



# Plug the marine litter tap

**A pilot study on potential marine  
litter sources in urban areas**



# **Plug the marine litter tap**

A pilot study on potential marine litter sources in urban areas

*Eva Blidberg and Elin Leander*

TemaNord 2017:501

### **Plug the marine litter tap**

A pilot study on potential marine litter sources in urban areas

*Eva Blidberg and Elin Leander*

ISBN 978-92-893-4836-2 (PRINT)

ISBN 978-92-893-4837-9 (PDF)

ISBN 978-92-893-4838-6 (EPUB)

<http://dx.doi.org/10.6027/TN2017-501>

TemaNord 2017:501

ISSN 0908-6692

Standard: PDF/UA-1

ISO 14289-1

© Nordic Council of Ministers 2017

Layout: NMR

Cover photo: unsplash.com

Printed in Denmark



Although the Nordic Council of Ministers funded this publication, the contents do not necessarily reflect its views, policies or recommendations.

### **Nordic co-operation**

*Nordic co-operation* is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland, and Åland.

*Nordic co-operation* has firm traditions in politics, the economy, and culture. It plays an important role in European and international collaboration, and aims at creating a strong Nordic community in a strong Europe.

*Nordic co-operation* seeks to safeguard Nordic and regional interests and principles in the global community. Shared Nordic values help the region solidify its position as one of the world's most innovative and competitive.

# Contents

Summary .....	5
Preface .....	7
1. Aims and background.....	9
2. Introduction .....	13
3. Legislation and strategies.....	17
3.1 Marine Strategy Framework Directive .....	17
3.2 Waste Framework Directive.....	19
3.3 Packaging and Packaging Waste Directive.....	19
3.4 Regional Action Plans .....	20
3.5 Circular economy in the EU.....	21
4. Sources of marine litter .....	23
4.1 Marine litter sources .....	23
4.2 Review of land-based marine litter sources .....	24
4.3 Marine litter indicators .....	25
5. Statistics .....	33
5.1 Statistics for potential land-based sources .....	33
6. Södertälje municipality, a case study .....	51
6.1 Case study of a municipality .....	51
7. General discussion and remarks .....	61
References.....	63
Swedish summary.....	65



# Summary

Marine litter is a growing environmental problem, especially plastic material is accumulated in the seas where it will fragment to smaller pieces. Marine litter has severe consequences for the marine life, as well as for economy and social development. Marine litter is high on the political agenda, and legislations, amongst all the Marine Strategy Framework Directive's descriptor 10 for determining good environmental status, aims at preventing waste to become marine litter. The purpose of the pilot study presented in this report is to raise awareness amongst officials at municipalities and authorities about the need to reduce the presence of litter in the marine environment and to give ideas/suggestions on how this can be done. The project has therefore developed a "Plug the Marine Litter Tap"-approach, which together with local knowledge and experience, can be used to identify sources of marine debris by using existing statistics. Södertälje is used as a pilot area where we give examples on indicators for marine litter in the urban environment and proposed measures for each indicator. We hope that this will encourage municipalities to reflect on how preventive measures against marine litter can be incorporated in local waste management plans and become part of their regular routine.



# Preface

This report is the outcome of the project “Marine litter and its sources in Nordic waters II” funded by the Nordic Waste Group (NAG) under The Nordic Council of Ministers in 2015–2016. The main aim of the project was to acquire knowledge of the major land-based litter sources affecting marine littering in the Nordic countries, thereby increasing knowledge of the relevant countermeasures. Since waste statistics do not tell us exactly what ends up in the sea, we have to use indirect information for the assessment. The project has developed a “Plug the Marine Litter Tap”-approach, a list of important potential local land-based sources of marine litter, that the individual municipality can evaluate based on their local knowledge. The approach is primarily designed to facilitate municipal efforts in combating marine litter.

The project group consists of Eva Blidberg and Elin Leander from the Keep Sweden Tidy Foundation. The Keep Sweden Tidy Foundation is a creator of public opinion that promotes recycling and combats litter through public awareness campaigns, awards and environmental education. The Foundation strives to influence people's attitudes and behaviour in order to encourage a sustainable development.

The project group would like to thank our Nordic colleagues; Hanna Haaksi at Keep the Archipelago Tidy, Sara Kline Waewer at the Danish Outdoor Council, Lise Gulbrandsen and Malin Jacob at Keep Norway Beautiful, and Anne Lise Bekken and Liv-Marit Hansen at Oslofjord Outdoor Recreation Council for information on their respective countries.

Further, the project group like to acknowledge Helena Dahlbo, Senior Research Scientist at the Finnish Environment Institute (SYKE), and the Nordic Waste Group for valuable comments on the report.



# 1. Aims and background

The main aim of this project is to increase knowledge about land-based sources of marine litter in the Nordic countries.<sup>1</sup> Moreover we hope to raise awareness amongst officials at municipalities and authorities about the need to reduce the presence of litter in the marine environment and to suggest ways of achieving this goal. A “Plug the Marine Litter Tap”-approach has therefore been developed. This approach is based on official statistics in order to develop existing knowledge about potential marine litter sources in urban areas. The overall goal is that the approach will help local authorities identify the urban sources of marine litter and thereby lead to cost-effective methods of reducing it. We would like to emphasise that local knowledge is a prerequisite for the approach to be successful.

A previous study on the sources of marine litter was conducted by Keep Sweden Tidy in conjunction with four other Nordic organisations. The core of that study was pick analyses of beach litter. The results showed that individual consumers accounted for 66–80% of the litter. 60–97% were short life/single use items and 54–78% of the items were packaging. The study also confirmed the most significant component material of marine litter is plastic (58–95%). (Blidberg *et al.*, 2015). It is also generally accepted that 80% of marine litter comes from land-based sources although this may vary between countries or regions.

---

<sup>1</sup> The overall marine litter situation in the Nordic countries is reviewed in Strand *et al.* (2015) in the Reference list.

Figure 1: Sorted beach litter from one of the pick analyses in the Nordic study in 2014 (Blidberg *et al.* 2015)



With this background we concluded that urban areas, especially near the coast, are important sources of marine litter. Candy packaging, coffee cups, ice cream sticks etc. which are thrown on the street may all end up in the aquatic environment due to winds or precipitation run-off. Poor waste management and overflow of sewage treatment plants are other sources/pathways of marine litter.

Many municipalities already employ preventive measures against littering and it should be noted that action taken against littering in urban areas also has the potential to improve the marine environment. However, with the alarming concerns about the impact of marine litter, local authorities are likely to have greater responsibility for prevention in the future. Even politicians are now taking the problem of marine litter seriously resulting in changes in legislation and policy (see Chapter 3). One

example is the Joint Nordic Statement on marine plastic litter and microplastics where Nordic Ministers of the Environment are in agreement on the issue,<sup>2</sup> its impact and the need for action. The document says, amongst other things, that they “Note with concern that marine plastic litter and microplastics is a rapidly increasing and serious threat to the marine environment, ecosystems and ecosystems services...” and that they “Agree on the need to assess the effectiveness of the relevant international and regional regulatory frameworks to combat marine plastic litter and microplastics...”

---

<sup>2</sup> Nordiska Ministerråd för Miljö (MR-R). Joint Nordic Statement on marine plastic litter and microplastics. Vedtaget 27/4 2016: LINK <http://www.norden.org/sv/nordiska-ministerraadet/ministerraad/nordiska-ministerraadet-foer-miljoe-mr-m/deklarationer-och-foerklaringar/joint-nordic-statement-on-marine-plastic-litter-and-microplastics-27.04-2016/>. Access: 2016-11-11.



## 2. Introduction

Unidentified pieces of plastic that originate from different kinds of single use packaging are the most common items found on Swedish beaches. This paints a pretty ugly picture of our habits and consumption patterns. (Håll Sverige Rent, 2016) It is not a big secret where all the marine litter comes from, it comes from you and me. Regardless of emotional impact of this realisation, it is a huge economic cost for society and it has a massive negative impact on the marine environment and its wildlife. The final cost is yet to be revealed.

**Figure 2: Marine litter (plastic fragments) that may end up on a beach somewhere**



Marine litter is defined as any persistent, manufactured or processed solid material discarded, disposed or abandoned in the marine coastal environment (UNEP, 2005), and we know by now that roughly 80% of marine litter originates on land. This is not only one of our biggest environmental problems, it is also a waste of resources that could have been recycled and reused (European Com-

mission, 2014). To reach our set aims of a good environmental status by 2020, we need to act now and with a common purpose.<sup>3</sup>

We need to reduce the amount of land sourced litter finding its way to the sea and becoming marine litter. It is both easier and more cost effective to plug the litter tap on land than working with end of pipe solution trying to pick up pieces of dispersed plastic in the oceans and on our beaches. As is often the case with marine environment issues, this is also best solved with cooperation between countries sharing the same sea. Marine litter knows no boundaries and it should be tackled across borders.

**Figure 3: Marine litter on the Swedish west coast**



---

<sup>3</sup> European Commission: LINK <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0056> . Access: 2016-11-11.

In the scope of this project has information about potential land-based litter sources in the Nordic countries been compiled on a local, regional and national level. Our case study from Södertälje with compiled statistic can be used by local authorities as an example of how to evaluate which indicators that affects the amount of marine litter most, enabling cost-effective preventive measures.



## 3. Legislation and strategies

Marine legislation and policy documents are necessary approaches in combatting marine litter. For the Nordic countries, EU legislation is especially important, since it is applicable in all EU countries. The Marine Strategy Framework Directive (MSFD) (2008/56/EC) is one of the most significant EU laws regulating the marine environment. The focus on marine litter increased when MSFD came into force. Marine litter is one of the eleven descriptors requiring national measures to achieve good environmental status. Another law that indirectly has great impact on marine litter is The Waste Framework Directive (2008/98/EC), as it regulates waste management. The Packaging and Packaging Waste Directive (94/62/EC) is also of great significance, since a large amount of packaging ends up as litter in the marine environment and on beaches. (Newman *et al.* 2013) These three laws are briefly presented below, together with two Regional Action Plans for the Baltic Sea (HELCOM) and the North Sea (OSPAR) and EU's Circular Economy Package.

Norway has several laws and regulations that are important for marine litter. The country is, however, not a member of the EU and has therefore not implemented MSFD. Nevertheless the management of marine resources in Norway is similar to the MSFD in many ways. Norway has also signed international agreements such as the OSPAR convention and also established management plans for their various marine environments e.g. Management of the Marine Environment of the Barents Sea and the Sea Areas of the Lofoten Islands. (SALT, 2015)

### 3.1 Marine Strategy Framework Directive

The EU's marine waters should achieve Good Environmental Status (GES) by 2020. This is regulated by the MSFD. It came into force on 15 June 2008 and was due to be implemented into national legislation by 15 July 2010. The aim is to protect our common marine resources. The MSFD has an ecosystem approach to the management of human activities with an impact on the marine environment, integrating the concepts of environmental protection and sustainable use.<sup>4</sup>

The MSFD, Annex I, considers 11 descriptors that define what constitutes a GES for different marine environments. Descriptor 10 focuses on marine litter, stating that a GES is achieved only when "properties and quantities of marine litter do not cause harm to the coastal and marine environment".

---

<sup>4</sup> European Commission: LINK <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0056>. Access: 2016-11-11.

Four qualitative indicators are set to determine GES with regard to marine litter: 1) marine litter on coastlines, 2) in the water column and on the seafloor, 3) micro-particles in the sea and, 4) litter ingested by marine animals.

The main indicator for marine litter pollution (10.1.1) is the amount of litter on the coastline, characterised as “trends in the amounts of litter washed ashore and/or deposited on coastlines, including analyses of its composition, spatial distribution and, where possible, source” (European Commission, 2010). It is further suggested that volunteers can be used to carry out surveys monitoring the amount of beach litter (JRC-IES, 2013).

According to the MSFD, each member state has to develop a Marine Strategy which includes an Action Plan to protect the marine environment and reach the goal of a GES. The measures included in the Marine Strategy should be implemented in 2016, and should for instance address marine litter.

In Sweden there is a monitoring programme established in 2014 (Havs- och vattenmyndigheten 2014) and a national Swedish Action Plan for the marine environment was adopted during 2015 (Havs- och vattenmyndigheten 2015). Five concrete measures against marine litter are determined. Those pertaining to local authorities are especially relevant for this pilot study. The measures are as follow:

- Promote efficient and sustainable collection and receipt of lost fishing equipment and to prevent future loss.
- In cooperation with the Environmental Protection Agency, develop a national information campaign targeted at the general public and consumers focusing on the negative impact of common litter objects in the marine environment, and the link to consumer behaviour.
- Supporting initiatives that promote, organize and carry out beach cleaning in particularly affected areas.
- Conducting strategic work by the inclusion of marine litter in the relevant waste management plans and programmes including the municipal waste management plans, where waste management implications for the incidence of marine litter are illuminated. Plastic waste streams need to be prioritized and approaches should be developed in order to reduce the occurrence of plastic items in marine waste.
- Revise the municipal waste management plan to identify and illustrate how to achieve a reduction in the amount of marine litter, and set targets for such work.

