

Union of 4 Sources

IMO Num...	Name	Ship type	Reporting Peri...	Technical efficiency	Technical efficiency [g CO2/t*n...	Port of Registry	Home Port	Ice Class	DoC issue d...	DoC
6703343	EQUALITY	Other ship types	2021	EIV (57.84 gCO2/t-nm)	57.84	Beirut	null	null	01/06/2022	30/0...
7037806	IONIAN STAR	Ro-pax ship	2021	EIV (19.4 gCO2/t-nm)	19.4	PANAMA	PANAMA	null	29/04/2022	30/0...
7043843	TALOS	Ro-ro ship	2021	EIV (48.71 gCO2/t-nm)	48.71	Piraeus	Piraeus	null	28/04/2022	30/0...
7128332	SEA WIND	Ro-pax ship	2021	EIV (9.29 gCO2/t-nm)	9.29	Tallinn	Tallinn	IB	20/04/2022	30/0...
7226952	FJARDVAGEN	Ro-ro ship	2021	EIV (43 gCO2/t-nm)	43	Mariehamn	Mariehamn	IA	28/04/2022	30/0...
7230599	MARKO POLO	Ro-pax ship	2021	EIV (45 gCO2/t-nm)	45	Rijeka	null	null	06/03/2022	30/0...
7305253	CORSICA VICTORIA	Ro-pax ship	2021	EIV (10.75 gCO2/t-nm)	10.75	Genova	null	null	03/04/2023	30/0...
7310507	FIDELITY	Other ship types	2021	EIV (31.13 gCO2/t-nm)	31.13	Beirut	null	null	02/06/2022	30/0...
7325095	LAMPEDUSA	Ro-pax ship	2021	EIV (35.34 gCO2/t-nm)	35.34	Catania	Catania	null	20/05/2022	30/0...
7346221	SUPERFERRY II	Ro-pax ship	2021	EIV (44.89 gCO2/t-nm)	44.89	PIRAEUS 9939	RAFINA	null	28/04/2022	30/0...
7349039	CORSICA MARINA SECONDA	Ro-pax ship	2021	EIV (11.49 gCO2/t-nm)	11.49	Genova	null	null	20/01/2023	30/0...
SUMMARY ^ 48,984 Rows – 64 Columns										

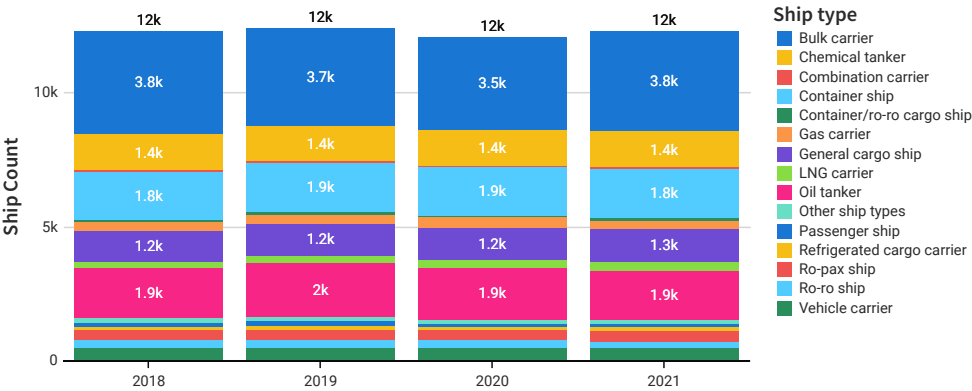
Analyzing the emissions data from the MRV system can provide valuable insights into the environmental impact of maritime transportation. Initial insights include:

- LNG carriers becominng more technically efficient than any other ship type (see bottom visual).
  - Future analyses could include identifying the best emission reduction strategies used by LNG carriers, such as newly adopted cleaner fuels, energy-efficient technologies (e.g. advanced engines, fleet renewal), or operational practices (e.g. better routes) that can be implemented for other ship types.
- Other future analyses could include
  - Investigating regulations (see total emissions from France), comparing emissions with existing regulations or standards, and assessing whether ships are meeting emission standards and progressing towards emission reduction targets.
  - Evaluating the environmental impact of ship emissions, such as their contribution to air pollution or the potential effects of climate change. This analysis can help raise awareness about the importance of reducing ship emissions and support policy-making efforts.

