Underwater noise emissions from Baltic Sea shipping in 2024

Baltic Marine Environment Protection Commission

Maritime activities

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Underwater noise emissions from Baltic Sea shipping in 2006-2024

Authors: Jukka-Pekka Jalkanen[1], Lasse Johansson[1], Elisa Majamäki[1] **with additional contributions from work of** Mattias Liefvendahl[2,3], Rickard Bensow[2], Peter Sigray[3], Martin Östberg[3], Ilkka Karasalo[3], Mathias Andersson[3], Heikki Peltonen[4] and Jukka Pajala[4]

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Key Messages

1. **Underwater noise emissions from ships, calculated as noise energy, have remained stable a decrease of -2% was predicted in the 63 Hz 1/3 octave band in 2024 compared to 2023.**

2. **Liquid tankers, bulk cargo, and containerships combined are responsible for over 72% of vessel noise** (37%, 18% and 17%, in 63 Hz 1/3 octave band).

3. Applying similar performance metric as for energy efficiency (in mass per ton nm cargo carried), unit noise energy emissions, over the 63 Hz 1/3 octave band considered, the **LNG tankers emit most noise energy per tonne nm** (1055 millijoules ton^{-1} nm^{-1}, -6%) and **general cargo ships are the most silent ones** (178 millijoules ton^{-1} nm^{-1}, -5%).

4. The **noise efficiency of ships was slightly improved in gas tanker** (2023→2024: 603→544 milliJ tonnne^{-1} nm^{-1}; -10%), **roro cargo** (2023→2024: 487→455 milliJ tonne^{-1} nm^{-1}; -7%), and **bulk cargo** (2023→2024: 235 →235 milliJ tonne^{-1} nm^{-1}; -0.1%) and **containerships** (2023→2024: 382 →376 milliJ tonne^{-1} nm^{-1}; -1%) **segments**.

5. **Noise efficiency of reefer cargo ships deteriorated** (2023→2024: 211→226 milliJ tonne^{-1} nm^{-1};+7%), **tankers** (2023→2024: 262→272 milliJ tonne^{-1} nm^{-1};+4%) and **ropaxes** (2023→2024: 608→625 milliJ tonne^{-1} nm^{-1};+3%).

6. Noise energy emitted by **cruise** ships decreased by -36% (63 Hz 1/3 octave band) when compared to 2023. However, at the same time, cruise ship travel distance in 2024 were +10% larger than that in 2023 and average cruising speeds were on average 61% of their design speeds.

1. Underwater noise emissions from ships

The values listed in this document represent noise energy emitted, and it cannot be taken as representative of shipping noise experienced by marine animals. Emission report of underwater noise should be taken in a similar manner to the emissions of atmospheric pollutants. They indicate the quantity emitted at the pollution source and consecutive impact assessments should be based on pollutant dispersion, or in case of noise, noise propagation modeling.

This work considers the impact of ambient conditions on modeled quantities, and the methodology is described in a recent paper (Majamäki et al., 2025).

1.1. Modeling of noise sources

The STEAM (Jalkanen et al., 2009, 2012, 2018; Johansson et al., 2013, 2017) emission modeling system was used for this work, which incorporates the Wittekind noise source module for ships (Wittekind, 2014). The noise model is based on vessel technical properties, and it describes separately contributions from vessel cavitation and machinery (Figure 1). Cavitation occurs when a fast-rotating propeller generates a large pressure difference between different sides of propeller blades and vacuum forms on the backside of the blade. Gas bubbles are formed which collapse generating loud noise. The noise quantities reported in this document include noise emissions at three specific frequency bands, 63, 125 and 2000 Hz, which are found to be relevant for animals. The two lowest frequencies are in the hearing range of several fish species and 2 kHz band is seen relevant for marine mammals, but it is outside the hearing range of most fish.

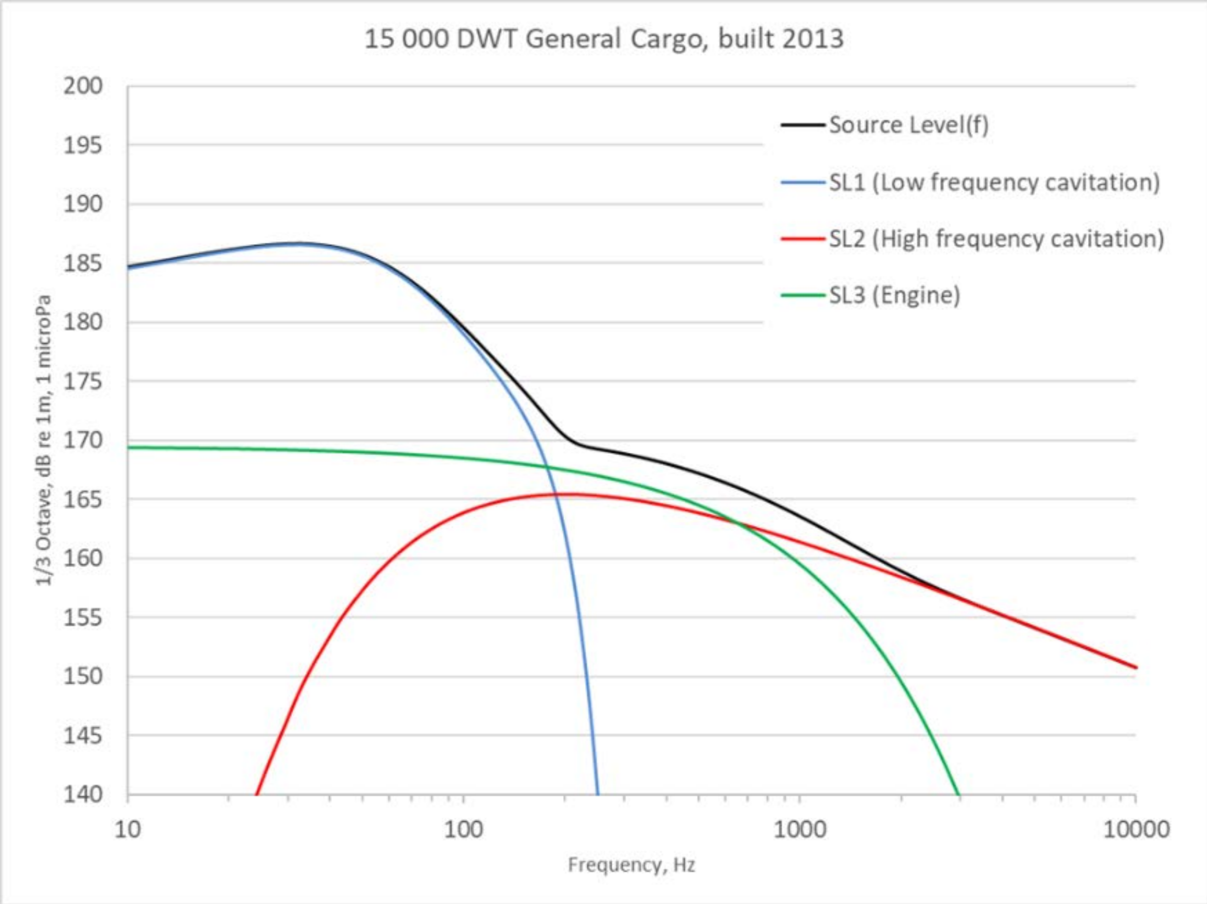

Figure 1 Noise contributions of a cargo ship according to Wittekind (2014). Low and high frequency cavitation contributions (Blue, Red lines) describe the contributions from vessel propeller whereas engine noise is depicted with Green color. Total source level is indicated with the Black line.

The time integration of noise emissions yields noise energy, which is reported in Joules. In Table 1, noise emitted is given as sum of energy emitted to water as noise in three different frequency bands (63, 125 and 2000 Hz). This allows cumulative description of noise in contrast to the logarithmic decibel scale which is used to describe instantaneous values.

The source levels (dB) obtained from the Wittekind formulation are related to the power emitted:

$SL[dB\ re\ 1m, 1\ \mu Pa] = 10log_{10}\frac{P}{P_{ref}}$where

$$P_{ref} = \frac{4\pi p_{ref}^2}{\rho c}$$

with p_{ref} is 1 µPa, ρ and c are water density and speed of sound in water. With this, the total emitted power is accumulated over time from all M ships in area A:

$$P_k^{tot}(t) = \sum_{m=1}^{M} P_{k,m}(t)$$

The sound power $P_{k,m}(t)$ in Joules per second describes the emitted energy of a single ship. This is summed up over time and over all ships, which yields noise energy emitted over an area. The calculation of noise source maps is described in (Jalkanen et al., 2018). It should be noted that the accumulated energies of Table 1 are totals for all the Baltic Sea area and cannot be converted back to source levels of individual ships. Thus, the noise source maps reported in this document are a visual aid than input data for noise propagation modeling. The annual summaries for the earlier years can be found in Appendix.

Table 1. Emissions of noise energy from Baltic Sea shipping in 2023. Noise energy is given in gigajoules. Unit emissions (noise index) are calculated by dividing the energy contributions from the 63 Hz 1/3 octave band and by the transport work.

	[GJ]	[GJ]	[GJ]	[10^6 tonne nm]	[millijoules tonne^{-1} nm^{-1}]
	187.8 (-2.1%)	54.5 (-1.1%)	0.9 (-1.0%)	611396.4 (-2.1%)	
	109.2 (-6.5%)	31.2 (-7.8%)	0.5 (-6.9%)	359529.9 (-2.6%)	
	46.2 (-6.2%)	12.6 (-6.3%)	0.2 (-5.6%)	141814.5 (-1.5%)	
	27.1 (+29.3%)	9.1 (+31.3%)	0.1 (+25.2%)	87286.1 (-1.8%)	
	7.3 (-6.2%)	2.1 (-7.2%)	0.0 (-4.3%)	21918.5 (+3.5%)	
	0.9 (-19.0%)	0.3 (-20.2%)	0.0 (-18.0%)	4260.9 (-6.4%)	
	10.7 (+4.9%)	4.2 (+4.8%)	0.1 (+4.7%)	17194.3 (+2.1%)	624.5 (+2.7%)
	0.4 (-22.6%)	0.2 (-19.6%)	0.0 (-18.0%)	1414.0 (-16.7%)	274.0 (-7.1%)
	11.3 (-11.6%)	3.3 (-7.0%)	0.0 (-5.8%)	24934.0 (-5.3%)	454.5 (-6.6%)
	33.6 (-6.9%)	9.3 (-1.6%)	0.2 (-1.8%)	142833.0 (-6.8%)	235.0 (-.1%)
	11.8 (-1.9%)	2.9 (-.2%)	0.1 (+.5%)	66073.3 (+2.8%)	178.2 (-4.6%)
	33.0 (+7.5%)	12.2 (-2.3%)	0.2 (-2.2%)	87702.6 (+9.1%)	376.5 (-1.4%)
	0.8 (+5.7%)	0.6 (+6.4%)	0.0 (+6.1%)	3392.6 (-1.4%)	225.9 (+7.1%)
	70.6 (-.1%)	18.6 (+1.5%)	0.3 (+.4%)	259593.7 (-3.7%)	272.1 (+3.8%)
	9.8 (-6.8%)	1.8 (-5.3%)	0.0 (-4.6%)	9330.0 (-.5%)	1055.4 (-6.3%)
	1.3 (-14.2%)	0.3 (-5.6%)	0.0 (-4.2%)	2321.2 (-4.8%)	543.9 (-9.8%)
	0.0 (-45.5%)	0.0 (-42.9%)	0.0 (-42.2%)		
	3.6 (-36.4%)	0.8 (-28.1%)	0.0 (-20.4%)		
	0.1 (-3.6%)	0.1 (-12.1%)	0.0 (-10.8%)		
	0.1 (+4.1%)	0.1 (+11.6%)	0.0 (+11.9%)		

In general, the three largest emitters of noise energy (63 Hz 1/3 octave band) are the liquid tankers (71 GJ; 37%), bulk carriers (34 GJ; 18%), and containerships (33 GJ; 17%), which together contribute over 72% to vessel noise emissions at 63 Hz band (Figure 2). However, they are also responsible for 80% of the transport work in the Baltic Sea area. If noise efficiency is considered (analogous to energy efficiency reported in grams of CO_2 emitted per tonne^{-1} nm^{-1} cargo carried), LNG tankers have largest unit emissions of noise (1055 millijoules per tonne^{-1} nm^{-1}), whereas lowest unit noise comes from general cargo ships (178 milliJ tonne^{-1} nm^{-1}). Figure 2 indicates the noise energy emission shares of various types of ships at 63 Hz frequency band and Figure **3** shows the share of transport work of different ship types.