In Denmark, the national monitoring programme is run via the Danish Ministry of the Environment. Marine litter is measured on reference beaches around the Danish coast. One of the goals of the Marine Strategy is that the proportion of litter visitors leave at Danish beaches should decrease.

The Ministry of Environment in Finland cooperates with several authorities and institutions to coordinate their work on MSFD. There is a national monitoring programme which includes marine litter in its scope. The Finnish Environment Institute SYKE and its Marine Research Centre will be responsi-

ble for the bulk of this work. Keep the Archipelago Tidy monitor marine beach litter. There are three phases of litter management: Mapping of sources, development of management methods, and management in action. The most important current measure is the implementation of national waste legislation. In Finland recreational use of the sea and beaches, shipping, boating, spillover from wastewater treatment plants, stormwaters, and fishing have been identified as particularly excessive sources of marine litter. The programme also mentions that HELCOM approved a recommendation for reducing litter and the Marine Litter Action Plan for the Baltic Sea in 2015. Due to lack of information, it has been impossible to predict the status of littering in 2020.<sup>5</sup>

### 3.2 Waste Framework Directive

The Waste Framework Directive is EU legislation which aims to protect the environment and public health by improving the efficiency of resource management and preventing or reducing the adverse impact of waste. Waste is defined generally as “any substance or object which the holder discards or intends or is required to discard” with clarification of different types of waste. It also defines such concepts as recycling, recovery etc. The legislation is based upon the waste hierarchy which describes how member states should prioritize national legislation and policy on waste. The waste hierarchy advocates prevention, followed by preparation for reuse, material recycling, other recycling e.g. energy recovery, and finally disposal. The scheme applies on the condition that it is environmentally justified and economically feasible. The legislation requires the member states to adopt national prevention programmes with measures such as campaigns to raise awareness among businesses and the public.

The Waste Framework Directive states how waste management should be conducted including permissions and planning of waste management as well as administrative requirements. Two concepts are introduced: the “polluter pays principle” and the “extended producer responsibility”. The legislation includes two recycling and recovery targets: 50% for re-use and recycling of certain waste materials from households and other origins similar to households, and 70% for re-use, recycling and other recovery of construction and demolition waste. Both these goals should be achieved by year 2020.

### 3.3 Packaging and Packaging Waste Directive

The Packaging and Packaging Waste Directive sets rules on the production, marketing, use, recycling and refilling of containers of liquids for human consumption and on the disposal of used containers.

---

<sup>5</sup> Programme of measures of the Finnish marine strategy 2016–2021: [LINK file:///C:/Users/evbl/Downloads/FIN\\_PoM\\_of\\_marine\\_strategy\\_2016\\_2021.pdf](file:///C:/Users/evbl/Downloads/FIN_PoM_of_marine_strategy_2016_2021.pdf). Access: 2016-04-10.

During 2015 the Directive was revised to adopt Directive (EU) 2015/720 of the European Parliament and of the Council amending Directive 94/62/EC as regards the consumption of lightweight plastic carrier bags. The plastic and packaging industries have an important role to play in the reduction of waste e.g. by using less plastic materials and avoiding unnecessary packaging through smart design.

## 3.4 Regional Action Plans

### 3.4.1 HELCOM

Baltic Marine Environment Protection Commission – Helsinki Commission or HELCOM is a governing body of member states around the Baltic Sea cooperating to protect the marine environment from all sources of pollution including marine litter.

The Baltic Sea Action Plan (BSAP) is a policy document by HELCOM, adopted in 2007. The vision is to achieve good ecological status of the Baltic marine environment by 2021. BSAP works predominantly with the effects of eutrophication, biodiversity, hazardous substances and maritime activities. The aims are to set specific ecological objectives and measurable targets in line with the ecosystem approach. The goal is to implement these targets through national programmes and regional interventions.

Figure 4: The Marine litter action plan developed by HELCOM adopted in 2015



HELCOM Recommendation 36/1: Regional Action Plan for Marine Litter (RAP ML) was adopted in 2015 (HELCOM, 2015). The RAP ML aims to significantly reduce marine litter by 2025, compared to 2015, and to prevent harm to the coastal and marine environment. The action plan includes regional actions where the contracting parties have jointly agreed to begin implementation of actions and develop these actions into concrete measures to prevent and reduce marine litter. It also includes voluntary national actions. The proposed actions cover both land-based and sea-based sources of marine litter, as well as education and outreach on marine litter. Some of the actions in HELCOM are in correspondence with the activities within the OSPAR Regional Action Plan for Prevention and Management of Marine Litter.

#### **3.4.2**     *The OSPAR Convention*

The Convention for the Protection of the Marine Environment of the North-East Atlantic (The OSPAR Convention) aims at protecting and conserving the North-East Atlantic and its resources.<sup>6</sup> It includes prevention and elimination of several anthropogenic activities with a negative impact on the marine environment, e.g. waste dumping, offshore wind-farms and tourism. Monitoring programmes have been developed in relation to these human activities.

OSPAR Regional Action Plan for Prevention and Management of Marine Litter in the North-East Atlantic is a policy document that was agreed in 2014 (OSPAR Commission, 2014). The Action Plan presents the measures to be taken during the next few years by contracting parties in OSPAR. 15 Contracting Parties and the European Commission (EU) constitute the OSPAR Commission.

### **3.5**     **Circular economy in the EU**

#### **3.5.1**     *Circular economy*

In 2015, the European Commission adopted the “Circular Economy Package, which includes revised legislative proposals on waste” to stimulate Europe’s transition towards a circular economy (European Commission, 2015). The aims are to increase global competitiveness, promote sustainable economic growth and generate new jobs. It contains concrete actions with measures to make a product valuable during its whole life cycle i.e. from production and consumption to waste management. Secondary raw material will also have a market. In connection to the Circular Economy Package is a schedule when the actions should be completed.

---

<sup>6</sup> OSPAR Commission: LINK <http://www.ospar.org/convention>. Access: 2016–11–11.

Marine litter is mentioned in the section about plastic. It is stated that “Increasing plastic recycling is essential for the transition to a circular economy. The use of plastics in the EU has grown steadily, but less than 25% of collected plastic waste is recycled and about 50% goes to landfill. Large quantities of plastics also end up in the oceans, and the 2030 Sustainable Development Goals include a target to prevent and significantly reduce marine pollution of all kinds, including marine litter”. A strategy on plastics in the circular economy will be discussed by 2017 at the latest (European Commission, 2015). The commission will also take actions to reach the proposed aspirational target of “reducing marine litter by 30% by 2020 for the ten most common types of litter found on beaches, as well as for fishing gear found at sea, with the list adapted to each of the four marine regions in the EU” (European Commission, 2014). Marine litter is also addressed in connection with port reception facilities (European Commission, 2015).

## 4. Sources of marine litter

### 4.1 Marine litter sources

There are two main source streams for marine litter, land-based and sea-based. Information on land-based and sea-based litter sources, however, does not give much guidance on how to “Plug the Marine Litter Tap”. These sources have to be broken down to a more detailed level. Usually it is necessary to identify the different activities or sectors that generate waste and assess the risk for littering, whether intentional or accidental. In practically all cases, human behaviour and actions are behind the statistics.

Figure 5: Industrial areas close to the coast are potential land-based sources for marine litter



Statistics regarding land-based sources of marine litter can indicate possible litter hot-spots and in turn suggest areas where preventive measures will be most useful. For this study, a review of marine litter land-based sources in literature was made. A selection of these sources was investigated further by Statistics Sweden.

## 4.2 Review of land-based marine litter sources

For this pilot study, a review of available literature on land-based marine litter sources was made. The data used in these studies all originated from marine litter surveys on beaches. Several authors mention the problem of differentiating litter items since they may belong to both land- and sea-based sources or to multiple sectors, if looking at a more detailed level. However, based on best practice by the researchers and experts, the suggested source of litter found in the literature is presented in Table 1.

**Table 1: Summary of suggested land-based litter sources presented in the reviewed reports marked with a reference report number corresponding to 1) UNEP (2005), 2) Aniansson *et al.* (2007), 3) UNEP (2009), 4) Ocean Conservancy (2012), 5) Mehlhart and Blepp (2012), and 6) ARCADIS (2012)**

Land-based litter source	Reference report number					
	1	2	3	4	5	6
Agriculture					x	x
Construction and demolition					x	x
Discharge from stormwater drains	x		x			
Household waste					x	x
Industrial outfalls (accidental spills, solid waste from landfills, and untreated wastewater)	x		x		x	x
Littering of beaches and coastal picnic/ recreation areas			x			
Municipal sewage (untreated)	x	x	x		x	x
Port activities						x
Public littering		x				
Recreational boating*					x	x
Recreational fishing*					x	x
River and floodwaters	x		x			
Sanitary and medical waste (sewage-related waste)		x		x		
Shipbreaking yards			x			
Smoking-related activities				x		
Tourism and recreational use of the coasts	x		x	x	x	x
Waste collection transport/treatment					x	x
Waste from legal and illegal dumpsites located on the coast or river banks	x		x	x	x	x

Note: \*Categorised as land-based sources by the authors when included in tourism activities however they may also be sea-based activities.

### 4.3 Marine litter indicators

The potential litter sources summarised in Table 1 are not rated. The sources mentioned in most of the reports are also sources we consider to be important. This is based on many years of work with marine litter, experience from beach litter measurements, beach litter picking campaigns and litter surveys in urban areas.<sup>7</sup> Out of this, ten potential land-based litter indicators were selected to be investigated by Swedish statistics. Added to this list we also included geographical characteristics of coastal areas such as length of coastline and surface currents and population density in the municipality or catchment areas. This information can be used in relation to e.g. coastal tourism, so for instance a short coastline with many tourists will be more littered than a long coastline with fewer tourists. We also asked about statistics relating to costs for public sanitation. However, no country had information about this in official databases.

These indicators are selected for this pilot study:

- Tourism.
- Commercial ports.
- Coastal industries and manufacturing companies.
- Littering on land and coast.
  - Number of trash cans.
  - Litter surveys.
- Attitudes towards littering.
- Wastewater overflow management.
- Management of silage plastics from agricultural activities.
- Recreational boating.
- Traffic and transport on coastal roads.
- Landfills.
- Geographical characteristics of coastal areas.
  - Length.
  - Surface currents
- Population density.
  - Municipality.
  - Catchment areas.

---

<sup>7</sup> Keep Sweden Tidy, [www.hsr.se](http://www.hsr.se). In Swedish. Access: 2016-08-26.

The marine litter indicators that could be of importance which were not investigated by Sweden Statistics in this pilot study are:

- Number of bins in cities and communities per capita.
- The recycling rate of plastic.
- Areas of illegal dumping near coasts or rivers.
- Boating / transport on waterways – not at sea.
- Number of private sewers close to the sea.
- The collection and disposal of household waste.
- Construction and demolition sites (usually temporary but may be semi-permanent) – number and geographical location.
- Number of festivals / events per year that occur within a municipality.

**Figure 6: Full bins close to water are potential land-based sources to marine litter**



There are also places in urban areas which are so called litter generators, like public places where people are gathering, e.g. parks, snack bars and take-away restaurants, bus stops, open-air markets. Overflowing litter bins are also more common in places where there are many visitors. Therefore, it is important that officers from various departments in a municipality collaborate to identify sources,

ensuring that local knowledge is utilized. This should be acknowledged when using the “Plug the Marine Litter Tap”-approach.

#### 4.3.1 *Investigated marine litter indicators*

##### **Tourism**

It is well known that litter has a negative impact on the number of visitors/tourists although this has rarely been quantified. Many tourists are attracted to the coast and clean recreational areas (river banks, beaches) are important for coastal municipalities in that sense. (Rijkswaterstaat Waterdienst, 2012; Jang *et al.* 2014) However, coastal tourism in itself also creates litter that eventually ends up in the marine environment. Hotel nights, holiday villages, hostels are examples of official statistics that may indicate areas with many tourists in a municipality. Such statistics can also indicate seasonal fluctuations. In municipalities where the coastal tourism is high this is a marine litter indicator to be attentive to.

