Marine Debris Monitoring Program

Background information for the program

For the Hunter Local Land Services Region
New South Wales

Supported by Hunter Local Land Services
and Tangaroa Blue Foundation

TANGAROA BLUE

AUSTRALIAN
MARINE DEBRIS INITIATIVE

NSW GOVERNMENT | Local Land Services Hunter

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ACRONYMS

AMDI	Australian Marine Debris Initiative
GPT	Gross Pollutant Traps
LLS	Local Land Services
MDMP	Marine Debris Monitoring Program
SQID	Stormwater Quality Improvement Devices
TAP	Threat Abatement Plan
UVNSW	Underwater Volunteers New South Wales
NPWS	National Parks and Wildlife Service

DEFINITIONS

Container Deposit Scheme: (CDS) is any law that requires collection of a monetary deposit on beverage, and/or other reusable packaging at the point of sale. When the container is returned to an authorised redemption centre, or to the original seller in some jurisdictions, the deposit is partly or fully refunded to the redeemer (presumed to be the original purchaser). It is a deposit-refund system.

Hotspot: is a location where there is an ongoing and significant level of marine debris / litter.

Key Threatening Process: (as under The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)). A threatening process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community.

Marine debris (or marine litter): is defined as any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment (UN Environment Program, 2009).

Microplastics: are fragments of plastic that measure less than 5 mm (as defined by NOAA).

TAngler Bins: are recycling bins for old recreational fishing line.

1 ACKNOWLEDGEMENTS

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Marine Debris Monitoring Program Background Information for the Program for the Hunter Local Land Services Region, NSW.

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2 ABOUT THIS DOCUMENT

This document provides background information about the design and implementation of the Hunter Region Marine Debris Monitoring Program (MDMP). The program has been developed at the request of Hunter Local Land Services (LLS) which has developed and supported initiatives throughout its region for marine debris education, prevention and removal activities. The monitoring program is part of the regions strategy to support and provide resources to the stakeholder group involved in marine debris activities.

The MDMP has been designed to bring together the requirements of the Australian Governments Threat Abatement Plan for the impacts of marine debris on vertebrate marine life (2009) (TAP) at the regional level and the growing willingness and capacity of the community to address marine debris. The regional natural resource management level is suitable for this because it provides a geographical and governance framework directly relevant to monitoring and addressing local sources and impacts of marine debris.

A number of concepts underpin the design of the program: (1) maximising the advantages of prevention and early interception of litter prior to it becoming marine debris, (2) promotion of community initiatives and ownership regarding local monitoring and related activities, (3) integration of removal, mitigation and prevention activities into the monitoring process and (4) program redesign to enable scaling up into other New South Wales regions.

A full description of the monitoring program and how to set up a monitoring project is provided separately in the counterpart to this document subtitled "Guide to monitoring providers".

3 CONSULTATION WITH STAKEHOLDERS

Stakeholders have been consulted and engagement sought through a series of activities including clean-ups, workshops, field days, survey results and one-on-one interviews to identify gaps and opportunities to implement the Marine Debris Monitoring Program. Stakeholders have a wide range of experience and expertise in their particular fields and are involved variously in local, regional and national programs that are relevant to marine debris management and monitoring.

A healthy environment for innovation and partnership is evident within the stakeholder group and this will be an important ingredient for achieving the aims of the MDMP.

A detailed account of the consultation process is contained in Appendix 1.

4 THREAT ABATEMENT PLAN

No substantial arrangements exist at the moment to connect local and regional initiatives into the TAP process. The stakeholder group which has been formed in the Hunter region around the marine debris issue and adopting this monitoring plan demonstrates a way of improving this connection.

The TAP is currently under review and the following notes are based on the outgoing version of the TAP (1).

4.1 REGIONAL CONTRIBUTIONS UNDER THE THREAT ABATEMENT PLAN

The MDMP supports the development of regional monitoring objectives guided by the TAP together with local objectives identified by the community as the way to connect local initiatives to the TAP process. The program also supports the TAP objectives through its practical application as follows.

1. Contribute to the long-term prevention of the incidence of harmful marine debris

The data collection systems used in the program involve detailed identification of the types of debris being found and this enables identification of origins of debris which assists with prevention, mitigation, source reduction and education activities.

2. Remove existing harmful marine debris from the marine environment

Data collection is mainly based on clean-up activities and hence removal of debris. The program additionally provides for the strategic assessment of hotspots to enable targeted remedial activities and the identification of specific industrial input processes such as plastic resin pellets where mitigation and prevention measures can be instituted.

3. Mitigate the impacts of harmful marine debris on marine species and ecological communities

The program aims to record and make available all positively identified processes involving the impact of marine debris on wildlife and habitat. For example, the impact of witches' hat crab traps on turtles has been identified as regionally important. Recent regulatory changes have been implemented in Port Stephens and it is recommended that the effectiveness of this management action to reduce turtle injuries and death be monitored in Port Stephens and compared to other estuaries not subject to the new rules.

4. **Monitor the quantities, origins and impacts of marine debris and assess the effectiveness of management arrangements over time for the strategic reduction of marine debris.**

   An estimate of quantities of marine debris in the region is possible and could be explored as part of the program. Factors such as human population density and levels of industrial, shipping and fishing activity can be assessed in conjunction with data related to those broad input sources to explore an appropriate method for such an estimate.

   Origins of local debris can be identified using a combination of statistics from the program data and local knowledge. Origins of non-local debris can be identified using statistics from the program data together with information developed on ocean circulation and other factors provided for in the TAP.

   Wildlife impacts will be monitored through the process described under objective 3 above. In support of this, wildlife rescue data will be reported to the Office of Environment and Heritage (OEH) and activities will be undertaken to support rescue organisations in continuing or improving the reporting process.

5 STRUCTURE OF THE MONITORING PROGRAM

5.1 MONITORING PROGRAM ELEMENTS

The Hunter region marine debris monitoring program offers a structured way of monitoring marine debris within a local land service region and is based on the following considerations:

1. Local communities and organisations within the regional setting provide the majority share of on-ground effort and initiative towards addressing the marine debris issue
2. Communities and organisations are involved in marine debris activities in a variety of locations for varying reasons and objectives
3. To establish a monitoring program on a regional basis requires bringing these groups together and providing a structure for conducting monitoring activities
4. The structure has the following requirements which become the monitoring program elements shown in Figure 1:
    a. the need for a standard terminology for places in the landscape as a whole, describing where litter and debris accumulates and the pathways it follows to the ocean
        i. this provides a whole of catchment basis for learning how to direct attention and develop strategies for places in the landscape where conditions allow for either the accumulation of litter or the release of litter into a pathway to the ocean
    b. results of information obtained from monitoring are an important component in formulating and refining regional marine debris objectives
    c. there are many opportunities available within a region to incorporate monitoring of marine debris in pre-existing and new activities
    d. clearly defining an investigative purpose for data collection improves the decision making around site selection, resource allocation and type of information collected
    e. data collection methodology needs to be consistent and also needs to be suited to the particular type of monitoring being undertaken.

Landscape terminology	Regional monitoring objectives	Data collection activity	Data collection purpose	Data collection methodology
Categorising the different parts of the landscape where monitoring takes place	Guided by the TAP and Local needs and decide on by the regional stakeholder group	The various investigative purposes for collecting the data at monitoring sites	The various investigative purposes for collecting the data at monitoring sites	The kind of data collection methodology and data sheet to be used

Figure 1. Monitoring program elements

These elements provide the regional structure for supporting local community initiatives carried out by members of the stakeholder group. The stakeholder group steers this process and is able to influence the strategic direction of monitoring activity and increase the knowledge of marine debris processes in the region.

5.1.1 Landscape terminology

Different parts of the landscape have different effects on the fate of litter and whether it becomes marine debris. The program encourages a focus on the settings where litter and debris problems are occurring and the processes involved in those settings. This has both a management and an educational value. The management value comes from identifying common factors leading to the generation and migration of litter in particular settings and the quick transference of successful actions to address these. The educational value can be realised by demonstrating to the public how marine debris results from particular actions in particular parts of the landscape as a whole and how practical and behavioural changes can make a difference.

5.1.2 Regional monitoring objectives

The TAP is used to guide regional objectives on marine debris and this top down approach is balanced by the bottom up approach of including locally originated objectives which are developed from experience within the region.

5.1.3 Data collection activity

Data collection takes place as part of research, education, municipal, wildlife rescue and other community activities. The specific purpose for the activity is not always connected to the data collection purpose. For example an education event may be providing a citizen science opportunity where data is recorded for the purpose of introducing participants to that process. A research project on the other hand will have specific questions it seeks answers for in the data. Community clean-up events usually collect data as a record of their efforts and in support of the general aim of programs such as the AMDI.

5.1.4 Data collection purpose

The data collection purpose aims to give the data collection activity a locally strategic direction focussed on source identification which then supports source reduction, mitigation, and prevention and education efforts.

5.1.5 Data collection methodology

The program promotes consistent methodology, and identifies the most appropriate destination for the different kinds of data. The AMDI system is used for all land based clean-ups including the tracking of plastic resin pellets. The UVNSW system is used for underwater clean-ups with some crossover into the AMDI system where the location of land and underwater activity is in close proximity (Appendix 5). Wildlife data collection methodology currently varies amongst the different stakeholders and the development of a standardised system is one of the aims of the program.

6 PROGRAM DATA

6.1 HISTORIC DATA

Historic data relating to the marine debris issue has been identified in the region and the program uses this data to assess the current situation and to assist monitoring providers in their setting up process. Historic data for the region is tabulated in Appendix 2, an analysis of AMDI data is provided in Appendix 3 and a quick view of historic data collection activity in each Local Government Area (LGA) by sector is provided in Appendix 4.

6.2 TYPES OF DATA

Organisations in the Hunter region hold data giving various kinds of information which is related to their specific charter. They target particular parts of the environment or particular aspects of the debris process which are discussed in the document "Hunter Region Data Types" in Appendix 6.

6.3 GAPS IN THE DATA

Gaps in the existing data can be of several kinds including the following:

- Lack of data related to specific issues
- Lack of data enabling an understanding of litter/ debris processes in a particular area
- Lack of data to support management decisions

The program maintains a record of these gaps and keeps them visible in the setting up stage for monitoring sites.

6.4 PROGRAM RECORDS

The program provides a central, easily accessed set of records where monitoring providers can find information. Specific information includes but is not limited to the following:

Maintained by the program and accessed on the program webpage

- A list of stakeholders and their monitoring initiatives to assist in coordinating activities between stakeholders, forming partnerships and preventing duplication of effort
- A list of unmet monitoring needs
- A list of litter and debris hotspots and their current status
- A record of marine debris processes affecting wildlife in the region

Maintained by one of the database providers

- A record of survey results using the rating system
- Survey results are held by the individual organisations and this is recommended as a backup measure for this type of data

6.5 DATA AND INFORMATION FLOW

Where possible, data entry and information extraction will be carried out online. Reporting and feedback requirements are recommended to be well defined, simple and timed according to the program's needs.

Figure 2 shows the anticipated flow of marine debris data and information for the region. Some decisions are required regarding wildlife and underwater data and these will be made by the program management group.

