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The Societal Effects of the Eighteenth-Century Shipworm Epidemic in the Austrian Netherlands (*c.* 1730-1760)

▼ **ABSTRACT** In the 1730s, the Austrian Netherlands (eighteenth century Belgium) faced the devastating effects of the Great shipworm epidemic. Shipworms are marine wood scavenging molluscs that use their shells to eat their way into submerged wood. Due to the changing environmental conditions (temperature, salinity, …) at that time, the shipworm population exploded along the West-European coast. Within a few years the wooden flood protection structures protecting the low-lying Flemish coastal plain were damaged beyond repair. Adoption of new technologies was successful in safeguarding the embankments, but conflicting interests with the governing elites provoked a political deadlock ultimately resulting in the collapse of the Slyckens locks. The ensuing popular anger – together with other political and economic developments – played an important role in toppling the ruling elites in the county of Flanders in 1754. The following enlightened reforms, backed by Vienna and Brussels, had a decisive and positive impact on both the Flemish waterway and flood protection system. As a consequence of this a new ecosystem emerged which reduced the shipworm's reproductive capacities.

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For Sarah & Guy, Rose & Fleur-Louise

Introduction

"Les Écluses de Slyckens [...] croulèrent [...] ce mois tout à fait comme nous l'avons prévu depuis 5 à 6 semaines, sans l'avoir toutefois appréhendé pour sitôt". This is how plenipotentiary minister Antoniotto di Botta Adorno informed Vienna that the Slyckens locks had crumbled in the early morning of 13 August 1752 (BA X152, CG XX). Situated on the Bruges-Ostend canal near Ostend, the Slyckens locks (1676) were of great importance for the Austrian Netherlands. It allowed ships to sail to Bruges, while protecting the low lying polders from flooding (Decavele-De Herdt-Decorte, 1976: 85-87). With the locks gone twice a day at high tide the sea water rushed into the canal all the way to Bruges, some 24 kilometres inland, threatening to spill into the Flemish coastal plain. Moreover, strong westerly winds could push the water into the canal to such an extent that it could breach the dikes. The swift ebb or reflux current eroded and weakened the canal's embankments. A breach in the canal dikes would flood at least a dozen villages and devastate the land between the coast and Bruges. By sheer luck nothing of this happened. The Slyckens locks collapsed just before neap tide in the midst of the cool, but mild North-Western European summer (AGR SEG, 1029, 1049). By the end of August, thousands of farmers, soldiers and labourers had closed the canal from the sea, hereby putting an end to the risks of flooding(AGR SEG, 1049-1050; Buisman, 2015: 70).

As a matter of fact, the first report touching on the precarious state of the locks went back to 1735 (RAG SvV, 10789). Ever since, a multitude of accounts stated that millions of little sea worms were gnawing and eating their way through the wooden sill plates carrying the locks' stone foundations (e.g. RAG SvV, 355, 399, 10791, 10800). Like its neighbours, the Austrian Netherlands' coast had fallen victim to a gigantic infestation of little marine wood scavenging molluscs. The Great shipworm epidemic of the 1730s, was a novel threat for coastal societies in North-Western Europe, as it destroyed the flood protection's wooden structures (dikes, embankments, sea walls, locks, etc.). It required new coping strategies

(Sundberg, 2016: 122-126). This article will focus on the Great shipworm epidemic in the Austrian Netherlands. Firstly, the mitigation process will be analysed. Why was it that the coastal population managed to ward off the shipworm threat with regard to the embankments rather quickly, but ended up in deadlock with regard to the Slyckens locks' protection? For nearly 20 years the coastal authorities were unable to find a solution. Secondly, we will look at how the different institutions, but also the population, sensed and viewed this deadlock with increasing dismay. How did this affect the overall resilience process after the locks' collapse and to what extent does it explain the political, economic and ecologic changes that occurred in Flanders in the 1750s. But before discussing this ecologic crisis it is of paramount importance to discuss its vector, that is the shipworm. Therefore attention must be given to this marine xylophage and its ecosystem and why its activities suddenly affected the coastal populations in the mid-eighteenth century.

Wood was the main building material for flood protection works in the Low Countries. Shipworms could completely destroy these wooden structures, making them obsolete in case of storms or even fierce gales. Flood protection and security became the main topic in the debate on how to stem the Great shipworm epidemic's impact. The historical literature on flood protection and security in the Low Countries has mainly focussed on documenting important storm induced floods (de Kraker, 2013: 149-153). Environmental historians increasingly raised the question if periods of increased storminess could function as game changers in the historical evolution (Soens, 2018: 144-145). Without completely discarding the role of storminess in the historical process, Tim Soens has urged to return to a somewhat more anthropocentric approach. He argues that "an 'Age of Storm Disasters' is not necessarily the result of an Age of Storms" or to put it differently that "storm disaster[s are] always co-produced by human agency" (Soens, 2013: 213-214; van Bavel-Curtis-Soens, 2018: 2-3).

Soens states that the flood protection's organisation in the North Sea area during Medieval and Early modern times went through three different stages. In an early stage (tenth to thirteenth century), flood protection was directly organised by the coastal landowners who provided labour to maintain the dikes, embankments and sea walls. Dike breaches occurred when the labour force was insufficient (direct entitlement failure). In the thirteenth century flood protection became monetarised, meaning that landowners now tax funded water boards to buy flood protection on the market. Floods now occurred when coastal communities were unable to follow market rules (market entitlement failure). Around 1500, flood protection was taken over by non-local investors and absentee landowners belonging to either the urban merchant elite, the nobility and/or state officials. This take over was only possible by the gradual infringement of the local communities' legal rights. Soens has called this the 'violation

of flood protection'-stage. These elite groups increasingly made decisions favouring their enterprises, hereby ignoring the coastal communities' flood security issues (extra-entitlement failure) (Soens, 2013: 219-230). This stage became widespread in Flanders in the sixteenth century (van Bavel-Curtis-Soens, 2018: 5-7). Piet van Cruyningen gives an excellent example of this flood protection violation. He researched how the Dutch urban merchant elite acted with regard to the flood protection of three different "calamitous polders" in the eighteenth century. When their interests were at stake they could act swiftly and decisively, but when this was not the case or when they were divided on the issue, little was done (van Cruyningen, 2017: 363-383).

From the 1730s on, for nearly 20 years, coastal Flanders lived in fear of imminent flooding. This points out that Flanders was deadlocked. It is not an exceptional situation. This often occurs when a society is confronted to a novel threat, like a sudden environmental change. Mankind often perceives the environment as a given, an unalterable and fixed stage where civilizations can deploy and perform their activities. However, changes to the environment, especially sudden and unforeseen, put societies under an increasing amount of stress. Ecological crises – such as the Great shipworm epidemic of the 1730s – are "crash tests" for societies (Elie-Locher, 2018: 220-223). Some societies pass relatively unscathed when a crisis only affects a small part of that society, or if an adequate response is readily available. But when this is not the case, the search for a suitable response to counter the ecological crisis' impact often divulges both the strengths and weaknesses of that particular society. Underlying societal structures and tensions suddenly appear in the quest for new adaptive strategies. Some advocate new measures to mitigate and curb the crisis' impact. Others fear that these measures threaten their privileges, rights or entitlements. When these latter groups block the new exit strategies, societies face ongoing crisis and end up in deadlock. A new societal equilibrium can be established when certain groups give up or are forced to give up their privileges, rights and entitlements. This allows the endorsement of new general measures. The state of affairs in which a new game-changing equilibrium is achieved is often tense and heavy with impending disaster, like in Flanders in the 1750s. Malcolm Gladwell called such a moment a "tipping point". It is often achieved by "little things [that] make a big difference". In such circumstances insignificant events can be magnified and play a meaningful role in the ongoing debate, tipping the balance to the other side. The newly achieved equipoise makes it possible to execute the previously unfeasible measures. If everything goes well these measures can help to mitigate and soften the crisis' impact (Parker, 2017: xxiv-xxv, 550; Soens, 2018: 144-145). The executed measures also have a societal and environmental impact of their own. In other words, the interplay between environmental

actions and human reactions also has its logic, which must also be taken into account (Winegard, 2019: 13-15).