##### **Commercial ports**

Commercial ports are naturally located close to water, usually with a lot of transshipments and transports in connection to the landing of ships. There are specific rules on solid waste from port operations, ships and cargos, including the MARPOL Convention 1973/1978 – International Convention for Prevention of Pollution from Ships (Annexes I, II, III, IV and V),<sup>8</sup> amongst others. It is however likely that regulation and normal waste control has little effect on littering in port areas. Statistical information can be good indicator for local authorities when deciding if ports should be subject to preventive measures.

##### **Coastal industries and manufacturing companies**

It is not difficult to imagine that fast food restaurants, kiosks and other businesses that use different types of disposable plastic packaging are potential litter indicators. Single use plastic, food containers, wrappers find their way out to sea in pathways like canals, rivers, and stormwater drains. Relevant enterprises close to waterways or the coast can, together with local knowledge about the littering situation in the municipality, indicate potential marine litter sources where preventive measures should be considered.

---

<sup>8</sup> International Convention for the Prevention of Pollution from Ships (MARPOL): LINK [http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-\(MARPOL\).aspx](http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx). Access: 2016-09-09.

### Littering on land and coast

This indicator is divided in two: number of trash cans and litter surveys. Information about the number of trash cans should be presented, if possible on a municipal level. The correlation between the number of bins and the amount of littering is up for discussion. The second most common reason for deliberate littering is however that there is no trash can or that the trash cans are full (Håll Sverige Rent, 2015). This would suggest that local authorities need to think about the number and placement of bins and increase the number available near known litter generators. Additional consideration should be given to the problem of overspill, ensuring the bins are large enough or emptied often enough to avoid this.

Litter surveys increase knowledge of the problem and thereby contribute to its long-term solution. The results give an overview of the litter situation and support litter control and action programmes. Knowledge of the litter management situation and how it is changing is crucial for effective policy-making at National and EU level. Litter surveys also support urban litter control, identifying action areas and driving changes in attitude. Litter measurement can be carried out in different urban environments and areas e.g. parks, streets, and squares. There are several methods available and the Clean Europe Network is currently developing a common approach to measuring litter in cities and in rivers.<sup>9, 10</sup>

When doing beach surveys, both litter from visitors and litter that originates from the sea can be quantified. Just as in urban surveys, a number of methods are used to monitor beach litter. The latest overviews are compiled by UNEP (Cheshire *et al.*, 2009), and NOAA (Opfer *et al.*, 2012). In the North-East Atlantic and for some parts of the Baltic Sea, the OSPAR method is used. For other parts of the Baltic Sea, a modified UNEP method called MARLIN is in force. HELCOM works in the current situation of trying to harmonize monitoring methods of beach litter in the Baltic States. Additionally there are a number of mobile applications on the market with the aim of supporting “citizen science” in beach clean-ups.

The objectives of beach litter surveys are to:

- Quantify and categorize litter on beaches and ultimately develop ways to stop marine litter at source. Illustrate trends over time.
- Identify potential sources.
- Provide comparable data for the global, national, regional and local assessments of marine littering.
- Increase public awareness of marine littering and participation in preventive activities.

---

<sup>9</sup> Exampels from Keep Sweden Tidy: LINK <http://www.hsr.se/fakta/statistikportal/valkommen-till-hall-sverige-rents-statistikportal>. In Swedish. Access: 2016-11-11.

<sup>10</sup> Clean Europe Network: LINK <http://www.cleaneuropenetwork.eu/>. Access: 2016-09-09.

- Increase knowledge of marine littering and how it affects the ecosystem.

#### **Attitudes towards littering**

Littering may seem to be a very easy environmental problem to solve. If people stop throwing their waste in the wrong places and pick up after others, litter would be scarce. But human nature is complex and so is the problem of littering. Our habits and values as well as societal norms play a part, leading to behaviour which is known to be very difficult to change. Increasing knowledge does affect behaviour but knowledge alone will not solve the problem. Instead it is the context and presentation of how attitudes affect social problems that can lead to behavioral change (Kollmus and Agyeman, 2002). Understanding how local residents perceive litter and littering helps indicate which preventive measures should be deployed, and where, for greatest effectivity.

#### **Wastewater overflow management**

During heavy rain or melt-off, the capacity of sewer and stormwater systems can be exceeded and untreated sewage may be directly discharged into the environment. This increases the likelihood of marine litter. Even well-managed and well-optimized wastewater treatment plants can be exposed of both sewer and stormwater overflow. Therefore it is important that the wastewater treatment plants are optimized for the correct number pe to avoid incidents with wastewater overflow.

#### **Management of silage plastics from agricultural activities**

Agricultural activities are perhaps not the primary land-based sources that come to mind when considering urban areas. Agricultural land can nevertheless be found very close to cities in the Nordic countries. Statistics, local knowledge and litter monitoring can help determine whether or not there is a problem with silage plastic in a municipality.

#### **Recreational boating**

The source of litter created by private marinas could be classed as either sea-based or tourism/recreational. In this study we consider a boat in harbour to be a land-based source. However it is categorised, the crucial factor for marine litter is proximity to water and recreational boating increases the risk. An area with more marinas needs to take this into account.

#### **Traffic and transport on coastal roads**

Anyone who has ever been in a car on a highway will have noticed how readily litter gathers at the roadside. Usually local authorities are responsible for maintaining and cleaning the roads. However, coastal routes are naturally longer and more remote, so regular cleaning may be costly. They are also often in exposed areas, increasing the risk of litter being blown into the sea. In addition, more tourists mean more litter. Authorities need to consider all the factors when implementing counter-measures.

## Landfills

Landfills are the worst option in the waste management hierarchy and should be avoided wherever possible. The standard of landfills in Europe has, however, improved as a result of the EU Directive on the landfill of waste (99/31/EC). The objective of the Directive is to prevent or reduce as far as possible negative effects on the environment. The Landfill Directive defines the different categories of waste (municipal waste, hazardous waste, non-hazardous waste and inert waste) and applies to all landfills, defined as waste disposal sites for the deposit of waste onto or into land.

Figure 7: Landfill of household waste as we do not like it to be



Poorly managed landfills, where mountains of waste blow around in the wind, are hopefully a thing of the past in the Nordic countries. But even when landfills are managed by the rulebook, the risk of litter spreading is high. A landfill located near a river or the sea should be considered to be a potential land-based source of marine litter.

## Geographical characteristics of coastal areas

The first geographical characteristic investigated is the length of coastlines and beaches. This can be combined with other factors, such as the number of annual tourists. Melhart and Blepp (2012) investigated land-sourced litter in three different regions; the Baltic Sea, the North Sea and the Mediterranean, using pressure indicators. The authors made the following observations, taking into account the relative length of coastline:

- Population density, tourism and port activity were least important in the Baltic Sea.
- The North Sea has the highest level of commercial port activity.
- The Mediterranean Sea is most affected by local inhabitants and tourists, compared to the other two seas.

The second characteristic considered was surface currents. These currents influence where marine litter ends up, and can be an indicator useful in identifying litter hotspots.

#### **Population density**

Population density is another indicator that should be considered in conjunction with related factors. Normally, a higher population correlates to the amount of marine litter due to littering from inhabitants directly on the coastline or beaches. If the coastline however is inaccessible the impact of litter from visitors may be insignificant.



## 5. Statistics

### 5.1 Statistics for potential land-based sources

Statistics Sweden has compiled qualitative data about a number of selected indicators, based on potential influencing sources for marine litter (Table 2–16). The primary focus was on publicly available statistics produced by public authorities. The secondary goal was to establish which statistical sources are available to the public at a local authority level. The list also includes, where possible, the source of individual statistics and whether they apply on a national, regional or municipal level. The data is from Sweden, Finland, Norway and Denmark. The results from Statistics Sweden has been supplemented with additional information from Nordic colleagues.

The aim of this study is to increase knowledge of land-based sources of marine litter. To achieve this, it is also important to consider information which is not available. This can be useful for authorities, so that they can implement measures to monitor key indicators e.g. littering. We could not collect data for the following indicators (listed by country). Note that this does not mean that the statistics are not available, only that we could not find them within the framework of this project.

#### 5.1.1 *List of indicators where no compiled statistics were found*

##### Sweden

- Littering on land and coast, number of trash cans per capita.
- Litter survey on land and coast (a small number of municipalities).

##### Finland

- Attitudes towards littering.

##### Denmark

- Population density for catchment areas.
- Littering on land and coast, a) number of trash cans per capita.
- Litter surveys.
- Wastewater overflow management.
- Attitudes towards littering.

- Management of silage plastic from agricultural activities.

#### Norway

- Littering on land and coast, a) number of trash cans per capita.
- Attitudes towards littering.

### *5.1.2 Qualitative information for the selected indicators*

The tables below (Table 2–16) show qualitative information about the selected indicators which can be used in the "Plug the marine litter tap"-approach.

**Table 2: Tourism**

	Sweden	Finland	Norway	Denmark
Background	Statistics Sweden conducts a monthly collection of data such as the number of nights spent in hotels, holiday villages, hostels, campsites and commercially arranged private cottages and apartments.	Statistics Finland produces accommodation statistics that describe the supply and use of hotel services, and provide data on the number of users and overnight stays.	Statistics Norway produces accommodation statistics. The purpose of the statistics is to measure and compare the number and development of guest nights at Norwegian collective accommodation establishments.	Statistics Denmark produces accommodation statistics. The purpose of the statistics is to describe the structure and development of guest nights spent in hotels and similar establishments.
Reported	Accommodation statistics published on Statistics Sweden's website for finding statistics, subject business statistics (posted at the county level). LINK <a href="http://www.scb.se/NV1701">http://www.scb.se/NV1701</a>	Statistics Finland: LINK <a href="http://www.stat.fi/til/matk/index_en.html">http://www.stat.fi/til/matk/index_en.html</a> <a href="http://www.stat.fi/til/matk/index_en.html">http://www.stat.fi/til/matk/index_en.html</a> Information on the number of overnight stays is also available at the Visit Finland website: LINK <a href="http://visitfinland.stat.fi/PXWeb/pxweb/en/VisitFinland/?rxid=bogee2ee-0031-40d5-85a9-7ef77797450b">http://visitfinland.stat.fi/PXWeb/pxweb/en/VisitFinland/?rxid=bogee2ee-0031-40d5-85a9-7ef77797450b</a>	Statistics Norway: LINK <a href="https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=SumOvernMnd&amp;nvl=&amp;PLanguage=1&amp;nyTmpVar=true&amp;CMSSubjectArea=transport-og-reiseliv&amp;KortNavnWeb=overnatting&amp;StatVariant=&amp;checked=true">https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=SumOvernMnd&amp;nvl=&amp;PLanguage=1&amp;nyTmpVar=true&amp;CMSSubjectArea=transport-og-reiseliv&amp;KortNavnWeb=overnatting&amp;StatVariant=&amp;checked=true</a> <a href="https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=SumOvernMnd&amp;nvl=&amp;PLanguage=1&amp;nyTmpVar=true&amp;CMSSubjectArea=transport-og-reiseliv&amp;KortNavnWeb=overnatting&amp;StatVariant=&amp;checked=true">https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=SumOvernMnd&amp;nvl=&amp;PLanguage=1&amp;nyTmpVar=true&amp;CMSSubjectArea=transport-og-reiseliv&amp;KortNavnWeb=overnatting&amp;StatVariant=&amp;checked=true</a>	Statistics Denmark: LINK, <a href="http://statbank.dk/turist1">http://statbank.dk/turist1</a> LINK <a href="http://statbank.dk/2466">http://statbank.dk/2466</a>
Level	County, municipality or optional distribution	Municipality	County	Region (Municipal level available on a fee basis).
GIS possible	All hotels, youth hostels and campsites (active during 2008 or later) in the accommodation registry, records have coordinates in the format SWEREF99TM.			
Frequency	Monthly	Monthly	Monthly	Monthly
Start year	1978	1971	1950	1969

