The Australian Marine Debris Status Review: Summary Report

February 1996

Preamble

This document is an expansion of the Executive Summary of the Final Report produced for the ANZECC Working Party on Marine Debris. The full report is referred to as the Australian Marine Debris Status Review.

It is acknowledged that the degree of detail in some sections of the full report has been limited by availability or existence of relevant data or literature.

A total of 179 pieces of literature were received from members of the Working Party, Government Departments, organisations and various other groups and individuals. Each piece of this literature is referenced in the reference list in Chapter 9 of the full report.

Information that was specifically utilised in producing this report is referenced by the annotation "(ref #)".

Table 1.1 is a matrix which identifies the various issues addressed by each piece of literature reviewed for this study.

Abbreviation List

AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AMCS	Australian Marine Conservation Society
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment and Conservation Council
AQIS	Australian Quarantine and Inspection Service
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CMC	Centre for Marine Conservation
COP	Code of Practice
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEM-N	Directorate of Environmental Management - Navy
EEZ	Exclusive Economic Zone
EPA	Environment Protection Agency
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GCCC	Gold Coast City Council
GESAMP	Group of Experts on the Scientific Aspects of Marine Pollution
ILAP	Integrated Local Area Planning
IMO	International Maritime Organization
IOC	International Oceanic Commission
KAB	Keep Australia Beautiful
LRRA	Litter Research and Recycling Association
MARPOL	International Convention for the Prevention of Pollution from Ships
MESA	Marine Education Society of Australasia
MRCC	Maritime Rescue Co-ordination Centre
MSANZ	Maritime Safety Authority of New Zealand
MSB	Maritime Services Board
NURP	National Urban Runoff Program
PACIA	Plastics and Chemicals Industries Association
QDEH	Queensland Department of Environment and Heritage
RANWMS	Royal Australian Navy Waste Minimisation Strategy
Recfish Australia	The Australian Recreational and Sport Fishing Confederation Inc.
SARDI	South Australian Research and Development Institute
SEPP	State Environment Protection Policies
SETFIA	South East Trawl Fishing Industry Association
SOMER	State Of the Marine Environment Report
SOS	State of Our Surf Review
SPREP	Convention for the Protection of the Natural Resources and Environment of the South Pacific Region
TRALAC	Tasmanian Recycling and Litter Awareness Council
UNCLOS	United Nations Convention on the Law of the Sea, 1982
UNEP	United Nations Environment Program
USEPA	United States Environment Protection Agency

Introduction and Background

The Australian and New Zealand Environment and Conservation Council (ANZECC) Standing Committee on Environment Protection (SCEP) established a Task Force on Maritime Accidents and Pollution consisting of representatives of CSIRO, the Commonwealth, New South Wales, Queensland, Western Australia and New Zealand to examine the issues of marine pollution in detail and prepare recommendations for consideration by Council.

One of the issues addressed by the Task Force was that of marine debris from shipping and boating. The issue was seen as a high priority issue since debris generated from shipping and boating is perceived as having severe impacts on the marine and intertidal environments.

The Task Force was replaced (in 1994) by the Maritime Accidents and Pollution Implementation Group, responsible for the development of a strategy and action plan to address the issues raised in the Task Force report. The strategy and action plan were endorsed by ANZECC in December 1995 and released in June 1996 as the 3-volume document *Working together to reduce impacts from shipping operations: ANZECC strategy to protect the marine environment*.

A national Working Party comprising representatives of state and federal government, industry and community groups was subsequently established (in April 1995) to consider the issue of marine debris.

The Tasks of the Working Party are:

1. to arrange any necessary additional survey work to ascertain the precise situation in regard to the quantities and types of debris entering Australian and New Zealand waters;
2. to attempt a differentiation between wastes and debris from maritime and non-maritime operations;
3. to identify any outstanding issues;
4. in collaboration with AMSA and other relevant organisations, develop policies, procedures and education programmes which aim to:
    4.1. reduce the amounts of debris and wastes entering the marine environment;
    4.2. encourage waste minimisation practices; and
5. make recommendations on changes to relevant legislation necessary to control marine debris in accordance with Australia's international treaty obligations.

The Working Party decided that these tasks would be broken up into a series of major tasks to be undertaken by consultant groups with oversight by the Working Party. .The first priority was to determine the relevance of existing information from surveys and research in understanding the overall marine debris problem in Australian and New Zealand waters.

The Terms of Reference for this initial consultancy are as follows:

1. Compile known information on amounts, types, locations and sources of marine debris in Australia and New Zealand and hence:
    1.1. Evaluate the magnitude of the problem;
    1.2. Estimate contributions from maritime and land-based sources if possible;
    1.3. Identify gaps in current information;

2. Compare/contrast and evaluate methodologies used in the various surveys and hence:

    2.1. Determine whether a statistically reliable baseline exists which will enable an assessment of the effect of changed management practices, legislation, education programmes on the amount of debris in the marine environment;
    2.2. Determine whether a series of reference monitoring sites around the coastline is a feasible option;
    2.3. Determine whether a standard assessment methodology is feasible;

3. Compile information on existing management practices, education programmes and domestic and international regulations and legislation and hence:

    3.1. Comment on their effectiveness;
    3.2. Identify gaps in existing legislation;
    3.3. Evaluate the need for additional or altered management practices, education programmes or legislation necessary to fulfil Australia's international treaty obligations.

It was subsequently agreed by the Working Party that the consultancy would not extend to New Zealand waters.

The definition of marine debris as developed by the Working Party on Marine Debris is: *Manufactured solid materials entering the marine environment, including garbage as defined by Annex V of MARPOL 73/78* .

The definition of garbage contained in MARPOL Annex V is: *All kinds of victual, domestic and operational waste, excluding fresh fish and parts thereof, generated during the normal operation of the ship and liable to be disposed of continuously or periodically except those substances which are defined or listed in other Annexes.*

The impact of marine debris on the marine environment is difficult to assess because of the environment's vast size, diversity and the complexity of the human and natural impacts affecting it.

The Australian coastline is about 36,700 km long with approximately 86% of Australia's total population living in the coastal zone. The marine environment includes Australia's 200 nautical mile Exclusive Economic Zone (EEZ) which came into effect in November 1994. The EEZ's area covers approximately 11 million square kilometres making it much larger than Australia's land area (ref 005).

Marine debris is recognised as having two main origins with these being debris derived from land based activities and debris derived from maritime activities.

Debris in the marine environment has multiple sources. Sources include municipal stormwater systems, poorly managed or illegal waste dumps adjacent to water bodies and coastal areas, windblown litter from communities and garbage from recreational, commercial and other vessels. Shipping and ancillary services are also seen as significant contributors to degradation of the marine environment.

Scope of Study

The primary objective of this study is to quantify, if possible, the amount of debris and other wastes entering the marine environment from maritime operations. In order to attempt a proper quantification of this problem, a secondary objective of the project is to quantify, if possible, the amount of debris and other wastes entering the marine environment from non-maritime operations.

The three main tasks of the study are firstly, to compile existing survey work: secondly, evaluate the methodologies used in existing data surveys; and thirdly, evaluate the effectiveness of current waste management policies, practices and education programs.

Literature matrix

A total of 179 reports, studies, surveys, guidelines, and other forms of literature were reviewed for this study. This literature is summarised in Table 1.1 which includes reference to the main study components.

The main study components are listed along the top of the table with the reference identification numbers listed down the left hand margin.

Each piece of literature is evaluated by identifying the issues it addresses.

