



Indicators for the Scheldt estuary

Threats to biodiversity



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Increasing traffic of goods and persons over large distances has contributed to the settlement of alien species in new environments. The Scheldt estuary where ports, shipping and transport are of particular importance, does not escape this trend. The total number of registered alien species with established populations in and around the Scheldt estuary amounts to 83 (situation 2009). Nine of these 83 species are provisionally considered as 'potentially invasive'. The brackish water zone turns out to be particularly sensitive to the establishment of non-indigenous species.

Why monitor this indicator?

One of the characteristics of the 2030 targets of the Long-term Vision for the Scheldt estuary [1] is a healthy estuarine ecosystem where typical habitats and species communities are preserved and strengthened as appropriate. Because of an increasing mobility of people and goods, non-indigenous (or exotic) plant and animal species have successfully established themselves in new environments all over the world. Considering the relative importance of ports, shipping and transport as vector for the introduction of alien species, the Scheldt estuary does not escape from this either. Even though in some cases the introduction of alien species brings opportunities and can increase local species diversity, in other cases they can become invasive and compete with local species or harm the ecological functioning of ecosystems. Monitoring the number of non-indigenous aquatic and terrestrial species, according to their potential occurrence in the salinity zones (fresh, brackish and saline) and their potentially invasive nature, is necessary to prioritize measures.

The policy of the Flemish and Dutch government with regard to alien species is based on article 8 of the international Convention on Biodiversity [3] that states that all participating countries need to prevent the introduction of those alien species which threaten indigenous species, habitats or ecosystems as far as possible. Once these species have established, they should be controlled or eradicated where possible and appropriate. In addition, the European Commission also develops a new strategy on invasive species. In 2008 an EU communication [3] on this issue emphasizes the importance of a pan-European 'Early Warning' system to report on new and encroaching invasive species. Prevention against invasive species, particularly preventing the establishment of invasive species, is easier and cheaper than fighting them.

The policy document on invasive exotic species ('Beleidsnota invasieve exoten') of the Dutch Ministry of Agriculture, Nature and Food Quality [4] specifies the Dutch policy on invasive species. The key principle is that not every exotic species is to be actively controlled. It takes into account the nature and extent of the problem that is caused by the alien species and the expected social and financial efforts that are necessary to control the species. Again here, prevention is preferred over control and it is therefore focus of the policy. In 2009 the 'Team Invasieve Exoten' (Team on Invasive Alien species) was established to support the government policy. This team advises Min LNV about the (potential) harm caused by invasive alien species in the Netherlands and the possible precautions. The team uses an (international) network of experts that draws attention to new exotic species in the Netherlands and performs risk assessments.



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The Flemish policy on exotic species also aims at preventing against invasive species and actively controlling them where necessary [5]. In the context of prevention and early warning, the Belgian Forum on Invasive Species has elaborated a protocol (ISEIA, Invasive Species Environmental Impact Assessment) to quantify the potential invasiveness of alien species, with emphasis on the consequences for biodiversity and ecosystem functions, and to establish priorities in terms of control [6].

What does the indicator show?

Number of established alien species in the Scheldt estuary

The measurement includes all non-indigenous species already described for both the aquatic (saline, brackish and freshwater) zones and the terrestrial zone of the Scheldt estuary. Regarding marine species the measurement relies on the list of 'alien species from the Belgian part of the North Sea' in which besides the Scheldt estuary, the marine areas are evaluated (see below). Only species with established populations are included in the measurement. These are species which were found to breed in the study area. When presumed that a cryptogenic species (a cosmopolitan species that is less well known) was introduced, it is also added to the list. Species that have found their way to the study area through natural migration, or species that were reported in the study area and from which it is not known with certainty whether they have established permanent populations, are not included in the list. This information is based on literature review, research and direct field observations by experts.