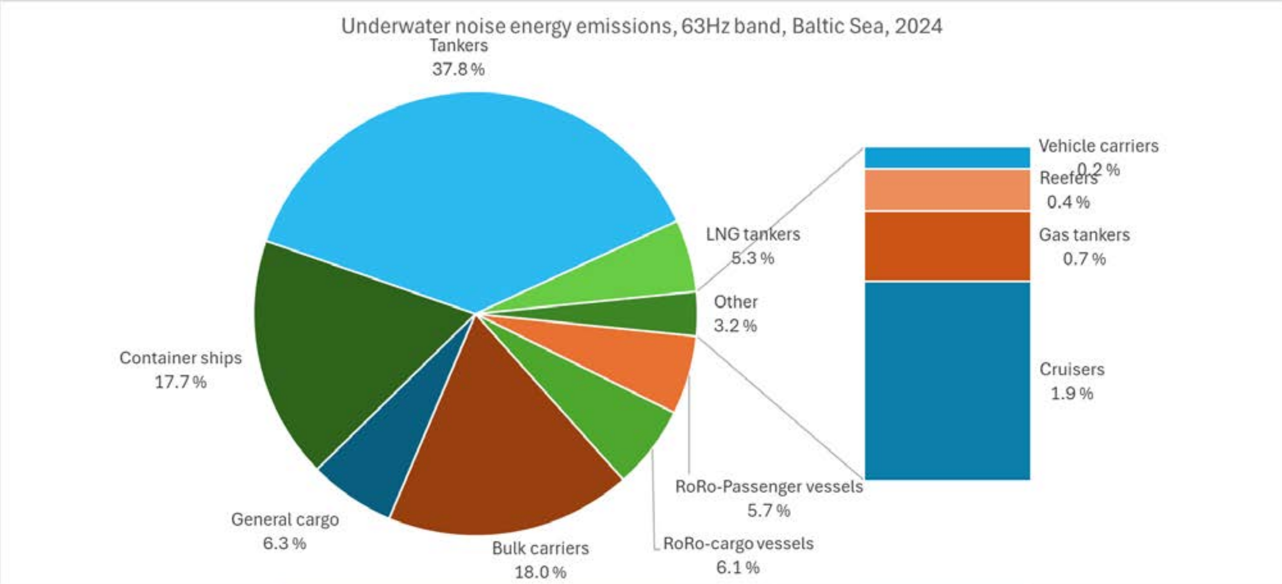

Figure 2 Share of emitted noise energy from various vessel types at 63 Hz band during year 2024. Note, that the tankers include all types of liquid (Crude, Product, Chemical) tankers.

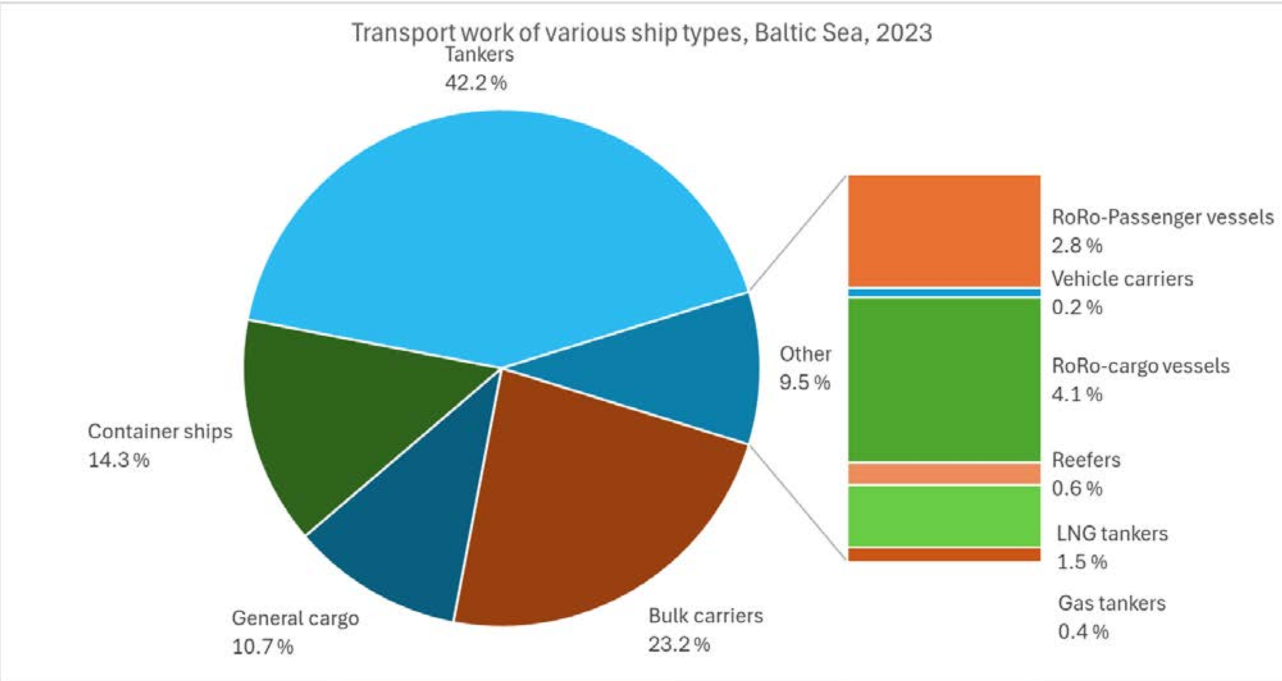

Figure 3 Share of total transport work of various ship types in the Baltic Sea during 2024.

2. Temporal evolution of noise emissions of the Baltic Sea fleet

The development of underwater noise emissions in the Baltic Sea shipping fleet during the time of 2006-2024 is illustrated in Figure 4. Noise energy emissions have not returned to the pre-pandemic levels (-8.5%) and the overall trend is decreasing.

Noise emissions are impacted by vessel operating speed, which has decreased during the same period (Figure 5). This figure plots the relation of average cruising speed to vessel design speed. A value of 1.0 indicates that a vessel would operate at its design speed, but a value lower than that indicates slower operation speed. For most of the ship types, the speed trend over the study period is negative (Figure 6), indicating slower operating speeds. For example, the average cruising speed of a containership in 2006 was 16.6 knots, but in 2024 this decreased to 13.2 knots. There are some ship types, most notably icebreakers and LNG tankers, for which the opposite is true (Figure 7), and ships of these types operate at higher speeds than in 2006. In the case of LNG tankers, the relative speed has increased from below 0.5 to 0.7, which corresponds to average speed changes from 8 to 12.8 knots over the period of 19 years in the Baltic Sea area.

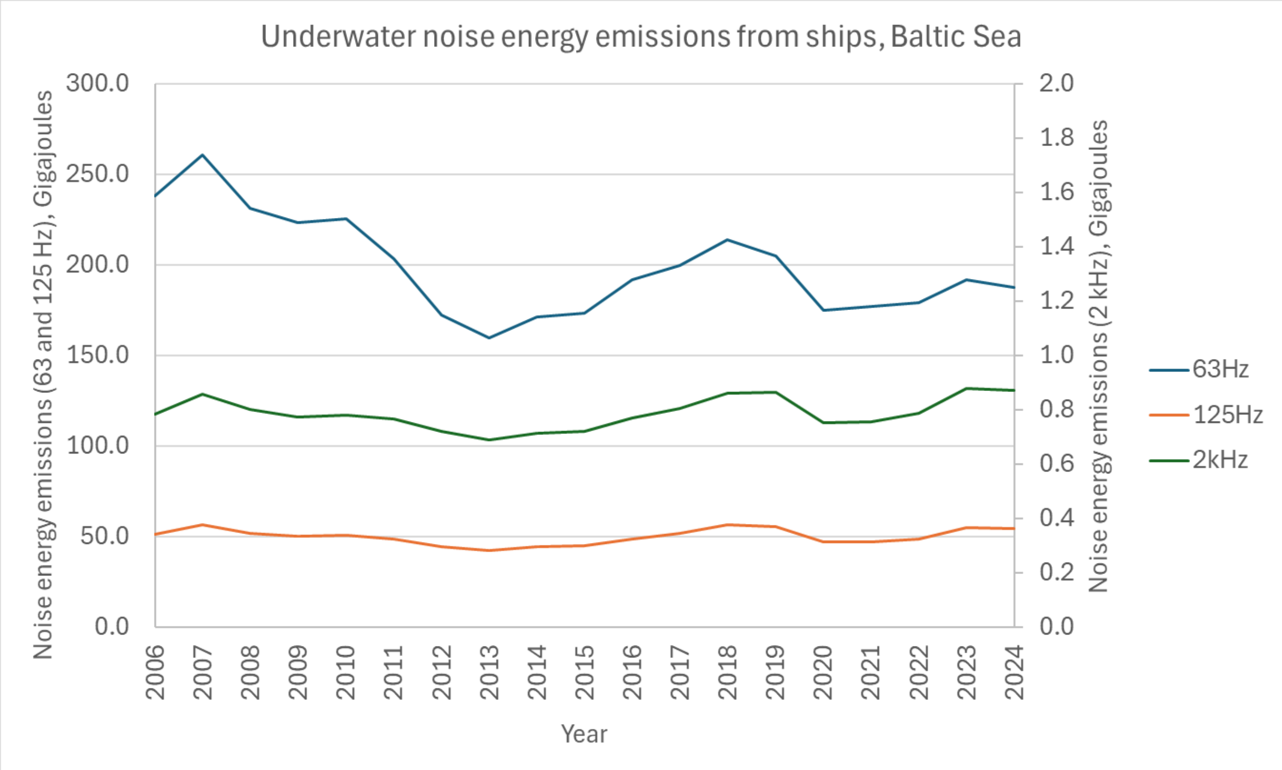

Figure 4 Underwater noise energy emissions from Baltic Sea shipping during 2006-2024. Energy is reported in gigajoules (GJ). Energy emissions for 2 kHz band are drawn using the right-side vertical axis.

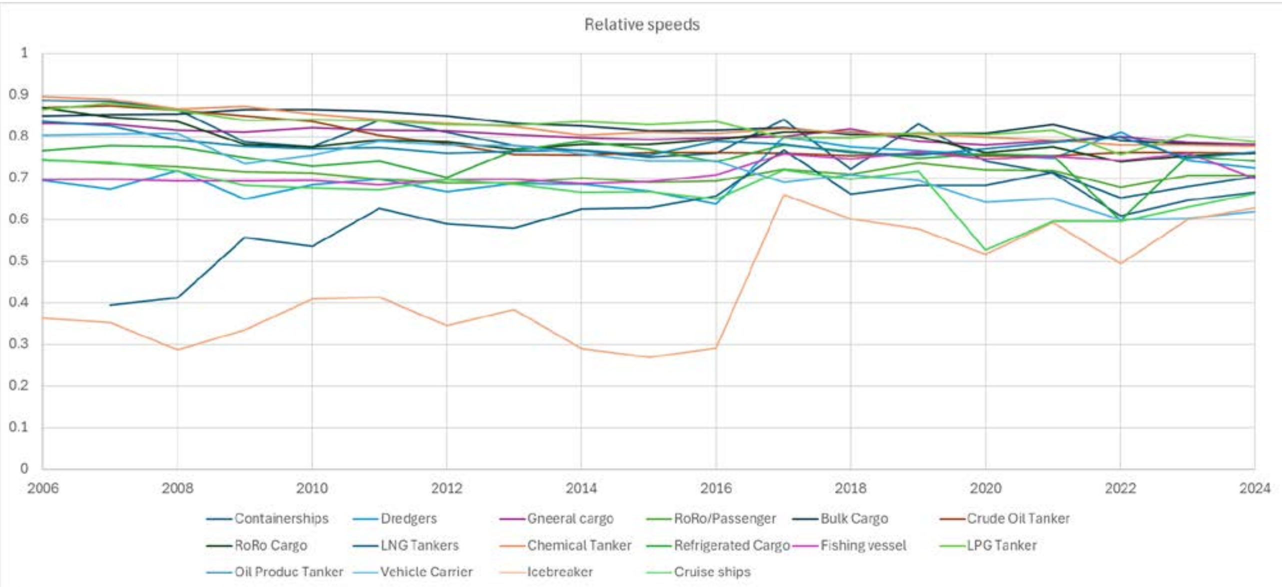

Figure 5 Operating speeds of various types of ships in the Baltic Sea fleet. The numbers presented report the relation between average cruising speed to the design speed of each class. This figure illustrates a widespread use of slow steaming across all ship types in the Baltic Sea fleet.

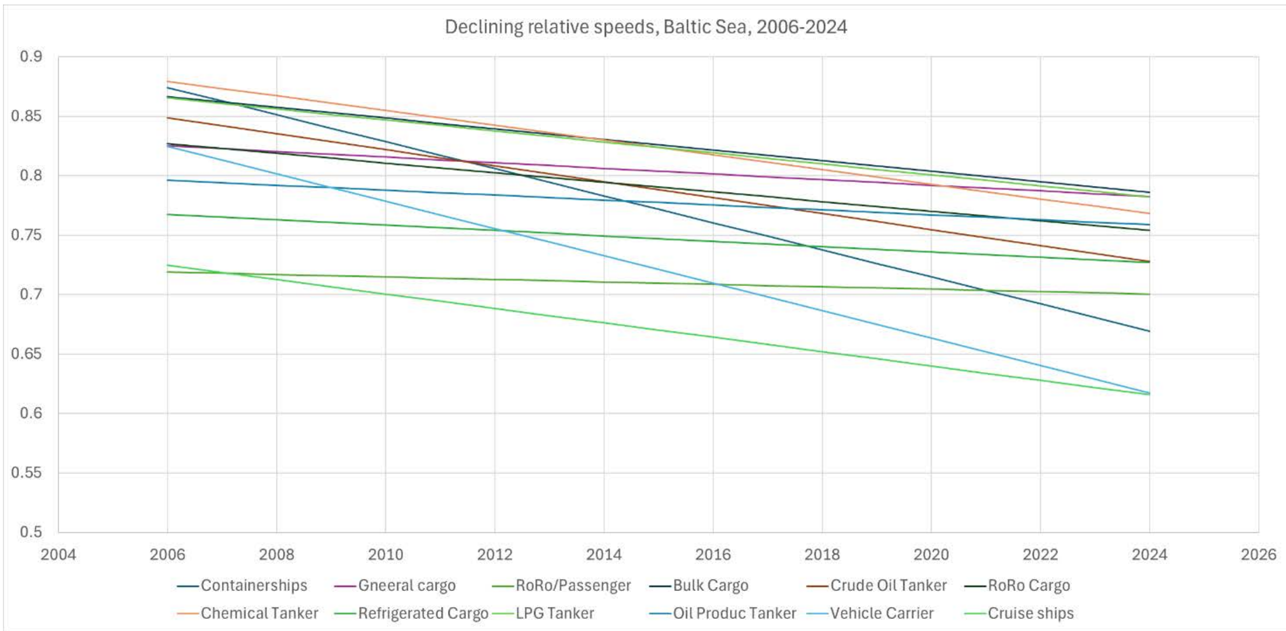

Figure 6 Smoothed trendlines of relative speeds for those ship types for which relative speed decreases over the study period.

