CCNR
CENTRAL COMMISSION
FOR THE NAVIGATION OF THE RHINE

European Commission

ANNUAL REPORT 2023

INLAND NAVIGATION IN EUROPE
MARKET OBSERVATION

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September 2023

II FOREWORD

Lucia Luijten
Secretary General
Central Commission for the Navigation of the Rhine (CCNR)

The Market Observation annual report of the Central Commission for the Navigation of the Rhine (CCNR) builds on years of close cooperation with the European Commission. The 2023 edition portrays a difficult year 2022 for the European economy including for inland navigation. Overall, the global economic context darkened in 2022 for most of the Rhine and Danube countries. It faced, and still is facing, uncertainty given its exposure to a great deal of shocks, such as the Covid-19 pandemic and the start of the armed conflict between Russia and Ukraine in February 2022, with destructive consequences for many people. The aftermath of this war for Europe and its economy should not be underestimated. In fact, the global economy was characterised by high inflation in 2022, weakening of GDP growth, falling consumer confidence, oil price volatility, high gas prices, a global energy crisis, repressed demand, longstanding supply chain disruptions, and commodity price increases. It is also not without consequences for the inland navigation sector which has suffered from these difficult macroeconomic framework conditions. Global trade was also negatively impacted by this situation as reflected in the throughput figures of major seaports such as the Port of Rotterdam or the Port of Antwerp-Bruges, which suffered a decline.

The low water period in July and August 2022, on the Rhine in particular, came as an additional blow and had negative impacts on inland navigation transport. In fact, the occurrence of this low water episode was a renewed reminder that this natural phenomenon is of urgent concern, with significant ecological, economic and social impacts. Such extreme weather conditions can limit efficient navigation on inland waterways in the short-term, while in the long-term, it might drive the modal choices of shippers away from inland navigation. Yet, the inland navigation sector has a vital role to play in achieving the ambitious modal shift and emission reduction targets in the transport sector that have been set at international level. Inland navigation will continue to be indispensable, especially for carrying large freight volumes or for the transport of heavy and oversized goods in the future. I would like to take this opportunity to highlight that the CCNR is committed to overcoming this challenge. In particular, it facilitates dialogue between the relevant industrial, logistical, political and environmental organisations and continuously monitors the impact of such low water events through market observation activities and its “Act now!” process. In this context, I am also very pleased to share this foreword with Mr Helmut Habersack, President of the International Commission for the Hydrology of the Rhine basin (CHR) whose contributions are essential to address the low water problem.

In light of the challenges lying ahead, but also the expected transformation of inland navigation transport, under the impulse of important trends such as energy transition, the role of the CCNR Market Observation reports is more than ever essential. Indeed, the monitoring on a yearly basis of the European inland navigation market situation, as well as its evolution and structural development, supports decision-making at various levels for the benefit of European inland waterway transport (IWT).

In line with previous reports, the 2023 edition analyses macroeconomic conditions, national investments in inland waterway transport infrastructure, commodity prices, trend developments related to goods segments and river basins, IWT in ports, operating conditions related to water levels and freight rates, the fleet of inland vessels, employment, passenger transport and an outlook of the main inland navigation market segments.

In relation to transport on the Rhine, not only the cargo volumes transported on the traditional Rhine (from Basel to the German-Dutch border) were analysed, but for the first time, so were the volumes transported in the lower Rhine delta in the Netherlands. This was made possible thanks to the support of the Rijkswaterstaat. A comprehensive analysis regarding transport volumes on the Rhine from Basel to the North Sea will therefore be presented from now onwards in the annual reports. This enables a more detailed analysis to be produced per Rhine stretches, and to better grasp the dynamics regarding transport of goods per type of products along the Rhine. We are thankful for this new cooperation which can only improve the quality of our reports in the years to come.

It goes without saying that we would also like to thank all the contributors to this report, our long-standing partners with whom we always have the pleasure of cooperating: the Danube, Moselle and Sava Commissions, Eurostat and national statistical offices, ports, national and regional waterway administrations as well as professional organisations, in particular the European Barge Union (EBU), the European Skippers’ Organisation (ESO) and the Corporation of Inland Tanker Barge Owners (CITBO).

I hope that you will enjoy reading the 2023 edition of our annual report and that it will provide the insights you are awaiting.

CCNR
CENTRAL COMMISSION
FOR THE NAVIGATION OF THE RHINE

It is our great pleasure to write you a message in honour of the publication of the 2022 European Inland Navigation Market Observation report, presented by the Central Commission for the Navigation of the Rhine (CCNR).

The cooperation between the Commission for the Hydrology of the Rhine basin (CHR) and the CCNR goes back a long way. During the celebration of the 50th anniversary of the CHR in 2021, the two Rhine Commissions signed a renewed cooperation agreement. An important aim of this cooperation is to expand our knowledge on the effects of climate change and low water conditions. This knowledge is indeed an important basis for ensuring sustainable and future-oriented inland waterway shipping. And in addition, the recognition of the Commissions' mutual observer status was once again confirmed.

We, as the CHR, are an organisation in which the scientific institutes of the Rhine riparian states formulate joint hydrological measures for sustainable development in the entire Rhine basin. The objective of the CHR is to expand knowledge of the hydrology in the Rhine basin and to contribute to the solution of cross-border problems. For this reason, the CHR members carry out joint research, exchange data, methods and information, develop standardised procedures and provide information systems as well as models.

Climate change and resultant low flows are part of our strategic research agenda, as such situations present critical threats to our catchment which we consider urgent and in serious need of improved knowledge and prediction. In addition, we seek to understand future socio-economic scenarios, as increasing water demand from nature, society and economic sectors will increase the risk of low water.

As in previous years, 2022 was another dry year with low water levels on the Rhine. Little precipitation in the Rhine basin, but also less meltwater from the Alps due to climate change affects these low flows. With its source in the Alps, the hydrological regime of the Rhine is influenced by meltwater in spring and summer. In recent years the CHR conducted a research project (known as ASG) on the proportion of snow and glacier melt in the Alps and how this affects the Rhine discharge and its tributaries. In doing so, we analysed the past 100 years, but also the next 100 years which represents the future development. Based on our used models and scenarios, we may assume that the total stream flow will be stable - also in the long run - and that the amount of water during low flows will remain in the familiar range during the next three decades, after which they will decrease quite rapidly over the next 50 years. The impacts of these changes are considerable and affect everyone who uses water along the Rhine: Rhine navigation and with it the important transport of goods will be affected as periods with impaired navigation in relevant sections will certainly get longer, but also power plants and electricity suppliers will not be able to produce so much electricity, and drinking water suppliers will have to prepare for more frequent water shortage situations.

In the coming years, the CHR will continue to focus on fundamental research related to climate change and low flows. We will certainly do this by taking into account the latest scientific insights such as the 6th IPCC report, regional climate scenarios, flash floods and extreme events such as droughts. Climate change is a major issue for the coming decades and requires answers to questions such as "how will high discharges develop?" and "what do longer periods of drought mean for water use?". A second topic is sediment management, which is important to navigation and where CHR will continue its analysis. Furthermore, socio-economics is a third theme on which CHR is working, and where navigation is naturally an important player. It is important that we anticipate and look to the future to determine what is needed and in which direction in order to support decision makers and the other commissions such as CCNR.

I would like to thank the CCNR Secretariat for their commitment and we very much look forward to continuing our collaboration in addressing the exciting challenges ahead.

Helmut Habersack
President
Commission for the Hydrology of the Rhine basin (CHR)

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Szczecin
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Linz
Vienna
Bratislava
Budapest
Belgrade
Ruse
Constanța

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II EXECUTIVE SUMMARY

In 2022, the year was overrun with events that hampered the economy in general. The inland waterway transport (IWT) sector could not escape the negative overflows which emerged from the armed conflict between Russia and Ukraine. The low waters, the rapid rise in commodity prices and the energy crisis among other unfortunate factors, led to an overall negative impact on the IWT activities. All cargo segments, except for coal, presented a negative growth rate with regard to their transport volumes, and the magnitude of this negative impact varied. In 2022, an economic recession was observed for the inland navigation freight transport sector. The amount of cargo transported in Europe decreased by -5.5%. On the entire Rhine (from Basel to the North Sea), this decrease reached -6.8% compared to 2021: specifically, the Traditional Rhine (from Basel to the German-Dutch border) had a decrease in cargo transport of -7.8%, and the Rhine delta in the Netherlands (from the German-Dutch border to the North Sea) had a decrease of -5.7%, compared to 2021. While the end of 2021 and the first two months of 2022 showed positive signs towards a certain growth in transport volumes on the Danube, the war in Ukraine led to the emergence of several factors weighing on Danube navigation. As a result, volumes of transport decreased for all cargo segments in 2022.

Due to the energy crisis observed in 2022, the demand for natural gas increased and the prices boomed at the start of the year. This incited other energy options to be used, such as coal, to the detriment of natural gas. Hence, the demand for coal significantly increased, which contributed to a growth rate of +10.6% for the entire Rhine, compared to 2021. The war between Russia and Ukraine, which was accentuated by the presence of low waters in 2022, the increase on commodity prices that inflated the production costs, and the closure of Ukrainian ports at the Black Sea, all contributed to a slowdown in the demand for the remaining segments and consequently their transport cargo reduced. On the Rhine, metals (-7.5%), construction materials (sand, stone, gravels) (-12.1%), containers (-11.1%) and agri-food products (-5.9%), experienced strong decreases. Contrary to the significant increase in 2021, the iron ore segment (-2.8%) experienced a slight decrease in 2022. Likewise, chemicals (-1.6%) suffered a slight decrease in 2022, compared to the moderate growth observed in the previous year. On the Danube, transport volumes were negatively affected, especially on its upper and middle section. More specifically, transport of grain and other agribulk dropped significantly, going downstream (from the ports of the Middle Danube in direction of Constanța). However, the Lower Danube region, in particular the canals connecting the Danube to the Black Sea, recorded a clear upward trend in goods transport.

The recessionary economic situation extended also to the main European seaports. However, some seaports such as Hamburg and the North Sea Port showed positive growth rates in 2022. The Port of Rotterdam (-4.1%) observed a decrease on the inland waterway cargo volume handled, as did the Port of Antwerp-Bruges (-7.5%). IWW cargo handling at the port of Constanța remained at a similar level as in 2021. Since the beginning of the war, the IWW cargo handled at this port in relation to Ukraine reached 5.4 million tonnes. Likewise, a decrease was observed in main inland ports in 2022, except for the two Ukrainian ports Reni and Ismail which recorded an exceptional growth of IWT volumes, driven by the need to support Ukrainian exports of grain via alternative routes.

Inland waterway transport in 2022 was also strongly affected by the low water level conditions observed in July and August 2022. Between 2015 and 2022, the two years with the highest number of low water days were 2018 and 2022. This is reflected on both the Rhine and the Danube by a higher number of critical low water days in 2022 compared to 2021. This number, however, remained smaller than in 2018. For instance, for the gauge station of Kaub at the Middle Rhine, the number of days below the equivalent water level was 41 in 2022, compared to 10 in 2021 and 107 in 2018. On the Danube, the two German gauge stations on the Upper Danube, Pfelling and Hofkirchen, registered a higher number of low water days in 2022, compared to 2021.

Driven by the effect of low waters, and taking into consideration all market segments, freight rates increased on average by +42.5% in 2022 compared to 2021. Since 2020, dry bulk and container freight rates have been following a rising trend due to their demand recovery from the pandemic, which was further accentuated in 2022 by booming coal transport, the transfer of vessel capacity from the Rhine to the Danube region, and low waters. Liquid cargo freight rates had been following a decreasing trend since 2019 owing to a weaker development of transport demand compared to dry cargo, both during and after the pandemic. However, liquid cargo freight rates also realised a strong increase in 2022 owing mainly to low water conditions. To illustrate the increase on the freight rate indices between 2021 and 2022, for the volatile dry bulk spot market, the freight rate indices at the end of the year 2022 (Q3 and Q4) were around 240.9 and 203.9, respectively, while for the year end of 2021 (Q3 and Q4) the freight rate indices were about 118.1 and 159.1, respectively. For liquid cargo, freight rate indices were 140.7 and 134.4 in 2022 (Q3 and Q4) compared to 92.9 and 114.2 in 2021 (Q3 and Q4), respectively.

In 2022, the fleet of inland vessels in Europe counted almost 10,000 vessels registered in Rhine countries, 3,500 in Danube countries and 1,200 in other European countries. Overall, from 2016 to 2020, newbuilding activity has shown a recovery, which is more pronounced for liquid cargo than for dry cargo. The year 2021 was marked by a moderation in newbuilding activity due to the deterioration of transport demand conditions caused by the pandemic, which was further accentuated in 2022. While the number of new dry cargo vessels remained the same (21 units) compared to 2021, the number of newly built tanker vessels (31 units) decreased by 27 units compared to 2021. The number of small dry cargo vessels continues to follow a downward trend while larger vessels tend to increase (liquid) or to remain stable (dry). With regard to innovative developments in the inland navigation fleet contributing to reducing emissions, it can be noted that the number of innovative vessels in service represents less than 0.2% of the entire inland navigation fleet in Europe. Nevertheless, their number increased significantly between 2021 and 2022.

With regard to passenger transport, figures show a recovery from the Covid-19 pandemic. Concerning river cruises, the yearly cruise vessel movement figures for the Danube, Rhine and Moselle show a remarkable rebound in 2022, compared to 2021, recovering to pre-pandemic values. In terms of vessel movements, the cruising activity on the Upper Danube (at the Austrian-German border) and the Moselle were respectively 5% and 1% above the pre-pandemic levels of 2019. However, on the Rhine, this figure was still 6.5% below the level of 2019. Beyond vessel movements, the evolution of passenger numbers and the cruise vessel utilisation rate are also crucial factors in assessing the recovery of the river cruise sector.

Figures for these two indicators confirm that the river cruise activity picked up significantly, even though it is still slightly below 2019 levels.

Despite the Covid-19 pandemic coming to an end, the new building for river cruises remained rather slow in 2022. The year was marked by inflationary tendencies, contributing to an increase in shipbuilding costs, which was a hurdle for the newbuilding activity and it is likely to remain weak in 2023. It is interesting to note that the armed conflict between Russia and Ukraine led to an increased demand for hotel capacity for war refugees. As a result, some vessels are being used as floating hotels, sometimes permanently (particularly the oldest vessels) or in parallel to their cruising activities.

Concerning the employment level in passenger transport in the IWT sector in Europe, there was a remarkable decrease between 2019 and 2020. This resulted from the Covid-19 pandemic, which severely affected passenger transport and interrupted the positive trend which had been observed since 2010. The number of employed people was 17,895 in 2010, 23,100 in 2019 and 17,503 in 2020. However, the number of companies has continuously increased since 2013 (from 3,529 companies in 2013 to 4,231 in 2020). Employment level in the goods transport sector has been following a slightly decreasing trend since 2010 (23,300 in 2010, 22,365 in 2019 and 22,417 in 2020). The lowest employment point was reached in 2018, which could be attributed to the impact of low waters. In the same sector, the number of active companies also followed a similar trend (from 5,995 companies in 2010 to 5,486 in 2020). Regarding the net turnover in the EU (plus Switzerland and Serbia) for inland waterway (IWW) freight companies in 2020, approximately 6.6 billion Euro was registered. This figure amounted to 1.6 billion Euro for the IWW passenger companies in 2020.

Overall, the outlook for cargo transport appears to be favourable, specifically from 2024 onwards. However, it is difficult to establish in 2023 a precise forecast for the near future due to the volatile underlying conditions stemming from the armed conflict between Russia and Ukraine and the resulting energy crisis. Regarding river cruises, their demand is expected to return to pre-pandemic levels in 2023. However, the outlook for the river cruise new building activity still seems uncertain for the near future.

01

MACROECONOMIC CONTEXT AND OUTLOOK

- **Overall, the global economic context darkened in 2022 for most of the Rhine and Danube countries. After the rapid post-pandemic global economic recovery observed in 2021, the armed conflict between Russia and Ukraine, including effects of high inflation, slow demand, low waters and pandemics re-surge in China heavily weighed on inland waterway freight transport in 2022.**
- **One of the highlights is the coal sector which observed a significant increase on its demand. It was favoured in particular by high prices and supply limitations on natural gas due to the armed conflict between Russia and Ukraine and the associated imposed sanctions. It is estimated that during the first three quarters of 2022, natural gas prices in Europe and seaborne coal prices have averaged 420% and 180% higher, respectively, than their average over the past five years. Risks of price spikes for gas remain somewhat elevated for the coming winter 2023-24.**
- **The Euro area GDP growth estimated at 3.7% in 2022 (compared to 5.6% in 2021), is predicted to fall below 1% in 2023 and to rise to 1.6% in 2024.**

Economic overview

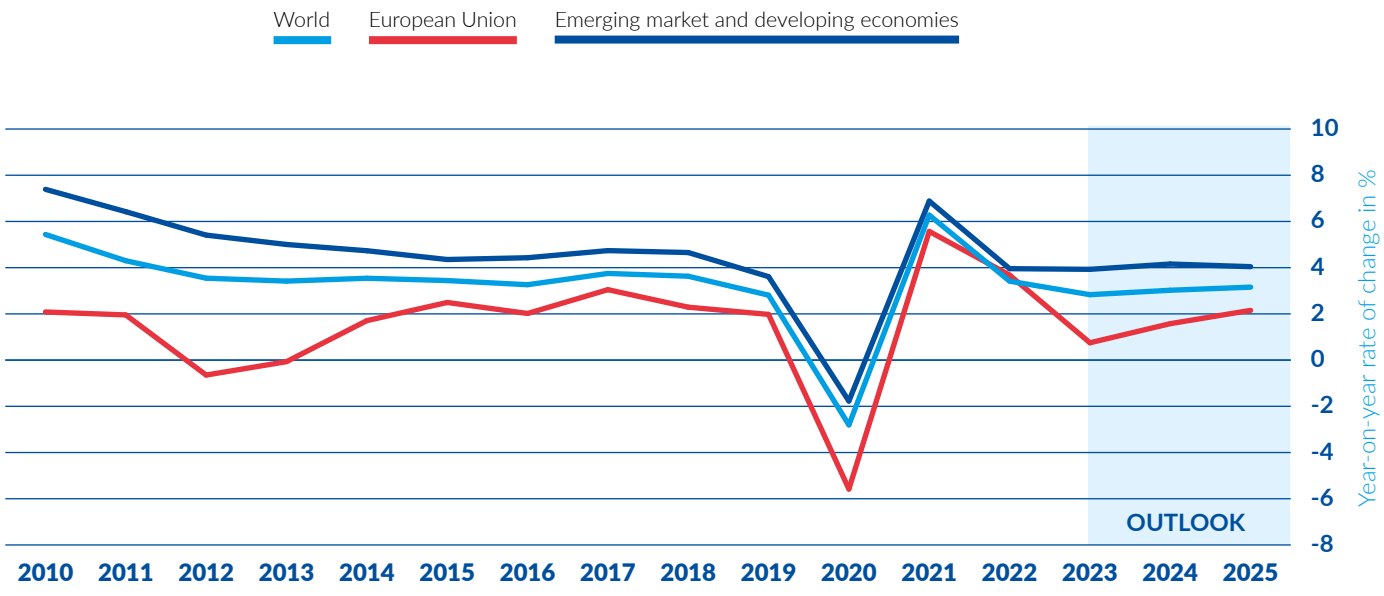
The global economy is still facing uncertainty given its exposure to many shocks, mostly notably, the Covid-19 pandemic and the armed conflict between Russia and Ukraine. Amid repressed demand, longstanding supply chain disruptions and increases in commodity prices, the global economy was characterised by high inflation in 2022 in many economies, leading to central banks tightening their policies. However, the headline inflation has been declining since mid-2022. The global still-high-but-falling inflation forecast points to 8.7% in 2022 and to 7% in 2023.

The global gross domestic product (GDP) growth estimated at 3.4% in 2022 is predicted to fall to 2.8% in 2023 and to rise to 3.0% in 2024. The feeble and uneven output growth is due to the adverse shocks since early 2022. For advanced economies, growth is expected to decline by half to 1.3% in 2023, before rising to 1.4% in 2024. For emerging markets and developing economies, estimates are, on average, stronger compared to advanced economies, but still uneven among regions, with a growth projection of 3.9% in 2023 and 4.2% in 2024. In low-income developing countries GDP is expected to grow by 5.1%, on average, over 2023-24.

Economic activity in Europe in 2022 was more resilient than anticipated given the negative terms of trade impact and the sanctions stemming from the war in Ukraine. In order to tackle the energy crisis, the European Union implemented large budgetary support measures for households and firms. Moreover, the demand compression for gas due to the mild winter and adjustments by industries to substitutes for gas were crucial for the EU economic outlook.

The surge of a more contagious Covid-19 variant brought new outbreaks. The disease evolution in 2022 made its way to China where strict containment measures and restrictions were implemented, and therefore, declines in mobility and economic activity in the fourth quarter of 2022 were registered. As Covid-19 waves subsided in January 2023, mobility normalised. As an important actor on world trade and a crucial exporter country, the reopening of China's economy will likely generate positive spillover effects, especially for countries with which China has stronger trade links.

FIGURE 1: **PERCENTAGE CHANGE IN GDP, CONSTANT PRICES**



Source: IMF World Economic Outlook Database, Outlook from April 2023

Trade

For the world trade volume, growth is projected to decline from 5.1% in 2022 to 2.4% in 2023. In the last two years, and as a result of the pandemic, a drawback in the global demand as well as a shift in the composition of spending from traded goods towards trade in services was observed. In 2022, the war in Ukraine came as an additional burden for goods trade. This trend is expected to further continue in 2023.

With the reinforcement of trade barriers in 2022, plus the negative effects of the US Dollar appreciation, traded commodities and products (which are often invoiced in US Dollars) became more costly for numerous economies. It brought negative spillover effects to the 2022 world trade growth which are foreseen to last in 2023. For the inland navigation transport, this led to a drawback of the demand for traded goods in 2022, which should last also in 2023. It will represent an obstacle for the growth of cargo transport. The reason is the strong relationship between trade in goods and cargo transports, particularly with regard to container transport.

Commodity prices and their impact on inland waterway transport

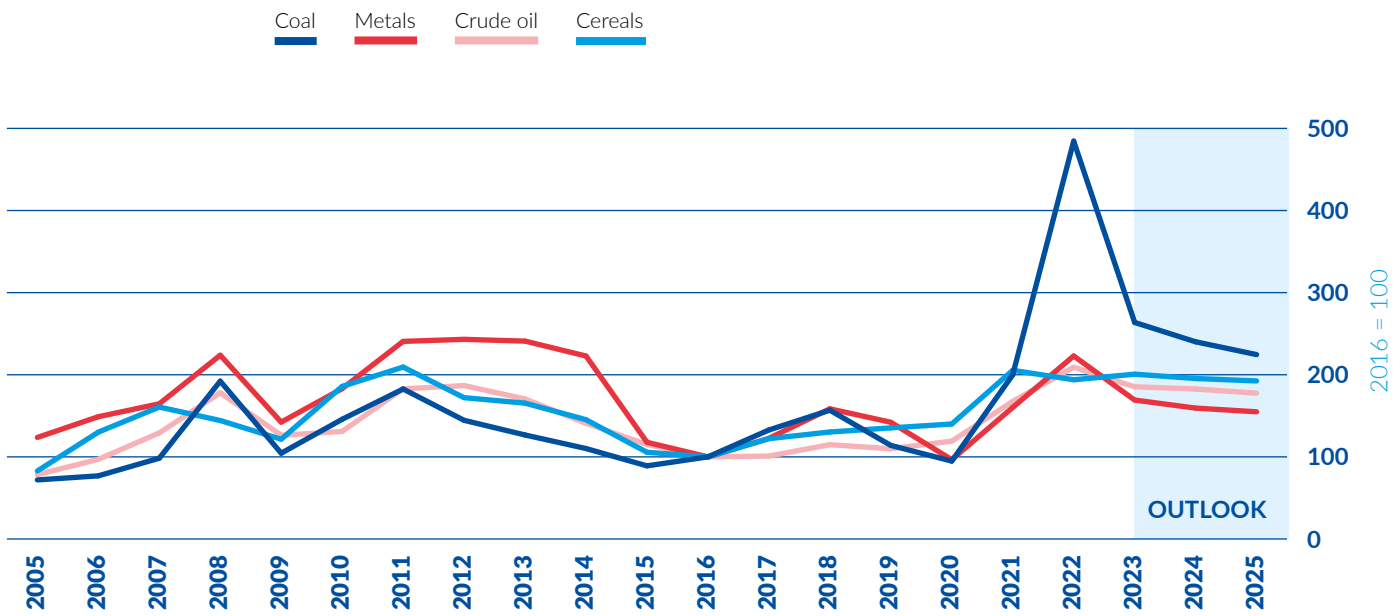
Crude oil

Initially, between 2021 and mid-2022, crude oil prices, together with fuel prices in inland navigation, significantly increased. From the second half of 2022, specifically between August 2022 and February 2023, this surge ceased. Indeed, crude oil prices receded by -15.7% between August 2022 and February 2023 because of the weakened demand due to a slowing global economy. According to future markets, the crude oil prices will retreat by -24.1%, costing on average $73.1 a barrel in 2023 compared to $96.4 a barrel in 2022 and continue to fall in the coming years, down to $65.4 in 2026.

Oil price is a leading indicator for the transport sector due to its essential utility for transport activities. From the supply side, with the crude oil prices decreasing in 2023, fuel costs for Rhine operators should reduce.

On the demand side, although the headline inflation (which accounts for all commodity prices) is foreseen to decline in 2023, it will most certainly remain at a high level. Considering the rising effects of global trade barriers, the level of demand is expected to weaken, contributing to the above-mentioned downward movement in oil prices.

FIGURE 2: **COMMODITY PRICE INDICES** (2016 = 100)



Source: IMF World Economic Outlook Database, Outlook from April 2023

Gas and coal

The first half-year of 2022 was marked by very high gas and coal prices. In the second half-year, natural gas prices at the European trading hub[1] receded by -76.1% from record highs in August 2022 to $16.7 per MMBtu[2] in February 2023 as concerns about supply shortages faded. Prices reached nearly $100 per MMBtu in late August when EU countries raced to refill their gas storage facilities amid fears of supply shortages during the winter. This followed Russia's shutdown of pipelines' gas supplies to European countries.

For the winter of 2022-2023, a crisis was avoided, due to large storage at European facilities owing to higher LNG[3] imports and lower gas demand amid high prices, as well as an atypically mild winter.

The reduced demand owing to an economic slowdown in China and substitution of other fuel sources such as coal also helped ease pressures on the global LNG market. There are risks that gas prices may increase for the winter 2023-2024. Spillovers from gas markets caused a +50.9% surge in coal prices between August 2022 and February 2023.

Agricultural commodities and foodstuff

In 2022, due to the supply shocks linked with the war in Ukraine, food and beverage prices peaked in May 2022. In the second half of 2022, the price surge came to a halt, but prices remained at a high level. Indeed, the supply outlook improved as Ukrainian wheat and other products entered the global market after the Black Sea corridor initiative was renewed in November 2022.

[1] *Natural gas prices at European Title Transfer Facility trading hub*
[2] *Million British thermal unit*
[3] *Liquefied natural gas*

High prices also provided incentives to other regions, such as the European Union and India, to step up wheat production. Between August 2022 and February 2023, prices of raw agricultural materials declined by -9.1% amid slowing global demand. However, similar to base metal prices, they have partly rebounded in recent months.

Metals

After a first rise in 2021 and 2022, the base metal price index decreased below levels preceding the start of the armed conflict between Russia and Ukraine. This decrease emerged after the invasion, but the broad-based retreat was amid slowing Chinese metal demand that accounts for approximately half of global consumption of major metals. With China's reopening of economic and ports activities and increased infrastructure spending, base metal prices partially rebounded, increasing by +19.7% from August 2022 to February 2023.

Economic sentiment - consumer confidence

At the beginning of 2022, consumer confidence started to crumble, reaching a low point in September 2022. It then started to recover, fuelled by better expectations of consumers regarding the general economic situation and major intentions for purchases. This represents a potential factor to boost future demand and consequently reflect increasingly on the transport sector activities. In May 2023, the Economic Sentiment Indicator was 95.2, which represents a fall compared to April 2023 which was at 97.3.

Main consequences for Rhine and Danube navigation in brief

The global economic context darkened in 2022 for most of the Rhine and Danube countries. Indeed, the armed conflict between Russia and Ukraine mainly resulted in a rapid rise of energy prices and inflation for the Rhine and Danube regions. For Rhine cargo transport, apart from other important factors, inflation further deteriorated the already weakened private consumption which contributed to a negative impact on container transport. For bulk markets in Europe, rising energy prices translated into an increase of production costs. This negatively impacted bulk transport overall, with the exception of coal transport.

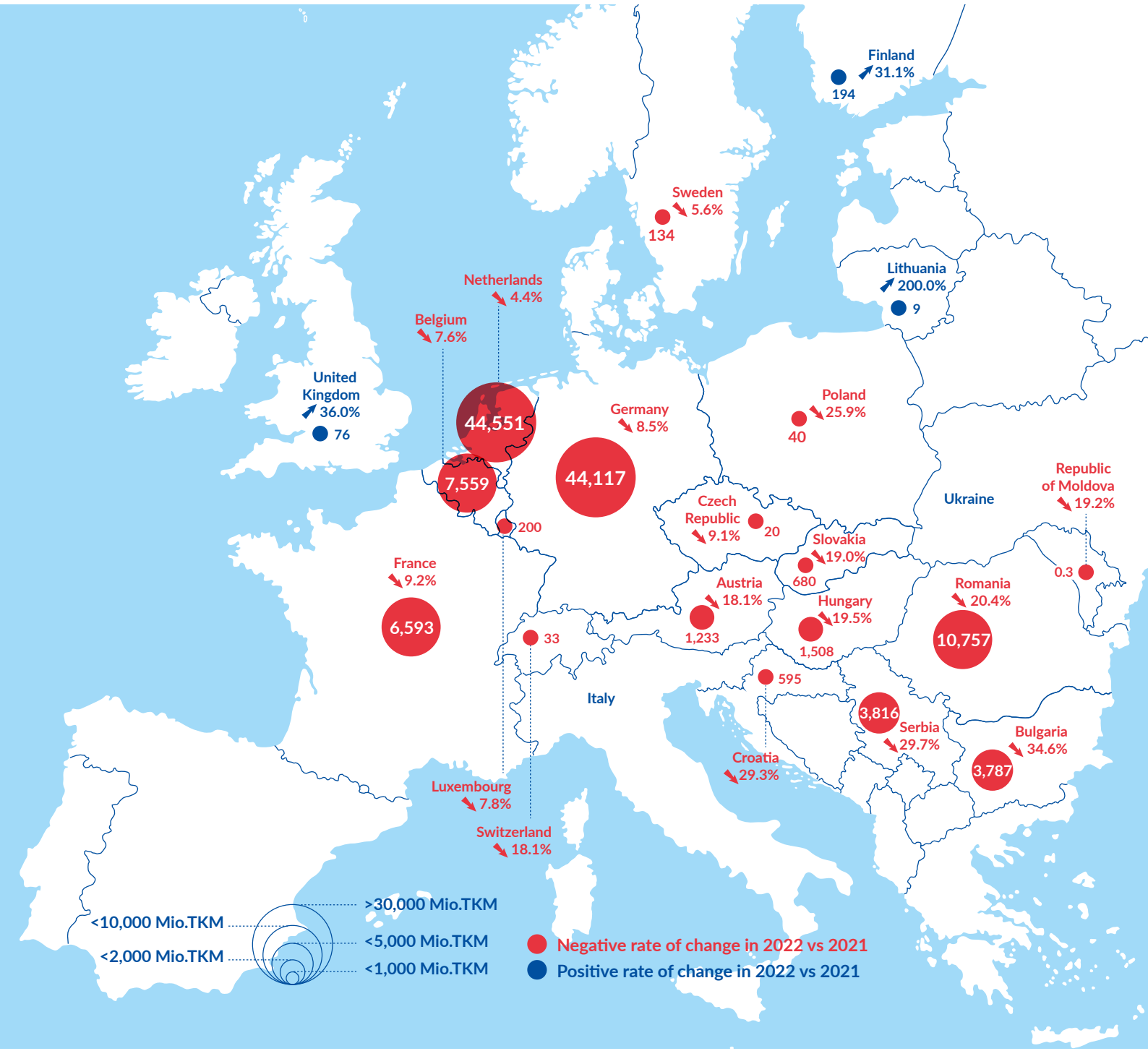
02

FREIGHT TRANSPORT ON INLAND WATERWAYS

- European inland waterway freight transport suffered from the difficult economic and geopolitical context as well as the low water levels of July and August 2022. Compared to 2021, the amount of cargo transported in Europe (EU-27 plus Switzerland, Serbia and Republic of Moldova) decreased by -5.5% to 485.4 million tonnes and freight transport performance decreased by -10.6% to 122 billion TKM.
- Transport volume on the entire Rhine (from Basel to the North Sea) decreased by -6.8% in 2022. Apart from coal which increased by around +10.6%, all product segments experienced a decrease, in particular containers (-12.2%), sands, stones and gravels (-12.1%), as well as mineral oil products (-9.5%).
- On the Upper and Middle Danube, transport volumes for all cargo segments decreased in 2022, particularly in the downstream direction for grain and other agribulk, which was near to collapse by losing -80% on the Middle Danube. The Lower Danube region, in particular the canals connecting the Danube to the Black Sea, recorded a clear upward trend in goods transport. Transport volumes on the Sulina canal more than doubled in 2022 compared to 2021 driven by the need to support Ukrainian exports of grain via alternative routes.

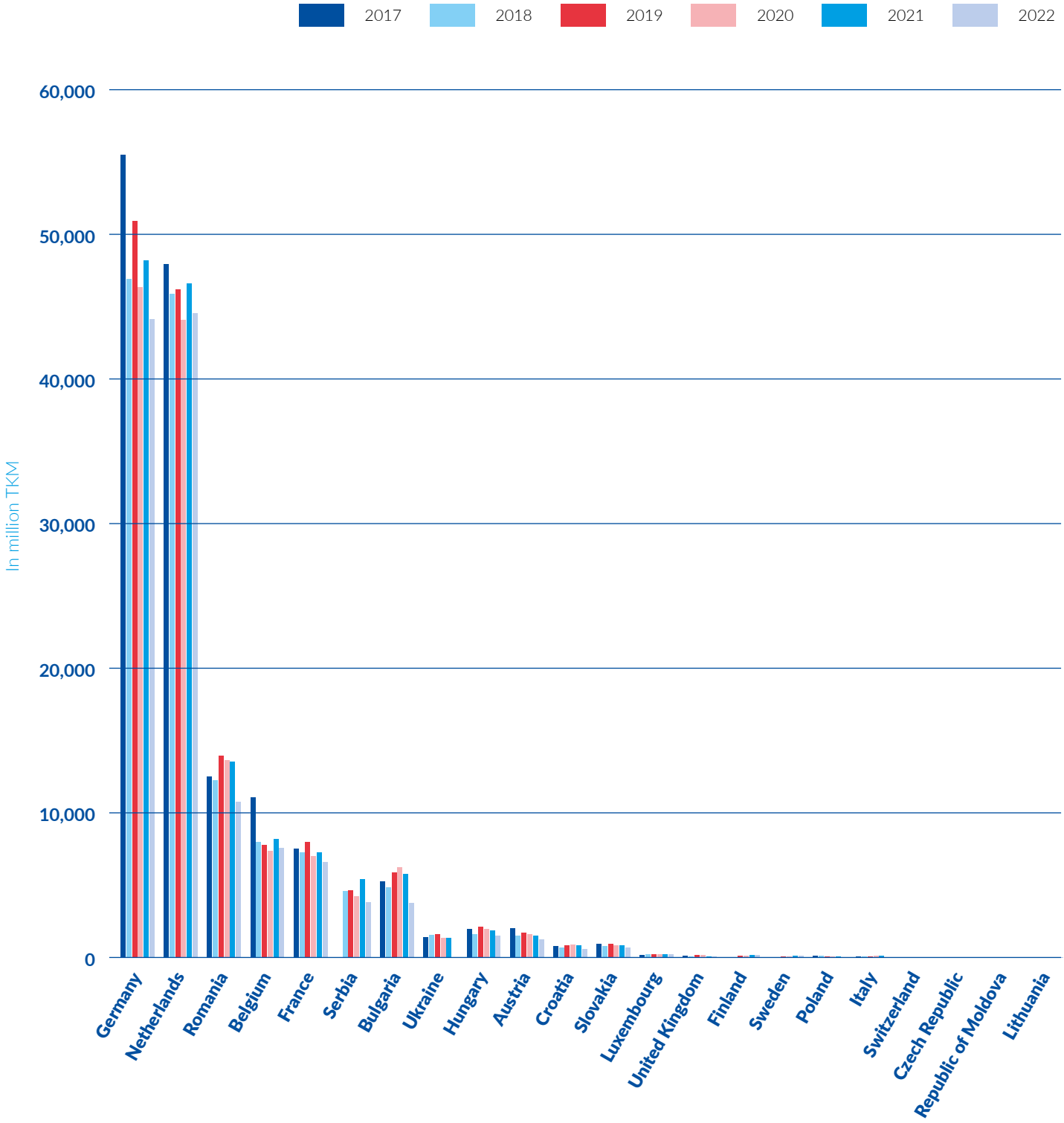
TRANSPORT IN EUROPE
AND BY COUNTRY

TRANSPORT PERFORMANCE IN IWT ON THE NATIONAL TERRITORY OF EACH COUNTRY IN EUROPE – COMPARISON BETWEEN 2021 AND 2022 (IN MILLION TKM)



Sources: Eurostat [iww_go_atygo] and [iww_go_qnave], OECD (Switzerland, and the Republic of Moldova), UK Department for Transport. The share of IWT performance in Europe in 2022 for Ukraine and Italy is not available due to a delay in the publication of the data.

FIGURE 1: **IWT TRANSPORT PERFORMANCE IN 2017, 2018, 2019, 2020, 2021 AND 2022 IN MAIN EUROPEAN IWT COUNTRIES** (IN MILLION TKM)

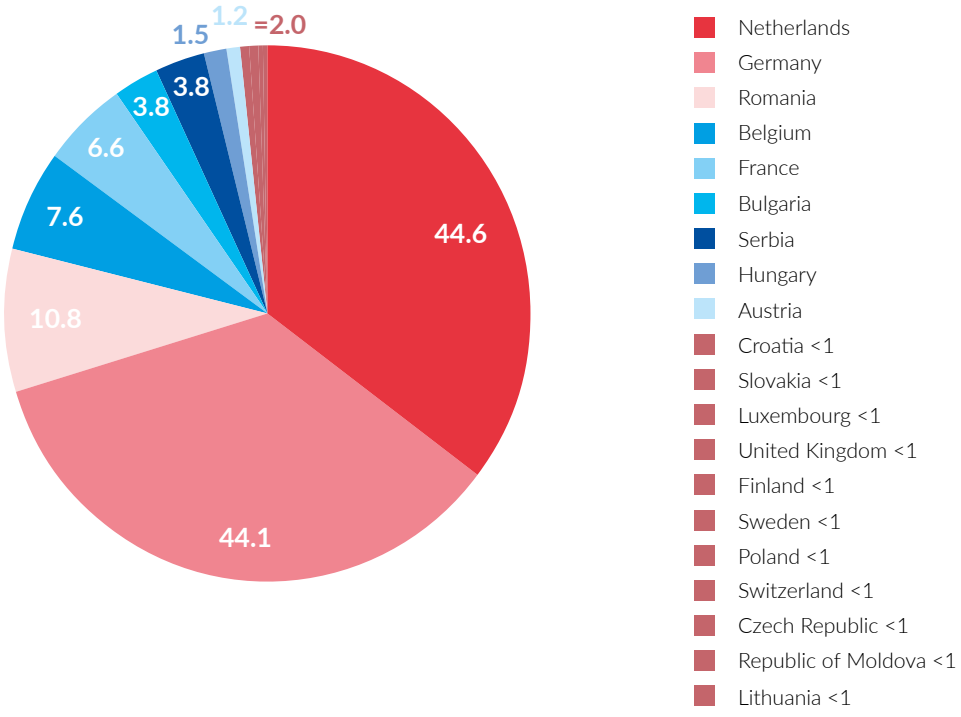


Sources: Eurostat [iww_go_atygo] and [iww_go_qnave], OECD (Switzerlandand the Republic of Moldova), UK Department for Transport. The values for Ukraine and Italy (2022) and Serbia (2017) are not available.

Note: for the UK, IWT is defined as non-seagoing traffic which takes place entirely within inland waters and sea-river transport (seagoing vessels navigating partly at sea and on inland waterways). In this figure, for the sake of consistency with the methodology used by Eurostat, only the transport performance related to the traffic taking place wholly within inland waters is reported (amounting to 76 million TKM). However, it is worth noting that most of IWT in the UK consists of sea-river transport (amounting to more than 1.3 billion TKM). Overall, the IWT performance in the UK is reported to reach almost 1.4 billion TKM.

In 2022, in terms of inland navigation for Europe (EU-27 plus Switzerland, Serbia and Republic of Moldova, and excluding Ukraine), freight transport performance decreased by -10.6% compared to 2021 and -5.5% in terms the cargo volumes transported for EU. Rhine countries (Belgium, France, Germany, Luxembourg, the Netherlands, Switzerland) accounted for 81.9% of total inland waterway transport performance in the EU-27, plus Switzerland, Serbia and the Republic of Moldova. The share for Danube countries was 17.8% (excluding Ukraine).

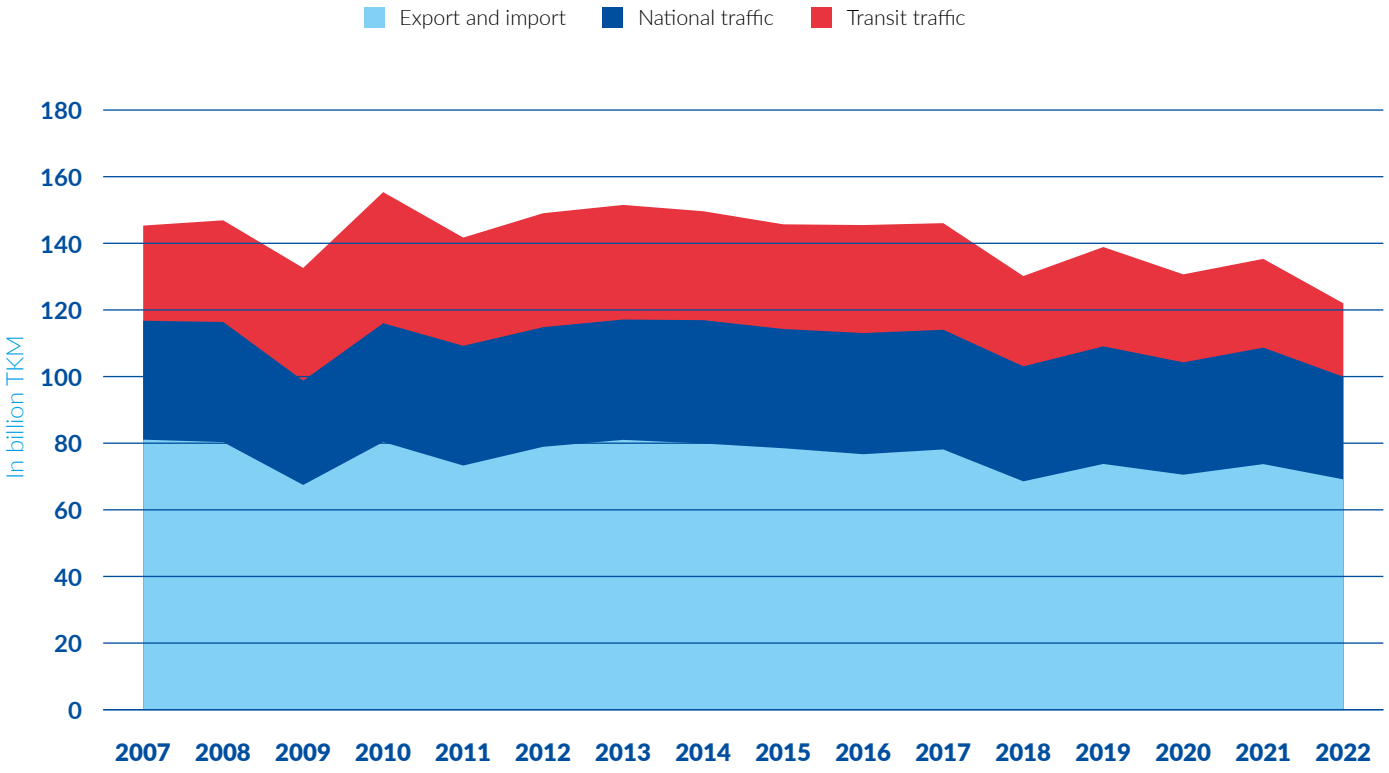
FIGURE 2: **INLAND WATERWAY TRANSPORT PERFORMANCE IN EUROPEAN COUNTRIES IN 2022** (IN BILLION TKM) *



Sources: Eurostat [iww_go_atygo] and [iww_go_qnave], OECD (Switzerland and the Republic of Moldova), UK Department for Transport
** Data for Ukraine and Italy were not available for 2022.*

From the total inland waterway transport performance in Europe in 2022, which amounts to around 122 billion TKM (without Ukraine, Switzerland, Serbia, and Republic of Moldova), 74.8% represented transport that crossed a border in one way or another – whether it be in the form of export, import or transit traffic. Transit traffic taken separately had a share of 18.1% and export and import traffic had a share of 28.8% and 27.8%, respectively.

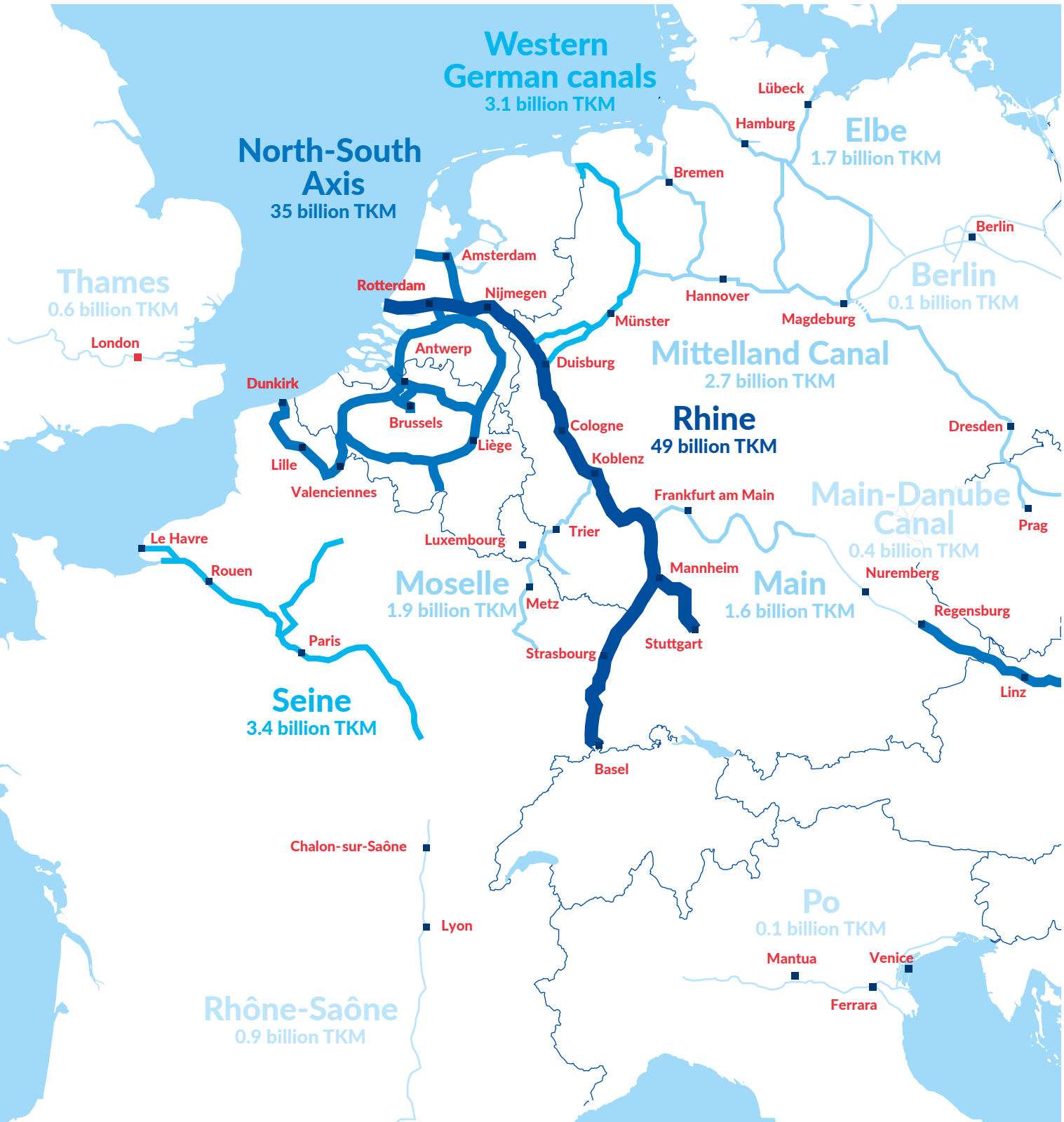
FIGURE 3: **YEARLY INLAND WATERWAY TRANSPORT PERFORMANCE IN THE EU-27** (IN BILLION TKM) *



Source: Eurostat [iww_go_atygo]
** EU-27 according to member countries in 2022*

TRANSPORT

PERFORMANCE BY MAIN EUROPEAN RIVER BASINS



TRANSPORT PERFORMANCE IN MAIN EUROPEAN RIVER BASINS (IN BILLION TKM)

Sources: CCNR analysis based on Destatis, VNF, Eurostat [IWW_GO_ATYGO], UK Department for Transport
Figures for the Po are from 2021, the others are from 2022.

RHINE BASIN

Transport volume and transport performance on the entire Rhine (from Basel to the North Sea)

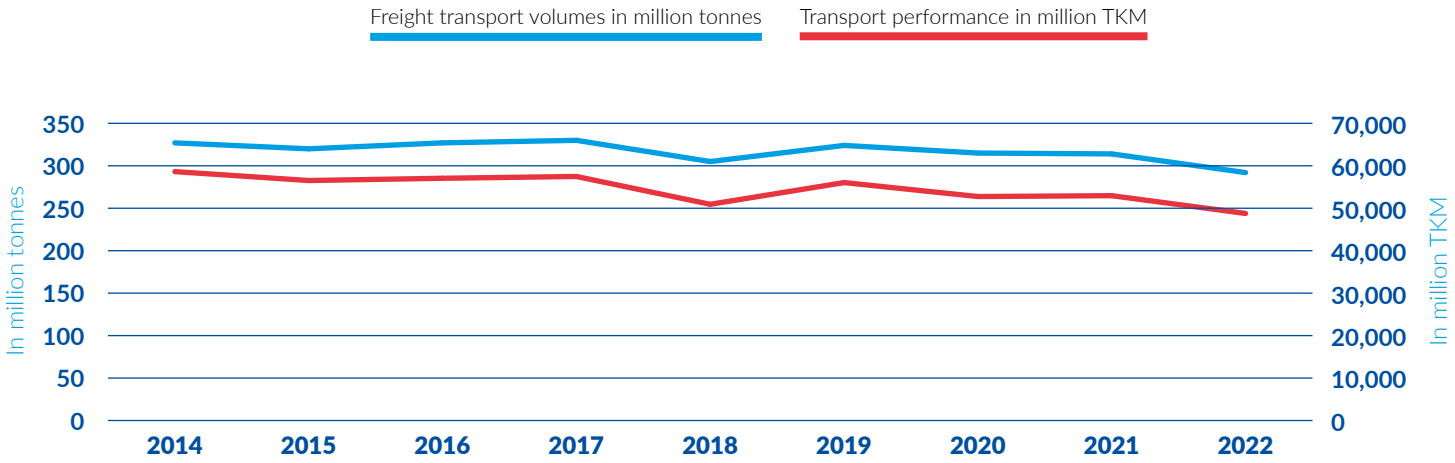
In the past, this chapter reported on the volumes transported on the Traditional Rhine only, namely the Rhine from Basel to the German-Dutch border. From now onwards, it will become possible to report on transport volumes on the entire Rhine from Basel to the North Sea.