The matrix clearly identifies the issues that have been covered by a wide variety of sources and the issues that remain relatively unresearched.

Summary report

Study Outline

This study presents the results of a review of existing data related to marine debris in Australia. The component sections of the study are listed below, together with the overview or introduction for each section taken *verbatim* from the full report:

- **Marine Debris Description (Section 2)**

There are many definitions of marine debris which have been used in various studies. For example ref 006 defines it as "human derived solid litter with the main categories being plastics and durable synthetic waste along with glass and metal". However, the definition adopted by this Working Party is "...manufactured solid waste entering the marine environment, including garbage as defined by Annex V of MARPOL 73/78" (Refer to **Introduction and Background** for further details).

Debris is discarded at sea or reaches the sea through waterways or domestic and industrial outfalls (ref 030). Marine debris causes impacts that are not primarily aesthetic including entanglement of animals and boat damage for example. This type of pollution has been identified by the International Oceanographic Commission as one of the five major pollutants of the marine environment (ref 006).

The sources of beach litter in Australia are influenced by a variety of factors including proximity to cities, access to beach, population of surrounding area etc. On remote coasts, fisheries are the most significant beach litter source. Coastal and offshore shipping are important sources near approaches to ports and along coasts and islands in heavily trafficked areas. Accurate quantification of the sources of debris is virtually impossible. It is estimated that there is in the order of 7 billion tonnes of debris entering the world's oceans annually and that this possibly travels thousands of kilometres from its source (ref 006). The topic of marine debris has become a serious enough problem to be the subject of international law and to warrant three international conferences in the past 11 years (ref 006).

The composition of land-based litter (refer to Sections 6.2 and 6.3) varies widely between survey locations because litter sources and types are subject to respective catchment conditions. It is therefore difficult to give an accurate representative description of land-based litter as the nature of the environment and litter control practises affects composition and production.

The most prevalent type of debris found on beaches world wide is plastic. Plastics exhibit various desirable features to manufacturers and consumers and a number of "unfriendly" attributes with regard to the environment. Plastics are generally very durable, the greater proportion of plastic products will not decompose over time frames less than hundreds of years (ref 003). However, it is reported (ref 129) that ultraviolet degradation can substantially degrade plastics within months. Plastics consistently comprise the highest percent of debris items recorded worldwide ranging from 48% to 99% (ref 003). It is claimed that plastics decay slowly with little ultraviolet degradation occurring at sea (ref 050) with the exception of some specially produced plastics (refer to section 2.2.3).

The high incidence of plastics in surveyed debris is probably due to the increased use of plastics over the last few decades, particularly for packaging, and the slow rate at which plastics degrade. Surveys in the North Sea and the coasts of northwest Europe have shown that most marine litter is primary or secondary packaging particularly plastic bottles, the majority of which originates from the disposal of garbage by ships at sea (ref 050).

The results of the 1994 International Coastal Clean Up conducted by the Centre for Marine Conservation - Washington (ref 001) are shown in the table below:

Plastic	56.97%
Glass	12.64%
Rubber	2.06%
Metal	12.29%
Paper	11.52%
Wood	2.99%
Cloth	1.53%
Total	100.00%

The 12 most abundant debris items collected in the 1994 International Coastal Clean Up have been termed the "dirty dozen" and comprise 61.68% of all debris collected. The "dirty dozen" include:

1. cigarette butts
2. plastic pieces
3. foamed plastic pieces
4. glass pieces
5. Plastic food bags/wrappers
6. Paper pieces
7. plastic caps/lids
8. glass beverage bottles
9. plastic straws
10. metal beverage cans
11. metal bottle caps
12. plastic beverage bottles

The most numerically abundant item collected in the 1994 International Coastal Clean Up, for the fourth consecutive year, was cigarette butts. The number of cigarette butts collected in 1994 represents over 76,194 packs of cigarettes (ref 001).

Sightings
Glass bottles (often Japanese) are common on cays in the southern Coral Sea, presumably from longline and purse seine tuna fisheries (ref 010).

Peculiar occurrences such as quantities of thick rubber or plastic sheeting, out of which the soles of thongs are cut, are abundant on Cocos-Keeling Island beaches. Indonesian fishing boats discard this plastic material after such footwear is hand made (ref 010).

Identification of litter at Eyre Bird Observatory on the western coast of the Great Australian Bight in 1990-91 yielded 494 items, mostly fishing gear. Here, as elsewhere, plastic formed the major component of ocean litter (ref 010).

- **Shipping Lines (Section 3)**

Shipping, both domestic and international, is a major user of our seas, estuaries and coastlines. In terms of tonnage carried and distance travelled, Australia ranks as the fifth largest user of shipping in the world.

Each year approximately 12,000 ships arrive in Australian waters and almost 380 million tonnes of freight is transported

- **Marine Debris Movement (Section 4)**

For ease of reference Australia has been divided into five geographical areas as follows:
· south coast of Australia (Sect. 4.2)

- south east corner of Australia including Tasmania (Sect 4.3)
- east coast of Australia (Sect 4.4)
- north and west coasts of Australia (Sect 4.5)
- selected enclosed waters of Port Philip Bay, Sydney Harbour and Brisbane River (Sect 4.6)

The movement of water around the coasts of Australia will be the resultant effects of currents, winds and tides as well as geographical features of the coast and the nature of the sea bed, particularly when related to the continental shelf and off-lying coastal reefs. For major surface ocean currents around Australia refer to Figure 4.1.

Sections 4.2 to 4.5 are considered in three parts of Currents, Wind and Tides. A fourth part considers the most likely movements of floating debris. Section 4.6 considers tidal flows only.

Currents are defined as the continuing flow of water over the earth's surface generally due to the earth's rotation. Currents may be permanent, seasonal or temporary and the direction and rate both surface and sub-surface may vary according to a number of factors.

Currents are generally used to indicate the directions from which litter approaches the coastline but experiments with drifting objects and observations of natural flotsam, suggest that wind is often a more important vector than current. Although ocean litter from distant sources follows similar courses to natural flotsam, it makes only a tiny contribution to beach litter as compared to that from local sources (ref 010).

Experiments with drift bottles show that southern Australian and New Zealand coasts are common areas for stranding of marine litter jettisoned in the far South Atlantic. Between 1964 and 1970 50,000 plastic drift cards were jettisoned off South Africa of which 334 were recovered ashore. Of the 334 recoveries, 124 (37%) came ashore on Australian and New Zealand beaches and of these 124 recoveries, more than 50% were found in SW Western Australia, 22% in Tasmania and Victoria and 8% in New Zealand (ref 029).

Wind is caused by meteorological conditions of high and low pressure areas and results in the formation of waves. The horizontal movement of water due to wind is dependent on the strength of the wind and the period over which it blows.

Tides are the vertical movement of water as caused by the gravitational forces of the moon, sun, and planets. They may be semi-diurnal (usual case - two tides per day of 24 hours and 50 minutes), diurnal (one tide per day) or virtually non-existent (in the case of certain enclosed bodies of water). Tidal streams are the horizontal currents caused by the tides.

The interplay of oceanic and local currents means our debris is part of the global garbage. Two major currents meet off Tasmania's World Heritage area: the Antarctic circumpolar currents from the west, sweeping debris across the South Atlantic and Indian Oceans and the East Australian Current from the Pacific. In summer, both currents merge near Pedra Branca Island where any debris is likely to accumulate and be washed ashore by local winds and swells (ref 018).