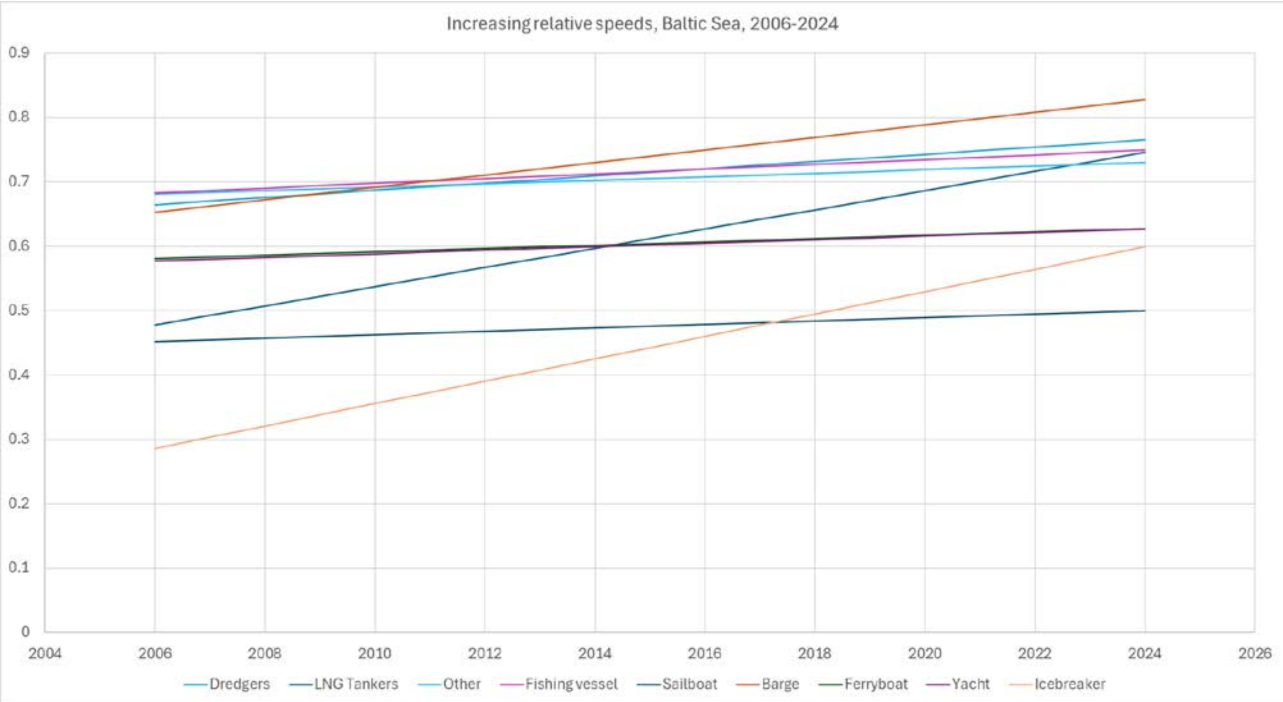

Figure 7 Smoothed trendlines of relative speeds for those ship types for which relative speed increases over the study period.

Most ships have slowed down during the 19-year period, and this includes the most significant noise emitters. Figure 8 illustrates the contributions to underwater noise emissions from different types of ships and their evolution during 2006-2024.

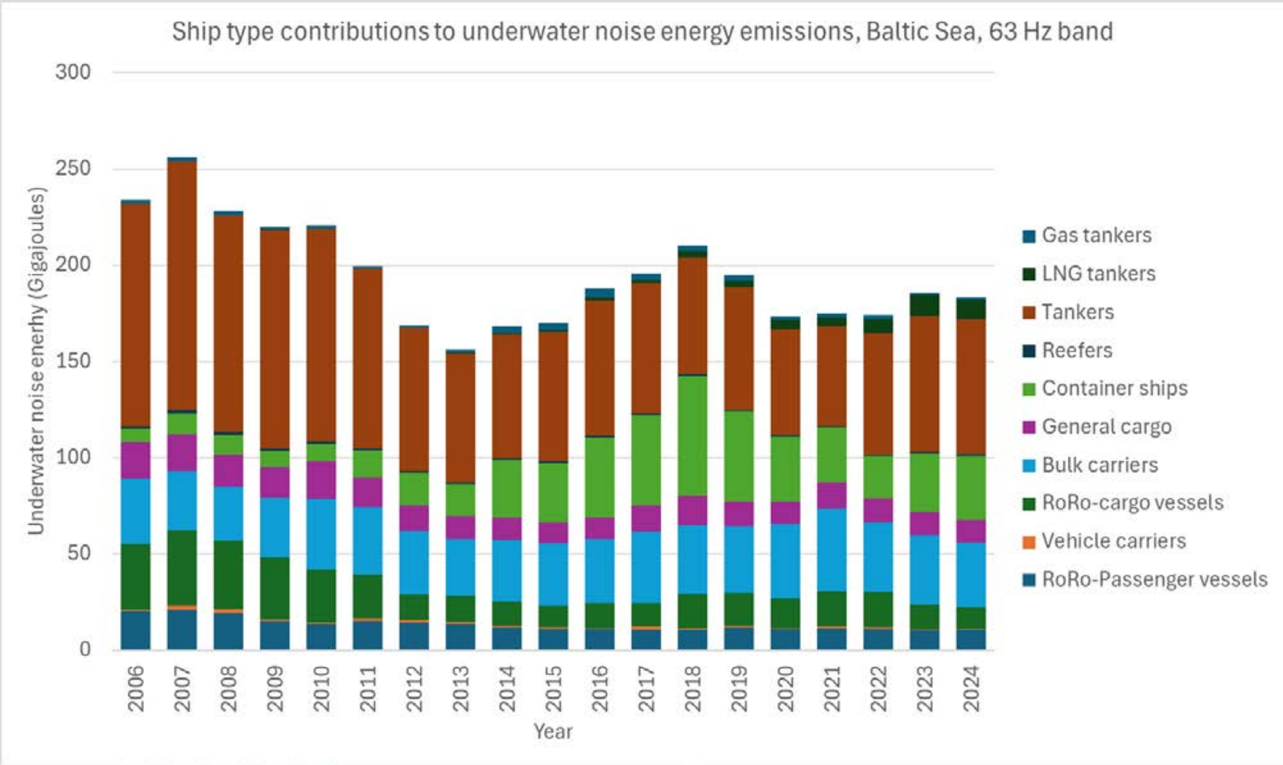

Figure 8. Emissions of shipping noise energy (GJ) during 2006-2024 in the Baltic Sea area. The columns indicate total noise energy at 63Hz band, whereas the colours indicate contributions from different types of ships.

The monthly totals of underwater noise over the whole study period are given in Figure 9. The emissions of noise during summer months usually have a maximum, which is like the observed maximum of atmospheric emissions during the holiday period each year. However, the disruption of passenger travel because of Covid19 seems to have temporarily broken this trend, and daily corrected noise energy emissions (gigajoules/day) peak during the months of September and October. High peaks in June-July 2010 correspond to a period of unavailable AIS data, and the monthly noise energy emissions have been scaled to 100% coverage based on the incomplete coverage. The totals for November 2017 and early months of 2018 reflect the decreased amount of AIS position reports in the Gulf of Bothnia and the Bothnian Bay area. Emission totals for these months have been scaled to 100% coverage based on the existing data which increases the uncertainty of modeled quantities.

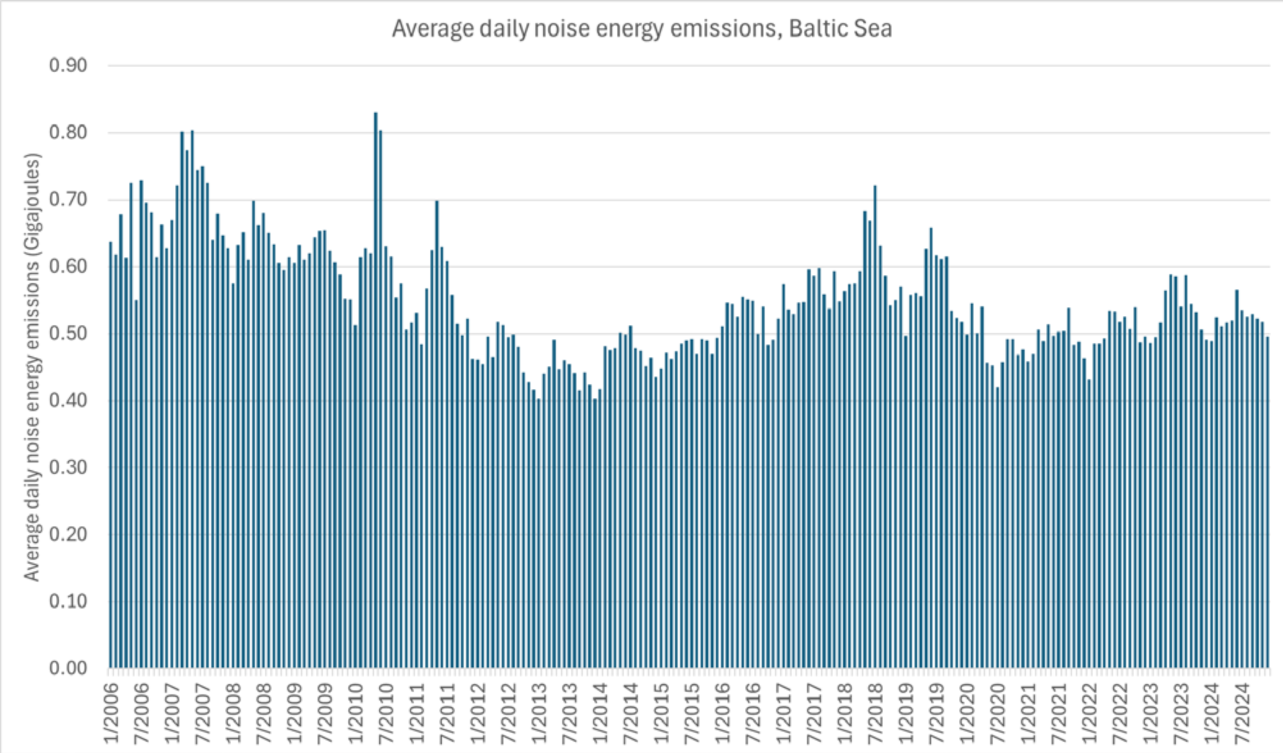

Figure 9 Daily average noise energy emissions (63 Hz 1/3 octave band) from ships in 2020-2022. The unit is gigajoules of average of energy released as noise from ships in one day.

For energy efficiency there exists various efficiency indices, like the Energy Efficiency Operational and the carbon intensity index of the IMO, but also noise efficiency index can be calculated for each vessel. In that case, the reported quantity would be the noise energy (in millijoules) towards each cargo mass (tonne) and distance unit (nm). This leads to a performance index with units of mJ $tonne^{-1}$ nm^{-1}, which facilitates comparison of performance indices across various ship types. This way, the transport work done by each ship type is included in the evaluation. The evolution of the noise efficiency of various ship types over the study period is depicted in Figures 10 and 11. According to the Wittekind noise module, vessel noise increases as a function of speed. The changes in emitted noise are more likely to be a result of operating speed changes because no reduction targets currently exist for shipping noise. For most ship types, the noise index has decreased over time, but an increase was predicted for vehicle carriers, containerships and LNG tankers. These three ship types illustrate increased unit emissions of noise over time in the Baltic Sea area.

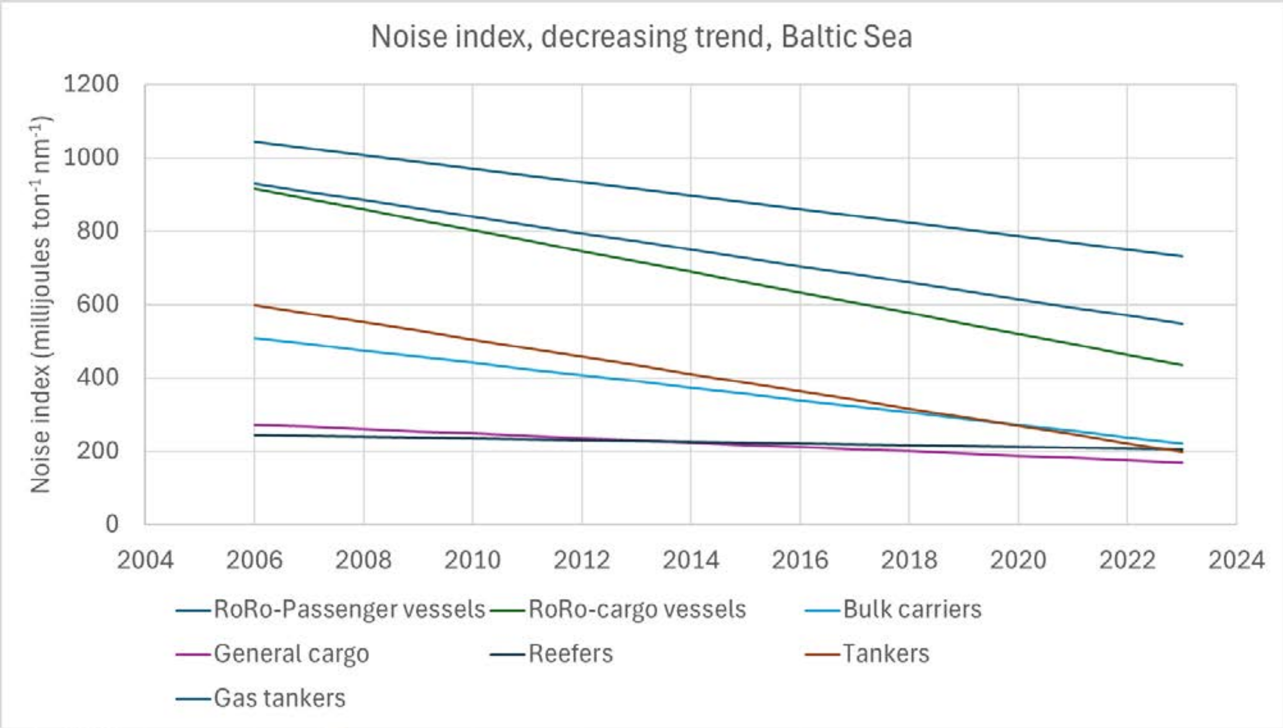

Figure 10 Noise efficiency index for various ship types sailing the Baltic Sea area. The period of 2006-2024 was studied, and an annual performance index was calculated for each ship type.

