

***Report of the Workshop:
“The impacts of climate change
in the marine environment
and coastal zone”***

21 April 2009, Ostend

WP 2.3.

Organized by the Maritime Institute

and

Agency for Maritime and Coastal Services – Coastal division

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The impacts of climate change in the marine environment and coastal zone

Workshop 21 April 2009, Ostend

1. Purpose of the workshop

The purpose of the workshop was to describe and evaluate the main climate change impacts for the Belgian part of the North Sea and to introduce the IMCORE project. This workshop is part of a series of workshops on adaptation to climate change impacts organized by the IMCORE partners in their local area and implementing WP 2.3. The results will be collated and analysed in order to provide a regional comparison.

The nine expert couplets of IMCORE are:

- Maritieme Dienstverlening en Kust (MDK) – Coastal division & Maritime Institute, University of Ghent (Belgium)
- Cork County Council & Coastal and Marine Resource Centre, University College Cork (Ireland)
- Donegal County Council & Centre of Coastal and Marine Research, University of Ulster (Northern Ireland)
- Severn Estuary Partnership & Marine and Coastal Research Group, Cardiff University (Wales)
- Aberdeen City Council & Aberdeen Institute for Coastal Science and Management University Aberdeen (Scotland)
- SIAGM - Intermunicipal Syndicate for Planning in the Gulf of Morbihan & Centre for Maritime Law and economy University of Western Brittany (Brittany)
- Durham Council & Envision, Newcastle University (UK)
- Sefton Council & Edgehill University (UK)
- Government Office (East of England), Colne Estuary Partnership & CoastNet (Essex) (UK)

The participants in the Belgian workshop, representing various coastal and marine sectors, were stimulated to assess the impacts of climate change on their specific activities at sea and on the beach, what they experience as clear signals due to climate change effects and how they think these impacts will evolve over time as well as how they plan to anticipate them. In order to prepare an adaptation strategy for the Belgian part of the North Sea and the coastal

zone, it is necessary to point out what the adaptation priorities are for coastal and marine sectors. The workshop created the opportunity to prioritise the responses to these impacts alongside any other issues that need to be managed.

2. Audience

The intention was to have all main coastal and marine sectors represented in the workshop. 84 invitations were sent a month before the workshop took place (see Annex 1 for the invitation). However, not all sectors were represented, probably due to an overload of workshops on coastal zone related matters during that period. Best represented was part of the invited research community. None of the 10 local municipalities was represented (cf. table).

| Sector | Invited | Present |
|--|---|--|
| <i>Local authorities</i> | 10 coastal municipalities | 0 |
| <i>Federal government</i> | 4 (three of the federal public service health, food chain safety and environment; one of the federal public service mobility and transport; one of the federal public service economy and energy) | 0 |
| <i>Province West Flanders</i> | 5 | 1 |
| <i>Flemish government</i> | 3 | 2 (one responsible for the coast/sea defence and the other responsible for mobility) |
| <i>Tourism</i> | 5 | 1 (mainly a representative of the marina) |
| <i>Ports/Shipping</i> | 5 | 1 |
| <i>Coastguard</i> | 3 | 0 |
| <i>Fisheries/Aquaculture</i> | 8 | 1 |
| <i>Dredging</i> | 6 | 1 |
| <i>Shipping assistance/Pilotage</i> | 3 | 0 |
| <i>Nature conservation</i> | 13 | 1 |
| <i>Energy</i> | 4 | 0 |
| <i>Sand and gravel extraction</i> | 1 | 0 |
| <i>Researchers working on climate change and the Belgian Coast</i> | 14 | 10 |
| Total: | 84 | 18 |

The above table shows that the results of this workshop have to be read with caution. Firstly, not all sectors were present at the workshop. Secondly, the number of people representing the sector was limited (see Annex 2 for the list of participants).

3. Location and timing

The workshop took place in Ostend, Conference Room Marine Board – Wandelaarkaai 7, one of the largest coastal cities in Belgium. The UGENT IMCORE team chose this location for two reasons: 1. it is the place of residence of our partner in our Expert Couplet; 2. it is the central place for the stakeholders invited to the workshop. The workshop was held in a round table format and ran for two and a half hours. The language was Dutch.

