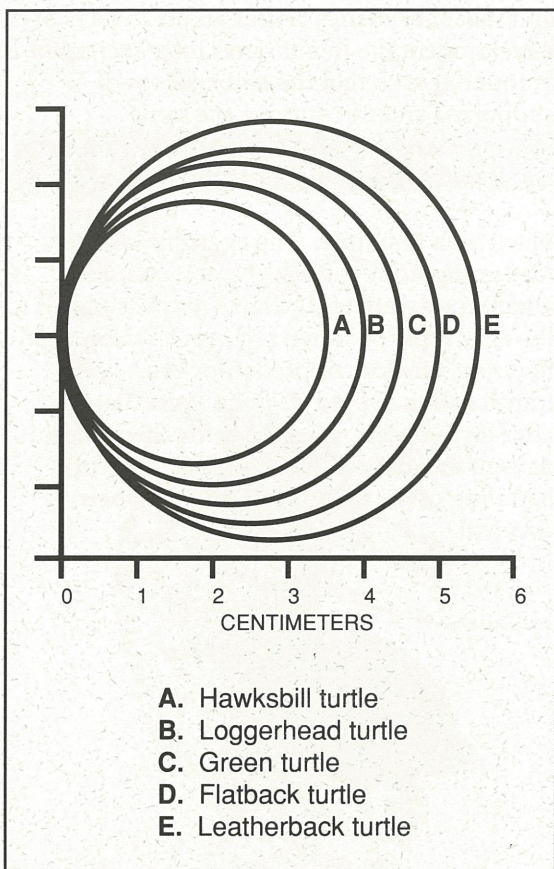
The embryo must breathe during development. A special respiratory membrane lies just inside the inner shell membrane and it is responsible for the uptake of oxygen and water for use by the embryo. Usually there is plenty of oxygen in the sand around the eggs.

#### FROM EMBRYO TO HATCHLING

The process of development can be divided into three general phases: early, middle and late development. During early development the body of the embryo is being formed and the rudiments of organs appear. One of the first recognisable organs is the heart. As soon as possible, the heart starts to pump blood through the network of vessels. This ensures that all the cells in the body receive oxygen and food and that the waste is carried away. Shortly after the heart becomes visible the liver and other organs are recognisable.

During the second phase of development the body of the embryo and its organs become





Relative diameters of the eggs of five species of marine turtles that nest in eastern Queensland.

bigger and the systems of the body begin to work together. Third phase is really one of growth. The body systems have been formed and are functioning. The shell (carapace) of the hatchling has developed and the pigmentation (colouration) of the body has begun. The embryo resides in its private globe and grows bigger and stronger.

As it develops the embryo draws food (energy) from the yolk, which in turn becomes smaller, until the embryo is substantially bigger than the yolk. It gets so big that it must curl to fit inside the egg shell. By the time the embryo is ready to hatch it takes up nearly all of the space inside the egg.

Hatching starts when the embryo begins to move inside the egg, some 6 to 9 weeks after the eggs are laid in the sand. Using the sharp point on the end of its nose the embryo tears a hole through the membranes and through the egg shell. As its head appears through the hole the embryo takes its first breath of air using its lungs, just as an adult turtle breathes. During the next two or three days the embryo struggles intermittently with its egg shell and eventually frees itself. The membranes drop

off and the hatchling's body flattens from the curled position it had inside the egg.

### LOOK OUT WORLD, HERE I COME

After nearly all of the hatchlings have emerged from their egg shells, they begin the digging out process. Together they claw at the top of the chamber. The sand trickles down between them as they burrow upwards. For the next 2 to 5 days the hatchlings will alternately dig and rest. Eventually they sit just under the surface of the sand, until just after dark when the surface of the beach has cooled from the heat of the day. Then the hatchlings emerge *en masse* and scramble across the beach to the sea. Crossing the beach takes only a few minutes. The alternating gait used to cross the beach is replaced with coordinated swimming strokes as they plunge through the waves. The hatchlings orient themselves perpendicular to the incoming waves and swim out into deep water beyond the reef edge. From this time until they return to the feeding areas as adults we know little of what happens to them.

### IMPLICATIONS FOR CONSERVATION

As long as the eggs remain in the nest cavity and are not disturbed most will hatch. However, it is sometimes necessary to shift the eggs to a safer place to protect them from storm surges and/or predators. In the early years of conservation efforts to save eggs, several researchers noticed that the hatching success of nests that had been moved to protected areas was lower than hatching success on the beach. At this time, the general practice was to mark the nests at night and move the eggs to the hatchery in the morning. In 1979 the results from a set of experiments were published that clearly demonstrated the problem was not one of lower fertility in the clutches moved to protected areas as had been suggested previously.

The problem was in the movement of the eggs during a critical period of their development. Inside the newly laid egg the embryo is in a resting phase, but within about 6 hours changes begin to occur. The area directly under the embryo becomes filled with fluid and the membrane around the yolk is stretched. If the egg is moved any time during the first few days the membrane surrounding the embryo and yolk ruptures

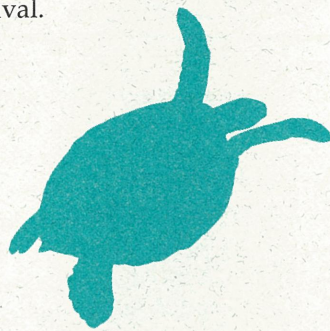




Green turtles in the process of hatching.  
Photo: C. J. Limpus

and the embryo dies. After about 25 days of development the membranes have increased in toughness so that the embryo is well supported and can survive the same movement that would have caused a rupture and death earlier.

The lesson is simple. The eggs of marine turtles should remain in the nest chamber where they were laid, whenever possible. If the eggs must be moved to protect them from flooding, erosion, or predators, the translocation should be done immediately after laying has finished, or after 25 or more days of incubation. In either case careful handling of the eggs is essential for their survival.



