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The Świna estuary navigation marks changes after 1793

1. INTRODUCTION

The Świna is one of the arms or straits draining the waters of the Bay of Szczecin – especially the Odra – into the Baltic Sea. The other arms are the Piana (Peenestrom or Peene) and the Dziwna. Seafaring between the Szczecin port, since the 11th century, and the Baltic has always depended on shifting depths and required precise marking of waterways. The Świna hasn't always been the main navigational channel for vessels heading from Szczecin towards the Baltic; for a long time this role was fulfilled by the Piana. This situation remained until 1793, when – by the decision of the king of Prussia – the construction of a port and city at the Świna estuary was commenced³. The reason behind this sudden decision was high duty imposed on ships navigating the Piana, under the jurisdiction of Sweden. The route mainly took into account favorable conditions of the Bay of Pomerania to create sheltered anchorage for ships waiting to be loaded or unloaded at either the Świnoujście or Szczecin port.

The Świnoujście port was expanded and its waterway deepened between 1738-1740; a few years later, in 1747, the harbour became a seaport. Municipal rights were granted in 1765. The banks of Świna within its estuary and the newly created port were reinforced as far as possible and as technology of the time allowed. This was done with fascine and wooden stakes set deep into the banks. At that time similar technologies were used in other ports, such as Gdańsk. In order to make the breakwaters marking the entrance to port clearly visible to ships, wooden joints were erected at their ends with a characteristic topmarks. At night fires were lit near them or placed on top of the signs as required. Between 1849-1855 the eastern bank of Świna was timbered and reinforced again as far as Chorzelin, introducing stone constructions [2].

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³ Prussian authorities purchased the Wolin and Uznam isles from Sweden in 1720. Author's note.

2. ENTRANCE LIGHTHOUSES AND LEADING LIGHTS⁴

The description of the first lighthouse at the entrance to the Świnoujście port in 1805 reads: "In spring 1805, a lighthouse called Leuchtbude was lit on the head of the east breakwater. It was a wooden construction with a fire kindled on top, amplified using a system of mirrors reflecting the light" [2]. This describes the first construction of a fixed entrance beacon, an image of which was found in the State Archives in Szczecin [15], shown in Fig. 2. The weak light emitted by candles or an oil burner was amplified using a polished metal mirror, described in the archives as a system of mirrors. Until the construction of the lighthouse in Chorzelin (a district in Świnoujście), entrance lights played a key role in the Świnoujście port.

Two stone breakwaters were built between 1818-1823 in the Świna estuary, changing navigation at the entrance to the port. New navigational aids were also introduced: the second entrance beacon, made of iron, 12.5 meters tall (Leucht-Baake), situated at the end of the east breakwater (1828), fitted with an Argand lamp with five reflectors in two rows, lighting a sector of 180° with a permanent light with a reach of 2.5 miles (Fig. 4) [7]. A maritime pilot's station was opened on the west river bank.

Until 1840, the Szczecin-Świnoujście waterway was only about 4m deep, making it impossible to navigate for larger vessels. They were partially unloaded in the Świnoujście port and then taken to Szczecin, with the reduced submergence improving safety. Development of seafaring during the second half of the 19th century and the introduction of ships driven by steam made it necessary to regulate and to deepen the Świnoujście-Szczecin waterway, at first to 6m and then to 7m, with the request submitted to the Prussian government in 1889. The construction of the Kaiserfahrt (the Piast Channel) between 1875-1890 was a major improvement to navigation along the route to Szczecin.

The stone breakwaters, approximately 1000m (western) and 1300m (eastern) long, were exposed to frequent storms causing gradual damage. As a result, works aiming to repair and extend the western breakwater were initiated in 1866. It was extended to 1491m, and a new iron entrance beacon measuring 14.25m was constructed on its head between 1872-1875. The old entrance beacon remained in place for some time, so the breakwater actually had two lights, shown on old maps and postcards from the period. The new entrance beacon

⁴ Entrance beacon, entrance lighthouse and entrance light are names of the same construction placed at the head of the breakwater leading to the port. Authors use the phrase entry beacon in general for day and night lights.