- **Programs and attitudes (Section 5)**

It is impossible to completely eradicate debris from the marine environment. However, through education, clean up and research programs we can work towards a cleaner marine environment.

This outcome can be achieved by educating the public on the impacts of debris, outlining the correct procedures for waste disposal and encouraging community, industry and organisations to become involved in clean up program . This will hopefully make people consider their actions in relation to waste disposal. Research into various aspects of marine debris may enable the identification of the main offending litter types and sources. This research will allow prediction of trends and assessment of the success or failure of campaigns and legislation aimed at reducing the input of debris to the marine environment.

Despite the numerous clean up, education and research programs that occur around Australia each year, there are still large amounts of litter in our marine environment. These programs are a short term solution to the problem with prevention being the long term solution.

Differentiation between clean up, educational and research programs is difficult. The programs are categorised as clean up, education or research depending on their aims and methodology. A large overlap exists between the programs categorised as either clean up or education programs due to the fact that clean up programs usually have an education component and vice versa.

- **Waste Management Practices and Policies (Section 6)**

Local, State and Federal governments have implemented a wide variety of strategies, codes and policies aimed at minimising waste production, recycling and disposal methods. Through such strategies, codes and policies significant reductions to the amount of land-based debris entering the marine environment can be achieved. Other initiatives have arisen from intergovernmental arrangements.

- **Legislation, Treaties and Conventions (Section 7)**

Throughout Australia's States and Territories there are various forms of legislation aimed at protecting the coastal zone from marine pollution.

Sections 7.1.1.1 to 7.1.1.7 summarise the legislation of each State and Territory. This legislation has been implemented as a means of protecting the coastal zone from marine debris by specifying offences and penalties for various acts or omissions that result in environmental degradation.

- **Marine Debris Databases (Section 8)**

This section describes and analyses research programs/surveys and makes recommendations for future surveys. Information obtained from communication with various study coordinators and a literature review of published reports and unpublished data are included in this section. A frequently expressed view of individual surveyors is that the number of Australian beach surveys is of limited use for a proper analysis. Standardisation of methodology in the future is necessary if proper comparisons are to be made.

Environmental factors affecting distribution and abundance of marine debris
All beaches absorb varying amounts of energy (depending on the type of coastline - refer to table 8.1) from the atmosphere and the ocean and are subject to the effects of rhythmic tides. Beaches are in a state of constant flux. Ocean litter is only a tiny component of the physical environment and is caught up in the large scale interactions of wind, sand and sea along the coast. Without some understanding

of this dynamic system within which stranded litter is transported and broken down it is impossible to interpret beachcombing yields, and their relation to inputs of litter from the ocean (ref 010).

Table 8.1: Composition of the Australian coastline (ref 170)

State	Sand (km)	% Aust coast	Rock (km)	Dune-rock (km)	Mud (km)
Queensland	3574	11.8	568	-	1714
N.S.W	1168	3.9	507	-	14
Victoria	1112	3.7	329	68	177
S. Australia	2058	6.8	484	424	281
W. Australia	4766	15.7	2535	472	1985
N. Territory	2195	7.3	345	22	2308
Tasmania	1061	3.5	1084	-	32
Totals	**15921**	**52.7**	**5852**	**986**	**6511**

Sandy coasts provide the most suitable beach survey locations and comprise just over 50% of the Australian coastline.

CSIRO surveys (ref 170) have comprehensively described the coastal lands of Australia in 10km sections, with reference to an extensive data base containing information on geology, landforms, vegetation and land use and reference to air photographs. Sandy beaches are the predominant form of coastline around Australia: coasts in the four States fronting the Southern Ocean have greater lengths of sand than rock/mud combined with the exception of Tasmania, where sandy and rocky coasts are about equal in length.

Most are situated in arid or semi-arid environments, remote from human settlements generating local beach litter or other pollution. In Australia, flotsam and jetsam comes ashore from the Southern Ocean on extensive, but relatively accessible, sandy beaches.

This combination of oceanographic and geomorphic circumstances gives Australia the opportunity to take an important initiative in establishing baselines for monitoring the state of the southern ocean by beachdrift surveys on our coasts (ref 029).

Key Conclusions

The key conclusions based on an assessment of the literature reviewed and the data analysed are given below.

Clean Up vs Source Control

The solution to the marine debris problem must focus on tackling the problem at the source which reduces the need for clean up and also minimises the environmental impact of debris. Beach clean ups and education programs receive a high level of media and community attention. However, clean ups are considered a "band-aid" solution to the marine debris problem as they don't reduce the amount of debris being produced. They do, however, remove some accumulated debris and play a crucial role in educating and involving the community and media, which hopefully creates a focus on overall debris production and management.

Clean up programs that collect statistics on the material collected (research projects) provide valuable information on debris composition and enable the identification of the main offending debris types.

Legislation and Community Involvement

Legislation prohibiting littering and the dumping of garbage by ships at sea is notoriously difficult to enforce but is nevertheless essential if we are to reduce the amount of debris entering the marine environment. Provision of adequate port waste reception and disposal facilities and procedures are also essential.

It is important to educate and involve the users of the coastal zone in issues of coastal management such as marine pollution by debris. Involvement of the broader community and industry is critical to facilitate understanding of the impacts of our actions. Specifically, land based activities may produce significant amounts of debris that is washed or blown into the marine environment.

Target groups

The main contributing industry groups such as the commercial fishers and boaters, plastics, shipping and packaging industry along with user groups such as recreational fishers and boaters, surfboard riders and decision makers such as governing bodies and the three levels of government need to be targeted to educate their members and staff on the detrimental effects of their activities on the marine environment.

Survey Results

While there has been a large number of surveys conducted around Australia there is no definitive statement identifying the major source of marine debris to the environment.
Substantial discrepancies exist between the findings of most surveys. Some of the conclusions made in various surveys are as follows:

- 70% of debris is sourced from land-based activities (ref 006);
- a high proportion of debris is sourced from fishing, boating, shipping and other maritime activities (ref 002, 018, 121);
- a low proportion of debris is attributed to ocean-based fishing activities with a high proportion being attributed to land-based activities (ref 023);
- large proportion of Tasmania's debris is derived from ocean sources (ref 002, 121); and
- a study of three large population centres found less than 50% of the surveyed debris to be attributed to maritime activities (ref 003).

From the above findings it is apparent that the composition of debris varies greatly around Australia. Delineation between composition of debris sourced from maritime and non-maritime activities, based

on past surveys, is difficult because these surveys varied greatly in their aims, methodologies and scopes. Notwithstanding the variation in survey results, it is apparent that both make significant contributions to Australia's marine debris problem and both should be targeted to reduce their inputs to the marine environment.

The information from past surveys needs to be complemented by co-ordination of future surveys. The information will be more valuable once the methodologies of the surveys are more congruent. Information that is necessary to compare the surveys needs to be an objective of future surveys. Knowledge of the area is helpful for sourcing particular types of debris, for example knowledge of local fisheries. Co-ordinating the operations of these surveys will achieve this in some way.

Taking this one step further, it would be beneficial to be a part of the international clean up program of the Centre for Marine Conservation (CMC). This clean up program, along with the survey method, has been active for a number of years and used by many countries. Any additional information sought by particular surveys can be incorporated into the basic methodology. Anxious Bay, for example, can continue the weighing of items to continue the trend assessment that has covered five years. While such modification is possible, it is recommended that a *standard Australia wide survey* be devised and employed for all future surveys.

