

# Indicators for the Scheldt estuary

## Surface water quality



The quality of surface water in the Scheldt estuary generally scores inadequate according to the European Water Framework Directive. In 2009 none of the surface water bodies in the Scheldt estuary obtains a good chemical or good ecological status. Concerning the chemical status levels of metals, industrial pollutants and pesticides meet the standards in more than 60% of water bodies. The problem is usually due to 'other pollutants'. Most water bodies also score less than good when assessing the ecological quality elements of the Directive (algae, other aquatic flora, benthic invertebrates, fish, physicochemical elements and specific pollutants). The fish populations of the estuary are in a moderate to poor condition. In recent decades, however, oxygen levels have much improved.

### Why monitor this indicator?

The quality of surface water in the Scheldt estuary is a crucial prerequisite for a healthy estuarine ecosystem and its communities. Good water quality is also of great importance for the various users such as industry, agriculture, fisheries, tourism, .... The Long-term Vision for the Scheldt estuary [1] therefore is committed to a quality that is no longer limiting to the ecosystem, by 2030.

The European Water Framework Directive (WFD, [2]) provides the framework for evaluation and sets the objectives for water quality. In the Netherlands and in Flanders, the WFD is also legally translated into national law respectively as the Water Act [3] and the Decree on Integrated Water Policy [4].

The WFD requires that all European 'natural' surface waters in 2015 achieve at least a 'good ecological status' (GES). For 'heavily modified' or 'artificial' surface waters, the ecological objectives are adapted as 'good ecological potential' (GEP). Artificial water bodies are man-made in areas where previously no natural waters were present. A heavily modified water body is a natural water body which characteristics have strongly changed by human activities. In the Scheldt estuary 9 out of 11 water bodies (see figure 2), are classified by the WFD as 'heavily modified'. Only the Flemish water body 'Zwin' and the Dutch water body 'Zeewse kust (kustwater)' belong to the natural waters.

In addition, all surface waters have to achieve - as a minimum - a good chemical status (GCS) in 2015. To follow up these and other objectives such as those established for groundwater, Member States have to draw river basin management plans every six years. In 2009, a first plan was drawn for the river Scheldt and other river basins [5].

This indicator shows status and trends in achieving the European objectives: namely, a GES or GEP and GCS in 2015, in the 11 tidal water bodies in the Scheldt estuary. The quality component 'fish', which is part of the assessment framework of GES, and the oxygen levels in the Scheldt estuary get a closer look. Fish are recognized as an indicator of the state of the lower levels in the food chain. Furthermore, they sustain important functions in terms of professional and recreational fishing. A good oxygen balance is critical to the ecological functioning of the Scheldt estuary and the objective is explicitly addressed in the targets of the Scheldt estuary Long-term Vision [1] and the Nature development plan for the Scheldt estuary [6].

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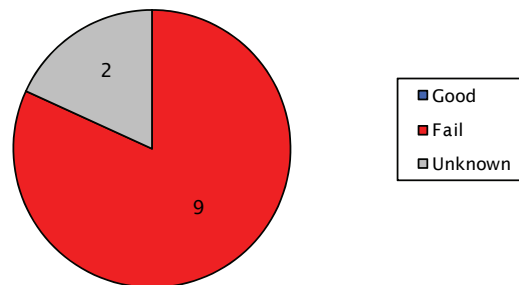
### What does the indicator show?

The assessment frameworks for water quality in Flanders and the Netherlands are determined by the EU WFD and are therefore comparable. When a different approach is followed in the Netherlands and Flanders, this is indicated in the text.

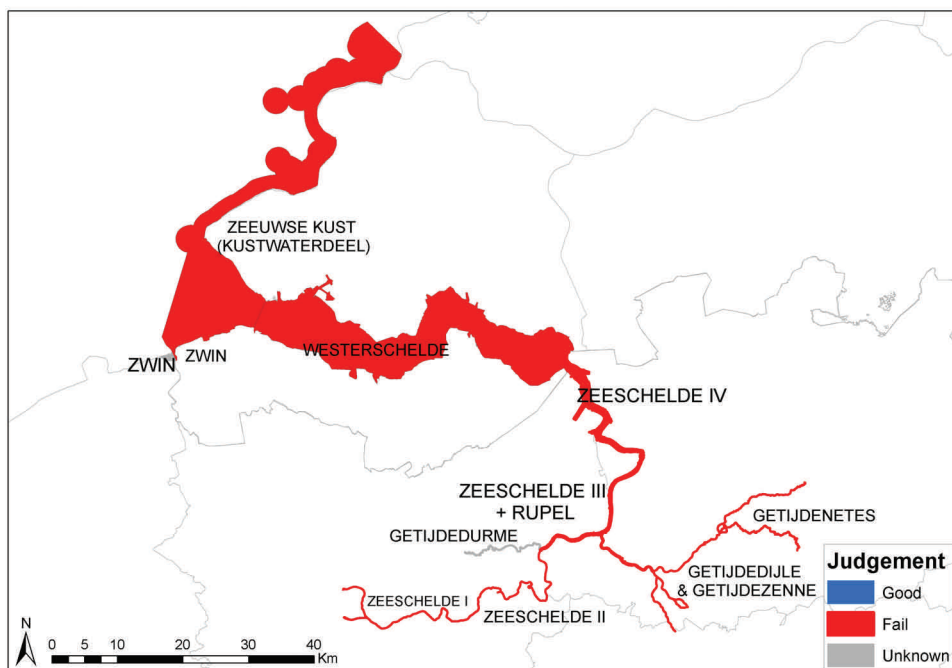
#### Chemical status of the surface waters

