European Research Studies Journal
Volume XXIV, Issue 3, 2021

pp. 439-449

Ecological Aspect of Vessel Decommissioning Market

Submitted 29/05/21, 1st revision 24/06/21, 2nd revision 30/07/21, accepted 25/08/21

Dorota Jarząbek[1], Kinga Drwięga[2]

Abstract:

Purpose: *The article shows the needs of vessel decommissioning market. Collected data used in the paper consist period of 2014-2019, before the COVID- 19 epidemy starts. To improve health, safety and life of workers as well as environmental protection related to the decommissioning process, which mainly take place in the South Asian shipyards, the concept of Design for Recycling DfR and Hong Kong Convention are brought up into the daylight. Implementing the DfR is to make the whole decommissioning process as simple and cost-effective as possible. The vessel design stage, with selection of building materials and new technologies used, is the area where constant changes and updates are taking place. Making the Honk Kong Convention alive, will put the duty on the ship owners to dismantle their vessels in shipyards, which are authorized by the adequate Administration of State.*
Methodology/Approach: *Data used for analysis were implemented from UNCTAD. Final deductions has been shown in tables and figures.*
Findings: *Ratification of HK Convention is essential to improve protection of the workers involved in decommissioning process and to protect environment.*
Practical Implications: *Analysis presented in the article underline the need of changes in vessel dismantling market.*
Originality/Value: *Collected data are the basement into the future analyses of the whole decommissioning market area.*

Keywords: *Decommission market, scrap yards, South Asian shipyards, Hong Kong Convention, recycling, ecology.*

Paper Type: *Case study.*

[1]*Maritime University of Szczecin, Poland, ORCID 0000-0003-3745-1932*
d.jarzabek@am.szczecin.pl
[2]*Maritime University of Szczecin, Poland, ORCID 0000-0001-8208-070X*
k.drwiega@am.szczecin.pl

1. Introduction

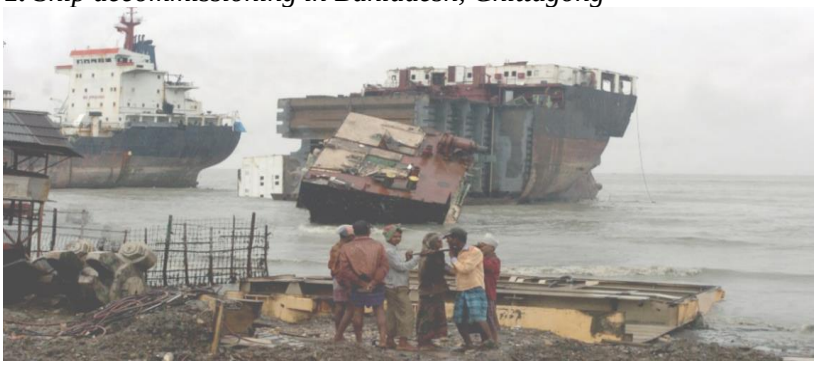
In times of ecology, the ship decommissioning market has become a very important issue that needs to be solved in a safe way both, for the environment and for the people involved in decommission operations of the vessel. To protect marine environment from pollution caused by vessels a number of conventions have been established. That includes conventions like MARPOL, Ballast water management BWM, Ani-fouling Systems on ships AFS and others. Decommission of harmful components from vessels out of service is time-consuming and expensive. Due to developing technologies, up to 1000 vessels are estimated to be decommissioned annually, mainly at the age of 20 to 30, but these includes also younger vessels (e.g., 16-year-old vessels). The decommissioning of such ships takes place mainly in South Asian shipyards, where the scrap industry is the fundamental source of income, and work under conditions without health and safety rules is a threat to the health and life of the workers (Klopott, 2013).

As environmental standards change, more complicated and expensive methods of ship decommissioning are required. This has resulted in ships being scrapped in countries where the law is 'more' liberal in its approach to environmental protection. In order to minimize the environmental impact of the waste at the recycling phase and to make the decommissioning process as simple and cost-effective as possible, the used materials and technologies should be selected already at the design stage. This means implementing the concept of Design for Recycling - DfR (Pawlak, 2016).

