

# Mapping shipping intensity and routes in the Baltic Sea



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This report is an English language version of the first section of the Swedish report "Sjöfarten kring Sverige och dess påverkan på havsmiljön", report 2014:4, which has been adapted for an international readership. The reports are the result of an expert group organised by the Swedish Institute for the Marine Environment.







PHOTO: KJELL LARSSON

# Mapping shipping intensity and routes in the Baltic Sea using historical AIS data

The Baltic Sea and the Skagerrak are heavily trafficked. More than 10,200 different vessels, fishing vessels excluded, visited the region in 2013. Although traffic was most intensive along the routes through the Sound, the Great Belt, the Baltic Proper and the Gulf of Finland, shipping affected the entire marine environment. Some ships were registered in countries with poor performance in Port State Controls.

Shipping in the Baltic Sea is continuously monitored using AIS tracking. By analysing historical data regarding vessels' identity, type, position and speed, traffic intensity can be mapped in detail and provide important input to marine spatial planning. Along with more precise information about the monitored ships and the results of port state controls, AIS data can also make it easier to assess different short- and

long-term effects of shipping on the marine environment.

## Different vessels, different impacts

The most common type of vessel in the Baltic Sea and Skagerrak is the cargo ship. Cargo ships are here defined as containerships, Ro-Ro vessels, dry bulk carriers and other vessels carrying dry or packed cargoes (see Figure 1). The next most common vessel types are tankers (crude oil carriers and product

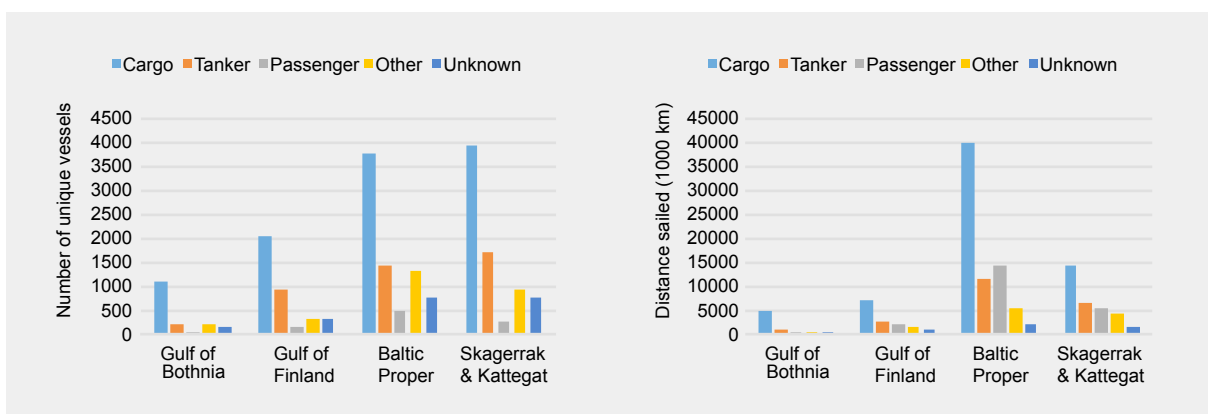


Figure 1. Cargo ships were the most common type of vessel and covered the greatest overall distance in all three areas in 2013.

tankers), and passenger ships, here including combined cargo/passenger Ro-Pax vessels and cruise ships. The more than 10,200 different vessels that visited the Baltic Sea and Skagerrak in 2013, also included various other types of ship, for example, tugs, dredgers and naval vessels. In addition, not all AIS messages provided information on the type of vessel.

Different types of vessel have different environmental impacts. For example, fewer passenger vessels than

tankers sail in the Baltic Sea, but the former are faster and so cover greater distances and produce more emissions of for example carbon dioxide. Average speed is an important factor, because a vessel's fuel consumption increases considerably with speed.

### High traffic intensity

An analysis of traffic intensity in the Baltic Sea in 2013 shows that the traffic was most intensive along the routes through the Sound, the Great Belt, the

Baltic Proper and the Gulf of Finland (see figure 2). It also reveals that no part of the sea area studied was completely free from shipping.

