



The international ZWIN project: an example of European cooperation?

Leo L.P.A Santbergen

ABSTRACT: The Zwin natural reserve, shared by Belgium (Flemish Region; 125 ha) and the Netherlands (33 ha), is the relict of a marine floodplain and important navigation route from Bruges to the North Sea. It has the characteristics of a slufteer area, dominated by tidal inflow and outflow of North Sea water through an entrance channel twice a day. Although parts of the reserve are maintained in the present state artificially, ecological processes and patterns still are mainly influenced by morphological and hydrodynamic processes. Due to the reduced size of the area (caused by drainage, canalisation and land reclamation), the disconnected discharge of fresh (river) water and sand transport processes along the shoreline, the area suffers from a silting up pressure. However, it is still an important saltwater intertidal area, and therefore part of the European Natura 2000 network. If nothing is undertaken, this relatively small but ecologically rare intertidal zone will develop itself into a desalinated and silted up dune valley, dominated by grasses, reed and willows. Biological rich mudflats and marshes will disappear. The importance of the slufteer valley for migrating and wintering birds will decrease considerably. Since 1950, the International Zwin Commission studies on long term (technical) solutions to preserve the nature values. The main question is how to control the (accelerated) silting up process in a sustainable way. Firstly, the paper gives an overview of the studied management scenarios with their estimated strengths and weaknesses. Secondly, the positions and perceptions of the involved stakeholders are briefly presented. Finally, principles of transboundary and integrated water management are discussed in relation to the approach of the International Zwin Commission.

KEYWORDS: Zwin nature reserve, ecological restoration, International Zwin Commission, slufteer, silting up processes, integrated water management, transboundary river basin management, Scheldt estuary, multi-stakeholder platforms, safety against floods, de-poldering.

Introduction

In the middle ages, the Zwin, as a natural marine floodplain, was part of the river Scheldt estuary, shared by Belgium and the Netherlands. Cities like Brugge, Damme (Belgium) and Sluis (Netherlands) owned their richness to the navigable Zwin connection with the North Sea. In the 19th century, after an ongoing land reclamation process, the flow directions of several drainage systems were reversed and disconnected from the Zwin floodplain. The International Zwin Dike (finished in 1872 as part of the reclamation of the Willem-Leopold Polder) act as a sharp barrier between the salt water from the North Sea and the fresh inland water [1, 2]. Figure 1 shows a map of the Zwin area.

Nowadays, the Zwin (158 ha) is the relict of this marine floodplain and has the characteristics of a so-called 'slufteer- area' [1]. A 'slufteer' may be defined as a salt or brackish dune valley which has a connection with the sea by an opening in the primary dunes. A slufteer is a temporary stage in a (highly) dynamic coastal zone, hence doomed to disap-