Cargo transport on the entire Rhine (from Basel to the North Sea) amounted to 292 million tonnes in 2022, compared to 314 in 2021 (-6.8%).

- The Traditional Rhine (from Basel to the German-Dutch border) amounted to 155.5 million tonnes in 2022, compared to 168.6 million tonnes in 2021 (-7.8%).
- The Rhine delta in the Netherlands (from the German-Dutch border to the North-Sea[4]) amounted to 237.8 million tonnes in 2022 compared to 254.6 million tonnes in 2021 (-6.6%).

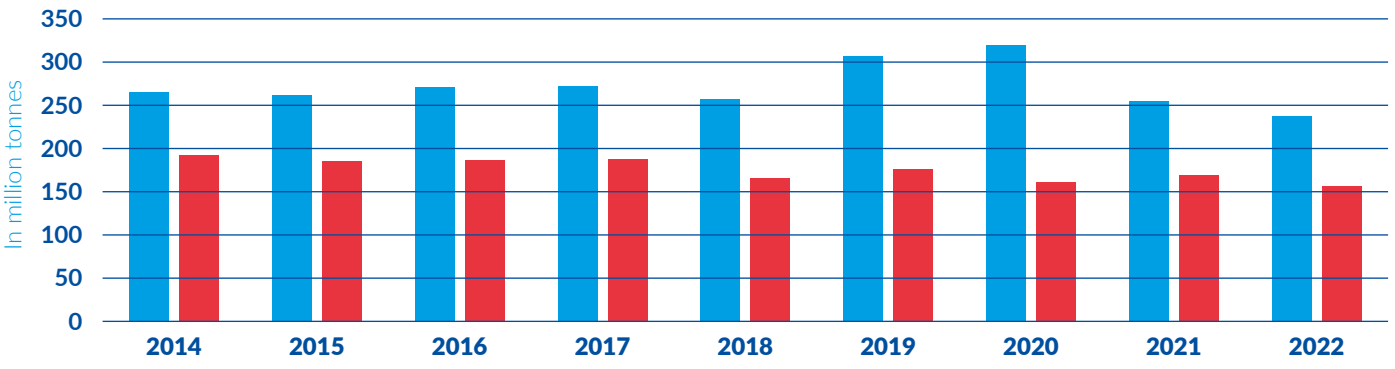
When calculating the total volume of goods transported on the entire Rhine, all the steps were taken to avoid the double counting of volumes transported on both stretches. This is why the volumes on these two stretches cannot simply be added together, as certain volumes are transported on both stretches.

FIGURE 4: **FREIGHT TRANSPORT VOLUME** (IN MILLION TONNES) **AND TRANSPORT PERFORMANCE** (IN MILLION TKM) **ON THE ENTIRE RHINE**



Source: CCNR analysis based on Destatis and Rijkswaterstaat. The transport performance is estimated based on the transport volumes on the entire Rhine

FIGURE 5: **FREIGHT TRANSPORT ON THE TRADITIONAL RHINE AND ON THE LOWER RHINE IN THE NETHERLANDS** (IN MILLION TONNES) *



Source: CCNR analysis based on Destatis and Rijkswaterstaat

** To avoid double-counting, the volumes on the different stretches cannot be added together, as certain volumes are transported on both stretches.*

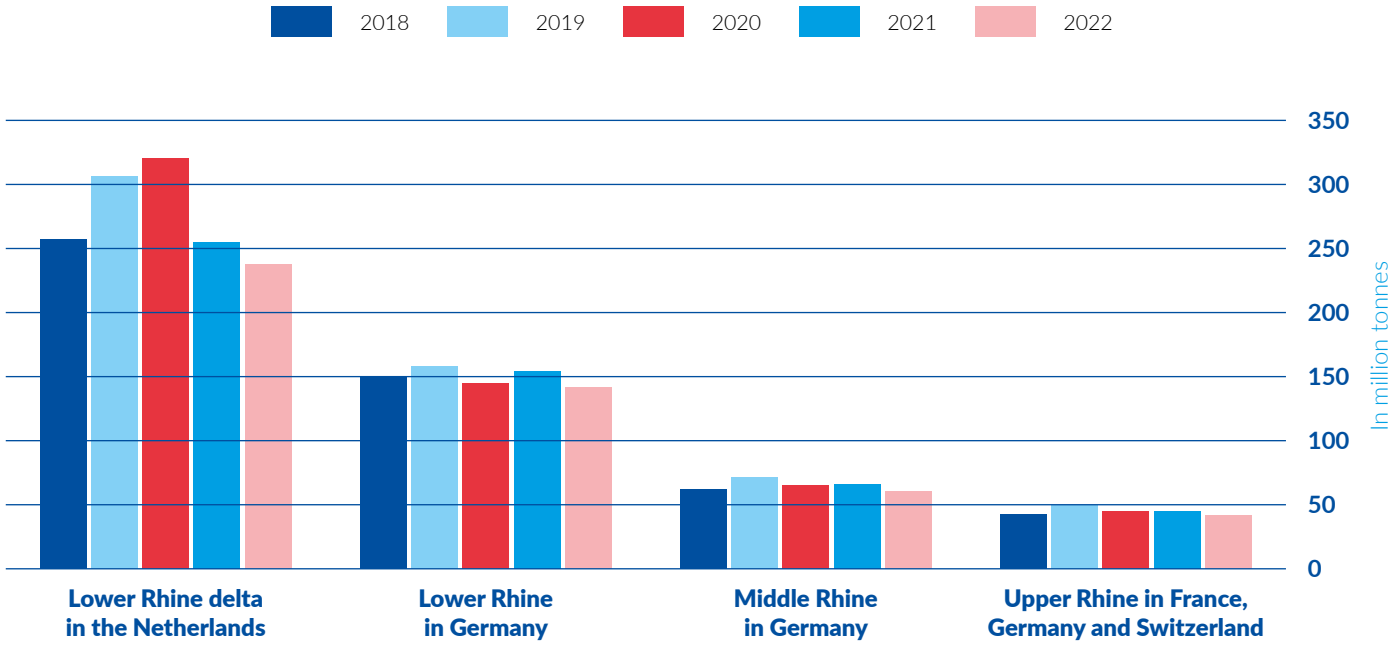
[4] Waterway sections considered: Waal, Hollands Diep, Boven Merwede, Oude Maas, Dordtsche Kil, Beneden Merwede, Lek, Nieuwe Maas, Noord, Nieuwe Merwede, Nieuwe Waterweg, Amsterdam-Rijnkanaal, Rijn-Schelde-Verbinding, Hartelkanaal, IJssel

Transport activity at different Rhine stretches, on Rhine affluents and on canals linked to the Rhine

In terms of geographical structure, the transport intensity is the highest on the Lower Rhine compared to the Middle and Upper Rhine, as illustrated in Figure 6. This higher intensity on the Lower Rhine can be explained by several reasons:

- Dense delta network in the Netherlands, with important petroleum and chemical industrial hubs and a high number of container terminals.
- Important steel and petroleum industrial hub in the Lower Rhine region in Germany.
- High fairway depths on the Lower Rhine.

FIGURE 6: **FREIGHT TRANSPORT ON THE DIFFERENT STRETCHES OF THE RHINE** (IN MILLION TONNES) *



Source: CCNR analysis based on Destatis and Rijkswaterstaat
** To avoid double-counting, the volumes on the different Rhine stretches cannot be calculated together, as certain volumes are present on several Rhine stretches.*

Along with the overall cargo transport on the Rhine, cargo transport and vessel movements are registered at specific measurement points (locks or border points). The relevant volumes represent the transport activity only at these points and do not represent total Rhine transport. However, this approach reveals existing differences in transport intensity between different Rhine stretches, for example between the Lower and the Upper Rhine.

TABLE 1: **MEASUREMENT POINTS FOR FREIGHT TRANSPORT IN THE RHINE BASIN**

Rhine stretch or affluent	Measurement point	Name	Volume of transport (in million tonnes)			Number of cargo vessels passing		
			2020	2021	2022	2020	2021	2022
Lower Rhine *	Border DE/NL	Emmerich	130.0	134.5	124.9	102,555	106,497	105,886
Upper Rhine	Border DE/FR	Iffezheim	16.9	19.1	16.3	21,121	23,631	24,274
Wesel-Datteln Canal *	Junction with Rhine	Wesel-Friedrichsfeld	17.0	19.1	17.9	18,085	18,961	16,520
Rhein-Herne Canal *	Junction with Rhine	Duisburg-Meiderich	13.2	13.6	12.4	10,650	11,688	15,400
Main	Junction with Rhine	Mainz-Kostheim	13.5	12.1	11.1	16,333	15,213	14,309
Moselle	Junction with Rhine	Koblenz	8.1	9.2	8.6	7,055	8,459	9,106
Neckar	Junction with Rhine	Mannheim-Feudenheim	5.1	5.7	5.5	6,564	5,663	5,484

Sources: German Waterway and Shipping Administration, Destatis, Moselle Commission
** The source for the Lower Rhine and for the two canals is the German Statistical Office (Destatis), whereas for all other data in the table, the source is the German Waterway Administration.*

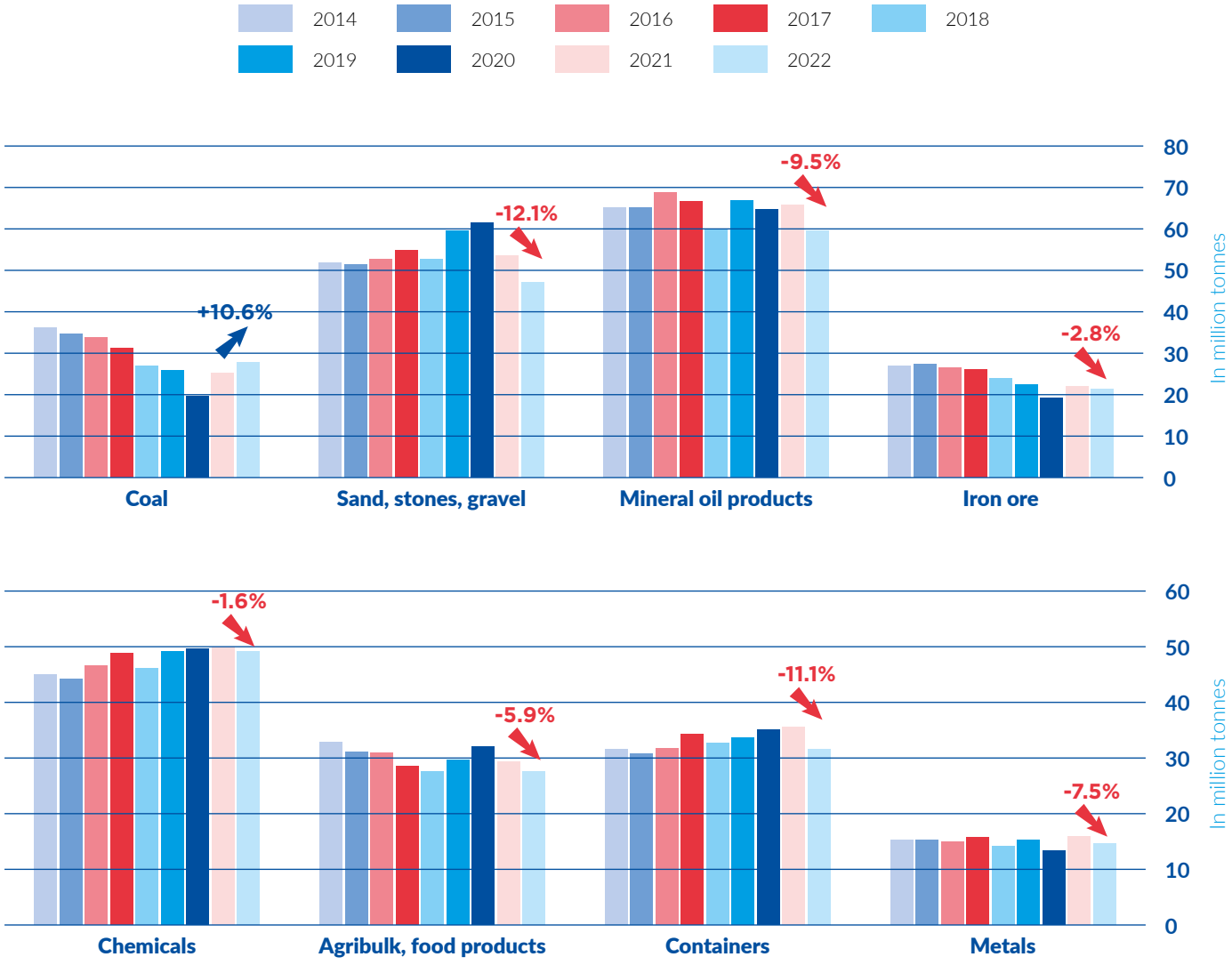
For the lock of Iffezheim on the Upper Rhine, a detailed dataset is available. Based on this dataset, the average loading degree of dry and liquid cargo vessels that passed this lock were calculated. Empty trips, which represent a share of 47.0% of all vessels passing the lock were not taken into account in this calculation. For dry cargo vessels, the highest average loading degree was reached in February (60.7%), and the minimum in August (31.3%), due to the low water period. The annual average loading degree for dry cargo vessels was 49.8%. For tanker vessels, the annual average was slightly lower (48.7%).

On the river Moselle, iron ore, coal and agribulk play a large role due to the steel production in the Saar region in Germany and the agricultural production in the region of Lorraine in France. In 2022, a strong increase in the transport of coal (+63%) was recorded at the lock of Koblenz, mirroring similar figures observed for the Rhine. An increase in coal transport is also recorded at the lock of Apach, which is located further upstream, at the border between France, Germany, and Luxembourg. Despite the booming of coal transport, less cargo transport was registered overall on the Moselle, mainly because of dwindling volumes of iron ore, sands, stones, and gravel.

Rhine transport by cargo segment

In terms of global cargo transport volumes for the entire Rhine, the segments of mineral oil products, chemicals and sand, stones, gravel, were the top three contributors both in 2021 and 2022.

FIGURE 7: **GOODS TRANSPORTED ON THE TRADITIONAL RHINE BY TYPE OF GOODS** (IN MILLION TONNES) *



Source: CCNR analysis based on Destatis and Rijkswaterstaat
** For containers: net-weight*

Overall, in the transition from 2021 to 2022, transport of goods on the entire Rhine was negatively affected by factors such as reduced aggregate demand, high inflation, the pandemic re-surge in China and the armed conflict between Russia and Ukraine leading to a global economic slowdown. The resulting supply side shortages for commodities, the energy crisis, and ultimately, the low water levels of July and August 2022, were additional negative elements which impacted transport on the entire Rhine.

In terms of cargo transport growth from 2021 to 2022, except for coal that increased roughly by +10.6%, all product segments experienced a decrease. Sand, stones, gravel (-12.1%); containers (-11.1%); mineral oil products (-9.5%); metals (-7.5%) and agri-food products (-5.9%) had relatively sharp decreases compared to slight reductions for iron ore (-2.8%) and chemicals (-1.6%).

Some particularities were observed in some of the segments. In 2022, for the agri-food segment, the war between Russia and Ukraine led to a disruption in grain exports which contributed to a fallout on the sectoral cargo transport. The rise in energy prices and production costs negatively affected the iron ore and steel, mineral oil products and chemicals transport volumes. Inflation and the global economic slowdown also had a negative impact on private consumption, thereby affecting all cargo segments.

The impact of low waters affecting Rhine navigation in July and August 2022 also contributed to this decrease. A comparison of monthly figures for 2021 and 2022 for the Traditional Rhine reveals that the segments that were most strongly hit by low waters and the war were fertilizers, chemical products, mineral oil products, building materials and containers. For fertilizer production (which is a part of the chemical segment), gas is the main feedstock, so that skyrocketing gas prices led to a decrease in fertilizer transport by as much as -26.0%.

Coal transport experienced a surge on its transport activity due to its important substitution effect in relation to natural gas. Indeed, the rise in gas prices and the abandonment of Russian pipeline gas imports triggered the need to find substitutes. Coal was hereby chosen as a main substitute, due to its availability and because renewable energies are still not sufficiently abundant to act as a baseload energy.

Before the start of the armed conflict between Russia and Ukraine, Russian coal accounted for 50% of all coal imports of the EU. In the first half year of 2022, the EU decided on an embargo against coal from Russia. Anticipating this embargo, which came into force in August 2022, the volume of Russian coal that was unloaded in ARA seaports in the first half year of 2022 was significantly higher than one year earlier.[5]

As hinterland transport of seaborne coal is mainly delivered on the Rhine towards Germany, coal volumes on the Traditional Rhine rose by around +27% in the first six months of 2022. For the entire year, the increase was somehow smaller (+11%). The transport of coal heightened again between September and December, which suggests that Russian coal could be substituted by coal from other parts of the world. Important coal producer countries (outside Russia) are the US, Australia, South Africa and Indonesia.

The rising import volumes of coal for the German industry, alongside the low water effects and the transfer of dry cargo capacity from the Rhine to the Danube, led to a lack of available vessel capacity for dry cargo in the Rhine region and partly explains the negative results for other dry cargo segments, such as sands, stones, gravel and construction material. Hence, the reported drop of -17.5% by the Port of Strasbourg for construction material in 2022 compared to the previous year, which was accentuated by the low water period.

[5] Source: Deutsche Welle (2022), Europäische Union - Keine Kohle mehr aus Russland für die EU, https://www.dw.com/de/keine-kohle-mehr-aus-russland-f%C3%BCr-die-eu/a-62756913 (last consulted on 30.03.2023)

The price increase for final products such as steel, caused by higher raw material and electricity prices, must also be mentioned. This effect propagated within the entire production chains. The result was an increase in production costs for various steel using sectors (construction sector, automobile industry, etc.), leading to less consumer confidence and less transport demand (as mentioned by the Port of Mulhouse). Supply shocks of this kind are usually propagated through the entire economy and can unfold macroeconomic downward spirals.[6]

Mineral oil products are a market segment that immediately came under pressure due to rising oil prices. As an illustration, due to this sharp oil price increase, the Swiss government had to release a quota of certain mineral oil product volumes which resulted in the mandatory storage volumes being emptied. This explains the sharp decrease for the segment of mineral oil products in the Swiss Rhine Ports of Basel. On the contrary, the Port of Strasbourg reported an increase in the transport of mineral oil products (+5.7%), pointing out that the French government had been obliged to build up stocks and anticipate further increases in the prices of mineral oil products.

This example above shows that individual reactions of market participants (inland ports, governments) can differ from one case to another. The agribulk market is a good example of this. The following box contains a description of such economic reactions that emerged during the year 2022 in this freight transport segment.

The hoarding concept and its market implications in the context of a conflict – Example of the segment of grain in the Rhine and Danube basins in the summer of 2022

"Hoarding in economics refers to the concept of purchasing and storing a large amount of products belonging to a particular market, often creating scarcity of that product, and ultimately driving the price of that product up".[7] This concept can be illustrated by two specific cases which, in the context of the armed conflict between Russia and Ukraine, had different market implications (saturation vs. scarcity).

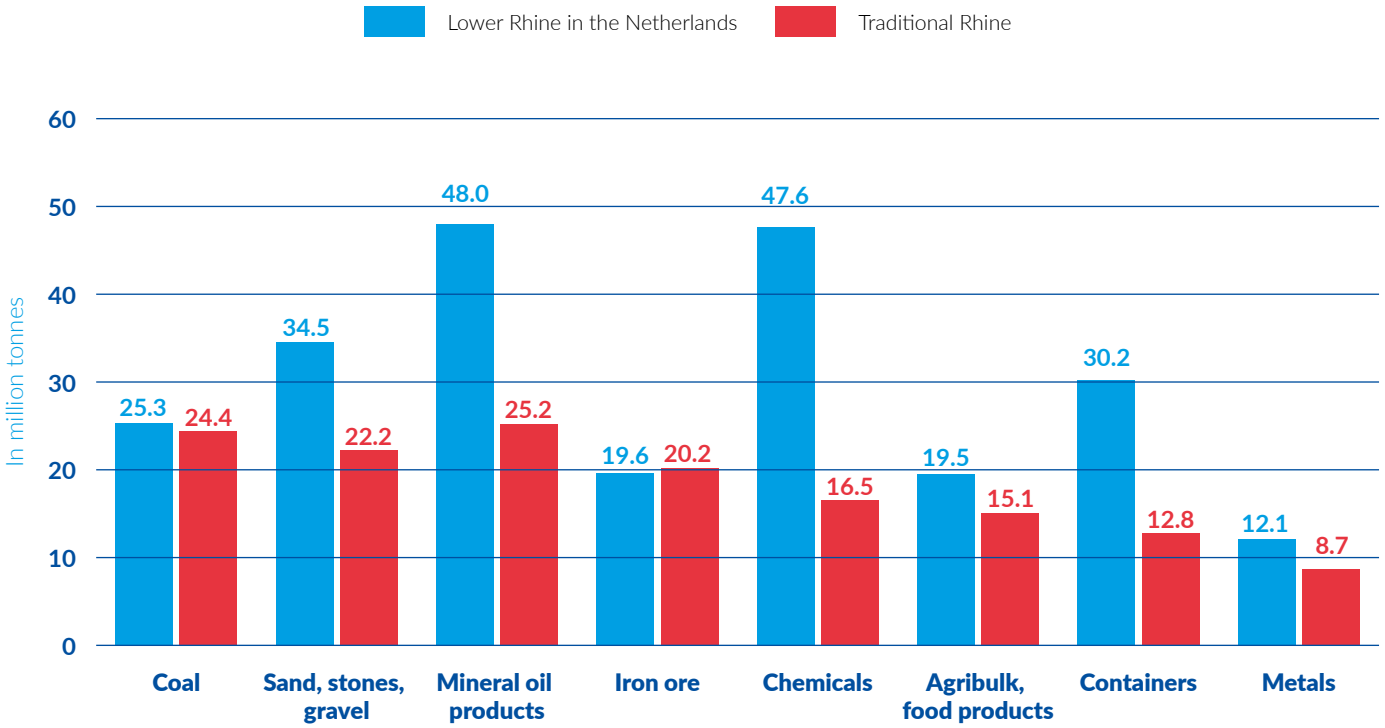
The Port of Strasbourg reported that French grain processors, whose companies are located at the port, feared at first a shortage of raw materials. Consequently, they made additional orders to compensate for a possible lack of Ukrainian grain and to secure their supplies. But following an agreement between Ukraine, United Nations, Turkey and Russia on 22 July 2022,[8] these food processors found themselves with a surplus of grain, due to the reopening of Ukrainian grain exports via the Black Sea ports. This situation resulted in a phenomenon of saturation of storage facilities throughout the Upper Rhine region.

In Serbia and Hungary, restrictions on exports of agricultural and food products were imposed by governments in order to accumulate national stocks at the very beginning of the war. Thus, by purchasing and storing a large amount of agricultural and food products, these Danube countries created scarcity on the grain market which eventually increased the price of these products further. In this case, the anticipation by such countries of a possible shortage of cereals has in fact caused an aggravation of the price surges.

[6] Similar effects related to the steel market were felt also outside the Rhine region. For the Rhône in southern France, the Ports of Lyon and Villefranche also reported a decrease in the transport of steel sheets which can be partly explained by the fact that the Arcelor Mittal steel company reduced its activity at Fos-sur-Mer (near Marseille), in connection with the drop of activity in the automotive sector.
[7] https://en.wikipedia.org/wiki/Hoarding_(economics)
[8] https://news.un.org/en/story/2022/07/1123062

An analysis of cargo segments split between the Lower Rhine in the Netherlands and the Traditional Rhine enables a better grasp on the dynamics regarding transport of goods per type of products along the Rhine. The Lower Rhine in the Netherlands has a far greater share of chemicals transport compared to the Traditional Rhine. Container transport as well as transport of sands, stones and gravels are also more intense in the Lower Rhine in the Netherlands. For commodities and final products of the steel industry, as well as coal for the energy sector, the volumes are rather evenly distributed between the Lower Rhine in the Netherlands and the Traditional Rhine.

FIGURE 8: **CARGO TRANSPORT ON THE RHINE BY TYPE OF GOODS – SPLIT BETWEEN THE LOWER RHINE IN THE NETHERLANDS AND THE TRADITIONAL RHINE IN 2022**
(IN MILLION TONNES)



Source: CCNR analysis based on Destatis and Rijkswaterstaat

Container transport on the Rhine

Between 2018 and 2022, container transport on the Rhine was impacted by a series of negative events.

- The low water period of 2018 and 2022 caused cargo losses in both years. The 2018 low water period led to modal share losses in the following years.
- The introduction of new tariffs in world trade in 2019 caused a deterioration in the business climate and in world trade activity, which is impacting both seaborne container throughput as well as inland container barging.
- The year 2020 saw the appearance of the Covid pandemic.

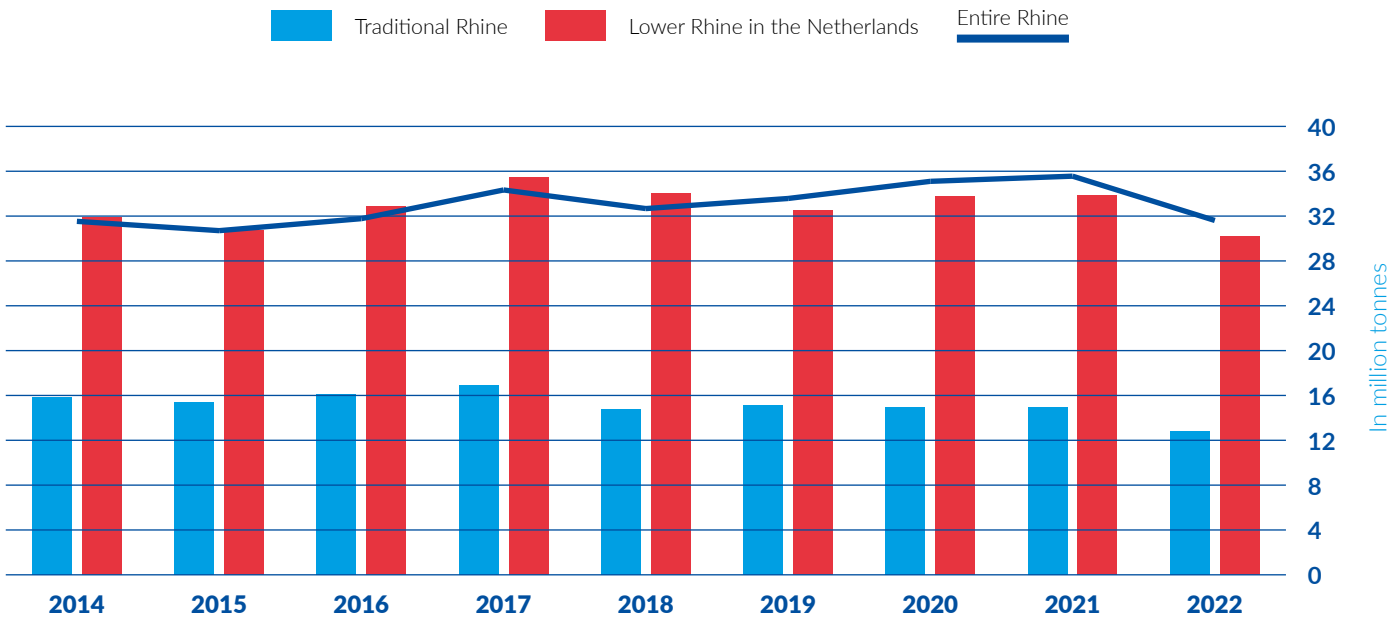
- In 2021, the overall business climate and world trade were still rather bleak due to disruptions in supply chains and a rising inflation.
- In 2022, the armed conflict between Russia and Ukraine broke out, causing high inflation and further disruptions in world trade.
- During all these years, inland container barging suffered also under congestion in seaports and related delays.

Both on the Traditional Rhine and on the Lower Rhine in the Netherlands, these factors can explain the lower average levels of container transport in the time span 2018-2022 compared to the period before 2018.

Measured in million tonnes, the result for container transport on the entire Rhine (from Basel to the North Sea) in 2022 was -11.1% lower than in the year 2021 (-14.5% for the Traditional Rhine and -11.0% for the Lower Rhine in the Netherlands). This is the strongest year-on-year reduction since 2014, showing, in addition to the impact of low waters, the negative impact of world trade disruptions. The impact of low waters is also visible in 2018.

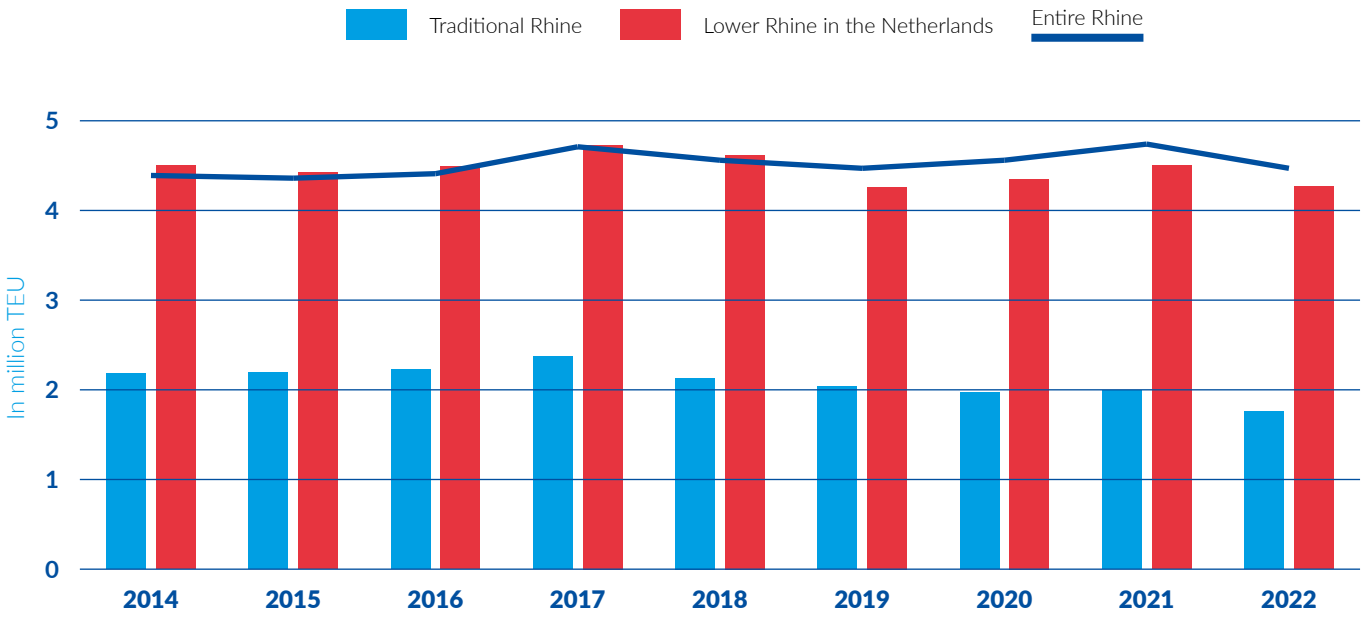
In the TEU unit, the rate of decrease was -5.7% (-11.6% for the Traditional Rhine and -5.0% for the Lower Rhine in the Netherlands).

FIGURE 9: **CONTAINER TRANSPORT ON THE ENTIRE RHINE, THE TRADITIONAL RHINE AND THE LOWER RHINE IN THE NETHERLANDS** (IN MILLION TONNES, NET WEIGHT OF GOODS IN CONTAINERS)**, 2009-2022**



Source: CCNR analysis based on Destatis and Rijkswaterstaat

FIGURE 10: **CONTAINER TRANSPORT ON THE ENTIRE RHINE, THE TRADITIONAL RHINE AND THE LOWER RHINE IN THE NETHERLANDS** (IN MILLION TEU)**, 2009-2022**



Source: CCNR analysis based on Destatis and Rijkswaterstaat

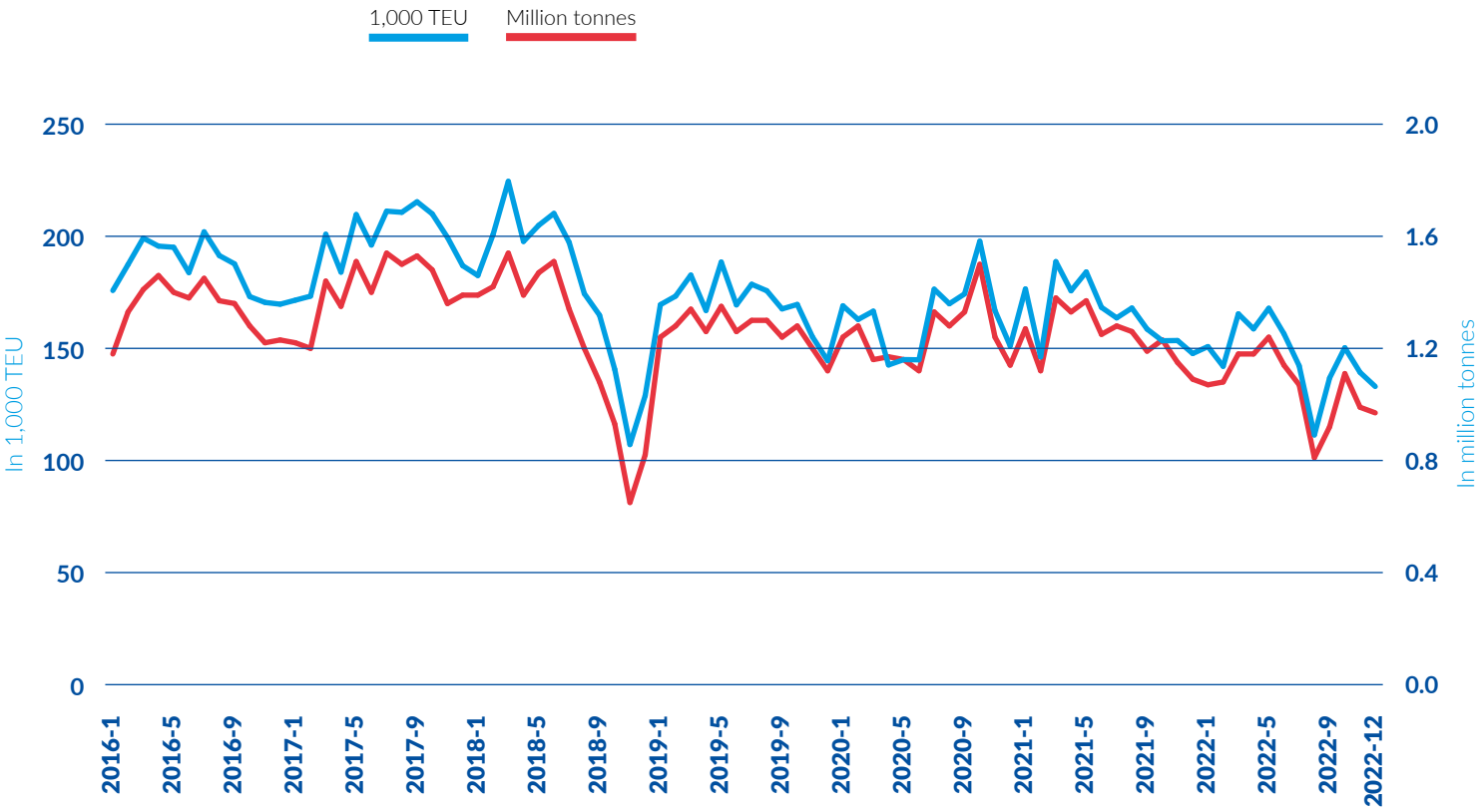
In-depth analysis regarding the Traditional Rhine: low waters and direction of transport

An analysis of monthly figures for the Traditional Rhine allows conclusions to be drawn regarding the impact of low waters on container transport. An analysis of monthly figures from January 2016 onwards shows the impact of the severe low water period in 2018. The level of container transport on the Rhine has never been the same since this extreme hydrological phenomenon (due to modal share losses). Regarding the Covid pandemic, data suggest that container transport on the Traditional Rhine was overall resilient. In fact, during Covid, barge operators reported that the development of container numbers much depended on the type of products (consumer products or feedstock for production processes) and the type of production processes. For instance, some consumer products boomed during Covid (such as food products or those ordered online) while other consumer products decreased. Some production processes (such as the production of cars in Germany) grounded to a halt, directly resulting in a sharp decrease of container numbers in this segment. On the other hand, other production processes boomed resulting in an increase of container numbers.

In addition, the end of the first lockdown in late 2020 clearly 'boosted' container transport. The return and aggravation of the pandemic in winter 2020-2021 left some traces.

A detailed comparison between 2021 and 2022 shows that monthly figures for 2022 were generally lower than in 2021. Although the development of the curve suggests that the low water period in July and August 2022 had a far more negative impact than the war in Ukraine, it is indeed difficult to distinguish the exact relative contribution of both effects.

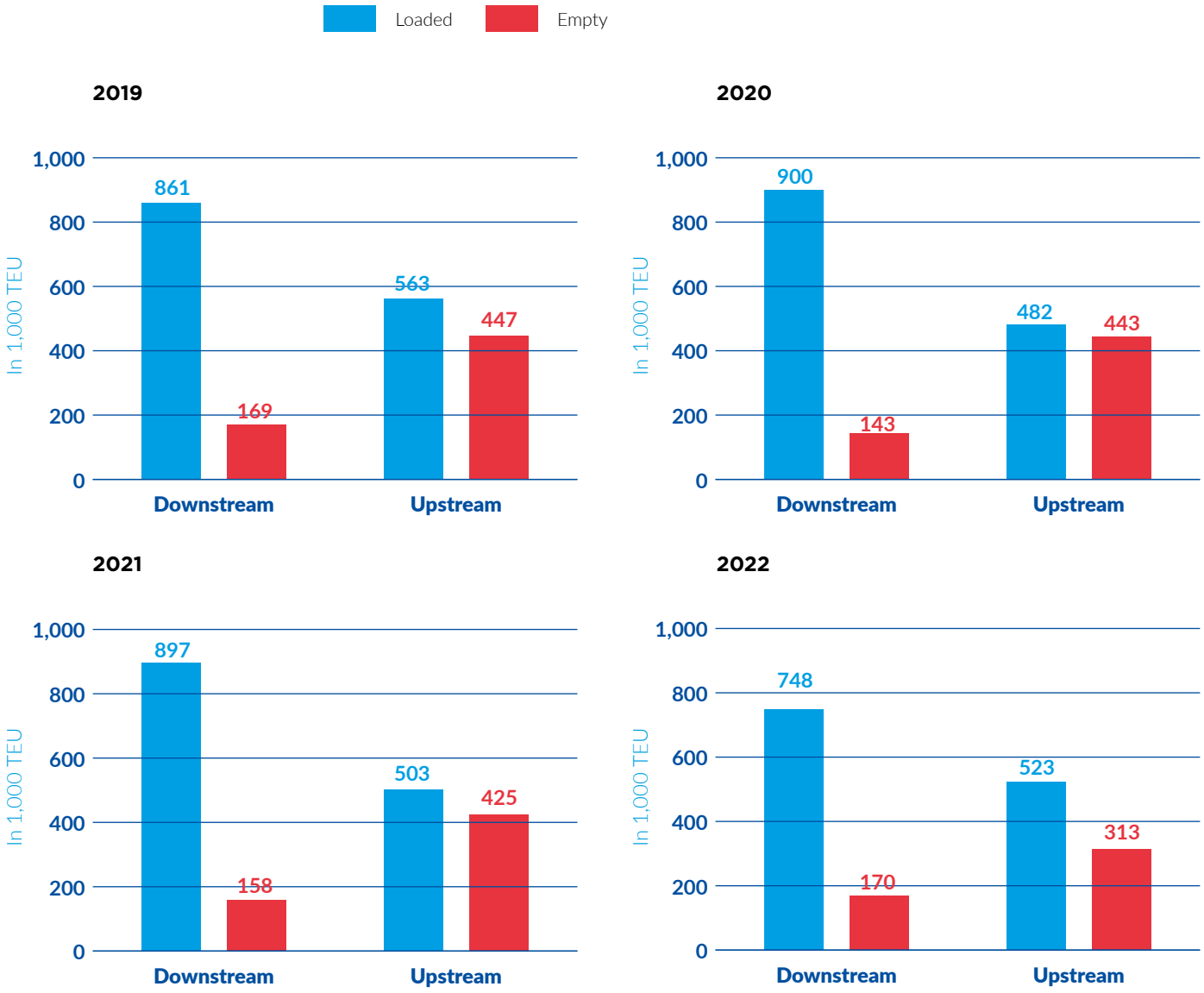
FIGURE 11: **MONTHLY CONTAINER TRANSPORT ON THE TRADITIONAL RHINE** (IN 1,000 TEU AND IN MILLION TONNES)**, 1/2016-12/2022**



Source: Destatis

Container transport on the Traditional Rhine can be differentiated according to direction of transport (export/import) and status of containers (filled/empty). These differentiations reveal that the main reduction taking place in 2022 is found in the category of 'filled export' (downstream transport of loaded containers). For this category, 748,000 TEU were recorded in 2022, representing a strong reduction of -16.6% compared to the year 2021. This pattern can be explained by a decrease in exports of machines and consumer goods from France, Germany and Switzerland towards ARA seaports.

FIGURES 12, 13, 14, 15: **CONTAINER TRANSPORT ON THE TRADITIONAL RHINE, DOWNSTREAM VERSUS UPSTREAM TRAFFIC AND LOADED VERSUS EMPTY CONTAINERS** (IN 1,000 TEU)



Source: CCNR analysis based on Destatis

Data on container transport on the Moselle[9] indicate a similar but not fully identical structure: container transport on the Moselle presents also higher values for loaded containers within the downstream or export direction. However, in contrast to the Rhine, for the upstream direction, the share of empty containers is higher than the share of loaded containers. This is a difference compared to the Rhine, where the share of loaded containers is higher for both downstream and upstream transport (although the ratio between 'loaded' and 'empty' is smaller for upstream transport).

While container transport has followed a growth trend on the Moselle in the last ten years, this trend weakened in 2021 and 2022. The peak in container transport on the Moselle was reached in the year 2020, with 25,521 TEU. After this peak, TEU volumes started to decrease in 2021 and 2022, down to 24,438 TEU (2021) and 17,484 TEU (2022).

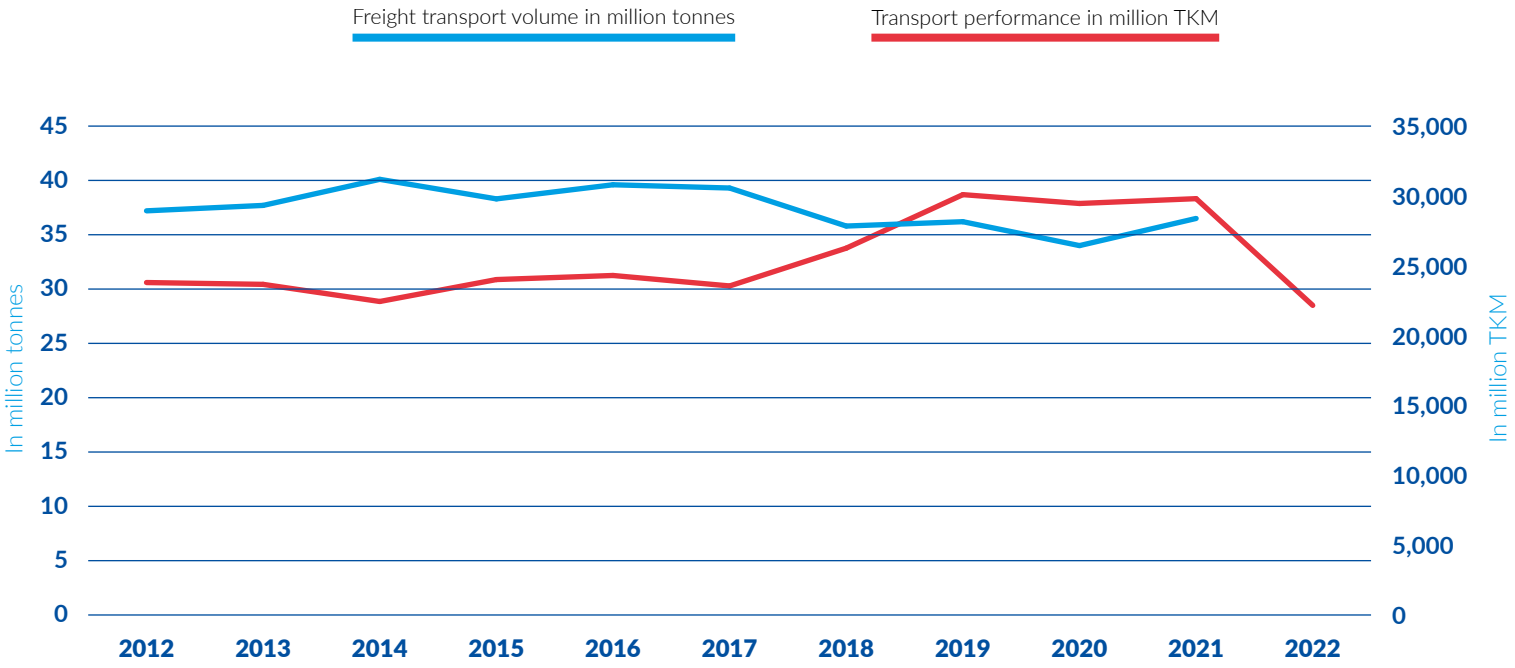
[9] *Source: Moselle Commission*

DANUBE BASIN

Transport volume and transport performance on the Danube

Cargo transport on the entire navigable Danube between Kelheim (Germany) and the Black Sea via the Danube-Black Sea Canal and the Sulina Canal lies in the range between 34 and 40 million tonnes per year.[10] Transport performance on the Danube (EU Danube countries plus Serbia) reached 23.9 billion TKM in 2022, a decrease of -20% compared to 2021.

FIGURE 16: **FREIGHT TRANSPORT VOLUME** (IN MILLION TONNES) **AND TRANSPORT PERFORMANCE** (IN MILLION TKM) **ON THE DANUBE ***



Sources: for transport volumes - viadonau, Annual reports on Danube navigation; for transport performance - Eurostat [IWW_GO_ATYGO] and [IWW_GO_QNAVE] (Serbia), Q4 CCNR estimation
** Transport performance in IWT in all EU Danube countries plus Serbia. Data for Serbia available since 2018.*

Danube transport at specific measurement points

The market observation system used for observing Danube cargo transport at certain measurement points is similar to the system in the Rhine basin. The waterway administrations register data at certain borders or measurement points which are described in the following table.

[10] *Source: viadonau, several annual reports available at https://www.viadonau.org/newsroom/publikationen/broschueren (last consulted 22.07.2022)*

TABLE 2: **MEASUREMENT POINTS FOR DANUBE FREIGHT TRANSPORT**

Danube stretch or affluent	Measurement point	Name	Volume of transport (in million tonnes)		
			2020	2021	2022
Upper Danube	Border Germany/Austria	Lock of Jochenstein	2.3	2.2	2.2
Upper Danube	Vienna	Lock of Wien-Freudenau	6.7	6.4	5.5
Upper Danube	Border Slovakia/Hungary	Lock of Gabčíkovo	5.0	4.9	4.3
Middle Danube	Border Hungary/Croatia/Serbia	Mohács	6.1	5.8	4.0
Danube-Black Sea Canal	No specific point, total volumes on the canal are taken into account	Canal authority CAN[11]	16.5	17.3	17.3
Sulina Canal	No specific point, total volumes on the canal are taken into account	Waterway Administration AFDJ[12]	4.5	5.1	10.6

Source: Danube Commission market observation

On the Danube, and in particular on the Lower and Middle Danube, transport by pushed convoys represents a high proportion within total goods transport. At the measurement point of Mohács on the Middle Danube, pushed convoys transported 73.0% of all cargo in 2022, compared to 78.0% in 2021, 75.7% in 2020, 79.5% in 2019 and 78.7% in 2018.

Due to the high-water depths in the lower Danube section, in particular in the Danube delta region (also known as 'maritime Danube'), cargo transport in the Lower Danube area attains much higher values than on river sections further upstream. This is notably the case for the Danube-Black Sea Canal, running from Cernavodă on the Danube River to Constanța on the Black Sea (southern arm) and to Năvodari (northern arm) on the Black Sea. In 2022, this canal had a transport volume of 17.3 million tonnes (same level as in 2021). Another estuary arm is the Sulina Canal, which flows into the Black Sea in the Danube delta region near the Romanian-Ukrainian border. Transport volumes on the Sulina canal more than doubled in 2022 compared to 2021 (10.6 million tonnes in 2022 compared to 5.1 million tonnes in 2021). This exceptional increase was driven by the blockade of Ukrainian seaports and the need to support Ukrainian exports of grain via alternative routes ('Solidarity Lanes EU-Ukraine'). In this respect, the Danube Commission undertook a number of initiatives to contribute to solving problems related to the proper functioning of the Lower Danube corridor and to facilitate existing IWT logistics. It also promoted a more active use of the transport potential of the Danube waterway based on a systematic analysis of identified cargo flows and throughput capacity of the ports on the Lower Danube, including the Port of Constanța.

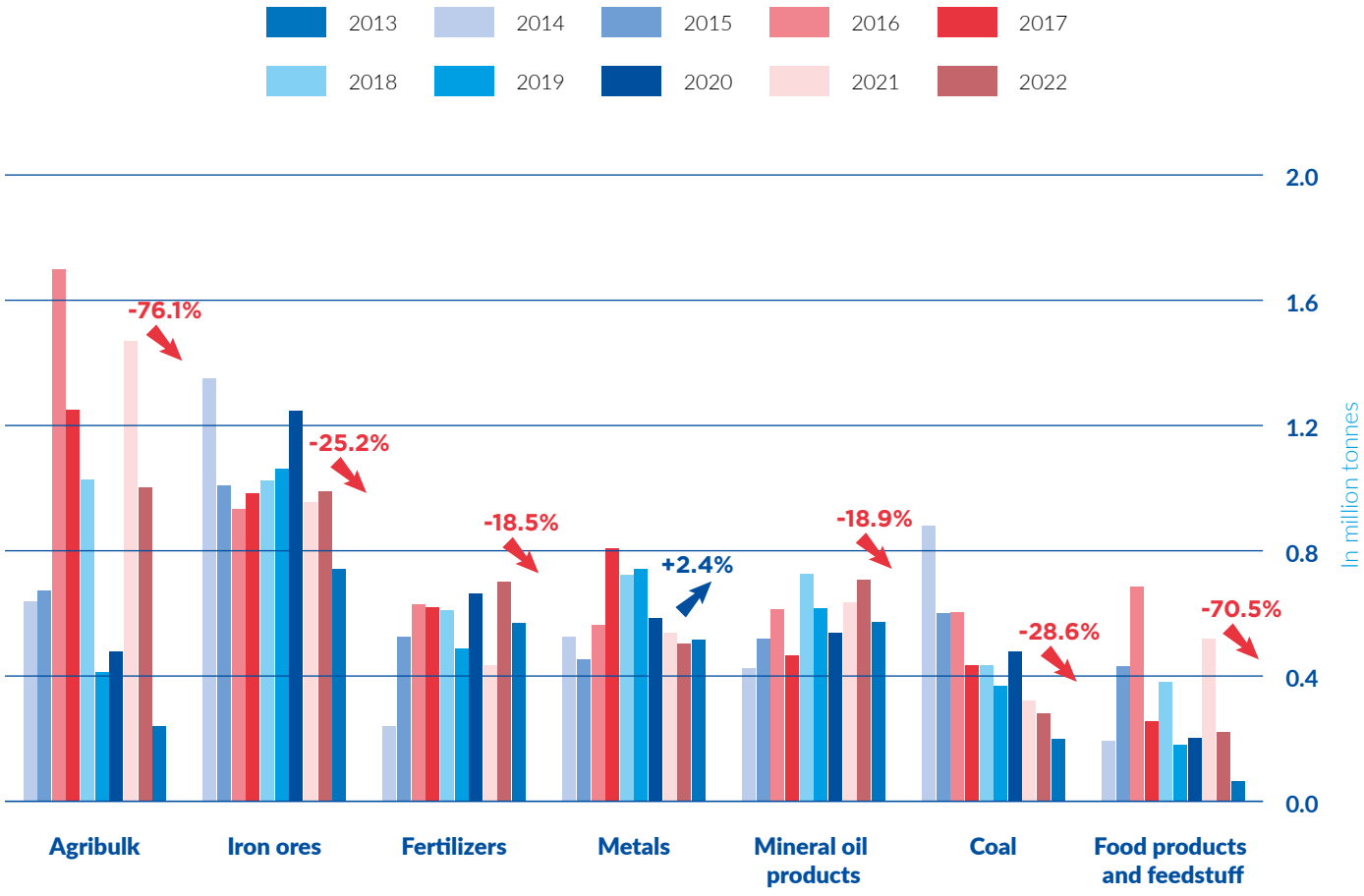
[11] *https://www.acn.ro/index.php/de/*
[12] *https://www.afdj.ro/en*

Danube transport by cargo segment

While the end of 2021 and first two months of 2022 were showing positive signs towards a certain growth in transport volumes on the Danube, the armed conflict between Russia and Ukraine led to the emergence of several factors weighing heavily on Danube navigation: the energy crisis, the shortage and rise in iron ore prices, restrictions to the export of grain and other food products as well as rising fuel prices.

