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Navigation and ship operation on Polish inland waterways

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Abstract

Natural conditions of Polish inland waterways, neglects in the range of hydrotechnical investments, incorrect tendences in the development of vessels design are contents of chapter 1. Recent state of navigation on Polish waterways, especially on rivers Odra, Vistula and connection between them contains chapter 2. Adaptation of Polish waterways to the requirements of European Union is described in chapter 3. Possibilities for not professional navigation are put in chapter 4.

1. Navigational conditions

In the area of Poland there is about 3980 km of waterways and in this number two main Polish rivers: Vistula and Odra. The waterway of Vistula to the port of Gdańsk is 964 km long and of Odra to Świnoujście 709 km. There is the great difference between water conditions of Rhine and Danube on the one hand and Vistula and Odra on the other. The first ones have twice an alimentation year, one from spring melt of snow and ice and the second in summer as a consequence of Alpine glacier melt. Unfortunatelly Polish rivers have only one source of alimentation. Therefore the differentiation of Vistula flows in its mouth amount to 42 times and of Odra flows 29 times. The comparison between the main European rivers is given in the table 1. Additionally it is important to know that Vistula (in respect of the flow value) fills lately the 22-nd position between European rivers and Odra still further one.

Neglects in the range of hydrological investments have been rising for many years. Too small interest of the state authorities and in the last twenty years catastrophic marasmus in inland shipping with simultanously charming of truck

transportation, caused the downfall of the number of shipowner enterprises, of inland shipyards and diminution of the number of propulsioned ships from about 2000 to about 1000 units. The cause of such situation was: default of waterways rebuilding of harbour boulevards on high speed streets or recreational promenades, without substitutional ports and fascinating truck conveyance. The latter one gave as result: 1) increasing of environment infection, 2) very fast destruction of roads.

Table 1. Comparison of flow values for peculiar European rivers (Hofman [1])

River	Q_{min}		Q_{max}		$\overline{Q}$		$\frac{Q_{max}}{Q_{min}}$
	[$m^3 s^{-1}$]	[%] of Vistula	[$m^3 s^{-1}$]	[%] of Vistula	[$m^3 s^{-1}$]	[%] of Vistula	[x]
Vistula	236	100	10 000	100	970	100	42
Odra	127	54	3 400	34	570	59	29
Elbe	155	66	3 600	36	715	74	27
Rhine	780	331	10 000	100	2 350	242	13
Niemen	180	76	6 000	60	570	59	33
Volga	1 230	521	61 000	610	7 800	804	50
Danube	2 000	847	28 000	280	6 200	639	14

Additionally within the last ten years the explosion of primitive environment protection activity took place. This movement renders impossible all economic uses of waterways, telling fables about intentions of concreting all river and canal beds and about gathering in them deposits of toxic gelatine. At the same time they promulgate an idea of creation the 1000 kilometre long natural museum of primeval flora and fauna. It is a mistake. The point of matter is that the grown wild river is not primeval one. Grown down is caused by error hydrological activity or no activity at all. As each populistic theory, such dezinformation finds many followers among poorly educated part of the community.

The other problem created the tendences in the development of vessels design with drive to imitation of Rhine or Danube style, instead of modernization of paddlers verified on shallow rivers (Michalski [3]). Efficiency of the propeller on shallow river is always low and its influence on the movement of bottom rubble is significant. Vistula and Odra waterways can be modified, but these rivers always will have their own character, always will have great differentiation of the flow and always will be shallow rivers, because the water resources always will be poor. Design of the ship has to be adapted to river possibilities, opposite situation is impossible to realization. We understand, that the waterways of the VI-th or VII-th European class cannot exist in Poland and it would be good if modification allowed to adapt our waterways to international importance to the IV-th class and only the mouth sections of both main rivers to the V-th class.

