Large scale monitoring design: developing robust and flexible approaches to support policy responses

Britta Denise Hardesty and Chris Wilcox

‘If you measure it, it can be managed’

CSIRO Marine Debris Research Program

Research ~ 10 years of work; 40+ pubs/reports

- Document **distribution** of waste/litter on coast and in ocean (incl. ghost gear)
- Identify **sources** of marine debris
- Collect data on exposure of wildlife
- Assess likely **risk** to wildlife and food fish
- Modelling & monitoring marine litter **movement, transport, accumulation**
- Identify potential **policy solutions** at local, regional, national and international scales
- Monitoring methods comparisons/data harmonization

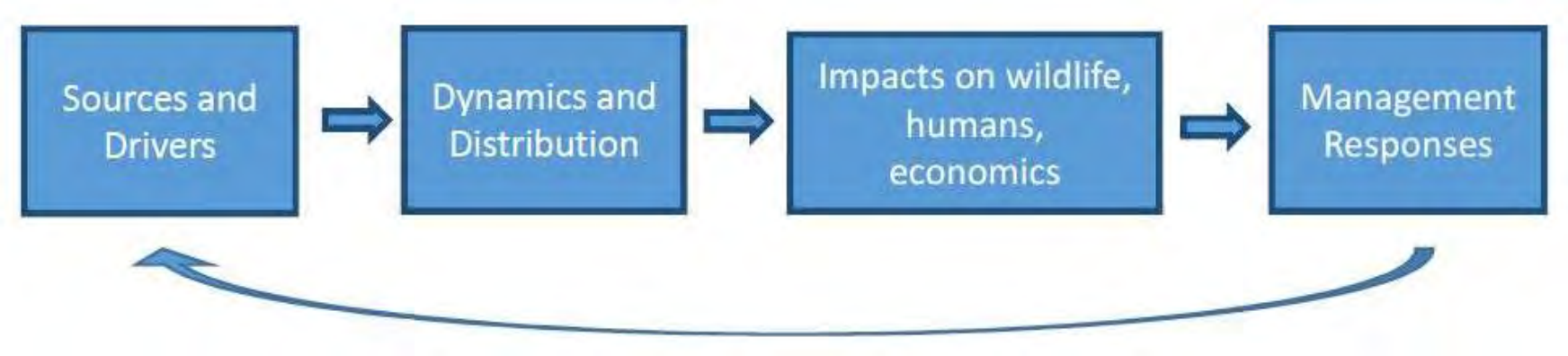
Engagement

- Citizen science program with Schools, Educators, Coastal Volunteers and Industry Leaders (~8,000 participants)
- Content for schools, linked to national curriculum
- Engage w/ government to deliver information on effective, affordable solutions

https://reserach.csiro.au/marine-debris

A framework for marine debris

Framework components



- Conceptually broad remit
- Framework for tackling issues with variable amounts/types of data
- **Data** to underpin/drive action
- Understand (*quantify) our uncertainty

‘If you measure it, you can manage it’

What are the goals?

- Establish a baseline?
- Sources and drivers?
- Risk to wildlife/human health/environment?
- Policy responses/effectiveness?
- Awareness raising/community engagement?

- What does large scale monitoring look like?
  - How much time?
  - How much cost?
- What can you learn from it?
  - Drivers, leakage points
  - Policy responses
  - Risk assessment
- What might it look like in Africa?

Continental survey across Australia

- Shape, substrate, backshore?
  - e.g. bays, mangroves, forest
- Local and regional population?
- Remoteness? Usage?
- Wind, currents, watershed?
- Socioeconomics?

