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Abstract. This paper studies the relationship between shipping, merchant business and product supply and demand from an economic-geographical perspective. The case study of grain transportation in the eighteenth century shows that it is established that structural changes in supply and demand led to the emergence of new transportation routes, provoking a shift from a bilateral trade pattern to a diversified pattern involving many locations, none of which were strictly dominant. An attempt is made to explain the effects of these changes on the structure of the Dutch maritime transport sector. Three spatial developments are singled out: (1) a movement from the Dutch North-Western coastline further inland to communities in Southern Frisia, (2) a shift in the organisation of maritime transport from the demand side (primarily Amsterdam) to the supply side of business (the Baltic) and (3) integration of shipping communities located in the Province of Groningen into the Dutch commercial system.

Résumé. La géographie mouvante du transport maritime néerlandais au XVIII^e siècle.

Cet article étudie les relations entre la demande et les évolutions du transport maritime, du commerce et de l'approvisionnement dans une perspective économique et géographique. À partir d'une étude de cas, celle du transport du grain au XVIII^e siècle, il montre que les changements structurels de l'offre et de la demande ont contribué à l'émergence de nouvelles voies de transport, provoquant le passage d'un modèle du commerce bilatéral à un modèle plus diversifié. Ces changements ont trois effets principaux sur la structure du transport maritime néerlandais : un déplacement du centre de gravité du littoral du Nord-Ouest des Pays-Bas vers le sud de la Frise ; un transport maritime de moins en moins organisé en fonction de la demande (principalement Amsterdam) mais de plus en plus en fonction de l'offre essentiellement en provenance de la Baltique ; enfin, l'intégration des sociétés de transport de la province de Groningue au système commercial national.

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It is commonly acknowledged that maritime transport was the foremost important engine of economic growth in the Early Modern world. Improved techniques in shipbuilding¹ and navigation² facilitated discoveries³, but also lead to change in the structure of international trade⁴ and to a shift in the focus of diplomacy and international politics⁵. From the late Middle Ages and throughout the Early Modern period, maritime transport emerged as an economic activity of great importance, which is reflected in the continuous efforts of cities, regions, and nations to expand and secure their interests through various kinds of economic partnerships, diplomatic agreements and – when deemed necessary – warfare.

In long-distance trade, transportation services were often an integrated part of commercial exchange, and were either the responsibility of chartered companies exerting exclusive rights on colonial routes to the East- and West-Indies⁶, or of “specialist” merchant firms who controlled trade at specific locations⁷. On short and relatively safe distances transportation was outsourced to third parties, which often were established and maintained with the financial support of merchants. This was the case in Baltic trade, where joint stock companies (*partenrederijen*)⁸ and shipmasters-entrepreneurs (*rederij van één reder*) were prominent providers of maritime transport services already in the sixteenth century⁹.

The integration of trade on a global scale, heralded by monopolistic companies and merchant firms leveraging colonial possessions from the early seventeenth century, was paralleled by the introduction of novel practices in the organisation of short-distance maritime transport. Regular transportation services were established on dense national and international routes, linking centres of trade like Amsterdam, London, Rouen, Hamburg and Bremen¹⁰.

1. A. WEGENER SLEESWYK, 2003; R.W. UNGER, 1978, 1997.

2. C.A. DAVIDS, 1985.

3. G.V. SCAMMELL, 1981; J.D. TRACY, 1990.

4. H. VAN DER WEE, 1990, p. 14-33; N. STEENSGAARD, 1990, p. 102-152; W. BARRETT, 1990, p. 224-254.

5. P.E. STEINBERG, 2001, Ch. 3: Ocean-space and merchant capitalism and Ch. 4: Ocean-space and industrial capitalism.

6. H.J. DEN HEIJER, 2005, p. 64-68.

7. J.D. TRACY, 1990.

8. S. HART, 1977, p. 106-125; F.J.A. BROEZE, 1977, p. 106-116; R.S. WEGENER SLEESWYK, 1996, p. 52-72; H. DEN HEIJER, 2005, Ch. 2: *Van partenrederij naar handelscompagnie*.

9. S. HART, 1977, p. 106.

10. J.M. FUCHS, 1946, p. 226-251; E. BAASCH, 1898; *Ordonnantie*, 1663.

As Michel Morineau righteously pointed out, Early Modern Baltic trade unfolded on the basis of changes in demand and supply and in accordance with a human and quasi-natural logic that implies nurturing exchanges with exchanges as well as the existence of mutual relations between producers and consumers. Indeed, Baltic commerce is conditioned as much by change West of the Sound as it is influenced by change East of the Sound¹¹. Therefore, any analysis of Baltic commerce would be seriously flawed if either part of the “whole” would be neglected, and this is equally true when Baltic transportation is observed.

The bulk of European commercial exchange was executed by merchants operating as individuals or in small businesses, far away from monopolies, exclusive rights and privileges. These entrepreneurs exploited family, descent, and religion to establish commercial networks from which they expected to benefit in one way or another. It is in this context that we situate a case-study on grain transportation through the Sound at Elsinore in the eighteenth century. The market for Baltic grain was highly competitive. There was no single producer, and demand varied from year to year. Throughout the Early Modern era, the Dutch Baltic grain trade was known by contemporaries as the “Mother of all trades” or *moedernegotie*, pointing out its vital importance for the Early Modern Dutch economy¹². Still, the role of the maritime transport sector in the Dutch Baltic grain trade has not yet been the subject of thorough analysis.

1. Goal and relevance

The goal of this paper is to explain trends and fluctuations in the location of the Dutch maritime transport sector in the eighteenth century, focusing primarily on grain transports in the eighteenth century. By adopting a functional approach in which hinterland, foreland and maritime transport are the fundamental components of trade routes, the paper aims to contribute to our knowledge and understanding of the maritime transport sector, its structure and its role in the Dutch commercial system of the eighteenth century. Such a contribution is deemed to be relevant for a number of reasons. First of all, in his seminal work on the economic decline of the Dutch Republic in the eighteenth century, Johannes de Vries acknowledges

11. M. MORINEAU, 1983, p. 31-32.

12. M. VAN TIELHOF, 2002, p. 4. The term “mother of all trades” was coined for the first time by Johan de Witt in 1671 to designate trade with the Baltic. See: J.Th. LINDBLAD, 1998, p. 8-27.

that very little is known and can be said about the development of the Dutch maritime transport sector¹³. Second, in Dutch historiography, maritime transport organisation is dominated by two viewpoints. One opinion is that shipmasters were not specialized in certain routes or products, but moved randomly across the seas in search for available cargoes¹⁴. Elsewhere, it is argued that the opposite was true and that the appearance of new routes coincided with the emergence of new shipmasters' domiciles in the structure of the maritime economy¹⁵. Both viewpoints ignore market entry constraints, path dependence, positive and negative lock-in or access to operational knowledge as relevant to the structure of maritime transport. Third, maritime transportation is a topic that is usually treated in relation to trade streams, good flows and merchant networks, but only rarely receives more profound attention, almost as if transportation can be assumed to be a fully integrated part of these streams, flows and networks, not requiring specific attention. Therefore, in this paper, an attempt is made to show that through analysis of transport routes and the role that local shipping communities played in their exploitation, the development of the Dutch maritime transport sector in the eighteenth century can be addressed and described in an innovative way.

2. Method

In this paper, I propose to study the demand for maritime transport from an economic-geographical perspective, arguing that changes in hinterland and foreland had reciprocal effects on the spatial structure of maritime transport. The changing spatial structure of maritime transport can be used to identify and assess changes in maritime business strategies. Market entry constraints, path dependence and access to operational knowledge are important influences on these maritime business strategies, and gaining insight in their structure and evolution is necessary to understand the changing geography of demand for maritime transport in the eighteenth century.

Using a dynamic geographic information system with semantically enriched data on good flows and ship movements, an attempt will be made to answer the following questions: (1) Who needed maritime transport? And (2) Who fulfilled these needs for maritime transport?

13. J. DE VRIES, 1959, p. 28-29.

14. P.C. VAN ROYEN, 1987, p. 17.

15. P.C. VAN ROYEN, 1998, p. 86-87.

The data set used in this paper is extracted from the ongoing digitization project *STR online*¹⁶ and completed with the database of Sound traffic in the years 1784-1795, created by Hans Christian Johansen and edited by George Welling in 2009¹⁷. The current stage of execution of this project imposes some limitations to the use of the data set. First of all, the standardization of cargo data has been limited to the items listed by Hans Christian Johansen under the codes 1400 to 1490, which were regrouped in this paper into the broad category *grain*¹⁸. Second, conversion of pre-modern weights and measures did not include local differences between them, as is the case in Werner Scheltjens¹⁹. Instead, conversion to metric equivalent values was limited to one value per weight or measure²⁰. Third, some measures could not be converted to metric equivalents and were omitted in the statistical procedures. This affected less than 2% of all grain cargoes shipped through the Sound in the years 1699-1795. The remaining quantities have been converted to litres first, and were then indexed to simplify calculations. Fourth, since data input has not yet been double-checked with the original tax records of the Danish customs office at Elsinore, it is inevitable that it contains errors. Nevertheless, the statistics generated on the basis of our data set fully comply with existing statistics, although the estimated volumes transported seem to be significantly lower than earlier estimates²¹. While

16. The Danish Sound toll registers are being digitized in a joint project of the University of Groningen (The Netherlands) and the Frisian State Archives (Tresoar, Leeuwarden, The Netherlands). REDS or Realization of an Electronic Database of the Danish Sound Toll Registers is a project carried out at the University of Groningen and financed by the Dutch NWO (grant number 175,010,2007,005). The Danish Sound Toll Registers contain tax registrations of all ships passing through the Sound at Elsinore on their way to or coming back from the Baltic Sea. The period covered by the Danish Sound Toll Registers is 1497-1857; upon completion, the database of Sound passages will contain approximately 1,7 million passages. For more information, see: www.soundtoll.eu.