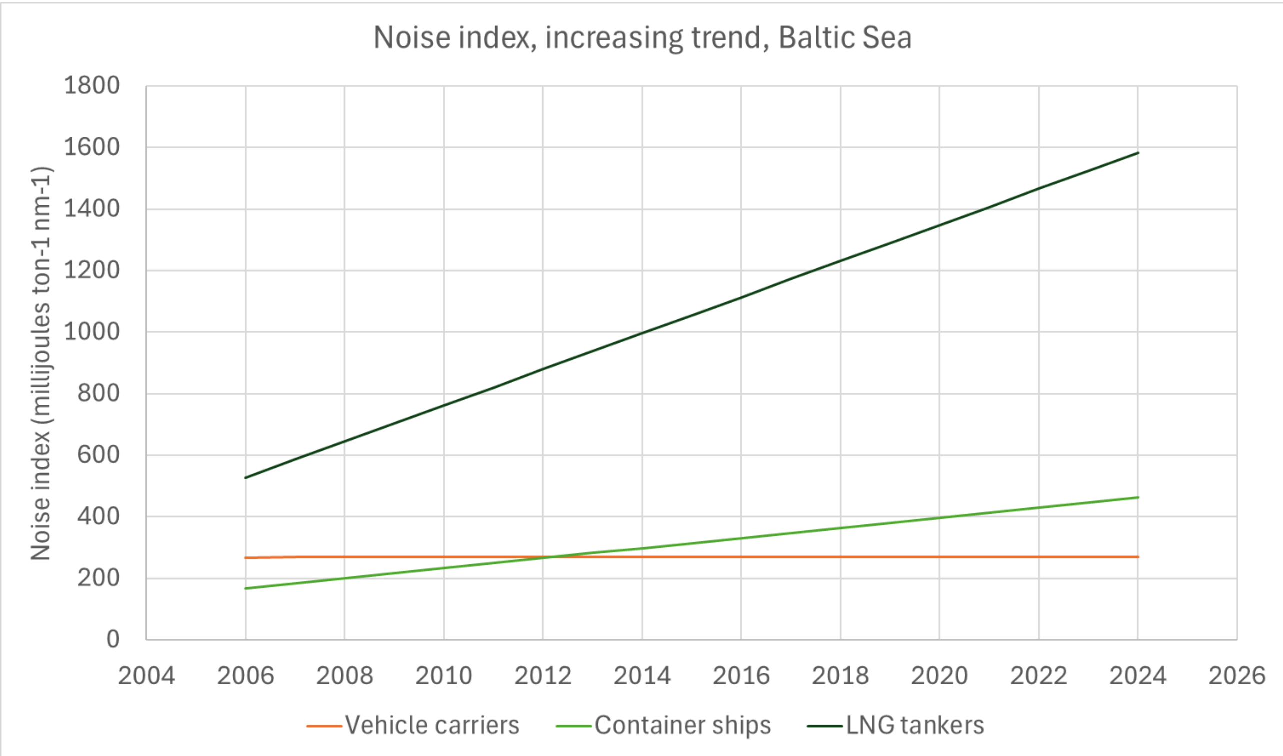

Figure 11 Noise efficiency index for various ship types sailing the Baltic Sea area. The period of 2006-2024 was studied, and an annual performance index was calculated for each ship type.

A significant increase in noise occurs with vessels which travel above the cavitation inception speed. This speed is the threshold value after which cavitation starts to occur and low- and high frequency contributions to cavitation noise increase sharply.

3. Geographical distribution of vessel noise emissions

The geographical distribution of annual noise energies in 63Hz band is given in Figure 12. The main shipping lanes are clearly visible in the noise maps, but it should be noted that this does not illustrate underwater noise propagation.

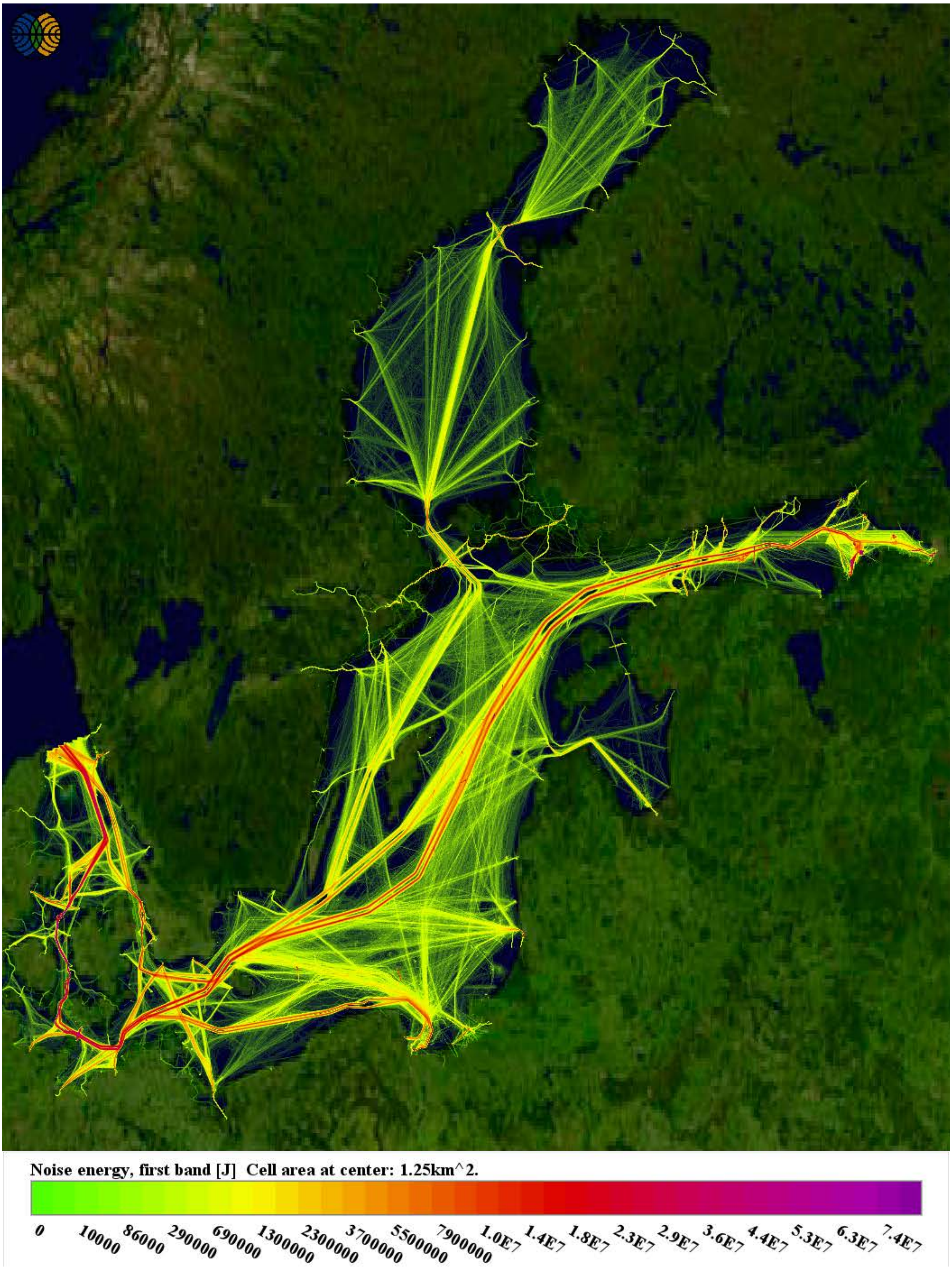

Figure 12 Noise energy emitted in the 63 Hz 1/3 octave band by the Baltic Sea fleet in 2024. Unit is joules per grid cell area (1.25 km²)

Values exceeding 100 dB are well within the hearing range of cod (Nedwell et al., 2004), but propagation modelling of noise is required to determine the noise levels experienced by marine life and assess the impacts of noise in the Baltic Sea area. A noise source emitting continuously one megajoule of energy for one year corresponds to 156 dB source level. Noise maps of this report are visual aids to illustrate the geographical distribution of noise emissions, but further propagation modelling should be done to indicate how noise travels underwater. Only then the impacts of noise can be assessed.

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Data

The emission estimates for the Baltic Sea area during the year 2024 are based on over 502 million AIS-messages sent by almost 27,000 different ships, of which 9,675 had an IMO registry number indicating commercial marine traffic. The AIS position reports were received by terrestrial base stations in the Baltic Sea countries and collected to regional HELCOM AIS data server. Emissions are generated using the Ship Traffic Emission Assessment Model, STEAM version 5.1 (Jalkanen et al., 2009, 2012, 2018, 2021; Johansson et al., 2013b, 2017b; Majamäki et al., 2025).

The Baltic Sea AIS data for year 2024 had no temporal gaps, AIS data was available throughout the year, and the temporal coverage was 100%. This is the third time for HELCOM AIS service with a perfect service record. Most of the messages originate from South-Western region of the Baltic Sea near the Danish and southern Swedish sea areas (Figure 13). On average, data flow was lower in 2024 (57,000) than in 2023 (90,000) messages per hour. STEAM applies distance, speed and identity checks during the AIS processing steps which allow consistent voyage construction, but vessels sailing without an active AIS transponder are not covered in this analysis. STEAM uses the technical details of the global fleet based on S&P Global database.

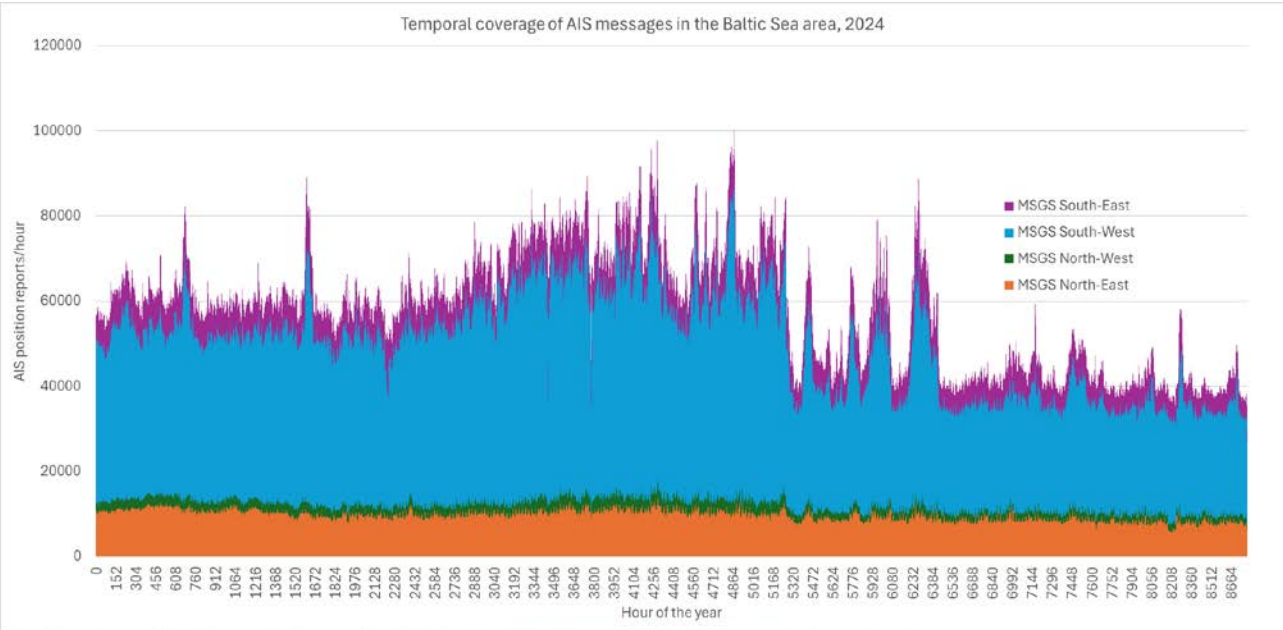

Figure 13 AIS-data hourly coverage in different parts of the Baltic Sea region for 2024.

Metadata

It should be noted that current estimates do not include contributions from vessels without active AIS equipment, which may lead to underestimation of ship activity. Work is in progress to investigate the significance of this issue using complementary datasets. All calculations were made including the effects of sea currents, winds, waves and ice cover thickness.

