



Nature and environment

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With an average water depth of 95 m, the North Sea is a rather shallow sea which is mainly located on the European continental shelf. The seabed is predominantly characterised by sandy habitats. In the North Sea, water of the North Atlantic Ocean is mixed with fresh water from rivers of the surrounding countries (Norway, Sweden, Denmark, Germany, the Netherlands, Belgium, France and the United Kingdom) (*OSPAR QSR 2010*, [website Operational Directorate Natural Environment](#), *Royal Belgian Institute of Natural Sciences (RBINS-OD Nature)*). The surface of the North Sea amounts to approximately 670,000 km² (*State of Europe's Seas 2015*), of which the Belgian part (BNS) covers a modest 3,454 km², approximately 0.5% of the surface area of the North Sea (*Belpaeme et al. 2011*, *Maes 2016*). More geographical information about the BNS can be found on the digital portal [Het Kustportaal](#) and the *Marine atlas*. The current text elaborates on the aspects which are characteristic for the BNS and its adjacent coastal area.

2.1 Characteristics of the marine and coastal environment

2.1.1 Sea

BATHYMETRY AND SUBSTRATE

The BNS is a shallow part of the North Sea with a seabed that gradually deepens in a northwest direction up to a depth of 40 to 45 m (figure 1). The relief is characterised by the presence of a complex system of gullies and sandbanks up to 30 m high relative to these channels, 15 to 25 km long and 3 to 6 km wide. The orientation of the banks varies from parallel to the coast to southwest-northeast further offshore (figure 1). The substrate of the seabed mainly consists of non-consolidated Quaternary sediments with a thickness that varies between a few metres in the gullies to 50 metres around the sandbanks (*Le Bot et al. 2003* (BELSPO), *Mathys 2009*, *Mathys 2010*, *TILES (TILES project BELSPO)*). Underneath these Quaternary sediments is Paleogenic clay which is locally found in the trenches (*Lanckneus et al. 2001* (BUDGET project BELSPO), *Le Bot et al. 2003* (BELSPO), *Mathys 2009*, *Mathys 2010*, *De Clercq et al. 2016*). In general, the grain size distribution of the sediment on the seabed generally becomes coarser as the distance from the coast increases, and varies from silt-rich sediment close to the coast over fine to coarse sand in deeper water (*Verfaillie et al. 2006*, *Van Lancker et al. 2007* (MAREBASSE project BELSPO), *Van Lancker et al. 2015*, *TILES (TILES project BELSPO)*).

HYDRODYNAMICS AND SEDIMENT TRANSPORT

The currents in the BNS are dominated by semi-diurnal tides. The tidal range can vary from 3 m during neap tide to more than 4.5 m during spring tide with a decreasing tidal range (between low and high tide) to the northeast. Tidal currents can reach up to 1.2 m.s⁻¹ and are an important means of sediment transport, although tides caused by wind may also play an important role (*Lanckneus et al. 2001* (BUDGET project BELSPO), *Fettweis and Van den Eynde 2003*, *De Moor 2006*, *Van Lancker et al. 2012* (QUEST4D project BELSPO), *Baeye 2012*, *Van Lancker et al. 2015*). Along the Belgian coast, a high concentration of suspended sediment occurs resulting in turbidity maximums (*Fettweis and Van den Eynde 2003*, *Fettweis et al. 2007* (MOCHA project BELSPO), *Baeye 2012*, *Fettweis en Baeye 2015*, *Fettweis et al. 2016*).

Data and information about the hydrographical and meteorological aspects (tides, currents, waves, wind, etc.) of the BNS can be consulted on the website [Flemish Banks Monitoring Network of the Flemish Hydrography](#). This institution is also responsible for the yearly publication of the tide tables (*Getijboekje 2018*). Operational models using e.g. the hydro-meteorological data are available on the [website](#) of RBINS-OD Nature.

SEAWATER CHARACTERISTICS

The seawater temperature in the BNS varies seasonally between 5°C and 20°C (*Flemish Banks Monitoring Network*). The seawater salinity in the BNS is strongly influenced by the river plumes of the Scheldt, Rhine, Seine and Meuse rivers. This inflow reduces the salinity of the water entering via the Channel (salinity 35 PSU or ‰) (*Lacroix et al. 2004*). The carbon chemistry of seawater undergoes a seasonal variation and affects the acidity (pH) of the water with a pH that fluctuates between 7.95 and 8.25 (*Gypens et al. 2011*, *Le Quéré et al. 2015*, *Le Quéré et al. 2016*, see also Integrated Carbon Observation System (ICOS)). Information about the nutrients and oxygen levels in the seawater was *inter alia* gathered in the context of the *AMORE (AMORE project BELSPO)*, *AMORE II (AMORE II project BELSPO)* and *AMORE III (AMORE III project phase 1 and phase 2 BELSPO)* projects and the monitoring obligations for the OSPAR Commission (see also *OSPAR IA 2017*), the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD) (see below 2.4 Protection of the marine and coastal environment). The impact of climate change

on the seawater characteristics in the BNS is discussed in [Van den Eynde et al. \(2011\)](#) (CLIMAR project BELSPO), the [Complex Project Coastal Vision](#) (formerly Flemish Bays, e.g. [De Maerschack et al. 2017](#)) and in the [CREST project](#) (see also theme [Safety against flooding](#)).

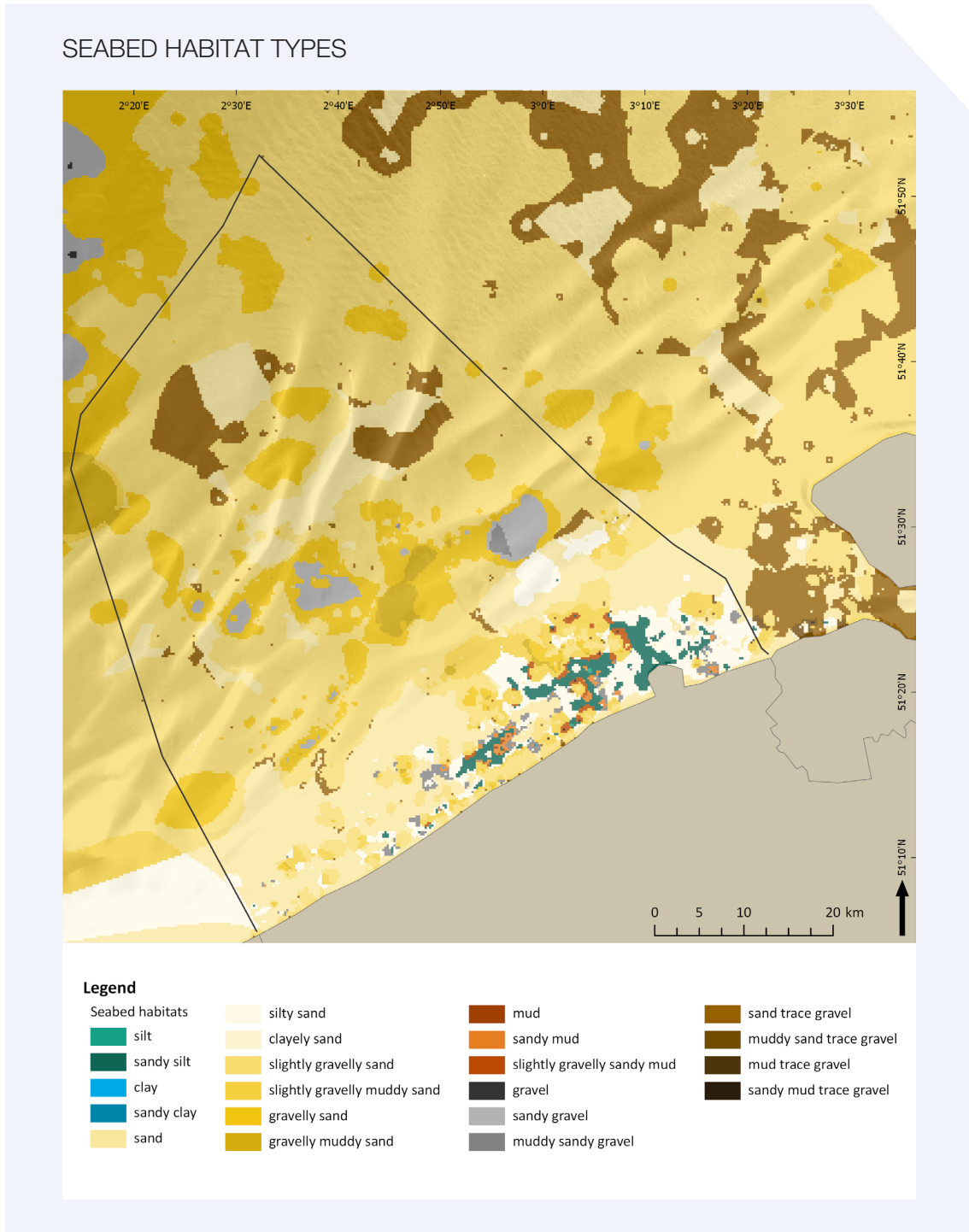


Figure 1. The bathymetry of the BNS and the occurrence and distribution of the seabed habitat types mapped on the basis of the percentages of silt, sand and gravel (Source: [EMODnet Bathymetry](#), [Van Lancker et al. 2013](#)).

MARINE ECOSYSTEM

Within the marine ecosystem, marine organisms are highly dependent on each other. For example, phytoplankton (photosynthetic plankton) is the main source of food for zooplankton. Zooplankton and bottom-dwellers (benthos) are used as food by many organisms, including most fish species. The fish, in turn, are an important source of food for higher trophic levels such as seabirds, (commercial) fish species and marine mammals. Bacteria, microbionts, fungi and macroalgae also play an important role in the marine ecosystem, both in the seabed and in the water column. The marine ecosystem is further discussed by means of a classification into the benthic, the pelagic and the marine mammals and seabirds.

Within the framework of the *BWZee project (BELSPO)*, the spatial distribution data of all components of the marine ecosystem were integrated and biological valuation maps were drawn up for the BNS (figure 2) (*Derous et al. 2007*). A complete overview of the species lists is available on the Belgian Register of Marine Species (*BeRMS, Vandepitte et al. 2010*).

