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COBSEA

COORDINATING BODY ON THE SEAS OF EAST ASIA

Marine litter

in the

East Asian Seas Region

UNITED NATIONS ENVIRONMENT PROGRAMME

Regional Seas

GPA

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A report by the COBSEA Secretariat

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Contents

Preface

This publication intends to provide up-to-date information to governments, private sector and the general public on the status and trend of the marine litter problem in the East Asian Seas region and to recommend suitable management measures.

This publication comprises of two parts:

- Part I: A Regional Review on Marine Litter in the East Asian Seas region; and
- Part II: The Coordinating Body on the Seas of East Asia (COBSEA) Regional Action Plan on Marine Litter (RAP-MALI).

The review on marine litter in the East Asian Seas region was undertaken for COBSEA. It was managed by the United Nations Environment Programme (UNEP) COBSEA Secretariat, and funded by the UNEP Regional Seas Programme (RSP). The efforts of Ellik Adler, the Coordinator of the UNEP RSP, and of Srisuda Jarayabhand and Birgitta Liss of the COBSEA Secretariat, in facilitating this review, are gratefully acknowledged.

The review was undertaken by Steve Raaymakers of EcoStrategic Consultants and supported by national consultants in the COBSEA member countries as follows:

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The COBSEA RAP-MALI was developed by the First COBSEA Marine Litter Workshop, Jakarta, Indonesia, 8-9 May 2007, and adopted by the 19th Meeting of COBSEA, Siem Reap, Cambodia, 22-23 January 2008.

List of acronyms

AMSA	Australian Maritime Safety Authority
APEC	Asia Pacific Economic Cooperation
APFIC	Asia-Pacific Fishery Commission
ASEAN	Association of Southeast Asian Nations
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
COBSEA	Coordinating Body on the Seas of East Asia
CUW	Clean Up the World
DPRK	Democratic Peoples' Republic of Korea
FAO	Food and Agriculture Organization (of the UN)
GEF	Global Environment Facility
GIS	Geographic Information System
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (of UNEP)
ICC	Ocean Conservancy's International Coastal Cleanup
IMO	International Maritime Organization (of the UN)
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IUU	Illegal, Unregulated and Unreported (fishing)
JICA	Japan International Cooperation Agency
KAB	Keep Australia Beautiful
LAFG	Lost and Abandoned Fishing Gear
MARPOL	International Convention for the Prevention of Pollution from Ships
MRCWG	Marine Resources Conservation Working Group (of APEC)
NSWMC	National Solid Waste Management Commission (of the Philippines)
NGOs	Non-Governmental Organizations
NOAA	National Oceanic and Atmospheric Administration (of the US)
NOWPAP	North West Pacific Action Plan
NPAs	National Plans of Action (of GPA)
PADI	Professional Association of Diving Instructors
PCU	Project Coordinating Unit (of PEMSEA)
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
RAP-MALI	Regional Action Plan on Marine Litter
RSP	Regional Seas Programme (of UNEP)
SDS-SEA	Sustainable Development Strategy for the Seas of East Asia
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
3R	Reduce, Re-use and Recycle

Definitions

East Asian Seas: For the purposes of this document, the term *East Asian Seas* refers to the coasts, territorial seas, exclusive economic zones and adjoining waters of the COBSEA member countries, as follows:

Australia
Cambodia
China
Indonesia
Malaysia
Philippines
Singapore
Republic of Korea
Thailand
Viet Nam

In the case of Australia the term only applies to its northern coasts, territorial sea and exclusive economic zone.

This definition does not preclude other countries and/or political entities in the general East Asian Seas region, that are not currently members of COBSEA, from joining or becoming partners in the COBSEA RAP-MALI including Brunei Darussalam, and Japan.

This definition also does not preclude other countries and/or political entities that are adjacent to the general East Asian Seas region, such as Papua New Guinea, from becoming partners in the COBSEA RAP-MALI.

Marine litter: For the purposes of this document, the term marine litter means any and all solid waste matter that is of anthropogenic origin that is found on the coast, on the sea-surface, in the water column and/or on the seabed, including but not limited to all forms of plastics, general garbage and debris and lost and abandoned fishing gear, from all sources including land-based and sea-based sources.

Part I:

A REGIONAL REVIEW ON MARINE LITTER IN THE EAST ASIAN SEAS REGION

1. Introduction and background

1.1 The issue

Marine litter can be defined as all solid waste matter that is of anthropogenic origin that is found on the coast, on the sea-surface, in the water column and/or on the seabed, including but not limited to all forms of plastics, general garbage and debris and lost and abandoned fishing gear, from all sources including land-based and sea-based sources.

Marine litter causes a wide range of ecological, environmental and socio-economic impacts, including ingestion by and entanglement of marine life, fouling of coastlines and interference with navigation. There have been cases of major shipping accidents, resulting in loss of human life, from the entanglement of vessel propellers and rudders in marine debris. Serious public health issues are also associated with hazardous materials, medical wastes, syringes, glass and other sharp and/or dangerous debris washed-up on beaches.

Global data on marine litter continues to show increasing levels of garbage washing up on coastlines and accumulating at sea. In 1995 the U.S. Academy of Sciences estimated the total input of marine litter into the oceans, worldwide, at approximately 6.4 million tonnes per year, nearly 5.6 million tonnes of which was estimated to come from merchant shipping (National Research Council 1995). However, a 2005 UNEP Report "Marine Litter – An Overview" notes that "There are no recent and certain figures on the amount of litter worldwide", and also quotes the 2002 Ocean Conservancy's International Coastal Cleanup (ICC) outcomes as indicating that: "58 per cent of the marine litter found could be attributed to shoreline and recreational activities" (such a result is to be expected from the ICC – which is focussed on beaches).

It is estimated that there are over 46,000 pieces of plastic floating on every square mile of ocean today (Algalita, 2007). It has been suggested by some researchers that an estimated three times more garbage (much of it plastic), is being thrown into the ocean each year than the amount of fish taken out (GPA, 2007).

Of particular concern are mass concentrations of marine debris in high seas accumulation areas, such as the equatorial convergence zone. In some such areas, 'rafts' of assorted debris, including various plastics, ropes, fishing nets, cargo-associated wastes such as dunnage, pallets, wires and plastic covers; drums and shipping containers along with accumulated slicks of various oils, often extend for many kilometres. Marine litter is also a compounding factor in the dispersal of invasive alien species across the oceans.

Marine litter is also found on the seabed. It could be that as much as 70 per cent of the entire input of marine litter sinks to the bottom and is found on the seabed, both in shallow coastal areas and in much deeper parts of the oceans (GPA, 2007).

A serious element in the broader issue of marine litter is the problem of Lost and Abandoned Fishing Gear (LAFG). S. Raaymakers (in preparation) reports that LAFG, including nets, lines, traps and floats, that are either accidentally lost or intentionally abandoned by fishing vessels at sea (or by fishers working from the shore), is increasingly becoming a major worldwide marine pollution concern. The impacts of LAFG are similar to those of marine litter in general and include:

- Navigational hazards and threats to human life and property when vessels entangle LAFG;
- 'Ghost-fishing' when LAFG continues to function as designed, catching target commercial species without economic benefit but with economic (and ecological) loss;

- The entanglement of non-target species, including sea-turtles, marine mammals and sea-birds, many of which may be of conservation concern and/or legally protected species;
- The accumulation of communities of fouling organisms on LAFG that then acts as an agent for the introduction of foreign species to new areas;
- Beaching of LAFG which can cause amenity impacts, preventing or hampering use of beaches and foreshores for tourism, recreation and other uses; and
- Economic impacts – including from the four other impact types listed above, and from the response to these impacts – which can be costly (e.g., emergency response to entangled vessels, LAFG recovery and clean-up campaigns, scientific research and monitoring).

1.2 The East Asian Seas region

The East Asian Seas region (Figure 1) embraces the most populous region in the world. It is home to almost 1.8 billion people, 60 per cent of whom are concentrated in coastal areas. In the past decade, the region has been the centre of considerable economic growth, bringing about increasing urbanization. Around 300 million people in the region are now living in coastal urban areas (PEMSEA, 2007).

Figure 1: The East Asian Seas region showing the COBSEA member countries (non-COBSEA members Brunei Darussalam, Democratic People's Republic of Korea, Japan and Papua New Guinea are not labelled) (source: COBSEA, 2007)

The East Asian Seas region embraces several large marine ecosystems or sub-regional seas (the East China Sea, South China Sea, Sulu-Celebes Sea, Indonesian Sea, North Australia, North-Western Australia and West-Central Australia). It includes two archipelagic countries (Indonesia and Philippines) and contains the greatest number of islands of all the regions in the world.

Around 30 per cent of the world's coral reefs, one-third of the world's mangroves as well as many other important critical habitats are found in the region. The region comprises the world's richest marine biodiversity and produces about 41 per cent of the total fish catch of the world (PEMSEA, 2007).

The region also has one of the world's highest concentrations of shipping and fishing vessel activity (Figure 2), and with a high rate of ongoing economic development, most major industrial ports in the region are undergoing significant expansion, and many new ports are being developed.

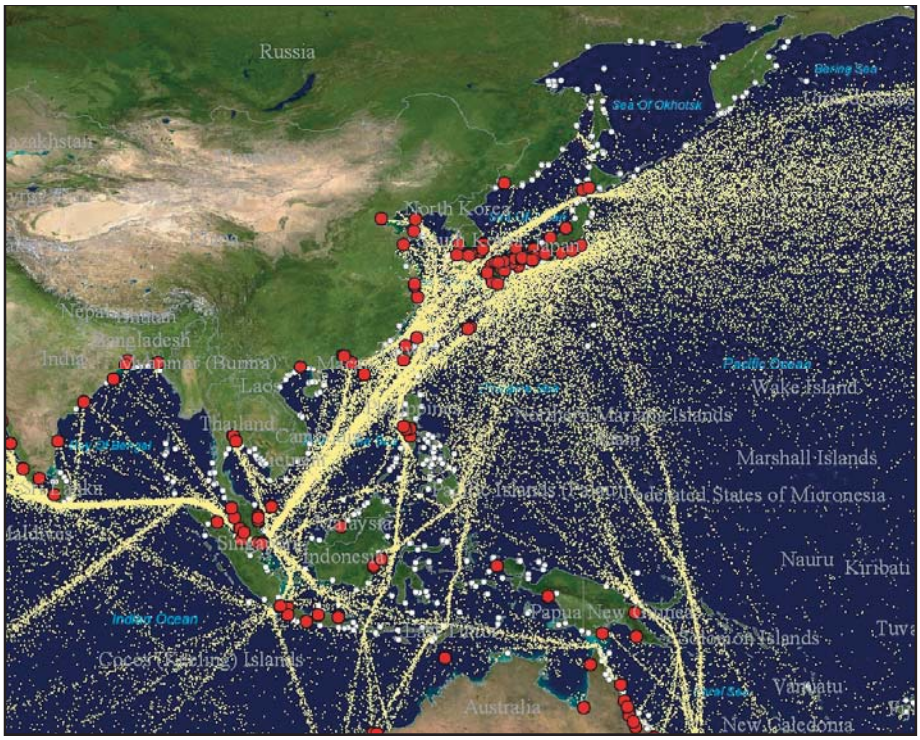

Figure 2: Shipping densities as represented by real ship position reports and major ports (red dots) in East Asia (source: Globallast, 2007)

While many countries in the region are party to various international environmental and marine-related conventions and other legal instruments, like most parts of the world national implementation of such is poor, due to a number of factors including capacity and cultural barriers.

These factors combined with others, including S. Raaymakers personal observations, indicate that the marine litter situation in the East Asian Seas is likely to be as severe as, if not worse than any part of the world. The massive industrial and urban development under-way in the coastal zones of the region, combined with an exponential and sustained growth in shipping activity serving their rapidly expanding economies, and the current lack of effective marine litter prevention and control measures in many East Asian countries, make marine litter a major marine pollution problem in the East Asian Seas region.

1.3 The response

As marine litter originates from many different sources, can move long distances and persist in the marine environment for many years, it is very difficult to determine who has responsibility for addressing the issue and how to target effective enforcement of laws and regulatory systems.

The International Maritime Organization (IMO) has acted to try and address pollution from ship-based sources, through the International Convention for the Prevention of Pollution from Ships (MARPOL). Annex V of MARPOL deals specifically with the disposal of garbage

from vessels, and includes a total ban on the disposal of plastics from vessels anywhere in the world's seas and oceans. It also places a legal requirement on port states to provide adequate facilities in ports to receive garbage from vessels.

The UNEP Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA), *inter alia* aims to reduce the amount of litter reaching the marine environment by prevention or reduction of the generation of solid waste, and to establish environmentally sound facilities for receiving, collecting, handling and disposing of litter. The Basel Convention also addresses this issue, *inter alia*, through programmes on plastic waste.

However, control and reduction of marine litter has not been covered by any single global convention, initiative or programme, and the increasing severity of the problem indicates that the various existing but un-coordinated initiatives are not currently effective.

In response to increasing concerns about the marine litter problem, in 2005 the 6th meeting of the United Nations Informal Consultative Process on the Law of the Sea (UNICPLOS) was requested by the United Nations (UN) General Assembly to discuss, amongst other issues, the problem of marine litter. Draft General Assembly Resolutions were prepared and later adopted by the General Assembly on 29 November 2005 as Resolution A/60/L.22 – Oceans and the Law of the Sea – as follows:

"…*The General Assembly*,

65. ***Notes*** *the lack of information and data on marine debris and encourages relevant national and international organizations to undertake further studies on the extent and nature of the problem, also encourages States to develop partnerships with industry and civil society to raise awareness of the extent of the impact of marine debris on the health and productivity of the marine environment and consequent economic loss;*

66. ***Urges*** *States to integrate the issue of marine debris within national strategies dealing with waste management in the coastal zone, ports and maritime industries, including recycling, reuse, reduction and disposal, and to encourage the development of appropriate economic incentives to address this issue, including the development of cost recovery systems that provide an incentive to use port reception facilities and discourage ships from discharging marine debris at sea, and encourages States to cooperate regionally and sub-regionally to develop and implement joint prevention and recovery programmes for marine debris;*

67. ***Invites*** *the International Maritime Organization, in consultation with relevant organizations and bodies, to review Annex V to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, and to assess its effectiveness in addressing sea-based sources of marine debris;*

68. ***Welcomes*** *the continued work of the International Maritime Organization relating to port waste reception facilities, and notes the work done to identify problem areas and develop an action plan addressing the inadequacy of such facilities;*

69. ***Calls upon*** *States to take all appropriate measures to control, reduce and minimize, to the fullest extent possible, marine pollution from land-based sources as part of their national sustainable development strategies and programmes, in an integrated and inclusive manner, and to advance the implementation of the Global programme of Action for the Protection of the Marine Environment from Land-based Activities and the Montreal Declaration on the Protection of the Marine Environment from Land-based activities;* [and]

70. ***Welcomes*** *the convening of the Second Intergovernmental Review Meeting of the Global Programme of Action in Beijing from 16 to 20 October 2006 as an opportunity to discuss marine debris in relation to the source categories of the Global Programme of Action, and urges broad high-level participation."*

It is also worth noting the UN Resolutions adopted by the UN General Assembly 60/31 and A/Res/61/105 Sustainable Fisheries which call upon states to address the issue of lost or abandoned fishing gear and related marine debris and encourages them to not only work closely amongst themselves but in coordination with Non-Governmental Organizations (NGOs) to address this important issue affecting the earth's oceans and seas. These resolutions by the UN General Assembly serve to bring the issue of marine litter to the centre of global attention and concern.

The work of IMO to address the issues identified in paragraphs 67 and 68 of the UN resolution is also well under way. This revision of Annex V of MARPOL is expected to be completed in 2008/2009, and issues to be discussed include clearer regulations for dealing with cleaning residues and cargo hold washings, tighter controls on discharges of dunnage, lining, and packaging materials, management of waste materials from hull cleaning, managing livestock wastes and including a general prohibition on the discharge of garbage except under the conditions set out in Annex V. The action plan to tackle inadequacy of port reception facilities was adopted by the Marine Environment Protection Committee of IMO in October 2006, and will include consideration of issues such as standard format for advance notification of the need for reception facilities, the development of an international port reception facilities database, and the provision of guidance and training in developing appropriate facilities for ships.

