



Australian Government

**National Land & Water Resources Audit**

*An initiative of the Australian Government*

**ESTUARINE, COASTAL  
AND MARINE HABITAT  
INTEGRITY**

INDICATOR HEADING

**Estuarine, coastal and marine  
habitat condition**

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INDICATOR GUIDELINE

**Presence of litter (rubbish and marine  
debris)**

**Recommended by the Audit for further consideration**

This version of the guideline has been developed through the National Land and Water Resources Audit and was informed by expert review and broad consultation on national indicators via national coordination committees and their associates. Version 1 – June 2008 does not yet have the final endorsement of any jurisdiction. The document is for guidance only and is presented to provide a basis for on-going discussion. It may require further consideration by a jurisdictional based reference group before national endorsement.

Presence of litter (rubbish and marine debris)

# Status of indicator agreement

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The National Land & Water Resources Audit (the Audit) coordinates the collation of data to support reporting on natural resource condition required under the National NRM Monitoring and Evaluation Framework (National M&E Framework).

The National M&E Framework identifies three requirements for monitoring natural resource condition:

- a set of resource condition indicators to measure progress toward the agreed national outcomes on a medium and long term basis
- a set of indicators for monitoring community and social processes relevant to or affected by NRM programs, as well as measures of the adoption of sustainable development and production techniques
- contextual data pertinent to the indicator being considered.

The Audit Advisory Council has agreed to a process for achieving a practical set of indicators under the National Monitoring and Evaluation Framework.

This process is to:

- obtain on-going **recommendations** from the relevant **National Coordination Committees** for each thematic area (including “Matters for Target”) on appropriate indicators, protocols and information needs
- seek **endorsement** from the **Audit Advisory Council** that the indicators and protocols can be implemented at the national, state / territory and regional levels
- seek **agreement** from the Natural Resource Policies and Programs Committee (**NRPPC**) (or the Marine and Coastal Committee –**MACC**- for Estuarine, Coastal and Marine) that the indicators will be used and promoted by jurisdictions to underpin evaluations of NRM initiatives.

The NRPPC and MACC report to the Natural Resource Management Ministerial Council (NRMMC).

# Introduction

This suite of “indicator guidelines” is relevant to the Estuarine, Coastal and Marine Habitat Integrity Matter for Target.

Two indicator headings are identified:

1. Estuarine, coastal and marine habitat extent and distribution
2. Estuarine, coastal and marine habitat condition.

Initially, 31 potential indicators were developed to measure the effect of the stressors on ecosystem condition (physical/chemical and biological) and habitat extent (Scheltinga et al., 2004). These indicators were reviewed at a national workshop (Souter and McKenzie, 2006) and further refined to 19 nationally agreed indicators (Table 1).

Drawing on a series of state/territory trials and national consultations; the documentation for the indicators has been modified from a “protocol” format that sought to define both measurement standards and reporting (information) products to one that presents “guidelines” for the collection and storage of monitoring data.

These “indicator guidelines” should be used as standards for the collection, collation and storage of data in order to assist NRM service providers and community groups make observations that can potentially be pooled and re-used at a later date.

Ten ECM indicators were prioritised and guidelines have been developed through extensive consultation and reviewed by key experts in the field.

Table 1. Nationally agreed ECM Resource Condition Indicators. Indicators prioritised for documentation and included in this document are shown with an asterisk.

Indicator heading	Indicator
<b>Estuarine, coastal and marine habitat extent and distribution</b>	1. Extent and distribution of key habitat types*
<b>Estuarine, coastal and marine habitat condition</b>	Biological condition 2. Algal blooms 3. Animal or plant species abundance* 4. Chlorophyll a* 5. Coral bleaching 6. Mass mortality events 7. Pest species (number, density, distribution)* 8. Targeted pathogen counts 9. Vertebrates impacted by human activities Physical/chemical condition 10. Dissolved oxygen* 11. Nutrients* 12. pH 13. Presence / extent of litter (marine debris)* 14. Salinity (EC) 15. Sedimentation/erosion rates* 16. Shoreline position 17. Temperature 18. Toxicants (in water / sediments / biota)* 19. Turbidity / water clarity*

# Litter

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## Matter for target:

Estuarine, coastal and marine habitat integrity

## Indicator heading:

Estuarine, coastal and marine habitat condition

## Indicator name:

Presence of litter (rubbish and marine debris)

This document presents the recommended monitoring guidelines for collecting, collating and reporting information on the presence of litter in estuarine, coastal and marine waters for national, state/territory and regional application.

