

National monitoring of beach litter in Denmark 2018

Amounts and composition of marine litter on reference beaches

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Preface

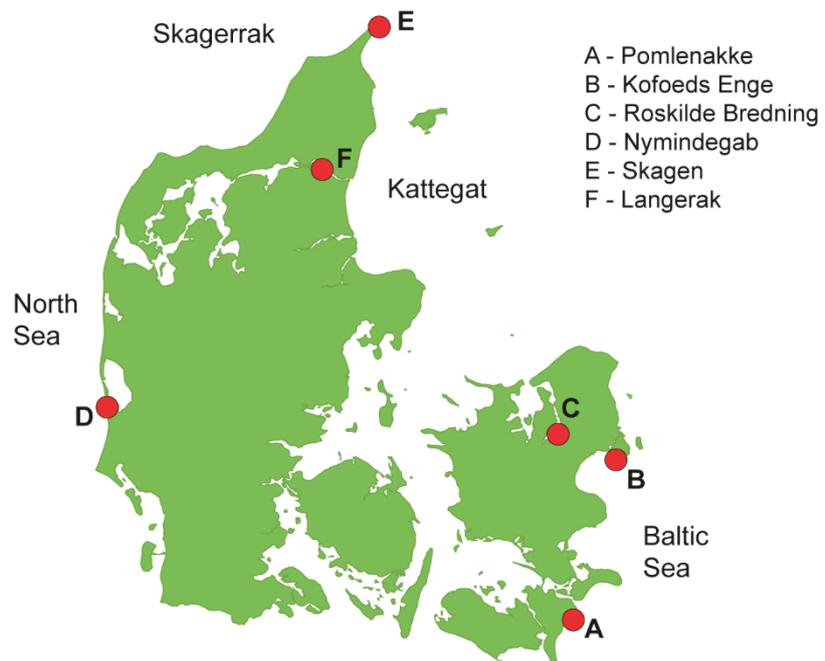
This research note describes results from national monitoring of beach litter at Danish reference beaches in 2018. National monitoring of beach litter in Denmark was implemented in 2015, in order to comply with the European Marine Strategy Framework Directive (MSFD) to assess the state, impact and trends of marine litter. Monitoring of beach litter at Danish reference beaches is performed by DCE – Danish Centre for Environment and Energy at Aarhus University in cooperation with KIMO Denmark on request from the Danish Environmental Protection Agency, Ministry of Environment and Food.

1. Danish reference beaches

1.1 Locations

The Danish beach litter monitoring program included in 2018 monitoring at five reference beaches, located within the OSPAR region or the HELCOM region, respectively. In addition, a sixth reference beach (Risø, Roskilde Bredning) in the HELCOM region has also been systematically monitored since 2015 and is included in this assessment. The beaches “Pomlenakke” at the east coast of Falster at the western Baltic Sea and “Kofoeds Enge” at the east coast of Zealand in Køge Bight together with “Risø” in Roskilde Fjord, represent beaches in the HELCOM region and are monitored by DCE, Aarhus University. The three beaches in Jutland “Langerak” in Limfjorden, “Skagen” at Skagerrak and “Nymindegab” at the North Sea, are monitored by KIMO Denmark and represent beaches in the OSPAR region (Skagen and Nymindegab) and at the border between the HELCOM and the OSPAR region (Langerak). Langerak will in this assessment be regarded as belonging to the OSPAR region. All reference beaches are selected to represent rural beaches located in an uneasily accessible location with relatively few visitors, and therefore dominantly receive litter washed ashore from sea. The monitoring length of the beaches is 100 m and the width of the beach cover from the water line to the back of the beach.

Figure 1.1. Locations of Danish reference beaches in the 2018 beach litter monitoring program.



1.2 Monitoring methods

All beaches are monitored systematically with three annual surveys performed in spring, summer and autumn, according to the Danish national guideline for beach litter monitoring (Strand & Metcalfe, 2016). Methods for monitoring and classification of beach litter items is based on the OSPAR (2010) technical guideline for monitoring of beach litter, but with national modifications including an extended beach litter item list with some sub-

grouping and hence additional item codes from the EU master list (2013). For each marine litter material category, various item types are recorded: Synthetic polymers/plastic = 89 item types, Rubber = 10 item types, Cloth/textiles = 9 item types, Paper/cardboard = 10 item types, Processed wood = 11 item types, Metal = 21 item types, Glass/ceramics = 10 item types, Other waste = 2 item types.