In a related move, UNEP commenced a global initiative on marine litter several years ago, called the Marine Litter Partnership, and this was presented at the second Intergovernmental Review Meeting (IGR-2) of the UNEP GPA held in Beijing, China, 16th October 2006. Under this initiative UNEP is working with a number of UN organizations including IMO, Food and Agriculture Organization (FAO), Intergovernmental Oceanographic Commission (IOC), Basel Convention, UNEP Division of Technology, Industry and Economics (DTIE), UNEP GPA and UNEP RSP; individual Regional Seas organizations; national governments and NGOs.

One of the main activities of this initiative is the provision of financial support by UNEP to several Regional Seas organizations to develop Regional Strategies and Action Plans on Marine Litter. These regions are the Black Sea, Caspian Sea, East Africa, East Asian Seas, Mediterranean Sea, North-West Pacific, Red Sea and Gulf of Aden, South Asian Seas; South East Pacific and the Wider Caribbean. The development of these regional strategies and action plans is now well under way in all of these regions, and this review is part of this initiative for the East Asian Seas.

This review covers the following ten COBSEA member countries:

- Australia
- Cambodia
- China
- Indonesia
- Malaysia
- Philippines
- Singapore
- Republic of Korea
- Thailand
- Viet Nam

The review included the following elements:

1. Development, distribution, collection and analysis of a *national survey* sent to all COBSEA member countries.

2. Preparation of a Regional Review of Marine Litter in the East Asian Seas region (this document) based on the national survey returns.

2. Objectives of the regional review

The objectives of the review were to establish the current state-of-play in the East Asian Seas region, at both the regional and national levels, and to make recommendations and proposals for change with regard to:

- Existing knowledge and data on the marine litter problem;
- Existing instruments, programmes and initiatives on marine litter; and
- Existing gaps and needs in relation to the prevention, control and management of marine litter.

3. Review methods

The review was undertaken as a desk-top literature study. National consultants were nominated in the COBSEA member countries and a standard national survey was prepared and distributed to them in September 2006. Responses were received from all ten countries except Singapore, and the last national survey response was received on 26 April 2007.

This represents a survey return rate of more than 90 per cent – a very positive result for such surveys. The use of appointed national consultants to coordinate survey responses would have been a major factor in this extremely high success rate.

Despite the high rate of survey returns, it should be noted that budgetary constraints on each country to undertake this task were very tight (US$500 per country), and time was limited. National survey responses should therefore not be considered as being fully comprehensive. Responses of 'no data or information' to some survey questions may not necessarily be correct.

Information from other relevant bodies, various national governments, marine science institutions and international environmental NGOs was identified and an international literature search was undertaken.

4. Review findings

4.1 Existing knowledge and data on marine litter

At the global level, scientific data and information on the problem of marine litter is geographically patchy, however, there are many studies that show alarming quantities of debris accumulating in ocean convergence zones and washing ashore to impact on coastal resources. Relatively good data is available from a few concentrated geographical areas where intensive studies have been conducted, such as near the Hawaiian Islands, the seas of North East Asia and the North Pacific generally. Some limited studies are available from other areas such as around Australia and in European seas, and many other regions have very little to absolutely no data on the marine litter issue at all (e.g., seas around Africa, South Asia and South America).

Perhaps the best data available is on marine litter that washes ashore. Globally, a large number of countries have coastal clean-up and monitoring programmes. Some of these are nationally coordinated, government-led initiatives such as in Japan (Uchida, 2007) and Korea (Cho, 2007), and others are focussed on specific areas and run by NGOs and/or community groups, such as the Carpentaria Ghost Net programme in Northern Australia (www.ghostnets.com.au) and

the Save the North Sea project initiated by NGOs in Sweden and now active in all North Sea States (www.savethenorthsea.com). Others are undertaken under the auspices of international conventions and multi-lateral organizations, such as the beached-debris monitoring undertaken in Antarctica under the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) (refer section 4.1 and www.ccamlr.org/pu/e/sc/deb/intro.htm).

Perhaps the most well established programme covering the largest number of sites globally is the community-implemented ICC (www.oceanconservancy.org) run by the US-based Ocean Conservancy, which on one day each year mobilizes thousands of volunteers in over 70 countries worldwide to undertake coastal clean-ups, and record and submit data using standard formats. During the 2005 ICC, 450,000 volunteers removed 8.2 million pounds of debris from 18,000 miles of coasts, spanning 74 different nations around the world (www.oceanconservancy.org).

There are a variety of other international clean-ups including:

- Clean Up the World (CUW) (www.cleanuptheworld.org), which does not have a specific marine or coastal focus;
- The UN World Environment Day each year, which many countries and communities celebrate through coastal clean-ups; and
- PADI Project AWARE – which amongst other things supports underwater clean-ups (www.projectaware.org).

All of these collect various types of data to varying degrees of rigour on litter, including coastal and marine. A major limitation in our knowledge and understanding of the global and regional marine litter situation is the lack of available systems to gather, store, manage, analyse and interpret the data from all of these programmes, to support policy-making and management planning.

4.1.1 Ocean circulation, movement and accumulation of marine litter

Brainard (2000) reports that marine debris found accumulating on many coastlines of the world often originates from far-distant sources, often even across the other side of a vast ocean. In developing actions and measures to address marine litter, it is important for scientists, regulators and industry to have an understanding of ocean circulation patterns. General charts of broad-scale ocean circulation patterns can be obtained from general navigation and oceanographic texts (e.g., Figure 3).

Over the long-term the mean of these generic patterns are probably indicative. However, over shorter time periods and at larger scales, which are of more relevance to the assessment and management of marine litter, the real situation is far more complex, highly variable and seasonally dynamic. In reality, marine litter may not follow generic, mean ocean circulation patterns, but will be driven by rather more complex influences resulting from a combination of wind-driven currents, wave-driven currents and thermohaline or density-driven currents (Brainard, 2000).

In recent years significant advances have been made in the mapping and modelling of complex ocean circulation patterns, at various scales, and incorporating the different elements that drive these patterns. The outputs of such models are often presented as colour-rich graphics and animations, based on satellite imagery and remote sensing, that can greatly assist scientists and managers in interpreting the results. Today an array of satellite sensors can be used by oceanographers to measure various aspects of the world's oceans, including for parameters such as surface winds (e.g., QuikSCAT), sea surface height and computed geostrophic currents (e.g., TOPEX/Poseidon), bathymetry (e.g., ETOPO) sea surface temperature (e.g., GOERS) and chlorophyll as indicated by ocean colour (e.g., SeaWiFS). When combined with numerical modelling, supported by in-field oceanographic data collection and physical tracking to verify

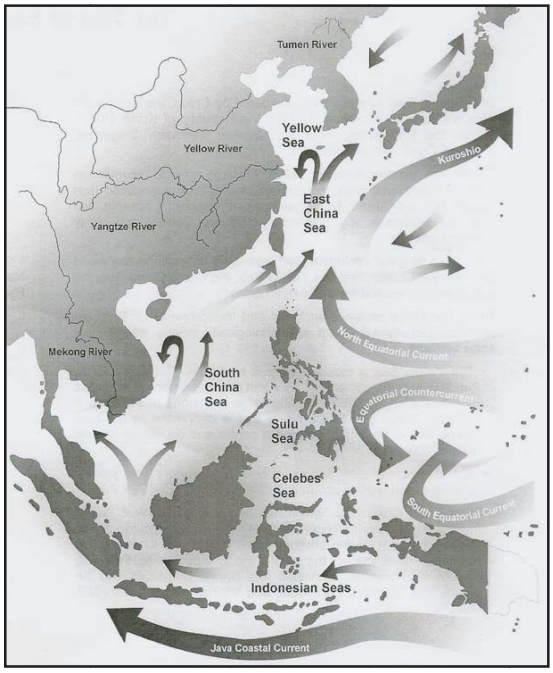

Figure 3: The major currents of the East Asian Seas
(source: PEMSEA, 2007)

the models, these systems provide very powerful tools to assist in the assessment and management of marine litter. Two examples from the Pacific, adjacent to East Asia, are presented in Figures 4 and 5.

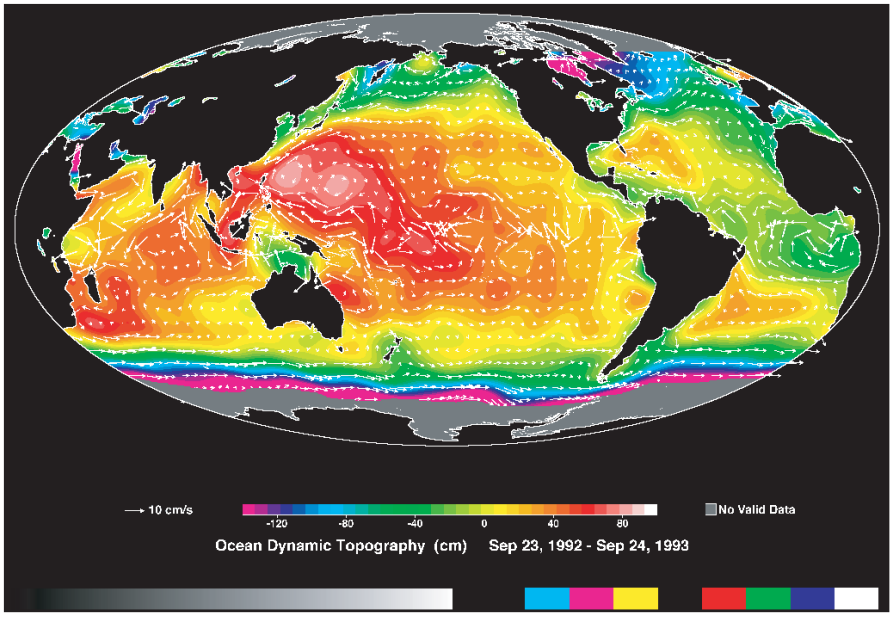

Figure 4: Ocean topography from TOPEX/Poseidon mission.
This map uses colour to show ocean topography and arrows to show the speed and direction of ocean currents
(source: TOPEX/Poseidon, 2007)

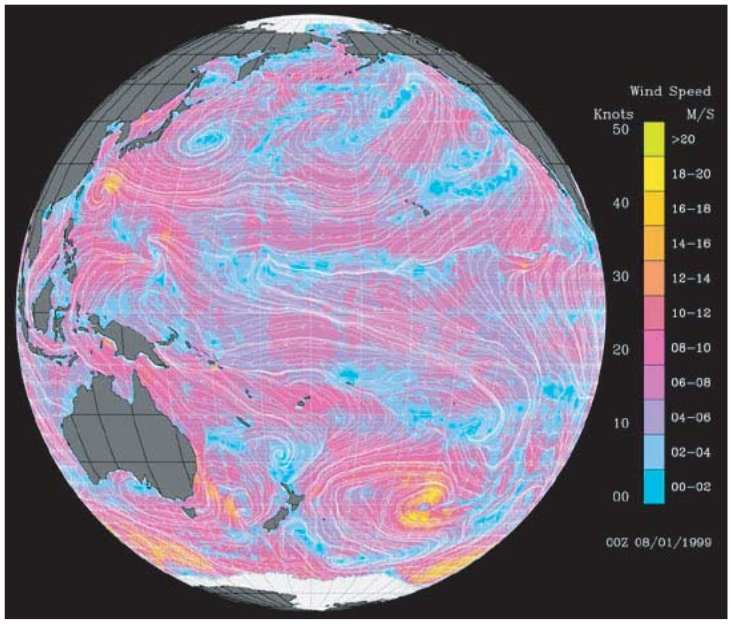

Figure 5: Surface winds in the Pacific – important drivers of ocean currents and marine litter
(source: QuikSCAT, 2007)

There are many examples where oceanographic tracking and modelling have been used in the assessment and management of marine litter. For example Kubota (1994) tracked virtual marine debris in the North Pacific using a simple numerical model over five years, which indicated the accumulation of debris from the whole north Pacific in the northern Hawaiian Islands. The results of this predictive modelling have been verified by real-life sightings in this area, including the current National Oceanic and Atmospheric Administration (NOAA) Marine Debris Programme – which is undertaking significant work in collaboration with many others to address LAFG in the Northern Hawaiian Islands, including further use of ocean circulation models (Donohue, 2004).

Work by various parties has shown that (logically) marine litter tends to accumulate (and often reside for extended periods of time) in ocean convergence zones, and will move away from ocean divergence zones. Mass concentrations of marine debris in high seas 'sink' areas, such as the equatorial convergence zone, are of particular concern. In some such areas, 'rafts' of assorted debris, including various plastics, ropes, fishing nets, cargo-associated wastes such as dunnage, pallets, wires and plastic covers; drums and shipping containers along with accumulated slicks of various oils, often extend for many kilometres (S. Raaymakers, 1989, 1998 & 2000, pers. obs.). Such zones have been modelled and mapped by various researchers and the results of such work are vital to improving the monitoring and management of marine litter.

In order to be effective in addressing marine litter, oceanographic models need to be developed and applied at much larger scales than the global examples depicted in the figures above, including at the regional, national and local scales.

In undertaking this review, very little detailed work was found on ocean circulation patterns within the East Asian Seas region, in contrast to the North West Pacific where Japan, Republic of Korea and Russia have high-resolution physical data such as the drifter track plots depicted in Figure 6. Such highly detailed data is invaluable in identifying major sources and sinks of marine litter, and thereby focussing the efficiency and effectiveness of prevention and response efforts.

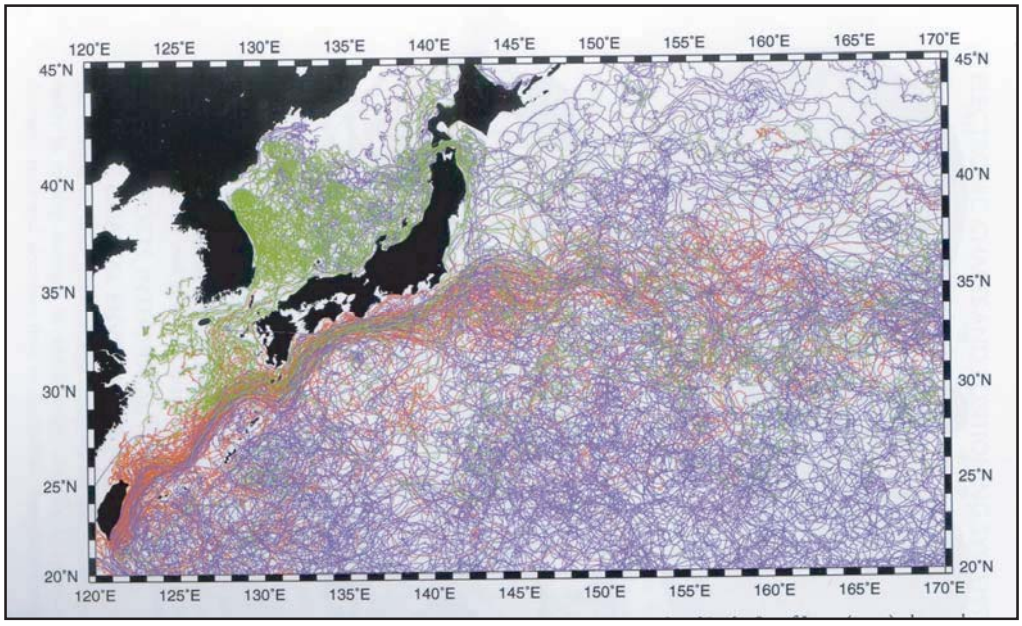

Figure 6: Plotted drifter tracks in the seas around Japan (source: UNESCO, 2007)

It is recommended that further work be undertaken in the East Asian Seas region in order to develop and run marine litter trajectory models for each sub-regional sea in the region.

4.1.2 Regional knowledge and data

In undertaking this review, no data or references on the sources, causes, quantities and distribution of marine litter at the regional level in the East Asian Seas region have been identified. As stated above, relatively good data is available for only two countries within the region – the Republic of Korea (a COBSEA member) and Japan (a non-COBSEA member). In Australia some data is available from various uncoordinated survey and monitoring efforts, undertaken at various geographical scales by different parties. These are reviewed in Appendix 1.