Many researchers, both in Australia and elsewhere, have consistently remarked on the need to implement a consistent methodology and to specify the aims and objectives of individual studies to enable meaningful comparisons to be made. While the methodology developed by the Centre for Marine Conservation (CMC) is and excellent starting point, most Australian surveyors and researchers appear to be of a view that this methodology may need modifying to suit Australian conditions.

In light of this, one of the prime recommendations to be made in this report is that a workshop be held to develop an Australian methodology, based on the CMC methodology, and which will be the basis of all future Australian surveys. An extension to this recommendation is that existing surveys, while providing a comprehensive backdrop to the problem, should be adapted to conform to the new methodology.

Any survey already conducted represents a baseline. However, the data reflects the differing aims, scopes and methodologies. A good representation of all kinds of sites is necessary to make comparisons between sites different in their environments. For example, ocean based debris can best be measured on remote beaches. Sites such as Cape York have been reported to be good for measuring shipping based debris. A gathering of knowledge of beach types and conditions would prove helpful in choosing future sites and the assessment of those sites. For certain questions certain sites need to be selected and sufficiently described. Reconnaissance surveys are valuable in this regard.

Indicator items need to be established in the area, first of all on a generic basis and then on a specific basis. Reconnaissance surveys are therefore first of all needed in each State and incorporated into existing studies.

Recording the amount of items would generally probably be a problem, yet may be some value in specific areas. Glass, for instance has been reported to be difficult to compare when counted but becomes meaningful when weighed.

Surveyors have mentioned the big gaps in knowledge about the Australian coastline. Increased surveying and monitoring at chosen sites would therefore be useful in analysing the amounts and composition of marine debris.

One of the tasks of the consultancy was to assess and recommend on the feasibility of establishing a small number of permanent marine debris monitoring sites around Australia. The purpose of establishing such a network would be to monitor trends to determine, among other things, the effectiveness of the implementation of Annex V to the MARPOL Convention.

Of extant surveys, only two (Tasmania and South Australia) meet the minimum requirement of 5 years to establish a baseline, the ability to determine the impact of Annex V on the marine debris load within Australian waters is severely impaired.

It is apparent that sufficient long-term data will not be available for at least 5 years to enable a meaningful assessment of both MARPOL compliance and local government initiatives to be made. It is also apparent that the entire issue of marine debris must be proactively addressed in the interim. This implies that the general view that both maritime and land-based sources are significant contributors to the marine debris problem and should be accepted and education programs be produced, focussing on various target audiences which are to be identified in a future consultancy.

The International Convention on Marine Pollution (MARPOL) covers all waters. Debris deposited in international waters moves at the whim of tides, currents and winds and may be deposited anywhere in the world regardless of what we do in our own sphere of control. Therefore, the Australian Government through the IMO should push for implementing more stringent record keeping and regulations.

Recommendations

Following are the recommendations extracted from the various sections of the full report.

Non-maritime

- Design an education campaign aimed at addressing the impact of improper disposal of syringes. This campaign should highlight the fact that disposal of syringes via sewerage and stormwater systems is not a suitable method and may result in them being deposited in the marine environment.

- Introduce requirements for gross pollutant traps, mesh grids and other suitable preventative devices to be installed on waterways draining developed catchments flowing into significant water bodies.

- Erect or stencil signs at appropriate locations indicating gutters, drains, channels etc that drain to significant waterbodies.

- Produce education campaigns to illustrate the amounts and types of debris entering the marine environment through stormwater drains and sewerage systems.

- Educate the public on how stormwater systems work ie.

Water, with debris, is disposed of *via* stormwater system	®	commonly no treatment occurs	®	debris deposited in water bodies
INFLOW		**TRANSPORT**		**OUTFLOW**

- Consider the location and operation of future landfills in relation to the potential impact on surrounding waterways from windblown litter. Existing and future landfills need to be suitably controlled to prevent litter escaping and becoming marine debris.

- Produce education campaigns to highlight the impact of illegal dumping of building waste, domestic rubbish and machinery such as old car bodies and TV sets particularly in coastal and riverine bushland.

- Provide bins in convenient locations at beaches, carparks and access tracks. The bins should be designed so that wind and animals can not remove the litter eg. bins with a swinging flap or rotational lid.

- Introduction of on-the-spot fines for offenders under the relevant State/Territory or Commonwealth legislation.

Maritime

- Produce stronger and/or more appropriate education campaigns to target recreational and Australian based commercial fishing industries. These campaigns should be designed in consultation with all pertinent sectors of the industry.

- Require ocean-going vessels to retrofit waste management systems, if possible, to MARPOL standards, to treat and store waste generated at sea.

- Implement legislation that makes it mandatory for vessels to maintain a logbook that records the amount of garbage disposed of or incinerated at sea and the amount disposed of ashore. This logbook should act as a standardised system for recording types and volumes of disposed garbage.

- Determine standard waste generation rates for vessels of various sizes and purposes. This data can then be compared to the amounts recorded in the log book as being disposed (refer to recommendation above). Discrepancies between the predicted amount of waste generated and the actual amounts disposed of will assist in quantify the amount of debris sourced from shipping, boating and fishing.

- Conduct a study to investigate the correlation between the amounts and sources of debris accumulated and the surrounding areas population and access to the beach.

- Produce education campaigns, aimed at the commercial fishers, on the effects of improper disposal of fishing nets at sea.

- Encourage manufacturers to provide repair and/or recycling facilities for damaged fishing nets, floats, lines and other equipment at marinas and harbours.

- Produce education campaigns designed to illustrate the impact of illegal disposal of rubbish at sea on the marine environment.

- Encourage the fishing industry to develop alternatives to plastic equipment

- In consultation with relevant industries, encourage minimisation of production of plastics used for products that occur as marine debris.

Shipping lines

- Establish realistic baseline information on waste production and disposal for vessels (details of this recommendation are outlined in section 2.3.2.8). Information needs to be collected at an international level due to the nature of shipping.

- The implementation of the new MARPOL Annex V requirement to maintain garbage record books should be enforced as soon as possible and consideration should be given to extending its scope, applicability and enforcement in local legislation. Consideration should be given to the various types of vessels under Australian registration and to the range of items that must be recorded, including mandatory recording of potential garbage characteristics.

Programs and attitudes

- Encourage the Surfrider Foundation to help them expand their coverage of Australian beaches through their annual 'State of Our Surf Review' and to adopt the "Standard Australia Wide Survey" as the basis of their reporting and analysis.

  This recommendation also applies to other non-profit organisations initiatives.

- Establish national guidelines for:

  i) Clean up programs;
  ii) Education programs; and
  iii) Research projects.

- These guidelines should be administered, possibly through a Working Party structure, to ensure:

  - co-ordination of past, present and future programmes;
  - consistent advice is supplied to organisations wishing to participate;
  - consistent methodology is applied;
  - minimum duplication of effort.

- Design future education programs with reference to the findings of past clean up and research programs.

- Produce education and advertising campaign that emphasises the link between stormwater, sewerage systems and the marine and estuarine environments, including graphic information of prominent areas that have been affected by marine debris.

- Design education campaigns for the workers of relevant industries such as plastics, packaging, shipping and commercial fishing and boating.

- Design education campaigns targeting the user groups and highlighting their activities that contribute to the marine debris problem.

- Continue support and production of campaigns designed to encourage recycling (especially of plastics).

- Design education campaigns aimed at the plastics and packaging industry and consumers so as to discourage production and use of disposable plastic containers.

- Devise campaigns to promote participation in clean up programs by individuals, groups and industry.