To achieve a good chemical status, European standards for specific (priority) substances and substance groups need to be obtained in surface waters. This assessment, however, is based on a "one out all out" principle. In other words, to achieve an overall good condition, the water bodies also have to score well on all the underlying chemical assessments. Therefore an improvement in the condition of certain chemical substances is not necessarily visible in the final overall score.

In 2009 the chemical status of two water bodies in the Scheldt estuary is classified as 'unknown', being the Flemish Zwin and the Getijdedurme. None of the remaining 9 water bodies achieves a good chemical status (see figure 1 and 2).



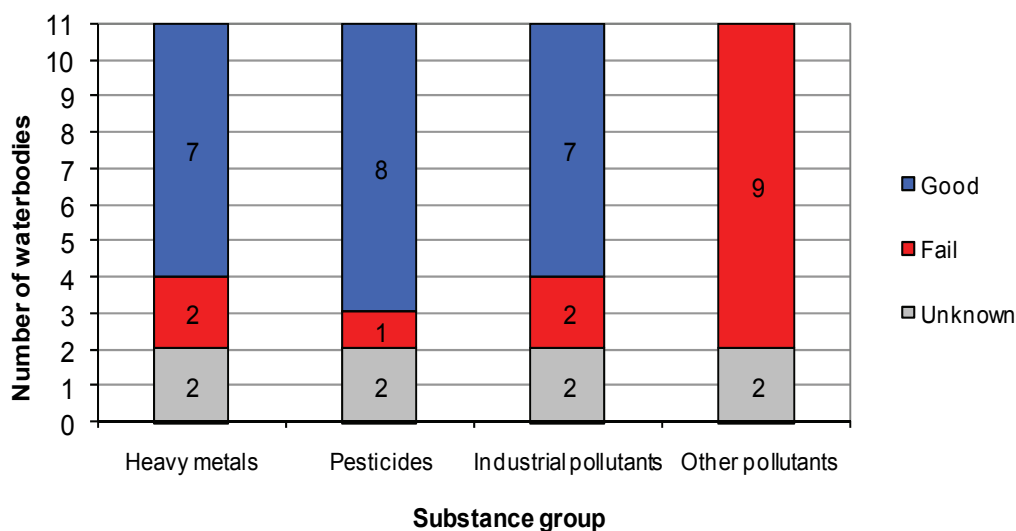
**Figure 1:** Number of surface water bodies in the Scheldt estuary according to each class of the chemical status. Data based on the most recent available assessment, of which the results were published in 2009. Source: Directorate General for Public Works and Water Management (RWS), Water Service, Flemish Environment Agency (VMM).



**Figure 2:** Chemical status of surface waters in the Scheldt-estuary. Data based on the most recent available assessment, of which the results were published in 2009. Source: Directorate General for Public Works and Water Management (RWS), Water Service, Flemish Environment Agency (VMM).

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According to this assessment, 7 or 8 of the 11 (more than 60%) water bodies achieve a good quality status for the underlying substance groups of heavy metals, pesticides and industrial pollutants (see figure 3). The cause of not achieving good chemical status is therefore primarily due to the group of substances classified as 'other pollutants'. An example is tributyltin (TBT), a substance once used in paint to discourage the growth of algae, barnacles and other organisms on ship hulls and of which use is now banned worldwide. An overview of the substances belonging to each of the substance groups is included in the technical fact sheet 'chemical status of surface waters in the Scheldt estuary' [7].



**Figure 3:** Number of surface water bodies in the Scheldt estuary according to each class of the chemical status, by substance groups which are part of assessing the chemical status. The numbers in the bars represent the number of surface water bodies that meet the respective class. Data based on the most recent available assessment, of which the results were published in 2009. Source: Directorate General for Public Works and Water Management (RWS), Water Service, Flemish Environment Agency (VMM).