As a component of the broader marine litter problem, Lost and Abandoned Fishing Gear (LAFG) is likely to be major concern in East Asia, due to the large size of the fishing industry and the difficulties in effectively regulating the industry, as well as a high level of Illegal, Unregulated and Unreported (IUU) fishing in the region.

The ICC collects potentially useful data (on beached marine debris generally), but this is not yet organized into a database, which allows identification of hot spots, trends over time and other parameters that managers would find useful. In 2006 the ICC included nine COBSEA members: Australia, China, Indonesia, Malaysia, Philippines, Singapore, Republic of Korea, Thailand and Viet Nam.

The COBSEA member country Cambodia has not been involved in the ICC to date. Within the region the ICC was also active in 2006 in Hong Kong (China), Japan and Taiwan (China) (which are not members of COBSEA). The 2006 ICC Coordinators for East Asian countries are listed in Appendix 2. Presentation of ICC data does not give a clear picture per country or of trends over time. It should also be noted that the ICC is primarily a community clean-up activity and that data collection is a secondary objective.

The development and maintenance of a central, regional database in the East Asian Seas region to which national administrations report annual statistics on the sources, causes, quantities and distribution of marine litter in their respective jurisdictions could be a means to improve the current lack of available data and information on this issue. The database could present outputs graphically on map-based Geographic Information System (GIS) – providing visual representation of the geographical spread of the problem. This would provide a powerful monitoring tool for assessing the true regional extent of the problem, including regional hot spots, trends over time and the effectiveness or otherwise of management and control responses. Such a regional database could possibly be housed and maintained by the UNEP COBSEA Secretariat, with appropriate support from COBSEA member governments, and could be part of the East Asian Seas Knowledgebase currently being developed by COBSEA.

4.1.3 National knowledge and data

Based on national survey responses and literature review, the situation relating to existing knowledge and data on the sources, causes, quantities and distribution of marine litter at the national level is not much better than for the regional level in the East Asian Seas region. Table 1 summarizes the responses to section 2 of the national survey – the state of the problem in each country. Adapted texts of these responses are given in Appendix 1. The full national survey returns are held by the COBSEA Secretariat (www.cobsea.org).

The only COBSEA member country that has a formal, nationally coordinated marine litter survey and monitoring program is Republic of Korea, covering underwater, island and sea-surface marine litter at 31 beach sites, six SCUBA sites and four remote islands, as depicted in Figure 7.

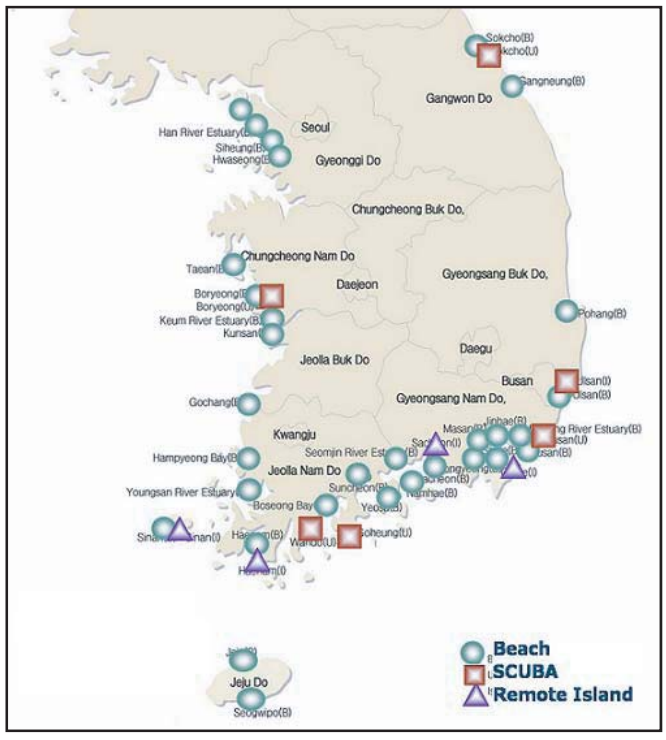

Figure 7: Monitoring sites under the Republic of Korea's National Marine Debris Monitoring Program (source: Shin, 2007)

In Australia a number of ad-hoc marine litter surveys have been undertaken at various sites by different parties. These surveys provide a reasonable, but still patchy, picture of the marine litter situation in that country. In most of the other countries, the ICC provides some limited data on the current situation at the restricted number of sites where ICC activities are conducted on one day each year. Cambodia has not participated in the ICC to date, in 2006.

In most COBSEA countries, CUW and PADI Project AWARE are active, but again both are more focussed on clean-up than data collection. In addition, CUW is focussed on general litter, not specifically coastal or marine.

In Thailand some data is derived from targeted clean-ups at high profile tourist areas and dive sites. In Jakarta Bay, Indonesia, island surveys repeated since the 1980's show significant increases in marine litter over time (Willoughby, 1986a, 1986b; Willoughby et al., 1997; Uneputty & Evans, 1997).

Overall, the current state of knowledge about the extent of the marine litter problem is very poor in the East Asian Seas region, and significant further work is required to address this major gap.

Table 1: Summary of existing knowledge and data on marine litter in each COBSEA member country, as reported in the section 2 of national survey responses

	Australia	*Cambodia*	*China*	*Indonesia*	*Malaysia*	*Philippines*	*Republic of Korea*	*Thailand*	*Viet Nam*
Existing surveys and monitoring:	Ad-hoc in disparate locales at different scales by various parties using different methods. ICC, PADI Project AWARE, CUW, Keep Australia Beautiful (KAB) etc.	None reported.	ICC.	Repeat surveys in Jakarta Bay – significant 20 years increases. ICC.	ICC.	ICC.	National Marine Debris Monitoring Program in place since 1999. ICC.	Regular clean-ups at resort areas and dive sites. ICC.	ICC.
Source differentiation:	Surveys near cities indicate up to 80% from land-based sources. In remote areas most from sea-based sources.	Not identified.	Not identified.	Not identified.	Not identified.	1997 Japan International Cooperation Agency (JICA) study indicates 15% of daily solid waste production in Manila disposed to water-bodies.	Land-based sources appear to be the major contributor, although sea-based sources high relative to other countries.	Not identified.	Not identified.
Accumulation zones:	No national survey to date but ad-hoc studies indicate accumulations at urban centres and certain remote coasts.	Not identified.	Not identified.	Not identified.	Not identified.	Not identified.	Not identified.	Not identified.	Not identified.
Ecological and environmental impacts:	A number of studies confirm the range of impacts caused by marine litter, especially on marine turtles, seabirds and similar wildlife.	No specific data reported.	No specific data reported.	No specific data reported.	No specific data reported.	No specific data reported.	Measured reductions in fisheries believed to be linked to ghost fishing by LAFG.	LAFG identified as marine litter type causing worst impacts.	No specific data reported.
Socio-economic impacts:	Australia supporting APEC study with Indonesia and Chile in 2007.	No specific studies reported.	No specific studies reported.	Indonesia supporting APEC study with Australia and Chile in 2007.	No specific studies reported.	No specific studies reported.	No specific studies reported.	No specific studies reported. High value tourism industry affected.	No specific studies reported.
Lost and Abandoned Fishing Gear:	Major problem along northern coastline. Carpentaria Ghost Net Programme specifically targeting the problem.	No specific work reported.	No specific work reported.	No specific work reported.	Anecdotal reports of LAFG from Fisheries patrol vessels.	No specific work reported.	High priority issue with unique waste fishing gear 'buy-back' programme.	No specific work reported.	No specific work reported.

4.2 Existing instruments, programmes and initiatives

4.2.1 Regional instruments, programmes and initiatives

There are currently no regional legal instruments such as multi-lateral treaties addressing marine litter or even marine environmental management generally for the East Asian Seas region. In fact the region is one of the few regional seas in the world where coastal states have not concluded a formal regional seas treaty, convention or other legal instruments.

There are several regional and sub-regional technical cooperation programmes and other initiatives that address various aspects of coastal and marine environmental management and protection in the region, and some of the major initiatives are summarized below. Collaboration between these programmes would enhance the effectiveness in addressing the marine litter problem in the East Asian Seas region and should be sought to the greatest extent possible.

Asia Pacific Economic Cooperation (APEC)

APEC, comprising all of the Pacific-Rim economies, through its Marine Resources Conservation Working Group (MRCWG), is funding a project entitled *Understanding the economic benefits and costs of controlling marine debris in the* APEC *region* that will be undertaken during 2007. This APEC initiative is co-sponsored by Australia, Chile and Indonesia.

The aim of the project is to develop an accurate assessment of the economic benefits and costs of controlling marine debris in the APEC region as a basis for determining relevant incentives and other measures for preventing it and mitigating its impacts.

The project will involve the collation and analysis of existing data on the direct and indirect impacts of debris on communities, governments, and specific industry groups (fishing, shipping and transport, tourism, insurance), and the design of an economic model of the expected (market and non-market) costs of marine debris on selected economic values and industries.

Project recommendations and an outreach programme will be developed with the aim of assisting governments, industry and communities to better understand the economic implications of marine debris, and thereby adopt incentives and other measures to limit its incidence as well as effectively target resources to mitigate its impacts.

While the APEC region comprises the entire Pacific Rim, it includes the East Asian Seas region and the outputs of the study will be of significant benefit to the COBSEA member countries.

Association of Southeast Asian Nations (ASEAN)

The Association of Southeast Asian Nations (ASEAN) (www.aseansec.org) has a Working Group on Coastal and Marine Environment (AWGCME), which although not currently active on marine litter issues, could provide a very useful vehicle for the promotion and implementation of regional marine litter prevention and control efforts.

Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)

This initiative commenced in January 1994 as the GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas, and ran for five years until December 1998. The programme was coordinated by a Project Coordinating Unit (PCU) in Manila, Philippines, and involved Brunei Darussalam, Cambodia, China, Indonesia, Malaysia, Democratic People's Republic of Korea (DPRK), Philippines, Singapore, Republic of Korea, Thailand and Viet Nam (all COBSEA members except Brunei Darussalam and DPRK). The programme provided institutional strengthening and capacity building to these countries to

prevent and manage marine pollution and to implement MARPOL and other international marine pollution conventions. Demonstration sites were established at several coastal cities in the region, including at Batangas Bay in the Philippines, where measures to reduce and manage marine pollution, including marine litter, were implemented.

In 2000 a second phase to the programme was funded by GEF, and renamed PEMSEA. The PEMSEA programme expanded the number of demonstration sites and broadened its focus to cover a wider range of integrated coastal zone management issues. However, up until now marine litter has not been a major focus for PEMSEA.

On 12 December 2003, 12 countries (the above 11 plus Japan) adopted the Putrajaya Declaration of Regional Cooperation for the Sustainable Development of the Seas of East Asia, at the East Asian Seas Congress in Putrajaya, Malaysia. The declaration provides for the cooperative regional implementation of the World Summit on Sustainable Development (WSSD) requirements for coasts and oceans in East Asia, through the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA), including *inter alia* implementation of the IMO conventions on sea-based sources of marine pollution and the UNEP GPA, both of which are important mechanisms for addressing marine litter. Through the signing of the "Haikou Partnership Agreement on the Implementation of the SDS-SEA" at the East Asian Seas Congress in December 2006, the implementation of the SDS-SEA is now commencing with probable funding from the GEF and World Bank. The PEMSEA PCU in Manila will be transformed into the PEMSEA Resource Facility and coordinate its implementation.

The SDS-SEA identifies both land-based and sea-based sources of marine pollution, implicitly including marine litter, as high priority issues for the region.

The UNEP/GEF Project "Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand"

The UNEP/GEF Project "Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand" was initiated by COBSEA in 2000. Its implementation started in 2002 in the seven COBSEA member countries Cambodia, China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam. The project's main focus is on habitat management and rehabilitation and has no explicit activities to address marine litter. The project will be completed in 2008.

Other GEF Projects

There are also current GEF proposals for new projects in the Arafura and Timor East Seas and the Sulu-Suluwesi Seas, both also within the COBSEA area. In addition, the UNDP/GEF Yellow Sea Large Marine Ecosystem project is being implemented, which lies within the area covered by the North West Pacific Action Plan (NOWPAP), COBSEA's neighbouring Regional Seas organization immediately to the north. The Yellow Sea Large Marine Ecosystem project is also working on broader coastal and marine biodiversity and fisheries management issues and do not currently incorporate explicit activities to address marine litter.

Adjacent Regions

Immediately to the north of the COBSEA region is the Regional Sea known as the North West Pacific, which is covered by NOWPAP. The NOWPAP member countries are China, Japan, the Russian Federation and the Republic of Korea, two of which are also members of COBSEA – China and the Republic of Korea.

NOWPAP has a highly developed programme on marine litter. In particular, Japan and Republic of Korea are amongst the most advanced countries in the world in addressing marine litter,

and have a lot to offer the other East Asian countries. While not a COBSEA member; Japan has strong economic and political ties with the East Asian Seas region and should be invited to participate in any marine litter activities in the East Asian Seas region.

In addition to economic, political and technical linkages, the COBSEA and NOWPAP regions are linked oceanographically, and both regions undoubtedly receive marine litter from sources in the adjacent region, including by ocean currents and from vessels from countries in the adjacent region.

Fisheries surveillance statistics from countries like Australia and Indonesia indicate that a major source of marine litter, including LAFG in the COBSEA region, is highly likely to be fishing vessels from countries in the NOWPAP region, including vessels involved in IUU fishing.

Both COBSEA and NOWPAP stand to benefit substantially from working closely together on the development and implementation of their respective regional action plans on marine litter. Recognizing that transboundary problems like marine litter require transboundary solutions.

4.2.2 National instruments, programmes and initiatives

Instruments, programmes and initiatives to address marine litter at the national level in the COBSEA member countries have been drawn from the national survey responses and are presented in Table 2.

The COBSEA member country with the most advanced programme to address marine litter is Republic of Korea, which has had a National Integrated Management Strategy for Marine Litter (NIMSML) in place since 1999, funded and managed by the Ministry of Maritime Affairs and Fisheries (MOMAF). This programme is fully comprehensive including, *inter alia* clear designation of a lead agency (MOMAF), clear structures and procedures for the involvement of all other relevant government agencies, local governments, NGOs, research institutions, the private sector and the community, a variety of funding mechanisms, a national awareness campaign, nationally coordinated marine litter survey and monitoring programme, linked to physical clean-ups; integration with the broader national solid waste management effort, a concerted technological research and development programme, and a major effort to address the problem of LAFG, including an innovative scheme where fishermen are paid to return waste fishing gear to port.

No other COBSEA member country begins to approach the level of sophistication and national coordination exhibited by Republic of Korea in addressing marine litter, and it is strongly recommended that the rest of the region should endeavour to learn as much as possible from Korean experience.

Overall, in all countries governmental responsibilities for marine litter issues tend to be shared by different government agencies, with environment ministries generally taking the lead for land-based sources and maritime administrations taking responsibility for sea-based sources. Local (e.g., municipal) governments tend to be responsible for general waste management matters in all countries. Of all the countries only Indonesia has a national task force to coordinate marine litter issues amongst the various government agencies, the *National Action on Coastal and Marine Cleanup* (Gerakan Bersih Pantai Laut), although this is reported in the national survey response to not be functioning very well.

Cambodia has a National Coastal Steering Committee and Viet Nam has a National Oil Pollution Response Committee, which could be used as structures or models for inter-ministerial coordination on marine litter issues as well, and the Philippines has a National Solid Waste Management Commission (NSWMC) and a Multi-Sectoral Task Force on Maritime Development, both of which could be used as national fora for the coordination of marine litter activities.

All countries reported that they do not have national legislation specifically addressing marine litter (except those that have implemented Annex V of MARPOL through national legislation, which addresses vessel-sources specifically). All countries reported that marine litter, especially from land-based sources, is addressed through a variety of environmental and natural resource management laws and regulations.

All countries except Indonesia, Thailand and Viet Nam reported being parties to Annex V of MARPOL, which deals with garbage from vessels.

