# Indicators for the Scheldt estuary

## Fisheries


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Commercial fishing in the Scheldt estuary only occurs in the Westerschelde. On the Beneden- and Boven-Zeeschelde there's no commercial fishing any more. As for the cockle fishery, more than 50% of the total harvestable quantities of cockle flesh were fished in the period 1992 - 1995. This rate fell sharply in the period 2006 - 2010 as no cockles were fished. 1998 and 2004 were good cockle years in the Westerschelde with a total quantity of "harvestable" cockle flesh of 3.59 and 3.43 million kg respectively. Of the 7 most important commercial fish stocks of the North Sea and adjacent areas in 2009, only 2 (haddock and plaice) are within safe biological limits. For the Scheldt estuary no area specific review assessment is available. Recreational fishing takes place over the whole estuary, but figures on this fishing pressure are not available.

## Why monitor this indicator?

Once, the Scheldt estuary was an important fishing area, but today commercial fishing is limited mainly to the catch of shrimps, sole, eel and cockles on the Westerschelde. There are less than 50 permits for commercial fishermen on the Westerschelde. How many fishermen are actually active, is difficult to say because not all permits are used or fishing only occurs in certain periods (de Ruiter, R., pers. comm.). In the Beneden- and Boven-Zeeschelde there is no commercial fishing any more. Sport fishing occurs throughout the whole estuary. The Long-term Vision of the Scheldt estuary (LTV, [1]) targets for 2030 "an equilibrium between all types of fisheries and the carrying capacity of the area (maternity and nursery function for aquatic life)".

The Ministry of Economic Affairs, Agriculture & Innovation (MIN EL & I, formerly the Ministries of Agriculture, Nature and Food Quality (LNV) and Economic Affairs (EZ)) is responsible for the Dutch fisheries policy. The Fisheries Act 1963 (Visserijwet, 1963) [2] is the basis of the Dutch legislation on commercial and sport fisheries. This law regulates i.a. who can fish where, which fishing gear should be used, which species and in what time of the year can be fished and what minimum sizes of landed fish must be. The Fisheries Law also serves as a basis for implementing the obligations for the Netherlands arising from the European Common Fisheries Policy and international fisheries treaties. Fisheries in the Dutch coastal waters (including the Westerschelde) is designated in the Fisheries Act as 'coastal fisheries'.

The policy decision "Shellfish fisheries 2005 - 2020" [3], draws the main features of the new policy for shellfish fisheries in Dutch saline waters. It envisions "a shellfish fisheries policy with perspective on an economically healthy industry including production methods that respect and, where possible, strengthen natural values". Concerning mechanical cockle fisheries (vessels pull knifes through the bottom and suck up cockles) in the Delta area including the Westerschelde, solutions are worked out to replace these fisheries by a sustainable cockle breeding programme within prevailing conditions and European directives: "because cockles occur on unstable places(freshwater currents) or in very high densities in the Westerschelde (and possibly also in the Voordelta), this system is a source of cockle spawn. This spawn can be put into sections of the more sheltered and stable Oosterschelde and cultivated ".

Since 1996, the cockle industry has decided that in all circumstances 4 million kg fresh weight of cockles should remain available as food source for birds in the Westerschelde. Below this precautionary limit fishing does not occur. If more than 4 million kg fresh weight is available but less than 8 million kg, a fishing plan is designed to guarantee food supply for birds. Furthermore, a number of areas in de Westerschelde are permanently closed to fisheries [3].

In Flanders, the Agency of Nature and Forests (ANB) is responsible for fisheries policy as part of the Environment and Nature policy and the Integrated Water Policy of the Flemish government. The two basic principles of the fisheries policy are “a sustainable management of the natural fish stocks and their environment” and “a wise use of these fish stocks and their environment”. The basic principle is the conservation of fish stocks in a natural way and exploitation of these fish stocks without a lasting negative impact on species richness and ecological functioning of the Flemish inland waters. Every fisherman with a fishing permit can fish in all Flemish public waters under a clear regulation. The Provincial Fisheries Committees are the statutory consultative body between fishermen's organizations and the government [4].