### Registered in numerous countries

Maritime transportation in the Baltic Sea and Skagerrak involves players from all around the world. The vessels visiting the region in 2013 were registered in no fewer than 122 different countries (see Figure 3). It should be noted, however, that most of these were

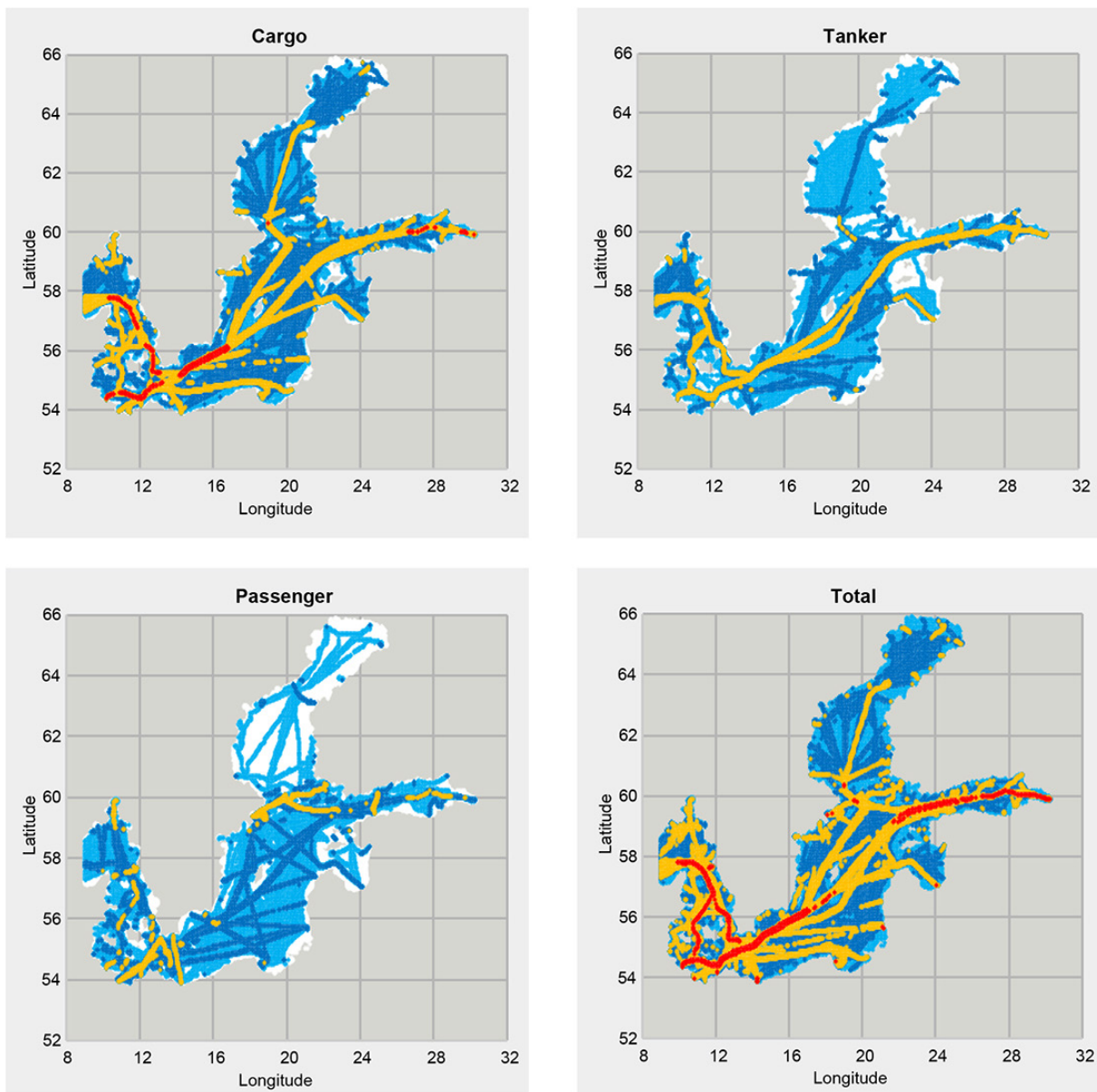


Figure 2. Traffic intensity for different types of vessel in different parts of the Baltic Sea can be mapped by dividing the sea into squares and counting the number of vessels visiting each one. Each small square has a height and width of 0.05 degrees (approx. 3 km by 5 km). The colour coding shows the number of vessels visiting each square in 2013 as follows: white = no vessels, light blue = 1-99 vessels, dark blue = 100-999 vessels, orange = 1,000-9,999 vessels, and red = 10,000 or more vessels.

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carrying cargoes and passengers within Europe, regardless of flag state.