Coastal plastic pollution in Australia

Darwin
Broome
Cairns
Brisbane
Perth
Adelaide
Sydney
Melbourne
Hobart

Hundreds of transects later…

4.1 items per meter of coast X 36,000 km coast

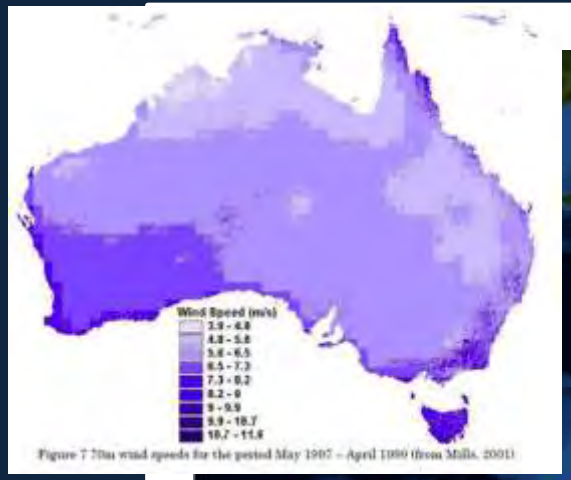
= 147.6M pieces on the coast

÷ 23M people = 6.4 items per person

Frontiers in Ecology and the Environment

stimating quantities and sources of marine ebris at a continental scale

Wind and current forcing drive debris onshore