Many authors (e.g. Esser, 2016: 98) have used the concept of resilience when studying the impact of ecological crisis and disasters. It describes the degree in which societies can both absorb a shock and also how they recover from its effects. The resilient society's key concepts are its adaptive and transformative capacities. Soens is however right in claiming that resilience is a rather problematic concept. Almost all the coastal societies around the North Sea fell victim to at least one flood disaster during the Middle Ages and the Early modern period. In the end, all of these societies survived by both adapting to the flood's consequences and by transforming to meet these changes. If nearly all societies survived and were resilient, what is the meaning of resilience? According to Soens, what really matters is if "a society is able to limit the exposure of people to suffering and disruption". As such, he claims that societies that are confronted with a substantial loss of life and property, but at the same time quickly regain their pre-disaster economic, cultural and social level cannot be viewed as resilient societies. Societies have to take care of their people, including those that are poor and vulnerable (Soens, 2018: 145-146, 160-166, 175-176). It is therefore important to ask the question to which degree the Austrian Netherlands were willing to take care of the potential victims and whether the mitigation process affected this willingness.

Belgian historiography remains almost completely silent on the Great shipworm epidemic. Only the collapse of the Slyckens locks has been mentioned by transport and maritime historians (Urbain, 1939: 295-298; Baetens, 1973: 56; Vandewalle, 1982: 88). Piet Lenders also discussed the locks' foundering in his excellent monograph on the political crisis in Flanders in the 1750s. This political crisis was of great importance in putting an end to the shipworm epidemic along the Flemish coast and by reforming the provincial flood protection policy (Lenders, 1956: 23). Nevertheless, none of these authors referred to shipworms. They all blamed the collapse on bad maintenance. In 2011, the Vlaams Instituut voor de Zee (VLIZ or Flanders Marine Institute) published a fact sheet on shipworms. Although it focusses mainly on the biological aspects of this animal, it refers to the Great shipworm epidemic. The author indicates that the first observation of shipworms along the Belgian coast occurred in the early 1730s, which corresponds with the Great shipworm epidemic (VLIZ Alien species consortium, 2011: 1-2).

Dutch historiography, on the other hand, has a rich literature with regard to shipworms. The wooden dikes that protected great parts of the low lying Netherlands were of course an enticing ecosystem for these marine xylophages. Already in the twentieth century's second half quite a few general synthesis on Early modern Dutch history referred to the Great

shipworm epidemic and its impact on Dutch society. Several authors have briefly mentioned the issue in a monograph or in a general synthesis, like on Dutch ports (Van Iterson, 1977: 61-62), on the Dutch landscape (van der Woud, 1998: 84-88), on the Dutch culture and *mentalité* (Schama, 1998, 604-606) and on the Dutch economy and finances (Israel, 1995: 1004; de Vries-van der Woude, 1997: 22, 123, 212, 345). Studies on the history of local dikes, such as the West-Frisian and Diemen sea dikes (near Amsterdam), and sea walls, like the one on the isle of Walcheren (Zeeland), have given us an insight perspective on how the shipworm epidemic was dealt with (Schilstra, 1975: 60-95; Fransen, 2011: 213-245; Hollestelle, 1996: 120-128). In the twenty-first century, historians have started to focus more on the Great shipworm epidemic itself, for instance on the different perceptions existing within Dutch society of this animal (Mouthaan, 2003: 3-22). The American historian Adam Sundberg has further elaborated the Dutch reactions, mainly providential, institutional and technocratic, to this epidemic (Sundberg, 2015b: 151-209; Sundberg, 2016: 122-138). Other authors have directed their studies on how the changing marine environment enhanced the living conditions of shipworms along the Dutch coast in the eighteenth century (van Brakel, 2015: 70-81) or on the dissemination of shipworm related news in journals, books and pamphlets (Koopmans, 2016: 139-150). The Austrian Netherlands and the Dutch Republic were not the only countries along the North Sea that were affected by shipworms. There is evidence that low lying coastal areas in both England (e.g. the Fens) and France (e.g. Dunkirk) also had to cope with shipworms (Koopmans, 2016: 144; Morera, 2017: 359). But, British and French literature mainly focusses on the impact of shipworms on their respective military navies (e.g. Rodger, 2004: 221, 303, 344-345; Acerra, 1998: 66).

Shipworms and their ecosystem

First things first: shipworms are not worms, but bivalve molluscs, closely related to mussels and oysters (VLIZ Alien species consortium, 2011: 1). As microscopic larvae, they float in the seawater until they land and attach themselves on a piece of wood. The larva then develops two shells with which it starts to bore into the wood. The entrance hole – through which the larva penetrates the wood – is only one millimetre wide. Inside the wood, the width of the tunnel rapidly increases to reach a diameter of four to nine millimetres. Under ideal circumstances and depending on the species – there are over 65 known species – shipworms can bore as much as 1.5 millimetre a day. Once a shipworm enters a piece of wood it will never exit it again. It will continue to feed until no wood is left. In one year, a shipworm can easily grow to reach a length of 20 to 30 centimetres,

Figure 1: Two adult shipworms. Both the siphons and shells can be seen at the animal's extremities © François Charles (CNRS-LECOB)

which explains why it has often been mistaken for a worm (see figure 1). The only part of the animal not buried within the wood are the siphons. These are two tubes protruding from the entrance hole. One tube is used to inhale water (oxygen) and perhaps also additional nutrition, the other is used to execrate (Balakrishnan Nair-Saraswathy, 1971: 345, 348, 401-409; van Brakel, 2015: 73-74).

When environmental conditions change, for instance the salinity or temperature levels, or when the wood is taken out of the water, the shipworm retracts his siphons and closes his burrow with two little calcareous plates called pallets (Balakrishnan Nair-Saraswathy, 1971: 350-351; van Brakel, 2015: 75). In the past, ship owners have sailed their contaminated ships up rivers in the hope that fresh water would kill the shipworms. Others have beached their ships and have left them to dry for several months. To no avail, shipworms not only survive these circumstances for several months, they also carry on with their destructive work (Strömberg-Spicer, 2003: 304-305). Shipworm larvae – who cannot survive outside water – need however far more stringent temperature and salinity levels than adults. Generally speaking water temperature levels between 15° and 25°C and salinity levels between 10‰ to 35‰ are sufficient. This can vary between different species (Hoagland, 1986: 92-95). According to Balakrishnan Nair and Saraswathy "the occurrence, abundance, and so

the intensity of attack, in any locality is dependent on these [ecological] factors" (Balakrishnan Nair-Saraswathy, 1971: 446).

A shipworm individual can spawn up to 5,000,000 eggs per animal per year. Sexual maturity is reached within three months after settling down (VLIZ Alien species consortium, 2011: 2-3; van Brakel, 2015: 74). Larvae often colonise the same or a nearby piece of wood. Yet the growth rates are still poorly known. In one test, pine blocks submerged in the Mediterranean showed an average of 6.58 ± 0.41 larval entries per square centimetre. After 300 days these pine wood blocks had lost about 50% of their weight (Charles et al., 2016: 23-24) and about 55 to 62% of their initial volume. The highest average tunnelling rate per shipworm was estimated at 185 cubic millimetres per day (Charles et al., 2018: 430, 432-433).