17. G.M. WELLING, 2009. On line resource: <http://www.let.rug.nl/welling/sont/>

18. The following products constitute the category *grain*: Grain, unspecified (*Da. Korn, unspecf.*, code 1400); Wheat (*Da. Hvede*, code 1410); Four of Wheat (*Da. Hvedemel*, code 1420); Rye (*Da. Rug*, code 1430); Barley (*Da. Byg*, code 1440); Barley groats (*Da. Byggryn*, code 1450); Barley and oats (*Da. Byg og Havre*, code 1460); Oats (*Da. Havre*, code 1470); Rye and Barley (*Da. Rug og Byg*, code 1480); Groats of Oats (*Da. Havregryn*, code 1490). We are aware of the limitations that come with this type of generalization. For a descriptive account of the differences in commercial organisation depending on the type of grain, see D. ORMROD, 2003, p. 236-244. In defense of the choice to generalize, it can be argued that often up to three different types of grain were loaded on one ship in the Baltic ports, which would make too strict a distinction between various types of grain unnecessary when transportation itself is the topic.

19. W. SCHELTJENS, 2009.

20. The conversion is based on data from H. DOURSTHER, 1965.

21. W. SCHELTJENS, 2009.

it may be possible that not every single grain cargo is part of our data set, the attempt to be exhaustive leaves little doubt about its representativeness.

On the basis of this data set, it will be examined what the effects of change in the geography of trade flows were on the maritime transport sector. Did maritime transporters change directions together with the trade flows? Did maritime transporters continue their business, regardless of the changing trade flows? In either case, when change occurred, who filled the gap? The analysis will be centered around the classical issue of route *vs.* cargo specialisation²².

3. Structure of demand

The analysis of grain transportation through the Sound in the eighteenth century comprises a statement about its volume, followed by an introductory survey of the changing spatial structure of the grain trade (§3) and its main routes (§4). Demand for maritime transportation services was strictly speaking a merchant's issue. He was the one who decided where he would purchase a cargo, and where this cargo would have to go. While there is no doubt that the rationale behind his decisions was subject to change in time and place, our survey will be restricted to the visible results of merchant's business decisions, in particular: the routes and directions of grain transportation through the Sound in the eighteenth century.

The central part of the analysis (§5) deals with an aspect of a merchant's business decisions that is often overlooked. The main question of this part of the analysis is: where did merchants look to fulfill their needs for maritime transport and why precisely there? What is reviewed here is the geography of *Dutch* maritime transportation services insofar as the transportation of ship loads of grain through the Sound at Elsinore is concerned. We focus on Dutch supply of maritime transport, but take into account both Dutch and non-Dutch demand, thus highlighting a particular topic in the study of early-modern commercial exchange: how does trade affect the maritime transport sector?

22. Treated extensively in: A.E. CHRISTENSEN, 1941, p. 241-290; W. SCHELTJENS, 2011, p. 115-147.

Figure 1. Total volume of Baltic grain transports, 1699-1795²³

Source. STR online.

Crisis and stagnation (1700-1760)

With the heyday of Baltic grain trade situated in the first half of the seventeenth century²⁴, the eighteenth century announced itself as a difficult period, disturbed by war in Western Europe (Spanish War of Succession, 1702-1713) and in the Baltic (Great Northern War, 1700-1721). A period of depression started in the late 1690s, lasted until about 1720 and was followed by a period of stagnation accompanied with great instability between 1720 and 1760²⁵. Annual fluctuations were enormous throughout this period, but despite a few peaks in the volume of grain shipped through the Sound (1713, 1729, 1740)²⁶, the average volumes shipped would remain fairly constant until the mid-1760s²⁷ (see Figure 1). The Amsterdam grain market served mostly its internal market during this period of stagnation²⁸.

Three factors have been put forward by Milja Van Tielhof as possible explanations of this enduring state of stagnation in the first half of the

23. Index 100 is set at 652,231 litres of grain, which corresponds to the average volume of grain transported on one route in one year.

24. M. VAN TIELHOF, 2002, p. 50.

25. M. MORINEAU, 1983, p. 36-39; M. VAN TIELHOF, 2002, p. 51.

26. For details, see Appendices 1 and 2.

27. M. VAN TIELHOF, 2002, p. 57.

28. J. DE VRIES & A. VAN DER WOUDE, 1995, Ch. 10.2.1. Similarly, Michel Morineau argued that the importance of re-exports of grain from Amsterdam should not be exaggerated: « À [l']allure épisodique de la réexportation [des céréales à partir d'Amsterdam] s'oppose, en partie, une constante rémanence des besoins de l'approvisionnement intérieur », See: M. MORINEAU, 1983, p. 33-34.

eighteenth century. Grain prices declined after 1662, population growth began to slow down or even decline in many regions in Europe, while grain cultivation was intensified, and political and economic issues at the supply side sometimes severely obstructed the grain trade²⁹.

The structure of Baltic grain trade in the first half of the eighteenth century is fairly simple (see Figure 2). Demand for Baltic grain was concentrated in the Netherlands, with small shares being distributed to the ports of Bremen and Hamburg, to Norway (primarily Bergen), the Swedish Westcoast and Scotland (Firth of Forth). Demand in England, France and Portugal was subject to external circumstances, like crop failures, and did not have the same regularity as the above-mentioned destinations of Baltic grain. Important is the emergence of England as a grain-exporter in the first quarter of the eighteenth century, which certainly had a negative effect on the size of Amsterdam's market for Baltic grain³⁰. Between 1710 and 1760, about 50% of all grain imported to Amsterdam came from England³¹.

With an average annual share exceeding 70% of all grain shipped through the Sound between 1700 and 1760, the dominance of Amsterdam is overwhelming³². The two moments when Amsterdam's share dropped suddenly to about 18%, in 1737 and in the 1750s, can be explained by external circumstances. In 1737, crop failure in the Baltic provoked a temporary shift in the direction of grain transportation. In 1756, grain transports were diverted to Bremen, Hamburg, Bergen and Gothenburg, probably under the influence of the Seven Year's War (1756-1763). This period marked the end of an era for Amsterdam. From 1763 onwards, Amsterdam's share would never again reach the same heights as in the first half of the eighteenth century. From more than 80% during the Great Northern War (1700-1721) and around 70% between 1720 and the late 1750s, Amsterdam's share dropped to a mere 40% after 1760 (see Figure 3).

29. M. VAN TIELHOF, 2002, p. 52-54; J. DE VRIES & A. VAN DER WOUDE, 1995, Ch. 10.2.1.

30. J. DE VRIES & A. VAN DER WOUDE, 1995, Ch. 10.2.1; D. ORMROD, 2003, Ch. 7: England, Holland and the International Grain Trade.

31. J. DE VRIES & A. VAN DER WOUDE, 1995, Table 10.2. Even so, David Ormrod argues that England's grain surplus accounted only for about 8% of its total domestic production. See: D. ORMROD, 2003, p. 207.

32. For details about the estimated volumes shipped annually to the main demand locations, see Appendix 1.

Figure 2. The spatial structure of Baltic grain transports in 1740

Figure 3. *Share of Amsterdam in grain traffic through the Sound, 1700-1783*

Source. STR online.

The supply of grain was dominated by Danzig and Koningsbergen, and completed by Russia's new possessions on the eastern shore of the Baltic (Riga, Reval, Pernau and Arensburg), two ports in the Kingdom of Prussia (Memel and Pillau), and two ports in the Duchy of Courland and Semigallia (Windau and Libau)³³.

The participation of Russia's ports in the Baltic, primarily of Riga and Reval, was the subject of a series of Russian tax regulations and domestic economic policies, which in the long run proved to be beneficial to these ports³⁴. A tax rule of 1731, in which the level of taxation in Riga was equalled to that of Danzig and Koningsbergen marked the breakthrough of Riga as a grain supplier³⁵. The same rule was applied to Pernau and Reval in 1732 and 1733 respectively³⁶. Another reason for the breakthrough of Russian ports were novel practices in agriculture, namely the use of highly fertile land in newly settled regions³⁷. Still, the Russian government had to deal with crop failures on various occasions, forcing them to prohibit grain exports in 1742, 1744, 1745-1752 and in 1756³⁸.

33. For details about the estimated volumes of grain shipped annually through the Sound from the main supply locations, see Appendix 2.

34. M. VAN TIELHOF, 2002, p. 60.

35. A. SEMENOV, 1997, p. 146-148.

36. A. SEMENOV, 1997, p. 147.

37. M. VAN TIELHOF, 2002, p. 60.

38. A. SEMENOV, 1997, p. 147-148.

Figure 4. *The Dutch Republic as destination of grain transports through the Sound, 1699-1795*

Source. STR online.

A particular position in the supply of grain was held by Swedish Pomerania, which had a relatively large number of small grain exporting ports from where shipments were carried out through the Sound on a regular basis. It is likely that Swedish Pomerania catered the Swedish home-market first and that Sound traffic was only an additional activity.