## STOP PRESS...

### OSCAR BOWS OUT

The Great Barrier Reef Aquarium is mourning the passing of Oscar, the 1.2 metre Queensland grouper on 12th June.

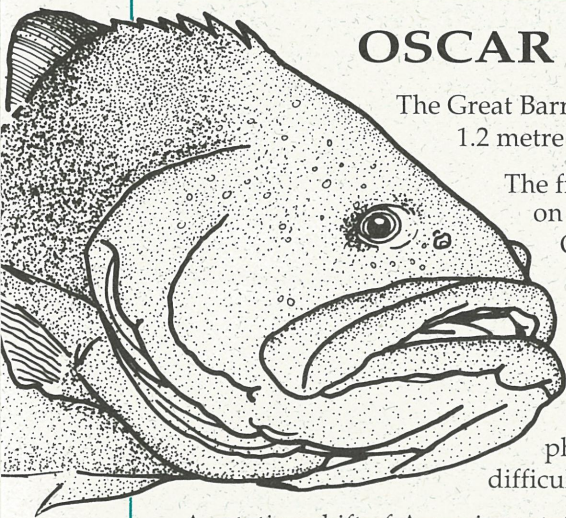
The first indication that anything was wrong came at 6.30 am on that day when the Aquarium security guard reported Oscar swimming upside down (...never a good sign).

After failing to get the 56kg star of the Aquarium's Predator exhibit back on an even keel, Aquarium divers removed him to an isolation tank where a closer examination revealed a slight swelling on one side of the belly. Otherwise, Oscar appeared to be in good physical condition but was very weak and having difficulty breathing.

A rotating shift of Aquarium staff and concerned helpers attended the ailing Oscar for about nine hours before he finally succumbed.

A post-mortem examination revealed a gut blockage of compacted fish bones and evidence of possible associated infection. Tissue samples are being examined by a veterinary pathologist whose findings should throw more light on the actual cause of death.

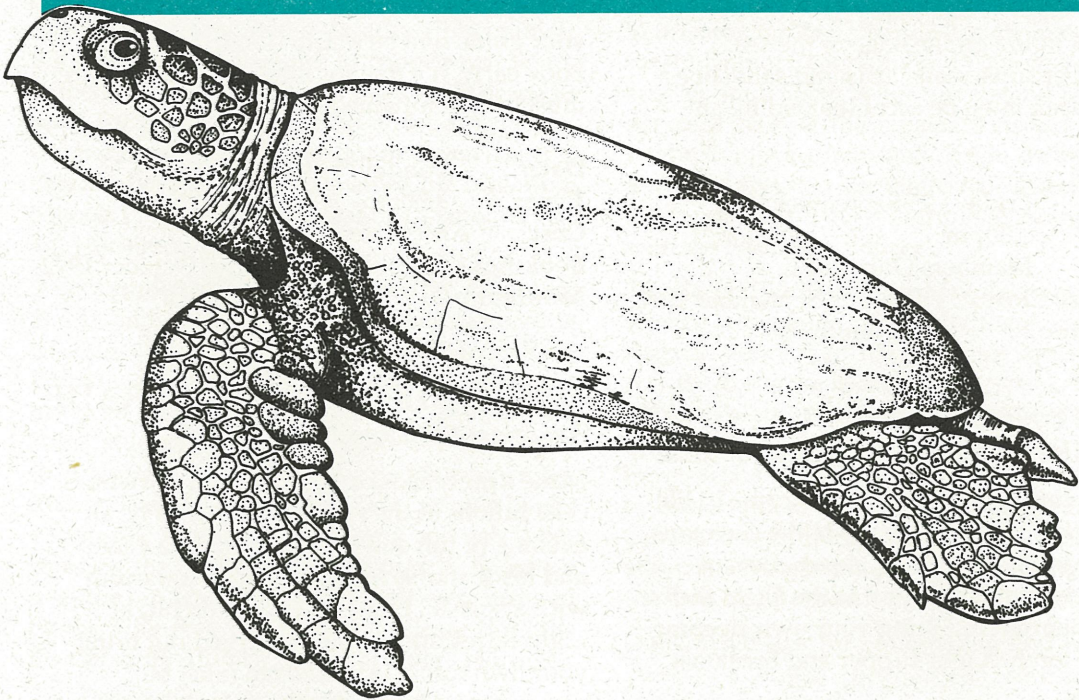
Oscar, then only 50cm long, arrived at the Aquarium in June 1989 after being raised in a home tank from a size of 2.5cm (1 inch).





# ACTIVITIES

SEPTEMBER 1992 - FEBRUARY 1993



**\*Theatrette presentations  
on the Great Barrier Reef:**

10.00 & 11.00am & 12.00noon, 1.00,  
2.00, 3.00 & 4.00 pm (Daily)

**\*Guided Tours:**

11.20 am and 2.20 pm (Daily)

**\* Turtle Feeding:** 10.15 - 10.45 am (Daily)

**\* Shark Talk**

**followed by Shark Feeding:**

Tuesday and Friday 3.20 pm

**\* Craft Activities:**

Saturday 2.00 - 3.00 pm

Sunday 11.00am - 12.00 noon

September School Holidays

11.00am - 12.00 noon (Daily)

Christmas School Holidays

11.00am - 12.00 noon(Daily)

**\*Discovery Sessions:**

**Something New** - 2nd and 4th  
Sunday of the month from  
1.30 - 2.30pm.

In a relaxed and informal atmosphere the Aquarium guides and volunteers will present workshops on various marine topics. The aim is to help members gain a greater appreciation of the marine environment and its inhabitants. Come along and join in.

Other activities may be scheduled during the day, please phone to confirm times.