The total number of registered non-indigenous species with established populations in the Scheldt estuary is 83 (situation 2009). The full list of alien species can be consulted on the indicator page [7]. The annual cumulative number of species recorded from 1900, is shown in figure 1. The seven species for which no date of the first time of observation was available from literature, were not included in the figure. The number of established non-indigenous species is increasing every year.

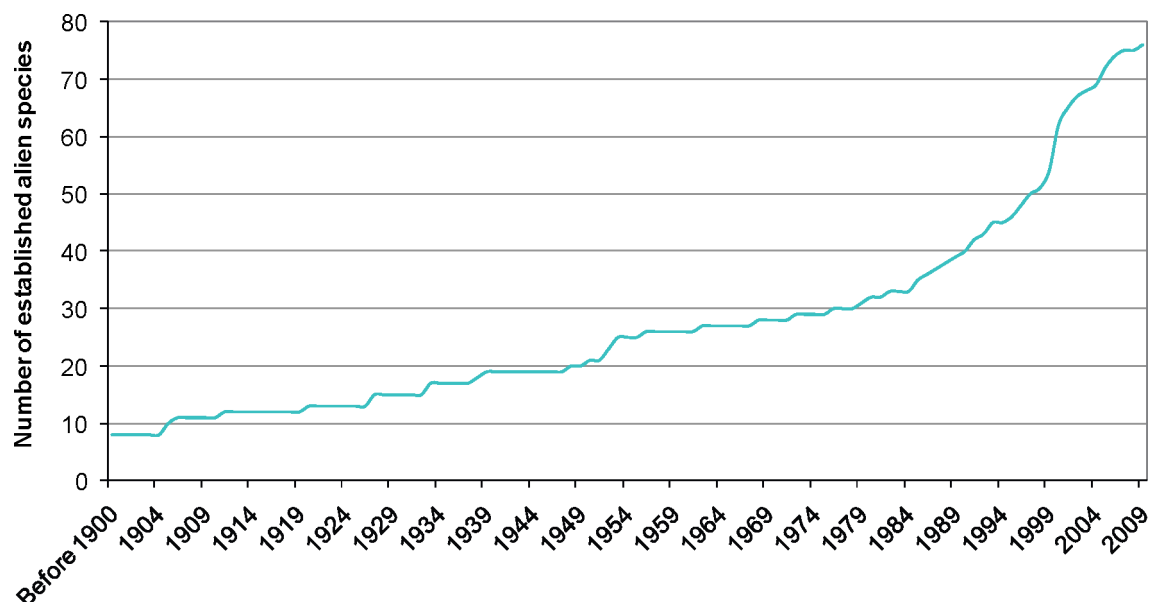


Figure 1: The annual cumulative number of alien species with established populations in the Scheldt estuary.



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Although most introduced species are unable to survive in their new environment, globalization and the increased traffic of goods and people over long distances has led to the establishment of an increasing number of alien species in the Scheldt estuary. The actual number is probably much higher because for many species the origin can no longer be determined or because the proportion of small organisms is underestimated.

The Scheldt estuary is one of the most intensively used shipping routes in Europe. For aquatic organisms an important way of introduction, is in the ballast water of ships and the attachment to ship hulls. Examples in the Scheldt estuary are the molluscs and crustaceans, two taxonomic groups that are highly represented among the established alien species (see figure 2).