Revival (1760-1780)

In the 1760s a period of renewed growth started as a consequence of rising grain prices provoked by renewed population growth³⁹. This relatively steady period was disrupted only by the Fourth Anglo-Dutch War (1780-1784) and crop failure in France in 1788⁴⁰. But while in most European countries population grew and prosperity increased in the second half of the eighteenth century, this was not so in the Netherlands⁴¹. The total volume of grain transported through the Sound rose quickly after 1760, but the volume of grain transported to the Dutch Republic stayed roughly at the same level as in the first half of the eighteenth

39. M. VAN TIELHOF, 2002, p. 58-60.

40. M. VAN TIELHOF, 2002, p. 58-59; J.A. FABER, 1988, p. 100-102.

41. J.A. FABER, 1988, p. 93-94; J. DE VRIES, 1959.

Figure 5. *Share of main destinations of Baltic grain in the Dutch Republic, 1760-1795*

Source. STR online.

century (see Figure 4). This resulted in a declining share of the Dutch Republic in total grain transports from the Baltic after 1760⁴².

After 1760, the spatial structure of Baltic grain trade started to change rapidly. First of all, the number of cities executing demand for grain increased significantly, with demand spread widely along the Dutch coastline, going as far South as Vlissingen and as far East as Delfzijl. A new concentration of demand for Baltic grain emerged in South-Holland, notably in Schiedam en Rotterdam, where jenever distilleries required more and more grain to fulfill the needs of an increasing number of consumers (see Figure 5)⁴³.

Demand for grain also spread along the East-Frisian coastline, with Emden as its main port. Along the Swedish West Coast and in Southern Norway, demand for Baltic grain became widely spread, most likely as a result of the economic prosperity and related population growth that was provoked by the so-called Bohuslän herring period that had started back in 1752⁴⁴. Demand in England and Scotland started to rise in the late 1760s and grew rapidly to a wide-spread, steady demand by the early 1780s. Not only ports located on the English East Coast were now involved in demand for Baltic grain, Liverpool also started to receive loads of grain

42. D. ORMROD, 2003, p. 231.

43. D. ORMROD, 2003, p. 221-225; K. SLUYTERMAN, 1995; J. VAN RIEMSDIJK, 1916.

44. A.V. LJUNGMAN, 1878, p. 220-239; A. CORTEN, 2001; S. LILJA, 1995, p. 50-76.

Figure 6. The spatial structure of Baltic grain transports in 1783

from the Baltic (see Figure 6). Clearly, England and Scotland were no longer capable of fulfilling their own demand for grain⁴⁵. In addition to a process of diversification in the traditional markets for Baltic grain, the emergence of demand concentrations in Southern Europe, mostly along the French Atlantic Coast and in Portugal, but also in the Mediterranean, are evidence of a second structural change on the demand side. A third structural change on the demand side occurred in the Baltic proper, where Sweden emerged as a grain importing country, procuring grain mostly from Pomerania and from the Baltic provinces of Russia⁴⁶. This reduced the surpluses available for export out of the Baltic sea region⁴⁷.

On the supply side, a structural change took place in the last quarter of the eighteenth century, when the first partition of Poland in 1772 led to the isolation of Danzig from its hinterland⁴⁸. The ports of Pillau, Königsberg and to a lesser degree Memel benefited most from the successful isolation of Danzig; the economic policies of the Prussian government were successful⁴⁹. Russian ports in the Baltic, like Riga, Pernau, Reval, and St. Petersburg also benefited from isolation of Danzig and from the fact that Russia began to produce grain surpluses on a regular basis⁵⁰.

Summary

In general, the evolution of the spatial structure of Baltic grain transport after 1760 has been accurately described by Johannes A. Faber as a process of “enlargement, dispersal and stabilisation of the [European] market” that made it no longer necessary for the staple function to be confined to the Netherlands⁵¹. While the Dutch Republic continued to play a major role in Baltic grain transport, their position was no longer one of clear dominance. The shares of England and Scotland and of other European countries increased significantly and, taken together, their volume surpassed that of the Netherlands (see Figure 7).

45. D. ORMROD, 2003, Ch. 7; J.A., FABER, 1988, p. 88.

46. M. VAN TIELHOF, 2002, p. 61.

47. M. VAN TIELHOF, 2002, p. 61.

48. M. VAN TIELHOF, 2002, p. 61.

49. M. VAN TIELHOF, 2002, p. 61.

50. M. VAN TIELHOF, 2002, p. 60.

51. J.A. FABER, 1988, p. 94.

Figure 7. *Geography of grain exports from the Baltic, 1699-1795*

Source. STR online.

4. Routes

Inevitably, the changes in the spatial structure of Baltic grain exports in the eighteenth century had profound effects on the routes that these exports followed. According to the Danish Sound toll registers for the years 1699-1795, grain transportation through the Sound was executed on 3,297 different routes, connecting more than 300 export locations and more than 500 import locations. The lion's share of grain traffic, however, was concentrated on a relatively small number of routes.

In 1700, for example, twenty-one routes accounted for almost 90% of all grain transports, the dominant routes being Danzig-Amsterdam, with a share of 43% and Koningsbergen-Amsterdam with a share of 26%. Additionally, the routes Danzig-Harlingen (6%), Reval-Amsterdam (5%) and Libau-Amsterdam (3%) accounted for another 15% of all grain transports in 1700. The total number of different routes in 1700 was 92, the majority of them accounting for very small volumes shipped.

In the first decades of the eighteenth century contraction resulted in increasing shares of the dominant routes in total grain distribution, however, this was no longer the case after the Great Northern War. In the long run, structural changes at the supply and demand side of the grain market, had reciprocal effects on individual routes. The shares of the traditional routes Danzig-Amsterdam and Koningsbergen-Amsterdam in total grain transportation from the Baltic underwent two phases of decline, one after

Figure 8. *Share of traditional routes in grain transports through the Sound, 1700-1795*

Source. STR online.

Figure 9. *Number of different routes of grain transportation through the Sound, 1700-1795*

Source. STR online.

1740 and a second, decisive one after 1772. The loss of market share of both routes in a period of renewed growth is yet another indication of the changing spatial structure of Baltic grain transport in the eighteenth century (see Figure 8).

In general, the spatial structure of the distribution of Baltic grain had a pattern in which contraction coincided with a smaller number of routes and growth was met by an increasingly diverse distribution pattern. The latter is particularly evident in exceptional years, like 1713, 1729, 1737 and 1740, and obtained a more permanent character during the period of renewed growth after 1760. The total number of different routes of grain transportation reached a peak in the mid-1780s, when in one year, Baltic grain was transported on almost 500 different routes (see Figure 9).

A major historiographical issue related to the increasingly complex spatial structure of Baltic grain transport in the course of the eighteenth century is that of the importance of the so-called *voorbijlandvaart*, by which routes are meant that bypass Amsterdam or other Dutch ports to connect places in Southern Europe directly with places in Northern Europe⁵². If, indeed, the Dutch maritime transport sector managed to secure its market position by establishing direct connections bypassing the Netherlands, this could be seen as the successful adaptation of the maritime transport sector to new economic circumstances. This issue will be treated in detail in paragraph 5.

The growing number of routes involved in Baltic grain transport and the dispersal or decentralisation of Amsterdam's economic functions⁵³ indicate that there is no single route that came in place of formerly dominant Danzig-Amsterdam and Koningsbergen-Amsterdam. Indeed, a comparison of the main routes and their respective average volumes and shares of total grain transports in a number of given years makes clear that the Baltic grain market became an increasingly complex market in which many parties were involved, both at the supply and at the demand side of business (see Table 1).

For reasons of clarity, we will refer to the routes from Danzig, Koningsbergen, Riga, Reval, Libau and Windau to Amsterdam as "traditional" routes and to routes from the Baltic ports to Rotterdam and Schiedam as "emerging" routes.

52. A.E. CHRISTENSEN, 1941, p. 246-248.

53. J.A. FABER, 1988, p. 92.

Table 1. *Main and emerging routes of Dutch grain transport from the Baltic, with indexed average volumes and shares*

Route	1720-1729	1750-1759	1780-1789
<i>Traditional routes %</i>			
Danzig-Amsterdam	51,1	34,5	4,9
Koningsbergen-Amsterdam	11,9	6,2	7,3
Libau-Amsterdam	0,5	2,3	3,4
Riga-Amsterdam	0,4	0,5	2,4
Reval-Amsterdam	0,4	0,7	0
Pillau-Amsterdam	1,9	2,9	7,9
Windau Amsterdam	0,5	0,5	1,2
<i>Emerging routes %</i>			
Windau-Schiedam	0	0	0,5
Libau-Schiedam	0	0,3	4,0
Koningsbergen-Rotterdam	0,1	1	0
Pillau-Schiedam	0	0	0,1
Danzig-Rotterdam	0,2	1,4	0,3
Libau-Rotterdam	0	0,5	1,5
Riga-Schiedam	0	0,2	1
Riga-Rotterdam	0	0,1	1,1

Source. STR online.

5. Services locations

In this paragraph, we will analyse how the Dutch maritime transport sector reacted to the changes in volume, spatial structure and geography of distribution routes that were described above. To this end, the evolution of turnover and operational patterns on the traditional and emerging routes of Baltic grain transport and the market shares of the Dutch maritime transport sector and its constituent parts (*i.e.* individual shipmasters' domiciles) on these routes are examined. Evolving market shares are necessary to gain insight in the demand for Dutch maritime transport on the traditional and emerging routes of Baltic grain, while turnover and operational patterns serve as indicators of the presence and strength of path dependence in the operational patterns of Dutch shipmasters.