\* The Aquarium reserves the right to cancel or change program times. To confirm daily events please telephone the Aquarium on (077) 81 8886 Monday to Friday and (077) 81 8891 weekends only.



## GREAT BARRIER REEF AQUARIUM

PROGRAM



## FAMILY FOSSICK

The intertidal area of our beaches is home to an amazing variety of plants and animals. The low tide on Friday, September 25 will give us an opportunity to fossick around the rocks at Rowes Bay. Bring the whole family and look at life on the edge of the sea. Remember sunscreens, hats and sandshoes! All children must be accompanied by an adult.

**Date:** Friday, 25 September 1992  
**Time:** 1.30pm  
**Cost:** Members Only FREE  
**Bookings Close:** Friday, 18 September 1992  
**Minimum:** 20      **Maximum:** 80

## NIGHT STALKERS

*A special Halloween Sleepout just for Kids!*

Want to find out which animals come to life after dark? Kids! See some of the skeletons that live in the Aquarium closet. Lots of Halloween fun is planned as the *Night Stalkers* reveal themselves. Bring your own sleeping bag and torch. Light supper and breakfast provided.

**NO PARENTS ALLOWED!**

**Ages:** 6 - 12 years  
**Date:** Friday, 30 October 1992  
**Time:** 7.00pm - 8.00am  
**Cost:** 1st child \$27.00    2nd child \$23.00  
          3rd child \$21.00  
**Members**  
          1st child \$22.00    2nd child \$18.00  
          3rd child \$16.00

**Bookings Close:** Friday, 23 October 1992  
**Minimum:** 20      **Maximum:** 30

## BEHIND THE SCENES TOUR

Here's your chance to find out the inside story. Why don't we need to feed animals in the Coral Reef Exhibit? How does the turf farm work? See what the predators eat. As we open up the back rooms to the members, your guide will be Martin Jones, Curator. Book early, it's free for members. All children must be accompanied by an adult.

**Date:** Sunday, 11 October 1992  
**Time:** 3.00pm  
**Cost:** Members Only FREE  
**Bookings Close:** Monday, 5 October 1992  
**Minimum:** 20      **Maximum:** 40

## FISHY FRIENDS MASQUERADE

*Aquarium Christmas Party*

Make a reefy mask and join in the Christmas celebrations at the Aquarium. It will be an evening of fun and laughter as Santa Claus and his seahorse sleigh visit the Aquarium with a splash. Enjoy carols by torchlight. Light refreshments will be served but bring your own torch. All children must be accompanied by an adult.

**Date:** Friday, 11 December 1992  
**Time:** 6.30 - 9.00pm  
**Cost:** \$15.00 adult, \$12.00 child  
**Members**  
          \$12.50 adult, \$8.00 child  
**Bookings Close:** Monday, 1 December.  
*(Presents for children under 12 years.)*  
**Minimum:** 80 children

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Book and pay early to avoid disappointment! Use the booking form when you book at the Aquarium Office or Shop. For further information or additional booking forms, please contact GBR Aquarium Office, P.O. Box 1379, Townsville OR Phone (077) 81 8886 Mon- Fri 9 am - 4 pm.

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1993

## VOLUNTEER INTAKE

GBR Aquarium volunteers donate their time and considerable talents to help the Aquarium expand and improve our services to the public. Depending on your time, talents and interests you can assist in a wide range of Aquarium activities: guiding, assisting with Friends and Schools Programs, clerical assistance, helping behind the scenes and some animal husbandry. Application forms available at the front desk from 13 February 1993.

An open night for prospective volunteers will be held on 2 March from 7.00 - 9.00 pm. Find out exactly what volunteers offer the Aquarium and what the Aquarium offers volunteers. Applications close on 2 March.



# EDUCATION NEWS

Loretta Saunders

You may wonder what Seaweed, art students, a city mural, rap music and a twenty five year strategic plan for the Reef all have in common. Simply they are examples of cooperation which helped students better understand the Reef and its need for protection in a fun and exciting way. Cooperation between the Aquarium and a host of organisations is what has enabled the Aquarium Schools Program to really soar this year but let me tell you about the rap first.

School students both in and out of the Aquarium and in and out of school have been involved in creating a future vision for the Great Barrier Reef. From that vision a strategy aimed at achieving it has been evolving in the form of a 25 year plan. Some students had the opportunity to express their future vision in a mural called *Saving our Seas* during Seaweed '92. The mural is painted on the Townsville Multi-storey car park and was sponsored by the Townsville City Council. So where does the rap music fit in? Students were inspired by the *Strat Plan Rap*, a special release from the *Planners with Attitude*. Some of it goes like this ...

*Cooperation is the name of this vision game,  
That will bring the Great Barrier Reef to  
global planning fame!*

More about co-operation! Our new teacher resource books for years 4 - 12 were released earlier this year and feedback to date has been very positive. Primary and secondary teachers were involved in the upgrading of these materials. Despite their being written during school holidays,

we had the opportunity to test at least some of the draft programs on class groups. One of the books *Tourism on the Reef* has been designed specifically for students of Geography and Tourism Studies. It enables students to better understand the fragile nature of the Reef, the impacts of visitors and how Reef activities are managed. If you are a parent or a teacher and you are interested in seeing these books, please call the Aquarium to arrange a time with the Education Officer.

The Early Childhood Teachers Association Conference was hosted in part by the Aquarium in August. More than 100 delegates squeezed into our theatre to hear keynote speaker Gerald Ashby explore opportunities for marine education with this age group of students. Young students have special needs so this session was welcomed by Aquarium staff as well as conference delegates. Our Volunteer Interpretive Trailer was a main attraction at the annual Under Eight's Barefoot in the Park celebrations in June.

Our Open House for Educators in 1993 will be on Tuesday afternoon, February 23 so come along and see for yourself.

