Waste collection in seaports in Szczecin and Świnoujście in the scope of ships entering ports

Introduction

In recent years, the European Union has been promoting activities that aim at development of transport in regards to The Concept of Sustainable Development. The objectives of its content are included in the most important European Union document, the White Paper. According to it, the main goal of EU Community should be opening up transport markets to competitive and resource-efficient solutions with the environment-friendly branches of transport. It is said that road transport freight flow should be reduced by 30% (for distances greater than 300 km) by 2030 and by 50% by 2050 in favour of environment-friendly branches of transport (waterborne and road transport). The strategy to design resource-efficient structure of branches of transport is a part of the concept of sustainable development for Europe. Growing importance of maritime transport caused by the development of ecological transport corridors, may have great influence on the development of maritime transport in the area of EU. Actions taken by European countires to support the “blue-industry” in the seas around Europe shall simplify the equal access of ships to waterways. Therefore, it is highly recommended to implement a ‘blue-belt’ and ‘blue-lanes’ which will allow to increase the potential of freight flow between EU ports. In terms of volume, 90% of the freight exchanges of Europe with the rest of the world are seaborne and local maritime oscillate around 40%. Among EU member states and EU candidates there are over 1300 ports providing services for around 3,5 mld tons of freight and 400 mln passengers.

The research object is the problematic nature of waste collection from ships in ports in Szczecin and Świnoujście. In order to fulfill the research the following statistical data from 2009–2013 of ports in Szczecin and Świnoujście, has been accomplished:

- the analysis of ships in ports in Szczecin and Świnoujście according to ships which disposed waste in these ports
- the analysis of ships which had disposed waste at ports in Szczecin and Świnoujście according to location of a previous port.
- The analysis of ships which had disposed waste at ports in Szczecin and Świnoujście according to type of waste.

The problem of disposed waste

Supporting the development of sea transport should have a direct effect on the growing number of ships disposing waste in EU ports. Intensification of seaborne freight may increase the environmental harm caused by ship-sourced pollution. Although modern ships use the latest technologies, they still are the source of threat to ecosystem. There are several activities related to actual ship service, i.e. waste and cargo residues creation that has to be disposed on board or at ports in an appropriate manner. Acting according to the “green ports” concept promotes the usage of the latest technologies on ships. Ships which use the environment-friendly installations (generating less volume of pollution) should be serviced faster and cheaper at seaports.

Concepts related to waste and cargo residues reception from ships are included in several regional and international acts in the field of marine environmental protection. The most important are: MARPOL 73/78 the International Convention, the Helsinki Convention protecting the Baltic Sea Area and EU Directive 2000/59/WE. In compliance with these law regulations, the EU sea ports are obliged to ensure the appropriate technical infrastructure for waste reception from ships. All services provided by sea ports shall be maintained by adequate port reception facilities and without needless delay. All ships which make use of EU port services are obliged to submit information about wastes generated on ships during their voyages. The principal aim of such obligations for ships and ports is to limit (or eliminate) the illegal disposal of wastes at seas.

The law and regulations concerning waste and cargo residues reception from ships in EU ports has been unified. As a result, there has been initiated a search of the best organizational and environmental solutions. Creation and implementation of the appropriate legal instruments worldwide and active participation of international organization like IMO (the International Maritime Organization) shall result in elaboration of optimal solutions regarding waste reception from ships in next few years.

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The number of legal instruments aiming at improving sea environmental conditions rises from year to year. In 2007 HELCOM (The Baltic Marine Environment Protection Commission) adopted Baltic Sea Action Plan (BSAP) to restore ecological status of the Baltic region. This aim shall be implemented by eliminating illegal disposal of wastes at Baltic Sea. Under the resolution MEPC.200(62) and regulations of MARPOL Annex IV, the Baltic Sea was designated as a special area. Thus, all Baltic ports are obliged to fulfill requirements in reference to adequacy (adequate receiving capacity: flow and volume of sewage) of port reception facilities. These regulations apply to passenger ships operating in the Baltic Sea. Under the new regulations the discharge of sewage from passenger ships within a special area will be prohibited for new passenger ships after January 2016 and for existing passenger ships after January 2018.