**Table 3: Commercial ports**

	Sweden	Finland	Norway	Denmark
Background	Transport analysis (TRAFKA) produces a survey relating to sea-going vessels calling at Swedish ports in commercial traffic. The organisation for Swedish Ports (Sveriges Hamnar) then processes this survey and reports data per port (only their member firms).	Finnish Transport Agency's website (Trafikverket) publishes statistics on international and domestic shipping. The statistics describe goods and passengers that entered Finnish ports. The Finnish Port Association publishes both the annual and monthly statistics on the information they receive from the member ports and Traffic Authority.	Statistics Norway provides statistics on marine transport. The purpose is to measure and describe the goods- and passenger transport at sea, and to compare it with other methods of transportation.	Statistics Denmark provides information about harbours and traffic in ports. The statistics are based on two separate data collections: Maritime traffic on larger Danish ports (quarterly) and Maritime traffic on minor Danish ports (annually). It is supplemented with information on goods on ferries from the data collection on Ferries and Passenger ships (quarterly).
Reported	The official statistics published by the Maritime Traffic Analysis Web site. LINK The processing of Swedish Ports member companies published on the Swedish Ports website. LINK <a href="http://www.transportforetagen.se/ForbundContainer/Svenska-hamnar/Branschfragor/Hamnstatistik/">http://www.transportforetagen.se/ForbundContainer/Svenska-hamnar/Branschfragor/Hamnstatistik/</a>	Information about domestic shipping on the Finnish Transport Agency's website. LINK <a href="http://www.liikennevirasto.fi/web/sv/startsidea">http://www.liikennevirasto.fi/web/sv/startsidea</a> Statistics on the Finnish Port Association member companies available. LINK <a href="http://www.finnports.com/eng/statistics/">http://www.finnports.com/eng/statistics/</a>	Statistics Norway: LINK <a href="https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=Godshavn&amp;nvl=&amp;PLanguage=1&amp;nyTmpVar=true&amp;CMSSubjectArea=transport-og-reiseliv&amp;KortNavnWeb=havn&amp;StatVariant=&amp;checked=true">https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=Godshavn&amp;nvl=&amp;PLanguage=1&amp;nyTmpVar=true&amp;CMSSubjectArea=transport-og-reiseliv&amp;KortNavnWeb=havn&amp;StatVariant=&amp;checked=true</a> <a href="https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=Godshavn&amp;nvl=&amp;PLanguage=1&amp;nyTmpVar=true&amp;CMSSubjectArea=transport-og-reiseliv&amp;KortNavnWeb=havn&amp;StatVariant=&amp;checked=true">https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=Godshavn&amp;nvl=&amp;PLanguage=1&amp;nyTmpVar=true&amp;CMSSubjectArea=transport-og-reiseliv&amp;KortNavnWeb=havn&amp;StatVariant=&amp;checked=true</a>	Statistics Denmark: LINK <a href="http://statbank.dk/10298">http://statbank.dk/10298</a> <a href="http://statbank.dk/10298">http://statbank.dk/10298</a>
Level			Port district	
GIS possible	No			
Frequency	Quarter and year	Monthly	Quarterly	See background
Start year	Starting in 1996, this survey is conducted according to EU directives.	1967	2002	

**Table 4: Coastal industries and manufacturing companies**

	Sweden	Finland	Norway	Denmark
Background	Statistics Sweden administers the business registry (FDB) which is a register of all companies, organizations and their workplaces. There are currently no developed statistics for coastal industries. It would nevertheless be possible with the help of FDB to retrieve information about the presence, size and type of business.	Statistics Finland maintains a Register of Enterprises and Establishments. It covers all enterprises, corporations and self-employed persons that are liable to pay value added tax or have paid employees. The Business Register data include e.g. enterprises' addresses which make it possible to compile information about coastal industries.	The Brønnøysund Register is a unit and enterprise registry that is responsible for registering all Norwegian and foreign entities and undertakings operating in Norway. At the moment there are no specific statistics for coastal enterprises.	Statistics Denmark has no available statistics on "coastal" industry – but all business statistics' could be tailor-made to focus on "coastal" areas, if these can be defined in a manner applicable to the data. This would be a fee-based task.
Reported	Statistics Sweden, FDB: LINK <a href="http://www.scb.se/sv_/Hitta-statistik/Statistik-efter-amne/Naringsverksamhet/Naringslivet-struktur/Foretagsdatabasen-FDB/">http://www.scb.se/sv_/Hitta-statistik/Statistik-efter-amne/Naringsverksamhet/Naringslivet-struktur/Foretagsdatabasen-FDB/</a>	Statistics Finland: LINK <a href="http://www.stat.fi/tup/yritysrekisteri/index_en.html">http://www.stat.fi/tup/yritysrekisteri/index_en.html</a>	The Brønnøysund Register Centre. LINK <a href="https://www.brreg.no/the-bronnoysund-register-centre/">https://www.brreg.no/the-bronnoysund-register-centre/</a> <a href="https://www.brreg.no/the-bronnoysund-register-centre/">https://www.brreg.no/the-bronnoysund-register-centre/</a>	Statistics Denmark, manufacturing industries: LINK <a href="http://www.dst.dk/en/Statistik/emner/industry">http://www.dst.dk/en/Statistik/emner/industry</a> Statistics Denmark, Enterprises in general: LINK <a href="http://www.dst.dk/en/Statistik/emner/virksomheder-generelt">http://www.dst.dk/en/Statistik/emner/virksomheder-generelt</a>
Level				
GIS possible				
Frequency		Annual		
Start year				

**Table 5: Littering on land and coast. Number of trash cans**

	Sweden	Finland	Norway	Denmark
Background	Some municipalities have detailed geographical information.	JLY-Finnish Solid Waste Association have detailed Geographic information showing the collection points and bins for recycling. Some municipalities also have geographical information about trash cans.		
Reported	No central reporting	No central reporting.	No statistics found.	No statistics found.
Level	Where it exists, there is information about specific bins.			
GIS possible	Yes, for those municipalities that have the GPS coordinates of the bins.			
Frequency	Not relevant.	Not relevant.		
Start year				

**Table 6: Littering on land and coast. Litter surveys**

	Sweden	Finland	Norway	Denmark
Background	Litter surveys are optional to implement and aimed primarily at municipalities. Two methods are available, one for streets and one for parks and other open spaces. Overall, about 20 municipalities have been active in the measurements. Monitoring of marine beach litter is conducted at six reference beaches in Bohuslän and at ten reference beaches along the rest of the Swedish coastline. The results are available at a Keep Sweden Tidy database LINK. A password is required.	Monitoring of beach litter data is conducted by Keep the Archipelago Tidy. Measurements are done three times per year and the results are available at a Keep Sweden Tidy database LINK. A password is required.	Information about marine littering can be found in the report: <i>Kunnskap om marin forsopling i Norge 2014</i> . This report is an updated compilation (first report in 2010) of existing knowledge on marine litter in the Norwegian seas and coastal areas.	The national monitoring programme is initiated by the Danish Nature Agency at the Ministry of Environment and Food. Monitoring of marine beach litter is conducted on five reference beaches. Measurements are done three times per year. Information about marine litter is available in the report: <i>Status on beach litter monitoring 2015</i> .
Reported	By The Keep Sweden Tidy Foundation. LINK <a href="http://www.hsr.se/">http://www.hsr.se/</a>	By The Keep Sweden Tidy Foundation. LINK <a href="http://www.hsr.se/">http://www.hsr.se/</a>	State of the Environment Norway: LINK <a href="http://www.miljostatus.no/Tema/Avfall/Forsopling-av-havet/">http://www.miljostatus.no/Tema/Avfall/Forsopling-av-havet/</a> Publication <i>Kunnskap om marin forsopling i Norge 2014</i> : LINK <a href="http://www.miljodirektoratet.no/Documents/publikasjoner/M265/M265.pdf">http://www.miljodirektoratet.no/Documents/publikasjoner/M265/M265.pdf</a>	<a href="http://www.miljodirektoratet.no/Documents/publikasjoner/M265/M265.pdf">http://www.miljodirektoratet.no/Documents/publikasjoner/M265/M265.pdf</a> <a href="http://www.miljodirektoratet.no/Documents/publikasjoner/M265/M265.pdf">http://www.miljodirektoratet.no/Documents/publikasjoner/M265/M265.pdf</a> Publication <i>Status on beach litter monitoring 2015</i> : LINK <a href="http://dce2.au.dk/pub/SR177.pdf">http://dce2.au.dk/pub/SR177.pdf</a>
Level	At the level of urban area (for measurements on the street) and on parts of urban areas (for parks and other open spaces). At the level of beach.	At the level of beach.		At the level of beach.
GIS possible	Yes, all completed surveys so far are performed with the GPS coordinates as sample.	Yes, all completed surveys so far are performed with the GPS coordinates as sample.		Yes, all completed surveys so far are performed with the GPS coordinates as sample.
Frequency	Usually annual for the towns / regions participating. Beach litter measurements are done three times per year.	Beach litter measurements are done three times per year.	2010, 2015	Beach litter measurements are done three times per year.
Start year	2009 street and 2013 parks / open spaces. 2012 beach litter. But not all surveys are from that first year.	2012		2015

**Table 7: Attitudes towards littering**

	Sweden	Finland	Norway	Denmark
Background	Included as an optional additional part of Statistics Sweden's voluntary citizen survey. 27 municipalities in total have at some point implemented this addition and about 5 municipalities are recurrent.			
Reported	Statistics Sweden website "Services". LINK <a href="http://www.scb.se/sv/_Vara-tjanster/Insamling-och-undersokning/SCBs-medborgarundersokning/">http://www.scb.se/sv/_Vara-tjanster/Insamling-och-undersokning/SCBs-medborgarundersokning/</a>	No statistics found.	No statistics found.	No statistics found.
Level	Municipal			
GIS possible	Not relevant.			
Frequency	Spring and autumn			
Start year	Additional questions added 2011.			

**Table 8: Wastewater overflow management**

	Sweden	Finland	Norway	Denmark
Background	<p>Currently there are no consolidated statistics on the frequency of wastewater overflow at sewage treatment plants or sewage systems. Information about overflows at sewage treatment plants are however available in SMP (Svenska Miljörapporteringsportalen), and would be possible to compile.</p> <p>For statistics on the management of wastewater from municipal wastewater treatment plants and some industries, see Statistics Sweden's publication "Utsläpp till vatten och slamproduktion". LINK <a href="http://www.scb.se/sv/_Hitta-statistik/Statistik-efter-amne/Miljo/Utslapp/Utslapp-till-vatten-och-slamproduktion---Kommunala-reningsverkskogsindustri-samt-viss-ovrig-industri/">http://www.scb.se/sv/_Hitta-statistik/Statistik-efter-amne/Miljo/Utslapp/Utslapp-till-vatten-och-slamproduktion---Kommunala-reningsverkskogsindustri-samt-viss-ovrig-industri/</a></p>	<p>Data on the annual loads and sludge from individual wastewater treatment plants can be obtained from the database maintained by the Finnish Environment administration. LINK <a href="http://www.ymparisto.fi/fi-FI">http://www.ymparisto.fi/fi-FI</a></p>	<p>It is possible that the Norwegian Water has statistics on waste water overflow, but this has not been possible to confirm within the framework of this project. LINK <a href="https://www.norsk vann.no/">https://www.norsk vann.no/</a></p>	
Reported	See background.	See background.	See background.	No statistics found.
Level				
GIS possible				
Frequency				
Start year				

**Table 9: Management of silage plastics from agricultural activities**

	Sweden	Finland	Norway	Denmark
Background	Svepretur is a trade association that gathers silage plastics. The collection is voluntary for operators. However, there is great coverage.	Ekokem Ltd collects and recovers agricultural plastics. The waste management companies who have environmental permits are required to report to the national VAHTI data system on the amounts and quality of waste they handle. Additionally, the collectors have to do bookkeeping.	Green dot Norway pcl are responsible for the recycling of silage plastics and other waste used in agriculture. The company has contract with local recycling stations where it is possible to leave the waste for free.	
Reported	By the Environmental Protection Agency in the publications: Avfall i Sverige 2010 (regarding 2003–2010) and Avfall i Sverige 2012 (regarding 2010–2012).	The amount of agricultural plastic is reported in a national report "Promoting the recycling of plastic packaging in Finland.	The amount of standard plastic packaging from agriculture activities can be found at Green Dot Norway pcl homepage. LINK <a href="https://www.grontpunkt.no/hva-er-gr%C3%B8nt-punkt/fakta-og-tall">https://www.grontpunkt.no/hva-er-gr%C3%B8nt-punkt/fakta-og-tall</a>	No statistics found.
Level	At the national level for general publication. For data on a finer or more local level, a question can be asked to Svepretur. However, they are not required to disclose the data.		At a national level for general publication. For data on a finer or more local level, it may be possible to receive those data from the company on request	
GIS possible	Not relevant			
Frequency	Yearly		Yearly	
Start year	2003		From 2008 (official data at their homepage)	