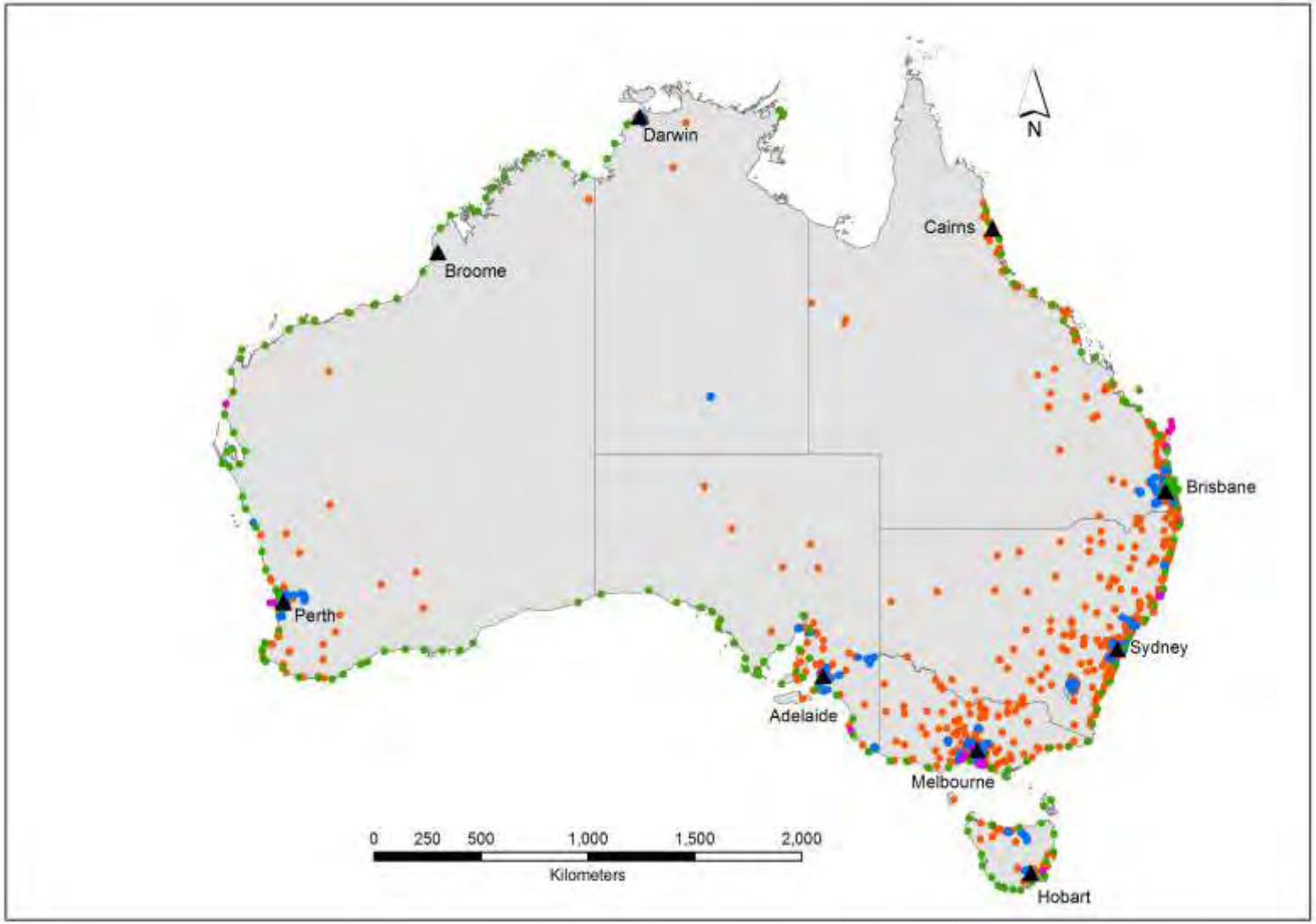


Most appears to stay local

Matches observations

- Consumer items near cities
- Marine users in remote areas

Resources
Population
Coastline length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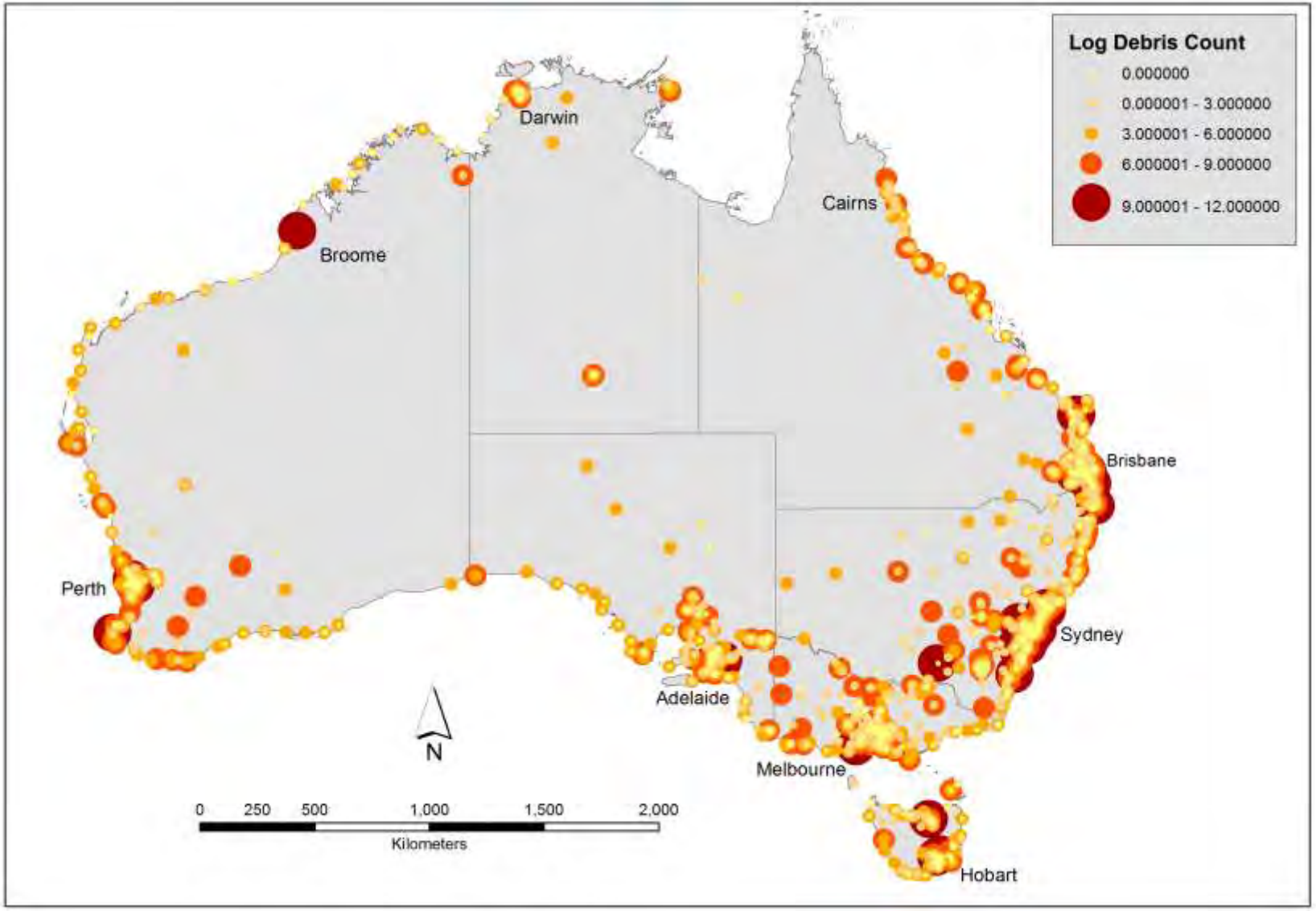
Log Debris Count
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Melbourne
Hobart
N
0 250 500 1,000 1,500 2,000
Kilometers