The analysis of number of ships serviced in ports in Szczecin and Świnoujście in relation to wastes collected

Picture 1 shows the number of ships serviced in port in Szczecin. It includes ships which discharged wastes to port reception facilities.

The study conducted, involving the service of ships in port in Szczecin, has shown that the biggest number of ships was serviced in 2013 and the smallest number in 2011-2012. The analysis of the absolute and relative fixed base growth has depicted that there was an increase in the volume of ships serviced in port in Szczecin by 1233 entities (50.59%) compared to the base year. The biggest fall of the volume of ships serviced, compared to the base year, was in 2012 and it stands at 26.71% (651 entities). Taking as the objective the number of ships serviced in port in Szczecin in the previous year, the results are as follows: the sharp rise was in 2013 (1884 entities, 105.49%) and the steep decline was in 2011 estimating at 29.22% (807 entities).

The research conducted for ships which disposed wastes to port reception facilities in 2009–2013, has shown that only some ships which are serviced discharge wastes (Pic. 1). The biggest number of ships which disposed wastes was observed in 2010. From the total of 2762 ships serviced, 1934 ships disposed wastes (which constitutes 70.54%).

The lowest number of ships which disposed wastes to port reception facilities occurred in 2012: 671 entities which constitutes only 37.57% of the total number of ships serviced in port in Szczecin. The values of absolute and relative fixed base growth has presented that there was a considerable fluctuation in the volume of ships which disposed wastes in port in Szczecin during the period analyzed. The biggest rise, compared to the base year, was in 2010 (215 entities, 12.51%). A great decline in number of ships which disposed wastes was observed in 2011 and 2012. The most notable decrease was in 2012 oscillating at 61% (1048 entities). Taking as the objective the number of ships serviced in port in Szczecin in the previous year, the results are analogous. The biggest rise took place in 2010 and the biggest fall in 2012.

In 2009–2013 the average increase of number of ships disposing wastes in port in Szczecin was 26 ships year on year. The average yearly pace of waste increase (T>0) was 1.47% which means that in 2009–2013 the number of ships that disposed wastes in port in Szczecin was rising with average of 1.47%.

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Picture 2 illustrates the number of ships serviced in port in Świnoujście. It includes ships which discharged wastes to port reception facilities.
The increasing tendency since 2011 of the volume of ships which disposed wastes in port in Świnoujście was observed in the study of 2009–2013. The analysis of the absolute and relative fixed base growth has indicated that in 2013 there was a significant increase in the volume of ships serviced in port of 702 entities (15.12%) compared to the base year. The biggest fall in the volume of ships serviced, compared to base year, was in 2011 and it stands at 36.32% (1686 entities). In 2009–2013 the average increase of number of ships disposing wastes in port in Świnoujście was 175 ships year on year. The average yearly pace of waste increase \((T>0)\) was 3.58% which means that in 2009–2013 the number of ships that disposed wastes in port in Szczecin was rising with average of 3.58%.

The research conducted for ships which disposed wastes to port reception facilities in 2009–2013 has exposed that the number of ships disposing wastes in port in Świnoujście oscillated at a similar level (Pic. 2). The biggest number of ships disposing wastes in port in Świnoujście was in 2013. From the total of 5344 ships serviced, 2061 ships disposed wastes (which constitutes 38.57%). The lowest number of ships which disposed wastes to port reception facilities occurred in 2011 (1778 entities which constitutes 60.15% of the total number of ships serviced in port in Świnoujście).

The analysis of absolute and relative fixed base growth has shown that the biggest rise, compared to base year, was in 2013 (141 entities, 7.341%). The greatest decline in number of ships which disposed wastes was observed in 2011 and it stands at 7.4%.