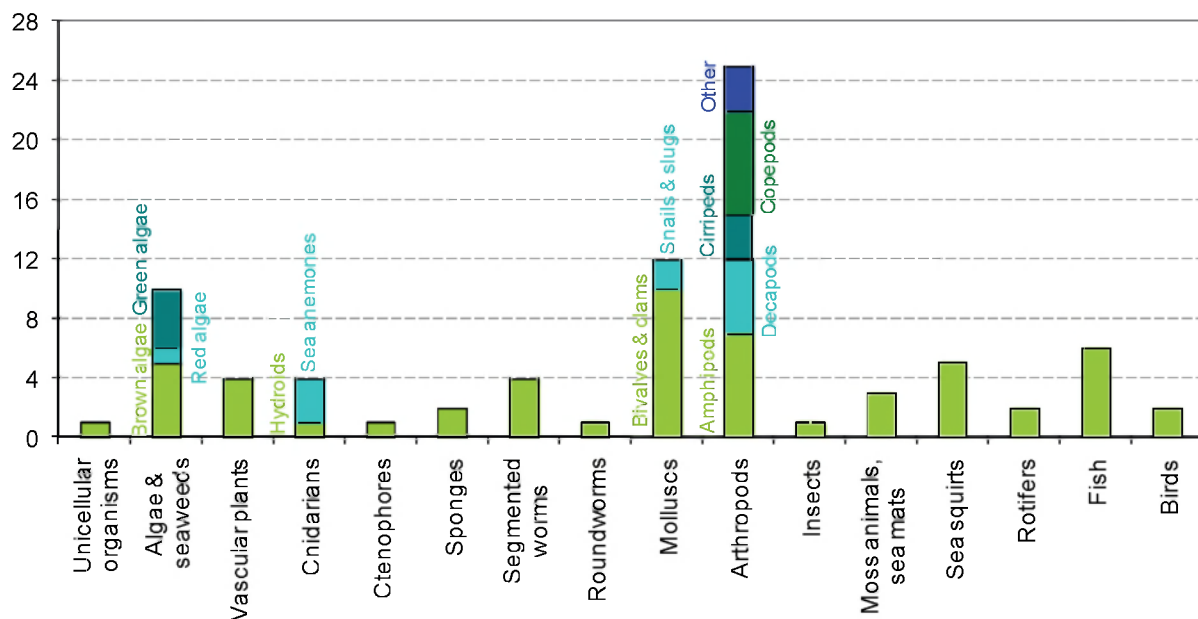


Figure 2: Number of alien species per taxonomic group, observed in the Scheldt estuary (situation 2009).

The most famous example is perhaps the Chinese mitten crab (*Eriocheir sinensis*), which appears in the Scheldt basin since 1933 and was probably transported as larvae in ballast water tanks. The crab spends most of its life in freshwater but moves to the sea each year to breed. The animal digs tunnels in dikes and embankments and in doing so it paves the way for erosion. On the contrary, juveniles of the American jackknife clam (*Ensis directus*), which occur very frequently in our saline coastal waters, are a potential food source for crustaceans, birds and fish.

Not only the aquatic environment represents a potential habitat for alien species. Other examples of established non-indigenous species in and around the Scheldt estuary are the common cord grass (*Spartina townsendii* var. *Anglica*) that was planted along the banks of the Westerschelde as from 1920 to reclaim land and the Indian balsam (*Impatiens glandulifera*) which was introduced as an ornamental plant.

Occurrence in the saline, brackish and freshwater salinity zone of the Scheldt estuary

The Scheldt estuary is one of the few estuaries in Europe that have an extensive freshwater tidal zone. Through this whole salinity gradient the Scheldt estuary provides a variety of habitats where non-indigenous species can feel at home. Figure 3 shows a rough delineation of the three major salinity zones of the Scheldt estuary, the saline or marine, the brackish and the freshwater zone. Figure 4 shows the number of alien species with established populations in the Scheldt estuary according to their potential occurrence in the saline, brackish and/or freshwater zone (relatively complete information for 64 species). Most species are found in the brackish zone. Further research is needed to confirm the possible sensitivity of the brackish zone in the Scheldt estuary to alien species (as has been demonstrated for

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several brackish seas of Europe including the Baltic Sea and the Black Sea).