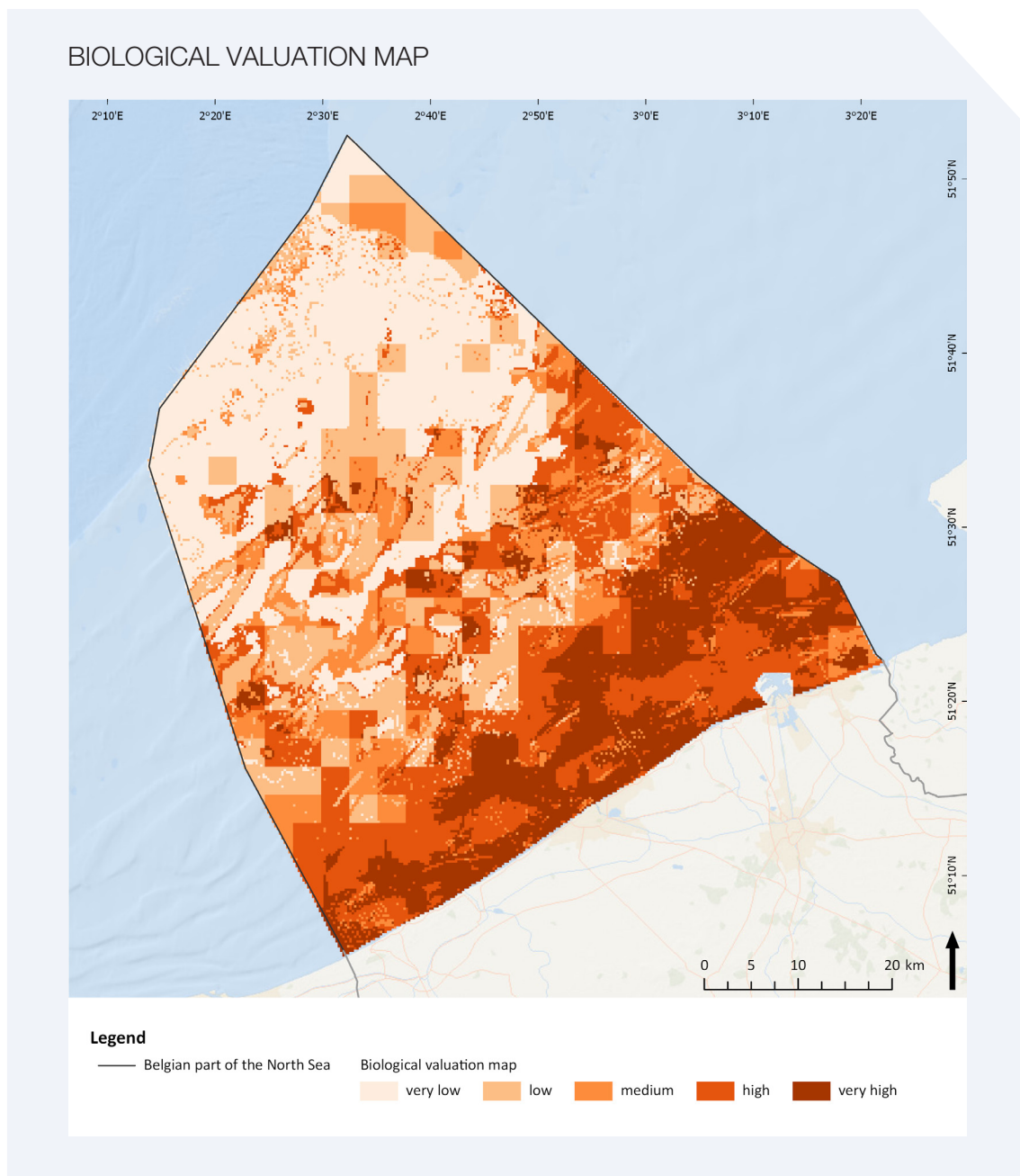


Figure 2. The biological valuation map of the BNS, which combines the valuation maps of the macrobenthos, epibenthos, demersal fish and seabirds (Source: *BWZee project BELSPO*).

BENTHIC LIFE

The sandbanks and channels in the BNS are characterised by a rich benthic life (benthos). Given the high turbidity of the seawater, phytobenthos is almost absent from the (subtidal) BNS. Benthic life here is dominated by the zoobenthos. The benthos has been the subject of intensive research since 1970 (e.g. [Cattrijsse and Vincx 2001](#), [Van Hoey et al. 2004](#), [Degraer et al. 2006](#), [Degraer et al. 2008](#), [Merckx et al. 2010](#), [Vanaverbeke et al. 2011](#), [Van Hoey et al. 2013](#), [De Backer et al. 2014](#), [Van Hoey et al. 2014](#), [Vieren 2014](#), [TROPHOS project \(BELSPO\)](#), [WESTBANKS project \(BELSPO\)](#), [ICES BEWG Report 2017](#), [Hummel et al. 2017 \(COST Actie EMBOS ES1003\)](#)). The benthos constitutes an important food source for fish, shrimps, crabs and even some birds, and actively influences the degradation and transport of organic matter and nutrients (e.g. [Braeckman et al. 2010](#), [Braeckman 2011](#), [Courtenis et al. 2017](#)). The following section looks at the classification and spatial distribution of benthic organisms in the BNS.

- Just above the seabed of the North Sea, in the lowest meter of the water column, the hyperbenthos can be found which mainly consists of fish larvae, crustaceans and mysid shrimps (e.g. [Mees 1994](#), [Dewicke 2002](#), [Beyst 2001](#), [Fockedeey 2005](#));
- Large numbers of starfish, brittle stars, shrimps, crabs, lobsters and squids can be observed on the seabed. Together with a number of less common species, they form the epibenthos, referring to their way of life just on the seabed (e.g. [Hostens 2003](#), [Calewaert et al. 2005](#), [Vieren 2014](#), [Vandendriessche et al. 2015](#), [De Backer et al. 2016](#));
- However, most species of soil-dwelling organisms can be found among the sand grains, up to an average depth of about 10 cm below the seabed: these are mainly bivalves, polychaete worms, small crustaceans (macrobenthos¹, [Degraer et al. 2006](#)), nematodes and copepods (meiobenthos²);
- The bacterial community in the seabed is clearly different from that in the water column ([De Tender et al. 2015](#)). The biochemistry of the seabed, including the carbon cycle, is described specifically for the Belgian coastal zone in [van de Velde et al. \(2018\)](#). The highest richness and diversity of bacteria in the soil is recorded in June, linked to the breakdown of phytoplankton blooms, while β -AOB³ and AOA peaks occur in September ([Yazdani Foshtomi et al. 2015](#));
- Very little information is available on the infralittoral microphytobenthos of the sandy beaches ([Speybroeck et al. 2005](#)) of the BNS.

The distribution of bottom-dwellers is not uniform and is strongly linked to the physical characteristics of the seabed (e.g. grain size of the sediment) and to the lower part of the water column (for more information on distribution and numbers of species, see [Degraer et al. 2008](#)). Firstly, the seafloor in the BNS is mainly characterised by soft substrates (from silt to fine and coarse sand). The soft mobile substrate of the subtidal sandbanks generally contains five macrobenthic communities ([Breine et al. 2016](#)):

- the *Limecola balthica* community;
- the *Abra alba* (- *Kurtiella bidentata*) community;
- the *Nephtys cirrosa* community;
- the *Ophelia borealis* (- *Glycera lapidum*) community, revised as *Hesionura elongata* community;
- the *Magelona-Ensis directus* community.

These communities are each characterised by distinctive species with a certain diversity and density, and are each observed in a specific and relatively well-defined environment ([Degraer et al. 2003](#), [Van Hoey et al. 2004](#), [Degraer et al. 2008](#), [Breine et al. 2016](#)).

In addition to the soft substrates, geogenic and biogenic reefs also occur in the BNS. Geogenic⁴ reefs contain a typical fauna that lives on top of the gravel beds (so-called hard substrate epifauna) with e.g. sponges, soft corals, bryozoans and sea anemones ([Houziaux et al. 2008](#), [Van Lancker 2017](#)). As hard substrates are important for biodiversity, the evolution of the natural gravel beds will be monitored ([INDI67 project BELSPO](#), [Montereale-Gavazzi et al. 2017](#), [De Mesel et al. 2017](#)). Biogenic reefs are mainly shaped by the sand mason worm (*Lanice conchilega*) ([Rabaut et al. 2009](#)). The increasing use of artificial hard substrates (e.g. offshore wind turbines and artificial reefs) creates new opportunities for benthic organisms. The dense coverage of the structures with a fauna typical of rocky substrates is striking: e.g. the mussel *Mytilus edulis*, the amphipoda *Jassa herdmani* and the sea anemone *Metridium dianthus*. In addition, the anti-erosion coating of these structures offers opportunities for various species: e.g. the European lobster *Homarus gammarus* and the North Sea crab *Cancer pagurus* ([Krone et al. 2017](#)), macroalgae, fish such as pouting *Trisopterus luscus* and cod *Gadus morhua* ([Degraer et al. 2013](#), [Reubens et al. 2013](#), [ICES WGMBRED Report 2017](#), [Degraer et al. 2017](#)), etc.

¹ Organisms that live on or in the seabed and are larger than 1 mm.

² Organisms that live on or in the seabed and measure between 0.063 and 1 mm.

³ Ammonium oxidizing bacteria (AOB) and ammonium oxidizing archaea (AOA).

⁴ Reefs whose topographical expression is the result of geological phenomena such as the gravel beds of the Hinderbanks.

These structures provide the first space for intertidal fauna to settle in open sea in Belgian waters, which is taken up by a considerable number of non-indigenous species (Kerckhof et al. 2016). Furthermore, the effects of these hard substrates on the structure and activity of the communities living in the surrounding soft substrates is monitored (e.g. Coates et al. 2013, Baeye and Fettweis 2015, FaCE-IT project BELSPO, PERSUADE project BELSPO, Derweduwen et al. 2016).

PELAGIC ORGANISMS

The pelagic zone or 'water column' (the ecological zone consisting of open water) mainly houses the floating phytoplankton, zooplankton, bacterioplankton and the actively swimming nekton (including specific fish species) and marine mammals (see below). The pelagic zone is the largest habitat in the world but, unlike the benthic ecosystem, has not been subject to a long research tradition in Belgian waters. The different components of the pelagic are briefly discussed below:

- Phytoplankton is an important link in the marine food web (Castellani and Edwards 2017). Changes in phytoplankton dynamics can strongly influence the zooplankton dynamics (Lancelot et al. 2007). Hence, it is important to monitor the problems related to the annual seasonal changes in phytoplankton composition (e.g. *Phaeocystis* blooms) as a result of eutrophication (see theme Agriculture) (Vasas et al. 2007). The LifeWatch observatory is also making efforts to map these phytoplankton communities (Flanders Marine Institute 2015, 2018). The phytoplankton concentration, which typically achieves high concentrations in the coastal waters, is also analysed on the basis of satellite images and chlorophyll-A concentrations (Rousseau et al. 2006);
- The zooplankton community⁵ of the BNS has a coastal nature but is occasionally influenced by introduced species originating from the inflow of Atlantic water (Van Ginderdeuren 2013). The crustaceans (Crustacea) or more specifically the calanoid copepods (holoplankton⁶, 66%), dominate the zooplankton with species such as *Temora longicornis*, *Euterpina acutifrons*, *Acartia clausi*, *Paracalanus parvus* and *Centropages typicus* being the most common (Van Ginderdeuren et al. 2012a, Deschutter et al. 2017, the LifeWatch observatory Flanders Marine Institute 2017). Also, meroplanktonic⁷ larvae of polychaetes, echinoderms, fish and barnacles are abundant in the BNS. In 2014, a total of 137 zooplankton taxa was listed for the BNS (Van Ginderdeuren et al. 2014a). May and June are the months with the highest mean zooplankton densities, followed by a smaller autumn peak in September. Zooplankton densities vary from 150 to 15,000 ind.m⁻³ and are highest a few kilometres off the coast, in the transition zone from coastal to offshore waters;
- Within the zooplankton community, specific attention has been paid to jellyfish (e.g. the non-indigenous warty comb jelly *Mnemiopsis leidyi* (Van Ginderdeuren et al. 2012b, Vansteenbrugge et al. 2015b) and the common jellyfish *Aurelia aurita* (Dulière et al. 2014)), and copepods (e.g. the invasive *Pseudodiaptomus marinus* (Desutter et al. 2018)). Zooplankton is generally considered to be one of the better bio-indicators to demonstrate environmental changes (e.g. ICES WGZE Report 2017);
- The bacterioplankton, which is dominated by Proteobacteria and Bacteroidetes, is also a sensitive ecological indicator. Since 2012, the bacterial communities in the seawater of the BNS have been studied using DNA-based techniques (De Tender et al. 2015, Kopf et al. 2015, ten Hoopen et al. 2015, De Tender 2017, Micro B3 KP7 project, LifeWatch observatory);
- In the pelagic zone, floating macroalgae (besides drifting debris) provide a special habitat for numerous organisms. These organisms can originate from rocky shores where the macroalgae were detached (e.g. various species of marine isopods) and from colonising species at sea (e.g. by larval stages of many crustaceans) (Vandendriessche 2007);
- The research on pelagic fish in the BNS is limited, mainly due to the fact that the BNS is relatively shallow, so that both the typical pelagic fishing nets and sonar images can only be used to a limited extent. Van Ginderdeuren et al. (2014b) revealed that herring and sprat are common in the BNS. It mainly concerns immature individuals (0- and 1-year class) in coastal waters. Adult herring *Clupea harengus* is only observed in autumn when the fish are migrating to the spawning areas in the Channel. In summer, two other pelagic species appear, namely mackerel *Scomber scombrus* and horse mackerel *Trachurus trachurus*. Young horse mackerels are present in the offshore pelagic fish community (Van Ginderdeuren et al. 2012a). The initial assessment of Belgian marine waters (Belgian State 2012) also shows that several anadromous fish (such as fint *Alosa falax*) that were included in the Habitats Directive Annex II are recovering (Breine et al. 2017).