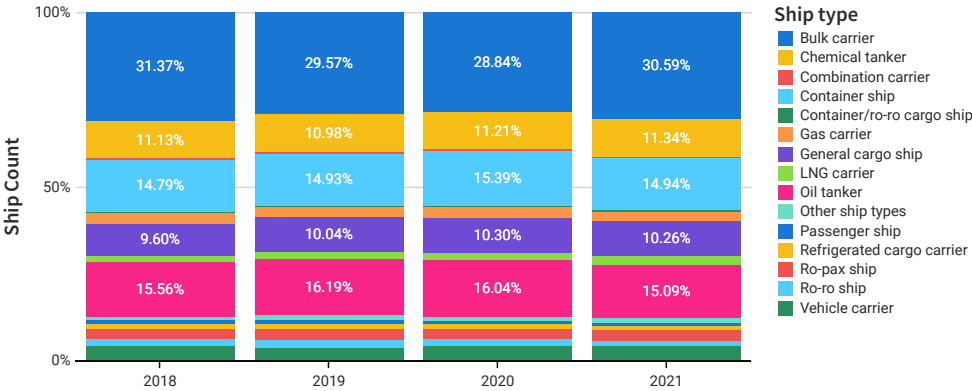
How many ships of each type are there?

- Bulk carriers, container ships, and oil tankers are the three most prevalent ships.
- We don't see a spike or reduction in ship types.

Ship Count by Year and Ship type



Ship Count by Year and Ship type



How do the emissions profiles differ for the different ship types?

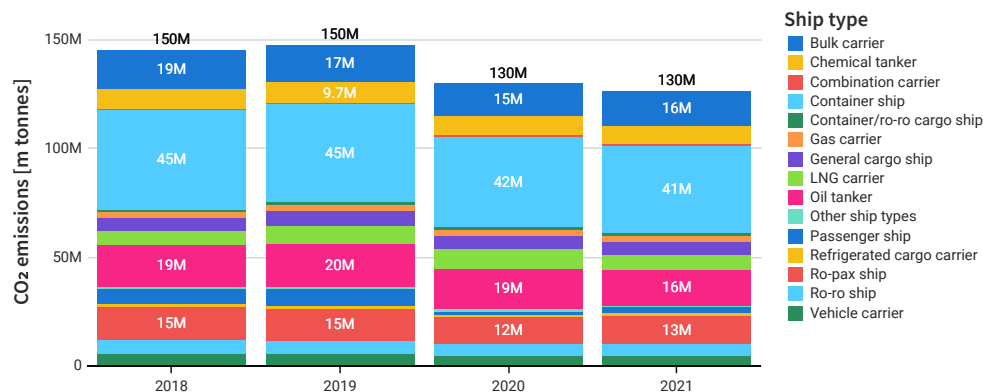
## Emission Trends

- No large fluctuations YoY. There is a ~15% drop in emissions in 2020 and 2021, likely due to the UK leaving the EU (see total emissions by country).

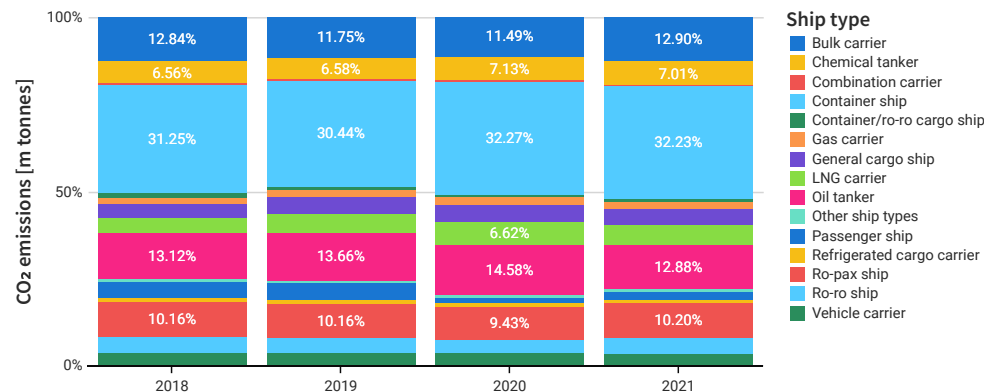
## Sector Analysis

- Although container ships are not the most prevalent ship, they make up for a third of total emissions, indicating the ships aren't fuel-efficient, they're travelling more nautical miles causing more emissions or both, etc. Let's investigate below.

