Sea-river shipping in Polish inland waters

Wiesław Galor
Maritime University of Szczecin, Faculty of Navigation
1–2 Wały Chrobrego St., 70-500 Szczecin, Poland, e-mail: w.galor@am.szczecin.pl

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Abstract
In many cases, sea ships are required to call at ports situated several hundred kilometers inland, including several different types of ship (freight, passenger, recreational). The main benefit of sea-river navigation is that ships may enter inland and carry cargo to the ports of other countries without their cargo having to be transferred several times. This method significantly reduces the risk of damage to the cargo and also lowers transport costs. An important element in sea-river shipping which is showing an increasing trend is that of passenger shipping (cruisers). This article analyzes the current situation of this type of navigation in Poland. Several examples of shipping routes on inland waters are presented.

Introduction
In many European countries, sea-river shipping is an important element of their transport infrastructure. Notably, the development of new transport corridors is currently increasing, to enable the efficient transport of goods and the provision of related services. The main advantage of sea-river shipping is that ships may travel inland, carrying their cargo to the ports of other countries without the need of one or more transshipments. This method significantly reduces the risk of damage to the cargo and also lowers the overall transport costs. This also relieves the need for cargo transport by road networks, which have become more and more burdened in recent years by increased transport requirements. Sea-river shipping involves ships travelling to ports situated several hundred kilometers inland from the sea, and several different types of ship operate in this way (freight, passenger, recreational). This sector of the overall transport system is the cheapest component and its further development is expected in Poland. Statistically, sea-river transport is approximately three times cheaper than rail transport and approximately eight times cheaper than road transport. EU countries are continuing to invest in sea-river transport, in order to increase its associated income and also to improve the security of ships during inland navigation. Shipping channels in Western Europe account for about 40% of the total length of the waterways and it is further observed that their numbers are continuously increasing. Particularly noteworthy is the possibility of sailing ships on inland waters. In many EU countries (the Netherlands, France, United Kingdom, Germany, Belgium) as well as in Russia, ships sail on inland waters up to several hundred kilometers inland (Figure 1).
The characteristics of ships for sea-river shipping

During the last few years there has been a trend for intensive development of ships for different areas of navigation, i.e. sea-river ships, which have a number of requirements that ships must meet in order to navigate in these restricted waters. Their dimensions have to be adapted to the conditions of river navigation. For Polish inland waters according to Vth class their draught should be up to 2.50 m, the breadth of the ship should not exceed 11.4 m and the total length can be up to 110 m. Load capacity is usually in the range of 2000–3000 t.

There are three types of vessels for inland navigation (Żylicz, 1979):

a) Inland ships, with permission to continue their voyage on certain marine waters, but only in sheltered weather conditions; this group is the most widespread.

b) River-sea ships, which are designed to travel on inland routes and also for coastal navigation or, with possible weather restrictions, on the open seas. The typical river-sea ships are marked by the entry for “restricted service”, which means “limited service”. This gives the possibility of navigation on the open sea up to approximately 15 miles from the coast in sea conditions of approximately up to 6° Beaufort force.

c) Sea-river ships, which are designed for sea voyages without weather restrictions and can travel on inland waterways with particular characteristics. They are actually sea-going ships, typically with limitations to any climatic zone (especially ice conditions).

The river-sea and sea-river ships must fulfill both the requirements of inland waterways and open seas. They should have the following features:

- high load capacity with low draught;
- sufficient naval efficiency, speed and strength;
- sufficient power to overcome the tide and the current of the river in critical places and periods;
- good maneuverability in all situations;
- small air draught.

Table 1 presents the comparison of the different types of ships used in sea-river shipping.

The inland waterways in Poland

Inland surface waters deemed as navigable, called “inland waterways”, are defined in the Polish Low from 10 December 2002. on inland waterways (based on Art. 66 section 1 of the Act of 18 July 2001 – Water Law (Dz. U. No. 115, item. 1229, No. 154, item. 1803 and 2002. No. 113, item. 984 and No. 130, item. 1112)). According to this document, the total length of the Polish waterways is almost 4000 km, with a total of 3115 km of these formal waterways adapted for transport use for inland water transport use. In practice, however, only 1829 km of these waterways are in use, with a further 433 km of waterways being used by the tourism industry and for passenger transport. This makes a total 2262 km of waterways currently in use. A diagram of these waterways is shown in Figure 2.

