

Memo

Title Project on sub-regional risk of spill of oil and hazardous substances in the Baltic Sea (BRISK)

Title Passenger transport prognosis for 2020

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1 Introduction

This document describes the prognosis for future vessels in Baltic Sea. The forecast include Ferry/RO-RO and passenger vessels. Traffic by cruise ships treated separately.

2 Data

The data is gathered from the involved countries (see data report). Some additional data has been gathered from ShipPax:

- The ShipPax Market Report from 2009 contains statistics for 2003, 2007 and 2008 (1).
- The ShipPax Market Report from 2010 contains statistics for 2004, 2008 and 2009 (2).

The traffic forecast includes experience with changes in traffic patterns, ferry routes, socioeconomic conditions etc. The routes from one country to other countries within Baltic Sea are discussed separately.

2.1 Denmark

The yearly growth rate between Denmark and other countries in Baltic Sea is shown below in Table 1. In the first row, the results show the historical development in that region. In the second row, expected future results are provided by applying some adjustment factors. These adjustment factors are discussed below the table where necessary.

Table 1 Yearly growth between Denmark and other Baltic Sea countries

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Denmark (Historical development)	0.0%	0.0%	1.7%	-3.0%	N/A	0.0%	2.3%	N/A	N/A	1.7%
Expected future results	0.0%	0.0%	1.7%	-3.0%	N/A	0.0%	2.3%	N/A	N/A	1.7%

The yearly growth rate within Denmark and from Denmark to Sweden and Germany is taken from the oil spill study for Danish waters carried out in 2006/2007 (3). According to the analysis the yearly growth rate within Denmark is estimated as 0.0%. The growth rate of passenger traffic between Denmark to Sweden and Germany is estimated as 0.0% and 1.7% respectively. Note that the ferry connection between Rødby (Denmark) and Puttgarden (Germany) will be replaced by the Fehmarn Belt Fixed Link by 2020. It has been seen that there is no ferry service between Denmark to Estonia and Latvia that is why it is not applicable for prognosis. It is assumed that the expected future results are going to be the same as obtained from the historical development.

In Denmark, there are a significant number of domestic ferry connections. The ferry routes are provided in **Error! Reference source not found.**

2.2 Sweden

The yearly growth rate between Sweden and other countries in Baltic Sea is shown below in Table 2.

Table 2 Yearly growth between Sweden and other Baltic Sea countries

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Sweden (Historical development)	0.0%	-2.0%	1.7%	-2.0%	-2.0%	-0.2%	14.0%	29.0%	-2.0%	1.7%
Sweden (Expected future results)	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	3.5%	11.0%	0.0%	1.7%

It can be seen from Table 2 that the growth rates from Sweden to Sweden, Poland, Russia and Estonia and Finland are negative, while the growth rates for Lithuania and Latvia are positive. The trend lines for these routes can be seen from Figure 1, Figure 2 and Figure 3.

The linear regression in Figure 1 contains the data for 12 years.

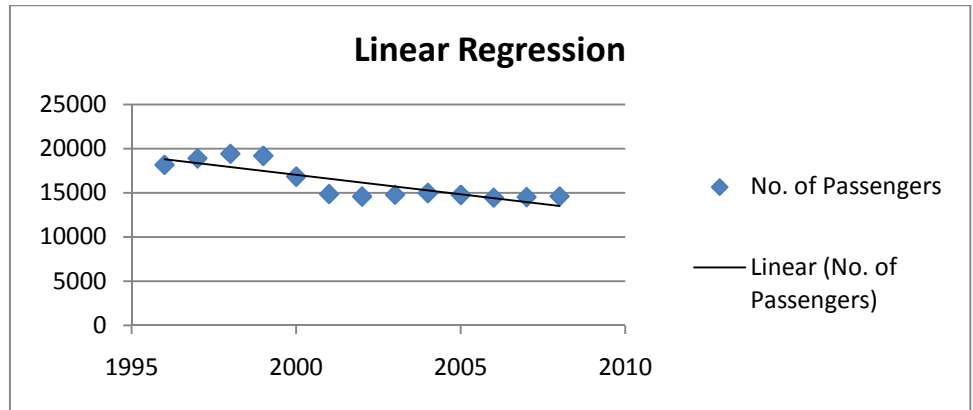


Figure 1 *Liner regression model for Sweden, Poland, Russia, Finland and Estonia from Sweden*