4. Resources

A week before the workshop took place templates were distributed to the stakeholders that confirmed their participation. The template was based on the Annual Report Card 2007-2008 of the Marine Climate Change Impact Partnership, as further developed and proposed by our IMCORE partner from the University of Ulster. The template was adapted to the specific conditions of the Belgian coast. The potential effects of climate change for this area were identified in the ongoing Belgian research project CLIMAR in which the Maritime Institute is a partner too (see Annex 3 for the CLIMAR report 1st phase).

The templates listed a number of climate change effects (temperature rise, rise of seawater temperature, sea level rise, increased storms and waves, acidification, coastal erosion, changes in fish population, impacts on wetlands, plankton and seabirds, harmful algal blooms) (see Annex 4 for a template model). Each potential climate change impact was briefly explained. Current impacts of climate change were identified and an assessment was made of future impacts. Together with the template, the stakeholders received a list of specific questions that gave them the opportunity to reflect in advance on these issues and the respective impacts for their sector. These questions were:

- How do coastal- and marine-stakeholders experience the impacts of climate change in their sector today?
- Which impacts of climate change will affect the sector in the future according to coastal- and marine-stakeholders?
- Over what period will these impacts occur according to coastal- and marine-stakeholders (short-, medium- or long-term)?
- What impact will most affect the sector?
- How well is the sector equipped to deal with these impacts?

5. Structure

9.30: Introduction Frank Maes (MI)

The IMCORE and CLIMAR projects were explained. CLIMAR is a Belgian research project funded by Belgian Science Policy with focus on adaptation of the coastal area and sea activities to climate change impacts. IMCORE is a 4 year project funded by the EU in the INTERREG IVB NW Europe program. Various sectors are involved e.g. universities, researchers, local authorities. Ghent University and MDK are the Belgian Expert Couplet. IMCORE contains several Work Packages. Focus of the Workshop is on Work Package 2 'Identification of drivers for climate change related issues'.

10.00: Sectoral impact analysis

Subsequently, the main climate change effects were expounded by Prof. Dr. F. Maes, as well as the potential impacts of climate change as a result of these effects both today and in the future. Every climate change effect and its potential impact were introduced, followed by a time slot of 10 minutes to allow the participants to fill in the template. Eleven climate change effects were introduced. Participants were asked to write down their experiences with climate change impacts to their sector and sectoral adaptation proposals. Furthermore they were asked to classify the climate change effects for their sector according to a scale from least important (0) to very important (10).

11.30: Roundtable discussion An Cliquet (MI)

Prof. Dr. A. Cliquet led a discussion, inviting stakeholders to present their main experiences with climate change effects and the impact for their business. Experiences and visions were expressed by representatives of the sectors tourism, fisheries, dredging, ports/shipping, nature conservation and the Flemish government. The representative of nature conservation could not produce a vision on climate change and nature conservation yet, as the sector is still working on a report related to this topic. The release of this report is expected at the end of August.

6. Results of the workshop

How do coastal- and marine-stakeholders experience the impacts of climate change in their sector today?

All participants noticed changes in the marine environment. They observed an increased presence of cormorants, seals, porpoises, dolphins, sea birds and warm water species (e.g. anchovies, Japanese oyster and sea horses) in the Southern part the North Sea. As an example, the Japanese oyster is on a large scale present in the ports, on the quays and on palisades. The question remains what the cause is of the increasing presence of these species. It can be expected that the presence of this exotic species is due to ballast water exchanges from ships and not due to climate change. The vast majority of those present noticed that there occur more storms than 20 years ago (more storm days) and that the intensity of the storms is more severe. They also stated that harbours after heavy storms are more bogged than before, what makes dredging more necessary and more often applied. The Flemish government also stated that sea level rise already has been recorded at the Belgian coast.

Which impacts of climate change will affect the sectors in the future according to coastal- and marine-stakeholders and over what period will these impacts occur? How will the different sectors adapt to these impacts?

Tourism (coastal marinas/ water recreation):

Ecological impacts

The presence of more marine mammals along the coast result in an increase of sailing days and will most likely result in more tourists excursions at sea.

Economic impacts

The main impact of climate change for this sector will be the increase of frequency and intensity of storms, followed by sea level rise and changes in coastal erosion and sedimentation processes. These impacts can lead to more damage to yachts and marinas, less available shipping days and more dredging activities. Consequently the exploitation and damage costs can increase due to higher maintenance and reparation costs of the marinas.

According to the sector these impacts will only be visible on the long term (100 years). It is not yet required to anticipate these impacts. As adaptation will depend on the financial condition of the marinas, the question remains whether the adaptation of marinas to sea level rise and

increased storms will be payable. Nevertheless, the sector already took into account the increasing number of storms by installing more ports poles to better anchor the boats during heavy storms.

