



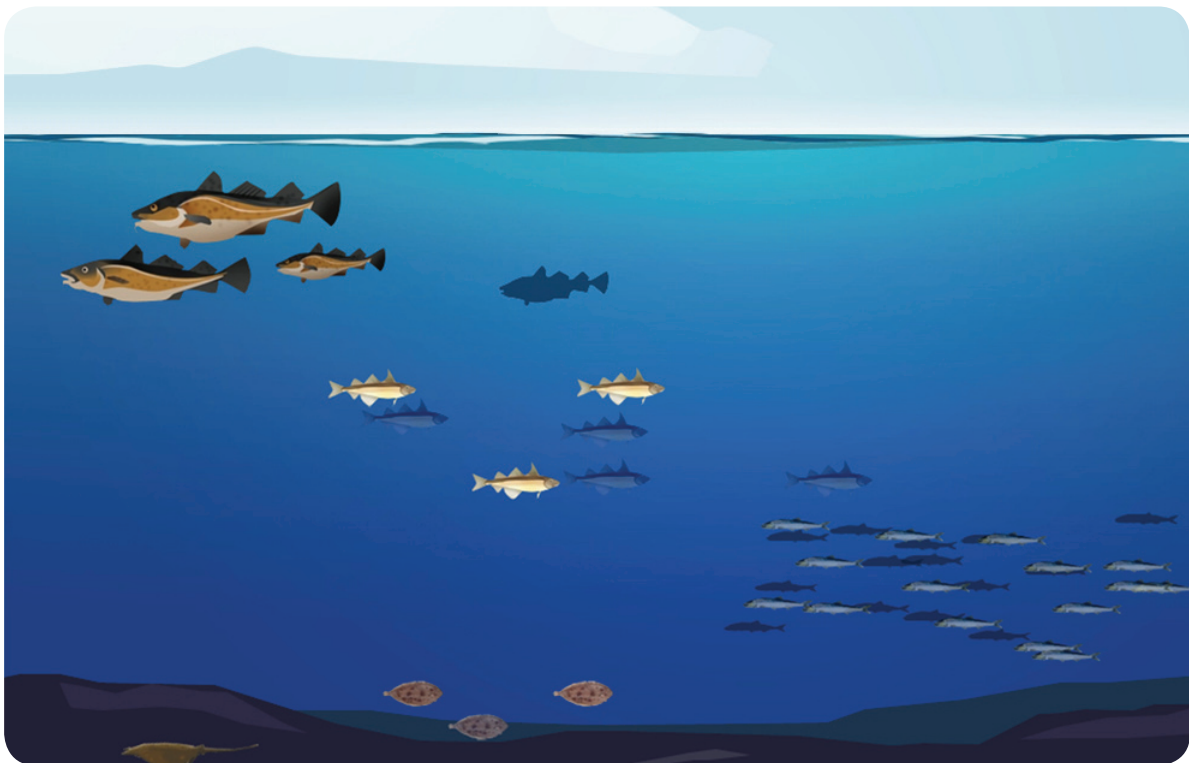
# Sheet 12 : Biodiversity in the North Sea

## A/ Description of the animation

Already weakened by overfishing, biodiversity in the North Sea now has to face up to yet another peril: climate warming. A temperature increase is not only happening in the air, it is also occurring in the water. The effects of temperature rise in the North Sea have been visible since the end of the 1980s.

This warmth is causing a change in plankton composition and promoting the establishment of other exotic marine species. In the North Sea, one exotic species is especially representative of this trend: the Pacific oyster which is progressively invading Belgian mussel beds. Over the long term, the establishment of this oyster in Belgian waters could cause radical modifications to the Belgian underwater landscape.

Another effect is also being observed in the North Sea: sea level rise. Due to climate warming, water expands and takes up more room. With time, a significant amount of northern Belgium could be submerged by water, triggering the disappearance of rare coastal ecosystems such as the mudflats of the Zwin reserve.

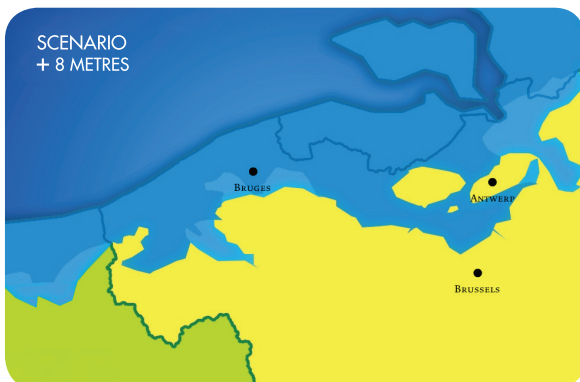


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### B/ Let's take a closer look...