The Odra River Waterway

The Odra River Waterway in Poland is the most important for shipping and cargo transport (Figure 3). Its length is 693.1 km, consisting of the Głogów Canal (41 km), the Kędzierzyński Canal (6.1 km), the canalized section of the Odra from Koźle to Brzeg Dolny (187 km), and the free flowing Odra Brzeg Dolny to Szczecin including the Odra Zachodnia (459 km). Unlike for other Polish waterways, the Odra River Waterway has very different parameters and technical solutions. The better conditions for navigation on the Odra are on the canalized part (between Kędzierzyzn-Koźle and Brzeg Dolny) and the lower Odra (from the mouth of the Nysa Łużycka, especially Warta river, to Szczecin), where shipping is possible for an average of nine months of the year. In contrast, the most difficult navigation conditions exist between the Brzeg Dolny and the mouth of Nysa. The most commonly used part of the Odra river is its lower section (boundary section 542.4–704.1) and additionally

Table 1. The comparison the types of ships in sea-river shipping

<table>
<thead>
<tr>
<th>Ship types</th>
<th>River ships</th>
<th>Sea-river ships</th>
<th>Small sea-river ships</th>
<th>Small sea shore ships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deadweight [tons]</td>
<td>800</td>
<td>700–2000</td>
<td>1500–4500</td>
<td>do 1500</td>
</tr>
<tr>
<td>$L/H$</td>
<td>17–25</td>
<td>15–17</td>
<td>13.5–14.5</td>
<td>12.5–13.5</td>
</tr>
<tr>
<td>$T/B$</td>
<td>0.27–0.33</td>
<td>0.27–0.32</td>
<td>0.38–0.40</td>
<td>0.43–0.47</td>
</tr>
<tr>
<td>$L/T$</td>
<td>17–27</td>
<td>17–25</td>
<td>15.5–16</td>
<td>14.5–15</td>
</tr>
<tr>
<td>$(L\cdot B \cdot H)$</td>
<td>0.49–0.62</td>
<td>0.32–0.50</td>
<td>0.50–0.55</td>
<td>0.52–0.56</td>
</tr>
</tbody>
</table>


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used for navigation are the Odra Wschodnia and Regalica (Galor & Galor, 2009). This is the most exploited section, especially in relation to West Germany through the canals of Odra–Spree and Odra–Havel, due to its parameters being suitable for sea-river shipping.

In recent times, there has been increased movement of river passenger ships from Western Europe to the Odra River. They are held to the south direction (Wrocław, Ścinawa, Lubin), and on the north to the Szczecin. These ships are luxury river cruisers with a length of approximately 80 m, a breadth of 9.5 m and draught of about 1.5 m. They take on board in the region of 90 passengers with 24 crew members. They arrive at the Odra–Havel canal via elevator lock at Niederfinow (34 metres difference in water level) and a lock at Hohensauten connecting to the Odra river (Galor, 2004). These ships also visit ports in Zalew Szczeciński (Galor, 2015). In the current year it is planned for about 100 such ships to arrive in Poland. Figure 4 presents an example of a river-sea cruiser (“Johannes Brahms”).

Figure 2. The inland waterways in Poland

Figure 4. The river-sea cruiser “Johannes Brahms”
Sea-river shipping on the Świnoujście–Szczecin fairway

The Świnoujście–Szczecin fairway with a length of 67.7 km includes the area from the head to the entrance of the port of Świnoujście, up to the port water area of Szczecin. It is used mainly by seagoing ships. Approximately 50 km along the fairway is situated the Sea Port, Police (Weintrit, 2010). In 1965 the construction of a Chemical Factory was started in Police. In 1969 a barge port (Port Barkowy) was built; the first barges carrying raw materials were docked in 1970. The mineral resources during this time, phosphates and appetites, were transshipped from sea ships to barges at Świnoujście Port, and further transported to the factory at Police. The barges also carried finished products (artificial fertilizers) by waterway. In 1979, due to the high turnover of the many cargos from various factories wishing to avoid transshipment, it was decided to build a terminal to service sea ships. Since 2004 this has been known as the Morski Port.
Police. The barge port was transformed into a barge terminal (Terminal Barkowy), which is located in the central part of the Kanał Policki, also called Wąski Nurt. The Świnoujście–Szczecin fairway is running alongside the Odra River (also called the Wide Nurt), separated by the island Długi Ostrów (Figure 5).