Beach litter data from all the surveys conducted at Danish reference beaches are reported to the Marine Litter Watch (MLW) and data for the three OSPAR relevant beaches are also reported to the OSPAR database.

A specific focus in the 2018 Danish beach litter monitoring program has been assessment of expanded polystyrene (EPS) beach litter items. Thus, further sub-division of litter item codes to measure the occurrence of EPS and other plastics separately has been conducted in 2018. Data from this assessment is further described in a technical report from the Danish Fishery Agency (COWI, in preparation).

2. Results of beach litter monitoring

2.1 Amounts and material composition

Monitoring data of total beach litter items from the six reference beaches shows variation in the amount of beach litter observed both between beaches but also between surveys performed within the same beach at different seasons (Figure 2.1). An approximately 20-fold difference in the numbers of total beach litter items were observed between the surveys with the lowest and the highest amounts of litter. In general, the highest amounts of both total beach litter items and total plastic items were registered at Skagen and Langerak. The highest total number of beach litter items per survey were observed for the Langerak autumn survey with 563 items and the Skagen summer survey with 536 items, respectively (Figure 2.1). The lowest number of total beach litter items were observed at Risø with 29 items registered both in the spring and in the summer survey, respectively. The three beaches in the HELCOM region generally had lower amounts of beach litter than beaches in the OSPAR region. However, an exception was the spring survey performed at Pomlenakke, where a high total number of 373 litter items were observed, compared to 120 and 39 items in the summer and autumn survey, respectively. The large amount of items observed in the spring survey was primarily due to a high number of glass/ceramics items (G204, n = 143) and a high number of paraffin items (G213, n = 126), but also a generally higher number of different litter items.

