

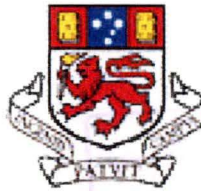
# **THE ROLE OF MARINE DISCOVERY CENTRES IN SUPPORTING ENVIRONMENTAL EDUCATION**

**Case Study: Woodbridge Marine Discovery Centre, Tasmania**

by

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## **DECLARATION**

This thesis contains no material that has been accepted for the award of any other degree or diploma in any tertiary institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except when due reference is made in the text.

Irene H. Sahertian

## ABSTRACT

This thesis examines the role of coastal and marine environmental education in Tasmania by using Woodbridge Marine Discovery Centre (Woodbridge MDC) as a case study. This study hypothesises that a marine discovery centre is an effective means of promoting marine environmental education. The aims of this thesis are (1) to critically analyse the extent to which the Centre promotes marine environmental education in Tasmania; and (2) to determine how effective the Centre is in facilitating environmental education for school students in Tasmania.

The features of five marine discovery centres in Australia are described, including Tasmania's Woodbridge MDC. These centres have a similar philosophy: to provide students with experiential learning and simultaneously equip them with marine knowledge. However, each Centre has its own program for students and communities based specifically on the local coastal and marine ecosystem types.

To find out how effectively marine studies are carried out at Woodbridge MDC, one hundred and five Grades 5 and 6 students were surveyed using a questionnaire. Surveys were conducted using fifty-two students as the Focus group. The same group (the Repeat group) was re-surveyed six weeks after their visit to the Centre. Fifty-three students who had not visited the Centre composed the Control groups. Some additional data were gathered from students at the Centre, through observation, and from teacher and education staff interviews.

The survey results differed from those expected from the hypothesis. They showed no significant difference between the Focus and Control groups with regard to their general knowledge of, and enthusiasm for, the coastal and marine environment. It is likely that this is because most Tasmanian students have had prior experience of fishing and activities at the beach, supporting their general knowledge and interest in the coastal and marine environment.

However, the Focus groups presented higher scores than the Control groups for specific knowledge about marine life and their characteristics. They were also more motivated to explore the coast as opposed to using the coast as a purely recreational

resource. The Focus groups also gained specific knowledge from their visit to Woodbridge MDC and appreciated exploring marine organisms at the Centre. Teachers and education staff gave very positive feedback on the benefits of Woodbridge MDC based on their experience in marine environmental education.

This study indicated that students' appreciation, knowledge and environmental behaviour related to coastal and marine environmental education cannot be adequately evaluated through a short-term study based on a single questionnaire survey. However, a visit to the Centre may result in a longer-term benefit. This study could be regarded as a pilot study with the findings interpreted tentatively. A longer-term study of students from kindergarten to higher levels is required to more fully assess the effectiveness of the Woodbridge MDC program.



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## **LIST OF ACRONYMS AND ABBREVIATIONS**

<b>CIESIN</b>	The Centre for International Earth Science Information Network
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation
<b>MAFRI</b>	Marine and Freshwater Resources Institute
<b>MDC</b>	Marine Discovery Centre
<b>MESA</b>	Marine Education Association of Australasia
<b>GPS</b>	Global Positioning Systems
<b>K-12</b>	Kindergarten to Year 12
<b>RV</b>	Research Vessel
<b>SOSE</b>	Studies of Society and Environment
<b>TASSAB</b>	Tasmanian Secondary Schools Assessment Board
<b>TCE</b>	Tasmanian Certificate Education

# CHAPTER 1

## INTRODUCTION

---

### 1.1 Introduction

Coastal and marine ecosystems are an essential part of the natural environment and an important reservoir of biodiversity. However, they are fragile and are easily impacted by human activities, both on land and in surrounding marine areas. Therefore they need to be protected and carefully managed. Education is recognised as having an important role to play in improving conservation and sustainable management of coastal and marine ecosystems (Martin 1983:1). It is important that school age students are educated about the principles of coastal and marine ecology and concepts of sustainability as part of their overall education. This is the primary role of Marine Discovery Centres (MDCs). To assess how effectively marine studies are applied in Tasmania, this thesis carries out a study at the Woodbridge Marine Discovery Centre (Woodbridge MDC). The Centre was explored as a case study on marine environmental education, with the purpose of examining the value of its contribution to the marine education of school children in Tasmania.

Agenda 21 from United Nations Conference on Environment and Development, as the universal guideline for the world's environmental development, is concerned with the position of young people as they make up almost thirty per cent of the world's population (UNSD-United Nations Division for Sustainable Development 2001:ch.25). It is stressed that all over the world young people are highly vulnerable to the effect of environmental catastrophes, but they are highly responsive to environmental thinking. It is a large and essential task to prepare this generation for their future as managers of natural resources and simultaneously to help them to develop environmental problem solving skills (including those related to the marine environment).

In addressing this problem, environmental education that leads to better use of natural resources is a conservation strategy supported by the United Nations Conference on Environment and Development (CIESIN 2002:1). This concept of

environmental education emphasises intellectual skills and life style in multi-disciplinary subjects such as social science, humanities, science, arts and global education (United Nations Division for Sustainable Development 2001:ch.25, Geesteranus 1999:3). It is hoped that such a strong educational system, will maintain the well being of society at large (Baird, 1998:39-40). However, the problem that presents itself is finding an effective approach for teaching the value of sustainable environmental practices.

## **1.2 The State of Marine Environmental Education in Australia**

Since the mid 1970s, marine environmental education at all levels has been taking action to support the world conservation strategy for coastal and marine environments and caring for local ecosystems health (Moffatt 1997:195). Various activities in coastal and marine environmental education have developed. Programs include aquaria, marine and wildlife parks, school courses (especially education for biodiversity, aquaculture, fishing, boating, navigation and oceanography), marine discovery centres, maritime colleges, university courses, associations (such as Marine Education Society of Australasia-MESA), and organisations (such as Seacare and Coastcare). In particular, for school students at least five marine discovery centres have been developed in four different Australian states. Detailed discussions of these centres are provided in Chapter 3.

An experiential learning approach in the centres' education programs is practised to enhance students' ability to learn about coastal and marine life. For this purpose, these centres set up onshore and offshore field trips, and provide adapted local coastal and marine ecosystems indoors. In addition, there are some unique characteristics of the Australian marine discovery centres that do not exist in MDCs in other countries. According to Moffatt (1997:196) Australian MDCs have the most innovative coastal and marine education program in the world, where students can study boating and snorkelling as part of the normal program, they can experience an unpolluted marine environment and be educated by accredited teachers. Australian MDCs are seeking to provide students with a quality coastal and marine education that will encourage them to become actively involved in environmental sustainability.

## **1.3 Research Approach**

### **1.3.1 Research Hypothesis**

The hypothesis of this study is:

- that a marine discovery centre is an effective means of promoting coastal and marine environmental education.

### **1.3.2 Research Aims**

The major aims of this study are:

- to critically analyse the extent to which the Woodbridge MDC promotes coastal and marine environmental education in Tasmania; and
- to determine how effective the Woodbridge MDC is as a means of developing environmental education for school students in Tasmania.

### **1.3.3 Research Objectives**

Based on the aims, specific objectives of the study are:

- to provide a brief overview of MDCs in Australia;
- to carry out a survey of school children at the Woodbridge MDC and in their school; and
- to interview teachers and other environmental educators about their views on the role of Woodbridge MDC.

### **1.3.4 Research Questions**

The aims and objectives were developed into five basic research questions below:

- a. To what extent does the Woodbridge MDC promote coastal and marine environmental education for Tasmanian students?
- b. Is the Woodbridge MDC an effective means for developing awareness of the coastal and marine environment for students?
- c. What aspects of the education program at Woodbridge MDC are effective for coastal and marine environmental education in Tasmania?

- d. How much practical and theoretical marine ecology knowledge is imparted to students?

### **1.3.5 Research Method**

As coastal and marine environmental education encompasses a broad range of topics, this study focuses on the promotion of coastal and marine knowledge for school students. Information was collected about MDCs in Australia through searching literature and related web sites. Additional information was collected about Woodbridge MDC from observations at the Centre and through interviews with the staff. This included information on its history, operation and promotional resources, and policies for the promotion of coastal and marine environmental education.

The focus of this research was to find out how effectively coastal and marine studies are carried out in the MDC in Tasmania. Simple questions (both oral and written) were asked to sample groups of students. The questions related to the students' opinions of their activities on the beach, their enjoyment with regard to coastal activities, and their knowledge of the marine environment. The purpose of the questions was to assess students' knowledge and their level of motivation to conserve the coastal and marine environment.

The questionnaire survey conducted with two different school groups. The first group was the Focus groups consisting of two classes from different school. They attended Woodbridge MDC in August 2001. These classes were again surveyed six weeks after their visit (the Repeat Groups) to find out what they remembered. The second group was the Control groups, which comprised two school classes that did not attend the centre. All classes were from Grades 5 and 6 with about fifty students in each group. The interviews were conducted in smaller groups of four to six students. Additional information was also gathered from education staff and teachers.

## **1.4 Intended Benefits of study**

It is hoped that this study will be useful for application in Indonesia (the author's home country), which has many coastal communities. The Woodbridge MDC

program could be adapted to include traditional or local knowledge and methods of coastal management, and then applied to coastal and marine environmental education in Indonesia. The research could ultimately be used to help developing marine studies centres.

It also is intended to use the results of this study as useful feedback for the Woodbridge MDC staff. No formal evaluation of the role of Woodbridge MDC has been done before.

## **1.5 Structure of Thesis**

This thesis consists of six chapters. It begins by addressing the proposition that coastal and marine environmental education is a good way to prepare the young generation to care for their environment in order to achieve a sustainable community in the future. Chapter 2 explores some related concepts of the role of marine discovery centres in supporting environmental education. An overview of marine discovery centres in Australia, including Woodbridge, and their environmental education programs is presented in Chapter 3. Chapter 4 outlines the research methodology used in the study. The results, interpretation and discussion are presented in Chapter 5. Chapter 6 concludes and provides some recommendations.

## **CHAPTER 2**

### **THE ROLE OF MARINE DISCOVERY CENTRES IN SUPPORTING ENVIRONMENTAL EDUCATION**

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#### **2.1 Introduction**

Students can learn about the coastal and marine environment in many ways, but learning by experience needs a certain set of circumstances that provides information about underwater life. Students are able to explore coastal and marine environments through direct visits or via environmental interpretation centres (such as aquaria and marine parks) or environmental education centres (such as marine discovery centres). This chapter concludes that marine discovery centres are an excellent place for study of the coastal and marine environment.

However, there is a lack of literature dealing directly with the education benefits of marine discovery centres. The literature reviewed has provided some elements that are relevant to marine discovery centre programs. These include outdoor environmental education activities, indoor facilities such as museums or display centres, and the experiential learning approach to learning. This chapter analyses critically the role of these three elements in assessing marine discovery centre programs.

#### **2.2 The Role of Marine Discovery Centres in Outdoor Environmental Education**

##### **2.2.1 What is Outdoor Environmental Education?**

Outdoor environmental education for students can be interpreted as ‘providing students with direct contact with nature’ (Simmons and Young 1993:96). In this way, outdoor environmental education can develop primary concepts to facilitate more understanding of complex ecological concepts (Novak 1987 in: Lisowski and Disinger 1991:19). The immediate aims of outdoor education are to emphasise



awareness, understanding, concern, commitment and problem solving abilities with regard to the environment (Crossen 1980:144). Therefore, this practical experience can stimulate students in their understanding of the value of the environment and find ways of improved environmental management.

A common feature of outdoor environmental education in schools has been a field trip as an extra curricular activity. In Australia, this concept was developed in the early 1980s by the First National Conference of the Australian Association for Environmental Education. Since then, it has evolved to become a part of the official school curriculum (Brookes 1989:15).

There are four major aspects of an outdoor environmental education program stated by Horwood (1996:10). The first is *earth links*, in which students gain knowledge and direct experience of their surroundings. The second is *stories*, in which students receive descriptions and explanations of the world in context. The third is *wonder*, in which students develop an appreciation and sense of wonder at living creatures. The fourth is *personal identification* related to their expanding personal view of 'outside' as being a part of the environment. These characteristics can be adopted simultaneously in an outdoor education program.

However, it is not easy for teachers to conduct outdoor environmental education. Some barriers to outdoor education will be discussed in more detail later in this chapter. Besides these barriers, teachers may also need to adapt their class program to suit the local circumstances.

Marine discovery centres adopt some aspects of outdoor environmental education but they cannot be seen as simply providers of outdoor environmental education. These centres do generally offer various field trips with the main objective of promoting knowledge about on-shore and off-shore communities. However, as well as providing direct affective experiences (such as context, a sense of wonder, and personal view of marine issues), they also provide cognitive skills. Moreover, being under the guidance of the school program and/or state education curriculum, the program is specifically supervised by a professional institution (including qualified teachers, suitable facilities and appropriate program).

### **2.2.2 Barriers to Outdoor Environmental Education**

The preparation involved for teachers can be a significant barrier to this form of education. Teachers' perceived lack of skill and knowledge to interpret and present the outdoor environmental education curriculum, and their duties and responsibilities in regard to students' comfort and safety are also barriers for outdoor environmental education (Simmons and Young 1993:96, Hanna 1996:11).

There are several barriers that teachers need to be aware of (Hanna 1996:12-14), some of which are described below. In each one, Woodbridge MDC has assisted Tasmanian teachers to overcome such barriers.

- **Senior administrative support**

A barrier arises if the school's senior administration staff is not supportive of outdoor environmental education activities for students. To overcome this barrier, the teacher needs to show the cross-curricular value of such activities.

However, this is not a problem for Woodbridge MDC. As a provider of an outdoor education program, the Centre has been in high demand since the first year of its existence. Lack of support by senior staff has not been a problem for Tasmanian students visiting the Centre.

- **Teachers' competence**

With limited training, experience and confidence, the teacher must deliver the program. As outdoor environmental education is a cross-disciplinary subject, the teacher requires assistance to complement his/her strengths and weaknesses. The involvement of one or more adults (parents, grandparents, friends or senior students) is often required to assist the teacher (McCormack 1996:22).

In the case of Woodbridge MDC, it is not necessary for visiting teachers to have professional expertise in marine science. The Centre employs experienced teachers and skilled staff to support the teachers in preparing students for coastal and marine education.

- **Scheduling outdoor environmental education field trips**

Scheduling of outdoor education has to be well managed. Taking a large group of school students into the outdoors increases risk, but taking several small groups is time consuming. A day-trip is generally needed, so that students become involved in an in-depth way (Ballantyne and Uzzell 1994:113).

Providing a variety of activities and good preparation before visiting the Centre has solved the potential overload of visitors at the Woodbridge MDC. Except for the introduction and discussion sessions, a visiting class is divided into sub-groups, which are rotated around the various workstations. Prepared work sheets (from the Centre and/or the school) and some senior assistance (from school teachers and parents) are also effective strategies.

- **Equipment**

Preparing adequate field equipment and facilities for coastal and marine studies is often expensive and difficult. This barrier can be overcome by taking the class to a purpose built marine studies centre.

Woodbridge MDC is set up to help Tasmanian students learn about coastal and marine environments, and its equipment and facilities have been improved over time. So, by choosing such an environmental education centre to conduct fieldwork, students are able to use quality equipment and resources.

- **Safety and legal liability**

It is important to understand common physical risks in the outdoors. Careful planning by teachers and preparation of students is required. Visiting an environmental education centre offers professional service, safe activities and legal liability insurance.

In the case of Woodbridge MDC teachers are notified to instruct the visiting students to obey certain regulations at the Centre, including during the boat trip. Regulations are designed to avoid risk to students and also to marine creatures.

There are also emergency procedures. These are discussed and explained to the schoolteachers when they attend the pre-visit seminar (see p27). In addition, Department of Education Tasmania has guidelines for outdoor environmental education (Department of Education Tasmania 1998).

- **Budget**

Cost is the most common obstacle to outdoor education. Cost is also a challenge for Woodbridge MDC to improve its services, especially in providing extra services, such as the travel program to other parts of the state. To support the continuation of the Centre's programs, the students are charged a small fee per class (from \$75).

## **2.3 The Role of Marine Discovery Centres in Environmental Education and Environmental Interpretation Programs**

Marine environmental education can be undertaken either through environmental education or environmental interpretation programs, even though the facilities are different. Both programs have similar principles: to communicate environmental messages and develop environmental literacy (Ballantyne and Uzzell 1994:112). Moreover, the first value of both environmental interpretation and environmental education can be described as a "wonder" experience toward an object as the initial response (Lisowski and Disinger 1991:19)

However, there are differences between the two approaches. Environmental interpretation programs are mainly undertaken in natural/protected areas, and aim to impart natural resource management knowledge including conservation issues (O'Brien 1996:15). On the other hand, at environmental education sites (such as discovery centres, museums and heritage sites), students are the targeted group, intended to gain environmental knowledge, concepts, skills, informed attitudes/values and develop sustainable environmental behaviour (Ballantyne and Uzzell 1994:113).

Environmental interpretation programs at interpretation sites are limited in their capacity to promote environmental education to visiting school students compared with environmental education facilities. Ballantyne and Uzzell (1994:115-116) assessed some of the limitations of environmental interpretation facilities for visiting school students, as shown below:

- **Interpretative methodologies do not match the aims of environmental education.** The interpretative aim does not focus on the school curriculum. Displays/experiences are broader and do not really focus on education of school students.
- **Interpretative experience does not match the age of the student group.** In most instances an exhibition and interpretative material will be aimed at a wide spectrum of visitors rather than focused upon the educational needs of young students.
- **Facilities and services are not matched to the needs of teachers/students.** The needs of students and teachers during school visits to interpretative education centres differ from those of recreational visitors and tourists. The displays and exhibitions are primarily designed for visitors and tourists. On the other hand, Uzzell and Parkin (1978) in: Ballantyne and Uzzell (1994:116) concluded that school visits have the following requirements:
  - a. The availability of both teacher and student educational resources;
  - b. Specialist staff;
  - c. Lecture room facilities;
  - d. Minimal costs; and
  - e. Provision of interpretative material linked to the national or state curriculum.
- **Interpretative resources are not matched to the constraints of curricula.** The majority of school visits have a curriculum-related purpose. Teachers have neither the time nor the resources to stray far from the formal curriculum. But the impact of curriculum and institutional constraints on the undertaking of environmental fieldwork will vary from one place to another.

As part of an environmental education program, coastal and marine environmental education links outside phenomena to the classroom and enables observations in a natural setting. According to Ballantyne and Uzzell (1994:114) learning about nature requires direct exposure to objects rather than learning about them in a classroom setting. Moorcroft *et al.* (2000:20) assert that classrooms traditionally have been very structured. Therefore, through discovery centres, students are provided with facilities to discover real examples or objects in natural ecosystems, apply theoretical knowledge in the field, and develop ideas to cope with environmental problems, which could improve positive behaviours toward the environment (Ballantyne and Uzzell 1994:114). However, not all students are able to go into the field. Especially for young students, a field trip can be difficult. So, in order to enrich the indoor programs, the marine discovery centres use live specimens from the local marine environment (Waters 1996:23).