To make the most of co-operation, one needs to be ready to go with the flow! Ideas for new activities are evolving all the time and 1993 promises to be a really exciting year. If you would like to be on our education contact list to receive the most up to date information, call us on 818886 or drop us a line with your details.

# EXHIBIT NEWS

Andi Cairns

## A CORAL CAY-IN-A-CORRIDOR!

Picture, if you will, the birth of an island - and a new Coral Cay Exhibit in a corridor!

A coral cay is a reef's child. Carried by waves and winds, reef skeletons pile up on top of the reef. Miles from the mainland, an island is born. At first it is nothing more than a sandbank. Seabirds visit, their droppings enriching the sand, enabling plants to grow. Gradually, what was once part of the sea and the Reef becomes land and offers a haven for roosting seabirds and marine turtles.

In our Coral Cay-in-a-corridor you'll learn how you can visit and enjoy these tropical islands with care and concern for the wildlife that lives there. You'll see turtle hatchlings in the Turtle Pool and learn about turtle research and conservation as well as the biology of these ancient reptiles.

Visit our new Coral Cay Exhibit soon, fall in love with the baby turtles, hear the sound of seabirds and, if you want, wriggle your toes in coral shingle and imagine that you too are miles from anywhere!



# FRIENDS NEWS

Anna Harreboomee

The Great Barrier Reef Aquarium Membership is changing rapidly to accommodate the needs of its many members. The Aquarium sees its members as friends of the Aquarium. Their support plays an important role in educating the community about the Reef. With this in mind the Aquarium has changed the name of the program to **Friends of the Aquarium**.

This is an exciting time for the new program with many of the comments received from our members being considered in its development. Changes to categories will

allow more people the opportunity to support the Aquarium's goal of educating people about the wonders of the reef and the need to use it wisely.

The program sees the addition of a 'Supporters' and 'Out of Town Family' category as well as changes to conditions applying to family memberships and the abolition of the 'Friends' category. Listed below are the new categories for the Great Barrier Reef Aquarium Friends' Program. Why not tell someone you know about the program?

## SUPPORTER

**Contribution:** \$30

**Benefits:**

- \$20 tax deductible
- Regular magazines eg. *Coralines* and *Reeflections*
- Bumper sticker
- Special offers
- VIP tour

## PATRON

**Contribution:** \$300 - \$999

**Benefits:**

- Contributions tax deductible after first \$150
- Same benefits as Members plus
  - Recognition in *Coralines*
  - 10 free passes
  - Invitation to Champagne Gala Evening with Chairman of the GBRMPA
  - Certificate of Acknowledgment

## MEMBER

**Contribution:**

Individuals	\$30
Family <sup>†</sup>	\$50
Student	\$20
Pensioner	20% discount
Defcom	10% discount
Day Care Mothers	\$70
Out of Town Family* <sup>†</sup>	\$40

\* For families residing 60km or more from the Aquarium.

<sup>†</sup> Family membership includes children under 18 only. Special consideration will be given to families with full time students living at home.

**Benefits:**

- Free admission for one year
- Regular magazines
- Bumper sticker
- Special offers
- Discount on guest admissions excluding family tickets
- Discount at Aquarium Shop on all items (except those already discounted) and selected shops in the Complex
- Discount on admissions to the Omnimax theatre

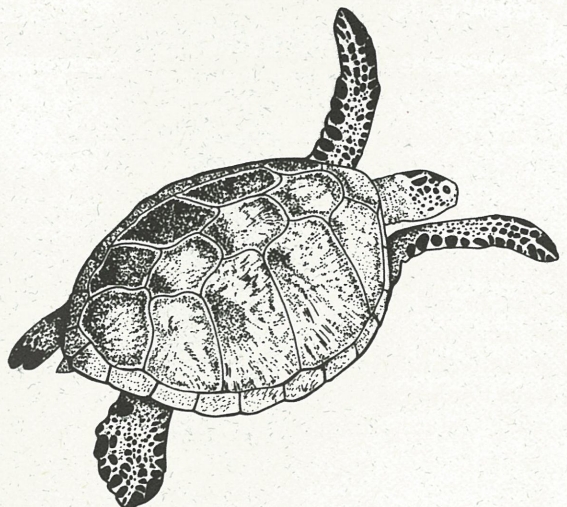
Not tax deductible

## SPONSOR

**Contribution:** \$1,000 and over

**Benefits:**

The Aquarium offers Sponsors naming rights for particular displays, media exposure and use of the facilities. For more information on benefits and privileges available contact the Promotions Officer Phone (077) 81 8892.



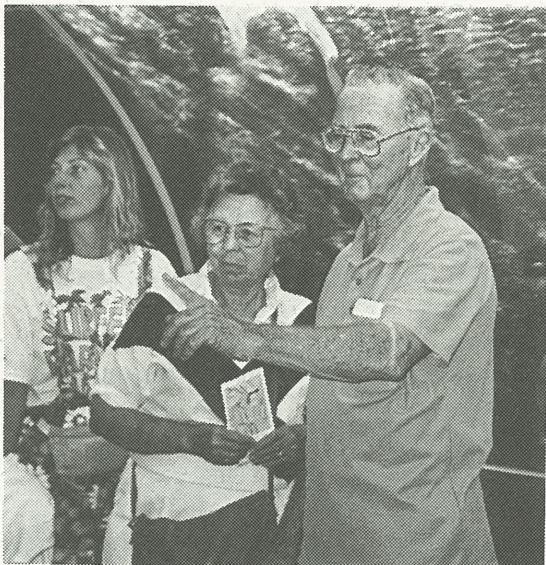


# VOLUNTEER NEWS

Alison Ferry

This year the Aquarium celebrates its fifth birthday. Much has been achieved in those years and it is pleasing to see the Aquarium grow and develop. In that time the Volunteer Program has also come a long way. The volunteers are now largely responsible for themselves through their own Association and decisions are made and new ideas implemented through the Volunteer Management Committee.