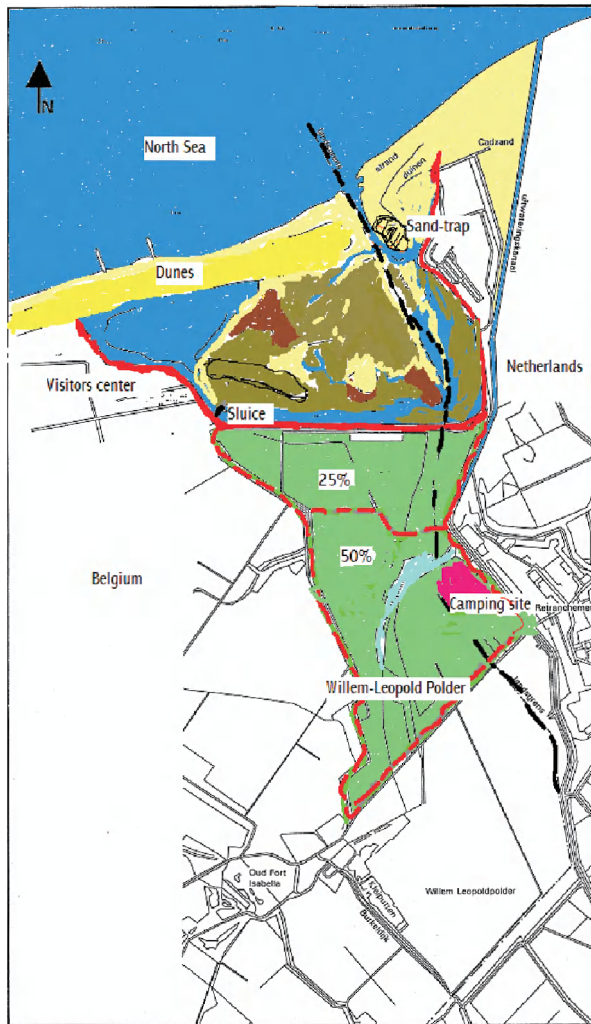


Figure 1: The Zwin nature reserve in its regional context.

Red line = International Zwin Dike. Dotted red line = potential future International Zwin Dike. Black dotted line = Belgian-Dutch frontier. Brown color = mud flats. Dark green color = silted up area with vegetation. 25% and 50% means a de-poldering scenario of 25% respectively 50% of the Willem-Leopold Polder.

pear. Because the Belgian and Dutch coastal zones have been mainly fixed, there is not much room left for the natural life-cycle of slufsters. They can only be preserved (in a certain state) by (periodic) human interference [3]. Although parts of the Zwin reserve are maintained in the present state artificially, ecological processes still are mainly influenced by morphological and hydrodynamic processes (Table 1).

The Belgian part of the present Zwin area (125 ha) is a private nature reserve since 1952. Private means that the area has no formal protected status, as meant by the official legislation. The Zwin reserve has been appointed by both the Belgian and Dutch

government as a wetland of international importance (RAMSAR Convention) and as a special protection area according to the European Birds and Habitats Directives. The entire Zwin reserve is part of the European Natura 2000 network [1, 2]. The entrance channel is situated at the frontier of both countries. The nature reserve includes a visitors center with a birds zoo. The visitors center is modernized including possibilities for (nature oriented) recreational activities [4].

Table 1: Characteristics of a 'slufter' – the case of the Zwin nature reserve

Characteristics of a 'slufter-area'	The Zwin nature reserve
Twice a day, in- and outflow of seawater in a channel through an opening in the sea defense zone/dunes. The water flows through the slufter valley by means of a multi-channel system.	Twice a day, North Sea water flows in and out the 'entrance channel' to a part of the slufter valley. Not all the channels are connected and filled during each tidal cycle. The slufter valley includes some artificial pools and a lake (western part) which is maintained by means of a small sluice.
The 'entrance channel' has a sandy threshold, caused by a net sedimentation process.	The 'entrance channel' has a sandy threshold. Due to the natural sand transportation process along the coast, from west to east, the 'entrance channel' moves to the Dutch border of the Zwin reserve. This process is accelerated by sand suppletions at the Belgian beaches. The 'entrance channel' is silting up.
The inundation of the slufter valley occurs minimal once a year.	The silted up, higher parts and some lower mud flats of the valley are only inundated during spring tide and/or storm events. Some of the lower parts are still inundated two times a day.
The slufter valley contains a strong sandy substrate.	The slufter valley includes both sandy and muddy spots as the basis for a diversity of dunes, gullies/ creeks, mud flats, sand plates & marshes.
In the slufter valley, freshwater – saltwater gradients occur, at some places only periodical.	The slufter valley includes gradients from fresh to salt water, from mudflats to higher silted up sandy area and from wet to dry spots. Salt water dominates since the fresh water outflow has been cut of from the system. The gradient from water to land (polders) is disrupted by the International Zwin Dike.
Ecological processes are mainly determined by morphological and hydrodynamic processes.	In the western part of the slufter valley, ecological processes are highly influenced by human activities; in the eastern part of the slufter valley, ecological processes are mainly determined by morphological and hydrodynamic processes.

Note: The characteristics in this table are mainly based on [4].

Problem definition

An accelerated silting up process

The Zwin reserve suffers from a silting up process, which already started in the middle ages. Although some severe floods occurred since then, the silting up process still continues [1]. Two major morphological processes are responsible for the silting up proc-

ess of the Zwin: the inflow and outflow of the tide ('filling and emptying'; process A) and the closure of the coastal line as a consequence of sediment transport (process B; Figure 2). Due to natural processes and human activities (like sediment storage and sand suppletion activities in the Belgian coastal zone), process B is becoming dominant. In this case the mouth of the entrance channel will close gradually; the inflow and outflow of seawater will no longer be able to clean up the sandy threshold. Land reclamation activities and the diversion of inland fresh water outflow have contributed to the acceleration of the silting up process (diminishment of the tidal volume capacity in the sluffer valley, hence reduction of process A) [6, 7].