2. Decommission of Vessel

The decommissioning industry is difficult and sometimes more unstable than new build ones. Decommission operations are usually carried out on beaches in South Asian countries using the beaching method under working conditions that are far from safety and hygiene (Picture 1).

Picture 1. *Ship decommissioning in Banladesh, Chittagong*



Source: *AFP Photo, Farjana Khan Gohuly.*

Number of out of order vessels at the age over 25 years are often life and health-threatening. The danger is mainly caused by materials used in their construction, such as asbestos or polychlorinated biphenyls (PCBs), perfluorooctane sulfonic acid (PFOS), mercury, cadmium, lead, chromium, organotin compounds, substances that deplete the ozone layer and even radioactive materials (Pawlak, 2016). Some much younger vessels were sold for scrapping simply due to economic and technical reasons. As a result of the necessity to decommission single-hull vessels in 2015, 40% more of tankers than all ships have been scrapped in 2010 (Regulation (EC) No 1726/2003, 2003, Marpol 73/78).

The largest tonnage of new built ships (over 20 million gross tons) have been delivered to the fleet in dry bulk sector. Same sector recorded the highest level of scrapping (over 8 million gross tons), which resulted of an 2.9 % net growth of the dry bulk fleet. Tanker sector recorded less activity in the new built fleet, but also less scrapping, which resulted in almost 5% net growth of the fleet. Merchant navy recorded more scrapping than new-built ships, which has resulted in a negative growth rate in this sector (UNCTAD, 2018).

The largest scrap yards in the 1970s were located in southern Europe and the United States. Nowadays, 80% of the total scrapped tonnage coming out from South Asian yards. Decommissioning of old ships takes place mainly in Asia. In 2015, about 95% of all dismantled ships took place in Bangladesh, China, India and Pakistan. Bulk carriers were dismantled the most with 73% of gross tonnage. Among other types of ships, Pakistan had the highest share of tankers, India container ships and Bangladesh offshore vessels (Table 1 and Figure 1).

Table 1. *Ship decommissioning in the years 2014-2017 (gross tonnage)*

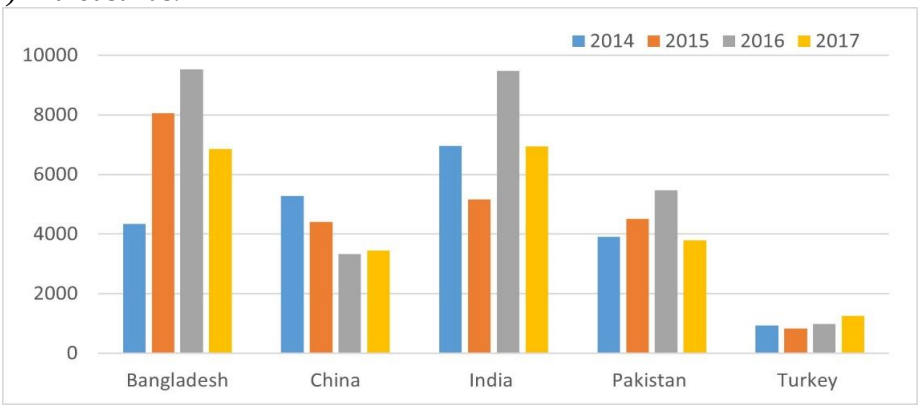
Year	**2014**	**2105**	**2016**	**2017**
India	**6 966 362**	5 167 041	9 477 130	**6 938 028**
China	5 281 169	4 414 908	3 331 546	3 445 145
Bangladesh	4 346 296	**8 050 930**	**9 530 264**	6 869 287
Pakistan	3 909 134	4 519 769	5 480 340	3 795 033
Turkey	933 073	834 665	980 662	1 257 082
Othes	716 455	168 460	87 575	383 482
Total	**22 431 039**	**23 339 989**	**29 134 953**	**22 915 519**

Source: *https://unctad.org/en/PublicationsLibrary/rmt2018_en.pdf*

Figure 1 shows the GT tonnage of ships sold for demolition. 2016 was a record year in terms of the number of scrapped vessels. The situation changed significantly in 2018 (Figure 2), when only the Bangladesh noticed the highest sales of recycled ships in comparison to other South Asian countries.