As a result, in 2022, volumes of transport decreased for all cargo segments. This decrease was particularly marked in the downstream direction for grain and other agribulk, which nearly collapsed by losing -80% on the Middle Danube. Food products and feedstuff – although of a lower importance in terms of volume – diminished by -90%. This can partly be explained by the fact that Middle Danube countries, in particular Hungary and Serbia, imposed export restrictions for agricultural and food products in order to accumulate national stocks at the very beginning of the war. Fears of a future shortage of grain and foodstuff, and the possibility of another period of severe drought fuelled this phenomenon, known as 'hoarding effect' (see previous box on hoarding).

FIGURE 17: **GOODS TRANSPORT ON THE MIDDLE DANUBE** (IN MILLION TONNES) *



Source: Danube Commission market observation
** At Mohács (southern Hungary - border area with Croatia and Serbia)*

CONTAINER TRANSPORT
PER COUNTRY IN EUROPE

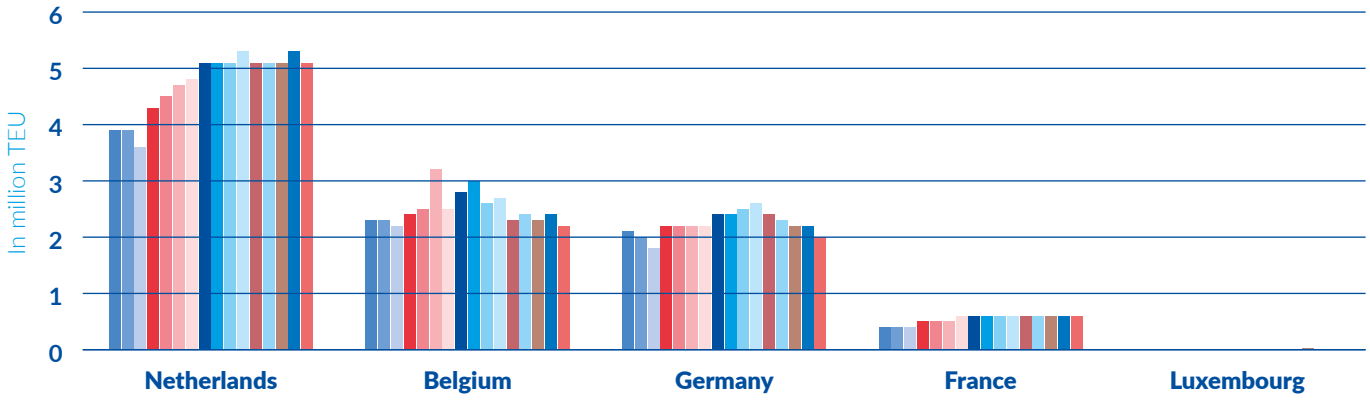
THE WHOLE EUROPE AND GEOGRAPHICAL STRUCTURE

With 12 billion TKM, more than 6 million TEU and over 52 million tonnes of cargo in containers, container transport on EU inland waterways represents 9.8% of the total IWW transport performance of approximately 122 billion TKM in the EU. Moreover, 99.4% of the container transport performance (TKM) takes place in Rhine countries (the Netherlands, Belgium, Germany, France, Switzerland, Luxembourg). Container transport on the Danube accounts for 0.5% and 0.1% in Sweden.

RHINE COUNTRIES

In 2022, container transport measured in TEU regressed by -4.4% in the Netherlands, by -11.3% in Germany, by -8.6% in Belgium and progressed by +3.8% in France. In the Netherlands, 45.6 million tonnes of cargo were transported in containers (-9.8% compared to 2021), making this country the frontrunner in inland waterway container transport in Europe.

FIGURE 18: **IWW CONTAINER TRANSPORT PER RHINE COUNTRY** (IN MILLION TEU) *



Source: Eurostat [iww_go_actygo]
** In Luxembourg, 17,436; 14,132; and 9,995 TEU were recorded for 2020, 2021, and 2022, respectively.*

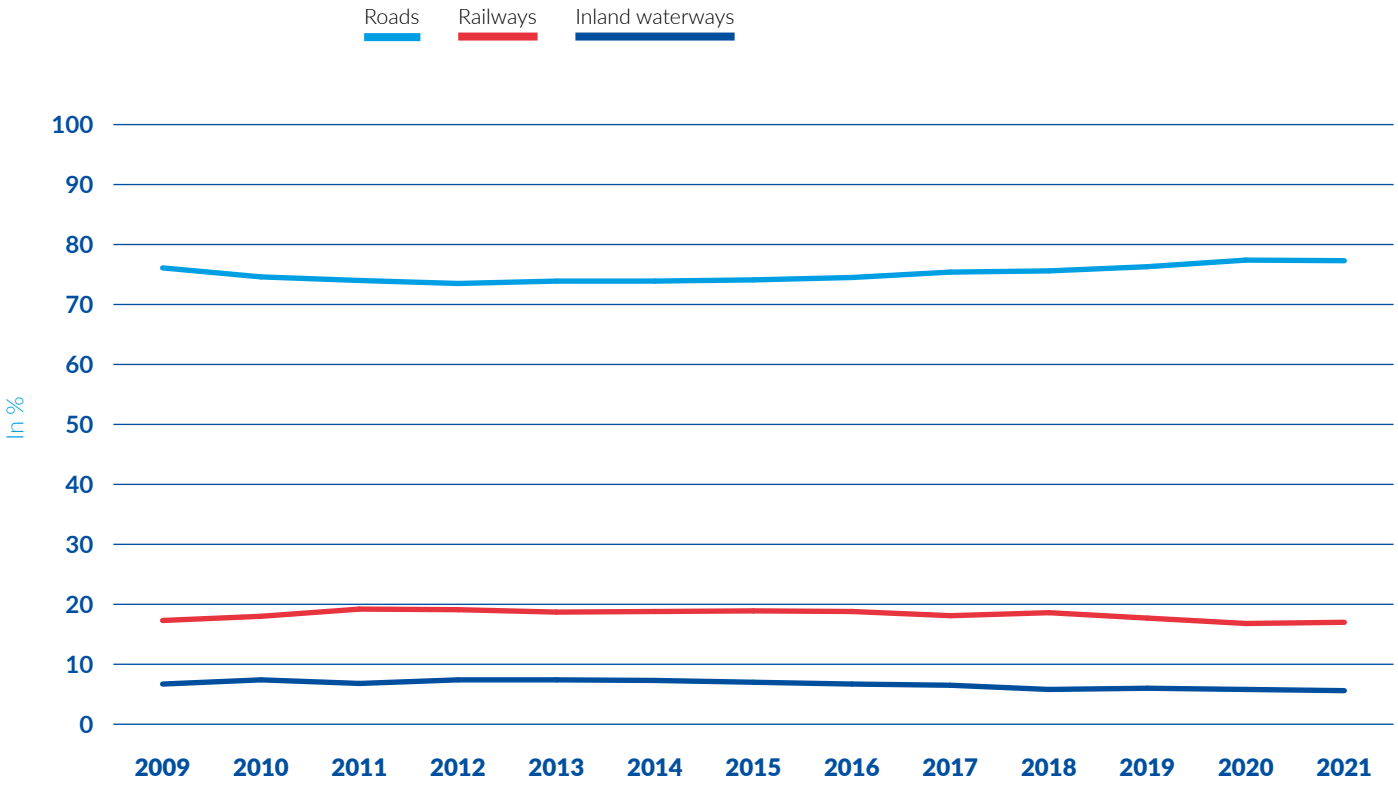
DANUBE COUNTRIES

The two Danube countries with the highest container transport are currently Romania and Hungary. In 2022, 4,360 TEU were transported on Hungarian inland waterways. In Romania, container transport amounted to 22,675 TEU in 2022, which was a spurred increase compared to 2018, 2019 and 2020. Considering the weight of cargo, container transport on Hungarian waterways represented 9,000 tonnes in 2022. In Romania, 190,000 tonnes of cargo were transported in containers. These values illustrate the immense gap towards Rhine countries. In 2022, 45.6 million tonnes were transported in containers on inland waterways in the Netherlands, 19.0 million tonnes in Belgium, 18.3 million tonnes in Germany and 3.5 million tonnes in France.

Container transport in Bulgaria reached 3,156 TEU in 2022. Over the last 15 years, no upward movement has been observed, and with a strong decline in 2017 and 2021, this has since remained at a more or less low level. In 2022, Austrian container transport reached 1,168 TEU.

INLAND NAVIGATION
AND OTHER MODES OF TRANSPORT

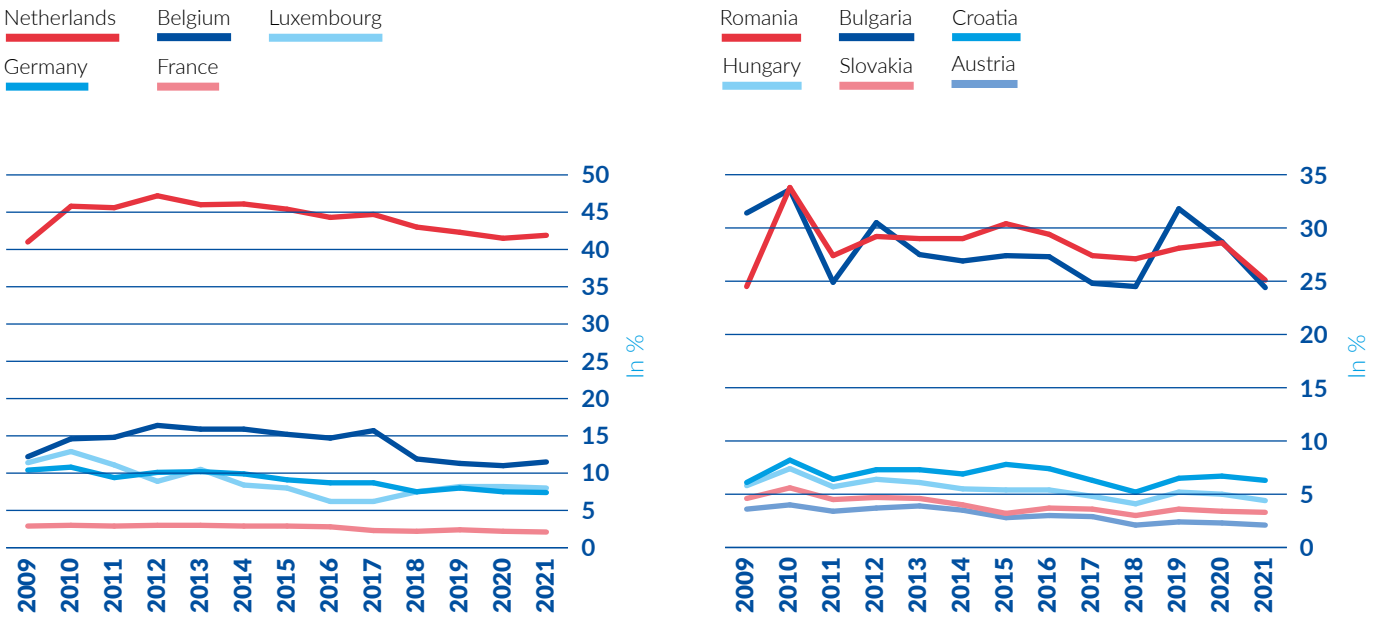
FIGURE 19: **MODAL SPLIT SHARE OF INLAND TRANSPORT MODES IN THE EU-27** (IN %) **2009-2021**



Source: Eurostat [tran_hv_frmod]

Over the last decade, modal split shares have overall remained rather stable. However, the modal split of IWT at the level of the EU-27 has lost a 1.8 percentage point in the last 10 years, to reach 5.6% in 2021, its lowest level since 2005. It is well behind road transport (77.3% in 2021, +3.4 percentage points in the last 10 years) and rail transport (17.0%, -1.7 percentage point in the last 10 years). As many EU countries do not have inland waterways, the overall modal split of IWT at the EU level should not be used as a performance indicator for the success of inland waterway transport in the EU.

FIGURES 20 AND 21: **IWW MODAL SPLIT EVOLUTION IN RHINE AND DANUBE COUNTRIES** (IN %, BASED ON TONNE-KILOMETRES) *



Source: Eurostat [tran_hv_frmod]

** Share of inland waterway transport performance in total (IWT + Road + Rail) transport performance*

In the Netherlands, the IWW modal split increased until 2012, to reach a peak at 47.2%. It decreased in the following years, reaching 41.9% in 2021. Similar trends are visible in Belgium, Germany and France. In Luxembourg, the modal split of IWT has increased in recent years and has remained stable since 2019 (8.0% in 2021). Within Danube countries, Romania and Bulgaria record high IWT modal shares reaching respectively 25.1% and 24.4% in 2021. But the IWT modal share in both countries lost respectively 3.7 and 4.3 percentage points between 2020 and 2021, to the benefit of road transport. In 2020, the IWT modal share in Bulgaria had already lost 3 percentage points, which also benefited road transport.


WORKUM

03

NATIONAL INVESTMENTS IN IWT INFRASTRUCTURE

- **Infrastructure represents a basic need for reliable inland waterway transport. Yearly data for infrastructure maintenance, as well as infrastructure investments, are reported for Rhine and Danube countries.**
- **Shortfalls in data arise due to varying methodologies in data collection.**
- **The data presented allow for an analysis per country but do not allow the comparison of trends in maintenance and investment spendings between different countries. For instance, maintenance spending can vary greatly between countries due to the length and nature of the waterway as well as the number of constructions on this waterway.**

II INTRODUCTION

In order to ensure a year-round navigability, the state of the inland navigation transport network must enable efficient, reliable and safe navigation for users by ensuring minimum waterway parameters and levels of service (Good Navigation Status). To achieve this goal, IWT infrastructure needs to be constructed, maintained, and upgraded through investments within a coherent corridor vision. It must also consider the growing demand for fast, reliable, high-quality, seamless movement of goods and persons. In this regard, monitoring national investments in IWT infrastructure is essential.

Maintenance, rehabilitation, and regeneration are key actions towards inland navigation reliability and performance. Any financial support ensuring more efficient maintenance, rehabilitation and regeneration activities positively impact infrastructure. However, it should be borne in mind that these are long-run activities, part of an investment life cycle approach.[13]

Infrastructure spending can be broken down into two main categories: investment and maintenance spending.

Maintenance spending focuses on already existing infrastructure and its upkeep. Maintenance spending, such as that related to dredging campaigns to maintain guaranteed navigable channel depth, are however, as of today, not eligible for EU co-funding in the context of the Connecting Europe Facility II programme (CEF II). Today, it is the responsibility of Member States to maintain their inland navigation networks, core and comprehensive, which is crucial for the development of the sector. Nevertheless, it is important to note that maintenance spending can vary greatly from one country to another, depending on:

- the length of the navigable waterway,
- its nature (free-flowing or not) and,
- the number of constructions on this waterway (locks and dams generally represent the most important expenditure items).

Investment spending embraces a new spending in new projects such as the enlargement or upgrading of waterways. Such investments are eligible for co-funding at EU level, for instance via CEF II. In legal understanding, an investment must undergo an environmental impact assessment whereas maintenance spending is usually not tied to such legal requirements.

Investments in port infrastructure are not within the scope of this chapter.

[13] *Draft recommendations for the development of common, harmonised guidelines/standards for Good Navigation Status*

SHORTCOMINGS
RELATING TO DATA COLLECTION ON INFRASTRUCTURE SPENDINGS

It might be tempting to compare data between countries, but there are some important shortcomings to be discussed to allow for reasonable conclusions. Such shortcomings arise from differing methodologies of data collection and the definitions behind these, but also from differences regarding the types of waterways present in the countries. For example, countries with a high share of free-flowing rivers need a higher amount of maintenance activities than countries with a lower share in this regard.

Regarding differing methodologies, infrastructure maintenance equipment is included for one country under infrastructure maintenance spending but might not be included in another. This could also partly explain possible discrepancies that may exist between one data source and another. Due to these different methodologies and different types of waterways, it is more advantageous to shed light on the trend for each country. In addition, the differentiation between investment spending and maintenance spending is sometimes not available.

Another important aspect lies in the competent authorities for data collection. For instance, whereas in Croatia the hydrological institute is responsible for the data collection, in most parts of the Rhine and Danube countries it is the waterway administrations that are responsible.

Last but not least, it should be mentioned that depending on the inland water CEMT[14] class, the entity responsible for managing infrastructure investment might vary, for instance, it could either be the national authority or the regional authorities. The infrastructure spending related to inland waterways falling under the responsibility of regional authorities, generally regional waterways of CEMT class III or below, might therefore not be reported in the national infrastructure spending data. For those countries that count numerous regional navigable waterways of CEMT class III or below, it is likely that the total amount of infrastructure spending reported in this chapter is underestimated. This would be the case for the Netherlands and Poland.

[14] *European Conference of Ministers of Transport*

OVERVIEW
PER COUNTRY

RHINE COUNTRIES

For the Rhine countries, relevant data regarding infrastructure maintenance and investment spending can be retrieved from the International Transport Forum (ITF).[15] Due to the shortcomings explained in the above section no country comparisons shall be made. This data serves to carry out a country trend analysis in the two given indicator variables. Note that data for the Netherlands, Switzerland and for infrastructure maintenance spending in Germany, is not available on the ITF data.

The ITF database encompasses both land and waterside infrastructures. Indeed, it is based on the OECD definition of inland waterway infrastructure (and related costs) which includes both landside and waterway-related components: "Infrastructure includes land, channels and permanent way constructions, buildings, navigation locks, mooring equipment, toll collection installations, as well as immovable fixtures, fittings and installations connected with them (signalisation, telecommunications, etc.) as opposed to IWT vessels".[16]

Regarding infrastructure maintenance spending in Germany, national data on maintenance spending in waterway transport do not, in most cases, distinguish between inland and maritime waterways, which makes an analysis quite impossible.

Data regarding transport infrastructure spending and maintenance in the Netherlands can be derived from the infrastructure fund.[17] This fund is part of the complete national budget for the Netherlands and, next to rail, road and main waterways, comprises three[18] further categories. Since 2017, an increase in the overall infrastructure fund is observed. The value of the fund reached 14.4 billion Euro in 2022, of which 1.3 billion Euro was dedicated to IWT infrastructure. For smaller waterways in provinces, the regional authorities are responsible for the budget allocation. Hence, they are not part of these figures and the infrastructure spendings in the Netherlands are therefore higher than 1.3 billion Euro.

[15] International Transport Forum is an intergovernmental organisation within the OECD system.
[16] https://stats.oecd.org/glossary/detail.asp?ID=3957
[17] Dutch Finance Ministry. Infrastructure fund. Available at: https://www.rijksfinancien.nl/visuals/2022/begroting/uitgaven/A?graph=pie (last consulted 04.05.2023)
[18] The three other categories are: 1) explorations, reservations and investment space, 2) traffic and transport mega projects, 3) regional and local infrastructure.

TABLE 1: **INLAND WATERWAY INFRASTRUCTURE MAINTENANCE SPENDING IN MILLION EURO** (ITF FIGURES)

Year / Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Belgium	65.0	58.0	71.0	66.0	27.0	82.0	103.0	87.5	60.0	61.0	55.0	94.0
France	60.0	61.0	61.0	61.0	60.0	59.8	59.6	62.2	59.8	59.2	60.1	59.1
Germany	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Luxembourg	0.3	0.2	0.3	0.2	0.2	0.1	0.2	0.2	0.2	0.3	0.1	n.a
Netherlands	544.0	343.0	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Switzerland	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a

Source: ITF

TABLE 2: **INLAND WATERWAY INFRASTRUCTURE INVESTMENT IN MILLION EURO** (ITF FIGURES)

Year / Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Belgium	154.0	152.0	152.0	167.0	103.0	291.0	225.0	237.5	197.0	197.0	249.0	562.0
France	253.2	264.3	236.0	224.4	180.0	164.1	192.3	35.1	226.3	163.0	306.6	349.5
Germany	1,100.0	1,070.0	780.0	740.0	780.0	730.0	780.0	720.0	760.0	1,000.0	1,220.0	1,090.0
Luxembourg	1.0	1.3	0.7	0.1	0.3	0.0	0.1	0.0	0.1	0.1	0.1	n.a
Netherlands	252.0	263.0	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Switzerland	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a

Source: ITF

DANUBE COUNTRIES

For the Danube countries, relevant data regarding infrastructure maintenance and investment spending in general can also be retrieved from the ITF.

TABLE 3: **INLAND WATERWAY INFRASTRUCTURE MAINTENANCE SPENDING IN MILLION EURO** (ITF FIGURES)

Year / Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Austria	n.a	11.0	12.0	17.0	19.0	14.0	12.0	13.0	12.0	13.1	13.4	14.0
Serbia	13.3	23.0	17.6	16.5	17.3	29.8	28.7	32.9	35.3	43.3	32.6	30.5
Slovakia	2.0	2.0	3.0	4.0	9.0	3.7	0.3	7.1	1.8	n.a	22.0	2.0
Republic of Moldova	0.0	n.a	n.a	n.a	n.a	0.1	0.1	0.1	0.1	n.a	n.a	n.a
Hungary	3.2	1.6	0.8	0.8	1.3	1.4	2.7	2.2	2.1	2.2	2.0	1.8
Bulgaria	1.0	1.5	1.0	1.0	1.0	1.0	1.3	1.4	3.4	3.6	3.6	3.1
Croatia	0.7	0.8	1.2	1.2	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Czech Republic	1.5	1.8	2.9	4.6	4.5	7.5	6.2	6.5	7.5	12.2	5.3	3.9

Source: ITF

TABLE 4: **INLAND WATERWAY INFRASTRUCTURE INVESTMENT IN MILLION EURO** (ITF FIGURES)

Year / Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Austria	11.0	2.0	3.0	11.0	10.0	2.0	2.0	3.0	3.0	4.5	3.7	4.3
Serbia	21.2	25.8	24.7	15.5	17.7	22.3	40.7	34.3	45.9	49.1	47.2	50.6
Slovakia	3.0	1.0	1.0	1.0	0.0	0.1	0.1	1.1	1.5	n.a	1.1	0.0
Republic of Moldova	0.0	0.7	0.2	0.1	0.1	0.1	0.1	0.1	0.1	n.a	n.a	n.a
Hungary	0.8	0.2	0.01	0.1	0.02	0.0	10.3	0.2	1.1	0.9	3.1	1.1
Bulgaria	0.0	0.0	0.0	0.0	0.5	1.3	0.0	0.2	0.0	0.0	1.0	0.0
Croatia	2.6	3.5	3.3	1.7	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Czech Republic	57.8	22.3	17.2	7.2	9.6	15.1	9.8	7.2	2.8	51.1	55.5	30.2
Romania	423.5	519.0	279.5	268.1	314.1	505.9	236.9	105.1	189.7	n.a	n.a	n.a

Source: ITF

In addition to the ITF data, more detailed data stemming from the FRMMP[19] are also available, covering waterside infrastructure only (no landside infrastructure). The FRMMP reporting is solely focused on waterway-related infrastructure and includes themes such as waterway dredging, fairway marking and fairway surveying. Land-side expenditures such as mooring places, tow paths, etc. are not included in the FRMMP reporting. Moreover, structural infrastructure investments are not reported in the framework of the FRMMP, as the focus is on maintenance activities only. Discrepancies between the ITF and the FRMMP data therefore exist mainly because of differences in the methodology, scope and definition.

For Austria, for example, there is somehow a large discrepancy between the value reported in the two different databases.

This example confirms that data regarding investment spending should be interpreted with caution. It also calls for improvement in the data collection process for such investment, perhaps through the development of harmonised criteria for reporting such infrastructure spending investments at European level.

No new update of the FRMMP figures was available for the year 2021. A new update of the FRMMP is expected in the course of 2023.

TABLE 5: **NATIONAL ACTION PLANS IN DANUBE COUNTRIES – INFRASTRUCTURE MAINTENANCE SPENDING IN MILLION EURO**

Year / Country	2017	2018	2019	2020	Change 2019/2020	Change 2018/2017
Austria	4.5	5.2	4.6	4.8	+4.8%	-7.4%
Bulgaria	0.4	2.4	2.9	2.9	+/-0.0%	+21.1%
Romania	15.3	13.6	13.2	16.0	+21.1%	+17.9%
Hungary	n.a	0.9	0.2	n.a	n.a	n.a
Croatia	0.5	1.1	1.1	1.1	+/-0.0%	+/-0.0%
Slovakia	2.6	2.3	1.8	2.6	+46.6%	+12.7%
Serbia	n.a	0.4	n.a	n.a	n.a	n.a

Source: FAIRway, National Action Plans, May 2021
Missing values are tied to no reporting by the countries.

The difference between free-flowing and not free-flowing rivers such as in the Upper Danube also contributes to the various need areas of infrastructure spending. The Iron Gates located at the Serbian/Romanian border set the border between the downstream free-flowing part of the Danube and the upstream part which counts many locks. This difference weighs on the specific need areas described in Tables 6.1 and 6.2. Indeed, a free-flowing river requires more maintenance activities.

[19] *FRMMP stands for Fairway Rehabilitation and Maintenance Master Plan.*

Tables 6.1 and 6.2 capture the secured infrastructure investments[20] in inland waterways for the period 2014 to 2020 for Danube countries. Despite possible discrepancies in the data reported for infrastructure investment between the two databases (ITF and FAIRway), the FAIRway database has the merit of providing a more detailed repartition according to need areas and allows a more complete picture of the amount of money dedicated to each need area.

TABLE 6.1: **NATIONAL ACTION PLANS IN DANUBE COUNTRIES – INFRASTRUCTURE INVESTMENTS IN INLAND WATERWAYS 2014-2020**

Country	Austria		Bulgaria		Romania		Hungary	
Need area	Investment secured 2014-2020 (in million €)	% of EU co-financed	Investment secured 2014-2020 (in million €)	% of EU co-financed	Investment secured 2014-2020 (in million €)	% of EU co-financed	Investment secured 2014-2020 (in million €)	% of EU co-financed
Minimum fairway parameters (width/depth)	n.a	n.a	10.6[21]	85.0	23.5	32.6	6.2	85.0
Surveying of the riverbed	n.a	n.a	3.8	85.0	0.4	85.0	1.7	59.0
Water level gauges	n.a	n.a	0.4	85.0	0.3	79.3	6.7	50.0
Marking of the fairway	1.2	20.4	4.1	85.0	3.8	85.0	8.7	85.0
Availability of locks/lock chambers	n.a	n.a	n.a	n.a	0.2	85.0	n.a	n.a
Information on water levels and forecasts	n.a	n.a	0.1	85.0	0.2	85.0	0.01	85.0
Information on fairway depths	n.a	n.a	0.3	85.0	0.4	85.0	0.02	85.0
Information on marking plans	n.a	n.a	0.0	n.a	0.1	85.0	0.3	85.0
Meteorological information	n.a	n.a	0.0	n.a	0.4	56.1	0.8	50.0
Other needs	n.a	n.a	0.2[22]	85.0	0.1	54.4	0.6	85.0
Total	**1.2**	**20.4**	**19.4**	**85.0**	**29.3**	**41.8**	**25.0**	**72.7**

Source: FAIRway, National Action Plans, May 2021

[20] *Secured infrastructure investment refers to the amount received/spent.*
[21] *The investment concerns the dredging equipment (pipeline, manoeuvring vessel, pontoon and barge) to be purchased via the OPTTI 2014-2020.*
[22] *The investment concerns the recalculation of the Low Navigable Water Level.*

TABLE 6.2: **NATIONAL ACTION PLANS IN DANUBE COUNTRIES – INFRASTRUCTURE INVESTMENTS IN INLAND WATERWAYS 2014-2020**

Country	Croatia		Slovakia		Serbia	
Need area	Investment secured 2014-2020 (in million €)	% of EU co-financed	Investment secured 2014-2020 (in million €)	% of EU co-financed	Investment secured 2014-2020 (in million €)	% of EU co-financed
Minimum fairway parameters (width/depth)	1.0	n.a	n.a	n.a	n.a	n.a
Surveying of the riverbed	0.4	85.0	0.6	85.0	n.a	n.a
Water level gauges	0.1	85.0	n.a	n.a	n.a	n.a
Marking of the fairway	1.1	85.0	1.4	85.0	0.7	85.0
Availability of locks/lock chambers	n.a	n.a	n.a	n.a	n.a	n.a
Information on water levels and forecasts	0.2	85.0	n.a	n.a	n.a	n.a
Information on fairway depths	0.1	0.0	0.02	0.0	n.a	n.a
Information on marking plans	n.a	n.a	n.a	n.a	n.a	n.a
Meteorological information	n.a	n.a	n.a	n.a	n.a	n.a
Other needs	n.a	n.a	n.a	n.a	n.a	n.a
Total	**2.8**	**53.4**	**2.0**	**84.1**	**0.7**	**85.0**

Source: FAIRway, National Action Plans, May 2021

OTHER COUNTRIES

TABLE 7: **INLAND WATERWAY INFRASTRUCTURE MAINTENANCE SPENDING IN MILLION EURO**

Year / Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Italy	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0	3.0
Lithuania	60.0	61.0	61.0	61.0	60.0	59.8	59.6	62.2	59.8	59.2	60.1	59.1
Poland	7.8	16.5	7.6	21.0	5.5	n.a	n.a	n.a	n.a	9.8	9.5	9.6

Source: ITF

TABLE 8: **INLAND WATERWAY INFRASTRUCTURE INVESTMENT IN MILLION EURO**

Year / Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Italy	42.0	36.0	52.0	136.0	358.0	509.0	436.0	239.0	246.0	79.0	99.0	n.a
Lithuania	1.0	2.0	0.0	1.0	3.0	1.0	0.0	0.0	0.0	0.0	7.0	10.0
Poland	24.8	29.1	0.2	n.a	61.0	n.a	n.a	n.a	n.a	56.0	39.2	64.5

Source: ITF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04

WATER LEVELS AND FREIGHT RATES

- The year 2022 was characterised by less favourable navigating conditions for both the Rhine and the Danube when compared to the year 2021 because of the extreme heat and a period of rapidly decreasing water levels in July and August 2022. This had a negative impact on cargo volumes transported on both waterways.
- Between 2015 and 2022, 2018 was the year that experienced the highest number of days with extremely low draught values both on the Rhine and the Danube.
- In 2022, freight rates in the Rhine region increased on average by +42.5% for all market segments compared to 2021 and were strongly impacted by the low water period. Dry cargo is the cargo segment for which freight rates increased the most. Beyond the low water effects, this results from the boom in coal transport and the transfer of Rhine capacities to the Danube.

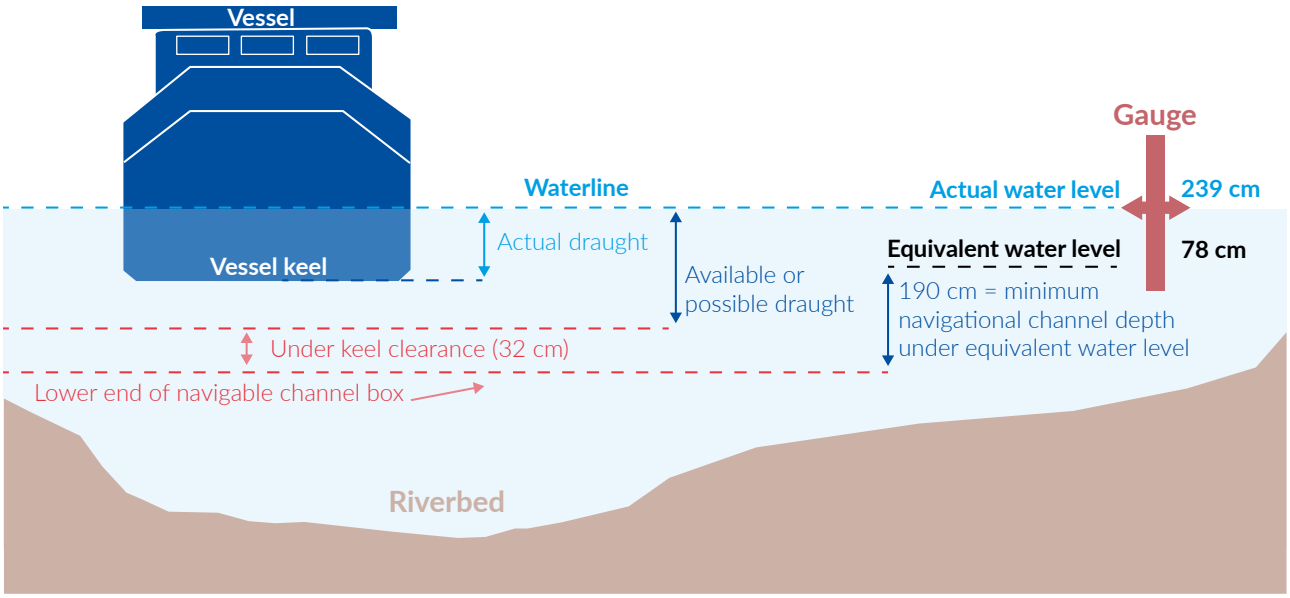
WATER LEVELS

AVAILABLE DRAUGHTS AND NAVIGATION CONDITIONS

The overall performance of inland waterway transport is linked to, among other factors, water levels, which determine the amount of cargo that a vessel can load and transport under safe navigation conditions. The load factor (ratio of cargo loaded to loading capacity of the vessel) influences the profitability of inland waterway transport. A high load factor represents a high volume of cargo transported per trip, and therefore a high level of revenue for a vessel, for any level of fixed costs. In addition, high water depths and the resulting high load factors enable inland waterway transport to reach a high degree of energy efficiency.

Low water periods therefore reduce not only the load factor and overall cargo transport on inland waterways but lead also to higher costs. Although the reduction of the load factor could be compensated by putting more vessels into operation, there are obvious limitations to this.[23] An example is the low water period in both autumn 2018 and summer 2022 on the Rhine. The amount of cargo that a vessel can load at a certain water level, while keeping safe navigation conditions, is determined by the available draught, as can be seen in the next figure.

FIGURE 1: **ACTUAL WATER LEVEL, ACTUAL DRAUGHT, EQUIVALENT WATER LEVEL, MINIMUM NAVIGATION CHANNEL DEPTH AND POSSIBLE OR AVAILABLE DRAUGHT AT KAUB/MIDDLE RHINE ***



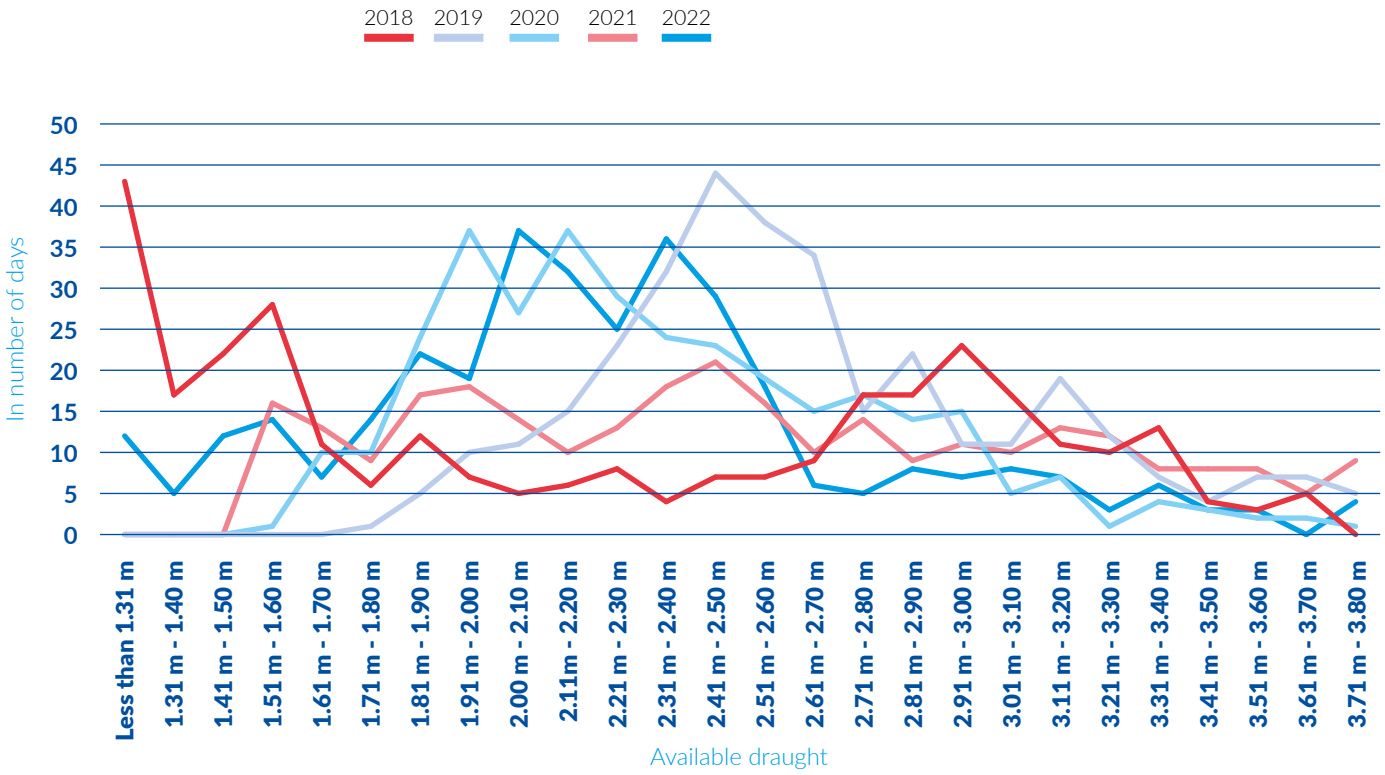
Source: CCNR based on the German Federal Institute for Hydrology (BfG) (2015)

** The distances in this drawing are not at scale. In this illustration, the date chosen to determine the available or possible draught is 3 September 2020, when the actual water level was 239 cm on average. For a sailing vessel, the actual draught also contains the squat effect. The latter results from hydrodynamic effects and leads to a higher draught compared to a vessel at rest. The squat effect is stronger the less water there is under the keel, and the faster the vessel is sailing.*

[23] The fleet of inland vessels is limited in size. It is also not possible to keep a large number of vessels 'on hold', as this would incur fixed costs (insurance, maintenance, etc.), while there would be no revenue at all from the particular vessel.

One way of assessing the impact of low water periods on inland waterway transport is to look at the statistical frequencies of available draught[24] values for different years. In the following graph, this statistical frequency is measured in the unit 'number of days' and calculated for intervals of available draught values.

FIGURE 2: **STATISTICAL FREQUENCY DISTRIBUTION OF AVAILABLE DRAUGHT VALUES AT KAUB ON THE MIDDLE RHINE PER YEAR** (IN NUMBER OF DAYS)



Source: CCNR calculation based on data provided by the German Federal Waterways and Shipping Administration (WSV), provided by the German Federal Institute for Hydrology (BfG)

The frequency distribution clearly shows that the year 2022 was characterised by less favourable navigating conditions when compared to the years 2021 or 2019. Indeed, compared to 2019, the peaks in the 2022 frequency distribution are 'shifted' to the left. The year 2018 however experienced a higher number of days with extremely low draught values, in the area below 1.80 m. The year 2021 was again different, as it contained several days with high water levels, resulting in a rather high frequency of days with a draught > 3.80 m.[25]

Another method for assessing the quality of navigating conditions over an entire year is based on the concept of counting the number of days when water levels are below a certain reference low water level, known as Equivalent Water Level (EWL) for the free-flowing sections of the Rhine and Low Navigable Water Level (LNWL) for the Danube. If water levels drop below this reference low water level, this indicates a situation of critical navigation.

[24] The waterway administrations recommend calculating the available draught on the basis of the actual water level and certain waterway parameters (shown in the drawing).
Actual water level
- Equivalent water level
+ Minimum navigational channel depth
= Lower end of navigable channel box
- Under keel clearance
= Available or possible draught
[25] As 3.80 m is the upper boundary on the x axis, the relevant frequencies for high water are not shown in the graph.


PEGEL KÖLN

NUMBER OF CRITICAL
LOW WATER DAYS FOR RHINE AND DANUBE GAUGE STATIONS

RHINE GAUGE STATIONS

The EWL is determined by the Central Commission for the Navigation of the Rhine (CCNR) for several gauge stations along the Rhine. The values are adapted every ten years, to take account of natural and anthropogenic changes.

The equivalent water level 2012 came into force in 2014 and retained its validity until the end of 2022. A new equivalent water level was introduced on 1 January 2023 and is applicable until the end of 2031.

Although the equivalent water level is measured in centimetres, the starting point of its determination is a flow concept. Indeed, equivalent flow values (indicated in the unit m^3/s) measured against the benchmark levels are recalculated every ten years as flows within a 100-year time series. The equivalent flow values are then used to recalculate the corresponding equivalent water level (EWL) values against the benchmark levels every ten years. The EWL consequently contains the following definition: "The equivalent water level (EWL) is the water level occurring along the Rhine at an equivalent water flow falling below the long-term average for 20 days [per year]".

TABLE 1: **HYDRAULIC PARAMETERS FOR IMPORTANT RHINE GAUGE STATIONS ***

Gauge station	Guaranteed navigation channel depth	Equivalent water level 2012
Tiel (Waal, NL)	280 cm	258 cm
Nijmegen (Waal, NL)	280 cm	523 cm
IJsselkop (Nederrijn, NL)	280 cm	694 cm
Lobith (Lower Rhine, NL)	280 cm	739 cm
Emmerich (Lower Rhine, DE)	280 cm	84 cm
Duisburg-Ruhrort (Lower Rhine, DE)	280 cm	233 cm
Cologne (Lower Rhine, DE)	250 cm	139 cm
Kaub (Middle Rhine, DE)	190 cm	78 cm
Oestrich (Middle Rhine, DE)	190 cm	87 cm
Maxau (Upper Rhine, DE)	210 cm	369 cm
Basel (Upper Rhine, CH)	300 cm	499 cm

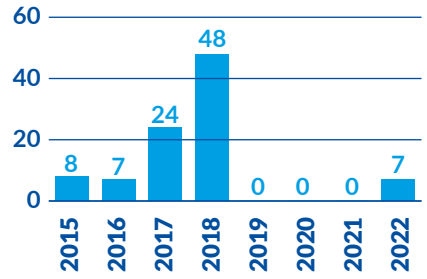
Sources: German Federal Waterways and Shipping Administration (WSV), Rijkswaterstaat
** Waal and Nederrijn are two branches of the Rhine delta in the Netherlands.*

For these eleven Rhine gauges, daily water level data were collected and analysed.

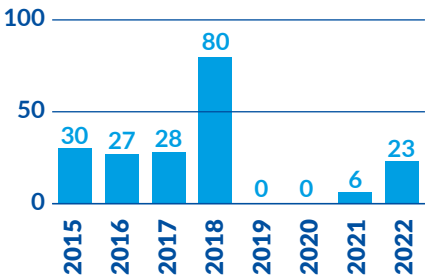
The figures show the number of days below the equivalent water level for the above-mentioned gauge stations.

NUMBER OF DAYS BELOW THE EQUIVALENT WATER LEVEL (EWL)

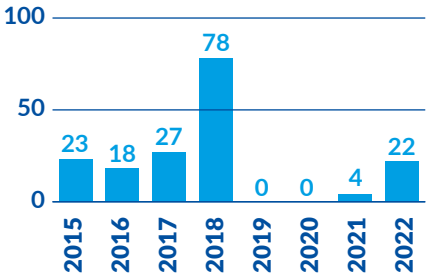
Basel



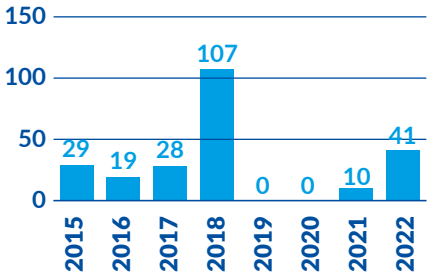
Maxau



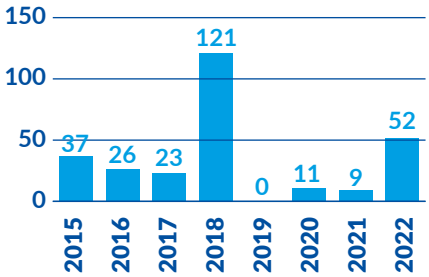
Oestrich



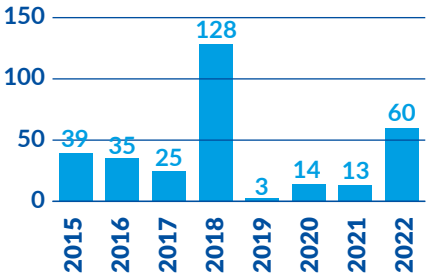
Kaub



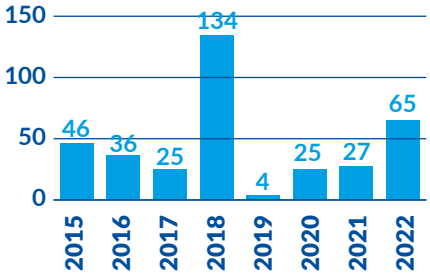
Cologne



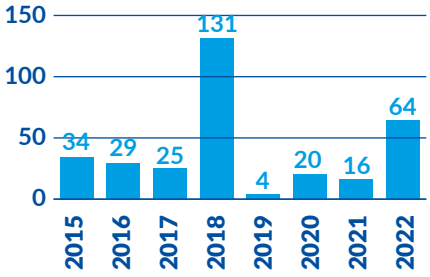
Duisburg-Ruhrort



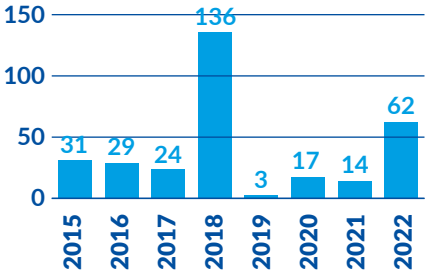
Emmerich



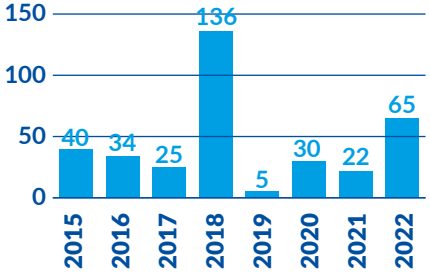
Lobith



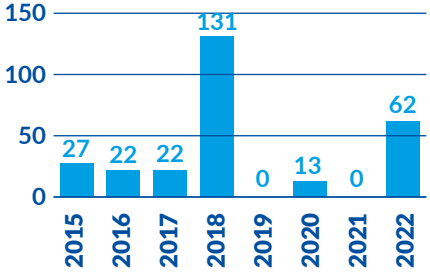
Nijmegen



IJsselkop



Tiel



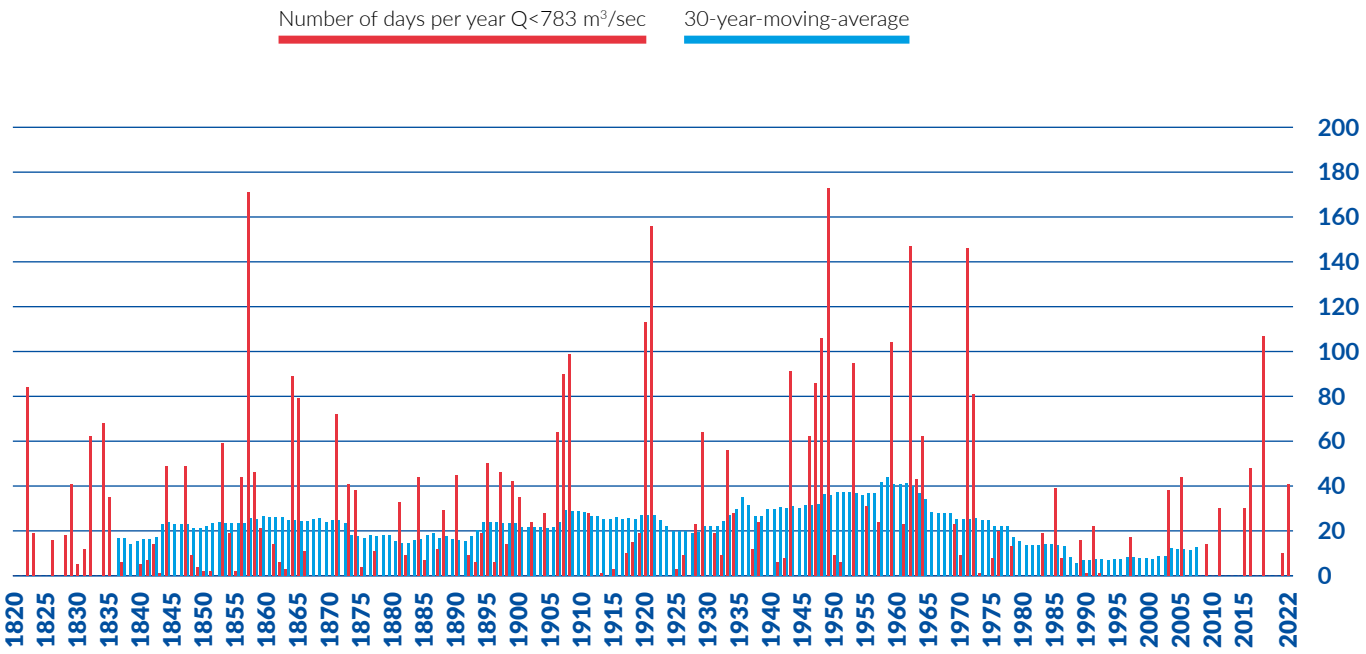
Sources: CCNR calculation based on data from the German Federal Waterways and Shipping Administration (WSV), provided by the German Federal Office for Hydrology (BfG), and from Rijkswaterstaat.

Between 2015 and 2022, the two years with the highest number of low water days were 2018 and 2022. Although the summer of 2022 experienced days of extreme heat and a period of rapidly decreasing water levels, the 2022 low water period did not last as long (from July to August 2022) as it did in 2018 (from August to November 2018). This explains the smaller number of days below the equivalent water level in 2022, compared to the year 2018.

Low water levels from a historical perspective

For Kaub, on the Middle Rhine, data on the number of days with a discharge of less than 783 m^3 per second (which is the equivalent flow value, corresponding to the equivalent water level of 78 cm at Kaub) are modelled statistically dating back to the year 1820. The aim of this procedure is to compare today's flows with the past. The resulting values show that years of severe low water periods also occurred in the past. However, their impact on transport volumes was not as strong, compared to 2018 and 2022, due to smaller vessels with a lower draught, different logistics (less 'Just-in-time') and less competition from other transport modes.