In 2009–2013 the number of ships which disposed wastes in port in Świnoujście increased by 35 entities year on year. The average yearly pace of waste increase \((T>0)\) was 1.79% which means that in 2009–2013 the number of ships that disposed wastes in port in Szczecin was rising with average of 1.79%.

Picture 3 presents the number of ships which came to port in Szczecin according to location of previous port.

![Pic. 2. The number of ships serviced in port in Świnoujście including ships which discharged. Wastes](Source: self-reported data based on information from ZMPSiŚ SA.)

![Pic. 3. The number of ships which came to port in Szczecin according to location of previous port](Source: self-reported data based on information from ZMPSiŚ SA.)
The research conducted has suggested that in 2009–2013 the most numerous group of ships which disposed wastes to port reception facilities in Szczecin constitutes entities from the Baltic Sea. In 2010, which was the year when the biggest number of ships disposed wastes (1042 entities), 53.88% came from the Baltic Sea area, 37.95% from the European waters of northwest and 8.17% from other regions. In the period analyzed the biggest number of ships disposing wastes to port reception facilities which came from the Baltic Sea area was in 2012. 449 ships came from the Baltic Sea which stands at 66.92% of the total number of ships which disposed wastes in port in Szczecin.

The analysis of absolute and relative fixed base growth has shown that the biggest rise in the number of ships disposing wastes which came from the Baltic Sea, compared to the base year, was in 2010 (the increase of 246 entities, 30.9%). The greatest decline of number of ships which came from the Baltic Sea area and which disposed wastes to ports reception facilities was in 2011 and 2012. The most significant decrease was in 2012 and it stands at 347 entities (43.59%). Taking as the objective the number of ships coming from the Baltic Sea which disposed wastes in port in Szczecin in the previous year, the results has showed that the biggest fall took place in 2011. There was a decrease by 553 ships (53.07%) compared to 2010.

The number of ships which came from the Baltic Sea disposing wastes in port in Szczecin in 2009–2013 increased by average 59 ships from year to year. The average yearly pace of increase (T>0) was 6.68% which means that in 2009–2013 the number of ships coming from the Baltic Sea which disposed wastes in port in Szczecin was rising with average of 6.68%.

The number of ships which came to port in Świnoujście according to location of previous port is presented in the Picture 4.

In 2009–2013 the most numerous group of ships which disposed wastes to port reception facilities in Świnoujście constitutes entities which came from the Baltic Sea. The number of ships disposing wastes in Świnoujście which came from the Baltic Sea area exceeded 83% in each year. In the period analyzed the biggest number of ships disposing wastes to port reception facilities which came from the Baltic Sea area was in 2009. 1746 ships came from the Baltic Sea which stands at 90.74% of the total number of ships which disposed wastes in port in Świnoujście (1920). The smallest number of ships form the Baltic Sea which disposed wastes to port reception facilities was in 2012 (83.63%). In 2013, which was the year when the biggest number of ships disposed wastes (2061 entities), 84.04% came from the Baltic Sea area, 12.72% from the European waters of northwest and 3.2% from other regions.

The analysis of absolute and relative fixed base growth has shown that the number of ships disposing wastes which came from the Baltic Sea, oscillated at a very similar level. Although, there has been observed a decreasing tendency in 2010–2013 compared to 2009. The greatest decline in the number of ships which came from the Baltic Sea area and which disposed wastes to ports reception facilities was in 2011. The number has fallen by 222 entities (12.71%). Taking as the objective the number of ships coming from the Baltic Sea which disposed wastes in port in Świnoujście in previous year, the results has showed that the biggest fall took place in 2010. There was a decrease by 119 ships (6.82%) compared to 2009. The biggest increase of 119 ships (10.46%) was in 2013 compared to the previous year.

The number of ships which came from the Baltic Sea disposing wastes in port in Świnoujście in 2009–2013 decreased by average 3 ships from year to year. The average yearly pace of decrease (T>0) was -0.2% which means that in 2009–2013 the number of ships coming from the Baltic Sea which disposed wastes in port in Świnoujście was falling with average of 0.2%.