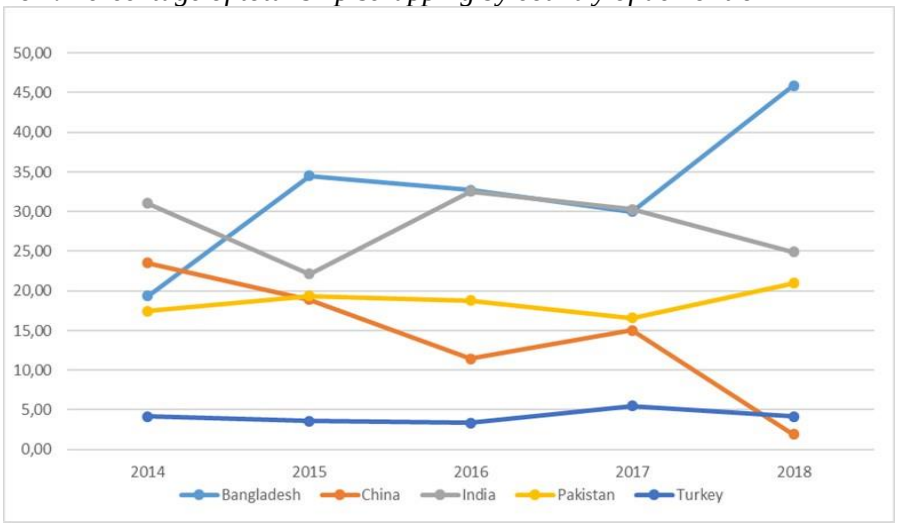
According to UNCTAD, in 2017 ship dismantling was almost a quarter less than in 2016. The scrapping of bulk carriers and container ships slowed down, but the recycling of tankers increased (Table 2).

Figure 1. *World ship disposals and losses by country of demolition gross tonnage (GT) in thousands.*



Source: *United Nations Conference on Trade and Development (UNCTAD) database*

Figure 2. *Percentage of total ship scrapping by country of demolition*



Source: *Own study.*

Table 2. *Ship scrapping tonnage declared in 2017 (in thousands of GT)*

	India	Bangladesh	Pakistan	China	Unknown – Indian subcontin	Turkey	Other/ unknown	World total
Oil tankers	1 935	3 245	0	1	749	12	40	5 982
Dry bulk carriers	1 062	1 460	2 527	2 464	470	139	0	8 123
General cargo ships	420	155	102	82	0	312	108	1 178
Container ships	1 755	892	748	650	140	309	3	4 498

Gas carriers	145	59	0	4	0	173	5	387
Chemical tankers	109	35	0	2	44	0	6	196
Offshore vessels	318	57	77	90	157	128	404	1 230
Ferries and passenger ships	165	35	5	0	0	51	21	277
Other	415	321	0	152	0	133	23	1 044
Total	**6 323**	**6 260**	**3 459**	**3 445**	**1 560**	**1 257**	**611**	**22 916**

Source: *https://unctad.org/en/PublicationsLibrary/rmt2018_en.pdf*

At the beginning of 2017, the average age of the merchant fleet was 20.6 years, a slight increase on the previous year (2016 - 20.3 years). Less new vessels than at the beginning of the decade, together with similar scrapping rates, have led to an aging of the fleet. However, compared to historical averages, the world fleet is still relatively young, especially in the bulk and container vessel segments. In 2016, shipbuilding activity dropped by 1.7% and ship decommissioning increased by 25.7%. A higher increase in stripping led to a slowdown in the growth of the world fleet.

Vessels in developing economies are on average 10 years older than those in developed countries. Among the different types of vessels, the oldest are general cargo vessels (more than 25 years old) and the youngest are bulk carriers (less than 9 years old). The age of the fleet also reflects the increase in the size of the vessel. Container vessels in particular have increased their capacity in recent decades. Containers built 15-19 years ago were much smaller than bulk carriers built at the time. Nowadays containers are the largest.