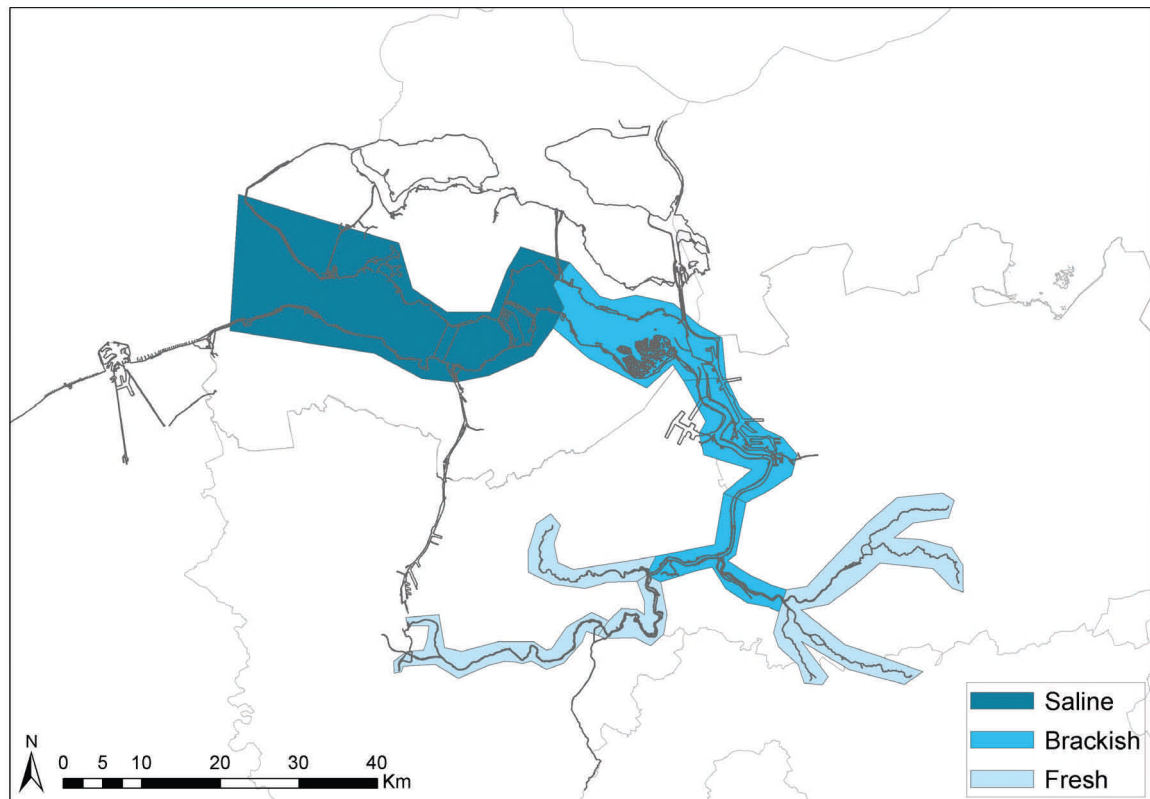


Figure 3: Salinity zones in the Scheldt estuary. After: Breine *et al.*, 2008 [8]. Fresh zone: < 0,5 PSU, Brackish zone: 0,5 - 18 PSU, Saline zone: > 18 PSU.