Picture 5 shows the number of ships which disposed wastes in port in Szczecin in relation to type of a ship.
The research conducted for 2009–2013 has suggested that the most numerous group of ships, serviced by port reception facilities in Szczecin in this period, were general cargo ships. The biggest number of ships of this type disposed wastes to port reception facilities in 2010 (1372 entities which constitutes 70.94% of the total number of ships disposing wastes). In 2010 the smallest number of general cargo ships disposed wastes to port reception facilities. It was 145 ships what stands at 21.6% of the total number of ships disposing wastes.

The analysis of absolute and relative fixed base based on the number of ships, which were serviced by port reception facilities the most often in Szczecin, has presented that the biggest rise of general cargo ships disposing wastes was in 2010 compared to the base year. The number increased by 211 entities (18.17%). The biggest decline was in 2012 compared to the base year (1016 entities, 87.57%). Taking as the objective the number of general cargo ships disposing wastes in port in Szczecin in the previous year, the biggest increase of 1221 ships (88.99%) was in 2011 compared to 2010.

The second group of ships which was most often serviced by port reception facilities in 2009–2013 in port in Szczecin were bulk carriers. The biggest number of ships of this type disposed wastes to port reception facilities in 2012 (195 entities which constitutes 29.06% of the total number of ships disposing wastes). In the analyzed period of time a systematic increase in the number of tankers was observed. The number of tankers increased by average 22 ships. The average yearly pace of increase ($T>0$) for tankers was 18.75% which means that in 2009–2013 the number of tankers which disposed wastes to port reception facilities in Świnoujście was rising with average of 18.75%.

In 2009–2013 the number of fishing ships was falling by 31.34% and container ships by 22.29% year on year. The number of chemical tankers and passenger ships which disposed wastes to port reception facilities was oscillating at the same level in 2009–2013 with the exception in 2011. 131 chemical tankers (17.8%), out of total number of ships disposing wastes, were serviced in 2011.

Different types of ships which discharge wastes in port in Świnoujście are shown in Picture 6.

In 2009–2013 the most numerous group of ships, serviced by port reception facilities in Świnoujście in this period, were passenger ships. The number of passenger ships disposing wastes in Świnoujście exceeded 70% in each year. The biggest number of ships which discharges wastes to port reception facilities was in 2009: 1520 entities what stands at 78.75% of the total number of ships disposing wastes.

The analysis of absolute and relative fixed base of ships, which disposed wastes to port reception facilities in port in Świnoujście, has presented that the number of passenger ships was maintained at the similar level. However, a slight declining tendency has been observed compared to 2009. The sharpest decline in the number of ships serviced in the port was in 2012 (193 entities, 12.76%). Taking as the objective the total number of ships serviced in port in Świnoujście in previous year, the results has shown that the biggest fall took place in 2011. There was a decrease by 119 ships (6.82%) compared to 2009. The biggest increase of 142 ships (10.77%) was in 2013 compared to the previous year. In 2009–2013 the number of passenger ships which disposed wastes in port in Świnoujście was falling with average of 13 ships year on year. The average yearly pace of decrease ($T>0$) was -0.85% which means that in 2009–2013 the number of passenger ships which disposed wastes to port reception facilities in port in Świnoujście was falling with average of 0.85%.
The second group of ships which was most often serviced by port reception facilities in 2009–2013 in port in Świnoujście consists of general cargo ships. The research has shown that in the analyzed period of time a systematic increase in the number of general cargo ships was observed. It raised by 39 ships year on year. The average yearly pace of increase (T>0) was 20,71% which means that in 2009–2013 the number of general cargo ships which disposed wastes to port reception facilities in port in Świnoujście was rising with average of 20,71%. The biggest number of this type of ships disposed wastes to port reception facilities in 2013 (293 ships what stands at 14,22% of the total number of ships disposing wastes).