The STEAM model used in this work was upgraded from v4.3 to v5.1. The new model version was used to recalculate the whole Baltic Sea ship emissions time series, to provide a consistent view over the last 19 years. Significant technical changes were made to improve the modeling accuracy and compatibility with the EU's Monitoring, Reporting, and Verification (MRV) data.

• The modeling of shipping in the Baltic Sea continued to rely primarily on AIS data from the HELCOM AIS data archive. For a broader global perspective, a combination of satellite-AIS and terrestrial-AIS data from Orbcomm Ltd was also utilized. Integrating global AIS data enables comparisons with the MRV reporting scheme. STEAM v5.1 adopted the same voyage-based emission allocation methodology used by both the IPCC and the Fourth IMO GHG Study for international and domestic shipping. Voyages were constructed from confirmed port calls and AIS position reports, ensuring 1:1 compliance with MRV reporting and enabling the detection of anomalies and deviations. AIS decoding and filtering rules have been strengthened. Handling of spurious or faulty identification numbers has been improved.

• The resistance calculation method in STEAM v5.1 is a hybrid approach, combining the Hollenbach method with the methodology consistent with the Fourth IMO GHG Study. The Hollenbach method is applied by default; however, if a vessel falls outside the applicable range or if data is insufficient, a simpler formula is used. It is important to note that static draught is assumed in the calculations, and changes in draught or trim are not accounted for.

• Weather effects—such as wind and current speed and direction, wave height and direction, and ice coverage and thickness—are included in STEAM v5.1 in the same way as in STEAM v4.3. Details of the methods used are described in Majamäki et al (2025).

• By default, STEAM v5.1 uses a simplified auxiliary engine model, like the one in STEAM 2, which improves the comparison scores of STEAM against the MRV data. Users still have the option to choose how auxiliary engines and boilers are modeled. However, due to limitations of the global fleet description, modeling auxiliary systems remains a significant source of uncertainty. This was evident during extensive comparisons with MRV fuel reports. Some biases found in large containership modeling have been addressed, resulting in improved consistency with MRV data, but some biases remain.

• Geographical rules for regional air and water environmental regulations have been updated. These now include vessel-type-specific discharge rules, such as the sewage discharge ban for passenger ships in the Baltic Sea region.

• The modeling of shore-side electricity in STEAM has been revised. The updated setup uses terminal data from the EU Alternative Fuel Observatory (https://alternative-fuels-observatory.ec.europa.eu/transport-mode/maritime-sea/ports-and-infrastructure) to identify ports and terminals equipped with shore power connections. Installation dates and applicable ship types for each terminal are also defined. The model now incorporates the EU requirement for shore power readiness within the TEN-T network by 2030 for container and passenger ships. However, the model does not account for potential incompatibilities between shipboard and land-based electrical frequencies. It also assumes that if both the ship and terminal are shore power-ready, connection is possible during berthing and power needed is always available from the land-based power grid.

• Ships operating in NOx Emission Control Areas (NECAs) now use SCR (Selective Catalytic Reduction) or EGR (Exhaust Gas Recirculation) systems only when required by regulation. This is different from the earlier versions of STEAM, which assumed that vessels with SCR systems would use them regardless of build year. For instance, in the previous model, a ship built in 2005 and retrofitted with SCR would have been treated as compliant with Tier III requirements. In STEAM v5.1, such a ship is modeled using Tier II emission factors, reflecting its exemption from Tier III and its likely focus on minimizing operational costs. Currently, 2,068 entries in the global fleet technical database indicate the presence of SCR systems. Modern EGR units, often paired with scrubbers, are modeled in line with IMO Tier III emission factors. Active SCR systems are modeled to reduce NOx based on engine load, with ammonia slip also considered.

• Global zones with EGCS (Exhaust Gas Cleaning System) discharge bans have been updated, particularly in the Baltic Sea. Recent updates to Danish, Swedish, and Finnish environmental legislation now include restrictions on both Open Loop and Closed Loop discharges. In STEAM, the guiding principle is that EGCS shutdowns must be required by maritime authorities, with clear geographical boundaries and start dates for the restrictions. Recommendations to avoid EGCS use are not included in the model as these are not compulsory bans.

- The model now includes a broader range of fuel types, including High Sulfur Heavy Fuel Oil (HSHFO), Intermediate Fuel Oil (IFO), Very Low Sulfur Fuel Oil (VLSFO), Marine Diesel Oil (MDO), Marine Gas Oil (MGO), Methanol, Ammonia, and LNG. The fuel allocation logic in STEAM v5.1 is based on a combination of technical feasibility, legal compliance, and cost. The model can also examine fuel mixtures, including the use of pilot and alternative fuels. Ships with engines capable of using gas as fuel are identified by manufacturer and engine type codes, with Brake Specific Energy Consumption (BSEC) curves provided by the engine manufacturer. Gas engines are categorized into compression-ignited dual-fuel low-pressure, compression-ignited dual-fuel high-pressure, spark-ignited, and turbines.

- The modeling of sewage discharges and the nutrients contained within assumes a removal rate of 70% for nitrogen (N) and 80% for phosphorus (P). However, these values may be somewhat optimistic, considering the variability in system type, maintenance, and operating conditions within the Baltic Sea fleet. There is also a lack of sufficient data regarding the specific types of sewage treatment systems installed on ships.

APPENDIX – Annual noise emission summaries

2006	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	238.2 (+.0%)	51.5 (+.0%)	0.8 (+.0%)	412979.4 (+.0%)	
Baltic Proper	153 (+.0%)	32 (+.0%)	0 (+.0%)	247574 (+.0%)	
Kattegat	50 (+.0%)	11 (+.0%)	0 (+.0%)	92409 (+.0%)	
Gulf of Finland	24 (+.0%)	6 (+.0%)	0 (+.0%)	47439 (+.0%)	
Gulf of Bothnia	11 (+.0%)	2 (+.0%)	0 (+.0%)	22474 (+.0%)	
Gulf of Riga	1 (+.0%)	0 (+.0%)	0 (+.0%)	3819 (+.0%)	
RoRo-Passenger vessels	20 (+.0%)	6 (+.0%)	0 (+.0%)	18185 (+.0%)	1104 (+.0%)
Vehicle carriers	1 (+.0%)	0 (+.0%)	0 (+.0%)	4146 (+.0%)	278 (+.0%)
RoRo-cargo vessels	34 (+.0%)	6 (+.0%)	0 (+.0%)	33588 (+.0%)	1015 (+.0%)
Bulk carriers	34 (+.0%)	8 (+.0%)	0 (+.0%)	68050 (+.0%)	497 (+.0%)
General cargo	19 (+.0%)	4 (+.0%)	0 (+.0%)	67386 (+.0%)	279 (+.0%)
Container ships	7 (+.0%)	3 (+.0%)	0 (+.0%)	42470 (+.0%)	169 (+.0%)
Reefers	1 (+.0%)	1 (+.0%)	0 (+.0%)	5414 (+.0%)	250 (+.0%)
Tankers	116 (+.0%)	21 (+.0%)	0 (+.0%)	172564 (+.0%)	670 (+.0%)
LNG tankers	0 (+.0%)	0 (+.0%)	0 (+.0%)	0 (+.0%)	0 (+.0%)
Gas tankers	2 (+.0%)	0 (+.0%)	0 (+.0%)	1912 (+.0%)	1071 (+.0%)
Passenger ships	0 (+.0%)	0 (+.0%)	0 (+.0%)		
Cruisers	3 (+.0%)	1 (+.0%)	0 (+.0%)		
Fishing vessels	0 (+.0%)	0 (+.0%)	0 (+.0%)		
Service ships	0 (+.0%)	0 (+.0%)	0 (+.0%)		
Unknown	0 (+.0%)	0 (+.0%)	0 (+.0%)		
Misc	0 (+.0%)	0 (+.0%)	0 (+.0%)		

2007	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules tonne^{-1} nm^{-1}]
Total	260.8 (+9.5%)	56.7 (+10.1%)	0.9 (+9.5%)	453439.1 (+9.8%)	
Baltic Proper	164 (+7.6%)	35 (+9.4%)	1 (+9.2%)	272467 (+10.1%)	
Kattegat	53 (+7.2%)	12 (+6.5%)	0 (+5.9%)	98864 (+7.0%)	
Gulf of Finland	28 (+14.9%)	7 (+14.7%)	0 (+15.0%)	55260 (+16.5%)	
Gulf of Bothnia	14 (+36.4%)	3 (+24.3%)	0 (+16.7%)	23551 (+4.8%)	
Gulf of Riga	1 (+5.6%)	0 (+12.6%)	0 (+13.1%)	4031 (+5.6%)	
RoRo-Passenger vessels	21 (+5.4%)	6 (+8.8%)	0 (+8.8%)	20297 (+11.6%)	1042 (-5.6%)
Vehicle carriers	2 (+55.0%)	1 (+41.3%)	0 (+40.2%)	5692 (+37.3%)	313 (+12.9%)
RoRo-cargo vessels	39 (+15.7%)	7 (+11.6%)	0 (+7.8%)	35932 (+7.0%)	1098 (+8.2%)
Bulk carriers	31 (-9.5%)	7 (-10.1%)	0 (-9.3%)	62909 (-7.6%)	487 (-2.1%)
General cargo	19 (+1.7%)	4 (+2.0%)	0 (+2.9%)	70433 (+4.5%)	271 (-2.7%)
Container ships	11 (+51.5%)	5 (+59.2%)	0 (+57.2%)	56988 (+34.2%)	191 (+12.9%)
Reefers	2 (+25.0%)	1 (+15.1%)	0 (+16.1%)	6571 (+21.4%)	257 (+3.0%)
Tankers	129 (+11.7%)	24 (+10.7%)	0 (+10.7%)	192948 (+11.8%)	670 (-.1%)
LNG tankers	0 (+.0%)	0 (+.0%)	0 (+.0%)	15 (+.0%)	0 (+.0%)
Gas tankers	2 (+.9%)	0 (+3.8%)	0 (+4.2%)	2017 (+5.5%)	1025 (-4.4%)
Passenger ships	0 (+.0%)	0 (+.0%)	0 (+.0%)		
Cruisers	4 (+17.4%)	1 (+7.2%)	0 (+7.4%)		
Fishing vessels	0 (+7.5%)	0 (+1.4%)	0 (-.2%)		
Service ships	0 (+24.9%)	0 (+5.5%)	0 (+8.5%)		
Unknown	0 (+98.7%)	0 (+101.8%)	0 (+100.1%)		
Misc	0 (+104.3%)	0 (+78.6%)	0 (+73.6%)		

2008	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules tonne^{-1} nm^{-1}]
Total	231.4 (-11.3%)	52.0 (-8.2%)	0.8 (-6.7%)	445217.4 (-1.8%)	
Baltic Proper	144 (-12.2%)	32 (-8.9%)	0 (-7.2%)	266606 (-2.2%)	
Kattegat	48 (-11.0%)	11 (-7.8%)	0 (-7.0%)	95982 (-2.9%)	
Gulf of Finland	26 (-7.3%)	6 (-4.1%)	0 (-2.9%)	55854 (+1.1%)	
Gulf of Bothnia	13 (-8.7%)	3 (-7.4%)	0 (-6.4%)	23543 (-.0%)	
Gulf of Riga	2 (+11.5%)	0 (+5.7%)	0 (+7.1%)	4692 (+16.4%)	
RoRo-Passenger vessels	19 (-9.2%)	6 (-5.3%)	0 (-4.7%)	20233 (-.3%)	950 (-8.9%)
Vehicle carriers	2 (+37.4%)	1 (+39.3%)	0 (+38.2%)	7610 (+33.7%)	322 (+2.8%)
RoRo-cargo vessels	35 (-11.1%)	7 (-8.5%)	0 (-6.0%)	36700 (+2.1%)	956 (-12.9%)
Bulk carriers	28 (-8.5%)	6 (-8.1%)	0 (-7.6%)	59180 (-5.9%)	474 (-2.7%)
General cargo	16 (-13.9%)	4 (-11.7%)	0 (-10.8%)	64893 (-7.9%)	253 (-6.6%)
Container ships	11 (-3.6%)	5 (-1.5%)	0 (-.9%)	63105 (+10.7%)	167 (-12.9%)
Reefers	1 (-13.2%)	1 (-7.0%)	0 (-7.5%)	6031 (-8.2%)	243 (-5.4%)
Tankers	112 (-12.9%)	21 (-11.2%)	0 (-9.3%)	185698 (-3.8%)	606 (-9.5%)
LNG tankers	0 (-54.8%)	0 (-42.2%)	0 (-49.1%)	6 (-58.6%)	#DIV/0!
Gas tankers	3 (+30.9%)	1 (+34.8%)	0 (+35.3%)	2886 (+43.1%)	937 (-8.5%)
Passenger ships	0 (-11.7%)	0 (-8.9%)	0 (-7.9%)		
Cruisers	2 (-38.0%)	1 (-13.6%)	0 (-4.8%)		
Fishing vessels	0 (-14.8%)	0 (+.6%)	0 (+.5%)		
Service ships	0 (-22.7%)	0 (-8.9%)	0 (-11.6%)		
Unknown	0 (+235.4%)	0 (+104.2%)	0 (+96.9%)		
Misc	0 (-7.7%)	0 (-1.4%)	0 (+.9%)		