Inland ships and sea ships of up to 120 m and current allowable draughts determined by the Captain of the Port of Szczecin, can enter the Terminal Barkowy. After the building of the Terminal Moriski (sea terminal), the role of Port Barkowy was changed (Galor, 2003). Now this port serviced only the Police Chemical Factory by supplying raw materials and exporting products by barge, and so Terminal Barkowy was transformed into a river-sea port. In addition to being used for handling bulk components required to manufacture the chemical plant and the final products, *i.e.* fertilizers, via sea-river ships travelling inland, the terminal facilities were also used for other purposes. Mainly commercial companies used them for the construction of ships hulls for heavy loads and items of equipment for the North Sea platforms or ships serving the platforms (mostly for Norway), and the hulls of inland pushed barges and motorboats, bulk carriers and tankers as well as the construction of sea pontoons for Dutch and German customers. An analysis of the types of individuals calling to the Barge Terminal showed that approximately 80% of them were sea-river ships built in the former Soviet Union. These ships are characterized by similar parameters: total length 108–118 m, width 13.3–15.0 m and maximum draught 3.26–4.3 m. Currently, these parameters allow entry to the port basin of Terminal Barkowy as they are within the parameters of the Kanał Barkowy (barge canal). Figure 6 shows an example of such a sea-river ship.

![Figure 5. The localization of Terminal Barkowy (barge terminal) in the Police Sea Port](image-url)
Shipping in relation Gdańsk–Zalew Wiślany (Wisła lagoon)–Kaliningrad

Many passenger ships have voyaged between the ports of the Tri-City (Gdynia, Sopot, Gdańsk) and Kaliningrad, via the area of the Zatoka Gdańska and the Zalew Wiślany (Figure 7). For several years the Gdańsk–Kaliningrad area was travelled by river-sea cruisers of German ownership. After crossing the German inland waterways to Szczecin, the ship could then travel through Zalew Szczeciński and the sea Polish coastal zone to the port of Gdańsk. The transition coastal zone requires adequate protection, such as the windows on the lower passenger deck must be blinded by special covers, and additionally the windows in the fore and aft must be protected by makeshift shields made of thick plywood. From Gdańsk the ship goes to the Wisła River and Szkarpacka River through the Zalew Wiślany Kaliningrad in Russia. It can also visit several ports on the Zalew Wiślany (including Elblag, Frombork, and Tolkmicko).

The River Szkarpacka is cut off from the Vistula River by lock dimensions of 61.0×12.5 m in Gdańska Główka. Fluctuations in water levels are consistent with equal variations of the Zalew Wiślany. The length of the navigating route on the Szkarpacka River is 25.4 km and its width varies between 16 to 20 m. The other three bridges on the route are suspended or rotating and do not limit the amount of flow of the rolling stock. Like Szkarpacka, Nogat is cut off by the Vistula lock and a weir at White Mountain. The River Nogat by Kanal Jagielloński joins the river Elblag and it is also connected to the Zalew Wiślany.

Conclusions

This article attempts to analyze aspects of shipping on the Polish inland waterways. Using these waters for inland shipping are river-sea and sea-river ships.

The use of the Polish inland waterways by typical inland ships ( barges, pushed convoys) is declining. However, one should note a concomittant increase in the number of sea-river and river-sea ships using these waterways. Especially important is the possibility of growth in passenger traffic, supported by river-sea cruise-type ships in relation to Western Europe – Szczecin by the lower Odra River, along the Polish sea coastal waters to Gdańsk, and from there through the Zalew Wiślany to Kaliningrad in Russia.

Recent intensive work on the revitalization, development and utilization of Polish rivers has helped to harness their economic potential. This applies to the lower section of the Wisła river and the border Odra river. It is planned to adapt the river to IVth class shipping in the future.

The implementation of these plans will undoubtedly contribute to increased shipping on the inland waterways in Poland.
References