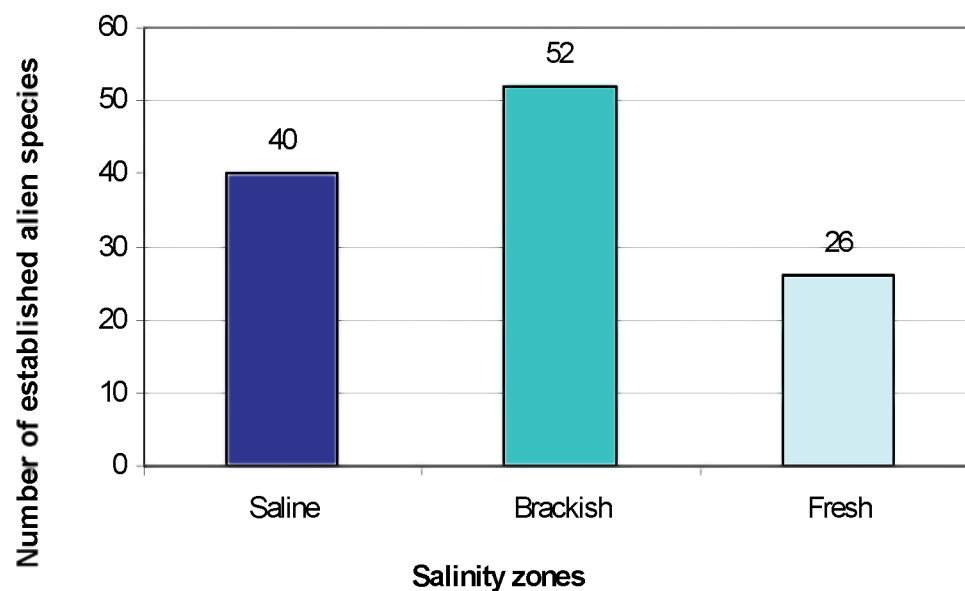


Figure 4: Number of alien species with established populations in the Scheldt estuary, divided into (potential) occurrence in the saline, brackish and fresh salinity zone (situation 2009). Some species occur in several zones as a result of which the graph is partially cumulative.

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Effects on biodiversity and ecosystem functions

Certain established alien species in the Scheldt estuary e.g. the blue crab (*Callinectes sapidus*), the Atlantic croaker (*Micropogonias undulatus*) and the softshell clam (*Mya arenaria*) do not have notable effect on biodiversity and ecosystem functions. Other species create problems and the focus of policy is primarily on those species.

Of the 83 established non-indigenous species recorded in and around the Scheldt estuary, nine appear on the list of the Belgian Forum on Invasive Species. Invasive species are non-indigenous species that can increase their population size, widely spread in the environment and colonize seminatural habitats. This list is far from complete. The assessment of the potential invasiveness of marine alien species is still in progress.

Of the nine species, six appear on the 'black list', the black list species with a high environmental hazard (impact) and a restricted or widespread distribution in Belgium (class A2 and A3 in figure 5). The established non-indigenous species from the Scheldt estuary on the black list are: the Canada goose (*Branta canadensis*), the Prussian carp (*Carassius gibelio*), the Japanese knotweed (*Fallopia japonica*), the water pennywort (*Hydrocotyle ranunculoides*), the Indian balsam (*Impatiens glandulifera*) and the stone moroko (*Pseudorasbora parva*).

Three species are on the gray list, the 'watch list' species with restricted range or widespread species that have moderate environmental impact (based on current knowledge, class B2 and B3 in figure 5). These are the pumpkins eed (*Lepomis gibbosus*), the zander (*Sander lucioperca*) and the Egyptian goose (*Alopochen aegyptiacus*).

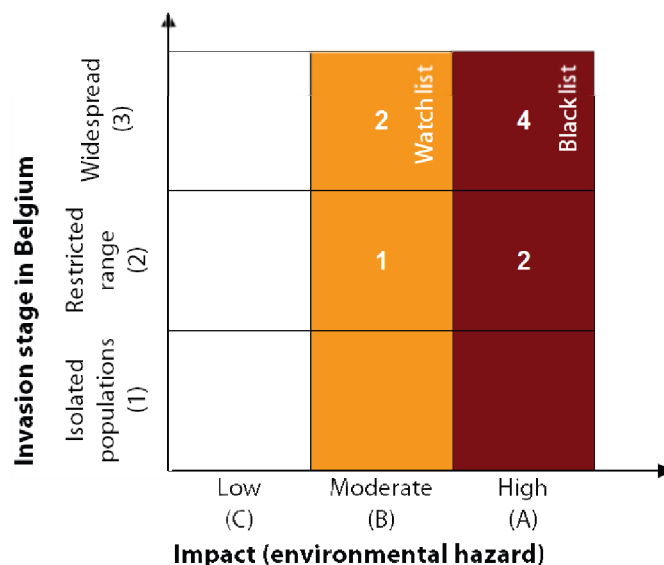


Figure 5: Total number of established non-indigenous species in and around the Scheldt estuary for each class of the ISEIA protocol (potential invasiveness, situation 2009).