The question remains of course why shipworms suddenly appeared along the North-Western European coast in the 1730s. Shipworms were well known by the European seafarers who sailed to the tropics. But in North-Western Europe the shipworm remained practically unknown. When Edualdus Reynvaan, a clerk working for the flood protection administration on the Dutch island of Walcheren, discovered the shipworm attack in November 1730, he believed no one had ever seen such creatures before (Hollestelle, 1996: 120). Dutch pamphleteers explained shipworms were an invasive species from either Asia or the Americas travelling in ship hulls (Sundberg, 2015b: 185). Already in 1720, when a minor shipworm epidemic struck Ostend, its postmaster and city chronicler Jacobus Bowens believed that these "kinds of worms" had come with Ostend East Indiamen. A decade later, in 1732, Bowens blamed Dutch ships for infecting the port of Ostend (Bowens, 1968: II, 33-34, 96). But even today it remains extremely difficult to locate a shipworm species' exact geographical origin. Shipworms have been migrating since time immemorial, using ocean currents and pieces of driftwood long before men invented ships (VLIZ Alien species consortium, 2011: 1-2; Rayes-Beattie-Duggan, 2015: 482). The migration of tropical species to more temperate zones cannot be completely discarded as Balakrishnan Nair and Saraswathy point out, but these species would have a hard time adapting (Balakrishnan Nair-Saraswathy, 1971: 451-452). It does however not explain why shipworms – as an invasive species – would only have started to appear in North-Western European waters in the 1730s, for Europeans had been navigating the world's seas since the fifteenth century.

Already in the eighteenth century, scientists like Godfried Sellius (who discovered shipworms were molluscs) and Jean Rousset de Missy claimed shipworms were native European species. The further development of taxonomy would prove them right (Palm, 1990: 93-95; Sundberg, 2015b, 182-183). Historical sources provide ample proof that shipworms had lived along the European shores well before the European maritime expan-

sion in the Early modern period. Several classic Greek and Roman authors, like Theophrastus, Ovid and Pliny the Elder mention shipworms. The Icelandic *Eiriks Saga* (*c.* 1260) describes the death of Bjarni Grimolfsson as his worm-eaten ship sinks in the so-called Sea of Worms near Ireland (Bakker, 2011: 283-284; Rayes-Beattie-Duggan, 2015: 483). In the Early modern period shipworm activities are reported all along the Western European coast, like in Caen (1666), Huisduinen (1680), Den Helder (1706-1716), Ostend (1720) and Brest (1722) (Bowens, 1968: II, 33-34; Clapp-Kenk, 1963: 300, 311; Buisman, 2006: 571). It seems that the damage and impact of these infestations was relatively minor, because otherwise the Great shipworm epidemic would not have been viewed as a "novelty" like Adam Sundberg suggests (Sundberg, 2016: 122-126). The question remains therefore why shipworms – as a native species – only started to appear in such great numbers in the 1730s. One of the great difficulties in this debate is that there are no certified shipworm remains left from the 1730s. This makes it impossible to determine through taxonomic or DNA research what kind of shipworm species was active in the mid-eighteenth century and whether this was an invasive or a native species. At the *The Naval Shipworm Teredo navalis. A global Player and its Entangled Histories Online-Workshop* (Berlin, January 2021) most marine biologists and environmental historians agreed upon the fact that the 1730s epidemic was caused by an unknown, and therefore cryptogenic species. They also concurred that the increase in shipworm activities in the 1730s was most probably caused by a noteworthy environmental change. This environmental change must certainly have included a rise of temperature and/or salinity levels increasing the larvae's survival rate (Hoagland, 1986: 95).

There are no temperature series known for the Belgian coast in the eighteenth century, but other sources can serve as a proxy. Figure 2 shows the yearly average, winter and summer temperatures and their 21 year moving average temperatures in Central England from the Manley-series for the 50 years preceding and following the Great shipworm epidemic (1680-1780). At the end of the seventeenth century (the end of the Little Ice Age), the yearly average temperatures hovered around 8.5°C (Parker, 2017: 11-13). In less than 40 years this yearly average increased by more than 1°C. It reached a maximum of a little over 9.5°C around 1730. After the 1730s, temperature levels decreased somewhat to linger just above 9°C (Buisman, 2006: 867-872; Buisman, 2015: 972-974). Although an average temperature rise of just over 1°C might not seem very much, research has shown that the effects of such a rise are quite significant (Parker, 2017: 15-17). With regard to shipworms, this 1°C temperature rise might have been just enough to revive an unnoticed endemic shipworm species or allow an invasive species to settle. Temperature levels are most important during the reproduction cycle in spring when shipworm larvae look for

wood (Balakrishnan Nair-Saraswathy, 1971: 414-416; Hoagland, 1986: 94-96). Figure 2 shows that the yearly average summer (June, July, August) temperatures remained relatively stable just above 15°C. Average winter (December, January, February) temperatures fluctuated much more and increased from 2.9°C to 4.2°C. Warm winters not only advance the breeding season, but also prolong it, gaining additional time for the shipworm larvae to settle (Buisman, 2006 and 2015: see yearly chapters).

Shipworm larvae also profit from increased salinity levels. Salinity depends on two factors, the degree of evaporation and the supply of fresh water via direct or indirect precipitation. The degree of evaporation is of lesser importance in the temperate North Sea (average salinity level of 34‰). Direct precipitation (rain, snow) and indirect precipitation via discharging rivers are far more important (Van Brakel, 2015: 75). Discharge of fresh water along the Belgian coast occurs via the river Yser near Nieuwpoort and canals such as the Bruges-Ostend canal near Ostend. Although this canal was primarily dug for shipping, it also drained a large part of inland Flanders including a sizeable part of the flood-prone Lys river basin. These rivers' or canals' volumetric flow rate depends largely on the degree of precipitation (de Rive, 1835: 147). Years with heavy rain stand for lower salinity levels in these estuaries or outlets. Figure 3 shows the yearly precipitation in the Dutch Republic. The 1720s and – especially 1731 (459 millimetres of rain) – were considered very dry years (Vanderlinden, 1924: 179-184, 327-328; Buisman, 2006: 854-855; Buisman, 2015: 977). The higher winter temperatures and the low influx of fresh water in the 1720s and early 1730s, thus created the ideal conditions for the shipworm larvae. Although dry, the early 1740s, were probably too cold to boost the shipworm population, which nevertheless survived endemically and resurfaced in the 1750s.

Dikes and locks: between technological innovation and deadlock

The Belgian coast consists of dunes interspersed by estuaries and canal outlets. Wooden embankments around these inlets, which make up the weaker points in the flood protection system, protect the low-lying Flemish plain from flooding. The shipworm was mostly active around the Yser estuary near Nieuwpoort and the port of Ostend. This article will focus on the port of Ostend, which was not only the most important, but also the best documented area (RAG SvV, 355). In the eighteenth century, the port of Ostend was a lagoon, which connected to the North Sea via a narrow channel known as the Geule (Farasyn, 1965: 141, 159, 161). The port of Ostend was formed in 1584, when the Dutch army breached the dunes to defend Ostend from the Spanish army. After the Spanish

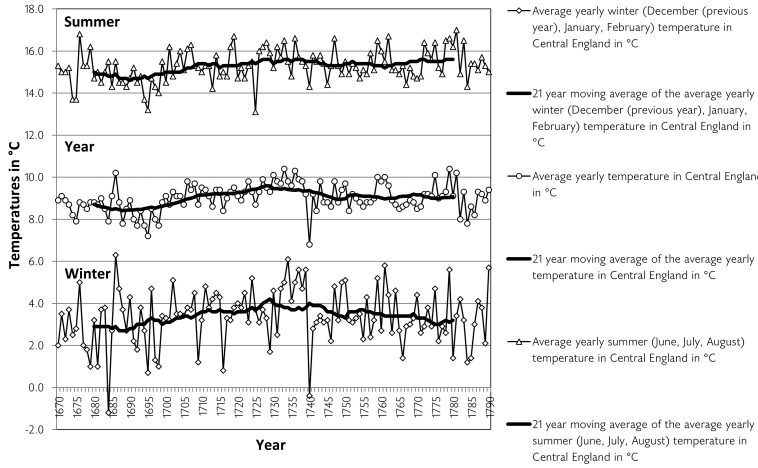

Figure 2: Average and 21 year moving average of the yearly, winter and summer temperature in Central England (1670-1790)
Sources: Buisman, 2006: 867-872; Buisman, 2015: 972-974.