Spatial structure

The Dutch market for maritime transport in the eighteenth century was concentrated in the Dutch Republic's main centres of trade, like Amsterdam and Rotterdam, and in the provincial areas surrounding these centres of trade, so basically, along the entire Dutch coastline. A concentration of maritime transport services related to the Baltic area is found North and North-East of Amsterdam, in West-Frisia, Frisia and the Province of Groningen, with a predominance of Frisian shipmasters in the first half of the eighteenth century and a shift towards the Province of Groningen in the second half of the eighteenth century (see Figure 10)⁵⁴.

For the Dutch communities that were involved in Baltic grain transport, their degree of participation was subject to changes in the spatial structure of the grain trade and the operational strategies adopted by the shipmasters belonging to these communities. A first distinction must be made between routes on which Dutch shipmasters had the dominant share in the transportation of grain, routes on which they were a minority and routes where their share was negligible. The latter were mostly routes that did not have a "Dutch" component, i.e. routes linking places in the Baltic Sea with places along the coastline of the North Sea. Dutch shipmasters had no share whatsoever in routes to England, Scotland, Norway and Bremen. Many of these routes, except those to Norway, were dominated by shipmasters originating from the port of destination of Baltic grain. For example, between 1770 and 1795, when England and Scotland became large importers of Baltic grain, the average share of shipmasters from Newcastle on grain transports between Danzig and Newcastle exceeded 90%. On the other hand, routes that emerged later in the eighteenth century, like Danzig-Liverpool, were dominated by shipmasters from Danzig (average share of 72% of all shipments)⁵⁵. Similarly, the grain routes on which Dutch shipmasters had a major share linked places in the Baltic Sea to Amsterdam. However, the market share of the Dutch underwent dramatic changes in the course of the eighteenth century, even on the most traditional of its routes (*in casu*, the six main ports in the Baltic that provided the bulk of grain imports to Amsterdam).

On the route from Danzig to Amsterdam, the share of Dutch shipmasters in the transportation of grain was exceptionally high until 1772. Then, rapid decline set in. The same happened on the Koningsbergen-Amsterdam route, although the decline after 1772 was slightly less dramatic. On the

54. A.M. VAN DER WOUDE, 1972, p. 384; P.C. VAN ROYEN, 1998, p. 86-87.

55. Unfortunately, a comprehensive survey of all of these routes lies outside the scope of this paper.

Figure 11. *Grain transports by shipmasters from Amsterdam and Danzig on the traditional routes*

Source. STR online.

other traditional routes, the situation was similar: grain transports from Riga to Amsterdam were dominated by Dutch shipmasters until the Fourth Anglo-Dutch War of 1780-1784. Dutch presence on the Reval-Amsterdam, Libau-Amsterdam and Pillau-Amsterdam routes followed the same course of development as the other traditional routes, but their significance was generally smaller. It can be assumed that these routes were complementary to the routes from Danzig and Königsbergen to Amsterdam; the same shipmasters' domiciles dominated all of them, with the exception of Pillau-Amsterdam after 1760, where shipmasters from the Province of Groningen obtained a dominant share. However, even in this case, the share of Dutch shipmasters as a whole on the Pillau-Amsterdam route also declined from 1772 onwards. A typical evolution on all traditional routes is the increasing share of shipmasters from the Baltic ports in grain transports to Amsterdam (see Figure 11).

In general, Dutch dominance on the traditional routes from the Baltic grain outlets to Amsterdam seems to have suffered a great deal from the deterioration of Amsterdam's staple function in the eighteenth century. Even though the quantitative changes in the volume of grain transports show a positive trend for the Dutch Republic as a whole (see Figure 4), the quantities shipped to Amsterdam declined and the effect of this negative trend was sharpened by a decline in the Dutch share of maritime transport on these traditional routes. This, however, does not mean that the shipmasters involved in grain transport on the traditional routes all dropped out of business once the decline of the staple market set in. On the contrary, as

was described above, increasing diversification in the grain market led to the emergence of new routes, especially after 1760. It is the goal of the remainder of this paragraph to gain insight in the ways in which the Dutch maritime transport sector dealt with them.

Some of the emerging routes were for several reasons inaccessible for Dutch shipmasters, like the previously introduced routes to England, Scotland, Norway and Bremen. Others can righteously be considered a (literal) prolongation of the traditional routes to Amsterdam. These routes bypassed Amsterdam to connect places in the Baltic directly with places along the Atlantic Coast and in the Mediterranean, an operational practice that is better known as *voorbijlandvaart* in Dutch historiography. Yet other routes were “new” to the Dutch commercial system, connecting the traditional Baltic grain outlets to “new” destinations like Schiedam and Rotterdam.

Both in the case of the so-called *voorbijlandvaart* and on the emerging routes it can be observed how these routes attracted more and more attention as the decline of Amsterdam’s staple market continued. However, when the shares and origins of Dutch shipmasters active on these routes are compared with the routes to Amsterdam, it becomes clear that the *voorbijlandvaart* was not a replacement of the traditional routes to Amsterdam. Clearly, Dutch shipmasters did not manage to stay in business through engagement in *voorbijlandvaart*. Its character was too sporadic for this strategy to be successful in the long run.

Operational patterns

In order to establish the relative importance of the *voorbijlandvaart* and of the emerging routes, it is necessary to look at transportation routes from the perspective of shipping communities. Calculation of respective shares of routes in the overall transportation pattern of one shipping community allows to assess the relative importance of *voorbijlandvaart* and emerging routes for Dutch shipping communities active in grain transport through the Sound. In the following survey, we will limit ourselves to the routes of the following Dutch shipping communities: Ameland, Amsterdam, Delfzijl, Dokkum, Groningen, Harlingen, Heerenveen, Hindeloopen, Hoorn, Joure, Lemmer, Makkum, Pekela, Rotterdam, Sneek, Stavoren, Terhorne, Terschelling, Texel, Vlieland, Woudsend and Workum. All of these shipping communities were regular participants on the traditional and/or emerging routes introduced above (see Table 1). Using the strength of the correlation coefficient between the participation of individual Dutch shipmasters’ domiciles and the traditional and emerging routes as a first

indication of different operational strategies being applied by different shipping communities, a categorisation of shipmasters' domiciles in three main groups could be established⁵⁶.

The first group consists of communities with a very strong positive correlation coefficient, a time-span covering the entire century on the traditional routes, and no or insignificant correlation on the emerging routes. The members of this group are the Wadden Islands, Harlingen, Hindeloopen and Hoorn. The level of engagement of shipmasters from these communities in *voorbijlandvaart* was limited, both in terms of volume and in terms of duration. Shipmasters from Ameland, for example, shipped grain from Danzig, Koningsbergen and other ports in the Baltic to destinations along the Atlantic Coast on special occasions and – apart from the extraordinary year 1770 – in small amounts.

To complete this picture, it is necessary to add that on some occasions, shipmasters with a strong positive correlation on the traditional routes to Amsterdam also supplied their transportation services on routes from the main grain outlets to Bremen, Emden and Hamburg. The extent of this diversion was limited to a small number of years and to small quantities of the overall grain transport secured by the communities in question. For example, Bremen, Emden and Hamburg received Baltic grain transported by shipmasters from Ameland in the years 1719-1726, 1728, 1731, 1762-1763, 1767-1768, 1771-1772 and 1775.

Sporadically, and, again, in small quantities, the shipping communities of the first group were engaged in shipments of grain to other ports in the Dutch Republic than Amsterdam. For example, this was the case for 24,8% of Ameland's grain transports in 1700, 7,5% in 1702, 7,8% in 1719 and 0,9% in 1726; all grain destined for the Frisian town Harlingen. In 1735, 1,6% of Ameland's grain transports went from Koningsbergen to Groningen, in 1736, 3,7% went from Riga to Dordrecht and, in 1742, 14,5% went from Koningsbergen to Zaandam. Rotterdam appeared as a destination of grain transports executed by shipmasters from Ameland in 1753 (7,1%) and 1761 (8%).

The changes in the spatial structure after 1760 resorted very little effect on the routes of shipmasters belonging to the first group. The decline of the Amsterdam staple market resulted in an general downturn in the activities of these shipmasters (see Figure 12). *Voorbijlandvaart*, as we have

56. For details, see Appendix 3.

Figure 12. *Turnover and operational patterns of the first group of Dutch shipping communities, 1700-1795*

Source. STR online.

Note. BEH = Bremen, Emden, Hamburg.

seen, played a marginal role, other ports in the Dutch Republic were hardly frequented by shipmasters belonging to the first group, and Bremen, Emden and Hamburg were destinations only on rare occasions. On top of that, the size of the shipping communities belonging to the first group seems to have declined in general and was not limited to grain transports alone⁵⁷. The position of Hindeloopen within the first group may be somewhat surprising: in historiography, the shipping community is known to be specialised in timber transportation rather than in grain transportation⁵⁸. Nevertheless, on the basis of the formal criteria applied in this survey, Hindeloopen had to be included in the first group.

To complete the survey of turnover and operational patterns of the first group, it is necessary to pay special attention to the activities of the shipping population of Amsterdam. This population behaved like the first group, but its size allowed to participate (be it to a limited extent) in grain transports on the emerging routes without having to abandon the traditional routes to Amsterdam (see Figure 13). Remarkable is that the part of Amsterdam's shipping community that was involved in Baltic trade

57. Clé Lesger, for example, mentions that the presence of ships domiciled at Hoorn declined from 150 to 180 in the third quarter of the seventeenth century to eleven at the end of the eighteenth century. See: C.M. LESGER, 1990, p. 139, p. 147.