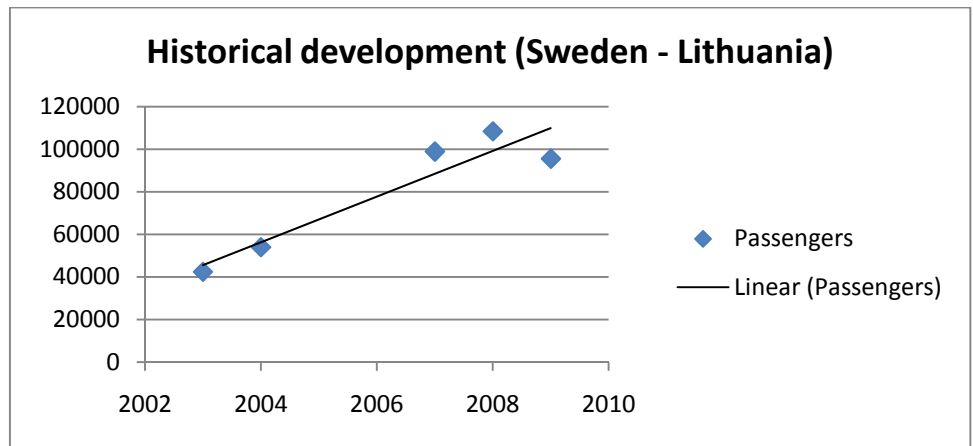


Figure 2 *Historical development for Sweden – Lithuania*

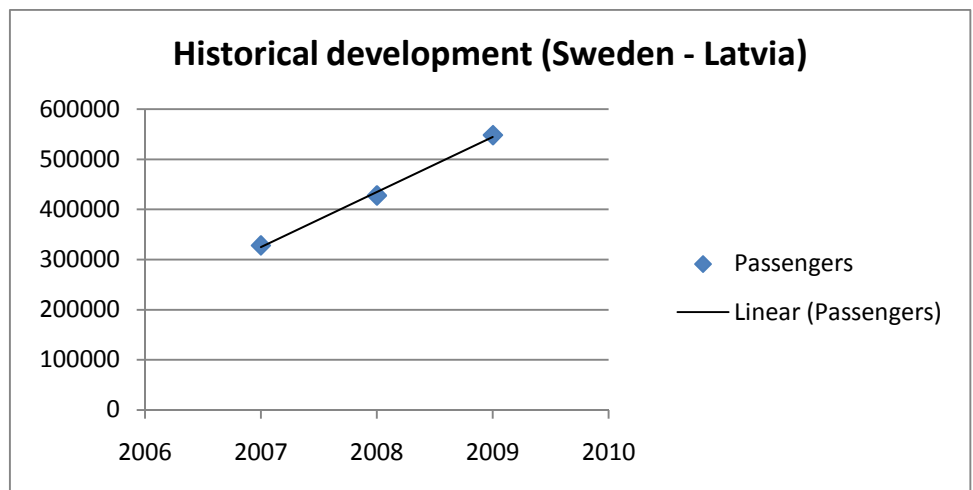


Figure 3 *Historical development for Sweden – Latvia*

It can be seen from Figure 1 that from year 1996-1999 that there was a small increase in the traffic. Subsequently, the traffic started to decrease rapidly during the next three years from 1999-2002. During the last 6 years from 2002-2008, the yearly traffic was essentially constant. Based on this observation it is fair to assume that this growth rate will remain constant in the coming years and that is why the yearly growth rate is taken as 0% from Sweden to Sweden, Russia, Poland, Finland and Estonia.

It can be seen from Figure 2 that the yearly growth rate between Sweden-Lithuania is considerably high. The reason could be that in last few years some countries like Lithuania and Latvia are progressing faster and these countries are catching up the market but it is not likely that the yearly growth will remain that high. When looking at the last three years the growth rate is almost constant in average. The yearly traffic between years 2007-2008 is 10% and the traffic between years 2007-2009 is -3%. This may be due to the financial crisis in 2008/2009. It is assumed that the market will revive itself so in the coming years the yearly growth rate is taken as the average of these two figures which is 3.5%.