2009	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	223.3 (-3.5%)	50.1 (-3.7%)	0.8 (-3.3%)	433290.9 (-2.7%)	
Baltic Proper	136 (-5.5%)	30 (-5.5%)	0 (-5.1%)	253438 (-4.9%)	
Kattegat	48 (+1.5%)	11 (+1.2%)	0 (+2.2%)	100173 (+4.4%)	
Gulf of Finland	25 (-1.1%)	6 (-2.8%)	0 (-2.6%)	54218 (-2.9%)	
Gulf of Bothnia	12 (-8.6%)	3 (-7.4%)	0 (-7.3%)	21160 (-10.1%)	
Gulf of Riga	2 (+12.1%)	0 (+3.6%)	0 (+3.0%)	5109 (+8.9%)	
RoRo-Passenger vessels	15 (-21.7%)	5 (-12.6%)	0 (-11.6%)	18988 (-6.2%)	793 (-16.5%)
Vehicle carriers	1 (-63.8%)	0 (-57.9%)	0 (-58.1%)	3016 (-60.4%)	294 (-8.6%)
RoRo-cargo vessels	32 (-8.1%)	6 (-8.6%)	0 (-9.3%)	32272 (-12.1%)	999 (+4.5%)
Bulk carriers	31 (+11.5%)	7 (+6.8%)	0 (+6.1%)	62289 (+5.3%)	502 (+5.9%)
General cargo	16 (-4.8%)	4 (-7.0%)	0 (-7.9%)	57794 (-10.9%)	271 (+6.9%)
Container ships	8 (-22.1%)	4 (-10.7%)	0 (-10.5%)	52725 (-16.4%)	155 (-6.8%)
Reefers	1 (-10.2%)	1 (-12.7%)	0 (-12.5%)	5500 (-8.8%)	239 (-1.5%)
Tankers	114 (+1.2%)	22 (+2.6%)	0 (+3.9%)	199446 (+7.4%)	571 (-5.8%)
LNG tankers	0 (+1930.0%)	0 (+907.6%)	0 (+931.4%)	30 (+370.9%)	606 (+331.1%)
Gas tankers	1 (-44.6%)	0 (-39.4%)	0 (-38.0%)	1825 (-36.8%)	821 (-12.5%)
Passenger ships	0 (+5.2%)	0 (+3.0%)	0 (+3.4%)		
Cruisers	2 (+11.9%)	1 (+9.5%)	0 (+7.8%)		
Fishing vessels	0 (-34.5%)	0 (-28.8%)	0 (-28.3%)		
Service ships	0 (+59.2%)	0 (+27.4%)	0 (+26.4%)		
Unknown	0 (-45.1%)	0 (-3.8%)	0 (-2.9%)		
Misc	0 (-26.2%)	0 (-27.6%)	0 (-27.9%)		

2010	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules tonne^{-1} nm^{-1}]
Total	225.4 (+1.0%)	51.0 (+1.8%)	0.8 (+1.0%)	441716.0 (+1.9%)	
Baltic Proper	139 (+1.9%)	31 (+2.3%)	0 (+1.4%)	258476 (+2.0%)	
Kattegat	48 (-1.4%)	11 (-.8%)	0 (-1.4%)	98564 (-1.6%)	
Gulf of Finland	24 (-6.5%)	6 (-1.2%)	0 (-.9%)	56291 (+3.8%)	
Gulf of Bothnia	14 (+16.7%)	3 (+14.7%)	0 (+12.2%)	23513 (+11.1%)	
Gulf of Riga	2 (-11.2%)	0 (-6.9%)	0 (-5.9%)	5289 (+3.5%)	
RoRo-Passenger vessels	14 (-9.9%)	5 (-7.3%)	0 (-7.4%)	17245 (-9.2%)	786 (-.8%)
Vehicle carriers	1 (+11.2%)	0 (+4.8%)	0 (+7.9%)	3734 (+23.8%)	264 (-10.2%)
RoRo-cargo vessels	27 (-14.8%)	5 (-13.0%)	0 (-12.9%)	29083 (-9.9%)	944 (-5.5%)
Bulk carriers	36 (+16.5%)	7 (+9.9%)	0 (+5.9%)	64644 (+3.8%)	563 (+12.2%)
General cargo	20 (+25.7%)	4 (+21.3%)	0 (+17.6%)	63928 (+10.6%)	308 (+13.6%)
Container ships	9 (+13.0%)	5 (+22.0%)	0 (+22.0%)	61004 (+15.7%)	152 (-2.3%)
Reefers	1 (-17.2%)	1 (-18.2%)	0 (-18.1%)	4518 (-17.8%)	241 (+.8%)
Tankers	111 (-2.7%)	21 (-2.1%)	0 (-3.1%)	195839 (-1.8%)	565 (-1.0%)
LNG tankers	0 (+66.5%)	0 (+48.0%)	0 (+52.4%)	39 (+29.8%)	778 (+28.3%)
Gas tankers	2 (+1.5%)	0 (-5.9%)	0 (-8.0%)	1564 (-14.3%)	971 (+18.4%)
Passenger ships	0 (-7.5%)	0 (-3.9%)	0 (-4.6%)		
Cruisers	3 (+40.3%)	1 (+16.7%)	0 (+10.8%)		
Fishing vessels	0 (-47.6%)	0 (-31.6%)	0 (-33.5%)		
Service ships	0 (+89.3%)	0 (+99.1%)	0 (+110.2%)		
Unknown	0 (+8.7%)	0 (+9.3%)	0 (+9.0%)		
Misc	0 (+83.7%)	0 (+13.2%)	0 (+17.5%)		

2011	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	203.5 (-9.7%)	48.6 (-4.7%)	0.8 (-2.2%)	476256.6 (+7.8%)	
Baltic Proper	123 (-11.1%)	29 (-5.9%)	0 (-2.7%)	283207 (+9.6%)	
Kattegat	46 (-3.9%)	11 (-1.8%)	0 (-1.1%)	102877 (+4.4%)	
Gulf of Finland	21 (-11.2%)	6 (-1.3%)	0 (+1.1%)	61007 (+8.4%)	
Gulf of Bothnia	12 (-13.7%)	3 (-9.1%)	0 (-5.5%)	24143 (+2.7%)	
Gulf of Riga	2 (+2.4%)	0 (+4.3%)	0 (+5.3%)	5779 (+9.3%)	
RoRo-Passenger vessels	15 (+12.6%)	5 (+9.3%)	0 (+10.0%)	20011 (+16.0%)	763 (-3.0%)
Vehicle carriers	1 (+20.9%)	0 (+20.1%)	0 (+21.0%)	4677 (+25.3%)	255 (-3.5%)
RoRo-cargo vessels	23 (-16.8%)	5 (-12.2%)	0 (-9.0%)	30552 (+5.1%)	748 (-20.8%)
Bulk carriers	35 (-4.3%)	7 (-1.4%)	0 (+2.5%)	75094 (+16.2%)	464 (-17.6%)
General cargo	15 (-21.4%)	4 (-19.8%)	0 (-15.8%)	62652 (-2.0%)	247 (-19.8%)
Container ships	14 (+54.2%)	7 (+25.4%)	0 (+22.3%)	75761 (+24.2%)	188 (+24.1%)
Reefers	1 (-10.2%)	1 (-11.5%)	0 (-11.3%)	3997 (-11.6%)	245 (+1.5%)
Tankers	93 (-15.8%)	19 (-11.6%)	0 (-8.0%)	202090 (+3.2%)	461 (-18.4%)
LNG tankers	0 (+41.9%)	0 (+47.7%)	0 (+53.7%)	53 (+37.9%)	801 (+2.9%)
Gas tankers	1 (-15.0%)	0 (-19.6%)	0 (-17.3%)	1477 (-5.5%)	874 (-10.0%)
Passenger ships	0 (+.5%)	0 (+4.8%)	0 (+5.4%)		
Cruisers	3 (-25.9%)	1 (-12.9%)	0 (-7.4%)		
Fishing vessels	0 (-24.9%)	0 (-19.2%)	0 (-18.6%)		
Service ships	0 (+44.5%)	0 (+34.6%)	0 (+35.9%)		
Unknown	0 (+84.7%)	0 (+60.0%)	0 (+59.5%)		
Misc	0 (+27.3%)	0 (+44.5%)	0 (+42.5%)		

2012	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules tonne^{-1} nm^{-1}]
Total	172.3 (-15.3%)	44.5 (-8.4%)	0.7 (-5.9%)	495513.4 (+4.0%)	
Baltic Proper	103 (-16.7%)	26 (-8.9%)	0 (-6.1%)	295842 (+4.5%)	
Kattegat	39 (-14.5%)	10 (-7.2%)	0 (-5.2%)	104323 (+1.4%)	
Gulf of Finland	19 (-8.7%)	6 (-4.6%)	0 (-2.2%)	66365 (+8.8%)	
Gulf of Bothnia	10 (-15.7%)	2 (-13.5%)	0 (-12.0%)	23769 (-1.6%)	
Gulf of Riga	2 (+.3%)	0 (+.5%)	0 (+.6%)	6189 (+7.1%)	
RoRo-Passenger vessels	15 (-4.3%)	5 (-3.6%)	0 (-3.7%)	19333 (-3.4%)	756 (-1.0%)
Vehicle carriers	1 (+1.5%)	0 (+5.8%)	0 (+5.1%)	5063 (+8.3%)	239 (-6.3%)
RoRo-cargo vessels	13 (-43.0%)	3 (-35.1%)	0 (-30.8%)	27235 (-10.9%)	478 (-36.1%)
Bulk carriers	33 (-5.0%)	7 (-3.3%)	0 (-1.0%)	83987 (+11.8%)	394 (-15.0%)
General cargo	13 (-14.6%)	3 (-13.1%)	0 (-11.1%)	60324 (-3.7%)	219 (-11.3%)
Container ships	17 (+18.9%)	8 (+15.2%)	0 (+14.4%)	80682 (+6.5%)	210 (+11.7%)
Reefers	1 (+6.0%)	1 (+8.2%)	0 (+9.0%)	5399 (+35.1%)	192 (-21.5%)
Tankers	74 (-20.5%)	16 (-13.5%)	0 (-9.4%)	212149 (+5.0%)	350 (-24.2%)
LNG tankers	0 (+97.8%)	0 (+109.0%)	0 (+109.6%)	144 (+170.0%)	586 (-26.8%)
Gas tankers	1 (-13.8%)	0 (-11.4%)	0 (-7.3%)	1549 (+4.9%)	719 (-17.8%)
Passenger ships	0 (+77.8%)	0 (+54.1%)	0 (+49.0%)		
Cruisers	3 (+9.3%)	1 (+5.4%)	0 (+4.7%)		
Fishing vessels	0 (-13.8%)	0 (-12.3%)	0 (-12.5%)		
Service ships	0 (-45.0%)	0 (-37.8%)	0 (-39.7%)		
Unknown	0 (+36.7%)	0 (+26.7%)	0 (+28.1%)		
Misc	0 (+1.6%)	0 (+39.4%)	0 (+34.4%)		

2013	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	159.6 (-7.3%)	42.3 (-5.0%)	0.7 (-4.4%)	497886.4 (+.5%)	
Baltic Proper	95 (-7.1%)	25 (-5.0%)	0 (-4.7%)	295767 (-.0%)	
Kattegat	35 (-11.4%)	9 (-9.8%)	0 (-8.3%)	102841 (-1.4%)	
Gulf of Finland	19 (-2.2%)	6 (+2.3%)	0 (+2.4%)	69628 (+4.9%)	
Gulf of Bothnia	10 (-1.9%)	2 (-.5%)	0 (-.5%)	24582 (+3.4%)	
Gulf of Riga	1 (-16.7%)	0 (-6.4%)	0 (-5.4%)	6124 (-1.1%)	
RoRo-Passenger vessels	14 (-7.3%)	5 (-4.7%)	0 (-4.4%)	18931 (-2.1%)	716 (-5.3%)
Vehicle carriers	1 (-8.3%)	0 (-1.8%)	0 (-1.1%)	5039 (-.5%)	220 (-7.9%)
RoRo-cargo vessels	13 (+3.7%)	3 (+1.7%)	0 (+1.3%)	27586 (+1.3%)	489 (+2.4%)
Bulk carriers	29 (-10.9%)	7 (-6.3%)	0 (-4.2%)	88635 (+5.5%)	332 (-15.6%)
General cargo	12 (-8.0%)	3 (-6.2%)	0 (-5.1%)	60269 (-.1%)	202 (-7.9%)
Container ships	16 (-3.0%)	7 (-6.6%)	0 (-7.5%)	77528 (-3.9%)	212 (+.9%)
Reefers	1 (-15.7%)	1 (-12.8%)	0 (-13.8%)	3847 (-28.7%)	227 (+18.3%)
Tankers	67 (-9.4%)	15 (-5.5%)	0 (-4.5%)	214341 (+1.0%)	313 (-10.4%)
LNG tankers	0 (+286.8%)	0 (+186.7%)	0 (+130.0%)	122 (-15.4%)	2682 (+357.4%)
Gas tankers	2 (+59.7%)	0 (+47.7%)	0 (+41.3%)	1970 (+27.1%)	903 (+25.6%)
Passenger ships	0 (-59.6%)	0 (-38.7%)	0 (-38.0%)		
Cruisers	2 (-13.3%)	1 (-4.2%)	0 (-3.1%)		
Fishing vessels	0 (+1.2%)	0 (+2.5%)	0 (+2.3%)		
Service ships	0 (-16.2%)	0 (-16.6%)	0 (-16.9%)		
Unknown	0 (-9.4%)	0 (+8.2%)	0 (+8.5%)		
Misc	0 (-34.0%)	0 (-30.8%)	0 (-30.6%)		