Shipbreaking process is associated with adverse impacts on ecosystems and health risks in the workplace. Scrapping is a segment of the maritime supply chain dominated by developing countries due to several factors, including lower labor costs, a high proportion of steel used from recycled ships for domestic production and sometimes poor enforcement. Most of the tonnage sold for demolition concerns tankers, bulk carriers and container ships. The data collected by UNCTAD for the period 2014-2018 show that, despite the shipbreaking yards in Europe, shipbreaking in South Asian countries is still developing and, comparing Tables 2 and 3 in particular, the demolition of tankers increased significantly in one year.

The increase in scrapping recorded in the second quarter of 2018 is a result of low freight rates, high scrap prices and an increasingly older fleet. Since the beginning of the year, tankers with a total capacity of 8 million dwt have been scrapped, including 17 VLCC tankers, 3 Suezmax and 14 Aframax. This is the highest result since 1982. In the second quarter of 2018, the average age of the scrapped unit was 20 years, although most of them were in the 17-18 year category. In recent years, there has been a large expansion of the tanker fleet, which resulted in an increase in the

scrapping of older vessels. In 2019 Bangladesh, India, Pakistan and Turkey maintained their leading position in this segment of the maritime supply chain. However, for the first time, Bangladesh became a major country of demolition. 2014-2018 data show that China and India, with a lesser extent Turkey, show a decrease in scrapping activity. Recent regulatory changes together with voluntary industry initiatives to make ship recycling more environmentally friendly and safe for people explain these trends (Table 3).

Table 3. *Reported tonnage sold for demolition by major vessel type and country of demolition, 2018 (Thousand gross tons)*

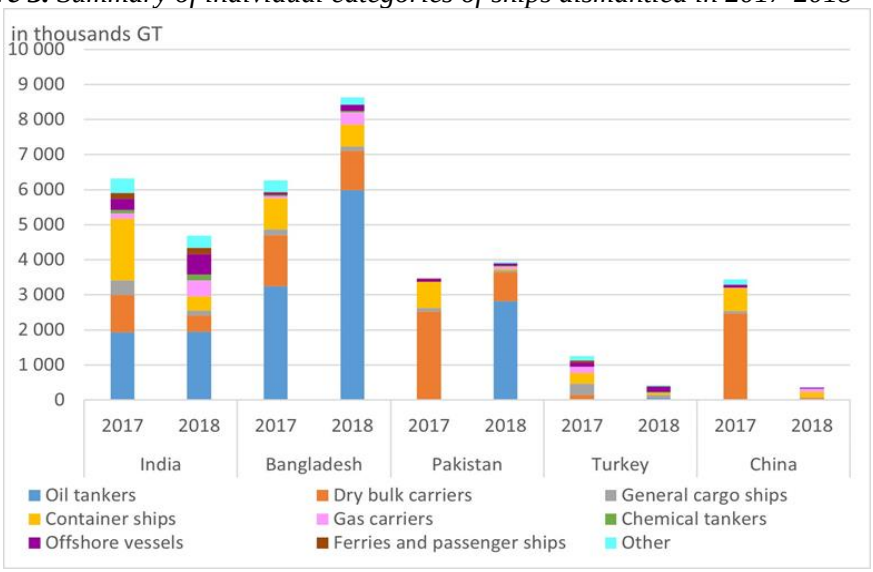
	Bangladesh	India	Pakistan	Turkey	China	World total	Percentage
Oil tankers	5 989	1 946	2 824	66	14	10 884	59.5
Bulk carriers	1 115	465	829	18	53	2 495	13.6
General cargo ships	127	149	57	65	5	405	2.2
Container ships	620	402	38	54	152	1 284	7.0
Gas carriers	347	455	48	3	97	951	5.2
Chemical tankers	43	167	28	28	2	268	1.5
Offshore vessels	181	581	72	143	30	1 156	6.3
Ferries and passenger ships		171		14		185	1.0
Other	210	353	47	29	5	673	3.7
Total	8 632	4 690	3 943	418	359	18 300.9	100
Percentage	47.2	25.6	21.5	2.3	2.0	100	

Notes: *Propelled seagoing vessels of 100 gross tons and above. Estimates for all countries available at http://stats.unctad.org/ shipscrapping.*
Source: *Clarksons Research.*

The annual Review of Maritime Transport show increase number of tankers sold for scrapping especially in Pakistan and Bangladesh, while the number of other ships to be recycled decreased as shown in Figure 3.