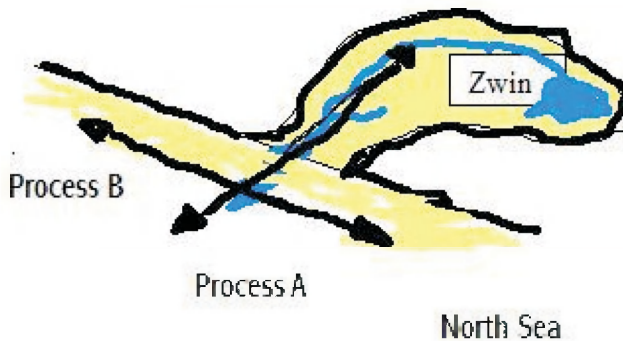


Figure 2: Sand transportation processes in the Zwin area

A decline in natural values

If no additional management measures will be implemented, the silting up process will continue. The tidal volume capacity of the sluffer valley will decrease gradually and the area will desalinate; a brackish water lagoon may develop, gradually drying and silting up. The dunes between the valley and the sea will develop in a more natural way from a green beach into a primary dune valley, dominated by grasses, reed and willows.

In the sluffer valley, due to the silting up process, 'biological rich' mud flats change into 'biological poor' sand plates. Vegetation patterns of higher and lower marshes will develop into more uniform ones, dominated by grass species like *Festuca rubra* and *Elytrigia pungens*. *Halimione portulacoides*, an indicator species for silting up has increased considerably since 1987. On the long term, *Salicornia-Suaéda* vegetation zones will disappear and the bird community will change following changes in vegetation patterns. The importance of the sluffer valley for migrating and wintering birds will decrease considerably [4].

Salt water tidal marshes, mudflats and sand plates are rare on the European level. Therefore, their protection and natural development is one of the highest priorities. The Dutch and Belgian government emphasize the preservation of the (rare) sluffer characteristics, because (primary) dune valleys are more common [1, 4]. Because of its unique character, the Zwin nature reserve has become an attractor for tourists of primary order. Despite the nature values and the favorable market conditions (for tourism and recreation in the coastal zone), the numbers of (paying) visitors of the Zwin reserve have declined from 300,000 in 1991 to 175,000 in 2001 [8].

Sea-level rise and flood protection

After the 1953 flood in the south-western part of the Netherlands, the International Zwin Dike has been enforced (as part of the so-called Deltaplan). Due to climate change, an estimated sea-level rise of 60 cm per century (moderate scenario), in combination with an increase of severe storms, may cause severe future floods. Dutch and Belgian experts and policy makers acknowledge that there are limits on dike enforcement. Other management options like rehabilitation of former flood plains, dike re-allocation, dynamic dunes, flood emergency areas and environmental friendly and green dikes are considered seriously. The challenge is to work with natural processes rather than against them, hence limiting human interference and maintenance costs [9]. If the International Zwin Dike will be enforced once again, parts of the present surface of the nature reserve will be lost [4].

Discharge of inland fresh water

The historical fresh water discharge in the Zwin region took place through the Zwin channel from Brugge (Belgium) to Cadzand (Netherlands). During the centuries separated discharge systems evolved in Belgium and the Netherlands including discharge canals outside the Zwin nature reserve. In some parts of the region, the natural discharge patterns are completely reversed, causing inundation problems in wet winter seasons, especially in the Belgian part [10]. The diversion of the fresh water discharges also had a negative impact on the estuarine nature values: large-scale fresh water – salt water gradients disappeared [1].

Proposed management scenarios

In 1987 the International Zwin Commission (IZC; founded in 1950) installed a Technical Working-Group (TWG) with experts from Belgium and the Netherlands. The (official) task of the TWG is:

To inventory the natural values of the Zwin reserve and to do recommendations of the most desirable future developments concerning the natural values and the technical solutions and management options that are considered to be necessary to maintain those natural values in relation to the continuing silting up process of the entrance channel.