2. Recent state of navigation (Figure 1)

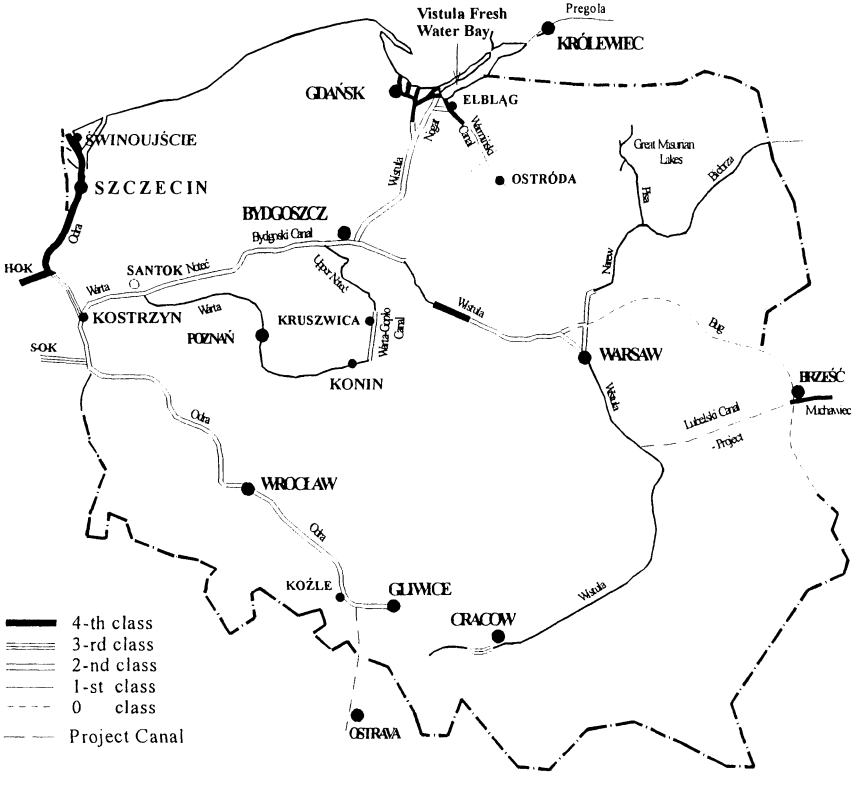

Figure 1: Polish waterways.

River Odra has four different sectors:

- the first 78 km long extends from the border of Czech Republic to the port of Koźle (km 98,1) and is quite wild, it is not used for inland shipping;
- the second one - 187 km long is cascaded (23 locks) and it is included to the second European class of navigability. In this sector ports of Opole (km 154,7) and of Wrocław (km 255,0 and 256,6) are located. The end of this sector is in the town Brzeg Dolny;
- the third one includes the middle course of river with the length about 334 km. It is free flowing sector in the second class. In this sector the ports in Malczyce (km 304,8), in Ścinawa (km 332,1), in Nowa Sól (km 429,8) and in Cigacice (km 471,8) are located. From km 542,4 the left shore belongs to Germany. The end of this sector marks the mouth of river Warta (km 617,6);

- the fourth one is free flowing river - 50 km long in third class, further 82 km in fourth class and the last 67 km between sea port Szczecin and sea port Świnoujście in fifth one.

Odra has following connections:

- from the port of Koźle (km 98,1) branch off Gliwicki canal 41,2 km long reaching the coal port Gliwice - 2-nd class, 6 locks;
- in km 553,45 begins in Germany S-O-K (Spree - Oder - Kanal) leading to Lower Havel and then to M-L-K (Mittellandkanal)
- in km 617,6 begins Vistula - Odra Waterway guiding in the east direction by the town Gorzów to the town Bydgoszcz. All this waterway is 294 km long in the 2-nd class; it has some ports: Kostrzyn (km 1,0 of Warta) Krzyż (km 174,1), Czarnków (km 132,1), Ujście (km 106,0), Bydgoszcz (km 5,4) and 22 locks;
- in km 667,6 begins in Germany
- H-O-K (Havel-Oder-Kanal) leading to Berlin and further to the west.
- at km 704,1 the border leave the river, the both sides are in Poland again.

Vistula devides itself into four different sectors:

- the upper river is cascaded and has 6 locks. This sector is 80 km long and ends in Cracow;
- the second one (middle Vistula) creates very wide and shallow river with great number of islands. It extend from Cracow to Warsaw and is 430 km long. There is no shipping now although there exist two ports in Sandomierz (km 269,2) and in Puławy (km 372,5);
- the third one (a part of lower Vistula) is a free flowing river, characterized with a great number of shallows. It is navigable, but it demands very high qualifications from the staff and especially from the captain. In Warsaw Vistula is connected with eastern waterway conducting along Żerański canal, Zegrzyńskie lake, river Bug and further to Byelorussia. In the middle of this sector there is Włocławek lake with the IV-th class of navigability and it is the second region of shipping (the height of the waves can be about 1,2 m). Below the lock the shipping is again more difficult (2-nd class);
- the fourth one below Bydgoszcz and beginning of Vistula - Odra waterway, the navigational conditions are better. This sector is about 130 km long and conduct to the Baltic port Gdańsk. On the way there is the connection along Nogat (62 km and 4 locks) to Vistula Fresh Water Bay and to the town Elbląg.