## What does the indicator show?

### *Fisheries pressure*

Cockle fisheries are the only form of fisheries for which it is possible to isolate landings for the Westerschelde. Data are collected since 1992 by Wageningen IMARES, Institute for Marine Resources & Ecosystem Studies. The Fish Registration Information System (VIRIS) from the Min EL&I contains catch data for all landings in the Netherlands and of Dutch vessels abroad (commercial fishing), on the level of the quadrants of the International Council for the Exploration of the Sea (ICES). The ICES quadrants 31F3 and 31F4 could be selected for the Westerschelde but these also include a part of the North Sea and the Oosterschelde. As a consequence data are not representative. Another possibility is the use of VMS (Vessel Monitoring System) data. Through the VMS position, speed and navigation direction of (fishing) vessels is determined using satellites. Verifying whether or not the vessel is fishing, is difficult with this system. Moreover, fishing in the Westerschelde often occurs on smaller vessels not equipped with VMS (Beare, D., Bult, T., pers. comm.).

Concerning recreational fishing in the Zeeschelde and its tributaries, there are no figures available that can measure or quantify fisheries pressure, except what is known of the sample-based fishery controls for enforcement by the ANB. One can assume that in the past two decades any or hardly any anglers went fishing in the Scheldt, while in recent years clearly an increasing number of anglers on the banks of the Scheldt is observed, a direct result of the improved water quality/oxygen balance (see also indicator ‘surface water quality’). This was first noticeable along the Beneden-Zeeschelde, but recently also along the Zeeschelde upstream of Antwerpen and its tributaries such as the Rupel (following the commissioning of the new wastewater treatment plant of Brussel) (Yseboodt, R. and Dillen, A., pers. comm.).

Figure 1 shows the amount of non-fished and fished cockles (million kg “harvestable” flesh, shells excluded) in the Westerschelde. 1998 and 2004 were good cockle years in the Westerschelde with a total amount of respectively 3.59 and 3.43 million kg of "harvestable" cockle flesh. It is hereby considered that cockles in densities lower than 50 per sqm are not harvestable for birds or fishermen.

More than 50% of the total harvestable quantities of cockle flesh were fished in the period 1992 - 1995. This rate fell sharply in the period 2006 - 2010 as no cockles were fished.

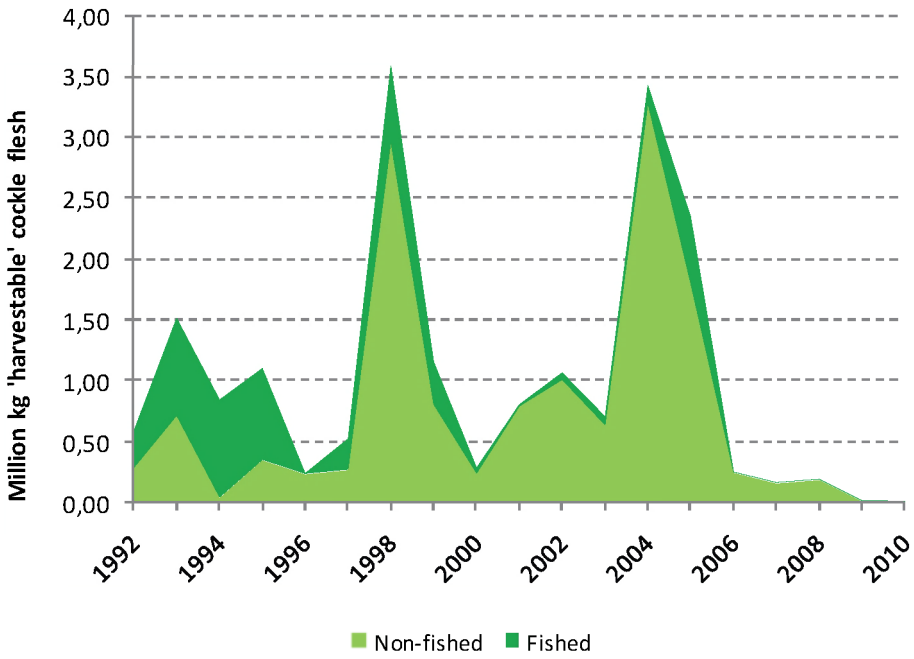


**Figure 1:** Amount of non-fished and fished cockles (million kg "harvestable" flesh) in the Westerschelde. Source: Wageningen IMARES.