### Ecological status of surface waters

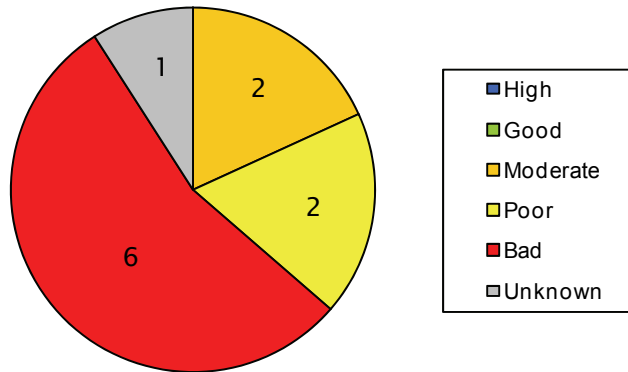
Due to the variety of types of water bodies, Member States establish their own methods for assessing the ecological status. To date, the calibration of these methods has not been conducted for all of the underlying quality elements. A second round of European calibration efforts runs from 2008-2011. After this it is expected that a true comparison is possible, also between the assessments of the Netherlands and Flanders. For more information, see the technical fact sheet 'ecological status of surface waters in the Scheldt estuary' [8].

In order to obtain a good ecological status score, water bodies are judged on both physico-chemical parameters such as oxygen, temperature, nitrogen and phosphorus, and specific pollutants which are not part of the European chemical status assessment. On the other hand, the GES is also based on four biological quality elements: phytoplankton or algae, other aquatic flora (aquatic plants, sessile algae, sea lettuce and seaweed), benthic invertebrates and fish. In assessing the GES, as for the GCS, the 'one out all out' principle applies: a good status can only be achieved if all the underlying quality elements score well.

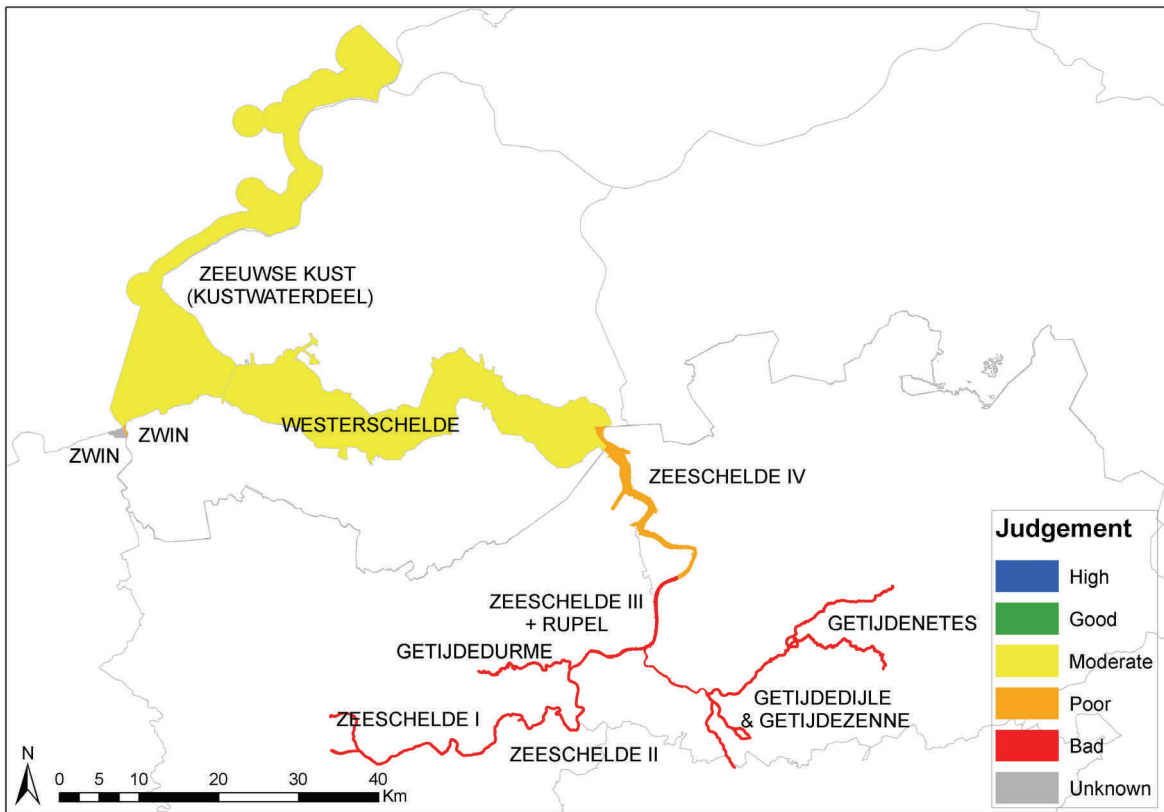
In 2009, none of the water bodies in the Scheldt estuary achieves a good ecological status (see figure 4). The farther upstream in the Scheldt estuary, the worse the situation gets (see figure 5). The ecological status of the Flemish Zwin in 2009 remains unknown.