**Performance in Port State Controls**

The Paris Memorandum of Understanding (Paris MoU) on Port State Control is an agreement between several European countries, Russia and Canada on the inspection of merchant vessels visiting their ports. Ships can be detained if deficiencies that are detected are

clearly hazardous to safety, health or the environment. On the basis of these inspections, flag states are ranked and placed on a white, grey or black list. The lists present the full spectrum from quality flags on the white list to flags with a poor performance on the grey and black lists. The lists are based on the total number of inspections and detentions over a 3-year rolling period for flags with at least 30 inspections in the period. Around 2.9 per cent of the vessels sailing in the Baltic Sea in 2013 were from flag states on the grey and black lists – a total of more than 300 ships. Their routes are shown in Figure 4.

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**Footnote:**

All figures in this chapter are based on statistical analysis of AIS data from base stations in Sweden and neighboring countries. The raw data for the calculations were provided by the Swedish Maritime Administration.

**Reference:**

Paris MoU. <https://www.parismou.org>

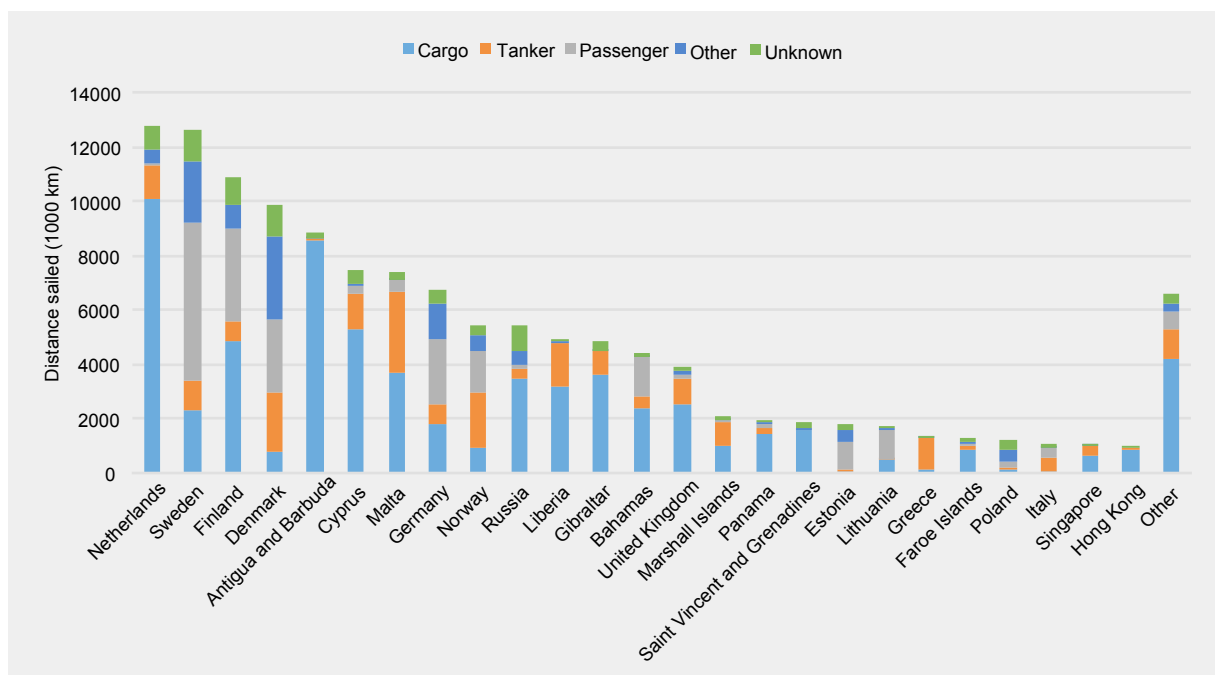


Figure 3. Distance sailed by vessels from the flag states with the greatest traffic in the Baltic Sea in 2013.



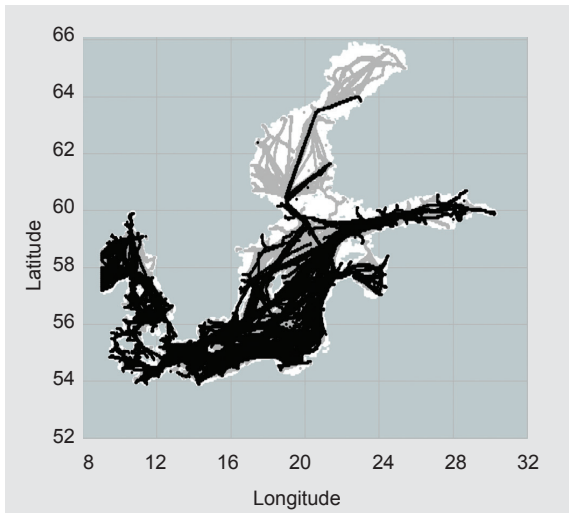


Figure 4a. Traffic by ships registered in flag states on the Paris MoU grey and black lists. Black squares represent areas which were visited by one or more vessels registered in a flag state on the black list, while grey squares represent areas which were visited by one or more vessels from a flag state on the grey list but not by any from one on the black list.