### *Commercial fish stocks within safe biological limits*

The International Council for the Exploration of the Sea (ICES) annually reviews the status of a number of commercial fish stocks as a basis for advice to fisheries authorities on fisheries policy and management. ICES makes use of the assessment of the spawning stock biomass (B) that reflects the total amount of fish that can spawn. The fishing mortality (F), characteristic of fishing pressure on fish stocks is also evaluated. The value of B and F compared to the predetermined reference points gives an idea of the state of the stock.

Until 2010 ICES made use of the 'precautionary approach'. For B, these reference points respectively are $B_{LIM}$, below which the reproductive capacity of the stock is considered to be impaired and there is a probability of stock collapse, and $B_{PA}$, above which the stock is described with an completely intact reproductive potential. For F reference points are respectively $F_{LIM}$, above which harvest rates are considered to be unsustainable and $F_{PA}$, below which harvest rates are defined as sustainable. I.e. when for a certain fish stock fishing mortality remains below the $F_{PA}$ and spawning stock biomass level remains above the $B_{PA}$, this stock is considered as safe within safe biological limits [5, 6]. Below the assessment of the seven most important commercial species of the North Sea and adjacent areas is discussed. For the Scheldt estuary, no area specific evaluation is available, although the status of fish populations is evaluated for each surface water as part of the assessment of ecological status in implementing the Water Framework Directive (see indicator "surface water quality"). In that assessment fisheries pressure is not explicitly taken into account.

Table 1 shows that in the beginning of the available time series, most of the assessed fish stocks assessed (plaice, sole, haddock, cod) were within precautionary limits both in terms of fishing mortality and level of spawning stock biomass. Herring soon experienced a reduced reproductive potential and risk of unsustainable exploitation from the late 60s onwards. In recent years, this species slightly does better but stocks of other species such as cod and whiting are doing less. In 2009, only the stocks of haddock and plaice are within safe biological limits.