- Promote awareness of the detrimental effects of various types of debris on the marine environment through campaigns aimed at the community and target industries and groups.

- Encourage the integration of small projects with similar aims to assist with increasing their efficiency and effectiveness.

- Produce extensive education campaigns aimed at reducing the amount of litter being carelessly discarded at entertainment functions.

Government

- Minimise the number of programmes funded by the various levels of government aimed at quantifying the marine debris problem. Focus the majority of funding on implementing action plans to remove accumulated debris and target the industries and groups responsible for the production of material and the consumer who discards litter that ends up as debris.

- Encourage local councils to implement regional programs aimed at cleaning up their waterways and minimising the amount of debris entering them. This can be achieved through educating user groups and industry and using various engineering initiatives such as gross pollutant traps to reduce the debris entering the aquatic environment.

- Future design of urban stormwater control facilities should give consideration to litter collection, entrapment and removal for disposal.

- Information on successful litter control devices, practices and systems (such as the Pollutec System, floating litter booms and grids) should be distributed to local authorities.

- Encourage local councils to improve litter control within their jurisdiction, especially where there is the potential for litter and other debris to enter water bodies through the stormwater system.

- Education programs should be undertaken by local councils (aimed at business and the community) identifying the problem areas (such as waterways) and their contributing activities.

Land-based industries

- Identify and promote alternatives to using plastics as packaging materials.

- Encourage the packaging industries to use alternatives to plastic and to recycle their material.

- Raise the awareness of the plastics industry regarding the problems caused by plastics in the marine environment and the advantages of using biodegradable plastics:

- Educate the workers of industries on the benefits of modifying their activities to minimise plastic (pellets, offcuts etc) entering the stormwater system.

- Encourage the packaging industry to reduce the amount of packaging used for each product.

Maritime industries

- Encourage 'Zero Discharge' from vessels.

- Encourage vessels to minimise potential waste production by control materials brought on board.

- Address at an international level, the issue of legal dumping of garbage outside the prohibited zone.

- Encourage the disposal of cargo residues and washings from holds at shore based facilities rather than to at sea.

- Devise and enforce requirements that require vessels operating in Australian waters to have adequate facilities and systems on board for garbage management. This will require action at the international level.

- Encourage liaison between local fishing organisations and local councils to establish appropriate rubbish collecting facilities at jetties, boat ramps and popular fishing spots.

- Place requirements on the fishing industry to produce codes of conduct for responsible fishing that includes provision for garbage disposal, operator conduct and reporting and retrieval of lost fishing gear at sea.

Waste management practices and policies

The following recommendations were made (ref 003) to reduce the amount of litter entering Australia's marine waterways at our major population centres:

General public

- increase public awareness of the consequences of discarding litter in streets and the connection between gutters, drains and the sea;
- launch educational advertising campaigns which give reasons for keeping Australia beautiful;

- *Schools*

- plan schools education programs;
- produce supporting educational materials;

- *Local and service authorities*

- increase council awareness of the link between sweeping streets and cleaning beaches;
- commence immediate design work on effective litter traps in stormwater systems;
- council recycling facility inadequacies should be investigated and rectified;
- raise awareness of landfill management impacts and investigate alternatives;
- Encourage recycling. While the benefits of this type of activity are well documented there are also downsides. Increased handling of this sort of material during recycling may lead to an increased rate of unintentional litter deposition.

- *Plastics industries*

- the Plastics Industry Association should commence a "responsible use" campaign;
- make industries more aware of the impacts of waste;

- *User groups*

- design activity-specific education programs with assistance from user groups.

Legislation

- States/Territories and the Commonwealth consider the incorporation of on-the-spot-fines for offences against MARPOL Annex V.
- Encourage uniformity in the application of land-based legislation in controlling the impact on the marine environment.

Marine debris databases

- Devise and implement a standard survey to be used Australia wide in consultation with key representatives from clean up and education programs, research projects, industry and user groups.

- The design and implementation of future survey needs to complement past surveys and to be consistent with the *standard Australia wide survey*. This implies that future surveys should include a core component which will be the *"Standard Australia Wide Survey"* and in addition may include extra information specific to a particular area or groups needs.

- Encourage the use of the *"Standard Australia Wide Survey"* to enable comparison of data collected by all groups, authorities and organisations.

- Encourage Australian participation in the Centre for Marine Conservation's International Clean Up to enable worldwide comparison of Australia's amounts and types of debris.

- Encourage Ocean Watch to co-ordinate their survey activities and education program development with initiatives arising from this report.

References

1. Sheavly, S (1995) "1994 International Coastal Cleanup Results". Centre for Marine Conservation. Washington D.C.

2. Slater, J (1991) "Flotsam and Jetsam - Marine Debris Bulletin 1". Department of Parks, Wildlife and Heritage. Tasmania, Australia.

3. Victorian Institute of Marine Sciences (1993) "Sources of coastal shoreline litter near three Australian cities" Victorian Institute of Marine Science. VIC.

4. Jones, M (1994) "Fishing Debris in the Australian Marine Environment" Australian Government Publishing Service.

5. Zann, L (1995) "State of the Marine Environment Report - Our Sea, Our Future". Department of the Environment, Sport and Territories, Canberra.

6. ANZECC (1995) "Maritime Accidents and Pollution: Impacts on the Marine Environment from Shipping Operations" ANZECC.

7. Zann, L. and Sutton, D. (1995) "State of the Marine Environment Report - Technical Annex I The Marine Environment". Department of the Environment, Sport and Territories, Canberra.

8. Zann, L. and Sutton, D. (1995) "State of the Marine Environment Report - Technical Annex 2: Pollution". Department of the Environment, Sport, Territories, Canberra.

9. Pemberton, D. "Entanglement of Australian fur seals in human debris". Tasmanian Parks and Wildlife Service. Tasmania.

10. Wace, N. "Ocean litter stranded on Australian Coasts" Research School of Pacific and Asian Studies. ANU. Canberra.

11. Commission for the conservation of Antarctic Marine Living Resources (1993) "Report of the twelfth meeting of the commission" CCAMLR. Tasmania.

12. Clean Up Australia Ltd (1991) "The Rubbish Report" Double Day Australia.

13. Clean Up Australia Ltd (1992) "Cleaning Up Australia Report on clean up Australia Activities 1992". Lend Lease Corporation.

14. Clean Up Australia Ltd (1993) "Cleaning Up Australia '93" P & I Publishing Pty Ltd. Sydney.

15. Clean Up Australia Ltd (1994) "Cleaning up Australia '94" P. & I. Publishing Pty Ltd. Sydney.

16. Clean Up Australia Ltd (1994) "K-6 Teacher's Resource Kit". Publishing Pty Ltd, Sydney.

18. Slater, J (1992) "The incidence of marine debris in the south-west of the World Heritage Area". In: The Tasmanian Naturalist, October 1992.

19. Slater, J. (1995) "Marine Debris of Tasmania, Australia: Sources and Solutions". In: Clary, J.C. (Editor) Poster Abstracts and Conference on Marine Debris, May 8-13, 1994, Miami, Florida. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-51.

20. The Age (25 September 1995) "The Yarra: a 'moving tip'".

21. The Age (26 September 1995) "A Feast of Pollution".

22. The Bureau Green Award.

23. Dick, S. (1992) "Adopt-A-Beach Report 1992". Tasmanian Recycling and Litter Awareness Council (1992)

24. Slip, D. et al (1991) "Accumulation of Fishing Debris, Plastic Litter and other Artefacts on Heard and Macquarie Islands in the Southern Ocean". In. Environmental Conservation. Vol. 18, No.3, 1991.