58. J.A. FABER, 1973, p. 274-281; J.Th. LINDBLAD, 1997, p. 103-114; S. LOOTSMA, 1940, p. 218-296; P. DEKKER, 1977, p. 229-262.

Figure 13. *Turnover and operational patterns of the shipping community of Amsterdam, 1700-1795*

Source. STR online.
Note. BEH = Bremen, Emden, Hamburg.

Figure 14. *Turnover and operational patterns of the second group of Dutch shipping communities, 1700-1795*

Source. STR online.
Note. BEH = Bremen, Emden, Hamburg.

participated predominantly, and on various occasions almost exclusively, in grain transports. The Amsterdam shipping community, insofar as it was involved in Baltic trade, was thus characterised by a high degree of cargo specialisation.

The second group of communities comprises those of which the grain shipping population has a relative low positive correlation, an N-count that is relatively low and a time-span that covers (almost) the entire century⁵⁹. This indicates that the presence of shipmasters from these communities was not continuous on the traditional routes and that – in fact – the traditional routes were replaced by emerging routes in the course of the eighteenth century. A feature that distinguishes the communities of the second group from the other communities in this survey is the presence and importance of the home-market in the shipping routes. The communities of the second group, Rotterdam, Groningen and Delfzijl, have their own portal functions and are not merely domiciles of a population of maritime shipmasters. In the case of Rotterdam, the home-market gained importance in the course of the eighteenth century and led to the abandonment of the traditional routes after 1760. In the case of Groningen and Delfzijl, the home-market had a larger impact on shipping routes of their respective populations before 1760, than it had afterwards (see Figure 14).

For shipmasters from Rotterdam, the home-market was the primary destination for the first time in the years 1738-1744, for the second time in the years 1751-1755 and then continuously after 1760. *Voorbijlandvaart* was only of marginal importance throughout the entire eighteenth century, as was the case for shipping to Bremen, Emden or Hamburg. In both instances, the diversion from the dominant routes only occurred occasionally, never obtaining a more regular character.

For shipmasters from Delfzijl, the home-market was very small and therefore never a primary destination. Nearby Emden, on the other hand, was a more important destination for shipmasters from Delfzijl than was Amsterdam. A first period during which shipmasters from Delfzijl were active as grain transporters in the Baltic area lasted from 1725 until 1744. Throughout this period, Danzig and Koningsbergen were the main supply ports and Amsterdam and Emden were the main destinations. During the second period of continuous presence of shipmasters from Delfzijl, after 1760, routes starting from Danzig disappeared almost completely, while

59. For details, see Appendix 3.

routes starting from Koningsbergen, Libau and Pillau gained importance. The share of Amsterdam as a destination for shipmasters from Delfzijl increased, while shipments to Emden were renewed only for a short period of time during the 1760s. The engagement of shipmasters from Delfzijl in serving ports other than Amsterdam after 1760 was low and thus contrary to the developments witnessed in the activities of shipmasters from Rotterdam and from communities of the third group (see below). Delfzijl's shipping community did not participate in grain shipments on the emerging routes to the Maas area (mainly Schiedam and Rotterdam). Similarly low was the presence of shipmasters from Delfzijl on routes between the Baltic and Bremen or Hamburg and on the *voorbijlandvaart*.

The situation for shipmasters from Groningen marks a third way within the second group. The presence of shipmasters from Groningen coincides with that of shipmasters from Delfzijl. During a first period between 1725 and 1744, Danzig-Groningen and Koningsbergen-Groningen were the dominant routes, exceeding Danzig-Amsterdam and Koningsbergen-Amsterdam in terms of volume and regularity. After 1760, Amsterdam gains importance as destination served by shipmasters from Groningen, but the home-market does not cease to exist. Small quantities of grain continue to be shipped from the Baltic ports to Groningen after 1760. As was the case for shipmasters from Delfzijl, routes between the Baltic and Bremen, Emden or Hamburg and routes of the *voorbijlandvaart* were occasional and never obtained a regular character. More important, however, is that – like Delfzijl – the Groningen shipping community only marginally participated in grain shipments on the emerging routes to the Maas area. Similar to the operational pattern of shipmasters from Groningen is that of the population of shipmasters of the provincial community of Pekela, which participated in grain transports through the Sound for the first time in 1760 and was predominantly involved in grain shipments from Pillau to Amsterdam.

The case of Pekela is interesting since it coincides with the emergence of the shipping community of Papenburg in East-Frisia on the same route from Pillau to Amsterdam, providing a clear link between the development of peat-bog digging and maritime transport in this region in the second half of the eighteenth century.

The third group of communities is characterised by a low positive correlation, low N-count and limited time-span (see Figure 15). The communities belonging to this group were present on both the traditional

Figure 15. *Turnover and operational patterns of the third group of Dutch shipping communities, 1700-1795*

Source. STR online.

Note. BEH = Bremen, Emden, Hamburg.

and the emerging routes. Interestingly, all of the communities belonging to the third group were located in Frisia. The third group consists of the following communities: Dokkum, Joure, Lemmer, Makkum, Sneek, Stavoren, Terhorne, Workum and Woudsend⁶⁰.

Voorbijlandvaart was a matter of occasion for the third group, like it was for the other shipping communities in this survey. But there is a significant difference: when the opportunity was there, shipmasters belonging to communities of the third group responded amply to this occasional demand, using the majority of their carrying capacity to serve destinations in France, Portugal and Spain. Just as quickly as they appeared on these routes, they moved back into their previous Amsterdam-dominated pattern when the opportunity had passed.

In the operational patterns of shipmasters from communities of the third group, the spatial change of routes from Danzig-Amsterdam and Koningsbergen-Amsterdam to Libau-Maas area and Riga-Maas area is reflected, indicating the presence of a business attitude quite different from that of the first group, which was marked by lock-in on routes to Amsterdam.

60. For details, see Appendix 3.

Figure 16. *Share of Dutch shipmasters in grain transports through the Sound, 1700-1795*

Source. STR online.

Market shares

The changing distribution pattern after 1760, which was in itself a consequence of structural changes in the supply and demand of Baltic grain, led to a recomposition of the spatial structure of the Dutch maritime transport sector in the last quarter of the eighteenth century (see Figure 10), and this spatial evolution is reflected in the involvement of Dutch shipping communities in grain transportation through the Sound. The characteristics of this recomposition were described in the previous paragraph.

In this paragraph, we will take a closer look at the evolution of the market shares of Dutch shipmasters in grain transportation through the Sound in the eighteenth century. In combination with the preceding analysis of spatial structure of the Dutch maritime transport sector and of its operational patterns, this analysis is deemed to provide us with a comprehensive picture of the changing geography of demand for Dutch maritime transport services in the eighteenth century grain trade.

At the most general level, it can be witnessed that the share of Dutch shipmasters in grain transports through the Sound declined from around 70% in the period 1700-1740 to around 45% in the period 1740-1780 and to around 15% after the Fourth Anglo-Dutch War of 1780-1784 (see Figure 16). In terms of market share, the Dutch maritime transport sector

Figure 17. *Market position of shipmasters from the Dutch Republic and from the Baltic on traditional routes, 1700-1795*

Source. STR online.

Figure 18. *Market position of shipmasters from the Dutch Republic and from the Baltic on emerging routes, 1700-1795*

Source. STR online.

lost its dominance only in 1780, but the decline set in much earlier. When the market position of shipmasters from the Dutch Republic on traditional and emerging routes is now observed, it becomes clear that on both types of routes the rise of a maritime transport sector located in the Baltic coincides with the decline of the Dutch maritime transport sector (see Figure 17).

On the Figure 18, it can be seen that the market position of Baltic and Dutch shipmasters alike is fairly constant between 1760 and 1780. It is only after 1784 that the share of Baltic shipmasters surpassed that of the Dutch, bearing witness of the significant changes in the Dutch maritime transport sector's operational patterns that were described in the previous paragraph. Baltic shipmasters active on the traditional routes came predominantly from Western-Prussia (Danzig and Elbing), Courland (Libau), Mecklenburg (Ribnitz, Rostock) and Pomerania (Barth, Damgarten, Neukalden, Stralsund and Wolgast). At the same time, it can be seen that shipmasters from other nations became an increasing threat to the Dutch maritime transport sector and even dominated grain transports through the Sound between 1781 and 1786. The dominant "other" regions supplying maritime transportation services in this period was East-Frisia (Emden, Juist and Norden). The same scenario of development after 1760 repeats itself on the emerging routes. The only substantial difference is that on these routes the market position of the Baltic maritime transport sector was even stronger than on the traditional routes.

6. Explanation

Throughout the analytical paragraphs of this paper, evidence has been gathered of the spatio-temporal evolution of the Baltic grain trade in terms of volume, locations of demand and locations of supply. Additionally, it was shown how these developments in the structure of the Baltic grain trade affected the direction and use of grain transportation routes. Structural changes in the geography of demand for grain led to the emergence of new grain transportation routes in the course of the eighteenth century, provoking a shift from a clear bilateral trade pattern to a diversified pattern in which many locations were involved, but none was strictly dominant. On the basis of this evidence, it could be established that these changes had reciprocal effects on the spatial structure of the Dutch maritime transport sector. In the following paragraph, an attempt will be made to explain these changes in the structure of the Dutch maritime transport sector chrySTALLING out three spatial developments: (1) a movement from the Dutch North-Western coastline (Wadden Islands and South-West Frisia) inland to locations in

South-East Frisia, (2) a shift in the organisation of maritime transport from the demand side of business (primarily Amsterdam) to the supply side of business (ports in the Baltic) and (3) integration of shipping communities in the Province of Groningen in the Dutch commercial system under the influence of increased demand for peat in the industrial centres of the Dutch Republic (Amsterdam, Maas area).