All countries except the Philippines report that waste reception facilities are provided in ports, although even in Australia improvements are needed, particularly regarding waste fishing gear. All countries except the Philippines report that port waste reception facilities are provided on a fee for service basis. Such an approach can be a barrier to the use of such facilities as vessel operators do not wish to pay such fees, and instead opt to dispose of garbage at sea at no cost.

An alternative model that has been shown to be effective, including at some ports in Australia – is a "no special fee" approach. This requires that all vessels using a port pay a standard environmental fee, which is used to fund the provision and operation of waste reception facilities, regardless of whether or not the vessels use the reception facilities. The result is that vessels are then more likely to use the facilities as they are paying for them anyway, and make no cost savings by dumping illegally at sea.

All countries except Thailand reported in their national surveys as being involved in the UNEP GPA. While Thailand did not report so, UNEP advises that it is also actively involved in the GPA.

All countries reported being parties to the Basel Convention and having national legislation of procedures to implement the convention.

All countries except Cambodia reported having active NGO involvement in marine litter activities, particularly coastal clean-ups and surveys at the local level. All countries except Cambodia are involved in the ICC and PADI Project AWARE. In Australia the PADI Project AWARE Foundation (Asia/Pacific) coordinates the ICC. As the central office for Asia/Pacific it represents a potential partner for further replicating both ICC and Project AWARE in the East Asian Seas region.

Most countries reported that they do not have economic instruments in place to address marine litter, although in Australia some ports charge a generic environmental fee which helps cover costs of waste reception facilities (see "no special fee" above), some States have charge schemes for plastic shopping bags and/or deposit pay-back for return of bottles and cans and Australia, China and a number of other countries have fines for littering in the marine environment.

The Philippines reported having a range of policies and government codes that provide for economic incentives and instruments to address solid waste management including national government grants and awards for local governments.

All countries except Cambodia reported having the elements of national integrated waste management systems, with Australia, Malaysia and Republic of Korea having the best developed systems, and China, Indonesia, Thailand and Viet Nam needing significant further development of their systems. The Philippines has a well-developed national integrated waste management system on paper, but is facing significant implementation challenges. Generally, countries reported that the management of marine litter is not integrated into their national waste management systems.

Table 2: National level programmes and initiatives to address marine litter in the COBSEA member countries, as reported in the national survey responses

COBSEA member country	*Lead Agency*	*Inter-ministerial Task Force*	*Policy and Laws*	*Party to relevant MEAs*	*Port Waste Reception Facilities*	*NGO activities*	*Integrated Waste Management (IWM)*	*Economic instruments*	*Coastal Clean-up and monitoring*
Australia:	No lead agency for marine litter but Department of the Environment and Water Resources, and Australian Maritime Safety Authority (AMSA) have principal responsibilities for marine litter issues.	None.	*Threat Abatement Plan* for marine debris under the *Environment Protection & Biodiversity Conservation Act* currently under development. Various State policies and laws.	MARPOL Annex V. GPA. Basel.	Provided in most ports but some improvements needed, especially regarding waste fishing gear. Responsibility is at State/local port level. AMSA maintains directory of such facilities.	At various levels in different areas. Includes action by seafood industry groups.	Well developed. Includes waste reduction measures by the packaging and plastics industries (details in national survey).	Environmental fees (generic or per use of facilities) that help cover costs of port waste reception facilities. Charge schemes for plastic bags. Deposit pay-back for return of bottles and cans. Fines for littering.	ICC, CUW. PADI Project AWARE. KAB. Various programmes. Tend to be ad-hoc.
Cambodia:	Not for marine litter.	National Coastal Steering Committee.	None specifically for marine litter. General environmental and marine resources laws.	MARPOL Annex V. GPA. Basel.	None. Private contractors have collected wastes from ports on occasion.	No NGO activities specifically on marine litter were reported.	Not developed.	None reported.	CUW activities just commencing.
China:	State Environment Protection Administration (SEPA). Maritime Safety Administration (MSA) for ports and ship-based sources.	None.	Not specifically for marine litter. General environmental and marine resources laws.	MARPOL Annex V. GPA. Basel.	Required in all ports in China by law. Still not provided in all ports and related costs discourage full use.	Volunteer clean-ups have started in some areas.	The *Blue Bohai Sea* Programme includes waste management by ports and harbours before 2010 without exceptions.	All ships entering ports are required to pay waste management fees for reception and disposal of wastes. China has fines for marine litter.	Joining ICC in 2007. Volunteers in several towns have organized coastal clean-ups in past years.
Indonesia:	Ministry of Marine Affairs and Fisheries. Ministry of Environment.	National Action on Coastal and Marine Clean-up.	Not specifically for marine litter. General environmental and marine resources laws.	Not party: MARPOL Annex V. GPA. Basel.	At some ports only, mainly ocean fisheries ports. All facilities are not adequate.	At various levels in various provinces.	IWM systems do operate at municipal/provincial level but port waste facilities not integrated with these.	None reported.	ICC, CUW. PADI Project AWARE.
Malaysia:	None, but Department of Environment appointed focal point for COBSEA marine litter activities.	None.	None specific to marine litter but local government bylaws on sanitation and disposal of solid wastes.	MARPOL Annex V GPA. Basel.	15 ports have waste reception facilities for garbage.	WWF Malaysia organizes beach clean-ups at the Ma' Daerah Turtle Sanctuary.	Waste management in Malaysia is fully privatized at municipal level; regulated by local governments or port authorities.	None reported.	ICC, CUW WWF Ma' Daerah Turtle Sanctuary. PADI Project AWARE.

Table 2: *(Continued)*

COBSEA member country	*Lead Agency*	*Inter-ministerial Task Force*	*Policy and Laws*	*Party to relevant MEAs*	*Port Waste Reception Facilities*	*NGO activities*	*Integrated Waste Management (IWM)*	*Economic instruments*	*Coastal Clean-up and monitoring*
Philippines:	Department of Environment and Natural Resources (DENR). Department of Transport and Communications (DoTC) for ship-based sources.	Multi-Sectoral Task Force on Maritime Development could provide a forum.	Section 42 of Philippines Environment Code (P.D. No. 1152) relates to waste mgmt. Marine Pollution Degree of 1976. Ecological Solid Waste Management Act (RA 900).	MARPOL Annex V. GPA. Basel.	No data reported.	The NGOs HARIBON and PADI are active on marine litter issues in Philippines.	NSWMC under Office of President. Local government Code places responsibility on local governments for waste management.	A large number of economic schemes provided for in National waste management policy and Local Government Code – not fully implemented.	ICC. PADI Project AWARE.
Thailand:	Marine Department, Ministry of Transportation. Pollution Control Department. Ministry of Natural Resources and Environment. Department of Industrial Works.	Not for marine litter but the 'National task force for oil pollution' may provide a suitable structure.	Not specifically for marine litter. General environmental and marine resources laws (details in national survey).	Not party: MARPOL Annex V. No info reported on GPA. Basel.	Most fishing ports provide reception facilities. For major ports waste companies are registered with the Marine Department. Fees vary.	Coastal clean-ups at famous tourist destinations. Considerable works done after 2004 tsunami.	Poorly developed.	Pollution Control Department and Department of Fisheries have plan for waste treatment for fishing ports, not implemented yet.	ICC. PADI Project AWARE. Various NGO and dive industry activities.
Republic of Korea:	Ministry of Maritime Affairs and Fisheries (MOMAF).	Marine Alliance of NGOs, Government sector and research Organization (MANGO).	National Integrated Management Strategy for Marine Litter (NIMSML). Marine Pollution Prevention Act (ship-sourced). Wastes Control Act (general waste management).	MARPOL Annex V. GPA. Basel.	Required by law.	Highly developed, including, formal partnerships with Government and research community to address marine litter through MANGO.	Highly developed and linked to marine litter activities.	Innovative programme to address LAFG though buy-back of waste fishing gear returned to port by fishermen.	Formal, nationally coordinated programme. ICC.
Viet Nam:	Viet Nam Environment Protection Agency (VEPA).	No.	Not specifically for marine litter. General environmental and marine resources laws.	Not party: MARPOL Annex V. Not involved in GPA. Basel.	Provided at most ports as a commercial service. Disposal of waste after collection is a problem.	Some NGO activities related to ICC and CUW.	Waste from some ships/ports transported to land dumps.		ICC. CUW.

4.3 Identified barriers and gaps

4.3.1 Regional barriers and gaps

In undertaking this regional review a number of barriers and gaps at the regional level in relation to the prevention and control of marine litter in the East Asian Seas region have been identified. Many of these stem from and are related to the national level barriers, gaps and needs which are presented in section 4.3.2 and so are only summarized here.

The major regional barriers and gaps are:

- A generally very low level of awareness of the problem at all levels, including at decision-making level – which translates into very low political will to address the problem;
- A major push for economic development in the region, often with scant regard for environmental consequences, and a cultural perspective that does not recognize the values of the oceans and the impacts of human activities on it;
- A broad range of competing, national development priorities, including law and order, food security, public health, education and socio-economic development; that often push environmental issues, especially marine environmental issues, down the government funding list in terms of order of priority;
- Lack of regional data on the nature and extent of the problem;
- Lack of a regional multi-lateral legal instrument on marine environmental protection, such as a convention or treaty, which would place legally binding obligations on signatories and provide a legal basis for regional action;
- Lack of a regional strategy or action plan on marine litter, which recognizes the trans-boundary nature of the problem and the need for regional cooperation and coordination, and lack of a regional coordination mechanism; and
- Lack of involvement of the private sector (e.g., shipping, ports, fisheries, coastal tourism, packaging, plastics and waste management industries) in addressing the issue.

4.3.2 National barriers and gaps

National level barriers and gaps in the COBSEA member countries have been drawn from the national survey responses and are presented in Table 3. Many of these are similar to those presented in section 4.3.1, but also include the following additional barriers and gaps:

- A very low-level of awareness about the marine litter issue and its impacts amongst all stakeholders in the each country;
- Lack of national level data on the nature and extent of the problem;
- Lack of a designated lead agency and coordination between government agencies and other stakeholders, including private sector;
- Cost of using port reception facilities based on fee for service approach (discouraging vessel operators from using them);
- For Australia and Indonesia (and to a certain extent the Philippines), vast and complex geography and many remote areas;
- No structured, nationally coordinated strategy and action plans on marine litter – activities tend to be ad-hoc in all countries;
- Very poor implementation of UNEP GPA NPAs;
- Some COBSEA member countries not being part of Annex V of MARPOL (Indonesia, Thailand and Viet Nam);
- Lack of implementation of the FAO Code of Conduct for Responsible Fisheries in relation to LAFG;
- Lack of relevant laws and regulations, and/or poor enforcement of existing laws and regulations;
- Lack of or inefficiencies with broader national waste management systems; and
- No marine litter trajectory models.

Table 3: National level barriers, gaps and needs in relation to marine litter in the COBSEA member countries, as reported in the national survey responses

Country	*Barriers*	*Gaps*	*Needs*
Australia	Lack of coordination between Federal, State and local levels (being addressed through development of national marine debris threat abatement plan). Lack of data on the extent and nature of the problem (national database being developed). Cost of using port waste reception facilities based on fee for service approach. Vast coastline with many remote areas making it difficult to undertake survey, monitoring, clean-up and enforcement activities.	No structured, nationally coordinated, strategic approach to marine litter (being addressed through development of national marine debris threat abatement plan). Efforts to implement GPA NPA appear to be largely superficial. Lack of enforcement of relevant laws and regulations (due in part to large coastline and many remote areas). No marine litter trajectory models (although now under development).	Greater coordination between Federal, State and local levels. National coordinated marine litter survey and monitoring programme (development of national guidelines underway). Adopt 'no special fee' approach to port waste reception facilities. Develop marine litter trajectory models (underway).
Cambodia	Very low level of awareness, including at decisionmaker level (low political will). Lack of data on the extent and nature of the problem. Competing socio-economic development priorities. Cost of using port waste reception facilities based on fee for service approach.	No designated Lead Agency. Lack of broader national and local integrated waste management system. Lack of relevant laws and regulations. Lack of technical capacity. No marine litter trajectory models. No national funding for marine litter.	Designate Lead Agency. Concerted awareness campaign at all levels. Develop broader national and local integrated waste management system. National coordinated marine litter survey and monitoring programme. Adopt 'no special fee' approach to port waste reception facilities. Technical training. Develop marine litter trajectory models. Join ICC.
China	Very low level of awareness, including at decisionmaker level (low political will). Lack of data on the extent and nature of the problem. Competing socio-economic development priorities. Cost of using port waste reception facilities based on fee for service approach.	Lack of enforcement of relevant laws and regulations. No marine litter trajectory models.	Concerted awareness campaign at all levels. National coordinated marine litter survey and monitoring programme. Adopt 'no special fee' approach to port waste reception facilities. Technical training. Develop marine litter trajectory models. Join ICC.
Indonesia	Very low level of awareness, including at decisionmaker level (low political will). Lack of data on the extent and nature of the problem. Competing socio-economic development priorities. Extremely vast and complex geography, including tens of thousand of islands. Lack of coordination between National, Provisional and local levels. Cost of using port waste reception facilities based on fee for service approach.	Confusion of roles and responsibilities between Government agencies. Inefficiencies of broader national and local integrated waste management system. Not a party to MARPOL. Lack of enforcement of relevant laws and regs. No marine litter trajectory models. No national funding for marine litter.	Designate clear Lead Agency. Accede to MARPOL. Concerted awareness campaign at all levels. Improve efficiencies of broader national and local integrated waste management system. National coordinated marine litter survey and monitoring programme. Adopt 'no special fee' approach to port waste reception facilities. Technical training. Develop marine litter trajectory models.

Table 3: *(Continued)*

Country	*Barriers*	*Gaps*	*Needs*
Malaysia	Low to medium level of awareness, including, at decisionmaker level, (but low political will). Lack of data on the extent and nature of the problem. Cost of using port waste reception facilities based on fee for service approach.	Lack of enforcement of relevant laws and regs. No marine litter trajectory models. No national funding for marine litter.	National coordinated marine litter survey and monitoring programme. Adopt 'no special fee' approach to port waste reception facilities. Develop marine litter trajectory models.
Philippines	No data on level of awareness. Lack of data on the extent and nature of the problem. Vast and complex geography, including many islands.	Confusion of roles and responsibilities between Government agencies. Inefficiencies of broader national and local integrated waste management system. Lack of enforcement of relevant laws and regs. No marine litter trajectory models. No national funding for marine litter	National situation assessment. Clearer designation of Government roles and responsibilities. Concerted awareness campaign at all levels. National coordinated marine litter survey and monitoring programme. Establish physical infrastructure for waste management.
Thailand	Low level of awareness, including, at decisionmaker level (low political will). Lack of data on the extent and nature of the problem. Competing socio-economic development priorities. Cost of using port waste reception facilities based on fee for service approach.	Inefficiencies of broader national and local integrated waste management system. Not a party to MARPOL. Lack of enforcement of relevant laws and regs. No marine litter trajectory models. No national funding for marine litter.	Accede to MARPOL. Concerted awareness campaign at all levels. Improve efficiencies of broader national and local integrated waste management system. National coordinated marine litter survey and monitoring programme. Adopt 'no special fee' approach to port waste reception facilities. Technical training. Develop marine litter trajectory models.
Republic of Korea	No major barriers – marine litter is well established as a high priority issue in Republic of Korea.	No major gaps. Spread of national marine litter monitoring sites could be more representative – some large stretches of coastline without sites (see Figure A.1.1.).	Ongoing commitment to funding if the existing national programme is to continue.
Viet Nam	Very low level of awareness, including, at decisionmaker level (low political will). Lack of data on the extent and nature of the problem. Competing socio-economic development priorities. Cost of using port waste reception facilities based on fee for service approach.	Lack of broader national and local integrated waste management system. Not a party to Annex V of MARPOL. Lack of relevant laws and regulations. Lack of technical capacity. No marine litter trajectory models. No national funding for marine litter.	Accede to Annex V of MARPOL. Concerted awareness campaign at all levels. Develop broader national and local integrated waste management system. National coordinated marine litter survey and monitoring programme. Adopt 'no special fee' approach to port waste reception facilities. Technical training. Develop marine litter trajectory models.