It can be seen from Figure 3 that the growth rate between Sweden-Latvia is also quite high and it is not likely that it will remain 29% over the next 11 years. As discussed in the above paragraph this growth rate will decrease presumably over the next year as the point of saturation will come closer. It can also be deducted from Figure 4 that the yearly growth rate between Poland and Finland is 11%. Poland is situated next to Latvia and its status as emerging market is comparable in many ways. Based on these considerations it is conservatively estimated that the yearly growth rate between Sweden-Latvia will be 11% similar to Poland. In the context of BRISK it is conservative to overestimate traffic growth as it will lead to more passenger ship and thus more potential collision partners for ships carrying oil and hazardous substances.

2.3 Germany

The yearly growth rate between Germany and other countries in Baltic Sea is shown below in Table 3.

Table 3 *Yearly growth between Germany and other Baltic Sea countries*

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Germany (Historical development)	1.7%	1.7%	-8.0%	N/A	-8.0%	3.7%	7.0%	-5.0%	N/A	1.7%
Germany (Expected future results)	1.7%	1.7%	-8.0%	N/A	-8.0%	3.7%	0.0%	-5.0%	N/A	1.7%

The yearly growth rate between Germany-Lithuania is 7% but it is almost constant during last three years as observed during the analysis. It is assumed that during the next years this rate will remain 0%. The yearly growth rate (-8%) between Germany to Germany and Russia is extracted from the raw data pro-

vided by the country. It has been found that there is no ferry service from Germany to Poland and Estonia.

A fixed link is going to be built in the Fehmarn Belt in near future. It is assumed that because of that link there will be no ferry service crossing the Fehmarn Belt. This assumption is uncertain and the link will probably be completed in 2020.

2.4 Poland

The yearly growth rate between Poland and other countries in Baltic Sea is shown below in Table 4.

Table 4 Yearly growth between Poland and other Baltic Sea countries

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Poland (Historical development)	-3.0%	-2.0%	N/A	N/A	N/A	11.0%	N/A	N/A	N/A	N/A
Poland (Expected future results)	-3.0%	0.0%	N/A	N/A	N/A	11.0%	N/A	N/A	N/A	N/A

The linear regression model for yearly traffic growth between Poland to Finland is given below in Figure 4.

There is not ferry service from Poland to Germany, Poland, Russia, Lithuania, Latvia, Estonia and the rest of the world.

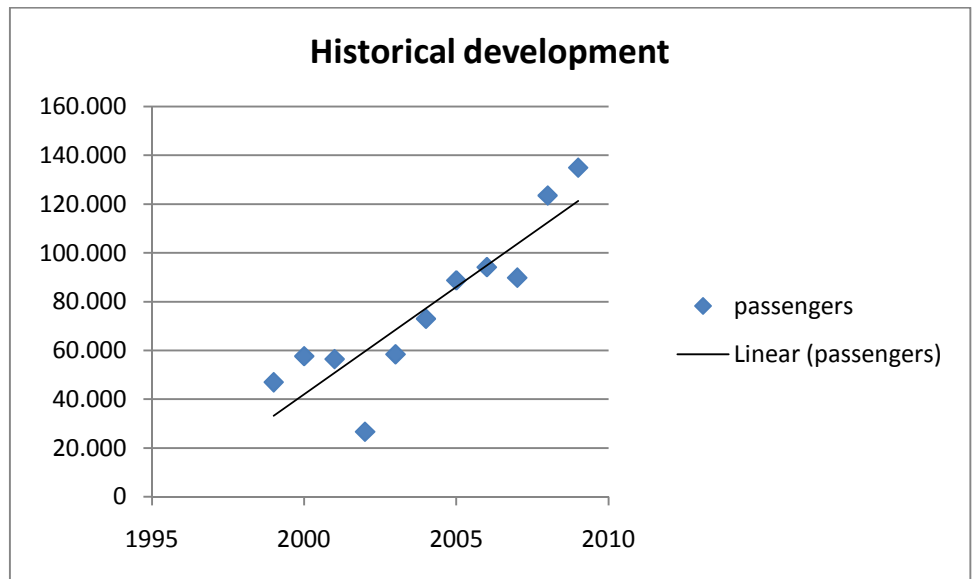


Figure 4 Historical development between Poland and Finland

2.5 Russia

The yearly growth rate between Russia and other countries in Baltic Sea is shown below in Table 5.

Table 5 Yearly growth between Russia and other Baltic Sea countries

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Russia (Historical development)	N/A	-2.0%	-8.0%	N/A	0.0%	-27.0%	N/A	N/A	N/A	N/A
Russia (Expected future results)	N/A	0.0%	-8.0%	N/A	0.0%	0.0%	N/A	N/A	N/A	N/A

The yearly traffic between Russia-Finland decreased rapidly during last 10 years. This decrease and the trend line can be seen in Figure 5.