A number of climate change effects can already be observed in the North Sea. These include a water temperature increase and sea level rise. Let's take a look at the consequences of these effects.



### 1/ TEMPERATURE INCREASE IN THE NORTH SEA

#### Emergence of exotic species:

##### the Pacific oyster

Over the past few years, new species have begun to appear in the North Sea. These species are said to be "exotic" when they have been imported into Belgium artificially through human intervention. Under "normal" conditions, some of these species would not be suited to survive in the Belgian climate. However, the rise in water temperature has enabled them to gain a foothold in our waters.

The Pacific oyster is a good example of the exotic species which have gradually become established in the North Sea after arriving in the ballast tanks of ships that had sailed in from warmer waters. The result of the water temperature having risen by just 1°C has enabled this exotic species to live and thrive in the North Sea. So much so, in fact, that it is now competing with the Belgian mussels. Larger and more invasive, the Pacific oyster is gradually replacing the mussel. Its establishment is further encouraged by the fact that there are no predators to the oyster in our local waters, unlike the mussel which has to contend with certain species of starfish and crabs. Much more competitive than the mussel, the oyster is taking over both the habitat (mussel beds) and the available food. Like the mussel, the oyster is a "filter-feeding" species that relies on particles suspended in the water. The Pacific oyster poses a direct threat to mussels and, consequently also, to the species that feed on them.

##### Migration of "cold" species towards the North

Whereas exotic species are slowly emerging, so-called "cold" species are becoming increasingly rare. This is the case of the Belgian shrimp populations (*Crangon crangon*) which have declined significantly.

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This does not mean that Belgian shrimps are dying out but rather that the area where they can be found has moved northwards. Why? Because the temperature of this part of the North Sea no longer suits their needs. This means the populations are forced to migrate to colder areas.

### 2/ SEA LEVEL RISE IN THE NORTH SEA

While the sea level has constantly changed over the course of history, climate warming caused by human activity has resulted in a constant rise over the 20th century of around 1.7 mm per year.

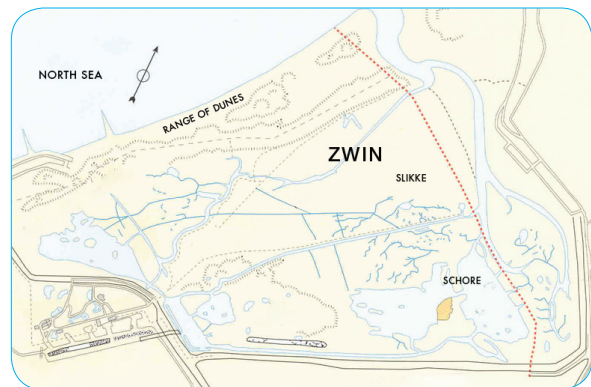
What will happen tomorrow? Experts see a range of different prospects for the future, but they all point in the same direction: sea level rise is irreversible. Another factor is more worrying still: sea level will rise faster and faster.

The intermediary scenario presented by the IPCC group of experts in its 2007 report predicts that the sea levels will rise at a rate of 4 millimetres a year during the 21st century – this would more than double the current rate!

#### Rare ecosystems under threat: the Zwin

If these projections come out true, a number of rare ecosystems like the one at the Zwin will be threatened. In Belgium, it has been forecasted that the sea level could rise by one metre between now and 2100. This may not seem like much, but the consequences of such an increase would be devastating. For Belgium, this would mean that a land area of about 63,000 hectares would be submerged by sea water if no dykes are built to protect them. In the longer term (over 1000 years), an 8 to 15 metre sea level increase is forecasted (as a result of the possible thawing of the Greenland & West Antarctic ice caps), enough to submerge one-tenth of the entire Belgian country (nearly 3,700 km<sup>2</sup>).

The Zwin natural reserve is an essential ecological and land resource. The reserve is made up of 4 successive environments: a dry beach, a range of dunes then, behind these, two saline environments (= containing salt) that are typical of the Zwin area, the 'slikke' (an expanse of mudflats) and the 'schorre' (an area of salt marshes).



Map of the Zwin

Normally, the Zwin is partly under water. When there are major storms, seawater reaches the foot of the dunes (intermediary environment). Close to the border between Belgium and the Netherlands, there is a breach in the row of dunes. This breach allows for seawater to penetrate into the natural reserve when the tide comes in. At high tide, the slikke is totally covered with water, whereas the schorres are only covered when there are king tides.

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These two saline environments (slikkes and schorres) are particularly rich and rare, providing shelter for a wide range of vegetation and birds. If sea level continues to rise, this reserve, trapped between the sea and seawall, risks being permanently flooded. Currently, the seawalls are built to withstand a rise of 60 cm in water levels. Elsewhere in the world, natural areas comparable to the Zwin are able to "withdraw" inland. This is not possible for the Zwin because it is a small natural zone located between a sea and a seawall, providing protection to the inside land.