5. Conclusions and recommendations

The following conclusions can be made from this regional review:

- Marine litter, also known as marine debris and marine garbage, from both land and sea-based sources, is one of the major threats to the world's oceans;
- Very little is known about the extent and nature of the problem in East Asian Seas region, including source differentiation, zones of accumulation and degree of ecological, environmental and socio-economic impacts;
- The problem of marine litter is likely to be particularly severe in the East Asian Seas region, due in part to the massive industrial and urban development under-way in the coastal zones of the region. This combined with an exponential and sustained growth in shipping activity serving the region's rapidly expanding economies, the current lack of effective marine litter prevention and control measures in many COBSEA member countries, and in many cases, cultural and awareness barriers often impedes political will to address the problem;
- As a component of the broader marine litter problem, LAFG is likely to be major concern in the East Asian Seas region, due to extremely large size of the fishing industry and lack of effective regulation of the industry in the region, including an extremely high level of IUU fishing in the region; and
- All countries in the region face significant barriers to the effective prevention and control of marine litter as outlined in section 4.3.

The following recommendations are made from this regional review:

- The COBSEA member countries should consider developing, adopting and implementing a regional action plan on marine litter, which recognizes the transboundary nature of the problem and the need for regional cooperation and coordination, and which includes actions to:
  - Prevent and reduce marine litter from land-based sources;
  - Prevent and reduce marine litter from sea-based sources;
  - Prevent and reduce Lost and Abandoned Fishing Gear;
  - Mitigate the impacts of marine litter;
  - Raise regional awareness of marine litter; and
  - Monitor and assess marine litter.
- As a sub-set of the regional action plan on marine litter, each country should consider developing and implementing national action plans on marine litter, which addresses the following elements:
  - National implementation the regional action plan on marine litter;
  - Provision for concerted and sustained awareness campaigns targeting industry, community and government groups with responsibility for preventing and managing marine litter;
  - Provision for more effective implementation at the national level of:
    - The elements of the GPA NPAs that address land-based sources of marine litter;
    - MARPOL Annex V to address sea-based sources of marine litter; and
    - The FAO Code of Practice for Responsible Fisheries to address the problem of LAFG.

- Adoption of a "no special fee" approach to port waste reception facilities in all countries in the region;
- Establishment of national coordinated marine litter surveys and monitoring;
- Provision for technical training and capacity building of relevant personnel from government, academia, coastal communities, NGOs and relevant industries on measures to prevent and reduce marine litter; and
- Further development of broader national integrated waste management arrangements and the integration of management of marine litter into these arrangements.

- Efforts should be made to encourage all countries in the region to apply consistent marine litter survey and monitoring methods (such as those being developed by UNEP and IOC) and to join ICC, CUW and PADI Project AWARE;
- A central, regional database should be established to which national administrations report annual statistics on the sources, causes, quantities and distribution of marine litter in their respective jurisdictions. The database could present outputs graphically on map-based GIS – providing visual representation of the geographical spread of the problem. This would provide a powerful monitoring tool for assessing the true regional extent of the problem, including regional hot spots, as well as trends over time and the effectiveness or otherwise of management and control responses. Such a regional database could possibly be housed and maintained by the COBSEA Secretariat, with appropriate support from COBSEA member governments;
- Marine litter trajectory models should be developed for each sub-regional sea in the East Asian Seas region;
- Close coordination and sharing of lessons should be undertaken with neighbouring regions – especially NOWPAP which has highly a developed programme on marine litter. With its geographical location directly adjacent to the East Asian Seas region, Japan could be invited to participate in the activities of the regional action plan on marine litter. Japan has a longer experience in addressing marine litter issues than most of the COBSEA members and could offer valuable input to the activities. Brunei Darussalam could also be invited to participate;
- Close coordination with APEC, ASEAN, PEMSEA and other relevant organizations or GEF-projects in the region in developing and implementing a regional action plan on marine litter; and
- Close coordination and joint activities should be undertaken with the Asia-Pacific Fishery Commission (APFIC), FAO, IMO and APEC Fisheries Working Group to address LAFG in the region.

Part II:

THE COORDINATING BODY ON THE SEAS OF EAST ASIA (COBSEA) REGIONAL ACTION PLAN ON MARINE LITTER (RAP-MALI)

1. Preamble

Recognizing the negative ecological, environmental and socio-economic impacts of marine litter globally and the severity of the marine litter problem in the East Asian Seas region specifically;

Considering the United Nations General Assembly Resolution on Marine Litter (UN GA Resolution A/60-/L-22), which *inter alia* "Urges States to integrate the issue of marine litter within national strategies dealing with waste management in the coastal zone, ports and maritime industries",… and also "encourages States to cooperate regionally and sub-regionally to develop and implement joint prevention and recovery programmes for marine litter";

Considering the Washington Declaration on Protection of the Marine Environment from Land-based Activities of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA), which recognizes litter as one of the land-based impacts upon the marine environment;

Welcoming the United Nations Environment Programme – Regional Seas Programme's Global Marine Litter Partnership and its support for Regional Seas Conventions, Action Plans and Organizations, including COBSEA, to develop and implement regional action plans on marine litter; and

Recognizing further that marine litter is a transboundary problem requiring a cooperative response involving regional cooperation and partnerships between governments, international organizations, the private sector and civil society.

The 19th Meeting of COBSEA:

Adopts the COBSEA Regional Action Plan on Marine Litter;

Agrees to prioritize the actions outlined in the COBSEA Regional Action Plan on Marine Litter with a focus on the activities related to:

I. Action 1: Preventing and reducing marine litter from land-based sources;

II. Action 2: Preventing and reducing marine litter from sea-based sources; and

III. Action 5: Raising awareness on marine litter.

Requests the Secretariat to approach COBSEA member countries, donor countries and relevant international organizations regarding possible financial and in-kind contributions to support the implementation of the COBSEA Regional Action Plan on Marine Litter.

Siem Reap, Cambodia
22-23 January 2008

2. Development of the COBSEA RAP-MALI

Taking into account the global concern about the issue of marine litter and the United Nations General Assembly Resolution on Marine Litter (UN GA Resolution A/60-/L.22), the UNEP RSP has initiated a global programme on marine litter, including addressing the problem at the regional level, through assistance to several Regional Seas organizations, including COBSEA.

With financial support from the UNEP RSP, COBSEA commenced its marine litter activity in late 2006 and in general accordance with the UNEP Guidelines, the COBSEA approach is being undertaken as follows:

Phase I: Assessment of the regional situation

National consultants were nominated by the COBSEA member countries and a regional consultant was identified to complete national surveys on marine litter and prepare a regional review on marine litter respectively. The resulting *Regional Review on Marine Litter in the East Asian Seas region* provides valuable background information supporting the COBSEA RAP-MALI.

Phase II: Preparation of the COBSEA RAP-MALI

A draft framework document of a regional action plan on marine litter, was developed and presented to the First COBSEA Marine Litter Workshop held in Jakarta, Indonesia 8-9 May 2007. The workshop reviewed and further developed the draft framework document. The outputs of the workshop were consolidated into the draft COBSEA RAP-MALI that was circulated among the member countries during 2007. The COBSEA RAP-MALI was adopted by the 19th Meeting of COBSEA, Siem Reap, Cambodia, 22-23 January 2008.

Phase III: Integration of the COBSEA RAP-MALI into the Programme of Work of COBSEA and implementation at the regional and national level.

In order to achieve implementation the COBSEA RAP-MALI will need to be approved and adopted by COBSEA and resources secured for its implementation, as part of the broader COBSEA Programme of Work.

3. Aim and objectives

The aim of the COBSEA RAP-MALI is to:

- Improve the quality of marine and coastal environments of the East Asian Seas by addressing the issue of marine litter through regional cooperation and partnerships.

The objectives of the COBSEA RAP-MALI are to:

- Prevent and reduce litter in marine and coastal environments of the East Asian Seas.
- Mitigate the environmental and socio-economic impacts of litter in marine and coastal environments of the East Asian Seas.
- Raise awareness about marine litter and its impacts, amongst all relevant stakeholders in the East Asian Seas region, including but not limited to government decisionmakers, the private sector such as fisheries, shipping, ports and the plastics and packaging industries, and the general public.

- Monitor and assess the types, sources, distribution, quantities and trends of litter in marine and coastal environments of the East Asian Seas, in order to provide science-based information for policy-making and management planning.

4. Institutional arrangements

The institutional arrangements for the coordination and management of the implementation of the COBSEA RAP-MALI will include:

- The establishment of a regional working group of marine litter consisting of national focal points and experts, to provide advice to the COBSEA Intergovernmental Meeting and guide the implementation of the COBSEA RAP-MALI. The group will discuss and advise COBSEA on its modality of work.
- Within the framework of COBSEA, cooperation with other global and regional organizations and programmes including civil society, the private sector such as fisheries, shipping, ports, the plastics and packaging industries and other relevant stakeholders.

5. Actions and activities

In order to achieve the aims and objectives of the COBSEA RAP-MALI as outlined in section 2, it is necessary for COBSEA and its members to carry out clearly defined and structured actions and activities. In line with the objectives, six major actions are proposed, as outlined below.

It should be noted that in developing and proposing these actions, the participants in the First COBSEA Marine Litter Workshop held in Jakarta, Indonesia, 8-9 May 2007 agreed that, given that the region is only just beginning to address the problem of marine litter, it is necessary to initially focus only on high-priority, foundational actions and activities, that will lay the basis for further development of more sophisticated marine litter prevention and response actions in the future.

In line with the objectives of the COBSEA RAP-MALI, the six major actions that are proposed are as follows:

Action 1: Preventing and reducing marine litter from land-based sources

Action 2: Preventing and reducing marine litter from sea-based sources

Action 3: Preventing and reducing Lost and Abandoned Fishing Gear (LAFG)

Action 4: Mitigating the impacts of marine litter

Action 5: Raising awareness of marine litter

Action 6: Monitoring and assessing marine litter

Actions 1 to 3 relate to objective 1 of the COBSEA RAP-MALI, and have been divided into these three sub-categories in recognition of the fact that quite different approaches are required to address the different sources (land-based and sea-based).

While it could be argued that LAFG is implicitly included in sea-based sources, because this type of marine litter is such a major concern, and because addressing it requires sector-specific measures, involving close cooperation with the fisheries sector, including international organizations that deal with fisheries as well as the fishing industry itself.

Within these actions, specific technical activities are proposed. Each action and its set of activities are described in more detail below, and these are summarized in a workplan in section 6.

Action 1: Preventing and reducing marine litter from land-based sources

In working to prevent and reduce marine litter from land-based sources, COBSEA will seek to work closely with the UNEP GPA including joint funding and/or implementation of projects where appropriate.

The following activities are proposed under Action 1:

Activity 1.1: **Legal and economic instruments:** Encourage and assist countries to develop and adopt legal and economic instruments to assist the management and prevention of marine litter from land-based sources.

Activity 1.2: **GPA National Plans of Action (NPAs):** Encourage and assist countries to develop and to achieve greater on-ground implementation of GPA NPAs.

Activity 1.3: **Integrated waste management:** Encourage and assist countries to promote integrated waste management systems for major municipal areas and coastal towns and villages, including the waste management principles of Reduce, Re-use and Recycle (3R).

Activity 1.4: **Urban catchments:** Encourage and assist municipal councils in each country to implement litter prevention and interception systems in urban catchments, by sharing information on the use of engineering and non-engineering approaches, including but not limited to litter booms, physical traps/interceptors, Stormwater Quality Improvement Devices (SQIDs) and similar measures.

Activity 1.5: **Training and capacity building:** Seek to provide technical training and capacity building to staff from national and municipal governments on the prevention and reduction of marine litter from land-based sources, through regional workshops and training courses.

Activity 1.6: **Award-based incentives:** Encourage and assist countries to develop and implement award-based incentive schemes for coastal villages, towns and cities that have integrated waste management systems, using models such as the Australian “Tidy Towns” programme.

Action 2: Preventing and reducing marine litter from sea-based sources

In working to prevent and reduce marine litter from sea-based sources, COBSEA will seek to work closely with the IMO and both the Transport and Marine Resources Conservation Working Groups of APEC, as well as the international and regional shipping and ports industries, as represented by bodies such as the International Association of Ports and Harbours (IAPH), the International Association of Tanker Owners (INTERTANKO) and the International Chamber of Shipping (ICS); including joint funding and/or implementation of projects where appropriate.

The following activities are proposed under Action 2:

Activity 2.1: **Legal and economic instruments:** Encourage and assist countries to develop and adopt legal and economic instruments to assist the management and prevention of marine litter from sea-based sources.

Activity 2.2: **MARPOL Annex V:** Encourage and assist countries in the region that are not party to MARPOL Annex V to become party, and assist countries with on-ground implementation of Annex V.

Activity 2.3: **Port waste reception review:** Consider undertaking a regional review of the adequacy of port waste reception facilities and publish a Regional Directory of such, similar to that published jointly by Australia and New Zealand.

Activity 2.4: **Port waste reception fees:** Seek to encourage countries in the region to adopt a coordinated regional approach to port waste reception facilities, based on a "General Fee" cost recovery basis.*

Activity 2.5: **Training and capacity building:** Seek to provide technical training and capacity building to staff from national governments, port authorities and the shipping industry on the prevention and reduction of marine litter from sea-based sources, through regional workshops and training courses.

* Note regarding Port Reception Fees: In the Regional Review of Marine Litter in the East Asian Seas region most COBSEA members reported that where port waste reception facilities are provided, it is on a fee-for-service (user pays) basis. Such an approach can be a barrier to the use of such facilities – as vessel operators may not wish to pay such fees, and instead may opt to dispose of their garbage at sea – at no cost (assuming they are not caught and fined).

An alternative model that has been shown to be effective in some instances is a "General Fee" approach. This requires that all vessels using a port pay a standard environmental fee, which is used to fund the provision and operation of waste reception facilities, regardless of whether or not the vessels use the reception facilities. The result is that vessels are more likely to use the facilities – as they are paying for them anyway, and make no cost savings by dumping illegally at sea.

Action 3: Preventing and reducing Lost and Abandoned Fishing Gear (LAFG)

The activities proposed under action 3 are in addition to those under action 2, which in themselves will help to address the issue of LAFG.

In working to prevent and reduce LAFG, COBSEA will seek to work closely with the FAO, APFIC, the Marine Stewardship Council (MSC) and both the Fisheries and Marine Resources Conservation Working Groups of APEC, as well as the fishing industry itself, including joint funding and/or implementation of projects where appropriate.

The following activities are proposed under Action 3:

Activity 3.1: **FAO Code of Conduct:** Encourage and assist the regional fishing industry to better implement/comply with the FAO Code of Conduct for Responsible Fisheries as it relates to LAFG.

Activity 3.2: **Gear marking:** Encourage and assist countries to develop national legislation that requires all fishing gear to be identified/marked.

Activity 3.3: **Gear registers:** Encourage and assist countries to establish national registers of fishing gear types (especially net types) used by their domestic fishing fleets.

Activity 3.4: **Waste gear buy-back:** Encourage and assist countries to establish waste fishing gear buy-back schemes such as that implemented successfully in Republic of Korea.

Action 4: Mitigating the impacts of marine litter

Recognizing that efforts to prevent and reduce marine litter from all sources as proposed under Actions 1 to 3 will not be entirely effective, and given the current severe state and increasing severity of marine litter in the Seas of East Asia, actions and activities are also required in order to mitigate litter that does and will continue to enter the marine and coastal environments of the region. As a starting point, under the COBSEA RAP-MALI the main mitigation measure that is proposed is marine litter removal and clean-up.

In working to mitigate the impacts of marine litter, COBSEA will seek to work closely with the ICC, PADI Project AWARE, CUW and similar programmes, as well as the plastics and packaging industries which may be interested to support clean-up activities, including joint funding and/or implementation of projects where appropriate.

The following activities are proposed under Action 4:

Activity 4.1: **International cleanup campaigns:** Encourage and assist all COBSEA member countries to join the ICC, PADI Project AWARE, CUW, Green Fins and similar campaigns and programmes and to spread these activities to additional sites in each country.

Activity 4.2: **Targeted cleanup campaigns:** Encourage and assist entities with particular interest in or responsibility for certain coastal areas, such as tourist resorts and port authorities, to undertake regular clean-ups of their areas.