Program data flow

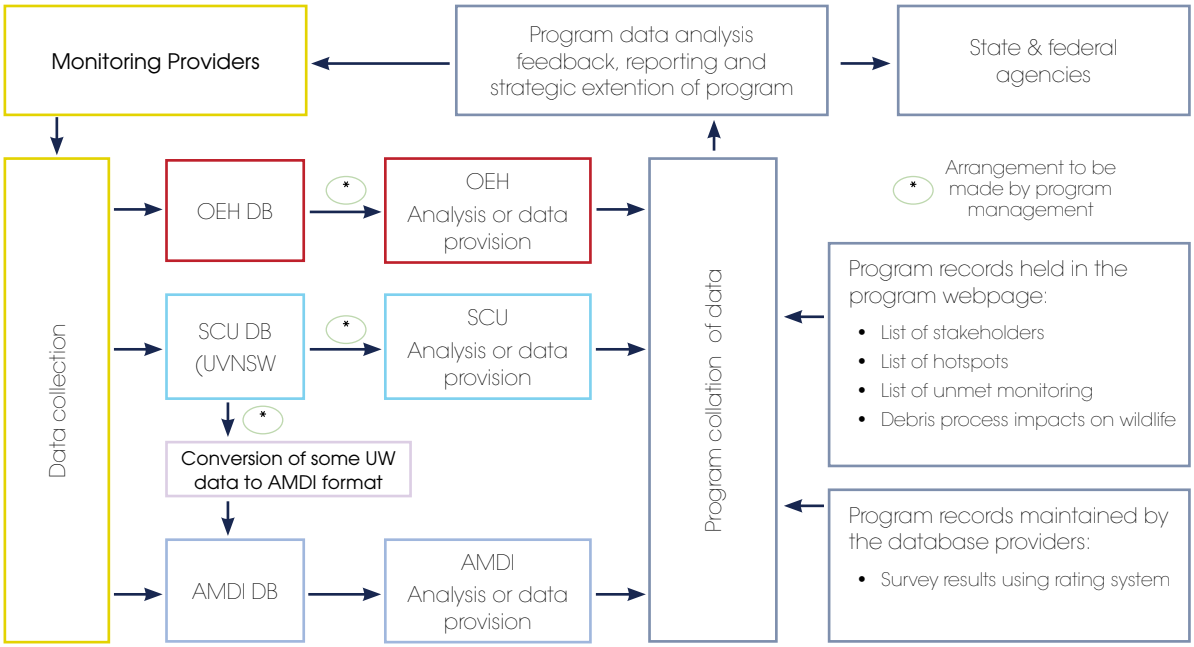


Figure 2: Program data flow

7 PROGRAM MANAGEMENT

The term management is used in this section but this function is not intended to be overly formal and the management group can also be called, for example, a coordinating or steering group.

7.1 RECOMMENDATIONS FOR PROGRAM MANAGEMENT

The following features are recommended for the management of the program:

1. Ownership of the program is shared between the stakeholders including Local Land Services
2. The management of the program is carried out by a core group of stakeholder representatives
3. The specific monitoring and management roles and responsibilities are developed and documented by the management group based on emerging experiences over time.

The initial management structure of the program should be kept simple, flexible and developed with stakeholders to maximise consensus and ownership. The program is bringing together a number of loosely related groups and processes around the issue of marine debris. It will need to allow for a period of learning and anticipated growth and requires an adaptive management approach.

7.2 FUTURE ACTIONS AND RECOMMENDATIONS

7.2.1 Drainage

The built drainage system is managed by the local government sector and efforts to address the flow of litter in that sector are subject to internal regulations and processes. Monitoring at Gross Pollutant Traps is recommended in this program as the starting point of monitoring within the wider drainage sector.

In the medium term a comprehensive evaluation of the capacity of stormwater quality infrastructure to capture litter in each catchment is a desirable goal. It would serve the purpose of providing a simple measure of the system's effectiveness compared to the inputs into that system (inputs are discussed below). The suggested approach would involve using a simple rating system during maintenance and inspection visits to selected sites strategically located within the system. The ratings data would ideally be backed up with a periodic catchment wide review of device effectiveness and deficits. The feasibility of this approach and the preparedness of the various LGAs to adopt this or a similar approach across the region will require some investigation and discussion.

7.2.2 On the ground sources of litter

An assessment of the major sources of on the ground litter is recommended in each major catchment. These assessments would involve firstly a desktop audit using mapping to identify sources such as shopping centres, fast food outlets, main roads and sports venues. These could be ranked according to surrounding population density, co-location and rates of visitation. The higher ranking facilities would then be monitored using the rating system and the ratings of these facilities would in turn provide a simple measure for their immediate inputs of litter into the local drains. A catchment level rating based on the facility ratings is feasible and would provide a simple indicator of the litter inputs into the drainage sector and assist in directing monitoring and management efforts.

7.2.3 Ongoing data analysis

Analysis of data is anticipated to provide the following ongoing information:

- Source reduction statistics and mapping showing distribution of items and wildlife impact information within the monitoring locality and supplied to the monitoring providers and the management group.
- Detailing of impact processes for particular species and habitats
- An assessment of inputs into the drainage system, the amount of litter intercepted within the drainage system and outputs from the system is recommended for development over time.
- A catchment wide assessment of litter abundance based on locations (facilities) where litter generating activities are high is recommended for development over time.
- Regional level statistics for monitoring, evaluation and reporting of the program supplied to the Hunter Local Land Services and the management group.

7.2.4 Ongoing reporting

Ongoing reporting is recommended as follows:

- Monitoring providers will be able to view source reduction statistics online in the AMDI Database. Mapping and additional analysis will be available periodically as determined by the needs of the monitoring providers.
- An annual summary of monitoring activity based on the data baselines shown in the tables in Section 7.2.6.
- A progress report including program evaluation is recommended at a frequency decided by the program management group.

7.2.5 Using the results of monitoring

Once the MDMP begins to produce results in the form of identifying sources of litter and debris it is recommended these results be used to create Source Reduction Plans (SRP). Creating a SRP formalises the monitoring result, provides a further course of action and becomes a measurement of program outcomes. SRPs can recommend a range of solutions including remediation of hotspots, referral of waste management and drainage problems, creating initiatives aimed at mitigation and prevention of particular issues and community education.

7.2.6 Evaluation of the monitoring program

Evaluation of each monitoring site together with an evaluation of the uptake of the program in each catchment is recommended. The evaluation data as per Tables 1 and 2 below would be provided as part of the annual data summary and also included in the progress reports.

***Table 1**: Data supporting the evaluation of each monitoring site*

Monitoring site	Sector	Monitoring occasions	Resulting mitigation and source reduction activities

***Table 2**: Data supporting the evaluation of the program uptake in different catchments and sectors*

Catchment*	Sector	Monitoring occasions	Number of groups involved

**A natural drainage catchment or sub catchment.*

7.3 SCALING UP THE PROGRAM

7.3.1 Scaling up the program to include other NSW regions

The program has been designed to provide a framework for monitoring which can be applied in any Local Land Services region.

There are 2 main options for scaling up the program to include other NSW regions:

- Replicating the program in other regions
- Developing a state-wide program with centralised program management

The desirable outcomes of maximising community involvement, interest and local priorities may be affected by different management options. Also, without direction and resources from State government for a state-wide approach, replication is perhaps the only possible option for scaling up the program to other regions.

7.3.2 Steps for replicating the program into a new region

The following steps are a guide to replicating the program. The amount of time and effort required to set up the program will vary according to factors such as the number of local government areas, number of potential stakeholders and the level of pre-existing marine debris activity in the region.

1) Conduct a preliminary meeting of stakeholders to provide feedback and networking and to introduce the program. The meeting should aim to complete the following tasks:
    a. create a list of stakeholders and their current action statements
    b. formulate a list of regional objectives based on the TAP
    c. formulate a list of locally identified objectives
    d. create a list of unmet monitoring needs
    e. discuss a schedule for the programs introduction
    f. select a steering group
    g. identify members of the steering group or a contractor to carry out the assessments in sections 2 and 3 below
2) Assess data held in the region to determine
    a. The kinds of data held by stakeholders
    b. how accessible the data is
    c. how the data can be used in the monitoring program
    d. where sufficient data is available conduct an analysis to provide an overview of current knowledge of marine debris in the region
3) Assess gaps in the region
    a. search current management plans for recommendations on litter and marine debris
    b. list other identified regional needs
    c. list current regional marine debris priorities
    d. identify and prioritise unmet recommendations and needs from a and b
4) Conduct a midterm meeting with the stakeholders to provide feedback and networking and to consolidate the following:
    a. Review and revise the lists begun in step 1
    b. Present the results of the assessments in step 2
    c. Present the results of the gap analysis in step 3
5) Write up the program in a brief and simple format
6) Conduct an end of term meeting of the stakeholder group to present the final program, confirm the makeup of the management group, identify training and resource needs and present any initial monitoring projects.

8 NOTES AND REFERENCES

A current review of the TAP has concluded that the key threatening process (marine debris) has not been abated and that the objectives of the TAP have not been met. A ministerial decision has been made that that a variation of the threat abatement plan should be drafted. Please click on the link below to view the current plan and the review document. DEWHA (Department of the Environment, Water, Heritage and the Arts) (2009) Threat Abatement Plan for the impacts of marine debris on vertebrate marine life. Available at:

http://www.environment.gov.au/marine/publications/threat-abatement-plan-impacts-marine-debris-vertebrate-marine-life

APPENDICES

1 CONSULTATION AND ENGAGEMENT

Stakeholders have been consulted and engagement sought through a series of activities including clean-ups, workshops, field days, survey results and one-on-one interviews to identify gaps and opportunities to implement the Marine Debris Monitoring Program (MDMP).

These initial efforts were aimed at:

- Consulting with stakeholders
- documenting current initiatives, and
- documenting current data collection and database processes.

1.1 CURRENT INITIATIVES

Support for the monitoring program has been expressed by stakeholders including community members, local councils, government agencies, tertiary institutions and not-for-profit (NFP) organisations. Stakeholders have a wide range of experience and expertise in their particular fields and are involved variously in local, regional and national programs that are relevant to marine debris management and monitoring. Stakeholders and their current activities are listed in Section 1.3 below.

1.1.1.1 Local Government

Local councils within the region play an integral role in managing marine debris for public and environmental health and are largely at the interface of implementing legislative requirements under State and Federal government legislation. All local councils have implemented innovative approaches and are constantly refining performance and investment targets to manage marine debris. Current projects primarily involve the upgrading of stormwater infrastructure and integrating marine debris monitoring into existing monitoring programs. These actions support the NSW State Government recommendations to mitigate marine debris under the Threatened Species Conservation Act 1995 and partially address the Australian Government's Threat Abatement Plan (TAP) for the impacts of marine debris on vertebrate marine life (2009).

1.1.2 Community

The community plays a key role in managing marine debris. This includes supporting research, addressing operational gaps and raising awareness about the impacts of marine debris. Within the Hunter LLS region 36 community organisations were identified as being directly involved in the management of marine debris. This includes not-for-profit community-focused organisations through to school and neighbourhood groups. This highlights the potential capacity for community action to monitor and mitigate marine debris when adequately resourced and supported.

1.1.3 Research

Marine debris has been a topical research theme in recent years and for good reason. The impact of marine debris is increasing due to the volume of plastics being used and discarded and their persistence and accumulation in the marine environment. Legislative requirements to manage the environmental impacts of marine debris have also encouraged recent research investment.

Southern Cross University coordinates the Underwater Volunteers NSW marine debris database, which provides valuable insight into marine debris below the water's surface. It coordinates a collaborative approach to link more localised groups and supports an open database to provide a valuable tool for management.

A three year CSIRO Flagship research project (2012-2014) specifically investigated marine debris distribution and volume estimates on a national scale in regards to ocean-coastal processes. The key objective of the research supports the TAP to develop a national risk assessment for wildlife species affected by marine debris.

Department of Primary Industries – Fisheries research highlighted the impact of crab traps on turtles in Port Stephens. This research and the communication of the results to community groups and key individuals, who played an advocacy role on the issue, was a critical factor in the introduction of recent regulations to reduce the impact of these traps on turtles.

Figure 1. Crab trapping brochure developed with input from scientific research

1.1.4 State and Federal Government

Marine debris is listed as a Key Threatening Process under the NSW Threatened Species Conservation Act 1995 and Federal Environment Protection and Biodiversity Conservation Act 1999. This means that both the State and Federal Governments have legislative requirements to support the management of marine debris with obligations to implement actions to achieve objectives.

1.2 FINDINGS FROM STAKEHOLDERS

This section outlines key findings collected from key stakeholders to inform the direction of the Marine Debris Monitoring Program. To achieve this, Tangaroa Blue Foundation conducted a workshop, field day, clean-ups, a survey and one-on-one interviews to investigate resource requirements and the existing capacity to monitor marine debris within the Hunter LLS region.

1.2.1 Workshop

A workshop was held on 1st August 2014 at the NSW State Emergency Services Building, 75 Elizabeth St, Tighes Hill, Newcastle. The workshop had 20 participants from across the Hunter LLS region representing various sectors with decision-makers, land/sea managers, researchers, educational outreach officers and teachers, not-for-profit coordinators and community representatives.

The goal of the workshop was to identify strategies to monitor and reduce marine debris in the Hunter LLS region. Five target outcomes were identified, including:

- Bring existing data together
- Identify data gaps
- Support partnerships and training
- Ongoing monitoring
- Implement feedback / recognition

1.2.1.1 Bringing existing data together

This outcome involves stakeholders sending marine debris meta-data and maps to Tangaroa Blue Foundation to act as a central collator and for stakeholders to provide wildlife stranding data to the NSW National Parks and Wildlife Services on a six-monthly and/or annual basis. Data from Underwater Volunteers' NSW clean-ups is being collated through a dedicated online portal on the UVNSW website.