Starting-point is the preservation of the tidal mud flats and marshes. To safeguard the saline character of the reserve, a regular inundation with salt water is a prerequisite. Therefore, the silting up process should be tackled by active forms of management.

In the first and second progress reports, the TGW mainly focuses on a sand trap and re-periodical re-allocation of the entrance channel. In her third progress report (1997) the TGW concludes that the sand trap in the mouth of the entrance channel delays the silting up process in the channel itself, but doesn't slow down the silting up of the sluffer valley. The TGW states that 'large-scale measures, after an once-only disturbance, offer the best opportunities for a development via natural processes'. A transboundary, integrated management program, based on a shared vision on the future development of the area will be a first important step.

In her fourth progress report (2001), the TGW advises to work out an integrated scenario more in detail. Because other promising scenarios were not studied to the same extend, the IZC requested the TGW to answer some additional questions. In October

2002, the TGW presented her fifth progress report and final advice to the Commission, based on a proposal to initiate a transboundary Environmental Impact Procedure (EIA) that includes three management scenarios. Table 2 describes these scenarios and gives a short overview of there (estimated) strengths and weaknesses.

Table 2: Strengths & weaknesses of the proposed management scenarios

No	Management options + strengths & weaknesses
1	<p>Spontaneous development (zero option): stop maintenance activities.</p> <p>Strengths :</p> <ul style="list-style-type: none"> • priority to natural processes/no bi-annual disturbance in the entrance channel, • higher diversity of ecotypes within the dunes/chances for colonization by toads, • first years: opportunities for migrating waders to feed and breed, • opportunities for orchid-rich vegetations in dunes supported by fresh water seepage, • preservation of (rare) orchids and toads in adjacent polders and creeks, • low socio-economic impact (no loss of farmers land, residences & camping sites). <p>Weaknesses:</p> <ul style="list-style-type: none"> • continuation of silting up process and desalinization process, • evolution to more uniform vegetation patterns dominated by grasses, • loss of high productive mud flats/decrease of wintering and migrating birds, • in the future: loss of surface due to dike enforcement works (sea level rise).
2	<p>Enlargement of the tidal volume capacity by internal measures: large scale exclamation of higher, silted up parts of the slufter valley in combination with widening/deepening of the entrance channel. Additional options are dynamic coastal zone management (dunes), inland fresh water discharge in the entrance channel (including an external retention reservoir) and measures to decrease coastal sand transport process (process B) and a re-allocation of the entrance channel to the western part.</p> <p>Strengths:</p> <ul style="list-style-type: none"> • enlargement of tidal volume capacity of slufter valley (process A), • rejuvenation of succession process in the slufter valley (process A), • no inland socio-economic impact (loss of farmers land, residences & camping site) <p>Weaknesses:</p> <ul style="list-style-type: none"> • In the future: loss of surface due to dike enforcement works (sea level rise) • Excavated material cannot be used within the project area itself. • Middle term option: repetition required, although not very frequently.
3	<p>Enlargement of the tidal volume capacity by external and internal measures: scenario 2, depoldering of 50% of the Willem-Leopold polder (circa 220 ha) and construction of a new (green) International Zwin Dike. Additional options like in scenario 2.</p> <p>Strengths:</p> <ul style="list-style-type: none"> • long term option: considerable enlargement of tidal volume capacity of slufter valley (process A), • work with work: use parts of the excavated sediments within the project area (flood defence), • extension of priority habitats like marshes, mud flats and sand plates/best potential for restoration of estuarine gradients (with fresh water inflow), • best opportunities for nature oriented recreational facilities. <p>Weaknesses:</p> <ul style="list-style-type: none"> • high inland socio-economic costs: loss of farmers land, residences & camping site, • parts of the excavated sediments may not be used within the project area.

Note: 'Internal measures' mean measures within the present borders of the nature reserve; 'external' outside.