Action 5: Raising awareness of marine litter

The Regional Review of Marine Litter in East Asian Seas region identified a severe lack of awareness about the marine litter issue amongst all levels and sectors of society in East Asia, as being perhaps the single biggest barrier to addressing the issue in the region. It is therefore deemed logical and prudent that the development and implementation of a concerted communication and awareness campaign should form one of the high-priority, initial, foundational Actions of the COBSEA RAP-MALI.

In working to raise awareness about marine litter in East Asia, COBSEA will seek to work closely with the ICC, PADI Project AWARE, CUW, Green Fins and similar programmes that have major awareness as well as clean-up objectives. COBSEA will also seek to work with the plastics and packaging industries, which may be interested to support awareness activities, including joint funding and/or implementation of projects where appropriate.

The following activities are proposed under Action 5:

Activity 5.1: **Regional communication strategy:** Seek to develop and implement a regional communication strategy on marine litter to promote awareness of the issue amongst all relevant audiences (government, industry, community), with consideration being given to the use of mass media (TV, radio and newspaper) as the most effective communication method.

Activity 5.2: **Targeted awareness campaigns:** Seek to develop and undertake awareness campaigns targeting high priority marine litter sources (e.g., fishing, shipping, municipal councils, port authorities).

Action 6: Monitoring and assessing marine litter

The Regional Review identified that there is a major lack of data on the sources, types, extent, distribution, impacts and trends over time of marine litter in the Seas of East Asia, and that this lack of understanding is a barrier to effective marine litter prevention and management in the region.

Monitoring and assessment programmes are required so as to determine the true regional extent of the problem, including identification of high priority sources and regional hot spots that require targeted management action, as well as trends over time and the effectiveness or otherwise of management and control responses.

In working to develop and implement marine litter monitoring and assessment programmes in East Asia, COBSEA will seek to work closely with UNEP and the IOC, which are jointly developing global standards for marine litter surveys and monitoring. COBSEA will also seek to work with the ICC, which generates some limited monitoring data from its annual clean-up activities, as well as marine and coastal scientific institutions which may be interested to support marine litter monitoring and assessment activities, including joint funding and/or implementation of projects where appropriate.

The following activities are proposed under Action 6:

Activity 6.1: **Data from ICC:** Seek to develop procedures in collaboration with ICC to improve the reporting of data to national governments and COBSEA that is collected from annual ICC events in the region.

Activity 6.2: **National surveys and monitoring:** Encourage and assist each COBSEA member to develop and implement formal, systematic, nationally coordinated marine litter survey and monitoring programmes, using standardized methods being developed by UNEP and IOC (standardization is vital for data quality control and inter-comparability).

Consider encouraging COBSEA members to annually report the results of any such programmes to the COBSEA Secretariat for inclusion in a possible Regional Marine Litter Information System, as proposed under activity 6.3, and for consideration by COBSEA Intergovernmental Meetings.

Activity 6.3: **Regional marine litter information system:** Consider the merits of establishing a central regional information system on marine litter at the COBSEA Secretariat and the role that the East Asian Seas Knowledgebase and other existing databases, such as the marine litter database managed by the NOWPAP Data and Information Network Regional Activity Centre (DINRAC), could play.

If developed, such an information system could be used for the storage, management, analysis and interpretation of the results of the national marine litter survey and monitoring programmes, as well as data returns from ICC events in the region and any other relevant sources of marine litter information in the region.

Such an information system could present outputs graphically on map-based GIS – providing visual representation of the geographical spread of the problem. This would provide a powerful monitoring tool for assessing the true regional extent of the problem, including regional hot spots, as well as trends over time and the effectiveness or otherwise of management and control responses.

Activity 6.4: **Trajectory modelling:** Consider to undertake marine litter trajectory modelling in the COBSEA region, to identify sources and accumulation zones for marine litter, and enable better targeted management actions.

6. Workplan

Table 1: The COBSEA RAP-MALI workplan

Action	*Activity*	*Timeline*	*Responsibility*	*Estimated regional budget*
1. Land-based sources:	**1.1 Legal and economic instruments:** a. Review and recommend effective legal and economic instruments with regards to the management of marine litter from land-based sources. b. Develop national legal instruments to address marine litter from land-based sources and/or strengthen existing national legislation.	Year 1 Year 1-5	COBSEA Secretariat Participating countries	US$15,000 National budget/ Other sources
	1.2 GPA NPAs: a. Develop, or update existing, GPA NPAs to strengthen the management and mitigation of land-based pollution including marine litter. b. Provide support to participating countries for the integration of actions addressing marine litter in GPA NPA development.	Year 1-5 Year 1-3	Participating countries in collaboration with UNEP GPA COBSEA Secretariat in collaboration with UNEP GPA	National budget/ Other source US$80,000
	1.3 Integrated waste management: a. Promote the use of integrated waste management among coastal municipalities. b. Develop guidelines for the application of 3R programmes in coastal communities. c. Assist local municipalities in developing and applying income generating 3R programmes in coastal communities. d. Promote the use of 3R programmes in marine parks and coastal tourism areas.	Year 1-5 Year 3 Year 3-5 Year 1-5	Participating countries COBSEA Secretariat Participating countries in collaboration with COBSEA Secretariat Participating countries, the COBSEA Secretariat and the Green Fins network	National budget/ Other sources US$20,000 US$50,000 US$20,000
	1.4 Urban catchments: Encourage municipal councils to implement litter prevention and interception systems in urban catchments.	Year 1-5	Participating countries	National budget/ Other sources
	1.5 Training and capacity building: a. Organize a training workshop to share review outcomes and experiences on effective legal and economic instruments to manage marine litter from land-based sources between COBSEA member countries. b. Organize a technical training workshop to share knowledge and experiences on the use of engineering and non-engineering approaches to litter prevention.	Year 2 Year 4	COBSEA Secretariat COBSEA Secretariat	US$20,000 US$30,000
	1.6 Award based incentives: a. Initiate or strengthen existing award-based incentives schemes for coastal towns and cities that have IWM systems at national level. b. Encourage the establishment of award-based incentives schemes through regional campaign activities, such as COBSEA Clean Beach awards or similar.	Year 1-5 Year 1-5	Participating countries COBSEA Secretariat	National budget/ Other sources US$50,000

Table 1: *(Continued)*

Action	*Activity*	*Timeline*	*Responsibility*	*Estimated regional budget*
2. Sea-based sources:	**2.1 Legal and economic instruments:** a. Review and recommend effective legal and economic instruments with regards to the management of marine litter from sea-based sources. b. Develop national legal instruments to address marine litter from land-based sources and/or strengthen existing national legislation.	Year 1 Year 1-2	COBSEA Secretariat Participating countries	To be combined with activity 1.1a National budget/ Other sources
	2.2 MARPOL Annex V: a. Ratify MARPOL Annex V, or strengthen the implementation of MARPOL Annex V, specifically regarding the prevention and mitigation of marine litter from sea-based sources. b. Provide support to participating countries to identify and implement concrete actions to address marine litter through on-the-ground implementation of MARPOL Annex V.	Year 1-5 Year 3-5	Participating countries in collaboration with IMO COBSEA Secretariat in collaboration with IMO	National budget/ Other sources US$80,000
	2.3 Port waste reception review: Undertake a regional review of the adequacy of port waste reception facilities and publish a regional directory.	Year 2	COBSEA Secretariat and participating countries in collaboration with IMO	US$50,000
	2.4 Port waste reception fees: a. Encourage the adoption of a "General Fee" cost recovery basis for port waste reception facilities at national/local ports. b. Develop a coordinated regional approach/recommendation to port waste reception facilities, based on a "General Fee" cost recovery basis.	Year 1-5 Year 3	Participating countries COBSEA Secretariat and participating countries in collaboration with IMO	National budget/ Other sources US$15,000
	2.5 Training and capacity building: Organize a training workshop to share review outcomes and experiences on effective legal and economic instruments to manage marine litter from sea-based sources between COBSEA member countries, specifically focusing on strengthened implementation of MARPOL Annex V.	Year 2	COBSEA Secretariat in collaboration with IMO	To be combined with activity 1.5a
3. LAFG:	**3.1 FAO Code of Conduct:** a. Strengthen the implementation and compliance with the FAO Code of Conduct for Responsible Fisheries as it related to LAFG. b. Provide support to participating countries to identify and implement concrete actions to address LAFG through the implementation of the FAO Code of Conduct for Responsible Fisheries.	Year 1-5 Year 5	Participating countries in collaboration with FAO COBSEA Secretariat in collaboration with FAO	National budget/ Other sources US$80,000
	3.2 Gear marking: Develop and/or strengthen existing legislation requiring all fishing gears to be identified/marked.	Year 1-5	Participating countries	National budget/ Other sources
	3.3 Gear registers: Establish national registers of fishing gear types (especially net types) used by domestic fishing fleets.	Year 1-5	Participating countries	National budget/ Other sources
	3.4 Waste gear buy-back: a. Assess the possibility of implementing waste gear buy-back schemes at national level. b. Organize a technical training workshop to share experiences on successful management initiatives such as the waste gear buy-back scheme implemented in the Republic of Korea.	Year 1-5 Year 4	Participating countries COBSEA Secretariat	National budget/ Other sources To be combined with activity 1.5b

Table 1: *(Continued)*

Action	*Activity*	*Timeline*	*Responsibility*	*Estimated regional budget*
4. Mitigating impacts:	**4.1 International cleanup campaigns:** a. Join Ocean Conservancy's ICC, CUW, PADI Project AWARE, Green Fins and similar campaigns and programmes and encourage active participation by NGOs, schools, private sector etc., in local clean-up campaigns. b. Encourage and assist participating countries to join Ocean Conservancy's ICC, CUW, PADI Project AWARE, Green Fins and similar campaigns and programmes through the organization of regional clean-up campaigns.	Year 1-5 Year 1-5	Participating countries COBSEA Secretariat in collaboration with ICC, CUW etc.	National budget/ Other sources US$100,000
	4.2 Targeted clean-up campaigns: Encourage and assist entities with particular interest in or responsibility for certain coastal areas, such as tourist resorts and port authorities, to undertake regular clean-ups of their areas.	Year 1-5	Participating countries	National budget/ Other sources
5. Raising awareness:	**5.1 Regional communication strategy:** Develop and implement a regional communication strategy on marine litter to promote awareness among all relevant audiences and identify potential funding for its implementation.	Year 1-5	COBSEA Secretariat and participating countries	US$50,000
	5.2 Targeted awareness campaigns: a. Develop and undertake national/local awareness campaigns targeting high priority marine litter sources (e.g., fishing, shipping, municipal councils, port authorities). b. Ensure active involvement by representatives from private sectors representing high priority marine litter sources (e.g., fishing, shipping, municipal councils, port authorities) in the implementation of the COBSEA RAP-MALI through the participation in training workshops, clean-up campaigns, potential funding for activities etc.	Year 1-5 Year 1-5	Participating countries COBSEA Secretariat	National budget/ Other sources N/A
6. Monitoring and assessing:	**6.1 ICC data:** Develop procedures in collaboration with ICC to improve the reporting of data to national governments and COBSEA that is collected from annual ICC events in the region.	Year 1	COBSEA Secretariat in collaboration with ICC	N/A
	6.2 National surveys and monitoring: a. Provide logistical and other (non-financial) support to the development of standardized marine litter monitoring methods that has been initiated by UNEP RSP and IOC. b. Develop and implement formal, systematic and nationally coordinated marine litter survey and monitoring programmes, using the standardized methods developed by UNEP RSP and IOC. c. Report the results of national surveys and monitoring to the COBSEA Secretariat for inclusion in a possible Regional Marine Litter Information System and for consideration by COBSEA Intergovernmental Meetings.	Year 1 Year 1-5 Year 1-5	UNEP RSP and IOC/UNESCO in collaboration with the COBSEA Secretariat Participating countries Participating countries	N/A National budget/ Other sources National budget/ Other sources
	6.3 Regional information system: Establish a central regional information system on marine litter as part of the developing East Asian Seas Knowledgebase.	Year 2	COBSEA Secretariat	US$20,000
	6.4 Trajectory modelling: Undertake marine litter trajectory modelling in the COBSEA region, to identify sources and accumulation zones for marine litter, and enable better targeted management actions.	Year 3	COBSEA Secretariat in collaboration with renowned research institution and participating countries	US$120,000
			Total estimated regional budget:	**US$800,000**

7. Funding and sustainability

The funding and sustainability arrangements for the implementation of the COBSEA RAP-MALI are as follows:

- Budget for the implementation of the COBSEA RAP-MALI shall be allocated from the COBSEA Trust Fund and financial and in-kind support shall be sought from other sources such as:
  - COBSEA members
  - Other bilateral donors
  - Multi-lateral donors
  - Relevant private sector industries
  - NGOs
- The implementation of the COBSEA RAP-MALI at the national level will be carried out by individual member countries.
- With a view towards longer-term sustainability, COBSEA and its members will endeavor to include user-pays, polluter-pays and other economic instruments in all marine litter activities, as and where appropriate and possible.

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Appendix 1: Summary of Responses to National Survey Section 2 – State of the Problem

Countries are listed in alphabetical order. The full survey returns are held by the UNEP COBSEA Secretariat.

Australia

(text provided by Ilse Kiessling)

Existing surveys and monitoring in Australia

A number of land-based coastal marine litter surveys have been undertaken around the Australian coastline. Most of these surveys tend to be ad-hoc, though an increasing number of longer-term monitoring programmes are becoming established. These surveys and monitoring programmes provide a picture of the extent of the marine litter problem along parts of the Australian coastline. However, due to inconsistencies in survey monitoring approaches and an absence of data on litter floating in the sea or present on the seabed, it is difficult to compare across regions or determine the magnitude of the marine litter issue on a national scale. As a consequence existing data almost certainly under-represent the actual quantity of marine litter in Australia's marine and coastal environments.

Plastics are found in all locations where litter has been reported around Australia. Some of the most abundant types of litter surveyed include cigarette butts, snack bags and confectionary wrappers, and plastic bottles and containers (Wace, 1995; 1994; KAB, 1996, Whiting, 1998; White, 2004; KAB, 2006). While many materials in marine litter are persistent (such as glass, metals, foam, and even timber and cloth), plastic is of primary concern as it tends to be the most abundant litter type (by number and weight) found on beaches and in sediments, and it tends to have some of the most obvious and pervasive impacts on marine species.

The composition of land-based litter varies widely between survey locations and specific catchment conditions. Not surprisingly general food packaging and urban litter tends to be reported in areas closest to population centres, and derelict recreational and commercial fishing gear is reported in the greatest densities near popular fishing locations. Commercial fishing litter (notably derelict fishing nets from foreign sources) also comprises the greatest proportion of litter by weight reported along a number of northern Australian beaches (Kiessling, 2003).

However studies have shown that the composition and source of litter may also change throughout the year. For example, one study has shown that the source of coastal litter during wet periods is polluted stormwater, but that during dry weather, the largest source of litter was from fishers who appeared to be responsible for plastic bags, cans and tangled fishing lines left in and near the water (Jackson, 1995).

Source differentiation

The origins of litter on Australian beaches are influenced by a number of factors. These include proximity to urban centres, population of surrounding areas, and vicinity of marine-based activities. Conclusive identification of the origins of litter is often very difficult as many items may be used either by people on land or on vessels at sea, and equally derelict fishing nets and other items from marine based activities may enter the marine environment through poor waste management practices on land. In general however, marine litter may

be classified as originating from either land-based sources or activities at sea. Given the durability of many types of litter and the distances it can travel, significant proportions of litter along parts of the Australian coastline also originate from land and marine sources beyond Australia's jurisdiction.

Around Australia, coastal surveys near cities have shown that around 75-80 per cent of shoreline litter is from land-based sources, and that this typically consists of cigarette butts, food packaging, plastic shopping bags, and metal bottle tops and can pull-rings that have reached beaches via streams and drains (O'Callaghan, 1993; Gregory and Ryan, 1994; Wace, 1994; 1995; Haynes, 1997; Edyvane et al., 2004; Clean Up Australia, 2006; KAB, 2006).