| Year | Her-ring* | Cod | Haddock | Plaice | Sole* | Whi-ting** | Mackerel |
|---|---|---|---|---|---|---|---|
| 1957 | ? | ? | ? | ✓ | ✓ | ? | ? |
| 1958 | ? | ? | ? | ✓ | ✓ | ? | ? |
| 1959 | ? | ? | ? | ✓ | ✓ | ? | ? |
| 1960 | Δ | ? | ? | ✓ | ✓ | ? | ? |
| 1961 | Δ | ? | ? | ✓ | ✓ | ? | ? |
| 1962 | Δ | ? | ? | ✓ | ✓ | ? | ? |
| 1963 | ✓ | ✓ | Δ | ✓ | ✓ | ? | ? |
| 1964 | Δ | ✓ | Δ | ✓ | ✓ | ? | ? |
| 1965 | Δ | ✓ | ✓ | ✓ | ✓ | ? | ? |
| 1966 | Δ | ✓ | ✓ | ✓ | ✓ | ? | ? |
| 1967 | Δ | ✓ | ✓ | ✓ | Δ | ? | ? |
| 1968 | Δ | Δ | ✓ | ✓ | Δ | ? | ? |
| 1969 | Δ | ✓ | ! | ✓ | Δ | ? | ? |
| 1970 | Δ | ✓ | ! | ✓ | Δ | ? | ? |
| 1971 | Δ | Δ | Δ | ✓ | Δ | ? | ? |
| 1972 | Δ | Δ | ! | ✓ | Δ | ? | ✓ |
| 1973 | Δ | Δ | Δ | ✓ | Δ | ? | ✓ |
| 1974 | Δ | Δ | Δ | ✓ | Δ | ? | ✓ |
| 1975 | Δ | Δ | ! | ✓ | Δ | ? | ✓ |
| 1976 | Δ | ! | Δ | ✓ | Δ | ? | Δ |
| 1977 | Δ | Δ | ! | ✓ | Δ | ? | ✓ |
| 1978 | ✓ | ! | ! | ✓ | Δ | ? | ✓ |
| 1979 | ✓ | Δ | Δ | Δ | Δ | ? | Δ |
| 1980 | Δ | Δ | Δ | ✓ | Δ | ? | Δ |
| 1981 | Δ | ! | ✓ | ✓ | Δ | ? | Δ |
| 1982 | Δ | ! | ✓ | Δ | Δ | ? | ✓ |
| 1983 | Δ | ! | Δ | ✓ | Δ | ? | ✓ |
| 1984 | Δ | ! | Δ | ✓ | Δ | ? | ✓ |
| 1985 | Δ | ! | Δ | ✓ | Δ | ? | ✓ |
| 1986 | Δ | ! | ! | Δ | Δ | ? | Δ |
| 1987 | Δ | ! | ! | Δ | Δ | ? | ✓ |
| 1988 | Δ | ! | ! | Δ | Δ | ? | Δ |
| 1989 | Δ | ! | Δ | Δ | Δ | ? | ✓ |
| 1990 | Δ | ! | ! | ✓ | Δ | ! | ✓ |
| 1991 | Δ | Δ | Δ | Δ | Δ | ! | ✓ |
| 1992 | Δ | Δ | Δ | Δ | Δ | ! | Δ |
| 1993 | Δ | ! | Δ | Δ | Δ | ! | Δ |
| 1994 | Δ | Δ | Δ | Δ | Δ | ! | Δ |
| 1995 | Δ | ! | Δ | Δ | Δ | ! | Δ |
| 1996 | Δ | ! | ✓ | Δ | Δ | ! | Δ |
| 1997 | Δ | Δ | ✓ | ! | Δ | ✓ | Δ |
| 1998 | Δ | ! | ✓ | Δ | Δ | ✓ | Δ |
| 1999 | Δ | ! | Δ | Δ | Δ | ✓ | Δ |
| 2000 | Δ | ! | Δ | ✓ | Δ | ✓ | Δ |
| 2001 | Δ | Δ | ✓ | ! | Δ | ✓ | Δ |
| 2002 | ✓ | Δ | ✓ | ✓ | Δ | ✓ | ! |
| 2003 | ✓ | ! | ✓ | Δ | Δ | ✓ | ! |
| 2004 | Δ | Δ | ✓ | ✓ | Δ | ✓ | Δ |
| 2005 | Δ | Δ | ✓ | ✓ | Δ | ✓ | Δ |
| 2006 | Δ | ✓ | ✓ | ✓ | Δ | ✓ | Δ |
| 2007 | Δ | ✓ | ✓ | ✓ | Δ | ✓ | Δ |
| 2008 | ✓ | Δ | ✓ | ✓ | ✓ | ✓ | Δ |
| 2009 | ✓ | Δ | ✓ | ✓ | ✓ | ✓ | Δ |
| 2010 | ? | ? | ? | ? | ? | ? | ? |

| Spawning Stock Biomass (B) | | Fishing mortality (F) | | |
|---|---|---|---|---|
| $< B_{LIM}$ | Reduced reproductive capacity | ! | $> F_{LIM}$ | Harvested unsustainably |
| $> B_{LIM}$ and $< B_{PA}$ | Risk of reduced reproductive capacity | Δ | $< F_{LIM}$ and $> F_{PA}$ | At risk of being harvested unsustainably |
| $> B_{PA}$ | Full reproductive capacity | ✓ | $< F_{PA}$ | Harvested sustainably |
| | No assessment | ? | | No assessment |

**Table 1**: Spawning Stock Biomass (B) and Fishing mortality (F) of the most important commercial fish stocks in the North Sea and adjacent areas. *For herring and sole no $F_{LIM}$-values are defined. **For whiting reference points of 2002 are used, because no recent values are available. Source: ICES, [7].

In the early 60s three to four of the assessed fish stocks in the North Sea and adjacent areas were within safe biological limits (see Figure 2). Thereafter, this number dropped to one or zero mid 80s and 90s (although more stocks were evaluated). In the last 10 years, the number increased again to 3 and 2 in 2008 and 2009.