**Table 10: Recreational boating**

	Sweden	Finland	Norway	Denmark
Background	Swedish Marinas (Svenska Gästhamnar) maintains a record of all the marinas that offer places for visiting, currently about 590 ports. Swedish Marinas collects statistics about the number of overnight boats in the Swedish guest harbours.	Finnish Guest harbours can be found with geographic information. No central reported statistics for number of overnight boats.	It is possible that the Norwegian Coastal Administration or Norwegian Maritime Authority have statistics on recreational boating and marinas, but it has not been possible to confirm within the framework of this project. The Norwegian Coastal Administration LINK <a href="http://www.kystverket.no/en">http://www.kystverket.no/en</a> , the Norwegian Maritime Authority LINK <a href="https://www.sjofartsdir.no/en/">https://www.sjofartsdir.no/en/</a>	Statistics Denmark provides information about marinas. The purpose of the statistics is to describe the structure and development of nights spent by visiting yachts in marinas and harbours. The most important variables are: Nights stayed per group by nationality.
Reported	Swedish Marinas has a register that is available. LINK <a href="http://www.svenskagasthamnar.se/se/">http://www.svenskagasthamnar.se/se/</a> Swedish Marinas can be reached by telephone: +46707-619 140.	Guest harbours: LINK	See background.	Statistics Denmark: LINK <a href="http://www.statbank.dk/10199">http://www.statbank.dk/10199</a>
Level		Municipality		Region, water
GIS possible	Yes			
Frequency	Updated continuously	Updated continuously		Annual, monthly for Summer
Start year				1991

**Table 11: Traffic and transport on coastal roads**

	Sweden	Finland	Norway	Denmark
Background	There are many thousands of measurement points / distances on the national road network. Through these, data can be generated on traffic flow on the roads at a very detailed level.	The Finnish Transport Agency produces statistics on transport and transport infrastructure. The regional classification is made according to road districts but part of the data is also presented according to the municipalities and provinces.	Statistics Norway provides statistics on Road Network and Road Traffic. The statistics contain information on roads by category, road maintenance and investments and traffic performance. The Directorate of Public Roads (Vegdirektoratet) also publishes a Road Traffic Index.	Statistics Denmark is providing statistics containing information of roads by category, road maintenance and investments and traffic performance. No statistics specifically for coastal roads – however tables on traffic for specific roads below.
Reported	On Trafikverket’s website, people can collect statistics using the road traffic flow map. LINK <a href="http://www.trafikverket.se/tjanster/trafikjanster/Vagtrafik--och-hastighetsdata/Kartor-med-trafikfloden/">http://www.trafikverket.se/tjanster/trafikjanster/Vagtrafik--och-hastighetsdata/Kartor-med-trafikfloden/</a>	Statistics Finland: LINK <a href="http://www.stat.fi/til/tiet/index_en.html">http://www.stat.fi/til/tiet/index_en.html</a> The Finnish Transport Agency: LINK <a href="http://www.liikennevirasto.fi/web/en/statistics/road-statistics--VoAonMblung">http://www.liikennevirasto.fi/web/en/statistics/road-statistics--VoAonMblung</a> <a href="http://www.liikennevirasto.fi/web/en/statistics/road-statistics--VoAonMblung">http://www.liikennevirasto.fi/web/en/statistics/road-statistics--VoAonMblung</a>	Statistics Norway: LINK <a href="https://www.ssb.no/statistikkbanken/selecttable/hovedtabellHjem.asp?KortNavnWeb=klreg&amp;CMSSubjectArea=transport-og-reiseliv&amp;PLanguage=1&amp;checked=true">https://www.ssb.no/statistikkbanken/selecttable/hovedtabellHjem.asp?KortNavnWeb=klreg&amp;CMSSubjectArea=transport-og-reiseliv&amp;PLanguage=1&amp;checked=true</a> The Directorate of Public Roads: LINK <a href="http://www.vegvesen.no/Fag/Trafikk/Trafikkdata/Vegtrafikkindeks">http://www.vegvesen.no/Fag/Trafikk/Trafikkdata/Vegtrafikkindeks</a>	Statistics Denmark: LINK <a href="http://h/">http://h/</a> <a href="http://h/">http://h/</a>
Level	Measuring points / distances	Road district/ Municipality	Municipality	Roads
GIS possible	Yes, the GPS coordinates are available but they need to be downloaded from the traffic map. Or order a special extraction from the database.			
Frequency	Measured with different frequencies and cycles.		Annual	Annual
Start year	Today, there are comparative values in digital form back to 1994 and comparisons to 1973. However, note that it is with varying quality. On the Swedish Transport Administration’s website there are annual statistics since 2004–2005.			1990

**Table 12: Landfills**

	Sweden	Finland	Norway	Denmark
Background	The Swedish Waste Management Association has a database about waste management in Sweden including landfill statistics. The database is available for members.	Statistics Finland has a website which provides information about waste and landfills in Finland.	The Norwegian PRTR website provides information about discharges to air and water, waste transfers, production volumes and energy use for the most of the emission sources in Norway. A list of available landfills.	The Waste Department of the Danish Environmental Agency has geodata describing landfills.
Reported	The Swedish Waste Management Associations homepage: LINK <a href="http://www.avfallsverige.se/">http://www.avfallsverige.se/</a> Annual report in Swedish: LINK <a href="http://www.avfallsverige.se/fileadmin/uploads/Statistikfiler/SAH_2015.pdf">http://www.avfallsverige.se/fileadmin/uploads/Statistikfiler/SAH_2015.pdf</a> Annual report in English: LINK <a href="http://www.avfallsverige.se/fileadmin/uploads/Statistikfiler/SAH_2015.pdf">http://www.avfallsverige.se/fileadmin/uploads/Statistikfiler/SAH_2015.pdf</a>	Official Statistics of Finland (OSF): Waste statistics [e-publication]. ISSN=2323-5314. 2013. Helsinki: Statistics Finland [referred: 11.10.2016]. Access method: LINK <a href="http://www.stat.fi/til/jate/2013/jate_2013_2014-11-27_tie_001_en.html">http://www.stat.fi/til/jate/2013/jate_2013_2014-11-27_tie_001_en.html</a>	The Norwegian PRTR: LINK <a href="http://www.norskeutslipp.no/no/Deponier/?SectorID=300">http://www.norskeutslipp.no/no/Deponier/?SectorID=300</a> <a href="http://www.norskeutslipp.no/no/Deponier/?SectorID=300">http://www.norskeutslipp.no/no/Deponier/?SectorID=300</a>	Inquiries regarding coordinates of landfills are made to: LINK <a href="http://mst.dk/virksomhed-myndighed/affald/affalddatasystemet/">http://mst.dk/virksomhed-myndighed/affald/affalddatasystemet/</a>
Level				Point level
GIS possible				Yes, see above.
Frequency				
Start year				2011

**Table 13: Geographical characteristics of coastal areas. Length**

	Sweden	Finland	Norway	Denmark
Background	Data available regarding the coastal and beach length at sea, sea islands, lakeshores, rivers and islands in lakes.	Statistics Finland provides the National Land Survey which is a publication regarding both real estate duties and mapping duties. Data available regarding territorial waters, islands, rivers and seas.	The Norwegian Mapping Authority (Kartverket) has information about the country's administrative units and departments and areas adjacent to water. LINK <a href="http://www.kartverket.no/">http://www.kartverket.no/</a>	The Danish Coastal Authority (Kystdirektoratet) is the official coastal government agency – a division of The Danish Ministry of the Environment. The coastal authority is an independent authority covering all of Denmark's 7,300 km of coastline.
Reported	At Statistics Sweden's webpage under "Kust, stränder och öar". LINK <a href="http://www.scb.se/sv/_Hitta-statistik/Statistik-efter-amne/Miljo/Markanvandning/Kust-strander-och-oar/">http://www.scb.se/sv/_Hitta-statistik/Statistik-efter-amne/Miljo/Markanvandning/Kust-strander-och-oar/</a>	Statistics Finland, year book: LINK <a href="http://pxweb2.stat.fi/sahkoiset_julkaisut/vuosikirja2014/html/ruoto007.htm">http://pxweb2.stat.fi/sahkoiset_julkaisut/vuosikirja2014/html/ruoto007.htm</a> <a href="http://pxweb2.stat.fi/sahkoiset_julkaisut/vuosikirja2014/html/ruoto007.htm">http://pxweb2.stat.fi/sahkoiset_julkaisut/vuosikirja2014/html/ruoto007.htm</a> Statistics Finland: LINK <a href="http://h/">http://h/</a>	The Norwegian Mapping Authority: LINK <a href="https://kartkatalog.geonorge.no/search">https://kartkatalog.geonorge.no/search</a> <a href="https://kartkatalog.geonorge.no/search">https://kartkatalog.geonorge.no/search</a>	The Danish Coastal Authority: LINK <a href="http://eng.kyst.dk/">http://eng.kyst.dk/</a> <a href="http://eng.kyst.dk/">http://eng.kyst.dk/</a> Statistics Denmark: LINK <a href="http://www.dst.dk/en/Statistik/emner/areal/arealanvendelse">http://www.dst.dk/en/Statistik/emner/areal/arealanvendelse</a>
Level	Municipal			
GIS possible	The material is developed using GIS. With the help of master data, you can manually retrieve the other levels.	Yes	Yes	
Frequency	Not relevant because the data are relatively static.	Continuous		
Start year	2012	About hundred years ago		

**Table 14: Geographical characteristics of coastal areas. Surface currents.**

	Sweden	Finland	Norway	Denmark
Background	The layer can be up to 100 meters deep. When the wind blows over the ocean surface, it forms waves and also a surface water stream. This is influenced by the earth's rotation and the net stream moves 45 degrees to the right of the wind.	The Finnish Meteorological Institute (FMI) is developing its new online service for data. The FMI will share data on e.g. Marine observations.	The Institute of Marine Research (Havforskningsinstituttet) is Norway's largest centre for marine science. State of the Environment Norway (Miljøstatus) is a cooperation between environmental authorities in Norway. The Norwegian Environment Agency has the overall editorial responsibility.	The Danish Meteorological Institute (DMI) collects and processes meteorological, climatological and oceanographic measurements/observations, and measures, collects and compiles related geophysical parameters throughout the Realm.
Reported	A variety of indicators in the subject reported on SMHI's website. Some stations are closed. LINK <a href="http://www.smhi.se/klimatdata/oceanografi/havsstrommar">http://www.smhi.se/klimatdata/oceanografi/havsstrommar</a>	Finnish Meteorological Institute: LINK <a href="http://sv.ilmatietaenlaitos.fi/datamaterial-som-oppnas">http://sv.ilmatietaenlaitos.fi/datamaterial-som-oppnas</a> <a href="http://sv.ilmatietaenlaitos.fi/datamaterial-som-oppnas">http://sv.ilmatietaenlaitos.fi/datamaterial-som-oppnas</a>	Information on surface water streams is published on the following websites: The Institute of Marine Research: LINK <a href="http://www.imr.no/temasider/kyst_og_fjord/den_norske_kyststrommen/nb-no">http://www.imr.no/temasider/kyst_og_fjord/den_norske_kyststrommen/nb-no</a> <a href="http://www.imr.no/temasider/kyst_og_fjord/den_norske_kyststrommen/nb-no">http://www.imr.no/temasider/kyst_og_fjord/den_norske_kyststrommen/nb-no</a> State of the Environment Norway: LINK <a href="http://www.miljostatus.no/Tema/Hav-og-kyst/Havstrommer/">http://www.miljostatus.no/Tema/Hav-og-kyst/Havstrommer/</a>	The Danish Meteorological Institute: LINK <a href="http://www.dmi.dk/en/hav/maalingers/troem/">http://www.dmi.dk/en/hav/maalingers/troem/</a> <a href="http://www.dmi.dk/en/hav/maalingers/troem/">http://www.dmi.dk/en/hav/maalingers/troem/</a>
Level	Measuring stations			
GIS possible	Yes, through coordinates for every measuring station			
Frequency	Hourly			
Start year	Different for every station, see availability matrix. LINK <a href="http://www.smhi.se/hfa_coord/BOOS/dbkust/Availability_Currents_SMHI.htm">http://www.smhi.se/hfa_coord/BOOS/dbkust/Availability_Currents_SMHI.htm</a>			