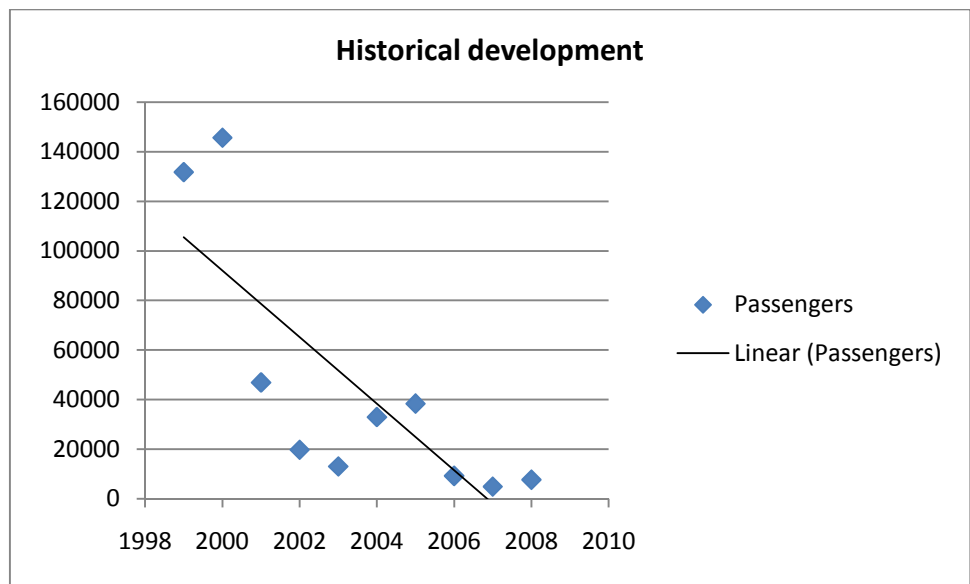


Figure 5 Historical development between Russia-Finland

It can be seen from Figure 5 that the traffic decreased rapidly, but more or less stabilised during the last 3 years. Based on this observation it is estimated that the yearly growth rate for the coming years will be 0%.

No ferry service is found from Russia to Denmark, Poland, Lithuania, Latvia, Estonia and the rest of the world.

2.6 Finland

The yearly growth rate between Finland and other countries in Baltic Sea is shown below in Table 6.

Table 6 Yearly growth between Finland and other Baltic Sea countries

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Finland (Historical development)	N/A	-0.2%	3.7%	11.0%	-27.0%	0.0%	N/A	N/A	0.2%	1.7%
Finland (Expected future results)	N/A	0.0%	3.7%	11.0%	0.0%	0.0%	N/A	N/A	0.2%	1.7%

In the above table, the traffic from Finland to Russia is expected to decrease rapidly. Based on the discussion in sub-section 2.5, this growth rate for future years is estimated as 0%.

There is not ferry service between Finland to Denmark, Lithuania and Latvia.

2.7 Lithuania

The yearly growth rate between Lithuania and other countries in Baltic Sea is shown below in Table 7.

Table 7 Yearly growth between Lithuania and other Baltic Sea countries

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Lithuania (Historical development)	2.3%	14.0%	7.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lithuania (Expected future results)	2.3%	3.5%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A

The yearly growth rate between Lithuania-Sweden is 14% as shown in Table 7. This values is adjusted to 3.5%, see sub-section 2.2.

There is no ferry service between Lithuania and Poland, Russia, Finland, Lithuania, Latvia, Estonia and the rest of the world.

The yearly growth rate between Lithuania and Denmark is estimated as 2.3%. The linear regression model for yearly growth rate between Lithuania and Denmark is shown in Figure 6.