What drives variation in litter?

Population was important – but economics, site types, land use more

Land use

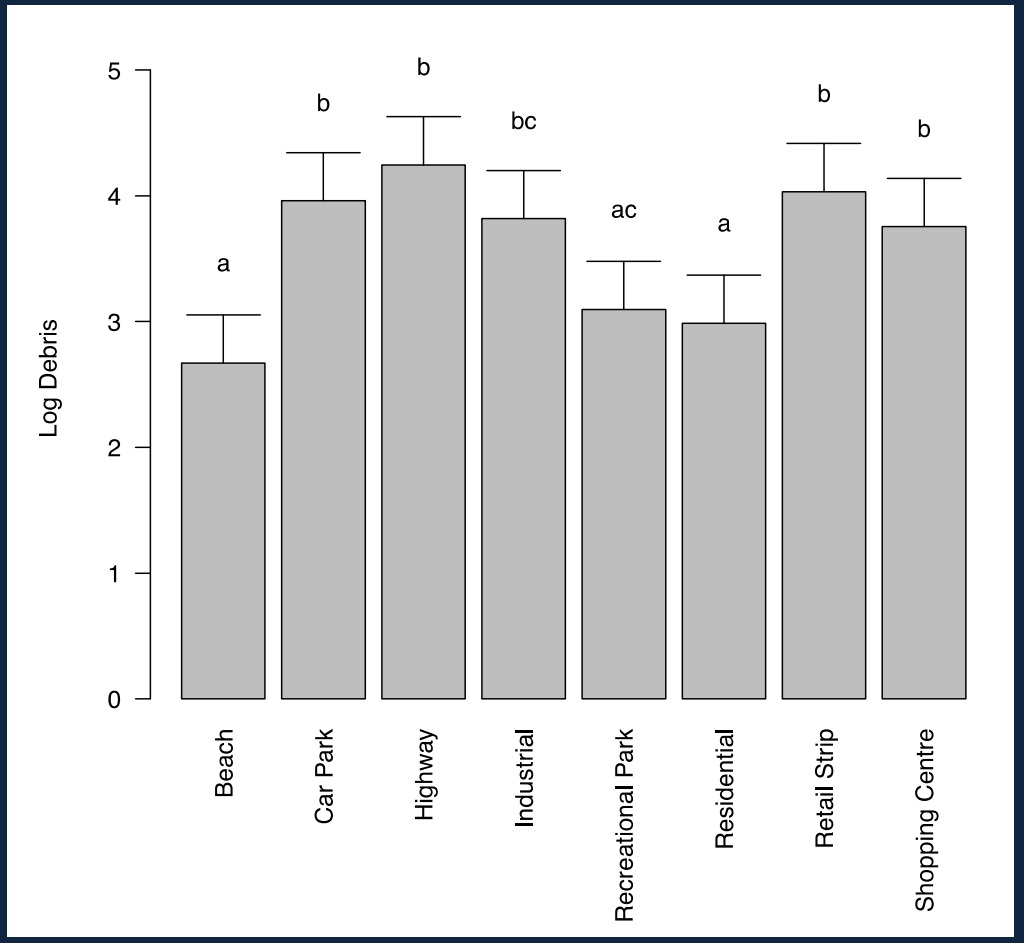
- Water >Grazing > Ag > Cons

Site types

- Transient = more plastic
- Aesthetic value matters

Socioeconomics (within 50km)

- Poverty
- Employment
- Education



Council Aspects

Regulations
Facilities
Actions

Policies and legislation

Legislation and policies

Example of policies and strategies	Name of the legislation, the strategy or the policy	Description, document or link, if new
Waste Legislation		
Regional's waste and recycling strategy		
Council's waste management strategy		
Zero waste strategy		
Container deposit legislation		

Actions and Programs

Community outreach

Education programs

Bag bans

Coastal clean ups

- Does investment matter?
- Which types are best?