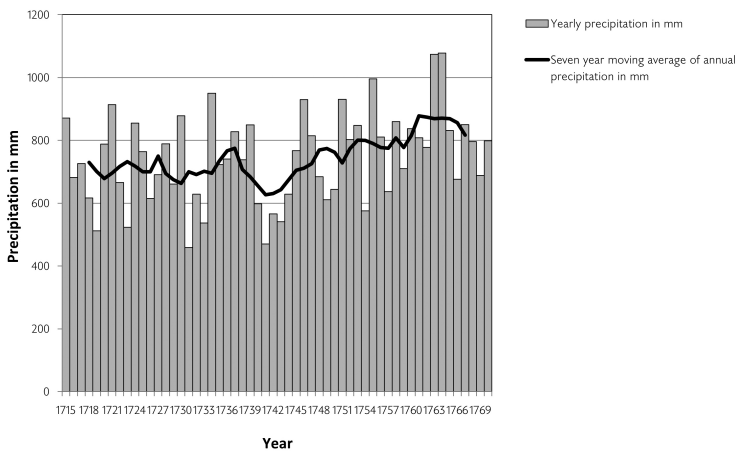

Figure 3: Yearly precipitation in Delft (1715-1727), Utrecht (1728-1734) and Zwanenburg (1735-1770) and the seven year moving average of the yearly precipitation in Holland
Sources: Buisman, 2006: 854-855; Buisman, 2015: 977.

victory in 1604, large parts of the lagoon were embanked and turned into farmland. However, a part of the lagoon continued to exist as a flush basin. The swift retreating ebb-flow kept the Geule at the right depth, enabling

ships to reach Ostend and the Slyckens locks. The latter giving access to the Bruges-Ostend canal (see figure 4). On the eve of the Great shipworm epidemic the flood protection works consisted of a 20 kilometres long system of embankments and groynes around the port of Ostend. This flood protection system's length fluctuated somewhat over time as the port of Ostend's flushing capacities sometimes needed to be readjusted. The States of Flanders were in charge of these flood protection works, with the exception of the quays in Ostend itself (AGR CF, 3079; Debaere, 2002: 49-51, 81-83; Moureaux (ed.), 1974: 26; Plasschaert-Plasschaert, 1995: 32-33).

A closer look at the States of Flanders is needed before analysing the flood protection works. In theory, this institution represented the population of the county of Flanders, but in practice this was limited to the so-called five members. These consisted of the bishops of Bruges and Ghent for the first estate and the cities of Bruges and Ghent, together with the castellany (district) of the Freedom of Bruges, for the third estate. The nobility, the remaining 24 cities and seven castellanies had little or no political influence (see figure 4). The States of Flanders' main task was to negotiate the yearly tax amount with the sovereign (*de facto* the Council of Finance in Brussels). They also had some other competences, like road construction, agriculture, trade, waterways and flood protection (Nuyttens-Zoete, 1997: 68-69, 73-75). The director of navigation, appointed and supervised by the States, was responsible for both flood protection and waterways. In the first half of the eighteenth century, this function was exercised by Pieter Legillon. For Ostend, Legillon could rely on Joseph Olleviers, who was the lockmaster in Slyckens (Nuyttens, 1986 : 288-289, 296-297).

Embankments in eighteenth century Flanders were generally built on top of large osier mats loaded with stones or clay, called *zinkrijs*. On top a wickerwork was constructed and reinforced with stones or heavy clay. Wooden piles kept everything together. In order to weaken currents eroding the embankments, groynes and even detached groynes were added to this elaborate flood protection system (Soens, 2009: 160; Sys, 2013: 51-54; Van Cruyningen, 2017: 368). In the eighteenth century, one oak pile – measuring *c.* 6.3 metres with a diameter of *c.* 30 to 50 centimetres – was used for every seven metres of embankment (RAG SvV, 10792). The upkeep of these embankments and groynes was a costly affair (labour and building material) and it often was a recurrent financial issue for many authorities (Van Cruyningen, 2017: 369). Every year, the States of Flanders received 24,000 guilders to maintain the flood protection works in both the port of Ostend and Nieuwpoort. This sum came from the Convooirechten's revenues, a kind of import and export tax on commodities entering and leaving Flanders (Coppens, 1992: 124-125).

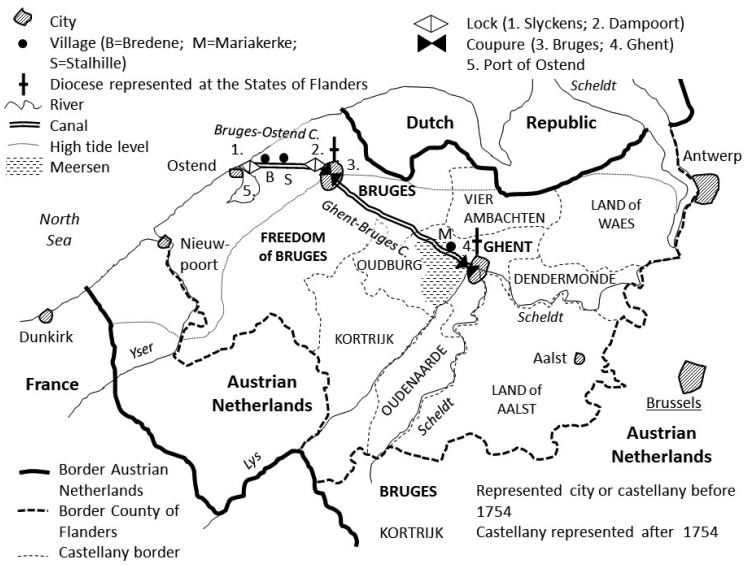

Figure 4: Map of the County of Flanders (mid-eighteenth century)
Source: Author

On 23 November 1733, a large storm hit Ostend. As usual, lockmaster Olleviers set out to check the embankments and groynes to report potential damage. He discovered that 20 of the 36 piles of the port's entrance groyne had been completely washed away. The remaining 16 piles were all "chewed through" and ready to collapse with the next storm. He immediately asked Legillon to send a repair crew and estimated the costs at 16,000 guilder (RAG SvV, 355). During the following months the damage was restored. In September 1734, Legillon proudly announced that the flood protection works were again in an excellent state (RAG SvV, 355). But in 1736, the shipworms were back in even greater numbers (RAG SvV, 10791-10792). After another great storm in January 1737, Legillon explained to the States of Flanders that nearly all the piles that had been replaced since 1734, had to be renewed. Over 100 piles and nearly all the wickerwork had been washed away. Some of the large oak piles that were put in place barely five months before, were almost gone. Because of this, the groynes were unable to break the surf, which in turn made the dikes cave in. (RAG SvV, 10792).

With disaster looming, the States of Flanders invited Legillon to forward every idea he could muster. Legillon acknowledged the financial difficulties to continue to meet the growing maintenance costs, but he also insisted on the necessity to innovate. The States of Flanders accepted this

and were willing to adopt new flood protection techniques. The bishop of Ghent recommended to look how the Dutch coped with repelling the shipworms from their flood protection works (RAG SvV, 10792). Indeed, Dutch newspapers widely reported and debated possible measures to protect the wooden piles from shipworms (Mouthaan, 2003: 8-10; Koopmans, 2016: 142-143). However Legillon already had a solution. In 1734, barely a month after Olleviers' initial report, he clad a wooden pile with iron nails to see if it would withstand shipworm attacks (AGR CC, 29954). Apparently it worked well, because he successfully proposed this method to the States of Flanders in March 1737 (RAG SvV, 10792).