⁵ A collective term for heterotrophic organisms floating or actively swimming in water.

⁶ Organisms that are planktonic throughout their entire life cycle.

⁷ Organisms that are planktonic only in a certain phase of life.

BIRDS AND MARINE MAMMALS

Marine mammals form a separate group, which is briefly illustrated below together with the occurrence of seabirds in Belgian marine waters:

- The BNS is an important wintering and foraging area for seabirds ([Seys 2001](#), [Stienen and Kuijken 2003](#), [Haelters et al. 2004](#), [Stienen et al. 2007](#), [Degraer et al. 2010](#)). During the winter months, internationally important numbers (i.e. more than 1% of the biogeographic population) of the grebe *Podiceps cristatus* and the great black-backed gull *Larus marinus* reside here. Furthermore, important numbers of the red-throated loon *Gavia stellate* and the common scoter *Melanitta nigra* are often recorded in the BNS in winter, and have both been included in Appendix I of the Birds Directive (see 2.4.2 Policy instruments).
- The beaches, the groynes and piers along the coast constitute resting places for internationally significant numbers of the European herring gull *Larus argentatus* and ruddy turnstone *Arenaria interpres* ([Adriaens and Ameeuw 2008](#)). In spring and summer, the coastal zone is an important foraging area for terns that mainly breed in the harbour of Zeebrugge, the Sluice Dock of Ostend and the Zwin. Although three tern species used to exceed the 1% standard on a regular basis (the Sandwich tern *Sterna sandvicensis*, the common tern *Sterna hirundo* and the little tern *Sternula albifrons*) ([Degraer et al. 2010](#)), the populations of terns and black-headed gulls in Zeebrugge-Heist and the western outer harbour of Zeebrugge declined sharply after 2008 ([Stienen et al. 2017](#)). Finally, the BNS functions as an important migration corridor which is used by more than a million seabirds each year. During the migration period, internationally significant numbers of the lesser black-backed gull *Larus fuscus*, the little gull *Hydrocoloeus minutus*, the Sandwich tern and common tern are regularly found ([Stienen et al. 2007](#));
- Furthermore, Belgian marine waters are important for two types of marine mammals that are discussed in appendix 2 of the Habitats Directive (see 2.4.2 Policy instruments) namely the harbor porpoise *Phocoena phocoena* and the harbour seal *Phoca vitulina* ([Degraer et al. 2010](#), [Haelters et al. 2016](#), [Haelters et al. 2017](#)). In the period February – April, the numbers of harbour porpoise in the BNS can increase to more than 1% of the estimated North Sea population ([Haelters et al. 2011](#)). Grey seals (*Halichoerus grypus*) are also increasingly seen in ports, at the coast and on the beach ([Haelters et al. 2017](#)).

The distribution of both seabirds and marine mammals is influenced by the intervention of human activities such as fishing and the presence of wind farms (see table 1 and 2.3 Impact on the marine and coastal environment, themes Fisheries and Energy (including cables and pipes)).

2.1.2 Beach

Beaches are relatively narrow, elongated strips that follow the boundary between land and sea, part of which is alternately situated above and below water due to tidal changes in the water level. They occur in coastal areas exposed to waves, resulting in mainly sandy sediments deposited. On the beaches along the Belgian coast, this concerns medium fine quartz sand with a lot of shell grit. The beaches are generally characterised by a microrelief of smaller shapes: low, elongated, longitudinal sand ridges separated by shallow, trench-shaped depressions (zwinnen), as well as other smaller features such as wallen and hoornen (rhythmic shapes). Waves and currents shape all sorts of ripple marks on the beach. The coast is subject to a semi-diurnal tide with tidal currents almost parallel to the coast. An elaborated overview of the geomorphology, processes and dynamics along the Flemish beaches is given in [De Moor \(2006\)](#) (see also: [Deronde 2007](#), [Van Lancker et al. 2015](#)).

The beach is also a unique habitat where large numbers of organisms are present. In [Speybroeck et al. \(2005\)](#), [Speybroeck et al. \(2008\)](#) and Ecosystem Vision for the Flemish Coast 2017 ([Van der Biest et al. 2017a](#)), an overview is given of the principal habitats, species and their interactions:

- Near the high water mark, on the dry beach, vascular plants can be found that are generally short living and dispersed by the sea (the most common species are the European searocket *Cakile maritima* and prickly glasswort *Salsola kali* subsp. *kali*). The establishment of the perennial species sand couch *Elymus farctus* subsp. *boreoatlanticus* or sea sandwort *Honckenya peploides* marks the starting point for the development of embryonic dunes because the sand deposited around these plants can accumulate permanently. The flood marks are also the habitat for several terrestrial arthropods (the most common species being the sand hopper *Talitrus saltator* and a number of specialised fly species ([Grootaert and Pollet 2004](#));
- Microphytobenthos⁸, especially diatoms, constitutes an important primary producer at the Belgian coast ([Speybroeck et al. 2005](#)). The meio⁹- and macrobenthos on the beach include specific communities such as the macrobenthic *Scolecopsis squamata-Eurydice pulchra* community. The geomorphology of the beaches,

⁸ Microscopically small plants that live on and in the upper centimetres of the soil.

⁹ Soil organisms between 1 and 0.063 mm in size.

including their grain size and slope, determines to a significant extent the distribution of the (marine) benthic life on beaches. Beaches with gentle slopes and fine grain are generally richer than steep-sloped beaches with coarse sand particles ([Degraer et al. 2003](#), [Vanden Eede et al. 2014a](#));

- The aforementioned beach fauna is an important food source for higher trophic levels of the marine environment, such as juvenile fish (e.g. plaice *Pleuronectes platessa*) and brown shrimps *Crangon crangon* ([Beyst et al. 1999](#)). It is currently being investigated whether the difference in beach morphology has an impact on the breeding ground function of the intertidal beach sections for juvenile flatfish ([Breine et al. 2018](#));
- Birds only breed in the quiet beach reserves of Heist, which are hardly disturbed by recreation, the *Sternenschiereiland* in Zeebrugge and the edges of the new breeding islands in the Zwin and the Sluice Dock in Ostend (e.g. little tern *Sternula albifrons*, common tern *Sterna hirundo*, common ringed plover *Charadrius hiaticula* and Kentish plover *Charadrius alexandrinus*). However, the beaches remain an important resting and foraging area for all kinds of gulls and waders ([Speybroeck et al. 2005](#), see also **Birds and marine mammals**).

Based on the available biological information about macro-, epi- and hyperbenthos and birds, biological valuation maps have been created in [Vanden Eede et al. \(2014b\)](#) for a number of beaches along the Belgian coast. Scientific knowledge about coastal processes and dynamics, including the occurring species and their interactions, is crucial to assess the impact of human activities on the coastal environment and the maintenance of a healthy coastal ecosystem ([Van der Biest et al. 2017a](#), [Van der Biest et al. 2017b](#)).

2.1.3 Dunes

The dune area of the Belgian coast, together with the mudflats and marshes and the upper beach are considered to be part of the 'Ecoregion of the Coast Dunes' ([Sevenant et al. 2002](#)). This area covers an area of 76.7 km². Based on pedology, this zone is characterised by the presence of sand that has been deposited by the wind. These deposits may date from the last ice age, but are generally not older than a few hundred years. The oldest dunes at our coast are situated between Adinkerke and Ghyvelde in the North of France. They supposedly originated 5,000 years ago and have continuously evolved since ([De Ceunynck 1992](#), [De Clercq and De Moor 1996](#)). At present, most of the coastal dynamics are limited to the dunes bordering the beach (zeereep¹⁰). However, one decade ago significant aeolian sand transport occurred in the Westhoek area and Ter Yde.

The age of the dunes determines the degree of decalcification of the sand, which is an important ecological determinant ([Ampe 1999](#), [Ampe et al. 2015](#)). Deeply decalcified soils can be found in the old dunes of Adinkerke, the inner dunes of Westende and Bredene-De Haan and locally in the inner dunes of Knokke. Quantitatively, the ecological diversity is mainly determined by the soil moisture, which in turn is determined by the dune relief in combination with the hydrology. A freshwater supply has built up below the dunes as a result of the percolation of excess precipitation, with the volume of this supply mainly depending on the width of the dunes. In the subsoil, this water body rests on an impermeable Paleogene clay layer of tens of metres thick. At the level of deep dune valleys (dune pans) or low-lying former beach plains, this groundwater can periodically rise above ground level and be subject to ecological conditions that can lead to the development of swamp vegetation ([Provoost et al. 2004](#)).

The complex of soil and vegetation developments and numerous biotic interactions lead to a further differentiation into ecotypes ([Rappé 1996](#), [Provoost et al. 2004](#)). In terms of the European Habitats Directive (see **2.4.2 Policy instruments**), 14 more or less natural coastal ecotypes that are limited to the coastal area within Flanders can be distinguished ([Decler 2007](#)) (see also *Natura 2000 in Flanders* website for more information). Six of these ecotypes are intertidal, the other eight belong to the dunes:

- 2110 – Embryonic shifting dunes;
- 2120 – Shifting dunes along the shoreline with European marram grass *Ammophila arenaria* ('white dunes');
- 2130 – Fixed dunes with herbaceous vegetation ('grey dunes');
- 2150 – Atlantic decalcified fixed dunes (*Calluno-Ulicetea*);
- 2160 – Dunes with sea-buckthorn *Hippophae rhamnoides*;
- 2170 – Dunes with creeping willow *Salix repens* ssp. *argentea* (*Salicion arenariae*);
- 2180 – Wooded dunes of the Atlantic, continental and boreal coasts;
- 2190 – Humid dune slacks.

In general, half of the species (organisms) in Flanders can also be found at the coast. The ecological specificity of the dune ecosystem is mainly related to the geomorphological dynamics of the contact zone between land and sea, the typical microclimate and the environmental gradients of fresh-saline, dry-wet and calcareous-decalcified

¹⁰ The row of dunes bordering the beach.

environments. In the dunes, the typical coastal species can almost all be found in the embryonic shifting dunes, the white dunes and the early stages of the grey dunes and dune valleys ([Provoost and Bonte 2004](#)). In the context of the European Habitats and Birds Directives (see 2.4.2 Policy instruments) the following species deserve special attention (see also website [Natura 2000 in Flanders](#)):

- Plant species in appendix II: creeping marshwort *Apium repens* and fen orchid *Liparis loeselii* (extinct at the Belgian coast);
- Bats in appendix IV: whiskered bat *Myotis mystacinus*, brown long-eared bat *Plecotus auritus*, Brandts' bat *Myotis brandtii* (hibernator), Daubenton's bat *Myotis daubentonii* (hibernator), grey long-eared bat *Plecotus austriacus* (hibernator), common pipistrelle *Pipistrellus pipistrellus* (during summer), Nathusius's pipistrelle *Pipistrellus nathusii* (during summer), serotine bat *Eptesicus serotinus* (during summer) and common noctule *Nyctalus noctula* (during summer) (De Maeyer and Velter 2004 in [Provoost and Bonte 2004](#));
- Breeding birds in appendix I: black-crowned night heron *Nycticorax nycticorax*, little egret *Egretta garzetta*, European honey buzzard *Pernis apivorus*, common tern *Sterna hirundo*, little tern *Sternula albifrons*, European nightjar *Caprimulgus europaeus*, middle spotted woodpecker *Dendrocoptes medius*, Sandwich tern *Thalasseus sandvicensis*, woodlark *Lullula arborea* and bluethroat *Luscinia svecica*;
- Amphibians in appendix IV: northern crested newt *Triturus cristatus* (appendix II), natterjack toad *Epidalea calamita* and European tree frog *Hyla arborea*;
- Snails in appendix II: narrow-mouthed whorl snail *Vertigo angustior* and Desmoulin's whorl snail *Vertigo moulinsiana*.