Debris from land-based sources may enter the marine environment via wind, streams, and drains from streets and municipal land fills as well as direct littering of beaches. Urban stormwater discharged from stormwater rains is also a major pathway for marine litter in Australia (Cunningham and Wilson, 2003). In Australian coastal cities many stormwater drains discharge directly into the ocean and many thousands more street drains provide opportunities for litter to enter waterways that ultimately end at the coastline. Landfills may also be a major source of litter in the marine environment, although it is not clear to what extent.

In areas remote from population centres marine-sourced litter makes up the greatest proportion of waste recorded. Along parts of the northern Australian coastline for example, between 80-99 per cent of litter recorded is likely to originate from marine sources (Sloan et al., 1998; Whiting, 1998; Kiessling, 2003), and on Australia's sub-Antarctic islands 100 per cent of litter recorded is from marine based activities (Slip and Burton, 1991).

On remote Australian coasts Lost and Abandoned Fishing Gear from both domestic and foreign commercial fisheries tends to be one of the most significant items of litter recorded both in terms of its quantities as well as the impacts it is having on marine species (Kiessling, 2003; Roeger et al., 2005). Recreational fishers tend to produce relatively small amounts of waste per person and per vessel in comparison to commercial vessels, in part due to the short duration of voyages (National Research Council, 1995).

However, studies in parts of Australia have found a positive correlation between litter on beaches and numbers of recreational boats (Widmer, 2002). The types of litter most frequently reported as associated with recreational boats are plastic bags, aluminium cans and glass bottles (Widmer, 2002), though recreational fishers are also responsible for the loss or disposal of lines, lures, and nets (Whiting, 1998; Thompson, 2000; Kiessling and Hamilton, 2001; 2003).

A large number of cargo ships operate in Australian waters including Australian and foreign flagged vessels in domestic or international trade. Evidence suggests that cargo ships are likely to be responsible for a proportion of waste in Australia's marine environment. For example, a number of plastic livestock syringes and associated glass antibiotic bottles used to dispense medication to cattle on livestock carriers have been found during surveys on Christmas Island (Environment Australia, 2001a) and Arnhem Land (Alderman et al., 1999, Kiessling and Hamilton, 2001, 2003), and livestock feedbags such as those used in the live cattle trade have also been reported to wash ashore in northern Australia (Leitch, 1997). One of these feedbags (originally containing 'Lucerne Cubes' manufactured in Australia) was responsible for the entanglement of a hawksbill turtle in northeast Arnhem Land (Leitch, 1997).

Other sources of marine based litter potentially include recreational leisure boats, coastal barges, surveillance vessels, offshore oil platforms, rigs and supply vessels, passenger cruise ships, and research vessels. Considerable amounts of waste are likely to be generated by most if not all of these vessel types, though all are required to conform with national,

state/territory and international waste management regulatory requirements aimed at prevention of pollution of the sea from ship-sourced waste.

Marine litter is not only a domestic issue for Australia, but is also an international issue both in terms of its sources and impacts. For example, the majority of derelict fishing nets washing ashore on Australia's northern coasts originates from fishing activities beyond Australia's jurisdiction, while only a small proportion has been identified as originating from Australia's prawn trawling fleet (Kiessling, 2003; White, 2004).

A significant proportion of litter other than derelict fishing nets in Australian waters is also believed to have international origins. Glass bottles thought to be from Japanese longline and purse seine tuna fisheries have been found on cays in the Coral Sea (Smith, 1992; Wace, 1995). Thick rubber and plastic sheeting from which the soles of handmade thongs have been cut and their residual 'blanks' that are believed to originate from Indonesia have washed ashore in parts of northern Australia, including the beaches at Cocos-Keeling Island (Wace, 1995). Numerous other items such as fishing net floats, sorting baskets, crates, buckets, hand reels, light globes, ropes and gloves which may also be directly attributed to fishing and general shipping activities are also found in large quantities (Sloan et al., 1998, Whiting, 1998; Kiessling, 2003).

Accumulation zones

No comprehensive assessment of marine litter around Australia's coastal environments has ever been undertaken, and as such it is difficult to determine exactly where litter is accumulating at the highest rates. However, a review of published papers on marine litter surveys around Australia suggests that high concentrations of litter accumulate on parts of the coastlines of every Australian state.

Specific areas where litter has been reported at comparatively high densities include coasts adjacent to all urban centres as well as more remote areas of the north western Cape York coastline, the northeast Arnhem Land coastline (Roelofs et al., 2005; White, 2004), Groote Eylandt (Sloan et al., 1998; Kiessling, 2003; White, 2004), the far north Great Barrier Reef region (Haynes, 1997), parts of the Western Australian coastline (Cary et al., 1987; Edwards et al., 1992; RAOU, 1996) parts of the south Australian coastline including Anxious Bay (Edyvane, 2004; Eglinton et al., 2005), and southwest Tasmania (Slater, 1991; Sustainable Development Advisory Council, 1996; Pryor, 1999).

Anecdotal evidence suggests that for more remote areas, marine litter 'hotspots' areas tend to be exposed sandy shorelines, and that while some beached litter may wash back out to sea during storms, that litter accumulation rates generally tend to increase after storms.

Ecological and environmental impacts in Australia

Records of entangled wildlife and wildlife that has ingested litter within Australian waters tend to be limited to land-based observations, and in many instances wildlife found adversely affected by marine litter is not recorded at all. However, information that is available suggests that disturbingly high numbers of Australia's marine wildlife are being harmed and killed by litter while at sea, or as a result of their injuries on shore.

Marine species may become tangled in litter when they feed on organisms attached or associated with it, or if they accidentally swim into unseen litter floating at sea. Plastic bands or net fragments entangled around young animals' necks may restrict their ability to feed properly, and eventually result in their strangulation and death as they grow. Lost and Abandoned Fishing Gear, ropes, and other types of litter tangled around the bodies, flippers, tails or flukes of marine wildlife may lead to infections, restricted mobility, protracted amputation of limbs, and eventual death through drowning, starvation or smothering.

Entanglement of marine species in litter may also have economic implications for commercial species.

A monitoring programme run by rangers from the Dhimurru Land Management Aboriginal Corporation in Arnhem Land (Northern Territory) since 1996 has recorded more than 300 hawksbill, olive ridley, flatback and green turtles stranded along a short stretch of coastline (Roeger et al., 2005). Of these, most (33 per cent) were hawksbill, and were found entangled in derelict trawl and drift nets of foreign origin, fishing line and plastic waste. Approximately 55 per cent of turtles recorded have been found alive, but it is currently unclear how many of these stranded turtles that are alive when found subsequently perish due to injuries sustained by their entanglement in or ingestion of litter (e.g., Chatto, 1995).

Most stranded turtles found during the Arnhem Land monitoring programme are observed between May and June each year. This period correlates with onshore southeast trade winds when marine litter accumulation is generally recorded to be higher than during other times of the year. The high number of stranded turtles found onshore during the period of southeast trade winds may provide some indication of the number of turtles that may be entangled in nets during other times of the year but never wash ashore and are therefore never recorded.

A marine wildlife stranding and mortality database maintained by the Queensland Environmental Protection Agency/Parks and Wildlife Service highlights that significant numbers of marine turtles are ingesting and becoming entangled in marine litter in Queensland waters (Greenland et al., 2004). During 2001/2002 for example, a total of sixteen hawksbill, loggerhead, and green turtles were found with longline hooks, other fishing hooks, fishing line, and plastic bags embedded in their flesh or trailing from their mouths. Thirteen of these animals were dead when found (Greenland et al., 2004).

A total of eighty-one turtles (hawksbill, loggerhead, green, flatback, and olive ridley) were found during the same period entangled in rope, fishing line, plastic bags, derelict fishing nets, crabpots and floats (Greenland et al., 2004). This database relies on public reports and ad-hoc sightings of stranded wildlife (rather than dedicated surveys) and in most instances it is unknown which records relate to Lost and Abandoned Fishing Gear, or gear that is in the control of fishers. Nevertheless, the numbers of animals recorded as entangled in or that have ingested litter are likely to be far less than actual numbers of turtles affected by marine litter across the Queensland coast (Miller et al., 1994). For example, extrapolation from counts of beach-washed nets and their entrapped turtles on the beaches of the north-western Cape York Peninsula suggest that several hundred marine turtles of at least four species are killed annually in derelict nets along the Queensland Gulf of Carpentaria coast (Limpus and Miller, 2002).

Other than turtles, many other protected species such as whales, dugong, and sawfish have been recorded entangled in fishing litter along other areas of the coastline, though little other than anecdotal reports of these strandings exist.

Waterborne litter such as balloons, plastic bags and confectionery wrappers may be ingested by vertebrate marine wildlife when it is confused with prey species. Debris such as fishing line, plastic pieces and ropes may also be ingested when wildlife targets prey that is attached to or associated with these items. Ingested litter may starve animals by preventing further ingestion, but it can also reduce absorption of nutrients, result in internal wounds and ulceration, and cause animals to become more buoyant thereby inhibiting diving (Beck and Barros, 1991; Bjorndal, et al., 1994; Sloan et al., 1998; EPA/QPWS, 2000). Research has also demonstrated that there is a strong potential for biological uptake of heavy metals and/or other toxic substances through ingestion of suspended ‘microplastics’. It is unknown how many animals may be harmed through ingestion of and/or uptake of toxic substances associated with microplastics in Australian waters.

Socio-economic impacts in Australia

Beyond the ecological impacts of marine litter on marine wildlife, marine litter may also have social, economic, and aesthetic impacts on marine habitats and environments, coastal communities, governments and industry as well as become a health risk, vector for invasive aquatic organisms and navigational hazard at sea (Kiessling, 2003).

The aesthetic impact of marine litter on coastal environments in Australia is obvious and compelling. While the true social and economic costs of marine litter in Australia are unknown, marine litter is likely to have significant economic implications for industries such as tourism, shipping and fishing due to a mix of aesthetic impacts, navigational, health and safety hazards, pollution of commercial fish catch, and gear maintenance costs and downtime. The social and cultural impact of marine litter on Indigenous people and communities across northern Australia in particular, is also considerable.

Reports suggest that the navigational hazard posed by marine litter in northern Australian waters is significant and increasing. For example litter, especially derelict fishing nets, has entangled rudders and propellers of marine vessels, and smaller items have been reported to clog cooling water intakes, causing engine failure (Nash, 1992; Haynes, 1997; Pooley, 2000). Most incidents involving marine litter, however, remain poorly documented.

Debris can also be a hazard to divers and beachgoers in Australia. Children playing on remote beaches on Cape York, for example, have been cut badly by broken glass from large numbers of light globes and fluorescent tubes washed ashore there. Hundreds of often full, rusty gas cylinders pose a significant explosive threat to beachgoers, and potentially hazardous substances (e.g., sump oil, detergents, fuels) regularly wash ashore in containers such as 44 gallon drums (Alderman et al., 1999).

The high cost of clean-up operations for polluted beaches is prohibitive for many remote coastal communities (Nash, 1992; Faris and Hart, 1995; Wace, 1995; Willoughby et al., 1997; Sloan et al., 1998), and the tonnes of fishing gear found washed ashore in some areas has resulted in public antagonism towards the fishing industry as a whole (Sloan et al., 1998).

Australia, Indonesia and Chile and recently submitted a project proposal to the APEC Marine Resource Conservation Working Group (MRCWG) entitled Understanding the economic benefits and costs of controlling marine debris in the APEC region. Funding for this project was recently approved by the MRCWG and it will be undertaken during 2007. The aim of the project is to develop an accurate assessment of the economic benefits and costs of controlling marine litter in the APEC region as a basis for determining relevant incentives and other measures for preventing it and mitigating its impacts.

Lost and Abandoned Fishing Gear (LAFG) in Australia

Lost and Abandoned Fishing Gear from both domestic and foreign commercial fisheries tends to be one of the most significant items of litter recorded both in terms of its quantities as well as the impacts it is having on marine species (Kiessling, 2003; Roeger et al., 2004).

Preliminary analysis of derelict fishing nets found in the Gulf of Carpentaria suggest that foreign fishing nets of Asian use and manufacture are likely to comprise the greatest proportion (around 80 per cent) of all nets washing ashore on beaches there. Nets used by Asian fisheries found on northern Australian coastlines tend to be of larger mesh size, and of much greater area and weight than Australian prawn trawl nets (Sloan et al., 1998; Kiessling and Hamilton, 2001; 2003; Whiting, 2004). Foreign nets are also causing some of the greatest harm to marine animals, especially turtles (Kiessling, 2003; Roeger, 2005).

Monofilament line that has been lost and discarded by recreational fishers is also of concern as it presents an entanglement threat to marine wildlife such as sea turtles. For example, recreational fishing line was responsible for the death of a green turtle at Magnetic Island in Queensland during 2000 (Thompson, 2000).

WWF Australia, Dhimurru Land Management Aboriginal Corporation and the Northern Territory Fisheries agency have developed a guide for the standardized identification and reporting of Lost and Abandoned Fishing Gear. Completed in 2001, 'The Net Kit' includes photographs of over 180 net types, with specifications of mesh size, twine size, colour, net use and probable country of manufacturing origin.

See also information detailed under ecological and environmental impacts above.

Cambodia

(text adapted from Pak Sokharavuth)

Existing surveys and monitoring in Cambodia

No survey and monitoring programmes specifically addressing marine litter were reported for Cambodia. Several studies have been undertaken looking at general solid waste management issues in various coastal cities, towns, villages and industries, including:

- *Integrated Coastal Management Project (ICM): 2000-2006 and 2007-2012* for Sihanoukville Authority covering one village Sangkat No. 4, Kan Mittapheap.
- *Environmental Management of the Coastal Zone-Cambodia (EMCZ): 2002-2007* for Ministry of Environment/Coastal Coordination Unit, covering Sihanoukville City, Koh Khyong and Boeng Kayak Villages. Data collected on market wastes, household wastes, fishing wastes, hospital waste and industrial waste, finding the above mentioned areas in bad condition with poor waste management practices.
- *NIDO: 2004-2008* Department Industry Mines and Energy Sihanoukville Municipality, covering garment factories and fishery processing factories. Data collected on solid waste and oil waste from all types of industry and processing factories.
- *Participatory Management Coastal Resources (PMCR/IDRC): PMCR/Solid Waste: 2002-2007* Ministry of Environment covering the coast and islands in Peam Krosob Wildlife Sanctuary in Koh Kong Province. Data collected on household solid waste.
- *Port's Waste Management*: Sihanoukville Municipality/Port Institution covering the collection of waste from ships in the port and waste generated in the port. Data has been published at www.pas.gov.kh.

Source differentiation in Cambodia

There is no data reported on marine litter source differentiation for Cambodia.

Accumulation zones in Cambodia

There is no data reported on ocean circulation patterns and accumulation zones for marine litter for Cambodia.

Ecological and environmental impacts in Cambodia

There is no research in Cambodia concerning ecological and environmental impacts of marine litter. There is a general statement in the State of the Coastal Environment and

Socio-economic Report 2005, regarding impacts on biological and marine habitats in relation to the pressures of exploitation on forestry, fisheries, water pollution, solid wastes and land use.

Socio-economic impacts in Cambodia

There is some information on socio-economic impacts on coastal and marine resources in Cambodia, but not specifically relating to marine litter. The 2005 State of the Coastal Environment and Socio-economic Report cites the relationship between socio-economic impacts and the solid waste problem due to the lack of management of marine activities and industries, especially impacts of improper management of solid and liquid wastes in fishing villages and coastal communities.

Lost and Abandoned Fishing Gear (LAFG) in Cambodia

There is no data reported on LAFG for Cambodia.

People's Republic of China

(text adapted from Huang Zhengguang)

Existing surveys and monitoring in China

There are only informal reports presented in NOWPAP Marine Litter Workshop, 14th November 2005, Toyama, Japan and the 1st NOWPAP Workshop on Marine Litter, 8th June 2006, Incheon, Republic of Korea by Dr. Linlin Hu.

Only some reports and maps on marine litter are found in local media. No other references, studies, reports, maps or graphs about marine litter in China can be found. Some coastal cleanup activities have been carried out by local volunteers in Dalian, Yantai and Qingdao on the Yellow Sea coastline, Shanghai and Xiamen on the East China Sea, and Shenzhen and Haikou on the South China Sea. There are no marine litter activities/programmes/ projects conducted and proposed before the end of 2006, at national and provincial levels in China.