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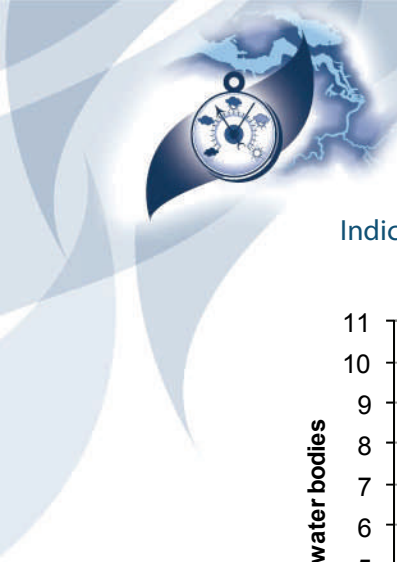


**Figure 4:** Number of surface water bodies in the Scheldt estuary according to each class of ecological status/potential. Most water bodies in the Scheldt estuary are heavily modified, making the best possible class 'good and above' instead of 'high'. Data based on the most recent available assessment, of which the results were published in 2009. Source: Directorate General for Public Works and Water Management (RWS), Water Service, Flemish Environment Agency (VMM).

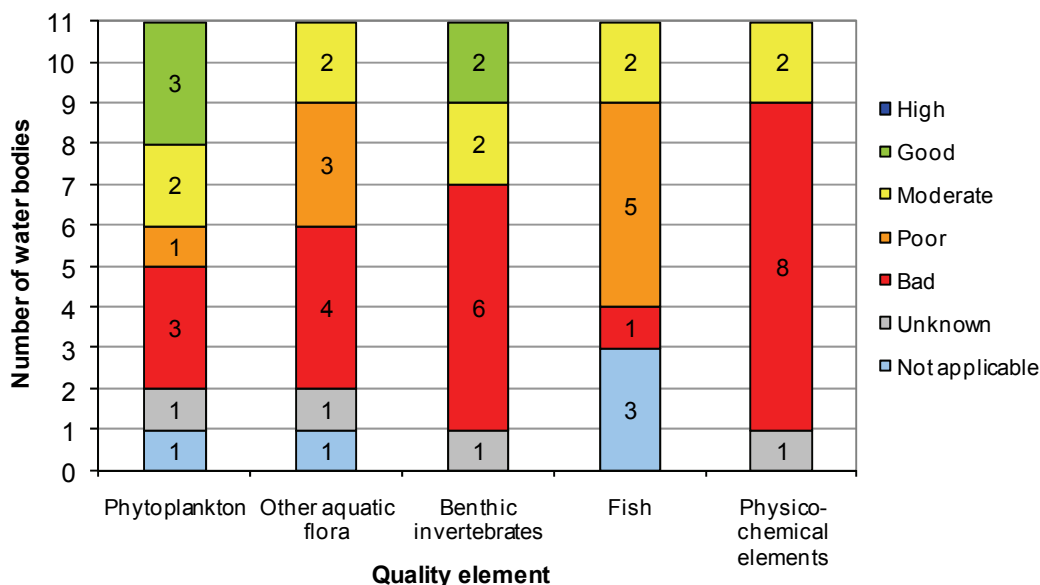


**Figure 5:** Ecological status/potential of the surface water bodies in the Scheldt estuary. Most water bodies in the Scheldt estuary are strongly modified so that the best possible score is 'good and above' instead of 'high'. Data based on the most recent available assessment, of which the results were published in 2009. Source: Directorate General for Public Works and Water Management (RWS), Water Service, Flemish Environment Agency (VMM).

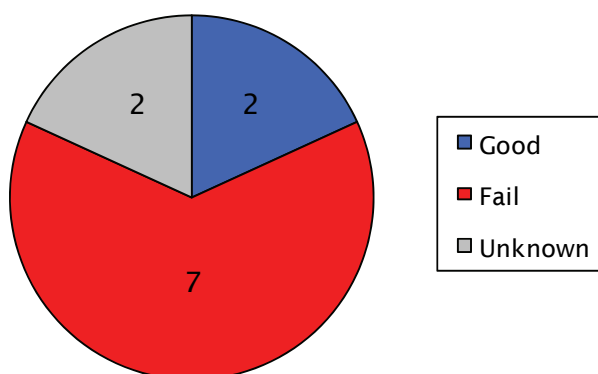
The cause of not achieving good ecological status is due to several factors. Fish, other aquatic flora and the physico-chemical elements did not achieve classification 'good' in any of the water bodies of the Scheldt estuary. Only 2 or 3 water bodies achieve the best possible score for phytoplankton (3), benthic invertebrates (2) (see figure 6) and the specific pollutants (see figure 7).



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**Figure 6:** Number of surface water bodies in the Scheldt estuary according to the 5 quality classes of the ecological status/potential. The numbers in the bars indicate the number of water bodies that achieve a particular quality class. Data based on the most recent available assessment, of which the results were published in 2009. Source: Directorate General for Public Works and Water Management (RWS), Water Service, Flemish Environment Agency (VMM).