The human influence on the coastal ecosystem is substantial. Approximately half of the dune area has been urbanised in the last 150 years and the remaining areas have undergone drastic changes in the landscape. The sand dynamics of dunes (see also [Provoost et al. 2016](#)) have largely stopped, and thicket and forest development have profoundly altered the vegetation structure. Within the coastal dunes, other important triggers for biodiversity changes are the external factors (atmospheric deposition of nitrogen and climate change), recreation, water extraction and expansion of exotic species ([Provoost et al. 2004](#)). These triggers put the typical dune biodiversity under pressure ([Provoost 2014](#)). Despite growing awareness of the role of dune dynamics in supporting human well-being and biodiversity, redynamisation of dunes is rarely implemented in coastal zone management. A dynamic dune complex is not only of great ecological importance but would also provide substantial economic added value for coastal protection and recreation ([Van der Biest et al. 2017](#), see also theme **Safety against flooding**).

2.1.4 Estuaries, mudflats and marshes

Intertidal mudflats and marshes occur in the lee parts of the coast where reduced marine dynamics allow sedimentation of fine-grained silt. Along the Belgian coast they can be found in the Yser Estuary, the Bay of Heist, the Zwin and the 'tern peninsula' in Zeebrugge (see also: Ecosystem Vision Flemish Coast 2017 ([Van der Biest et al. 2017a](#))), covering a total area of approximately 200 ha. Real estuarine nature is only present in the river mouth of the Yser. Outside the Belgian coast, mudflats and marshes also occur in the Scheldt Estuary (see also theme **Scheldt Estuary**). The bibliography of all these areas can be searched thematically in the [catalogue](#) of the VLIZ library. Mudflats and marshes are by nature dynamic systems. A healthy and dynamic system is therefore characterised by the interaction between sedimentation processes and erosion processes. The trend and speed of habitat changes tells if the dynamics in the system are too large, too small or in balance ([Maris et al. 2014](#), Ecosystem Vision Flemish Coast 2017 ([Van der Biest et al. 2017a](#))).

The Atlantic salt marshes and salt meadows are included in three European habitat types ([Decler 2007](#)):

- 1310 – One-year pioneering vegetation colonising mud and sand areas;
- 1320 – Coastal salt muds with cordgrass vegetation;
- 1330 – Atlantic salt meadows.

Estuaries are considered as a separate habitat type (1130) and may include, in addition to the water biotopes, different habitat types of the mudflats and marshes.

The Zwin used to belong to an Estuary reaching Bruges (see *inter alia* [Claeys 1981](#), [Termote 2012](#)). At present, the Zwin park is a cross-border nature reserve (Belgium-the Netherlands) consisting of an interrupted dune belt with tidal mudflats and marshes behind it. The North Sea enters the area through a gully, creating a system of creeks. The protection of the habitat types and species occurring in the Zwin, by means of the European Habitats Directive is discussed in [Bot \(2007a\)](#). The tidal area serves as an important place to rest, forage, moult, breed and migrate for several birds, including different species which are protected by the European Birds Directive (see [Bot 2007b](#)). Several of these species make use of the food availability that is present in large numbers as benthos in the Zwin nature reserve ([Van Colen et al. 2009](#)). Due to the siltation of the Zwin, measures have been taken in the context of the Development Sketch 2010 for the Scheldt Estuary (see theme **Scheldt Estuary**) to restore the mudflats and

marshes and expand the nature reserve (Verhaegen et al. 2010, Van Nieuwenhuysse et al. 2016, see also: *The Zwin in transformation*).

On the right bank of the Yser, between its mouth in the North Sea and the Ganzenpoot sluice complex, there is an area that is still under tidal influence. This area is part of the Flemish nature reserve of the Yser Estuary (Hoffman 2006). As a result of a nature restoration project, the natural transitions of the various components of the coastal ecosystem (including tidal mudflats and marshes) were restored (Hoffman et al. 2006). The protection of nature in the Yser Estuary by the European Habitats and Birds Directives was elaborated in more detail in Spanoghe et al. (2003).

The Bay of Heist constitutes an ecological beach where estuarine vegetation has developed in a central depression (Cosyns et al. 2002).

2.1.5 Polders and Polder complex

'The Polders' is the name of the former intertidal areas, which have been almost completely excluded from the marine influence by land reclamation since the early Middle Ages. It is a flat and low-lying landscape with inversion relief, caused by the consolidation of clay layers and the subsidence of peat (Baeteman 2007, Baeteman 2013). It is also the name of the habitats directive area in the coastal zone (MD of 24 May 2002) which overlaps with the birds directive area 'Polder complex' (MD of 17 July 2000) (see 2.4.2 Policy instruments) (More information about the Polders in the context of Natura 2000 can be found on the website of *Natura 2000 in Flanders*).

- These special protection areas (SPAs) have been designated for six European protected habitat types and 21 European protected animal species (Paelinckx et al. 2009). The habitat types include marshes, salt meadows, nutrient-rich herb communities, grasslands, fens and swamp forests. The species for which the habitats directive area has been established are the pond bat *Myotis dasycneme* and northern crested newt *Triturus cristatus*. For this last species, only very few recent observations in the Polders are known;
- The birds directive area 'Polder complex' has been established because the following European protected species breed in this area: Eurasian bittern *Botaurus stellaris*, little bittern *Ixobrychus minutus*, ruff *Philomachus pugnax*, short-eared owl *Asio flammea* and bluethroat *Luscinia svecica*. Also some non-breeding birds directive species are relevant for the poldercomplex: red-throated loon *Gavia stellata*, Bewick's swan *Cygnus bewickii*, whooper swan *Cygnus cygnus*, the lesser white-fronted goose *Anser erythropus*, barnacle goose *Branta leucopsis*, red-breasted goose *Branta ruficollis*, western marsh harrier *Circus aeruginosus*, hen harrier *Circus cyaneus*, merlin *Falco columbarius*, golden plover *Pluvialis apricaria*, wood sandpiper *Tringa glareola* and common kingfisher *Alcedo atthis* (Courten and Kuijken 2004). The 'Polder complex' has also been established because significant numbers of geese stay in this area during winter months. The pink-footed goose *Anser brachyrhynchus* and the greater white-fronted goose *Anser albifrons* annually exceed the 1%-limit (Kuijken et al. 2005, Wetlands International 2006 – *Waterbird Population Estimates*, Devos and T'Jollyn 2016).

The Polders are also characterised by the occurrence of valuable historical permanent grasslands (HPGs). These were mapped by De Saeger et al. (2013). On 27 November 2015, the Government of Flanders definitely approved the map of the historical permanent grasslands (HPG) in the agricultural region of the Polders (see theme **Agriculture**).

2.2 Ecosystem goods and services

The Millennium Ecosystem Assessment (MEA 2005) describes ecosystem services as the benefits that humans obtain from the ecosystem. They can be divided into goods, regulatory services, cultural services and support services. The concept of ecosystem services has been elaborated to also include the economic aspects of the ecosystem (The Economics of Ecosystems and Biodiversity, TEEB). The average economic value of the services the marine and coastal ecosystems deliver has been estimated by Costanza et al. (1997) to be 252 and 4,052 US dollars per hectare per year respectively. According to a study by WWF (Hoegh-Guldberg et al. 2015), the overall value of ocean 'gross marine product' amounts to 24 trillion US dollars. The demarcation of 20 to 30% of all seas would create 1 million jobs worldwide (Balmford et al. 2004). This equals an estimated yield of 294 billion euro (compared to a cost up to 15 billion euro in protection measures) (Seys 2006, Slabbinck et al. 2008).

The BEES project aims to map ecosystem services in Belgium, and the ECOPLAN toolbox has been developed to assess ecosystem services on land. Jacobs et al. (2010) published the first inventory of ecosystem services (and potential ecosystem profits) for Flanders. The new version of the nature report for Flanders (NARA, 2014–2018) has been drafted as an ecosystem assessment in which 16 ecosystem services have been further elaborated (Stevens 2014). An entire chapter is dedicated to coastal protection (Provoost et al. 2014). Furthermore, nature valuation studies are also available (e.g. Hutsebaut et al. 2007). The calculation instrument 'Natuurwaardeverkenner' has been

developed as a support for the quantification and economic estimation of the ecosystem services in a social cost-benefit analysis (SCBA) or other evaluations of (infrastructure) projects with an impact on nature (more information: [Liekens et al. 2013](#)).

Scientific knowledge about the ecosystem goods and services of the BNS (and the wider North Sea) and the adjacent coastal zone has not yet been studied to any great extent:

- A preliminary overview of the types of goods and services delivered by marine biodiversity in the BNS can be found in [Beaumont et al. 2007](#);
- Within the renewed Ecosystem Vision for the Flemish Coast ([Van der Biest et al. 2017a](#)), an analysis of ecosystem services is made based on the [CICES v4.3](#) classification of ecosystem services for the purpose of the development of the long-term vision 2100. [Van der Biest \(2018\)](#) presents the scientifically based methods developed for assessing and managing ecosystem services. It is mentioned here for the coastal ecosystem that the most important economic value is created in the dunes by recreation, and in the second place by protection against flooding ([Van der Biest et al. 2017](#)). The extraction of drinking water is also an important ecosystem service, although the net extraction of natural groundwater has a significant negative impact on biodiversity. This ecosystem vision emphasises that, despite current scientific knowledge on the impact of human use on the marine environment, it is a challenge to deal with uncertainties (e.g. carbon sequestration in the marine environment) and thus to preserve coherence between human activities and a healthy ecosystem. The determination of the cumulative effects of human activities remains a major challenge ([Stelzenmüller et al. 2018](#));
- In the framework of the Marine Strategy Framework (MSFD), a first socio-economic analysis of the use of Belgian marine waters and the costs associated with the degradation of the marine environment was prepared in 2012 ([Belgian State 2012](#), [Börger et al. 2016](#)), and an update of this socio-economic analysis in the framework of the MSFD was published in 2018 ([Volckaert and Rommens 2018](#)). In this study, the costs of the measures to prevent contamination of the BNS are calculated at a minimum of 2.5 million euro per year ([Volckaert and Rommens 2018](#));
- In the context of this socio-economic analysis, the potential of an ecosystem services approach is also offered ([Volckaert and Rommens 2018](#)). This approach provides information on the value of the difference in ecosystem goods and services that would be provided in the event of good environmental status (GES as defined in the MSFD) compared to normal use, and focuses here on the Flemish banks for the aggregate extraction sector (see also theme **Sand and gravel extraction**). At present, the methodology and empirical application are not yet sufficiently developed to apply the ecosystem approach within the current reporting cycle of the MSFD;
- OSPAR is also taking action to establish an assessment framework for evaluating the economic and social value of the OSPAR maritime area ([OSPAR IA 2017](#));
- The 2018 [MAES report](#) (Mapping and Assessment of Ecosystems and their Services) report proposes a list of policy-relevant core indicators to assess the pressure of ecosystem services on the marine ecosystem and the condition of the marine ecosystem.