25. Ryan, PG and Watkins, BP (1988) "Accumulation of Stranded Plastic Objects and Other Artefacts at Inaccessible Island, Central South Atlantic Ocean". In S. Afr. T. Nav. Antarkt., Deel 18, No. 1, 1988.

26. Wace, N. (1994). "Beachcombing for ocean litter". In: ANH Magazine.

27. Croxall, et al. "Entanglement in man-made debris of Antarctic fur Seals at Bird Island, South Georgia". In. Marine Mammal Science, b(3): 221-233 (July 1990).

28. Ryan, P.G. "The Origina and Fate of Artefacts Stranded on Islands in the African Sector of the Southern Ocean" University of Cape Town. South Africa.

29. Wace, N. (1990). "Flotsam and Jetsam in the Southern Ocean: Monitoing Ocean Litter on Australian Coasts". Vol. 13. No. 2.

30. Rees, G. & Pond, K. (1995) "Marine Litter Monitoring Programmes - A Review of Methods with Special Reference to National Surveys" In. Marine Pollution Bulletin. Vol. 30. o. 2 pp 103-108.

31. Marine Pollution Bulletin "Message in a bottle", "Ship-Generated Waste in the Carribean" and "Oceans at Risk". In. arine Pollution Bulletin Vol. 30 No. 5 May 1995.

32. Queensland Transport (1995), "Think About It!!" campaign.

33. AMCOR Fibre Packaging, "BIO Bait Box: Cost Efficient & Wildlife Friendly".

34. Dalgety, A & Hone, P. (1993). Southern Fisheries Vol. 1, #1, pp. 10-13.

35. Torres, DN et al (1992) "Analysis of Marine Debris found at Cape Shirreff Livington Island, South Shetlands, Antarctica", Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Chile.

36. Shears, J et al (1992) "Beach Litter Survey Signy Island, South Orkneys 1991/92", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

37. Arnold, J.P.Y. et al, (1993) "Entanglement of Antarctic Fur Seals *Arctocephalus Gazella* in Man-Made Debris at Bird Island, South Georgia During the 1992 Winter and 1992/93 Pup-Rearing Season", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK

38. Shears, J.R. et al, (1993), "Beach Litter Survey Signy Island, South Orkney Islands, 1992/93", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

39. CCAMLR (1993) "Guidelines for Conducting Surveys of Beached Marine Debris". Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR)

40. Reid, K. (1993). "Beach Debris Survey - Main Bay, Bird Island South Georgia 1991/92", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

41. Arnold, J.P.Y. (1993). "Beach Debris Survey - Main Bay, Bird Island South Georgia 1990/91", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

42. Croxall, JP and Rodwell, S (1990). "Entanglement of Antarctic Fur Seals in Man-Made Debris at Bird Island, South Georgia, During the 1989/90 Pup-Rearing Season", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

43. Woehler, E.J., (1990). "Two Records of Seabird Entanglement at Casey Antarctica", (CCAMLR). Australia.

44. Ryan, P.G. et. al. (1990). "Rockhopper Penguins and Other Marine Life Threatened by Driftnet Fisheries in the South Atlantic Ocean", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). South Africa.

45. Joyce, J (1990). "Observations of Debris in Antarctic Waters During the IWC/IDCR Southern Hemisphere Minke Whale Assessment Cruises", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). USA.

46. Rodwell, S (1990). "Beach Debris Survey - Main Bay, Bird Island, South Georgia, 1989/90", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

47. Chalmers, M.O. et al, (1991). "Beach Litter Survey Signy Island, South Orkney Islands, 1990/91", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

48. Arnould, J. (1991). "Entanglement of Antarctic Fur Seals in Man-Made Debris at Bird Island, South Georgia", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

49. CCAMLR (1985). "Marine Debris", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). NZ.

50. Slip, D.J. et. al. "The Composition and Origin of Marine Debris Stranded on the Shores of SubAntarctic Macquarie Island", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). Australia.

51. CCAMLR (1989). "Report on the Wreck of the *Bahia Paraiso* Near Palmer Station and Environmental Impact Due to Oil Contamination", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). USA.

52. Torres, D.N. et. al. (1994). "Marine Debris Collected at Cape Shirreff, Livingston island, During the Antarctic Season 1993/94", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). Chile.

53. Huin, N. et. al. (1994). "Fishing Gear, Oil and Marine Debris Associated With Seabirds at Bird Island, South Georgia, 1993/94", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

54. Lewis, N.J. et al, (1994). "Beach Litter Survey Signy Island, South Orkney Islands, 1993/94", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

55. Reid, K. (1993). "Beach Debris Survey - Main Bay, Bird Island, South Georgia 1992/93", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

56. Arnould, J. (1992). "Entanglement of Antarctic Fur Seals in Man-Made Debris at Bird Island, South Georgia", Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR). UK.

57. Melbourne Parks and Waterways (1993). "Backyard to Bay Tagged Litter Report". Melbourne.

58. Melbourne Parks and Waterways, (1993). "Backyard to Bay Catchment Impacts". Melbourne.

59. Ryan, T. (1990) "Marine Pollution". Wet Paper, Ashmore, Queensland.

60. Department of Defence (Navy Office) (1994). Defence Instructions (Navy). "Policy for the Disposal of Shipborne Waste", Canberra DI(N) OPS 19-1.

61. Waterways Authority Harbour Cleaning Service (1995). "Harbour Cleaning Operations". Sydney.

62. Jones, M (1995). "Fishing Debris in the Australian Marine Environment", Department of Primary Industries and Energy. Parkes, ACT.

63. Jones, M (1994). "Fishing Debris...What is Washing Up?", Australian Fisheries.

64. Wace, N (1991). "Beachcombing at Anxious Bay, Eyre Peninsula".

65. Hayes, B. (1994). "Save our Seals", The Bulletin.

66. Walker, S. (19890. "Deadly Debris", Cruising Helmsman.

67. Australian Maritime Safety Authority (1995). "Observer Cruise Reports". Belconnen, ACT.

68. N.C. State University, (1995). "Marine Debris Worldwide", Vol. 1, No. 2. USA.

69. Parks, Wildlife and Heritage, Tasmania, "Marine Debris Pollution - Education Kit".

70. Parks, Wildlife and Heritage, Tasmania, "Sink into the Marine Debris Science Project and Help Save Our Marine Wildlife". Tasmania.

71. Marine Debris Third International Conference (1994). "Seeking Global Solutions", Miami, Florida, USA.

72. Galil, B. et. al. (1995). "Litter at the Bottom of the Sea: A Sea Bed Survey in the Eastern Mediterranean". Marine Pollution Bulletin, Vol 30, No. 1, 1995.

73. Robards, M et. al. (1995). "Increasing Frequency of Plastic Particles Ingested by Seabirds in the Subartic North Pacific", Marine Pollution Bulletin, Vol. 30, No. 2 (1995).

74. Galgani, F. et al. (1995). "Distribution and Abundance of Debris on the Continental Shelf at the Bay of Biscay and in Seine Bay", Marine Pollution Bulletin, Vol. 30, No. 1, 1995.

75. Ribic, C.A, et al. (1992), "Marine Debris Survey Manual", NOAA Technical Report NMFS 108, U.S. Department of Commerce.

76. The Royal Australian Navy (1995). Waste Minimisation Strategy, "A Cleaner Navy". Royal Australian Navy.

77. Polglaze, JF & Hofstede, HT "The Characteristics and Vermicultural Treatment of Ship-Generated Organic Waste", Murdoch University, Perth, Western Australia.