In the analyzed period of time a systematic increase in the number of tankers was observed. The number of tankers raised with average 9 ships year on year. The average yearly pace of increase (T>0) was 15,43% which means that in 2009–2013 the number of tankers which disposed wastes to port reception facilities in port in Świnoujście was rising with average of 15,43%.

Results

It is very difficult to estimate the accurate volume of wastes generated by ships during their journeys because it comprises of many different variables. It is problematic as well to elaborate any systemic solutions for waste collection procedure which will be organizationally, environmentally and economically optimal.

The most essential aspect is to promote solutions based on the concept of sustainable development from the environmental point of view. It needs to be emphasized that the organization of waste reception from ships is complicated due to the specificity of marine transport. It is important to enact appropriate international law in order to limit negative effects of marine transport on the environment. Even more important for the Baltic Sea region was the implementation of several law instruments which limit the number of wastes disposal from ships at the Baltic Sea. The research has shown that a significant issue for port in Świnoujście was the prohibition to discharge sewage from passenger ships.

From the economical point of view, it is important to elaborate such economic instruments which would encourage ships to dispose wastes to port reception facilities. Ships calling at ports in Szczecin and Świnoujście have the right to dispose defined types and quantity of wastes under tonnage fee. Thanks to this, the majority of ships should dispose certain quantities of wastes.

The research conducted has shown that not all of the ships calling at ports in Szczecin and Świnoujście dispose wastes every time they call at port. In the period analyzed the biggest number of ships serviced in port in Szczecin was in 2009 (what constitutes 70,54%) and the smallest number was in 2012 (37,57%). The biggest number of ships disposing wastes to port reception facilities in Świnoujście was in 2011(60,15%) and the smallest number was in 2013 (38,57%). It is worth mentioning that in 2013 port in Świnoujście serviced the biggest number of ships. Although, it does not mean that bigger number of ships dispose their wastes compared to total number of ships calling at port. A reason for abovementioned case could arise from the fact that the ships travelling on short voyages do not generate enough wastes to discharge them at port.

From the organizational point of view, the most important issue is to ensure the sufficient number of port reception facilities which can collect wastes from all ships calling at ports in a fast and efficient manner and without needless delays. Thus, it is essential to adjust the technical and operational parameters of reception facilities to the specificity of ships being serviced. Moreover, it is important to take into consideration maritime lanes (location of previous port) of ships serviced in ports. It will help to estimate the need of waste discharges and optimal forecasting.
The research conducted has shown that:

- the most numerous group of ships disposing wastes in port in Szczecin were general cargo ships
- the most numerous group of ships disposing wastes in port in Świnoujście were passenger ships
- the most numerous group of ships disposing wastes in ports in Szczecin and Świnoujście were ships coming from the Baltic Sea area.

Abstract

The research object is the problematic nature of waste collection from ships in ports in relation to ships serviced at ports in Szczecin and Świnoujście. Due to the growing development of sea transport in European Union, it is particularly significant to ensure proper technical infrastructure for waste reception from ships which would be fast and efficient at the same time. The unification of legislation concerning the EU ports has created chances to take actions aiming at elaboration of optimal solutions for wastes reception from ships. The main purpose of the article was to analyze the specificity of ships which dispose wastes at ports in Szczecin and Świnoujście in 2009–2013. The research has been conducted to show how many ships in total discharge wastes to port reception facilities, where do these ships most often come from and what types of ships dispose wastes most often. Such analysis is extremely significant to create optimal environmental, organizational and economical solutions within the scope of waste collection from ships at sea ports.

BIBLIOGRAPHY

7. A. Deja, praca doktorska, Analiza odbioru odpadów ze statków w portach morskich w Szczecinie i Świnoujściu, Uniwersytet Szczeciński, Szczecin 2012.
8. A. Ćwirko, praca inżynierska, Ocena portowych urządzeń do odbioru odpadów i pozostałości ładunkowych ze statków w portach morskich w Szczecinie i Świnoujściu, Akademia Morska w Szczecinie 2014.