## 1. Definition

This indicator reports on the presence of litter in estuarine, coastal or marine systems.

AIM 1: To document the type and amount of litter on a regular basis.

INDICATOR 1: Presence (standing crop) of litter.

INDICATOR 2: Litter accumulation rate.

## 2. Rationale

The presence of litter in estuarine, coastal and marine systems detracts from the visual amenity of an area and can harm humans (eg broken glass, used needles) or animals (which eat, become entangled in, or are suffocated by, the litter). Many species of endangered or threatened marine mammals, turtles and seabirds are at risk from litter (<http://marine-litter.gpa.unep.org>). Floating litter may aid in the movement (introduction) of marine animals and plants which may become pests. Toxic substances can leach out of litter affecting animals and plants; a simple example is the toxic effect of cigarette butt litter. Toxic substances leach out of cigarette butts and can kill small animals. Animals also mistake butts for food. The toxic chemicals absorbed by cigarette cellulose acetate filters and found in remnant tobacco in butts are quickly leached from the butts by water.” (Global litter information gateway, <http://marine-litter.gpa.unep.org/facts/effects-wildlife.htm#top>).

The origins of debris on Australian beaches are influenced by a number of factors including: proximity to urban centres; population of surrounding areas; and vicinity of marine-based activities. Identification of the origins of debris on beaches or in the marine environment is often difficult as items may be discarded on land or by vessels at sea.

Plastic is the most prevalent type of debris found on beaches world wide, comprising 50–90% of all debris items recorded (Coe and Rogers 1987; UNEP 2005). In Australia, plastic waste, including derelict fishing gear (nets, lines and ropes), is one of the most harmful types of debris to marine wildlife (Chatto 1995; Eriksson and Burton, 2001a,b; Laist 1996; Limpus et al. 2003; Pemberton et al. 1992; Slip & Burton 1990, 1992; Roeger et al. 2005).

Plastics pose a particular threat due to their durability and their ability to float. While plastics do break up physically into smaller pieces over time, there is no mechanism for biodegradation of conventional plastic (Andrady 2000). Plastics in the marine environment tend to break up even more slowly than they do on land (Andrady 1990, 2000; Derraik 2002). Microscopic plastic fragments and fibres are now widespread in the world's oceans and have accumulated in the pelagic zone and sedimentary habitats (Thompson et al. 2004). Large items of plastic debris are also frequently recorded in oceans and on shorelines from the equator to the poles (Pruter 1987; Thompson et al. 2004). However, these large items probably represent only a small proportion of the plastic in the environment (Thompson et al. 2004).

Fishing-related activities are the major source of marine-based debris in Australian waters (Jones 1994, 1995; Edyvane et al. 2004; Slater 1991, 1992; Heislors 1994). The levels of marine debris recorded generally reflect the level and type of inshore and offshore fishing and shipping activity (and distance from major shipping routes).

### **3. Monitoring methodology**

There are two basic methods of litter monitoring: 1) 'standing crop' which measures the amount of litter present at a point in time (litter is not necessarily removed); and 2) accumulation (or flux) rate of litter over a specific time period (requires litter removal)

#### **3.1 Monitoring locations**

Beach and river reaches should be monitored. Monitoring in remote coastal areas, ie away from major rivers and population centres, should be used to estimate primarily marine-based sources of litter (eg Sloan et al. 1998; Whiting 1998; Kiessling 2003; Edyvane *et al.* 2004; White 2003, 2006). Monitoring in areas adjacent to major urban centres or estuaries should be undertaken to assess primarily land-based (ie catchment) sources of litter (eg O'Callaghan 1993; Gregory & Ryan 1997; Wace 1994, 1995; Haynes 1997; Clean Up Australia 2006; Keep Australia Beautiful 2006).

The nature of coastal processes operating along beach systems (ie longshore currents) results in sections of the beach accumulating litter at significantly different rates. Representative sections along the entire beach system should be monitored.

#### **3.2 Monitoring frequency required**

Monitoring should occur at low tide every three months over a one-year period. The first monitoring event will provide information on the litter standing crop (indicator 1), including plastics, while the subsequent monitoring will give accumulation rates (indicator 2).