Polish shipyards have built about 400 freight motor ships with load capability about 500 ton and the same number of pushboats. The push kit consists of one or two pushed barges. Maximum length of the kit on Odra is possible to 187 m, on upper Vistula to 85 m, on lower Vistula to 115 m., on Gliwicki canal to 72 m and on Vistula - Odra waterway to 57,4 m.

Before 1989 there were 7 state shipowner's enterprises in Poland. In this number only 3 are restructured and some number of small enterprises, as well as one German firm are created.

The great number of Polish inland ships is used abroad, due to wrong concurrence between different branches of transportation, e.g. the railway obtains state allocation, and can use dumping prices. Inland shipping has no allocations. The prise of fuel

includes the road tax and the ships after all do not destroy the roads. Such anomalies ought to be quickly liquidated.

3. Future of European waterways in Poland (Figure 2)

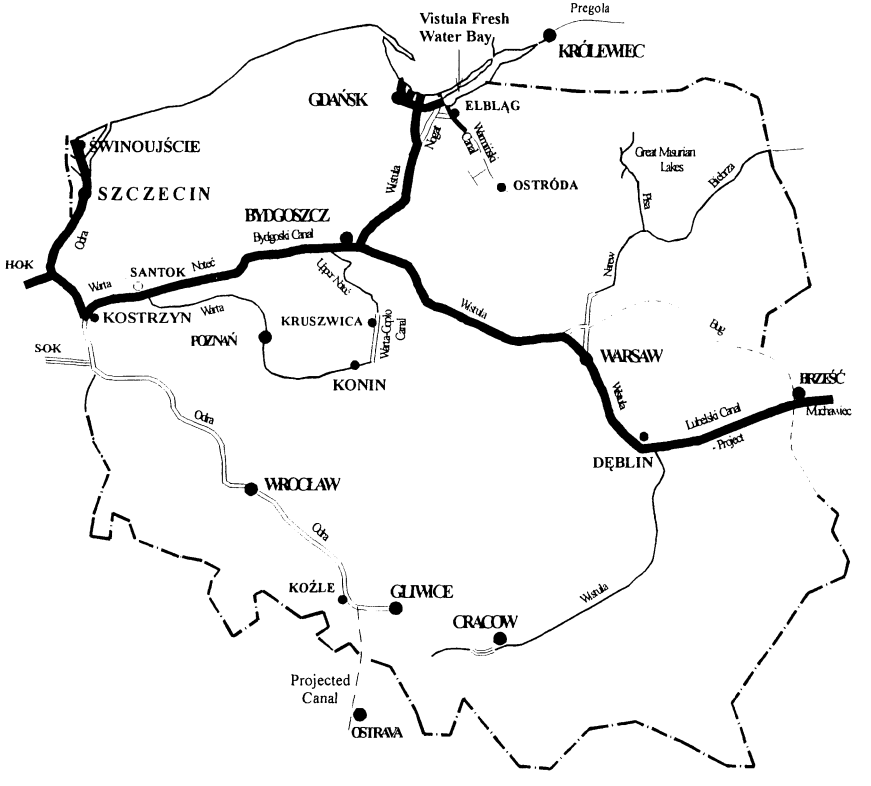

Figure 2:Project of transeuropean waterway „West-East".

Poland is placed on the European waterway west - east. To our west border leads the main German eastern waterway, from Rhine along Wesel-Datteln-Kanal (W-D-K) or Rhein-Herne-Kanal (R-H-K), Dortmund-Ems-Kanal (D- E-K), Mittellandkanal (M-L-K) to the Elbe and further along Elbe-Havel-Kanal (E-H-K), Lower Havel, Havel-Oder-Kanal (H-O-K). This waterway couples France, Belgium, Luxemburg, the Netherlands, Switzerland and Germany with Poland. Along the Elbe it is joined additionally with Czech Republic.