78. Polglaze, JF (1995). "Characterisation of the Waste Stream and the On-site Vermicomposting of Food Wastes Generated in Ships of the Royal Australian Navy", Murdoch University, Perth, Western Australia.

79. Beachwatch (1994). "A Marine Debris Survey by the Parks and Wildlife Commission of the Northern Territory", Palmerston, NT.

80. Ocean Rescue 2000, "A Marine Debris Survey".

81. Moffat, B. (1995), "Marine Environment Student Manual". Wet paper, Ashmore, Queensland.

82. South Australian Government Gazette (1994), "Environment Protection (Marine) Policy 1994". South Australian Government.

83. AFMA (1996), "AFZ Observer Program consolidated report for the 1995 Tasmanian winter season". Australian Fisheries Management Authority.

84. Industry Commission (1995), "Packaging and Labelling" (Draft Report).

85. Australian Marine Conservation Society, Enrolment and Information form.

86. Greenpeace - The adopt a beach campaign (1993), "Leave only footprints - Marine Debris on Australia's Coastline", Sydney.

87. Sanders, C. (1996). Department of Environmental Protection. General Comm. on Maritime Accidents and Pollution Implementation.

88. Phillips, J. (1995). Keep South Australia Beautiful Inc. General Comm.

89. National Plan Advisory Committee, "Public Awareness Campaign".

90. Survey to quantify the requirements for reception facilities in Australian Ports.

91. Qld, Department of Environment and Heritage (1994) "Over and Over - Your Guide to Recycling in Qld". Waste Management Branch, Brisbane.

92. Commonwealth Environment Protection Agency (1993). "Urban Stormwater" Pollution Avoidance Section, Canberra.

93. Qld Department of Environment and Heritage (1995). "Green Office Guide", Waste Management Branch, Brisbane.

94. Commonwealth Environment Protection Agency, "National Waste Minimisation and Recycling Strategy".

95. Qld Department of Environment & Heritage (1994). "Draft Waste Management Strategy for Qld". Waste Management Branch, Brisbane.

96. Royal Australian Navy (1994). "ABR 6111 Volume 1 & 2 - Royal Australian Navy Environmental Policy Manual". Defence Centre, Canberra.

97. United Nations Environment Program (1995). "Draft Global Program of Action for the Protection of the Marine Environment from Land-based Activities". United Nations.

98. National Kerbside Recycling Taskforce (1992). "Report on the Establishment and Implementation of a National Kerbside Recycling Strategy" ANZECC.

99. Lord Donaldson's Inquiry (1994). "Safer Ships, Cleaner Seas" HMSO Publications Centre, London.

100. Department of Transport Maritime Policy Division (1995). Letter from "Paspaley Pearls" regarding Fishing Nets.

101. Pollutec, "Pollutec CDS Technology", Water Pollution Control, Mornington.

102. Jackson, L.A. (1995). "Discharging Storm Water onto the Beach - Report No. 207", Gold Coast Coastal Research and Development.

103. Jackson, L.A. (1993). "1993 Environmental Symposium - International Environmental Co-operation", Gold Coast City Council.

104. Qld Department of Transport (1995). "Transport Operations (Marine Pollution) Act 1995" - Information Kit, Brisbane.

105. Mous, H. "Hay-Bale Investigation Report". Report No. 204, Gold Coast.

106. Beecham, S & Sablatnig, S "Hydraulic Modelling of Stormwater Trashracks".

107. Jackson, L.A. "Litter Control at a Local Government Level: The Gold Coast Strategy", Gold Coast City Council.

108. Gold Coast City Council, "20 Ways to Care for Our Coast".

109. Gold Coast City Council, "Seaweek".

110. Gold Coast City Council, "Concerned About Gold Coast Effluent".

111. Bandalong Engineering, "The Bandalong Trap".

112. Alletson, T. et. al. (1995). "Loders Creek - Caring for Our Backyard Habitat", Wet Paper Publications. Ashmore, Queensland.

113. Moffatt, B., (1994). "Stormwater Education and Research Report", Wet Paper Marine Education, Ashmore.

114. Senate Environment, Recreation, Communications and the Arts References Committee, (1995). "Marine Pollution Inquiry" information booklet.

115. Surfrider Foundation Overview (1995). "The Work of Surfrider Foundation Australia", Gold Coast.

116. Roseblade, R.J., (1995). "Disposal of Garbage Aboard RAN Ships - A Review of Possible Options", Department of Defence, Aeronautical and Maritime Research Laboratory, Melbourne.

117. United Nations Environment Program (1995). "Global Program of Action to Protect the Marine Environment from Land-Based Activities", Inter-Governmental Conference, Washington D.C.

118. Commonwealth Department of Tourism (1995). "National Cruise Shipping Strategy", Canberra.

119. Melbourne Water (1992). "Drains to the Bay", Curriculum unit.

120. Office of Catchment Water Management Boards (1995). "Initial Catchment Water Management Plan, Pantawalonga Catchment".

121. Slater, J (1994). "Marine Debris of Australia: Sources and Solutions". Third International Conference of Marine Debris - NOT PUBLISHED.

122. Commonwealth Government (1995). "Living on the Coast". The Commonwealth Coastal Policy.

123. Office of Catchment Water Management Boards (1995). "Initial Catchment Water Management Plan, River Torrens Catchment".

124. MFP Australia and BC Tonkin & Associates, "Revised Initial Patawalonga Catchment Management Plan" for Patawalonga Catchment Water Management Board.

125. Primary Industries, South Australia Fisheries, "Southern Fisheries", Volume 3, Number 1 (1995)

126. South Australian Research and Development Institute, "Anxious Bay Ocean Litter Survey Results, update 1995".

127. Roseblade, J & Upsher, J (1995). "Strategies for Disposal of Shipboard Garbage", Ship Structures & Materials Division, Defence Science & Technology Organisation, Aeronautical & Maritime Research Laboratory, Melbourne.

128. The Association of Australian Ports & Marine Authorities Incorporated (1995). "Environmental Guidelines for Australian Ports".

129. Centre for Advanced Materials Technology, "Photodegradation of Hi-Cone Carriers". Monash University, Victoria,

130. Hi-Cone Eco Carriers Brochure.

131. Coe, J. (1995) National Oceanic and Atmospheric Administration - General Comm.

132. The Ocean Outlook Congress (1994). "Blueprint for the Oceans".

133. International Council of Scientific Unions, Scientific Committee on Antarctic Research, SCAR Bulletin (1993) No. 110

134. Report of the United Nations Conference on Environment & Development (1992) Chapter 17, "Protection of the Oceans, All Kinds of Seas, including enclosed and semi-enclosed seas, & coastal areas and the protection, rational use and development of their living resources".

135. Institute of Engineers Australia and Australia Water and Wastewater Association (1989) "Urban Stormwater Pollution Processes, Modelling and Control".

136. Surfrider Foundation, (1995) - "Save Our Surf Review (to be published by Surfrider Foundation at a later date).

137. Keep Australia Beautiful National Inc. Association (1994). "Annual Report for year ended 31 December 1994"

138. Australian and New Zealand Environment and Conservation Council (1992). "Australian Water Quality Guidelines for fresh and marine waters".

139. UNEP (1995). "Global Programme of Action for the Protection of the Marine Environment from Land Based Sources of Pollution". Washington.