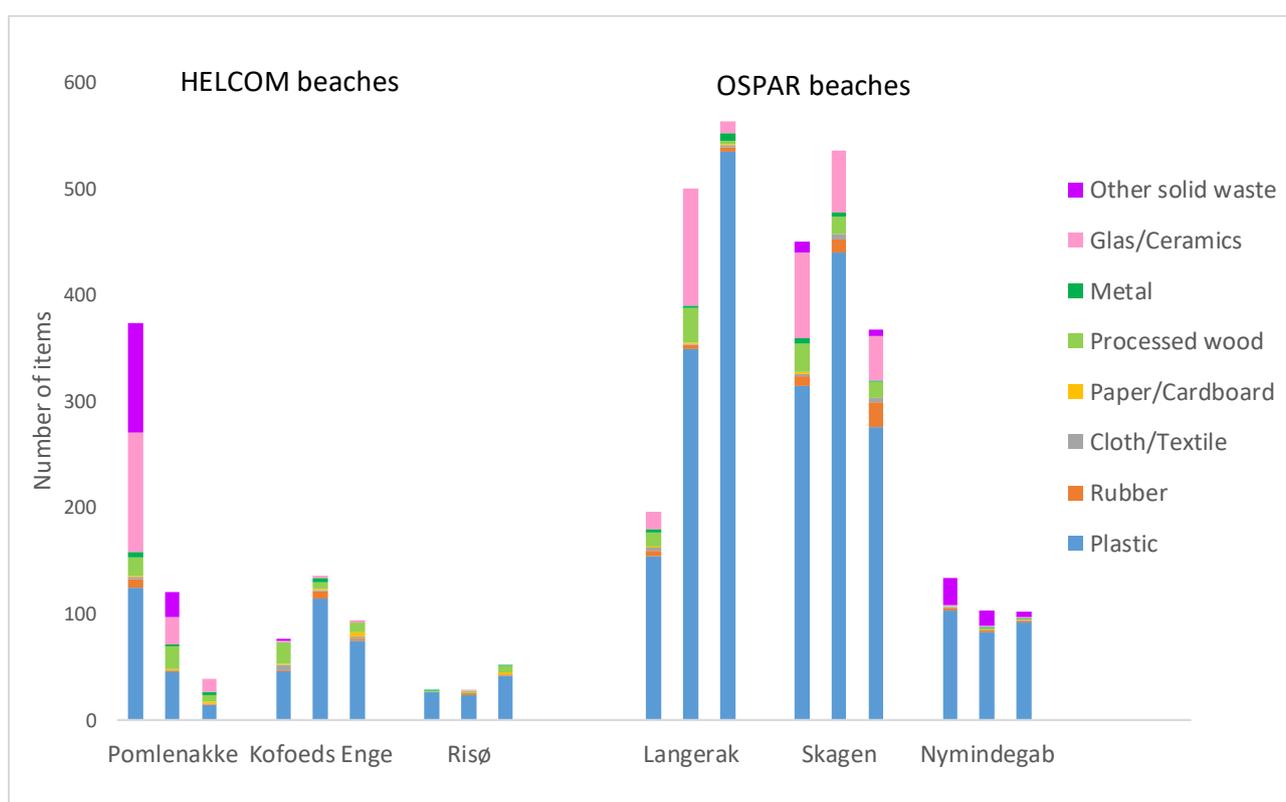


Figure 2.1. Total amount and distribution of material types of beach litter items monitored in 2018. The figure shows data from the six Danish reference beaches located in the HELCOM region (Pomlenakke, Kofoeds Enge, Risø) and the OSPAR region (Langerak, Skagen, Nymindégab). For each reference beach, the three columns represent the spring, summer and autumn surveys, respectively.

The amounts of beach litter at Skagen in 2018 (and also 2016-2017) are significantly lower than reported for 2015 (Strand et al, 2016). This might be due to altered hydrodynamics conditions, storm events before surveys, and/or altered morphological conditions on the beach caused by large sand movements. Similar tendency have not been observed for the other beaches.

The distribution of material types of the beach litter showed that items consisting of plastic polymers comprised the largest fraction of the total beach litter. Overall, for the HELCOM beaches and OSPAR beaches, plastic items comprised 80 % and 87 % (median values) of the total number of beach litter items, respectively. At Pomlenakke, plastic polymer items comprised a smaller fraction (38 %, median) of the total beach litter, as compared to the five other reference beaches with 76 % - 90 %. As mentioned above, a relatively high number of glass/ceramics items and other waste items, mainly represented by paraffin, were observed at Pomlenakke.

2.2 Top 10 item lists

The top 10 lists of the most frequently occurring specific types of beach litter items at the Danish reference beaches in 2018 to some extent reflects the overall material composition of the total beach litter, and hence are dominated by litter items consisting of plastic, as shown in Table 2.1 (HELCOM beaches) and Table 2.2 (OSPAR beaches). A comparison of the top 10 list for the HELCOM and the OSPAR beaches shows that six of the litter item types are common on the two lists. These include unidentifiable fragments of plastic pieces (2.5 – 50 cm), polystyrene pieces (2.5 – 50 cm) and other foamed sponges, in addition to different litter types from identifiable sources, such as plastic crisp packets/sweets wrappers, plastic string and cord from fishery-related waste and processed or worked pieces of wood < 50 cm (Table 2.1+2.2).

Table 2.1. Top 10 lists of most frequently occurring beach litter items at HELCOM beaches. n represents the total number of litter items collected at all HELCOM beaches during all surveys performed in 2018. Ranking of litter items are performed according to procedure described in Strand (2017).

Item code	Top 10 - HELCOM Beaches	Material	Primary sources
G171	Other wood < 50 cm (n=68)	Processed/worked wood	Construction waste
G79	Plastic pieces 2.5 > < 50 cm (n=90)	Plastic	Unidentifiable fragments
G82	Polystyrene pieces 2.5 cm > < 50 cm (n=60)	Plastic	Unidentifiable EPS fragments
G73	Foam sponge (n=46)	Plastic	Foam fragments
G21	Plastic caps/lids drinks (n=28)	Plastic	Food and beverages packaging
G30	Crisps packets/sweets wrappers (n=29)	Plastic	Food and beverages packaging
G50	String and cord (diameter < 1cm) (n=30)	Plastic	Fishery-related waste
G70	Shotgun cartridges (n=38)	Plastic	Hunting
G125	Balloons and balloon sticks (n=19)	Rubber	Single-use plastics
G23	Plastic caps/lids unidentified (n=22)	Plastic	Food and beverage packaging

As the ranking of top 10 litter items were performed using a weighted procedure of the most frequently occurring litter types, the ranking does not completely reflect the total number of items collected at all beaches during all surveys. This ranking procedure was applied so that the listing of most frequently occurring litter items represents a relatively even high occurrence at all beaches and all surveys, and reduces bias imposed by a large number of items found at a single beach or a single survey (Strand, 2017).