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### C) Group activity to be conducted in the classroom

#### EXPERIMENTS ON RISING WATER LEVELS

##### Aims

- highlight the fact that the rising sea level is (partly) caused by land glaciers melting and not by icebergs and sea ice melting
- illustrate the thermal expansion of water caused by climate warming

##### Equipment

- 2 ice cubes
- 2 glasses / transparent drinking cups
- 2 saucers
- 1 ruler/support with holes
- transparent plastic ballpoint pen
- adhesive tape
- cold water
- receptacle of very hot water (60°C)

**Timing :** 10 minutes (the time it takes for the ice cubes to melt completely)

##### Step 1:

To illustrate floating ice (icebergs):

- Place 1 ice cube in a glass and put the glass on a saucer.
- Then, fill the glass with water all the way to the brim. The ice cube illustrates ice floating on water.
- Watch to see whether the level of water in the glass rises when the ice cube melts totally.

➡ No, the level of water remains the same. This means that melting icebergs don't affect sea level.

##### Step 2:

To illustrate a land glacier (like the Antarctic icecap):

- Fill the glass with water, completely to the brim and place a saucer under the glass.
- Place a support of some kind or strip of wood with holes on top of the glass so that the ice cube can melt above the glass
- Place the ice cube on the support positioned above the glass
- Watch to see whether the level of water in the glass rises.

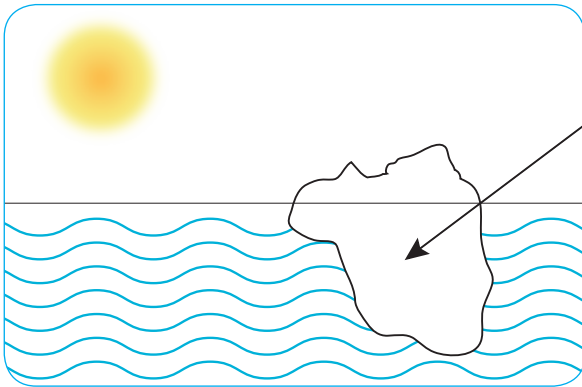
➡ Yes, this time the water level rises because the quantity of water from the ice cube is added to the water in the glass – unlike part one of the experiment in which the ice cube was already in the glass. This demonstrates that the melting of ice caps would cause the water level to rise.

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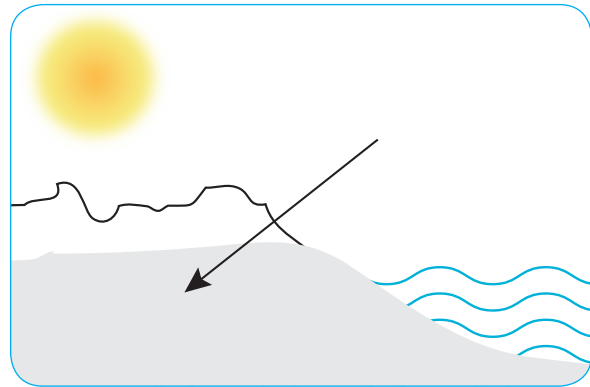
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### Step 3:

On the blackboard draw:



the cross-section of an iceberg floating in the water



the cross-section of a land glacier close to the sea

Ask the children to say which of the experiments each of the drawings reminds them of.

### Etape 4 :

To illustrate the way water expands as the result of climate warming:

- remove the tip and ink reservoir out of a ball point pen (if necessary, use sticky tape to block the little hole you often find on the side of the plastic tube)
- seal one of the ends using the little stopper on the pen
- fill the plastic tube with cold water
- dip the pen vertically into a receptacle containing very hot water
- watch and see whether the water overflows from the tube (YES, after a few moments, a jet of water will spray out from the pen)

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### D/ Resources / references

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- Report issued by the non-profit Royal Institute for the Sustainable Management of Natural Resources and the Promotion of Clean Technologies.  
<http://www.irgkint.be/Repositories/Documents/medias/docs/cahier12FR.pdf>
- Greenpeace report: "Impacts of climate change in Belgium"  
<http://www.geo.ucl.ac.be/Pacte/Greenpeace.pdf>
- The effects of climate change on young cod  
[http://www.ouestfrance.fr/dossiers/climat\\_detail.asp?IdArt=348226&IdThe=&IdCla=9444&NomCla=Actualit%E9&PageCour=1&PageTot=2](http://www.ouestfrance.fr/dossiers/climat_detail.asp?IdArt=348226&IdThe=&IdCla=9444&NomCla=Actualit%E9&PageCour=1&PageTot=2)
- Earth Google maps showing water rise simulations:  
<http://flood.firetree.net>