As if to seal their fate the volunteers now have their own air-conditioned room which is awaiting some new furniture. This little 'den' serves as a meeting place, a library, work station and relaxation corner where volunteers may snatch a five minute break during their roster. A computer has been purchased and already several volunteers are undergoing training so that notes and course manuals etc may be produced on the spot without having to rely on the Aquarium secretarial support service.



Volunteer David Young shown here conducting a tour was recently presented with a special badge for 1000 hours service. Photo: Sue Hutchinson

Our seventh volunteer course went under way in March and this time it was another 'first' for the volunteers - the very first course completely organised and run by volunteers themselves. It was highly successful and additional feedback has enabled the planning of future courses. Loosely termed as 'user friendly' the courses are structured so that as much knowledge as possible is passed on in

as simple a form as possible. Detailed scientific knowledge is available to volunteers on a variety of topics depending on that person's interest.

Another way of updating information is to attend the Monthly Volunteer meetings held on the first Tuesday of each month. Different speakers are invited to come along and give an illustrated talk on a specific topic. To date this year there have been talks on 'Tiny Sea Creatures' by Professor Bill and Mrs Peggy Hamner from the USA, 'The International Tourist' by Trevor Schofield of James Cook University, 'Emergency Procedures' from Carol Vejle of GBRMPA and 'Getting Across the Conservation Message' from David Lloyd of the Aquarium.

Regular workshops are run for volunteers. This, again, is an ideal way of expanding one's knowledge of a particular subject. Richard Fitzpatrick ran a very interesting Fish Workshop in which volunteers were schooled in the art of identifying fish, Norm Hatherly introduced a Beachcombing Workshop, Loretta Saunders has launched a new Schools Program and ran a workshop entitled Schooling in the Aquarium, and volunteers themselves ran workshops on molluscs and venomous animals. The latter is a very popular topic with visitors and the guided tours and spot talks involving venomous animals are always very well attended. It must be something to do with the macabre in people!

Our ever popular trailer has been doing the rounds solidly ever since its inception and has lately been seen at the Fisherman's Fair in Anzac Park, at Leisurama at Lavarack Barracks, at various school fetes, the Coral Sea '92 Flinders Street East Party and at Anderson Park for the Under Eight's Week. The trailer, which has filled a much needed promotional role for the Aquarium, came about as a result of fund raising by volunteers and a grant from the Sheraton Breakwater Island Trust.

In addition to the Marine Biology Course for Beginners structured by Richard Fitzpatrick, a Home Aquarium Course has proved to be popular. Both these courses now receive advance bookings.



# BLACK REEFS ?

Paul Hough

**The increased frequency of ships transporting oil and goods through Great Barrier Reef waters has increased the potential of a serious oil spill. Will this pose a direct threat to the Reef?**

Most of us have seen the devastating environmental effects caused by large oil spills such as the Exxon Valdez. The television images of blackened beaches and oil covered seabirds invoke reaction from conservationists worldwide. These powerful images sometimes provide the catalyst for action and provoke questions needing immediate answers.

**What would happen to the Reef if there was a large oil spill?**

The answer is not a simple one, because coral reef ecosystems are complex and dynamic. The effect on this system would depend on the type and amount of oil spilled, the prevailing sea conditions and the proximity of the spill to the Reef. Long term studies on coral reefs exposed to chronic oil pollution in the Red Sea have determined serious effects on coral growth, reproduction and species diversity.

Despite research efforts into the effects of oil pollution on corals both overseas and in Australia, very little is known. Many questions remained unanswered, especially concerning Great Barrier Reef corals, and the pollutants they are most likely to be exposed to in the event of an oil spill in Great Barrier Reef waters. This article will provide some of the answers resulting from my research.

## Oils ain't Oils!

Not all oils are the same and some are more toxic

(they contain more toxic compounds) than others. When added to seawater, some oils mix in, others don't (this is generally due to the water solubility of the oil). Some oils evaporate readily, others take a long time to break down. The most common oil carried by ships in Great Barrier Reef waters is used as fuel for ships' engines. This is therefore the most likely oil to be involved in an oil spill on the Great Barrier Reef. This oil, Bunker C fuel oil, was used in this study.

## The Last Resort

Chemical dispersants are used as a 'last resort' in oil spill clean up operations. Together with surface skimmers and boom devices, they are commonly used as the only available method to treat an oil slick. Chemical dispersants effectively increase the surface area of an oil slick. This accelerates the natural weathering processes such as sunlight (via photochemical oxidation and evaporation), water movement (mechanical degradation and dispersal), and biological degradation (via microbial activity). The chemical dispersant used to treat oil spills in Great Barrier Reef waters is Ardrex 6120. This dispersant was used in my research.

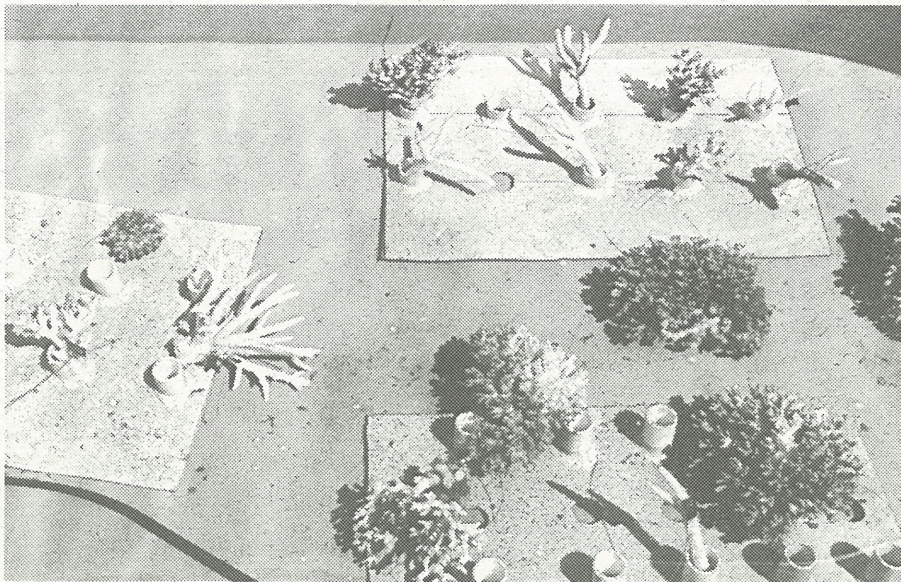
## 'The Effects of Oil and Chemical Dispersants on GBR Corals'