was an octagonal pyramid, tapering towards the top, with a dome-shaped prism lantern⁵ placed on top. Analysis of a cross section of the building gave following details: the base was constructed from granite blocks and anchors, with two levels of steel ribs with an obtuse section attached on top. The centre of the beacon, up to the height of 6.3m, was a forged iron cylinder 1.3m in diameter with an entrance and iron staircase leading to the service room. The interior of the cylinder also housed a manual hoist. The keeper's room, with insulated and wood-paneled walls, was located above the service room. The top section of the keeper's room held a cylindrical hatch 0.55m tall used for accessing the lantern room. The uppermost part of the cylinder was closed using a double door. The lantern room had eight glass panels. It housed the fire specially ordered Fresnel lens and a mineral oil burner emitting red light with the use of a filter. Its arc of visibility was 360°. The height of the light beam above sea level was 13m, and it had a range of 10.6 miles. A bell mounted on the outside of the beacon was used to transmit fog signals. The total cost of the construction of the new beacon was 22,527 marks, with the Fresnel lens costing 2,760 marks. A total of 11,918 kg iron, 7,639 kg sheet iron and approx. 10,000 rivets were used in the construction [5].

The third harbour light (Fig.6) survived until the outbreak of the First World War, although it was disassembled or destroyed in 1914⁶. After the end of the war, in 1918 a new (fourth) lighthouse was erected in its place with a similar iron construction, slightly broader, and with a different roof construction. The fog bell was replaced with a multi-segment acoustic nautophone. The lighthouse survived many years and was modified several times. It was eventually replaced with the fifth construction in 2002, with a temporary light mounted on a 4.3m pole used during the works.

The next navigational aid placed in the central part of the eastern breakwater was the Winkbake beacon (Fig.5). Its wooden construction was frequently changed, and the one built in 1814 was modernised as soon as 1857. For many years the Winkbake beacon, together with the beacon on the eastern Świnoujście beach (Richtungsbake, Richtbake or Landbake⁷), formed the line of leading lights at the port approach with a true bearing of 146.2°. The leading light was removed following the modification of the channels leading into the port⁸.

⁵ Lantern – the top, glazed section of a lighthouse housing the lighting system. Author's note.

⁶ A model of the beacon with a fragment of breakwater can be seen at the Museum of Technology in Berlin. Author's note.

⁷ Maps from 1837, 1848, 1850 and 1940 show different names of this beacon standing near the eastern beach. Author's note.

⁸ List of Lights from 1943 and a German map No. 1300 from 1942 with corrections dated 1948 and 1950 list the "Winkbake" ("Wolin 1") beacon and "Wolin 2" beacon, set on the east riverbank, as forming the leading light at a bearing of 146.2° in 1950.

As follows from the analysis, as an important Baltic port and naval base Świnoujście's entrance and breakwaters date back to the 18th and 19th centuries. Lighthouses, entry beacons and leading lights have been and remain important elements marking the entrance to the port. The markings have been modified with the passing time and changing technologies, as can be seen on the attached figures and descriptions.

Another issue for the Świnoujście port was appropriate signage and marking of navigational routes within the Bay of Pomerania at approaches to the port from the north. Here depths were around 8-12 meters for vessels approaching Świnoujście, but there also was and remains the Ławica Odrzana shoal with depths of 8m and a minimum depth of 6m. This shallower area needed to be marked well so that vessels with a greater draught didn't have any problems in approaching Świnoujście. The shoal was initially marked with buoys, although there was a proposal of placing a lightship at its southern edge. The project was abandoned because of high costs associated with constructing a lightship (approx. 257,000 marks in 18 84) and annual maintenance (30,000 marks per year). Another plan was put forward at the end of the 19th century, projecting placing a permanent lighthouse on Ławica Odrzana with foundations set into the seabed, similarly to the Roter Sand lighthouse in the North Sea. There were also plans to place a new light beacon at Kiesberg (Kikut) to the west of Dziwnów and increasing the light range of the Greifswalder Oie lighthouse.

Studies of the base of the shoal, drilling into the seabed and bathymetric measurements were carried out prior to preparing technical designs for the concept. The works were carried out in 1903 by the Port Construction Authority in Świnoujście [16]. Thirty eight boreholes were drilled to the depth of approx. 30m below the average water level. The plan was to construct the bottom, cylindrical section of the lighthouse with a diameter of 15m and height of 35m. The top edge of the cylindrical construction was to be 10m above the average water level. The height of the light above sea level was projected to be 40m. Unfortunately, the project was never carried out for unknown reasons.