From the Hohensaaten Eastlock our waterway runs 50 km upstream along the Odra to the town Kostrzyn, then 294 km along the waterway Vistula - Odra (it is composed of 68 km upstream along Warta, 187 km upstream along Noteć with 14 locks, 25 km of

Bydgoski canal with 6 locks and 14 km with the stream of river Brda - 2 locks). On the end of this way we reach the town Bydgoszcz. In the mouth of Brda the transeuropean waterway is devided into two arms (Michalski [4]).
The northern one leads 114 km with the stream of Vistula, then we flow 62 km with the stream of Nogat (4 locks) and about 40 km along Vistula Fresh Water Bay (2-nd region of shipping) to the Polish-Russian border and then along Pregoła, Dajma, Gilia, Niemen to Lithuania and Byelorussia.
The southern one leads 252 km upstream along Vistula to Warsaw, by the way we pass the lock of Włocławek and Włocławskie lake. In Warsaw Żerański canal begins (17 km long, 1 lock), 7 km of Zegrzyńskie lake (2-nd region of shipping) and the river Bug (291 km) upstream to Polish - Byelorussian border in Brześć. Here the waterway goes along river Muchawiec, Royal Canal, rivers: Pina, Prypeć to Dniepr. This waterway binds Ukraine, Byelorussia and Russia with European Union Countries. The middle part of river Bug causes however some difficulties. Bug is peculiar river. It has in its upper course lowland-river character and in lower course - mountain character. Such situation is caused by stone reef in the middle section of the river. Therefore the Polish specialists anticipate the change of the route. The future version will be continued from Warsaw with Vistula upstream additionally 150 km to the town Dęblin and further through the mouth of river Wieprz and along projected Lubelski canal to the mouth of river Krzna to river Bug (Miłkowski [5]). In this variant the part of waterway along river Bug will be decreased to only 10 km.
The Odra river has actually its waterway from km 98,1 (port of Koźle) to the mouth of river Świna in the sea - port Świnoujście. From Koźle this waterway is lengthtened with Gliwicki canal to the coal port Gliwice. The length of all waterway Gliwice-Świnoujście amounts 751 km and has 29 locks.
Poland, Czech Republic, Slovakia and Austria are interested in building the new canal coupling the Danube in Devin near Bratislava and Odra in Koźle (334 km and 22 locks) (Kubec [2]). This canal will have a side arm to river Elbe in Chvaletice (additionally 150 km and 8 locks). The first step towards this project is a planned construction of Odra lateral canal to the industrial district of Czech Republic in Ostrava. The length of this section amounts to about 80 km. Odra in km 553 is bounded with German Spree-Oder-Kanal (S-O-K) and along Teltow Kanal is connected with Lower Havel and further to the west of Europe.
Actually the Polish inland waterways are default. They demand of the renewal and heighting of their class. Presently we have some number of bridges with too low construction (similarly as in east Germany). The great capital of Poland is educated society. There are three technical schools for education of officers for inland shipping. There is also a faculty of inland ports and fleet operations at the Szczecin Maritime University. The students are graduated to B.Sc.ing. and M.Sc.ing. degrees. Polish Register of Ships is our own classification institution dealing also with inland ships; „Navicentrum" is a design office; some technical universities educate the specialist in the range of hydrotechnique or shipbuilding.

4. Offer to recreational navigation in Poland

According to the author there are four most interesting possibilities for recreational navigation in Poland:

1) in northern Poland - Great Masurian Lakes (Figure 3) create some waterways about 220 km long for ships and yachts and several times longer for smaller units. This complex consists of some great lakes: Mamry, Śniardwy, Niegocin, Tałty, Bełdany, Nidzkie, Roś) bound with the net of canals. The main centres of touristics are the towns Giżycko and Mikołajki. In this complex there are only two locks.
   The lake Roś is the beginning of the river Pisa 80 km long, with great number of meanders, full of wild nature. This waterway is good for small ships (to 20 m in the length). The mouth of Pisa to the river Narew allows for further journey (141 km) with the stream to Zegrzyńskie Lake near Warsaw. Narew is a shallow river fitted for ships with small draught.