In applying an environmental education model, therefore, MDCs offer outdoor and indoor programs. The outdoor programs consist of both on-shore and off-shore activities. For the Woodbridge MDC experience, these programs have been seen as ideal opportunities to study ecosystems and the oceanography of the local area (Martin *pers.com.*, 2002). Goodwin and Adkins (1997:50) and Ballantyne *et al.* (2001:10) agree that if field trips and research about local marine environmental issues are interesting and enjoyable, they will stimulate students' enthusiasm about environmental problems as well as encouraging a sense of responsibility for caring for their environment.

## **2.4 The Role of Marine Discovery Centres as Museums or Display Centres**

Museums are a setting for imparting knowledge to visitors through displays. If discovery centres, or in this case, marine discovery centres, also display artistic, historic, or scientific objects, they can be categorised as museums (Heffernan 1998:26). Screven (1976) in: Heffernan (1998:26) emphasized that through displayed objects, discovery centres are significant alternative environments for self-education. They are also designed as a place for communicating knowledge (Heffernan 1998:27). Ballantyne and Uzzell (1994:112) and Russell (1990:p) in: Rix and McSorley (1999:579) maintained that for the visiting students, discovery centres

provide good teaching methods and education, the program contributing to the development of knowledge, positive attitudes, and an interest in marine science.

As will be shown in Chapter 3, the museum role relates to marine discovery centres as an ideal place to study the natural environment and wildlife, because it provides valuable collections of marine species and artefacts. Heeps (1996:583) took the view that marine discovery centres play a crucial role in public understanding of the marine environment. He explained that centres commonly display underwater creatures, which are rarely encountered by the general public. Through visiting a marine discovery centre, people often have their first experience of life below the sea surface (Heeps 1996:583).

## **2.5 The Role of Marine Discovery Centres in Experiential Learning**

Science educators take the view that a hands-on approach or learning by experience is important in developing students' cognitive skills. Examples include Crossen (1980:146) who stated that exploring natural environments through involvement is a good technique for learning. Halpin (1992) in: Nabors (1999:744) found that learning through experience tends to increase students' knowledge. Dale (1969) in: Diem (2001:46) studied the importance of learning by experience. She found that most of what students see, hear, discuss and practise together will be remembered (90 %). However, a much smaller percentage of what they only see, hear, or read without discussion and practice, will be remembered (20 – 30 %). These findings indicate that learning in and about the natural environment (including the coastal and marine environment) requires actual experience using a hands-on approach.

Other literature supports the effectiveness of the experiential learning approach in the process of learning science, particularly environmental science. As Diem (2001:46) suggested, to make learning science easier and more enjoyable, it should be based on learning from experience. He argued that the experiential learning approach allows students to be presented with a problem, situation or activity which they can solve with minimal guidance from an adult (Diem 2001:47). This learning process follows the diagram presented in Figure 2.1. It explains that the first step of the learning process is introducing students to enjoyable activities (experience), followed by

reflecting their experience by sharing and processing, and then by summarising their experience through generalisation and application of their experience.

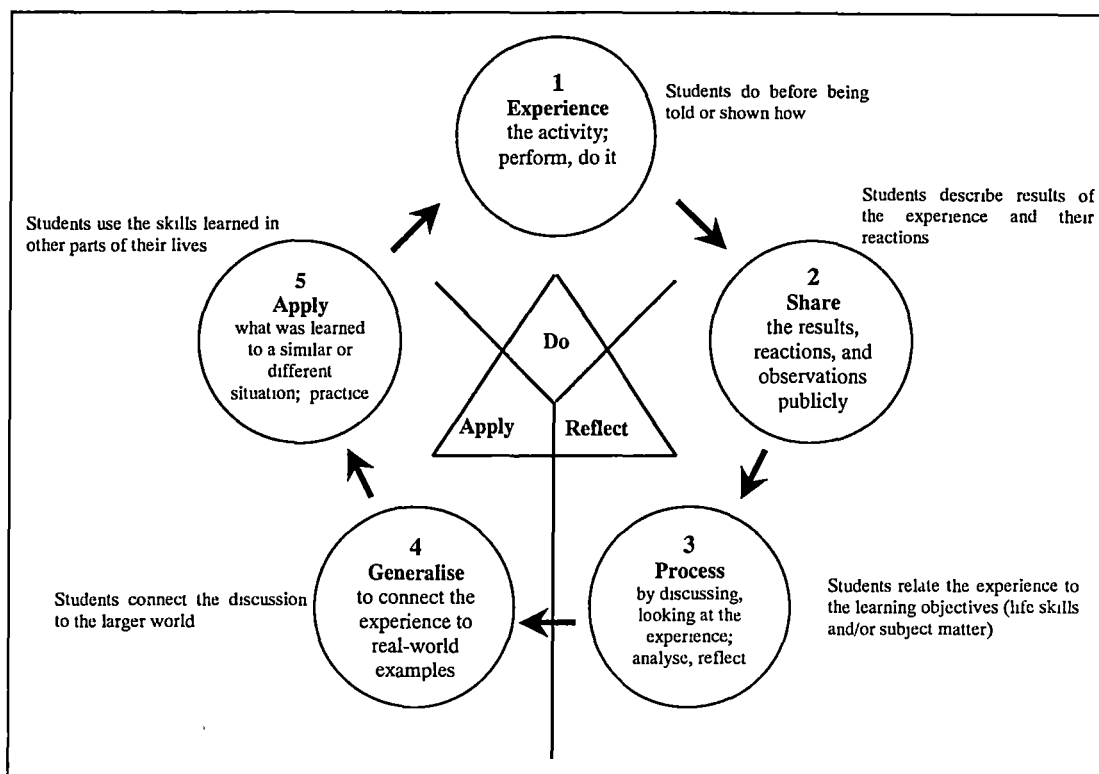


Figure 2.1.

Diagram of Three Main Processes of the Experiential Learning Model

(Adapted from Diem 2001:49).

Another model of experiential learning is 'the 4-E Science Learning Cycle Model', (Martin *et al.*, 1997 in: Friedrichsen 2001:563). The concept consists of four phases in the learning process: (1) exploration, (2) explanation, (3) expansion and (4) evaluation. Crowther and Bonnstetter (1997) in: Friedrichsen (2001:567) found that:

*The students initially express reservations and hesitation, then move into an enjoyment stage, followed by an intrinsic shift in which the students focus on their own learning. The fourth stage is a rapid building of self-confidence and self-efficacy, leading to the final stage of empowerment.*

In conclusion, using a hands-on approach or experiential learning can enhance the possibilities for students to discover natural phenomena, investigate the process



scientifically, and finally to formulate the applied concepts for themselves. It is understood that a hands-on approach encourages a better retention of students' knowledge from their fieldwork.

The experiential learning approach is highly recommended in the learning process to gain an understanding and appreciation of the environment at the marine discovery centre. The programs at marine discovery centres allow students and other visitors to touch, play and experiment with the exhibits to increase their knowledge. By first-hand problem-based learning, Goodwin and Adkins (1997:49) stated that it would help students with a wide range of abilities to learn about nature using different learning styles.

## **2.6 Summary**

In relation to the pedagogical theory explained above, MDCs offer many benefits for environmental education. The MDC programs provide students with outdoor environmental education experiences, marine education displays, and an experiential learning approach in order to develop their knowledge and positive behaviour. In particular, the Centres help visiting teachers to overcome the significant barriers to outdoor environmental education.

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## CHAPTER 3

### AUSTRALIAN MARINE DISCOVERY CENTRES

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#### 3.1 Introduction

Marine discovery centre programs have been part of school curriculum programs for more than two decades, imparting knowledge to Australian students about marine environmental issues (Moffatt 1997:195). The aims of the centres are to guide learners in practical hands-on activities to facilitate the discovery, observation, investigation, research and formulation of basic concepts of environmental issues related to coastal and marine environments.

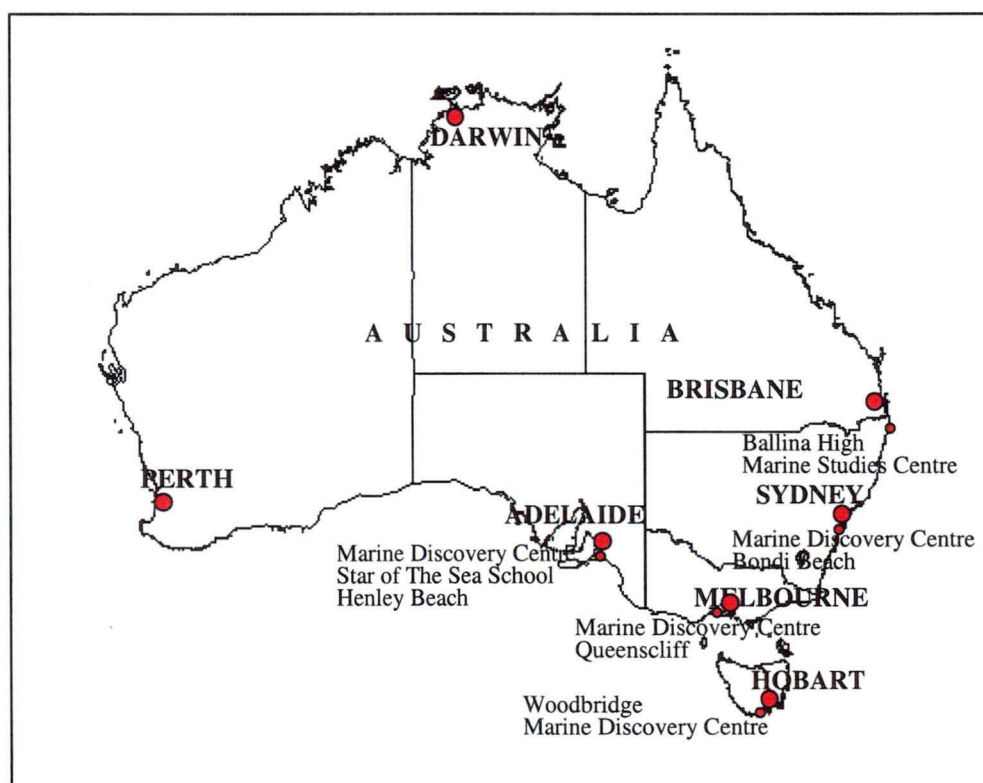


Figure 3.1

Locations of Selected Marine Discovery Centres in Australia

Around Australia there are at least five MDCs in four states (Figure 3.1). These are in New South Wales (Ballina High Marine Studies Centre and the Marine Discovery Centre Bondi Beach), Victoria (Marine Discovery Centre Queenscliff), South

Australia (Star of the Sea Catholic School), and Tasmania (Woodbridge Marine Discovery Centre – Plate 3.1). These centres are not the only way Australian students are taught about the marine environment as some schools have their own marine education program (e.g. Port Vincent School, South Australia and St. Helens District High School, Tasmania). Moreover, extra curricular programs such as visits to public aquaria (such as the Sydney and Melbourne aquaria), and Seahorse World in Tasmania, are other examples of centres that provide information to young people interested in marine life.

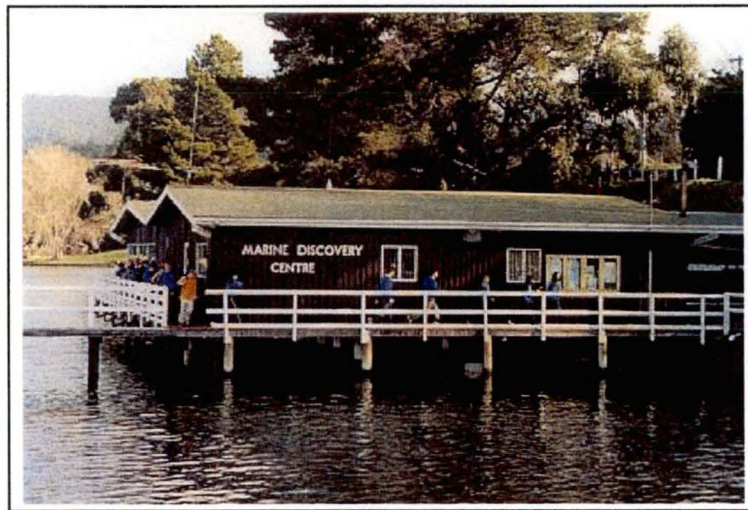


Plate 3.1

Woodbridge MDC

The following is a brief description of five MDCs, mostly summarised from their web sites and related documents including promotional information. This assessment is looking for similarities and differences between the Woodbridge MDC program and other Australian MDCs. In particular, the role of the different centres in the coastal and marine education of school students will be considered. However, there will not be a detailed discussion from a pedagogical or teaching perspective.

### **3.2 Ballina High Marine Studies Centre, New South Wales**

Ballina High Marine Studies Centre is located on the State's north coast. The centre is under the management of Ballina High School and it receives collaborative assistance and support from the New South Wales National Parks and Wildlife Service, New South Wales Fisheries, and New South Wales Department of

Education and Training. It was opened officially in 1999 (Marine Education Society of Australasia 1999:1). Initially, it aimed to fulfil the local community need for environmental education and to address major local environmental issues. Additional information about the centre is summarised on the Ballina High Marine Studies Centre web site (Northern Exposure Technologies 2000).

Ballina High Marine Studies Centre is one of the marine environmental education and resource centres in New South Wales that provide local students with knowledge of coastal and marine issues. The Centre offers programs varying from pre-school to higher school certificate programs as well as supporting members of the community interested in studying marine environments. The programs are based on discovering and investigating marine creatures by self-directed learning. They are provided under the state education curriculum, but the flexibility provided by this arrangement allows visiting students to select their own courses.

Activities for early childhood learners include exploring mini touch tanks indoors and exploring local coastal ecosystems outdoors. Senior level programs support human society and the marine environment, and advanced learners are offered a program of professional marine studies skills. These include practical work on marine ecology, geology and oceanography, water safety and emergency care, fishing and food processing, aquaculture, taxonomy, and a snorkelling course. The more advanced classes learn about small boat handling, sailing, scuba diving, telecommunications, water quality monitoring and practical fishing.

### **3.3 Marine Discovery Centre Bondi Beach, New South Wales**

Marine Discovery Centre, Bondi Beach, the newest MDC in Australia, was established in 2001. The following information about the centre is summarised on its web sites (Marine Discovery Centre Bondi Beach 2001 and 2002).

The MDC Bondi Beach provides a program for visitors to learn about and enjoy marine environments. Bondi Beach is a famous Sydney beach with over 10 million visitors per year. As a potential site for viewing local marine diversity (such as sea dragons, giant cuttlefish, and blue grouper) the Centre was not only established to

promote marine education to school groups, but also to educate local communities, and local and international tourists. The Centre's program provides for both education facilities and entertainment including aquaria and a marine display centre.

### **3.4 Marine Discovery Centre Queenscliff, Victoria**

The information below is summarised from the Marine and Freshwater Resources Institute of Victoria web site (1997) and the Department of Natural Resources and Environment Victoria web site (2001).

The Marine Discovery Centre Queenscliff is part of the Marine and Freshwater Resources Institute (MAFRI). The Centre is located at MAFRI's Queenscliff campus. It is a non-profit educational organisation and offers formal education programs for all ages to discover southern Australia's marine environment with the aim of promoting conservation by increasing awareness and understanding of the marine environment. Even though the Centre's program focuses on school students, it also supports the wider community in learning about local marine environments. Programs are offered for school level from early childhood through to tertiary level and there are also summer holiday programs. These are conducted through coastal field trips, which can be day excursions or camps.

The Centre is ideally situated between the sub-tropic and temperate zones, which provides a place for learning about marine biodiversity in the variety of habitats found in these zones (including rocky shores, mudflats, mangrove, sand dunes and temperate reefs). The Centre is located close to the water encouraging people to explore in safety (Department of Natural Resources and Environment Victoria web site 2001).

Besides having a stimulating environment in which to study, the Centre also employs professional marine environment teachers and provides educational facilities for all levels. Students are encouraged to have a hands-on exploration experience. The facilities are follow-up classroom work, a laboratory, oceanographic equipment, aquaria that show the coastal habitats and local marine species, displays, artefacts, books, tanks, toys and an educational gift shop.

### **3.5 Marine Discovery Centre, Star of the Sea Catholic School, South Australia**

The following information is summarised from Marine Discovery Centre, Star of the Sea Catholic School brochure and web site (Star of the Sea Catholic School, n. d.). The Centre was established to provide marine knowledge to students, especially from pre-school to year seven. Its programs encourage students to appreciate and understand the coastal and marine environment with the aim of promoting conservation and sustainable use.

The activities provided are based on the Education South Australia curriculum framework. They consist of a learning experience with a focus on science and studies of society and the environment through hands-on activities including discovering beach issues through the 'beach trail' program, and finding out about how the local Aboriginal groups related to the coastal environment. At the same time students experience the local environment through beach and marine field trips, exploring aquaria and tanks, doing marine research (using computers, water testing instruments, and other experimental equipment), and searching for information from books, charts, and maps.

### **3.6 Woodbridge Marine Discovery Centre, Tasmania**

#### **3.6.1 Location**

The Woodbridge Marine Discovery Centre is located on the edge of D'Entrecasteaux Channel in the Woodbridge district of southeastern Tasmania, which is approximately 43 kilometres by road from Hobart the capital city of Tasmania. Woodbridge is a part of the Kingborough Municipality. This municipality has the longest stretch of coastline in Tasmania, 336 kilometres, and covers a total area of 720 square kilometres (Kingborough Council 2002).

The Centre's location, in a sheltered part of the D'Entrecasteaux Channel is protected from the waves and provides shelter from the wind. The location also provides a chance for students to explore coastal zone communities in the surroundings of the Centre (such as seagrass and algae communities, and rock pools). Moreover, a boat trip offers potential for students to learn about the foreshore,



specifically to address issues of biodiversity and oceanography, and to learn about the impacts of local land uses on the coast (Figure 3.2).

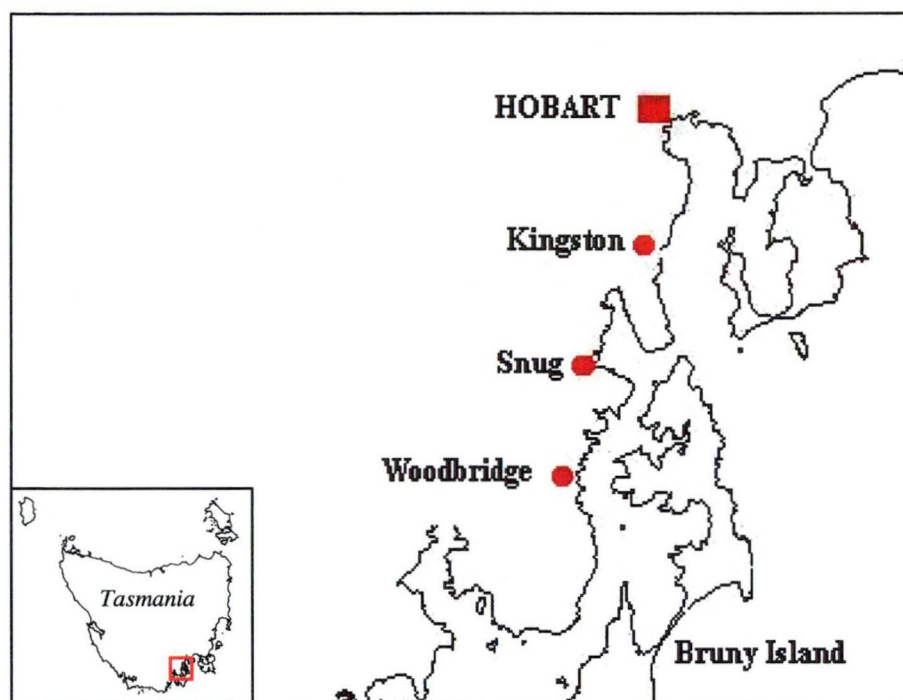


Figure 3.2  
Location of Woodbridge MDC

### 3.6.2 History

The Centre is located in a former scallop splitting shed. It was remodelled and developed as a marine education facility in 1978 (Martin 1979). One of the classrooms is shown below in Plate 3.2. It took one year to set up and was officially opened on 28 April 1979 (Marine Study Centre 1979). This Centre was initially called the Marine Studies Centre, to foster marine education among local students. It played a crucial role in the new concept of formal marine education in Tasmania (Education Department of Tasmania 1987). Additionally, this Centre may have been the first in Australia where marine science education for primary and secondary students was provided.