Cladding wooden piles with nails was extremely costly. It was labour intensive and a tremendous amount of nails was needed. Legillon calculated that 37,250 nails were needed to cover one pile. Depending on the pile's length, costs per pile (labour included) fluctuated between 60 to 70 guilder. That was 60 times the daily wage of a qualified carpenter in Ostend (RAG SvV, 10792; Serruys, 2005: 55-56). Ostend was not the only place where piles were clad with nails. In 2014, a Dutch team of archaeologists found 41 nail covered wooden piles from 1776 in Medemblik. Their report corroborates Legillon's findings (Bartels-Swart-de Weerd, 2015: 9, 16-20, 22-24, 26-33). In any case, figure 5 shows that the flood protection costs continued to rise after 1737, as large quantities of nails were needed. Although more information is required, it seems that the increased demand in nails matches the take-off of Charleroi's metal industry, one of the top spots of the Belgian Industrial revolution. Flood protection costs started to decrease after 1741, as the wooden piles were better shielded from shipworms, the temperature levels dropped significantly, but also because the War of Austrian Succession (1740-1748) started to drain the financial resources (AGR CC, 29948-29966; Hasquin, 1971: 190). In any case, the States of Flanders and their director of navigation had shown the ability, first to mitigate, then to invent or adopt new technologies.

The Slyckens locks, which belonged to the States of Flanders, also played their part in the water management system, by keeping the sea out of the Bruges-Ostend canal and by draining inland Flanders. But unlike the embankments, both Legillon and the States of Flanders were unable to cope with the shipworm infestation in the locks. Although Legillon could use the lockage revenues for the locks' routine maintenance, this was not enough to stop the shipworms' damage (RAG SvV, 4913). Furthermore, Legillon lacked the freedom to experiment and innovate as he had done before. The different members of the States of Flanders had vested interests in these locks and were unwilling to loosen their grip. This situation would ultimately lead to a deadlock and the locks' collapse in 1752.

In 1733, the locks' wooden sill plates were mildly infected with shipworms. Therefore Olleviers preferred not to open the locks at low tide, fearing that the sill plates on which the locks' foundations rested would be

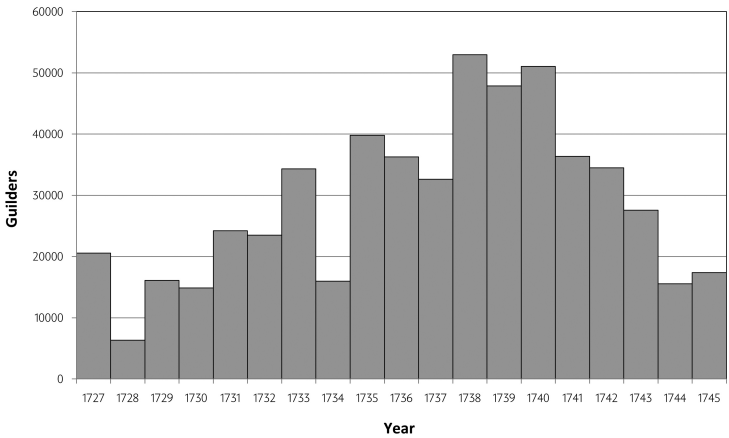

Figure 5: Flood protection costs in guilders per year for the port of Ostend (1727-1745)
Sources: AGR CC, 29948-29966.

further damaged. The locks were only opened at high tide when the sea level was equal to the water level in the canal. This allowed maritime traffic to and from Bruges to continue (RAG SvV, 355, 10789). Everything went well until the extremely rainy winter of 1734-1735, when large quantities of water were being channelled into the Bruges-Ostend canal causing it to overflow in early January 1735. When Olleviers refused to open the locks, the Freedom of Bruges' magistrates journeyed to Bruges to find the director of navigation. They wanted Legillon to join them in Slyckens to enquire the possibility of opening the locks to lower the canal's water level. Bruges' city council however grounded Legillon and forbade him to leave Bruges (RAG SvV, 10789; Vanderlinden, 1924: 185; Buisman, 2006: 611-612, 616-617, 619, 621). Bruges' ruling merchant oligarchy feared that the lowering of the canal's water level would impede shipping and thus their commercial livelihood. When Bruges' city council also refused to meet the Freedom's representatives, the latter had no other option than to ask for an audience with Mary-Elisabeth, the Austrian Netherlands' governor in Brussels. After several admonishments, Bruges finally gave in to the governor's orders (RAG SvV, 10789). The locks were opened, saving villages like Stalhille and Bredene from flooding. As the canal's water level dropped to four feet, numerous ships became stranded in Bruges' harbour and in the canal. It would take several months to reach the former water level of 15 feet, which re-allowed shipping activities (RAG SvV, 10789). This was a typical example of conflicting interests between two members of the States of Flanders. Only through the central government's

intervention an inadequate mitigation action took place. It did not solve the shipworm infestation, nor did it put an end to the canal's water level dispute, for in 1737 the same problems occurred once more (RAG SvV, 10789).

During the following years, the States of Flanders regularly checked the locks' state and replaced damaged parts that could be easily substituted. The sill plates remained however a problem (RAG SvV, 10792). When engineers predicted a collapse, the States of Flanders often resorted to a second opinion in the hope that these would go against the first report. At times, the States also ordered makeshift or stopgap measures (Lenders, 1956: 23; Parker, 2017: 517). By 1741, it was clear that the locks had to be rebuilt. Jeanty, a French engineer, devised a plan to build new locks at the same location. A short by-pass would be dug to allow small ships to navigate to Bruges. This plan was deemed too expensive and impracticable by Ostend's maritime elite. Heavily divided, the States of Flanders were again unable to make a decision. Governor ad interim Friedrich von Harrach, one of the early architects of modern Belgian enlightened absolutism better known as the Theresian compromise, skilfully used this as an excuse to interfere in Flemish politics. He opted for Jeanty's plan and pinned the bill on the States of Flanders (AGR CF, 3431; RAG SvV, 399-400). It explains why the States of Flanders moved painstakingly slow to construct the new locks (RAG SvV, 399). Barely a year later France declared war on the Austrian Netherlands, which in turn led to a decrease in financial means. The Austrian army furthermore requisitioned building material for military purposes. In June 1744, all the construction works were halted (RAG SvV, 400).

In February 1749, Ostend returned to the Habsburg fold after a short French occupation (Bowens, 1968: II, 124-125). The locks of Slyckens disappeared from the political agenda, lulled by a report made by a military engineer – colonel Spalart – in December 1750. He claimed the seepage was of little importance (AGR SEG, 1049). But in July 1752, one report after the other was sent to Ghent, warning the States of Flanders of the locks' imminent collapse (RAG SvV, 10800). It was to these reports that Botta Adorno referred to in his letter to Silva Tarouca in Vienna (BA X152, CG XX). The deadlock in which it had geared itself, showed that the States of Flanders were unable to ensure flood protection to coastal Flanders when their members had different and opposed interests. It was quite similar to what happened with the calamitous polder's flood protection and security in Zeeland (van Cruyningen, 2017: 375-379). The locks' collapse is an excellent example of what Soens called the 'violation of flood protection'-stage. Local inhabitants had absolutely no say in the locks' or flood protection management. Moreover decisions were taken by absentee councillors with other interests at heart, like trade, shipping or budgetary

affairs, but with little concern for the vulnerability of the common people living in the polders (Soens, 2013: 227-230; Soens, 2018: 174-177).

Fear, solace, panic and anger in coastal Flanders

Coastal societies were aware of the risks and benefits of living next to the sea. The sea could be a trusted friend, but also a feared enemy (Therry, 1988: 32). There was however a difference between the fear of a storm induced flood, which came suddenly, and that of millions of little creatures gnawing and boring slowly, tirelessly and almost invisibly at the dikes and sea walls. Fear and panic were perceptible in Legillon's reports on the dikes in 1736 and 1737. He was fully aware that one more storm would completely wash away the sea walls protecting the low lying polders (RAG SvV, 10791-10792). Not all the areas along the coast were that prone to flooding. Ostend, which was built on the foot of the dunes, was slightly higher than the surrounding polders and not only protected from the sea by embankments, but also by its fortifications. Bowens, who was good at describing "urban emotions", doesn't mention fear when writing about shipworms. He rather depicts them as a nuisance (Bowens, 1968: II, 33-34, 96). Another fact that seems to indicate that Ostenders didn't fear a shipworm induced flood was that gangs of Ostend youngsters regularly stole wood from the flood protection works (RAG SvV, 10791).