The 'Team Invasieve Exoten' in the Netherlands is currently using several lists of non-indigenous species (e.g. of the 'Werkgroep exoten' (Working Group alien species) [9] or the 'Nederlandse soortenregister' (Dutch Register of Species) [10]). This information is used together with the advice from a group of experts, to determine on an ad hoc basis for which species risk assessments are to be carried out. A protocol to realize this in a structured manner is developed. Therefore no fixed list of invasive alien species in the Netherlands and their environmental effects is available for the moment. For the non-indigenous species in the Scheldt estuary it is possible to determine which are (potentially) invasive on Dutch territory, but this is currently unknown.



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Where do the data come from?

- Data on established non-indigenous species of the Scheldt estuary are based on the 'Checklist for aquatic alien species in the Belgian part of the North Sea and adjacent estuaries' of the 'VLIZ Alien Species Consortium'. http://www.vliz.be/EN/Figures_Policy/Alien_Species
- For the freshwater and terrestrial part of the Scheldt estuary, data were provided by the Research Institute for Nature and Forest (INBO).
- The Belgian Biodiversity Platform (Royal Belgian Institute of Natural Sciences) elaborated the protocol (ISEIA) which provided the evaluation of potential or actual invasiveness of non-indigenous species.

Several organizations in the Netherlands (e.g. Naturalis, European Invertebrate Survey, the 'Werkgroep Ecologisch Waterbeheer', SOVON, FLORON, Stichting Anemoon, ...) have information on non-indigenous species in the Netherlands. In addition, the Netherlands is drawing up a National Flora and Fauna Database. Because of the extent of the task to convert distribution data of these species into the spatial scale of the Scheldt estuary, this information is currently not available.

In addition, the Dutch 'Team Invasieve Exoten' works on a standardized methodology for risk assessments of potentially invasive species.

Opportunities and threats

For this indicator, policy can rely on updated information and data supplied by a well-developed network of authorities and volunteers-experts. The awareness on the importance of practical measures to protect the environment has also grown with stakeholders, partly due to the international, European and national legislation and information campaigns (ICES 'Codes of practice' 1995, International Maritime Organization Guidelines for control and management of ballast water Resolution A.868 (20) 1997, IMO Ballast Water Convention 2004, Biodiversity Convention). The increase in research and monitoring in recent decades has also led to increased alertness. Alien species require special attention if they become invasive. Meanwhile, progress is also booked in identifying and quantifying the threats from invasive species. Discussion between water managers is initiated to work out a joint action plan to control invasive species. Flanders and the Southern Netherlands work together in the Invexo-project (Interreg) to combat four problem species (major water navel, "goose summer", American bull frog and black cherry) [11].

Measures are often inadequate and further considerations to achieve an integrated approach to control is necessary. Besides the role of governments in combating problem species, the public can also contribute in prevention by removing invasive species, and reporting hotspots of invasive species. More information is available on the websites of the Min LNV and ANB [4,5].

The Standard Indicator Format (SIF) describes the limitations of the indicator definitions, data and methodology. The SIF is available at: <http://www.scheldemonitor.org/indicatorfiche.php?id=14>

Integration with other indicators/measurements?

Non-indigenous species can bring opportunities but also threats to native biodiversity and therefore to the species and habitats designated under the Habitats and Birds Directives (92/43/EEC and 79/409/EEC, respectively). In calculating the indices for biodiversity and ecological quality of surface water, attention needs to be paid to this issue. The tolerance of non-indigenous species to local variations in the salinity gradient, determines whether new species can successfully establish. Furthermore, the increase in non-native species and their distribution is related to the intensity of shipping and ship movements, and especially to the lack of specific measures to prevent the introduction and spread of potentially invasive species into the environment.

In some cases the presence of (large numbers of) non-native species can also influence recreation and



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perception of the natural environment.

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