**Figure 7:** Number of surface water bodies in the Scheldt estuary according to the quality classes, for the specific pollutants that are part of the GES assessment. Data based on the most recent available assessment, of which the results were published in 2009. There is no European norm for these specific pollutants and therefore they are not legally bound to the GCS. The status of these pollutants is classified as 'good' or 'fail' as is the case for the GCS. Source: Directorate General for Public Works and Water Management (RWS), Water Service, Flemish Environment Agency (VMM).

### Status of fish populations

Flanders and the Netherlands evaluate the condition of fish stocks in implementation of the Water Framework Directive. These data are part of the biological quality elements included in the assessment of good ecological status (see above). Flanders uses the term 'fish index' (visindex) for this assessment while in the Netherlands the 'fish indicator' (maatlat visser) is used. As is the case with other biological quality elements of the GES assessment, methods have to be calibrated and this has not happened yet for the element 'fish'.

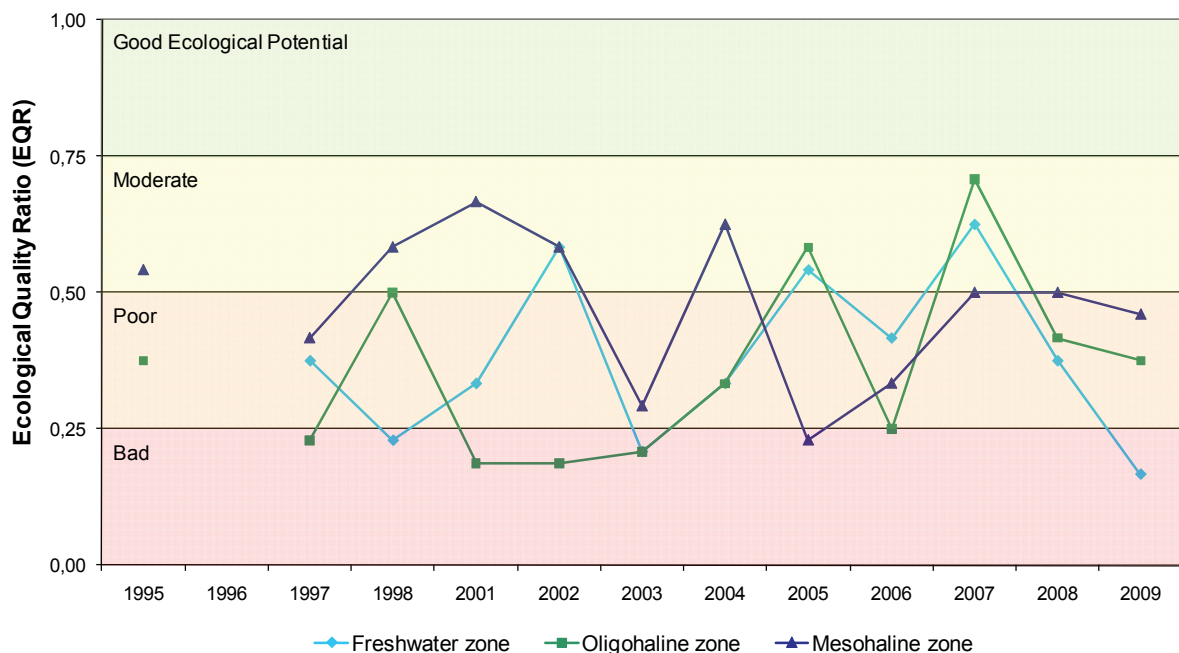
More information about the methods used can be found in the technical fact sheet 'status of fish populations in the Scheldt estuary' [9]. For the Dutch part of the Scheldt estuary data are available on the sta-

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te of the fish stocks for 2009 (baseline). For the Flemish part of the Scheldt estuary annual data are available from 1997.

The quality element 'fish' in the Dutch part of the Scheldt estuary only applies to the water body 'Westerschelde': in 2009 the state of the fish stocks are 'moderate'.

The condition of the fish stocks in the 'Zeeschelde' in 2009 scores insufficient for the mesohaline and oligohaline zone and scores bad for the freshwater zone (see figure 8). The delimitation of the different salinity zones is described in the technical fact sheet 'status of fish populations in the Scheldt estuary' [9]. Since 1995 the fish index shows a somewhat erratic course and has not reached a good ecological potential (GEP).