140. CSIRO (1987). "The East Australian Current", Division of Oceanography.

141. Intergovernmental Oceanographic Commission Technical Series (1994). "Marine Debris: Solid Waste Management, Action Plan for the Wider Caribbean", Paris.

142. Pearce, A (1982). "A Current Setting to the Southward like a Sluice" - Discoveries and Researches in the East Australian Current System, " CSIRO Division of Oceanography.

143. Pearce, A. (1980). "Variability of Currents off Cape Hawke, NSW 1978-79", CSIRO Division of Fisheries and Oceanography.

144. Jeffrey, S.W. et.al. (1990). "Oceanography of the Australasian Region", CSIRO Marine Laboratories, Hobart.

145. Huyer, A. (1999). "Currents of South-eastern Australia : Results from the Australian Coastal Experiment", College of Oceanography, USA, Division of Oceanography, CSIRO.

146. Keep Australia Beautiful Council Victoria (1995). "Designing representative litter survey strategies".

147. PAC : "Trash from Afar Fouling Beaches".

148. The Advocate, (1995). "Weather map for mariners", Saturday November 4.

149. The Mercury (1995). "Maps for Sea Safety", Friday October 6.

150. The Age (1995). "Adrift in a sea of Trash", Wednesday 27 October 1995.

151. Martin, J (1995). Department of Lands, Planning and Environment. General Comm: Northern Territory Legislation.

152. Welsh, T. (1995) Bandalong Engineering. General Comm.

153. O'Callahan, P. (1995) Victorian Institute of Marine Sciences. General Comm.

154. Kirkegaard, I. (1995). General Comm. - SA Legislation - Department of Environment and Natural Resources Office of the Environment Protection Authority.

155. Royal Australian Navy (1995). "Pollution Discharge Restrictions", an aid to provide abbreviated guidance from DI (N) OPS 19-1.

156. Hammond, R. (1995). General Comm. - Tasmanian Legislation.

157. Government Statisticians Office - Estimated Resident Population of Australia's Coastal Cities & Towns, 30 June 1994.

158. Harrison, J (1996). General Comm. - Australian Recreational and Sport Confederation Inc.

159. The Association of Australian Ports and Marine Authorities Incorporated, (1995) "Environmental Guidelines for Australian Ports".

160. Australian Maritime Safety Authority, Nelson, P (1995). General Comm 12/1/96/ Office of ports and policy.

161. Australian Maritime Safety Authority, Nelson, P (1995). General Comm., 27/11/95.

162. Miers, D. Captain & Le Grice, T. (1995). "Preserving the environment - A Royal Australian Navy Engineers Perspective", Eleventh International Maritime and Shipping Symposium.

163. Barrett, R. and Lee W.Y. "Degradable plastics and the Environment" symposium transcript.

164. ANZECC Working Group on Waste Management from Shipping and Boating, (1996). "Survey of Waste Reception Facilities". Maunsell Pty Ltd - Brisbane.

165. Australian Maritime Safety Authority - Nelson, P (1995). General Comm. - Treaties and Conventions.

166. Gibbs, C. Environmental Protection Authority - Victoria (1996). General Comm. Victorian Legislation.

167. Sanders, C (1996). General Comm. Western Australian Legislation.

168. Carter, S (1995). Environmental Protection Authority NSW. General Comm. NSW Legislation.

169. Semple, P (1996). Department of Environment and Heritage. General Comm. Queensland Legislation.

170. Galloway R W et.al. (1984). "Coastal Lands of Australia". Institute of Biological Resources Commonwealth Scientific and Industrial Research Organisation.

171. Moffitt, RC Captain (1996). Pers Comm. - "Sightings of Abandoned Fishing Nets by RAN Vessels". Royal Australian Navy.

172. Jones, M. Bureau of Resource Science (1996). General Comm. - Comments on fishing debris.

173. Fiordland Fishermen's Association et.al. (1992). "Code of Practice for Commercial and Non-commercial Users of Fiordlands". Fiordland Fishermen's Association, The Fiordland Lobster Co. and the Oceanographic section of the DSIR. NZ.

174. NZ Commercial Fishing Industry (1993). "Code of Practice for Commercial Fishers in the Hauraki Gulf". NZ Commercial Fishing Industry. NZ.

175. AFMA (1996). "AFZ Observer Program". Australian Fisheries Management Authority.

176. Dobson, G. (1995) Ocean Care Rescue Program - General Comm.

177. The Naval Architect "Galleys and Waste Disposal", September 1995, Enquiry No. H11.

178. Tamlin, E. (1996). Keep Australia Beautiful Council (WA). General Comm.

179. Keep Australia Beautiful National Association (Inc) 1994 "Looking at Litter".

Further Reading

The Australian Marine Debris Status Review

The full version of this report can be purchased.

Survey of Waste Reception Facilities in Australian Ports, Boat Harbours and Marinas

The full version of this report, including appendices, is available. The full report without appendices is also available.

The summary versions of both these reports are available free of charge.

For information on cost and payment details for the above reports, please contact kirkegi@dep.sa.gov.au

Working together to reduce impacts from shipping operations: ANZECC strategy to protect the marine environment

This 3-volume document can be purchased through the Australian Government Printing Service at a cost of $34.95 for the full 3 volumes or $24.95 for volumes 1 and 2. Both prices include surface postage within Australia.

Contents
Volume 1 - Strategy and Action Plan
Volume 2 - Technical Annex
Volume 3 - Analysis and Evaluation of Industry and Community Comments

Membership of the ANZECC Marine Debris Working Party

Mr Richard Hammond	Environment Tasmania - Chair
Mr Bill Thomson	Association of Australian Ports and Marine Authorities Incorporated
Mr Paul Nelson	Australian Maritime Safety Authority
Mr Duncan Leadbitter	Australian Seafood Industry Council
Mr Bob Hartley	Australian Shipowners Association
Dr Angela Ivanovici	Environment Protection Agency
Mr Ian Kirkegaard	Environment Protection Authority - South Australia
Dr Colin Gibbs	Environment Protection Authority - Victoria
Ms Janet Slater	Great Barrier Reef Marine Park Authority
Mr Chris Baker	Plastics and Chemicals Industries Association
Mrs Pauline Semple	Queensland Department of Environment
Mr Jim Huggett	Queensland Transport
Mr Tom Le Grice	Royal Australian Navy

Corresponding Members

Mr Greg Bondar	Australian Chamber of Shipping
Mr Richard Stevens	Australian Fisheries Management Authority
Mr Graham Sansom	Australian Local Government Association
Mr Gordon Anderson	Australian Nature Conservation Agency
Mr John Harrison	Australian Recreational and Sport Fishing Confederation
Mr Derek Staples	Bureau of Resource Sciences
Mr Terence Collins	Clean Up Australia
Dr Eugene Sabourenkov	Commission for the Conservation of Antarctic Marine Living Resources
Dr Paul Vogel	Department of Environmental Protection - Western Australia
Mr Helge Pedersen	Department of Lands, Planning and Environment - Northern Territory
Mr Philip Price	Department of Transport - Commonwealth
Ms Denise Boyd	Greenpeace Australia
Mr Phil Hurst	Keep Australia Beautiful
Mr Peter Shmigel	Litter and Recycling Research Association
Mrs Jan Oliver	Marine Education Society of Australasia
Ms Megan Linwood	Maritime Safety Authority of New Zealand
Mr John Gilbert	New Zealand Ministry of the Environment
Mr Geoff Noonan	NSW Environment Protection Authority
Ms Lyn Varty	Packaging Council of Australia