3. ŚWINOUJŚCIE LIGHTHOUSE

The concept to construct a tall lighthouse in Świnoujście was first raised during city and port development works. Vessels approaching Świnoujście did, in fact, need to be directed to the correct orientation point along the lower coastline at the Świna estuary. Previously, in 1885, the Greifswalder Oie lighthouse was built on an island of the same name, located near the channel leading to Świnoujście. Construction works on the Świnoujście

lighthouse lasted over three years (1854-1857) and it was eventually switched on 1 December 1857. The lighthouse and its adjoining complex of keepers' quarters was and remains the tallest construction of its type in Europe.

A lantern containing a 2nd order Fresnel lens and an oil burner with several concentric wicks was located in the top section of the lighthouse, above the gallery. The catadioptric lens had a height of 2.25m and diameter of 1.4m. The changing light characteristic was created by a set of covers rotating around the light source. The covers were driven by a clockwork mechanism whose weights were raised several times during the night using a manual winch.

Instructions for keepers dating from that period describe work undertaken by keepers, their specific duties, notes logged in lighthouse journals, etc. Detailed descriptions of activities divided duties among junior and principal keepers.

General instructions contained requirements concerning the following:

- maintaining the light from sunset until sunrise,
- guidelines concerning cleaning the light equipment,
- cleanliness inside the lighthouse,
- staff attire,
- responsibility for official matters, supplies, space, etc.

Principal keeper was responsible for:

- keeping watch,
- maintaining regular watch,
- cleaning the apparatus,
- cleanliness and order in the lighthouse,
- safeguarding supplies,
- frugality in their use,
- maintaining an official log and inventory,
- writing monthly reports on supplies used,
- reporting faults and repair dates,
- maintaining the condition of signaling flags, flagpole and lines,
- logging atmospheric conditions and rainfall following a separate instruction,
- notifying the inspector of any incidents and noting them in the log,
- training junior keepers.

Subsequent sections of the instructions included junior keepers' duties, descriptions of rotary mechanisms, specifications of oil purity and density, rules defining daytime and nighttime duties, principles of observing the surface of the sea, signaling rules following the International Code of Signals (ICS), guidelines on receiving supervisors, organising sightseeing of the lighthouse, etc. In addition the instructions contained drawings and technical sketches of burners, reflectors and other lighthouse equipment [17].

Following technological progress and other achievements in light technology, lighthouses were fitted with the latest light systems. The same was the case for the Świnoujście lighthouse, which received several new burners and optics. Until 1863 the burners were fuelled with rapeseed oil, which was replaced with paraffin until 1918, when electrical optical systems were introduced [19].

The octagonal tower of the Świnoujście lighthouse, together with the spiked domed roof, was 68m tall. The external surface of the tower was finished in yellow brick from the nearby Stettiner Haff brickyard, although the finish turned out to have low resistance to atmospheric conditions following years of use. The tower was considered for renovation works as early as 1869. During the meeting of the Architects' Association in Berlin on 21 November 1869 plans were presented outlining renovation works and principles of constructing scaffolding and a special hoist for lifting building materials onto the gallery [10]. Severe weathering was observed, resulting in bricks falling off, leading to conservation works in 1886 and 1899. Some sections of masonry were weathered and cracked to depths of 0.75m. Unfortunately the renovation works did not improve the situation, and the peeling brickwork continued to be a danger in the vicinity of the tower. As a result a decision was taken to carry out a general overhaul of the lighthouse tower between 1902-1903. During the works the profile of the tower was changed from octagonal to oval, and the weathered bricks were knocked off. The sheet iron gallery balustrade was also changed to an openwork metal construction to reduce wind resistance. Following the renovations and changes, the top section of the lighthouse tower was oval-shaped, becoming a quadrangle and octagon towards the bottom. The external layer was formed by clinker bricks from the Skromberg factory in Sweden, while the dark finish elements originated from the H. Zastrow factory in Wittemberg. In order to reinforce the new construction, the walls were fitted with 29x30cm mortices, which created a strong support linking the old core to the new elevation. The total cost of renovation works was 79,500 marks. The works were overseen by Messrs Riepe, Ruhtz and Jacobi under the direction of the engineer Kohlenberg [11]. The lighthouse continued to function for many years following the renovation works, although its optical

systems were updated. Oil burners were eventually replaced with paraffin lamps and finally electric lights.