Table 2.2. Top 10 lists of most frequently occurring beach litter items at OSPAR beaches. n represents the total number of litter items collected at all OSPAR beaches during all surveys performed in 2018. Ranking of litter items are performed according to procedure described in Strand (2017).

Item code	Top 10 - OSPAR Beaches	Material	Primary sources
G79	Plastic pieces 2.5 > < 50 cm (n=788)	Plastic	Unidentifiable fragments
G50	String and cord (diameter < 1cm) (n=443)	Plastic	Fishery-related waste
G73	Foam sponge (n=256)	Plastic	Foam fragments
G30	Crisps packets/sweets wrappers (n=97)	Plastic	Food and Beverages packaging
G171	Other wood < 50 cm (n=91)	Processed/worked wood	Construction waste
G204	Construction material (brick, cement, pipes) (n=170)	Glass/ceramics	Construction waste
G82	Polystyrene pieces 2.5 cm > < 50 cm (n=137)	Plastic	Unidentifiable EPS fragments
G4	Small plastic bags, e.g. freezer bags incl. pieces (n=57)	Plastic	Plastic bags
G208	Glass or ceramic fragments > 2.5 cm (n=112)	Glass/ceramics	Construction waste
G95	Cotton bud sticks (n=80)	Plastic	Sanitary waste

At the three HELCOM beaches (Pomlenakke, Kofoeds Enge and Risø), processed or worked pieces of wood < 50 cm were the highest ranking type of specific litter items monitored, followed by different types of unidentifiable polymer fragments (plastics, polystyrene and foam sponges) (Table 2.1). At the OSPAR beaches (Langerak, Skagen and Nymindégab), the most dominating type of litter monitored, was unidentifiable fragments of plastic pieces (2.5 - 50 cm), followed by plastic string and cord items and foam sponges (Table 2.2).

Four litter item types were represented in the top 10 list for the HELCOM beaches but not for the OSPAR beaches. Hence, plastic caps/lids from drinks or from unidentified sources, shotgun cartridges from hunting as well as balloons or balloon sticks, were registered relatively more frequently at the three reference beaches in the HELCOM region compared to the three beaches in the OSPAR region. Oppositely, single-use plastic bags and cotton bud sticks from sanitary waste were more dominating at the OSPAR beaches (Table 2.1+2.2). Likewise, construction-related waste such as bricks, cement and pipes or glass or ceramic fragments were also generally more dominating at the OSPAR beaches. However, the occurrence of bricks, cement and pipes was very unevenly distributed at the beaches with large number of items found at some beaches (Pomlenakke, Skagen and Langerak) and an insignificant number at the other beaches (Kofoeds Enge, Risø and Nymindégab). The large number of these items found at some of the beaches probably derive from older coastal dump sites, coastal protection sites or from historical buildings or roads washed away by the sea.

2.3 Source assessment of synthetic polymer litter

The total number of synthetic polymer litter items (i.e. all types of plastic polymer and rubber items) monitored at the HELCOM and the OSPAR reference beaches during the 2018 surveys was 534 and 2408, respectively. The source-related distribution of these items is shown in Figure 2.2 and 2.3. At the HELCOM beaches, single-use plastics from identifiable sources comprise a relatively larger fraction of the synthetic waste compared to the OSPAR beaches. At the HELCOM and OSPAR beaches, packaging from food and beverages

comprise 12 % and 9 %, other single-use plastic 18 % and 5 %, and plastic bags 6 % and 4 %, respectively. Oppositely, strings and cords from fishery-related activities comprise a larger fraction at the OSPAR beaches with 17 % compared to 9 % at the HELCOM beaches. Likewise, waste from unidentifiable sources such as plastic fragments comprise a much larger fraction at the OSPAR beaches with 50 % compared to 10 % at the HELCOM beaches (Figure 2.2 and 2.3).