Shipmasters from the Wadden Islands, Harlingen, Hindeloopen and Hoorn were major victims of the decline of the Amsterdam staple market and the subsequent decline of the traditional grain routes linking grain outlets in the Baltic to Amsterdam. Apparently, these shipping communities did not have the necessary means to react to such structural changes in the grain trade; their decline was general and not limited to grain transports alone, and it seems fair to suggest that the rather rigid operational strategies of these shipping communities did no longer answer to the needs of the Baltic grain business and prevented them from entering new markets. Still, the course of development of these shipping communities is not entirely clear nor univocal. The participation of shipmasters from Hindeloopen in grain transports from the Baltic, for example, seems to have been rather exceptional within its community of shipmasters. Hindeloopen was known to be specialised in timber transportation from Norway in the seventeenth and from the Gulf of Finland during much of the eighteenth century. It seems that only a small group within this community was specialised in grain transports. The decline of the shipping community of Hoorn in the eighteenth century has been analysed before and can be said to be an absolute decline. The same is true for the Wadden Islands, but data that can confirm this is scattered. Regardless, the sudden upswing in the exceptional year 1770 is rather puzzling (see Figure 12), since it shows that these shipping communities did not just cease to exist. It is unknown what kind of activity replaced the grain transports to Amsterdam. There is no evidence that supports the hypothesis that these shipmasters shifted to shorter distances, not entering the Baltic, at least as far as grain shipments to Amsterdam between 1771 and 1787 are concerned (see Figure 19)⁶¹.

One element that unites all the communities of the first group is a decline in the population of each of them, which is likely to have resulted in a decrease of available human capital for the maritime transport sector and, as a consequence, loss of market share.

61. Based on data extracted from the database of the levy of "paalgeld" at Amsterdam in the years 1771-1787. See: G.M. WELLING, 1998. The database itself is available as on-line resource at: <http://www.let.rug.nl/~welling/paalgeld/appendix.html>

Figure 19. *Origin of grain imports in Amsterdam, 1771-1787*

Source. *Database of the levy of Paalgeld at Amsterdam.*

In part, shipmasters from Frisian communities took the place of the previous group, introducing a different business strategy in which flexibility in the choice of cargoes and routes was more important. It was shown that, for some time, these shipping communities could maintain their position in grain transports from the Baltic, especially because of their adaptive behaviour that was necessary to make a successful shift to the emerging routes after 1760. But even so, market share was lost to foreign (non-Dutch) shipping communities, who increasingly occupied the emerging routes.

Despite this general context of decline and loss of market share of the Dutch maritime transport sector and its involvement in the Baltic grain trade, there is an upside to the declining Frisian participation on the traditional routes to Amsterdam after 1760. The shift of the Frisian shipping communities from the traditional routes to Amsterdam to the emerging routes to the Maas area coincided (see Figure 16) with yet another spatial evolution that turned out to be favorable to the shipping population of the Province of Groningen (and across the Dutch border equally to the shipping population of East-Frisia). In this cross-border peat soil region, the increasing intensity of proto-industrialisation put growing pressure upon natural resources. Their exploitation became more and more institutionalised, with soil being

cultivated at a growing pace⁶², which in turn led to the rapid expansion of a regional shipbuilding industry⁶³. It seems that, thanks to the increasing demand for peat in Amsterdam and the maturation of the shipping sector, the communities of the peat soil region in the Province of Groningen could profit from the decline of the participation of the shipping communities on the Wadden Islands, Hoorn and Hindeloopen in grain transports through the Sound.

The general loss of market share on traditional and emerging routes, we may argue, has its foundation in a structural change in the organisation of grain transportation through the Sound and the role of the Dutch commercial system in it. At the beginning of the eighteenth century, it can be witnessed that the transportation of Baltic grain was organised at the demand side of business, in case in Amsterdam. When grain was ready to be transported from the Baltic to Amsterdam, ships would be sent to the Baltic, many of them in ballast. As was shown on several occasions in the previous paragraphs, transportation services were outsourced primarily to third parties who were located relatively nearby (in Frisia, on the Wadden Islands, in the Province of Groningen), but already at the beginning of the eighteenth century, shipmasters domiciled in the Baltic grain ports of Danzig and Königsberg participated in these transportation services to Amsterdam. During the eighteenth century, the organisation of maritime transport would gradually move from the demand side of business to the supply side of business, provoking a major shift in the search of third parties when grain transportation was outsourced. In fact, the Wadden Islands and Frisia could no longer maintain their position as nearby service locations. And, seen from this angle, it is no surprise that shipmasters from Mecklenburg, Pomerania, Courland and Western Prussia could take their place, given their clear locational advantage. In general, it can be said that as long as Amsterdam served as the place where grain transports were organised, the operational knowledge offered by Frisian shipmasters and those from the Wadden Islands was easily accessible. This, however,

62. Michiel A.W. Gerding notes that in the eighteenth century the amount of peat soil cultivated in Pekela rose steadily from about a 9,000 tons in 1700 to more than 72,000 tons in the 1790s. The developments across the border, in Papenburg, for example, were similar, with cultivation increasing from 1,800 tons in 1700 to 16,200 tons in 1798. In both cases, we assume that the traditional peat measure of one “dagwerk” or “Tagwerk” equals nine tons. See: M.A.W. GERDING, 1995, p. 69-71; B. KAPPELHOFF, 1986, p. 322-328.

63. According to Engbert Schut, there were three shipbuilding wharfs in Pekela in 1732, thirteen in 1790 and sixteen in 1811. Again, developments in Papenburg were similar. see: E. SCHUT, 1991, p. 86; B. KAPPELHOFF, 1986, p. 332-340; K.P. KIEDEL, 1986, p. 265-272.

changed dramatically when the supply side of the grain trade started to take care of the organisation of transportation.

Not surprisingly, this line of reasoning is in agreement with developments in the structure of the Dutch commercial system in the eighteenth century and, more precisely, the role of Dutch merchant colonies in it. While until the beginning of the eighteenth century, Dutch merchant communities abroad were “integral to the mechanism of Dutch world-trade primacy”⁶⁴, their role started to change under the influence of the “postal revolution”, leading to a situation where travelling or settling abroad was no longer required⁶⁵. For a large part of their business, merchants could rely on local partners with whom intense correspondence was established. Local merchants were also able to make business, and when maritime transport needed to be organised, it was logical that these merchants would rely increasingly on shipping services that were supplied by communities that were easier to access than the distant traditional shipping services regions of the Dutch Republic.

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64. J.W. VELUWENKAMP, 1996, p. 162.

65. M. MORINEAU, 1983, p. 41-42; J.W. VELUWENKAMP, 2006, p. 121-134; 2008, p. 70-72.

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Appendices

Appendix 1, *Total volume of grain transports through the Sound to main demand locations, 1700-1795 (in litres)*

	<i>Amsterdam</i>	<i>Rotterdam</i>	<i>Schiedam</i>	<i>Bremen</i>	<i>Bergen</i>	<i>Hamburg</i>	<i>London</i>	<i>Göteborg</i>
1700	47,680,239			972,120	955,575	1,194,672	6,182	701,657
1701	79,301,766	139,095		414,194	1,225,206		6,182	366,284
1702	72,904,517			398,739	1,494,946	496,106		43,274
1703	29,706,380			1,228,673	822,340	207,097		60,790
1704	56,104,999			107,670	864,314		9,273	173,096
1705	84,316,498			1,932,648	3,123,873		28,849	349,655
1706	44,059,629			2,061	2,209,557			213,279
1707							15,455	
1708	56,264,283				1,045,166			559,471
1709	87,710,745			44,820	1,046,834			123,640
1710	47,881,136			12,364	1,181,726			1,546
1711	106,081,314	145,277		264,281	152,900			
1712	89,113,633	89,639		1,948,876	500,754	46,365	1,693,353	98
1713	158,644,877	287,463		769,659	833,619		973,150	3,091
1714	95,260,004	618,200		2,095,698	561,174	238,007	229,764	
1715	29,120,188			197,824	152,049	37,092	261,190	
1716	33,436,377	153,005			350,672		371,779	
1717	17,147,646			216,370	701,569	272,781		
1718	28,206,239	179,278		139,095	1,732,074	757,295		
1719	46,042,712			1,075,827	670,747	1,044,758		
1720	24,250,473	122,095		1,739,203	4,614,094	1,851,509	200,915	641,146
1721	58,319,089			491,469	4,672,175	2,192,034		709,994
1722	26,739,442			1,021,576	933,269	3,732,383	414,194	680,999
1723	74,830,817	219,461		4,269,444	635,201	6,007,359	176,187	810,039
1724	95,575,845	618,200		8,743,409	1,117,401	10,583,584	800,410	450,235
1725	96,948,527	715,567		9,396,640	2,099,941	5,821,899		438,470
1726	46,642,500	880,935	417,285	3,156,684	2,500,684	2,326,750	78,110	2,440,881
1727	23,655,900			265,826	2,965,392	6,028		2,492,903
1728	74,549,685	293,645		253,462	1,863,321	565,653	1,856,285	526,601
1729	157,472,366	880,935		3,797,294	3,134,095	1,275,349	18,860,918	367,422