Świnoujście was a naval base for many years. All navigational systems continued to operate during the Second World War, and the radio beacon in Chorzelin didn't stop functioning. Observation radars were installed on observation towers in 1943. Raids by the allied forces in 1945 brought severe destruction to the port and the city. Navigational systems were also damaged. Although the lighthouse remained standing, it sustained cracks as a result of nearby explosions of aerial bombs and the walls of the tower required reinforcement [1].

The Świnoujście lighthouse owes its survival of war turmoil to a decision taken by the German lighthouse principal, who disobeyed an order to blow up the tower during the withdrawal of the German troops. Nowadays the story is retold by the current keepers, who in turn heard it from the son of a German keeper visiting Świnoujście [14].

4. POST-WAR YEARS

Between 1945-1954, the seashore and port facilities were administered by the Soviet military authorities (Soviet Baltic Navy). Hydrographical studies in Western Pomerania, especially in Świnoujście, were frequently delayed by personnel changes, difficulties in obtaining experts, and numerous restrictions from commanders of the Soviet Navy stationed in the region. Although the Soviet military authorities permitted a review of the Świnoujście lighthouse by the Poles as early as 1947, it was not handed over to Polish administration at the time⁹. Lighthouse workers and employees of the Navigational Signage Base in Świnoujście attending the lighthouse required Soviet permissions until as late as the 1950s. The Świnoujście lighthouse was finally handed over to the Polish authorities in 1954. The structure and equipment were received from the stationed Russians by Marian Sankowski, a long-term employee at Maritime Authorities in Gdynia and Szczecin, together with Karol Wojnusz, the first Polish principal of the Świnoujście lighthouse¹⁰.

At the point of handover, Polish workers received the following from the stationed Soviet troops:

⁹ In his article "Stationed Soviet troops in Świnoujście after the Second World War", published in *Nautologia* 3-4 from 1999, R. Techman gives a precise date of handover of the Świnoujście lighthouse and radio beacon as 11-17 November 1954. Author's note. [13]

¹⁰ Account of M. Sankowski, retired employee at the Maritime Authority in Szczecin, from 24.10.2007.

- a complete and functioning lighting system consisting of a 3000W electrical bulb and an emergency gas lamp,
- spare optics for the lighthouse and light bulbs,
- a large amount of assorted spare kit,
- calibration equipment removed from a German battleship,
- bottled propane-butane gas fuelling the emergency lighting system [8].

The Świnoujście lighthouse is the tallest along the Baltic coast and one of the tallest lighthouses in the world. The lower part of the tower, up to 16m, has a square cross-section 8.8m per side. Higher up the cross-section becomes octagonal, with the shape becoming regular and culminating with a lower viewing gallery at 22.5m, supported by 24 ceramic brick brackets and surrounded with a brick balustrade with decorative grating. Above the gallery the tower has a circular cross-section with the diameter decreasing from 7.4m to 6.6m. However, the internal diameter of the tower is constant at 4m. This effect was achieved by changing the wall thickness from 1.7m above the lower gallery to 1.3m at the upper gallery. The tower's main gallery is at 60.9m. It is supported by arcaded brick cornices and surrounded by a wrought iron balustrade. The gallery and lantern can be reached by climbing over 300 steps, which are readily scaled by visitors enjoying the glorious views from the upper gallery.

Two-storey living quarters, paneled with red bricks, are adjacent to the north and south sides of the lighthouse tower. The buildings previously contained four-room apartments housing the keepers and their families. Today all keepers live off-site.

The lantern room currently houses cylindrical optics consisting of Fresnel lens 2.9m tall and 1.8m in diameter, with a bi-positional changer containing two large light bulbs 4200W each. The light characteristic is still obtained using rotating shutters which cover and expose the light source, although nowadays they are powered by an electric motor rather than a weight system driven by hand. The optical system has changed little since being put into operation. Modernisation of the optics in the Świnoujście lighthouse, carried out by the Maritime Authority in Gdynia, involved replacing the previous 3000W light bulb with a 4200W one, and replacing the spare gas light source with another 4200W light bulb [4]. However, the light characteristic remains unchanged since the 1930s, as shown in the table below, prepared on the basis of Polish and German Lists of Lights from 2004 and 1935 respectively. The Świnoujście lighthouse (Fig.7) is the only one in Poland to emit red light alongside the usual white, directed southwards, marking a sector dangerous to navigation.

The white light has a range of 24 nautical miles, and the red 9 nautical miles. The light beam remains visible from the sea for 4 seconds and is invisible for 1 second.