But in the small villages in the polders, like Bredene or Stalhille (see figure 4), fear must have been widespread. The villagers did what they always did in times of distress, they turned for solace and comfort to God and the Catholic church (Therry, 1985: 240). The church played a somewhat ambiguous role. Like everywhere else in Early modern Europe natural disasters, such as floods, drought, storms, diseases, etc., were viewed as divine actions, readily interpreted by the church as divine punishments (e.g. Therry, 1988: 58; Sundberg, 2015a: 241-245; Parker, 2017: 8). Throughout the 1730s, the population in the diocese of Bruges was regularly informed that drought, heavy rainfall, rinderpest, cold weather, etc. were caused by God's ire and displeasure. The bishop of Bruges repeatedly asked his flock to pray and to repent when his diocese was confronted with such natural disasters. This was not uncommon during summer, because extreme weather conditions were of prime importance for the upcoming harvest. But this rarely happened during winter months, the time period when winter storms brought havoc to the shipworm ravaged flood protection works. In fact, the bishop didn't mention shipworms at all (e.g. BAB F, 67-68; Therry, 1988: 58-59). Only in 1741, did he bring up the subject of the heavy burden of the flood protection works, but again without referring to the shipworms (BAB F, 67). It seems strange that the bishop of Bruges, Hendrik Jozef Van Susteren, didn't refer to

shipworms like he did for the above mentioned disasters. However, doing so would inevitably point to the States of Flanders' responsibility, and that meant the bishop would have to incriminate himself, for he constituted the first estate together with the bishop of Ghent (Leplae, 1985: 178-189; Nuyttens-Zoete, 1997: 71). In a more theoretical framework one could say that the violation of flood protection had to be shielded from the local inhabitants who might reclaim their legal rights to flood security (Soens, 2013: 219-230). Instead Van Susteren explained God's displeasure with the fact that many farmers and labourers didn't always show up in church. The Catholic church also tried to restrain leisure activities, such as drinking, dancing, partying, playing games, etc. after the Holy Mass on Sunday. But also more serious matters, such as whoring, adultery and inebriety aroused God's wrath. In any case, the Great shipworm epidemic offered a great opportunity to discipline the people and to call for moral improvement (BAB F, 67; Cloet, 1985: 170; Van Eeghem, 1985: 228; Sundberg, 2015a: 245).

Nevertheless the bishop and the church did everything they could to mend the perceived strained relations between God and the sinning population, like setting up days of prayer. These mainly consisted of the celebration of the Holy Mass, the veneration of the Blessed Sacrament and the organisation of processions. These days could be reiterated, sometimes lasting several weeks (BAB F, 67; Therry, 1985: 241; Therry, 1988: 58-60). The performed rituals focussed on the salvation of the sinners. Not surprisingly Psalm 66 – one of the so-called redemption Psalms – was sung (BAB F, 67; Rose, 2009: 564). This Psalm was well chosen, for its sixth verse – "Who turneth the sea into dry land, in the river they shall pass on foot" – showed that those who received God's mercy would emerge unscathed from the shipworm induced flood ($Psalm^{MT}$ 65:6).These acts of devotion were important for coastal communities, as they believed to gradually regain God's mercy and thus His solace and comfort in times of distress. It was basically a healing process in which the spiritual vulnerability of the people was taken care of (Therry, 1985: 244).

It is difficult to find sources describing how common people really experienced disasters and divine punishment. Nevertheless, it is possible to find traces and indications of how the people felt and how they tried to invoke God's protection (Cloet, 1968: 25; Therry, 1988: 12-14). A good example can be found in Bredene, a small village close to the sea and the first in line to be swept away in case of a breach in the dikes. In 1736, its population therefore petitioned the bishop to build a small stone chapel near the sea in honour of the Virgin Mary. In coastal communities, the intercession of the Virgin Mary was extremely popular in times of need or danger. 1736 was indeed a year of distress, as the shipworm had destroyed large parts of the flood protection (BAB B, 54; Therry, 1988: 69). Bishop Van Susteren acquiesced and even granted a 40 day indulgence for those

who recited five *Ave Marias* and *Paternosters* at the chapel (BAB B, 54). This little chapel still exists and is known as the Fishermen's chapel Our Lady of the Dunes. Today, it is a popular place of worship for maritime people. However, in the eighteenth century, there were no fishermen or sailors in Bredene (Desnerck-Desnerck, 1974: I, 30; Dansercoer, 1980: 143). It was not a fishing community, but a rural village next to the sea which lived in fear of being swept away. The chapel was not built for the seamen's protection, but likely to ward off shipworm induced floods.

This is just an example of the widespread fear that gripped coastal Flanders during the Great shipworm epidemic. For nearly 20 years all the praying seemed to have achieved its goal, but on 13 August 1752, fear turned into panic as the locks collapsed threatening to flood the coastal plain. According to the *Europische Mercurius*, a Dutch journal, the population was terrified when the locks caved in and bells started tolling (Buisman, 2015, 70).[1] Several eye-witnesses have described in detailed letters how the situation evolved in the days and weeks following the collapse. From these letters it is quite clear that the population was dismayed by the events (AGR SEG, 1049-1050). Bossaert, Ostend's tax collector, was straight out panicking in his daily letters, vividly describing the race between the rising sea, the changing winds and the shovelling labourers (AGR SEG, 1029). It is only after 3,000 to 4,000 labourers had heighten the canal's embankments with several feet that the population's fright started to subside (AGR SEG, 1037, 1049). The fear disappeared in early September, when a dam had been thrown across the canal. Botta Adorno made a veiled reference to Bernard Alexandre de Crombrugghe, the bishop of Ghent's representative in the States of Flanders, that it was time to discuss what had gone wrong with the locks. Whereas de Crombrugghe was still ecstatic of having walked across the new dam, Botta Adorno was fully aware that the population's mood had shifted from panic to anger (AGR SEG, 1038). One of Bossaert's letters to Botta Adorno was indeed emblematic of what a growing number of people were thinking in Flanders: "Car il n'est plus temps de songer aux écluses qui ne sont plus [...] je parle en homme zélé pour le bien général et en même temps pour mes intérêts particuliers qui en sont inséparables" (AGR SEG, 1029).

Moving towards the Tipping Point: The Political Crisis in Flanders

The States of Flanders' provincial executive consisted of eight deputies, who took care of its daily affairs and implemented its decisions. In real