This research project was funded by the GBRMPA and the results are to be published as a GBRMPA scientific report. The research objectives were to (1) determine the effects of an oil spill and use of dispersant on two species of hard coral and (2) examine the effects of rough seas and direct exposure due to low tide on corals after exposure to oil and dispersant. Whole



Paul Hough, Research Officer making one of the many daily observations during the recovery phase. Photo: Lisa Shugg





The experimental corals showing various stages of bleaching due to dispersed oil. Photo: Lisa Shugg

colonies of *Acropora formosa* (staghorn coral) and *Pocillopora damicornis* (brown stem coral) were collected from a reef near Townsville. After collection the coral colonies were transported to the Aquarium, where they were cut into pieces of similar size and tagged for identification. These pieces were maintained in a large tank with good quality seawater supplied for 2 weeks before each experiment.

Each experiment lasted 24 hours. The corals were then removed from their treatment tanks and resituated in clean tanks where they were observed for 21 days.

Wave machines were used to simulate rough sea conditions and pumps were activated at six-hour intervals to simulate the rise and fall of tides.

Observations of coral health were conducted hourly for the 24 hour treatments, then daily for 21 days.

### The Results

- All the corals reacted immediately when treated, initially withdrawing the polyp tentacles.
- *Acropora formosa* appeared more affected than *Pocillopora damicornis* throughout the series of experiments.
- Sea condition does influence the affect of the treatment on corals. This conclusion is supported by the fact that corals exposed to calm seas and treated were the least affected and corals in rough seas were the most affected.
- Corals exposed during simulated low tides were immediately affected and became less able to withstand repeated exposures. Many corals began to bleach during the second low tide.
- The combination of oil and chemical disper-

sant had the most effect. Oil produced more effect than dispersant.

- The corals that were not treated with chemicals remained unaffected.
- Corals which bleached after oil or dispersant exposure were often colouised by algae and, on two

occasions, infestations of marine bacteria were found on colonies of *Pocillopora damicornis*. These unusual manifestations of stress clearly show the complexity of the effects that could be produced by an oil spill.

### Is the Reef at Risk ?

A large oil spill on or near a reef may immediately affect those corals directly exposed either by wave action or low tide. Different organisms will have varying tolerances to the toxic components of oil or dispersed oil. The duration of exposure, type and amount of oil, water temperature and climatic conditions will all have an influence on any potential impact of a spill.

The results of this research show that oil and dispersants can bleach coral under certain conditions and can decrease a coral's tolerance to further stress.

This project proved to be a most challenging one and vitally important to the understanding of the fate and effect of a large oil spill on the Great Barrier Reef. I gratefully acknowledge the assistance given to me by Aquarium staff and volunteers throughout the series of experiments.



A segment of *Pocillopora damicornis* coral showing dispersed oil contact on tips as a result of low-tide exposure. Photo: Lisa Shugg



# THE INS AND OUTS OF VOLUNTEERING AT THE AQUARIUM

By Alison Ferry

Volunteers are unique individuals. They come in all shapes and sizes. Their ages range from teens to the seventies and many of them already have paid work. They are all at the Aquarium with one common goal - their love of the Great Barrier Reef.

Why do people volunteer? What motivates them in the first place? There is no doubt that the Aquarium is a wonderful environment in which to work. If you are feeling stressed out then a perfect remedy is to spend half an hour or so gazing at the fish swimming in the Coral Reef Exhibit, watch the soft corals waving gently in the sunlight and marvel at the myriad of colours of all the plants and animals. Thus, the place of work is in itself, a motivating factor.

However, throughout the past seven volunteer courses offered by the Aquarium, research has shown that volunteers are there for a variety of reasons. First and foremost is the wish to learn more about the Reef. Many have the desire to help and to give of themselves and have an eagerness for new experiences. Some live alone and seek the companionship of new friends and the possibility of having fun as well as having the need to feel wanted. Students in particular want the experience to add to their resumes. For many there is an opportunity to be creative and the desire to become more skilful, more knowledgeable, more useful and more competent. With those skills automatically comes self confidence and new interests.

The benefits of having volunteers in the workplace are numerous. Olive and Doug Tweedie are typical of the



couples who volunteer and enjoy working together and sharing their experiences. They are retired and roster together once a week. Their sense of fun is infectious and Olive says 'We call Tuesday our "Happy Day". We forget about all our worries. The Aquarium makes us feel relaxed and happy. We find that we can relate well to staff - they are so enthusiastic and they inspire us.'

This actually works both ways as staff have often commented that they are motivated by volunteers. Their sheer enthusiasm and willingness often act as a catalyst and many new ideas stem from volunteers. Because volunteers work where they feel they are best suited, boredom very rarely sets in and the visitor reaps the benefits of an effective organisation. An example of this could be in the case of an exceptionally artistic volunteer put to work on a new display. The creative energies of that person will flow onto the staff and the job is often completed in record time. The same applies with craft groups. Each Sunday there is a children's craft session in the Aquarium. To find new ideas and put new games and activities

into place would be a supervisor's nightmare. However, call a group of creative volunteers together and all sorts of ideas evolve.