Following the opening of a base for reloading chemical raw materials in 1980, the area surrounding the lighthouse suffered severe air and ground pollution. Significant amounts of chemical particles in the air damaged the masonry and led the keepers to abandon the buildings adjacent to the lighthouse tower. The building required renovation. Numerous expert reports were drawn up together with documentation for a general overhaul of all buildings in the lighthouse complex. After many attempts, works were finally commenced in November 1998 following plans prepared by the Monument Conservation Design Workshop in Szczecin [3]. The works involved the dismantling and complete reconstruction of both the lower and upper galleries, re-plastering the interior, cleaning the exterior walls, and filling cracks in the masonry. The roof of the lantern room was repainted and glass paneling replaced. The engine room, currently housing the keepers' duty office, was renovated, and the area surrounding the lighthouse developed. The renovation of adjacent buildings was finished at the shell stage [12].

Thanks to efforts of the Lovers of Lighthouses Association in Szczecin, in 2000 the Świnoujście lighthouse was reopened to visitors for the first time since the 1960s, and it is frequently visited by tourists from Germany and Poland.

5. LIGHTHOUSE MAINTENANCE

The Świnoujście lighthouse has always been maintained by several keepers. In 1920 the team included three keepers and one assistant [9]. Nowadays the Świnoujście lighthouse is one of just two Polish lighthouses maintained by a large group of keepers; the other is located in Gdańsk. The Świnoujście team is five strong. This is because their tasks include not just maintenance of the lighthouse itself, but also of all the navigational lights within the Szczecin-Świnoujście channel. Staff turnover among the keepers is high. Low wages are the most likely reason for them abandoning the profession to look for better paid work. In 2007, the team included the people listed next. Romuald Bauza, principal keeper, says he became a lighthouse keeper by incident. While working as an electrician in the Świnoujście port in 1983, he took an opportunity to move to a keeper's job because the work is easier than the physical labour in the port. In 1994 he became principal keeper. One of the keepers working for Romuald Bauze in 2007 was Marcin Burakowski, the electrician by training and member of a keeper family. He became a keeper in 2003,

and as well as working in Świnoujście he also kept watch at the Karsibór nautical station – just like his father. Marek Matecki has over 25 years of experience; he arrived in Świnoujście from central Poland in 1968 intending to work as a lifeguard for a month. And yet his life took a different turn, so after his stint working at the beach came to an end he took up an electrician's job at the Maritime Authority, since he graduated an Electrical Engineering Technical School. After two years he wanted to take up shift work and moved to a position of a keeper. He started off working at the Karsibór nautical station, and after a while he took up the watch at the lighthouse. The next keeper at the lighthouse at the time was Radosław Bułka. He became a keeper in 2005 after resigning from his job at the Świnoujście shipyard. His duties included monitoring port entrance lights, that is the Młyny and Galeriowa beacons, and keeping watch at the lighthouse. In 2007 the fifth and only keeper whose main duties included monitoring and servicing the Świnoujście light was Marcin Lisowski. He became a keeper in 2000, much like his colleagues partly by accident and partly for economic reasons – he had no other work. He didn't feel hopeful when he took up his job as a keeper and thought it was just going to be a temporary job. And yet life took a different turn; after Romuald Bauza's resignation in 2008 he became principal keeper, and now he manages the other keepers and continues to monitor the light.

The newest keeper at the Świnoujście lighthouse is Mirosław Czupryński, who joined the team in 2008.

Marcin Lisowski and his colleagues believe that the heyday of lighthouses has passed. Automation of lighthouses and navigational aids will most likely result in reducing the numbers of keepers. However, as lighthouses themselves are magnificent buildings arousing great interest among tourists, they are likely to survive and serve maritime education of future generations.

6. CONCLUSIONS

Structures of described beacons have changed over time and were introduced to new characters with better lighting systems. The modernization of the Szczecin-Swinoujscie waterway also required adjustment of the entrance beacons. Some details of these changes are presented in this paper. All these described beacons required constant vigilance and perfect service by lighthouse keepers, whose working conditions were also presented in this paper. Some of the names of lighthouse keepers were mentioned, who have been working here in recent years. The most important navigation sign of Swinoujscie has been, and remains today a lighthouse of over 68 m, which is ranked among the highest in Europe.