2.3 Impact on the marine and coastal environment

The marine and coastal environment, described above, is a region where various human activities take place, each of which have a specific impact on the environment (see theme **Integrated ocean policy**: figure 7). In a number of reports, an overview of the activities and associated impact is provided: [Maes et al. \(2004\)](#) ([MARE-DASM project BELSPO](#)), [Maes et al. \(2005\)](#) ([GAUFRE project BELSPO](#)), [Goffin et al. \(2007\)](#), [André et al. \(2010\)](#), [Initial assessment of the state of the marine environment \(Belgian State 2012a\)](#), [Review of the initial assessment for Belgian marine waters](#). The Marine Strategy Framework Directive ([Belgian State 2018, public consultation](#)), the second federal environmental report ([2015a](#) and [2015b](#)), as well as [State of Europe's Seas \(2015\)](#) and [OSPAR IA \(2017\)](#) at a larger geographical scale. Next to these integrated reports, numerous studies exist on the (direct and indirect) impact of a specific user function. These publications are discussed in the texts of the different user functions under the section 'Impact'. In table 1, a list of the various theme texts of the Knowledge Guide Coast and Sea is given, in which information sources on a specific type of impact can be found. This table does not provide an exhaustive overview of the impacts on the marine and coastal environment but serves as a readers' guide. In addition, the problems of marine litter are specifically addressed below, as this theme is not specifically linked to any particular user function.

LITTER

The presence of marine litter is a global problem on land and at sea. Litter is caused by multiple activities and/or sectors and has a potential negative impact on multiple user functions. For more than ten years, the occurrence and effects of litter and microplastics on the beach and in the sea has been studied in Flanders ([Devriese et al. 2016](#),

Table 1. Reference table with an overview of the type of impacts discussed within the specific theme texts of the Knowledge Guide Coast and Sea of the Compendium for Coast and Sea.

Impact	Theme texts
Impact on air quality	Maritime transport, shipping and ports; Tourism and recreation; Fisheries; Agriculture; Sand and gravel extraction; Safety against flooding; Energy (incl. cables and pipes)
Impact on the pelagic ecosystem (eutrophication, pollution, etc.)	Energy (incl. cables and pipes); Agriculture; Tourism and recreation; Aquaculture; Maritime transport, shipping and ports; Military use; Dredging and dumping; Fisheries; Sand and gravel extraction
Impact on fish stocks	Fisheries; Aquaculture; Tourism and recreation; Energy (incl. cables and pipes)
Impact on seabirds and marine mammals	Energy (incl. cables and pipes); Maritime transport, shipping and ports; Fisheries; Aquaculture; Military Use
Impact on the seabed/ habitats	Sand and gravel extraction; Dredging and landfill; Energy (including cables and pipes); Military use; Safety against floods; Fisheries; Aquaculture; Agriculture
Impact on hydrographic properties	Energy (incl. cables and pipelines); Maritime transport, shipping and ports; Military use; Safety against floods; Aquaculture; Dredging and landfilling; Sand and gravel extraction
Impact on spatial use (incl. Impact on nature area)	Social and economic environment; Tourism and recreation; Energy (incl. cables and pipes); Fisheries; Aquaculture; Agriculture; Safety against floods; Sand and gravel extraction; Maritime transport, shipping and ports
Impact on beach and dunes	Tourism and recreation; Safety against floods
Impact on groundwater	Tourism and recreation; Agriculture; Safety against floods

Devriese and Janssen 2017). In order to protect the marine environment, marine litter has already been included in the OSPAR targets and in the MSFD environmental targets (descriptor 10) (see below **2.4 Protection of the marine and coastal environment**). The revision of the initial assessment for Belgian marine waters (*Belgian State 2018, public consultation*) shows that on average 136 objects of litter per 100 m beach are found on Flemish beaches (of which approximately 80% are plastic), and an average of 126 objects per km² are found on the seabed (of which approximately 90% are plastic). The intermediate assessment of the OSPAR Commission also showed that plastic is the most common material on the seafloor and the beach (*OSPAR IA 2017, ICES WGML Report 2018*). These pieces of plastic can further fragment into very small pieces of plastic, the so-called microplastics or nanoplastics. Not only large plastic objects, but also microscopically small particles can cause a negative impact, both socially, economically and ecologically (see overview in *Devriese and Janssen 2017, Everaert et al. 2018*). Both in the field of fundamental and applied scientific research, and in the context of (government) policy, there are clear needs to tackle the problem of litter and microplastics in Flemish aquatic environments (*Devriese and Janssen 2017*). On 23 November 2017, the federal *Action Plan Marine Litter* was approved by the Council of Ministers, in which measures and actions were formulated as concretely as possible. The Flemish Integrated Action Plan Marine Litter (*OVAM 2017*) also proposed 21 objectives and 36 measures to tackle this problem at the Flemish level.

2.4 Protection of the marine and coastal environment

2.4.1 Policy context: administrations and organisations

The environmental policy concerning the coast and sea is directed by several international, European and regional organisations (see also theme **Integrated ocean policy**). In 2015, the Sustainable Development Agenda 2030 (United Nations - *UN*) was adopted, including 17 Sustainable Development Goals (*SDG*). Sustainable Development Goal 14 (SDG 14) addresses the conservation and sustainable use of the seas, oceans and marine resources and addresses threats such as climate change, overfishing and pollution. The International Maritime Organisation (*IMO*) of the United Nations is a specialised agency responsible for the safety and security of shipping and the prevention of marine pollution caused by ships (see also theme **Maritime transport, shipping and ports**). The United Nations Environment Programme (*UNEP*) aims to coordinate the development of the environmental policy on a global and regional level by bringing the environment to the attention of the governments and international community and by signalling new points of interest.

On a European level, the Directorate-General for the Environment (*DG ENV*) of the European Commission (EC) aims to protect, maintain and reinforce the European environment. The Directorate-General for Maritime Affairs and Fisheries (*DG MARE*) of the European Commission (EC) operates in two policy areas: the Common Fisheries Policy (*CFP*, see theme **Fisheries**) and the Integrated Maritime Policy (*IMP*). The IMP aims to provide an integrated answer

to the current challenges of the Europe's seas: marine pollution, environmental protection, coastal development, job creation, etc. The European Marine Strategy Framework Directive (MSFD) is an important instrument for the protection of the marine environment. The European Environment Agency (EEA) of the European Union provides reliable and objective information about the environment to anyone involved or interested in environmental policy. In the *OSPAR commission*, 15 national governments from Western Europe (including Belgium) and the EU collaborate to protect the marine environment of the North-East Atlantic Ocean.

In Belgium, the *Marine Environment Service* of the FPS Health, Safety of the Food Chain and Environment is competent for the environmental policy in the BNS. The department also presides the advisory commission for marine spatial planning (MSP) in the Belgian maritime regions (RD of 13 November 2012). The scientific and technical support for the marine environmental policy is provided by the Management Unit of the North Sea Mathematical Models of the Royal Institute of Natural Sciences (RBINS-MUMM). With regard to sand and gravel extraction, the *Continental Shelf Service* of the FPS Economy, SMEs, Self-Employed and Energy is the competent authority. The objectives of the *policy statement (2016)* of the secretary of state of the North Sea include further nature development, a revision of the marine spatial plan and the expansion of a North Sea vision by 2050. In 2017, an initiative was launched with the aim of drawing up this 2050 vision for the future of the North Sea. This vision will be used as a guideline for the new marine spatial plan (MSP) 2020-2060 (see also theme *Integrated ocean policy*). Three working groups were set up for this initiative (naturalness, multiple use of space and blue economy and innovation). Within the working groups, naturalness was defined and the necessary steps towards sustainable naturalness by 2050 were formulated, which are reflected in the long-term vision for the North Sea (*De Backer 2017*). The initiative has since been renamed the *Think Tank North Sea*, which, under the chairmanship of RBINS-OD Nature and Flanders Marine Institute (VLIZ), will facilitate bottom-up consultation on the future of the BNS.

All aspects of the environmental policy with regard to the coast (landward of the baseline) are an exclusive competence of Flanders (*Policy Memorandum on the environment 2014-2019*). The Environment Department (OMG) is the environmental administration of the Government of Flanders and is responsible for the preparation, follow-up and evaluation of the Flemish environmental policy. The OMG Department is also responsible for operational matters such as environmental enforcement, environmental permits and approvals, environmental impact and safety reports, environmental and nature education, and nature conservation and development. In addition to the OMG Department, the following relevant entities are included in the policy area Environment: the Agency for Nature and Forest (ANB), the Research Institute for Nature and Forest (INBO), the Flemish Energy Agency (VEA), the Public Waste Agency of Flanders (OVAM), the Flemish Environment Agency (VMM) and the Flemish Land Agency (VLM).

The *province of West Flanders* acts as an intermediary between the federal Government, the regions and the municipalities, and has competences with regard to the environment as it is responsible for the coordination of an integrated water policy, the management of provincial domains and green corridors, and nature and environmental education.

The municipal environmental services are competent for the treatment of complaints concerning the environment and nature, local nature preservation, monitoring and advice about environmental permits, waste management, environmental policy planning, development of a sustainable policy and raising awareness on the themes of nature, environment and sustainability towards the citizens and other target groups.

2.4.2 Policy instruments

The intense activities at sea and at the coastal zone have led to an elaborated package of legislations and regulations with the aim of mitigating, reducing or avoiding the impact of certain user functions on the environment (see *Verleye et al. 2018*). These mostly sectoral legislations and regulations (e.g. MARPOL Convention) are discussed in the theme texts of the relevant user functions in the sections 'Policy Context' and 'Sustainable Use'. Hence, the most relevant nature and environment-related policy instruments for the BNS and the coastal zone are briefly discussed below (see also theme *Integrated ocean policy* for more information).

RAMSAR CONVENTION (1971)

The *Ramsar Convention* (Ramsar, Iran, 1971) is an intergovernmental treaty aimed at the global protection and sustainable management of wetlands with special attention to the conservation of habitats of water birds (*Goffin et al. 2007*). The convention attempts to achieve the protection and rational and sustainable use of wetlands of international importance (including marine waters where the depth of water at low tide is less than 6 metres) by means of local and national measures and international cooperation.

OSPAR CONVENTION (1992)

The [OSPAR Convention \(1992\)](#) constitutes an overarching legal framework for the protection of the marine environment of the North-East Atlantic Ocean (including the North Sea) with a cooperation of 15 national governments and the EU (= the 16 Contracting Parties). The OSPAR Convention replaces the Convention of Oslo (1972) and the Convention of Paris (1974). The convention contains general regulations on the protection of the marine environment from specific sources of pollution, such as pollution from land by disposal or combustion and by offshore activities. Furthermore, agreements on the evaluation of the quality of the marine environment ([OSPAR QSR 2010](#), [OSPAR IA 2017](#)) and the protection and preservation of the ecosystems and biological diversity are part of the OSPAR Convention ([Goffin et al. 2007](#)).

Overall, the work of the OSPAR Commission is guided by the ecosystem approach towards an integrated management of human activities in the marine environment. This is supported by an obligation of Contracting Parties to apply the precautionary and polluter pays principle (see theme **Integrated ocean policy**), and the use of best available techniques (BAT) and best environmental practice (BEP), including clean technology. The implementation of the Ecosystem Approach is undertaken in OSPAR's North-East Atlantic Environment Strategy ([NEAE Strategy](#)). The NEAE Strategy was drawn up in 2010 based on the holistic approach in the [OSPAR QSR 2010](#) and focusses on a suite of five thematic strategies that address the main threats (hazardous substances, eutrophication, radioactive substances, biodiversity and ecosystem loss and the impact of offshore activities). The OSPAR mid-term review ([OSPAR IA 2017](#)) updates the OSPAR QSR 2010 and can be integrated into national obligations for the assessment of marine waters in the context of the European Marine Strategy Framework Directive (MSFD, see below).

The OSPAR secretariat also acts as secretariat for the [Bonn Agreement](#) (1969). This is the mechanism by which the North Sea States, and the European Union (the Contracting Parties), work together to help each other in combating pollution in the North Sea Area from maritime disasters and chronic pollution from ships and offshore installations; and to carry out surveillance as an aid to detect and combat pollution at sea.