Social impacts

Extreme weather conditions and sea level rise will negatively influence the safety on board the yachts and in the marinas (on quays and jetties). The presence of marine mammals, however, could lead to more tourists and tourism activities.

Ports and maritime transport:

Ecological impacts

Changing coastal erosion and sedimentation processes can have an increased impact on shipping lanes (displacement of sand, sedimentation, etc.) in the Belgian part of the North Sea that will on its turn require more dredging.

Economic impacts

The main climate change impact on harbours will be the rising sea level. Since increases from 1 to 1.5 meters can cause problems related to safety and protection of harbours, higher safety factors will be required to anticipate sea level rise. The sector assumes that rising sea level will only take place gradually and in the long term (100 years). Adaptation is therefore not immediately required, but major infrastructure changes will be needed in the future. The main constraint to anticipate sea level rise will be the outline of costs.

The second most important impact will be increased frequency and intensity of storms and the wave height. This situation will be more damaging to ships and harbour infrastructure, might result in less available shipping days and difficulties in executing certain harbour activities the year round.

Another economic impact indicated by the sector is the fact that temperature rise will increase the need for cooling. Consequently technical measures will have to be taken to adapt ships to this primary impact.

Social impacts

Climate change impacts (extreme weather events, sea level rise, etc.) will negatively influence the working conditions on board ships and increase the risk on accidents.

General comment

The sector noted that mitigation policies on climate change will have a major impact on international shipping, which will take place in a short term (10-20 years). Carbon Dioxide (CO₂) emissions represent about 60% of the global Greenhouse Gas emissions and its most important sources are the industry, the energy sector, traffic and transport. From 2011 on, also the aviation sector shall be covered by the European Emission Trading System which intends to reduce CO₂ emissions. Therefore, it is likely that in the future also the international shipping sector will be covered by an emission reduction obligation. The question remains on which international decision-making level the reduction requirements will be established: the UNFCCC/Kyoto Protocol, the International Maritime Organization or within the European Union. If emission reductions of ships will be regulated on the European level, there may also be changes in the import/export patterns and fuel consumption.

Fisheries:

Ecological impacts

The main impact of climate change on the marine environment will be the shift of species. Due to a rise in seawater temperature, a northward shift of marine species is already taking place in the North Sea and will occur more in the future. The northward shift will have an impact on the presence of cod, haddock and halibut in the North Sea, as these species inhabit in colder waters and there will be a higher incidence of warm water species in our region (including anchovies, sardines, seahorses and mullet). However, not all of these species are of interest for commercial fishing, such as seahorses. Besides the northern shift of marine species, it is likely that the rise in sea level, changes in wetland areas and in erosion and sedimentation processes can affect the existing nursery areas for shrimps, sole and plaice.

Another ecological impact would be the increase of harmful algal blooms due to rising seawater temperatures. At present we read in the newspaper about contaminated mussels, but this coverage is often not correct. Harmful algal blooms are indeed a problem, but the amount of harmful algal blooms is primarily dependent on the tidal force. Therefore, the sector should reckon with the harmful algal blooms during the harvest of mussels which they do by taking daily samples of the water quality. Finally, although the presence of marine mammals is of interest for tourism, it is not for fisheries. The increase of marine mammals is detrimental to fisheries as these animals also eat fish, and thus create food-web competition. Food-web competition occurs when there is potential overlap of the trophic flows supporting a given group (e.g. marine mammals) with the trophic flows supporting another group (e.g. fisheries).

For the sector there are two problems to anticipate climate change effects. The first problem of anticipating these changes is the European Common Fisheries Policy. This policy is based on a set of quotas for species that can be caught. Each country is given a quota based on the total allowable catch and their traditional share of the catch. Up till now, the Belgian fishery vessels do not have a quota for the capture of anchovies. As the changes of climate change will become more visible and perceptible, the European Common Fisheries Policy should be adjusted accordingly.

The second problem is lack of scientific knowledge in the sector. Scientific research regarding the relationship between temperature, seabed and fish populations is already carried out, but there is little cooperation between scientist and fisheries. Various maps (including bathymetry, tidal currents and sand banks) are available at the MUMM (Management Unit of the North Sea Mathematical Models) but the fisheries sector is not aware of the existence of these maps. In order to adapt to the ecological impacts of climate change, more and detailed research will be needed and a better cooperation between scientists and fisheries should be established. Scientific documents must be accessible and understandable for the fishing industry. The sector does not see a threat in the cooperation with scientific researchers, but rather an opportunity to develop a better Common Fisheries Policy while these quotas are not attuned to the reality.