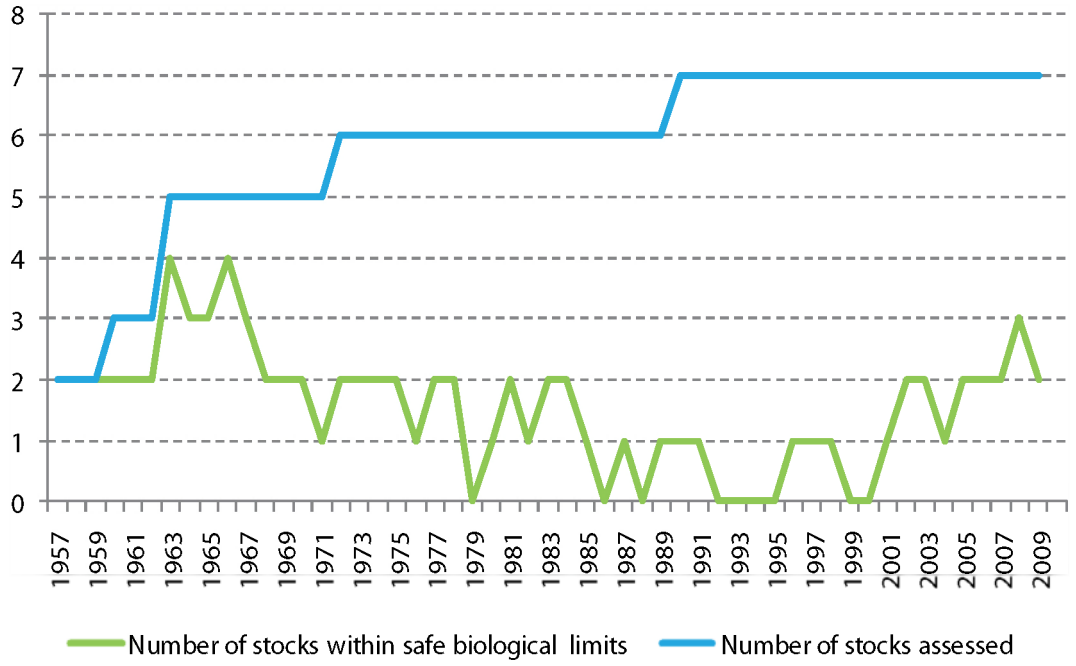


**Figure 2**: Trend in the number of analytical assessed commercial fish stocks within safe biological limits in the North Sea and adjacent areas. Source: ICES, [7].

Since 2010 ICES is working on a new new approach for evaluating the state of commercial fish stocks. This approach is based on the 'Maximum Sustainable Yield' (MSY) according to the UN Convention on the Law of the Sea (1982), the World Summit on Sustainable Development in Johannesburg (2002) and the EU MSY policy [8]. The EU MSY policy wishes to maintain or restore stocks to levels that can produce the maximum sustainable yield, with the aim of achieving these goals not later than 2015. '*MSY is the maximum yield that may be taken year after year. It is characterized by a level of fishing mortality that will, on average, result in a stock size that produces the maximum sustainable yield*'. The MSY concept thus also uses reference points for fishing mortality and biomass: $F_{MSY}$ and $B_{MSYtrigger}$. $F_{MSY}$ is the fishing mortality that will maximise average yield in the long term and is generally lower than the fishing mortality $F_{PA}$ that is used in the precautionary approach. The $B_{MSYtrigger}$ is a biomass reference point that triggers a cautious response. In practice, this means that when stocks fall below a certain trigger level, the advice will be to will be to decrease fishing mortality below $F_{MSY}$. A transition period for the ICES MSY framework to be put in place is needed, as it will take some time to gather all the necessary data, e.g. needed to esta-

blish reference points [9; Poos, J.J., pers. med.].

## Where do the data come from?

- Data on the amount of cockle flesh in the Westerschelde are collected and published by Wageningen IMARES.
- Data on the assessment of commercial fish stocks in relation to safe biological limits originate from the International Council for the Exploration of the Sea (ICES)

## Opportunities and threats

Historical data shows that a thriving fishing industry has existed on a variety of fish species in the Scheldt estuary. A quote from L. Guicciardini (1567) testifies: "*Because of the proximity of the Meuse estuary, sturgeon can occasionally be found in the Scheldt. Many species of fish swim upstream: salmon and salmon trout, large lamprey, turbot, sea eel, shad, weever, grey mullet, different types of 'spider crab' (presumably edible crab), flounder, very tasty sole, delicious goatfish (presumably red mullet), 'sea grasshoppers' (presumably shrimps), sardines (presumably sprat, juvenile herring or anchovy), and many other appetizing species. Large schools of all these marine fish large schools arrive in the waters of the Scheldt, because these waters are extremely suitable for them as a food source and to spawn. Thus every year in spring and summer, for two to three months one can catch together with large fish such an extraordinary, unimaginable amount of small, young and even newborn fish that many people in this period use it as their daily food*" [10].