In return for all these ideas and energies the Aquarium seeks to help volunteers realise their goals. In some cases it may be overcoming the hurdle of public speaking. In others it may be mastering the computer or other office equipment. For others it may be animal husbandry work behind the scenes or scrubbing



Olive Tweedie shows a young visitor the jaws of a shark. Photo: Sue Hutchinson





*Shirley Leonard enjoys working with children of all ages.*  
Photo: Sue Hutchinson

algae off the screens on the turf farm. Skills may be built up gradually and expanded upon and knowledge gained leads to the quest for more knowledge.

When asked why she enjoys volunteering, Olive Tweedie says 'I enjoy talking about the Aquarium to people and helping them to get the most out of what they are looking at. I like people to get their money's worth and visitors appreciate the contact.' Olive's ambition is to be a better guide and to be the best that she can by increasing her knowledge. She feels that this is the first volunteer group she has belonged to that has really satisfied her. 'Other groups that I have been involved in have been useful in helping other people but did not meet my needs', she commented. 'To be satisfied you have to get something out of it yourself.'

Volunteering for a particular cause is easy once the motivation is there. Retaining that volunteer for a period of time is not so simple. It is imperative that motivation levels remain high and recognition comes along often.

Jennifer Brazier is a fine example of the level of retention Aquarium volunteers have achieved. She was part of the first intake of volunteers in 1987 and has rostered on a weekly basis ever since. One important factor to Jennifer is the feeling of being needed. 'What I enjoy is learning something every time that I go', she says. 'It is nice to feel that I am wanted and needed. The Aquarium helps me to keep my mind open to new things. I want to improve my guided tours and spot talks and to keep improving my knowledge.' Jennifer says she enjoys interacting with people.

One way to achieve a high motivation rate is to set goals for volunteers. Susan Hutchinson, Volunteer Coordinator says, 'The volunteers must be continually motivated as they do not

have the monetary rewards of paid employees. Having specific goals motivates the volunteer to engage in activities to achieve these goals. The more challenging and more specific the goal is, the higher the level of performance will be. Once a goal has been accomplished, the goals must be reset to continue to motivate the volunteer.'

Shirley Leonard is a member of the latest intake of volunteers and although confined to a wheelchair finds working in the Aquarium en-

joyable. What may be seen as a problem to others, certainly is not to Shirley and she enjoys being upstairs at the Touch Pool where children especially seem to relate to her. 'Being at the Aquarium helps to build my confidence to do things. I have been practising to do a theatrette presentation and volunteering will help me to speak in front of the public. It will also help me to handle people - in fact not just people, but everything - a lot better.' Shirley's ambition is to give a shark talk, to do a theatrette presentation and later a guided tour. She also wants to work with children doing craft activities.



*Leone Lauriston interprets the Touch Pool to visitors in Townsville for Coral Sea celebrations.* Photo: Sue Hutchinson

Recognition comes in a variety of ways at the Aquarium. A system of tallying hours worked and then credited for Membership of the Aquarium or complimentary passes for friends has been popular since the inception of the Volunteer Program. Lately honour badges showing milestones worked have been awarded. Volunteers reaching 200 hours, 500 hours and more recently 1000 hours have been rewarded with badges at a special ceremony. A Volunteer Breakfast, cooked and served by the staff, has been held once a year as a way of saying 'thank you for all your help'.



# CURATORIAL NOTES

## Marine Cuisine

All animals in the Aquarium need food. Some find their own food growing in the tanks while others must be fed by the staff.

Every second day the animals in the small exhibit tanks are fed a range of foods prepared by aquarists. This can range from fresh to frozen seafoods but a few will only accept live food. Seahorses, pipefish and pineapple-fish, for example, are fed tiny live shrimps and fish fry. Larger barramundi and mangrove jacks receive live mullet, whiting and prawns. Squid, cuttlefish and octopuses also prefer live food which they hunt actively. Their spectacular colour changes are fascinating to watch.



Aquarist Ian Preece preparing the Predator Exhibit feed.  
Photo: Doug Drummond

Fish are usually fed according to their size. Large fish get pieces of prawn or fish while small fish are fed a special mash made by putting fish, prawns, commercial 'marinara mix' and peas through a mincer. This is supplemented by packaged frozen brine shrimp.

Animals that are either slow feeders or not scavengers are fed using a spike. Feeding with the spike also ensures that food is evenly distributed to all animals.

Sharks and other large animals in the Predator Exhibit are fed mainly on whole fish which are purchased from local trawlers. This 'trash bait' includes species like goatfish, flathead,

whiting, trevally and grunter. At each feed these predators devour up to 13 kilograms of food. They are fed twice a week.

Ian Preece

## Reef Alive

There is a place in our Coral Reef Exhibit that only a few select people ever see ... the reef top! These select people are the Aquarium divers and lately the reef top has been an exciting place to see.

In the last year we have introduced 15 special damselfish called *Stegastes apicalis*. These fish are extremely territorial and defend their small area of reef real estate against intruders. So aggressive are these fish that they don't allow algal-eating fish to stay around for long on the reef top. The activity of these damselfish has allowed a luxuriant algal lawn to flourish, along with healthy colonies of hard and soft corals.

One of the most exciting discoveries in the Coral Reef Exhibit was our first home-grown coral. Diver Geoff Shannon found the baby *Pocillopora* coral when it was only the size of a finger tip. It had grown from an adult coral that had spawned in the tank. Since then, baby soft corals have started to appear everywhere, both on the rocks and the walls. Some of these new soft corals have arisen from small detached pieces of a parent colony. Also the adult soft corals are growing and expanding, as you can see through the large viewing window near the crayfish tank.