Economic impacts

Due to an increase in storms and inclement weather, there will be more annual storm days and thus less shipping days. This is especially important for inshore fishing; they can only fish at sea up to 4-5 Beaufort. These climate change impacts will also adversely affect the safety on board vessels and in harbours. According to some, storms also have a positive impact on the catching of fish. After a storm the seabed is turbulent, therefore more food is available and more fish can be caught. But this theory only applies to bottom fish. Another reason for the increasing presence of fish could be that there was no fishing for a period of time in that area due to risk of storm.

Social impacts

Extreme weather events and sea level rise will negatively influence the safety on board the fishing vessels and in harbours. Climate change together with other stress factors on the sector (e.g. fuel and fish price) could lead to a further reduction of the Belgian fishery fleet.

General comment

Climate change is still not the biggest threat for the Belgian fishery sector. The Belgian fishery fleet is characterized by strong specialization with regard to fishing method (93% beam trawlers) and target species (mainly flatfish). Beam trawling is very fuel consuming and has a heavy seafloor impact. This and declining fish stocks and changes in fish prices make the

Belgian fishery sector more vulnerable than effects of climate change. The sector stated that today climate change is not the biggest threat for the fisheries but the fuel and fish prices. Nevertheless the sector is aware of climate change and believes that within 15 years climate change could indeed be a serious threat if by then the sector is not sufficiently adapted to the effects of climate change.

Dredging:

Ecological impacts

Massive algal blooms can lead to problems with the engines if these algal blooms are sucked through the cooling water and result in blockage of the engines. As such problems are already taking place today (e.g. India), the sector is searching for possible solutions to avoid these problems.

Economic impacts

The dredging sector has stated that temperature rises have an impact on the rate of corrosion of ships and the operation of the engine cooling and acidification influences the wear of ships. However, according to the dredging industry, the impact on ships and their machinery will be rather minimal and thus controllable as the sector is already equipped to anticipate these impacts (e.g. material selection, installation of protection layers).

Another economic impact will be the reduction of cargo that can be transported since the rising of sea temperature will lead to lower water density which ensures that ships submerge in the sea and consequently are less able to carry cargo. Even today there are differences in water density across the world although the sector can do little against this impact.

As already stated by the fisheries and shipping sector, the dredging sector would also have less shipping days, due to more intense and frequent storms and waves.

Climate change could also create opportunities for the sector since sea level rise and the increase of storms and wave height would ensure more need for constructing and maintaining coastal defence in which the dredging industry can play a very important role. Thus, the sector sees sea level rise as the main impact of climate change but in a positive sense since it would create new opportunities. In what rate climate change would be an opportunity depends on the coastal defence policies that will be implemented by governments around the world. The Dutch government has already chosen for beach nourishment and also the Belgium government chooses to give priority to soft coastal defence structures (e.g. beach nourishment). The British government on the other hand, intends to give more attention to managed retreat.

Social impacts

Demand for more dredging activities, due to sea level rise and changes in sedimentation processes, will lead to a growth of the sector with more jobs as result.

General comment

The sector noted that alongside the primary effects of climate change (e.g. temperature increase, sea level rise, changing fish populations, harmful algal blooms, changing wetlands, acidification, etc.) also legislation effects the sector, albeit indirectly. Due to the impact of climate change, there would be more need for protective legislation (more marine protected areas and more protected fishing areas), which might hamper dredging and building constructions at sea.

Flemish government (AMCS - Coastal division)

One of the main tasks of the Coastal Division of MDK is to guarantee the safety of the population and cultural heritage against storms and floods. In order to achieve this objective, MDK mainly focuses on sea level rise, since this climate change impact will have the greatest impact on the safety of the entire coastal zone.