From the first year, contributions from related government agencies and interested local communities assisted the Centre's development. The first step in establishing Woodbridge MDC was getting permission from the Tasmanian Schools'

Commission (Nelán n.d.:1). The next step was gaining essential support from related government agencies.

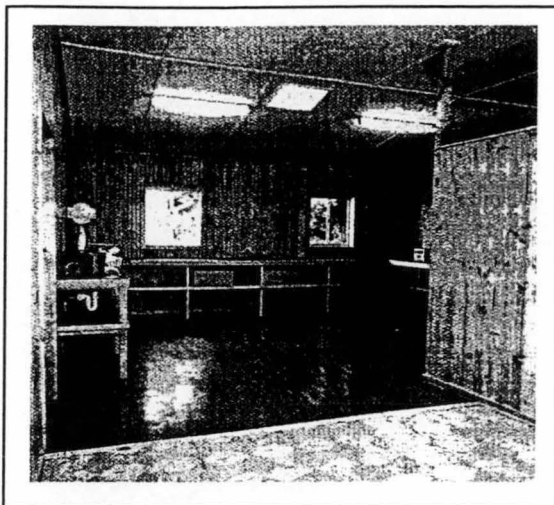


Plate 3.2

First Laboratory/Secondary Room (Martin 1979:1)

Support included funding from the Innovations Programme of the School Commission (Education Department of Tasmania 1980), and the donation of the retired Research Vessel (RV) 'Penghana' and another small boat 'Larus' by the Tasmanian Fisheries Development Authority (Martin *pers.comm.*, 2002). Meanwhile a number of teachers, administrative officers and volunteers prepared for regular school class visits. The Centre has been successful as shown by the increasing number of visitors (section 3.6.8). However, due to funding difficulties the Centre administration was taken over by Woodbridge District High School at the end of 1997 (Nelán n.d.:9).

### 3.6.3 Philosophy

The motivation behind the Centre's establishment was principally to foster the idea to students that knowledge of the marine environment is essential. Martin believed that a better way to appreciate and study one's surroundings is through first hand experience (Martin 1983:1). The program is based on the diversity of the shore and sea based environments of the D'Entrecasteaux Channel (Woodbridge MDC 2002).



The Centre's function is to challenge students of all ages to learn, discover and care for the coastal and marine environment (Martin *pers.comm.*, 2002, Woodbridge MDC 2002). These programs consist of comprehensive cross-curricular activities linking with school subjects such as science, studies of society and the environment (or SOSE), English, maths, art, and drama.

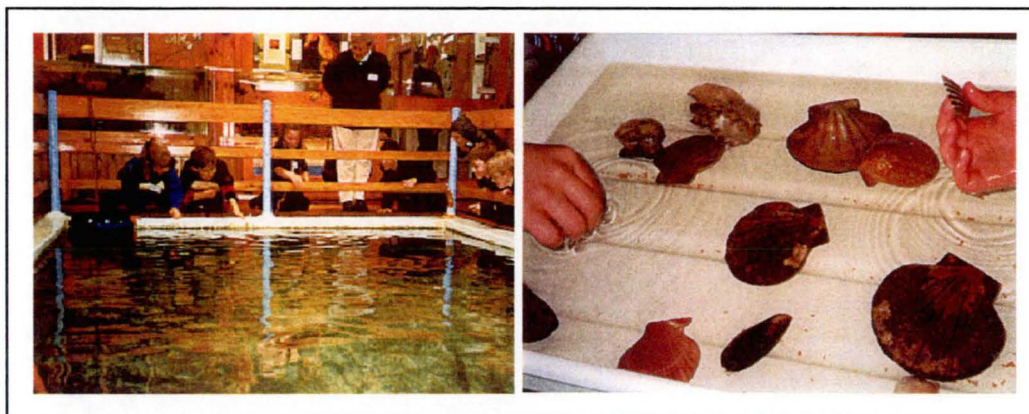


Plate 3.3

Students Practise 'Hands-on' at Woodbridge MDC

To support learning using the principle of first-hand experience, some real marine life communities are replicated indoors. Plate 3.3 shows examples of indoors hands-on activities at the Centre. These accommodate young students who can practise hands-on activities and learning about the outdoor environment in a secure way. Meanwhile, the older students can maximise their learning process from indoors exploration and outdoors discovery (offshore trips with the boat).

#### 3.6.4 Number of Visitors

The Woodbridge MDC program is provided for people of all ages including young children, interested visitors such as their parents and teachers, and public and community groups. The main visitors to the Woodbridge MDC are school student groups and their teachers. Other occasional visitors include tourists, politicians, fishermen, the media, and educators from overseas.

The number of students visiting has increased slightly in the last decade. Figure 3.3 shows that there are a large number of students, around 4,000 per year, visiting the Centre (the 1998 data were not available). In 2001 the number of visiting students

was 5,630 from government and private schools. This number comprises mainly primary and secondary level government school students. More than seventy five per cent were from government schools. In addition, around five per cent of students had participated in more than one visit to the Centre.

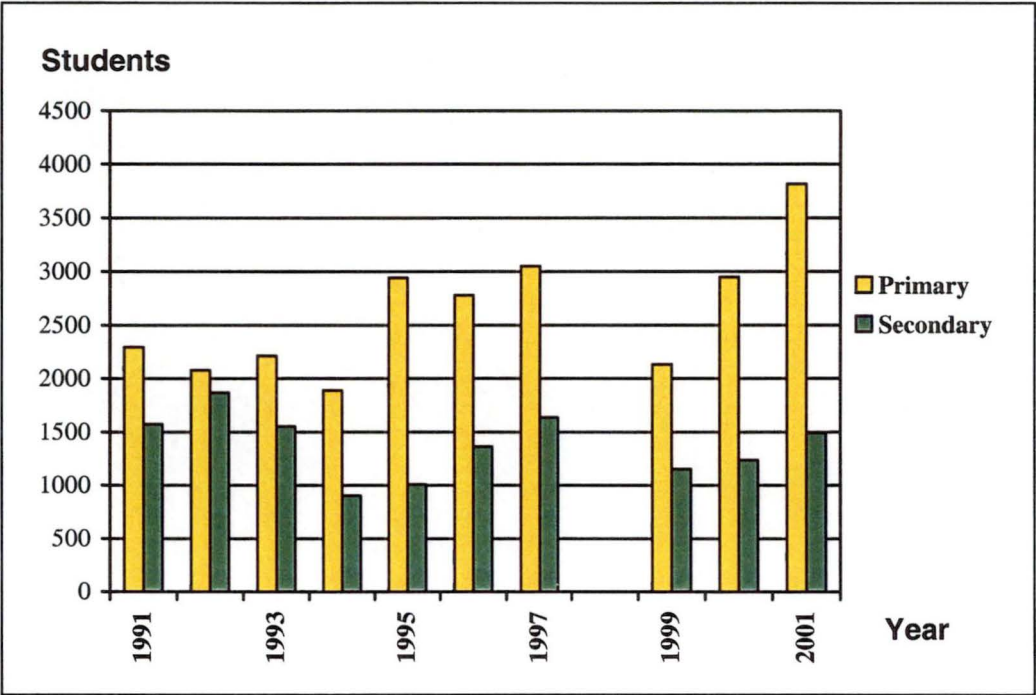


Figure 3.3  
Number of Primary and Secondary School Children Visiting Woodbridge MDC  
(1998 data missing)

3.6.5 Student Visit Programs

The target group for Woodbridge MDC comprises school students from kindergarten to year 12 (K-12) undertaking coastal and marine education during the school year. Through the program provided at the Centre and in the surrounding area, students are guided to explore the coastal and marine environment. All levels undertake basic activities at the Centre, such as an explanation and class discussion of marine issues at either primary or secondary levels (Plate 3.4a), and various exploration activities based on work sheets and information provided (Plate 3.4b). Outdoor activities are offered to all grades from Grade 5. On the research vessel ‘Penghana’ (Plate 3.4c), students have opportunities to explore marine life directly by using sampling equipment, fishing gear and oceanographic tools as well as discussing their findings.



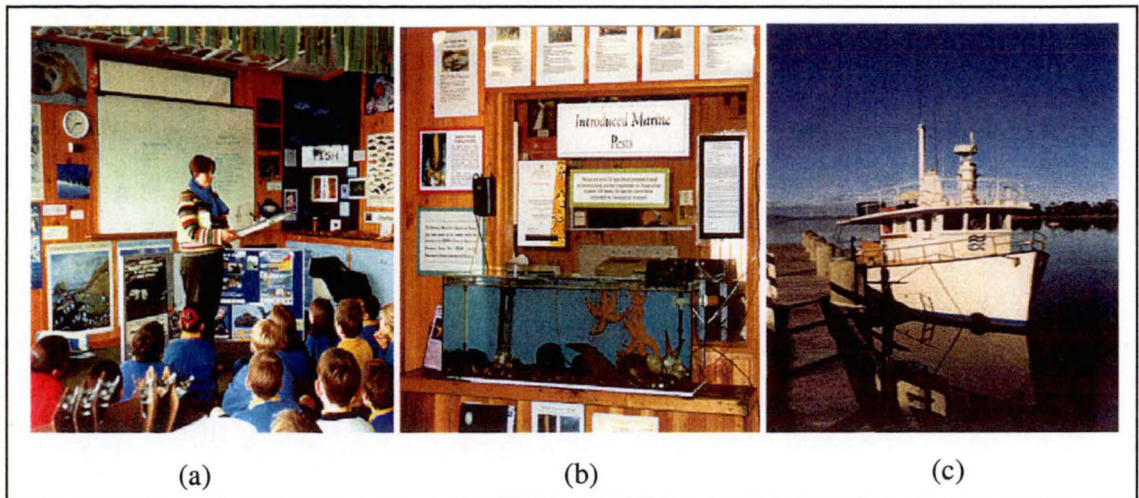


Plate 3.4

- (a) Primary Classroom Program at the Woodbridge MDC,
- (b) Some Information about Introduced Species
- (c) Research Vessel 'Penghana'

#### *3.6.5.1 Primary Level Programs*

Generally the aim of the primary level program at Woodbridge MDC is to develop students' appreciation of, and responsibility for, caring for the local coastal and marine environment. The visiting school may also choose from some optional activities. They have the opportunity to explore the underwater world and interpretative displays at the Centre as well on the local Woodbridge foreshore (Woodbridge MDC 2002). Students are able to explore marine life directly and to learn more about scientific methods for studying coastal zones and discovering animal adaptations.

The program at the Centre varies for each school group depending on the individual class needs and specific aims of the visit. The class teacher will choose either one day or two-day programs. One-day visit programs are mostly orientated towards an overview of coastal and marine life through hands-on activities, sometimes using prepared work sheets. Two-day programs focus on detailed investigations based on work sheets prepared by the Centre's teachers and sometimes also work sheets from the class teachers. The two-day program (including a trip on the Centre's Research vessel) is only offered to upper primary groups (Grades 5 and 6).

At the primary level, programs are categorised into three groups of similar ages:

- **Kindergarten, Grades 1 and 2** are usually offered hands-on activities and an explanation about basic concepts of ecology, kinds of marine life, pollution, and boating and marine safety.
- **Grades 3 and 4** carry out discovery activities based on work sheets covering different marine habitats, diversity, the Antarctic ecosystem, and features of marine animals.
- **Grades 5 and 6** focus more on facilities such as the touch tank, the marine pond, and the aquaria. They also use work sheets focusing on the structure and adaptation of marine life, and management issues including introduced species, pollution, aquaculture and fishing. Some of the groups choosing the two-day program are offered a boat trip session to explore the foreshore marine environment.

#### 3.6.5.2 Secondary Level Programs

There is no specific curriculum guidance for marine environmental education for secondary level (Grades 7 to 10), but visiting the Centre may be chosen as part of the science unit at a school. Some schools prepare their students before their visit to the Centre. The purpose of the visit is to gain a broader picture of foreshore life by hands-on experience (Elliott *pers. comm.*, 2002).

A variety of one-day programs, two-day programs, and a week-long program or science extended course called 'S Courses' are provided for secondary level students. These programs disseminate knowledge through class discussion, learning experience through hands-on activities at the Centre and boat activities (Marine Discovery Centre 2001b). Visiting students on a one-day trip have the option of participating in sessions of fishing for the future, marine biology or foreshore ecology. The two-day visit program comprises a detailed introduction to marine ecology and aquaculture issues and a trip with the research vessel. On the boat trip, a variety of activities is provided, including boating safety and navigation, practising with scientific oceanographic equipment and fishing gear, and sampling marine species.

The Science Extended course (S Course) consists of two courses with accredited programs in marine science and aquaculture (Woodbridge MDC 2002). Marine science comprises ecological sustainability, marine ecology and environmental science. Aquaculture comprises aquatic ecology, boat handling, navigation and meteorology. Meanwhile, Grades 9 and 10 are offered an S Course that is accredited by Tasmanian Secondary Schools Assessment Board (TASSAB) in aquaculture. The program includes some models of aquaculture farms such as mussel, scallop, Atlantic salmon and shellfish, crayfish, and culturing of the giant kelp (*Macrocystis* spp). These have been designed to support the education needs of the marine culture of Tasmania as an island community.

### 3.6.5.3 College Programs

At college level (years 11 and 12) marine science and aquaculture courses are accredited in the Tasmanian Certificate of Education (TCE). Visiting the Woodbridge MDC may be included to gain more knowledge and experience about marine science relevant to school class subjects. The five-day visit programs are divided into class discussion, interaction with marine scientists, visiting aquaculture farms near the Centre, working with provided sheets, and exploring information on specified topics. From their foreshore trip and visit to the aquaculture farms, students are able to explore more practical marine issues with backup from resources at the Centre. For example, the Centre has a juvenile crayfish aquarium, and a giant kelp culture tank. These miniature aquaculture techniques provide opportunities for students to learn more about marine culture species, and the way to develop a marine farm.

### 3.6.6 Other Programs

#### 3.6.6.1 Pre-Visit Teacher Seminars

Seminars for both primary and secondary science teachers are held regularly throughout the year. The seminars aim to prepare and familiarise teachers with learning opportunities and the programs provided before they bring a school group. Teachers have an opportunity to discuss the available programs and possible experiences that could be gained by their students in more detail with the Centre's staff. Additionally, the seminars assist teachers to prepare students particularly with

regard to their treatment of the live specimens, and to provide them with some basic information on marine issues before their visit.

#### 3.6.6.2 *Holiday Programs*

The holiday programs help students who are interested in visiting the Centre but who have not had the chance to visit with their school. This program consists of hands-on learning about marine life, and creating arts and crafts based on marine creatures. Through this program, students are encouraged to learn and discover information about Tasmanian coastal and marine life as well as the enjoyment of handling the live specimens such as sharks and shellfish (Woodbridge MDC 2002). Depending on their interests, students learn more every visit even though the holiday program provides similar activities on a regular basis.

#### 3.6.6.3 *Travel Programs*

The staff travel program is an integral part of the Centre's mission to provide coastal and marine environmental education for all Tasmanian children. This program is specifically provided to primary level students who have limited ability to visit the Centre or live far from it (Elliott *pers.comm.*, 2002). Because the Centre is located in southern Tasmania, the travel program gives priority to the west, north, northwest and northeast coasts. This program was conducted eight times in the last three years.

The staff travel with specimens and a range of activities. The program provides live animals in many forms of display, activities, and knowledge of coastal and marine science issues to students, teachers and residents (Woodbridge MDC 2002). The program equips students with water safety knowledge (including boat safety and safety issues regarding dangerous and poisonous fish), and offers an awareness program that aims to develop students' appreciation of marine animals (Elliott *pers.comm.*, 2002).

#### 3.6.6.4 *Collaborative Research Projects (Introduced Species Monitoring and Giant Kelp Aquaculture)*

Introduced species monitoring in D'Entrecasteaux Channel is a collaborative project between Woodbridge MDC and the Parks and Wildlife Service Tasmania. The

program is being undertaken between June 2001 and December 2002. During this time, students at the Centre are taught to recognise introduced species and classify those that might include marine pests of local waters, and to monitor the impact of marine pests on the local environment (Albion *pers.comm.*, 2001).

Another research project is the giant kelp (*Macrocystis* spp) culture project. This activity is conducted in collaboration with the Woodbridge MDC and SeaCare (a community-based program) and is funded by the Natural Heritage Trust (Woodbridge MDC 2002). The program is developing kelp aquaculture to help in the recovery of the local marine ecosystem, as the plants will be distributed in the waters around Tasmania.

#### 3.6.6.5 Occasional Events

The annual open day at the Woodbridge MDC has been a way of introducing marine environmental education to the general public since 1983. It is also an occasion to remind a large number of visitors to care for their surrounding marine environment. For example, almost 2000 visitors at the last open day were made aware of the need to conserve local marine biodiversity (Collins *pers.comm.*, 2002). Another program celebrates Seaweed annually by promoting a foreshore investigation of local creatures and the history of aboriginal culture (Marine Discovery Centre 2001b). This event is an opportunity for the involvement of community members of all ages and backgrounds.

#### 3.6.7 Promotional Resources

Information and promotional resources are presented in many different ways. They include the marine pond, touch tanks, aquaria, aquaculture models, artefacts, posters and pictures, students' artwork, books and printed information. The marine specimens include parts of large marine species (such as the skeleton of dolphins and the gills of whales), a selection of foreshore marine biota, and a sample of plankton that can be studied through a microscope monitor. These resources are grouped into two major sections: the indoor resources and the research vessel. The Centre's facilities are briefly described below and the schema of the building is shown in Figure 3.4.