FIGURE 3: **NUMBER OF DAYS PER YEAR WITH A DISCHARGE Q < 783 M³/S AT KAUB, MIDDLE RHINE INCLUDING 30-YEARS-MOVING AVERAGE ***



Source: German Federal Office for Hydrology (BfG)
** Corresponds to a water level of 78 cm (equivalent water level).*


55
54
53
52
51

DANUBE GAUGE STATIONS

The reference low water level of the Danube is known as 'Low Navigable Water Level (LNWL)'. It is defined as the water level exceeded on 94.0% of days in a year (i.e. on 343 days) during ice-free periods with a reference to a 30-year observation period (1981 – 2010).[26]

Based on this definition, equivalent calculations can be carried out for the Danube.

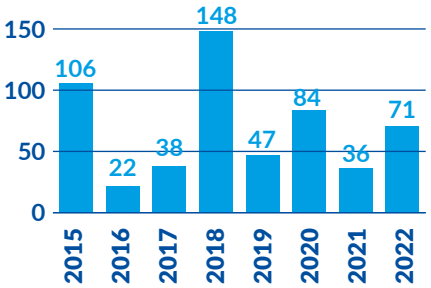
Danube navigation also suffered from a low water situation which started at the end of June 2022 and lasted until August the same year. During this period, on certain critical sections of the river, some convoys were stopped, sometimes for long periods. This had a negative impact on cargo volumes transported on the Danube.

[26] *Source: viadonau*

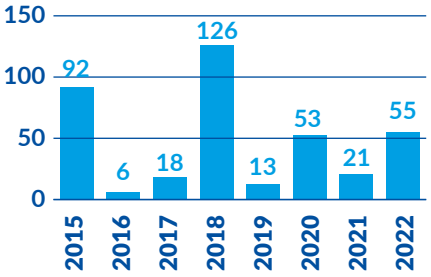
For nine important gauge stations on the Danube, daily water level data were collected and analysed. The figures below show the number of days per year on which the actual water levels fell below the Low Navigable Water level.

NUMBER OF DAYS BELOW THE LOW NAVIGABLE WATER LEVEL (LWL)

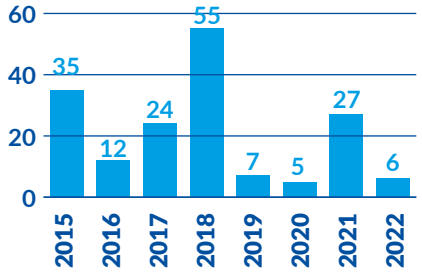
Pfelling, Upper Danube (DE)



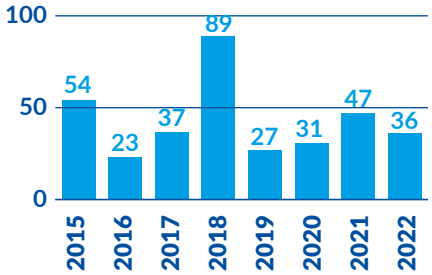
Hofkirchen, Upper Danube (DE)



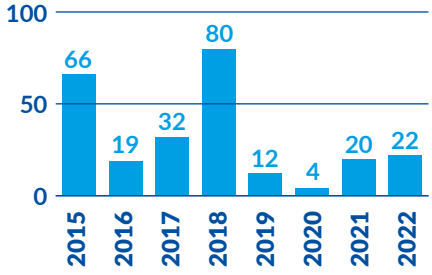
Kienstock, Upper Danube (AT)



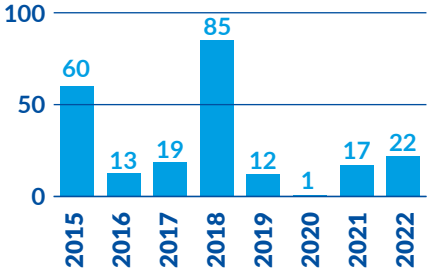
Wildungsmauer, Upper Danube (AT)



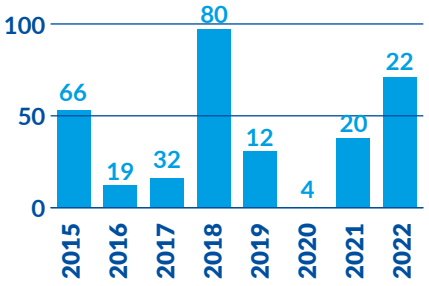
Devin, Upper Danube (SK)



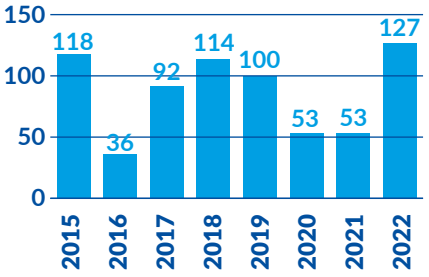
Budapest, Middle Danube (HU)



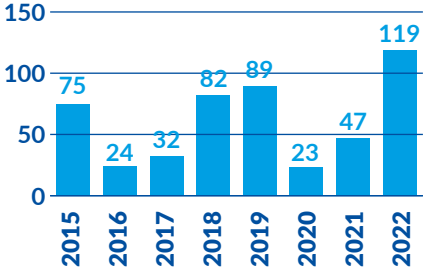
Bezdan, Middle Danube (RS)



Calafat, Lower Danube (RO)



Calarasi, Lower danube (RO)



Sources: CCNR calculation based on data from the German Federal Waterways and Shipping Administration (WSV), provided by the German Federal Office for Hydrology (BfG), data from the Federal State of Lower Austria and the Danube Commission.

FREIGHT RATES
IN THE RHINE REGION

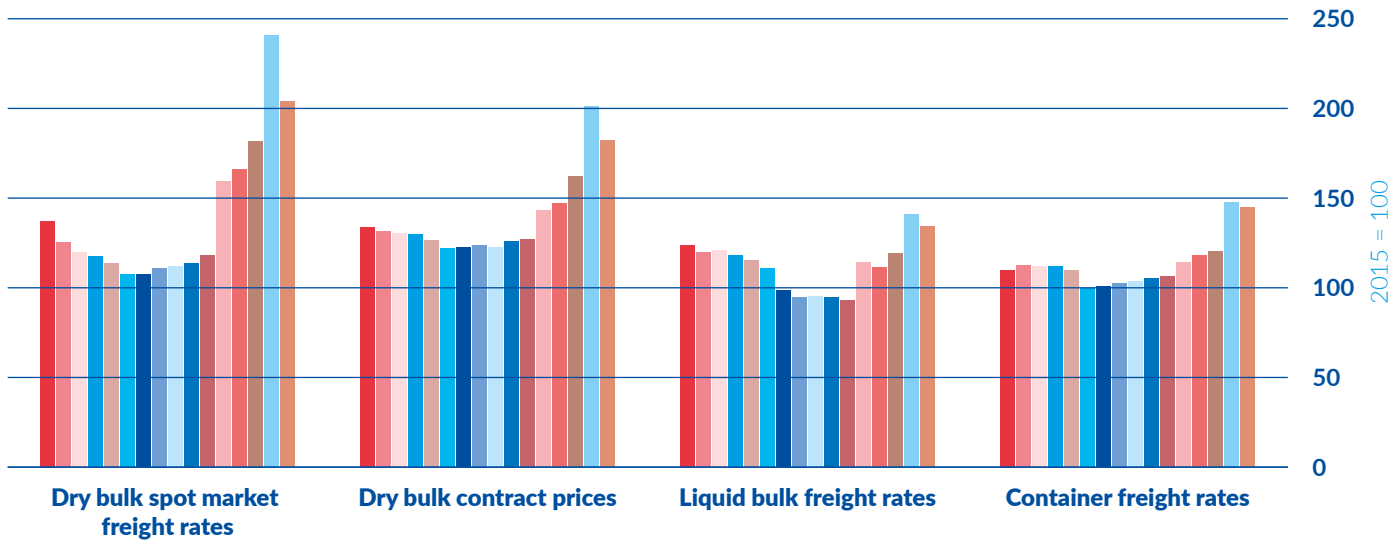
CBS FREIGHT RATE INDEX FOR THE RHINE REGION

Statistics Netherlands (CBS) collects freight rate data from a panel of Dutch IWT companies. The price levels are based on fixed routes for which questionnaires are sent out twice a quarter. They comprise the sailing costs including fuel and low water surcharges and exclude cargo handling costs. In 2022, considering all market segments together, freight rates increased on average by +42.5% compared to 2021.

More specifically, dry bulk and container freight rates have been following an increasing path since the third quarter of 2020, as the underlying transport demand recovered from the pandemic. Dry cargo is the cargo segment for which freight rates increased the most. This development can be explained by several factors, in particular booming coal transport, the transfer of vessel capacity from the Rhine to the Danube region and low water effects.

On the contrary, liquid cargo freight rates have been following a decreasing trend since 2019. This stems from a weaker development of transport demand compared to dry cargo, both during and after the pandemic.[27] Also, the liquid cargo segment experienced a stronger expansion of its supply side, in terms of a higher newbuilding rate and thus more additional cargo carrying capacity. This changed the supply-demand-relationship and put transport prices under pressure. However, despite these trends, liquid cargo freight rates also attained an increase in 2021 and 2022. The main reason for this escape from the downward trend is the low water period in both years.

FIGURE 4: **CBS FREIGHT RATE INDICES PER QUARTER** (2015 = 100)



Source: CBS, Table 84050NED

** The prices of established routes are observed twice a quarter and include fuel and low water surcharges but exclude loading and unloading. The time of observation is in the middle and at the end of the quarter. All prices are nominal prices.*

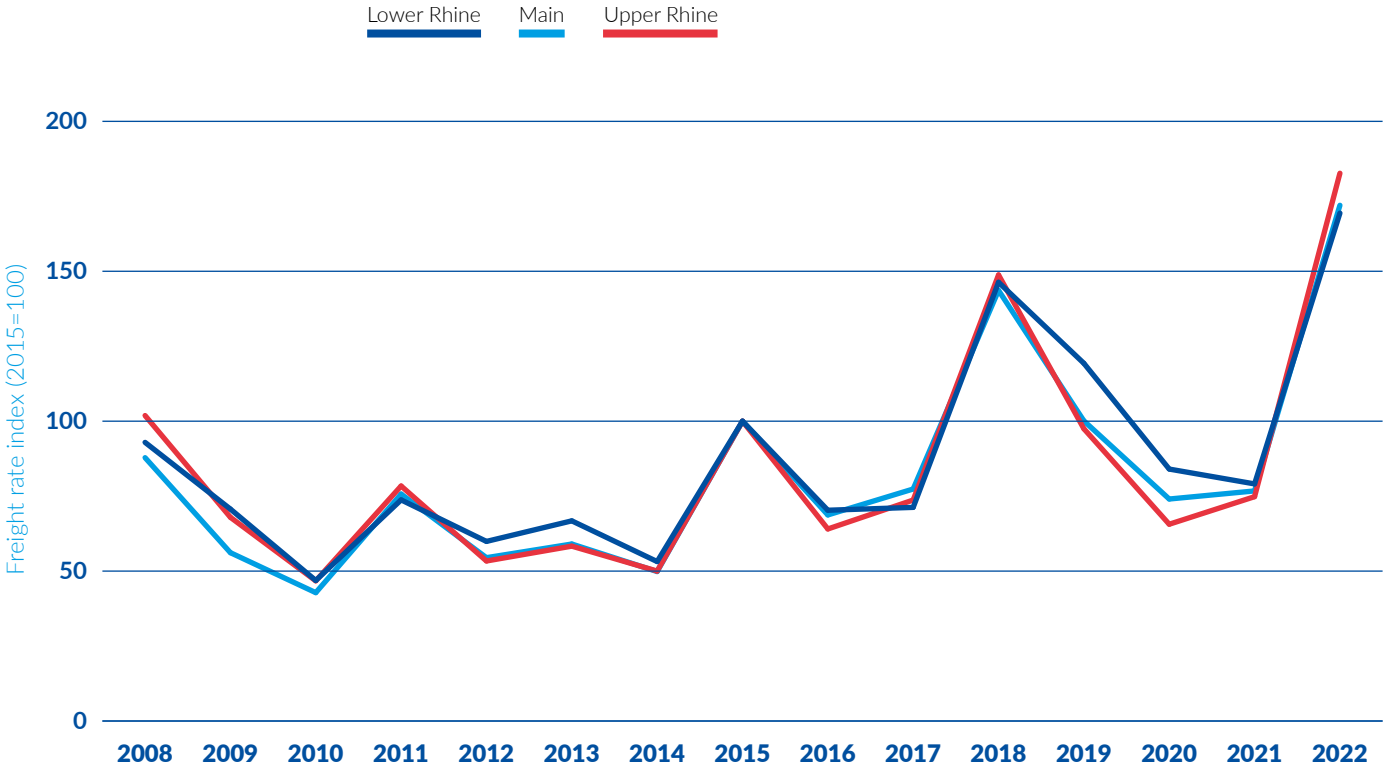
[27] *See also Chapter 2*

LIQUID CARGO FREIGHT RATES IN THE RHINE REGION

Figure 5 illustrates the liquid cargo spot market freight rate index for gasoil for ARA-Rhine transport (yearly averages). Since 2010 an overall positive trend is seen. To some extent, this positive trend was driven by low water periods, which occurred in 2011, 2015, 2018 and 2022.

The observed trends are almost identical for the three different geographical entities shown - two stretches of the Rhine (Lower Rhine, Upper Rhine) and the Main affluent.

FIGURE 5: **PJK FREIGHT RATE INDEX FOR LIQUID CARGO TRANSPORT IN THE ARA-RHINE AREA** (2015 = 100)



Source: CCNR calculation based on PJK International

CITBO FREIGHT RATE INDEX FOR THE FARAG REGION

Geography of the CITBO transport activity and product segment structure

For the liquid cargo transport within the extended ARA region, between Amsterdam, Antwerp, Flushing, Ghent, Rotterdam and Terneuzen, a dataset on spot market freight rates provided by the tanker barge cooperation CITBO[28] was analysed. The shares of the different product groups within cargo transported were as follows:

- **Gasoil and components:** share of 38% in 2022 (41% in 2021)
- **Gasoline and components:** share of 29% in 2022 (24% in 2021)
- **Biodiesel:** share of 26% in 2022 (28% in 2021)
- **Chemicals:** share of 6% in 2022 (5% in 2021)
- **Heavy and other products:** share of 1% in 2022 (3% in 2021)

Of all liquid cargo transport in 2022, the five ports with the highest shares are represented as follows:

- in loaded cargo, volumes accounted for 81% and,
- in unloaded cargo, volumes accounted for 66%.

Port of loading	Cargo volume - share in %	Port of unloading	Cargo volume - share in %
Antwerp	35% (in 2021: 34%)	Rotterdam	28% (in 2021: 24%)
Rotterdam	27% (in 2021: 32%)	Antwerp	17% (in 2021: 29%)
Amsterdam	8% (in 2021: 9%)	Amsterdam	12% (in 2021: 14%)
Flushing	6% (in 2021: 8%)	Ghent	6% (in 2021: 6%)
Ghent	5% (in 2021: 5%)	Dunkirk	4% (in 2021: 4%)
All other ports	19% (in 2021: 24%)	All other ports	34% (in 2021: 23%)

The locations of other ports of loading and unloading are mainly found in Belgium and in the Netherlands, but locations in France, Germany and Switzerland also appear.

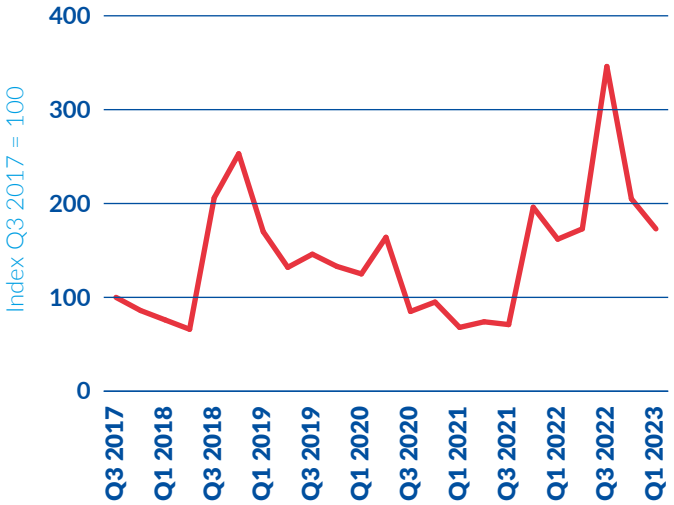
Results of the calculation of freight rate indices

A freight rate index was calculated for the four main different product segments.[29] From these indices, it can be observed that low waters (in 2018 and 2022) had a strong influence on freight rates for all product segments.

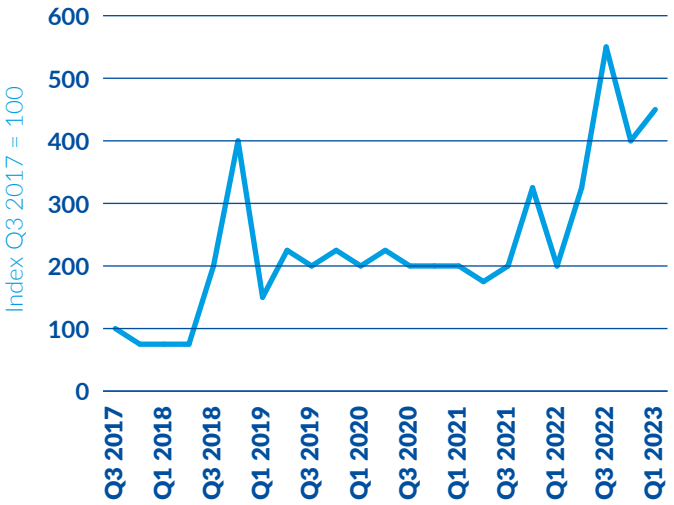
[28] *https://citbo.com/*
[29] *Thus, the absolute spot market freight rate data (given in Euro per tonnes) were transformed into index figures with base period Q3 2017 = 100. For heavy and other products, no index could be calculated due to missing values in several quarters.*

FIGURES 6, 7, 8 AND 9: **CITBO FREIGHT RATE INDEX FOR LIQUID CARGO SEGMENTS**
(INDEX Q3 2017 = 100)

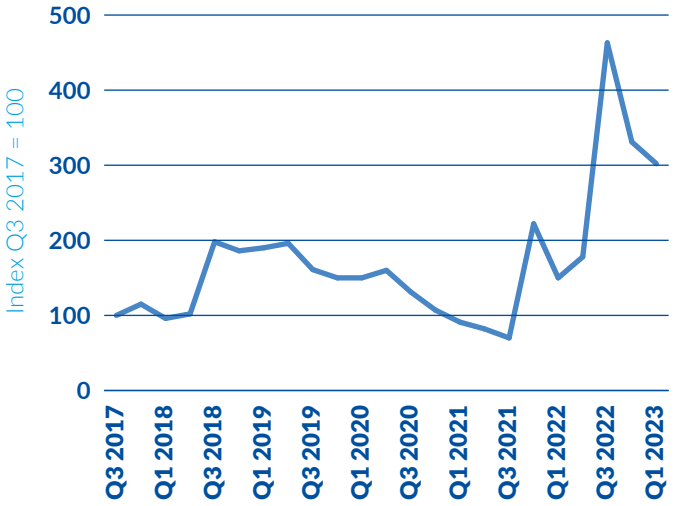
Gasoil and components



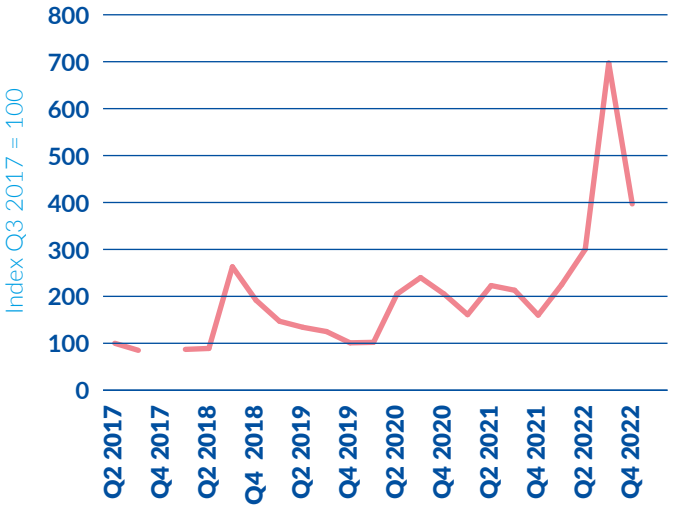
Gasoline and components



Biodiesel



Chemicals



Source: CCNR analysis based on spot market data provided by CITBO

Taking into consideration the entire period between Q3 2017 and Q1 2023, freight rates were quite stable for chemicals and gasoline and components, except during periods of low water. For gasoil and components, as well as for biodiesel, the general trend was more orientated downwards, again except during periods of low water.

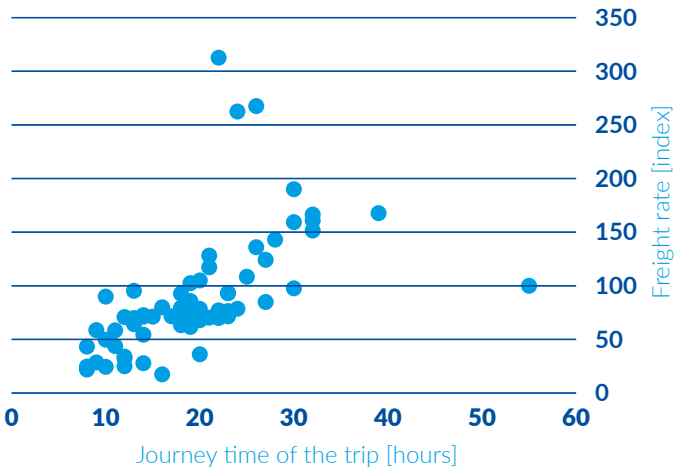
Influencing factors for CITBO freight rates

The longest journey time observed is for the transport of gasoline. In 2022, the average duration of trips was 24.5 hours for gasoline and components, compared to 17.4 hours for gasoil and components, 16.5 hours for chemicals and 16.4 hours for biodiesel. Longer journey time leads to higher costs, thereby contributing to higher freight rates.

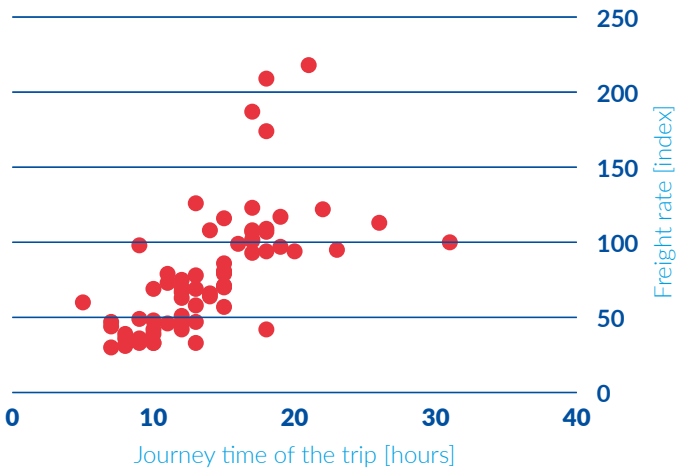
The strong influence the journey time for trips has on the level of freight rates is confirmed in Figures 10 and 11. The correlation between these two indicators is not perfect - however, outliers can be explained by low water periods. As an example, the three outlier points in the figure on gasoline and components (with freight rate index values above 250) represent three months in late 2018.

FIGURES 10 AND 11: **RELATIONSHIP BETWEEN JOURNEY TIME OF A TRIP AND FREIGHT RATE INDEX VALUE** (INDEX Q3 2017 = 100) *

Gasoline and components



Gasoil and components



Source: CCNR analysis based on spot market data provided by CITBO
** The dots in the graphs represent the combination of average journey time and average freight rate index for a certain month.*

Additional influencing factors for freight rates exist. Overall, it can be observed that chemicals have by far the highest spot market freight rates in absolute terms (€/tonne), followed by gasoline and its components. The high freight rate levels for chemical transports cannot be explained by journey times, as these are rather low for chemicals. The high freight rates can be attributed primarily to the relatively expensive ships, often with stainless steel tanks, as well as the high safety standards and high cleaning costs. The essential demand on the shippers' side to transport their chemicals by IWW therefore contributes to higher freight rate levels for chemical products within the CITBO database.


KOCKS
U A S C
Hapag-Lloyd

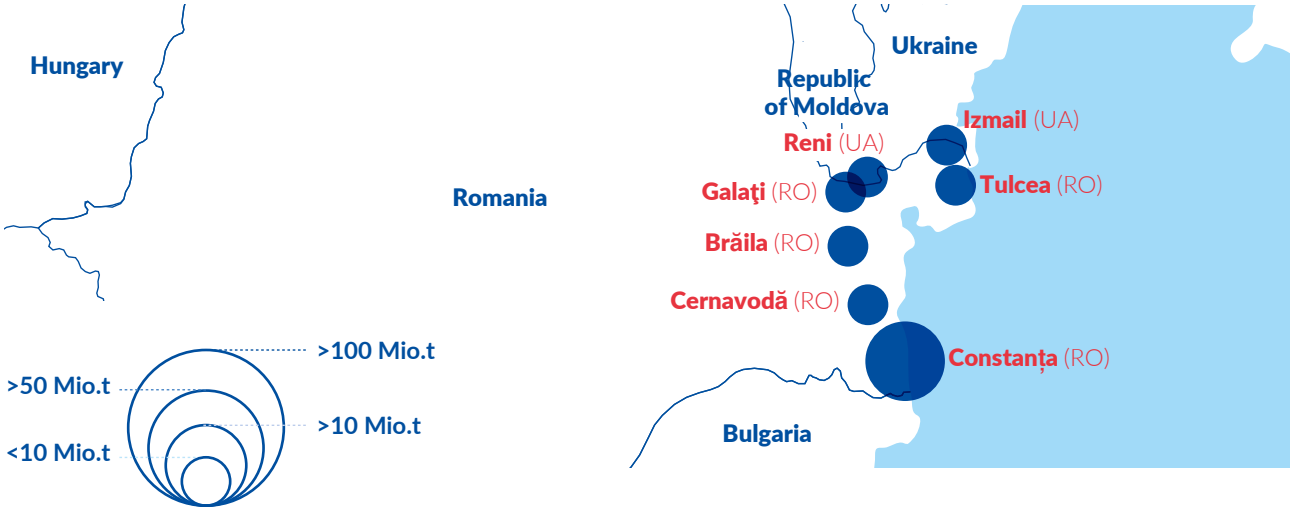
05

INLAND WATERWAY CARGO HANDLING IN PORTS

- **In 2022, the war in Ukraine, the sanctions against Russia, the changes in global energy flows and the low water episode of the summer impacted inland waterway transport in the European ports significantly.**
- **With regard to the main European seaports, on the one hand, the ports of Rotterdam, Antwerp-Bruges and Constanţa all registered a decrease in the volumes of inland waterway cargo handling (-4.0%, -7.5% and -2.9% respectively). On the other hand, the North Sea Port and the Port of Hamburg both registered a significant growth (+7%), mainly driven by an increase in the transport of petroleum products.**
- **The overall 2022 results for the inland ports under study reflect a decrease with the exception of the two Ukrainian ports of Reni (+ 398.2%) and Ismail (+118.4%), on the Danube, which recorded an exceptional growth of inland waterway transport volumes. They benefitted from the *Danube Solidarity Lanes EU-Ukraine initiative* ensuring continuity of trade, and the export of agricultural products from Ukraine.**

MAIN EUROPEAN SEAPORTS

Sources: Ports' statistics, Destatis, CBS, Eurostat [iww_go_aport] and Danube Commission
** For Szczecin, data are for 2021.*

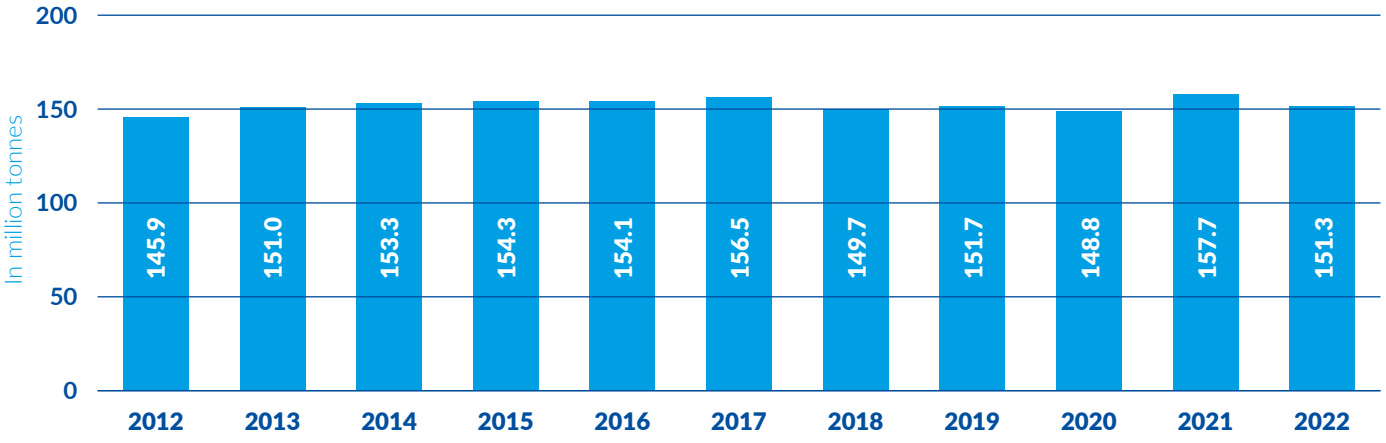


Source: Romanian national Institute of Statistics

ROTTERDAM

In 2022, 82,763 inland vessels called at the Port of Rotterdam. The volumes of inland waterway cargo handling at the Port of Rotterdam decreased by -4.1% to 151.3 million tonnes in 2022 (compared to 157.7 million tonnes in 2021). While the handling of liquid cargo (-5.4%), and containerised cargo (-11.2%) decreased, the handling of dry cargo (+1.9%) increased. The war in Ukraine, the sanctions against Russia, the changes in global energy flows and the low water episode of the summer 2022 were the main drivers underlying these trends in 2022.

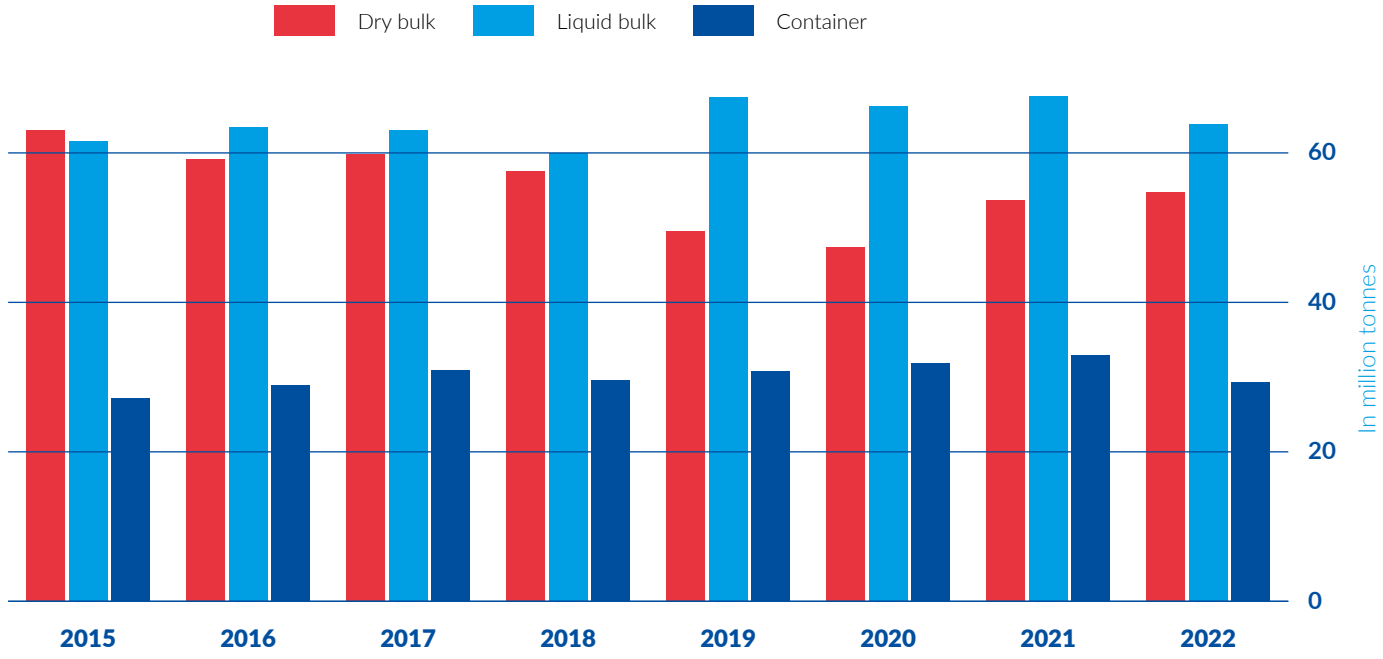
FIGURE 1: **INLAND WATERWAY CARGO HANDLING IN THE SEAPORT OF ROTTERDAM** (IN MILLION TONNES) *



Source: CBS

** Note that data from the Port of Rotterdam based on CBS data were used in previous years, which can explain a difference in the numbers reported in the last years. However, the overall trends remain identical.*

FIGURE 2: **INLAND WATERWAY CARGO HANDLING IN THE SEAPORT OF ROTTERDAM PER CARGO SEGMENT** (IN MILLION TONNES) *



Source: CBS
** General cargo is not taken into account in these calculations. In 2022, the volume transported for general cargo amounted to 3.4 million tonnes.*

ANTWERP-BRUGES

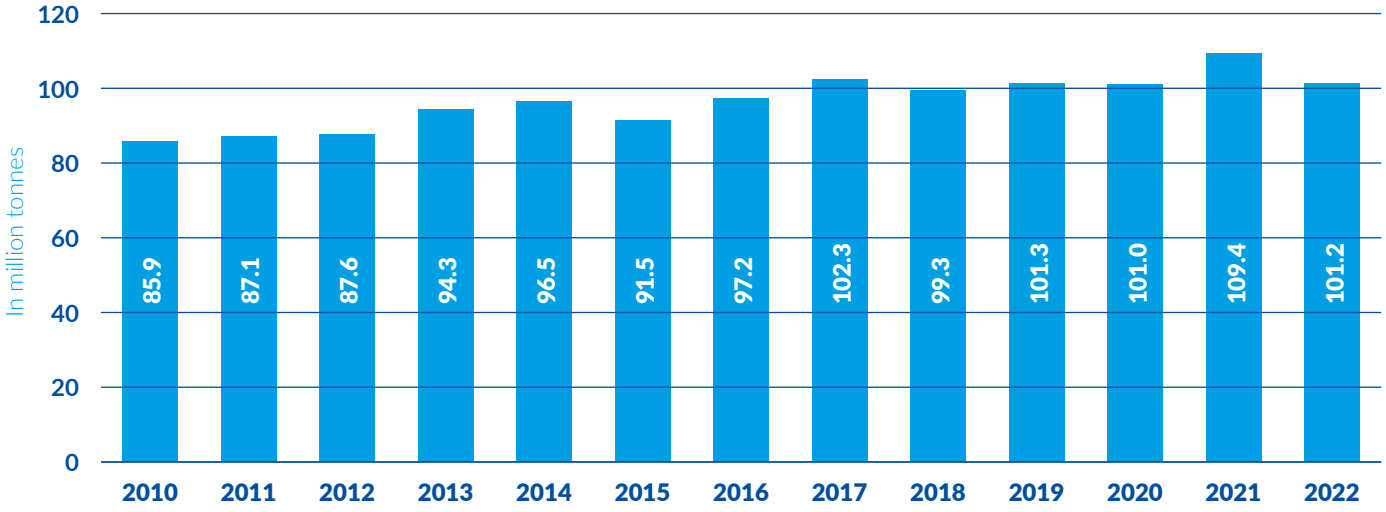
The ports of Antwerp and Zeebrugge have been operating under the name 'Port of Antwerp-Bruges' since April 2022. Most of IWW cargo handling at the port takes place on the Antwerp site. In 2022, the number of vessels calling at the port decreased to 57,961 (compared 60,819 in 2021).

Liquid bulk is the most important cargo type (56.1%), followed by containers (22.6%) and dry bulk (13.8%). The IWW cargo handling decreased in 2022 (-7.5%) reaching a volume of 101.2 million tonnes (compared to 109.4 in 2021).[30] This result was driven by a sharp decrease in the transport of liquid bulk (-8.7%), in particular petroleum products (-12.7%). Containers (-10.9%) also sustained a sharp decrease because of the disruptions in global containerised liner shipping, exacerbated by the war in Ukraine. Dry bulk increased slightly (+1.5%) driven by higher transport volumes of crude minerals, building materials and solid mineral fuels.

The IWW modal split within total maritime throughput (excluding industrial traffic[31]) in 2022 was 51.4%, the same as in 2021. The IWW modal split share within container transport to and from the hinterland was 35.1%.

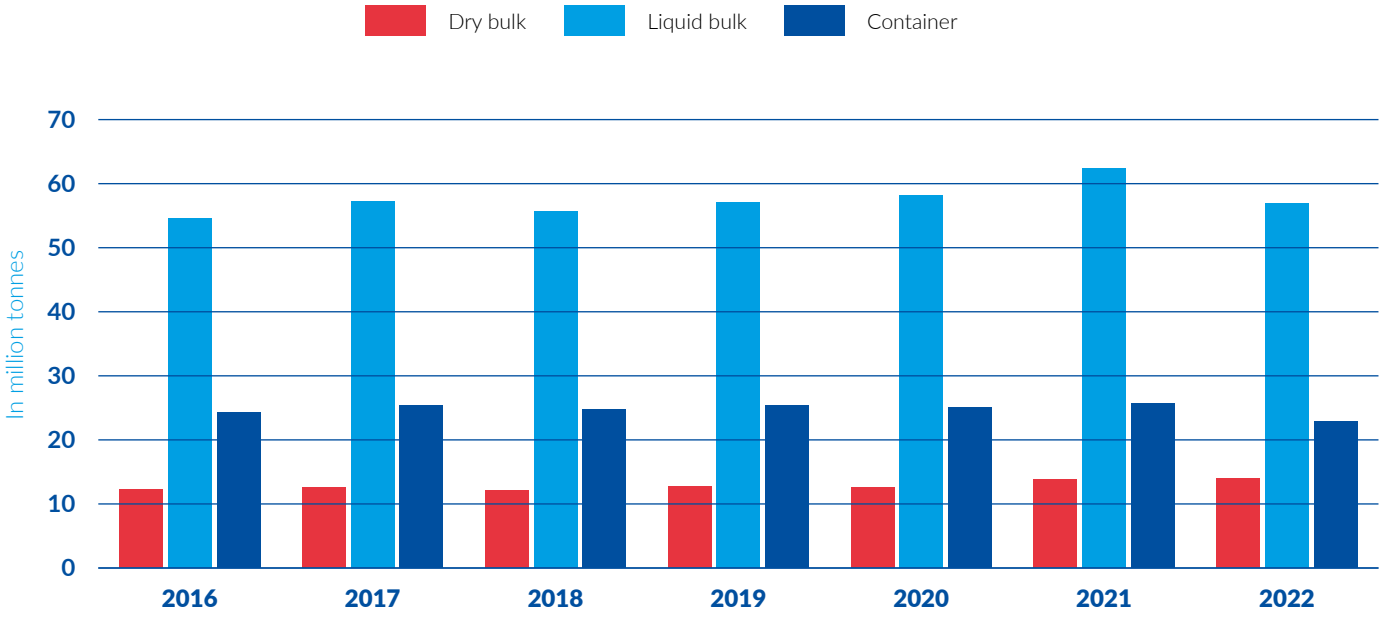
[30] This figure includes inland waterway cargo handling at the Port of Antwerp and Zeebrugge. Indeed, in 2022, 108.5 million tonnes of cargo were transported by inland barge on the Antwerp site only.
[31] Industrial traffic refers to the traffic taking place directly between the industries located in the port area (such as BASF, AIR LIQUIDE, EUROCHEM...) and the hinterland.

FIGURE 3: **INLAND WATERWAY CARGO HANDLING IN THE SEAPORT OF ANTWERP-BRUGES** (IN MILLION TONNES) *



Source: Port of Antwerp-Bruges
** From 2021 onwards, figures for inland waterway cargo handling at the Port of Antwerp and Zeebrugge appear under the name "Port of Antwerp-Bruges".*

FIGURE 4: **INLAND WATERWAY CARGO HANDLING IN THE SEAPORT OF ANTWERP-BRUGES PER CARGO SEGMENT** (IN MILLION TONNES) *



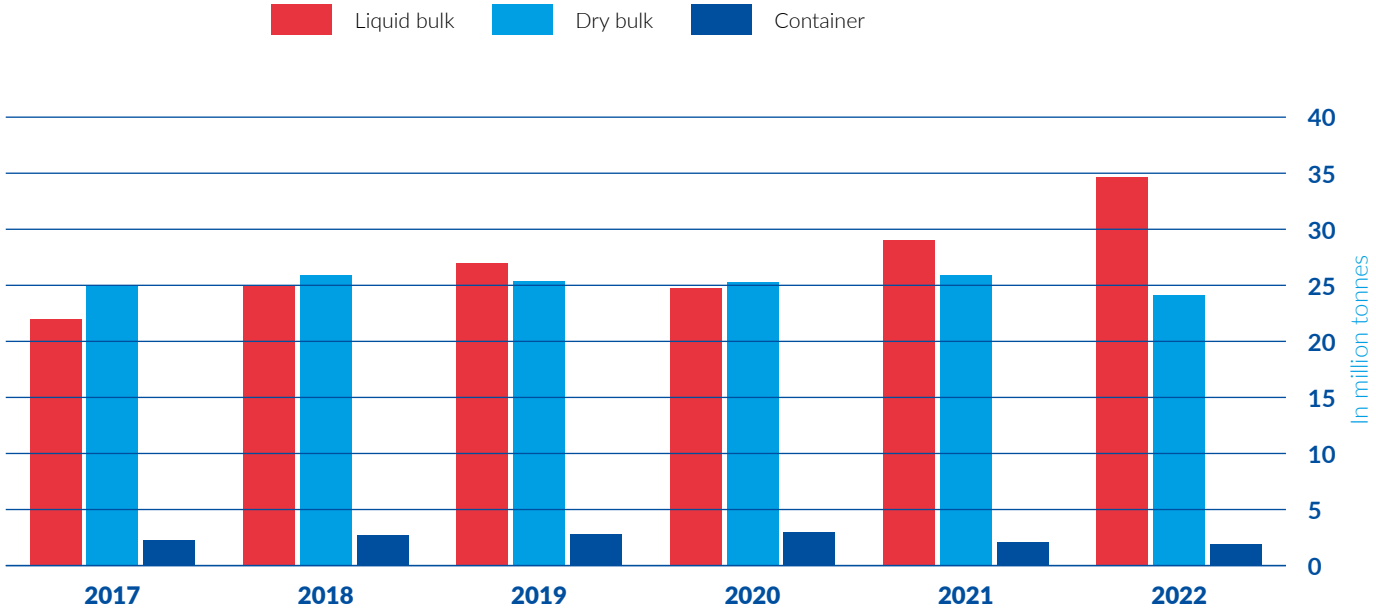
Source: Port of Antwerp-Bruges
** Ro/ro general and not assigned goods are not taken into account in these calculations (in 2022, the volume transported for these three cargo types amounted to 7.4 million tonnes, mostly attributed to general goods).*
From 2021 onwards, figures for inland waterway cargo handling at the Port of Antwerp and Zeebrugge appear under the name "Port of Antwerp-Bruges".

NORTH SEA PORT

In 2022, 40,645 inland vessels called in at North Sea Port (Ghent, Terneuzen, Borsele, Flushing), compared to 40,912 in 2021. Despite a lower number of vessels calling at the port, inland navigation cargo handling at North Sea Port experienced a record year for the second time in a row.[32]
Its volume reached 64.6 million tonnes in 2022 (+8.0% compared to 2021). Liquid bulk grew significantly (+19.6% compared to 2021), reaching its highest level since 2017. This is driven by a strong increase in the transport of petroleum products which can be explained on the one hand by a restauration of the volumes to pre-pandemic levels and, on the other hand, by a more accurate registration of inland navigation volume within the port's database for this specific segment. However, dry bulk decreased (-6.9% compared to 2021). Container transport decreased (-8.6% compared to 2021) for the second year in a row. This is mainly linked to disruptions within global containerised liner shipping, particularly between Asia and Europe.

As for the modal split within hinterland transport, inland navigation ranks first with a share of 58% followed by road (30%), rail (10%) and transshipment or feeder traffic (2%).

FIGURE 5: **INLAND WATERWAY CARGO HANDLING IN THE NORTH SEA PORT** (IN MILLION TONNES) *



Source: North Sea Port
** Ro/ro and conventional cargo are not taken into account in these calculations (in 2022, the volume transported for these two cargo types amounted to respectively 0.5 million tonnes and 3.4 million tonnes).*

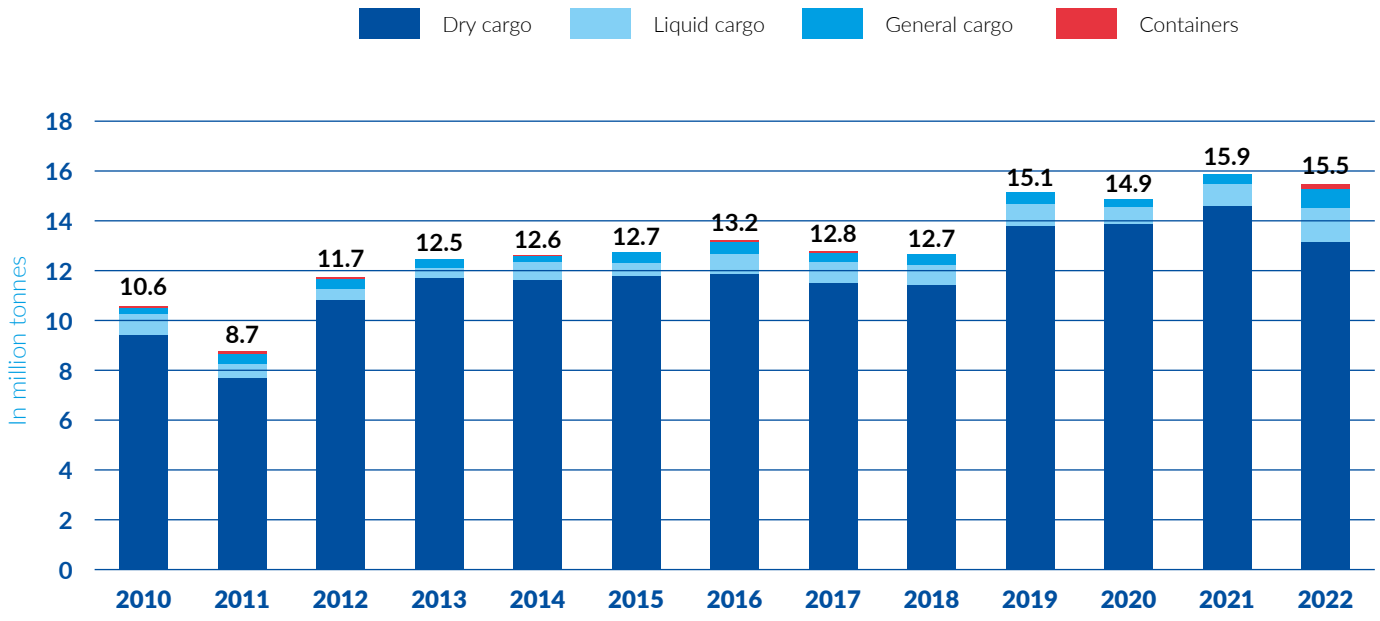
[32] *That is to say cargo volumes per vessels were higher than in 2021.*

CONSTANŢA

In Constanța, 10,890 inland vessels called at the port in 2022 (10,619 in 2021). IWT traffic remained on a similar level as in 2021 with 15.4 million tonnes. Since the beginning of the war, the cargo handled at the port of Constanța in relation with Ukraine has registered 11.85 million tonnes, of which 5.4 million tonnes were river traffic and 6.4 million tonnes were maritime traffic. It is mainly attributed to the transport of grain.

Regarding IWT specifically, mainly dry cargo is handled at the Port of Constanța, with a share of 85% of the total cargo volume handled in 2022. Dry cargo volumes however registered a -10% decrease compared to 2021. Liquid cargo saw a substantial increase of +59.3% compared to 2021. Container transport reached a record year, increasing by 16 times. It however remains at low levels (202,000 tonnes). General cargo more than doubled. As was the case in 2021, cabotage and transit traffic combined had a share of 98% in 2022 while export and import traffic had a share of only 2%.

FIGURE 6: **INLAND WATERWAY CARGO HANDLING IN THE SEAPORT OF CONSTANŢA** (IN MILLION TONNES)



Source: Port of Constanța

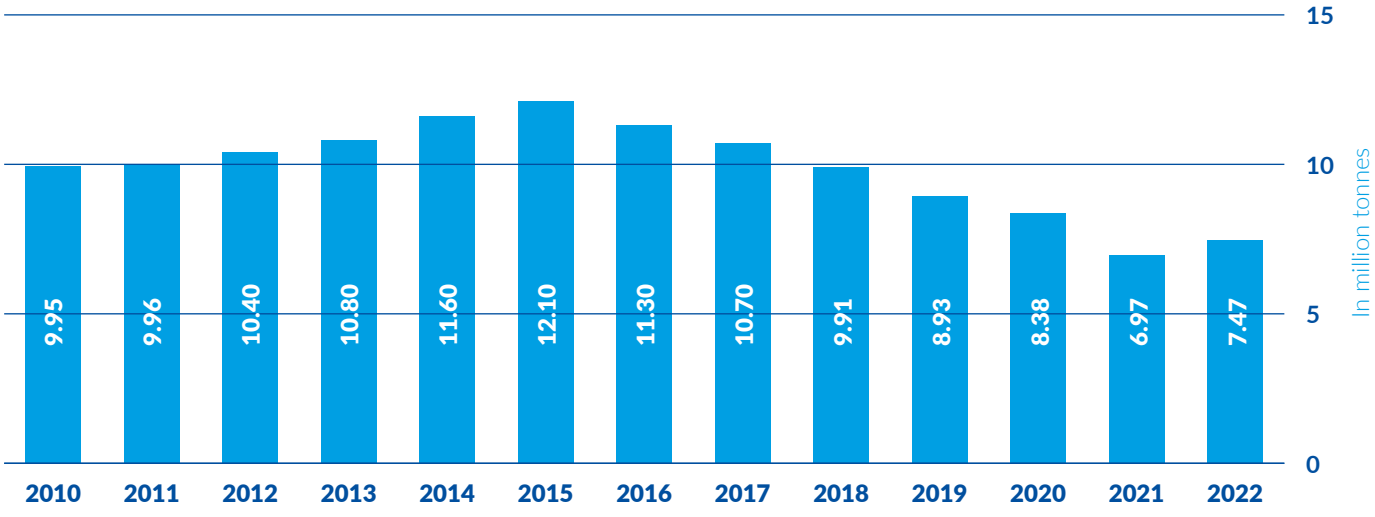
HAMBURG

IWT cargo handling was +7.2% higher in 2022 (7.47 million tonnes) compared to 2021 (6.97 million tonnes). Exports experienced a higher increase (+10.5%) than imports (+4.5%). This development was mainly driven by more liquid bulk transport, which had a strong rise of +31.6%, returning almost to its pre-pandemic level. This is attributed to petroleum products (+37.7%). The year 2022 therefore brings a stop to the yearly and steady decline observed in this market segment since 2015.