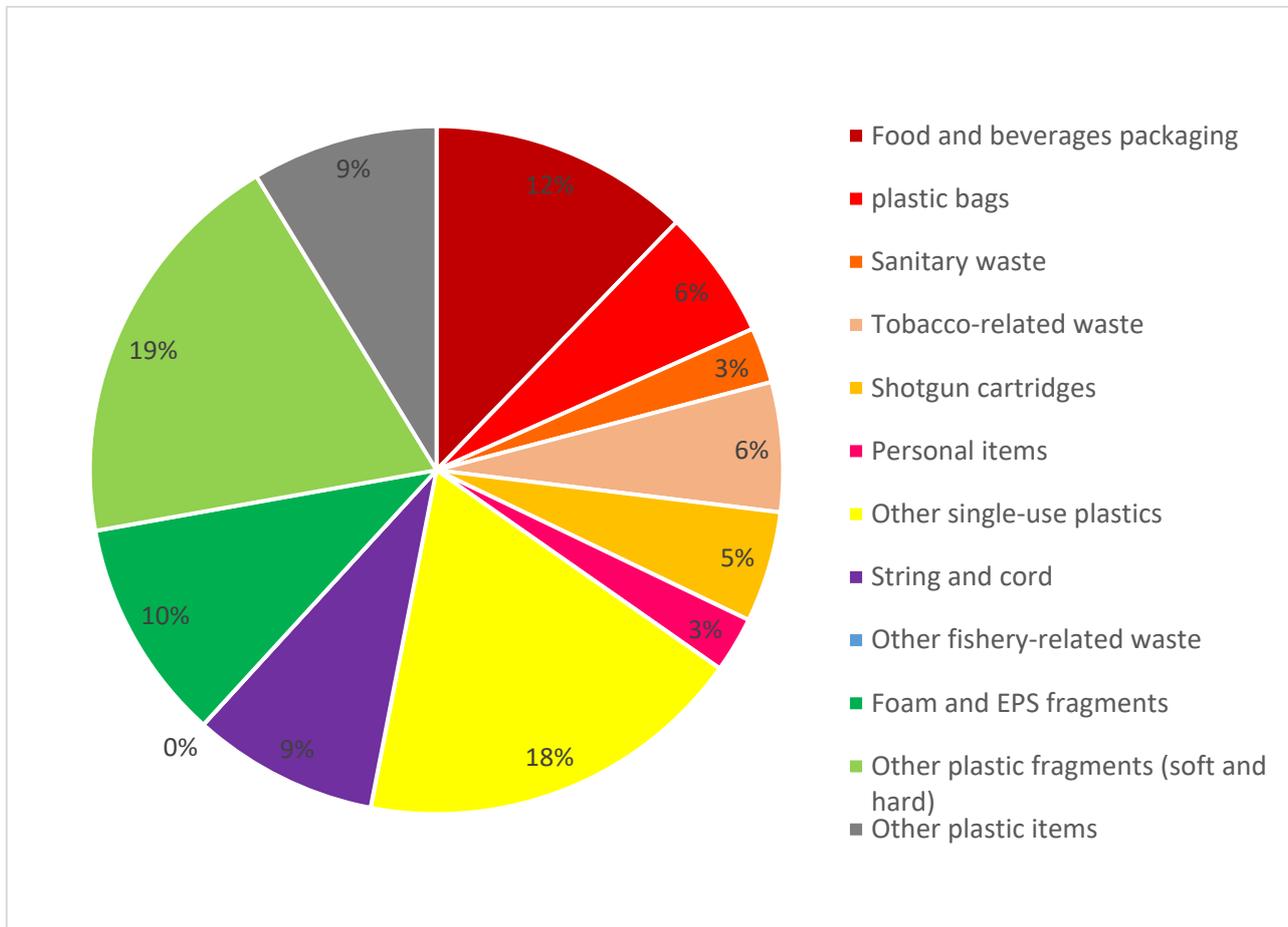


Figure 2.2. Source-related distribution of all synthetic polymer/plastic litter items from HELCOM beaches (Pomlenakke, Kofoeds Enge, Risø). For each specific litter item type, the median of the total number of that item monitored on the three beaches during the three annual surveys is calculated. Subsequently, the median numbers for each item type belonging to each of the source-related categories are summed and the figure shows the percentage distribution.