UNITED NATIONS CONVENTION ON THE LAW OF THE SEA (1982)

The United Nations Convention on the Law of the Sea ([UNCLOS 1982](#)) can be considered as the first intergovernmental convention that creates an integrated legal framework for the use of the oceans. Notwithstanding the broad scope of this convention, part XII of UNCLOS (Protection and Preservation of the Marine Environment) specifically addresses the protection and preservation of the marine environment.

CONVENTION ON BIOLOGICAL DIVERSITY (1992)

The [Convention on Biological Diversity](#) (CBD) was established at the UN Convention on Environment and Development (UNCED, 3-14 June 1992, Rio de Janeiro) and covers ecosystems, species and genetic resources. The convention has three main objectives: (1) the conservation of biological diversity, (2) its sustainable use and (3) the fair and equitable sharing of benefits arising from of the utilisation of genetic resources. The national biodiversity strategies and action plans ([Biodiversity 2020](#), [Actualisation of the Belgian national strategy 2013](#)) provide a principal instrument for the conservation and sustainable use of biological diversity with contracting parties cooperating where there are bilateral interests or where there is no national jurisdiction over the matter.

HABITATS DIRECTIVE (1992)

The European Habitats Directive (92/43/EEC) aims to maintain and restore the threatened European natural habitats and wild fauna and flora. The Member States need to designate special protection areas (SPA-H or habitats directive areas) for certain habitats and species of European importance which are listed in the Annexes I and II of the directive. Together with the birds directive areas, these habitats directive areas constitute the European Ecological [Natura 2000 network](#). Of the entire 3,190 ha of undeveloped dunes, 94% has been included within SPA-H. All intertidal mudflats and marshes (in total approx. 200 ha) are also designated as SPA-H. The Habitats Directive also applies to the BNS where an area of 109,993 ha (Flemish Banks) is designated as SPA-H. The area consists mainly of shallow, flooded sandbanks, but also of biogenic and geogenic reefs.

The aim is to achieve a good conservation status for the habitats listed in annex I and for the species listed in Annex II and IV to this directive. Conservation objectives (COs) determine the scientific standards against which the FCS must be assessed (see also [Bot 2007](#) and [T'Jollyn et al. 2009](#) (local conservation status)). For the marine protected

areas, too, COs were determined in the context of the Birds and Habitats Directives (see also: [Degraer et al. 2010](#)). This study, together with the aims of the MSFD, formed the basis of the MD of 2 February 2017 on the adoption of conservation targets for marine protected areas.

According to the Habitats Directive (art. 17), the Member States are obliged to report every six years to the EC about the conservation status of the habitat types and species as well as about the results of the policy pursued. For the landward side, the conservation status of the species and habitats of European importance was reported by [Louette et al. \(2013\)](#) for the period 2007-2012. A methodology was developed for monitoring the quality of nature within the habitats directive areas on the landside, based on a mapping of habitats, a monitoring network for monitoring habitat quality ([Westra et al. 2011](#)) and a monitoring network for monitoring the populations of a selection of internationally important species ([Adriaens et al. 2011](#)). On the sea side, there was a general evaluation of the conservation status at [Degraer et al. \(2009\)](#) on which the reporting to the EC was based.

DECREE OF THE DUNES (1993) – FLEMISH ECOLOGICAL NETWORK – SPATIAL IMPLEMENTATION PLANS

Besides the aforementioned Ramsar Convention and the Habitats and Birds Directives, other policy instruments for the protection of nature areas in the coastal zone are of importance. At the Flemish level, the decree of 21 October 1997 on nature conservation and the natural environment provides direction to the overall objectives of the nature policy and the elaboration of policy instruments with regard to species as well as certain areas. The spatial basis of these instruments is constituted by the regional spatial plans of the seventies. In the context of the Dune decree (14 July 1993 and following), additional areas have been protected, either as 'protected dune area' for the hard destinations or as 'agricultural area important for the dune area' for the agricultural land ([Provoost 1999](#)).

The Flemish Ecological Network (*FEN*) comprises currently valuable nature in Flanders, supplemented by areas with high potential as nature centres or as nature links. In these areas, nature is additionally protected and users and owners are given additional resources and opportunities to help build a nature- and people-friendly environment.

Finally, space for nature development is provided by spatial planning through the demarcation of the natural structures in the spatial structure plans (*Spatial Structure Plan Flanders*, *Provincial Structure Plan West Flanders*), subsequently implemented as spatial implementation plans (SIPs) (formerly: regional plans).

LONG-TERM VISION OF SCHELDT ESTUARY (2001)

The policy and management of the Scheldt Estuary is a cross-border matter in which both Flanders and the Netherlands are involved. For the policy context, including cross-border treaties and memorandums for the Scheldt Estuary, we refer to the theme **Scheldt Estuary** (and the [VNSC website](#)). Within the framework of the Long-Term Vision of the Scheldt Estuary (LTV, *Directie Zeeland and AWZ 2001*), the permanent working group Research and Monitoring (R&M) of the Flemish-Dutch Scheldt Commission was established. The R&M working group coordinates a long-term monitoring and research programme (MONEOS, [Meire and Maris 2008](#)) to support the policy and management of the Scheldt Estuary. This includes the six-yearly evaluation of the Scheldt Estuary (evaluation method: [Holzhauer et al. 2011](#), [Maris et al. 2014](#)). Within this evaluation method, each indicator is individually supported according to a pyramid structure in which the relevant test parameters, calculation parameters and explanatory variables are included (see also: Indicators for sustainable management in [Goffin et al. 2015](#)). The evaluation method is a dynamic document that is reviewed after each evaluation report. The first evaluation report (T2009-report: [Depreiter et al. 2014](#)) serves as a reference for the subsequent evaluations, with T2015 evaluating the data on the Scheldt Estuary from 2010 up to and including 2015 ([Barneveld et al. 2018](#)).

MARINE ENVIRONMENT ACT (1999) AND MARINE SPATIAL PLANNING ACT

The law on the marine environment and marine spatial planning act (MMM law of 20 January 1999) aims to maintain the nature, biodiversity and integrity of the marine environment through protective measures (including the establishment of marine protected areas) and through measures to repair damage and environmental disturbance. In addition to a ban on a number of activities, this law introduces objective liability for damage and environmental disturbance ([Goffin et al. 2007](#)). The MMM law also lists the activities that are subject to a prior licence or authorisation granted by the minister. The MMM law links this licence or authorisation for existing and new activities at sea to a preceding environmental impact assessment (EIA). Since 20 July 2012, the law also regulates the organisation and procedure of marine spatial planning.

WATER FRAMEWORK DIRECTIVE (2000)

The European Water Framework Directive (WFD, 2000/60/EC) stipulates that all European 'natural' surface waters must have at least a good ecological status (GES) and a good chemical status (GCS) by 2015. For 'heavily modified' or 'artificial' surface waters/water bodies¹¹, the ecological objectives have been adjusted, and a good ecological potential (GEP) is mentioned. The deadline (2015) for achieving these objectives may be conditionally extended up to a maximum of two updates of the River Basin Management Plan (2021/2027). For the purposes of the GES, the WFD extends to 1 nautical mile on the seaward side of the baseline and for the purposes of the GCS up to 12 nautical miles on the seaward side of the baseline.

In order to achieve the objectives of the WFD, Member States are required to develop river basin management plans every six years. The first plans were drafted in 2009. In the decree of 18 December 2015, the Government of Flanders adopted the river basin management plans for the rivers Scheldt and Meuse for the period 2016-2021, including the programme of measures for the river basin management plans, the revised zoning plans and the area-wide implementation plans ([website Coördinatiecommissie Integraal Waterbeleid, Programme of measures for the river basin management plans for Scheldt and Maas 2016-2021](#)). On 20 January 2017, an amendment to the revised zoning plans and the area-wide implementation plans for Landen, Ostend, Sint-Katelijne-Waver and Zandhoven was published. All the surface waters of the coastal zone of Flanders belong to the international river basin district of the Scheldt: in accordance with the competences of the Flemish and federal authorities, the river basin management plans have been divided into a river basin management plan for the Scheldt ([River basin management plan for the Scheldt 2016-2021](#)) and a river basin management plan for the Belgian coastal waters ([River basin management plan Belgian coastal waters 2016-2021](#)). Coordination takes place between the managing authorities of the river basin district (the Netherlands, France, the three regions and the federal Government of Belgium) via the International Scheldt Commission ([ISC](#)) and at Belgian level via the Coordination Committee on International Environmental Policy ([CCIEP](#)).

The WFD is supplemented by the Subsidiary Directive on Groundwater (2006/118/EC) (on the protection of groundwater against pollution and deterioration) and the Subsidiary Directive on Priority Substances (2008/105/EC) (on environmental quality standards in the field of water policy for surface water for a number of hazardous substances). Furthermore, the WFD is closely related to a number of other directives that are further discussed in the various theme texts. These include the Urban Waste Water Directive (91/271/EC), the Nitrates Directive (91/676/EC) (see theme [Agriculture](#)), the Bathing Water Directive (2006/7/EC) (see theme [Tourism and recreation](#)) and the Floods Directive (2007/60/EC) (see theme [Safety against flooding](#)).

The implementation of the WFD is provided for by the RD of 23 June 2010 – surface water status at the federal level and the decree on Integrated Water Policy (decree of 18 July 2003) at the Flemish level. Flanders has opted for an area-oriented approach, in which the aim is to achieve good environmental status by 2021 in the spearhead areas and by 2027 in the focus area. Article 19(2) of the Framework Directive states that the Commission shall review the directive at the latest 19 years after the date it came into force and shall propose any amendments necessary to achieve the objective of the directive. To this end, the Commission published a roadmap on 20 October 2017 ([Fitness Check of the Water Framework Directive and the Floods Directive](#)).

MARINE STRATEGY FRAMEWORK DIRECTIVE (2008)

The European Marine Strategy Framework Directive (MSFD, 2008/56/EC) is the environmental pillar of the European Union's Integrated Maritime Policy (IMP) (COM (2007) 575). The aim of the MSFD is to achieve good environmental status (GES) of European marine waters by 2020 and to protect the resources on which economic and social activities depend. The GES is defined in Article 9 of this Directive on the basis of 11 descriptors (table 2) for which Member States are required to develop indicators with associated environmental targets ([DG Leefmilieu 2012](#)). The European Union shall support Member States in developing the methodology of the indicators through a technical report, scientific opinions by descriptor (table 2) and Decision [2017/848/EU](#), establishing criteria and methodological standards on GES of marine waters and specifications and standardised methods for monitoring and assessment. An overview of relevant legislation, guidelines, technical and scientific reports can be found on the website of the [Directorate-General for Environment](#). With the adoption of the MSFD, OSPAR is expected to play a key role in harmonising the environmental objectives and the programmes of measures drawn up and implemented by the EU Contracting Parties.

¹¹ Artificial water bodies have been created by humans in places where no natural water body was present. A heavily modified water body is a natural water body that has changed significantly due to human activity.

Table 2. An overview of the 11 descriptors and the associated technical reports included in the MSFD.

Descriptors MSFD		
1	Biological diversity	Cochrane et al. (2010) ; 2017/848/EU
2	Non-indigenous species	Olenin et al. (2010) ; 2017/848/EU
3	Commercially exploited species of fish, crustaceans and molluscs	Piet et al. (2010) ; 2017/848/EU
4	Marine food webs	Rogers et al. (2010) ; 2017/848/EU
5	Eutrophication	Ferreira et al. (2010) ; 2017/848/EU
6	Seafloor integrity	Rice et al. (2010) ; 2017/848/EU
7	Hydrographical conditions	2017/848/EU
8	Contaminants	Law et al. (2010) ; 2017/848/EU
9	Contaminants in fish and other seafood	Swartenbroux et al. (2010) ; 2017/848/EU
10	Marine litter	Galgani et al. (2010) ; 2017/848/EU
11	Energy, including underwater noise	Tasker et al. (2010) ; 2017/848/EU

Following the implementation of the MSFD (RD of 23 June 2010 – marine strategy), Belgium has prepared an [initial assessment of the state of the marine environment \(Belgian State 2012a\)](#) for the BNS, including a [socio-economic analysis of the users of the BNS \(Belgian State 2012b\)](#). Furthermore, a document with the [Description of the good environmental status and determination of environmental targets \(Belgian State 2012c\)](#) was published for the BNS. On this basis, a [monitoring programme \(2014\)](#) was drawn up by MUMM to measure the evolution of the state of the environment's health. Subsequently, the Marine Environment Service developed a programme of measures ([Programme of measures for Belgian marine waters 2016](#)), describing additional measures necessary to achieve good environmental status. In the meantime, studies are being carried out specifically with regard to nature values to restore and strengthen the gravel beds and the (lost) oyster beds. Every six years (2018, 2024, etc.), the evaluation must be reviewed and, if necessary, revised in the light of the results obtained on the basis of the monitoring programme and the programme of measures ([DG Leefmilieu 2012](#)). At the end of 2018, the final evaluations for the initial assessment for each MSFD descriptor will be made public ([Belgian State 2018](#) and [Belgian State 2018b](#), public consultation).