2014	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	171.6 (+7.5%)	44.7 (+5.8%)	0.7 (+3.9%)	520078.2 (+4.5%)	
Baltic Proper	101 (+6.2%)	26 (+5.4%)	0 (+3.5%)	308717 (+4.4%)	
Kattegat	40 (+15.0%)	10 (+9.4%)	0 (+5.6%)	107155 (+4.2%)	
Gulf of Finland	20 (+5.1%)	6 (+5.2%)	0 (+5.3%)	73371 (+5.4%)	
Gulf of Bothnia	10 (-1.8%)	2 (-1.1%)	0 (-.8%)	25243 (+2.7%)	
Gulf of Riga	2 (+11.9%)	0 (+10.6%)	0 (+10.2%)	6894 (+12.6%)	
RoRo-Passenger vessels	12 (-13.6%)	4 (-7.5%)	0 (-7.6%)	18006 (-4.9%)	650 (-9.1%)
Vehicle carriers	1 (-4.5%)	0 (-1.8%)	0 (-2.8%)	4790 (-4.9%)	221 (+.4%)
RoRo-cargo vessels	13 (-7.0%)	3 (-2.9%)	0 (-.9%)	28177 (+2.1%)	445 (-9.0%)
Bulk carriers	32 (+7.7%)	7 (+9.5%)	0 (+11.3%)	104451 (+17.8%)	304 (-8.6%)
General cargo	12 (-3.1%)	3 (-.7%)	0 (-.7%)	61697 (+2.4%)	191 (-5.3%)
Container ships	30 (+82.3%)	10 (+36.1%)	0 (+23.6%)	83703 (+8.0%)	358 (+68.9%)
Reefers	1 (-13.2%)	1 (-11.0%)	0 (-11.2%)	3504 (-8.9%)	217 (-4.7%)
Tankers	64 (-4.3%)	15 (-3.3%)	0 (-2.7%)	212916 (-.7%)	302 (-3.6%)
LNG tankers	0 (+34.9%)	0 (+38.4%)	0 (+44.8%)	290 (+138.1%)	1519 (-43.4%)
Gas tankers	4 (+118.6%)	1 (+102.1%)	0 (+93.0%)	3475 (+76.4%)	1118 (+23.9%)
Passenger ships	0 (+48.0%)	0 (+44.4%)	0 (+38.2%)		
Cruisers	3 (+16.4%)	1 (+5.6%)	0 (+3.8%)		
Fishing vessels	0 (-2.5%)	0 (+2.2%)	0 (+1.8%)		
Service ships	0 (-3.4%)	0 (+.7%)	0 (+.0%)		
Unknown	0 (+24.7%)	0 (+26.6%)	0 (+26.0%)		
Misc	0 (-37.9%)	0 (-37.0%)	0 (-37.6%)		

2015	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	173.5 (+1.1%)	45.2 (+.9%)	0.7 (+1.0%)	524543.9 (+.9%)	
Baltic Proper	104 (+3.0%)	27 (+2.0%)	0 (+1.6%)	310718 (+.6%)	
Kattegat	40 (+1.7%)	10 (+2.6%)	0 (+3.5%)	112467 (+5.0%)	
Gulf of Finland	20 (+.6%)	6 (+.3%)	0 (+.2%)	73141 (-.3%)	
Gulf of Bothnia	8 (-18.0%)	2 (-11.4%)	0 (-9.1%)	23735 (-6.0%)	
Gulf of Riga	2 (+3.7%)	0 (+6.2%)	0 (+5.0%)	6829 (-.9%)	
RoRo-Passenger vessels	11 (-5.4%)	4 (-4.6%)	0 (-5.0%)	17438 (-3.2%)	635 (-2.3%)
Vehicle carriers	1 (-36.6%)	0 (-36.3%)	0 (-36.0%)	3200 (-33.2%)	210 (-5.1%)
RoRo-cargo vessels	12 (-7.9%)	3 (-5.6%)	0 (-2.5%)	28042 (-.5%)	412 (-7.4%)
Bulk carriers	32 (+1.3%)	7 (+4.0%)	0 (+4.0%)	109467 (+4.8%)	294 (-3.3%)
General cargo	11 (-6.6%)	3 (-4.5%)	0 (-4.8%)	61129 (-.9%)	180 (-5.7%)
Container ships	31 (+2.3%)	10 (-.1%)	0 (-.1%)	80270 (-4.1%)	382 (+6.6%)
Reefers	1 (-8.0%)	0 (-5.9%)	0 (-6.1%)	3222 (-8.1%)	217 (+.0%)
Tankers	68 (+5.3%)	16 (+5.5%)	0 (+5.0%)	219943 (+3.3%)	308 (+1.9%)
LNG tankers	1 (+78.7%)	0 (+76.8%)	0 (+62.9%)	480 (+65.8%)	1637 (+7.8%)
Gas tankers	4 (-4.0%)	1 (-.0%)	0 (+2.4%)	3699 (+6.4%)	1008 (-9.8%)
Passenger ships	0 (+12.9%)	0 (+23.6%)	0 (+21.6%)		
Cruisers	3 (+12.6%)	1 (+6.4%)	0 (+5.3%)		
Fishing vessels	0 (+13.7%)	0 (+13.0%)	0 (+12.7%)		
Service ships	0 (-12.3%)	0 (-10.9%)	0 (-11.4%)		
Unknown	0 (+28.4%)	0 (+32.3%)	0 (+31.0%)		
Misc	0 (+45.2%)	0 (+27.4%)	0 (+28.5%)		

2016	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	191.7 (+10.5%)	49.0 (+8.5%)	0.8 (+6.7%)	544103.6 (+3.7%)	
Baltic Proper	114 (+9.0%)	29 (+7.3%)	0 (+6.0%)	319504 (+2.8%)	
Kattegat	48 (+19.6%)	12 (+16.6%)	0 (+12.9%)	120206 (+6.9%)	
Gulf of Finland	21 (+2.8%)	6 (+.4%)	0 (+.3%)	74433 (+1.8%)	
Gulf of Bothnia	8 (+4.4%)	2 (+3.0%)	0 (+2.5%)	23939 (+.9%)	
Gulf of Riga	2 (-7.8%)	0 (-4.2%)	0 (-4.5%)	6538 (-4.3%)	
RoRo-Passenger vessels	11 (+.1%)	4 (+.6%)	0 (+.8%)	17547 (+.6%)	632 (-.5%)
Vehicle carriers	1 (-12.8%)	0 (-2.9%)	0 (-2.4%)	3217 (+.5%)	182 (-13.2%)
RoRo-cargo vessels	13 (+9.7%)	3 (+7.1%)	0 (+6.1%)	28538 (+1.8%)	445 (+7.8%)
Bulk carriers	33 (+3.0%)	8 (+3.3%)	0 (+3.4%)	113056 (+3.3%)	293 (-.3%)
General cargo	11 (+2.3%)	3 (-.0%)	0 (+.5%)	61346 (+.4%)	184 (+2.0%)
Container ships	42 (+36.4%)	12 (+25.8%)	0 (+22.1%)	89720 (+11.8%)	466 (+22.1%)
Reefers	1 (+12.6%)	1 (+13.6%)	0 (+13.2%)	3556 (+10.4%)	221 (+2.0%)
Tankers	70 (+3.6%)	16 (+1.8%)	0 (+1.4%)	221592 (+.7%)	317 (+2.9%)
LNG tankers	2 (+123.9%)	0 (+126.8%)	0 (+125.5%)	1301 (+170.9%)	1352 (-17.4%)
Gas tankers	4 (+17.9%)	1 (+16.8%)	0 (+15.8%)	4201 (+13.6%)	1047 (+3.8%)
Passenger ships	0 (-31.7%)	0 (-31.4%)	0 (-29.2%)		
Cruisers	3 (+3.8%)	1 (+3.1%)	0 (+2.6%)		
Fishing vessels	0 (-9.0%)	0 (-11.1%)	0 (-10.8%)		
Service ships	0 (+46.3%)	0 (+28.6%)	0 (+27.9%)		
Unknown	1 (+141.3%)	0 (+43.3%)	0 (+42.8%)		
Misc	0 (+31.5%)	0 (+38.8%)	0 (+37.0%)		

2017	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules tonne^{-1} nm^{-1}]
Total	199.9 (+4.3%)	51.8 (+5.7%)	0.8 (+4.5%)	548183.8 (+.7%)	
Baltic Proper	124 (+8.7%)	32 (+10.0%)	0 (+8.0%)	326870 (+2.3%)	
Kattegat	50 (+3.5%)	12 (+3.4%)	0 (+2.4%)	118845 (-1.1%)	
Gulf of Finland	22 (+4.7%)	7 (+7.4%)	0 (+6.8%)	76028 (+2.1%)	
Gulf of Bothnia	9 (+2.9%)	2 (+7.2%)	0 (+7.1%)	24311 (+1.6%)	
Gulf of Riga	1 (-11.7%)	0 (-10.5%)	0 (-9.7%)	5762 (-11.9%)	
RoRo-Passenger vessels	11 (-2.6%)	4 (+1.2%)	0 (+1.1%)	17650 (+.6%)	612 (-3.2%)
Vehicle carriers	1 (+136.3%)	1 (+73.9%)	0 (+68.3%)	4235 (+31.6%)	327 (+79.5%)
RoRo-cargo vessels	12 (-2.3%)	3 (-2.8%)	0 (-2.4%)	27447 (-3.8%)	452 (+1.5%)
Bulk carriers	37 (+11.2%)	9 (+10.8%)	0 (+10.2%)	124314 (+10.0%)	296 (+1.1%)
General cargo	14 (+22.2%)	3 (+26.2%)	0 (+19.9%)	64298 (+4.8%)	214 (+16.6%)
Container ships	47 (+12.2%)	14 (+12.8%)	0 (+11.7%)	90831 (+1.2%)	517 (+10.9%)
Reefers	1 (-1.6%)	1 (-1.3%)	0 (-1.4%)	3577 (+.6%)	216 (-2.2%)
Tankers	68 (-3.3%)	16 (-.9%)	0 (-1.9%)	214556 (-3.2%)	316 (-.1%)
LNG tankers	2 (-1.9%)	0 (+4.8%)	0 (+8.4%)	1596 (+22.6%)	1081 (-20.0%)
Gas tankers	3 (-22.0%)	1 (-21.0%)	0 (-20.5%)	3299 (-21.5%)	1040 (-.7%)
Passenger ships	0 (+406.3%)	0 (+219.7%)	0 (+208.0%)		
Cruisers	6 (+89.6%)	1 (+57.6%)	0 (+44.7%)		
Fishing vessels	0 (+19.5%)	0 (+16.2%)	0 (+15.5%)		
Service ships	0 (+14.5%)	0 (+35.7%)	0 (+35.5%)		
Unknown	2 (+182.2%)	0 (+37.6%)	0 (+39.5%)		
Misc	0 (+50.9%)	0 (+16.4%)	0 (+15.9%)		

	E(noise, 63Hz)	E(noise, 125 Hz)	E(noise, 2000 Hz)	Transport Work	Unit emissions
2018	[GJ]	[GJ]	[GJ]	[10^6 tonne nm]	
					[millijoules tonne^{-1} nm^{-1}]
Total	214.0 (+7.0%)	56.5 (+9.1%)	0.9 (+7.2%)	560264.6 (+2.2%)	
Baltic Proper	135 (+9.3%)	36 (+12.1%)	1 (+10.2%)	333772 (+2.1%)	
Kattegat	54 (+7.4%)	13 (+8.2%)	0 (+5.7%)	120543 (+1.4%)	
Gulf of Finland	21 (-1.5%)	7 (+2.8%)	0 (+2.4%)	79497 (+4.6%)	
Gulf of Bothnia	9 (+7.3%)	2 (+9.7%)	0 (+7.9%)	25516 (+5.0%)	
Gulf of Riga	1 (-1.6%)	0 (+2.8%)	0 (+3.7%)	6273 (+8.9%)	
RoRo-Passenger vessels	10 (-3.2%)	4 (+.2%)	0 (+.4%)	18054 (+2.3%)	579 (-5.4%)
Vehicle carriers	1 (-12.9%)	1 (-1.3%)	0 (-.9%)	4149 (-2.0%)	291 (-11.1%)
RoRo-cargo vessels	18 (+42.3%)	4 (+26.1%)	0 (+19.9%)	27653 (+.7%)	638 (+41.2%)
Bulk carriers	36 (-3.5%)	9 (+.5%)	0 (+1.1%)	127690 (+2.7%)	278 (-6.0%)
General cargo	15 (+11.1%)	4 (+10.7%)	0 (+9.0%)	70456 (+9.6%)	217 (+1.4%)
Container ships	63 (+33.2%)	19 (+32.9%)	0 (+32.1%)	99815 (+9.9%)	627 (+21.2%)
Reefers	1 (-25.4%)	0 (-23.0%)	0 (-23.1%)	2837 (-20.7%)	203 (-6.0%)
Tankers	61 (-10.3%)	15 (-5.3%)	0 (-4.3%)	210181 (-2.0%)	290 (-8.4%)
LNG tankers	3 (+90.9%)	1 (+76.3%)	0 (+51.2%)	1702 (+6.7%)	1935 (+79.0%)
Gas tankers	3 (-16.1%)	1 (-13.6%)	0 (-12.2%)	3047 (-7.7%)	945 (-9.1%)
Passenger ships	0 (+.0%)	0 (+.0%)	0 (+.0%)		
Cruisers	6 (+.9%)	1 (+1.7%)	0 (+3.3%)		
Fishing vessels	0 (+7.4%)	0 (+2.7%)	0 (+3.5%)		
Service ships	0 (+.0%)	0 (+.0%)	0 (+.0%)		
Unknown	2 (+50.2%)	1 (+41.5%)	0 (+38.9%)		
Misc	0 (+35.0%)	0 (+22.2%)	0 (+16.9%)		