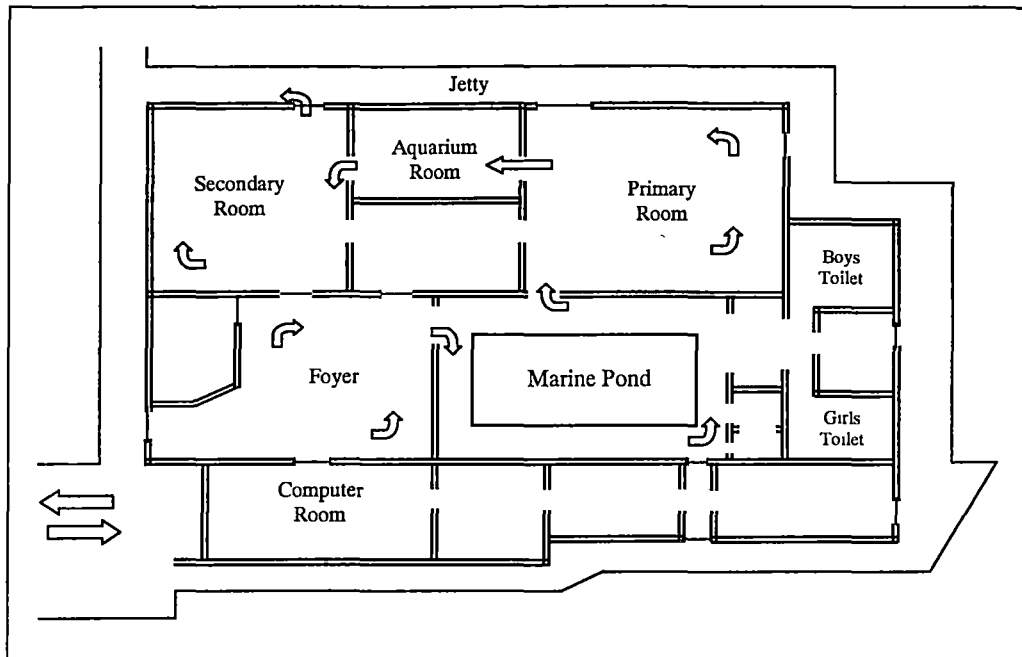


Figure 3.4

Schema of Woodbridge MDC

Source: adapted from Woodbridge District High School (n.d.)

- **The Foyer** of the Centre has been designed to show students as many aspects of marine studies as possible. The main focus of this section is on the human impacts on the marine environment, followed by boating safety displays, miniatures of aquaculture technology and aquaculture guidance books, and introduced species aquaria with its information. Besides these main displays, marine debris and threatened species posters and information are also provided with the aim of encouraging students to minimise impacts on the marine environment. Finally, there is a presentation of the Centre's history and a display of fishing and marine science equipment.
- **The Marine Pond, Touch Tanks and Aquaria** have been developed for relevant hands-on activities and science observation providing an opportunity for students to learn more about individual marine species. Kindergarten to college students are offered sessions on the observation and study of the adaptation and behaviour of marine species collected from the D'Entrecasteaux Channel.



The use of local species and marine ecosystems is aimed at developing students' appreciation of local marine biodiversity. In addition, supporting books and information on marine science are also provided. These include detailed information of species in the Centre.

- **Classrooms**

**The primary room** can accommodate the needs of Kindergarten to Grade 6 students to observe real marine life in the classroom. For example, among the resources provided are pictures and posters of various marine organisms, a miniature Antarctic ecosystem, samples of foreshore animals, a touch tank, microscope and computers, and marine arts and crafts equipment. The room has been built over the water with glass walls, providing enjoyment for the students who can see foreshore and water while learning about the coastal and marine environment.

**The secondary classroom** is a dual-purpose laboratory and lecture room. As the aim of the visit is to equip students as scientists, this room is furnished with marine ecology resources and navigation science equipment. For example, dissection tables can also be used as chart tables for learning about navigation, while a monitored microscope, regular microscopes, marine organism identification books, and navigation tools are available. This equipment is used to help students do experiments and data collection related to plankton diversity, coastal and marine life cycles, and the effect of tides and weather, analysis of local water samples and the impact of the surrounding habitation on the D'Entrecasteaux Channel.

- **The Computer Room** has programs for exploring coastal and marine ecosystems. Through these programs, students gain extra information about different types of coastal communities and food webs.

- **Boat and navigation equipment**

R.V. Penghana is a research vessel that has been used since 1979 by the Centre. It is equipped with scientific oceanographic and navigational tools (GPS, radar, echo sounder and other sonar equipment). This boat is 15 m long and used as a floating classroom carrying a maximum of 29 people to explore the D'Entrecasteaux Channel.

### 3.6.8 Staff and Management

The Centre operates as an annexe of the Woodbridge District High School, with a total of six permanent staff including the manager, a qualified skipper, an experienced marine life maintenance technician, an administrator and two teachers who double as marine science technicians. Besides the permanent staff, voluntary teachers and “guest” teachers (usually marine scientists) occasionally help. These marine experts include staff from the University of Tasmania, CSIRO, the Antarctic Division and other government agencies.

## 3.7 Summary

The programs provided by the five Marine Discovery Centres discussed above are influenced by their individual geographical sites and surrounding ecosystems. Owing to these factors, each centre provides specific programs to highlight their role in coastal and marine environmental education. They have an important role in informing students about the uniqueness, value, and fragility of different environments (Ballantyne and Uzzell 1994:112). According to Smith and Vaughn (1986:58) that:

*A natural environment, albeit limited in geographical size, can provide a learning opportunity that a classroom could not duplicate. In addition, nature centers have proven to be equal importance in helping to foster a greater awareness and understanding of their local natural environment.*

Based on the significance of its geographical position and specific types of local ecosystems, Woodbridge MDC in Tasmania provides different visitor programs from other MDCs in Australia. The Centre emphasises Tasmanian coastal ecosystems, which focus on endemic species, local coastal and marine problems, as well as the potential for aquaculture in the region.

For example, the Centre does not provide as much information about coral reefs as in Queenscliff MDC (Victoria), mangroves and dugongs as in the Ballina High MDC (New South Wales), or sand dune ecosystems as in Star of the Sea School (South Australia). But the Centre has the opportunity to introduce Antarctic ecosystem communities as a topic that students can explore. It differs from other Centres in

providing boat trips and offshore exploration. Woodbridge MDC underlines boat safety and navigation to equip Tasmanian children to become responsible citizens of a boating community.

At the school level, the programs vary. Basic information (such as recognising marine organisms, their habitat and behaviour) and marine environmental issues (environmental problems and human impacts) are aimed mostly at younger students. Older students learn details of marine ecology and applied science, and are able to obtain certified skills for career development. Some programs at Woodbridge MDC such as the boat trip, are costly (Stevens 1982:191), but this program is enjoyable and considered useful for students and teachers alike.

Woodbridge MDC has operated for more than two decades. Over this time, the number of visitors and the range of programs have increased. The Centre is probably the oldest MDC in Australia and its activities are still evolving, providing daily school education programs in addition to the additional programs outlined earlier. In comparison with other marine discovery centres, Woodbridge MDC occupies a small building which has remained the same size since the Centre was developed. Woodbridge MDC has not been supported as a tourism facility such as has happened at Bondi Beach and Queenscliff. For more than two decades the purpose of its existence has focused on achieving excellence in environmental education despite the limited resources allocated to run it.

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CHAPTER 4

DESIGNING THE QUESTIONNAIRE SURVEY

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4.1 Introduction

This study assessed the effectiveness of Woodbridge MDC as a means of promoting coastal and marine environmental education in Tasmanian school students. The main research was conducted at Woodbridge MDC and schools during August and September 2001. Details on the attributes of the main study are provided in Table 4.1. In addition, three main aspects are discussed in this chapter. They are the research details of participants, preparation, and survey design.

Table 4.1  
Attributes of the Main Study

Kind of groups	Grade	Number of Students	Date of Survey	Place
Focus Groups				
Group 1	6	26	8 August 2001	Woodbridge MDC
Group 2	5 and 6	26	9 August 2001	Woodbridge MDC
Repeat Groups				
Group 1	6	26	26 Sept. 2001	School
Group 2	5 and 6	26	27 Sept. 2001	School
Control Groups				
Group 1	5 and 6	22	3 Sept. 2001	School
Group 2	6	31	4 Sept. 2001	School

4.2 Student Participants

The study was conducted with students from four Tasmanian primary school classes as the main participants. The students were divided into the Focus and the Control groups. Fifty-two Grades 5 and 6 students from two school classes were the Focus groups. These classes conducted a previously scheduled two-day school trip to Woodbridge MDC. The same classes were surveyed again six weeks later as the Repeat groups to evaluate how much knowledge they retained from their visit to the

Centre (see Table 4.1). Fifty-three students from two other schools who had never visited Woodbridge MDC were surveyed as the Control group.

The Control groups were chosen on the basis of their similarity to the Focus groups on a number of variables (Babbie 1999:316). The variables considered were; age/grade, and the size of class. The socio-economic background of students based on the sample school locations was also considered, to avoid discrepancies between the Focus and Control groups (Brody 1996:22). The study selected two schools located in city areas and two in semi-rural areas. The survey approach was similar in both cases.

The participants were aged between ten and eleven years old. These students were assumed to be mature enough to work with, yet young enough to express their ideas spontaneously. The classes were selected after consultation with local education experts.

### **4.3 Other Information Sources**

Further information about the educational effectiveness of the Woodbridge MDC program was gathered from other sources, including education staff from Woodbridge MDC, the accompanying schoolteachers, staff of the Department of Education Tasmania, and lecturers from the University of Tasmania. Specific information about the Centre's history, curriculum materials, details of introduced species monitoring project, and general student experiences was obtained from past and present staff of the Centre, a senior curriculum officer from the Education Department Tasmania, and an education officer from the Department of Parks and Wildlife Tasmania.

### **4.4 Preparation**

#### **4.4.1. Field Approach**

The preliminary step of this study was the selection of Woodbridge MDC as the only formal education department centre in Tasmania for students undertaking coastal and marine environmental education. However, there are some schools, private marine

interpretation centres, and community organisations which also provide coastal and marine ecology education in Tasmania as discussed in Chapter 3. An introductory meeting with the Centre staff was held in order to find out more information about the Centre.

The next step was familiarisation with the comprehension level of the targeted age group. This was achieved through observing and talking with children at Sunday school programs before starting the research. This was helpful in determining the level of difficulty of questions for this age group.

Discussions with local education experts were a helpful way to understand the background and culture of a field study, especially those relating to Australian students and local environmental issues. These discussions provided input to the research methods, selection of participants, and structure of work with student groups and questionnaire procedure.

Professor Yaxley (*pers.comm.*, 2000) suggested the use of supporting instruments such as a picture and a story to give students some background on the issues to be studied. This method encourages students to participate effectively and collaborate in the process of the research. He suggested that the presented story or picture theme, focusing on local issues, would encourage students to express more details and provide reasons for their answers. This technique can also make the students more comfortable with the researcher's presence, thereby maximising the quality of research.

Designing research questions for children is more difficult than designing questions for adults. Therefore, intensive pilot work and extra care is needed when sampling children (Oppenheim 1999:107). The problem is overcome by designing appropriate questions aimed at the participants' level of knowledge. Professor Yaxley recommended designing a set of relevant questions which would stimulate the group to express their beliefs, thoughts or responses to a particular problem, and to focus on a specific local issue.

#### 4.4.2. Work Permission

Permission to access school students was obtained before the research was conducted. This is a requirement of social research, especially working with school students (Oppenheim 1999:107). Accompanying the formal request for permission was an information sheet, which consisted of outlining a brief summary of the study. The information sheet is provided in Appendix 1.

Permission was granted by the Social Sciences Ethics Sub-Committee (Hobart) of the University of Tasmania, and the Department of Education Tasmania following completion of security screening (Appendix 2). The study also required the permission of each participating school principal and the agreement of the class teachers. It took four months to arrange permission before the pilot study began.

#### 4.4.3. Pilot Study

The pilot study was carried out one month before the formal study was conducted. It was trialled with one visiting school at Woodbridge MDC with two sub groups each consisting of six students. Some outcomes from the pilot study were used to modify the final study and some difficult questions were clarified. The pilot study was also beneficial as a trial approach for the researcher.

### 4.5 Research Design

#### 4.5.1. Questionnaire Design

The researcher considered several possible methodologies, selecting the Mangas *et al.* (1997:29) model called ‘research-action’ model that placed the learning process into a research context, and Babbie’s (1999:315) interpretation of ‘evaluation research’ that proposed measuring outcomes of a program intervention. Using these methodologies, the study combined an open and closed question survey, which aimed to assess students’ retention and understanding about coastal and marine environment issues obtained while visiting Woodbridge MDC.

The study questions did not directly ask about the program at Woodbridge MDC but about general coastal and marine environmental issues. They asked for students' opinions about coastal and marine environmental management, activities on the beach, enjoyment with regard to coastal and marine activities, and some basic coastal and marine environmental knowledge (see questionnaires in Appendices 3a and 3b).

The open questions were mainly asked orally, but the closed questions were provided in multiple-choice and written form. The open questions were asked to elicit more explanation of the topic, and to make it easier for students to respond fully.

The survey was based on five major questions. These were:

- Why is the coast important?
- What stimulates enjoyment and learning from visits to the coast?
- What was the students' knowledge of coastal and marine ecology?
- What are the risks to the coastal and marine environment?
- How should the coastal and marine environment be managed?

#### 4.5.2. Procedure

The selected class was divided into small groups consisting of four to six students. These small groups were selected by the school class teacher. The survey took twenty to twenty-five minutes for each group. It started by introducing the researcher and research, and continued with a hypothetical short story about the activities of some Indonesian children at the beach. The theme of the story about children's awareness of the coastal and marine environment was the entry point for the oral questions. Supporting the survey procedure, some pictures related to the story were provided to elicit more interest from students. Following the story, students answered orally, and then filled out the written questionnaires. A tape recorder was used so that students' oral answers could be reviewed at a later time.

The same process was conducted with the Repeat groups at their schools six weeks after their visiting the Centre. A similar procedure was conducted with the Control groups at their schools. In order to avoid repetition for the Repeat groups survey, the story and questions about the story were amended, using the same theme, but the questions were intended to be of the same level of difficulty.



Some additional questions were asked to find out students' interest in coastal and marine knowledge and the role of Woodbridge MDC in developing this interest. Some students at the Centre were asked about which activities at the Centre provided them with most enjoyment and satisfaction. Six weeks later, the Repeat groups were asked again about their experience at the Centre.

#### 4.5.3. Completion of Work

Data gathering comprised a combination of interviews, a literature search, and field observations. Interviews were conducted using techniques such as direct meetings, phone calls and e-mails with other informants. Literature was gathered from libraries, related agencies and the Woodbridge MDC. Field observations included investigating information and equipment in the Centre building, observing the teaching approach and student activities at the Centre and involvement in some events at the Centre such as teacher seminars and the annual open day.

#### 4.5.4. Data Analysis

Data from the three study groups (the Focus, Repeat and Control groups) were compared based on their number or frequency of 'correct' answers. Some data were presented in percent, which was calculated from the total frequency of students' answers divided by the total number of each group. These are shown in tables, histograms and pie charts in the following chapter.

## CHAPTER 5

### RESULTS AND DISCUSSION

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#### 5.1 Introduction

The results section in this Chapter consists of three subsections of findings: the students' questionnaire survey; additional information; and significance of the class interview procedure. The discussion relates the findings to three possible roles for Woodbridge Marine Discovery Centre. These are: a resource for information on the coastal and marine environment; encouragement of students' interest in coastal and marine environmental issues; and development of students' knowledge about coastal and marine issues.

#### 5.2 Results

It was expected that the survey results would follow a pattern from a higher to a lower level of knowledge as shown below:

Focus groups > Repeat groups > Control groups

This statement is based on the following assumptions:

- the Focus groups would be most informed in the issues and the prepared questions;
- the Repeat groups would be less informed than the Focus groups because, having been back in their normal situation for six weeks, they may have forgotten the lessons they gained at the Woodbridge MDC; and
- the Control groups would not be as informed as either of the above two groups because they had not been exposed to the stimulation of a visit to the Centre.

However, the results were different from those expected. In terms of the presented questions, the results showed no specific pattern among the three study groups, but revealed a generally high positive interest in, and understanding of coastal and marine environmental issues from all groups.

### 5.2.1 Students' Questionnaire Survey

#### 5.2.1.1 Oral Question Number 1 (see Appendices 3a and 3b)

**Version 1: How does this story make you feel?** (Focus and Control groups)

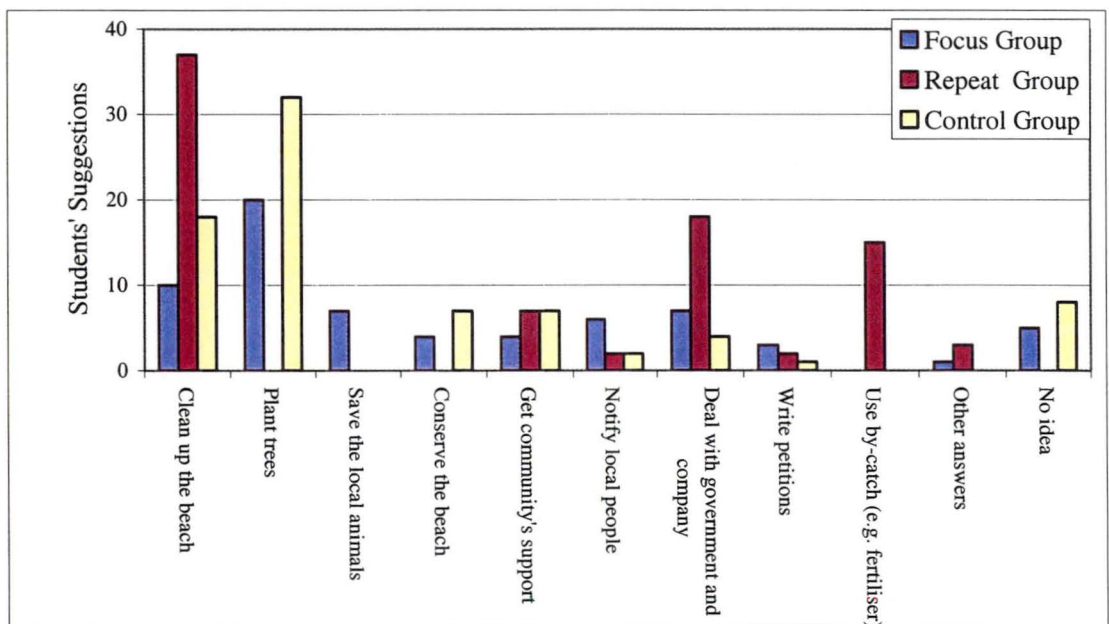
**Version 2: Should Nyong and Nona try to save the beach again? If yes or no, give your reason.** (Repeat groups)

After telling the introductory story, the students were asked how it made them feel. The question was an opening one, encouraging students to become involved in the survey and take a role as an environmental actor. The results found that all three groups expressed sadness and/or anger at the environmental troublemakers. The results also showed that students appreciated the value of the local environment and demonstrated their awareness of the need to keep the coast sustainable and healthy. In addition, selected responses to the questions are presented in Appendix 4a.

#### 5.2.1.2 Oral Question Number 2

**Version 1: If you were Benny and his friends in this story, what would you do to care for your coast?** (Focus and Control groups)

**Version 2: What could Nyong and Nona do about the dead fish?** (Repeat groups)



**Figure 5.1**

Suggestions for Caring for the Coast

Students were then asked to show their knowledge about the ways to care for and manage coastal and marine environments, by making suggestions (see Appendix 4b).

Their responses are shown in eleven categories as illustrated in Figure 5.1. The figure shows planting a tree on the beach is the most common suggestion by the Focus and Control groups (question version 1). The Repeat groups had a different story, so their most common suggestion was to clean the beach of the dead fish (question version 2), but they did not mention planting trees. The other two groups also mentioned cleaning the beach as a way to overcome the problem. Some of the Focus groups also developed two alternatives such as dealing with the government and company, and the use of the dead fish for fertiliser to overcome pollution to the beach. In this case, their responses indicated the students' ability to recognise the problem and their desire to protect their environment based on the root of the problem.