1730	60,484,226	78,821		809,842	2,082,703	185,460	1,276,601	666,241
1731	71,033,604	1,747,703		2,006,059	2,222,579	128,277	548,653	802,932
1732	25,207,351	795,933		268,917	1,708,921			547,483
1733	30,050,385	1,055,061		613,564	1,230,484		165,526	827,362
1734	51,633,039	2,049,333		2,255,657	27,007,901	344,647	403,610	1,011,056
1735	33,817,814	1,576,410		1,840,691	1,529,145	544,016	233,371	525,914
1736	9,063,918	315,282		1,105,033	1,791,576	233,371	155,323	668,920
1737	3,129,650			241,150	2,073,708		139	254,709
1738	38,729,570	1,360,383		2,041,090	1,517,217	198,597	3,091	234,043
1739	74,910,631	3,864,516	321,464	2,774,018	3,314,341	177,733	102	106,640
1740	181,572,872	11,744,282	1,157,580	16,343,108	3,877,032	3,701,641	2,479,474	460,460
1741	133,130,530	6,538,694	608,154	9,508,080	14,299,367	5,039,283	1,714,430	1,543,535
1742	59,674,938	2,273,946	717,112	1,006,636	19,064,125			2,249,213
1743	23,492,542	1,949,391	404,921	1,395,587	8,870,920		123	1,092,799
1744	34,297,492	1,511,499		740,295	2,142,063			195,763
1745	10,088,462	275,099		1,269,628	3,068,078	290,554	70	339,738
1746	12,110,522			3,091	1,439,480		21,440	605,998
1747	22,962,345	384,830	160,732	170,623	2,140,827		137,981	404,847
1748	29,449,976	612,018	268,917	3,623,785	5,234,931		1,252	1,242,604
1749	45,721,192	1,171,489	1,023,121	7,805,187	7,318,172	202,461	278	1,889,541
1750	85,662,391	5,335,066	488,378	4,480,099	3,071,344		1,739	924,323
1751	101,187,375	9,698,603	1,727,436	2,262,406	5,015,675		278	39,490
1752	81,513,527	8,611,268	2,984,361	1,847,984	3,005,857	976,756	139	39,738
1753	41,283,332	10,892,169	2,287,855	6,236,445	3,289,144		1,190	179,278
1754	52,596,962	5,307,657	1,922,602	41,755,364	3,171,196	1,268,938	2,415,069	420,889
1755	25,144,215	812,933	731,525	6,525,732	3,306,745	676,671	56,605	2,536,804
1756	3,390,688			2,580,040	1,361,482	571,835	139	3,019,595
1757	21,389,232			4,666,363	1,609,183	3,864,884	1,530	1,034,866
1758	9,740,204	112,176		110,627	3,340,921	5,123,075	155	1,937,624
1759	28,164,359			1,116,160	2,393,833		1,530	1,467,815
1760	46,550,038	3,121,652	3,803,476	5,697,465	3,386,800	1,180,762	47,554	1,567,575
1761	78,052,216	4,058,483	2,596,748	29,137,589	3,935,398	17,162,875	147,113	1,580,583
1762	25,904,066	2,165,254	1,143,670	26,609,086	3,129,128	25,293,691	89,726	4,772,629
1763	39,115,294	4,960,025	1,675,322	9,260,134	4,752,973	6,968,356	4,516,507	6,725,681
1764	56,300,930	2,735,020	5,419,547	9,555,086	3,848,947	7,421,106	45,021	6,477,952

1765	29,780,198	730,548		7,225,284	9,787,676	12,260,339	771,419	5,113,849
1766	46,312,008	3,155,911	536,031	6,535,945	6,702,578	9,794,796	3,031,878	1,780,733
1767	74,891,843	4,753,701	1,016,939	2,623,615	6,240,720	8,854,788	8,633,438	1,009,693
1768	51,742,074	10,983,053	796,860	3,805,934	4,890,124	6,145,101	3,454,579	6,186,152
1769	68,806,161	6,797,150	2,765,415	1,614,583	9,014,009	1,726,715	131,548	5,553,026
1770	88,706,163	41,668,023	35,692,957	4,753,204	1,597,738	4,915,205	442,131	3,546,896
1771	52,871,080	7,626,572	5,129,403	9,433,116	2,746,494	7,291,595	969,691	365,855
1772	72,053,425	13,636,748	9,361,163	19,351,196	3,582,373	24,219,156	2,937	6,921,997
1773	61,151,174	10,714,092	4,970,372	2,632,632	5,450,038		4,196,599	3,823,940
1774	72,695,871	11,988,905	6,836,641	9,403,858	2,241,597	7,320,203	23,881,757	3,058,141
1775	77,601,031	17,120,188	8,949,311	13,578,304	2,213,589	9,790,779	6,546,762	
1776	52,894,942	10,565,854	6,614,086	1,665,101	3,552,375	318,373	3,246,749	3,306,746
1777	49,431,936	14,273,924	5,455,409	98,680	1,800,672	219,616	3,300,050	6,844,722
1778	70,178,814	17,682,402	7,459,613	2,257,207	3,201,415	5,508,587	1,969,900	5,081,541
1779	32,858,995	7,820,920	13,667,681	4,105,318	4,449,404	445,104	2,829,662	9,170,325
1780	58,224,243	11,372,183	15,533,769	2,317,362	8,823,371	123,640	864,563	5,797,366
1781	26,477,788	2,608,073	7,443,204	3,320,188	4,335,899	1,879,328	1,811,939	5,483,729
1782	35,224,000	5,657,904	11,033,700	697,130	4,616,662	389,466	914,599	13,946,488
1783	61,397,409	12,714,088	22,642,007	9,362,939	9,591,206	6,195,566	19,711,944	20,369,309
1784	63,664,967	14,430,786	20,226,332	13,124,764	14,925,901	25,448,540	16,734,646	17,820,539
1785	66,813,326	8,926,309	23,994,930	5,265,487	14,135,443	15,844,318	5,022,547	13,301,537
1786	18,568,987	765,329	2,223,717	1,218,646	15,340,205	8,311,841	3,336,887	11,135,891
1787	14,872,446	522,897	2,539,985	339,400	6,701,027	2,001,362	678,774	11,128,089
1788	24,365,509	1,443,990	2,907,602	427,313	4,527,899	1,613,174	1,414,306	8,780,959
1789	82,554,011	9,738,447	12,312,013	1,017,118	3,822,399	1,675,367	1,811,397	7,258,519
1790	69,568,568	16,067,149	22,656,433	6,787,466	4,209,287	1,505,348	5,698,090	6,436,987
1791	38,245,220	10,924,459	32,954,659	2,267,539	5,110,557	2,004,777	25,845,788	8,058,318
1792	108,875,798	17,982,526	47,292,886	10,951,595	4,668,183	19,957,218	22,786,954	8,023,783
1793	75,861,183	17,514,147	36,250,622	9,249,224	4,147,079	1,320,479	48,976,276	9,293,202
1794	45,697,967	48,150,592	45,495,737	912,176	3,783,104	352,007	24,233,026	12,641,632
1795	36,463,955	2,355,195	4,514,071	479,706	657,776	1,954,212	19,747,302	8,483,223

Source. STR online.

*Appendix 2. Total volume of grain transports through the Sound
from main supply locations, 1700-1795 (in litres)*

	<i>Danzig</i>	<i>Königsberg</i>	<i>Riga</i>	<i>Pillau</i>	<i>Libau</i>	<i>Memel</i>	<i>Windau</i>	<i>Reval</i>
1700	29,231,587	14,975,895	735,658	748,022	2,420,253	132,913	1,502,226	3,757,111
1701	36,426,862	24,261,259		2,364,615	10,024,113	456,695	3,024,544	561,017
1702	48,740,808	20,532,740	990,666	1,097,305	877,844	115,913	200,915	46,365
1703	13,757,268	14,908,666	321,464		258,099		3,091	
1704	28,120,373	26,096,540	200,915		468,287		200,915	
1705	46,887,637	34,686,944	1,491,923	1,026,212	1,251,855	880,935	1,412,587	
1706	29,637,281	12,508,762	817,570	1,349,994	1,684,080	80,366	440,468	
1707		20,092			4,637			
1708	45,174,932	13,369,685		358,556	638,292	283,342	829,161	
1709	65,400,151	23,307,170		607,382	63,366	212,506	214,825	
1710	25,939,157	17,733,067	111,276	2,596,440	58,729	148,368	182,369	
1711	62,610,781	35,339,197	1,669,717	3,774,111	1,338,403	789,658	108,185	1,720,142
1712	65,655,416	24,331,322	1,848,263	3,993,572	1,344,585	445,877	386,375	499,197
1713	109,844,867	43,731,468	7,939,440	4,930,145	3,397,009	694,702	1,280,447	6,191,273
1714	37,304,764	45,287,926	2,973,800	3,954,935	6,752,290	2,537,196	4,182,123	1,870,313
1715	9,684,103	1,521,287	4,171,696	516,197			77,275	13,245,450
1716	18,954,012	4,784,868	4,001,128	565,653	409,558	43,274	831,479	3,908,570
1717	13,758,814	4,350,840	503,833					1,217,854
1718	24,164,351	7,563,677	159,702	43,274	58,729	51,150	80,366	84,487
1719	42,595,064	8,104,602	193,347	723,294	414,194	312,191	352,374	10,819
1720	23,450,490	13,073,127	27,819	411,103	37,092	18,546		
1721	56,781,473	8,527,983			24,728	544,016	70,320	
1722	31,043,618	4,933,843	309,100	448,195			76,348	
1723	77,858,439	13,183,630		1,401,769	196,279	114,367	454,377	86,548
1724	106,216,183	20,833,444	326,205	1,628,957	918,800	86,033	614,079	3,617
1725	88,689,156	28,568,128	31,210	2,103,941	1,780,416		1,791,235	
1726	41,543,555	8,894,481	200,915	1,478,013	895,077	21,637	1,196,217	3,771
1727	26,190,024	2,344,008		625,928	513,106		83,457	92,730
1728	53,941,995	21,104,253	716,082	7,039,753	834,570		576,472	2,148,245
1729	110,829,775	58,118,528	7,868,012	11,012,903	738,598	296,736	973,665	4,691,906
1730	37,580,430	9,755,196	1,429,588	1,339,949	915,709		825,297	5,346,935
1731	23,000,775	25,335,353	6,433,247	2,744,808	3,998,209	57,184	2,613,441	9,977,671