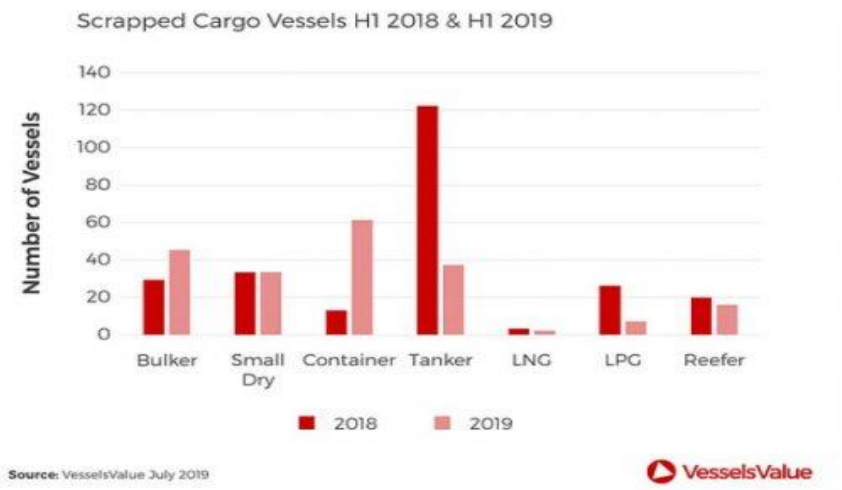
The Vessels Value summary (Figure 4) shows, that the number of ships sold for demolition in the first half of 2019 fell in almost all sectors, compared to the same period the previous year. A total of 201 cargo ships were sold for demolition during this period, of which 75% were scrapped in Bangladesh or India and Bangladesh received the majority. Note these figures were 18 percent lower compared to the first half of 2018. The number of tankers scrapped in the first half of 2018 was three times higher than the number of tankers scrapped in the first half of this year, showing a clear decrease in the number of tankers scrapped this year. The small dry sector was the only sector that remained consistent in terms of the number of ships scrapped compared to previous year.

Figure 3. *Summary of individual categories of ships dismantled in 2017-2018*



Source: *Own study.*

Figure 4. *Scrapped cargo vessels H1 2018 & H1 2019*



Source: *https://worldmaritimenews.com/archives/280926/vesselsvalue-201-cargo-ships-scrapped-in-first-half-of-2019/*

Prediction is to remain low demolition of tankers in 2019. Among the biggest vessels scrapped at that time were: 3 Panamax, 1 Aframax, 5 Suezmax and 4 VLCC. This is a clear contrast to 2018, when more than 150 tankers were scrapped. Lower scrapping prices discouraged demolition. From March to October, the price per ton of scrap metal dropped from $435 to $375, this situation may change from the second quarter of 2020. Global oil consumption is dropping and this is likely to lead

into a slow increase in demand for oil tankers next year. Such situation may increase the scrapping number of these units.

In the first quarter of 2019, 142 vessels of a total number of 181 decommissioned vessels were sold to beaches in South Asia, where the whole decommission process took place under conditions that cause damage to both, human health and the environment. On the beaches of Bangladesh, three workers lost their lives and four were seriously injured during the decommissioning of ships within three months. There is lack of data available on serious accidents from India or Pakistan.

As above mentioned, ship decommissioning is undertaken using simple methods and without any specific facilities. The work is carried out by unskilled workers, using very basic tools. An accident can happen at any time because there are practically no measures to protect the environment and the workers from harmful substances from decommissioned vessels.