Containers and dry cargo volumes decreased slightly, by -1.9% and -2.8% respectively. For dry cargo, this was mainly driven by ores and mining products (-14.9%) for the second year in a row (already -18% in 2021 compared to 2020). Ores are the second most important cargo type at the Port of Hamburg. In line with 2021, when transport of coal, crude oil and natural gas had already experienced a strong upwards movement by +70%, this cargo type (the third largest at the port of Hamburg), also increased by +12.2% in 2022. This is mainly driven by a rise in coal transport, attributed to the high gas prices observed in 2021, further enhanced in 2022 by the consequences of the war in Ukraine, resulting in a shift towards coal in the energy sector.

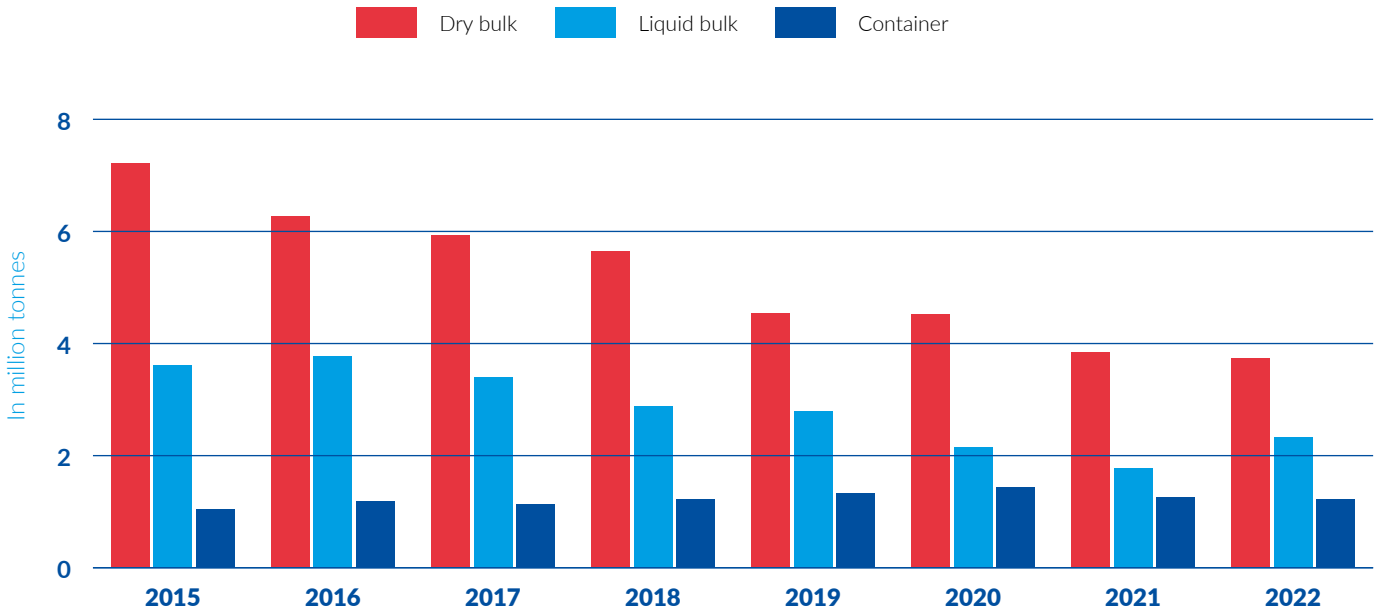
In 2022, the entire hinterland transport amounted to 88 million tonnes (compared to 92 million tonnes in 2021). With a share of 53.9% (+1.0 percentage point), railway transport is ahead of truck transport with 37.6% (-2.1 percentage point) and inland waterway transport with 8.5% (+0.9 percentage point).

FIGURE 7: **INLAND WATERWAY CARGO HANDLING IN THE SEAPORT OF HAMBURG** (IN MILLION TONNES)



Source: Statistical Office of Hamburg and Schleswig-Holstein

FIGURE 8: **INLAND WATERWAY CARGO HANDLING IN THE SEAPORT OF HAMBURG PER CARGO SEGMENT** (IN MILLION TONNES) *



Source: Statistical Office of Hamburg and Schleswig-Holstein

** General cargo is not taken into account in these calculations (in 2022, the volume transported for this cargo type amounted to almost 0.2 million tonnes).*

MAIN EUROPEAN INLAND PORTS[33]

RHINE PORTS

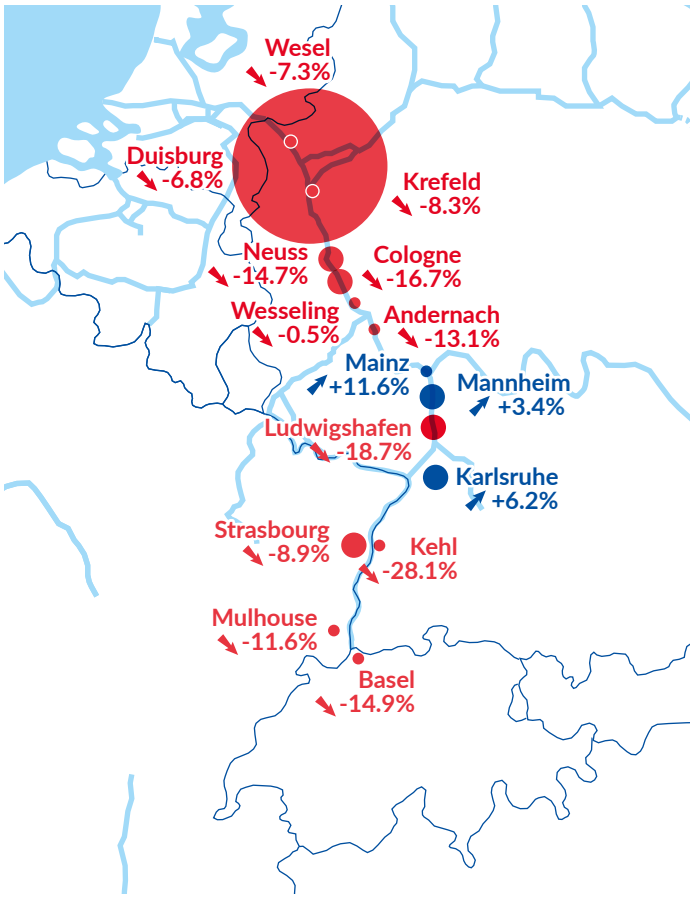
TABLE 1: **INLAND WATERWAY CARGO HANDLING IN MAJOR RHINE PORTS** (IN MILLION TONNES) **AND RATE OF CHANGE 2022/2021 ***

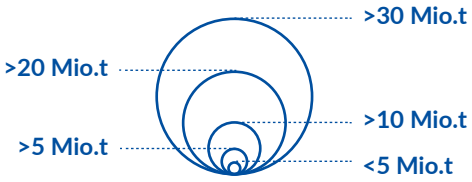
	2019	2020	2021	2022	2022/2021
Duisburg	47.8	42.4	44.9	41.9	-6.8%
Cologne	9.1	9.1	9.8	8.2	-16.7%
Mannheim	7.9	6.9	7.3	7.6	+3.4%
Karlsruhe	6.9	6.2	6.4	6.8	+6.2%
Strasbourg	7.5	6.8	6.9	6.4	-8.9%
Neuss	6.9	6.5	6.6	5.6	-14.7%
Ludwigshafen	6.6	6.8	6.9	5.6	-18.7%
Basel	6.1	5.1	5.4	4.6	-14.9%
Mulhouse	4.9	4.2	4.1	3.6	-11.6%
Mainz	3.7	3.8	3.1	3.5	+11.6%
Kehl	4.2	4.4	4.4	3.2	-28.1%
Krefeld	3.6	3.0	3.4	3.1	-8.3%
Andernach	2.7	2.7	2.7	2.3	-13.1%
Wesseling	2.7	2.5	2.1	2.1	-0.5%
Wesel	2.0	2.0	2.1	1.9	-7.3%
Total	**122.6**	**112.4**	**116.3**	**106.5**	**-8.7%**

Sources: Destatis, Port de Strasbourg, Swiss Rhine ports, Port de Mulhouse
The "total" relates only to the ports mentioned in the table, not all Rhine ports.
** Data on German ports are based on the geographical approach, which means that all cargo turnover within a city is taken into account and not only the cargo handled in a specific port.*

[33] *For German, French, Belgian, Dutch and Rhine ports, the number of ports shown is limited to the 15 largest ports.*

TOTAL YEARLY WATERSIDE TRAFFIC (IN MILLION TONNES)





Negative rate of change in 2022 vs 2021

Positive rate of change in 2022 vs 2021

PORTS IN GERMANY OUTSIDE THE RHINE *

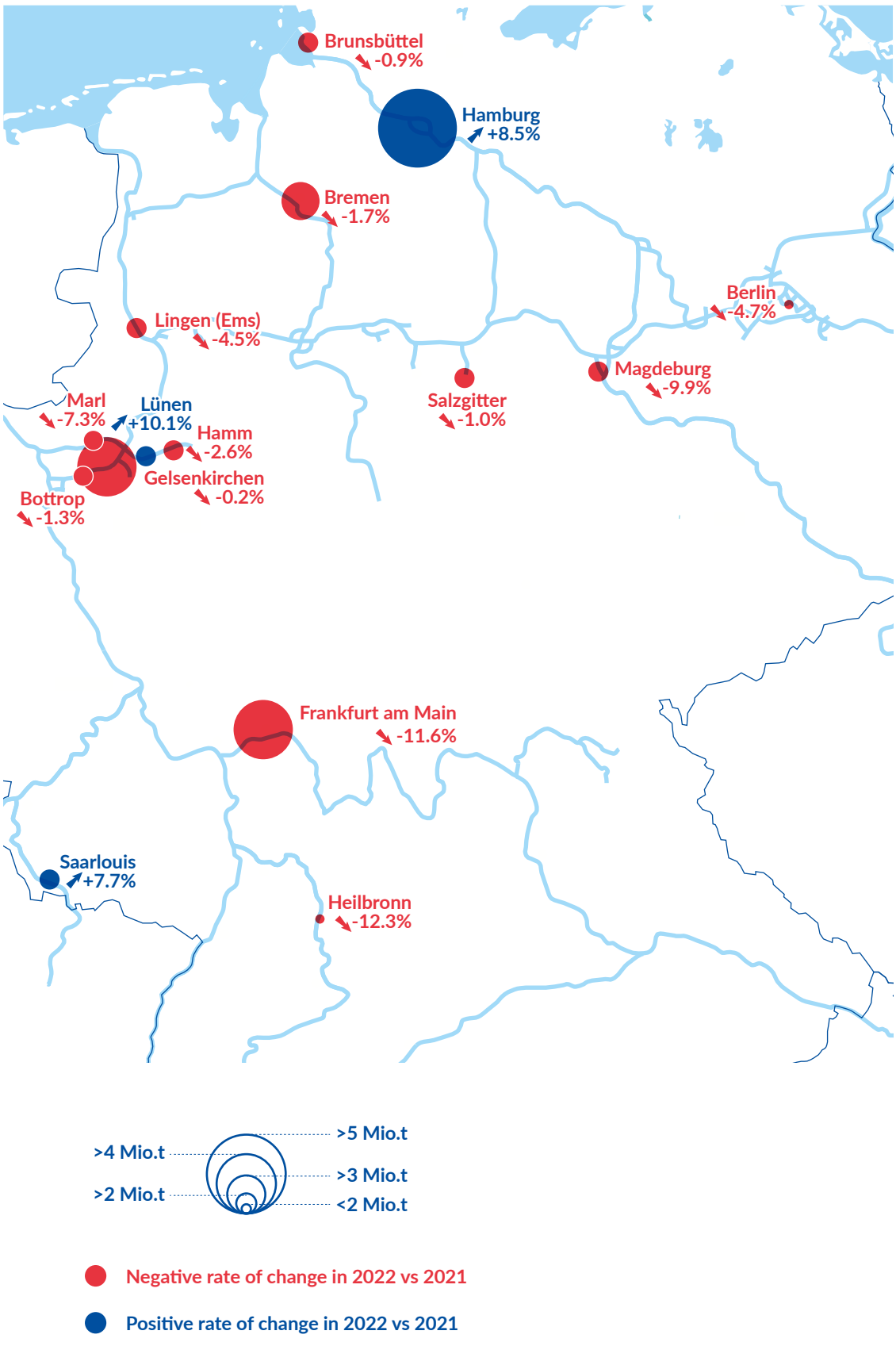
TABLE 2: **INLAND WATERWAY CARGO HANDLING IN MAJOR NON-RHINE PORTS IN GERMANY** (IN MILLION TONNES) **AND RATE OF CHANGE 2022/2021** *

	2019	2020	2021	2022	2022/2021
Hamburg	8.7	7.9	7.6	8.3	+8.5%
Gelsenkirchen	4.7	4.6	4.9	4.9	-0.2%
Frankfurt am Main	5.4	5.7	5.4	4.8	-11.6%
Bremen	2.8	2.7	3.3	3.2	-1.7%
Marl	3.3	3.2	3.1	2.9	-7.3%
Brunsbüttel	3.1	2.7	2.8	2.8	-0.9%
Saarlouis	2.6	1.9	2.6	2.8	+7.7%
Bottrop	3.8	3.1	2.8	2.8	-1.3%
Salzgitter	2.9	2.2	2.7	2.7	-1.0%
Lünen	2.6	1.8	2.3	2.6	+10.1%
Magdeburg	2.3	2.6	2.7	2.4	-9.9%
Hamm	2.8	2.7	2.1	2.1	-2.6%
Lingen (Ems)	2.3	1.9	2.1	2.0	-4.5%
Heilbronn	2.3	1.8	2.2	1.9	-12.3%
Berlin	1.9	1.8	1.8	1.7	-4.7%
Total	**51.5**	**46.6**	**48.4**	**47.7**	**-1.4%**

Source: Destatis

** Data on German ports are based on the geographical approach, which means that all cargo turnover within a city is taken into account and not only the cargo handled in a specific port. For Hamburg, the figures according to this approach are therefore higher than the figures of the Port of Hamburg, due to other transshipment places in the city.*

TOTAL YEARLY WATERSIDE TRAFFIC (IN MILLION TONNES)



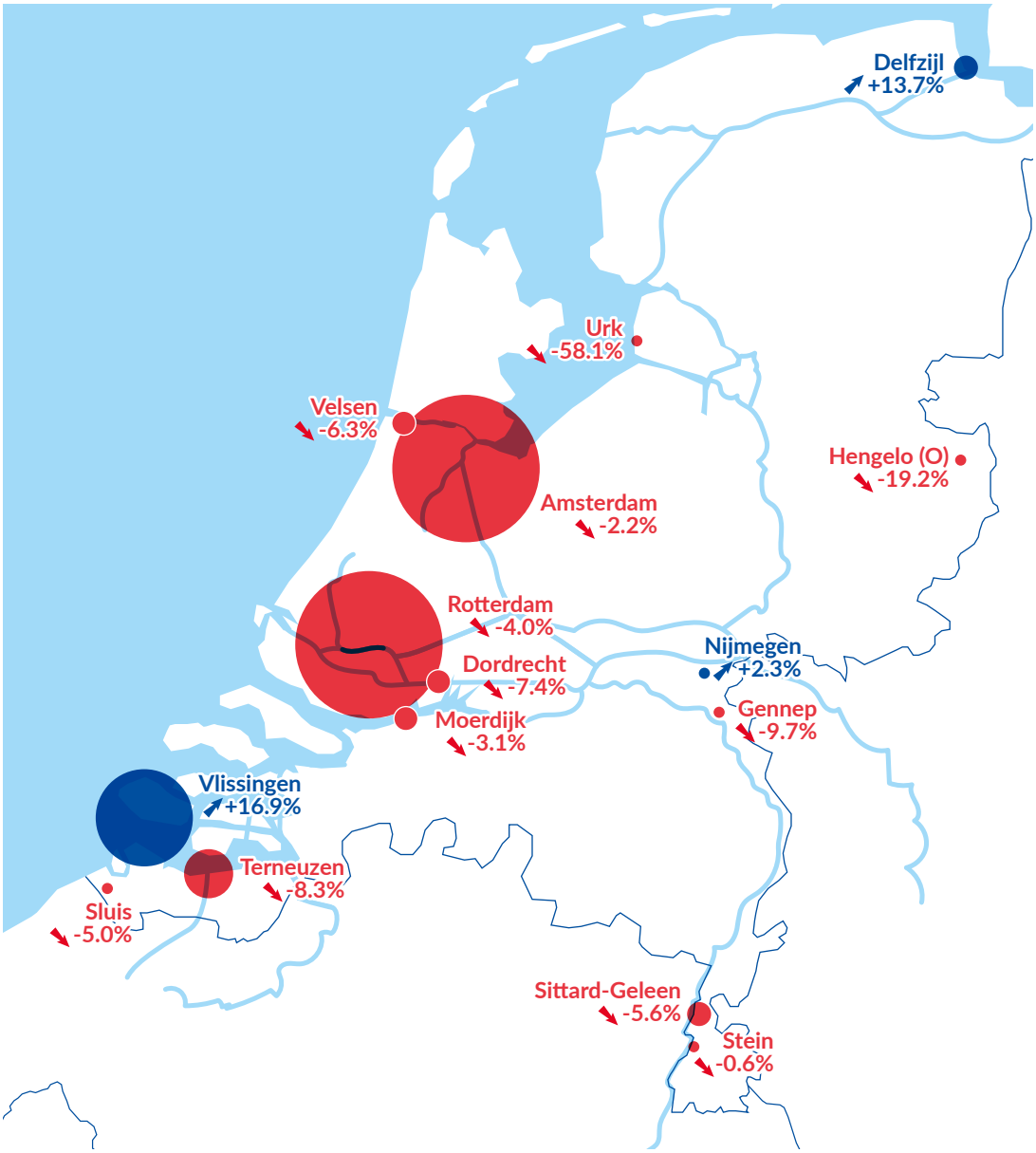
DUTCH PORTS

TABLE 3: **INLAND WATERWAY CARGO HANDLING IN MAJOR DUTCH PORTS** (IN MILLION TONNES) **AND RATE OF CHANGE 2022/2021**

	2019	2020	2021	2022	2022/2021
Rotterdam	151.7	148.8	157.7	151.3	-4.0%
Amsterdam	57.3	50.7	56.3	56.3	-2.2%
Vlissingen	18.9	15.9	21.1	24.6	+16.9%
Terneuzen	13.8	13.4	12.7	11.6	-8.3%
Moerdijk	8.9	9.1	9.7	9.4	-3.1%
Sittard-Geleen	6.8	6.4	7.1	6.7	-5.6%
Velsen	6.5	6.8	7.2	6.7	-6.3%
Dordrecht	5.5	5.9	6.5	5.9	-7.4%
Delfzijl	5.2	4.1	4.5	5.0	+13.7%
Stein	3.1	3.0	3.3	3.2	-0.6%
Nijmegen	2.5	2.8	2.9	2.9	+2.3%
Gennep	3.1	3.1	3.3	2.9	-9.7%
Hengelo (O)	4.0	3.8	3.6	2.9	-19.2%
Sluis	2.7	3.0	2.9	2.8	-5.0%
Urk	5.4	2.4	0.5	0.2	-58.1%
Total	**295.3**	**279.1**	**300.5**	**292.9**	**-2.5%**

Source: CBS

TOTAL YEARLY WATERSIDE TRAFFIC (IN MILLION TONNES)



FRENCH AND BELGIAN PORTS

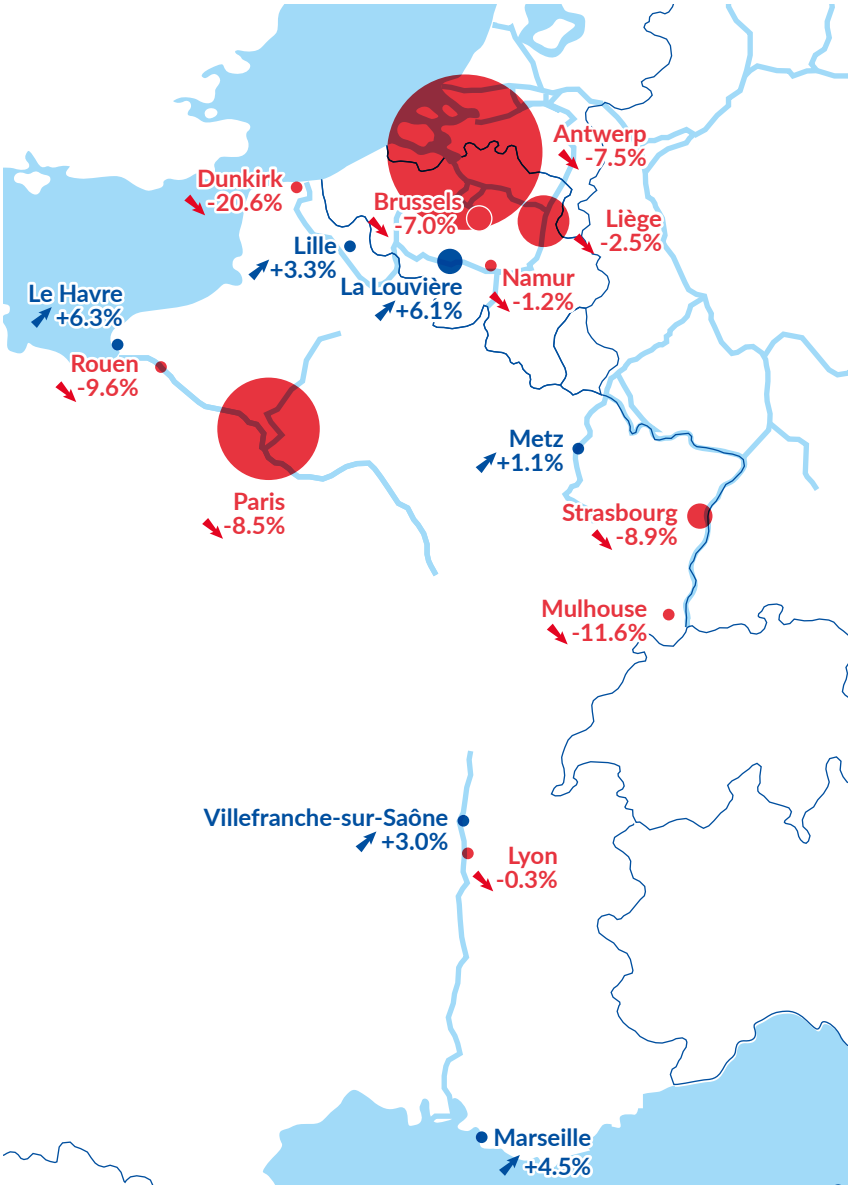
TABLE 4: **INLAND WATERWAY CARGO HANDLING IN MAJOR FRENCH AND BELGIAN PORTS** (IN MILLION TONNES) **AND RATE OF CHANGE 2022/2021**

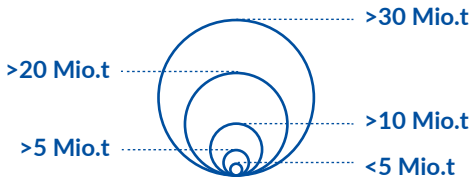
	2019	2020	2021	2022	2022/2021
Antwerp	101.3	101.2	109.4[34]	101.2	-7.5%
Paris	25.3	22.8	22.5	20.6	-8.5%
Liège	16.0	13.9	14.9	14.5	-2.5%
La Louvière	6.9	6.2	6.4	6.8	+6.1%
Strasbourg	7.5	6.8	6.9	6.4	-8.9%
Brussels	5.2	4.9	5.4	5.1	-7.0%
Rouen	5.5	5.9	5.4	4.9	-9.6%
Namur	4.6	3.8	4.3	4.3	-1.2%
Mulhouse	4.9	4.2	4.1	3.6	-11.6%
Le Havre	3.4	2.7	3.0	3.2	+6.3%
Marseille	2.8	1.9	2.0	2.1	+4.5%
Lille	1.9	2.0	2.3	2.4	+3.3%
Dunkirk	2.5	2.9	2.6	2.1	-20.6%
Metz	2.2	2.0	1.7	1.8	+1.1%
Lyon	1.1	1.0	1.2	1.2	-0.3%
Villefranche-sur-Saône	0.8	0.7	0.7	0.7	+3.0%
Total	**191.9**	**183.4**	**193.1**	**180.8**	**-6.4%**

Sources: Voies Navigables de France, Ports de Paris, Port de Liège, Port Autonome du Centre et de l'Ouest, Port de Strasbourg, Port de Mulhouse, Port de Bruxelles, Port de Namur, Nouveau Port de Metz, Port de Lille, Port de Dunkerque, Port of Antwerp-Bruges
The "total" relates only to the ports mentioned in the table, and not to all French and Belgian ports.

[34] *From 2021 onwards, figures for inland waterway goods transport at the Port of Antwerp and Zeebrugge appear under the name "Port of Antwerp-Bruges".*

TOTAL YEARLY WATERSIDE TRAFFIC (IN MILLION TONNES)





Negative rate of change in 2022 vs 2021

Positive rate of change in 2022 vs 2021

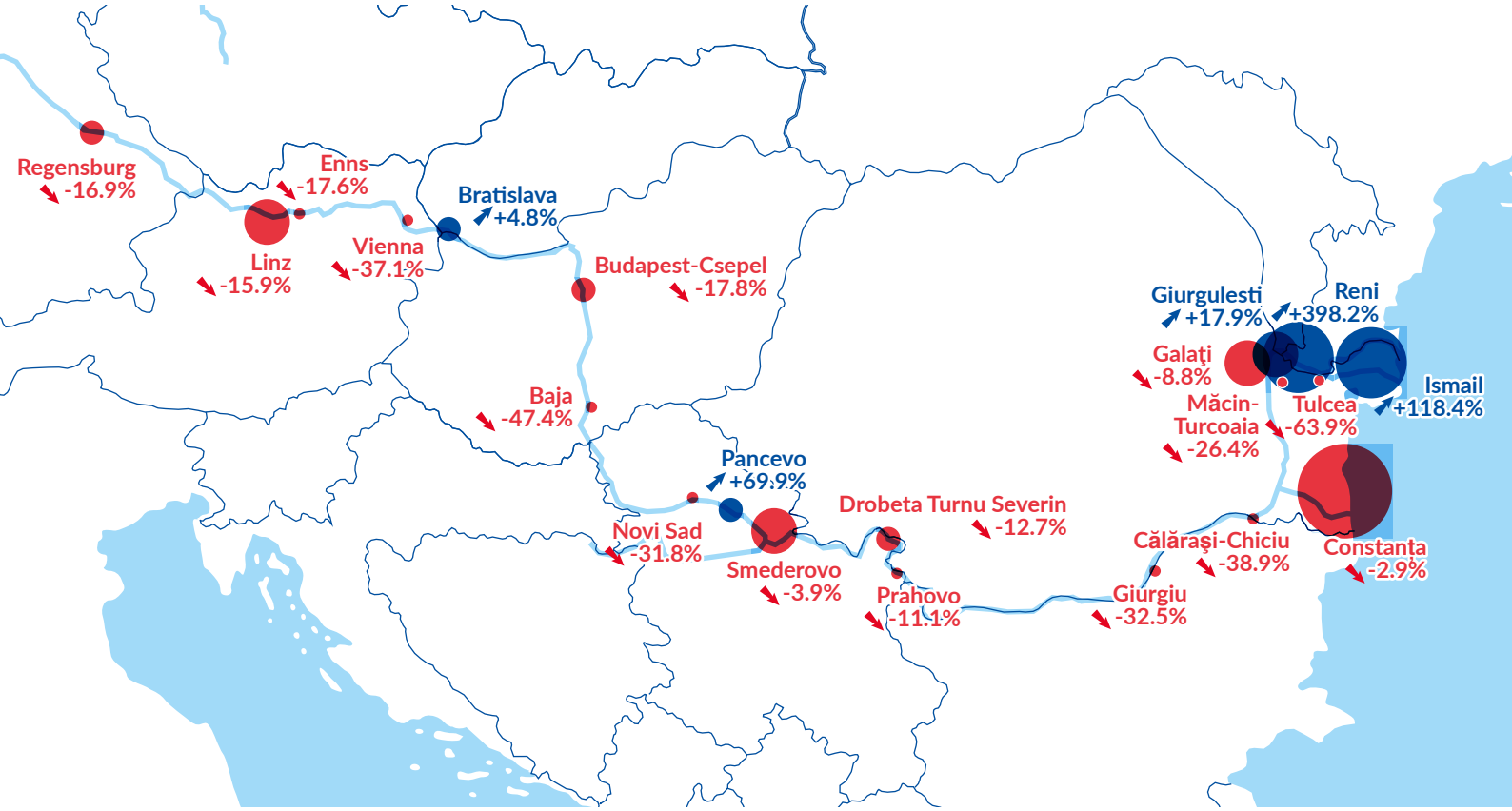
DANUBE PORTS

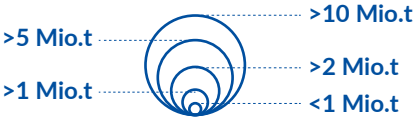
TABLE 5: **INLAND WATERWAY CARGO HANDLING IN MAJOR DANUBE PORTS** (IN MILLION TONNES) **AND RATE OF CHANGE 2022/2021**

	2019	2020	2021	2022	2022/2021
Constanţa	14.5	14.5	15.8	15.4	-2.9%
Ismail	4.3	3.2	4.1	8.9	+118.4%
Reni	1.3	0.8	1.4	6.8	+398.2%
Smederovo	4.0	2.6	3.2	3.0	-3.9%
Galaţi	3.1	2.8	3.3	3.0	-8.8%
Linz	3.3	3.4	3.5	2.9	-15.9%
Giurgulesti	1.3	1.2	1.8	2.1	+17.9%
Bratislava	1.7	1.5	1.8	1.9	+4.8%
Pancevo	1.5	2.0	0.9	1.6	+69.9%
Regensburg	1.3	1.5	1.3	1.1	-16.9%
Drobeta Turnu Severin	1.2	1.0	1.2	1.0	-12.7%
Budapest-Csepel	1.1	1.2	1.2	1.0	-17.8%
Prahovo	1.1	1.2	1.0	0.9	-11.1%
Măcin-Turcoaia	0.9	1.2	1.2	0.9	-26.4%
Novi Sad	1.4	1.6	1.4	0.9	-31.8%
Giurgiu	0.8	0.8	1.0	0.7	-32.5%
Vienna	1.2	0.8	0.9	0.6	-37.1%
Călăraşi-Chiciu	1.1	0.9	0.9	0.6	-38.9%
Enns	0.8	0.6	0.7	0.5	-17.6%
Tulcea	1.6	1.2	1.3	0.5	-63.9%
Baja	0.5	0.8	0.6	0.3	-47.4%
Total	**50.8**	**46.9**	**48.7**	**54.9**	**+12.7%**

Sources: Danube Commission market observation, Romanian National Institute of Statistics
The "total" relates only to the ports mentioned in the table and not all Danube ports. The data used in Figure 6 come from the Port of Constanța while the data used in this table come from the Romanian National Institute of Statistics. This can explain the slight difference in the figures reported.

TOTAL YEARLY WATERSIDE TRAFFIC (IN MILLION TONNES)





Negative rate of change in 2022 vs 2021

Positive rate of change in 2022 vs 2021

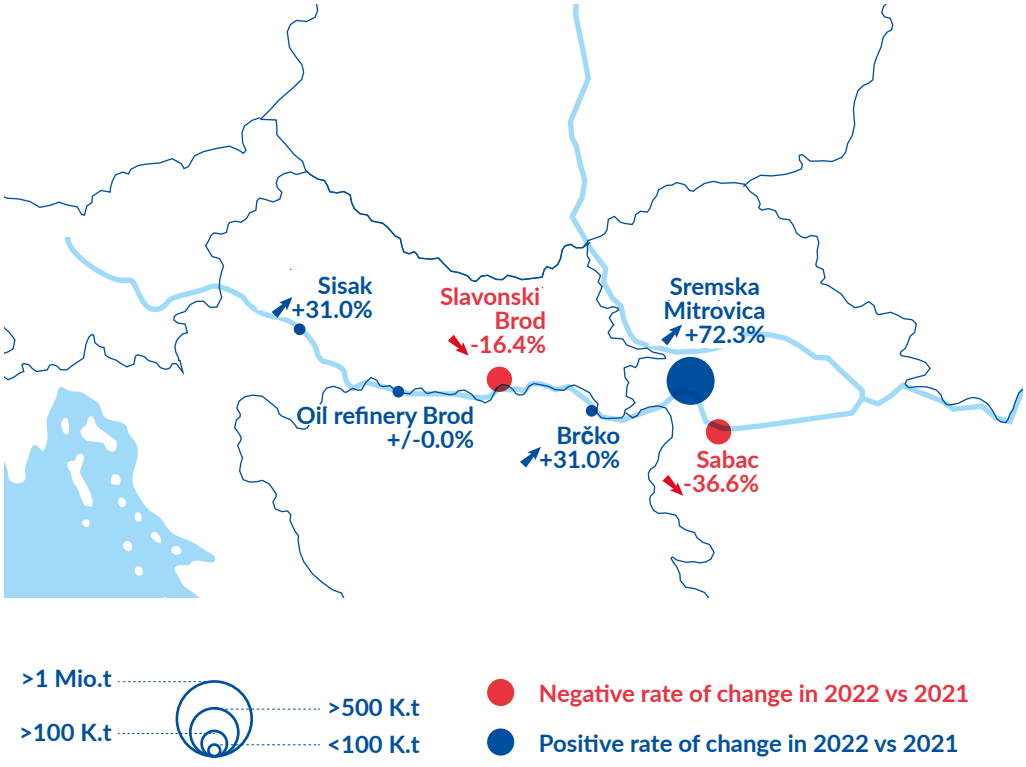
SAVA PORTS

TABLE 6: **INLAND WATERWAY CARGO HANDLING IN MAJOR SAVA PORTS** (IN THOUSAND TONNES) **AND RATE OF CHANGE 2022/2021 ***

	2019	2020	2021	2022	2022/2021
Other ports (Serbia)	949	2,100	2,283	3,200	+40.2%
Sremska Mitrovica (Serbia)	560	486	693	1,194	+72.3%
Sabac (Serbia)	149	170	224	142	-36.6%
Slavonski Brod (Croatia)	199	138	192	161	-16.4%
Sisak (Croatia)	70	55	29	38	+31.0%
Brčko (Bosnia and Herzegovina - BaH)	125	73	31	41	+31.0%
Oil refinery Brod (BaH)	8	0	0	0	+/-0.0%
Total	2,060	3,022	3,452	4,775	+38.3%

Source: International Sava River Basin Commission
** In 2015, the Port of Šamac in Bosnia and Herzegovina reported bankruptcy, therefore no transshipment of cargo has been recorded since then. Due to the Covid-19 pandemic in 2020 and reconstruction of the Brod oil refinery in 2021, no transshipment at the river terminal was recorded in 2020 and 2021. Since 2018, data for smaller transshipment places in Serbia began to be collected which explains the increasing amount of transshipped goods recorded in Serbia for those years.*

TOTAL YEARLY WATERSIDE TRAFFIC (IN THOUSAND TONNES)

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06

CARGO FLEETS

- The fleet of inland cargo vessels in Europe consists of approximately 10,000 vessels registered in Rhine countries, 3,500 vessels registered in Danube countries and more than 1,200 vessels registered in other European countries.
- The total loading capacity of the dry cargo Rhine fleet has remained rather constant since 2008 and amounted to 10.6 million tonnes in 2022. The total loading capacity of the liquid cargo Rhine fleet amounted to 3.4 million tonnes in 2022.
- Overall, the newbuilding activity in 2022 for the Rhine fleet slowed down compared to the previous year. This can partly be explained by the overall decline in the transport of dry goods in the year preceding 2022, weaker growth in tanker shipping and cost increase in shipbuilding.
- The number of innovative vessels in service increased significantly between 2021 and 2022 but still represent less than 0.2% of the entire inland navigation fleet in Europe.

SIZE OF FLEETS
PER MACRO-REGION AND COUNTRY IN EUROPE

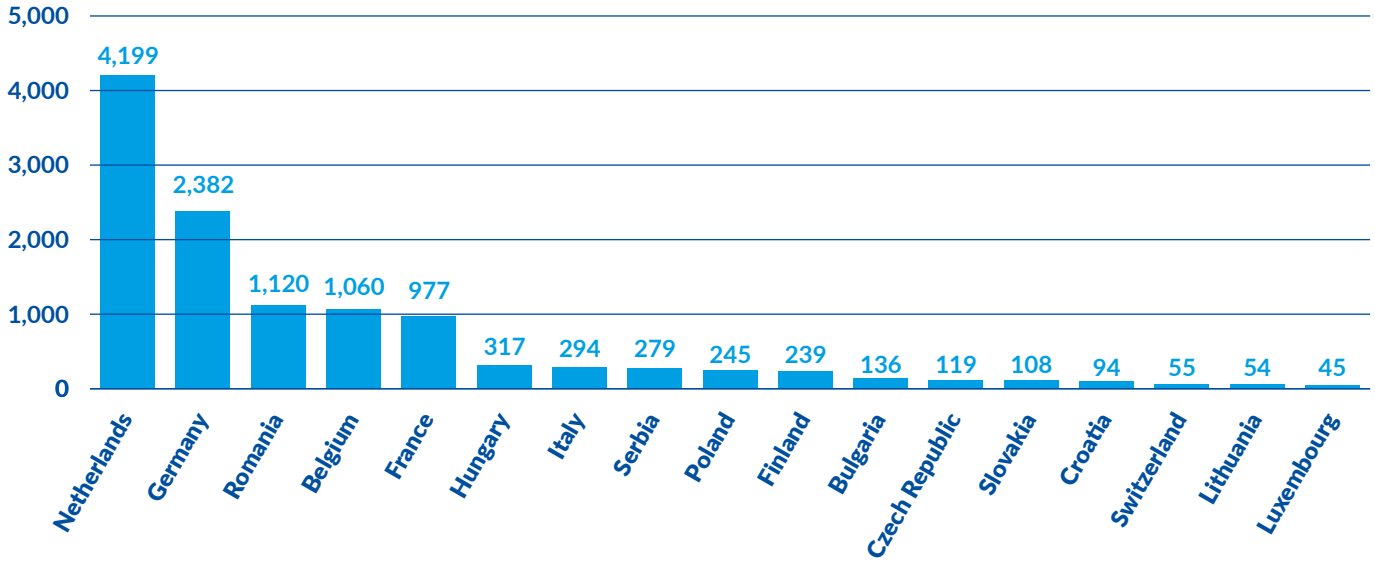
TABLE 1: **SIZE OF FLEETS** (NUMBER OF INLAND VESSELS) **PER MACRO-REGION AND VESSEL TYPE IN EUROPE**

	Dry cargo vessels	Liquid cargo vessels	Push and tug boats	
RHINE FLEET	7,283	1,435	1,268	9,987
DANUBE FLEET *	2,652	204	642	3,498
TOTAL NUMBER OF VESSELS (RHINE AND DANUBE)	9,935	1,639	1,910	13,484
OTHER COUNTRIES **	951		266	1,217
	12,525		2,176	14,701

Sources: 1) Rhine countries: VNF (France), CBS/Rijkswaterstaat (Netherlands), ITB (Belgium), German Waterways and Shipping Administration (WSV), national fleet register of Luxembourg, Swiss Waterway Administration. 2) Danube countries: Danube Commission. 3) Other countries: Eurostat [iww_eq_loadcap], [iww_eq_age], Ministry of Transport of the Czech Republic, Statistics Poland, Statistics Lithuania. For push and tugs: Eurostat [iww_eq_age].
** Data for 2017*
*** Other countries = Poland, Czech Republic, Italy, Finland, Lithuania*

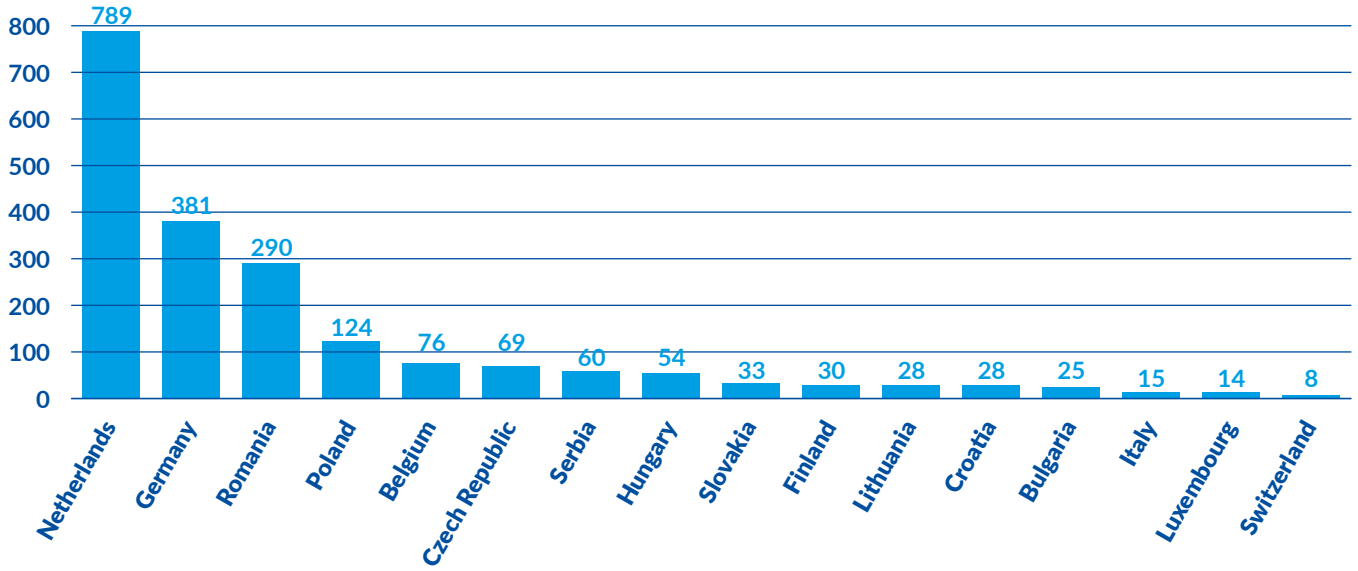
The following figures show the number of dry and liquid cargo vessels taken together (self-propelled vessels and barges) and the number of push and tugboats per country in Europe.

FIGURE 1: **NUMBER OF DRY AND LIQUID CARGO VESSELS PER COUNTRY IN EUROPE ***



Sources: Eurostat [iww_eq_loadcap] and national sources for Rhine countries
** Most data are from 2021 or 2022.*

FIGURE 2: **NUMBER OF PUSH BOATS AND TUGBOATS PER COUNTRY IN EUROPE ***



Sources: Eurostat [iww_eq_age], ITB (Belgium), National fleet register of Luxembourg
** Most data from 2021 or 2022, Italy figure for 2017*

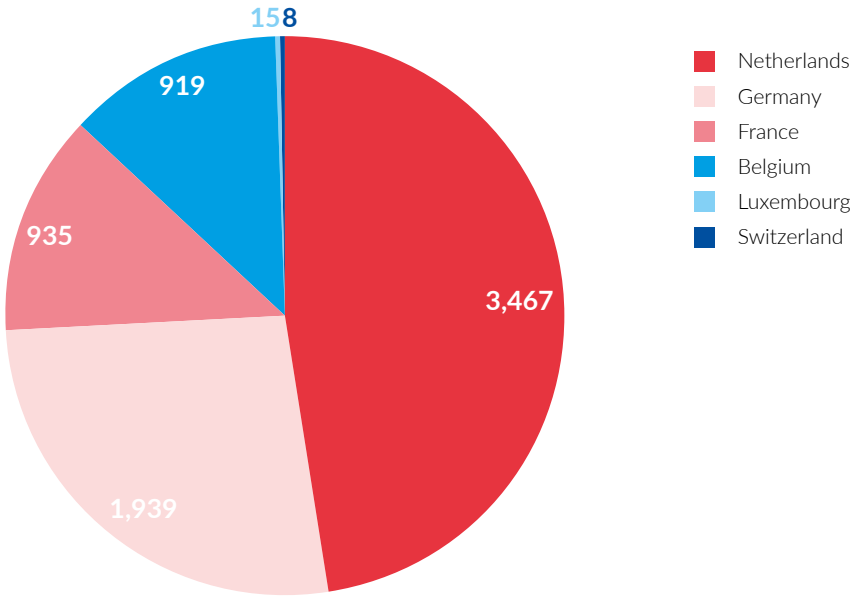
EVOLUTION
OF THE RHINE FLEET

DRY CARGO FLEET IN RHINE COUNTRIES

Fleet data used for this part are entirely based on national fleet data from waterway administrations. The reason for this is that a distinction between dry and liquid cargo vessels is only available in national fleet databases and in the IVR database, but not in the Eurostat databases.

Data used for the Dutch fleet contain the inland vessels that are registered in the Netherlands and which were active in that country in 2022.[35] The total number of dry cargo vessels registered in Rhine countries was, according to these sources, 7,283 in 2022 compared to 7,377 in 2021, 7,423 in 2020 and 7,510 in 2019.

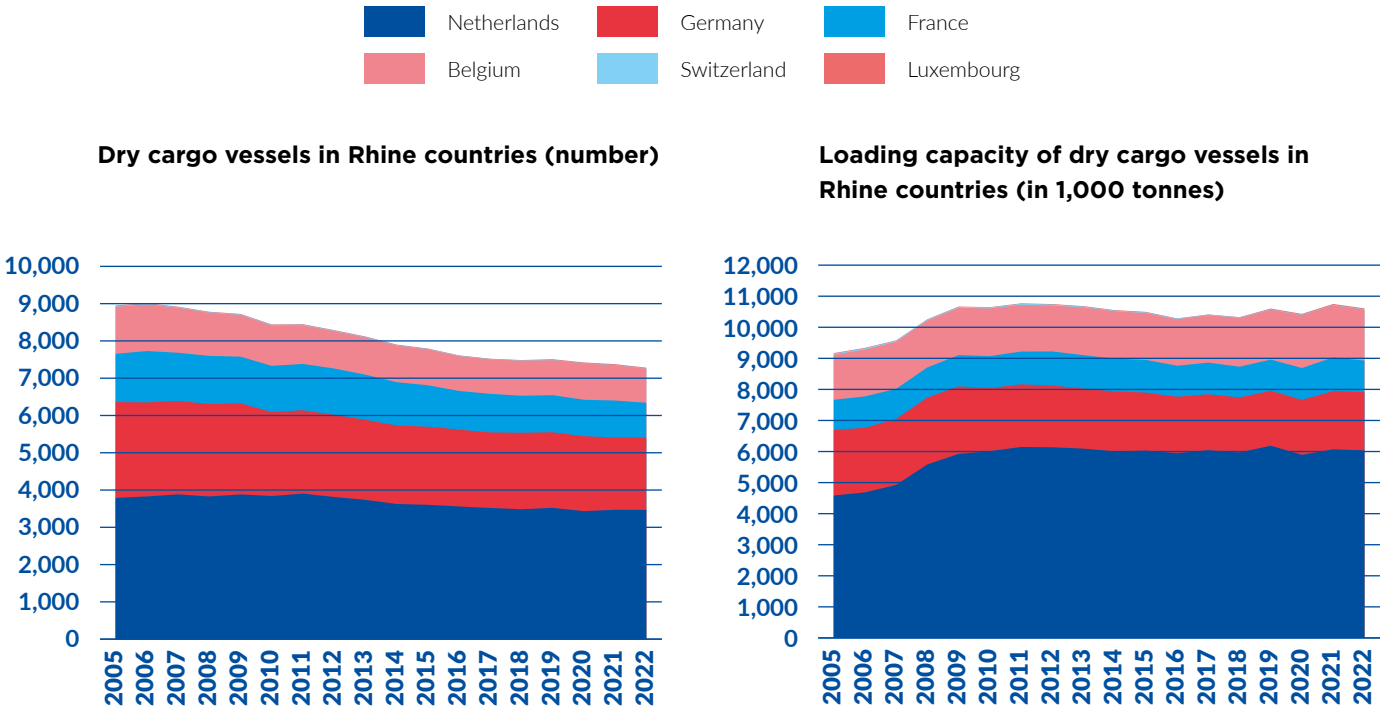
FIGURE 3: **NUMBER OF DRY CARGO VESSELS IN RHINE COUNTRIES IN 2022 ***



Source: CCNR based on national data (see Table 1)
** Data for Germany relate to 2021.*

[35] *The Statistical Office of the Netherlands (CBS) receives raw data about the operative fleet in the Netherlands from the Waterway Administration (Rijkswaterstaat) and transmits them to the CCNR. These vessels are operative as they have passed measurement points in 2022 in the Netherlands.*

FIGURES 4 AND 5: **DRY CARGO FLEET IN RHINE COUNTRIES ***



Source: CCNR based on national data (see Table 1)
** Data for Germany relate to 2021.*

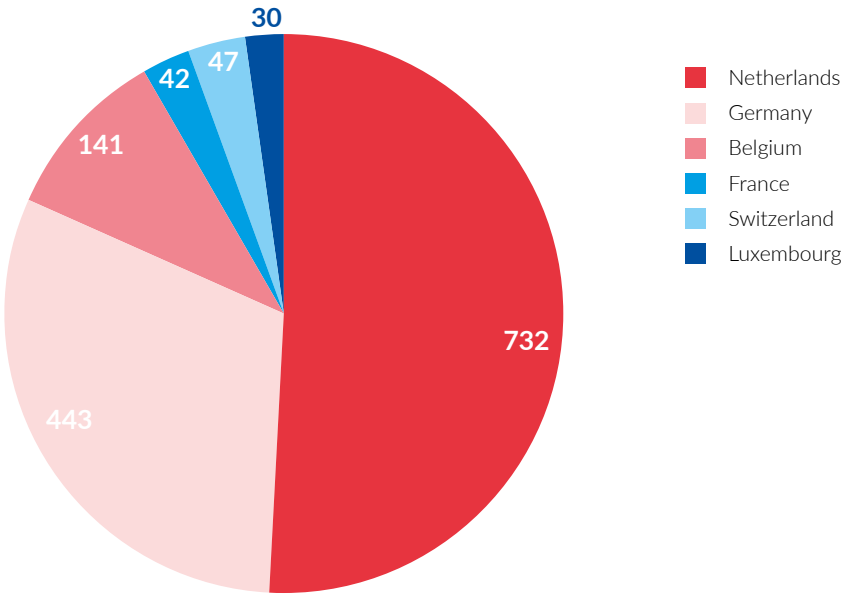
The total loading capacity of the dry cargo Rhine fleet has remained rather constant since 2008 and amounted to 10.6 million tonnes in 2022.

It is often cited that the number of small vessels in the inland navigation sector is decreasing. Long-term data tend to confirm this hypothesis (see 2022 Annual Report, Chapter 6).