1.2.1.2 Identifying data gaps

This outcome involves improving wildlife data collection, developing a break wall data collection methodology (Underwater Volunteers NSW) and preparing a literature review on marine debris hotspots and toxicology.

1.2.1.3 Supporting partnerships and training

This outcome recommends community organisations use Tangaroa Blue Foundation methods and Australian Marine Debris Initiative (AMDI) methodology, developing a stakeholder list to form a benchmark to measure expansion of partnerships and to source data where possible and send to Tangaroa Blue Foundation to act as a central collator. In addition, State government are to provide mapping resources for local councils to have adequate support in GIS (Geographical Information Services).

1.2.1.4 Ongoing monitoring

This outcome recommends regular monitoring and clean-up training days for community volunteers, in particular, support key leading community organisations to share knowledge with other community volunteers. Another key outcome involves the monitoring of TAngler Bins (Oceanwatch Australia) and specific education and awareness of marine debris for recreational fishers.

1.2.1.5 Feedback / recognition

This outcome recognises the value of feedback and recognition to maintain momentum. A confirmation of data received by community volunteers and organisation would support ongoing acknowledgement, an annual 'report' delivered by Hunter LLS would support partnership development or online engagement tools to help collate information, studies and photos (NB: Red Map for fishers is a desirable model for all stakeholders to work towards).

Four Key Performance Indicators (KPIs) were identified to help guide the structure of the marine debris monitoring program:

1. Decrease in litter collected as a result of increased investment
2. Use of monitoring information for local action
3. Implementation of source reduction plans and results
4. Number of stakeholders involved (aim to increase per annum)

1.2.2 Survey

A targeted stakeholder approach was used to specifically encourage those who are involved in marine debris management within the Hunter LLS region to complete a survey. A total of 34 participants were invited via email. Participants represented a variety of roles/positions including decision-makers, land/sea managers, researchers, educators, NFP organisation coordinators, community leaders and community volunteers. A total of 15 participant responses to the survey were recorded.

The details of the survey are included as Appendix 7. Key points that were recorded from the survey include:

- A lack of sufficient allocated human resources to physically collect and remove marine debris
- Concern about the effectiveness of stormwater related programs (e.g. upgrade of Gross Pollutant Traps) to intercept marine debris from entering receiving water bodies
- Positive recognition of existing partnerships between stakeholders, active community participation in marine debris management and waste prevention education programs
- A need for more resources and upgrading of management plans, and implementation of plans to say achieve a level of sufficient resources
- A need for increased education, support from Federal and State government levels, and hard infrastructure (e.g. Gross Pollutant Traps)
- A need for more effective partnerships
- Concern that microplastics and underwater marine debris were not necessarily a management priority due to the enormity of the issue
- A need for further resource investment into enforcement (time and funding) to ensure the law is upheld.

1.3 LIST OF STAKEHOLDERS AND ACTIVITIES

Organisation	Organisation type	Org Note
Lake Macquarie City Council	Local government	Eco Angels program is run through the Lake Macquarie City Council.
City of Newcastle	Local government	Retrofitting GPTs and record data on a quarterly basis and additiona events.
Port Stephens Council	Local government	GPTs installed.
Great Lakes Council	Local government	GPTs installed and a number of constructed wetlands and other water sensitive urban design structures. Report minimal data in the State of Environment report but have commenced innovative project in Penenton Creek sub catchment.
Greater Taree City Council	Local government	5 major GPTs plus additional trash racks and a constructed wetland at Black Head. There is some historic data from about 5 years ago on GPT volumes, but nothing since. Plan to improve monitoring as part of new environmental levy.
Tangaroa Blue Foundation	Not for profit	Supports community groups and individuals, ocal councils, government departments and other institutions and organisations to collect marine debris data through the Australian Marine Debris Initiative (AMDI) and implement source reduction strategies.
Take 3	Not for profit	Work to reduce the impact of plastic pollution through education and action.
Clean Up Australian Day	Not for profit	Facilitates Clean Up Australia Day, 300 sites across the region with coastal/beach sites. Data is collected and could be used to better inform the monitoring program protocol.
Surfrider Foundation Hunter Branch	Not for profit	Facilitates clean-up initiatives and raise awareness of single-use plastics, among other coastal related initiatives.
Ocean & Coastal Care Initiatives Inc. Lake Macquarie - Newcastle & Port Stephens arms	Not for profit	Facilitates clean-up initiatives and raises awareness of single-use plastics. Also coordinates local community training.
Australian Seabird Rescue	Wildlife Organisation	Raises awareness about the impacts of marine debris on wildlife. Data is submitted to the NSW National Parks Wildlife Services.

Organisation	Organisation type	Org Note
Oceanwatch Australia	Not for profit	Facilitates projects that raise awareness of waterway and ocean health. Relevant projects include sustainable fishing practices (e.g. TAnglerBins).
Catherine Hill Bay Dunecare	Not for profit	Facilitates projects that raise awareness about conservation, environmental management and the protection of beaches, e.g. Landcare, beach clean-ups.
Combined Hunter Underwater Group Inc.	Not for profit	Provides citizen science opportunities aimed at bridging the gap between research and the community about underwater and reef health. Marine debris data collected is submitted to Underwater Volunteers NSW.
Great Lakes Underwater Group	Not for profit	Provides citizen science opportunities aimed at bridging the gap between research and the community about underwater and reef health. Marine debris data collected is submitted to Underwater Volunteers NSW.
Saltwater Boardriders	Not for profit	Raises awareness about healthy beaches and oceans.
Toronto Area Sustainable Neighbourhood	Not for profit	Raises awareness of living sustainability and involved in on ground projects.
Pacific Palms Public School	School	Involved in beach clean-ups and report marine debris data to AMDI.
Southern Cross University Underwater Volunteers NSW	Institution	There are three active underwater groups in the Hunter LLS region that provide data to Southern Cross University. This is ongoing and provides valuable insight into underwater marine debris.
CSIRO	Institution	CSIRO is currently investigating offshore microplastic concentration, has a turtle program, coordinates ongoing marine debris education through Atlas of Australia and facilitated a nation-wide marine debris research program. Data is not publically available until research papers are published.
Australian Marine Debris Initiative (AMDI)	Not for profit	AMDI provides a database to house clean-up data submitted by the community and this data is made available for marine debris research.

Organisation	Organisation type	Org Note
Hunter Local Land Service (LSS)	Natural resource mangement	Facilitate regional marine debris projects, e.g. fund research projects and currently this marine debris monitoring program.
Department of Primary Industries	State government	No current activities although there has been historical data collected on derelict fishing debris (e.g. crab trap data and compliance).
Department of Agriculture	Australian government	Biosecurity data and seaports data is entered into the AMDI.
Department of Environment community	Australian government	Review TAP outcomes, fund research and initiatives.
Worimi Local Aboriginal Land Council (LALC) Green Team	Indigenous Organisation	Worimi LALC Green Team has been previously engaged with the marine debris project in partnership with Hunter LLS.
John Clark	Individual	To find out from the local fisherman on the capacity of them to collect / record marine debris and derelict fishing gear.
Organisation for the Rescue and Research of Cetaceans in Australia (ORRCA)	Wildlife Organisation	Collect data on wildlife impacted by marine debris in their rescue reports. Anecdotal and recorded data available for the region.
Port Stephens - Great Lakes Marine Park	State government	Has limited wildlife and trap data.
Taronga Zoo - Wildlife Hospital	Wildlife Organisation	Operates database on wildlife that have been confirmed that they are impacted by marine debris.
Hunter Water	Land, Port and Water Managers	Carries out water pollution monitoring as part of EPA requirements. Not directly involved in waterway litter.
MidCoast Water	Land, Port and Water Managers	Carries out water pollution monitoring as part of EPA requirements. Not directly involved in waterway litter.
Port of Newcastle	Land, Port and	Will produce an environmental management plan.
WetlandCare Australia	Not for profit	WetlandCare Australia coordinates marine debris and urban waterway clean-ups and source control engagement programs.

2 HISTORIC DATA

Table 1 contains a review of data collection activities that have occurred in each monitoring sector to date and lists key points at the end of each table.

2.1.1 On the ground sector

Setting	Activity resulting in data collection	Data summary	Notes	Groups involved with AMDI to date (not including events such as Clean-up Australia Day)
MS1 Litter on the ground and able to migrate to the next sector	Clean-up litter on the ground	Existing data for this sector is limited and currently shows the lowest count of items per clean-up and the second lowest effort level in the AMDI data. Clean-up Australia Day data for 2014 shows a similar effort pattern with their "other", "Schools" and "Shops and Malls" site categories having the lowest number of sites but they also have the highest average items per site in contrast to the (limited) AMDI Data	here is a shortfall in the data for built facilities where high visitation rates occur. Although these areas generally have waste management and litter prevention infrastructure in place there is a need to increase monitoring of the amount of litter escaping these systems and making its way into the drainage system	Bahtabah Aboriginal Land Council Belmont Neighbourhood Centre C3 Victory Church Charlestown Combined Hunter Underwater Group (CHUG) Great Lakes Council Great Lakes Underwater Research Group (GLUG) Hunter LLS Lake Macquarie City Council Lake Macquarie City Council - Eco Angel Program Lake Macquarie Scouts Lions Club of Belmont Ocean & Coastal Care Initiatives (OCCI) Pelican Area Sustainable Neighbourhood Group Take 3 Teralba Scouts Toronto Area Sustainable Neighbourhood Warners Bay Guides West Wallsend District Sustainable Neighbourhood Group Worimi Local Aboriginal Land Council
1. A shortfall in data, and information about the processes involved, exists for litter escaping from built facilities into the drainage system				

Table 1: Historic data

2.1.2 Drainage network

Setting	Activity resulting in data collection	Data summary	Notes	Groups involved to date
MS2 Litter accumulating at stormwater quality improvement devices (SQIDs)	Clearing debris from SQIDs	Limited historic data have been identified but not assessed	Data collection at Gross Pollutant Traps in locations with high human traffic would be a worthwhile starting point. A data collection strategy is needed for the drainage network sector and is discussed in 6.2.3.2 below	Great Lakes Council Greater Taree City Council Lake Macquarie City Council Newcastle City Council Port Stephens Council
1. Data collection at GPTs located in places with high visitation rates is recommended				

2.1.3 Waterways

Setting	Activity resulting in data collection	Data summary	Notes	Groups involved to date
MS3 Litter accumulating on the bank or shoreline including around drain outfalls	Clean-up waterway banks	ata to date from waterway clean-ups return the highest count of items per clean-up for any sector	Upstream catchment inputs are compressed into the narrow confines of rivers and creeks making this sector strategically important for interception of litter	Conservation Volunteers Australia Hunter LLS Hunter Wetlands Centre Australia (Shortland Wetlands Centre Ltd) Linuwel School Newcastle City Council Ocean & Coastal Care Initiatives (OCCI) Throsby Creek Rehabilitation Group WetlandCare Australia Worimi Local Aboriginal Land Council
1. Waterways have the highest levels of litter based on current data 2. Waterways are strategically important for interception of litter				

2.1.4 Lakes and estuaries

Setting	Activity resulting in data collection	Data summary	Notes	Groups involved to date
MS3 Litter accumulating on the bank or shoreline including around drain outfalls	Clean-up lake and estuary shorelines	The lake and estuary sector has the second highest count of items per clean-up for the sectors	A significant amount of litter and abandoned and derelict fishing gear and aquaculture materials is known to reside in the lakes and estuaries of the region	Bahtabah Aboriginal Land Council Caterpillar Mining Equipment Combined Hunter Underwater Group (CHUG) Great Lakes Council Hunter Bird Observers Club Hunter LLS Kooragang Wetland Rehabilitation Project Lake Macquarie City Council Lake Macquarie City Council - Eco Angel Program MacMasters Beach SLSC Ocean & Coastal Care Initiatives (OCCI) Oze Eco Management Take 3 Taree Indigenous Development and Employment (TIDE) Ltd Worimi Green Team Worimi Local Aboriginal Land Council
MS5 Litter, abandoned and discarded fishing gear and aquaculture materials in deep water	Survey and clean-up benthic regions of lakes and estuaries	These underwater locations show higher levels of pollution compared to offshore sites and there is evidence that human population density is a factor(3)	Numbers of surveys have been limited to date	Combined Hunter Underwater Group Great Lakes Underwater Group Southern Cross University Terrigal Underwater Group (TUG)

Continued over page.