1 The *Europische Mercurius* erroneously mentioned the flooding of the coastal plain.

terms the deputies were the province's leading policy makers (Lenders, 1956: 8-9; Nuytens-Zoete, 1997: 71). 1752 was a difficult and stressful year for these deputies. Firstly, they had to deal with the growing interference from the new absolutist minded central government in Brussels. Designed by Harrach, the absolutist reforms consisted of nominating enlightened and centralising senior civil servants. To perceive higher tax revenues, these civil servants gradually started to check and control the provincial finances throughout the Austrian Netherlands. Of course the provincial authorities opposed these checks, which they viewed as unconstitutional intrusions upon their age old liberties and privileges. Yet the Flemish deputies had a hard time to explain the dire financial situation of both Ghent and Bruges, as well as that of their province (Lenders, 1956: 9-10; Lenders, 1988: 46-49). Secondly, the central government's transit policy, an economic recovery plan aiming to link Ostend with the rest of the country via an elaborate east-west transport system, greatly annoyed the deputies. The central government had even restricted the privileges of opposing cities and provinces, like Mechlin, when they didn't cooperate. It spurred the States of Flanders' deputies to dig the missing links in the Flemish waterway system, the so-called "Coupures", through respectively Bruges and Ghent. These canal cuts would link the Ghent-Bruges canal with both the river Scheldt and the Bruges-Ostend canal (and the North Sea) (see figure 4). Both the bargemen and porters in Bruges and Ghent opposed the deputies' canal plans. They feared for their navigation monopoly and their profitable transhipment activities (Decavele-De Herdt-Decorte, 1976: 95-96; Serruys, 2007: 336-339; Serruys, 2008: 156-158). In this already stirring and unwholesome atmosphere, the Flemish deputies became conspicuous in their mismanagement of the Coupures' construction: mounting costs, technical failures, rioting workers, profiteering contractors. Especially the dissipation of funds by Pycke and O'Donoghe de Glanfleske, the respective pensionaries of Ghent and Bruges, were viewed with disgust (Lenders, 1956: 21-22; Lenders, 1995: 54). Finally, the provincial executive faced the growing resentment from the seven Flemish castellanies without representation in the States of Flanders, the so-called subalterns. Because of the dire financial situation, the States of Flanders increasingly pinned the fiscal bill to the subalterns. Led by viscount Jean Vilain XIIII, the burgomaster of Aalst, the castellanies vigorously retorted with the age old adagio: "No taxation without representation". The confrontation between the States of Flanders, headed by Pycke, and the subalterns gained in intensity and viciousness, especially since both their leaders loathed each other (Lenders, 1995: 50-54).

In the months preceding the collapse, jokes and gossip about the deputies' ineptitude and corruption were increasingly told in Flanders (Lenders, 1956: 23-24; Winnepenninckx, 1956: 122-123). Rumours about being incompetent or untrustworthy were seen as grave insults in Early

modern times. When believed, the social repercussions could be very important for the indicted person. Defamation could completely wreck one's social, commercial and/or political reputation (Roodenburg, 1992: 368-370; Shoemaker, 2000: 97). The locks' collapse in August 1752, didn't better the situation, as the people in Flanders, like Bossaert, now publicly voiced their anger. The population also began to question the deputies' management. From this moment on, the deputies' position would gradually start to shift, as they increasingly ventured onto thin ice to absolve themselves. When the Dampoort lock (near Bruges) also collapsed in September 1752, rumours swelled and protests became far more overtly (AGR SEG, 1029; Lenders, 1956: 23-24; Lenders, 1995, 54). The provincial executive now faced the costly reconstruction of both locks. However a group of merchants from Bruges, closely connected to the Chamber of Commerce, lobbied vigorously not to rebuild the locks. Already on 17 August, they anonymously petitioned Botta Adorno to support their plan. They greeted the collapse of the Slyckens locks as "un coup de ciel". An open connection with the sea would revive Bruges' maritime trade like in its medieval heydays. There was precious little consideration for the flood protection or the population's vulnerability (AGR SEG, 1049).

The Chamber of Commerce's plans were rejected by Ostend which protected its maritime activities, by the Freedom of Bruges which feared for a dike breach along this new open canal, and by the deputies who had become increasingly more prudent (Lenders, 1956: 24). Although sympathetic at first, Botta Adorno rapidly became aware of the maritime issues at stake. The loss of Ostend's maritime knowledge was far too important for the transit policy's success to support Bruges' commercial revival (AGR SEG, 1037; Laenen, 1901: 173-174; Serruys, 2007: 334-339). Bruges' Chamber of Commerce, secretly helped by colonel Spalart, set out to ridicule the deputies even more in the hope to win them over, or more likely to have them replaced by more complacent deputies. He even published pamphlets focussing on the deputies' errors and their bungling. In the end, he was mutated to Luxembourg by the central government. This was a rather mild punishment, giving the impression that the central government agreed with Spalart. It was another blow for Pycke and his fellow deputies (Lenders, 1956: 24-27; Winnepenninckx, 1956: 133-139).

After all these attacks, the deputies' position was now seriously weakened. With the open canal plan out of the way, the Flemish provincial executive tried to regain its leadership over the county by heading the locks' reconstruction. The deputies decided to rebuild the locks according to the plans of Fruytière and Taquet, two French engineers from Dunkirk. Costs amounted to 1,833,300 guilders (Gevaert, 1983: 39, 46). Pycke hoped to pin the bill on the subalterns, but the seven castellanies refused to grant the necessary funds unless they received voting rights. As a last resort, the States of Flanders tried to raise the money by subscription. This

was an outright failure because of Ghent and Bruges' dire financial state and because the population lost its confidence in the deputies. The central government tried to intervene, but with little success. Feeling Brussels was unable to alter the situation in Flanders, Pycke blamed the deadlock on the subalterns and tried to take advantage by threatening not to pay the taxes to the central government. This was playing for high stakes. It was however also the tipping point, for Brussels couldn't let this happen. Charles von Cobenzl – the new plenipotentiary minister – intensified his contacts with the seven castellanies. In June 1754, empress Mary-Theresa changed the Flemish constitution and gave voting rights to the subalterns in the States of Flanders. Vilain XIIII, who had shown to be an excellent enlightened, financial and economic manager, replaced Pycke and became the head of the Flemish provincial executive in March 1755. It was time for change (Lenders, 1956: 27-62; Lenders, 1995: 50, 54-58).

Change: politics, economy, ecosystems

Vilain XIIII had worked relentlessly to provide the central government with a viable alternative to govern Flanders. His reform plan – *Réflections sur les finances de la Flandre* – was published in limited numbers in 1755. It consisted of a long list of well thought and enlightened measures, based amongst others on Montesquieu, Buffon, Diderot and D'Alembert (Lenders, 1995: 55, 59-64). Much attention was given to what we could call geographic representation. Before the reforms only North-Western Flanders was represented. It would be farfetched to call the post-1754 States of Flanders democratic, but at least all the Flemish castellanies were represented (see figure 4). Vilain XIIII further emphasized the need to introduce fairer taxes (Lenders, 1995: 55, 65-72; Serruys, 2014: 203). Although not all the reforms mentioned in the *Réflections* were put in place, the "Flemish model" became well known in Europe. In the Austrian Netherlands the Flemish reforms of 1754 announced a form of enlightened governance on one side, while on the other it heralded absolutism and despotism. The enlightened measures were welcomed by many, but local authorities throughout the Austrian Netherlands were well aware that the age old Flemish constitutional framework, guaranteed by the Habsburg sovereign, had been cast aside. 1754 is the year when local authorities became aware of a political paradigm shift, or to what has been termed in historiography as the Theresian compromise, that is the Belgian version of enlightened absolutism (Lenders, 1956: 65-66, 85, 331-335; Lenders, 1981: 74-75; Serruys, 2007: 339-341).

One of the main Flemish reform topics centred on the flood protection issue. Vilain XIIII was appalled by the States of Flanders' lack of measures. According to the new leader the old flood protection authority was "une

direction abandonné au Monopole & à l'avidité de quelques particuliers". Vilain XIIII not only viewed such a management as "un danger continuel", but also as "une ruine certaine". (Vilain XIIII, 1755: 12-13). A new Department of public works was created in 1755. Its director had to be someone with a thorough knowledge of flood protection and engineering skills. These directors had to operate independently from the States of Flanders and its regional and oligarchic interest groups. The new department had to be financially independent from the Tax department. In the 1730s, Legillon's main task still consisted of levying toll to fund the waterway and flood protection works. Hendrik Pulinx jr., the new director – Legillon had passed away in 1750 – was freed from this tax collecting burden and could instead devote his full attention on flood protection issues. Regional and oligarchic interest groups were barred from intervening in technical discussions or to block necessary funds (Lenders, 1956: 232-235; Nuyttens, 1986: 296-297, 539-540; Van Cruyningen, 2017: 382-383). Flood protection became increasingly a task for professionals, like engineers, and less for the Flemish urban merchant elite. Vilain XIIII's reforms marked the end of the 'violation of flood protection'-stage in Flanders, introducing what could perhaps be labelled the 'professionalization of flood protection'-stage. Contrary to Bruges' Chamber of Commerce, the new States of Flanders also set a great effort in reducing the population's vulnerability from flood disasters. The Flemish society became – to use Soens' words – more resilient (Soens, 2013: 231; Soens, 2018: 176).