LIQUID CARGO FLEET IN RHINE COUNTRIES

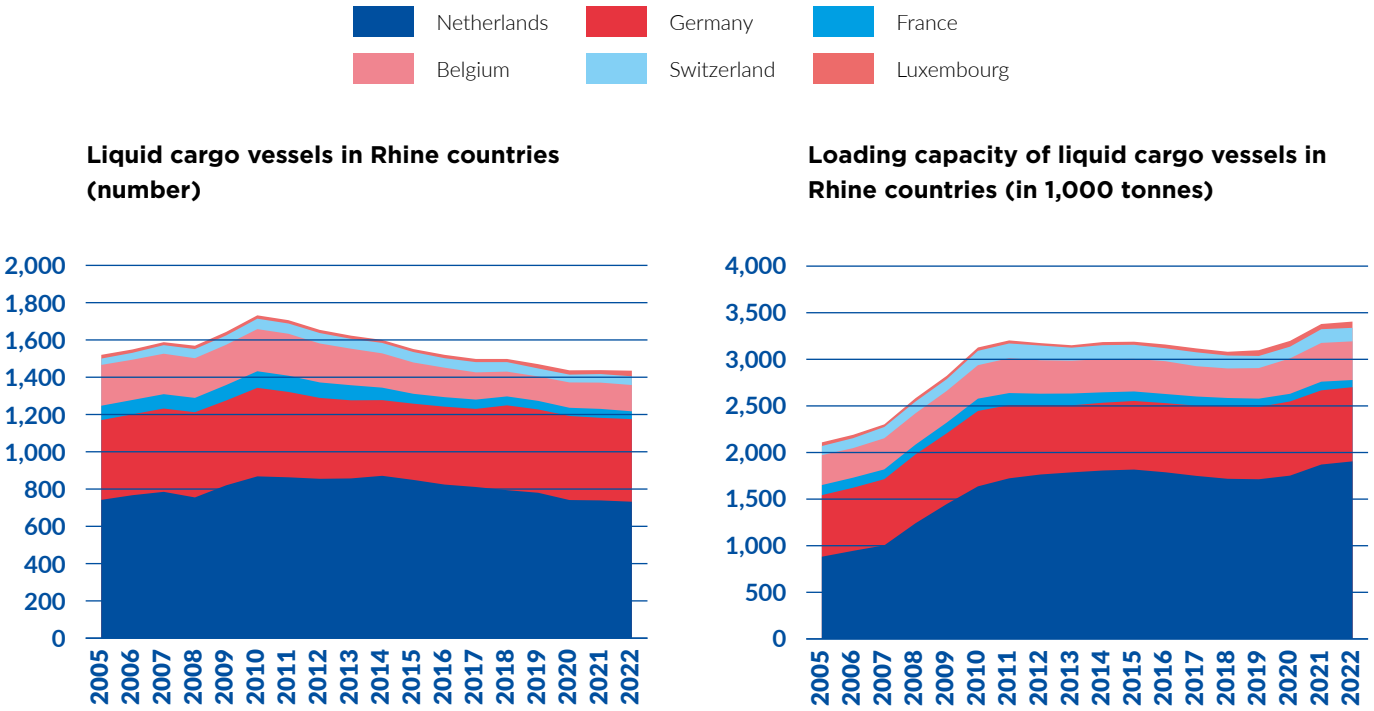
The share of the Dutch fleet within all liquid cargo vessels in Rhine countries is 52%. Switzerland and Luxembourg have relatively high numbers of tanker vessels. From a quantitative perspective, the total number of tanker vessels decreased since 2012, as the number of vessels being phased out was higher than the number of new double hull vessels entering the market.

FIGURE 6: **NUMBER OF LIQUID CARGO VESSELS IN RHINE COUNTRIES IN 2022 ***



Source: CCNR based on national data (see Table 1)
** Data for Germany relate to 2021.*

FIGURES 7 AND 8: **LIQUID CARGO FLEET IN RHINE COUNTRIES ***



Source: CCNR based on national data (see Table 1)
** Data for Germany relate to 2021.*

The total loading capacity of the liquid cargo Rhine fleet amounted to 3.4 million tonnes in 2022.

II EVOLUTION OF THE DANUBE FLEET

DRY CARGO FLEET IN THE DANUBE REGION

According to the statistics of the Danube Commission (with clarification based on surveys of shipping companies in the DC Member States), by the end of 2017,[36] there were around 400 push boats, 242 tugs, 409 self-propelled dry cargo vessels, and circa 2,100 dry cargo barges in the Danube fleet (the German-flagged fleet is counted by port of registry on the Danube). More than 70% of the total transport volume is carried by pushed convoys, whose composition is set out in the following table, depending on the waterway class and shipping conditions.

TABLE 2: **TYPE OF DRY CARGO TRANSPORT ON THE DANUBE** (SHARE OF TOTAL TRANSPORT IN %)

Push boat + 7-9 pushed barges (lighters)	**40-42%**
Push boat + 6 lighters	**20-23%**
Push boat + 4 lighters	**12-14%**

Source: Danube Commission market observation

The total Danube fleet of dry cargo vessels diminished as from 2005. However, from the year 2014 onwards, this decreasing trend came to a halt, and the fleet size has now stabilised. The Romanian dry cargo fleet is the largest in the Danube area with a share of around 48% of all dry cargo vessels. Its size is increasing.

LIQUID CARGO FLEET IN THE DANUBE REGION

According to the statistics of the Danube Commission (with clarification based on surveys of shipping companies in the DC Member States), by the end of 2017, there were 74 self-propelled tanker vessels and 128 tanker barges, with a total cargo capacity of around 0.22 million tonnes.[37]

[36] There were no data available for later years for the Danube fleet, which would have allowed a distinction between dry cargo and liquid cargo vessels.
[37] The 2017 fleet data were the latest available from the Danube Commission.

NEW VESSEL CONSTRUCTION IN RHINE COUNTRIES[38]

Overall, newbuilding activity in 2022 has slowed down compared to the previous year. While the number of new dry cargo vessels remained the same compared to 2021, the number of newly built tanker vessels decreased by 27 units (40 in 2019, 54 in 2020, 58 in 2021 and 31 in 2022).

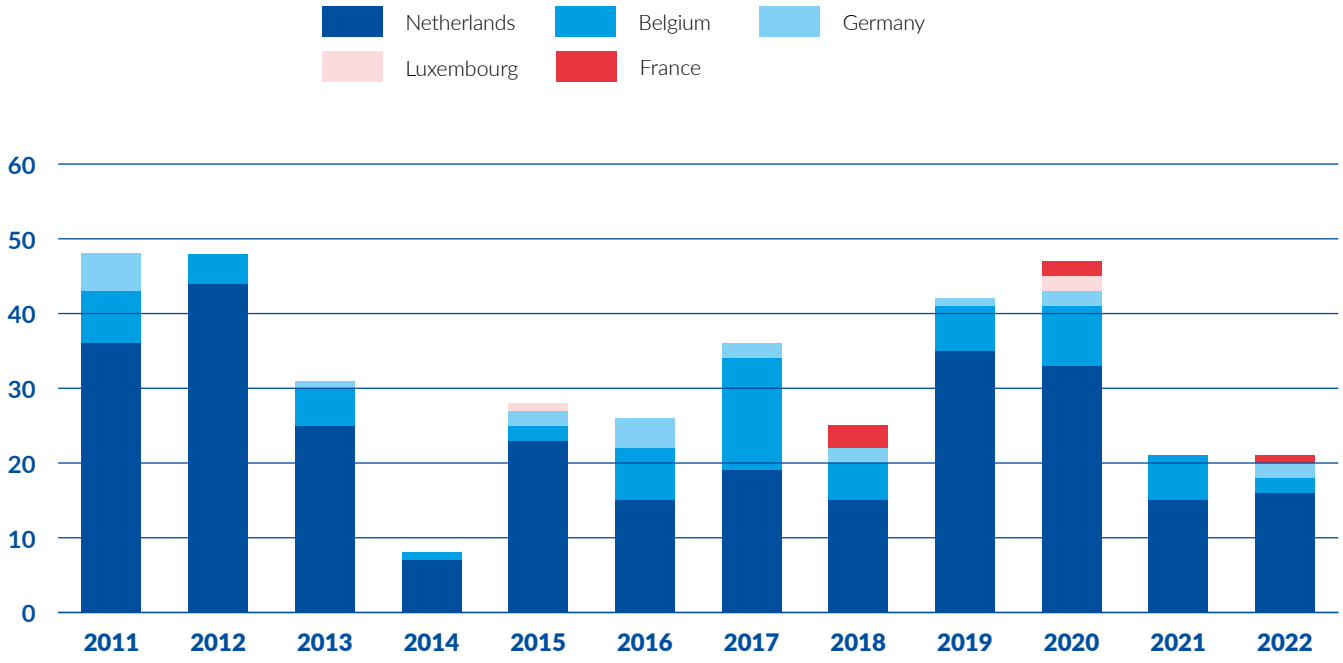
The strong decrease in the newly built capacity can be explained by several factors: overall decline in the transport of dry goods in the year preceding 2022, weaker growth in tanker shipping, cost increase in shipbuilding. In addition, for the dry cargo segment a constant decrease has been observed since 2020, which corresponds to the start of the pandemic. With the boom in coal transport and the pressure on dry cargo capacity, a reversal of this tendency might be observed in 2023.

This will however strongly depend on the evolution of inflation. Indeed, as a result of inflationary tendencies, steel prices and prices for other materials that are needed in shipbuilding have strongly increased. Up to 50% in cost increases for new builds has been reported by the sector.

Dry cargo

The majority of the new dry cargo vessels entering the market in 2022 are registered in the Netherlands (16 out of 21), followed by Belgium and Germany with two new vessels each.

FIGURE 9: **NEW DRY CARGO VESSELS COMING ON THE MARKET PER COUNTRY OF REGISTER** (NUMBERS, 2011-2022)

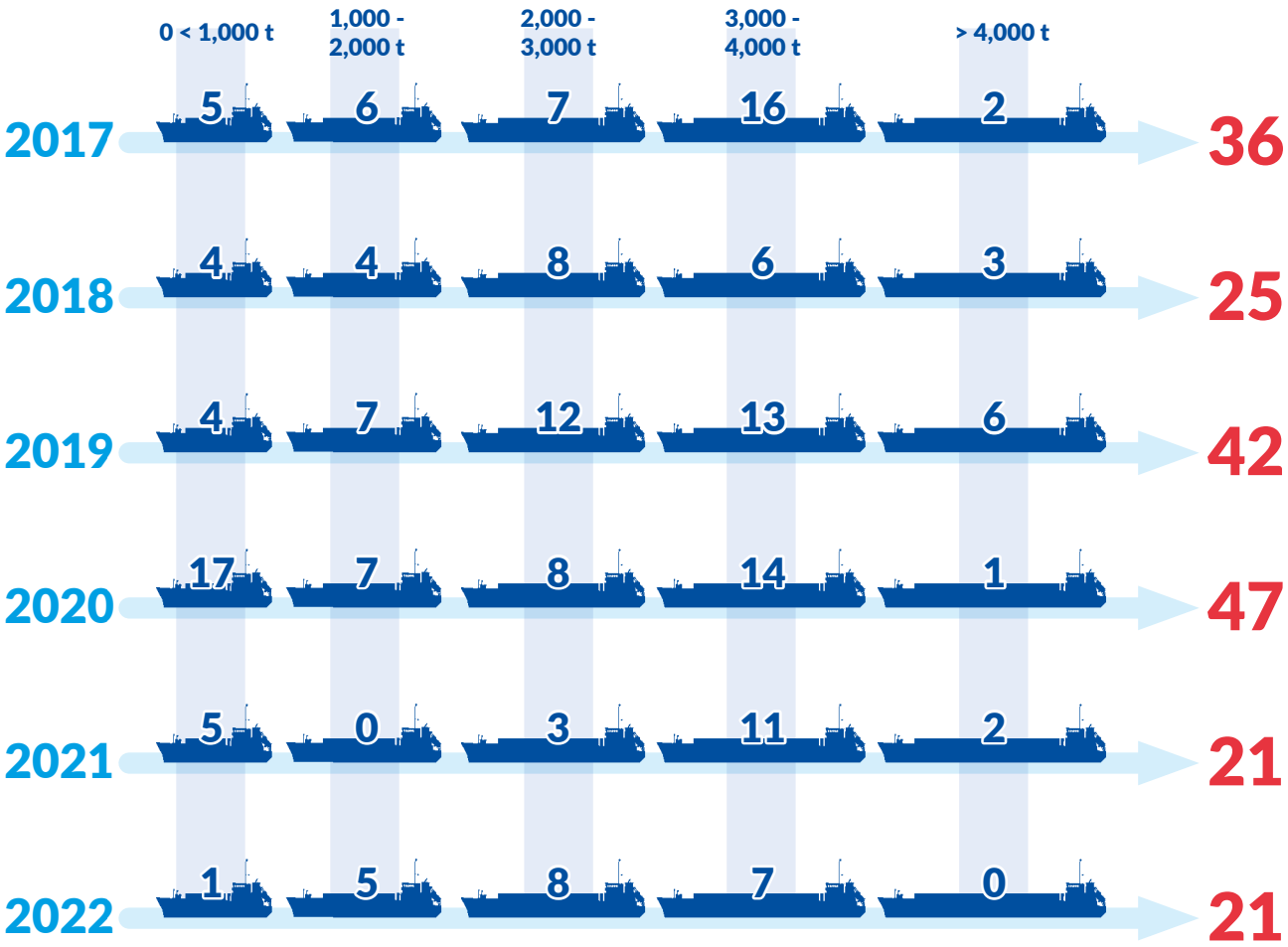


Source: IVR

[38] *The Netherlands, Germany, Belgium, France, Switzerland, Luxembourg*

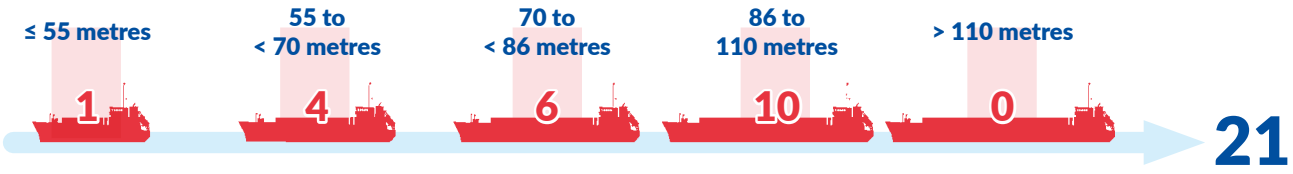
The most common loading capacity within this vessel type is usually 3,000 < 4,000 tonnes. In 2022, most newbuilt were however recorded within the category 2,000 < 3,000 tonnes. The average capacity of newly built dry cargo vessels amounted to 2,499 tonnes in 2022, which is a slight decrease compared to the average of 2,726 tonnes in 2021.

TABLE 3: **NEWLY BUILT DRY CARGO VESSELS ACCORDING TO LOADING CAPACITY**



Source: IVR
Note that in 2022, for five newly built vessels the deadweight was partly estimated due to initially missing values. Estimations were also made in the previous years.

TABLE 4: **NEWLY BUILT DRY CARGO VESSELS IN 2022 BY LENGTH**

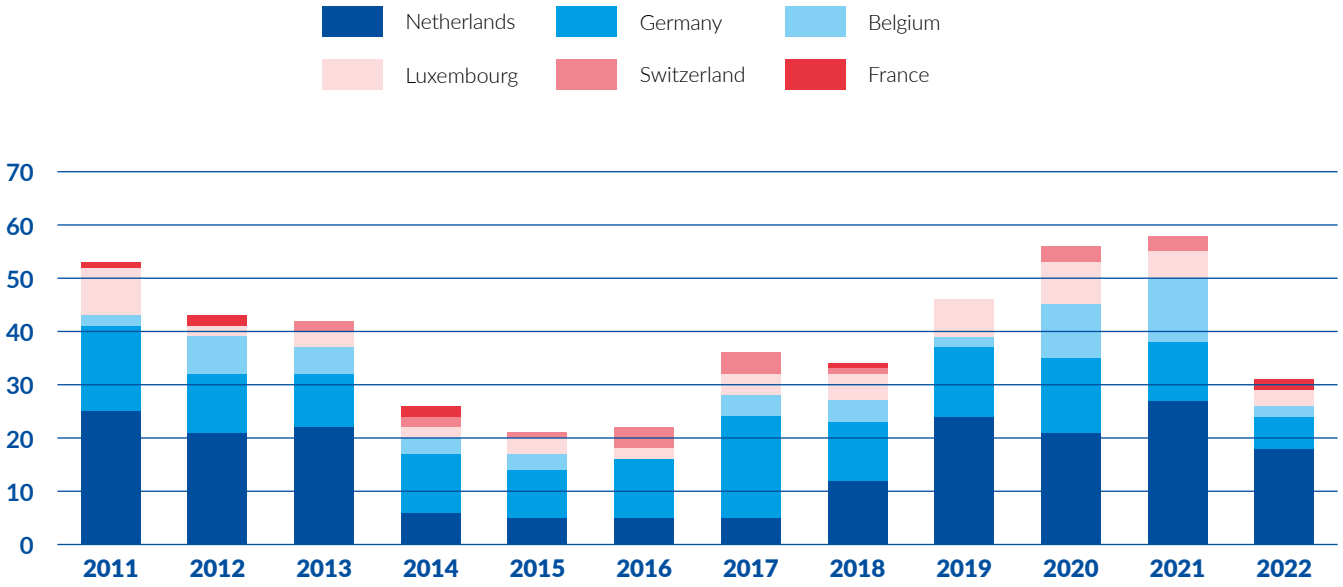


Sources: IVR, CCNR analysis

Liquid cargo

According to the IVR database, 31 new tanker vessels entered the market in 2022, 27 less than in 2021. In the Netherlands 18 new vessels were registered, six were registered in Germany, two in Belgium, three in Luxembourg and two in France.

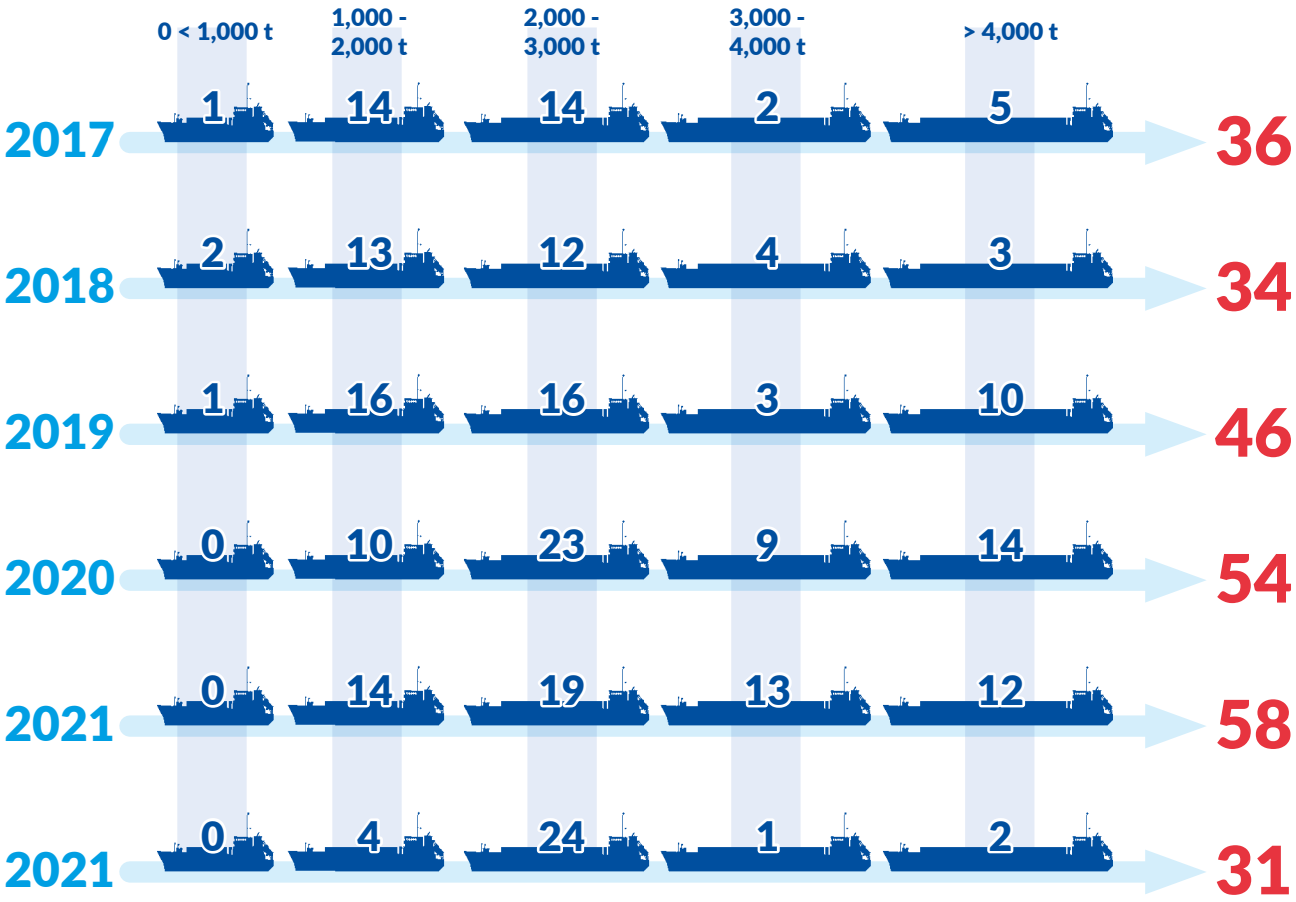
FIGURE 10: **NEW TANKER VESSELS COMING ON THE MARKET PER COUNTRY OF REGISTER** (NUMBERS, 2011-2022)



Source: IVR

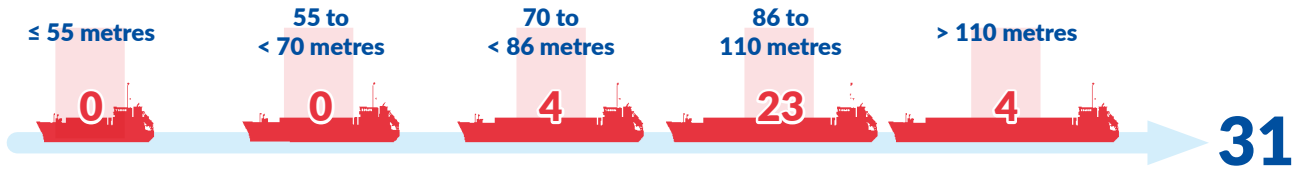
The most common loading capacity of the new tanker vessels is in the category 2,000-3,000 tonnes with 24 new tanker vessels in 2022. The overall average loading capacity reduced from 3,452 tonnes in 2021 to 2,868 tonnes in 2022.

TABLE 5: **NEWLY BUILT TANKER VESSELS ACCORDING TO LOADING CAPACITY**



Sources: IVR, CCNR analysis
Note that in 2022 for four newly built vessels, the deadweight was partly estimated due to an initially missing value. Estimations were also made in the previous years.

TABLE 6: **NEWLY BUILT TANKER VESSELS IN 2022 BY LENGTH**

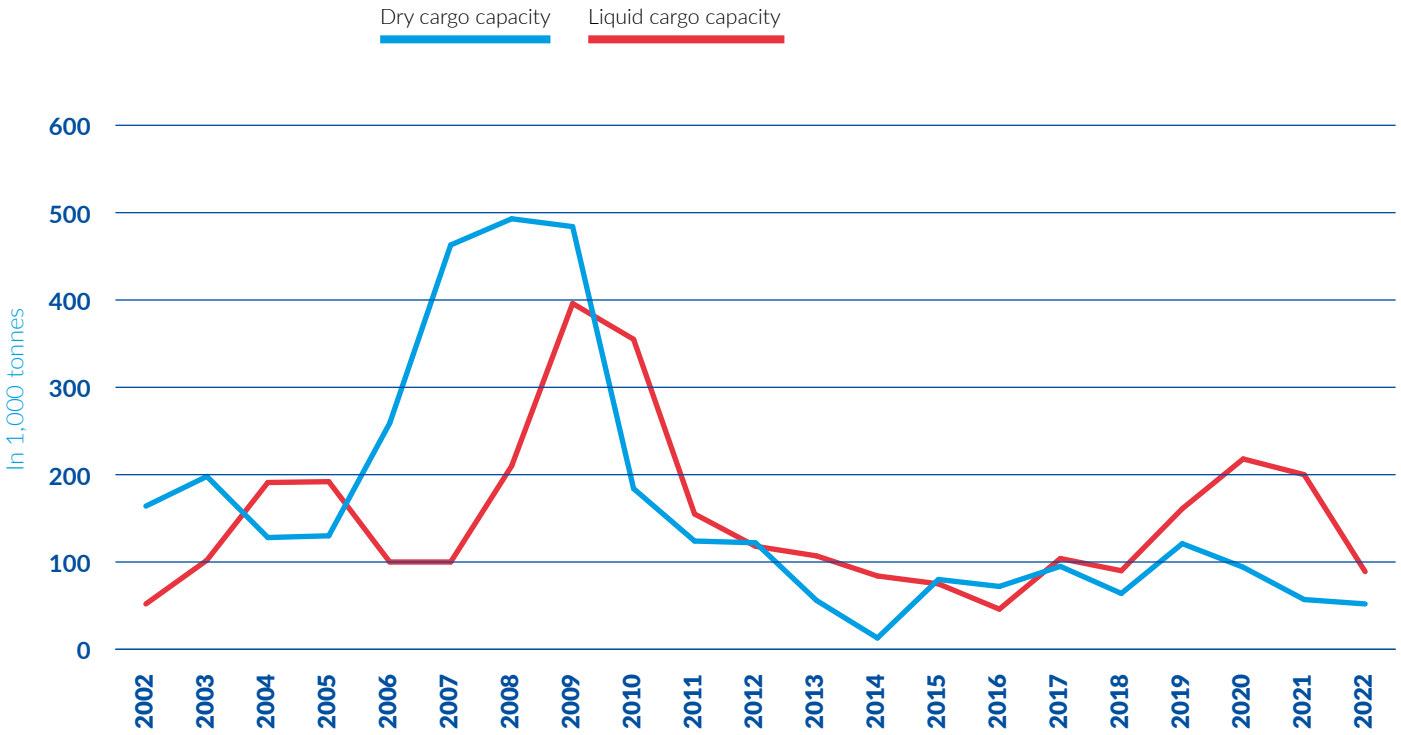


Sources: IVR, CCNR analysis

In the category of push boats and tugs, four new builds came on the market (compared to seven in 2021) of which three are registered in the Netherlands and one is registered in Germany.

Figure 11 illustrates the new loading capacity entering the market by year and for dry and liquid cargo vessels. After a long decline following the financial crisis, new dry and liquid capacity showed an increase in recent years. For liquid cargo vessels, this was more significant than for dry cargo vessels. The year 2021 was marked by a moderation in newbuilding activity due to the deterioration of transport demand conditions caused by the pandemic. This moderation was further accentuated in 2022, particularly for liquid cargo capacity, most probably as a result of the economic and geopolitical uncertainties which were already high in 2021 and remained high in 2022.

FIGURE 11: **NEW CAPACITY COMING ON THE MARKET FOR DRY AND LIQUID CARGO** (LOADING CAPACITY IN 1,000 TONNES)

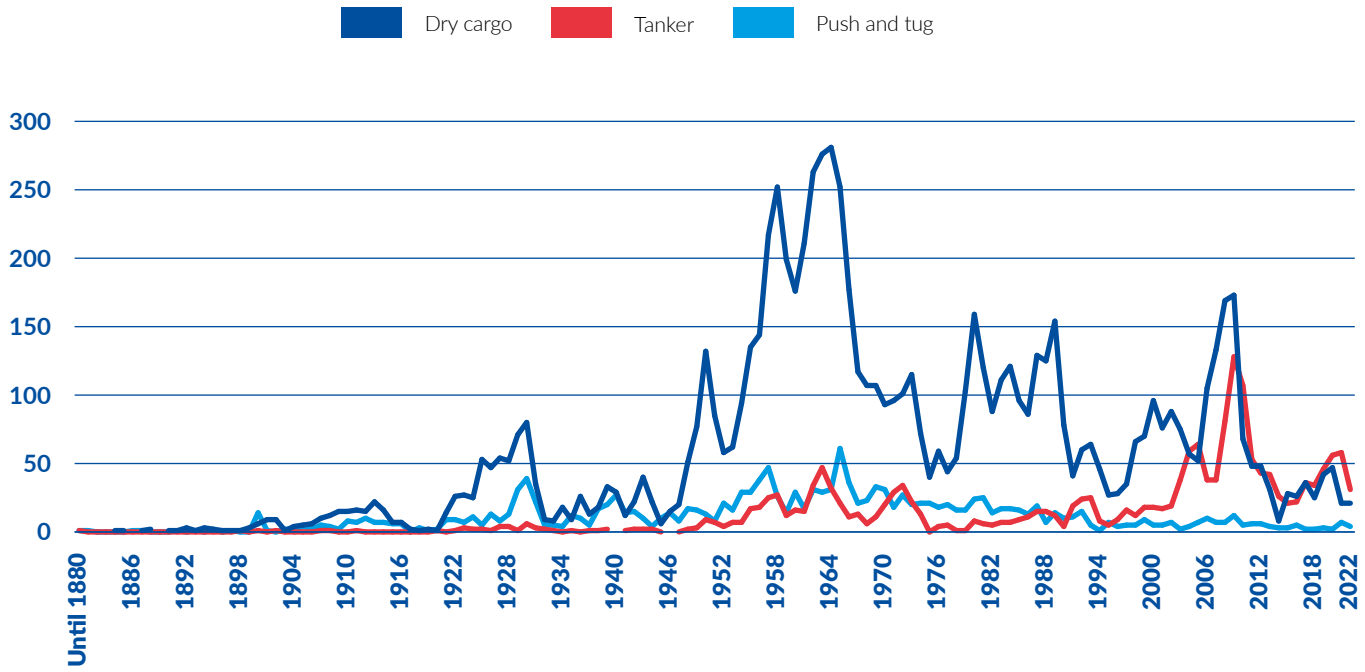


Source: IVR

AGE STRUCTURE
OF THE RHINE CARGO FLEET

According to the vessel database of the IVR,[39] around 85.3% of the dry cargo fleet was constructed in the 20th century whereas the respective share for the tanker fleet amounts to 48.0%. According to the IVR database, the Netherlands holds the largest vessel numbers within the Rhine fleet in almost every vessel category, followed by Germany.

FIGURE 12: **COMMISSIONING YEARS FOR THE RHINE FLEET OVER TIME** (NUMBER OF INLAND VESSELS)



Sources: IVR, CCNR analysis
Note that 121 dry cargo vessels and 15 push and tug vessels have an unknown year of construction. Furthermore, 235 additional tanker vessels, 1,750 dry cargo vessels and 500 push and tug vessels are recorded in the IVR database as being registered in countries other than Rhine countries.

[39] *The IVR database accounts for active vessels but might also include some inactive vessels, in particular those commissioned in earlier years.*

CAPACITY MONITORING

DRY CARGO VESSELS

The armed conflict in Ukraine led to violent disruptions of supply chains in the dry cargo segment. As a result of the blockade of deep-sea ports in Ukraine, there was a great need for capacity in the Danube basin, in particular to export grain from Ukraine to ports in Romania (Galați and Constanța). As indicated in previous chapters, a large number of dry cargo vessels were then sold from the Rhine basin to the Danube Basin.

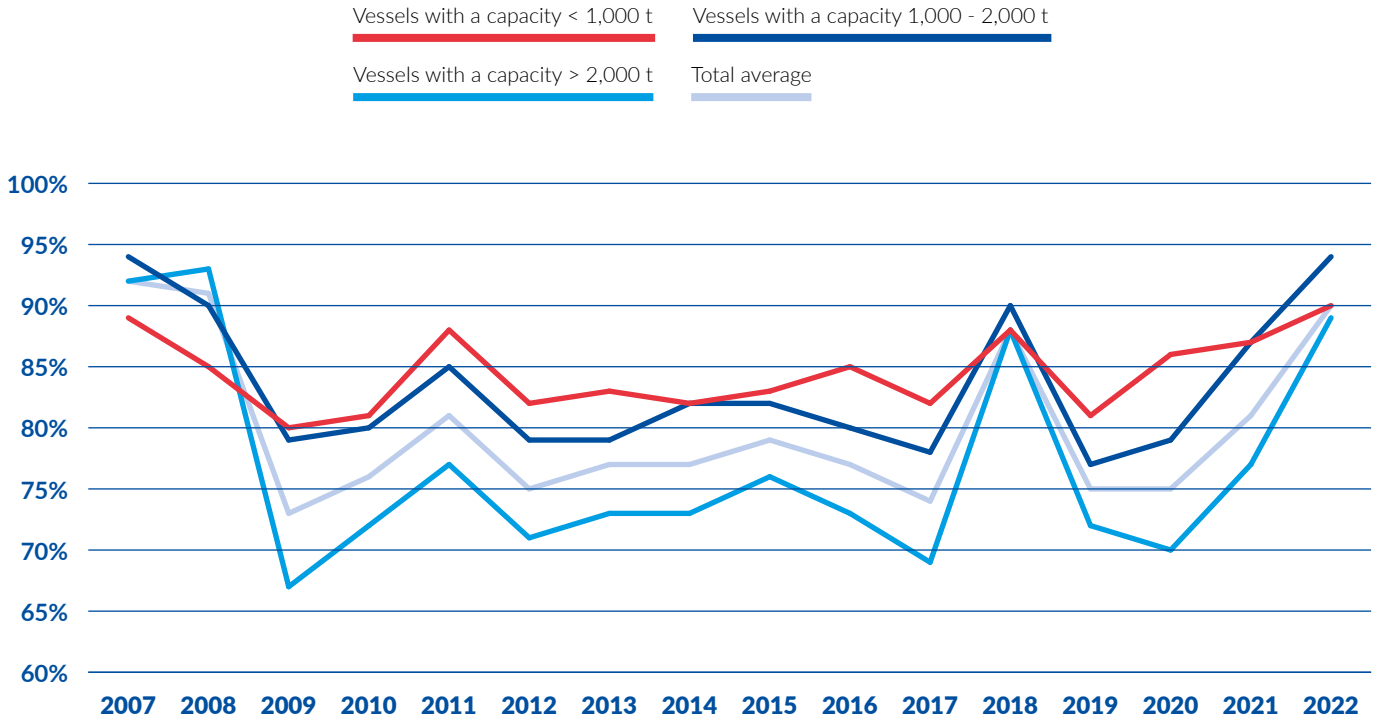
As explained in previous chapters, the tensions in the gas market associated with the war in Ukraine led to an increase in demand for coal transport on inland waterways. Many vessels were therefore used to transport coal which would have instead been used to transport other goods, including containers for instance.

Last but not least, the effects of the low water period in July and August 2022 came as an additional strain on dry cargo vessel capacity, to the extent that some cargo could no longer be transported.

Overall, the dry cargo capacity in 2022 was too low compared to the demand for dry cargo capacity. As a result, capacity utilisation was at its highest level since many years, exceeding values from 2018, for all vessel size categories. The average utilisation rate was 90% in 2022, showing signs that the fleet capacity is tight to cope with low water periods. This is significantly higher than in 2021 (81%) and comparable to the low-water year of 2018 (88%). The highest increase took place for the large vessels (> 2,000 tonnes), from 77% in 2021 to 89% in 2022.

At the same time, the macroeconomic outlook remains highly uncertain. Similarly, it is uncertain whether the drivers that led to the increase in demand for dry cargo vessel capacity in 2022 are only temporary or will remain in future years. For instance, under the pressure of climate change, demand for coal transport is expected to decline again, in line with the decreasing trends observed in previous years. Similarly, it remains unclear whether the Rhine basin dry cargo capacity which was transferred to the Danube basin will come back to the Rhine basin or not depending on the evolution of the armed conflict in Ukraine.

FIGURE 13: **CAPACITY UTILISATION FOR THE DRY CARGO FLEET IN RHINE COUNTRIES** (PER VESSEL SIZE CLASSES) *



Source: Panteia analysis based on data provided by CCNR

**The methodology according to which water levels affect capacity utilisation was modified compared to previous years. This leads to a divergence in the absolute values reported in this year's report compared to previous years without affecting the trend analysis. German fleet data are accurate for 2021 and estimated for 2022. A correction for the German fleet data is always applied for the year N-1.*

LIQUID CARGO VESSELS

For tanker shipping, the average utilisation of the fleet in 2022 also increased sharply compared to the previous year. The average utilisation rate was 81% in 2022 compared to 65% in 2021, a similar level as in 2018 (82%).

This increase was driven mainly by the effect of low waters and not necessarily by the macroeconomic conditions. Indeed, the tanker market is more sensitive to low water periods than the dry cargo market due to the higher deadweight of tanker vessels. To give an example, where a standard dry cargo vessel can still use about 20 to 25% of its cargo capacity at a water level of 40 centimetres in Kaub, a standard tanker can only use 5 to 10% of its capacities.[40]

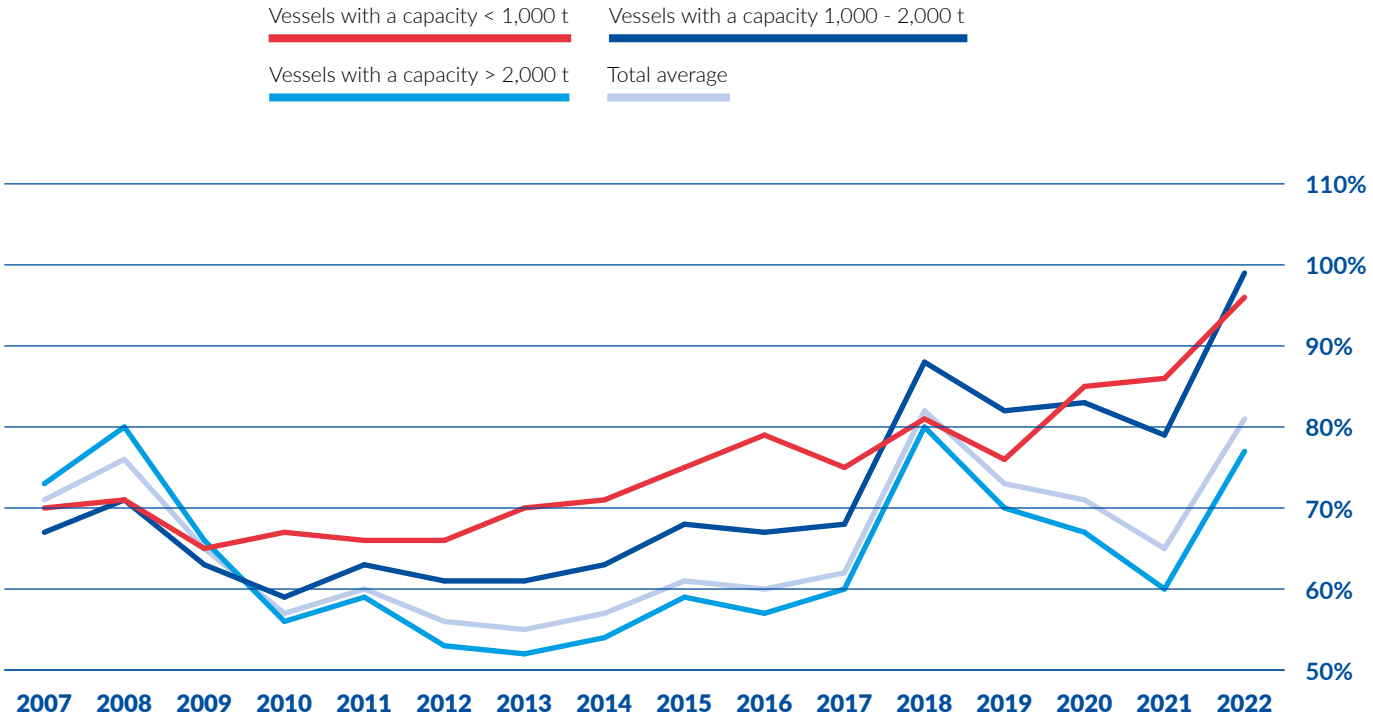
In the liquid segment, capacity was almost fully used for small (< 1,000 tonnes) and medium-sized (1,000 to 2,000 tonnes) vessels, reaching respectively 96% and 99%. In almost all cases, these are highly specialised tankers that are active in the transport of specific products, for example, cement or edible oils. In other cases, they are specifically built for a single client and are therefore used in an optimal way. In this market, capacity is under pressure and a disruption such as prolonged low water levels are expected to cause production losses or modal shift.

[40] *Standard means a vessel with the following dimensions: 110 x 11.45 x 3.6 metres*

For large-size (more than 2,000 tonnes) tanker vessels, capacity utilisation reached 77%.

It is worth highlighting that, despite the substantial navigation restrictions in summer 2022, transport was still able to continue, and security of supply was not compromised. This statement is true for both the dry, container and the liquid cargo segments.

FIGURE 14: **CAPACITY UTILISATION FOR THE LIQUID CARGO FLEET IN RHINE COUNTRIES** (PER VESSEL SIZE CLASSES) *



Source: Panteia analysis based on data provided by CCNR
** Same as Figure 13*

INNOVATIVE
DEVELOPMENTS IN THE INLAND NAVIGATION FLEET CONTRIBUTING TO REDUCING EMISSIONS

In accordance with the mandate given by the Mannheim Ministerial Declaration of 17 October 2018, the CCNR adopted in December 2021 a roadmap for reducing emissions from inland navigation,[41] which called for the creation of a database on innovative vessels.

To develop such a database, available data on innovative inland navigation vessels was compiled within the framework of the Inspection Regulation Committee of the CCNR, with the following scope:

- innovative vessel understood as designed to emit less air pollutants or greenhouse gases than a conventional diesel vessel;
- freight and passenger vessels with a Rhine Vessel Inspection Certificate or a Union certificate;[42]
- vessels planned, under construction, in service or projects cancelled.

Even if biofuels contribute to reducing - under certain conditions - greenhouse gas emissions, vessels running on biofuels were not taken into account in the analysis, as switching to biofuels does not call for a specific design or technical adaptation at the level of the vessel.

For the purpose of this analysis, 49 freight vessels, of which nine were eventually cancelled or put out of service, and 13 day-trip passenger vessels, were considered.[43] The vast majority of the innovative vessels sail with a Rhine Vessel Inspection Certificate. They are mainly new built vessels, but also retrofitted vessels.

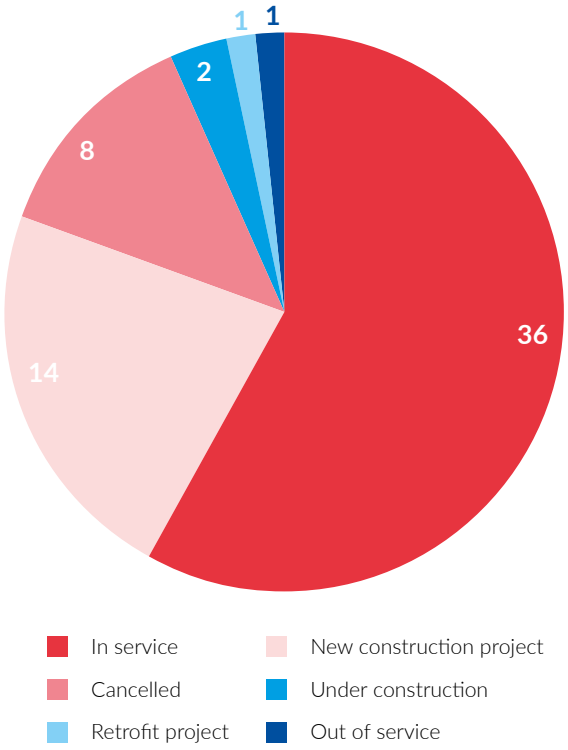
While the number of innovative vessels in service represent less than 0.2% of the entire inland navigation fleet in Europe, their number increased significantly between 2021 and 2022. This trend is expected to continue given the 12 innovative vessels expected to become operational in the coming years. Several projects were foreseen to be built in 2022 and 2023 but suffered some delays. This trend does not prejudge the evolution of the number of innovative vessels outside the scope of this database.

These innovative vessels run or are expected to run on - as the primary energy carrier[44] - batteries, compressed natural gas (CNG), liquefied natural gas (LNG), methanol, compressed hydrogen (GH_2) mainly in combination with batteries, or sodium borohydride with batteries ($NaBH_4$).

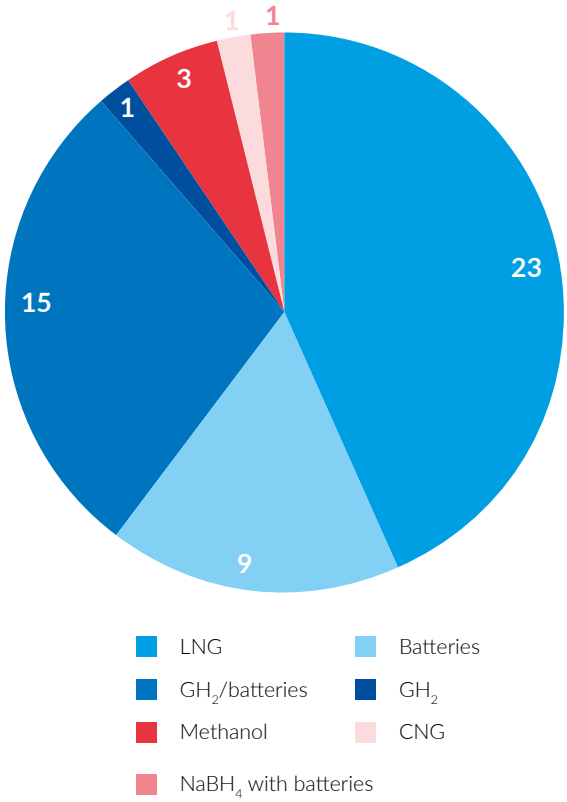
[41] See https://www.ccr-zkr.org/files/documents/Roadmap/Roadmap_en.pdf
[42] This excludes vessels with a strictly national certificate or vessels below the thresholds of the Rhine Vessel Inspection Regulations (RVIR) and the directive (EU) 2016/1629.
[43] The training vessels and floating equipment were not taken into account for the purpose of this analysis but are included in the database.
[44] The primary energy carrier is the most commonly used for vessel propulsion, while secondary and tertiary energy carriers are used to a lesser extent.

FIGURES 15 AND 16: **NUMBER OF VESSELS CONSIDERED IN THE DATABASE PER STATUS AND PER PRIMARY ENERGY CARRIER**

Number of vessels per status



Number of vessels per primary energy carrier (excluding projects cancelled or out of service)



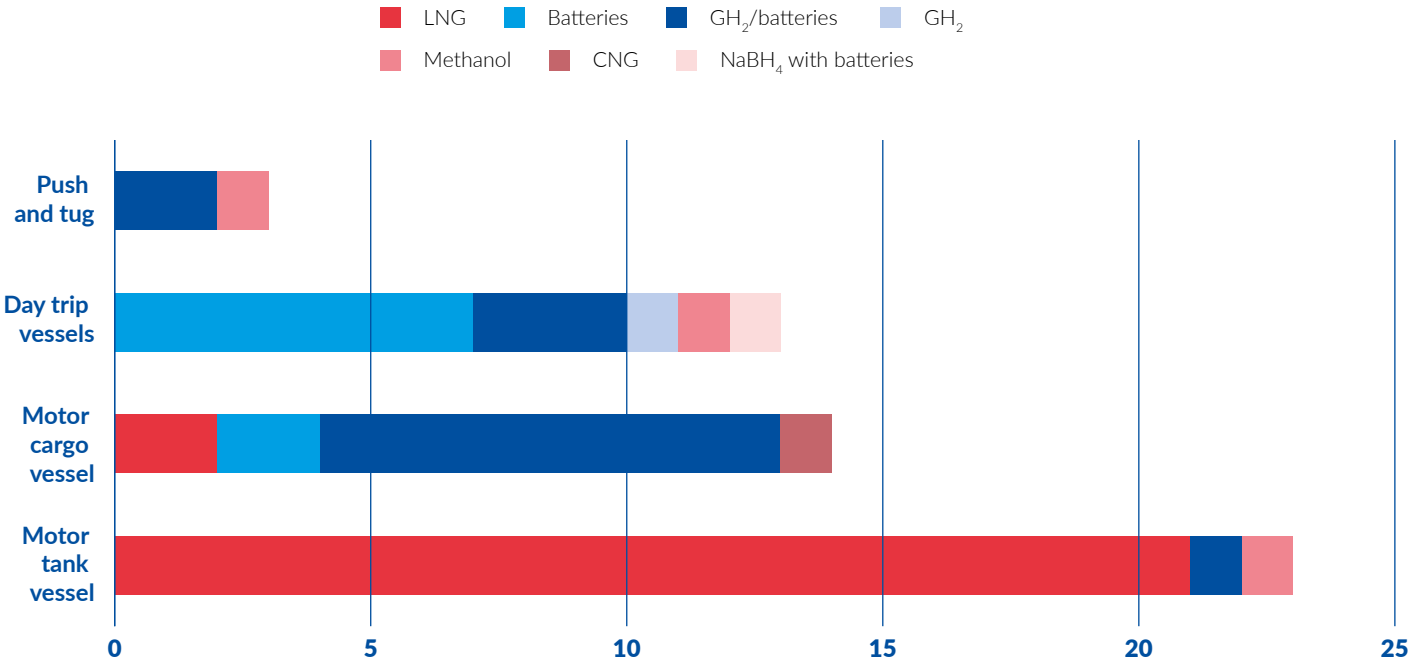
Regarding Figure 15, the reasons behind the cancellation of a project could be of a different nature, economic (not enough demand, lack of subsidies), organisational (withdrawal of a partner) or even technical (safety or operational issues). Most of the projects cancelled were LNG propelled vessels. Indeed, fossil LNG is no longer considered as a long-term option, notably for reducing carbon emissions in inland navigation.

Figure 16 above reflects the technologies used (possibly combined) as the primary energy carrier for vessel propulsion. It often comes with other energy carriers onboard, notably diesel engines for redundancy purposes or as an emergency power source. In other words, it is anticipated that different (modular) options for zero-emissions powertrains, using mixes of energy sources/fuels, will play a role in achieving the ambitious emission reduction objectives set at international level. This is confirmed by the profile of the innovative vessels (in service, under construction or project) which almost all use multiple energy carriers.

Moreover, there is no “one-size-fits-all” solution for achieving the energy transition. The choice of an appropriate emissions reduction technology depends on several factors, that include the sailing profile of the vessels, their type, the market segment in which they operate, but also the related technical constraints.

This is reflected in the following figure, showing how innovative applications find their way into the inland navigation sector.

FIGURE 17: **DISTRIBUTION OF INNOVATIONS PER VESSEL TYPE AND PRIMARY ENERGY CARRIER**[45]



Most of these innovative vessels still operate with a combustion engine (32), of which 27 are also equipped with an electric motor. This is a positive evolution which should facilitate a modular system approach. Indeed, the integration of batteries or fuel cell systems in existing vessels require a vessel to be equipped with an electric motor in the first place. Sixteen vessels operate with battery electric propulsion systems and six with fuel cell systems. It should be highlighted that one vessel is designed to use swappable batteries containers. The number of vessels with similar design might grow in the coming years.

[45] *Projects cancelled or out of service excluded.*

07

PASSENGER TRANSPORT

- In 2022, the number of active river cruise vessels in Europe reached 410, representing 60,600 beds (compared to 407 active vessels in 2021 with 59,750 beds). The new building for river cruises remained rather slow, due to some extent by inflationary tendencies.
- With the start of the armed conflict between Russia and Ukraine, a new development which has been observed is the increased demand for hotel capacity for war refugees from Ukraine. As a result, some vessels are being used as floating hotels, sometimes permanently or in parallel to their cruising activities, outside the main touristic seasons.
- Overall, 2022 can be seen as a year of recovery for the river cruise activity on the Rhine, Danube and Moselle, as shown by the positive figures in relation to the number of cruise vessels passing locks, passenger demand and the utilisation rate of river cruise vessels.

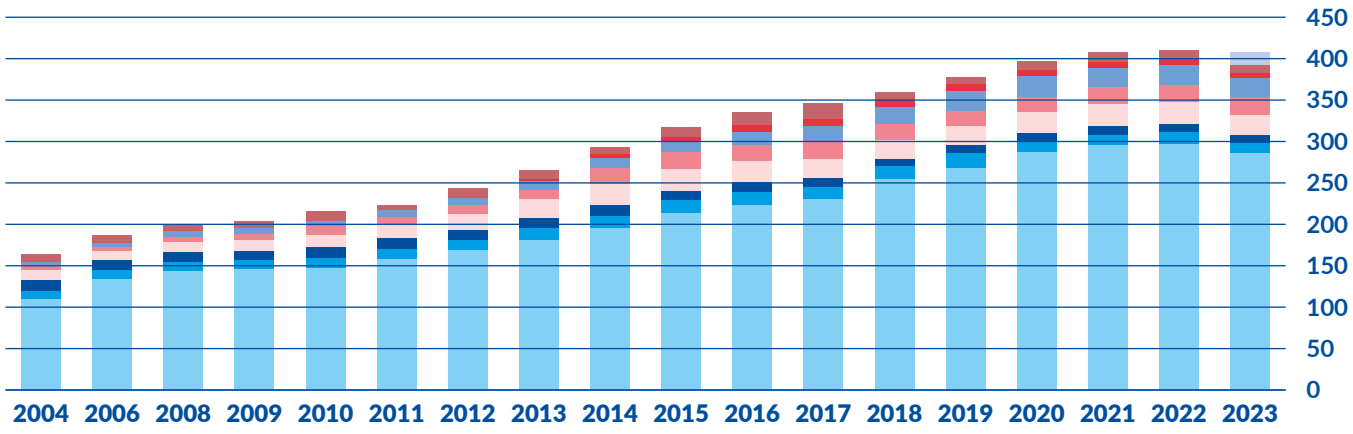
FLEET
FOR RIVER CRUISES[46]

The active river cruise fleet in Europe[47] represents more than 40% of the world active river cruise fleet. The fleet for river cruises in Europe is mainly concentrated on central European waterways[48] (close to 75% of the total river cruise fleet in Europe). In 2022, the number of active river cruise vessels in Europe reached 410, representing 60,600 beds (compared to 407 active vessels in 2021 with 59,750 beds).