2.1.4 Lakes and estuaries (continued)

Setting	Activity resulting in data collection	Data summary	Notes	Groups involved to date
MS6 Shoreline infrastructure	Clean-up of jetties, breakwaters, groynes and other coastal infrastructure including underwater	The top ranking items in this setting come from fishing activities and include fishing items, food and drink packaging and cigarette butts	Clean-ups at these locations have focussed on break walls to date. Targeting of boat ramps, and carparks adjacent to beaches is a desirable next step	Organisation Bahtabah Aboriginal Land Council Combined Hunter Underwater Group (CHUG) Great Lakes Council Great Lakes Underwater Research Group (GLUG) Hunter Local Land Service Lake Macquarie City Council - Eco Angel Program Take 3
1. Lakes and estuaries have high levels of litter 2. Lakes and estuaries have high levels of abandoned and derelict commercial fishing and aquaculture gear 3. Additional focus on a variety of infrastructure types is desirable				

2.1.5 Coastal

Setting	Target of activity	Data summary	Notes	Groups involved to date
MS3 Litter accumulating on the bank or shoreline including around drain outfalls	Clean-up beaches	Coastal clean-up data shows a similar count of items per clean-up to the on the ground sector litter but is less than estuarine levels and significantly less than waterway levels. The proportion of land sourced litter near population centres is 67% and this drops to 19% away from population centres. The figures generally show that population density directly influences litter levels at coastal beaches	Specific data on litter around drain outfalls is lacking	Bahtabah Aboriginal Land Council Bungwahl Public School Catherine Hill Bay DuneCare Catherine Hill Bay Progress Assoc. Combined Hunter Underwater Group (CHUG) Department of Primary Industry Great Lakes Council Great Lakes Underwater Research Group (GLUG) Hunter Bird Observers Club Hunter Local Land Services Kooragang Wetland Rehab Project Lake Macquarie City Council Lake Macquarie City Council - Eco Angel Program MacMasters Beach SLSC Ocean & Coastal Care Initiatives (OCCI) Oceanwatch Australia Ltd NSW Odyssea Old Bar Primary School Pacific Palms Public School Raymond Terrace 4WD Club Saltwater Boardriders Surfrider Foundation Australia NSW Take 3 TIDE
MS6 Shoreline infrastructure	Clean-up of jetties, break walls, groynes and other coastal infrastructure including underwater	The top ranking items in this sector indicate that fishing activities are closely associated with the prevalence of food and drink packaging together with cigarette butts at these locations	Clean-up activity at these locations has focussed on break walls to date. Targeting of boat ramps, and carparks adjacent to beaches is a desirable next step	
1. There are gaps in the data for drain outfalls, boat ramps and carparks at or adjacent to coastal beaches				

2.1.6 Offshore sector

Setting	Target of activity	Data summary	Notes	Groups involved to date
MS8 Offshore underwater	Underwater debris impacts on benthic environments	Underwater debris is dominated by fishing related items especially fishing line (3)	Underwater debris is dominated by fishing related items especially fishing line (3)	Combined Hunter Underwater Group Great Lakes Underwater Group Southern Cross University Terrigal Underwater Group
MS7 Offshore surface	Surface trawls for marine debris	No data currently available	This activity currently depends on funding success. The main issue is human resources to sort the marine debris	NSW Government: Office of Environment and Heritage
MS7 Offshore surface	Microplastics in offshore waters	No data currently available	Currently, data cannot be provided due to Intellectual Property (IP) issues and publications. Funding is limited for this activity	CSIRO

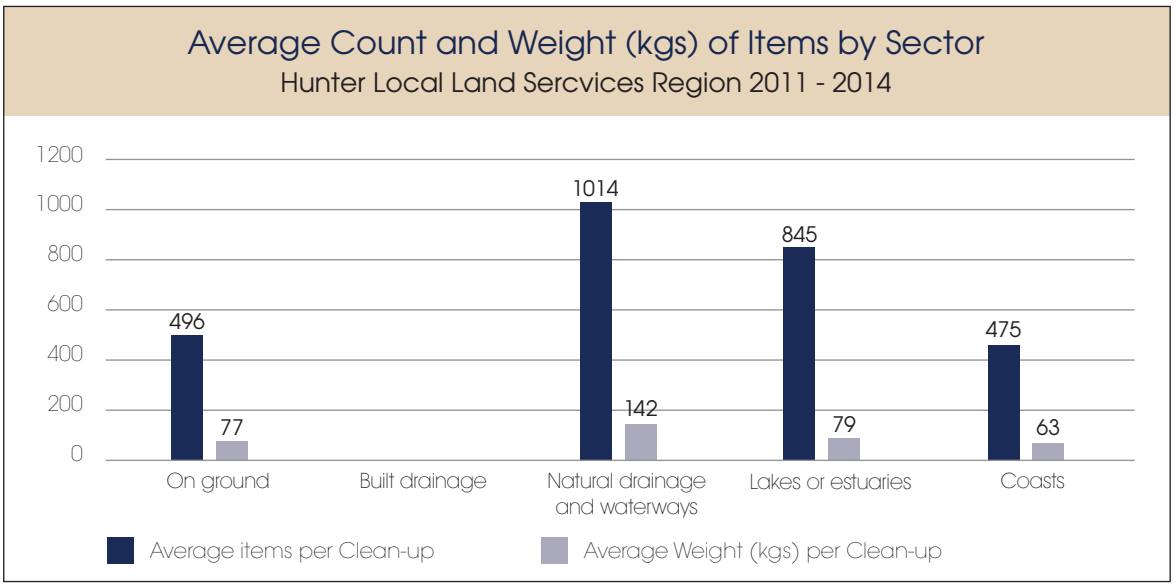
1. Offshore underwater data to date shows fishing activity as the major contributor of items
2. Surface data collection is limited and existing data is not available

3 ANALYSIS OF AMDI CLEAN-UP DATA

3.1.1 Abundance of debris in sectors

Figure 1 shows the average number of items and weight recorded per clean-up in the period 2011 to 2014. The data suggests waterways, lakes and estuaries return significantly more litter per clean-up than the on the ground and coastal sectors.

Figure 1: Average count and weight of items by monitoring sector.

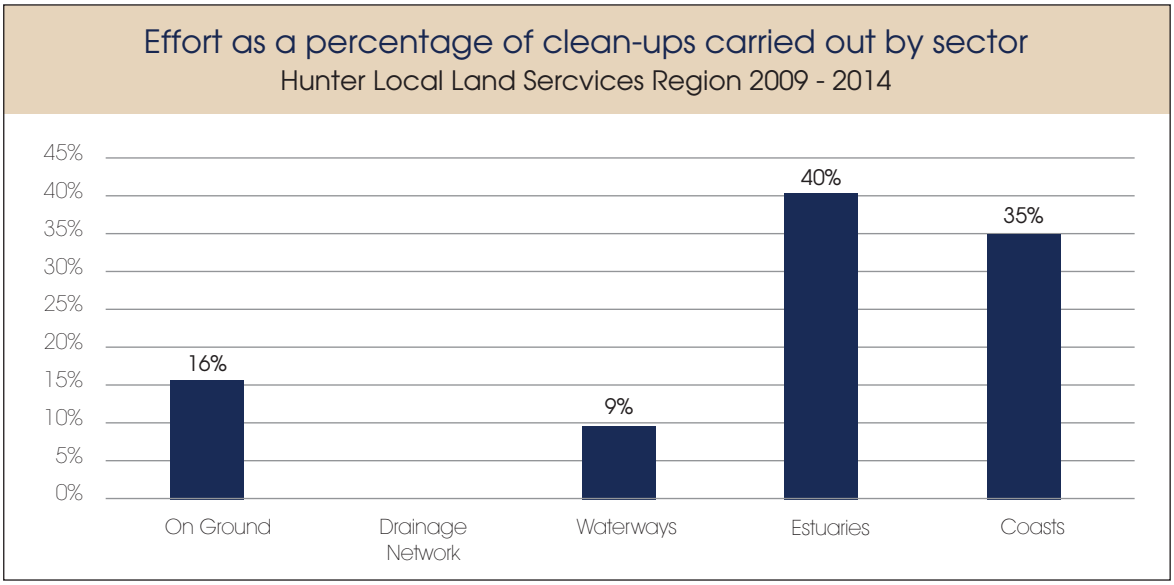


There are several reasons for the concentration of litter in the waterway and estuary sectors. The first, especially in the case of waterways, is the spatial restriction placed on the debris load compared to the expanse of preceding built area and the succeeding open ocean. The second is that these systems can capture significant amounts of debris in vegetation, especially in the physically complex mangrove systems. The third reason is that towns and cities housing most of the population are usually situated around these systems, more so in the two southernmost local government areas of Newcastle and Lake Macquarie. In addition to these factors, there is a large amount of abandoned and derelict fishing gear and aquaculture materials awaiting removal.

3.1.2 Distribution of clean-up effort in the region

Figure 2 shows effort in the region as the percentage of clean-ups carried out in each sector between 2009 and 2014. Clean-up activity has been concentrated in coastal and estuary locations in this period with activity related to marine debris in the 'on the ground' sector only recently commenced.

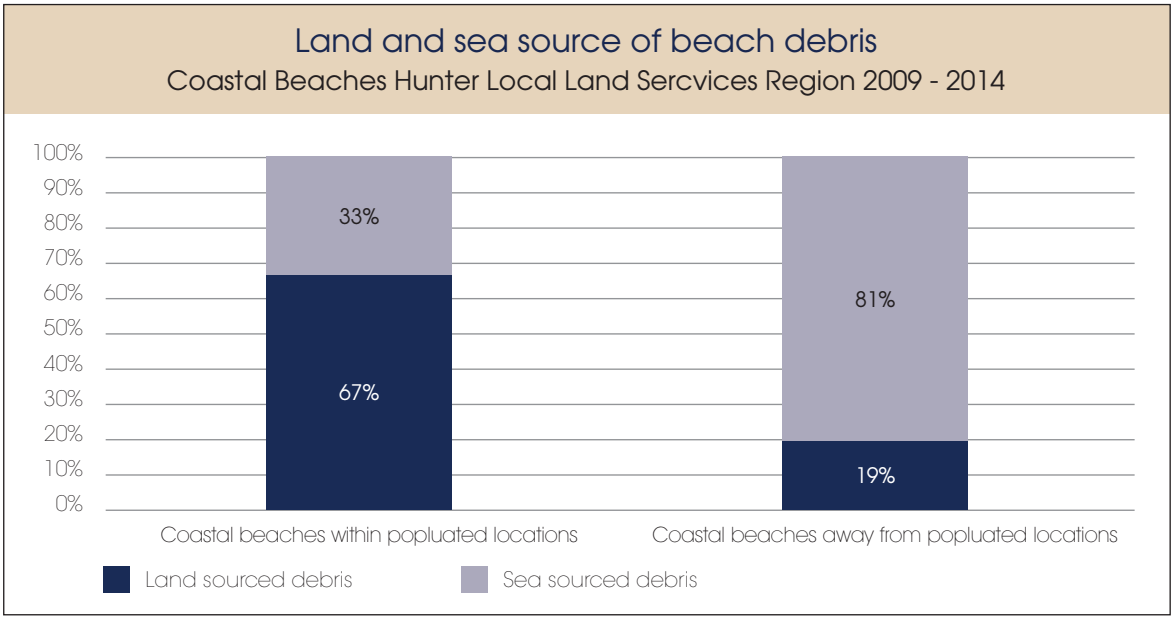
Figure 2: Effort by monitoring sector



3.1.3 Land and sea sources of debris on coastal beaches

Coastal beaches situated in populated parts of the regions receive on average two thirds of their debris from local sources including littering whereas beaches away from population centres receive one fifth of their debris from local sources and littering (Figure 3). An explanation of the Land Sea Source Index is given in Appendix 8.

Figure 3: Land and sea sources of debris



3.1.4 Estimate of various debris source proportions on coastal beaches

In Figures 4 & 5, items are grouped according to their being readily identified with a particular marine debris source. Some items do not have a clear origin and these are split between the categories of "garbage washed ashore" and "beach litter", the split being calculated using the land and sea source percentages.