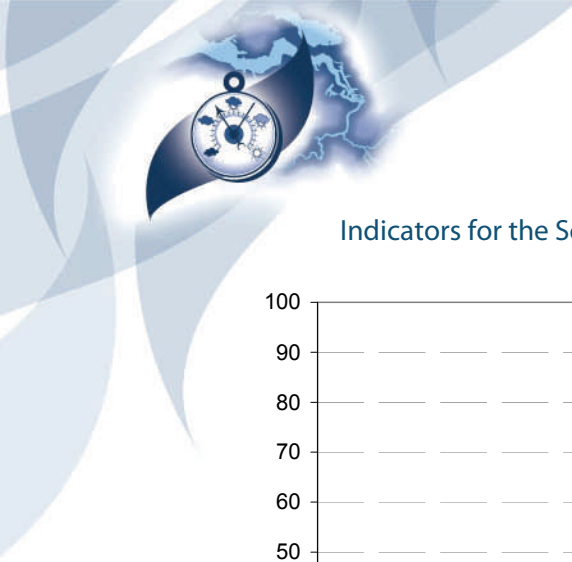


**Figure 8:** Fish index for the different salinity zones in the Flemish part of the Scheldt estuary. Source: Breine, J., Stevens, M., Van Thuyne, G., Belpaire, C. (2010). *Opvolging van het visbestand van de Zeeschelde: resultaten voor 2008-2009*. Reports of the Institute for Nature and Forest Research INBO.R.2008.39., 47 pp.

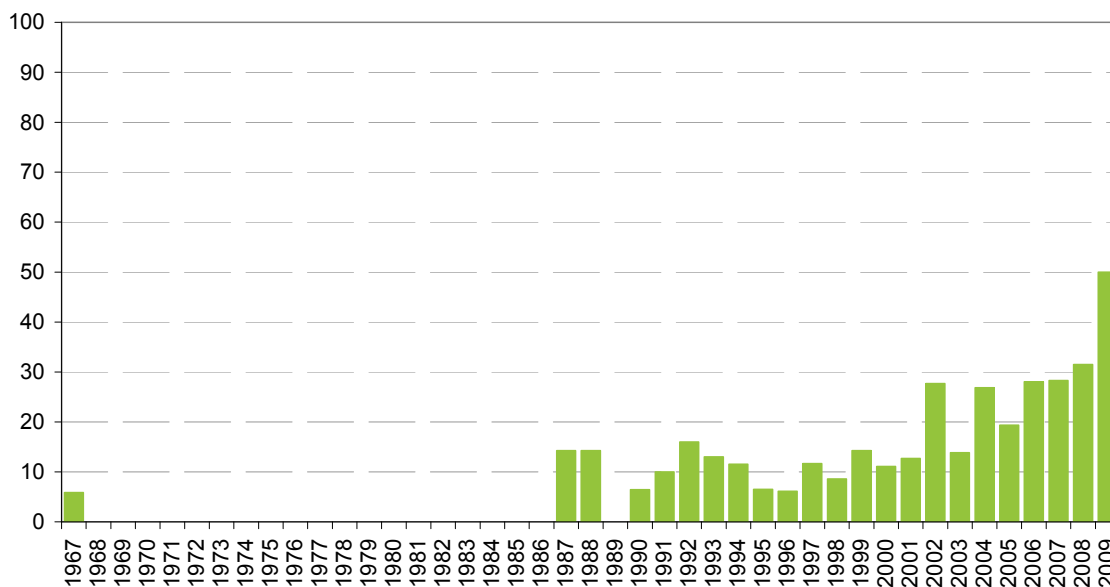
### Oxygen levels in the Scheldt estuary

Different Dutch and Flemish institutions monitor the oxygen levels in the Scheldt estuary. A comparison of methods for data collection occurs in the context of the 'integrated monitoring of the Scheldt estuary.' For more information, consult the fact sheet 'oxygen levels in the Scheldt estuary' [10]