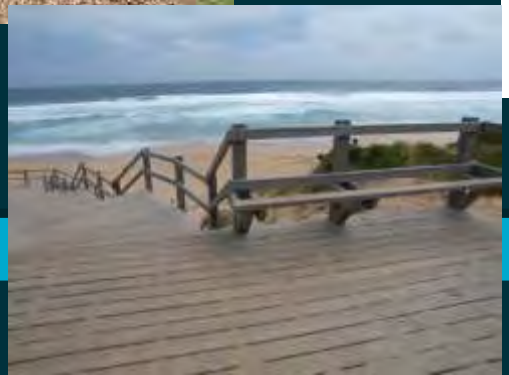
How do councils spend their money?

Does it matter?

What reduces coastal waste?

Invest in regulations, facilities or programs?

- Investment in programs is better than facilities or regulation



Sampling in Africa

Current method

1 sample every 100 km

30,500 km of total coastline

305 sample sites

Approximate cost

Site survey time: 45 minutes (2 people)

Transit time: 2.5 hours (average)

Australian Coast: 176 sample sites

19,320 km/90 days = 214 km/day covering 3 sites

US West Coast

2,900 km/14 days = 207 km/day covering 3 sites

Sampling in Africa

Key Considerations

- Site access
- Country jurisdictions/contributions

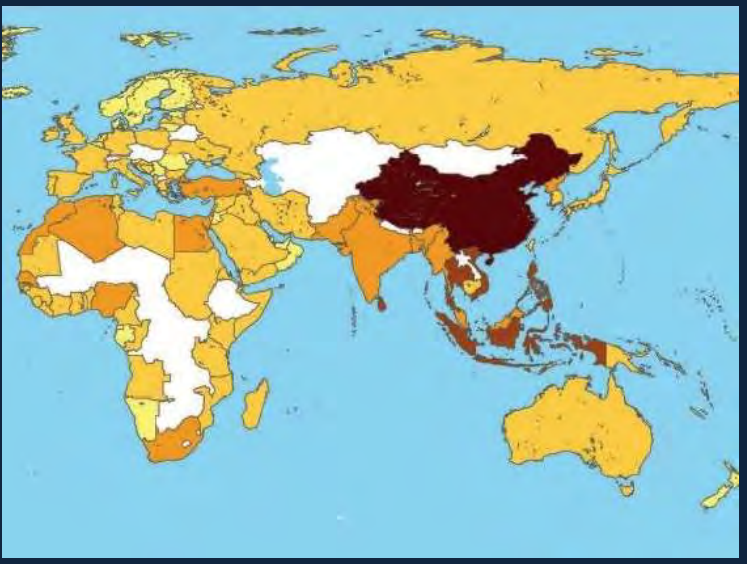
Design considerations

- Multiple samples per site
- Control of sampling effort
- Evenly and random site selection