Figure 4: Percentage of debris from selected sources – coastal sites in populated areas

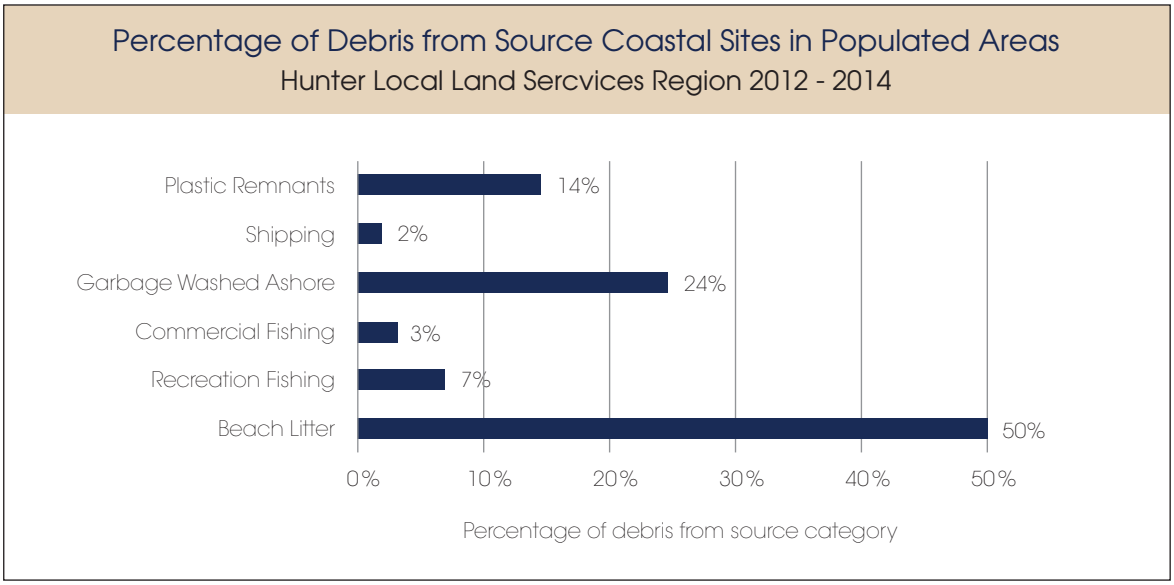
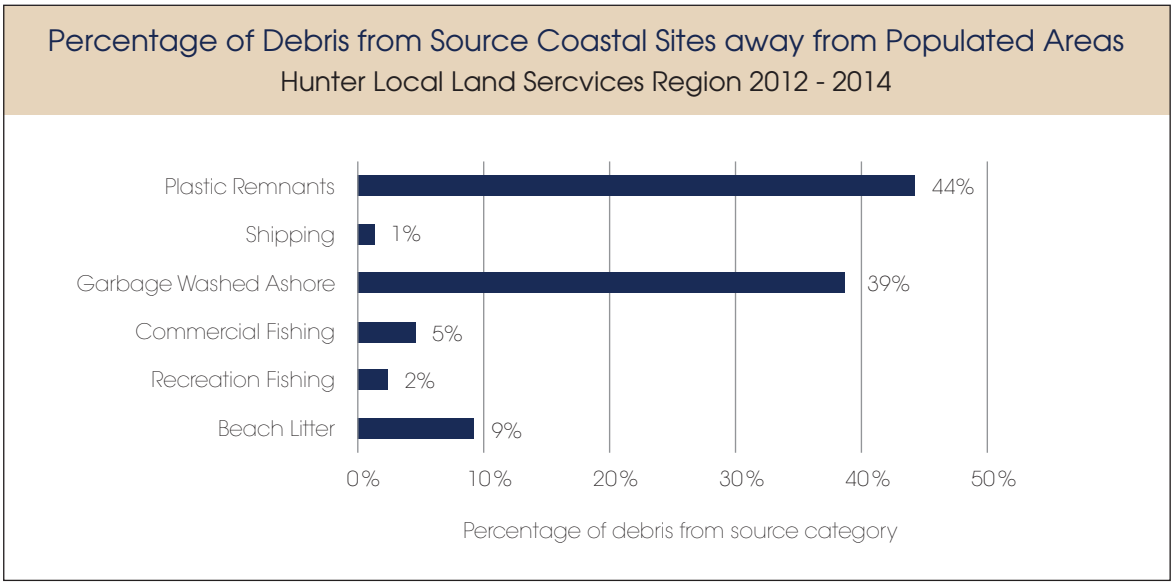


Figure 5: Percentage of debris from selected sources – coastal sites away from populated areas



These graphs provide direction for developing data collection purposes on coastal beaches:

- The "beach litter" category broadly includes items coming from drain outfalls, adjacent facilities such as carparks and from beach users.
- "Recreation fishing" activity tends to be concentrated at coastal infrastructure locations.
- The "Shipping" percentage is made up of a small number of representative items so the percentage provided is an underestimate. The true figure would include a proportion of the "garbage washed ashore" category as this can be partly composed of galley waste from shipping(4). Recording label details provide information on foreign sourced items and these data assist in correlating with shipping activity.
- The "plastic remnants" category also suffers from ambiguity with respect to its offshore / onshore origin. Away from populated areas the likelihood of an offshore origin is higher while within populated areas the likelihood is lower. Targeted monitoring of drain outfalls on beaches should provide information on plastic remnant origins near population centres.

3.1.5 Top ranking items in the region

The top 10 ranking items (in terms of individual numbers of items) are shown in Table 1. The packaging category accounts for 26% of the top 10 items, remnant items 25%, consumer articles (solely cigarette butts) 7%, and rope net and line (solely fishing-line) accounts for 4% of the total number of items.

Item	Item Total	Percentage of Total
Plastic bits & pieces hard & solid	13,368	10%
Glass or ceramic broken	13,337	10%
Cigarette butts & filters	9,263	7%
Glass beer stubbies & pre-mixed alcohol bottles	9,144	7%
Plastic drink bottles (water, juice, milk, soft drink)	8,612	7%
Plastic packaging food (wrap, packets, containers)	6,402	5%
Plastic film remnants (bits of plastic bag, wrap etc.)	6,363	5%
Lids & tops, pump spray, flow restrictor & similar	5,373	4%
Fishing line in metres (Recreation)	5,072	4%
Foam insulation & packaging (whole and remnants)	4,930	4%
10	**81,864**	**63%**

Table 1: Top ranking items in the region

3.1.6 Container deposit scheme

The container deposit scheme (CDS) is expected to have an impact on the amount of packaging items found in the environment. Monitoring sites will be well placed to monitor the progress of this initiative. The percentage of CDS items being recorded in clean-ups in the Hunter LLS region are shown in Figure 6 and the percentage of each type of item is shown in Figure 7.

CDS items are recorded in the following AMDI item classes:

- Aluminium cans
- Glass beer stubbies & pre-mixed alcohol bottles
- Glass wine, spirit and similar bottles
- Plastic drink bottles (water, juice, milk, soft drink)

Figure 6: Container Deposit Scheme items as a percentage of total items collected

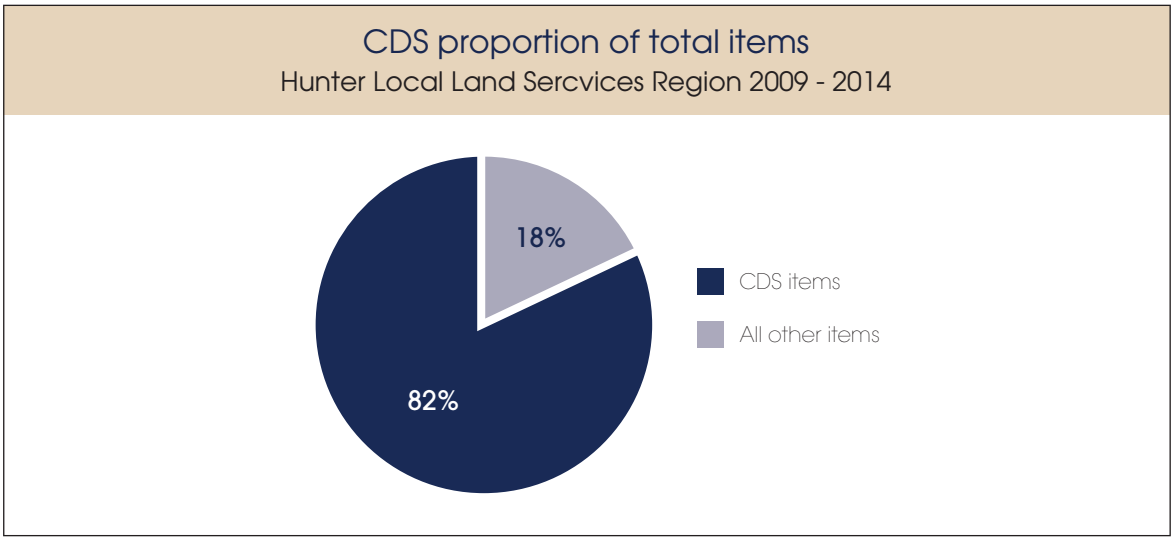
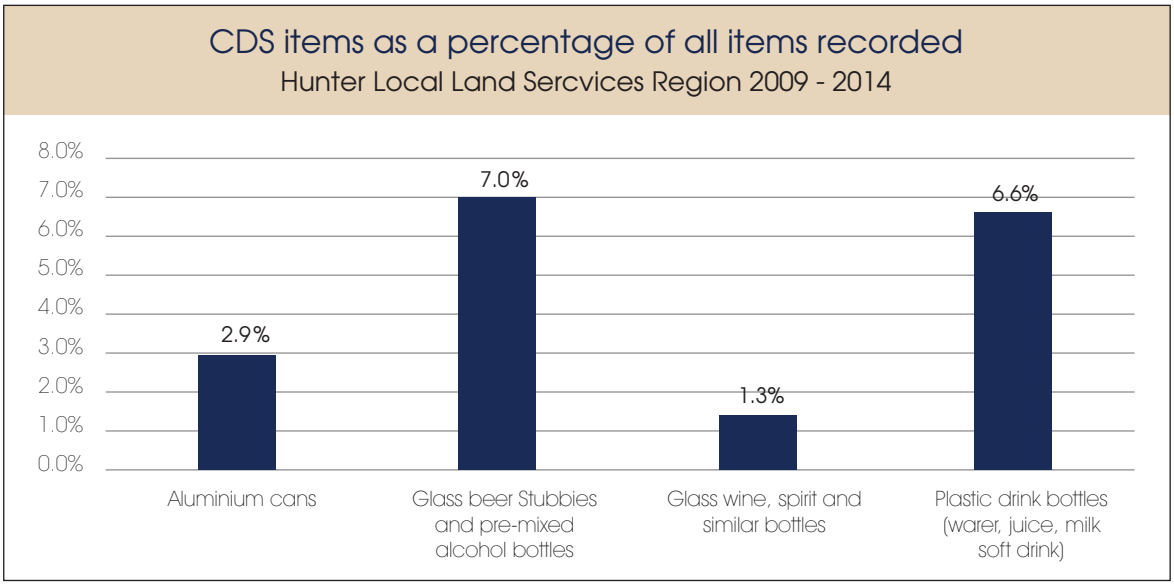


Figure 7: Individual CDS items as a percentage of all items recorded



4 HISTORIC DATA COLLECTION ACTIVITY IN THE LOCAL GOVERNMENT AREAS

Table 1 shows the sectors and settings where litter and marine debris data collection activity has occurred to date within each Local Government Area and shows the total number of clean-ups (AMDI and UVNSW Underwater) for the period up to December 2014.

Table 1: Number of clean-up/monitoring events in each monitoring sector for each Local Government Area in the Hunter LLS region

	Lake Macquarie	Newcastle	Port Stephens	Great Lakes	Greater Taree
On the ground	7	2	0	0	0
Built drainage	*See note below				
Natural drainage & waterways	0	5	0	0	0
Lakes and estuaries	16	13	2	17	0
Coasts	4	7	10	11	7
Offshore	0	0	0	13	2

**Note: Local councils have advised that some monitoring of built drainage has taken place but this has been inconsistent and of limited detail. Improving monitoring in this sector is an important action for Local council partners in the MDMP.*

5 ALIGNMENT OF UNIVERSITY OF NEW SOUTH WALES (UVNSW) AND AUSTRALIAN MARINE DEBRIS INITIATIVE (AMDI) ITEM NAMES

As part of the Marine Debris Monitoring Program – LLS Hunter, a method is sought to align the UVNSW and AMDI Databases. This can be achieved by creating a tool to convert one set of item names into the other. The conversion is required to enable comparison of clean-up data collated from land and underwater clean-ups for the purposes of the monitoring program.