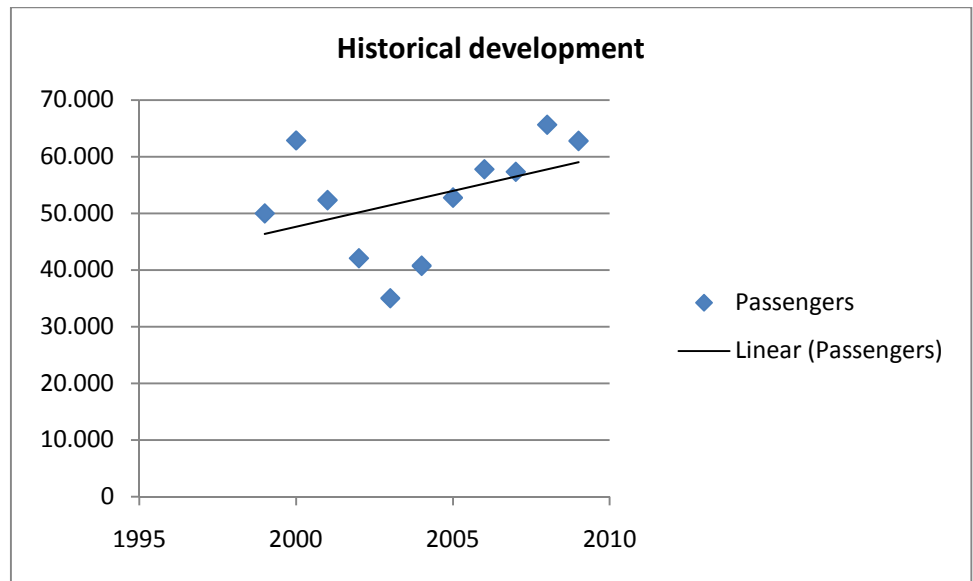


Figure 6 Historical development between Lithuania and Denmark

2.8 Latvia

The yearly growth rate between Latvia and other countries in Baltic Sea is shown below in Table 8.

Table 8 Yearly growth between Latvia and other Baltic Sea countries

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Latvia (Historical development)	N/A	29.0%	-5.0%	N/A	N/A	N/A	N/A	N/A	12.2%	N/A
Latvia (future expected results)	N/A	11.0%	-5.0%	N/A	N/A	N/A	N/A	N/A	12.2%	N/A

The above table shows -5% yearly growth rate between Latvia-Germany, 29% between Latvia-Sweden and 12.2% between Latvia and Estonia.

The yearly growth rate between Latvia-Sweden is adjusted to 11% by considering different adjustment factors as discussed in sub-section 2.2.

There is no ferry service from Latvia to Denmark, Poland, Russia, Finland, Lithuania, Latvia and the rest of the world.

2.9 Estonia

The yearly growth rate between Estonia and other countries in Baltic Sea is shown below in Table 9.

Table 9 Yearly growth between Estonia and other Baltic Sea countries

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Estonia (Historical development)	N/A	-2.0%	N/A	N/A	N/A	0.2%	N/A	12.2 %	4.0%	N/A
Estonia (Future expected future results)	N/A	0.0%	N/A	N/A	N/A	0.2%	N/A	12.2%	4.0%	N/A

The yearly growth rate and linear regression models for Estonia are shown above under different country headings.

There is no ferry service between Estonia to Denmark, Germany, Poland, Russia, Lithuania and the rest of the world.

2.10 Rest of the world

The yearly growth rate between the countries in Baltic Sea and the rest of the world is shown below in Table 10.

Table 10 Yearly growth between Baltic Sea countries and the rest of the world

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Rest of the world (Historical development)	1.7%	1.7%	1.7%	N/A	N/A	1.7%	N/A	N/A	N/A	N/A
Rest of the world (Expected future results)	1.7%	1.7%	1.7%	N/A	N/A	1.7%	N/A	N/A	N/A	N/A

3 Prognosis for all routes

The countries like Poland and Latvia have yearly growth rate reasonably high. The analysis has been carried out based upon the historical data provided by these countries. Latvia has already done some calculations for yearly growth rate and provided some results for year 2020 which are used instead.

The prognosis for all ferry routes in Baltic Sea are provided in Table 11.

Table 11 Prognosis for all routes in Baltic Sea

	Denmark	Sweden	Germany	Poland	Russia	Finland	Lithuania	Latvia	Estonia	Rest of the world
Denmark	0.0%	0.0%	1.7%	-3.0%	N/A	N/A	2.3%	N/A	N/A	1.7%
Sweden	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	3.5%	11.0%	0.0%	1.7%
Germany	1.7%	1.7%	-8.0%	N/A	-8.0%	3.7%	0.0%	-5.0%	N/A	1.7%
Poland	-3.0%	0.0%	N/A	N/A	N/A	11.0%	N/A	N/A	N/A	N/A
Russia	N/A	0.0%	-8.0%	N/A	0.0%	0.0%	N/A	N/A	N/A	N/A
Finland	N/A	0.0%	3.7%	11.0%	0.0%	0.0%	N/A	N/A	0.2%	1.7%
Lithuania	2.3%	3.5%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Latvia	N/A	11.0%	-5.0%	N/A	N/A	N/A	N/A	N/A	12.2%	N/A
Estonia	N/A	0.0%	N/A	N/A	N/A	0.2%	N/A	12.2%	4.0%	N/A
Rest of the world	1.7%	1.7%	1.7%	N/A	N/A	1.7%	N/A	N/A	N/A	N/A