Despite the Covid-19 pandemic coming to an end, the new building for river cruises remained rather slow in 2022. The year was marked by inflationary tendencies, contributing to an increase in shipbuilding costs, acting as a hurdle for the newbuilding activity.

With the start of the armed conflict between Russia and Ukraine, a new development that has been observed is the increased demand for hotel capacity for war refugees from Ukraine. In addition to that, the rising number of people asking for asylum in Europe also plays a role. As a result, some vessels are being used as floating hotels, in parallel to their cruising activities outside the main touristic seasons. Some vessels, particularly the oldest ones (more than 50 years old), are permanently turned into floating hotels with no prospect of resuming their river cruise activities. This was the case for six vessels in 2022, which were removed from the river cruise fleet statistics in 2022. In early 2023, outside the touristic seasons, 16 vessels were indicated as being used as floating hotels.

FIGURE 1: **NUMBER OF RIVER CRUISE VESSELS IN THE EU BY REGION OF OPERATION** (2004 – 2023) *

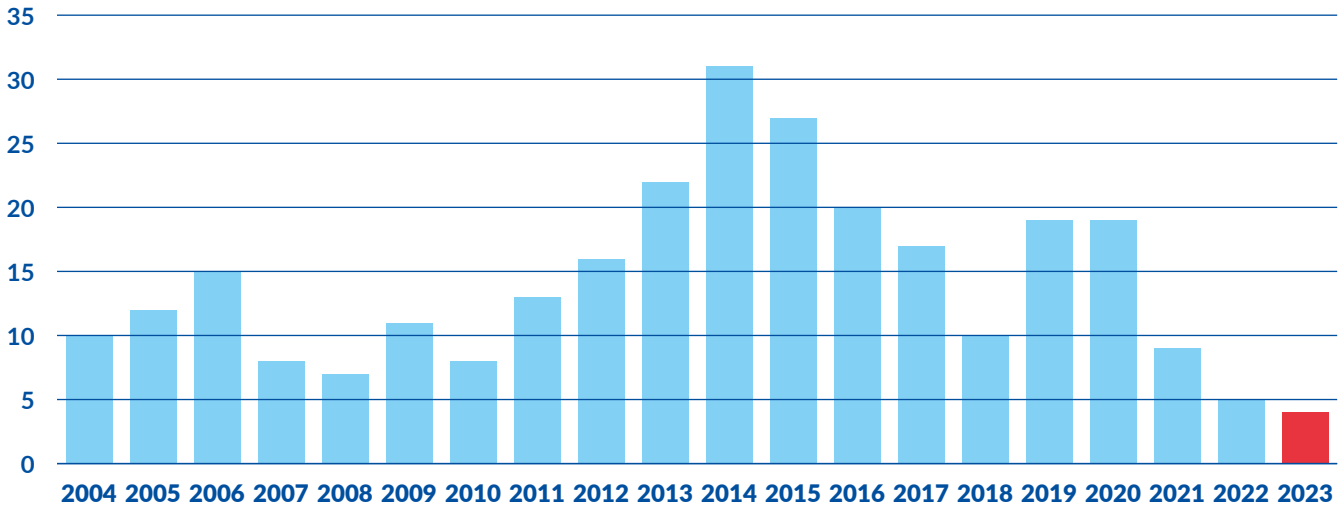


Source: A. Hader, The River Cruise Fleet Handbook (May 2023)
** 2023: based on order books as of May 2023, of which 16 are temporarily being used as floating hotels.*

[46] *A. Hader, The River Cruise Fleet Handbook (May 2023). Only river cruise vessels with a minimum of 40 beds are considered in this analysis.*
[47] *Europe without Russia and Ukraine*
[48] *Rhine, Main, Main-Danube Canal, Danube, Elbe-Oder*

In the 2022 season, five new vessels were built (compared to nine in 2021), two of which were commissioned in 2021 but postponed. The downward trend in new building orders is expected to continue in 2023, as only four new vessels are planned to be delivered.

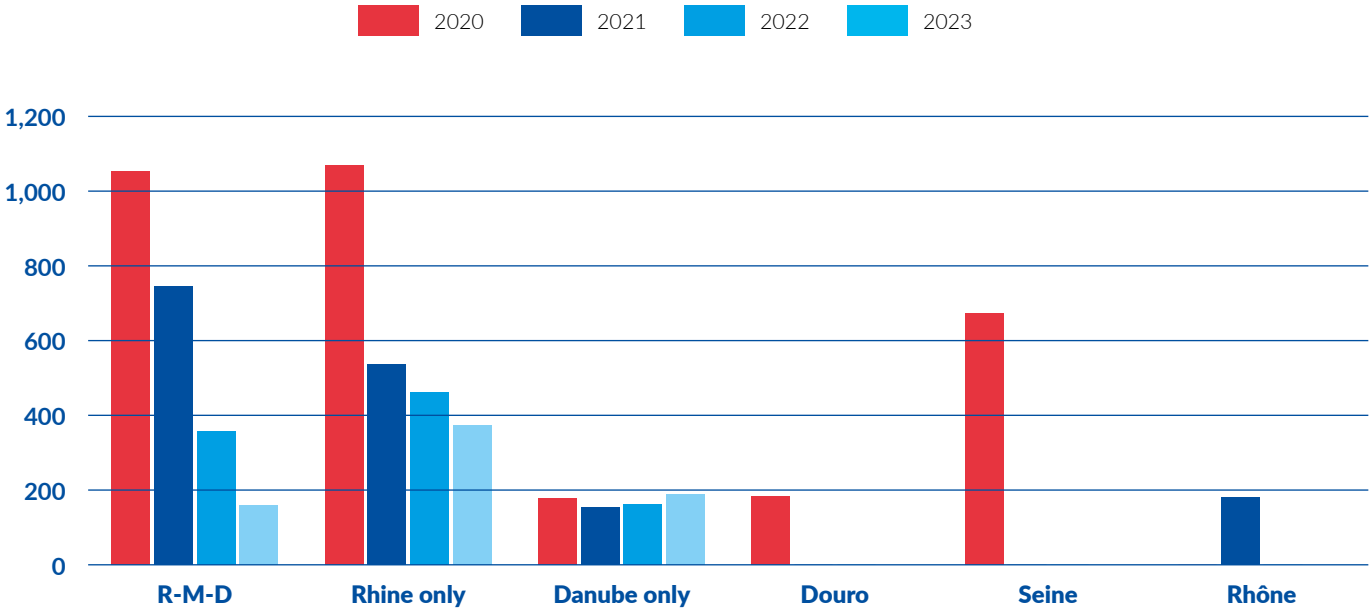
FIGURE 2: **NEW RIVER CRUISE VESSELS FOR THE EUROPEAN MARKET 2004-2023 ***



Source: A. Hader, The River Cruise Fleet Handbook (May 2023)
** 2023: based on order books as of May 2023*

In 2022, the five new vessels brought an additional capacity of 980 beds (compared to 1,615 beds in 2021) to the river cruise market in Europe.

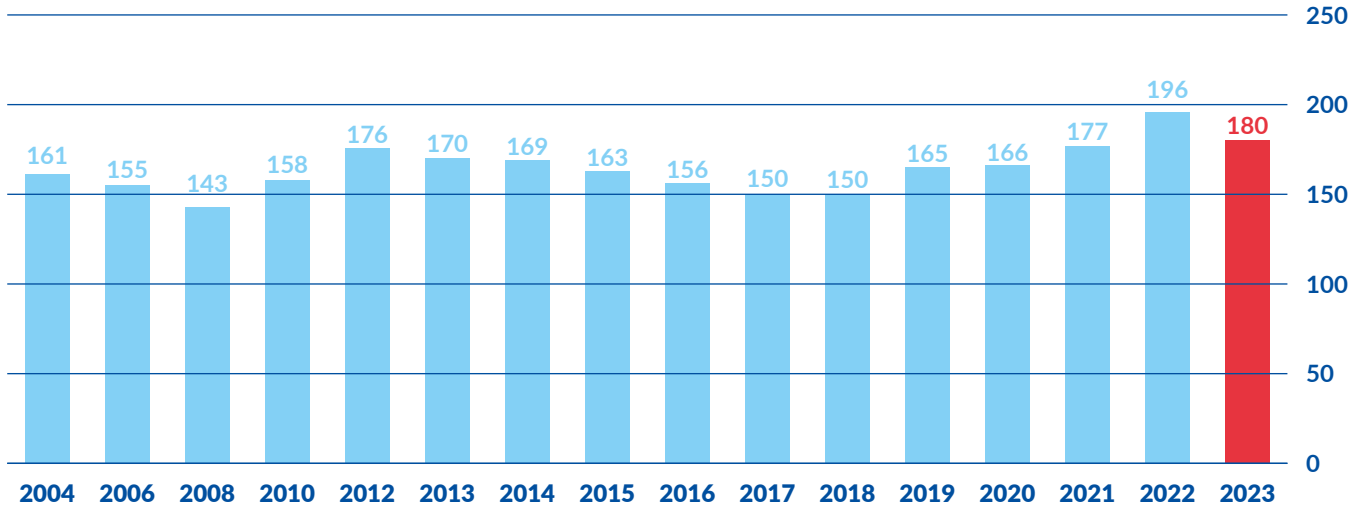
FIGURE 3: **NEW CRUISE CAPACITIES FROM 2020 TO 2023 PER REGION OF OPERATION** (NUMBER OF BEDS) *



Source: A. Hader, The River Cruise Fleet Handbook (May 2023)
** R-M-D= Rhine/Main/Main-Danube Canal/Danube. 2023: based on order books as of May 2023.*

After a decrease between 2014 and 2018, the average number of beds in new cruise vessels has been rising continuously. In 2022, the important increase in the average number of beds is explained by the entry into the market of the A-ROSA SENA which has a capacity of 280 beds.

FIGURE 4: **AVERAGE NUMBER OF BEDS IN NEW RIVER CRUISE VESSELS IN EUROPE BY YEAR OF CONSTRUCTION ***



Source: A. Hader, The River Cruise Fleet Handbook (May 2023)
** Figure for 2023: forecast*

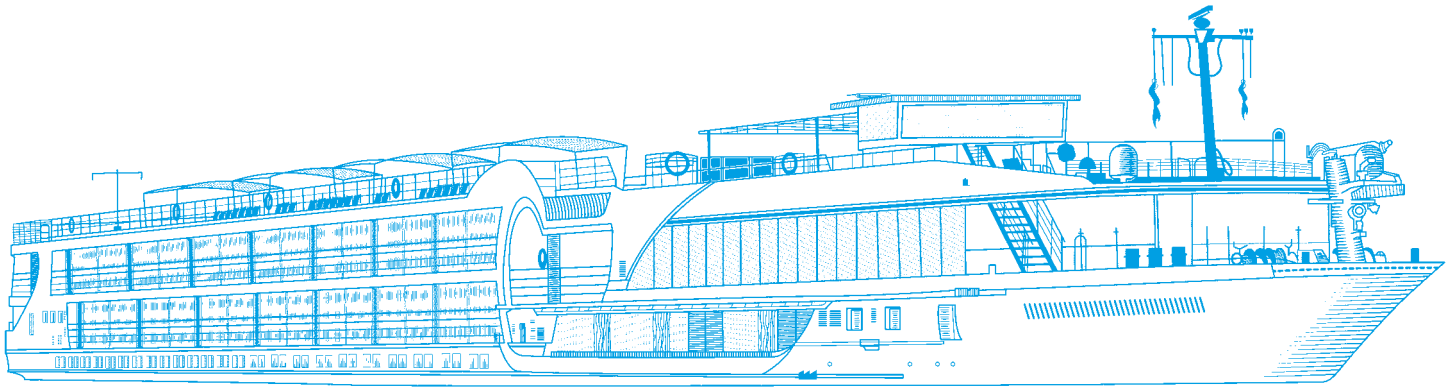
DEMAND
FOR RIVER CRUISES

The year 2022 shows that the river cruise sector is on the path to recovery, with values similar to, and sometimes higher than, pre-pandemic levels concerning vessels' movements. Figures are also on the rise regarding the number of passengers embarking on river cruises and the passenger capacity utilisation rates of vessels.[49]

Regarding the German travel market, the number of passengers who booked a river cruise in Germany increased by +75.0% in 2022, to attain 319,977 passengers. Those numbers are however still -40.8% below the passenger numbers recorded for the year 2019 (with 541,133 passengers).[50]

The yearly cruise vessel movement figures for the Danube, Rhine and Moselle show a remarkable rebound in 2022, compared to 2021. In terms of vessel movements, the cruising activity on the Upper Danube (at the Austrian-German border) and the Moselle were respectively +5% and +1% above the pre-pandemic levels of 2019. However, the cruising activity on the Rhine was still -6.5% below the level of 2019.

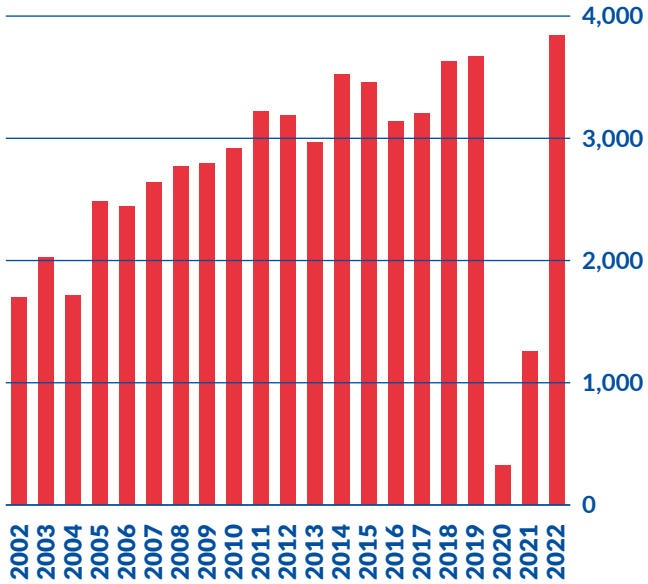
The utilisation rate of the river cruise vessels passing the locks is also a key indicator with regard to assessing the recovery of the river cruise sector. For the year 2022, overall, this sector still reported lower utilisation rates of cruise vessels compared to the pre-pandemic levels. However, this indicator shows positive evolutions, as suggested by the data obtained for the Danubian river cruise sector (see following box - focus on capacity utilisation in the river cruise sector).



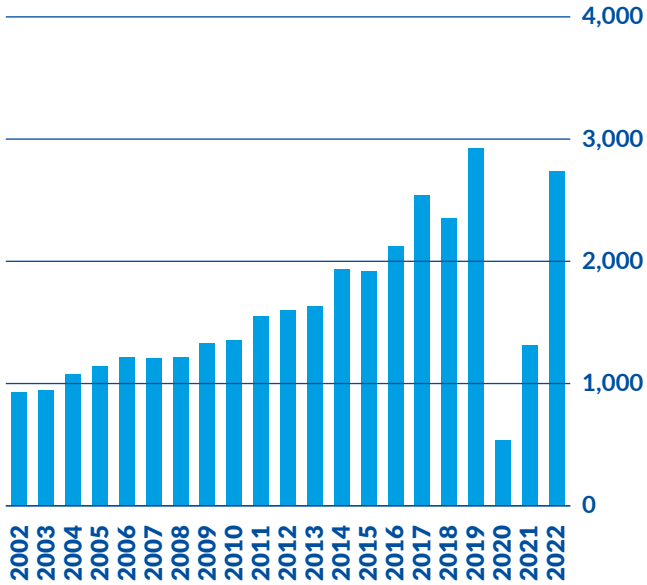
[49] *Source: IG RiverCruise - Der Fluss-Kreuzfahrtmarkt 2022*
[50] *Idem*

FIGURES 5, 6 AND 7: **YEARLY NUMBER OF CRUISE VESSEL TRANSITS ON DANUBE, RHINE AND MOSELLE ***

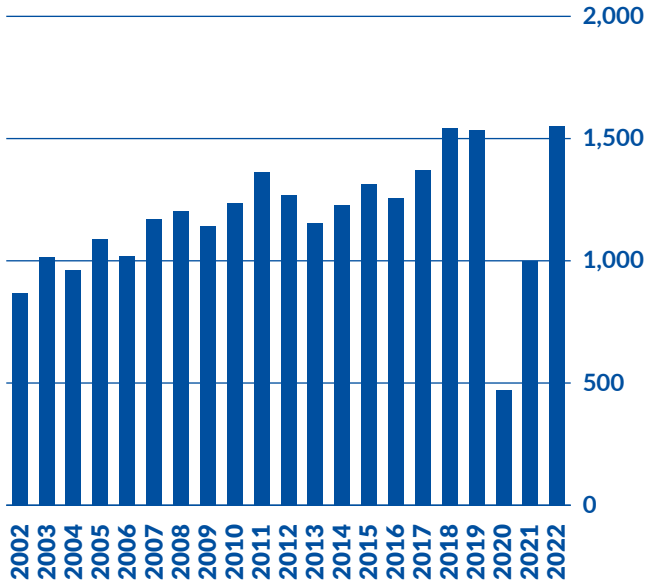
Danube



Rhine



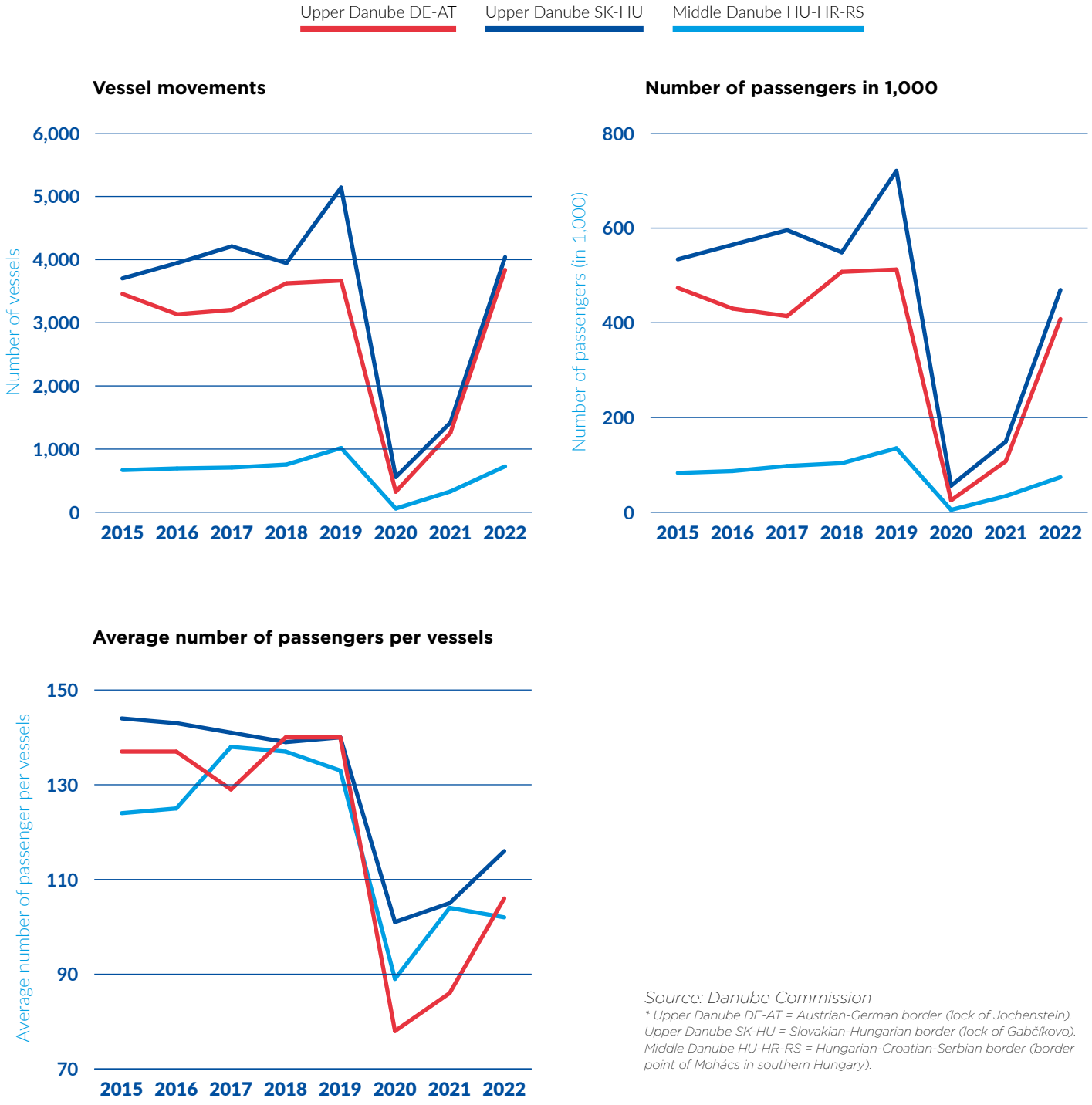
Moselle



Sources: German Waterway and Shipping Administration (WSV) and Moselle Commission
** Danube = Upper Danube, Austrian-German border (lock of Jochenstein). Rhine = Upper Rhine (lock of Iffezheim). Moselle = lock of Koblenz.*

For two stretches of the Danube (Upper and Middle Danube), data regarding vessel movements and the number of passengers is available from 2015 onwards. This geographical distinction makes it possible to observe differences in cruising intensity on the different stretches of the Danube. The analysis shows that the activity is highest on the Upper Danube. Cruising activity on the Middle Danube south of Budapest is lower than on the Danube stretches upstream of Budapest.

FIGURES 8, 9 AND 10: **EVOLUTION OF VESSEL MOVEMENTS AND PASSENGER NUMBERS PER STRETCHES OF THE DANUBE AND AVERAGE NUMBER OF PASSENGERS PER VESSEL ***



Source: Danube Commission

** Upper Danube DE-AT = Austrian-German border (lock of Jochenstein). Upper Danube SK-HU = Slovakian-Hungarian border (lock of Gabčíkovo). Middle Danube HU-HR-RS = Hungarian-Croatian-Serbian border (border point of Mohács in southern Hungary).*

Most of the passenger traffic in the Sava and Kupa river ports is recorded at the Port of Belgrade in Serbia. Since 2015, the number of river cruise passengers recorded by the Port of Belgrade (passenger terminal) has increased constantly, from 60,000 passengers in 2015 to 104,000 in 2019. This reflects the positive evolution of cruising activity observed on the Danube. Indeed, most of the cruise vessels that stop in Belgrade are generally for cruises that take place along the Danube and stop in the main eastern European capitals.

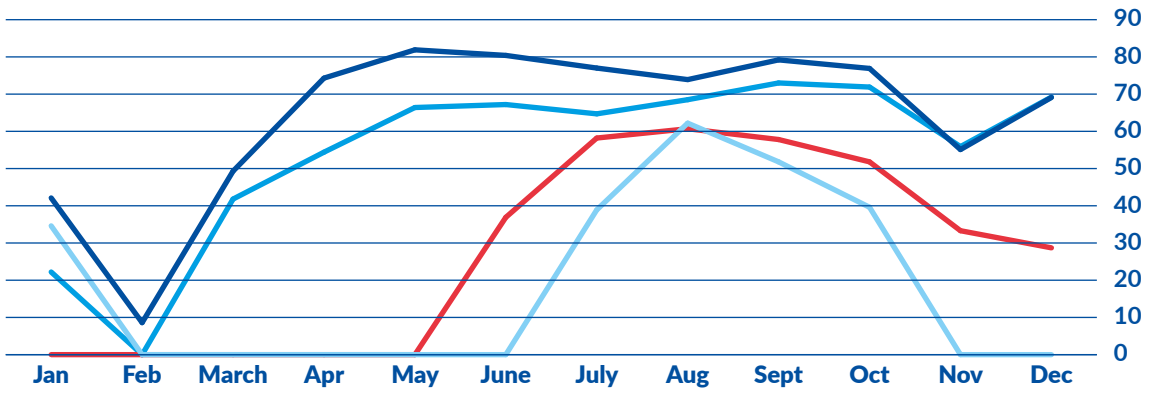
As is the case in other regions, passenger traffic suffered from the Covid-19 pandemic. In Belgrade, only 561 passengers were recorded by the port in 2020, compared to 19,000 in 2021. In 2022, the number of passengers increased to 55,069, a figure which remains below the pre-pandemic levels (103,523), but which is also a positive sign towards a return to normality. In addition, at the beginning of May 2023, Serbia opened the Sava River new passenger terminal in Sremska Mitrovica while the opening of another passenger terminal in Šabac is expected this year. This should certainly support the development of passenger transport in the region. Navigability conditions on the waterways also remain an obstacle for the further development of passenger transport in this region.[51]

FOCUS ON CAPACITY UTILISATION IN THE RIVER CRUISE SECTOR

The analysis of the capacity utilisation of a fleet enables a thorough overview to be undertaken of how the supply/demand relationship evolves throughout the years.

The degree of capacity utilisation of river cruise vessels on the Upper Danube can be calculated on the basis of data provided by the German Waterway Administration on river cruise vessels passing the lock of Jochenstein (German-Austrian border) on the Danube

FIGURE 11: **DEGREE OF CAPACITY UTILISATION OF RIVER CRUISE VESSELS ON THE DANUBE** (%) *



** At the lock of Jochenstein (German-Austrian border)*
Capacity utilisation = ratio of number of passengers divided by passenger capacity

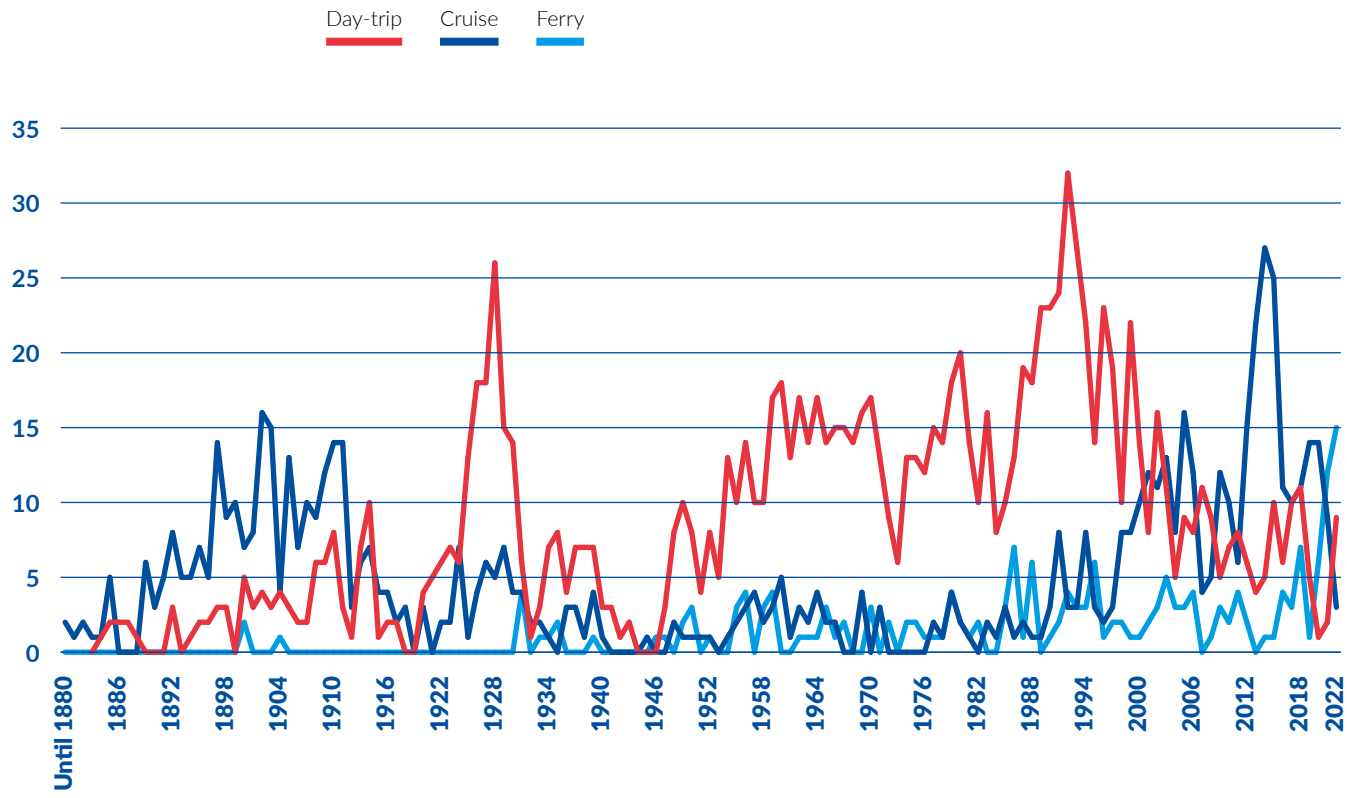
This figure brings to the fore the recovery of the river cruise sector on the Danube. In fact, during the year 2022, a catch-up phenomenon for capacity utilisation could be observed, when comparing the 2022 data with 2019. Even though such data were not available for the Rhine and the Moselle, passenger demand is expected to increase, as suggested by different sources.[52] This will certainly have a positive effect on the degree of capacity utilisation.

[51] *Passenger transport data have so far not been processed in a detailed manner due to a lack of up-to-date records, as well as non-harmonised methodology between the countries.*
[52] *A. Hader, The River Cruise Fleet Handbook (May 2023) and the Baromètre de l'activité tourisme fluvial, édition 2022, Entreprises fluviales de France – E2F*

AGE STRUCTURE
OF THE RHINE PASSENGER FLEET

As far as the passenger fleet is concerned, a distinction is made between passenger ferries, river cruise and passenger day-trip vessels. The following figure provides the best available representation of the current fleet and its evolution over time. However, it might be the case that vessels which are inactive today are included in these figures and that some of the newest vessels are not included. Most passenger ferries and passenger day trip vessels were built in the 20th century. The newbuilding activity for river cruises has been particularly intense in the 21st century.

FIGURE 12: **COMMISSIONING YEARS FOR THE RHINE PASSENGER FLEET OVER TIME** (NUMBER OF INLAND VESSELS)



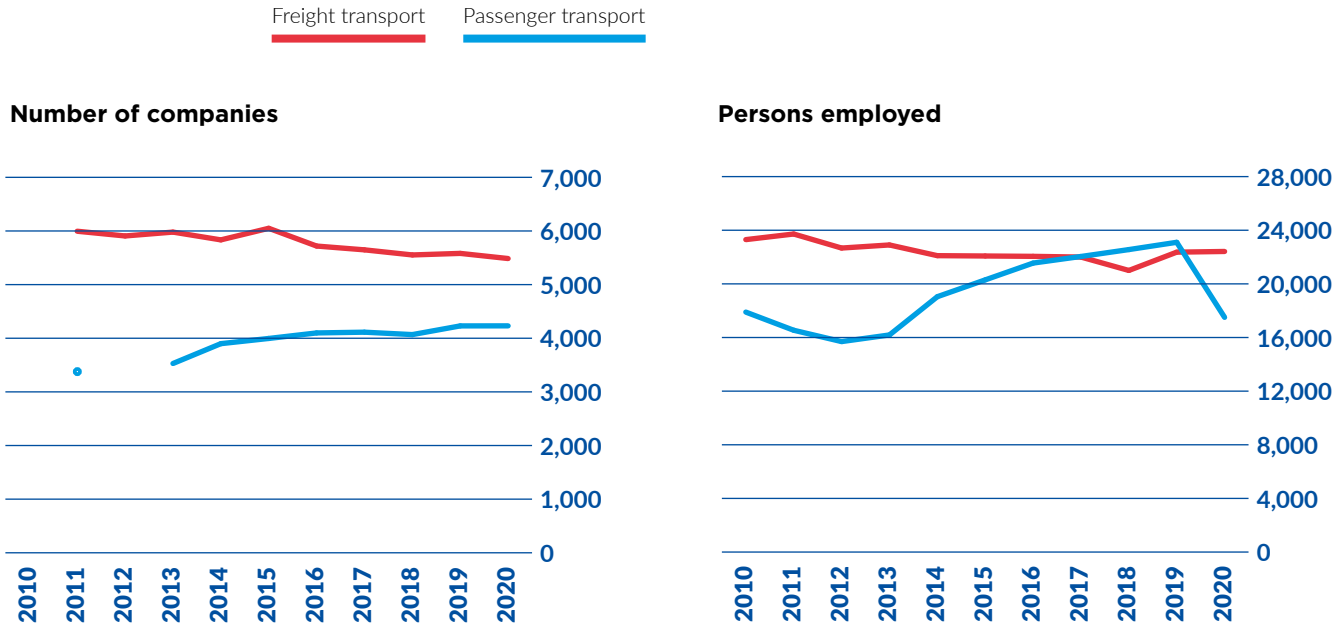
Sources: IVR, CCNR analysis
Note that two river cruise vessels and 20 day-trip vessels have an unknown year of construction. The database of IVR accounts for active vessels but also includes some inactive vessels, in particular those commissioned in earlier years.

08

COMPANIES, EMPLOYMENT, TURNOVER, WAGES AND PERSONNEL COSTS

- **In the EU plus Bosnia-Herzegovina, Serbia and Switzerland, 5,486 IWW freight companies are registered with a total employment of 22,417 persons. In 2020, employment in the freight sector remained stable compared to 2019. Companies in the Rhine region account for 88% of the total number of companies and for 76% of the total number of persons employed. For the Danube region the figures are 4% (number of companies) and 15% (employment).**
- **Regarding the IWT passenger transport sector, 4,265 companies are registered with a total employment of 17,503 persons. Employment in the passenger sector decreased by 24% in 2020 compared to 2019, due to the Covid crisis. Companies in the Rhine region account for 44% of the total number of companies and for 64% of the total number of persons employed. For the Danube region the figures are 9% (number of companies) and 8% (employment).**

FIGURES 1 AND 2: **DEVELOPMENT OF NUMBER OF COMPANIES AND EMPLOYMENT IN FREIGHT AND PASSENGER TRANSPORT IN THE INLAND WATERWAY TRANSPORT SECTOR IN EUROPE**



Sources: Eurostat [sbs_na_1a_se_r2] and Swiss Federal Tax Administration (FTA) (for the number of companies in Switzerland)

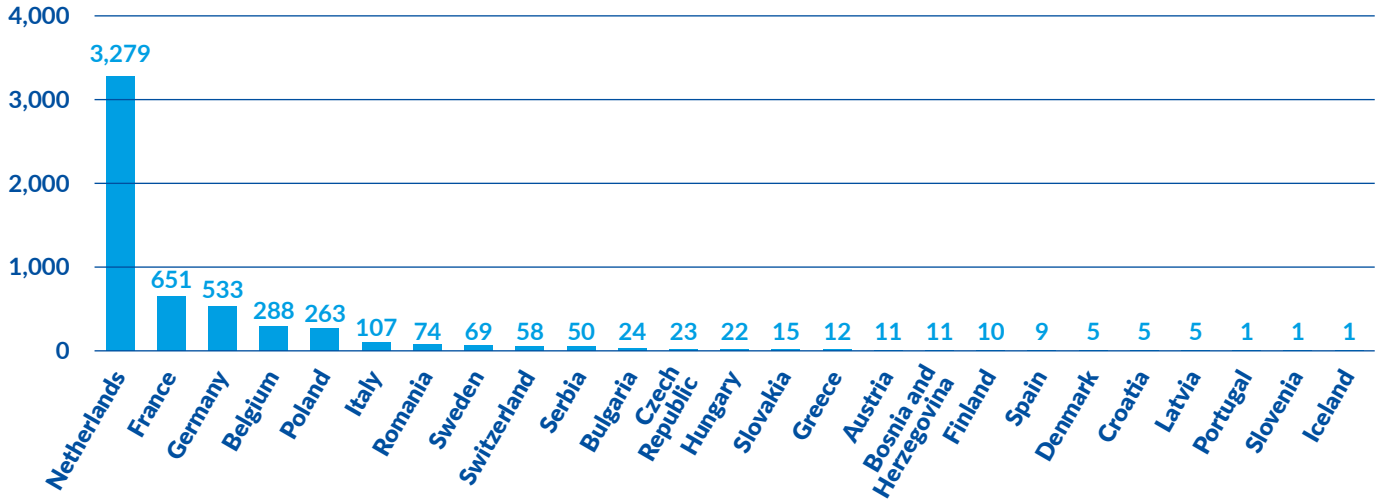
COMPANIES
AND EMPLOYMENT IN FREIGHT TRANSPORT

According to Eurostat figures,[53] 5,486 IWW freight transport companies are active in Europe (EU-27 plus Bosnia-Herzegovina, Serbia and Switzerland). Around 88% (4,809 in absolute numbers) are registered in Rhine countries.[54] In the Netherlands alone, 3,279 IWW freight companies are counted, which represents 60% of the total number in Europe and 68% of the number in Rhine countries.

The number of companies in Danube countries is relatively low (201 which is equivalent to a share of 4%), compared to the share that the Danube has within total transport performance on EU-27 inland waterways (18%). It should then be mentioned that companies in the Danube region have a far higher number of employed persons on average than companies in the Rhine region. Eastern European countries taken together (including Danube countries) account for 9% of all IWW freight companies in the EU-27, and southern European and Scandinavian countries account for 2% each.

[53] *Latest Eurostat figures for the number of enterprises [sbs_na_1a_se_r2] are available for the year 2020.*
[54] *The Netherlands, Germany, Belgium, France, and Switzerland*

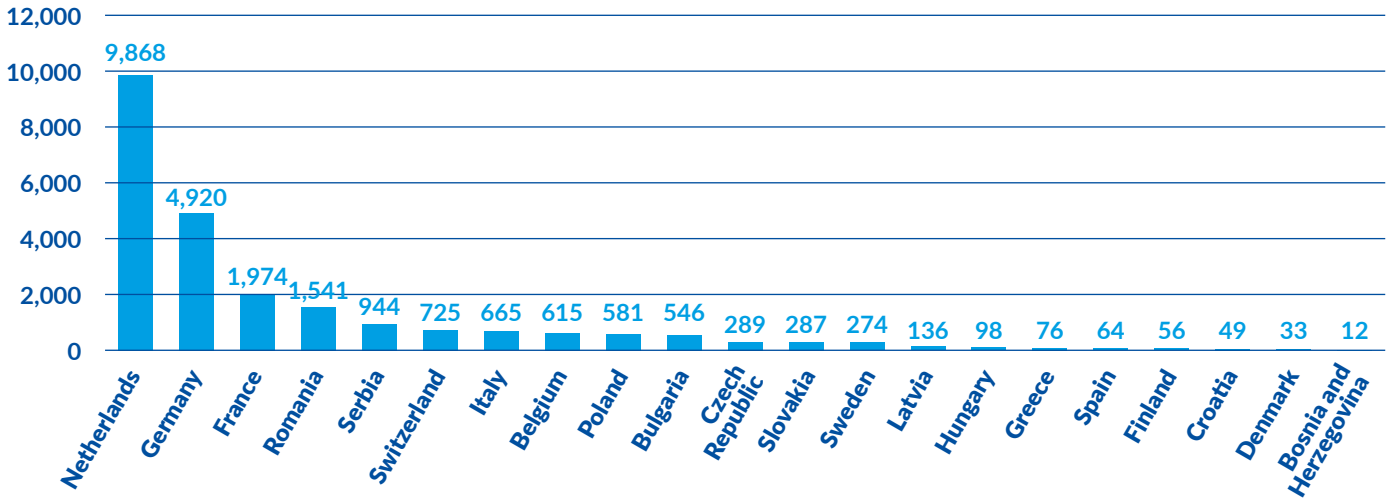
FIGURE 3: **NUMBER OF COMPANIES IN IWW FREIGHT TRANSPORT IN EUROPE ***



Sources: Eurostat [sbs_na_1a_se_r2] and Swiss Federal Tax Administration (FTA)
** Data refer to 2020.*

The number of employed persons in freight transport includes self-employed, helping family members and employees. The total number of this variable was at 23,753 in 2020. Rhine countries account for 76%, Danube countries for 15% and companies in countries outside the Rhine and Danube regions for 9%.

FIGURE 4: **NUMBER OF PERSONS EMPLOYED IN IWW FREIGHT TRANSPORT IN EUROPE ***



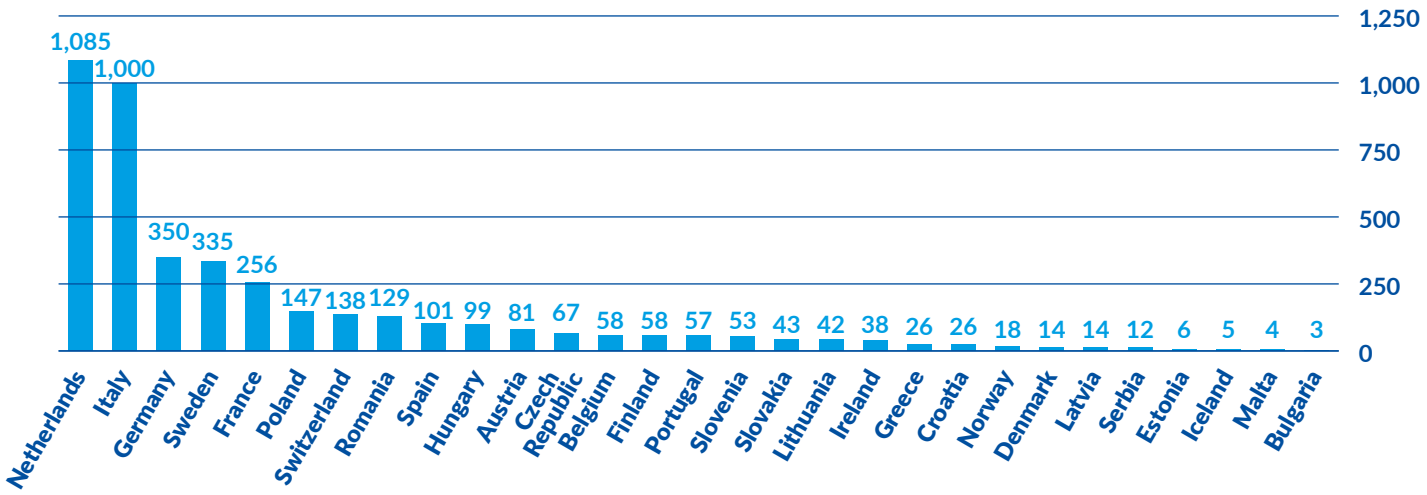
Sources: Eurostat [sbs_na_1a_se_r2] and Swiss Federal Tax Administration (FTA)
** Data refer to 2020.*

It should be noted that figures obtained from national labour market institutions or from other national offices might differ substantially from figures obtained from Eurostat, due to different statistical labour market concepts. For cross-country comparisons, Eurostat is treated as the preferred source because data are harmonised across countries and are thus comparable.

COMPANIES
AND EMPLOYMENT IN PASSENGER TRANSPORT

The number of IWW passenger companies in Europe (EU-27 plus Bosnia-Herzegovina, Serbia and Switzerland) was 4,265 in 2020.[55] The geographical distribution shows that 44% of them are registered in Rhine countries. Southern Europe accounts for 28%, eastern Europe for 16% and Scandinavia for 10%. Danube countries are considered in this sense a part of eastern Europe. If they were counted separately, they would represent 9%. Although the total figure for 2020 was almost the same as in 2019, variations in the number of companies can be observed for major countries. The numbers decreased in Italy (-50), Germany (-59), Sweden (-20) and Switzerland (-8), due to economic problems during the Covid pandemic. In the Netherlands, the number was higher than the previous year (+45), while it remained almost constant in France (+2).[56]

FIGURE 5: **NUMBER OF IWW PASSENGER TRANSPORT COMPANIES IN EUROPE ***

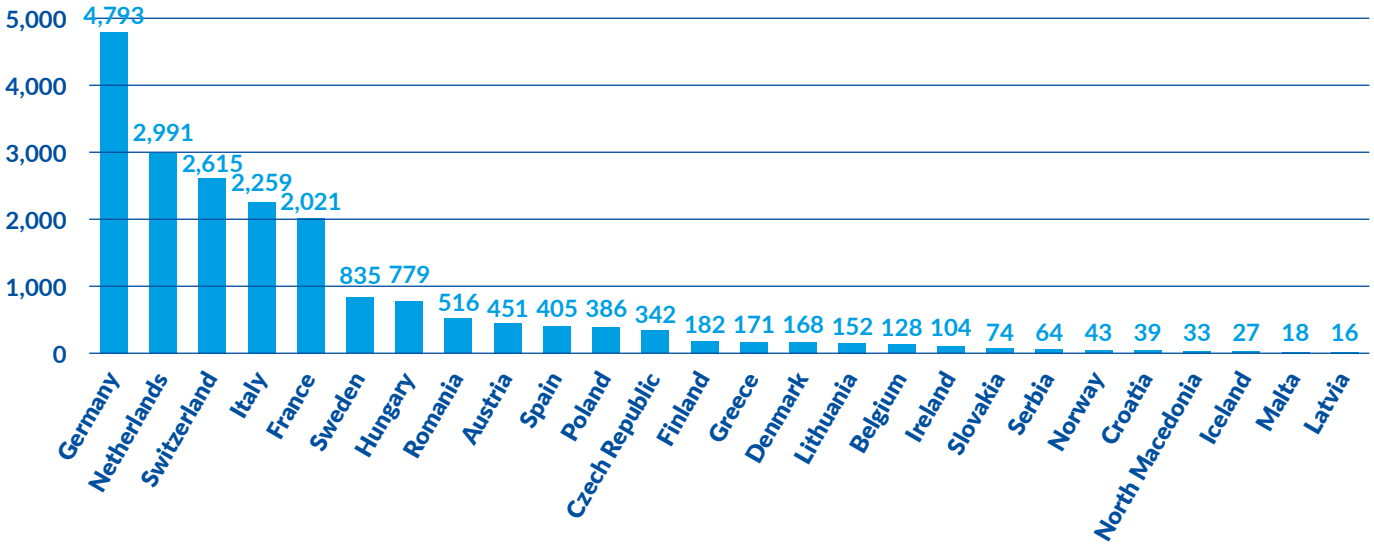


Sources: Eurostat [sbs_na_1a_se_r2] and Swiss Federal Tax Administration (FTA)
** Data refer to 2020.*

The total number of persons employed in European IWW passenger transport amounted to 17,503 in 2020[57] and was therefore -24% lower than in the previous year. The explanation for this decrease is the Covid pandemic, which led to a sharp decrease in passenger transport and had an impact on employment.

[55] 2020 is the latest year for which the data were available.
[56] The underlying basis for these Eurostat data is the NACE sector H50.30 with the title 'Inland passenger water transport'. It entails companies in IWW passenger transport that are active in river cruises, day trip navigation on rivers, canals and lakes, ferries for commuter and tourist transportation. The Eurostat data do not allow to split company numbers according to these sub-categories.
[57] Non-nautical crew (i.e. hospitality staff) are included in this figure except for cases where this staff is hired as agency workers.

FIGURE 6: **NUMBER OF PERSONS EMPLOYED IN IWW PASSENGER TRANSPORT IN EUROPE ***



Source: Eurostat [sbs_na_1a_se_r2]
** Data refer to 2020 except for Hungary, Poland, Malta (2019), the Czech Republic (2018) and Austria (2014).*

Around 64% of all persons employed in EU inland waterway passenger transport are employed in Rhine countries. The share of Danube countries amounts to 8%. Mediterranean countries account for 15% of employment, and Scandinavian countries for 6%.

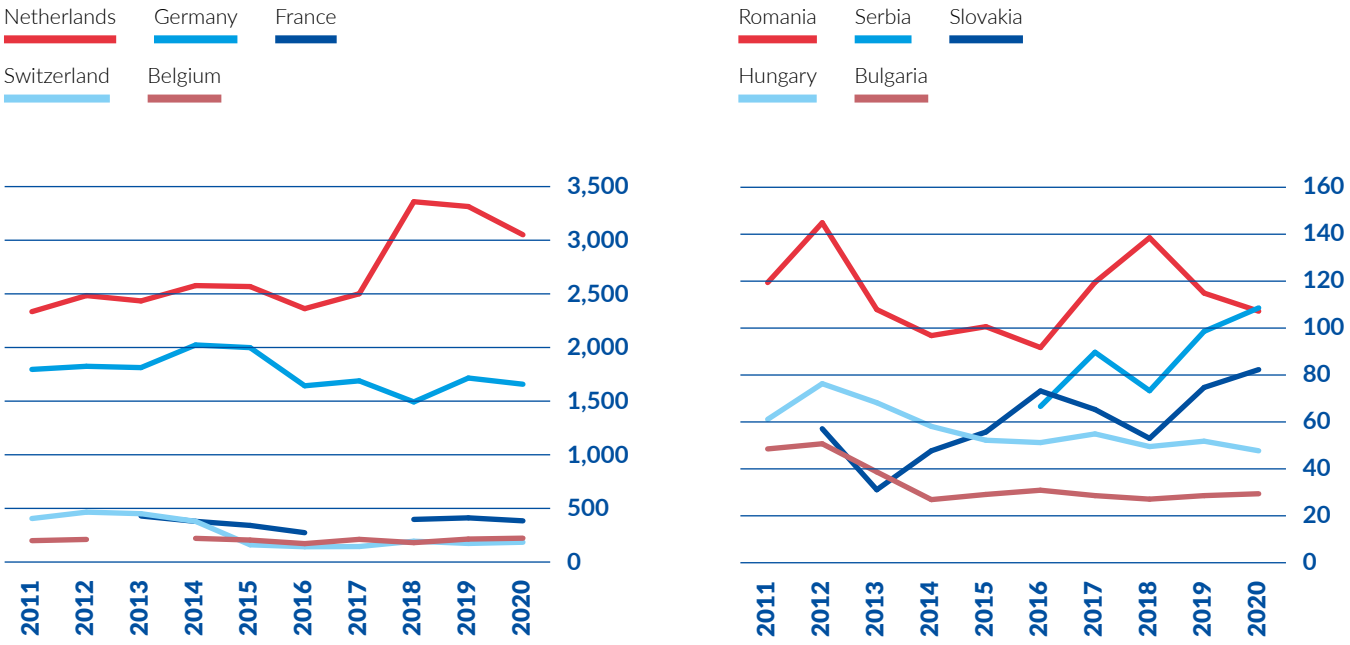
II TURNOVER

As sources for turnover figures, the Eurostat SBS database, the database of the Dutch Statistical Office CBS and the database of the Swiss Tax Administration are used[58]. In all three cases, the amount of the value added tax is excluded. However, the definition of turnover according to the CBS differs from the Eurostat concept in some areas. For example, the Eurostat concept includes certain charges and taxes invoiced which the CBS concept does not include. As a result, the CBS figures are probably underestimated. The data for Switzerland are transformed from Swiss Francs to Euro, and the added value tax is excluded.

TURNOVER IN IWW FREIGHT TRANSPORT

In 2020, for IWW freight companies in the EU-27 (plus Switzerland and Serbia), a turnover of approximately 6.213 billion Euro was registered. IWW freight companies from Rhine countries counted a turnover of 5.500 billion Euro (share of 90%).