UVNSW item names are quite specific while AMDI names (item classes) in most cases are more general. Their compatibility is examined below. A complete table of the 40 names sourced from the Southern Cross University document "Underwater Volunteers NSW, A Standardised Protocol for Assessing Marine Debris in NSW Waters", Robert J. Edgar and Stephen D. A. Smith, and the comparable AMDI items classes can be obtained from TBF.

5.1.1 Name compatibility

Name compatibility is assessed as good, fair or poor based on being able to identify the more specific UVNSW item name within the AMDI item class. Table 1 shows 8 are fair and 3 are poor with the remaining 29 (not listed here) having a good comparability out of the 40 represented items.

Table 1: Item names with a fair or poor compatibility rating

UVNSW Item	AMDI Item	Compatibility	Comment
Dive clip	Metal outdoor equipment, implements, furniture	Fair	Loses specific identity
Dive weight	Metal outdoor equipment, implements, furniture	Fair	Loses specific identity
Fish trap	Metal Fishing Items (Sinkers, lures, hooks, traps, pots)	Fair	Loses specific identity
Fishing knife	Metal Fishing Items (Sinkers, lures, hooks, traps, pots)	Fair	Loses specific identity
Fishing lure (non-plastic)	Metal Fishing Items (Sinkers, lures, hooks, traps, pots)	Fair	Loses specific identity
Monofilament	Fishing line in metres (Recreation)	Fair	Note 1
Plastic bottle	Plastic drink bottles (water, juice, milk, soft drink)	Fair	Note 2
Rope	Rope (estimated length in metres)	Fair	Note 1
Monofilament and hook	Fishing line in metres (Recreation)	Poor	Note 3
Monofilament and sinker	Fishing line in metres (Recreation)	Poor	Note 3
Monofilament, hook, sinker, swivel	Fishing line in metres (Recreation)	Poor	Note 3

Notes to Table 1.

1. *AMDI uses a count of items but for fishing line and rope an estimate of length in metres is requested. Each metre of rope or line is then represented as 1 item (e.g. 30m of rope = 30 rope items). The purpose of this is to better represent the amount of rope or line within the total amount of debris.*
2. *Plastic bottles have 2 item classes in the AMDI system – Plastic drink bottles, personal care and pharmaceutical bottles.*
3. *The AMDI system would record the monofilament and the metal tackle separately.*

These differences should not seriously affect the conversion of names within the context of data being used for project purposes.

5.1.2 Material class compatibility

10 of the 40 representative items have different material classes in each system as shown in Table 2.

Table 2: Compatibility of material classes

UVNSW Item	UVNSW Material	AMDI Item	AMDI Material
Wire - electrical	Mixed	Plastic electrical cable, connectors & fittings	Plastic
Twine/string	Other	Binding, thread, string & cord (natural fibre)	Cloth
Tile (building)	Other	Construction material (brick, cement, pipe)	Glass & ceramic
Shoe	Mixed	Shoes leather & fabric	Other
Fishing rod	Fibreglass	Recreation fishing items (lures, floats, rods, reels)	Plastic
Fibreglass fragment	Other	Fibreglass fragments	Plastic
Brick	Other	Construction material (brick, cement, pipe)	Glass & ceramic
Monofilament, hook, sinker, swivel	Mixed	Fishing line in metres (Recreation)	Plastic
Monofilament and sinker	Mixed	Fishing line in metres (Recreation)	Plastic
Monofilament and hook	Mixed	Fishing line in metres (Recreation)	Plastic

Because of its more generalised item class system AMDI classifies the material for each class by giving priority to plastic if that is a significant material component. In the AMDI system synthetic polymers are included as plastic such as in fibreglass. These differences should not affect the conversion.

5.1.3 Conversion tool and procedure

The conversion tool consists of 1 or more tables where one set of item names are stored and related to the other set of names. The tool can be set up using MS Access but conversions could also be carried out manually if necessary. The list of UVNSW items may grow over time and the tables would need to be updated accordingly. Carrying out a conversion within the AMDI online database is not feasible at this time.

Options on how to proceed could include the following;

1. Converting the data when needed for analysis
2. Creating a query in the UVNSW database to make the conversion and then forwarding relevant project data to AMDI for online entry.
3. Converting submitted UW data sheets while entering into the AMDI online database.
4. Using AMDI item classes in underwater surveys conducted as part of the monitoring project when this is the preferred option and does not affect UVNSW requirements for the site.

5.1.4 Conclusion

The differences in item names and material classes identified should not present an obstacle to making a useful conversion of UVNSW data into the AMDI format to enable a comparison of underwater and land debris for project sites. The rider is that little work has been done on analysing land based and related underwater data and we do not know what this data is able to reveal.

The procedure for converting the data is relatively straight forward while deciding which method and which group carries out the procedure is a group decision. A discussion of the preferred option for the project should be undertaken by the project management group.

6 HUNTER REGION DATA TYPES

Organisations contacted in the Hunter region hold data giving various kinds of information which is related to the organisations specific charter. They target particular parts of the environment or particular aspects of the debris process and these include;

6.1.1 Target of Activity

- Coastal beaches, inland waterways, lakes and adjacent parks, drains and structures
- Infrastructure – mainly gross pollutant traps
- Underwater environments
- Derelict fishing gear
- Wildlife impacts
- Surface trawl
- Other monitoring providing indirect supporting information

There is a range of data measurements used by the organisations. These are shown in Table 1.

Table 1: Measurements used by organisations

Target	Metrics	Removal
Beach clean-ups	Count of items and aggregate weight for clean-ups	Debris removed
Beach surveys	Count of items within transects	Debris may or may not be removed
Infrastructure	Volume and other metrics yet to be determined	Debris removed
Underwater surveys	Count of items within transects	Debris may or may not be removed
Derelict fishing gear	Specifics not yet known	Debris removed
Wildlife impacts	Specifics not yet known	N/A

Data held by organisations is maintained in the following formats;

- Online database
- Desktop database
- Spreadsheet
- Internal records – format may be paper based or electronic
- Notes on forms

6.1.2 Types of data

There are 5 broad approaches to data collection by the organisations and these are shown in Table 4

Table 4: Assessment of the data types
(Please note some details assessed on limited information and may require amendment)

Grouping	Collection approach	Debris Item identity	Count & weight	Density	Temporal variation of debris	Differentiation of onshore and offshore sources of debris
AMDI	Inventory of whole site	Detailed	Count of items, aggregate weight	Items per metre of beach	Ideal clean-up frequency is monthly to track variations	Estimation of the percentage of debris from land and sea
CSIRO, UVNSW	Transect/s of site	Limited detail/ UW detailed	Count of items, volume (CSIRO)	Items per square metre	Unknown for CSIRO, UVNSW has regular monitoring of sites	Not yet determined
Local Government	Volume of debris from GPT	No detail	Not yet known	N/A	Not yet determined	N/A
Derelict fishing gear	Volume of debris from GPT	No detail	Not yet known	N/A	Not yet determined	N/A
Wildlife Organisations	Records of individual impacts	Yet to be assessed	Count of species impacted, impact type	N/A	N/A	Not yet determined

6.1.3 Discussion

There are 3 broad types of data needed to address the marine debris problem at a regional level. These are:

- Data on local inputs of debris within the region
- Data on offshore inputs of debris affecting the region
- Data on impacts of marine debris within the region

Water, wind and people all play a role in transporting land generated rubbish to the sea. The accumulation and transport of debris can be continuous in some parts of the environment and episodic in others. Data collection objectives might entail one or more of the following configurations of sites;

1. Measuring the volume of debris flowing from one sector to another
2. Identifying the type of debris accumulating within, entering or leaving a particular sector
3. Finding the proportion of debris accumulating underwater from, for example, a breakwater
4. Collecting data across sectors to gauge the overall input for a local system
5. Collecting data across the region at strategic points to gauge the regional input of debris

If the data collection has a broad focus (e.g. 5 above) it may diminish the management value of the data and conversely a narrow (local) focus may not give a true regional account of the problem. For the project at hand both focus levels are required to meet its objectives. It may be necessary therefore to establish several groups of monitoring sites (choosing representative examples for the region) to cover the objectives of establishing a baseline for Threat Abatement Plan (TAP) progress and collecting data in one or several site configurations that can deliver data for adaptive management purposes.

7 RESULTS FROM THE STAKEHOLDER SURVEY FOR A MARINE DEBRIS MONITORING PLAN: HUNTER LOCAL LAND SERVICES, NEW SOUTH WALES

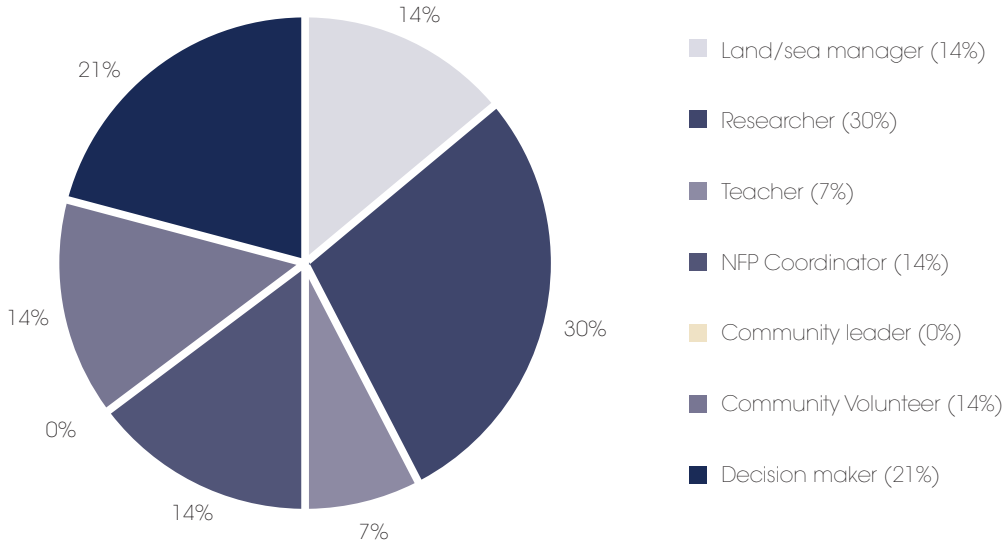
Tangaroa Blue Foundation conducted a survey to investigate needed resources for monitoring marine debris within the Hunter Local Land Services (Hunter LLS) region in New South Wales.

A targeted stakeholder approach was used to specifically encourage those who are involved in marine debris management within the Hunter LLS region to carry out the survey. A total of 34 participants were invited via an email, which of whom represented varying positions including decision-maker, land/sea manager, research, educational teacher, NFP coordinator, community leader and community volunteer. A total of 15 responses were recorded at time of reporting in May 2015.

7.1.1 Responses to survey are as follows:

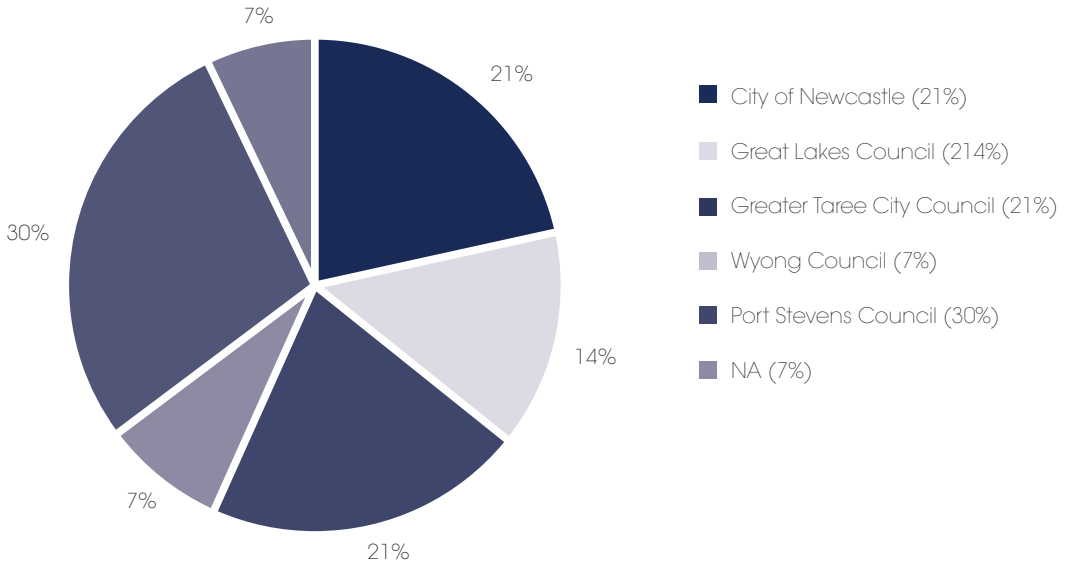
Question 1: Participant's role in marine debris management.