Source differentiation in China

No data on source differentiation was reported for China, although the national consultant states that "it is obvious that in China most marine litter comes from land-based sources, much more than sea-based ones."

Accumulation zones in China

No information was reported for ocean circulation patterns and accumulation zones for marine litter in China.

Ecological and environmental impacts in China

No information was reported on the ecological and environmental impacts of marine litter in China.

Socio-economic impacts in China

No information was reported on the socio-economic impacts of marine litter in China.

Lost and Abandoned Fishing Gear (LAFG) in China

No information was reported on LAFG in China, however studies in other countries in the Pacific have indicated that Chinese (and other) vessels may be major contributors to LAFG in the region.

Indonesia

(text adapted from Nat Budiawan)

Existing surveys and monitoring in Indonesia

A number of marine litter survey and monitoring programmes have been carried out in Indonesia, as follows:

- *Bersih Pantai (Coastal Clean-Up) 2005;* undertaken by the Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang, Central Java. This clean-up covered Semarang and Jepara Provinces in Central Java and was undertaken in July 2005. It assessed the amount of organic and inorganic waste accumulated in coastal areas of Semarang and Jepara. The data is unpublished and is held by the Faculty of Fisheries and Marine Sciences, Diponegoro University.
- *Beach Litter Survey at Thousand Islands (Kepulauan Seribu), Jakarta*; undertaken by Willoughby (National Resources Institute, Kent, UK), in 1985 and covering 24 islands of the Thousand Islands, Jakarta. The survey classified types of litter and seven types were recognized (plastic bags; footwear; polystyrene blocks of more than 10 cm diameter; plastics/glass bottles; metals can and containers; ropes and pieces of fishing net, and light bulbs). The data is published – Willoughby, N.G. (1986a) (1986b).
- *Beach Litter Survey at Thousand Islands (Kepulauan Seribu), Jakarta*; undertaken by Uneputty (Pattimura University, Ambon, Indonesia) and Evans (University of Newcastle-upon-Tyne, UK) in 1994. The survey covered 19 Islands at Thousand Islands, Jakarta and assessed each litter accumulation. The main findings were that litter has accumulated on shores of unmanaged islands in the Pulau Seribu Archipelago. Shores of most of the islands surveyed were severely polluted with beach litter. The main source of litter was assessed to be the city of Jakarta. Types of litter recognized included plastic bags; footwear; polystyrene blocks; plastics/ glass bottles; metals can and containers; ropes and pieces of fishing net, and light bulbs). Severe pollution has evidently spread to more distant parts of the archipelago. Islands beyond about 20 km from the mainland were largely free of litter (in 1985), but those up to 45 km of it were severely polluted by 1994. Data is published – Uneputty & Evans (1997).
- *Domestic Waste and TBT pollution in Coastal Areas of Ambon Island, Indonesia;* undertaken by Evans, Dawson, Frid, Gill and Porter (University of Newcastle upon Tyne, UK) and Pattisina (Pattimura University, Ambon, Indonesia) at 56 sites on Ambon Island, Eastern Indonesia in 1995. Main findings were that coastal areas of the island of Ambon were polluted by domestic waste. There was severe beach litter pollution and contamination of inshore waters. Data is published – Evans et al. (1995).
- *Beach Litter Survey at Thousand Islands (Kepulauan Seribu), Jakarta, Indonesia*; undertaken by Willoughby (National Resources Institute, Kent, UK), Sangkoyo (Planology Department, Indonesian Institute of Technology and Lakaseru (WWF, Indonesia) in 1997. The main findings were that strandline litter levels on the

shorelines of 23 of the Thousand Islands, Jakarta Bay, comprised nearly 34,000 items of litter belonging to 11 categories. Litter levels have almost doubled on islands close to inshore, and are more than five times higher on the offshore islands, since a similar survey in 1985. Polystyrene blocks, plastic bags and discarded footwear made up 80 per cent of the items counted. Jakarta is still considered to be the source of most of the litter, though litter which is self-generated by tourist activities is more important than before. Social developments in Indonesian lifestyles have resulted in the appearance of litter items not seen in the 1985 survey. Plastic bags probably carpet the bottom of inshore Jakarta Bay. Data is published – Willoughby et al. (1997).

Source differentiation in Indonesia

The sources of marine litter in Indonesia come from both land-based sources and ship based sources, and apart from the studies referenced above, no additional data on source differentiation was reported in the national survey response.

Several published papers and articles from local newspapers mention that domestic waste is the main source of litter at marine and coastal areas in Indonesia (Uneputty and Evans 1997 and Willoughby et al., 1997 and several local newspapers (Harian KOMPAS, Harian Sinar Harapan, Majalah TEMPO and Majalah GATRA, Jurnal Celebes, 2003-2006).

Accumulation zones in Indonesia

No information was reported as being available on accumulation zones for marine litter in Indonesia.

Ecological and environmental impacts in Indonesia

No information was reported as being available on the ecological and environmental impacts of marine litter in Indonesia.

Socio-economic impacts in Indonesia

Nash (1992) investigated two beaches close to Jayapura, Irian Jaya province, for types and amounts of waste. The source of litter is a municipal dumpsite on the coastline in a nearby bay. In that bay lives a small community of traditional fishermen. These fisher folk mainly use gill nets, hook and line, or gather shellfish and molluscs by hand. The respondents described impacts such as propeller entanglements, fouling of gill nets and hooks, damage to the fishing gear, and injuries. These problems were viewed by some as serious enough to cause modifications to their fishing behaviour (sometimes against their best economic interest) such as avoidance of some fishing areas, and use of different types of gear. Plastic bags are the most common type of debris reported by the fishermen. More than half of gill net fishing expeditions had debris fouling the nets.

Lost and Abandoned Fishing Gear (LAFG) in Indonesia

No information was reported as being available on the problem of LAFG in Indonesia.

Malaysia

(text adapted from Nizam Basiron)

Existing surveys and monitoring in Malaysia

No marine litter survey and monitoring programmes were reported for Malaysia.

Source differentiation in Malaysia

No information was reported as being available on source differentiation for marine litter in Malaysia.

Accumulation zones in Malaysia

No information was reported as being available on accumulation zones for marine litter in Malaysia.

Ecological and environmental impacts in Malaysia

There have been newspaper articles in Malaysia on turtles entangling in LAFG and choking on plastic.

Socio-economic impacts in Malaysia

No information was reported as being available on the socio-economic impacts of marine litter in Malaysia.

Lost and Abandoned Fishing Gear (LAFG) in Malaysia

There is anecdotal information on LAFG in Malaysia collected by Department of Fisheries vessels while on patrol. However no records are kept. As stated above here have been newspaper articles in Malaysia on turtles entangling in LAFG and choking on plastic.

Philippines

(text adapted from Ella Deocadiz)

Existing surveys and monitoring in the Philippines

The national survey response does not identify any existing survey and monitoring activities in the Philippines. However the Philippines is a participant in the Ocean Conservancy's International Coastal Cleanup (ICC), which does provide some survey and monitoring data. Since 1994, the Philippine ICC effort was spearheaded by the International Marine-life Alliance with major support from the Department of Environment and Natural Resources (DENR). Reports have stated that through this effort, the Philippines consistently placed second only to the United States in terms of areas covered and volunteers generated. It was noted that the DENR, through its field offices, has been instrumental in recruiting these volunteers nationwide.

It is also understood that marine litter survey and monitoring was carried out at the Batangas Bay demonstration site in the late 1990s under the GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas.

Source differentiation in the Philippines

A study by the Japan International Cooperation Agency (JICA) on Metro Manila solid waste management was conducted in 1997. The study was able to determine the volume of solid wastes being disposed to waterbodies (mainly rivers), which represents approximately 15 per cent of the daily waste generation of approximately 5,000 metric tonnes.

Accumulation zones in the Philippines

There are anecdotal reports of marine litter accumulations in water bodies in the vicinity of urban centres but there are no systematic data gathering activities in the Philippines.

Ecological and environmental impacts in the Philippines

No information was reported as being available on the ecological and environmental impacts of marine litter in the Philippines.

Socio-economic impacts in the Philippines

No information was reported as being available on the socio-economic impacts of marine litter in the Philippines.

Lost and Abandoned Fishing Gear (LAFG) in the Philippines

No information was reported as being available on LAFG in the Philippines.

Republic of Korea

(text adapted from Won-Tae Shin)

Existing surveys and monitoring in Republic of Korea

The Republic of Korea's government is one of the few governments in the world to have designated marine litter as a major national marine environmental protection priority, along with marine sediment contamination, harmful algae blooms (red tides), beach damage, marine ecosystem disturbance and maritime accidents. A National Integrated Management Strategy for Marine Litter (NIMSML) has been implemented in Republic of Korea since 1999, funded and managed by the Ministry of Maritime Affairs and Fisheries (MOMAF).

Prior to funding by MOMAF marine litter surveys and monitoring in Republic of Korea were limited to local NGO and citizens' activities on special days such as 'Earth Day' and 'Environment Day', and were undertaken on ad-hoc basis in limited areas (as is still the case in most countries that have marine litter activities). Since commencement of the NIMSML in 1999, the Marine Alliance among Non-governmental organizations, Governmental sector and research Organizations (MANGO) was established. Utilizing the resources and expertise of the three sectors (NGO, government and research), MANGO has supported a National Marine Debris Monitoring Program (MDMP) in Republic of Korea, with more than 23 local NGOs monitoring 20 coastal sites regularly since 2000. The types, weight and numbers of marine debris are identified and measured according to the guidelines of the ICC. The actual monitoring is undertaken by community members/citizens, and includes actual clean-up as well, and so has a major community outreach and awareness-raising benefit.

Korea trialed underwater monitoring using SCUBA divers in 2002, as much marine litter is deposited in the coastal waters. An underwater monitoring manual was developed in 2003, and since 2004, the national monitoring programme has expanded to include underwater, island and sea-surface marine litter, comprising 31 beach sites, six SCUBA sites and four remote islands, as depicted in Figure 6 of the main report.

Source differentiation in Republic of Korea

The national survey response reports that land-based sources of marine litter are the largest, but compared to other countries, sea-based sources are also significant because of dense activity in the coastal waters of Republic of Korea.

Accumulation zones in Republic of Korea

Despite the existence of a National Marine Debris Monitoring Program the national survey response did not report any results identifying recognized accumulation zones in Republic of Korea.

Ecological and environmental impacts in Republic of Korea

The national survey response reported that there is very little quantitative data on the ecological and environmental impacts of marine litter in Republic of Korea. It was found that litter destroys the habitat and spawning grounds of fisheries resources, and that lost and abandoned fishing gear resulted in ghost fishing which eventually leads to the reduction of fish resources, although it is difficult to differentiate this cause from other possible causes such as over-fishing and non-litter forms of pollution. Marine litter at the seaside also significantly affects coastal amenity in Republic of Korea. Impacts of marine litter on seabirds are partially presented in Korean data, and as there are few marine mammals on Korean coasts, the damage on them is rarely reported.

Socio-economic impacts in Republic of Korea

No information was reported as being available on the socio-economic impacts of marine litter in the Republic of Korea.

Lost and Abandoned Fishing Gear (LAFG) in Republic of Korea

LAFG is identified as a major issue in Republic of Korea, including impacts on vessels and cases where lives have been lost at sea due to vessel entanglement in LAFG. Addressing LAFG forms a major part of the National strategy, including a programme where MOMAF purchases waste fishing gear returned to port by fishermen, which is deemed to be highly effective and serves as a possible model for other countries and regions.

Thailand

(text adapted from Sakanan Plathong)

Existing surveys and monitoring in Thailand

In Thailand the Office of Marine Conservation and Rehabilitation, Department of Marine and Coastal Resources, Ministry of Natural Resources and Environment, undertakes an underwater garbage collection contest each year at coral reef and beach areas used as major tourism resources along the Thai coastline.

Fishing net constituted the highest proportions being about 54 per cent of the total weight. The other types of garbage are aluminium cans, tires, batteries, wood, plastics and foam.

Most data from these clean-ups are contained in unpublished reports to the Department of Marine and Coastal Resources.

Source differentiation in Thailand

Apart from the garbage collection contest referenced above, no information was reported as being available on source differentiation for marine litter in Thailand.

Accumulation zones in Thailand

No information was reported as being available on accumulation zones for marine litter in Thailand.

Ecological and environmental impacts in Thailand

There are no studies that have comprehensively investigated the impacts of marine litter in Thai waters, although a small number of isolated studies provide an indication as to the nature of the problem. Lost and Abandoned Fishing Gear has been identified as the type of marine debris most hazardous to marine species. Lost fishing gear and gear scraps have been shown to entangle to coral reef, marine turtles and manta rays. In Thai waters, reports of entangled and stranded marine wildlife are almost entirely limited to land-based observations over a small area of coastline. However it is suggest that disturbingly high numbers of marine species are being harmed and killed by debris while at sea, or as a result of their injuries on shore.

Some species of marine turtles are thought to mistake plastic bags and other plastic items for prey, especially hawksbills, eat encrusting organisms that grow on floating plastics and nets, and are likely to become ensnared when attempting to feed.

There are also directly threaten to coral reef ecosystems through the abrading and scouring of coral substrates as Lost and Abandoned Fishing Gear (LAFG) snags on coral reef. There are many volunteer campaigns to remove fishing nets form the coral reefs.

Socio-economic impacts in Thailand

Coastal and marine tourism is a major component of the Thai economy and the aesthetic impact of marine debris on coastal environments is obvious and compelling. Indeed, the aesthetic degradation from marine litter that is evident on many beaches in Thailand may be more compelling to the general public and policy-makers than detailed analyzes of animal mortality or other biological/ecological impacts. While the true social and economic costs of marine litter in Thailand are unknown, marine litter is likely to have significant economic implications for industries such as tourism, shipping and fishing due to a mix of aesthetic impacts, navigational, safety and health hazards, and gear maintenance costs and downtime. The social and cultural impact of marine litter on local people and coastal communities is also likely to be considerable.

Anecdotal reports suggest that the navigational hazard posed by marine floating debris in Thai's waters is significant and increasing, although incidents remain poorly documented. Debris, especially derelict fishing nets, has been reported entangling rudders and propellers of marine vessels, and smaller items have been reported to clog cooling water intakes, causing engine failure. However, many incidents are undocumented.

Debris can be a hazard to divers and beachgoers. Children playing on remote beaches have been cut badly by broken glass from large numbers of light globes and fluorescent tubes washed ashore.

The high cost of clean-up operations for polluted beaches is prohibitive for many remote coastal communities and the tonnes of fishing gear found washed ashore in some areas has resulted in public antagonism towards the fishing industry as a whole.

Lost and Abandoned Fishing Gear (LAFG)

Refer sections above.

Viet Nam

(text adapted from Le Dai Thang)

Existing surveys and monitoring in Viet Nam

No existing marine litter survey and monitoring programmes were reported for Viet Nam.

Source differentiation in Viet Nam

No information was reported as being available on source differentiation of marine litter in Viet Nam.

Accumulation zones in Viet Nam

No information was reported as being available on accumulation zones for marine litter in Viet Nam.

Ecological and environmental impacts in Viet Nam

No information was reported as being available on the ecological and environmental impacts of marine litter in Viet Nam.

Socio-economic impacts in Viet Nam

No information was reported as being available on the socio-economic impacts of marine litter in Viet Nam.

Lost and Abandoned Fishing Gear (LAFG) in Viet Nam

No information was reported as being available on LAFG in Viet Nam.

Appendix 2: Key Contacts

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National Consultants on Marine Litter

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Note: In addition to the National Consultants' details above, each national survey response contains contact details for stakeholders from various sectors involved in marine litter activities in each country. The national survey responses are held by UNEP COBSEA Secretariat.

National ICC Coordinators in each COBSEA member country (2006)

Country	Person	Organization	Location	E-mail
Australia:	Joanne Marston	* Project AWARE Foundation (Asia/Pacific)	Sydney	joannem@projectaware.org.au
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* In Australia the PADI Project AWARE Foundation (Asia/Pacific) coordinates the ICC. As the central office for Asia/Pacific it represents a potential partner for further replicating both ICC and Project AWARE in the East Asian Seas region.

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