Benefits

- Predict outside of sample locations
- Separating ocean, river, and land sources
- Identify drivers: land use, infrastructure, socio-economics

… A New project



Objectives

1. Validate estimates of pollution from lan
2. Identify hotspots for loss
3. Investigate driving variables

Initial Focus Areas: Asia and Africa

Global Land-based Litter to Oceans Project

Approach: Statistically robust sampling for UPLAND, COASTAL, RIVER, AT-SEA sites
Urban areas

Collaborative project

Surveys in collaboration with country partners

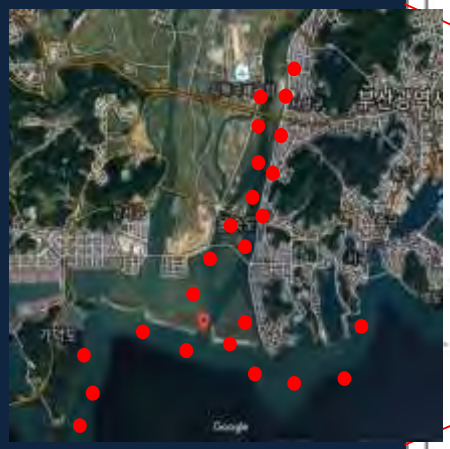
Capacity building: field and analysis training

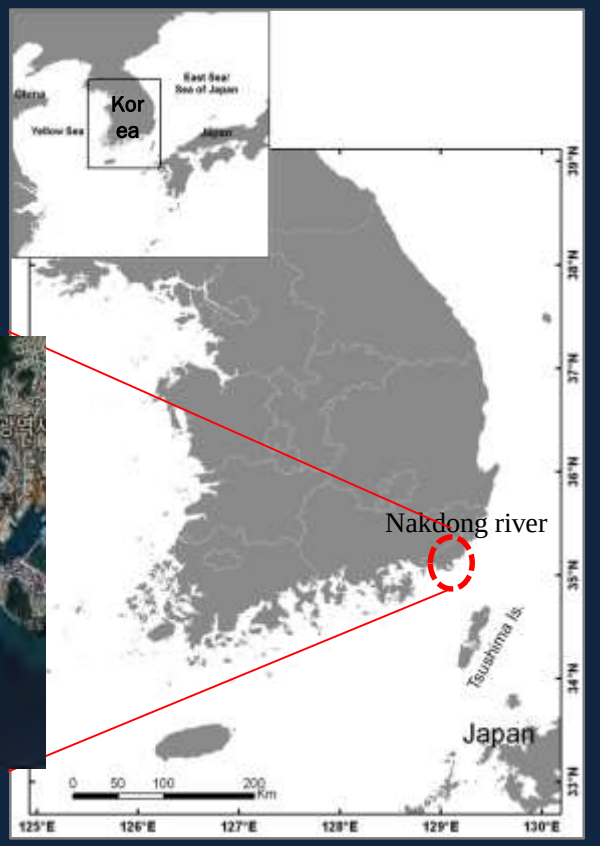
Sampling to estimate:

1. Load of solid waste on land as a source
2. Volume lost to the ocean
3. Leakage points

Developing models for:

1. Predicting sources
2. Pollution plume





Global Land-based Litter to Oceans Project

Partners: We can't do this without you!

Lead coordinating partner for Asia (OSEAN)

Country Partners

- Bangladesh
- China
- Korea
- Taiwan
- Vietnam

Other participating countries

India
Indonesia
Pakistan
Thailand
United States
South Africa

Global Land-based Litter to Oceans Project

Outcomes

- Well-designed sampling strategy
- A Global network of partners working together
- Comprehensive dataset
- Maps of plumes of plastic emerging from cities
- Capacity building for partners
- Country-level estimates and reports

A success story from Jakarta

Thank you

Denise Hardesty

t +61 3 6232 5276
e denise.hardesty@csiro.au
w www.csiro.au/science/marine-debris

Chris Wilcox

+61 3 6232 5306
chris.wilcox@csiro.au