FIGURE 7: **ANNUAL TURNOVER IN IWW FREIGHT TRANSPORT IN RHINE AND DANUBE COUNTRIES** (IN MILLION EURO) *



Sources: Eurostat [sbs_na_1a_se_r2], Centraal Bureau voor de Statistiek (NL), Swiss Federal Tax Administration (FTA) and CCNR estimation based on data from Eurostat for France for the year 2019

** The value for Dutch companies is an estimation based on net turnover data for the entire inland navigation sector in the Netherlands. Therefore, the statistical office CBS estimates that 92% of total turnover is related to freight transport. Value for Swiss companies was converted to Euro according to the yearly average exchange rate.*

[58] *Eurostat turnover data are neither available for the Netherlands nor for Switzerland.*

TABLE 1: **TURNOVER IN IWW FREIGHT TRANSPORT IN RHINE COUNTRIES IN 2020** (IN MILLION EURO) **AND GROWTH RATE** (IN %)

	2019	2020	Growth rate (%)
Dutch companies	3,314	3,051	-7.9
German companies	1,715	1,658	-3.4
French companies	n.a	384	n.a
Belgian companies	214	222	+3.9
Swiss companies	173	185	+6.4
Rhine countries	**5,828 ***	**5,500**	**-5.6**

Sources: same as Figure 7
** Total value takes into account an estimated value for France in 2019.*

Turnover generated in inland waterway freight transport companies registered in Danube countries amounted to 378 million Euro in 2020.

TABLE 2: **TURNOVER IN IWW FREIGHT TRANSPORT IN DANUBE COUNTRIES IN 2020** (IN MILLION EURO) **AND GROWTH RATE** (IN %)

	2019	2020	Growth rate (%)
Serbian companies	99	109	+10.1
Romanian companies	115	107	-6.7
Slovakian companies	75	82	+10.2
Hungarian companies	52	48	-7.9
Bulgarian companies	29	29	+2.8
Croatian companies	2	3	+4.0
Danube countries *	**372**	**378**	**+/-0.0**

Source: Eurostat [sbs_na_1a_se_r2]
** Austria is not included in this table as the latest data available dates back from the 2017 Statistik Austria Structural Business Statistics (23 million Euro).*

Turnover of companies registered in European regions outside the Rhine and Danube region reached 167 million Euro in 2020. The countries with the highest turnover are Poland (44 million Euro), Italy (40 million Euro), the Czech Republic (27 million Euro) and Sweden (25 million Euro).

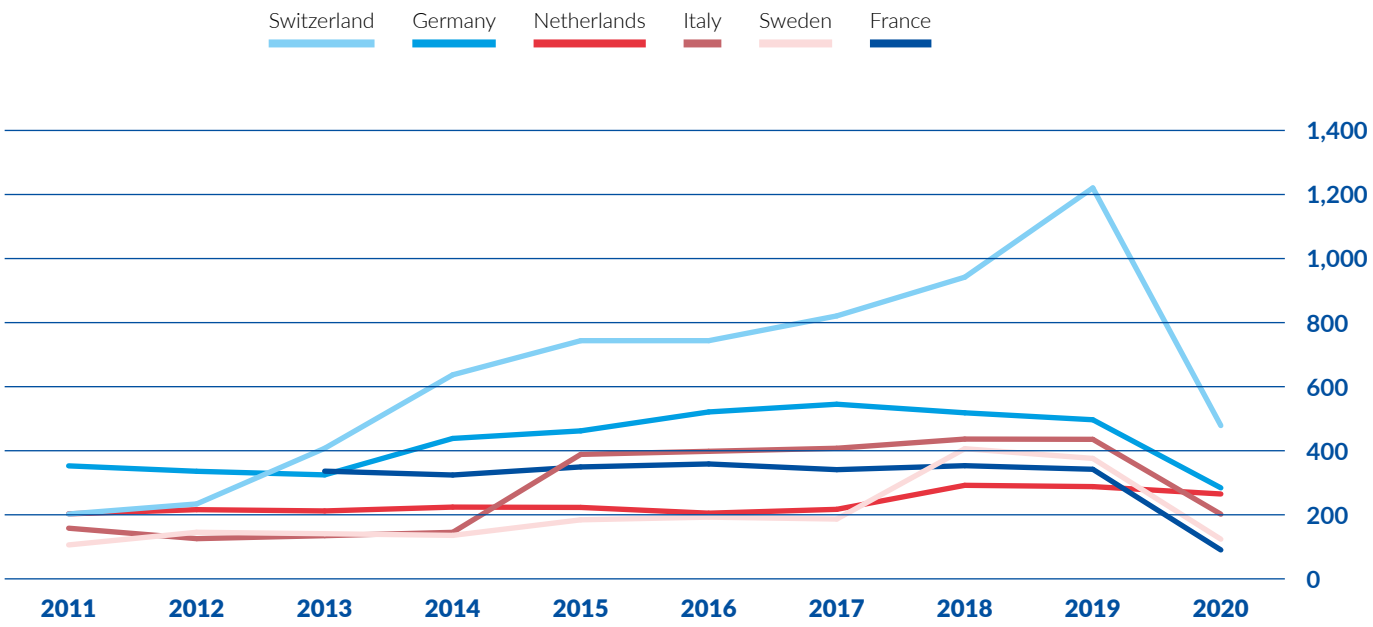
TURNOVER IN IWW PASSENGER TRANSPORT

Regarding the turnover in EU (plus Switzerland and Serbia) for IWW passenger companies in 2020, approximately 1.578 billion Euro was registered.

It is important to note that the following turnover figures include those generated by all passenger market segments (day trips, river cruises or ferries). For some countries, the turnover figures are based almost entirely on river cruise activities or day trip activities.

Despite considerable financial losses due to the Covid pandemic, Swiss passenger transport companies are still on rank 1 when it comes to turnover figures. Such high figures are almost entirely generated from the river cruise activity. Of the total European turnover, the share of Rhine countries is 72% and the share of Switzerland is 30%. As these data refer to 2020, a year that suffered substantial losses in this segment, an even higher share for Switzerland can be expected after the recovery from the Covid pandemic.

FIGURE 8: **ANNUAL TURNOVER IN IWW PASSENGER TRANSPORT IN MOST RELEVANT COUNTRIES** (IN MILLION EURO) *



Sources: Eurostat [sbs_na_1a_se_r2], Centraal Bureau voor de Statistiek (NL), Swiss Federal Tax Administration (FTA) and CCNR estimation based on data from Eurostat only for France for the year 2019

** The value for Dutch companies is an estimation based on net turnover data for the entire inland navigation sector in the Netherlands. In this instance, the statistical office CBS estimates that 8% of total turnover is related to passenger transport. Value for Swiss companies was converted to Euro according to the yearly average exchange rate. Data unavailable for many countries.*

TABLE 3: **TURNOVER IN IWW PASSENGER TRANSPORT IN RHINE COUNTRIES IN 2020** (IN MILLION EURO)

	2019	2020	Growth rate (%)
Swiss companies	1,220	479	-60.8
German companies	497	284	-42.8
Dutch companies	288	265	-8.0
French companies	n.a	90	n.a
Belgian companies	31	11	-62.4
Rhine countries	**2,378 ***	**1,129**	**-52.8**

Sources: same as Figure 8
** Total value takes into account an estimated value for France in 2019.*

For companies in Danube countries, the existing data[59] show significantly lower values than in Rhine countries. This can be explained by lower wage levels in Danube countries. Lower wages and therefore lower personnel costs imply lower total costs, especially in passenger transport which is quite labour-intensive. Lower total costs, in return, imply lower price levels and therefore also lower turnover figures.

As a second explanation, it should be recalled that large parts of the activities in passenger transport on the Danube, in particular river cruising, is carried out by companies from the Rhine region (see vessel data in the chapter on passenger transport).

Two countries in Europe outside the Rhine and Danube region with a considerable level of turnover in IWW passenger transport are Italy (202 million Euro in 2020) and Sweden (124 million Euro in 2020). It can be noted that for Italy, the turnover is almost entirely generated from the day trip activity. Both countries registered considerable losses in financial turnover due to the Covid pandemic. The turnover decreased by -54% and -67% respectively in 2020, compared to 2019.

[59] *For several Danube countries, turnover data in the Eurostat SBS database is missing for confidentiality reasons. Likely, the turnover values reached low levels that could not be displayed.*

PERSONNEL COSTS AND WAGES

Eurostat SBS data show that annual personnel costs[60] per employee are higher in IWW freight transport than in IWW passenger transport. For Belgium, Germany and France,[61] the average annual personnel costs in IWW freight transport were around 51,000 Euro per employee in 2020, compared to 24,000 Euro per employee in IWW passenger transport.

For eastern European countries, the ratio was 15,000 Euro per employee (freight transport) to 12,000 Euro per employee (passenger transport). These values also indicate that personnel costs per employee are at least twice as high in western Europe than in eastern Europe for passenger transport, and at least three times as high in freight transport. The missing data for the Netherlands and Switzerland make it difficult to indicate more precise relationships.

At the EU-27 level,[62] the average was 44,000 Euro (freight transport) and 28,000 Euro (passenger transport). The higher average for the EU-27 compared to western and eastern Europe stems from the fact that Scandinavian countries such as Sweden play an important role in passenger transport, and the companies in this part of Europe pay the highest wages.

The most important part of personnel costs are wages. According to the Eurostat SBS database, the average share of wages within total personnel costs is 79% for IWW passenger transport and 80% for IWW freight transport in the EU-27.

[60] In the SBS dataset, personnel costs are defined as the total remuneration, payable by an employer to an employee. Personnel costs are made up of wages and salaries and employers' social security costs.
[61] For the Netherlands and Switzerland, Eurostat SBS data about personnel costs and wages are not available.
[62] Considering only countries for which data is available in the SBS dataset.

09

OUTLOOK FOR INLAND WATERWAY FREIGHT TRANSPORT AND RIVER CRUISES

- The iron ore and steel segments experienced a decrease in both Rhine and Danube countries in 2022. The effects of the war, inflation and supply-chain related disruptions are expected to continue in 2023 and will lead to persisting uncertainty. A rebound is foreseen in 2024.
- Regarding the 2022/23 harvest season, on the one hand, wheat and barley harvest volumes are expected to increase, whereas on the other hand, maize harvest volumes are foreseen to contract, compared to the previous year.
- In light of the uncertain geopolitical environment and the deteriorated economic conditions, prospects remain bleak for the chemical industry in 2023. Production and demand are expected to decline as a result of lack of orders, disrupted supply chains and high energy costs.
- The demand for river cruises is expected to return to pre-pandemic levels in 2023. However, it remains uncertain to which extent factors such as rising energy and fuel prices, difficulties in recruiting staff and inflation will impact the new building activity.

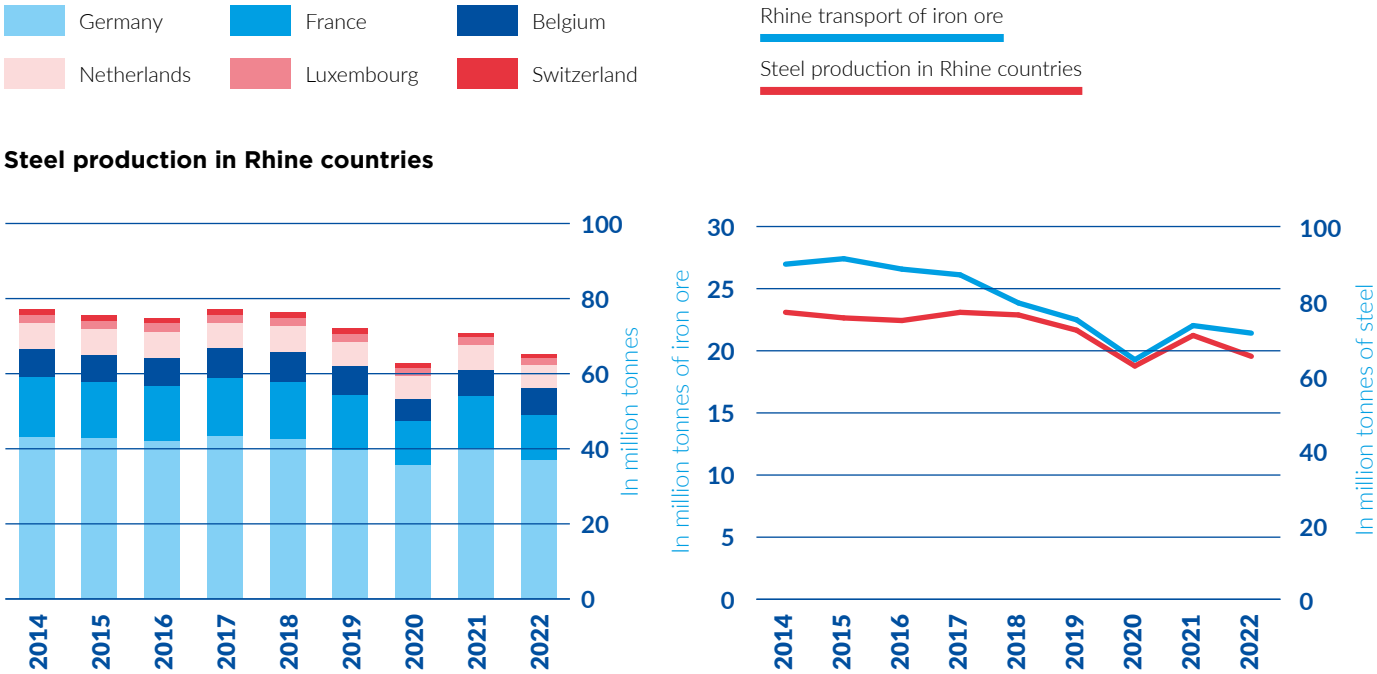
Inland waterway transport in its present structure relies on traditional market segments. Examples are the steel, agricultural, chemical and food segments.

IRON ORE
AND STEEL SEGMENT

On the entire Rhine, around 20% of all cargo transport is related to steel production in 2022 (iron ore, scrap steel, coking coal, metals, metal products). On the Danube, this share is even higher and amounts to 40% for the Middle Danube.

Iron ore transport on the Rhine in general follows the trend in steel production. Steel production in Rhine countries decreased by -7.9% in 2022 compared to 2021. Transport of iron ore on the entire Rhine decreased by -2.8% in 2022.

FIGURES 1 AND 2: **STEEL PRODUCTION IN RHINE COUNTRIES AND TRANSPORT OF IRON ORE ON THE ENTIRE RHINE**

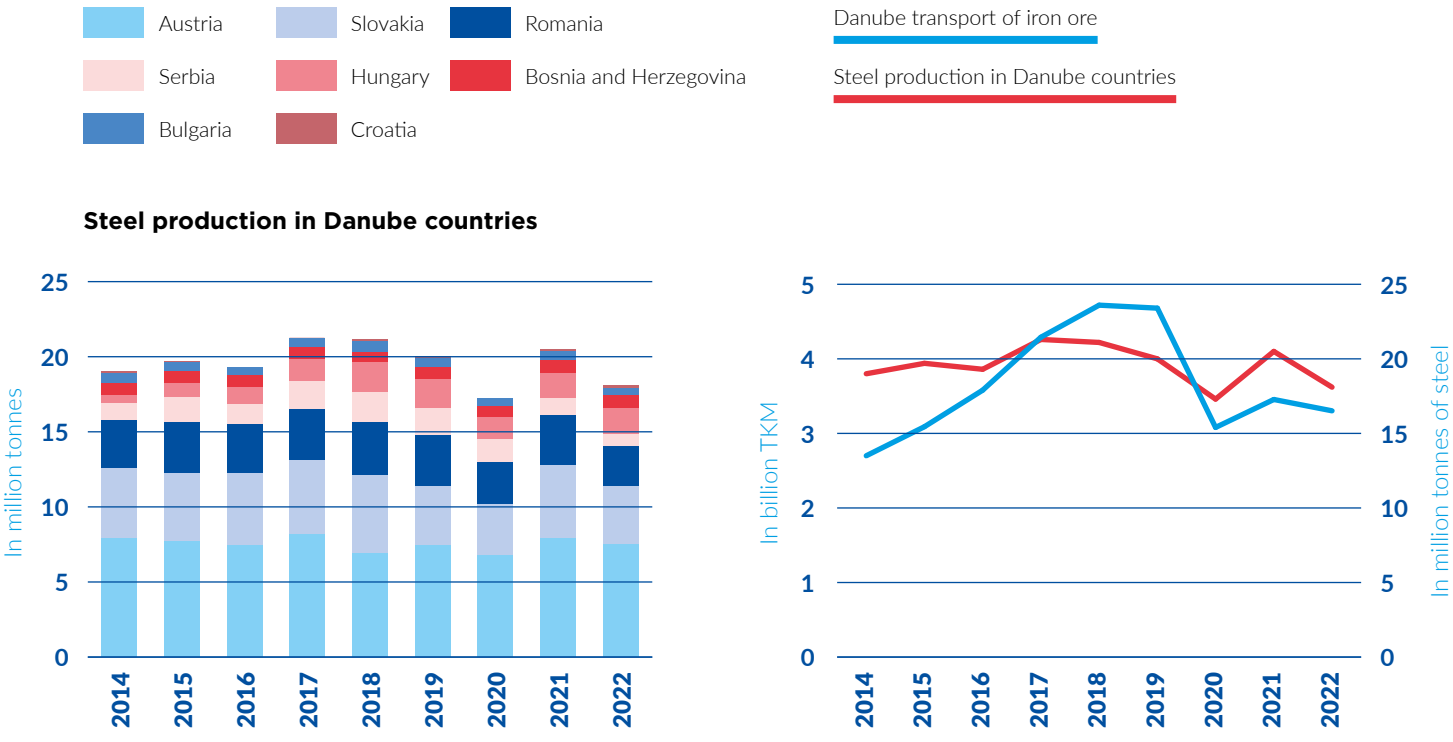


Sources: World Steel Association, Eurofer, Destatis, Rijkswaterstaat, CCNR

Steel production in Danube countries[63] amounted to 18.1 million tonnes in 2022, a decrease of -12% compared to 2021. Transport of iron ore in Lower Danube countries decreased by -4.4% in 2022.

[63] *Without Ukraine*

FIGURES 3 AND 4: **STEEL PRODUCTION IN DANUBE COUNTRIES AND TRANSPORT OF IRON ORE ON THE LOWER DANUBE ***



Sources: World Steel Association, Eurostat [iww_go_atygo]
** Lower Danube = Romania and Bulgaria*
Data for Middle Danube countries were mostly missing.

Outlook for the iron ore and steel segment

According to Eurofer[64], the second quarter of 2022 - taking into account the global geopolitical context, the war-related disruptions, weaker demand and the rise in energy prices and production costs - saw a rapid end to the positive post-Covid trend which had prevailed for the steel market until the first quarter of 2022. Hence, in 2022, steel demand experienced its third recession in four years. This is expected to continue in 2023, but at a lower rate. The steel outlook for 2024 is more favourable and steel demand is expected to rebound.

Despite the above-mentioned difficult conditions, production growth of steel-using sectors was still observed in 2022. It is expected to slow down in 2023 (+0.3%)[65] and to pick up some speed again in 2024 (+2.3%) thanks to improved economic confidence and recovery in the industrial cycle. The automotive sector will be the only exception as growth is expected to continue moderately in 2023 and a drop in output is foreseen for 2024 (-1.8%).

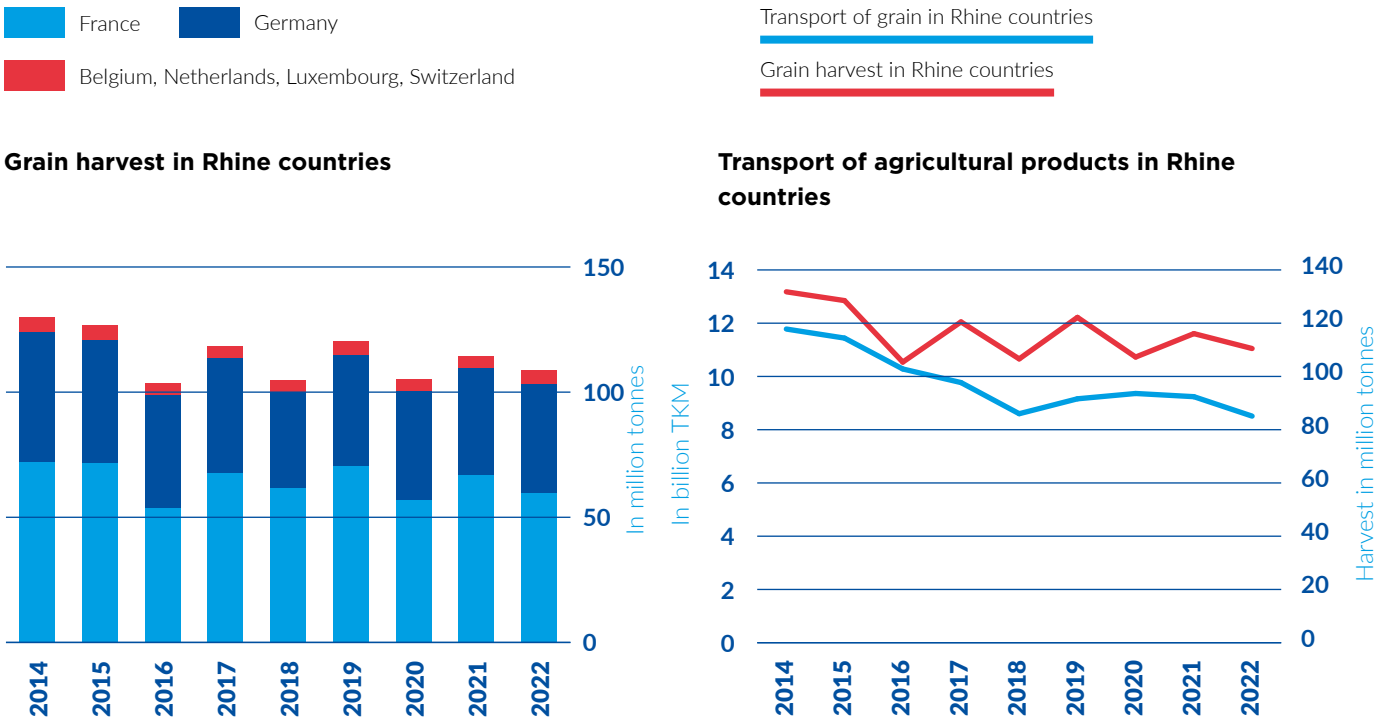
The World Steel Association, in its short-range outlook dating from May 2023,[66] foresees similar trends as Eurofer, with a tendency to more pronounced changes. A slight decline in steel demand within the European Union and the UK (-0.4%) is expected in 2023 due to the lasting effect of the war, as well as due to inflation and supply-chain related disruptions. A rebound of +5.6% is foreseen in 2024 as it is assumed that the afore-mentioned effects will dissipate. However, the outlook is subject to persisting uncertainty.

[64] Eurofer, Economic and steel market outlook 2023-2024, second quarter: https://www.eurofer.eu/publications/economic-market-outlook/economic-and-steel-market-outlook-2023-2024-second-quarter/
[65] Note that this consists in a slight improvement compared to previous outlooks which foresee a contraction of -0.6%
[66] World Steel Association, Short Range Outlook April 2023: https://worldsteel.org/steel-topics/statistics/short-range-outlook/ (last consulted 05.05.2023)

AGRICULTURAL AND FOOD PRODUCTS

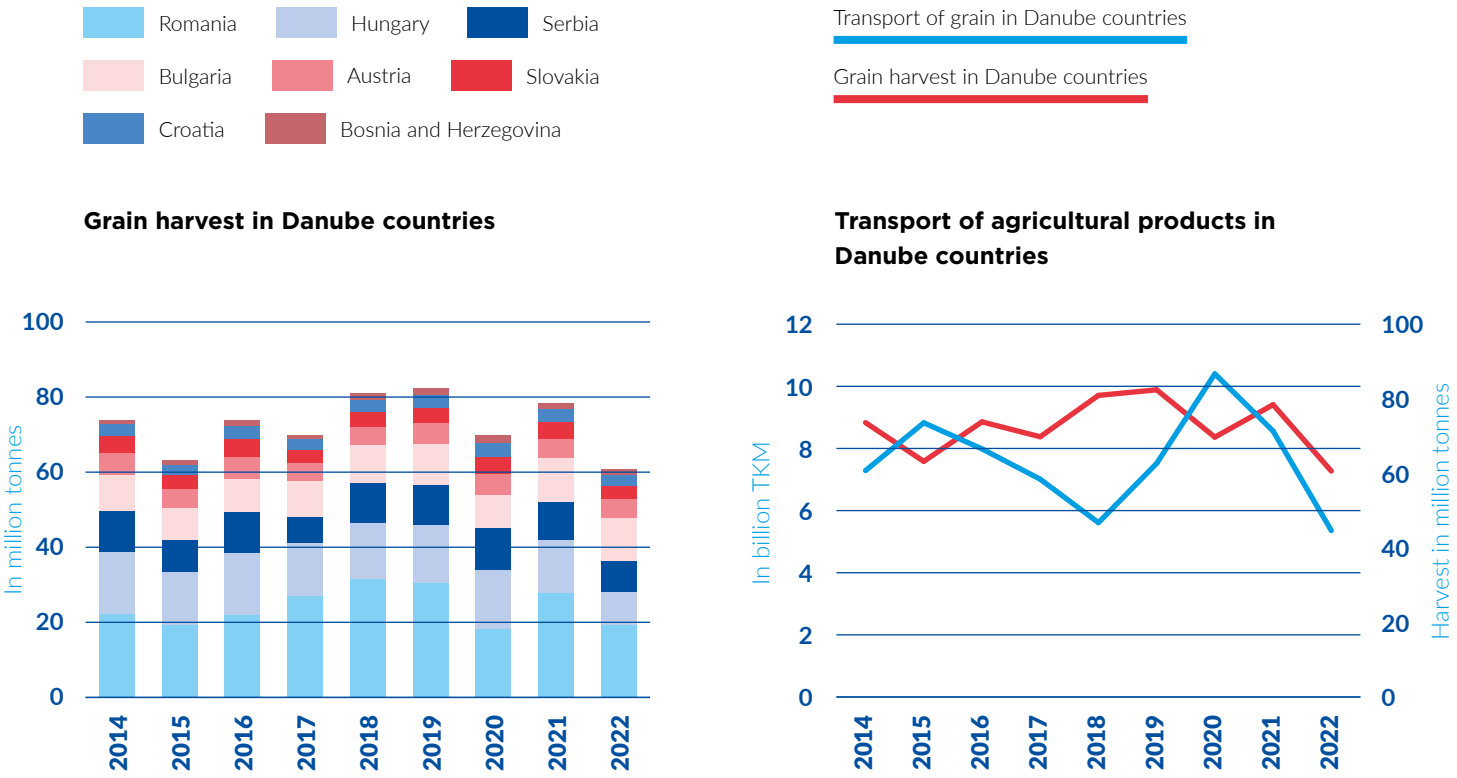
Agricultural and food products have a share of around 10% in Rhine navigation and around 23% in Danube navigation. In general, agricultural transport on inland waterways in one specific year is partly determined by harvest results in the previous year.

FIGURES 5 AND 6: **GRAIN HARVEST PRODUCTION AND TRANSPORT OF AGRICULTURAL PRODUCTS IN RHINE COUNTRIES**



Source: Eurostat [apro_cpsh1] and [iww_go_atygo]

FIGURES 7 AND 8: **GRAIN HARVEST PRODUCTION AND TRANSPORT OF AGRICULTURAL PRODUCTS IN DANUBE COUNTRIES**



Source: Eurostat [apro_cpsh1] and [iww_go_atygo]

Outlook for the agri-food segment

The war disrupted the Ukrainian and Russian grain exports, mainly due to the closure of Ukrainian ports on the Black Sea, and sanctions imposed on Russia. The increase in prices for agricultural commodities that followed lasted until the end of July 2022. In August 2022, the Black Sea ports were reopened. The supply shortage disappeared, bringing prices down to their pre-crisis levels. Until the end of 2022, maize and barley prices remained on this pre-crisis level, while wheat prices continued a downward trend.[67]

Wheat

For the 2022/23 harvest season[68] of soft wheat, an increase is foreseen on a worldwide scale, as well as for the EU-27. For France, as the most important producing country in the EU-27, volumes are expected to be slightly lower than the 5-year-average. For the following season 2023/24, soft wheat harvest volumes are expected to rise further, to reach 787 million tonnes. The growth is supposed to come from Russian, Ukrainian and US-American regions.[69] For hard wheat, the 2022/23 harvest season produced 33 million tonnes, which is a 5% higher result than in the previous season.

[67] *Source: FranceAgriMer (2023), Conjonctures grandes cultures, Mars 2023*
[68] *This harvest season is stretching from the middle of the year 2022 until the middle of the year 2023.*
[69] *Source: FranceAgriMer (2023), Conjonctures grandes cultures, Mars 2023*

Exports of soft wheat (grain and flour) from the European Union are expected to increase in the 2022/23 harvest season by +7% compared to 2021/22 and by +11% compared to 2020/21. The main destinations of these exports are countries in northern Africa such as Morocco, Algeria and Egypt.[70] Grain is, in particular, exported from ports in northern France to these countries, and inland vessels are used to deliver the grain from the hinterland to the seaports. The river-sea Port of Rouen is the largest export harbour for grain in Europe.

Barley

Worldwide production is foreseen to increase by +3% in the 2022/23 season, to 154 million tonnes. The prices for European barley have decreased, which strengthened the competitive position of European barley compared to Russian barley.

Maize

Harvest results are expected to contract by -6% in the 2022/23 season compared to the previous one. A strong reduction for maize exports from Argentina is the main contributing factor, the reason being the low harvest volumes in Argentina. Maize exports from the US are also expected to decrease.

TABLE 1: **HARVEST VOLUMES IN THE SEASON 2022/23 COMPARED TO 5-YEAR-AVERAGE**

Harvest season 2022/23 in million tonnes	World	EU-27	France
Soft wheat	**768**	**126.0**	**33.7**
5-year-average	728	124.1	35.0
Hard wheat	**33**	**7.1**	**1.3**
5-year average	34	7.6	1.7
Maize	**1,150**	**52.1**	**9.9**
5-year average	1,144	66.4	12.9
Barley	**154**	**51.5**	**11.4**
5-year-average	149	52.4	11.8

Sources: FranceAgriMer mai 2023, Banque CIC agriculture, European Commission, Service de la statistique et de la prospective (SSP) du Ministère de l'agriculture et de l'alimentation (France)

On the demand side, the forecasts for wheat consumption have been revised downwards due to the economic situation in 2023. This downward revision is made for all kinds of wheat consumption (human, industrial and animal consumption).

[70] *Source: FranceAgriMer (2023), Conjonctures céréales, Mars 2023*

II CHEMICALS

In 2022, the main macroeconomic indicators influencing the chemical sector were mostly linked with the aftermaths of the armed conflict between Russia and Ukraine: global inflation, weakening of GDP growth, falling consumer confidence, oil price volatility impacting the financials of several global chemical producers, high gas price, bottlenecks in the supply of feedstock and high prices affecting the entire chemical value chain, extreme weather events (low waters) affecting transport of chemicals and leading to further economic disruption.[71]

The share of chemicals transported on the entire Rhine amounts to approximately 17% and 11% on the Danube. The transport performance for chemicals in Rhine countries has remained at somewhat stable levels over the last five years, with significant drops in 2018 (low water effect) and 2022 (as a consequence of the war in Ukraine and the low waters).

In Rhine countries, production of chemical products followed the upward movement of the business cycle until 2018. In 2019 and 2020, it came under pressure from various trade barriers and the Covid-19 pandemic. In 2021, chemical production recovered in a rebound effect. It then sustained a sharp decrease in 2022 in all Rhine countries, due to the price surges for its petrochemical input factors. Indeed, the chemicals sector is resource-intensive and the largest energy consumer in Europe.

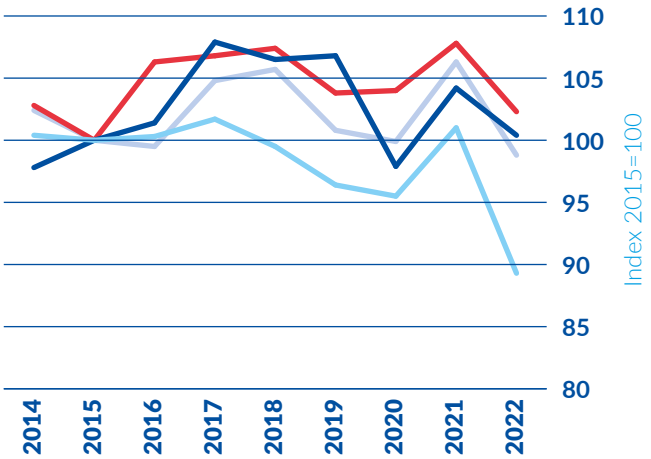
The volumes of chemicals transported along the Danube, albeit on a lower level, follow a rather positive trend, with, like in Rhine countries, some decreases in 2018 and 2022. In 2022, chemical production in Romania and Hungary decreased, while it remained stable in Austria and even increased in Bulgaria.

[71] Deloitte, 2023 US chemical industry outlook (last consulted 12.04.2023): https://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/us-2023-outlook-chemical.pdf

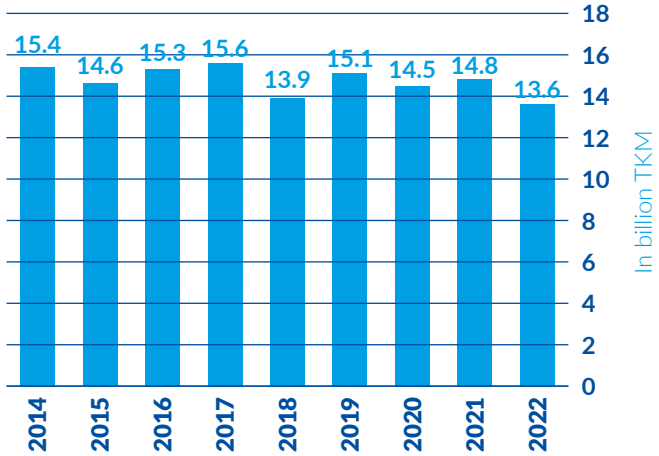
FIGURES 9, 10, 11 AND 12: **INDEX OF CHEMICAL PRODUCTION AND TRANSPORT OF CHEMICAL PRODUCTS IN RHINE AND DANUBE COUNTRIES**

Germany France The Netherlands Belgium

Index of chemical production in Rhine countries

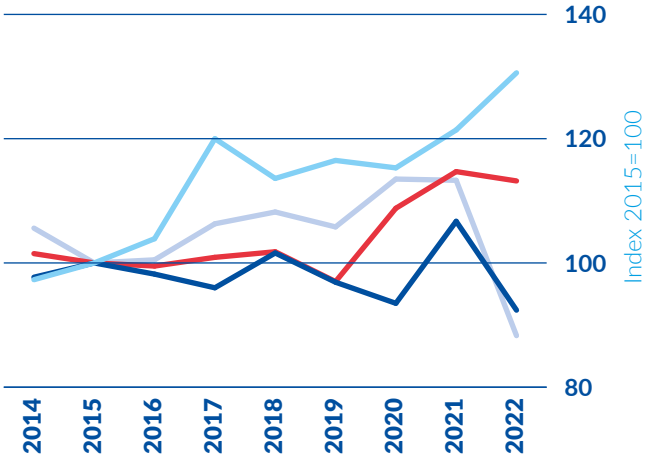


Transport of chemical products in Rhine countries

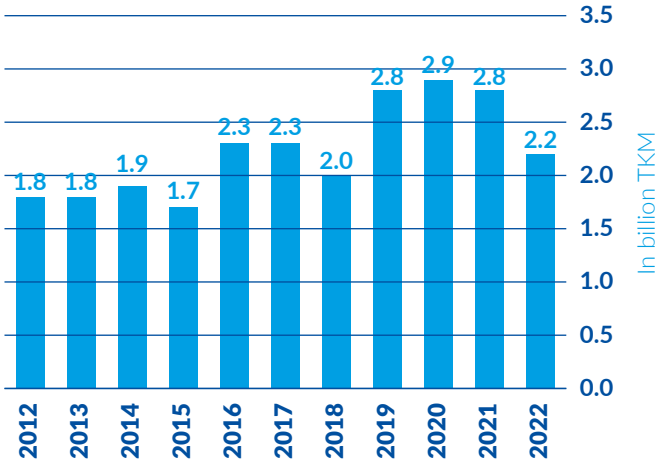


Bulgaria Hungary Austria Romania

Index of chemical production in Danube countries



Transport of chemical products in Danube countries



Source: Eurostat [STS_INPR_A], [IWW_GO_ATYGO]

Outlook for the chemical segment

Given that 88% of all chemical products in the EU are produced in eight countries, of which four are Rhine countries (Germany, the largest producer, followed by France, the Netherlands and Belgium), the development of the chemical sector in Rhine countries strongly influences the EU chemical sector. Overall, in 2022, chemical production in the EU declined by -6.2% compared to 2021. The last comparable slump in production was in 2009 in the wake of the global economic crisis (-12.1% compared to 2008). The chemical sector is the manufacturing sector whose production growth reduced the most compared to 2021, in a context where the production growth of manufacturing sectors increased overall by +2.2% in 2022 (compared to 2021).[72]

In light of the uncertain geopolitical environment and the deterioration in economic conditions, prospects remain bleak for the chemical industry in 2023. Unlike the Covid-19 pandemic or the 2009 global economic crisis post-periods, no powerful or rapid recovery is expected. A precise forecast is however difficult to establish due to the volatile underlying conditions which the armed conflict between Russia and Ukraine and the resulting energy crisis represent. In particular, the trend in industrial weakness is expected to continue during the year 2023. A further decrease in chemical production in Germany is expected, according to the Association of the German Chemical Industry (VCI).[73] However, the economic recovery in China and the gradual decrease of energy prices are expected to support the recovery of the European economy in the mid-term. The challenges for the industry are therefore expected to remain significant in 2023 in the form of reduced demand for chemical products resulting from lack of orders, disrupted supply chains and high energy costs.

The current regulatory and financial framework also plays against the competitivity of the chemical industry in Europe, particularly when comparing the European competitive framework with regions where energy prices are more favourable than in the EU, which is an additional challenge.

In the longer term, other parameters linked with the restructuring of the chemical industry in general might also affect inland waterway transport. In fact, the disruption of 2022 has highlighted supply chain vulnerabilities in this industry. This might lead to a reorientation of the industry's main production regions and sales channels or to the search for new sources of raw materials. In addition, regulatory issues and environmental concerns might also drive the transformation of this sector, particularly regarding the use and the transport of alternative feedstocks for the production of chemicals and final products.

[72] CEFIC, 2023, Chemical Monthly Report: https://cefic.org/cefic-chemicals-trends-report/ (last consulted 12.04.2023)
[73] VCI, 2022, Press release "Dark year with bleak prospects - The chemical-pharmaceutical industry has presented its results for 2022" (15.12.2022). Available at: https://www.vci.de/vci-online/presse/pressemitteilungen/dark-year-with-bleak-prospects-stock-taking-of-the-chemical-pharmaceutical-industry-2022.jsp

OUTLOOK
FOR RIVER CRUISES

The new building activity for river cruises in Europe is expected to remain low in 2023. While the capacity of vessels leaving the fleet has been far below the added capacity in the last decades, leading to a continuous increase of the European river cruise fleet bed capacity, an additional capacity of only 100 beds is estimated compared to 2022. This is explained by the higher number of withdrawals foreseen compared to the number of new buildings entering the river cruise market. This would seem to be linked to the fact that some river cruise vessels are being permanently turned into floating hotels in order to host Ukrainian refugees in the context of the ongoing conflict.

The river cruise branch is optimistic that the demand for river cruises should return to pre-pandemic levels in 2023. This might encourage future investment in the newbuilding activity. Managers of inland waterway tourism companies remain optimistic but also indicate that they face several concerns that could delay their investments: rising energy and fuel prices, difficulties in recruiting staff, inflation and rising prices of raw materials, difficulties for the supplies and the procurement of the latter. Thus, despite their will to invest in the forthcoming 12 months, it remains uncertain to what extent the new building activity will be impacted by the above-mentioned factors in the near future.[74]

[74] Baromètre de l'activité tourisme fluvial, édition 2022, Entreprises fluviales de France – E2F

GLOSSARY

ACTUAL DRAUGHT OF A VESSEL: the vertical distance between the vessel's keel and the waterline at which the vessel is sailing. For a moving vessel, the actual draught comprises also the squat effect (see 'SQUAT EFFECT' in this glossary).

ACTUAL WATER LEVEL: a measurement indicated on a water level stick that is installed at or near the shore of a river at a gauge station. It does not measure the actual depth of the river, as rivers become deeper in their mid-section. Actual water levels are nevertheless needed to calculate the available draught for the navigation of a vessel on a particular river stretch.

ARA REGION: Amsterdam-Rotterdam-Antwerp

AVAILABLE OR POSSIBLE DRAUGHT OF A VESSEL: the maximum depth to which the vessel may be safely immersed when loaded with cargo. Both for inland and for seagoing vessels, this depth varies with the ship's dimensions. For seagoing vessels, it depends also on the time of the year and the mass density of the water encountered. The available draught of inland vessels sailing on free-flowing rivers takes into account several parameters that are specific to each river stretch and gauge station. It is calculated as follows:
Available draught = Minimum navigation channel depth + (Actual water level – Equivalent water level) – Under keel clearance.

AVERAGE UTILISATION RATE (OF A CARGO FLEET): relation between the needed cargo carrying capacity (needed due to transport demand in a certain year) and the available capacity of the fleet in that same year, in percentage terms.

BLACK SEA GRAIN INITIATIVE: initiative on the Safe Transportation of Grain and Foodstuffs from Ukrainian ports. It is an agreement between Russia and Ukraine made with Turkey and the United Nations (UN) during the 2022 Russian invasion of Ukraine. It was signed on 22 July 2022 and was set to expire on 19 November 2022. On 17 November 2022, the UN and Ukraine announced that the agreement had been extended for a further 120 days. In March of that year, Turkey and the UN announced that they secured a second extension for at least another 60 days. In May 2023, the deal was once again extended for 60 days, expiring on 18 July.

BN: billion

CAPACITY UTILISATION (IN PASSENGER TRANSPORT): ratio of the number of passengers divided by the passenger capacity in a given year, in percent. The analysis of the capacity utilisation of a fleet makes it possible to provide a thorough overview of how the supply/demand relationship evolves throughout the years.

CENTRAL EUROPEAN WATERWAYS: Rhine, Main, Main-Danube Canal, Danube, Elbe-Oder

CONNECTING EUROPE FACILITY II PROGRAMME (CEF II): an EU funding instrument to promote growth, jobs and competitiveness through targeted infrastructure investment at European level.

DANUBE COUNTRIES: Austria, Bulgaria, Croatia, Hungary, Republic of Moldova, Romania, Serbia, Slovakia, Ukraine

DANUBE SOLIDARITY LANES EU-UKRAINE: lanes aimed at facilitating the forwarding of agricultural produce from Ukraine, but also bilateral trade in goods and access of Ukraine to international markets and global supply chains making sure much needed cereals reach the world market.

DEADWEIGHT (DWT): it is the maximum loading capacity of a ship, therefore the maximum weight that it can carry (measured in tonnes). This weight includes cargo, fuel, fresh water, ballast water, provisions, passengers, and crew. It does not include the empty weight or lightweight of the vessel itself. The sum of deadweight and lightweight of a ship gives the maximum displacement (measured in tonnes).

EQUIVALENT FLOW: equivalent flow values (indicated in the unit m^3/s) measured against the benchmark levels are recalculated every ten years as flows within a 100-year time series. The equivalent flow values are then used to recalculate the corresponding equivalent water level (EWL) values against the benchmark levels every ten years.

EQUIVALENT WATER LEVEL (EWL): refers to the water level occurring along the Rhine at an equivalent low water flow falling below the long-term average for 20 days.

EU: European Union

EUROPE: European inland navigation in this report includes five countries that are not members of the European Union - United Kingdom, Republic of Moldova, Serbia, Switzerland and Ukraine.

EUROPEAN CONFERENCE OF THE MINISTERS OF TRANSPORT CLASS I-VII (CEMT CLASS I-VII): the Classification of European Inland Waterways is a set of standards for interoperability of large navigable waterways forming part of the Trans-European Inland Waterway network within Continental Europe and Russia. It was created by the European Conference of Ministers of Transport in 1992, hence the range of dimensions are also referred to as CEMT Class I–VII.

EUROPEAN CRUISE FLEET: cruise vessels with more than 39 beds operating in the EU and in Switzerland.

EUROPEAN TRADING HUB: a dynamic market area for gas trading in the heart of Europe.

FAIRWAY REHABILITATION AND MAINTENANCE MASTER PLAN (FRMMP): this highlights national needs and short-term measures in order to ensure the efficient and effective realisation of harmonised waterway infrastructure parameters along the entire Danube and its navigable tributaries.

FARAG REGION: Flushing, Amsterdam, Rotterdam, Antwerp, Ghent

FREIGHT RATE: price at which a cargo is delivered from one point to another.

FRMMP: Fairway Rehabilitation and Maintenance Master Plan

GDP: Gross Domestic Product (basic measure of the overall size of a country's economy)

GOOD NAVIGATION STATUS (GNS): the state of the inland navigation transport network, which enables efficient, reliable and safe navigation for users by ensuring minimum waterway parameter values and levels of service.

HOARDING: in economics, it refers to the concept of purchasing and storing a large amount of products belonging to a particular market, often creating scarcity of that product, and ultimately driving up the price of that product.

INTERNATIONAL TRANSPORT FORUM (ITF): an intergovernmental organisation within the OECD system

IRON GATES: these set the border between the downstream free-flowing part of the Danube and the upstream part which counts many locks. They are located at the Serbian-Romanian border.

IWT: Inland Waterway Transport

IWW: Inland Waterways

LNG: liquified natural gas

LOWER DANUBE: stretch of the Danube from the Iron Gates at the border between Serbia and Romania to Sulina on the Black Sea in Romania

LOWER RHINE: section of the Rhine which flows from Bonn, Germany, to the North Sea at Hoek van Holland, the Netherlands.

LOW NAVIGABLE WATER LEVEL (LNWL): refers to a low water level on the Danube under which the water levels do not fall below more than 22 ice free days per year.

MARITIME DANUBE: the Danube Delta region

MIDDLE DANUBE: stretch of the Danube from Devín Gate at the border between Austria and Slovakia to the Iron Gates

MIDDLE RHINE: stretch of the Rhine between Bingen am Rhein and Bonn

MINIMUM NAVIGATIONAL CHANNEL DEPTH: this corresponds to the minimum depth that should prevail in the fairway area (depth of the fairway box below the equivalent water level). This minimum depth is related to the equivalent water level, as it is the channel depth that should still be present, even if water levels drop to the level of the equivalent water level.

MIO: million

MMBtu: Million British thermal unit

MODAL SPLIT SHARE: the percentage of inland waterway freight transport performance (in TKM) within total land-based transport performance. Land-based freight transport modes include road, rail and inland waterways.

NET TURNOVER (this definition applies in the report only to the turnover data in the Netherlands, the source of which is the CBS statistical office): business returns, excluding VAT (value added taxes) from the selling of goods and services to customers. Turnover is calculated after deduction of discounts, bonuses, returnable deposits and on-charged freight costs.

NORTH SEA PORT: the name of the port formed by the cross-border merger between Zeeland Seaports (Flushing, Borsele and Terneuzen) in the Netherlands and Ghent Port Company in Belgium.

OPTTI: Operational Programme Transport and Transport Infrastructure

RHINE COUNTRIES: Belgium, France, Germany, Luxembourg, the Netherlands, Switzerland

SECURED INFRASTRUCTURE INVESTMENT (IN INLAND WATERWAYS): the amount received/spent

SMALL VESSELS: vessels with a loading capacity of up to 1,500 tonnes. According to an alternative definition, small vessels have a loading capacity of 650 tonnes or less.

SQUAT EFFECT: a hydrodynamic effect that is related to the velocity of the water flow under the vessel. The shallower the waterflow under a vessel is, the higher is its flow velocity, and the higher is its dynamic pressure. Due to the Bernoulli principle, total pressure is a constant which implies that a higher dynamic pressure implies a lower static pressure. This lower static pressure leads to a lower resistance of the water towards the vessel and implies therefore a further sinking of the vessel into the water, thereby increasing the vessel's actual draught.

TEU: Twenty-foot Equivalent Unit, is a unit of cargo capacity for container transport. It is based on the volume of a 20-foot-long (6.1 m) intermodal container, a standard-sized metal box which can be easily transferred between different modes of transport, such as ships, trains, and trucks.

TKM: Tonne-Kilometre (unit for transport performance which represents volume of goods transported multiplied by transport distance)

TRADITIONAL RHINE: section of the Rhine from Basel to the border between Germany and the Netherlands

TURNOVER: sales volume net of sales taxes

TURNOVER (EUROSTAT DEFINITION): it comprises the totals invoiced by the observation unit during the reference period, and this corresponds to market sales of goods or services supplied to third parties; it includes all duties and taxes on the goods or services invoiced by the unit with the exception of the VAT invoiced by the unit to its customer and other similar deductible taxes directly linked to turnover; it also includes all other charges (transport, packaging, etc.) passed on to the customer. Price reductions, rebates and discounts as well as the value of returned packing must be deducted.

UNDER-KEEL CLEARANCE: the distance between the lowest point on the ship's keel (or hull) and the highest point on the channel bottom beneath the ship. This is so to say the "security margin" under the keel.

UPPER DANUBE: section of the navigable Danube from Kelheim, Germany, to Devín Gate, at the border of Austria and Slovakia

UPPER RHINE: section of the navigable Rhine in the Upper Rhine Plain between Basel in Switzerland and Bingen in Germany

NATIONAL STATISTICAL OFFICES

Acronym	Original Name	English Name	Country
CBS	Centraal Bureau voor de Statistiek	Central Statistical Office	The Netherlands
Destatis	Statistisches Bundesamt	Federal Statistical Office of Germany	Germany
INSSE	Institutul National de Statistica	National Institute of Statistics	Romania
Statistik Austria	Statistik Austria	Statistics Austria	Austria

BOOKS, JOURNAL ARTICLES AND STUDIES

Original Name	Country
A. Hader, The River Cruise Fleet Handbook (May 2023)	Europe
CCNR roadmap for reducing emissions from inland navigation. Available at: https://www.ccr-zkr.org/files/documents/Roadmap/Roadmap_en.pdf	Europe
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Banque CIC agriculture	CIC Bank agriculture	France
Bundesanstalt für Gewässerkunde (BfG)	German Federal Office for Hydrology	Germany
CCNR/ZKR/CCR	Central Commission for the Navigation of the Rhine (CCNR)	Europe
Corporation Inland Tanker Barge Owners (CITBO)	Corporation Inland Tanker Barge Owners (CITBO)	Belgium
Donaukommission	Danube Commission	Europe
Eidgenössische Steuerverwaltung (ESTV)	Federal Tax Administration (FTA)	Switzerland
European Steel Association (Eurofer)	European Steel Association (Eurofer)	Europe
EUROSTAT	EUROSTAT	EU
FAIRway project	FAIRway project	EU
FranceAgriMer	FranceAgriMer	France
Institut pour le Transport par Batellerie/ Instituut voor het Transport langs de Binnenwateren (ITB)	Institute for transport by skippers (ITB)	Belgium
International Monetary Fund (IMF)	International Monetary Fund (IMF)	World
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Land Niederösterreich	Federal State of Lower Austria	Austria
Ministère de la Transition écologique et de la Cohésion des Territoires	Ministry for Ecological Transition	France
Ministerie van Financiën	Dutch Finance Ministry	The Netherlands
Ministerstvo dopravy České republiky	Ministry of Transport of the Czech Republic	Czech Republic
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Service de la statistique et de la prospective (SSP) du Ministère de l'Agriculture et de la Souveraineté alimentaire	Statistics and Forecasting Department (SSP) of the Ministry of Agriculture and Food	France
Statistikamt Nord	Statistical Office for Hamburg and Schleswig-Holstein	Germany
UK Department of Transport	UK Department of Transport	United Kingdom
Verband der Chemischen Industrie (VCI)	Association of the German Chemical Industry (VCI)	Germany
viadonau	viadonau	Europe
Voies Navigables de France (VNF)	Navigable Waterways of France (VNF)	France
Wasserstraßen-und Schifffahrtsverwaltung des Bundes (WSV)	German Waterways and Shipping Administration	Germany
World Steel Association	World Steel Association	World

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