THE ŚWINA ESTUARY AIDS TO NAVIGATION CHANGES AFTER 1793

Abstract

The paper presents an evaluation of changes in aids to navigation at the mouth of the Świna which followed after opening the port in 1747. There were described also the beacons and leading lights and the lighthouse, which were founded in 1857. Modernization of the entrance to the port brought changes in the construction of breakwaters, on which in turn appeared new lights. The analysis included also some problems of lighthouse service.

ZMIANY OZNAKOWANIA NAWIGACYJNEGO W UJŚCIU ŚWINY PO 1739 R.

Streszczenie

W opracowaniu przedstawiono ocenę zmian oznakowania nawigacyjnego w ujściu Świny, które następowały po uruchomieniu portu w 1747 r. Opisano tu stawy i nabeżniki wejściowe oraz latarnię morską, która powstała w 1857 r. Modernizacje wejścia do portu przyniosły zmiany w konstrukcjach falochronów, na których kolejno pojawiały się nowe stawy świetlne. Analizie poddano też obsługę latarni i świateł nawigacyjnych.

REFERENCES

- [1] Biranowska-Kurtz A., Świnoujście. Fortyfikacje nowożytne w planach, projektach i rycinach. Szczecin 2005.
- [2] Burkhardt R., Geschichte des Hafens und der Stadt Swinemünde. 1 Teil: Bis zum Jahre 1806. A. Die Vorgeschichte und Hafenbau., B. Die Entstehung und die Entwicklung der Stadt.
- [3] Collections of the Archive of the Maritime Authority in Szczecin
- [4] Drozd W., Ledóchowski M., Dobre oznakowanie nawigacyjne torów podejściowych do portów polskich. Technika i Gospodarka Morska, 10, 1978.
- [5] Landesarchiv Greifswald, Centralblatt der Bauverwaltung No. 37, 10 December 1881
- [6] Landesarchiv Greifswald, Landesamt für Kultur und Denkmalpflege.
- [7] Landesarchiv Greifswald, List of Lights - Prussen's See Atlas. Berlin 1841.
- [8] Landesarchiv Greifswald, Rep. 41 No. 193.
- [9] Landesarchiv Greifswald, Rep. 80 No. 1888.
- [10] Landesarchiv Greifswald, Zeitschrift für Bauwesen. Jahrgang XIX. Berlin 1869.
- [11] Landesarchiv Greifswald, Zentralblatt der Bauverwaltung 17 December 1904.
- [12] Rajchowiak M., Latarnie morskie wybrzeża zachodniego, Agruss, Szczecin 1997.
- [13] Pietkiewicz I., Jak przejmowano w 1954 r. latarnię morską w Świnoujściu. Nautologia 145, 2008.

- [14] Poniecki Z., Fragments of memories of the reconstruction of the Niechorze lighthouse following the Second World War. Manuscript, January 2000.
- [15] The State Archive in Szczecin, Files of the Port Construction Authority in Świnoujście.
- [16] The State Archive in Szczecin, Hafenbauamt Swinemünde.
- [17] The State Archive in Szczecin, Naczelne Prezydium Prowincji Pomorskiej.
- [18] Wasser – und Schiffahrtsamt Stralsund documents.
- [19] Wiedemann G., Deutsche Seezeichenwesen 1850-1990 zwischen Segel - und Container – Schiffsverkehr. DSV – Verlag GmbH. Hamburg 1998.