#### **3.3 Data measurement method**

##### **Litter collection**

*Excerpt (with slight modification) from the Waterwatch Queensland's 'Community Estuarine Monitoring Manual' (NRM, 2003) (see also the excellent WWF Marine Debris Survey Information Manual (White, 2005)):*

##### **Equipment required:[BT]**

- Heavy-duty plastic or hessian bags
- Scales

- GPS to locate the site
- Trundle wheel or 50 m measuring tape
- Special container for dangerous material
- Gloves
- Protective shoes.

*Safety tips:*

- Have a first aid kit available.
- Always wear gloves and protective shoes.
- Pick up glass or sharp metal pieces with care.
- Place any syringes found in a suitable container.
- Do not pick up heavy objects (eg fishing nets, drums, etc) by yourself.
- Leave dead animals where they are, but record them on your datasheet. Animals obviously killed as a result of human activities (ie entangled with litter, boat strike, etc) should be recorded and reported to the appropriate government authority.

*Site selection*

Sites chosen should preferably:

- be readily accessible
- encompass both ends and the central region of the beach system
- receive no other routine cleaning
- have a known build-up of litter
- have a moderate slope without wide intertidal flats
- be remote (away from population centres) if monitoring is assessing marine-based litter.

*Procedure*

1. Set up transect.
  - Locate the site using a GPS. Once the starting point has been located, lay out a 100 to 1000 m long transect using the measuring tape or wheel. Record the starting point and location along the beach system and width of beach (transect to be examined).
2. Collect litter.

- Begin walking along the beach from the start of the transect to the end of the transect and cover the area of the beach between the base of the primary dune and the low water mark. Collect all rubbish and place into a suitably strong bag. Once finished take all bags from the beach to the sorting area.
  - Minimum size of litter needs to be defined – generally 2.5 by 2.5 cm (about the size of a bottle top)(White, 2005).
  - Some litter will be too heavy to lift (drums) or remove (buried fishing nets) so these items will need to be recorded *in situ*, ie number and length/height (White, 2005).
3. Sort the litter.
- At the sorting area, empty all bags and sort the litter into categories listed on the datasheet. Count the number of items in each category and record on the datasheet. Estimate the length of any rope, fishing line and fishing nets found, as well as counting the pieces. The type of litter found (eg plastic, foam, netting, metal, biohazard) should be recorded for each ‘origin’ category (eg land/catchment (storm water, recreation) or marine (eg shipping, fishing)).
4. Clean and weigh litter in each category.
- Using a brush, clean each item of litter of sand and place into a plastic bag labelled with the appropriate category name. Weigh each of the plastic bags and record the weight on the datasheet. Note that light items are not weighed. Foam items can be placed into 90 cm x 60 cm sized bags, and the number of bags filled recorded on the datasheet.

The Waterwatch Queensland Community Estuarine Monitoring Manual (NRM, 2003) CD includes an Excel spreadsheet designed to automatically calculate the total amount and weight of litter collected during a survey. The spreadsheet will also calculate the percentage each litter category contributes to the total amount and weight of litter.

### **3.4 Data collation / calculation method**

Data for a specific site should be collated over a one-year study period (where possible). The mean number and weight of ‘standing crop’ litter pieces per m<sup>2</sup> and ‘accumulation’ litter pieces and weight per m<sup>2</sup> per three months should be calculated.

### **3.5 Data storage and management**

Data should be stored by state/territory agencies and by the collectors (if different) of the data. If possible, the public should have access to the data (and report summaries) through a website hosted by state/territory government.

### **3.6 Data analysis and interpretation**

The presence of any litter impacts on the visual amenity and health of an area. Through monitoring the amount and type of litter present, the major sources, quantities and types of litter can be determined.

Recent storms, cyclones, strong winds and strong currents are likely to cause increased litter transport and deposition, particularly of floating debris. Seasonal variation in tourism/beach

or river use (eg hot summers and increased beach use versus cold winters) will also alter the amount of litter found and should be considered when analysing and interpreting the data collected.

*Excerpt (with slight modification) from the Waterwatch Queensland's 'Community Estuarine Monitoring Manual' (NRM, 2003):*

By sorting litter into buoyant and non-buoyant items, its origins can be determined. Items such as metals and uncapped bottles are non-buoyant, and are most likely to have been left behind by beachgoers. Therefore, large numbers of such items may indicate that beach littering is an issue that needs to be addressed locally. A large proportion of buoyant litter may indicate that the debris is not locally sourced, and has washed in from the sea.

### **3.7 Reliability, validity and quality assurance**

Quality assurance and control measures are important to minimise avoidable errors in the data and thus give more confidence in the data collected and conclusions made. Individuals collecting the data must have had adequate training in sample collection.