2019	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	205.2 (-4.1%)	55.4 (-2.0%)	0.9 (+.0%)	567699.8 (+1.3%)	
Baltic Proper	127 (-6.1%)	34 (-4.0%)	1 (-2.2%)	335189 (+.4%)	
Kattegat	49 (-8.8%)	13 (-2.2%)	0 (+1.5%)	123696 (+2.6%)	
Gulf of Finland	22 (+4.8%)	7 (+4.4%)	0 (+4.9%)	81265 (+2.2%)	
Gulf of Bothnia	10 (+3.3%)	2 (-.4%)	0 (-.6%)	24568 (-3.7%)	
Gulf of Riga	1 (-4.5%)	0 (-1.4%)	0 (-2.2%)	5773 (-8.0%)	
RoRo-Passenger vessels	12 (+12.2%)	5 (+6.8%)	0 (+6.1%)	18480 (+2.4%)	634 (+9.6%)
Vehicle carriers	1 (-10.2%)	0 (-11.6%)	0 (-10.6%)	4048 (-2.4%)	267 (-8.0%)
RoRo-cargo vessels	17 (-4.0%)	4 (-3.9%)	0 (-3.3%)	26211 (-5.2%)	645 (+1.2%)
Bulk carriers	34 (-2.9%)	8 (-3.4%)	0 (-3.2%)	126167 (-1.2%)	273 (-1.7%)
General cargo	13 (-15.9%)	3 (-14.1%)	0 (-10.8%)	66188 (-6.1%)	194 (-10.5%)
Container ships	47 (-24.8%)	16 (-12.9%)	0 (-7.4%)	103451 (+3.6%)	455 (-27.4%)
Reefers	1 (+16.9%)	1 (+18.2%)	0 (+17.5%)	3043 (+7.3%)	221 (+8.9%)
Tankers	64 (+4.8%)	15 (+3.7%)	0 (+3.4%)	214876 (+2.2%)	297 (+2.5%)
LNG tankers	3 (+2.8%)	1 (+9.5%)	0 (+25.3%)	2956 (+73.7%)	1146 (-40.8%)
Gas tankers	3 (-.2%)	1 (+1.0%)	0 (+.9%)	3232 (+6.1%)	889 (-6.0%)
Passenger ships	1 (+.0%)	0 (+.0%)	0 (+.0%)		
Cruisers	9 (+46.7%)	2 (+31.8%)	0 (+23.0%)		
Fishing vessels	0 (-1.4%)	0 (+5.1%)	0 (+3.9%)		
Service ships	0 (+.0%)	0 (+.0%)	0 (+.0%)		
Unknown	2 (-2.9%)	1 (+84.8%)	0 (+88.1%)		
Misc	1 (+.0%)	0 (+.0%)	0 (+.0%)		

2020	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	175.3 (-14.6%)	47.2 (-14.7%)	0.8 (-12.8%)	551381.5 (-2.9%)	
Baltic Proper	104 (-18.3%)	28 (-17.9%)	0 (-15.5%)	322072 (-3.9%)	
Kattegat	42 (-15.0%)	11 (-15.3%)	0 (-13.3%)	118537 (-4.2%)	
Gulf of Finland	22 (-.5%)	7 (-6.5%)	0 (-7.5%)	82298 (+1.3%)	
Gulf of Bothnia	8 (-13.9%)	2 (-13.2%)	0 (-11.1%)	25593 (+4.2%)	
Gulf of Riga	1 (-19.9%)	0 (-15.1%)	0 (-14.3%)	5129 (-11.2%)	
RoRo-Passenger vessels	11 (-6.8%)	4 (-11.1%)	0 (-11.3%)	17037 (-7.8%)	641 (+1.1%)
Vehicle carriers	1 (-32.0%)	0 (-20.5%)	0 (-21.3%)	3040 (-24.9%)	242 (-9.4%)
RoRo-cargo vessels	15 (-10.0%)	3 (-7.0%)	0 (-6.0%)	26086 (-.5%)	584 (-9.5%)
Bulk carriers	39 (+12.6%)	9 (+9.8%)	0 (+8.1%)	132773 (+5.2%)	293 (+7.0%)
General cargo	12 (-9.7%)	3 (-11.9%)	0 (-9.3%)	68151 (+3.0%)	170 (-12.3%)
Container ships	34 (-28.7%)	12 (-25.8%)	0 (-23.7%)	97567 (-5.7%)	344 (-24.4%)
Reefers	1 (+3.2%)	1 (+6.6%)	0 (+6.1%)	3109 (+2.2%)	224 (+1.1%)
Tankers	55 (-13.5%)	13 (-13.7%)	0 (-12.1%)	199765 (-7.0%)	276 (-6.9%)
LNG tankers	5 (+38.2%)	1 (+32.8%)	0 (+24.7%)	3486 (+17.9%)	1342 (+17.2%)
Gas tankers	2 (-36.2%)	0 (-31.3%)	0 (-28.9%)	2587 (-20.0%)	708 (-20.3%)
Passenger ships	0 (-90.5%)	0 (-80.4%)	0 (-77.3%)		
Cruisers	2 (-83.6%)	0 (-83.6%)	0 (-84.7%)		
Fishing vessels	0 (-10.3%)	0 (-13.9%)	0 (-13.2%)		
Service ships	0 (-62.5%)	0 (-44.3%)	0 (-49.4%)		
Unknown	1 (-69.9%)	1 (-42.8%)	0 (-43.2%)		
Misc	0 (-53.5%)	0 (-42.6%)	0 (-42.2%)		

2021	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules $tonne^{-1}$ nm^{-1}]
Total	177.0 (+1.0%)	47.0 (-.6%)	0.8 (+.3%)	568349.7 (+3.1%)	
Baltic Proper	110 (+5.8%)	29 (+2.6%)	0 (+2.9%)	339430 (+5.4%)	
Kattegat	41 (-2.1%)	11 (-2.6%)	0 (-1.1%)	116453 (-1.8%)	
Gulf of Finland	20 (-11.6%)	6 (-4.7%)	0 (-2.5%)	85131 (+3.4%)	
Gulf of Bothnia	9 (+7.8%)	2 (+4.1%)	0 (+2.9%)	24790 (-3.1%)	
Gulf of Riga	1 (-7.2%)	0 (-15.6%)	0 (-13.9%)	5268 (+2.7%)	
RoRo-Passenger vessels	11 (+5.0%)	4 (+2.7%)	0 (+2.8%)	17493 (+2.7%)	656 (+2.3%)
Vehicle carriers	1 (+26.2%)	0 (+4.6%)	0 (+6.0%)	3324 (+9.3%)	280 (+15.5%)
RoRo-cargo vessels	18 (+19.6%)	4 (+15.5%)	0 (+12.1%)	27639 (+6.0%)	659 (+12.9%)
Bulk carriers	43 (+9.8%)	10 (+6.1%)	0 (+6.3%)	141022 (+6.2%)	303 (+3.4%)
General cargo	14 (+18.2%)	3 (+13.4%)	0 (+13.2%)	74623 (+9.5%)	184 (+8.0%)
Container ships	29 (-14.2%)	10 (-12.8%)	0 (-11.8%)	91038 (-6.7%)	316 (-8.1%)
Reefers	1 (-18.4%)	0 (-19.1%)	0 (-18.9%)	2823 (-9.2%)	201 (-10.1%)
Tankers	52 (-5.6%)	13 (-2.1%)	0 (-1.6%)	208276 (+4.3%)	250 (-9.5%)
LNG tankers	4 (-9.4%)	1 (-5.6%)	0 (+3.4%)	3534 (+1.4%)	1199 (-10.7%)
Gas tankers	2 (+12.1%)	0 (+5.7%)	0 (+4.9%)	2792 (+7.9%)	735 (+3.8%)
Passenger ships	0 (+22.9%)	0 (+24.2%)	0 (+22.9%)		
Cruisers	3 (+78.9%)	1 (+82.0%)	0 (+103.4%)		
Fishing vessels	0 (+5.4%)	0 (-4.0%)	0 (-3.5%)		
Service ships	0 (+54.4%)	0 (+83.7%)	0 (+77.8%)		
Unknown	1 (+18.9%)	1 (+19.2%)	0 (+19.2%)		
Misc	0 (-14.2%)	0 (-5.7%)	0 (-5.0%)		

2022	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules tonne^{-1} nm^{-1}]
Total	179.5 (+1.4%)	48.9 (+4.1%)	0.8 (+4.3%)	575295.5 (+1.2%)	
Baltic Proper	110 (+.4%)	30 (+3.9%)	0 (+4.3%)	343422 (+1.2%)	
Kattegat	43 (+5.6%)	12 (+7.7%)	0 (+8.2%)	126578 (+8.7%)	
Gulf of Finland	20 (+3.3%)	6 (+.3%)	0 (-.5%)	80659 (-5.3%)	
Gulf of Bothnia	9 (+2.1%)	2 (+8.8%)	0 (+7.7%)	23610 (-4.8%)	
Gulf of Riga	1 (+16.4%)	0 (+22.6%)	0 (+19.1%)	4902 (-7.0%)	
RoRo-Passenger vessels	11 (-3.7%)	4 (+3.6%)	0 (+4.3%)	17433 (-.3%)	634 (-3.4%)
Vehicle carriers	1 (-28.0%)	0 (-32.2%)	0 (-35.4%)	2065 (-37.9%)	324 (+15.9%)
RoRo-cargo vessels	18 (+1.0%)	4 (+13.4%)	0 (+15.7%)	29690 (+7.4%)	620 (-6.0%)
Bulk carriers	36 (-14.7%)	9 (-7.7%)	0 (-6.5%)	140562 (-.3%)	259 (-14.4%)
General cargo	12 (-11.3%)	3 (-10.9%)	0 (-11.4%)	65256 (-12.6%)	187 (+1.5%)
Container ships	22 (-23.2%)	9 (-15.3%)	0 (-14.2%)	70234 (-22.9%)	314 (-.5%)
Reefers	1 (-5.1%)	0 (-2.5%)	0 (-2.9%)	2798 (-.9%)	192 (-4.3%)
Tankers	63 (+21.6%)	16 (+21.1%)	0 (+19.9%)	241521 (+16.0%)	262 (+4.9%)
LNG tankers	7 (+70.5%)	1 (+75.2%)	0 (+75.5%)	6807 (+92.6%)	1061 (-11.5%)
Gas tankers	2 (-2.4%)	0 (+1.8%)	0 (+1.2%)	2769 (-.8%)	724 (-1.6%)
Passenger ships	0 (+79.3%)	0 (+88.2%)	0 (+84.9%)		
Cruisers	5 (+85.9%)	1 (+100.2%)	0 (+104.5%)		
Fishing vessels	0 (-11.9%)	0 (-11.3%)	0 (-10.7%)		
Service ships	0 (-17.0%)	0 (-32.9%)	0 (-32.0%)		
Unknown	3 (+234.5%)	1 (+64.7%)	0 (+65.0%)		
Misc	1 (+106.5%)	0 (+34.2%)	0 (+18.2%)		

2023	E(noise, 63Hz) [GJ]	E(noise, 125 Hz) [GJ]	E(noise, 2000 Hz) [GJ]	Transport Work [10^6 tonne nm]	Unit emissions [millijoules tonne^{-1} nm^{-1}]
Total	192 (+6.9%)	55 (+12.8%)	1 (+11.8%)	624223 (+8.5%)	
Baltic Proper	117 (+6.1%)	34 (+13.1%)	1 (+12.2%)	369049 (+7.5%)	
Kattegat	49 (+14.0%)	13 (+16.4%)	0 (+15.0%)	144012 (+13.8%)	
Gulf of Finland	21 (+3.8%)	7 (+9.8%)	0 (+9.3%)	88906 (+10.2%)	
Gulf of Bothnia	8 (-13.7%)	2 (-6.1%)	0 (-5.7%)	21185 (-10.3%)	
Gulf of Riga	1 (+2.0%)	0 (+15.4%)	0 (+12.0%)	4554 (-7.1%)	
RoRo-Passenger vessels	10 (-7.3%)	4 (-7.9%)	0 (-7.4%)	16844 (-3.4%)	608 (-4.1%)
Vehicle carriers	1 (-25.2%)	0 (-12.1%)	0 (-11.2%)	1697 (-17.8%)	295 (-9.0%)
RoRo-cargo vessels	13 (-30.3%)	3 (-18.5%)	0 (-13.3%)	26329 (-11.3%)	487 (-21.4%)
Bulk carriers	36 (-1.0%)	9 (+6.1%)	0 (+6.3%)	153206 (+9.0%)	235 (-9.2%)
General cargo	12 (-1.5%)	3 (+1.0%)	0 (-.1%)	64279 (-1.5%)	187 (+.0%)
Container ships	31 (+39.0%)	13 (+41.9%)	0 (+39.9%)	80394 (+14.5%)	382 (+21.5%)
Reefers	1 (+34.7%)	1 (+34.6%)	0 (+34.3%)	3440 (+22.9%)	211 (+9.6%)
Tankers	71 (+11.6%)	18 (+15.6%)	0 (+14.4%)	269679 (+11.7%)	262 (-.1%)
LNG tankers	11 (+46.2%)	2 (+45.9%)	0 (+44.3%)	9378 (+37.8%)	1126 (+6.1%)
Gas tankers	1 (-26.6%)	0 (-20.1%)	0 (-16.5%)	2439 (-11.9%)	603 (-16.6%)
Passenger ships	0 (-42.9%)	0 (-34.2%)	0 (-34.1%)		
Cruisers	6 (+12.1%)	1 (+1.0%)	0 (-9.0%)		
Fishing vessels	0 (+38.6%)	0 (+15.1%)	0 (+15.4%)		
Service ships	0 (-13.7%)	0 (+.8%)	0 (+.5%)		
Unknown	3 (+1.5%)	1 (+9.4%)	0 (+10.5%)		
Misc	0 (-22.0%)	0 (+32.7%)	0 (+34.9%)		