1732	12,639,904	9,626,550	1,419,027	637,519	982,938		936,573	282,827
1733	21,836,548	7,137,588	534,743	1,404,860	1,278,129		494,560	126,731
1734	19,417,739	13,527,965	8,318,630	3,785,702	2,943,405	545,562	1,890,919	5,019,784
1735	17,395,427	14,159,717	4,210,261	1,186,944	1,548,591	30,910	2,946,136	817,570
1736	3,879,293	1,786,289	1,775,780	417,285	3,290,370	30,910	2,217,793	1,565,437
1737	305,479	255,615	2,545,945		329,192			1,747,590
1738	8,135,677	7,233,759	10,931,837	977,955	2,780,355	114,367	3,281,869	5,016,693
1739	20,825,972	21,286,970	19,151,321	3,058,339	4,713,775		2,715,444	10,375,923
1740	62,376,845	47,674,652	53,340,806	7,776,956	10,423,367	550,198	5,685,895	26,824,595
1741	51,130,157	18,413,372	52,779,933	2,249,269	11,329,545	24,728	4,783,323	12,633,284
1742	38,277,657	32,162,177	1,081,850	394,103	8,344,670	231,825	978,302	
1743	17,862,374	22,014,979	176,187	1,094,214	1,488,317	208,643	641,383	
1744	26,289,058	13,418,623	35,218	9,273	1,454,831		400,285	170,005
1745	4,443,328	4,061,574	3,012,008	173,096	3,489,739	60,275	534,743	908,445
1746	10,067,336	447,577		111,276	32,456			2,818,992
1747	18,596,722	6,181,493	29,365	381,842	550,198	196,794		
1748	27,802,949	11,804,686		2,174,519	2,261,839	1,310,404	108,185	
1749	42,120,698	12,856,023		3,868,387	7,277,244	1,459,725	2,047,788	
1750	55,375,648	27,093,053	223,248	10,040,521	3,387,736	1,142,125	1,196,217	1,514,590
1751	96,402,489	30,070,969	291,618	6,678,724	6,933,113	3,695,832	1,496,044	340,010
1752	96,429,977	19,670,944		3,653,717	10,174,880	432,740	2,287,340	
1753	47,206,325	8,776,070	3,874,043	2,644,351	8,502,568	395,425	992,211	2,421,799
1754	55,856,595	10,587,934	2,252,593	3,455,738	7,118,803	119,828	2,020,484	1,417,842
1755	25,336,360	2,405,326	3,379,588	287,463	5,172,882	604,291	282,827	2,138,818
1756	5,083,358	813,047	2,531,773	142,186	1,555,114	187,778	108,185	496,786
1757	26,851,604	2,729,353	604,291	2,253,339				618,200
1758	17,252,997	1,104,260	836,303	1,344,459	417		139	
1759	20,814,692	7,717,126	61,820	2,308,977	430,164	636,746	154,550	
1760	39,270,245	15,970,582	3,086,198	636,746	10,552,932	1,574,659	2,312,841	401,830
1761	40,750,634	30,692,619	42,271,031	409,558	18,991,063	2,862,266	2,539,257	5,107,878
1762	16,651,774	14,746,800	40,293,166	225,643	12,286,725	3,036,908	1,847,645	9,480,221
1763	35,346,910	26,352,069	15,808,040	4,939,418	5,783,647	377,360	632,110	3,227,870
1764	59,978,058	25,163,503	14,606,172	1,975,149	7,476,000	193,188	1,264,219	1,185,522
1765	50,878,368	20,789,435	11,506,990	1,202,399	5,105,559	2,463,527	214,825	3,296,583
1766	54,737,919	27,216,732	4,834,100	1,897,874	7,217,485	3,784,930	61,820	2,160,857

1767	72,411,720	37,093,593	1,339,480	2,814,098	14,376,705	4,784,868	1,397,132	431,875
1768	58,170,611	35,230,214	3,617,480	3,652,841	15,233,823	7,814,048	2,690,716	291,389
1769	106,726,440	29,740,376	12,685,642	6,039,938	7,052,117	7,890,550	1,789,689	1,258,037
1770	183,325,045	38,877,135	41,820,520	6,132,544	17,152,142	3,690,654	4,987,329	293,789
1771	15,015,048	17,079,540	27,006,784	2,216,247	20,540,468	1,143,465	4,137,304	2,942,632
1772	32,761,741	22,962,101	73,640,592	3,744,747	17,512,061	1,424,951	2,013,787	2,873,043
1773	23,347,818	30,795,630	28,807,829	5,396,475	18,600,670	7,993,845	2,238,657	1,038,128
1774	17,677,781	46,759,685	42,847,738	8,195,787	34,333,746	9,187,083	6,194,364	4,423,097
1775	10,436,905	25,280,229	53,155,238	6,613,735	24,309,749	6,454,994	4,760,913	6,361,531
1776	9,402,826	17,058,608	12,200,483	9,276,864	16,044,750	2,188,428	5,289,474	1,154,675
1777	10,164,065	17,526,219	12,833,224	9,257,545	16,529,919	3,724,088	4,200,669	816,024
1778	11,341,267	16,346,084	18,842,631	13,359,896	29,893,437	3,604,106	7,022,907	1,415,678
1779	5,800,843	11,689,441	13,241,125	3,389,282	26,550,969	983,144	6,675,015	1,591,247
1780	12,474,980	32,601,550	7,173,523	10,311,190	35,443,271	1,835,653	6,406,098	503,833
1781	8,657,827	25,846,504	6,744,244	9,937,844	12,849,759	2,461,982	2,326,750	272,008
1782	3,460,633	17,808,220	20,089,391	9,590,238	15,764,811	1,376,461	3,592,000	593,472
1783	26,905,919	68,731,328	43,244,878	27,497,034	35,877,846	24,795,253	7,970,401	1,828,636
1784	67,250,447	68,481,346	59,518,995	56,742,232	25,523,049	27,249,481	7,882,249	1,925,381
1785	76,764,172	58,865,047	27,413,596	70,977,432	19,517,123	14,713,523	5,254,733	1,816,676
1786	40,813,465	12,909,757	6,651,989	31,536,723	3,627,023	1,951,023	514,498	1,481,390
1787	12,750,365	11,135,321	135,480	21,208,637	4,234,919	1,748,789	287,169	
1788	9,984,176	13,533,826	4,610	19,088,176	3,117,070	944,032	1,007,345	
1789	54,855,700	27,279,857	7,851,520	58,423,146	9,860,783	634,234	1,136,646	
1790	31,772,076	31,585,629	35,193,210	67,040,299	24,542,247	2,425,341	5,059,278	
1791	57,941,646	41,262,861	41,713,944	54,113,843	22,749,573	4,966,473	6,890,666	
1792	57,016,294	67,508,711	60,995,845	79,266,229	39,367,068	17,551,208	9,044,545	
1793	62,480,814	49,244,956	53,535,281	66,111,162	38,078,672	14,370,560	7,758,120	
1794	90,482,028	31,383,917	31,748,821	43,383,293	28,539,850	4,989,072	9,097,115	
1795	19,329,594	11,043,159	15,442,928	19,516,680	4,054,498			

Source. STR online.

Appendix 3, *Characteristics of selected Dutch shipping communities active in grain transports through the Sound, 1700-1795*

	<i>Danzig-Amsterdam (trad.)</i>		<i>Libau-Schiedam (emerg.)</i>	
	CORREL	N	CORREL	N
Ameland	0,8872	89	n/a	n/a
Amsterdam	0,8496	89	0,3934	21
Delfzijl	0,2489	31	0,0754	3
Dokkum	0,1033	38	0,0356	8
Groningen	0,2692	44	0,5333	8
Harlingen	0,7339	68	0,4661	4
Heerenveen	0,5851	36	0,4432	6
Hindeloopen	0,6396	35	n/a	n/a
Hoorn	0,6086	56	n/a	n/a
Joure	0,2376	32	-0,4349	6
Lemmer	0,4279	54	0,5508	7
Makkum	0,2382	52	0,7649	7
Pekela	n/a	n/a	0,7375	4
Rotterdam	0,5334	40	0,4780	17
Sneek	0,3732	24	n/a	n/a
Stavoren	0,4119	46	0,2789	9
Terhorne	0,4321	41	0,3128	8
Terschelling	0,7554	78	n/a	n/a
Texel	0,1265	32	n/a	n/a
Vlieland	0,5744	48	n/a	n/a
Workum	0,3551	54	0,6079	11
Woudsend	0,4304	49	0,4831	5

Source. STR online.

Note. n/a = not applicable, N = number of years of activity.