### 5.2.1.3 Oral Question Number 3 (All groups)

*When you go to the beach, what do you like to do?*

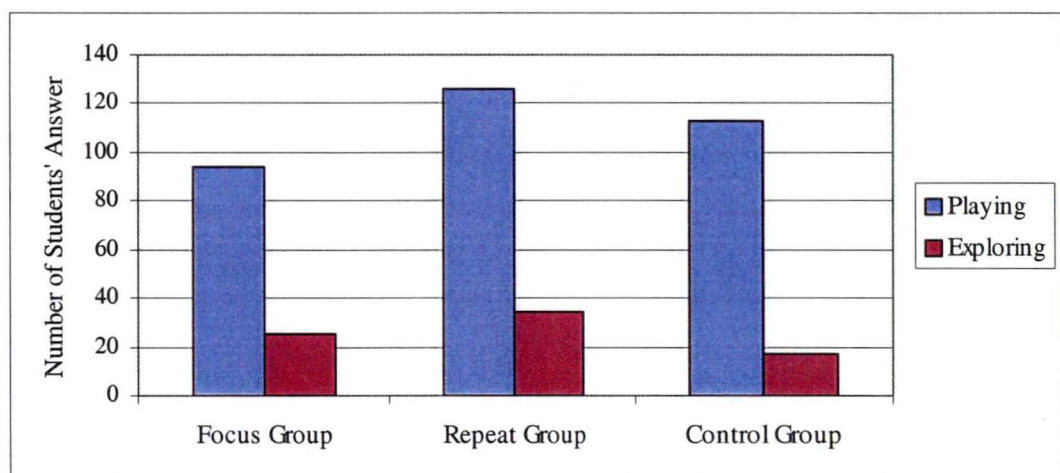


Figure 5.2

Preferred Activities at the Beach

Students were asked what sort of activities they liked to do when they go to the beach in order to determine how they valued visiting the beach. Students were able to nominate more than one preference. Figure 5.2 above shows the survey groups preferred two main activities: playing and exploring. All of the groups chose playing as their favourite thing to do at the beach including activities such as swimming, surfing, body boarding, rowing, playing with sand dunes, building sand castles, and getting a sun tan. There was not much difference between the Focus, the Repeat and the Control groups in terms of their interest in spending their time playing in these ways when visiting the beach. However, some of them were also interested in exploring coastal and marine ecosystems.



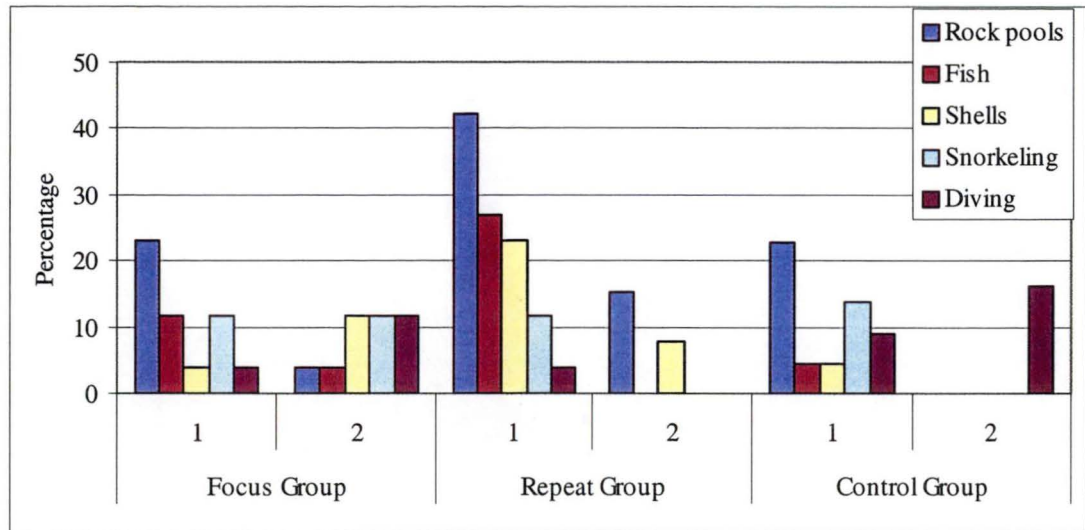


Figure 5.3  
Exploring Activities at the Beach

Figure 5.3 gives a summary of student preferences for exploring activities at the beach by sub-group. In comparing two semi-rural groups, Focus group 2 at Woodbridge MDC showed more interest in exploring activities than Control group 2 (students who had never visited the Centre). Meanwhile, both Focus group 1 and Control group 1 from urban areas apparently have a similar interest in exploring activities. Following their visit to the Centre as Repeat group 1, these students showed twice the rate of preference for exploring activities. However, Repeat group 2 did not show the same result, possibly because they were asked to write their responses, rather than answer orally as in their initial survey.

5.2.1.4 Oral Question Number 4 (All groups)

*Is there anything about the beach that you dislike? Why?*

Table 5.1  
Reasons for Disliking Going to the Beach

Students' Dislikes*	Focus Group (n = 52)		Repeat Group (n = 52)		Control Group (n = 53)	
	Frequency	%	Frequency	%	Frequency	%
Pollution on the coast	20	38.5	29	55.8	26	49.1
Too crowded	5	9.6	5	9.6	1	1.9
Occurrence of dangerous marine species	13	25.0	18	34.6	19	35.8
Natural conditions (too sandy, windy, hot/cold )	16	30.8	13	25.0	5	9.4
Other factors	5	9.6	14	26.9	10	18.9

\*Students were able to nominate more than one answer

To balance the question about students' preferences at the beach, they were also asked if there was anything they disliked. Their responses were classified into five major issues as shown in Table 5.1. The table indicates that pollution (such as rubbish and dead animals) during their visit to the beach was the biggest dislike of all the groups.

All groups mentioned their dislike of some marine species such as jellyfish, sharks, oysters, and seaweed. This finding might indicate that children were generally concerned about unpleasant circumstances, because they valued the beach as a place for playing, and their fear of these creatures may affect their enjoyment of playing in the water. Other factors mentioned in Table 5.1 included a criticism of beach management. For example, no bins and toilets were provided at the beaches the students visited, and dogs were not allowed on the beach.

#### *5.2.1.5 Oral Question Number 5 (All groups)*

- a. Have you ever been fishing with your family?*
- b. How often do you go fishing with your family?*
- c. What kind of fish do you catch?*

Students were asked if they had ever been fishing, their frequency of fishing and what kinds of fish they caught, in order to determine their interest in, and experience of fishing activities. When students were asked if they had ever been fishing, between 88 % to 98 % of all groups said yes. This indicated that going fishing for Tasmanian children is very common, but its frequency differs individually.

The survey found no pattern in students' responses about the frequency of fishing. For example, thirty per cent of the Focus groups replied that they go fishing with family during holidays and warm weather, but half of this group changed their answer in the repeat survey. This indicated that current weather is likely to affect the recalled frequency of students' fishing activities.

Table 5.2  
Knowledge of Fish Names

Name of Fish*	Focus Group (n = 46)	Repeat Group (n = 48)	Control Group (n = 45)
	Frequency	Frequency	Frequency
Flathead	34	30	32
Squid	11	2	10
Salmon	9	6	6
Shark/Gummy shark	5	4	3
Trout	4	3	4
Cod	7	2	2
Gurnard	6	1	1
Leather jacket	2	1	4
Mullet	2	2	1
Other fish names	6	13	6
<b>Total</b>	<b>86</b>	<b>64</b>	<b>69</b>

\*Students were able to nominate more than one name of fish

The students were also asked what kind of fish they caught, in order to show their basic knowledge about recognition of marine species. They mentioned twenty-four fish (including mollusc) names, nine of which are presented in Table 5.2. The table shows that all the groups had a similar level of knowledge. In this question, Repeat group 2 were not able to provide the answers orally as in the first survey, and they had a limited time to write their answers. Consequently their number of answers decreased.

5.2.1.6 Oral Question Number 6 (All groups)

*Where do you learn about the coast?*

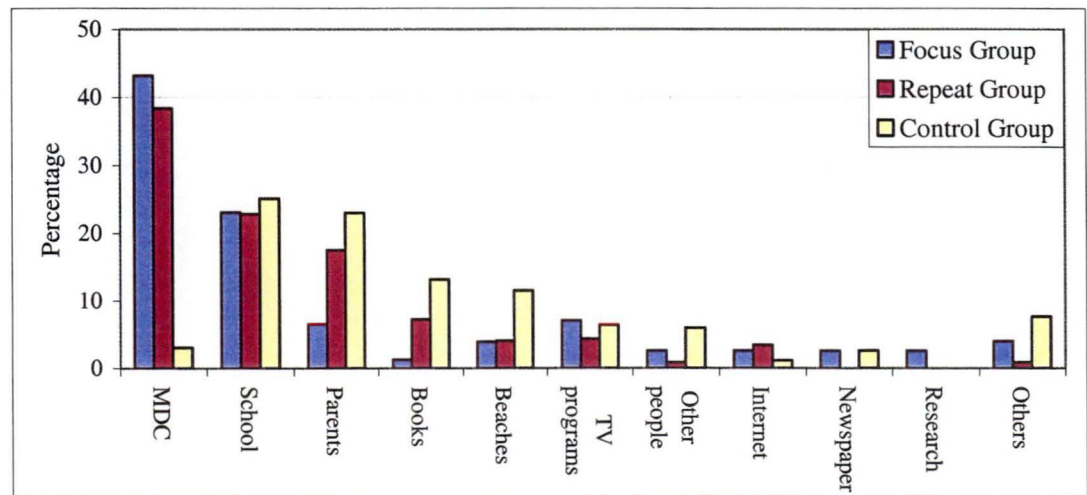


Figure 5.4  
Sources of Information about Coastal and Marine Environment

Finally, the students were asked orally where they learned about the coast, in order to find the most common sources of information about coastal and marine environments for students. Their answers are summarised in Figure 5.4. This figure shows that both the Focus and Repeat groups, as visitors to Woodbridge MDC, believed that they gained information about the coast from two major sources. These were the Marine Discovery Centre and their school. A small number of the Control groups who had had a trip to the Centre either individually or with their previous school mentioned the Centre. If they had not been to the Centre, the Control groups believed that school and their parents were the most important source of information. In addition, students obtained information from books, marine science programs on television and marine science websites, as well as research and exploring the beach.

#### 5.2.1.7 Written Question Number 1 (All groups)

*How often do you go to the beach?*

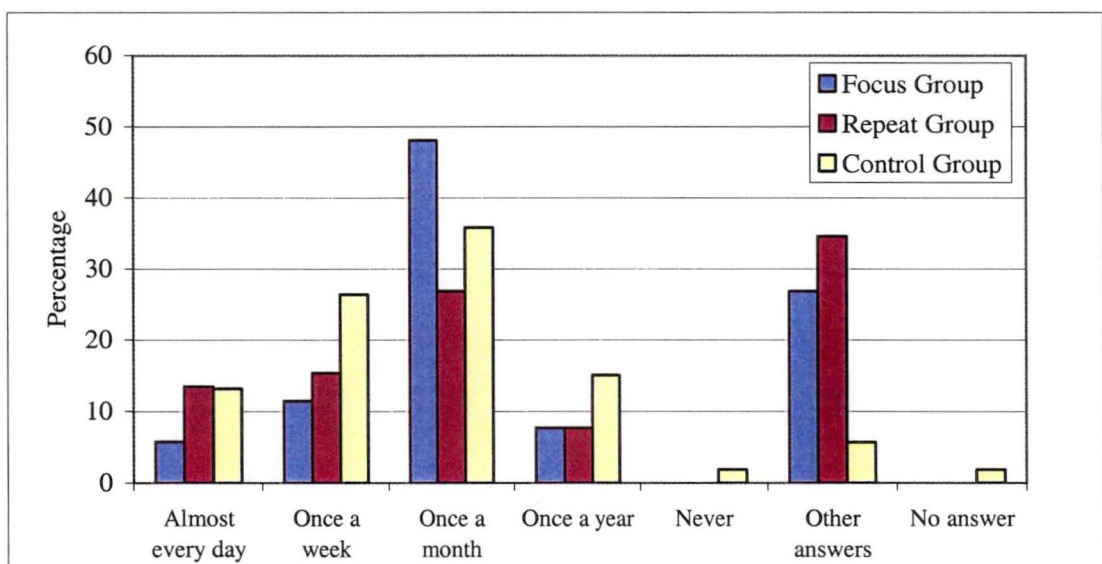


Figure 5.5

Frequency of Visiting the Beach

In order to explore students' interest in visiting the beach, they were asked how often they went there. The question did not relate directly to the role of Woodbridge MDC, but it was believed that students' responses may indicate their interest in gaining experience and knowledge about the local coastal and marine environment.



Figure 5.5 summarises students’ answers about how often they go to the beach based on five specific options provided and one open option. The figure above shows both the Focus and Control groups apparently had a chance to go to the beach more than once a year. However, when comparing students’ answers at the Centre to six weeks after the visit, the table shows no specific pattern going to the beach.

This may simply show that students have a short memory and do not think about their usual activities over a long term. The fact that ‘other answers’ has a bigger percentage for the Repeat groups might indicate that they could not remember exactly how often they visited the beach or could not relate to the pattern of time provided in the questionnaire.

5.2.1.8 Written Question Number 2 (All groups)

*Which would you rather go to: the beach or a swimming pool, and why?*

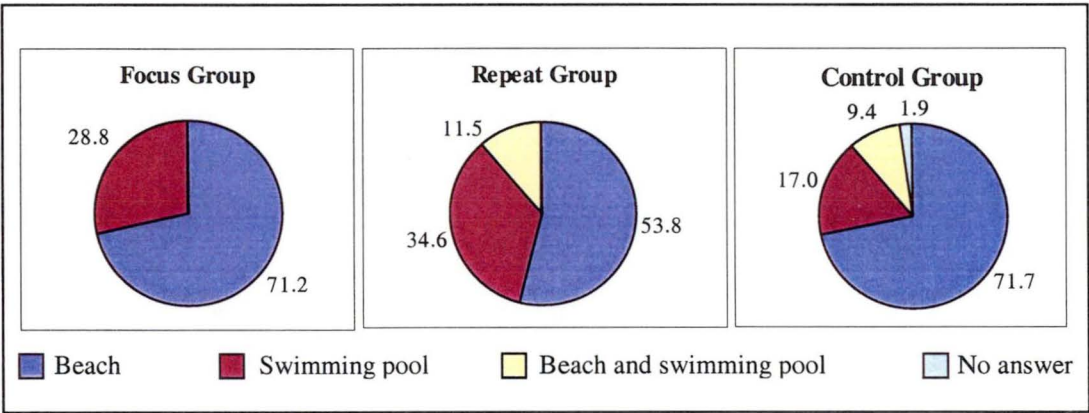


Figure 5.6

Preference Between the Beach and a Swimming Pool

Students were asked whether they preferred going to the beach or swimming pool and to explain their reasons in order to further understand their interest in the beach. Figure 5.6 demonstrates that more than half of the groups preferred to go to the beach, of which the highest number is shown by the Control group. The Focus groups at the Centre chose to go to the beach rather than a swimming pool. However, after six weeks, the proportion of students retaining their preference for the beach fell in the Repeat group, as some of them chose both the beach and a swimming pool.

Table 5.3

Reasons for Choosing the Beach

Reason*	Focus Group (n = 37)		Repeat Group (n = 28)		Control Group (n = 38)	
	Response	%	Response	%	Response	%
Enjoyment	17	45.9	13	46.4	25	65.8
Nature	12	32.4	11	39.3	10	26.3
Free (space and no charge)	8	21.6	9	32.1	11	28.9
Less Crowded	1	2.7	4	14.3	5	13.2
Values and Beauty	1	2.7	1	3.6	5	13.2
Marine creatures/wildlife/exploring	1	2.7	2	7.1	1	2.6

\*Students were able to nominate more than one reason

Six major reasons for choosing the beach are summarised in Table 5.3. The most frequent responses of these groups included enjoyment of playing at the beach; its naturalness (for example it is healthy and there are no chemicals in the water); and it is free.

5.2.1.9 Written Question Number 3 (All groups)

*Have you seen any pollution or damage at the beach?*

This question was asked in order to determine students’ knowledge about risks to the coastal and marine environment. Their responses showed that there was a high level of recognition of pollution or damage at the beach by all groups. The highest level was shown by the Focus groups (90 %), followed by the Repeat groups (88 %) and the Control groups (79 %).

Students’ explanations about the kinds of pollution and destruction at the beach are grouped in six categories. All groups had similar concerns about domestic rubbish (bottles, cans, plastic, glass, paper, food wrapping and syringes) as the main pollution at the beach that they had visited. The second major problem was coastal ecosystem damage such as earth moving activities on the coast and coastal environment that resulted in erosion also mentioned by all the groups. Other minor issues were other forms of waste (oil debris, metal and rubber), graffiti and vandalism.

5.2.1.10 Written Question Number 4 – True and False Questions (All groups)

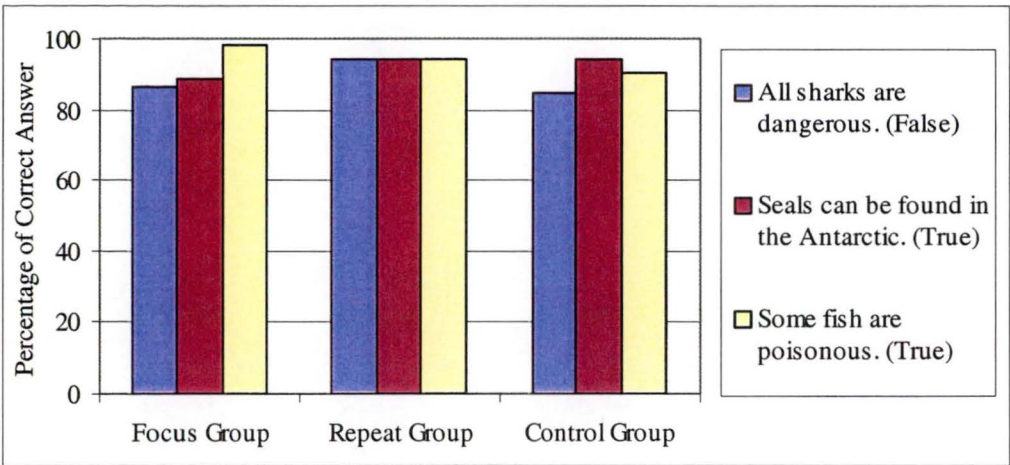


Figure 5.7  
Knowledge of Marine Species

In an effort to compare the level of students’ knowledge about marine ecology that they gained from visiting the Centre and their general marine knowledge, the survey groups were asked some selected questions about marine species. Figure 5.7 shows the percentage of students who answered correctly. The figure shows that between the three groups, there is only a small percentage difference in their understanding of issues addressed in these questions. In particular, six weeks after their visit to the Centre, the groups apparently improved their knowledge about sharks and seals, but knowledge about poisonous fish declined. However, the groups who had not visited the Centre showed a higher percentage of correct answers about seals than did students at the Centre. This indicates that all groups basically had a good level of knowledge in terms of the presented questions.

Table 5.4  
Knowledge of Poisonous/Venomous Fish

Name of Fish*	Responses		
	Focus Group (n = 51)	Repeat Group (n = 49)	Control Group (n=48)
Puffer fish	18	27	11
Gurnard	17	27	3
Stingray	1	6	12
Stone fish	6	4	6
Scorpion fish	3	9	2
Cow fish	5	0	2
Blue ringed octopus	0	1	0
Goblin Fish	1	0	0
Total	51	74	36

\*Students were able to nominate more than one name of fish



Following the question about venomous fish, students were asked to name some. Table 5.4 summarises student answers as showing that the groups that had been to Woodbridge MDC knew more names of venomous fish than the Control groups. Six weeks after their visit, the Repeat groups gave more names of venomous fish. This may have happened because one of the familiar topics taught at the Centre, as part of marine safety issues was venomous fish.