The TGW stressed that, based on *technical-scientific grounds*, scenario 3 has to be preferred as the most promising long term option. However, the TGW recognized also the high political sensitiveness of this scenario related to the expected socio-economic impact. In response, the IZC requested the TGW to work out a short additional paper including a *political compromise scenario* (scenario 4). This scenario differs from scenario 3 by an enlargement of the reserve by means of de-poldering of 25% of the Willem-Leopold polder (circa 90 ha) instead of 50%. Estimated strengths of this scenario are the less severe socio-economic impact (90 ha instead of 220 ha farmers land) and less initial costs. The initial costs for the scenario 3 are estimated to be 56 million euros (options to influence process B are excluded); scenario 4 will cost approximately 15 million euros less (rough estimation).

In conclusion, the International Zwin Commission advised the responsible ministers in Belgium and the Netherlands to initiate an environmental impact assessment procedure, with the *political compromise scenario* as the central one.

The International Zwin Commission: perceptions of the stakeholders

The decision-making process within the IZC is largely influenced by the perceptions of the stakeholders related to differences in interest, influence, competencies and power. The following overview of perceptions and positions is based on a (preliminary) analysis of IZC and TWG documents and the experiences and perceptions of the author (as a former chairman of the TWG).

The IZC is chaired by the Province of West-Flanders (Belgium) and the Province of Zeeland (Netherlands). Compared to the Dutch equivalent, the Province of West-Flanders seems to have a less powerful position. It is a pronounced (and diplomatic) ambassador of regional economic development. The Province of Zeeland, in its role as a regional director of national policy implementation, is responsible for policy-making for inland water systems including groundwater systems and nature conservation. Due to a strong sympathy for nature restoration plans of both the chairman and some of his civil servants, the Province act as a warm ambassador of a long term, sustainable solution, but realizes that the Zwin nature reserve is mainly Belgian territory.

The Flemish Region as the decision-making authority in the Zwin case is represented by two administrations, one for Environment, Land-, Nature and Water Management (AMINAL) and one for Waterways and Marine Affairs (AWZ). AMINAL is responsible for integrated coastal zone management and nature conservation. In their view, the Zwin area still is one of the few remaining intertidal area in the coastal zone of Western-Europe, where a entire gradient occurs from coastal banks in the shallow sea, beaches, dunes, mudflats and marshes to inland polders. A totally silted up (and desalinated) Zwin reserve (resulting in a dune valley) would still be valuable, but more common. At an European level, salt mudflats and marshes have become scarce. No matter which scenario will be chosen, a management plan should be made, including European legislation and arrangements on management practices and recreational activities. The best option for this would be the *formal* recognition of the Zwin nature reserve. In this case, the manager of the reserve may obtain subsidies. Finally, AMINAL is much in favor of the establishment of a transboundary, international nature reserve, by applying BEN-ELUX legislation, as an example of European co-operation.

As the Belgian chairman of the TWG, AWZ is in favor of long-term solutions for the silting up process of the Zwin nature reserve, but act as a more neutral stakeholder due

to the given political complications. AWZ stresses that there will be no scenario possible to maintain the present nature values forever, unless human interference is repeated. As an equivalent at the Dutch side, Rijkswaterstaat Zeeland, which is the Regional directorate of Ministry of Transport, Public Works and Water Management is the responsible administration for integrated (water management) of the coastal zone, including flood protection. In this position, Rijkswaterstaat chaired the TWG until October 2002. It is in favor of long term, sustainable solutions and dynamic coastal zone management where possible. However, it has bad experiences with public opinion concerning de-poldering proposals for the Scheldt estuary. It will support a scenario with de-poldering activities only if the International Zwin Commission is advising and supporting it (especially by say of the Belgian stakeholders, because the involved polder mainly is situated on their territory). Finally, the administration is in favor of integrating a long term Zwin scenario in the future program on nature development in the entire Scheldt estuary (also shared by Belgium and the Netherlands).