### **3.8 Metadata**

Metadata documentation should be completed for all datasets (see Appendix A). The metadata statement should be consistent with current ANZLIC standards, which now comply with ISO 19115.

See the following web site for the Metadata Profile:

[http://www.osdm.gov.au/ANZLIC\\_MetadataProfile\\_v1-1.pdf?ID=303](http://www.osdm.gov.au/ANZLIC_MetadataProfile_v1-1.pdf?ID=303)

For the Metadata Guidelines see:

[http://www.osdm.gov.au/ANZLIC\\_MetadataProfileGuidelines\\_v1-0.pdf?ID=397](http://www.osdm.gov.au/ANZLIC_MetadataProfileGuidelines_v1-0.pdf?ID=397)

## **4. Reporting / information products**

### **4.1 Audiences**

Regional natural resource managers will be the main audience for information on specific estuaries and coastal waters. State and federal managers will be more interested in the collation of information into regional summaries/reports.

### **4.2 Products**

At the smallest reporting level (ie at the site scale) the amount of litter collected is reported against the area monitored, and against time for litter accumulation. There are several ways to report the amount of litter collected, each with its pros and cons. Weight of litter is generally regarded as a good measure of the amount of litter present because litter often breaks up. However, some litter such as fishing nets can be too heavy to lift/weigh or are buried in sand and can't be removed. In these cases, counts or length of net should be reported. Some other litter is best reported against measures such as length (eg rope, fishing line, fishing nets) or number of bags filled (eg foam). We here recommend using both counts and weights as the best method for standardising nationally and allowing comparison against thresholds for scoring (Tables 1 and 2). More detail can be reported at the local scales.

The amount of litter per unit area and the litter's source should be reported against each of the litter categories used, in tables and graphs. Once sufficient information on litter is available for a location, litter category or source, it will be possible to produce tables or graphs showing trends/change and their statistical significance. These trends can then be reported as an

estimate of change.

When reporting at an estuary or larger scale the average standing crop and accumulation rates of litter should be reported.

#### **4.3 Confidentiality**

Data confidentiality is the responsibility of the data custodian.

#### **4.4 Data collation/calculation method**

The development of regional summaries/reports for state and national managers will require the collation of local datasets.

#### **4.5 Data analysis, integration and interpretation information**

Any national/regional level information products (ie interpreted products) need to be linked to the regional/local information that was used to create it (ie to the relevant state/territory and regional databases/information systems). Any specific methodologies, assumptions, additional data and changes in confidence in the interpreted products need to be stated.

#### **4.6 Data access and storage**

National level products should be developed with the needs of the various stakeholders in mind. Data access and storage for national level products should be through a nationally known and recognised web site such as 'Clean Up Australia' and 'OzCoast and OzEstuaries'. Links should then be made to state/territory and regional web sites to access the underlying products/datasets.

#### **4.7 Product definition statement**

Each product should have a product definition statement. The product definition statement follows the same general format as the metadata statement referred to in 3.8.

### **5. Current national activities**

Clean Up Australia runs a national Clean Up Australia Day campaign every year. Data on these activities (and any other activities logged into the system) are collected by Clean Up Australia and can be accessed via an interactive website located at [www.cleanup.org.au/coastal](http://www.cleanup.org.au/coastal).

### **6. Future development**

Many of the current litter cleanup programs lack any comprehensive data collection component as, justifiably, they are run by the community with their own objectives. Minor modification to their methodologies and reporting structure (for consistency) should easily allow the data they collect to be used for local, regional, state and national reporting. Clean Up Australia is the most practical and obvious organisation to be involved.. Tables providing classes that describe the general condition of the beach for varying amounts of debris should be constructed. These will help to interpret the calculated values in meaningful everyday language. For example,

The Australian Government is developing a national Threat Abatement Plan (TAP) for the impacts of marine debris on vertebrate marine life. The purpose of the TAP is to:

- contribute to the long-term prevention of the incidence of harmful marine debris

- remove existing harmful marine debris from the marine environment
- mitigate the impacts of harmful marine debris on marine species and ecological communities
- monitor the quantities, origins and impacts of marine debris and assess the effectiveness of management arrangements over time for the strategic reduction of debris.

## 7. Links to other indicators

Animal or plant species abundance (indicator)

## 8. Further information

Clean Up Australia Online. [www.cleanup.com.au](http://www.cleanup.com.au)

Cunningham, D. and S. Wilson (2003) *Marine Debris on Beaches of the Greater Sydney Region*. Journal of Coastal Research: 19(2): 421–430.