#### 5.2.1.11 Written Question Number 5 - *True and False Questions* (All groups)

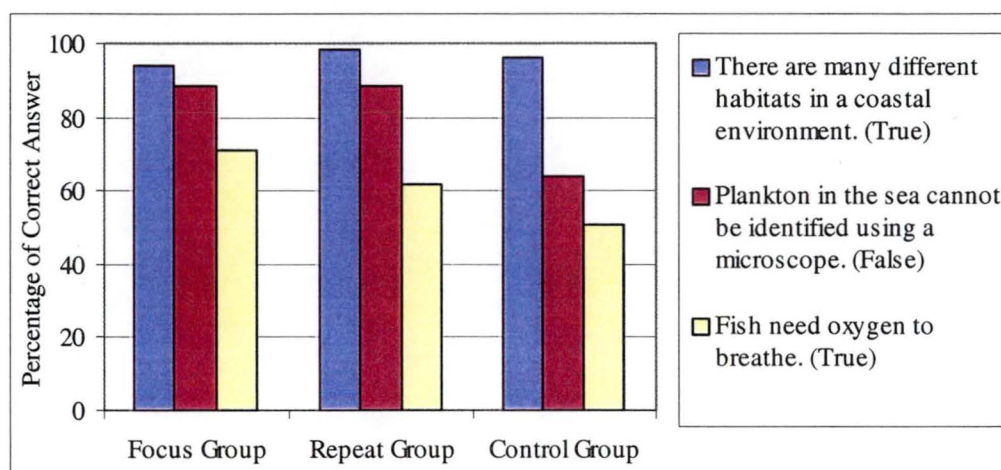


Figure 5.8

Knowledge of Marine Ecology

Selected questions about marine ecology asked students to show their knowledge gained from their visit to the Centre. Figure 5.8 shows that students at the Centre (the Focus groups) had a higher level of knowledge than other groups in terms of the presented questions. Even though there is not a big difference between groups, the statement that 'fish need oxygen to breathe' was the most difficult for all groups. The lowest percentage of correct answers is shown in the Control groups.

#### 5.2.1.12 Written Questions Number 6 – *True and False Questions* (All groups)

Questions about three kinds of risks to the coastal and marine environment were asked. Figure 5.9 shows that it is likely all groups had knowledge related to the questions.

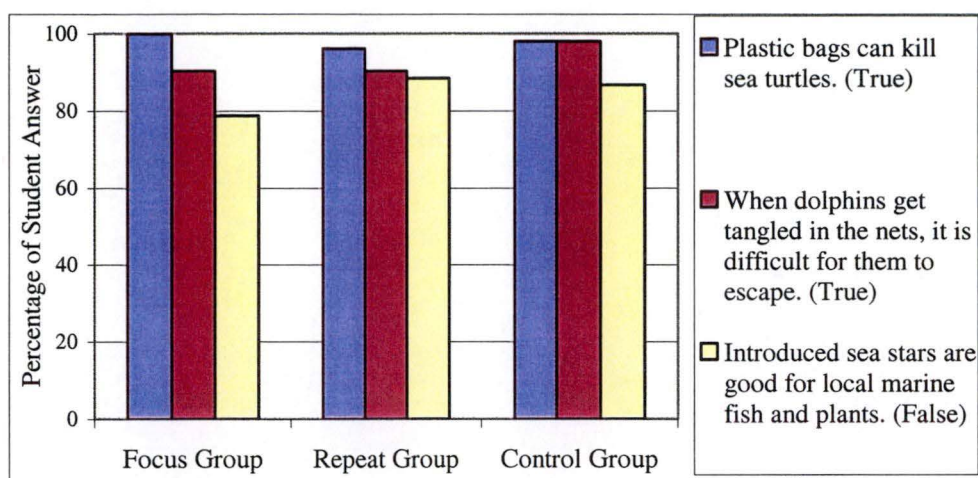


Figure 5.9

### Knowledge of Risks to the Coastal and Marine Environment

In this case, most students in all the groups seemed familiar with the risks of plastic bags for marine biota such as the marine turtle, even though some of the Repeat groups got slightly fewer correct answers. The Focus groups retained their knowledge correctly about the risk for dolphins caused by fishing nets, and had correct answers increasingly for the question about introduced sea stars.

#### 5.2.2 Summary of Survey Results

All students appear to have a good level of knowledge about some coastal and marine topics such as the characteristics of marine species and their habitat, fish names, and beach and water problems. Interestingly, students who had not visited the Centre as the Control groups seemed to answer the questions as well as the visiting students.

However, in some particular areas of coastal and marine knowledge, students who had visited the Centre as the Focus groups gained more knowledge than the students who had not visited the Centre. Repeat surveys found that the Repeat group retained some knowledge from their visit. The Focus group and Repeat group showed more understanding and knowledge than the Control groups regarding questions about venomous fish names.

The presented questions cannot prove different levels of knowledge between these groups as they only explore the ‘surface’ of the local marine knowledge in Tasmanian students, especially the visiting students. At the Centre, the students had been given much more varied and detailed information than appeared in the prepared issues of the questionnaire. The students also learned in various ways such as discussion with Centre’s staff and experts, data gathering and interpretation by hands-on experience and conducting science research.

### 5.2.3 Additional Information

Some additional information about the effectiveness of Woodbridge MDC providing information to visiting students was gathered either from students at the Centre or at the schools in informal discussion. Additional information was also gathered from the visiting teachers, education staff and the Centre staff. Generally, there was a positive response to the Woodbridge experience.

#### *5.2.3.1 Students*

Sixty-eight visiting students were asked their opinions about their interest and enjoyment of the Woodbridge MDC program (see Appendix 5a). This number included fifty-two students from the Focus groups, and other visitors from Prep, Grades 1, 3, and 9 (Science S course students).

All the participants expressed their interest and enjoyment with more than half of them gaining the most enjoyment from exploring animals in the Centre program. The favourite activities were touching the shark in the marine pool and exploring invertebrates in the touch pond. Additionally, some students who had the opportunity to go on the boat trip, reported that the research vessel was an interesting experience. The respondents were enthusiastic about the program provided at the Centre with 91% of them expressing enjoyment from their visit and involvement in the program. They also mentioned that they gained new experiences from their visit. The following are some of the students’ responses (in their words):

- a. The Centre stimulates learning about aspects of coastal and marine environment.
  - *It allows children to learn about marine life.*
  - *I discovered new facts about animals.*

- *There are some fish and creatures that I have never seen.*
- b. The Centre provides hands-on experience of marine biota.
- *I can learn about sea animals and plants, close up and not just in books and video.*
  - *I can pat animals that live in the ocean*
  - *I can find out about different types of sea creatures.*
- c. The Centre offers a conducive situation to study.
- *The Centre is good, because it is educational but lots of fun at the same time.*
  - *It teaches me new things every time I come.*
  - *It is full of really interesting things to touch, feel, smell, even taste.*

Some participants suggested improvements to the Centre's service based on their previous visit to the Centre or from visits to other aquarium centres. A quarter of the students suggested improvements mostly relating to the provision of a bigger marine pond and aquariums with larger animals than are currently present. However Woodbridge MDC cannot display larger live specimens, because it has limited room for extending the marine pond. In order to impart marine knowledge through hands-on activities, the Centre has a different approach to educating students than have aquarium centres, which are environmental interpretation centres.

The Repeat groups were asked about their experience of visiting Woodbridge MDC. Selected responses to their opinions of the Centre is presented in Appendix 5b. Overall, 98 % of students reported a learning and fun experience from their visit. Some of them said that they had learned new and more things about life underwater since their last visit to the centre. Their answers also indicated that the Centre is a place for learning experiences with programs and facilities to provide enjoyment and learning at the same time.

#### 5.2.3.2 Teachers and Education Staff

Anecdotal evidence from teachers and educational staff showed that the Centre provides special benefits for students. There were some important comments from observers. Through visiting the Centre: students become involved in practical issues by interacting with the real object (Martin, *pers.comm.*, 2002); they gain extra

knowledge about marine life and environmental safety (Clark, *pers.comm.*, 2002); they have a chance of asking questions as well as participating in scientific and recreational activities (Pratt, *pers.comm.*, 2002); they can be stimulated into an interest in ongoing research (Herbert *pers.comm.*, 2002), and they can learn about the bigger picture of foreshore and offshore environment in the only formal marine environmental education in Tasmania (Elliott *pers.comm.*, 2002).

Regarding teachers' observations at the Centre, it was concluded that the hands-on approach encourages students to learn more about marine life and to do the right things for the biota at the beach. Bogner (1998:26) stated that environmental education motivates individuals to take responsibility for their actions, and helps them to understand ecological principles. The boat trip is a favourite activity for students to do sampling and practise using fishing gear. In addition, longer visits to the Centre, such as the two-day and week programs are more effective in imparting detailed knowledge to students, than a day visit.

Tasmanian students seems have a good general knowledge and interest as benefits from their marine and fishing background. However, visiting the Centre may help them to gather more detailed coastal and marine knowledge. Moreover, the teachers stated that one of the potential future benefits of the Centre is its role in inspiring students to develop their interest in marine science careers.

#### 5.2.4 Implications of using a Class Interview Procedure

The study found difficulties implementing a similar procedure in the schools to that carried out at Woodbridge MDC. The Repeat and the Control group surveys were conducted at the school (upon invitation by the teachers). However some of the students could not fully concentrate on the questionnaire, especially the oral questions as the survey was interrupting their current lesson, especially Repeat group 2. Consequently, the class teacher was approached to conduct the survey as a whole class rather than in sub groups. This approach, using the whole class as one of the Repeat groups, resulted in fewer written answers, as students did not have enough time. In addition, as predicted, some students of the Control groups apparently were not interested in being involved in the survey process, which further influenced the



results. These conditions are acceptable as it showed a general difference in interest among comparison groups.

There are three other lessons from the methodology of the survey presented to the Focus group. They are:

- First, the Focus group survey at the Centre found that the students were more relaxed and interested in talking about coastal and marine issues. Generally, the groups gave more responses for the oral questions. They also added more personal information related to the question such as their experience of their family activities at the beach, for example, a parent's occupation as a marine ecologist, and what they had learned about marine ecosystems from their parents.
- The introductory part of the survey using a short story helped students to become involved in the survey process. The researcher believes that in this study, the story gave a double benefit to the survey procedure: it gained student attention at the start, and encouraged them to give their opinions to the questions.
- Asking question about fish names orally is easier for students to respond to. They were able to express themselves more quickly. For example, some students knew that some fish in Tasmanian waters are poisonous, but they were unable to say the proper name of the fish. It was assumed that answers to the questions posed in this survey would be general knowledge to many Tasmanians without having visited the Woodbridge MDC. In this case, using the appropriate word also should be considered for the next survey.

### **5.3 Discussion**

Fortner and Mayer (1991:34) stated that an evaluation of marine environmental education programs can indicate their strengths and weaknesses, although it is difficult to obtain reliable data from school-aged students. The results of this survey did not find any significant pattern of difference between the Focus group students who had visited Woodbridge MDC and the Control group students who had not visited the Centre. In terms of the presented questions of the main study, it cannot be stated that the visiting students learnt more than other students who had never visited. The results show a very similar level of knowledge and interest between the

two groups. However, most students who visited the Centre acknowledged the Centre as an important place to learn about the coastal and marine environment. Even though the results of the study cannot find a significant role of the Centre in providing students with interest and knowledge, it is believed that this is a short-term endeavour resulting in a long-term benefit. Bogner (1998: 27) stated that:

*There is delay from reasoning to action, so a paradigmatic shift in our long lasting approaches are needed to endure that statistically significant research results are reflected in real life.*

### 5.3.1 Sources of Information of Coastal and Marine Environments

In terms of respondents acknowledging potential sources of information about the coast, generally schools and parents play an important role. Indeed, nearly every Tasmanian student spent time fishing or going to the nearby beach with their family. Meanwhile television programs as a source of information is similar for all the groups. School and television programs have been proposed as the most important sources of information on environmental issues (Connell *et al.* 1998:44).

In Tasmania, Woodbridge MDC plays an important role in providing students with information and a place to study coastal and marine environments. It provides detailed information about related issues and facilitates experiential learning for visiting students. The unanimous viewpoint of the informants was that benefits have been provided since the first year. As the purpose of the Centre's establishment was to provide resources for learning about local coastal and marine environment, the Centre's program creates students' interest and stimulates their curiosity, giving them an opportunity to learn more about coastal and marine environment and to develop their awareness of the need to care for the local environment.

### 5.3.2 Encouragement of Students' Interest in Coastal and Marine Issues

Fishing is a good way for all young Tasmanian students to learn about the coast by equipping them with basic knowledge. Most of the students surveyed reported that they had been fishing with their family at least a few times. Students learn things about the coast such as fish names, poisonous fish and some basic knowledge as part of the learning process.

Regarding the results of this study, it is not possible to conclude that students who visited the Centre had more interest in coastal and marine issues than students who had not visited the Centre. All groups responded with similar enthusiasm and interest in coastal and marine issues. They preferred enjoyment and playing rather than pursuing other interests when they go to the beach. Similarly they were all concerned about pollution at the beach and disruption of marine biota and prefer going to the beach rather than a swimming pool because of enjoyment, and reported that they often went fishing with their family.

The students surveyed represented both city and semi-rural backgrounds of southern Tasmania, and reflect a strong interest in gaining experience from visiting the beach. Hungerford and Volk (1990:14) asserted that fishing and other outdoors activities foster environmental sensitivity, which is a function of individual contact with the outdoors in relatively pristine environments (either alone or with close personal friends or relatives) that is not often associated with formal education. Nevertheless, enjoyment is not enough to support the environmental education aim to promote the environmental learning process, the way of environmental thought and action (Ballantyne *et al.* 1998:8).

Even though only a small portion of the students who visited the Centre was surveyed, they showed more interest in the discovery of marine life than the groups who had not visited the Centre. As expected, class lessons and hands-on activities at the Centre provided students with a higher motivation to learn about marine creatures rather than just playing.

Therefore, it is believed that although part of a short-term visit, students at the Centre may be influenced to develop further knowledge about marine ecology concepts and coastal problems dealing with humans as well as marine technology. This finding concurs with Bogner (1998:27) about the role of outdoor ecology education programs that link direct experience in influencing student behaviour towards more positive environmental attitudes.

### 5.3.3 Increasing Students' Knowledge of Coastal and Marine Issues

It was expected that students who visited the Centre would be stimulated by new coastal and marine information and that knowledge of coastal and marine ecology

would be fresh in their minds. This would provide them with motivation and inspiration to learn more details about marine creatures at the Centre. Enjoyment, hands-on activities, lessons, field trips in the boat and some discovery activities using work sheets do support the learner in gaining more understanding. However, the survey results did not find any significant differences between the Focus, Repeat, and Control groups.

In the Repeat group survey, when students were back in their normal situation it was found that some had forgotten some of what they had learned at the Centre, while others remembered their experience exactly.

It had been expected that the two groups that had never visited the Centre (the Control groups) would have less experience and knowledge than the Focus groups. The results showed that these groups responded as well as the groups at the Centre to the questions about naming marine biota, types of marine ecosystems, and marine life characteristics. Apparently the Control groups have a similar understanding of coastal and marine issues to both the Focus groups and the Repeat groups. This may be because southern Tasmanian children have many opportunities to go to the beach and gain information on marine ecology from other sources such as from their parents, their school and from television.

Even though the results do not show any real differences between the groups, learning by experience at the Centre was more than just learning names of fish and other general things about coastal and marine environments. For example, the class discussions presented detailed information about local marine biota and their behaviour, human impacts on the coastal and marine environments, marine life cycle concepts and direct observation of marine life adaptations. Advantages of constructive outdoor education programs include a combination of first hand experience, participatory interactions, adequate preparation and reinforcement. These are crucial variables in preparing students for a positive environmental behaviour for in the future (Bogner 1998:27).

A two-day visit to the Centre for Grades 5 and 6 students includes a boat trip. This session consists of an introduction to boat equipment and navigation tools, boat safety, learning about fishing gear and how to use it, practising sampling methods

and data analysis including oceanographic and climate data. The knowledge gained during this session may stimulate student interest in the future. However, a question designed to evaluate this session was not included in this study.

#### **5.4 Summary**

The inconclusive results from the questionnaire survey were insufficient to compare the level of enthusiasm, basic knowledge, and awareness of the learners at Woodbridge MDC and non-learners. This may be because the prepared questions were too broad to justify the assumption that visiting students learned more and were more interested in coastal issues than non-visiting students.

In the short term the benefits of the visit are not readily apparent. Evaluations of education effectiveness generally are difficult to perform including evaluation of education programs (Ryan 1991:30), although the activities at the Centre might stimulate students to learn more about marine ecology over the longer term. Evaluation of the effects of outdoors environmental education should be seen as a long-term process (Bogner 1998:27). The evidence suggests that improving students' knowledge and developing positive environmental attitudes cannot simply be evaluated from a short-term study.

On the other hand, the Centre has had an implicitly powerful influence based on experience of people who have been involved with it during its twenty-two years existence. The researcher found from student responses to additional questions, feedback of visitors, observation at the Centre, and anecdotal data gathered from key informants, that the Centre provides a complete coastal and marine education program and also develops students' interest in marine science careers. It is also possible that visiting the Centre and the experiences they had there may foster positive environmental behaviour, but the survey did not specifically explore these issues. Classroom sessions, boat trips, hands-on activities, and extra programs for younger and distance students endeavour to provide and equip learners with knowledge about marine science and promote long-term conservation behaviour.

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## CHAPTER 6

### CONCLUSION AND RECOMMENDATIONS

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#### 6.1 Conclusion

This study used four approaches in attempting to address the research hypothesis concerning the effectiveness of Woodbridge MDC in imparting coastal and marine environmental knowledge to Tasmanian students. The approaches were:

- (1) analysing student questionnaire results and some additional questions that asked opinions about related issues;
- (2) observing Woodbridge MDC and reviewing the literature on other marine discovery centres in Australia;
- (3) seeking opinions of local key informants; and
- (4) studying Australian and world literature of coastal and marine environmental education concepts.

The results of the questionnaire survey were inconclusive because of some limitations in the prepared questions and because most students already had some basic coastal and marine knowledge. However, the three other approaches consistently support Woodbridge MDC as playing a crucial role in influencing knowledge and positive environmental behaviour. The overview of the study is presented in Figure 6.1.

On the basis of the questionnaire survey, it cannot be claimed that the students visiting Woodbridge MDC learned more than students who had never visited the Centre. The results did not identify the Focus groups as having a stronger knowledge than the Control groups. This may be because the prepared questions were not probing enough or were too basic. Moreover, the literature reports that a short-term evaluation is unlikely to demonstrate students' progress in learning, but the result may be relevant to the long term learning process. A study of this kind, evaluating education effectiveness, generally is difficult to perform (Ryan 1991:30). As Bogner (1998:27) predicted that '...long lasting approaches are needed to ensure that statistically significant research results are reflected in real life'

The extent to which fishing and playing at the beach foster environmental sensitivity in individuals of a maritime community such as Tasmania was underestimated when the questionnaire was prepared. During such outdoors activities, it appears that students enhanced their basic knowledge such as knowing local fish names and their characteristics. The study results showed that both the Focus groups (who had visited the Centre) and the Control groups (who had not visited the Centre) had the same level of interest in the beach. The study also indicates that young students are inconsistent in their responses to questions over time. Some changed their preference for going to the beach based on the current weather and activities at the beach. In conclusion, the questionnaire results were insufficient to establish whether Woodbridge MDC is effective in increasing knowledge and raising awareness in visiting students.