In the IZC two specialized inland water administrations are present. At the Belgian side, the Zwin Polder Board, responsible for the quantitative water management in the Willem-Leopold polder, is not in favor of de-poldering scenarios as the first option. On the other hand it supports an EIA procedure for the 25% scenario (in which the most profitable farmers lands may be maintained). It is much in favor of restoration of more natural patterns of inland fresh water discharge via the Zwin nature reserve and emphasizes that water quality on Belgian territory will improve considerably within the next five years. The Water Board Zeeuws-Vlaanderen is responsible for operational inland fresh water system management (quantity, quality and ecology) and partly for maintenance of dunes and dikes. Like the Zwin Polder Board, it is also much in favor of restoration of more natural patterns of inland fresh water discharge via the Zwin nature reserve, in order to control both inland inundation and the silting up process in the reserve. The water board is ambivalent concerning the de-poldering plans. Historically spoken, the water board has strong roots in farmers interests and flood defense by technical means, while nowadays the tasks are more oriented at integrated water management including giving more room for natural processes.

In 2000, the IZC decided to extend the commission with four new members: the managers of the nature reserve and the councils of the involved municipalities. The Compagnie 't Zoute, as the owner and manager of the Belgian part of the Zwin reserve, faces difficulties with the conservation of the (artificial) lake in the western part of the reserve due to dynamic character of the natural processes (1), suffers from the silting up process of the reserve (declining bird and vegetation values; 2) and is irritated by disturbance of the nature reserve by (illegal) visitors from the Netherlands entering through the coastal zone (3). It perceives a win-loose situation: restrictions on recreational facilities development as imposed by the Flemish government (loose) whilst the Dutch municipalities have built competitive camping sites and summer residence parks and have further plans for development; win). The Compagnie is much in favor of scenario 2 in which parts of the silted up Zwin reserve will be excavated, and a closer international cooperation with the Dutch manager of the reserve (although facing some cultural differences). The Foundation Het Zeeuwse Landschap, as the manager of the Dutch part of the nature reserve, is against the continuation of the bi-annual exclamation of the sand trap and re-allocation of the entrance channel. It is much in favor of a long term scenario including enlargement of the nature reserve as long as existing nature values like orchid fields in polder area may be preserved. Like the Zwin Polderboard

and the Waterboard Zeeuws-Vlaanderen, it is in favor of the restoration of inland fresh water discharges via the Zwin reserve following natural patterns, although it doubts whether irregular discharges by means of a pumping station will be beneficial for the estuarine characteristics. Finally, it is also in favor of closer international cooperation with the Flemish manager of the reserve (although it faces some cultural differences).

The municipality council of Knokke-Heist (Belgium) is in favor of enforcing its position as attractor for tourists; to their opinion the Zwin reserve in its present size is important but big enough. The silting up process should preferably be controlled within the boundaries of the present nature reserve. They suffer from restricted policy for building houses and recreational facilities at the Flemish side, while the Dutch municipalities have built many recreational houses/facilities and are planning additional projects. Some of the proposed management options for the Zwin nature reserve are considered as a serious threat to the interests of some of the farmers in the Willem-Leopold polder. The Dutch municipality council of Sluis-Aardenburg seems neutral to de-poldering scenarios as long as it fits to its own plans for a yacht harbor and recreational and nature development proposals in the area adjacent to the Zwin nature reserve (the so-called 'Sluis-Aan-Zee' project). De-poldering scenarios may offer possibilities to upgrade recreational sites but in the same time may be a threat to (a limited) number of houses.

Discussion

The Global Water Partnership [11] defines integrated water resources management as '*a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems*'. In his definition of transboundary water management, Santbergen [in: 12] mixes modern elements of a policy analysis with post modern elements of stakeholder involvement: *A participatory and iterative decision-making process (including governments, groups of interest, non governmental organizations, individual citizens and scientists from α -, β - and γ - disciplines) aiming at an identification, selection, implementation and evaluation of measures on a sustainable development and management of water systems on different spatial and temporal scales, based on their natural, social and economic characteristics and interrelationships.*

Mitchell [13] talks about three levels of integration: the systematic consideration of the various components of water (surface and ground water, quantity and quality; 'a'); interactions of the water system with other (natural) systems like water, land and the environment ('b'); interrelations between water and social and economic development ('c'). At level 'c', the concern is to determine the extent to which water is both an opportunity for and a barrier against, economic development, and to ascertain how to ensure that water is managed and used so that development may be sustained over the long term. Others talk about modernist and postmodernist water management in which a modernist approach is characterized by command and control, focus on (technical) solutions, monistic, a (technocratic) planning-approach, sectoral water policy, rapid outflow of water (pumping, dikes, drainage), hierarchical and closed. A postmodernist approach is the opposite: prevention and anticipation, focus on design, pluralistic, a (societal) process approach, integral spatial policy, retaining location-specific water (retention & natural storage), participatory & interactive [in: 12].