BIRDS DIRECTIVE (2009)

The European Birds Directive (2009/147/EC) aims to protect all species of wild birds. Special protection measures have been taken for the habitats of the bird species listed in Annex I and all species which are found in internationally significant numbers as breeding, migratory or winter birds. Each Member State is required to designate special protection areas (SPAs or birds directive areas) that are part of the European ecological [Natura 2000 Network](#). According to the Birds Directive (art. 12), the Member States are obliged to report every six years about the conservation status of the species and on the outcome of the policy pursued to the EC. The MD of 2 February 2017 contains the conservation objectives (COs) that were adopted for the BNS in the context of the Birds and Habitats Directives (see also the [Habitats Directive](#)). The most recent report under the Birds Directive covers the period 2007-2012 (see [Anselin et al. 2013](#)). The next official report to Europe will be in 2019, in which the status of these bird species will be compared with the conservation objectives. In [Paelinckx et al. \(2009\)](#) and [Degraer et al. \(2010\)](#), the current conservation of the bird species of the Birds Directive at the level of Flanders and the North Sea (see also [DG Leefmilieu 2010](#)) has already been determined, in support of the setting of COs.

The implementation of the Habitats and Birds Directives in the federal legislation has been provided by several decrees under the law of 20 January 1999: e.g. the RD of 21 December 2001, the RD of 14 October 2005, the RD of 5 March 2006 and the RD of 27 October 2016. The decision of the Government of Flanders of 23 March 2014 resulted in the definitive designation of the SPA on the (landward side of the) coast ([Achterhaven Zeebrugge-Heist](#), [Dune areas](#) and [Polders](#)) and the associated conservation objectives (see additional information and approved conservation objectives at www.natura2000.vlaanderen.be).

PROGRAMME-BASED APPROACH TO NITROGEN (PAN)

The atmospheric deposition of nitrogen from agriculture, traffic, industry and households is in certain cases a bottleneck for the realisation of the nature objectives set within the framework of the Habitats and Birds Directives (see also theme **Agriculture**). The Programmatic Approach to Nitrogen (PAN) was created to address this problem through both source- and effect-oriented measures (so-called recovery management). In the framework of the PAN, an area analysis for the coast will be carried in 2018, proposing the most appropriate restoration measures for a set of habitat types.

2.4.3 Protected areas

Belgium has several statutes for the protection of nature areas in the coastal and marine region: Wetlands or Ramsar areas, Natura 2000 areas, Flemish and recognised nature reserves, areas of the decree of the Dunes, protected landscapes and the Flemish Ecological Network (FEN) (see 2.4.2 **Policy instruments**). The working areas of two or more of the mentioned regulations often overlap. In total, more than 1,200 km² or about 36% of the BNS has been designated as a marine protected area (table 3, figure 3).

Natura 2000 comprises a European network of sites designated by the Member States of the European Union as Special Protection Areas (SPAs) for the implementation of the Birds and Habitats Directives (see 2.4.2 **Policy instruments**). The target date for achieving all nature objectives is 2050, for which six-yearly cycles are used. The Flemish Natura 2000 programme describes the actions within a single cycle and is included in the Nature decree of 21 October 1997 (*Pecceu et al. 2016, Belgian state 2016*).

On 27 October 2016, a new RD was adopted on the procedures for the designation and management of marine protected areas in the BNS (see 2.4.2 **Policy instruments, the Habitats and Birds Directives**). As mentioned above, the MD of 2 February 2017 sets the conservation objectives of the marine protected areas. For activities that are likely to have a significant impact on marine protected areas, the impact should be determined through appropriate assessment, and activities will only be allowed where there is no risk of negative impacts on marine protected areas. Activities that may have negative consequences may be authorised when there is a compelling motive of great public interest, but only when there are no alternatives available and if compensation is provided.

The marine spatial plan (RD of 20 March 2014, see also *Van de Velde et al. 2014, Pecceu et al. 2016, Marine atlas*) does not add any additional areas to the protected areas delimited by previous RDs (table 3, figure 3). The MSP aims to better align activities in existing areas with the protection of the environment. For example, a number of subareas within the nature reserve of the Flemish Banks are delimited where restrictions apply to seabed disturbance activities such as beam trawling (*Pecceu et al. 2014*) and sand extraction. The current MSP runs for a period of 6 years (2014-2020). A revision of the MSP was launched in 2017: the new MSP shall enter into force in 2020 and run until 2026. It was proposed to provide a solution for the 'Vlakte van de Raan' in the new MSP. This site is on the European list of sites of community importance (*Commission Implementing Decision (EU) 2015/2373 of the Commission*) but was suspended by the State Council, resulting in the fact that Belgium does not comply with the EU obligation to protect this site. A new nature conservation zone 'Vlakte van de Raan' is proposed, which is an extension of the original zone. This creates an area of high ecological value that also includes the gradient of the sand bank from top to trench (*Degraer and Hostens 2016, MSP 2020-2026, public consultation 2018*). Nevertheless, in view of the ever-increasing use of space by human activities at sea, consideration is being given to allow new human activities into the Natura 2000 areas under the new MSP (pre-draft approved by the Council of Ministers on 20 April 2018).

Approximately 22% of the surface of the coastal communities has been assigned some kind of protection with regard to nature conservation (figures 4 and 5). This share is higher compared to the hinterland (+/- 16%) and Flanders (+/- 14%) (*Maelfait et al. 2012*). The maps and surface area of the Natura 2000 areas in the coastal zone can be consulted on the website *Natura 2000 in Flanders*.

The remaining ecologically valuable dune areas with a total surface area of approximately 2,830 ha are almost entirely protected. Only 5% of these domains do not belong to nature areas of the regional spatial plan or are not protected by 'higher' protection statutes (protected dune area, nature protocol for military domains or nature reserves). It mainly concerns inner-dune areas and areas at the edge of the dunes, e.g. at *Cabour* (old dunes of Adinkerke), *Sandeshoved* (the 'dune tongue' of Nieuwpoort) and *Oude Hazegraspolder* in Knokke. However, these areas have been marked as special protection areas and belong to the 'agricultural areas important for the dune area' of the decree of the Dunes (chapter 9 of the law of 12 July 1973) (*Dumortier et al. 2003*). In 2013, the Provincial Spatial Implementation Plan (PSIP) '*Strand en Dijk*' was approved. It indicates a division of the different beach zones, which allows a better licensing policy to be implemented and vulnerable zones to be better protected.

Table 3. An overview of marine protected areas, their surface area, status and legal anchoring.

Protected areas in the BNS			
Protected area	Surface area	Status	Legislation
Special Protection Area SPA-1 (Birds Directive)	110.01 km ²	Conservation objectives (COs) adopted	RD of 14 October 2005 – special protection zones for the conservation of nature
		Management plan drawn up and adopted on 19 January 2018	RD of 27 October 2016 MD of 2 February 2017
Special Protection Area SPA-2 (Birds Directive)	144.80 km ²	COs adopted	RD of 14 October 2005 – special protection zones for the conservation of nature
		Management plan drawn up and adopted on 19 January 2018	
Special Protection Area SPA-3 (Birds Directive)	57.71 km ²	COs adopted	RD of 27 October 2016 MD of 2 February 2017
		Management plan drawn up and adopted on 19 January 2018	
Special Protection Area H2 Vlake van de Raan (Habitats Directive)	19.17 km ²	Destruction of the designation of the Habitats Directive site by the State Council in 2008	RD of 14 October 2005 – special protection zones for the conservation of nature
Special protection area 'Flemish Banks' (Habitats Directive)	1,099.939 km ²	Expansion of the 'Trapegeer-Stroombank' area for which a policy plan is already available	RD of 14 October 2005 – special protection zones for the conservation of nature
		Study for demarcation of area: Degraer et al. (2009)	RD of 16 October 2012 amending the RD of 14 October 2005
		COs adopted	RD of 27 October 2016
		Management plan drawn up, yet to be adopted	MD of 2 February 2017
Marine reserve (Bay of Heist)	6.76 km ²	Policy plan available	RD of 5 March 2006
Ramsar site Western Coastal Banks	19 km ² (list Ramsar areas)		

These statutes only provide spatial protection, but do not guarantee that the natural values present will be safeguarded. This usually requires active nature management ([Maelfait et al. 2012](#)). The Nature Conservation decree (decree of 21 October 1997) provides an appropriate legal framework for this purpose, providing for the designation of nature reserves and the drafting of management plans.

According to [De Saeger et al. \(2013\)](#) there are approximately 12,000 ha of historical permanent grasslands (HPG) in the coastal polders. The Nature decree stipulates a prohibition or authorisation with regard to alterations of the vegetation and specific physical properties of these grasslands. In 2015, the Government of Flanders decided to protect 8,000 ha of grasslands of which a part being protected by nature legislation and the other by European agricultural policy (see theme **Agriculture**).