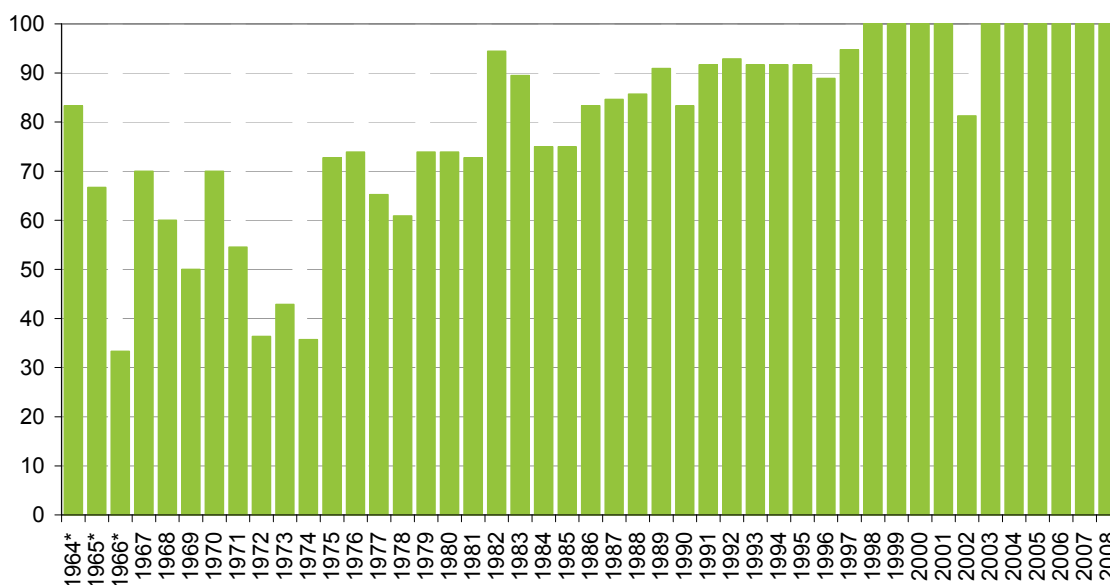
The oxygen levels in the Scheldt estuary, measured here as the concentration of dissolved oxygen, has improved substantially over the last 40 years. In 2009, in 50% of the measuring stations in the Flemish part of the Scheldt ('Zeeschelde') and its tidal tributaries, the oxygen concentration never dropped below 5 mg / L, a target that is set in various science-based (policy) documents [11-13]. A limit of 5 mg / L is recognized as the minimum value for achieving good biodiversity. In the late 60s, the 70s and early 80s this was the case for 0% of the measuring stations (see figure 9). In the Westerschelde 100% of the stations achieved this target in 2008, compared to 70% in 1967 (see figure 10). A spatial representation of the number of points that never drop below the 5 mg / L in 2008, shows that apart from the Westerschelde, the points that have good oxygen levels are located at the 'ends' of the Zeeschelde en its tidal tributaries: e.g. Durme, Kleine and Grote Nete (see figure 11).



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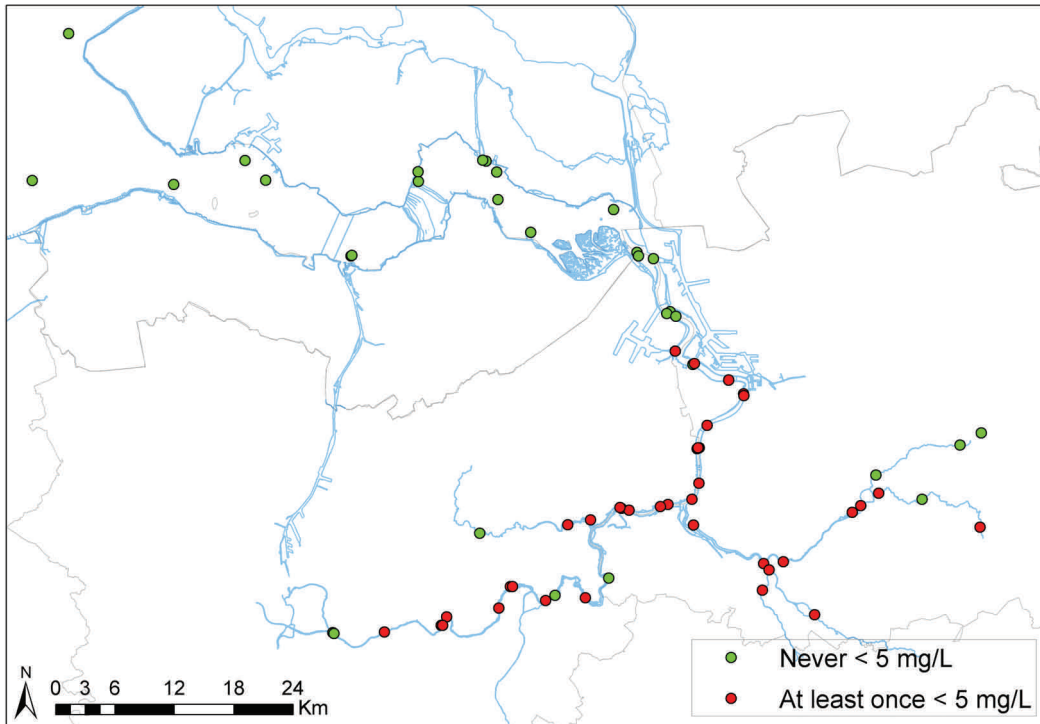
**Figure 9:** Annual percentage of measuring stations in the Flemish part of the Scheldt (Zeeschelde) and its tidal tributaries, where oxygen concentrations do not drop below 5mg/L. Source: Netherlands Institute for Ecology, Centre for Estuarine en Marine Ecology (NIOO-CEME); Flemish Environment Agency (VMM); OMES research programme.



**Figure 10:** Annual percentage of the measuring stations in the Westerschelde where oxygen levels never drop below 5 mg/L. \* Data for 1964 – 1966 are based on only 6 measuring stations. Source: Netherlands Institute for Ecology, Centre for Estuarine en Marine Ecology (NIOO-CEME); Directorate General for Public Works and Water Management (RWS), Water Service.