From the 15 respondents there was equal weighting between decision-maker and researchers (22%). Land/sea managers (e.g. NRM Officers) constituted 29% of the participants, with non-for-profit coordinators (14%), community volunteers (7%) and teachers (7%). There were no recorded community leaders.



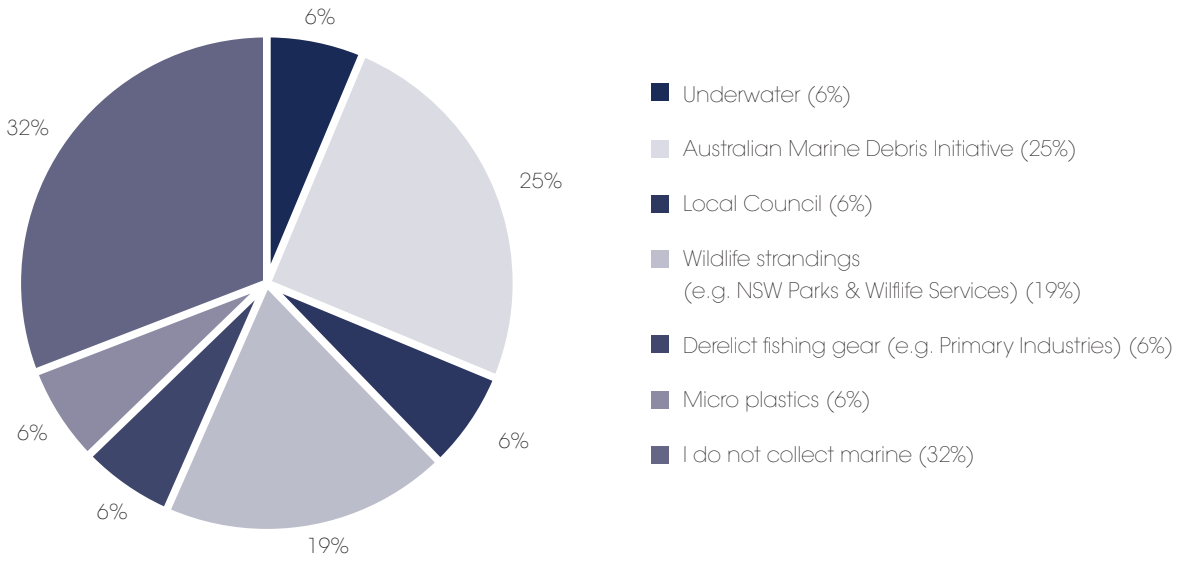
Question 2: Participant location in the Hunter LLS region in regards to local council jurisdiction, nearest beach and waterway

From the 15 respondents there was equal weighting between decision-maker and researchers (22%). Land/sea managers (e.g. NRM Officers) constituted 29% of the participants, with non-for-profit coordinators (14%), community volunteers (7%) and teachers (7%). There were no recorded community leaders.



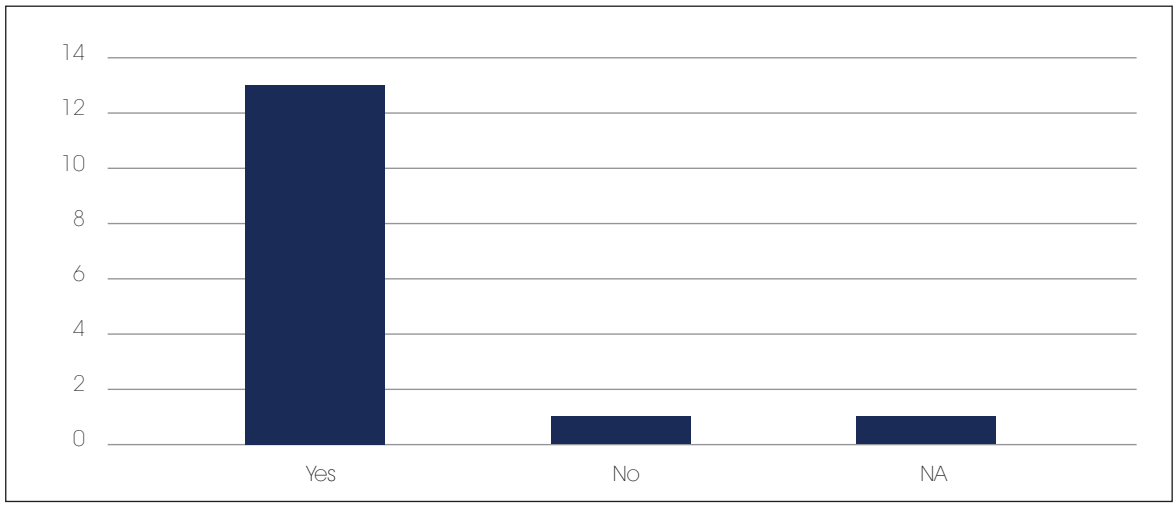
Question 3: Whether participants record marine debris data and preferred database.

From the 15 responses 31% recorded that they do not submit marine debris data into a database. However, there was equal weighting between the Australian Marine Debris Initiative and miscellaneous reporting of wildlife strandings to the NSW Parks and Wildlife Services. There was lower representation of other databases with Underwater Volunteers NSW, derelict fishing gear, miscellaneous local council data and the Atlas of Australia's TeachWild program representing 18% of the responses.



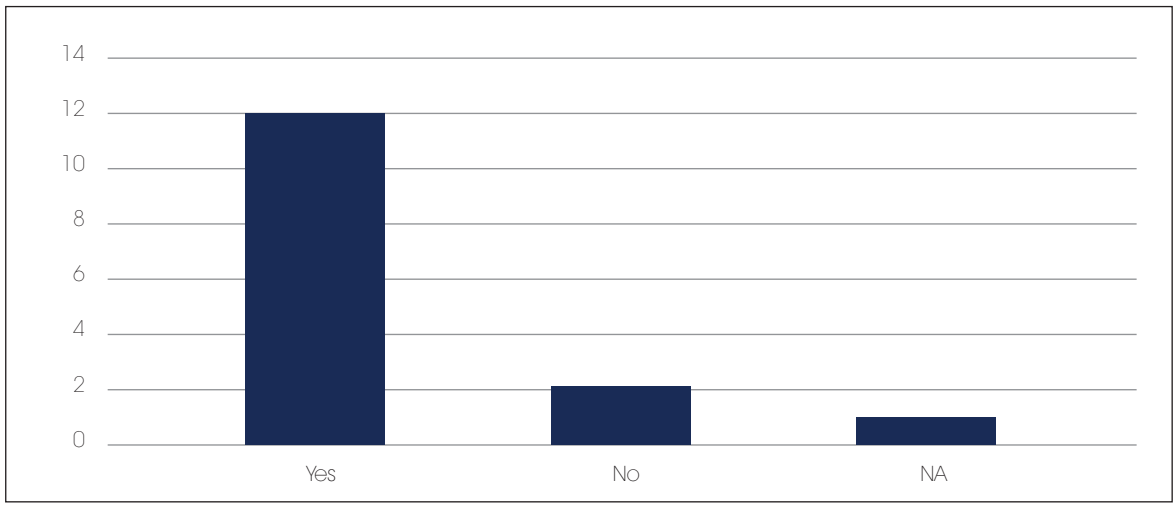
Question 4: Participant consensus on whether or not there are common marine debris items within the Hunter LLS region.

It is clear from the responses to question 4 that marine debris found within the Hunter LLS region constituents common items. There were specific references to fishing line (7 comments), cigarette butts, plastic bottles and other plastic items (e.g. food packaging and microplastic residue). One participant specifically highlighted issues with polluted stormwater entering receiving water bodies contributing to marine debris that could otherwise be prevented or intercepted with the right resources.



Question 5: Highlights whether participant comments to question 4 reflected their core interest in marine debris management within the Hunter LLS region. For instance, comment on fishing line and their involvement in wildlife strandings, fisheries or Underwater Volunteers NSW, or more specifically, common items listed as microplastics when participant research is on microplastics.

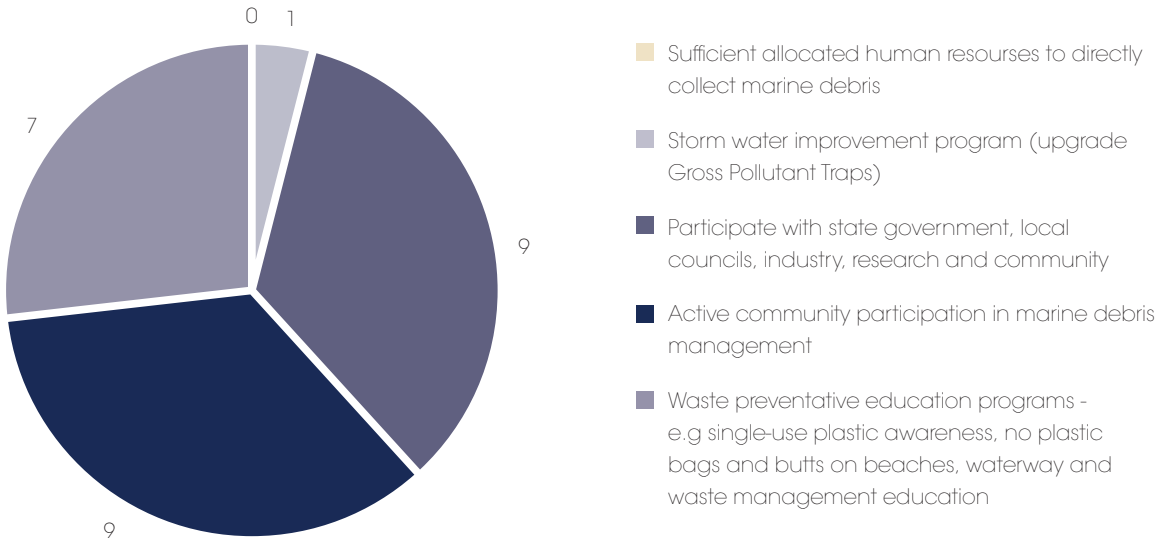
From the 15 responses, 12 participants agreed with the majority recording 'yes'. This shows answers to question 4 are dependent on their role in marine debris management and must be noted when interpreting the results of the survey.



Question 6: Identified existing resources that support the management of marine debris within the Hunter Valley LLS region.

Unfortunately it was found that there is a lack of sufficient allocated human resources to directly collect marine debris with no responses recorded to highlight that there was (0%). On the same token, only 4% suggested there were effective stormwater important programs (e.g. upgrade of Gross Pollutant Traps) to intercept marine debris from entering receiving water bodies. However, there was positive recognition of existing partnerships between stakeholders, active community participation in marine debris management and waste preventative education programs. Specific comments allured to the fact that more human resources are needed, such as:

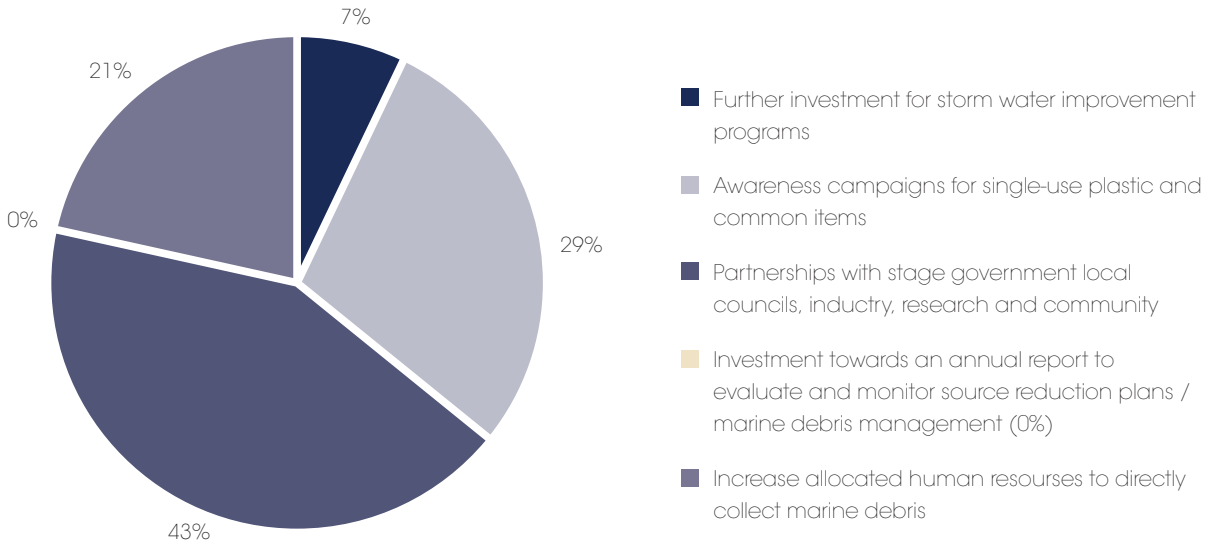
- "We need more resources, upgrading of management plans and implementation of plans to say we have sufficient resources. More education is needed; more support from the Federal and State level is needed and hard infrastructure (e.g. Gross Pollutant Traps)."
- "A GPT maintenance program currently in development - previously done occurred on an ad hoc basis & no data was collected (Greater Taree City Council).