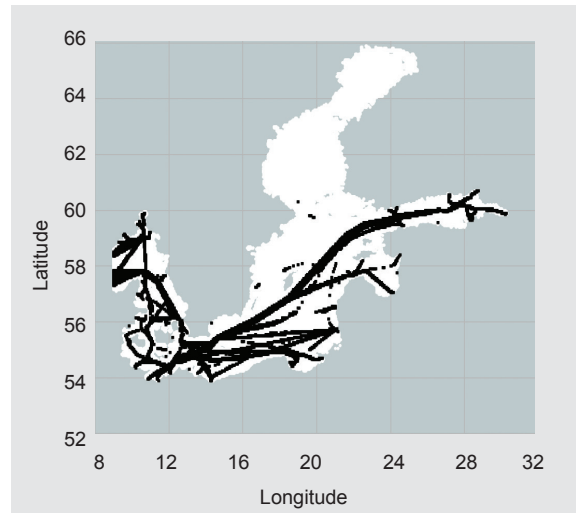


Figure 4b. Traffic by ships registered in flag states on the Paris MoU black list. Black squares represent areas which were visited at least ten times by vessels from a flag state on the black list.

## What is AIS?

**Automatic Identification System (AIS)** is a maritime tracking system intended primarily to increase maritime safety and make it easier for authorities to monitor and manage sea traffic. AIS data on a vessel's identity, position, course and speed are available in real time both to other vessels and to those onshore. The data are also linked to information on vessel type, size, cargo and destination. The system is based on communication between transponders installed on board ships, onshore base stations and a growing number of satellites.

**The use of AIS** is governed by Regulation 19 of the International Convention for the Safety of Life at Sea (SOLAS) adopted by the International Maritime Organization (IMO), an agency of the United Nations. Under the convention, all vessels in international traffic with a gross tonnage of 300 or more have had to be equipped with AIS since 2005. Vessels not in international traffic must also be fitted with AIS equipment if they have a gross tonnage of 500 or more or if they carry passengers. With very few exceptions, a vessel's AIS equipment must be activated at all times.

**Historical AIS data** from base stations in the countries around the Baltic Sea have been collected in a database since 2006. Under an agreement reached through the Baltic Marine Environment Protection Commission (HELCOM), these data are available for environmental research.

**Read more about AIS** on the IMO's website:  
<http://www.imo.org/OurWork/Safety/Navigation/Pages/Default.aspx>

## AIS data for environmental research

**Historical AIS data** can be used more widely in environmental research. One reason why the AIS-data has been underutilized may be that the data is collected primarily for purposes other than assessing the impact of shipping on the marine environment. Another may be that the sheer volume of data is daunting. The figures presented in this publication are based on the analysis of data tables containing more than 500 million AIS messages. The number of gaps in the data and false values may also hinder proper analyses. Our review of AIS data showed that on some days there can be significant amounts of missing information on vessel types and cargoes for the vessels and positions recorded. Calculations of time and distance between observations for specific vessels also revealed that some positions are clearly inaccurate. On balance, however, the AIS data from 2013 are of sufficient quality to warrant greater attention in environmental research.



## THE SWEDISH INSTITUTE FOR THE MARINE ENVIRONMENT

The Swedish Institute for the Marine Environment, SIME, is a national centre for interdisciplinary analysis and synthesis based on collaboration between four universities: University of Gothenburg, Linnaeus University, Stockholm University and Umeå University. The Institute, which has a coordinating secretariat in Gothenburg, was established by the Swedish Government in 2008 in order to make best possible use of available scientific knowledge for managing the sea.

One of the institute's main tasks is to facilitate the exchange of knowledge between researchers, authorities and policy makers to facilitate qualified decision-making concerning the future of the sea. Another aim is to increase public understanding about marine environmental problems, and their links to human activities. The Institute also provides an important link to international players and stakeholders.

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