Derraik, J.G.B. 2002. *The pollution of the marine environment by plastic debris: a review*. Marine Pollution Bulletin 44: 842–852.

Edyvane, K., A. Dalgetty, P. Hone, J. Higham and N. Wace (2004) *Long-term marine litter monitoring in the remote Great Australian Bight, South Australia*, Marine Pollution Bulletin, 48 (11-12): 1060-1075.

Faris, J. and Hart, K. 1996. *Seas of Debris: A Summary of the Third International Conference on Marine Debris*. Miami, Florida, 8-13 May 1994. 54 pp. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle.

Frost, A. and Cullen, M. 1997. *Marine debris on northern New South Wales beaches (Australia): Sources and role of beach usage*. Marine Pollution Bulletin 34: 348-352.

Global Litter Information Gateway. <http://marine-litter.gpa.unep.org/facts/effects-wildlife.htm#top>

Gregory, M., and P. Ryan (1997) *Pelagic plastics and other seaborne persistent synthetic debris: a review of Southern Hemisphere perspectives..* In Coe, J.M., Rogers, D.B. (Eds.), *Marine Debris- Sources, Impacts, Solutions*. Springer-Verlag, New York: 49-66.

Haynes, D. (1997) *Marine debris on continental islands and sand cays in Far Northern Section of the Great Barrier Reef Marine Park, Australia*. Marine Pollution Bulletin, 34(4): 276-279.

Herfort, A. 1997. *Marine debris on beaches in New South Wales with a special focus on fishing debris*. Ocean Watch Australia, Sydney.

Jones, M. (1995) *Fishing Debris in the Australian Marine Environment*. Marine Pollution Bulletin 30(1): 25-33.

Laist, D.W. 1987. *An overview of the biological effects of lost and discarded plastic debris in the marine environment*. Marine Pollution Bulletin 18 (6B): 319-326.

Keep Australia Beautiful (1996) *Looking at Litter and what's being done about it. A Survey of Litter in Australia*. Keep Australia Beautiful Association Inc.

Keep Australia Beautiful (2006) *Marine Litter Index*, McGregor Tan Research on behalf of Keep Australia Beautiful, June 2006.

O'Callaghan, P (1993) Sources of shoreline litter near three Australian cities. Victorian Institute of Marine Science, Queenscliff, Victoria, Australia.

Pryor, H. (1999) *World Heritage Area Beach Clean Up*, Coastcare Information Sheet, Tasmania

Slater, J. (1991) *Flotsam and Jetsam, Beach Survey Results January 1990-1991*. Marine Debris Bulletin 1. Tasmania Department of Parks, Wildlife and Heritage, Hobart, Australia.

Waterwatch Queensland, 2003. *Community Estuarine Monitoring Manual*. The State of Queensland (Department of Natural Resources and Mines).

White, Damian. 2005. *Marine Debris Survey Information Manual 2nd edition*, WWF Marine Debris Project, Arafura Ecoregion Program. WWF Australia.

## **9. Glossary**

Buoyant – Floating

Debris – Pieces of rubbish or litter

GPS – Global Positioning System

Litter – Personal artificial/synthetic objects that have been scattered or abandoned

Standing crop – The amount of litter present in an area which has not been 'cleaned' within the last 1 year at least

## Appendix A: Metadata statement

<b>Monitoring program</b>	The name of the monitoring program
<b>Custodian of data/Contact</b>	The business name and address/contact details of the custodial organisation or responsible party
<b>Summary of program</b>	A brief narrative summary of the program
<b>Geographic extent</b>	The ordinary name(s) of the locations where the data was collected (ie study area)
<b>Indicators monitored</b>	List of all indicators monitored
<b>Method of data collection</b>	Summary of the methods used to collect the data
<b>Past/future sampling</b>	Description of when sampling started, how often it occurred, when it will finish
<b>Quality assurance</b>	Description of the quality control/assurance procedures used
<b>Data access</b>	1) Location: Where and how the data is stored. If it can be accessed remotely (ie from a website) 2) Format in which dataset is stored and available 3) Any restriction or legal prerequisites that may apply to access and use of the data
<b>Other comments</b>	Any other comments
<b>Information source(s)</b>	Where information on the program can be found (eg reports, literature, websites)
<b>Date metadata created</b>	Date when the metadata record was created

## Appendix B: product definition statement