The action described is unethical as the costs (e.g., health) associated with such kind of ship recycling are borne by the population living in poor Asian regions. In developed countries this kind of decommission is unacceptable. Therefore there were voices against beaching and new international rules on safe and environmentally friendly ship recycling has been put in life.

3. Hong Kong Convention, European Parliament and Council Regulation

For the sake of the environment and those working in shipyards like in South Asia, a number of guidelines have been developed not only for ship owners but also, and most importantly, for the ship recycling yards, which are included in the international convention signed in 2009 in Hong Kong. The Hong Kong Convention (HKC) fully focused on the safe and environmentally friendly recycling of ships is not yet in force. This convention refers to the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (BC). The HKC covers the design, construction, operation and maintenance of ships and the preparation for ship recycling in order to promote safe and environmentally friendly recycling, without compromising the safety and operation of ships.

The Convention specifies that vessels to be recycled are required to maintain an inventory of hazardous materials specific to each ship. In the meantime, ship recycling yards are required to submit a "Ship Recycling Plan" setting out the recycling method of each ship, its particulars and inventory. The IMO has concluded that 13 participating countries represent 29.42% of the worldwide shipping tonnage. (https://safety4sea.com/germany-enters-the-hong-kong-convention/ 17.07.19).

The HKC apply to ships under the flag of a State Party to this Convention and to ship recycling facilities located in that State. A significant contribution to the development of the HKC, in addition to the Basel Convention, was made by a

document adopted by the European Parliament entitled "A European Union strategy for better ship dismantling".

Ships sailing under the flag of an EU will have to maintain an inventory of any hazardous materials kept on board throughout their lifetime. While new ships sailing under the flag of UE are required to establish such a list immediately, existing ships will have to establish such a list within 5 years, unless those ships are sent for decommission earlier (Romowicz, 2017). This list shall be updated and completed before the ship is sent for recycling in such a way as to ensure that all hazardous materials and waste carried on board will be managed by a selected recycling ship yard.

Any vessel under the HKC may be inspected for the requirements of the Convention, at any port or terminal of a State Party to the Convention other than its flag State. The documents required by the HKC are: International Certificate on Inventory of Hazardous Materials and International Ready for Recycling Certificate. Lack of such certificates may cause the vessel additional specific inspection or she may be detained in port.

Further regulation of the HKC refers to the preparation of a ship for recycling. Regulation 8 provides that only authorized Ship Recycling Facilities (SRF) may carry out recycling according to Ship Recycling Plan (SRP). SRP is made separately for specific recycling area of each vessel which is not covered by regulations of SRF. Vessel recycling area, which is not covered by SRF regulations, has her own separate SRP. The purpose of the inspections made by adopted organizations, is to check whether the lists of hazardous materials meet the relevant requirements of Regulation 1257/2013. Upon successful completion of the final survey of a ship, a Ready for Recycling Certificate should be issued by the administration or an authorized organization.

This certificate shall be accompanied by an inventory of hazardous materials and a ship recycling plan. The impact of cargo residues, oils and sediments should be minimized before any recycling takes place. Caution should be taken in the case of tankers. States Parties of HKC should also have national rules on the recycling. The administration must issue an International Ready for Recycling Certificate before any work starts. It should be highlighted that SRFs undertake not only to decommission old ships but also to storage, process and re-use materials obtained from ships. When the recycling is completed, SRF declares the Statement of Completion of Ship Recycling (Koziński, 2014).

Each State Party is required to have full regulation in order to effectively prevent accidents and damage occurring in ship recycling processes. It shall also require action to increase the safety and health protection of human health throughout the life of a ship, including when it is taken out of service and recycled. The Convention requires each State Party it to develop systems for the effective control of ships

under its flag and to introduce a system of survey and certification. The development of an authorization scheme for ship decommissioning companies is an extremely important commitment of the HKC Parties (Pawlak, 2016).

In November 2016, The European Maritime Safety Agency has published best practice guidelines on the inventory of hazardous materials for operators, ship owners and national authorities. Port authorities in EU Member States will inspect ships to ensure that they hold a ready for recycling certificate or a valid inventory of hazardous materials on board.