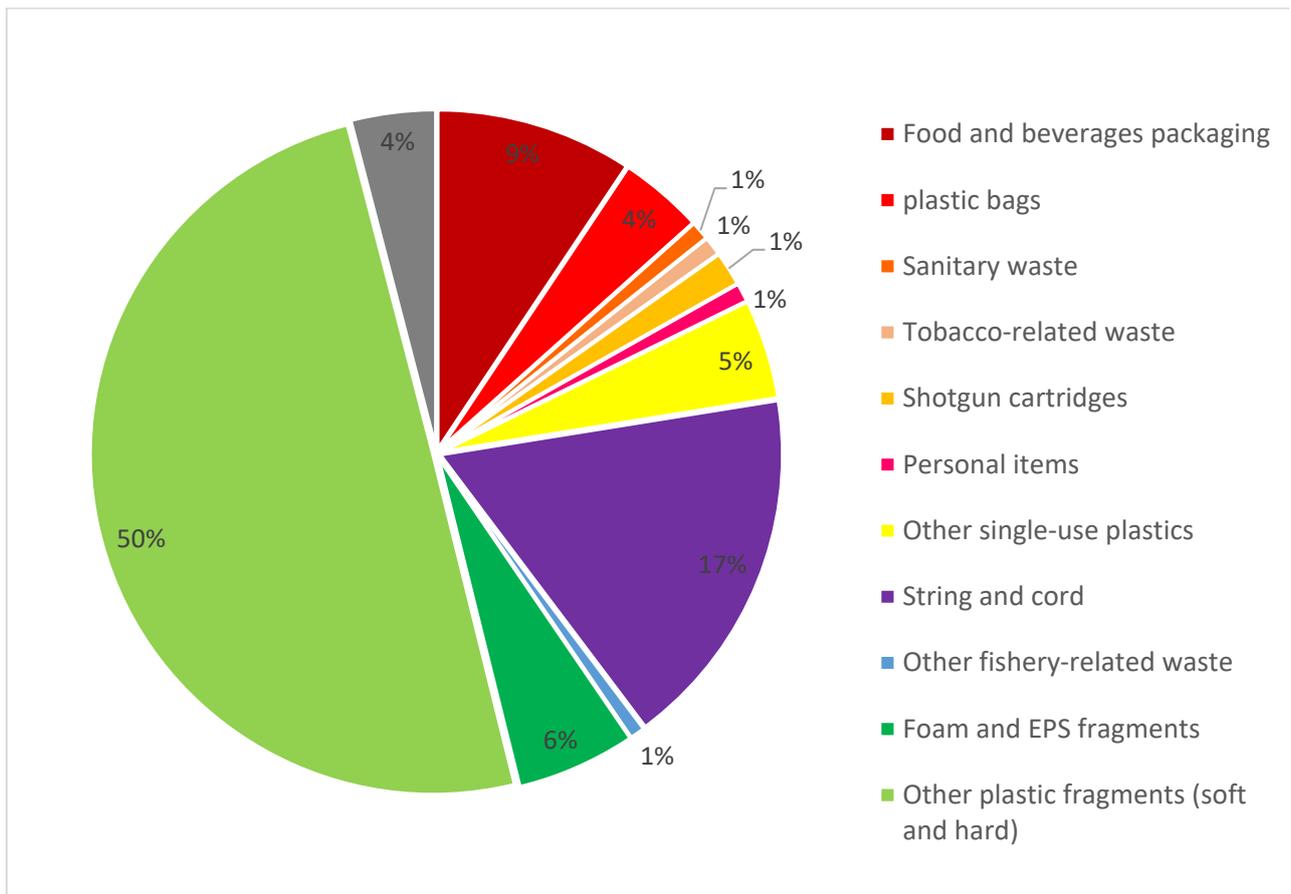


Figure 2.3. Source-related distribution of all synthetic polymer/plastic litter items from OSPAR beaches (Langerak, Skagen, Nymindgab). For each specific litter item type, the median of the total number of that item monitored on the three beaches during the three annual surveys is calculated. Subsequently, the median numbers for each item type belonging to each of the source-related categories are summed and the figure shows the percentage distribution.

3. References

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