**Table 15: Population density. Municipality**

	Sweden	Finland	Norway	Denmark
Background	Population statistics are based on the information on registered residents by the Tax Authority, information which is shared with Statistics Sweden.	Statistics Finland provides statistics on the structure of the population. The statistics are available on municipal level.	Statistics Norway provides statistics on the composition of the population over time. The statistics are available at municipal level since 2000.	Statistics Denmark provides population statistics and statistics on municipalities.
Reported	At Statistics Sweden's webpage "Population Statistics". LINK <a href="http://www.scb.se/hitta-statistik/statistik-efter-amne/befolkning/befolkningens-sammansattning/befolkningsstatistik/">http://www.scb.se/hitta-statistik/statistik-efter-amne/befolkning/befolkningens-sammansattning/befolkningsstatistik/</a>	Statistics Finland: LINK <a href="http://www.stat.fi/til/vaerak/tauen.html">http://www.stat.fi/til/vaerak/tauen.html</a>	Statistics Norway: LINK <a href="https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=NY3026&amp;nvl=&amp;PLanguage=0&amp;nyTmpVar=true&amp;CMSSubjectArea=befolkning&amp;KortNavnWeb=folkemengde&amp;StatVariant=&amp;checked=true">https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=NY3026&amp;nvl=&amp;PLanguage=0&amp;nyTmpVar=true&amp;CMSSubjectArea=befolkning&amp;KortNavnWeb=folkemengde&amp;StatVariant=&amp;checked=true</a> <a href="https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=NY3026&amp;nvl=&amp;PLanguage=0&amp;nyTmpVar=true&amp;CMSSubjectArea=befolkning&amp;KortNavnWeb=folkemengde&amp;StatVariant=&amp;checked=true">https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=NY3026&amp;nvl=&amp;PLanguage=0&amp;nyTmpVar=true&amp;CMSSubjectArea=befolkning&amp;KortNavnWeb=folkemengde&amp;StatVariant=&amp;checked=true</a> <a href="https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=NY3026&amp;nvl=&amp;PLanguage=0&amp;nyTmpVar=true&amp;CMSSubjectArea=befolkning&amp;KortNavnWeb=folkemengde&amp;StatVariant=&amp;checked=true">https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&amp;ProductId=&amp;MainTable=NY3026&amp;nvl=&amp;PLanguage=0&amp;nyTmpVar=true&amp;CMSSubjectArea=befolkning&amp;KortNavnWeb=folkemengde&amp;StatVariant=&amp;checked=true</a>	Density can be calculated by municipalities from the tables linked below. LINK, <a href="http://statbank.dk/are207">http://statbank.dk/are207</a> LINK <a href="http://statbank.dk/statbank5a/search2003/searchresult.asp?place=statbank&amp;PLanguage=1&amp;searchtext=folk1">http://statbank.dk/statbank5a/search2003/searchresult.asp?place=statbank&amp;PLanguage=1&amp;searchtext=folk1</a>
Level	Municipality, also some statistics available for urban/small towns.	Municipality	Municipality	Municipality
GIS possible	Yes			
Frequency	Annual	Annual	Annual	Annual
Start year	1991	1950	1970 (2000 on municipal level)	

**Table 16: Catchment areas**

	Sweden	Finland	Norway	Denmark
Background	Population waterfront location. Registered less than 100 m from water's edge. (Inland and sea water, water more than 6m.)	Data can be generated by using Value-tool, developed by SYKE, specifying the catchment area and combining this with data from geoinformatic systems.	The Norwegian Water Resources and Energy Directorate (NVE) is a directorate under the Ministry of Petroleum and Energy. NVE provides the database REGINE (REGIster over NEdbørfelt) in which information can be found regarding population in catchment areas.	
Reported	At Statistics Sweden web page "Kust, stränder och öar". LINK <a href="http://www.scb.se/sv/_Hitta-statistik/Statistik-efter-amne/Miljo/Markanvandning/Kust-strander-och-oar/">http://www.scb.se/sv/_Hitta-statistik/Statistik-efter-amne/Miljo/Markanvandning/Kust-strander-och-oar/</a>	Finnish Environment Institute, SYKE.	The Norwegian Water Resources and Energy Directorate: LINK <a href="https://www.nve.no/karttjenester/kartdata/vassdragdata/nedboerfelt-regine/">https://www.nve.no/karttjenester/kartdata/vassdragdata/nedboerfelt-regine/</a>	No statistics found.
Level	Municipal			
GIS possible	The material is developed using GIS. With the help of master data, you can manually retrieve the other levels.			
Frequency	Data exists for 2013, no decision yet for when data will be produced again.			
Start year	2013			

## 6. Södertälje municipality, a case study

In this easy to use “Plug the Marine Litter Tap” -approach we provide the information needed to determine which indicators to target with measures for reducing marine litter. The first step is to identify potential marine litter sources in the chosen area. By applying a selection of indicators to a chosen area, e.g. a municipality, local knowledge can be added to determine which indicators exert the most influence. This list can then be used to effectively search the statistics. The sources of the statistics are shown in the approach, and analysis of this data enables the municipality to employ targeted preventive measures. If the region or municipality is not yet measuring litter, a good idea is to start with that to establish a baseline for comparison and to measure the effect targeted measures have had.

This case study for the municipality of Södertälje shows how useful the statistics can be and propose some measures.

### 6.1 Case study of a municipality

We have investigated the municipality of Södertälje, population 93,000, 35 km south of Stockholm and with close proximity to the Baltic Sea. Södertälje is a popular tourist area but also has sizeable industrial areas.

We used the list of indicators and applied them on our chosen municipality, and for this example a couple of them stood out. See Table 2–16, List of Qualitative information for the selected indicators, for a breakdown of the statistics of the specific indicators.

#### 6.1.1 *Tourism*

##### **General information**

Statistics Sweden gathers data on the number of nights spent in hotels, holiday villages, hostels, campsites etc and publishes the statistics on their website on a monthly basis.

## Result

Tourism is a common source of income for a municipality and to attract tourists, especially return visitors, a clean environment is crucial. However, studies show that tourists are more prone to littering than local residents, so this is an important indicator. High numbers of tourists in a particular area or a particular season require special attention if authorities are to act in reducing marine litter. This is even more important in places like Södertälje where the bulk of tourist accommodation is situated on the coast (Figure 8 and Figure 9). Plastic litter on the beach, for instance, is easily washed out to sea, contributing to the problem.

Figure 8: Number of tourist accommodations in Södertälje grouped into hotels/hostels and campsites

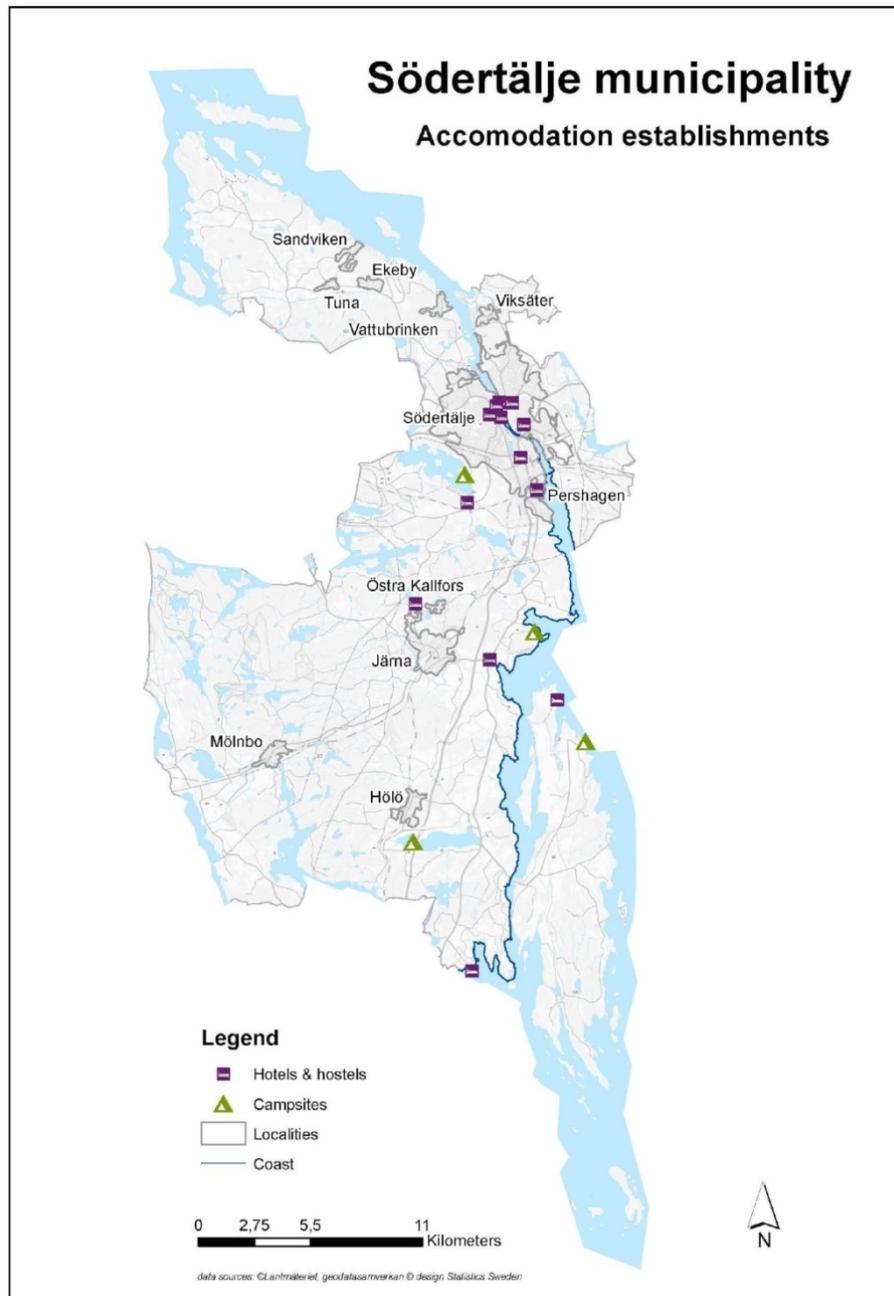
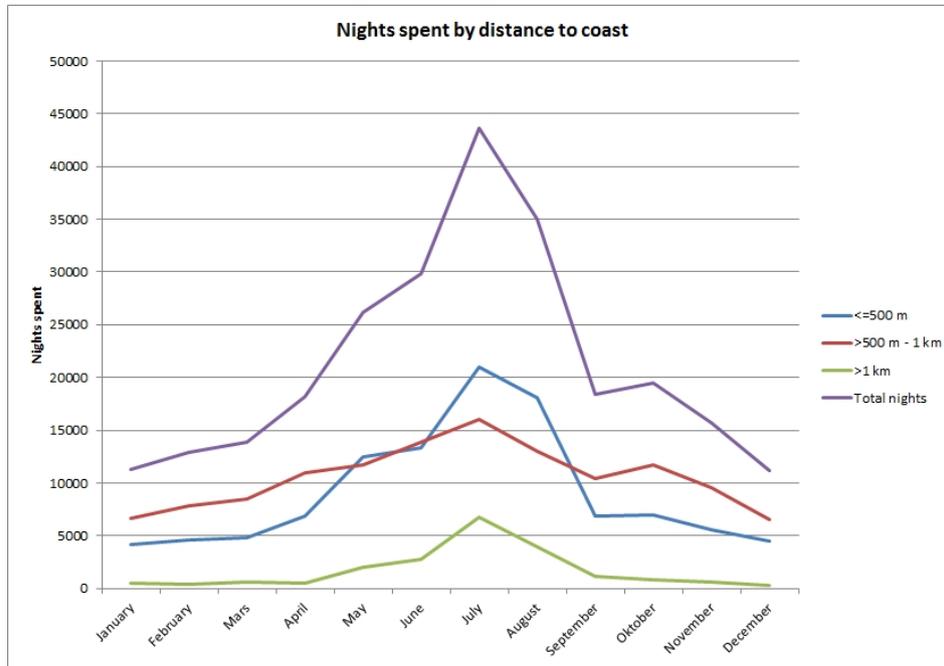


Figure 9: Number of guest nights grouped by distance to the coast 0.5 km, >0.5–1 km, > 1km. There are seven accommodations with less than 0.5 km to the coast, five within 1 km and four over 1 km from the coast. Coastline is here defined as contact with the ocean (Baltic Sea) and it runs to the locks of Södertälje, which means that a part of Södertälje canal is here described as ocean water and therefore coastline. Data from Statistics Sweden 2014, coastline determined by Statistics Sweden



### Measures to prevent littering

In order to reduce littering, municipalities may, for instance, arrange awareness campaigns, produce informational material for tourist offices, and secure the availability of trash cans in popular tourist areas e.g. on beaches. It is also important that the bins are well-designed and emptied frequently to reduce overspill.