On the other hand, the description of Woodbridge MDC in Chapter 3 indicated that the Centre provides a complete coastal and marine education program and facilities relevant to the local coastal and marine issues. However, this interpretation is subjective, based on observation of education material and provided programs. Nevertheless, through its long history the Centre has built up expertise and presents the program to accommodate the students' needs. Moreover, its fully booked schedule, its increasing number of visitors and a high public attendance at the annual open days, demonstrate that the Centre is an important part of the Tasmanian coastal and marine education system.

Additionally, the opinions of local key informants strongly support the existence of Woodbridge MDC. They believe that the Centre programs are useful for all ages, especially for imparting basic knowledge to younger students and in developing an interest in science related careers for upper school students. In increasing students' interest in the coastal and marine environment at the Centre, the most effective approach is experiential learning through a hands-on and the boat trip (learning offshore). These perspectives may be biased because some of the informants have a regular association with the Centre program. Even so, their opinions would be based on their pedagogical skill and teaching experience. Indeed, most of the Centre's visitor programs are designed to provide programs through learning by experience, a method highly recommended by environmental education experts all around the world.

Finally, based on information from local key informants, from observation of the program activities at Woodbridge MDC, and the literature review of the experiential learning approach, it can be concluded that the Centre plays a crucial role in providing various activities, and it has become an integral part of marine environmental education programs in Tasmania.

## **6.2 Recommendations**

The results of this study should be seen as a pilot study with the findings interpreted tentatively. It is recommended that further research should be done to improve on the depth of the information collected. The survey format using the introductory story followed by open and closed questionnaires was effective. In designing such a study, a larger group of students could be used, over a longer period, to measure the Focus groups' progress as they develop their appreciation, knowledge and environmental behaviour. A multifaceted evaluation, and a greater number of more targeted questions are recommended by Bogner (1998:27) and Howard (1999/2000:155) in attempting an evaluation of an environmental education program. In designing a future study, it would be valuable to have an opportunity to conduct a follow-up survey six months after the initial survey.



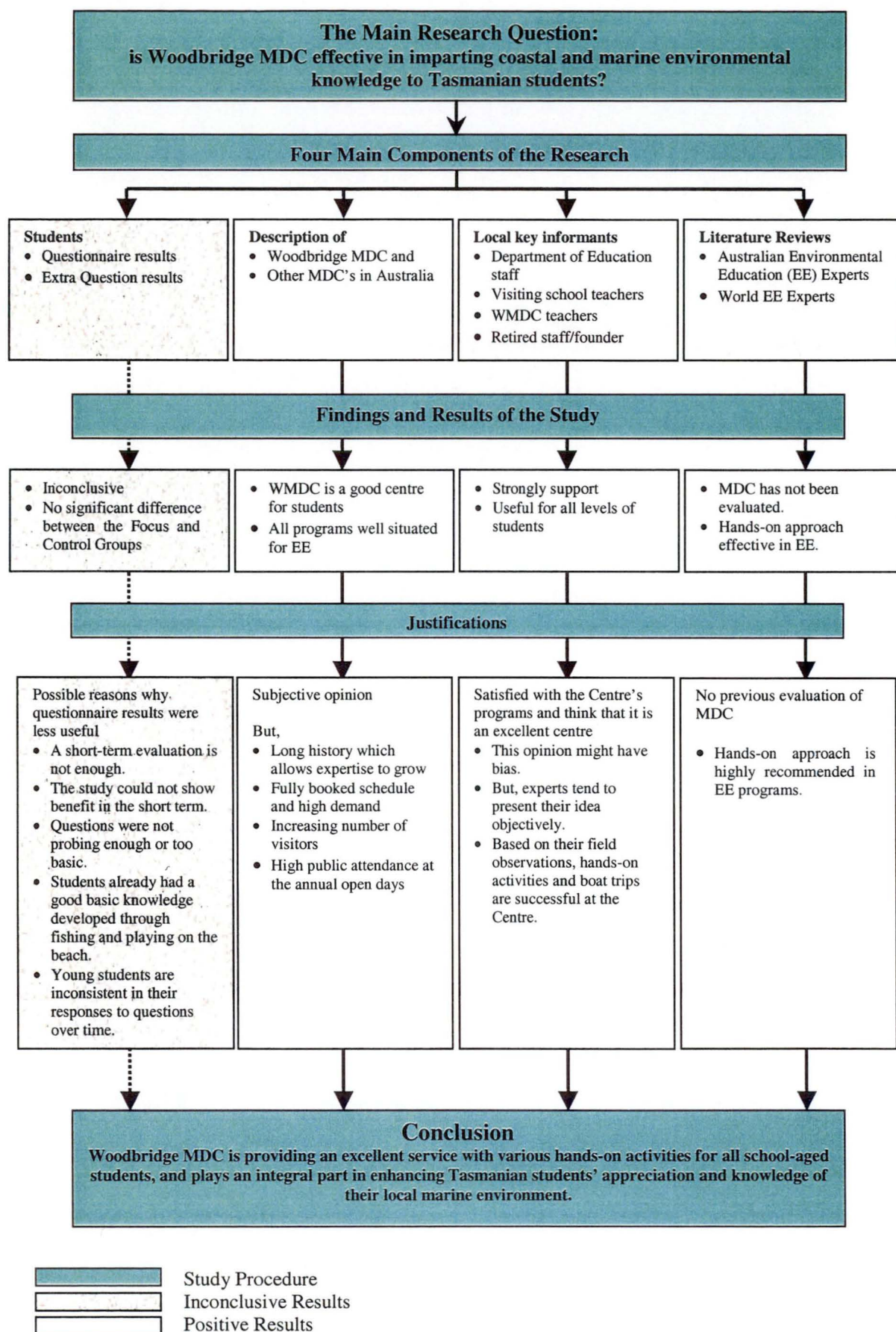


Figure 6.1

Overview of the Study Findings

## REFERENCES

- Babbie, E.R., 1999; *The Basics of Social Research*; Wadsworth Publishing Company, Belmont, California.
- Baird, R.C., 1998; Marine Education: A Vision for Sea Grant, *Current* **15** (1), 39-40.
- Ballantyne, R.R., Fien, J. and Packer, J., 2001; Programme Effectiveness in Facilitating Intergenerational Influence in Environmental Education: Lessons from the Field, *Australian Journal of Environmental Education* **33** (3), 8-15
- Ballantyne, R.R. and Uzzell, D. L. 1994; A Checklist for the Critical Evaluation of Informal Environmental Learning Experience, *International Journal of Environmental Education and Information* **13** (2), 111-124.
- Ballantyne, R., Connell, S. and Fien, J., 1998; Factors Contributing to Intergenerational Communication Regarding Environmental Programs: Preliminary Research Findings, *Australian Journal of Environmental Education* **14**, 1-10.
- Bogner, F.X., 1998; The Influence of Short-Term Outdoor Ecology Education on Long-Term Variables of Environmental Perspective, *Journal of Environmental Education* **29** (4), 17-29.
- Brody, M.J., 1996; An Assessment of 4<sup>th</sup>-, 8<sup>th</sup>-, and 11<sup>th</sup>-Grade Students' Environmental Science Knowledge Related to Oregon's Marine Resources, *Journal of Environmental Education* **27** (3), 21-27.
- Brookes, A., 1989; Outdoor Education: Environmental Education Reinvented, or Environmental Education Reconceived?, *Australian Journal of Environmental Education* **5** (August), 15-23.
- CIESIN (Center for International Earth Science Information Network) Columbia University, 2002; Education for Sustainability: an Agenda for Action <http://www.gcric.org/edu/pcsd/toc.html> (Accessed 28 April 2002).
- Connell, S., Fien, J., Sykes, H., and Yencken, D., 1998; Young People and Environment in Australia: Beliefs, Knowledge, Commitment and Educational Implications, *Australian Journal of Environmental Education* **14**, 39-48.
- Crossen, T., 1980; Black Hill Native Flora Park – Policy on Outdoor Education and Recreation, in: *Proceedings of the First National Conference Australian Association for Environmental Education*, Bridgewater, South Australia, October, 1980, 143-150, AAEE (Australian Association for Environmental Education), South Australia.

## References

- Department of Education Tasmania, 1998; *Outdoor Education Management Book: A Management Guide and Instructions for Schools and Colleges, Tasmania* <http://www.discover.tased.edu.au/hpe/omh>, (Accessed 14 May 2000).
- Department of Natural Resources and Environment Victoria, 2001; Marine Discovery Centre, <http://www.nre.vic.gov.au/mafri>, (Accessed 25 September 2001).
- Diem, K.G., 2001; Turn Any Science Topic Into Hands-on Fun, *Science Scope* **24** (7), 46-49.
- Education Department of Tasmania, 1980; *The Marine Studies Centre Woodbridge, Tasmania*, Brochure.
- Education Department of Tasmania, 1987; *Education in Tasmania, A Quality Experience*; Curriculum Resources Section, Public Relation Office, Hobart.
- Fortner, R.W. and Mayer, V.J., 1991; Repeated Measures of Students' Marine and Great Lakes Awareness, *Journal of Environmental Education* **23** (1), 30-35.
- Friedrichsen, P.M., 2001; A Biology Course for Prospective Elementary Teachers, *The American Biology Teacher* **63** (8), 562-568.
- Geesteranus, C. M., 1999; Achieving Sustainability Through Learning about Biodiversity: Bull Puncher or Bullshit? Presented paper for *Conference Program Southern Crossings: Pointers for Change, Australian Association for Environmental Education (AAEE), International Conference on Environmental Education*, NSW, January 14-18, 1999, 61, AAEE, NSW.
- Goodwin, D. and Adkins, J.C., 1997; Problem-Solving Environmental Science on the Chesapeake Bay, *School Science Review* **78** (284), 49-55.
- Hanna, G., 1996; Jumping Deadfall: Overcoming Barriers to Implementing Outdoor and Environmental Education, *Green Teacher* **46** (February-March), 11-14.
- Heeps, C., 1996; Sharing the Secrets of the Sea: New Approaches to Marine Environmental Education, Interpretation and Public Participation, in: Taussik, J. and Mitchell, J. (eds), *Partnership in Coastal Zone Management*, 1996, 581-587, Samara Publishing Limited, Cardigan, United Kingdom.
- Heffernan, B.M., 1998; Evaluation Techniques for the Sandy Point Discovery Centre, Great Bay National Estuarine Research Reserve, *Journal of Environmental Education* **30** (1), 25-33.
- Horwood, B., 1996; Why Disturb the World Outside, *Green Teacher* **46** (February-March), 8-10.
- Howard, J., 1998; Environmental Education and Interpretation: Developing an Affective Difference, *Australian Journal of Environmental Education* **14**, 65-70.

## References

- Howard, J.; 1999/2000; Research in Progress: Does Environmental Interpretation Influence Behaviour through Knowledge or Affect? *Australian Journal of Environmental Education* **15/16**, 153-156.
- Hungerford, H.R. and Volk, T.L., 1990; Changing Learner Behaviour Through Environmental Education, *Journal of Environmental Education* **21** (3), 8-19.
- Kingborough Council, 2002; Location and Map of Kingborough.  
<http://www.kingborough.tas.gov.au> (Accessed 19 March 2002).
- Lisowski, M. and Disinger, J.F., 1991; The Effect of Field-Based Instruction on Student Understandings of Ecological Concepts, *Journal of Environmental Education* **23** (1), 19- 23.
- Mangas, V.J., Martinez, P., and Pedauy , R., 1997; Analysis of Environmental Concepts and Attitudes Among Biology Degree Students, *Journal of Environmental Education* **29** (1), 28-33.
- Marine and Freshwater Resources Institute of Victoria, 1997; Marine Discovery Centre, Queenscliff Victoria; <http://www.home.vicnet.net.au/~vims> (Accessed 6 December 2001).
- Marine Discovery Centre, 2001a, *Seaweed 2001; Ocean Culture on the Woodbridge Foreshore*, Brochure.
- Marine Discovery Centre, 2001b; *Secondary programs 2001*, Woodbridge, Brochure.
- Marine Discovery Centre Bondi Beach, 2001; *Imagine*, <http://www.tnd.com.au/~MDC-BB> (Accessed 25 September 2001).
- Marine Discovery Centre Bondi Beach 2002; *Marine Discovery Centre Bondi Beach* <http://www.marinediscovery.org.au> (Accessed 30 April 2002).
- MESA (Marine Education Society of Australasia), 1999; *Undercurrents*, Victoria, Newsletter.
- Marine Study Centre, 1979; *Official Opening*, Woodbridge, Tasmania, Document.
- Martin, A.P.G., 1979; *Deed of Surrender*, Woodbridge, Tasmania, Document.
- Martin, A.P.G., 1983; The Case for Marine Education, *Newsletter No. 14*, AAEE.
- McCormack, K., 1996; McQueen Lake: Ducking the Cuts, *Green Teacher* **46** (February-March), 22.
- Moffatt, B., 1997; Roundup of Marine Education around Australia, in: *Earthlinks Conference Proceedings of Australian Association for Environmental*

## References

- Education and Marine Education Society of Australasia*, Hobart, Tasmania, January 13-17, 1997, 195-202, AAEE (Tasmanian Branch), Hobart.
- Moorcroft, T.A., Desmarais, K.H., Kathleen, H. and Berkowitz, A.R., 2000; Authentic Assessment in the Informal Setting: How It Can work for You, *Journal of Environmental Education* **31** (3), 20-24.
- Nabors, M.L., 1999; "Principals" for Hands-On Science, *Education* **119** (4), 744-746.
- Natural Resources and Environment (NRE) Victoria, 2001; *Marine Discovery Centre, Queenscliff Victoria; Summer Holiday Program*, <http://www.nre.vic.gov.au> (Accessed 14 June 2001).
- Nelan, C., (n.d.); *Marine Discovery Centre (1979-1999) "The First Twenty Years"* (A "personal" View), Woodbridge, Unpublished.
- Northern Exposure Technologies, 2000; *Ballina High: Marine Discovery and Resource Centre*, <http://www.norex.com.au~bhnmarine> (Accessed 25 September 2001).
- O'Brien, C., 1996; How Wading Through the Murk is FOR a Better Environment: Case Studies in Environmental Interpretation, *Australian Journal of Environmental Education* **12**, 15-18.
- Oppenheim, A.N., 1999; *Questionnaire Design, Interviewing, and Attitude Measurement*, Cassell, London.
- Rix, C., and McSorley, J., 1999; An investigation into the role that school-based interactive science centres may play in the education of primary-aged children, research report, *International Journal Science and Education* **21** (6), 577-593.
- Ryan, C., 1991; The Effect of a Conservation Program on Schoolchildrens' Attitudes toward the Environment, *Journal of Environmental Education* **22** (4), 30-35.
- Simmons, D.A. and Young, C., 1993; Perceived Resource Needs for Providing Nature Experience: Urban Teacher' Perspective, *International Journal of Environmental Education and Information* **12** (April - June), 95-106.
- Smith, B.F. and Vaughn, P.W., 1986; The Role and Organization of Nature Centers in The United States, *International Journal of Environmental Education and Information* **5** (2), 58-61.
- Star of the Sea School, (n.d.); *Marine Discovery Centre; A Gateway to SA's Cool Water*, Henley Beach, South Australia, Brochure.
- Star of the Sea School South Australia, (n.d.); *Marine Discovery Centre*, <http://www.staroshb.adl.catholic.edu.au> (Accessed 15 December 2001).

## References

- Stevens, J. R., 1982; *A Case for the Construction of a Curriculum Framework for Environmental Education in Australian Schools, based on Teacher Perceptions in Tasmania: An Illuminative Study with Recommendations for Further Innovation and Implementation in the Light of the Current Trend Towards School-Based Curriculum Development*. Masters Thesis. Centre for Environmental Studies, University of Tasmania, Hobart, Tasmania.
- TASSAB (Tasmanian Secondary Assessment Board), 2001; *Aquaculture*, Curriculum for Aquaculture Subject 9/10 SC250/251 B and 9/10 SC081-089 S. Tasmanian Educational Leaders' Institute, Hobart, Tasmania.
- UNSD (United Nations Division for Sustainable Development), 2001; *Agenda 21*, <http://www.un.org/esa/sustdev/agenda21.htm> (Accessed 25 June 2001).
- Waters, D., 1996; Sealife Science Workshop, *Green Teacher* 46 (February-March), 23.
- Woodbridge District High School, (n.d.); *Marine Discovery Centre*, Woodbridge, Tasmania, Brochure.
- Woodbridge MDC , 2002; *Marine Discovery Centre*, <http://www.woodbridge.tased.edu.au/mdc> (Accessed 30 April 2002).

## LIST OF PERSONAL COMMUNICATIONS

No	Respondents	Status	Date
1.	Prof. Bevis Yaxley	The Tasmanian Senior Curriculum Officer, Department of Education Tasmania	4 April, 2001
2.	Mrs. Ingrid Albion	Education officer, Department of Parks and Wildlife Tasmania	26 June 2001
3.	Mrs. Lee Herbert	Visited teacher, Princes Street Primary School	21 March 2002
4.	Mrs. Debby Clark	Visited teacher, Woodbridge District High School	25 March 2002
5.	Mrs. Pam Elliott	Senior teacher, Woodbridge MDC	25 March 2002
6.	Ms. Jennifer Collins	Marine Biologist and teacher, Woodbridge MDC	25 March 2002
7.	Jennifer Pratt	Co-ordinator of Tasmanian Marine Links, Tasmanian Educational Leaders' Institute, Department of Education Tasmania	27 March 2002
8.	Mr. Alistair Martin	Founder and former teacher, Woodbridge MDC	4 April 2002

## **List of Appendices**

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- Appendix 1 Information Sheet
- Appendix 2 Approval of Ethical Clearance
- Appendix 3a Story and Questionnaire Version 1
- Appendix 3b Story and Questionnaire Version 2
- Appendix 4a Selected Responses to Oral Question Number 1
- Appendix 4b Selected Responses to Oral Question Number 2
- Appendix 5a Additional Questions of Students' Perceptions of Woodbridge MDC  
(Focus Groups)
- Appendix 5b Selected Responses to Students' Opinions of Woodbridge MDC  
(Repeat Groups)



## Appendix 1

### Information Sheet

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### INFORMATION SHEET

#### ENVIRONMENTAL EDUCATION IN A COASTAL COMMUNITY

This information sheet provides a brief summary of a research project being carried out by Irene Sahertian as part of her Master of Environmental Management degree at the University of Tasmania. Irene is investigating the effectiveness of the Woodbridge Marine Discovery Centre in its provision of information and stimulation of interest in primary school children. Depending on the outcomes of this research, Irene hopes that the Centre might serve as a model for coastal environmental education in her home country of Indonesia.