The reef top is now a nursery for soft and hard corals. Some of these corals have resulted from adult colonies spawning in the tank, whilst others have been individually collected from the field or brought in on algal rock. Reef top varieties include brain coral, plate coral and mushroom coral as well as anemones and many types of typical reef algae. All are surviving well, thanks to our reef top damselfish, unseen heroes in the Coral Reef Exhibit.

Chic Nelson



# Kids' Corner

Hi Kids! I hope you enjoy the activity put together for you. Rosemary and Lyn tell me that they are looking forward to receiving your letters so write soon. Remember, if you have any jokes or riddles about the sea please enclose them with your letter. Here is a Jig-Saw Puzzle for you! Photocopy the picture of me talking to some of my Aquarium friends first, colour us in then cut out the Jig-Saw pieces and you can have lots of fun trying to put us back together again! Look in on me the next time you are in the Aquarium.

Sidney



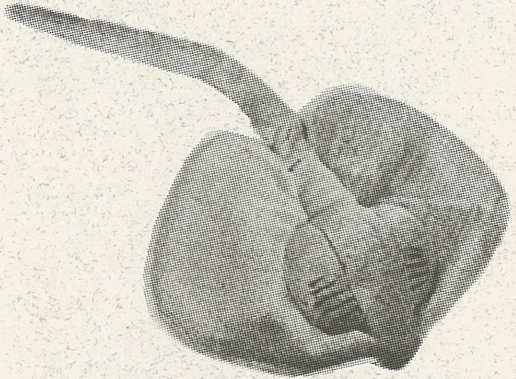




To obtain any of the items listed please visit the Great Barrier Reef Aquarium Shop,  
Great Barrier Reef Wonderland Complex, Flinders Street East, Townsville.

Phone (077) 818875 OR write to:

The Great Barrier Reef Aquarium Shop  
P.O. Box 1379, Townsville, 4810 QLD  
Fax No. (077) 818713

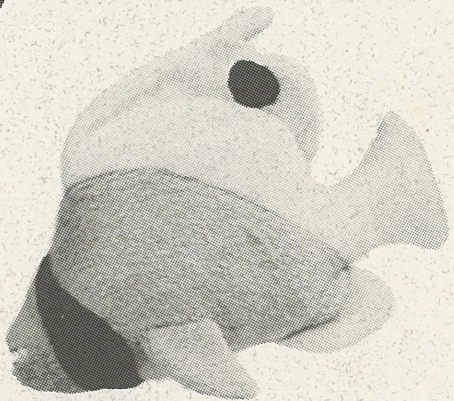
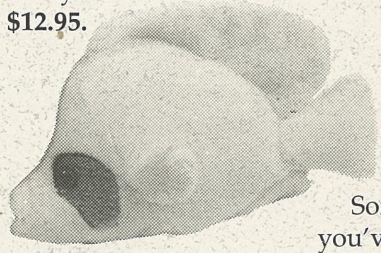
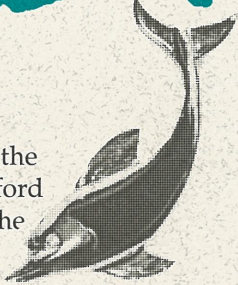


# Shop Talk

## Brooches

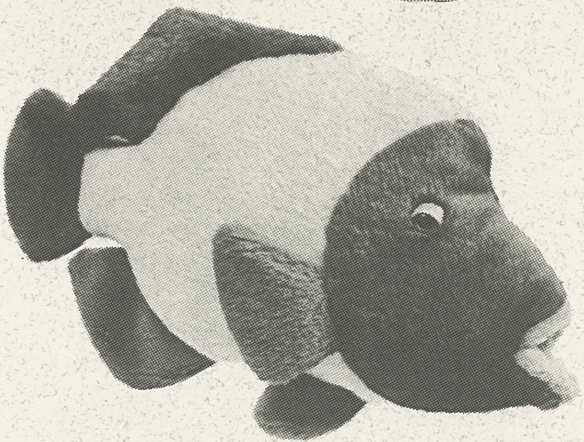
Beautiful brooches designed especially for the lady with style. At these prices you can afford to change your designs every day. Be the envy of every woman, we have designs to suit everyone.

Priced from \$12.95.



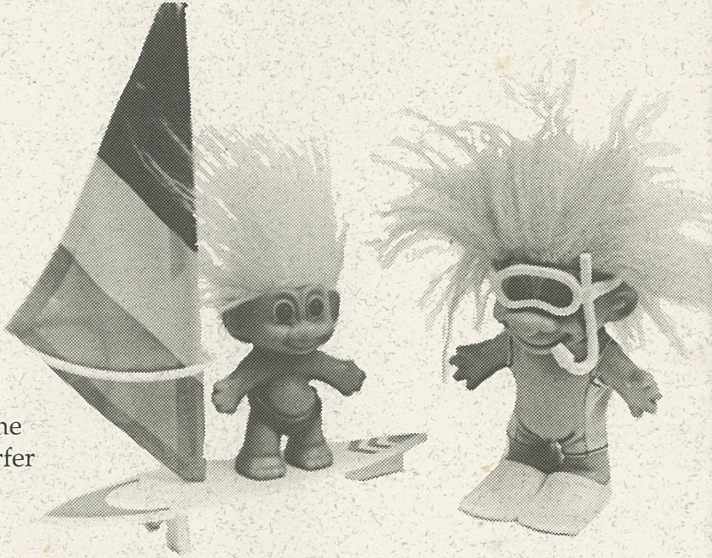
## Soft Toys

Soft, plush toys galore, the cuddliest cuties you've ever seen, from seals to sharks, a wide variety to love as toys or mascots, priced from \$4.95.



## Troll Dolls

These tiny terrors of Townsville tantalise the tourists and locals alike. We have windsurfer and snorkeller designs to choose from, priced at \$11.95.



*Prices are effective until 28/2/93 and do not include postage and handling.*