#### 6.1.2 Commercial ports (transport activities in commercial ports)

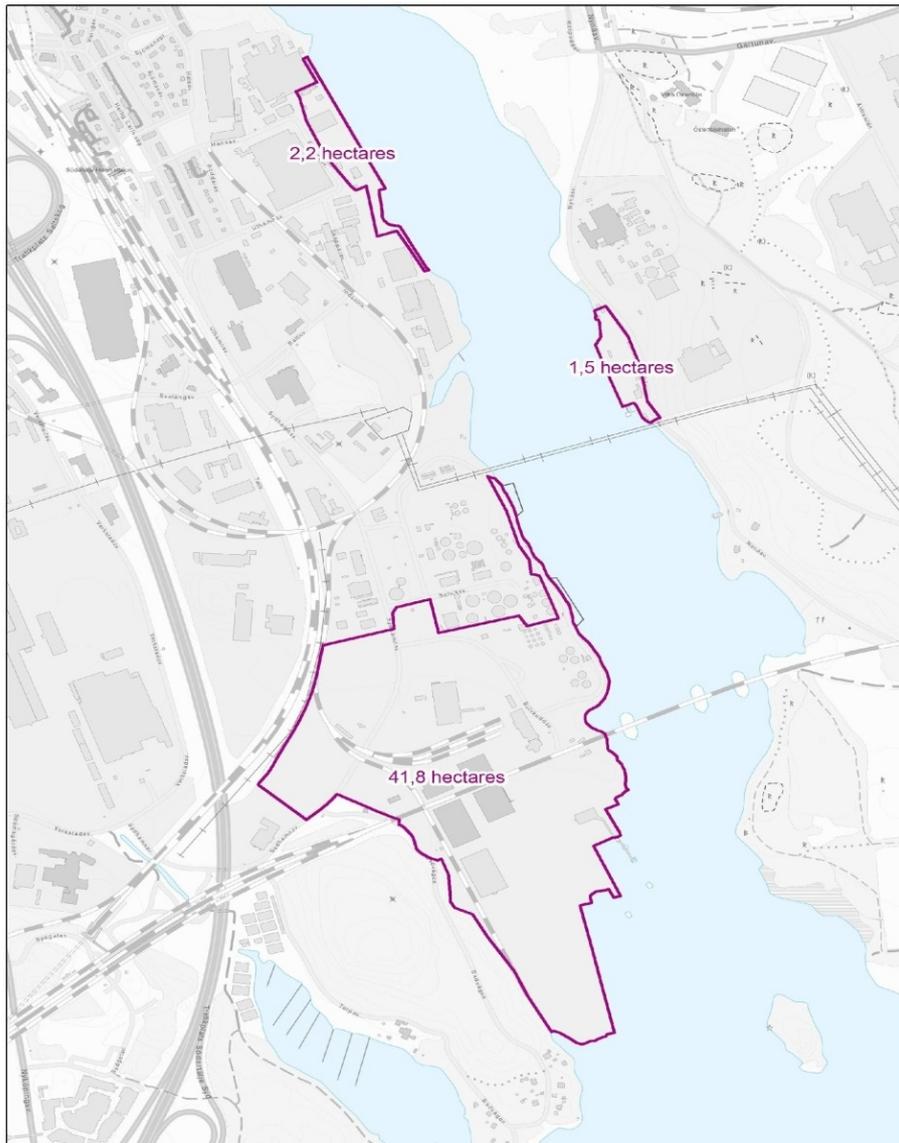
##### General information

Statistics Sweden data for Södertälje port is originally collected from the register of Real Estate and property map, and can be supplemented with detailed information about the companies' activities in the port area from Södertälje municipality's webpage (Figure 10). This is classed as transport-related.

### **Result and proposed measures**

Large, busy ports deal with lots of cargo and inevitably this means plastic materials, packaging and litter risk ending up in the sea. Suggested preventive measures could include routines for closing trailers in the port area and installing recycling bins or containers.

Figure 10: Map of the port of Södertälje, the three docks are marked, area given in hectares



Source: Statistics Sweden, 2015.

### 6.1.3 Coastal industries and manufacturing companies (Fast food/take away)

#### General information

There are currently no statistics collected relating specifically to coastal industries, but these can be obtained via a custom search of the Statistics Swedens enterprise database (FDB). Results from Södertälje are shown in Table 17. In this example, we look at fast food/street food outlets where the guests typically eat standing up (Figure 11).

Single use plastic, food containers, and wrappers find their way out to sea in pathways like canals, rivers, and stormwater drains. 75% of the litter found on the Swedish west coast consists of single use products. 68% is packaging like plastic bags, bottles and cans (Håll Sverige Rent, 2014).

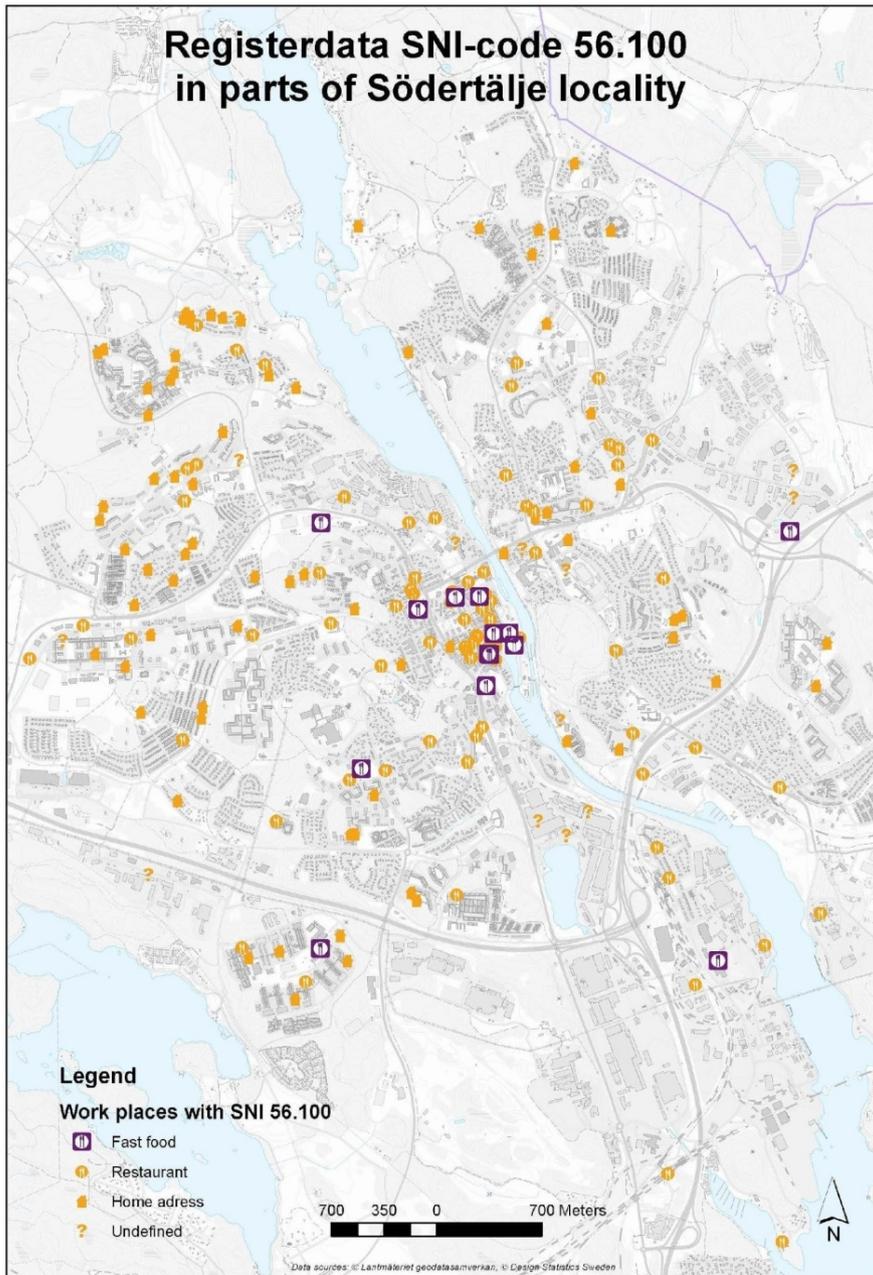
We looked at commercial fast-food/take away restaurants, categorising them as places where customers generally eat standing up. The FDB register includes Thai restaurants and pizzerias in this category (SNI 56,100), but we intended to exclude these as we wanted to focus on single-use plastic materials like plastic spoons, food wrappers etc.

**Table 17: Workplaces classified as restaurants (SNI-code 56,100) with take away in Statistics Sweden's enterprise database (FDB)**

In Södertälje municipality			In Södertälje locality		
Total workplaces	Fast Food	Restaurants	Home Addresses	Others/undefined	Total workplaces
277	16	93	90	25	224

Unfortunately the quality of the information in the database was too unreliable to identify the location of many fast-food outlets. The main reason is that most proprietors list their home address as the address of the business, so a person living in Södertälje could have a restaurant, snack-bar or take-away anywhere in the country. The amount of time required to manually check this information would not have justified the results.

Figure 11: Map of central Södertälje marked with Fast Food/take away restaurants

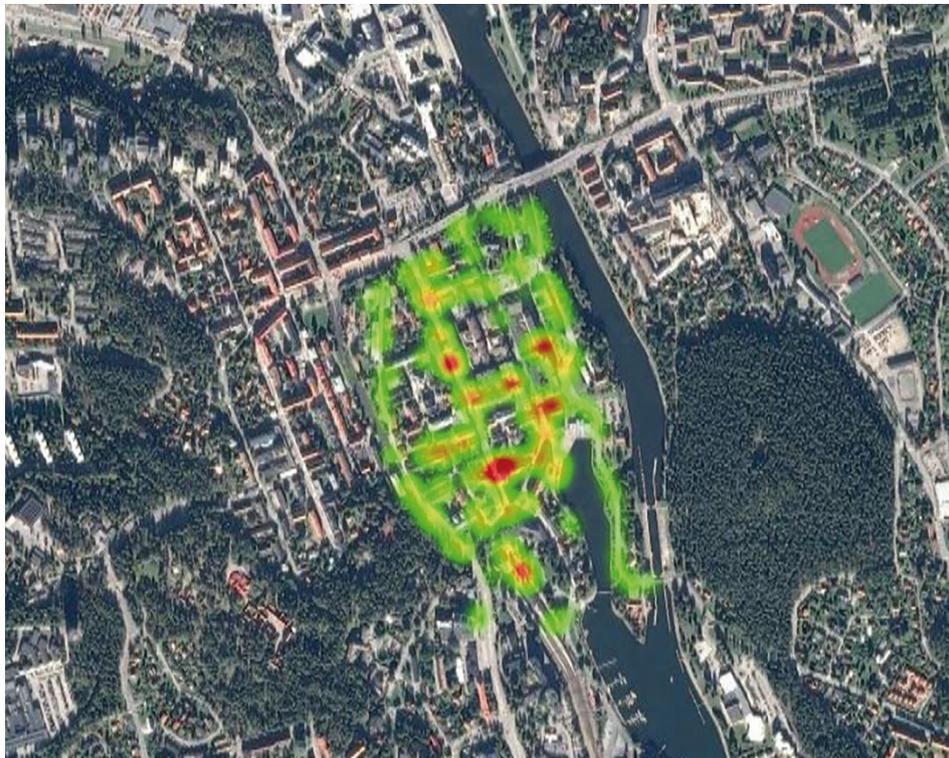


#### 6.1.4 Litter surveys

##### General information

Litter surveys are optional to implement and aimed primarily at municipalities. Two methods are available, one for streets and another for parks and other public spaces. Overall about 20 municipalities in Sweden are active in the measurements; most of them measure on streets and in parks and some also on beaches. Participating municipalities increase their knowledge of the sources of litter and how to prevent it. The measurement method is developed by Keep Sweden Tidy and Statistics Sweden. Surveys conducted by the Keep Sweden Tidy foundation show that cities in participating municipalities the amount of litter on streets has actually been reduced, partly due to increased awareness. An example of a heatmap for Södertälje is shown in Figure 12.

**Figure 12:** Heat map of Södertälje city, 2015. The colors give an overall picture of the geographical distribution of the litter at the moment of measurement. The scale goes from green (little litter) to red (much litter). Keep Sweden Tidy and Sweden Statistics



### **Result and proposed measures**

Examples of preventive measures may include litter surveys on land and at the coast, and encouraging local residents to participate in litter-picking campaigns.