4 Cruise Ships

The cruise industry is growing globally. The analysis in ShipPax (1) shows that the yearly growth rate of cruise ships in Baltic Sea is around 8%. This 8% change confirms the earlier models used in Danish oil spills (3).

The yearly worldwide growth rate in 2000-2009 according to ShipPax (2) is shown in Figure 7.

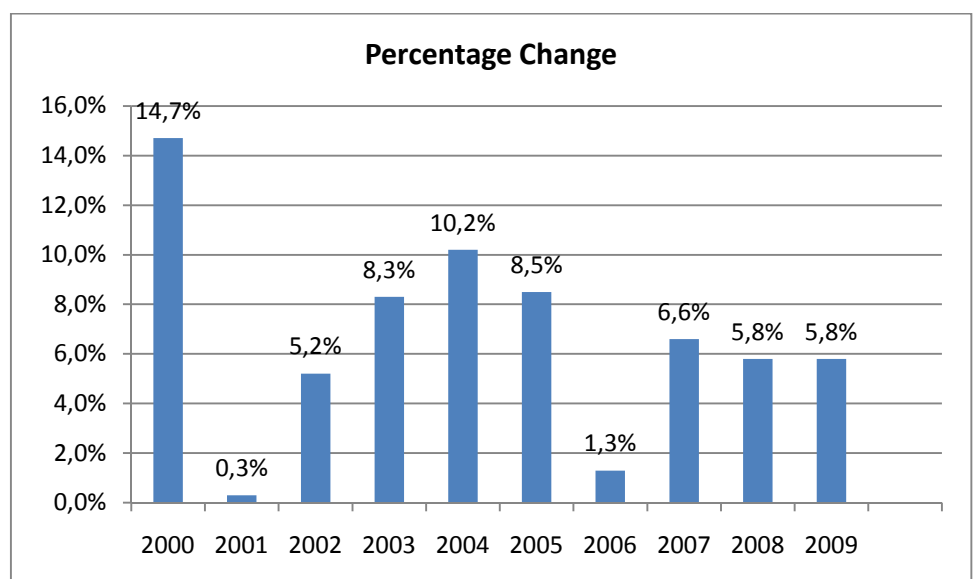


Figure 7 Yearly growth rate world wide

According to the ShipPax analysis about the cruise market, the number of cruise passengers world-wide increased with 2.6% from 19,097,452 to 19,591,843. It was the lowest increase in three years time, reducing the average five year growth to 5.6%; the lowest figure in this millennium. The long term five year average increase has always remained constant to a 6 – 10% level. It has been seen from ShipPax analysis that the yearly increase in number of passengers in countries around Baltic Sea is more than the other countries world-wide. So, the yearly increase in Baltic Sea is assumed to be more than the yearly increase worldwide. This also justifies the 8% yearly growth rate of old oil spill study in Danish waters. For this estimate, the effect of possible changes in the average cruise ship size have not been considered.

Counted in passenger hours, the cruise industry is close to carrying as much volumes as the ferry industry and it is growing faster. The three largest operators Carnival, Royal Caribbean International and Apollo control 75% of the capacity.

5 Implementation

This chapter describes how the figures for passenger ship traffic in 2020 are implemented in the BRISK traffic model.

The report passenger transport prognosis (4) treats three types of passenger ships

- Ferry
- Ferry/Ro-Ro
- Cruise ships

The first two mentioned is treated together in the prognosis report.

Cruise ships are treated separately in the prognosis report, and are therefore also treated separately here.

5.1 Ferries and Ferry/Ro-Ro

In the prognosis report the extrapolation of ferry traffic depends on the country of origin and location of destination (see Table 11).

Since it is relatively complicated to take the growth of vessel size into account, this is left out of account. This simplification is presumably on the safe side, as it will cause an overestimation of the ferry traffic measured in number of ship passages and travelled nautical miles.