To protect the coast and the hinterland against flooding, MDK is preparing a coastal safety plan (Masterplan 2050). This Masterplan employs a 'hold-the-line' policy and outlines actions in the short term (2010-2015) and a long-term approach (2050). The 'hold-the-line' policy implies that the Flemish government works with a fictitious line. The line must be maintained and no flooding may exceed that specific safety line. Actions in the short term imply that every five years the entire coastline is subjected to a so-called safety check. The safety line must be resistant against a 1000-year storm (=super storm); if this is not the case, the coastline needs further protection. The long-term approach takes not only super storms into account but also sea level rise, coastal erosion and sedimentation processes. To assess the future sea level rise, MDK relies on the findings made in the IPCC. The IPCC climate report assumes an average sea level rise of ± 22 cm the first 50 years (period 2000-2050) and ± 38 cm the next 50 years (2050-2100). Take also into account that the observations along the Flemish coast indicate an increase of the high waters of ± 30 cm to 2050 and ± 80 cm to 2100. With regard to coastal erosion and sedimentation processes various studies are carried out.

The adaptation measures that will be taken by the Flemish government to protect the coastline against super storms and sea level rise are divided into 2 categories. On the one hand, soft coastal defence measures which are measures that respond to the dynamics of the coast. The best example is sand nourishment. On the other hand, hard coastal defence measures, hard, inflexible structures that directly intervene in the dynamics of the coastal processes. Examples of hard coastal defence are dikes, beach managers, cribs beach, breakwaters.

Furthermore, some problems are encountered in the planning of adaptation measures. Firstly, there must be enough sand available to implement the sand nourishment. Therefore, further research is needed to establish new sand mining areas. Secondly, the government needs to take into account nature conservation legislation when planning adaptation measures (e.g. environmental impact assessment, environmental permits, strategic environmental assessment).

Another task of the MDK is to support coastal and marine tourism, recreational activities and cultural and educational initiatives. With respect to this task, MDK expects in the medium term (2050) more tourists due to rising temperature. This has implications for the policy since more budgets will be required to develop tourism infrastructure along the coast. Other climate change impacts of importance for the Flemish government are acidification and harmful algal blooms as these impacts have an influence on the water quality.

Classification of the effects of climate change per sector according to their impact on the sector to a scale from least important (0) to very important (10).

| Sectors | Temperature | Seawater temperature | Sea level | Storms and waves | Acidification | Coastal erosion | Harmful algal blooms | Fishing | Wetlands | Plankton | seabirds | Legislation/ Policy |
|---|-------------|----------------------|-----------|------------------|---------------|-----------------|----------------------|---------|----------|----------|----------|---------------------|
| <i>Tourism</i> | 0 | 0 | 9 | 10 | 0 | 8 | 7 | 0 | 0 | 0 | 0 | 0 |
| <i>ports and shipping</i> | 3 | 3 | 10 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 8 |
| <i>Fisheries</i> | 1 | 9 | 3 | 7 | 4 | 0 | 5 | 10 | 2 | 6 | 1 | 10 |
| <i>dredging</i> | 3 | 3 | 10 | 10 | 5 | 10 | 3 | 5 | 7 | 5 | 1 | 6 |
| <i>Flemish government – Coastal defence</i> | 8 | 7 | 9 | 9 | 3 | 10 | 3 | 1 | 5 | 1 | 1 | 7 |

The above table reflects the impact of the climate change effects on the respective sectors. The ranking of the Flemish government is the outcome of the result of one of the participants, since the other participant did not complete the classification.

The classification shows that the increase of frequency and intensity of storms and waves will have the biggest impact on the majority of the sectors, together with sea level rise and changes in erosion and sedimentation patterns. For fisheries, the changes in fish stocks will have the biggest impact. Legislation and changes in policy as a result of climate change are (very) important for the Flemish government, fisheries, the dredging industry as well as the ports and shipping sector. Changes in seabird population, further acidification and changes in wetlands are less important for the sectors.

7. Conclusions

- Raising awareness about the need to adapt (some sectors already take adaptation measures, others not).
- Some climate change effects are already visible but it is not always clear what the cause is of these effects (e.g. more storms; more marine mammals like seals and dolphins; more warm water species like anchovies, Japanese oyster, seahorses, more sludge after a storm, contaminated mussels).
- Some climate change effects are positive, whereas others could be negative depending on the sector (e.g. sea level rise).
- Some sectors will be more affected by climate change effects than others. For instance fisheries will be affected by 90% of the climate change effects (changes in fish population, harmful algal bloom, changes in temperature etc.), while the shipping industry will be less affected by climate change effects.
- There is a need for more scientific research and a better cooperation with the scientific community (to have enough information about the impacts of climate change in order to adapt efficiently).
- According to the respective sectors the increase of frequency and intensity of storms and waves will have the biggest impact, followed by sea level rise and changes in erosion and sedimentation patterns.