Since the 19th century, overfishing in the river and adjacent coastal areas, major water pollution and infrastructure and maintenance works in function of transportation and drainage, have caused a significant decline of the status of fish stocks in the Scheldt estuary (as early as the 14th century 'overexploitation' was already mentioned) [10].

A healthy and ecologically sound water system management in the Scheldt estuary is the precondition for human use of this system and hence for fisheries. Reducing the load of environmental pollutants to the Scheldt estuary is one of the key objectives in order to create not only a healthy habitat for fish and other fauna and flora but also to meet current environmental quality and consumption standards for fish (see indicator "loads of pollutant substances"). Water quality is closely monitored by the European member states in implementing the Water Framework Directive (WFD) that requires a good ecological and chemical status of all surface waters by 2015. The national River Basin Management Plans for the Scheldt and the international management plan for the Scheldt, made in the context of the WFD, contain an outlined measurements program (see indicator "surface water quality"). The realization of new natural areas in implementing the updated Sigma Plan and Westerschelde Nature Plan ('natuurpakket' Westerschelde) (see indicator "protection and development of natural areas"), will increase the suitable area for foraging and growth of i.a. fish. The removal of fish migration barriers (see indicator "opportunities for nature") is important to restore migrating fish populations in the Scheldt estuary. Dredging, disposal and sand extraction (see indicator "soil interfering activities") can have a burying and/or blurring effect on benthic flora and fauna and thus on food availability of fish species that depend on these organisms. As part of the third expansion of the navigation channel, little impact is expected on cockle stocks on the short and medium term (> 5 years) [11, 12].
A good estimate of fishing pressure (both commercial and recreational fisheries) at the level of the Scheldt estuary is important for policy and management. The limited knowledge of the catches (at the level of the Scheldt estuary) makes it difficult to formulate policies and take measures that lead to sustainable fish stocks and healthy exploitation [11, 13]. Meanwhile, the policy decision "Shellfish fisheries 2005 -2010" envisions a preservation of the shellfish fisheries policy in the Netherlands, where possible extrapolating the insights from the EVAII (Evaluation Shellfish fisheries Policy Phase II) study on mechanical shellfish fisheries in the Wadden Sea and Oosterschelde to other waters [3].

The technical fact sheets describe definitions, data and methodology. The fact sheets are available at: http://www.scheldemonitor.be/indicatorfiche.php?id=18

## Integration with other indicators/measurements?

The Scheldt estuary has an important nursery function for the growth of young fish (e.g. sole and plaice), crustaceans and molluscs (e.g. shrimp). Determining factors for this are water quality and the presence of suitable reproductive and breeding areas (shallow areas with low current velocity). Using the Flemish and Dutch ecotope systems, the development of ecologically valuable ecotopes can be followed (see indicator 'morphology and dynamics in the estuary').

With the 'flexible disposal strategy' in the framework of the third expansion of the navigation channel, the disposal of dredged material can be adjusted based on the meticulous monitoring of quality parameters in order to counter undesirable effects. By disposing dredged material on the sand flat edges (in addition to the secondary and main channels), it is further intended to create ecologically valuable ecotopes. The first test disposals on the sand flat of Walsoorden were a success from the morphological point of view and generated no adverse ecological effects (see indicator 'soil interfering activities').

## How to cite this fact sheet?

**Anon.** (2010). Fisheries. Indicators for the Scheldt estuary. Commissioned by the Maritime Access Division, project group EcoWaMorSe, Flemish-Dutch Scheldt Commission. *VLIZ Information Sheets*, 233. Flanders Marine Institute (VLIZ): Oostende. 8 pp.

Online available on http://www.scheldemonitor.org/indicatoren.php

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