PROTECTED AREAS IN THE BNS

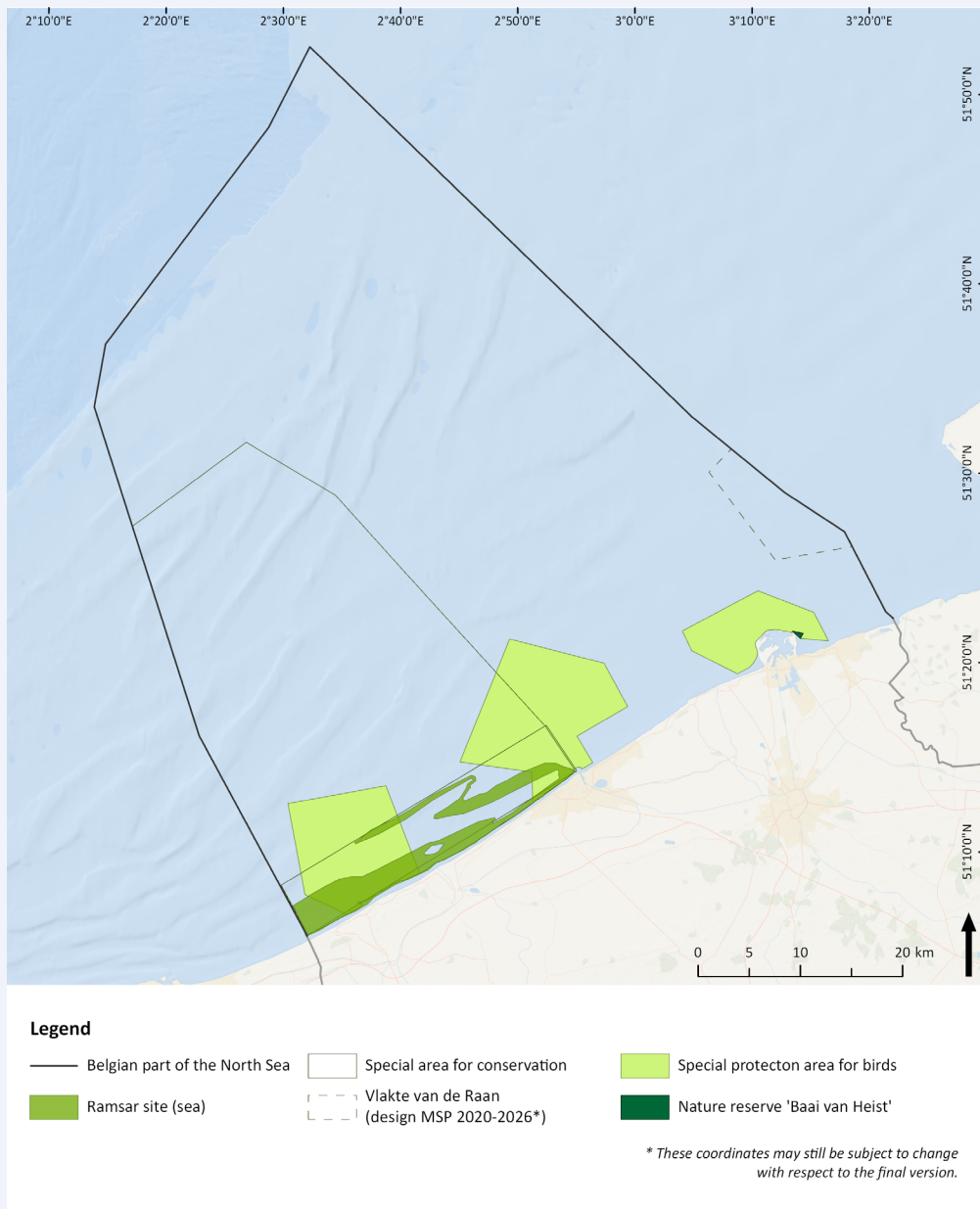


Figure 3. Demarcation of the protected areas in the BNS (Source: RBINS, marineatlas.be (based on RD of 20 March 2014, MSP 2020-2026, public consultation 2018).

PROTECTED AREAS IN THE COASTAL ZONE

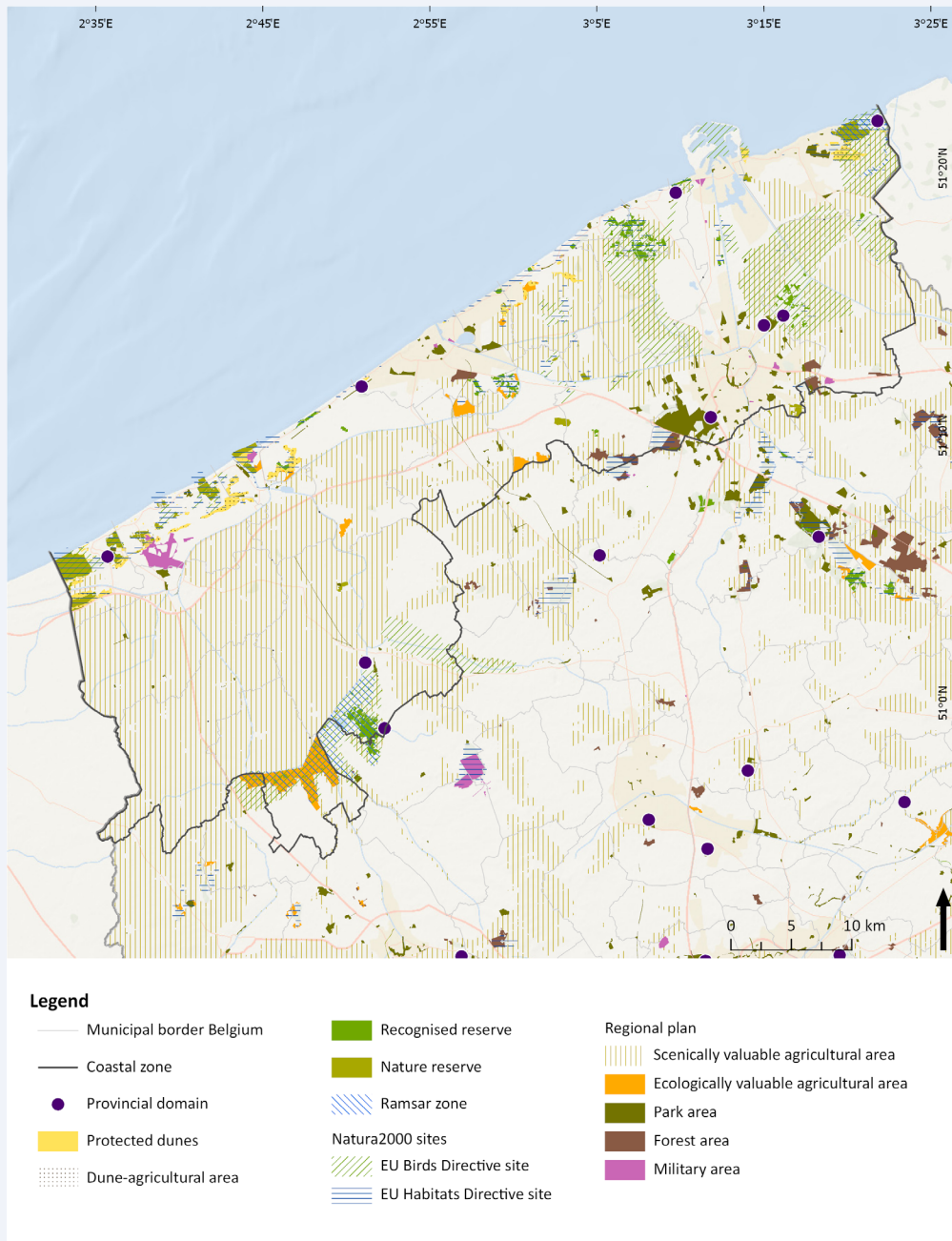


Figure 4. Protected areas and nature areas in the coastal zone (Source: Province of West Flanders, Agency for Nature and Forest, Natura 2000, Environment Department (Government of Flanders) - Section Vlaams Planbureau voor Omgeving).

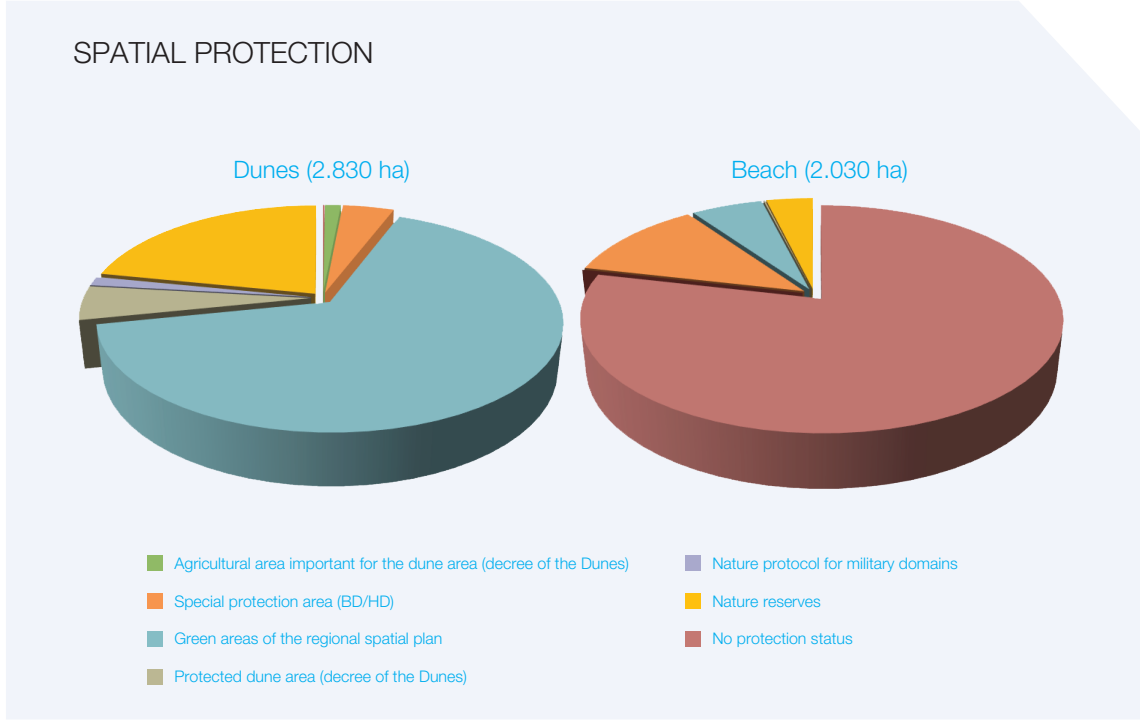


Figure 5. Spatial protection of the ecologically valuable dune ecotypes and beaches according to the different statutes for nature conservation. In the context of the decree of the Dunes, both categories of protection were added to the analysis (Dumortier et al. 2003).

Legislation reference list

Overview of the relevant legislation at the international, European, federal and Flemish level. For the consolidated European legislation we refer to [Eurlax](#), the national legislation can be consulted in the [Belgisch staatsblad](#) and the [Justel-databanken](#).

International agreements, treaties, conventions, etc.		
Title	Year of conclusion	Year of entering into force
The Convention on Wetlands, called the Ramsar Convention, is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources (Ramsar Convention)	1971	1975
International Convention for the prevention of pollution from ships, as modified by the Protocol 1978 (MARPOL Convention)	1973	1978
United Nations Convention on the law of the sea (UNCLOS)	1982	1994
Convention for the protection of the marine environment of the North-East Atlantic (OSPAR Convention)	1992	1998
Rio de Janeiro Convention on biological diversity Convention on Biological Diversity (Convention on Biological Diversity)	1992	1996

European legislation		
Title	Year	Number
Decision of the Commission of 1 September 2010 on establishing criteria and methodological standards for the good environmental status of marine waters	2010	477
Communication from the Commission (COM): An integrated maritime policy for the European Union (Integrated Maritime Policy)	2007	575
Directive concerning urban waste water treatment	1991	271
Directive on the protection of waters against pollution caused by nitrates from agricultural sources (Nitrates Directive)	1991	676
Directive on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)	1992	43
Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive)	2000	60
Directive 2006/118/C of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (Groundwater Directive)	2006	118
Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (Floods Directive)	2007	60
Directive establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)	2008	56
Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy amending and subsequently repealing Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC and 86/280/EEC of the Council, and amending Directive 2000/60/EC (Proprietary substances directive)	2008	105
Directive on the conservation of wild birds (Birds Directive)	2009	147
Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning (MSP Directive)	2014	89

Belgian and Flemish legislation		
Abbreviation	Title	File number
Decision of the Government of Flanders of 8 December 1998	Besluit van de Vlaamse Regering tot aanduiding van de oppervlaktewateren bestemd voor de productie van drinkwater categorieën A1, A2 en A3, zwemwater, viswater en schelpdierwater, ter omzetting van Richtlijn 2006/7/EG van het Europees Parlement en de Raad van 15 februari 2006 betreffende het beheer van de zwemwaterkwaliteit en tot intrekking van Richtlijn 76/160/EEG	1998-12-08/51
Decree of 18 July 2003	Decreet betreffende het integraal waterbeleid	2003-07-18/72
RD of 4 August 1981	Koninklijk besluit houdende politie- en scheepvaartreglement voor de Belgische territoriale zee, de havens en de stranden van de Belgische kust	1981-08-04/31
RD of 23 June 2010	Koninklijk besluit betreffende de vaststelling van een kader voor het bereiken van een goede oppervlaktewatertoestand	2010-06-23/04
RD of 23 June 2010	Koninklijk besluit betreffende de mariene strategie voor de Belgische zeegebieden	2010-06-23/05
Law of 20 January 1999	Wet ter bescherming van het mariene milieu en ter organisatie van de mariene ruimtelijke planning in de zeegebieden onder de rechtsbevoegdheid van België	1999-01-20/33