The Ghent-Bruges-Ostend waterway, which included the canal cuts and Slyckens locks, had become a symbolic issue in Flemish politics in the 1750s. Because of this, and also because of the transit policy's importance for the central government, Vilain XIIII made sure the new public works department took great care in maintaining and developing this waterway. The new Slyckens locks (18 November 1758) were immediately inserted into an elaborate time schedule mentioning at what time the locks had to be opened and closed. This time schedule was based on the tide and it regulated all the locks along the new Ghent-Bruges-Ostend waterway. Thanks to these regulations, the water level was always sufficient, allowing seagoing ships to sail from Ostend to Ghent (RAG SvV, 10503; Lenders, 1956: 232; Winnepenninckx, 1956: 147; Gevaert, 1983: 46). In the following decades, the Ghent-Bruges-Ostend waterway, became one of the Austrian Netherlands' major transport arteries. The growing revenues and passenger numbers on the Bruges-Ghent barge (*trekschuit*) in figure 6 demonstrate this (RAB FdB, 1739-1741, RAG SvV, 4783-4803, 6311-6316, 6358-6383, SAB OA, 66). Urban historians have shown that revenues and passenger numbers between cities are representative for the economic and commercial interaction between these urban centres (de Vries, 1978: 347-354; Blondé, 1999: 208-209). The increasing revenues and passenger numbers between Ghent and Bruges is further evidence of the transit

policy's success in linking the coast with the hinterland. It also reveals the Austrian Netherlands' maritime revival via Ostend in the late eighteenth century, as several Belgian maritime historians have recently pointed out (Serruys, 2007: 345-346; Scheltjens-Serruys, 2019: 196; Parmentier, 2021, 351-352).

Because of the canal cuts in Bruges and Ghent a substantial part of the river Lys did not flow to the North Sea via the river Scheldt anymore, but was now redirected to this new waterway. Thanks to this, the lockmasters were able to maintain a water level of 18 feet in the canal, allowing shipping activities between Ostend and Ghent throughout the year (de Rive, 1835: 150; Winnepenninckx, 1956: 147). This had an important impact on the Flemish water management system and several local ecosystems. Before the canal cuts' construction, the river Lys regularly flooded large areas to the west of Ghent, the so-called *meersen* (see figure 4). These marshes or wetlands were used as meadows in summer and functioned as water storage areas during wet winters. The new waterway not only channelled excess water from the river Lys, but also drained parts of these wetlands. As such, there was a noticeable decline in the number of flood occurrences in the villages along the Ghent-Bruges canal, like in Mariakerke (Andries, 1838: 26; Decavele-De Herdt-Decorte, 1976: 111; Pairon, 1980: 631). Not everyone shared the same enthusiasm. In 1755, several inhabitants from Bruges complained that several city canals, like the Smedenrei and Gouden Handrei, were drained and emptied from their water. They claimed it became impossible to deliver or dispatch goods by boat from their bleaching fields and saltworks (SAB OA, 292). On a more positive note, the discharge of fresh water in the port of Ostend increased substantially. Although it isn't possible to give an estimate of this additional fresh water inflow, it must have had a negative impact on the shipworm larvae's survival rate (Hoagland, 1986: 92-93, 95). Shipworms didn't completely disappear for there were recurrent infestations in warm years, like in 1759 and 1762, but none of these caused the level of destruction encountered in the 1730s (RAG SvV, 481; Buisman, 2015: 973). In 1771, the threat of shipworm induced flood disappeared, as the States of Flanders' Department of public works decided to build stone embankments (Bowens, 1968: II, 144-145).

Conclusion

Can we understand the many changes that occurred in mid-eighteenth century Flanders by simply pointing out to the shipworms? The Great shipworm epidemic was almost certainly a climate induced phenomenon. Higher temperatures and drier weather in the 1720s and 1730s are to be blamed, as these conditions boosted the shipworm activity along the

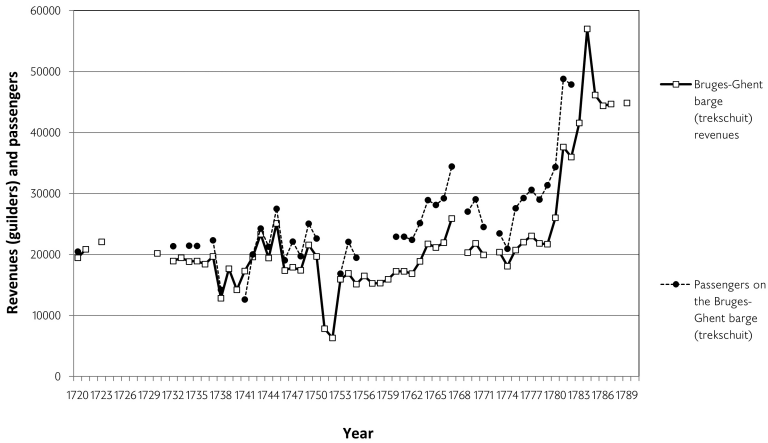

Figure 6: Revenues and passenger numbers on the Bruges-Ghent barge (*trekschuit)*, 1720-1790
Sources: RAB FdB, 1739-1741, RAG SvV, 4783-4803, 6311-6316, 6358-6383, SAB OA, 66.

North Sea coast. The repeated destruction of Ostend's wooden embankments, as well as the slow, but ceaseless, undermining of the Slyckens locks' foundation was undoubtedly of the shipworms' doing, regardless of the Catholic church's effort to pin the blame on a so-called sinful population. Van Susteren, Bruges' bishop, nevertheless did everything he could within his spiritual powers to attenuate his flock's fear and to give them whatever solace he could muster. It was the States of Flanders, the worldly power, which was unable to meet all the flood protection's requirements. Only the embankments could be taken care of, as these didn't require too much additional funding or went against the interests of the non-local elites. It was even possible to adopt new technologies in this case. But when the vested interests of the different ruling elites diverged – like in Slyckens – flood protection failed. It was a typical example of what Soens called an extra-entitlement failure in the 'violation of flood protection'-stage.

It was the inability of a deadlocked society facing a novel threat, in this case shipworms, that ultimately led to the collapse of the locks in Slyckens in 1752. The locks' collapse was a hard blow to the States of Flanders, but probably not sufficient to initiate the political and economic changes that were witnessed in the 1750s. Apart from shipworms, the States of Flanders also faced stressing and game changing demands of an anthropocentric nature, such as the central government's absolutist and economic policy and the castellanies' insistence on a fairer political

and fiscal representation. Both the central government as the castellanies could easily propose a more viable political alternative for the deadlocked Flemish society. The shipworm induced collapse on the other hand was the necessary disaster to weaken the Flemish provincial executive to such a degree that a tipping point (in this case a threat not to pay the taxes) was almost an accident waiting to happen. The Flemish reforms of 1754, who brought the enlightened Vilain XIIII to power, took great care of both the waterway system and the flood protection. The new provincial executive was well aware of the population's anger and demands with regard to these topics, as the popular voice had played an important role in the toppling of their predecessors. Both the waterways and flood protection were taken care of by the newly structured Department of public works, which was financially independent and managed by professionals. It heralded a new flood protection stage, namely that of the 'professionalization', with a keen interest in reducing the population's vulnerability to flood induced disasters. The Department of public works' other measures (in collaboration with Brussels) increased the drainage and navigational capacities of the Flemish waterway system, which was almost always beneficial to the coastal communities. Not all of this can be attributed, both negative or positive, to the shipworm, for anthropocentric actions remain of paramount importance in handling an ecologic crisis. But it cannot be denied that the Great shipworm epidemic's impact was significant for the eighteenth century Austrian Netherlands.

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