Question 7: Identified resources that would benefit the management of marine debris within the Hunter Valley LLS region.

43% recognised partnerships as a key resource needed to benefit management outcomes while 29% of participants suggested awareness campaigns were needed. Both responses support the need for further investment to monitor marine debris with 21% of responses agreed for the need of more resources. The investment in stormwater improvement programs was recorded by 8% of respondents and no participant suggested investment towards an annual report to evaluate and monitor source reduction plans/ marine debris management was needed. The latter questions participants understanding of the value of evaluation and monitoring programs to deploy the right resources to be most effective when managing marine debris.

However, there were specific comments that suggest 'more effective' partnerships are needed, which as a result would support all suggested resource needs with one participant stating, "All of the above but an effective partnership with stakehold7ers could create the others." Two participants were concerned that microplastics and underwater marine debris was not necessarily a management priority due to the enormity of the issue, and another participant suggested more resources invested into enforcement (time and funding) is needed to ensure the law is upheld.



Question 8: Identified key strategies that would address marine debris sources to reduce marine debris in the environment. The table below highlights the strategies participants suggested.

Target the recreational fishing community to raise awareness of the impact of discarded fishing line on wildlife in local fishing & tackle shops, boating stores and where bait is sold.
Education, community awareness, stormwater management, direct management and control, enforcement and advertise the fact that people have been/can be fined.
Improve recycling and stormwater runoff.
Use of the print media (including images of volunteers in the field collecting and cataloguing debris), radio interviews with those involved in dealing with the issue of minimising marine debris, inserts in local government notices to rate payers, a 'travelling marine debris show' at natural resource field days, schools and public events.
Education campaigns targeting single-use packaging, State and National waste legislation reform to limit single-use items or increase take-back rates. Better infrastructure to collect waste. Better education programs to activate local community and visitors. Broader partnerships with Regional, State bodies to evaluate and enforce action on source reduction.
A Regional Marine Debris Management Plan
Pick the top 3 items for regions and where resources permit implement source reduction plans and actions.

Discussion:

A relationship in participant responses was identified, which was dependent on their role in marine debris management and more specifically their locality – e.g. Local Government Area within the Hunter LLS region.

All participants from Newcastle suggested everyday items such as cigarette butts, plastic packaging and beverage-associated items were common marine debris items, and that waste preventative education programs were needed (e.g. no plastic bags, butts on beaches, waterway and waste management education and single-use plastics). Although existing partnerships and active community participation is present, it was evident current partnerships and community participation needs to be strengthened and adequately resourced.

Participants from the Taree district currently support Underwater Volunteers NSW, Australian Marine Debris Initiative and wildlife strandings, which suggest they have an in-depth understanding of the issue at play. All participants recognised the need for strengthened participation and resourced active community participation in marine debris management. Preventative education programs were a preferred strategy to support the above, in particular the use of monitoring data to guide awareness campaigns/ initiatives.

Port Stephens was another local area with specific requests for needed resources to benefit the management of marine debris (e.g. "Use of the print media (including images of volunteers in the field collecting and cataloguing debris), radio interviews with those involved in dealing with the issue of minimising marine debris, inserts in Local Government notices to ratepayers, a 'travelling marine debris show' at natural resource management field days, schools and public events"). All participants from Port Stephens also agreed with the majority that strengthened partnerships and resourced active community participation are needed.

Above all, it is evident that there is a lack of leadership across the region at present, which the Hunter LLS has taken on board with supporting the development of a Marine Debris Management Plan.

This survey report supports the Marine Debris Management Plan for Hunter Local Land Services, New South Wales. For more information please contact Tangaroa Blue Foundation by emailing:

info@tangaroablue.org

8 DESCRIPTION OF THE LAND SEA SOURCE INDEX

8.1.1 Use of the Land Sea Source Index (LSSI)

The Land Sea Source Index (LSSI) is a tool assisting in the first step of identifying the source of debris in a sample of beach clean-up data using AMDI methodology. This step involves estimating the proportions of onshore and offshore debris within the sample.

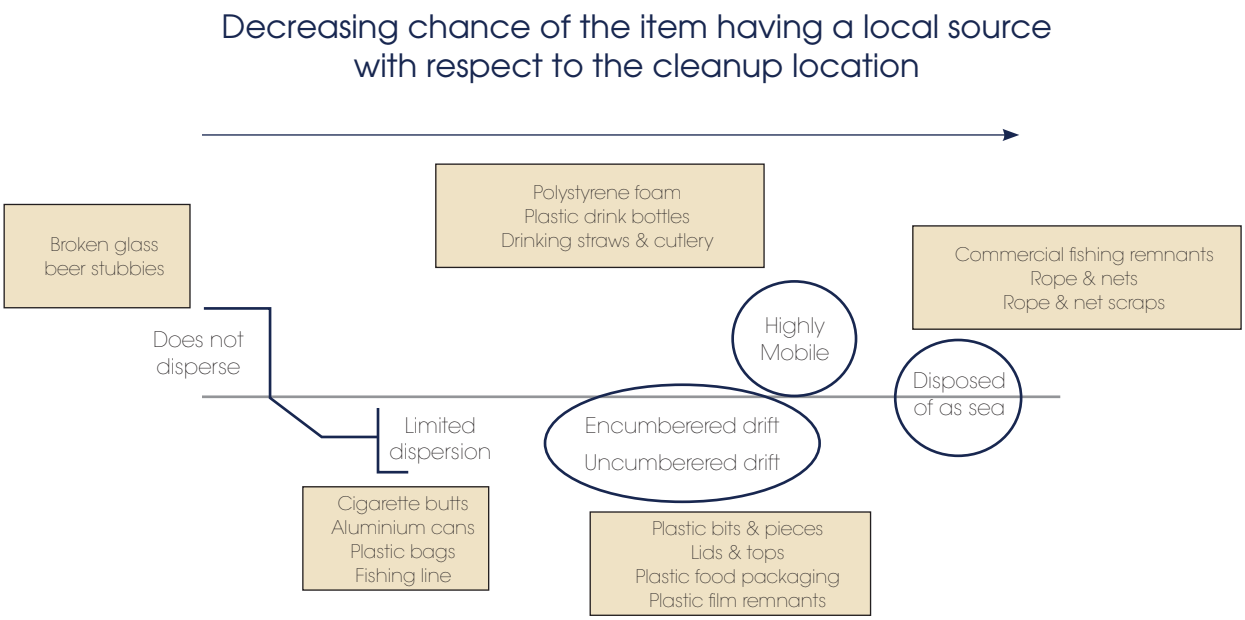
The LSSI is most accurate with respect to the given beach where the data has been collected. It can be averaged over a number of sites but the accuracy decreases once the type of site begins to vary (e.g. remote sites Vs populated sites).

8.1.2 LSSI Concept

The LSSI concept makes use of the fact that different items behave differently in the coastal and marine environment. This difference of behaviour is based on the physical properties of items including form, material, buoyancy etc. House bricks and bicycles found on a beach are much less likely to have floated ashore than fishing buoys. Some items quickly lose their form, sink or snag and therefore do not or cannot travel far. Other items drift to a greater or lesser extent and some items such as lidded plastic water bottles and polystyrene foam travel great distances relatively quickly. Six categories are identified and are called Dispersion Categories. The underlying principle involves estimating the probability that items grouped under a particular dispersion category have a local source. (A local source can be direct littering, litter escaping nearby drains or any other local land based action resulting in loss into the environment). These estimates range from the item being 100% likely to have a local land origin to 0%.

The concept is depicted in the Figure 1. Example items belonging to the category are given in the pink boxes.

Figure 1: LSSI concept



8.1.3 Calculation of the LSSI

Calculation of the LSSI involves 3 steps.

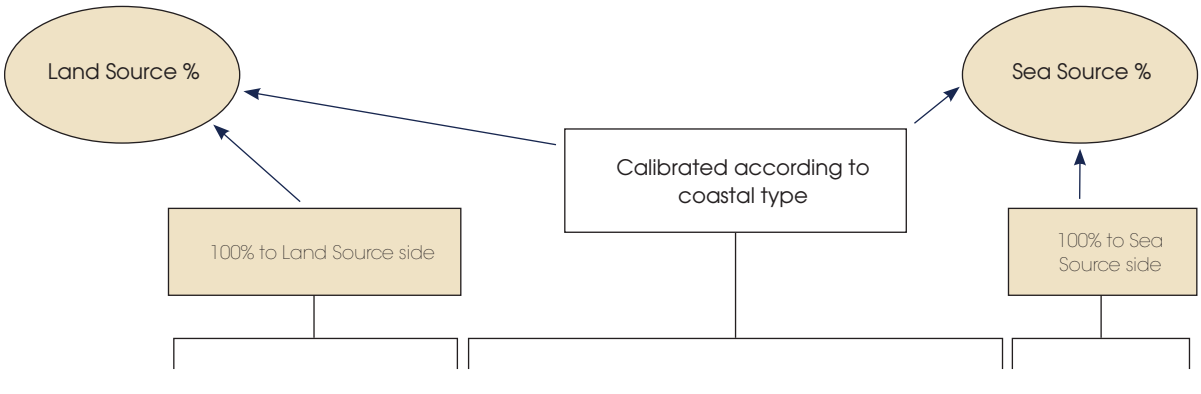
1. AMDI item classes are assigned to one of the 6 dispersion categories shown in table 1.

Table 1: Dispersion Categories

Dispersion Characteristic	Does not disperse	Limited drift	Encumbered drift	Unencumbered drift	Very mobile	Discarded at sea
DC Code	1	2	3	4	5	6

2. The grouped totals for each dispersion category are then further allocated to one side of the index or the other according to the diagram below. An algorithm performs this allocation, taking into account the different types of clean-up sites when allocating dispersion categories 3, 4 and 5. (See also Table 2 below)

Figure 2: LSSI allocation process



3. The resulting table of figures includes the land and sea proportions together with the overall total of items for each clean-up allowing for the calculation of the percentages as shown in Figure 3.

Figure 3: Calculation of the LSSI percentage

Site name	Started	Sum of land	Sume of sea	Sum of total	Land%	Sea%
4MB South End	15/06/2008	38.35	16.65	55	70%	30%

8.1.4 Weighting of categories

The values in the table below are used to weight the calculations in step 2 toward the land source side of the index1. AMDI item classes are assigned to one of the 6 dispersion categories shown in table 1.

Table 2: Combination of and weighting values for the Land Sea Source Index allocation process

		Does not disperse	Limited dispersion	Encumbered drift	Unencumbered drift	Very Mobile	Discarded at sea
Coastal code name	Coastal Code	1	2	3	4	5	6
Populated Coast - Sheltered Waters	1	1	1	0.75	0.2	0.2	0
Populated Coast - Open Water	2	1	1	0.5	0.1	0.1	0
Sparsely populated Coast - Sheltered Waters	3	1	1	0.2	0.05	0.05	0
Sparsely populated Coast - Open Water	4	1	1	0.1	0	0	0
Island - populated or high tourist numbers	5	1	1	0.5	0.1	0.1	0
Island - unpopulated, low or no tourist numbers	6	1	1	0.1	0	0	0
Inland waterway	7	1	1	1	1	1	0
Parks, drains and structures	8	1	1	1	1	1	0

Protect Our Oceans

Prepared by Tangaroa Blue Foundation
An Australian Marine Debris Initiative Report

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