From 31 December 2018,merchant navy vessels under the flag of an EU, may only be recycled in authorized ship recycling facilities listed in the European list of ship recycling facilities (https://ec.europa.eu/environment/waste/ships/).

4. Conclusion

At present, the main problem and goal is to "civilise" the entire process of ship decommissioning and stop the so-called beach recycling in India, Bangladesh and Pakistan. The recycling of large ships has moved there for economic reasons, because a number of factors determine when a ship is to be decommissioned, such as the cost of maintaining an ageing fleet, freight rates and scrap price. This price, depends on the demand for recycled steel in the region concerned and on the cost of infrastructure to protect workers and the environment. In the South Asia region, unfortunately, neither workers' rights nor environmental requirements are respected. Currently there are 30 approved ship recycling facilities in the EU and 4 in third countries, with 3 yards in Turkey and 1 in the US.

In July 2019, at the Faculty of Chemistry of the Adam Mickiewicz University in Poznań, a meeting of the Working Group on the "Green Shipyard in Poland" project was held. The Green Shipyard project, as one of the pillars of the Batory programme, is an innovative, interdisciplinary project, combining an economic approach with the highest requirements of environmental protection. The Green Shipyard is based on the concept of circular economy, which provides for the implementation of technology for the full, environmentally friendly recycling of ships and the management of all their components.

In 2018, a total of 744 large ocean-going merchant ships were sold to scrap yards, of which 518 were decommissioned on beaches in South Asia. In the first half of 2019, 201 cargo ships were sold for scrapping. where three quarters of this tonnage went to the scrap yards in Bangladesh and India, with the majority going to Bangladesh. Lower scrapping prices noted in 2019 discouraged demolition. This trend may change from the second quarter of 2020. As world oil consumption is falling, it is likely to lead to a slow increase in demand for oil tankers next year. Such situation may increase the number of units scrapped.

References:

Hong Kong Convention – Międzynarodowa konwencja o bezpiecznym i przyjaznym dla środowiska recyklingu statków, 2009.

Klopott, M. 2013. Rynek demontażu statków morskich – zarys zagadnienia. Logistyka 6/2013 s.875-884.

Koziński, M.H. 2014. Recykling statków w prawie Unii Europejskiej. Zeszyty Naukowe Akademii Morskiej w Gdyni, Nr 87, 54-83.

Marpol 73/78 International Convention for the Prevention of Pollution from Ships.

Pawlak, M. 2016. Projektowanie zorientowane na recykling jako strategia skutecznego i bezpiecznego recyklingu statków wycofanych z eksploatacji. Autobusy: technika, eksploatacja, systemy transportowe. Tom R. 17, nr 4, 39-43.

Regulation (EC) No 1726/2003 of the European Parliament and of the Council of 22 July 2003 amending Regulation (EC) No 417/2002 on the accelerated phasing-in of double-hull or equivalent design requirements for single-hull oil tankers. Official Journal of the European Union, L249 01.10.2003.

Regulation (EU) No 1257/2013 of the European Parliament and of the Council of 20 November 2013 on ship recycling and amending Regulation (EC) No 1013/2006 and Directive 2009/16/EC, Official Journal of the European Union L 330/1, 10.12.2013.

Romowicz, M., Madejska, B.E. 2017. Recykling statków - nowe decyzje wykonawcze Komisji UE. At: https://www.portalmorski.pl/prawo-polityka/37351-recykling-statkow-nowe-decyzje-wykonawcze-komisji-ue.

UNCTAD, Review of Maritime Transport 2018, United Nation Publication, Geneva, 2018.

UNCTAD, Review of Maritime Transport 2019, United Nation Publication, Geneva, 2019

https://safety4sea.com/germany-enters-the-hong-kong-convention/.

https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx.

https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=89492.

https://safety4sea.com/germany-enters-the-hong-kong-convention/ 17.07.19.

https://ec.europa.eu/environment/waste/ships/.

https://worldmaritimenews.com/archives/280926/vesselsvalue-201-cargo-ships-scrapped-in-first-half-of-2019/.