In fact, from the beginning, the IZC, was mainly working from a modernist perspective: the governments and specialized water and nature administrations at both sides of the Belgian-Dutch frontier asked the TWG to come up with technical solutions for controlling the silting up process. The TWG was mainly operating in the levels 'a' and 'b' of Mitchell, gradually realizing that level 'c' is necessary to come up with integrated, long term options. Although the TWG members not unanimously agreed upon the conclusions, study reports occurred on the estimated socio-economic impact of the proposed (de-poldering) scenarios (with a special focus on agriculture and tourism and recreation). Finally, the TWG advised an integrated, long-term scenario.

Unfortunately, the decision-making process in the IZC is slow and complex. The relations among different stakeholders in the Flemish part may be called delicate and complicated as an understatement. For example: the mayor of the municipality of Knokke-Heist in the same time is also dike-reef of one of the involved polder boards and an important shareholder of the Compagnie 't Zoute. This may be one of the major reasons, besides the fact that the Flemish stakeholders own the major part of the reserve and adjacent polders, that the Dutch stakeholders for a long time were not willing to venture into this political hornets' nest. Within this context it is remarkable that especially some of the Dutch stakeholders started to invest much energy and time in the process to get to a long term solution. It is good to remember that after the 1953 flood the Dutch were even in favor of closing of the slufte from the North Sea.

Supported by numerous study reports, the TGW progress reports, and informal meetings on both expert and political level, the stakeholders involved in the IZC grew towards a common sense that at least an EIA procedure could be wise to start up. According to the Belgian stakeholders, the political compromise scenario (scenario 4) should be in the heart of it. The final advice of the IZC includes an important political statement: *In the mean time, urgent management activities, as a first step of this integrated scenario could be implemented.* Politically spoken, it is a necessary statement to keep all stakeholders on board of the IZC. From both an EIA procedural and from a scientific point of view, one may question the value and potential impact of this statement. However, additional required studies may be integrated in the EIA procedure which offers also possibilities to come to integration level 'c'. In this respect, one challenge may be to include a long-term societal cost-benefit analysis based on the goods and services of all involved ecosystems (from dunes till polders).

If we analyze the IZC case within the framework of the definition of the Global Water Partnership, it seems that the present approach is an integrated one, but emphasizing more on ecosystem sustainability than on maximizing social and economic welfare in an equitable manner. Concerning Santbergen's definition of transboundary river basin management, one may notice that within the IZC, governmental administrations and experts work closely together in a technocratic, solution oriented manner, without including non-governmental organizations, media, groups of interests and individual citizens. The IZC seems to struggle more with the limitation of its own advisory competence and the internal diversity of perceptions than it is able to focus also on the possible opportunities and threats of the studied management scenarios. However, an important step forward is the extension of the commission with the involved municipalities and managers of the nature reserve.

Conclusions

Firstly, sluffers like the Zwin are doomed to silt up as a natural phenomena, unless active forms of management are carried out. The silting up process will continue but may be influenced in such a way that the tidal entrance will keep stable. The restoration of the historical, natural drainage patterns, both in Flanders as the Netherlands, combined with de-poldering of (a part of) the Willem-Leopold polder will offer the best opportunities for a longer term, integrated scenario including an improvement of the inland water management system (1), a rehabilitation of rare natural values (2), an improved flood control anticipating on climate chance (3) and an enforcement of the attractiveness of tourists of municipalities in the coastal zone (4).

Secondly, as stated by a representative of AMINAL, how difficult it even is to bridge differences in national or regional legislation and governmental cultures, it will be an absolute necessity to invest in transboundary cooperation among Flemish and Dutch stakeholders. Parallel to the discussions on the set up of a formal nature reserve in Flanders, the IZC should consider the establishment of an international nature reserve. Existing BENELUX regulation may be useful in this respect.