#### **6.1.5 Wastewater overflow management**

##### **General information**

During heavy rain or melt-off, the capacity of sewer and stormwater systems can be exceeded and untreated sewage may be directly discharged into the environment. This increases the likelihood of marine litter. Even well-managed and well-optimized wastewater treatment plants can be exposed to both sewer and stormwater overflow. Therefore it is important that the wastewater treatment plants are optimized for the correct number of people to avoid incidents with wastewater overflow. In the case of Himmerfjärdsverket, a controlled overflow was conducted due to a planned stop of the treatment plant. (Stark Fujii, 2014) Marine litter can find its way to the sea during overflows and it is an important pathway for municipalities to be aware of in terms of prevention.

A total of 43,100,000 m<sup>3</sup> sewage water was treated during year 2014.

Of the total volume only 0.06% was completely untreated sewage water discarded to the sea due to the planned stop. A small amount of volume was only partially treated due to heavy rain and melt-off.

##### **Proposed measures**

Renew or renovate the wastewater treatment plants. Keep track of the overflow and develop techniques to prevent any litter passing through the system in case of planned stops or known flooding.

## 7. General discussion and remarks

Everyone wants litter-free seas but to achieve this vision we must have an understanding of the complexity of the problem. One factor is that once marine litter has entered the sea, there are very limited opportunities to clean it up. It is estimated that only 15% of the litter is washed up on the coast (UNEP, 2005) and only a few of the beaches can actually be cleaned, at a high cost to society. There are currently no techniques for cleaning large areas of the sea bottom or the water column. The seas are at risk of becoming a repository of human waste.

Consequently, we need to acquire knowledge concerning where litter comes from and how it reaches the sea. The “Plug the Marine Litter Tap”-approach developed in this study is an approach to facilitate the identification of sources and pathways of potential marine litter. The approach suggests indicators that, on a statistical basis, indirectly show the risk for a source in an urban area to be a contributor to the amounts of marine litter. Södertälje municipality is used as an example and relevant measures are proposed for each indicator. The pilot study does not intend to tell the whole story or dictate what municipalities should do. Instead we like to inspire and give ideas about how to “Plug the Marine Litter Tap”. Again, it is worth mentioning that local knowledge and experience are essential for the approach to be useful.

Municipal responsibility regarding littering is crucial and preventing waste from becoming litter may mean investments. But it should be added that preventive measures can also lead to savings, in terms of fewer cleaning operations and more satisfied and secure inhabitants (Håll Sverige Rent, 2016). It is the experience of Keep Sweden Tidy that few municipalities are aware of their costs for cleaning litter. This is supported by the fact that no Nordic countries investigated by Statistics Sweden compiled official data on the cost of litter cleaning. It is recommended to implement budget accounts where these costs are made visible.

Measurement of litter can be helpful to establish a baseline to evaluate the effectiveness of any eventual measures. Regular measurements of litter can inform about the amount, type and source material, as well as trends over time. For marine litter, this can also reveal seasonal or weather-dependent variations. Monitoring programmes can be used both for litter on land (streets, parks, river banks, etc.) and marine litter (beaches, the aquatic environment). As an example Norwegian beach litter is known to come from industrial sources to a greater extent (42%) than from individual con-

sumers (13%) (Blidberg *et al.*, 2015). For Norway it may be more important to focus efforts on identifying sea-based sources and relevant preventive actions. Marine litter sources from the sea have recently been highlighted in a study by EUNOMIA (Sherington *et al.*, 2016), amongst others.

Another complicating factor with marine litter is the number of players contributing to both littering and its solutions; e.g. individuals, municipalities, authorities, politicians, The plastics industry, landowners, the tourism industry, the waste sector, commercial fishing and shipping etc. It is a challenge to unite all these actors to reach a common goal, reducing marine litter. Measures need to be taken across a broad front. This is confirmed by the number of governing documents that directly or indirectly contribute to diminishing marine litter.

The Marine Strategy Framework Directive (MSFD) is the core legislation intended to limit the prevalence of marine litter in the European seas. The Nordic countries, except Norway, have all begun the work of developing action plans, though not all of them are completed. It is however clear that the responsibility lies both with the authorities and municipalities as well as with the individual. This is further supported by the HELCOM Regional Action Plan on Marine Litter and the OSPAR Regional Action Plan for Prevention and Management of Marine Litter in the North-East Atlantic. In addition, the Waste Framework Directive establishes good waste management and a waste hierarchy, reducing the production of waste. With regard to packaging, the Packaging Waste Directive is targeted at producers. Since packaging is very common in marine litter, it is of great importance to use less packaging when producing goods, as well as using less plastic materials. Measures to this end are found in the Circular Economy Package.

It is our hope that this report will increase understanding and knowledge about sources of marine litter and littering in urban areas. It is high time to act and ensure that waste does not become marine litter. It is high time to use the “Plug the Marine Litter Tap”-approach.

# References

- ARCADIS (2012) Case study on the plastic cycle and its loopholes in the four European regional seas areas. European Commission DG Environment Framework contract. ENV.D.2./ETU/2011/0041.
- Aniansson, B., Bell, G., Brito, F., Dagevos, J., Elliot, B., Fleet, F., Guéna, A., Hägerhäll, B., Jörgensen, H-H., Kerckhof, F., Lahuerta Mouriño, F., Nickerson, R., Nilsson, P., Olin, R., Span, I., Sverrisdóttir, S. and Wenneker, B., (2007). OSPAR Pilot Project on Monitoring Marine Beach Litter. Monitoring of marine litter in the OSPAR region. Biodiversity series.
- Blidberg, E., Bekken A.L., Bäckström, A., Haaksi, H., Hansen, L-M., Hole Skogen, M., Lembrecht Frandsen, B., Thernström, T. & Ångström J. (2015). *Marine Littering and Sources in Nordic Waters*. TemaNord 2015:524. <https://doi.org/10.6027/TN2015-524>
- Cheshire, A. C., Adler, E., Barbière, J., Cohen, Y., Evans, S., Jarayabhand, S., Jeftic, L., Jung, R.T., Kinsey, S., Kusui, E.T., Lavine, I., Manyara, P., Oosterbaan, L., Pereira, M.A., Sheavly, S., Tkalin, A., Varadarajan, S., Wenneker, B., Westphalen, G. 2009. *UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter*. UNEP Regional Seas Reports and Studies 186 (IOC Technical Series No. 83): 120.
- European Commission (2010) COMMISSION DECISION of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters. Official Journal of the European Union (2010/477/EU).
- European Commission (2014) Towards a circular economy: A zero waste programme for Europe. Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. Brussels, 2.7.2014 COM(2014) 398 final.
- European Commission (2015) Closing the loop – An EU action plan for the Circular Economy. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 2.12.2015 COM(2015) 614 final.
- Havs- och vattenmyndigheten (2014). God havsmiljö 2020, Marin strategi för Nordsjön och Östersjön. Del 3: Övervakningsprogram. Havs- och vattenmyndighetens rapport 2014:20. In Swedish.
- Havs- och vattenmyndigheten (2015). God havsmiljö 2020, Marin strategi för Nordsjön och Östersjön. Del 4: Åtgärdsprogram för havsmiljön. Havs- och vattenmyndighetens rapport 2015:30. In Swedish.
- HELCOM (2015), Regional Action Plan for Marine Litter in the Baltic Sea. 20 pp.
- Håll Sverige Rent (2014) Rapport från Kusträddarna. Om skräpet på den svenska västkusten. In Swedish.
- Håll Sverige Rent (2015) Skräpprapporten 2015. In Swedish.
- Håll Sverige Rent (2016) Skräpprapporten 2016. In Swedish.

- Jambeck, J.R., Geyer, R., Wilcox, C., Siegler, T.R., Perryman, M., Andrady, R. and Lavender Law, K. (2015) Plastic waste inputs from land into the ocean. *Science*. Vol. 347, no. 6223, pp. 768–771. <https://doi.org/10.1126/science.1260352>
- Jang, Y. C., Hong, S., Jongmyoung, L., Lee, M. J., and Shim, W. J. (2014) Estimation of lost tourism revenue in Geoje Island from the 2011 marine debris pollution event in South Korea. *Marine Pollution Bulletin* 81: 49–54. <https://doi.org/10.1016/j.marpolbul.2014.02.021>
- JRC-IES (2013) A guidance document within the Common Implementation Strategy for the Marine Strategy Framework Directive. MSFD GES Technical Subgroup on Marine Litter. EUR 26113 EN – 2013.
- Kollmus, A. and Agyeman, J. (2002) Mind the gap. Why do people act environmental friendly and what are the barriers to pro-environmental behaviour? *Environmental Education Research*, Vol. 8, No. 3. Pp. 239–260. <https://doi.org/10.1080/13504620220145401>
- Mehlhart, G. and Blepp, M. (2012) Study on land-sourced litter (LSL) in the marine environment. Review of sources and literature. In the Context of the Initiative of the Declaration of the Global Plastics Associations for Solutions on Marine Litter. Report from the Öko-Institute e.V. – Institute für angewandte Ökologie.
- Naturstyrelsen (2014) Danmarks Havstrategi, Overvågningsprogram, rev 26/9–2014. In Danish.
- Newman, S., Watkins, E., and Farmer, A. (2013) How to improve EU legislation to tackle marine litter. Institute for European Environmental Policy, London.
- Opfer, S., Arthur, C. and Lippiatt, S. (2012) NOAA Marine Debris Shoreline Survey Field Guide. National Oceanic and Atmospheric Administration.
- OSPAR Commission (2014) Marine Litter Regional Action Plan. 18 pp.
- Rijkswaterstaat Waterdienst (2012) Recreational benefits of reductions of litter in the marine environment. Final report, 15 November, 2012.
- SALT (2015) Marin forsøpling: Kunnskap, tiltak og behov. SALT rapport nr: 1011. In Norwegian.
- Sherrington, D., Darrah, C., Hann, S., Cole, G., and Corbin, M. (2016). Study to support the development of measures to combat a range of marine litter sources. Report for European Commission DG Environment. EUNOMIA, 29<sup>th</sup> of January, 2016
- Stark Fujii, K. (2014). Bräddning av avlopp under 2014, Syvab Himmerfjärdsverket- miljörapport 2014, bilaga B anmälda bräddningar. 2015–03–31. In Swedish.
- Strand, J., Tairova, Z., Danielsen, J., Würgel Hansen, J., Magnusson, K., Naustvoll, L.-J. and Kirk Sørensen, T. (2015) Marine litter in Nordic waters. *TemaNord* 2015:521. The Nordic Council of Ministers. <https://doi.org/10.6027/tn2015-521>
- UNEP (2005) Marine Litter. An analytical overview. Nairobi: UNEP 2005.
- UNEP (2009) Marine Litter. A Global Challenge. Nairobi: UNEP 2009.

## Swedish summary

Marint skräp är ett växande miljöproblem där framför allt plastmaterial ackumuleras i haven där det fragmenterar till mindre bitar. Marint skräp har allvarliga konsekvenser för det marina livet, men har också en negativ ekonomisk och social påverkan på samhället. Marint skräp står högt på den politiska dagordningen och lagstiftning, framför allt Havsmiljödirektivets deskriptor 10 för att fastställa god miljöstatus, syftar till att förhindra att avfall blir marint skräp. Syftet med den nu presenterade förstudien är att öka medvetenheten bland tjänstemän på kommuner och myndigheter om behovet av att minska förekomsten av skräp i den marina miljön och att ge idéer/förslag på hur detta kan göras. Projektet har därför utvecklat "Plug the Marine Litter Tap", ett tillvägagångssätt för kommunerna att, tillsammans med lokal kunskap och erfarenhet, identifiera källor till marint skräp genom att använda befintlig statistik. Södertälje används som ett pilotområde där vi ger exempel på indikatorer för marint skräp i stadsmiljön och föreslår åtgärder för varje indikator. Med detta vill vi uppmuntra kommunerna att reflektera över hur förebyggande åtgärder mot marin nedskräpning kan införlivas i lokala avfallsplaner och vara en del av det dagliga arbetet.



Nordic Council of Ministers  
Ved Stranden 18  
DK-1061 Copenhagen K  
[www.norden.org](http://www.norden.org)

## Plug the marine litter tap

Marine litter is a growing environmental problem where especially plastic material is accumulated in the seas where it will fragment to smaller pieces. The purpose of the presented pilot study is to raise awareness amongst officials at municipalities and authorities about the need to reduce the presence of litter in the marine environment and to give ideas/suggestions on how this can be done. The project has therefore developed a "Plug the Marine Litter Tap"-approach, which together with local knowledge and experience, can be used to identify sources of marine debris by using existing statistics. Södertälje is used as a pilot area where we give examples on indicators for marine litter in the urban environment and proposed measures for each indicator. We hope that this will encourage municipalities to reflect on how preventive measures against marine litter can be incorporated in local waste management plans and become part of their regular routine.



9 789289 348362