Irene will be working with two cohorts of students: one will have visited the Centre and the other, the control group, will not. Students, from grades 5 and 6, will be divided into small groups of 5 or 6 students. Irene will tell the group a short story about children in a coastal community in Indonesia and then ask a few questions about the story. She will then ask some questions about the groups own experiences on beaches here in Tasmania and give each student a short questionnaire to fill in.

Irene will also be talking with teachers and other environmental educators about the merits and limitations of a 'discovery centre' approach to coastal environmental education.

The information provided by students will be analysed and presented such that individual respondents cannot be identified.

The results will be presented in a thesis that will be available through the University library. Irene will also prepare a summary of her findings that will be available to anyone assisting with this research.

A summary of the research aims and contact addresses for Irene and her supervisors is attached.

Please feel free to contact me if you have any further questions.

Assoc Prof John Todd (supervisor).  
date

## Appendix 2

### Approval of Ethical Clearance



Tasmania

DEPARTMENT of EDUCATION

24 August 2001

Keith Scott ☎ (03) 6233 7204

Ms Irene Sahertian  
1/79 York Street  
SANDY BAY TAS 7005

Dear Ms Sahertian

Recently you have applied for clearance with the Department of Education. Your application has now been processed and I can confirm that you have been cleared to work in Tasmanian Government Schools.

This clearance is valid for three years and will need to be re-assessed at that time. In the meantime you will need to inform the Department's Grievances and Investigations Unit of any impending charges which may impact on your eligibility to work in a school-based position.

Please retain this letter for your records.

Please contact me on the above number if you have any queries.

Yours sincerely

A handwritten signature in dark ink, appearing to read 'Keith Scott'.

for: Keith Scott  
MANAGER (GRIEVANCES AND INVESTIGATIONS)

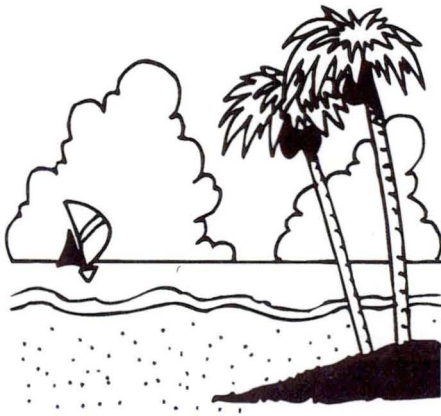
## Marine Life and Myself

### Questions about the story



1. How does this story make you feel?
2. If you were Benny and his friends in this story, what would you do to care for your coast?

### Questions about students' activities on the beach



3. When you go to the beach, what do you like to do?
4. Is there anything about the beach that you dislike?  
Why?
- 5 a. Have you ever been fishing with your family?  
b. How often do you go fishing with your family?  
c. What kind of fish do you catch?
6. Where do you learn about the coast?



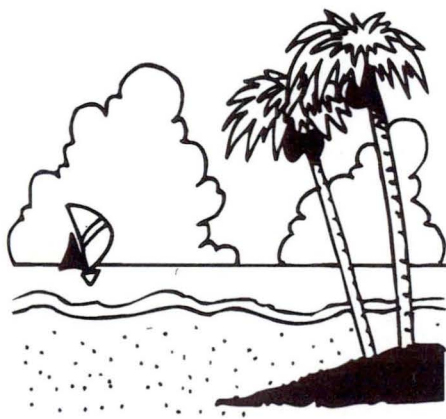
## Marine Life and Myself

### Questions about the story



1. How does this story make you feel?
2. If you were Benny and his friends in this story, what would you do to care for your coast?

### Questions about students' activities on the beach



3. When you go to the beach, what do you like to do?
4. Is there anything about the beach that you dislike?

Why?

- 5 a. Have you ever been fishing with your family?  
b. How often do you go fishing with your family?  
c. What kind of fish do you catch?
6. Where do you learn about the coast?



## Written Questions

1. How often do you go to the beach?

- ☐ Almost every day
- ☐ Once a week
- ☐ Once a month
- ☐ Once a year
- ☐ Never
- ☐ .....



2. Which would you rather go to :

- ☐ The beach
- ☐ The swimming pool

Why? .....



3. a. Have you seen any pollution or damage at the beach?

- ☐ Yes
- ☐ No

b. If yes, what was it ?

.....



4. True or False

- ☐ T - F All sharks are dangerous.
- ☐ T - F Seals can be found in the Antarctic.
- ☐ T - F Some fish are poisonous. If you answer T or true, can you name any?

- ☐ .....
- ☐ .....

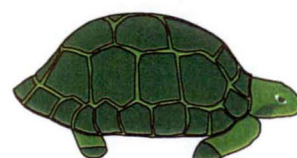
5. True or false

- ☐ T - F Plastic bags can kill sea turtles.
- ☐ T - F When dolphins get tangled in the nets, it is difficult for them to escape.
- ☐ T - F Introduced sea stars are good for local marine fish and plants.



6. True or false

- ☐ T - F There are many different habitats in a coastal environment.
- ☐ T - F Plankton in the sea cannot be identified using a microscope.
- ☐ T - F Fish need oxygen to breathe.





## Appendix 3b

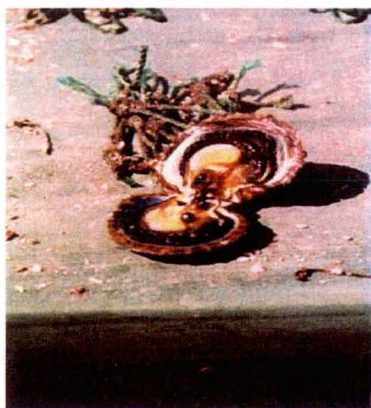
### Story and Questionnaire Version 2

(Presented to the Repeat Groups)

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#### Nyong and Nona At The Beach

*By Irene Sabertian (University of Tasmania)*



This is a story about two Indonesian children, who were brother and sister. Their names were Nyong and Nona. They lived in a house near the beach, and they liked to play there. They lived on a small island village called Koba (Picture 1). Their village was a long way from the city and market.

Because of the long distance to the market, the whole family depended on the forest and coast to get their daily food. So after school each day, the children went to the beach to find food to eat.

Sometimes they even dived in the shallow water to find pearls. They helped their mum and dad to find food or pearls for money. Besides finding something to eat, they loved to play on the beach. Because they could see crabs scuttling over the sand, sea grasses waving in the shallow water, schools of fish dancing, and the beautiful colors of the coral reef (picture 2).

One day, Nyong and Nona thought that they should do something to keep their beach healthy. They thought that a healthy beach makes a good habitat for animal, plants and also for people. Nona suggested that they clean up and take out the rubbish from the beach in the next time when they go to the beach. So, they started to clean up the rubbish such as bottles, cans, plastic and other things. "Where does the rubbish come from?" Nyong asked. They looked out to the sea and noticed that most of this rubbish came from fishing boats that operated close to their village.

They kept on collecting rubbish and trying to keep the local animal, plant and environment clean. While the cleaning up worked very well, unfortunately another problem faced Nyong and Nona's beach again.

One day, when they were walking along the beach, they saw many rotten fish were floating into shore and washed up onto the beach. The rotten fish had come from a commercial fishing boat. Because the fisher only needed prawns and high price fish. It caused a bad smell for people in the surrounding area and also polluted the beach for the sea animals and plants.

Nyong and Nona had fixed one environmental problem -  
now they had a new challenge to face - what could they do about the dead fish?

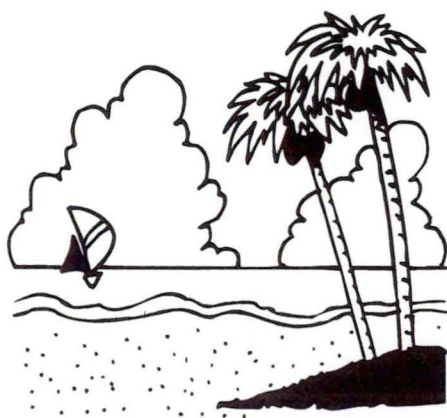
## Marine Life and Myself

### Questions about the story



1. Should Nyong and Nona try to save the beach again? If Yes or No, give your reason.
2. What could they do about the dead fish?

### Questions about students' activities on the beach



3. When you go to the beach, what do you like to do?
4. Is there anything about the beach that you dislike?  
Why?
- 5 a. Have you ever been fishing with your family?  
b. How often do you go fishing with your family?  
c. What kind of fish do you catch?
6. Where do you learn about the coast?



## Written Questions

1. How often do you go to the beach?

- ☐ Almost every day
- ☐ Once a week
- ☐ Once a month
- ☐ Once a year
- ☐ Never
- ☐ .....



2. Which would you rather go to :

- ☐ The beach
- ☐ The swimming pool

Why? .....



3. a. Have you seen any pollution or damage at the beach?

- ☐ Yes
- ☐ No

b. If yes, what was it ?

.....



4. True or False

- ☐ T - F All sharks are dangerous.
- ☐ T - F Seals can be found in the Antarctic.
- ☐ T - F Some fish are poisonous. If you answer T or true, can you name any?

- ☐ .....
- ☐ .....

5. True or false

- ☐ T - F Plastic bags can kill sea turtles.
- ☐ T - F When dolphins get tangled in the nets, it is difficult for them to escape.
- ☐ T - F Introduced sea stars are good for local marine fish and plants.



6. True or false

- ☐ T - F There are many different habitats in a coastal environment.
- ☐ T - F Plankton in the sea cannot be identified using a microscope.
- ☐ T - F Fish need oxygen to breathe.





## Appendix 4a

### Selected Responses to Oral Question Number 1

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The question was for the Focus and Control groups;

**How does this story make you feel?**

#### **Focus groups**

- ☐ ...*sad because Benny and his friends had planted all the trees and then they were lost.*
- ☐ ...*sorry for the animals because their habitat was taken away.*
- ☐ ...*other people [government and mining company] did not care for the environment.*
- ☐ ...*the environment needs protection*
- ☐ ...*the children planted trees but the government came and ruined all the trees because of the mining and digging activities.*
- ☐ ...*sad and angry over what happened because money won over nature.*

#### **Control groups**

- ☐ ...*the story was really good at the start, and bad at the end because all the group's work was destroyed.*
- ☐ ...*they made the beach really nice and then it was destroyed.*

The question was for the Repeat groups;

**Should Nyong and Nona try to save the beach again?**

#### **Repeat groups**

- ☐ ...*yes, they should try to clean up and get other people to help, so that animal and animals still there for the next generation.*
- ☐ ...*yes, they should because it is beautiful and provides food and money.*

## Appendix 4b

### Selected Responses to Oral Question Number 2

---

The question was for the Focus and Control groups;

**If you were Benny and his friends in this story,  
what would you do to care for your coast?**

#### Focus groups

- ☐ ... ask other people to help plant the trees again.
- ☐ ... collect and clean rubbish from the beach.
- ☐ ... get involved in a group and get others to care for the coast.
- ☐ ... write a petition and ask the local community to help.
- ☐ ... complain to mining company.

#### Control Groups

- ☐ ... go to the local government and ask them to conserve the beach.
- ☐ ... go to the local community and tell them that if they want a clean beach, they should come and help.
- ☐ ... do something about the rubbish and protect the animals.

The question was for the Repeat groups;

**What could they do about the dead fish?**

#### Repeat Groups

- ☐ ... the children should clean the dead fish and tell the government to stop the fishing boat throwing away the fish.
- ☐ ... pick up the dead fish and make compost, to make the ground more fertile.
- ☐ ... they could try to stop the fishing boats throwing away the dead fish.
- ☐ ... they should protest because lots of people love the beach.
- ☐ ... put up signs and bins on the beach.

## **Appendix 5a**

### **Additional Questions of Students Perceptions of Woodbridge MDC (Focus groups)**

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#### **Summary of the Table**

The table below shows:

- Date of survey.  
The surveys were conducted on 17 and May 2001, 21 and 26 June 2001, and 8 and 9 August 2001.
- Total number of students questioned.  
They were 68 students from six schools.  
From primary school (Prep, Grades 1, 3, 5 and 6), and secondary school (Grade 9-S Course).
- The questions were about:
  - What the students enjoyed most when visiting Woodbridge MDC.
  - What were the best things about the Centre.
  - What should be improved.

Date	Grade	No.	Students' Opinions		
			The most enjoyable	The best things	Should be improved
31-05-01	Grade 3	1.	Touching the sharks	Exciting	Not really as exciting as Sydney aquarium. It is a big aquarium and has bigger animals, bigger sharks than in WMDC. We can walk along the "tunnel" (we can walk below the aquarium)
		2.	Touching the sharks	Exciting	Went to Melbourne aquarium. It is bigger than in Woodbridge MDC.
	9 (S Course)	3.	The small aquarium with crayfish	Enjoyable The centre is pretty good.	No
		4.	All of the MDC	Enjoyed all activities This centre is good Getting new information especially about marine environment.	No
21-06-01	9 (S Course)	5.	Information about the human impacts	Learning lots of marine ecology.  The human impact section is interesting because it is what happens with humans.  The MDC really provides good educational information, but Sydney is only for tourists.	No
		6.	Pond ;	Good information.	No
		7.	Touch pond Playing with sharks.	Finding out more information, when comparing with the first visit (in Grade 2).	No
		8.	All sections are important.	Interesting	No
26-06-01	Prep/1	9.	Hook with the long line	Enjoyable	No
		10.	Shark		
		11.	Shark		
		12.	Shark		
		13.	Shark		
		14.	Shark		
		15.	Scallops		
		16.	Cow fish		
		17.	All sections of the WMDC		
		18.	Painting		

Date	Grade	No.	Students' Opinions		
			The most enjoyable	The best things	Should be improved
08-08-01	6	19.	The fish (spotted dog shark).	There is lots of information.	No
		20.	The marine pond The touch tank The Aquarium	It has lots of information and hands on work.	-
		21.	The marine pond	I can learn about sea animals, plants close up and not just in book and videos, etc. I can see the sea fish close up and pat them.	No
		22.	The marine pond	It teaches me about marine life. It is interesting.	No
		23.	The marine pond.	I really like most of the fish and like patting the dog shark.	-
		24.	The touch tank The Marine Pond	It is interesting.	-
		25.	The fish	Yes	No
		26.	The Marine Pond	I can pat animals that live in the ocean.	-
		27.	The Marine Pond and patting the sharks.	It helps me learn about sea life. It is fun.	No. It is great as it is.
		28.	The Touch Tank The Marine Pond Everything.	It is excellent, because I learn lots of information.	More information
		29.	The Marine Pond	It lets me know about marine life.	Computers
		30.	How things live Irene's story	There is very good education. It is fun.	No. It's great, but the plankton is scary.
		31.	The Marine Pond	It allows children to learn about marine life.	No.
		32.	Learning about the dog shark.	Discovering new facts about animals I can travel on the boat. I can learn a lot from the centre.	No. It is really good.
		33.	The large Touch Tank.	It is really good because it teaches you about marine life.	The centre is fine as it is.
		34.	Seeing all the different fish and learning about them.	It tells me to look after animals and learn lots more.	The fishpond could be a bit bigger
		35.	The Marine Pond Aquarium room Computers Basically, everything.	It is interesting and fun to pat fish and investigate sea life.	It is good the way it is.

Date	Grade	No.	Students' Opinions		
			The most enjoyable	The best things	Should be improved
08-08-01	6	36.	Boat and the story	It lets me learn about marine life.	No.
		37.	The first hand contact with marine life.	It offers a unique learning opportunity.	The questions on activity sheets should be more challenging.
		38.	The Marine Pond	The centre is good, because it makes the Centre educational but lots of fun at the same time.	The marine pond could be improved by putting some vegetation and rocks in.
		39.	Seeing the fish and learning about the coast	I can learn a lot.	No.
		40.	The boat. The hands-on activities with the animals. I like learning about them	It is good, because I can learn about all sorts of creatures.  It is fun	
		41.	The boat trip	It is full of really interesting things to touch, feel, smell and even taste.	No. It is perfect.
		42.	The boat trip The Marine Pond	It teaches children about marine life and I can touch and smell the animals.	No. It is really good.
		43.	The boat trip	There are lots of hands-on things	No. It is perfect.
09-08-01	5/6		The Marine Pond Because we are allowed to touch them. The boat trip because : I am speechless	I learnt a lot of things.	The Centre is perfect.
			Marine Pond	It is easy to see fish	The jetty should go out longer. Get another eel in the pond.
			Marine Pond	It is exciting	Nothing
			Marine Pond	It is easy to see fish	Need another eel in the pond.
			Marine Pond	It is good fun to see the sharks and fish	Nothing
			The touch tank	I can find out about different types of sea creatures.	There is a need for a big tank with the shark in it and it should have eels.
			The cow fish in the pool, because it gives a lot of information on the sea		We do most of the same things every year.

Date	Grade	No.	Students' Opinions		
			The most enjoyable	The best things	Should be improved
09-08-01	5/6		The sharks		It is ok but it is a bit boring. I have been here so many times. The big fish pond, because it is really dirty.
			The touch tank	I can learn from it	There is a need for a big tank because it is so dirty
			Touch tank Shark pool	There are some fish and creatures that I have never seen; Also enjoy studying about them	No
			Touch tank Shark pool	It teaches me new things every time I come.	No, everything is already good.
			The shark tank and touch tank	There are lots of animals	Nothing
			Boat Touch tank Pool	You can do fun things here.	Do not think so.
			Shark pool Touch tank	It teaches me about marine life	Not really
			Marine Pond which has shark	The centre is very good because I can learn about sea animals	No, there should be nothing improved because it is a natural environment.
			The big pond which has the shark in it	It helps me learn.	No
			Penghana (boat), Marine pond which has sharks in it.	It teaches me more about marine life.	There should be a bigger pond and different kinds of fish.
			Shark Pond and Boat	I can learn, but it is not hard.	Maybe the shark pond could be bigger.
			Going on the boat	There are good things there.	No
			Going on the boat	I like all the activities	No
			Going on the boat	There is lots of activities to do	No
			On the Boat	It teaches me a lot of stuff	The touch tank.
			The touch tank	Good	No
			The boat Irene's story	It makes me think about what I am doing	No
			Marine Pond	It is fun	Need a better computer

## Appendix 5b

### Selected Responses to Students' Opinions of Woodbridge MDC (Repeat Groups)

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The question asked about their experiences at Woodbridge MDC, six weeks after their visit.

Students' opinions:

- ☐ ... my experience in the MDC was great, as always when I go there. Although I already know some of the things they talk about from dad. I still learn new things which is fun. The WMDC is a great place to have fun and also to learn.
- ☐ ...going out on the boat is a fantastic experience and I would recommend it to anyone.
- ☐ ...the Centre does not need any improvement, it is fine the way it is. I really enjoyed being there.
- ☐ ...it was informational and fun to look at the fish and learn about the coast, although I lived by a beach and knew a lot. It is always fun to learn more.
- ☐ ...I learnt a lot from the MDC especially about habitats of animals and plants and how they are killed.
- ☐ ... I learnt some sea creatures I have never thought existed and overall it was definitely great fun.
- ☐ ...the Centre is a good place to go if you want to learn about the ocean.
- ☐ ...I think it was good way to learn about the sea.
- ☐ ... it is a very educational place.
- ☐ ...I like the MDC because there are lots of different types of marine life.
- ☐ ...at the MDC, I learnt a lot about different kinds of fish and what kind of litter that kills animals. I will much careful about what I throw in the bin.
- ☐ ...it was fun because I got to see the real sharks and pat them.
- ☐ ...I had fun in the MDC and I loved it with looking at the plankton.