Two different methods have been utilised to implement the growth rate in the Baltic Sea for year 2020.

- 1 The first method is to mark the routes between two countries and update them with the growth rate. This method is used where the tracks of ferries are easy to identify. For example:
 - The track between Lithuania-Sweden (Route Id: 2422, 2261, 2198, 2090, 2089, 1956, 1490, 1467, 1438, 1436, 1393, 1360, 1338, 1253)
 - The tracks between Latvia-Sweden (Route Id: 2620, 2593, 2536, 2476, 2454, 2452, 2348, 2240, 2215, 2213, 2032, 2031, 2001, 1883, 1847, 1799, 1767, 1766, 1728, 1692, 1678, 1649, 1657 and 2995, 2911, 2909, 2816, 2779, 2666, 2654, 2635, 2552, 2514, 2444, 2416, 2377, 2308, 2305, 2222, 2220, 2135, 2044, 1999, 1915, 1839, 1829, 1790, 1757)
 - The track between Poland-Finland (Route Id: 1781, 1840, 1863, 1874, 1900, 1932, 1950, 2007, 2028, 2048, 2074, 2075, 2150, 2175, 2176, 2243, 2293, 2321, 2354, 2390, 2393, 2436, 2472, 2473, 2515, 2516, 2569, 2585, 2606, 2607, 2639, 2696, 2763, 2792, 2836, 2858, 2849, 2848)
 - And the tracks between Estonia-Finland (Route Id: 3009, 3008, 2981, 2960, 2901, 2875, 2874, 2849, 2848 and 3095, 3094, 3089, 3083, 3084, 3085, 3098, 3104, 3111, 3108, 3109, 3127, 3126, 3117, 3113, 3103, 3102, 3009, 3090, 3092, 3122) are updated by using this method.
- 2 The second method is to find out the IMO number of all the ferry vessels that are sailing in the Baltic Sea and update them with the growth rate for year 2020 for each ferry according to Table 12. This method is used in the Baltic Sea area where different route are overlapping each other and difficult to mark a route. The IMO numbers of the ferry ships that are used are provided in table below.

Table 12 Countries and IMO numbers of ferries sailing in between those countries

	Countries	IMO numbers of ferry vessels
1	Denmark-Germany	9323704, 9323699, 7633143, 9073098, 9321823, 7803205, 7803190, 8000226, 9141807, 7432202, 9144419, 9144421, 9151539
2	Denmark-Lithuania	9357597
3	Denmark-Poland	7516761
4	Sweden-Germany	9319454, 9010163, 9017769, 9336256, 8903155, 8515893, 5266489, 9133915, 8705383, 7925297, 7229514, 7907661, 9138800, 9138795, 8703232,

	Countries	IMO numbers of ferry vessels
		9087477, 9087465, 9217230, 9217242
5	Germany-Russia	8311900, 7528594, 9197533, 9198989, 7804065, 8002640, 8706040
6	Germany-Latvia	7716074, 7214002, 7826867, 7315143, 7826855
7	Estonia-Latvia	7215290
8	Estonia domestic	6809771, 7215290, 8725577, 8727367, 7830832, 7051058
9	Germany-Finland	9212656, 9212644, 9010151, 9336268, 9319466, 9319442, 8002640, 8500680, 7528647, 8807416, 7521950, 9181077, 9348936, 9348948, 8020599, 8020604, 9198941, 9198953, 9234094, 9307372, 9234082, 9214678, 9227259, 9121998, 9227053
10	Denmark-Rest of the world	9374519, 9378682, 8917613, 8701674, 9058995, 9176060, 7807744, 7907257, 8917871, 7802067, 7911545
11	Finland-Rest of the world	9307372, 9307360, 9214678, 9227259, 9307358, 9307384, 9002659, 9002647, 9183788, 9348936, 9348948
12	Germany-Rest of the world	9278234, 9349863
13	Sweden-Rest of the world	7037806, 8317942

5.2 Cruise ships

The yearly growth rate of cruise ships is estimated as 8%. This growth rate is implemented in the model for all cruise ship routes for year 2020 in Baltic Sea.

6 References

1. **ShipPax.** *[MARKET:09] Statistics, Market report and outlook for ferry, cruise, ro-ro and hi-speed shipping.* ISSN 1403-3305. 2009.
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