ILLUSTRATIONS



Fig. 1. The Świna estuary on old postcard
Source: Authors collection

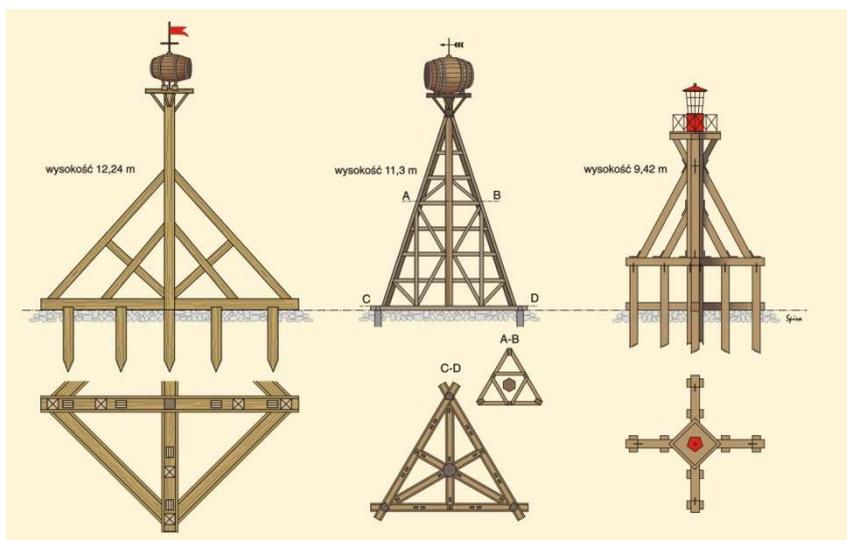


Fig. 2. Reconstruction of wooden beacons from 1805
Source: Authors collection

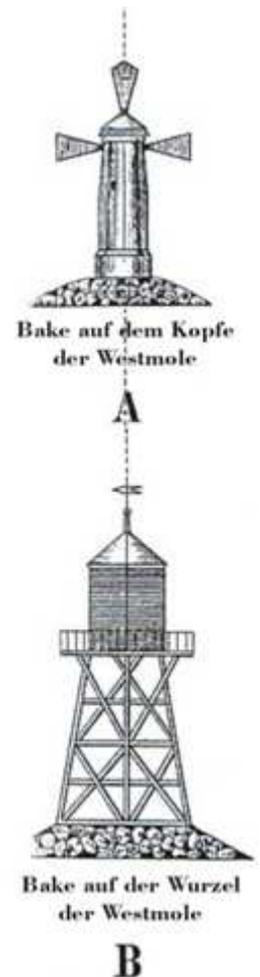


Fig.3. Beacons of entrance leading lines „Młyny”and „Galeriowa”.
Source: Authors collection

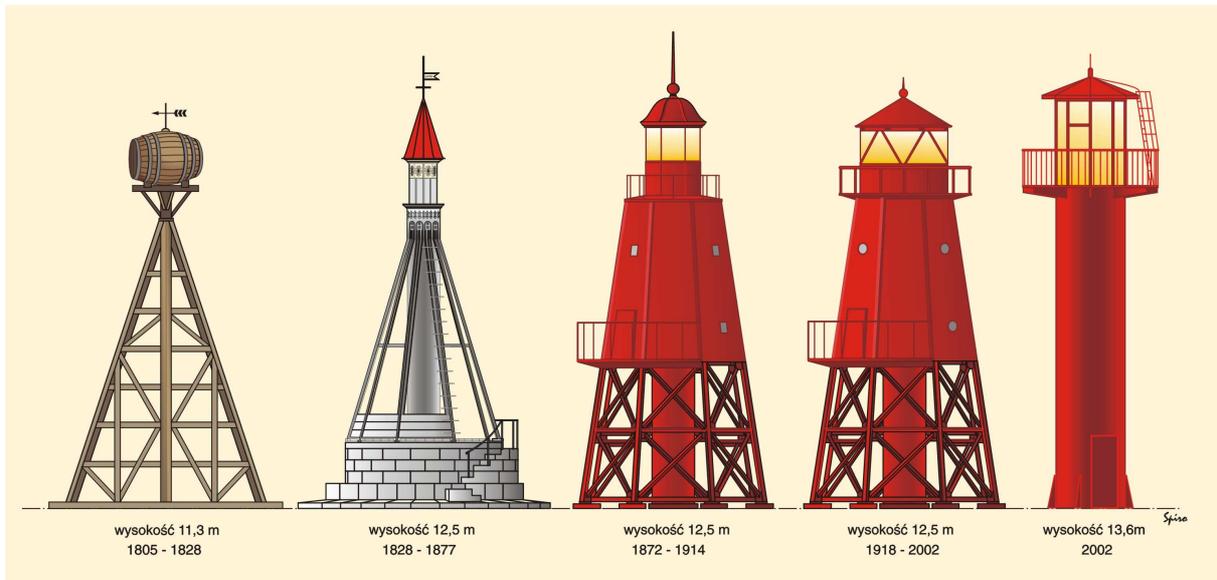


Fig. 4. Reconstruction of entrance beacons of the eastern breakwater

Draw. S. Sierakowski



Fig. 5. The „Winkbake” beacon on copie of old postcard

Source: Authors collection



Fig. 6. Entrance beacon (3) on eastern breakwater

Source: Authors collection



Fig. 7. Świnoujście lighthouse – contemporary view.

Photo. A. Komorowski