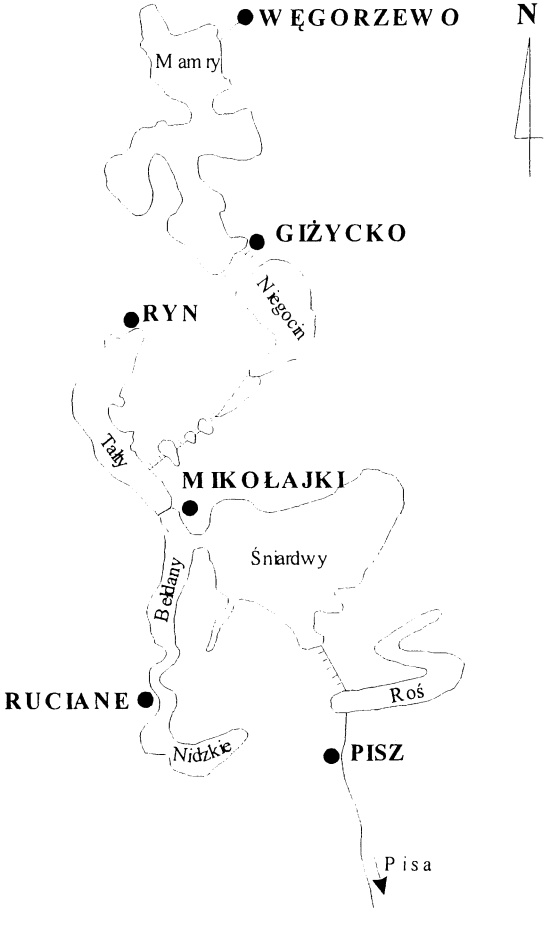

Figure 3: Great Masurian Lakes.

2) Augustowskie lakes are situated in east-northern part of Poland. They create a chain with Augustowki canal (built about 1830). The main town Augustów is situated on the side of lake Necko. From 18 locks 15 are located in Poland and further 3 in Byelorussia. The parameters of the locks limited the parameters of ships: the length less than as 43,25 m, the width less the 5,94 m.. From Necko begins the lower part of the canal, connected with the river Biebrza (the length about 84 km). The mouth of Biebrza to the river Narew allows after 210 km with the stream, to reach Zegrzyńskie lake near Warsaw.
3) Another very interesting roundabout route, is situated in the area reckoning as the cradle of Poland (Figure 4). This waterway begins in Santok (the village in the mouth of river Noteć to Warta).The journey can go in both directions. For example: up the stream of Noteć (187 km, 14 locks), then Bydgoski canal (16 km, 4 locks), Górnonotecki canal (89 km, 8 locks with the gates' width only 4,93 m and the length of the chamber 42,00 m, additionally the lowest railway bridge has only 2,90 m. to its construction) to the lake Gopło with the legendary Polish capital Kruszwica (over 1000 years old). The further way leads along the lake Gopło (26 km), then along the canal Gopło - Warta (the next 32 km, 4 locks). Canal connects with river Warta 3 km over the town Konin. Now the route guides 339 km with the stream to the end of this circuit. On the way we can see interesting monastery in Ląd, very cosy town Śrem and great centre of international fair Poznań, then interesting towns Sieraków and Międzychód. Along Warta one can see white eagles, beavers and many other natural views. The length of all circuit amounts to 688 km.

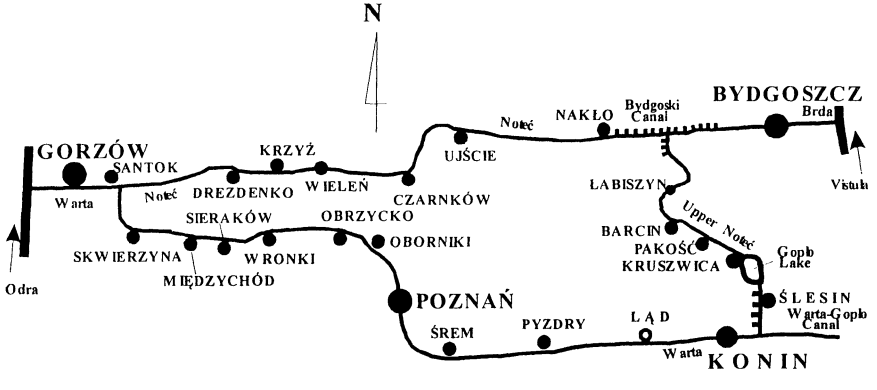

Figure 4: Roundaboute route to the cradle of Poland.

4) Especially interesting route runs along Warmiński canal. It begins in the town Ostróda on the side of Drwęckie lake. This route is only 74 km long. Canal has two locks and five devices having, on both slopes, inclined planes on which carts for ships are rolling. These five devices allow to surmount the differentiation over

100 m between the level of the first and the sixth section of the canal. Such devices are working only in one place in the world. It is an unique sight to see a ship flowing on the grassed slope. There is the limitation for ships. The width amounts to 3,25 m and the length max. 29,30 m. The canal is connected with Drużno Lake (ornithological reserve). The last sector runs along the river Elbląg to the town Elbląg. From this route some side excursions are possible, additionally 70 km. Of course this route can be covered in the opposite direction.

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