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**Figure 11:** Measurement points in the Scheldt estuary where oxygen concentrations never (green) or at least 1 time (red) drop below the threshold of 5 mg / L (data 2008). Source: Dutch Institute of Ecology, Centre for Estuarine and Marine Ecology (NIOO-CEME); Directorate General for Public Works and Water Management (RWS); Flemish Environment Agency (VMM); OMES research program.

### Where do the data come from?

- The data for evaluating the ecological and chemical status of surface waters are collected for the preparation of river basin management plans every six years (from 2009 onwards) in implementing the Water Framework Directive. For the Netherlands this is done by the WFD Working Group for Information Monitoring and Reporting of the Directorate General for Public Works and Water Management (RWS). For Flanders, this is done by the Department Water Reporting of the Flemish Environment Agency (VMM).
- The data for the fish index in the Scheldt estuary are provided by the Institute for Nature and Forest Research (INBO).
- The Dutch data of oxygen concentrations are supplied by the chemical monitoring network of the MWTL program (Nationwide Monitoring network of the hydraulic conditions) of RWS and the physico-chemical analysis data of the Dutch Institute of Ecology, Centre for Estuarine and Marine Ecology (NIOO-CEME). The Flemish data of oxygen concentrations are collected through the monitoring network for surface waters from the Flemish Environment Agency (VMM), the OMES research programme and NIOO-CEME.

### Opportunities and threats

In the last century, the water quality of rivers in the basin of the Scheldt strongly deteriorated. The discharge of untreated industrial and municipal wastewater caused the oxygen levels to decrease significantly. In the late '70s there was a total oxygen depletion in certain places and in some periods of the year, seriously affecting aquatic life.





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The water quality in the Scheldt estuary has improved gradually in recent years, in terms of oxygen levels, thanks to the construction of water treatment plants and the treatment of wastewater [14, 15]. At national and European level, agreements were made to improve water quality. Nevertheless, in many places a good water quality is not a reality yet. National River Basin Management Plans for the Scheldt and the international management plan for the Scheldt, drawn in the context of the WFD, should bring the necessary changes by implementing a devised plan with measures.

Measures for achieving good water quality have a price tag. The WFD promotes a greater use of economic analysis in pursuit of that good water quality. The benefits of good water quality expressed in monetary terms provides the policy level an idea about the consequences of the actions being taken [16].

Monitoring water quality in implementation of the WFD, should be conducted by all member states in a similar way, and the goal is clear: a good ecological and chemical status for all surface waters by 2015. The specifications of the measurements on this indicator further describe definitions, data and methodology, and their limitations. The fact sheets are available at: <http://www.scheldemonitor.org/indicatorfiche.php?id=10>

## Integration with other indicators/measurements?

The quality of surface water affects a variety of functionalities and features of the Scheldt estuary. Good water quality is a crucial condition for aquatic communities and species (benthic organisms, fish, ...) to achieve a good conservation status in accordance with the European Habitats and Birds Directive and/or local conservation priorities (see indicator 'status of species and habitats'). Many of the environmental contaminants are fat-soluble and can accumulate in elevated concentrations in biota and negatively affect these organisms (see indicator 'loads of pollutant substances'). Humans also benefit from a good water quality, creating a pleasant environment for recreation and tourism and for residents in the first place. In conditions of good water quality, the hazards associated with fish consumption decrease. Healthy bathing water also creates a positive image for the Scheldt estuary for tourists and residents (see indicator 'loads of pollutant substances' and 'socio-economic importance of residential tourism').

Improving the quality of the river bed sediments and reducing the nutrient loads (see indicator 'loads of pollutant substances'), both sources of pollution to surface waters, increases water quality and the potential for ecological restoration of the watercourse. Further development of water treatment plants, construction of nature friendly river banks and removing obstacles in migration for fish (see indicator 'opportunities for nature') are some of the many measures that were included in river basin management plans to achieve the goals imposed by the Water Framework Directive on the European countries, to realize.

The Nature development plan for the Scheldt estuary [6] suggests that measures which give space to the river, are necessary to achieve the goals in terms of naturalness (including a non-limiting water quality) as formulated in the Long-term Vision for the Scheldt estuary. Such measures are part of the Flemish Sigmaphan and the Dutch Natuurpakket (Nature plan) (see indicator 'protection and development of natural areas').

## How to cite this fact sheet?

**Anon.** (2010). Surface water quality. Indicators for the Scheldt estuary. Commissioned by the Maritime Access Division, project group EcoWaMorSe, Flemish-Dutch Scheldt Commission. *VLIZ Information Sheets*, 222. Flanders Marine Institute (VLIZ): Oostende. 10 pp.

Online available at <http://www.scheldemonitor.org/indicatoren.php>

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