Thirdly, although the selected management alternatives are the outcome of a delicate decision-making process, in which different views on the contents and the impact of an EIA procedure exist, to the opinion of the author, this procedure should not exclude scenario 3 as the most promising long-term scenario. Finally, there is an urgent need for a broader regional based, transboundary multi-stakeholder platform (including groups of interest, non-governmental organizations and experts from various α -, β - and γ - disciplines) in which the issues of the Zwin natural reserve may be discussed in relation to other social, economic and natural issues at both sides of the Dutch-Belgian frontier. The main competence of such a platform still may be advisory to the involved decision-makers. Such a postmodernist constellation of the International Zwin Commission may facilitate the highest level of Mitchell's integration ('c').

References

1. Herrier, J.-L., 2003. Het Zwin in de context van het Europees en Vlaams natuurbeleid. In: Mees et al. (eds), *Feestzitting ter afsluiting van het jubileumjaar 50 jaar Zwin – Het Zwin: van gisteren naar morgen*. Vlaams Instituut voor de Zee (VLIZ) and Compagnie 't Zoute. VLIZ Special Publication 13, Oostende (Belgium).
2. Econnection, 2001. *Overzicht van verschillende maatregelen en scenario's voor het behoud van het Zwin*. Study report in order of the Technical Working-Group of the International Zwin Commission.
3. Santbergen, L.L.P.A., 1997. De oevers van de Westerschelde. Slufter in zicht! In: *Waterbouw Info*, 25, Dutch Ministry of Transport, Public Works and Water Management.
4. Eysink, W.D., Hoekstra, A. and Hoozemans, F.M.J., 1992. *Nederlandse sluffers. Een verkennende studie naar abiotische parameters*. Report H1464, Delft Hydraulics.
5. Lippens, M., 2003. Inleiding feestzitting. In: Mees et al. (eds), *Feestzitting ter afsluiting van het jubileumjaar 50 jaar Zwin – Het Zwin: van gisteren naar morgen*. Vlaams Instituut voor de Zee (VLIZ) and Compagnie 't Zoute. VLIZ Special Publication 13, Oostende (Belgium).
6. Termaat R. et al, 2002. *Morfologische kansen en bedreigingen voor scenario KBE-c ter voorkoming van aanzanding van het Zwin*. Internal paper (memo AXL-02-12) of Rijkswaterstaat directie Zeeland.

7. Wolf, P. de, 2003. Naar een oplossing van het verzandingsprobleem? In: Mees et al. (eds), *Feestzitting ter afsluiting van het jubileumjaar 50 jaar Zwin – Het Zwin: van gisteren naar morgen*. Vlaams Instituut voor de Zee (VLIZ) and Compagnie 't Zoute. VLIZ Special Publication 13, Oostende (Belgium).
8. Boerjan, P., 2003. Het toeristisch belang van het Zwin in de context van de Vlaamse kust. In: Mees et al. (eds), *Feestzitting ter afsluiting van het jubileumjaar 50 jaar Zwin – Het Zwin: van gisteren naar morgen*. Vlaams Instituut voor de Zee (VLIZ) and Compagnie 't Zoute. VLIZ Special Publication 13, Oostende (Belgium).
9. Blaakman, E., 2002. *Kustveiligheid Zwin*. Internal document Rijkswaterstaat Zeeland, Middelburg, the Netherlands.
10. Provoost et al., 2002. *Waterafvoer door het Zwin – aanvullende notitie*. Report in order of the Technical Working-Group of the International Zwin Commission.
11. Global Water Partnership – Technical Advisory Committee, 2000. *Integrated water resources management*. Background Paper, number 4, Stockholm (Sweden).
12. Verhallen, J.M., Huisman, P., Santbergen, L.L.P.A. and Barneveld, R.J., 2004. *Integrated Water Management –Course Manual HWM-21304*. Wageningen University and Research Centre, Wageningen (Netherlands).
13. Mitchell, B. (ed.), 1990. *Integrated Water Management: International Experiences and Perspectives*. Belhaven Press, London and New York.

Author:

Leo L.P.A Santbergen, Lecturer and researcher integrated water management, Wageningen University and Research Centre, Chair Hydrology and Quantitative water management, Nieuwe Kanaal 11 (Building 500), 6709 PA Wageningen, e-mail: leo.santbergen@wur.nl