### Total CO<sub>2</sub> emissions [m tonnes] by Year and Ship type



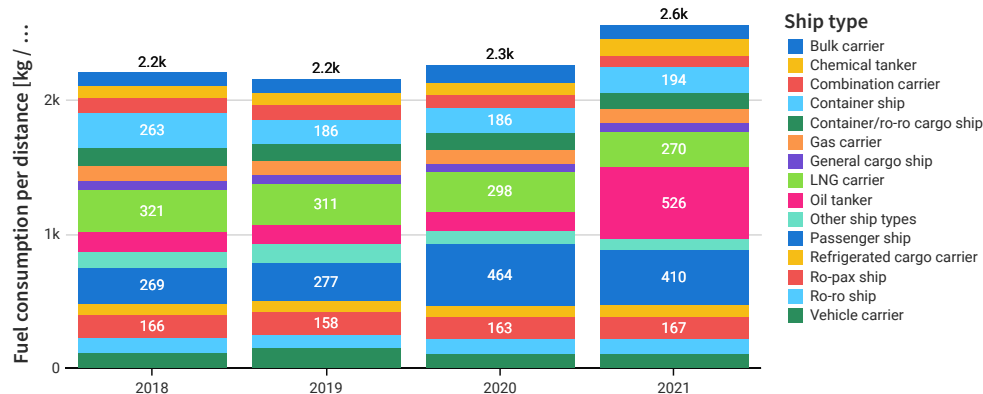
### Total CO<sub>2</sub> emissions [m tonnes] by Year and Ship type



## How many miles did each vessel in the database travel?

- Instead of miles travelled, we consider the average fuel consumption per nautical mile travelled.
  - A steady decline in LNG carrier fuel consumption per n mile indicates newer cleaner fuels, energy-efficient technologies, or operational practices as mentioned above.
  - On the other hand, in 2021, there was a spike in oil tanker fuel consumption per n mile, indicating some external factor is the cause.
- Answering our note from above (are container ship's emissions high because of fuel inefficiency or because they're travelling more?).
    - We see container ships' fuel efficiency improve by almost 40% so, container ships must be travelling further distances or their capacity has increased.
      - If the former, is there a possibility of optimizing their shipping routes?
      - If the latter, are there cleaner fuel options or more efficient engines?

### Average fuel consumption per distance [kg / n mile] by Reporting Period and ...



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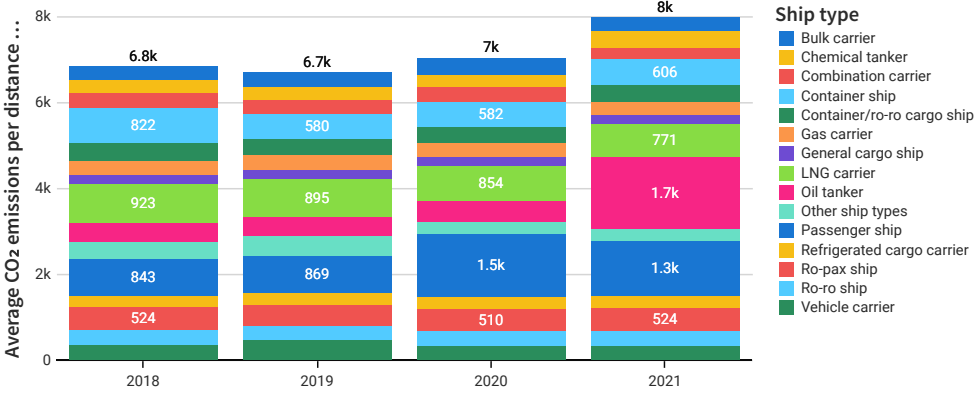


What is the relationship between ship Deadweight and emissions intensity?

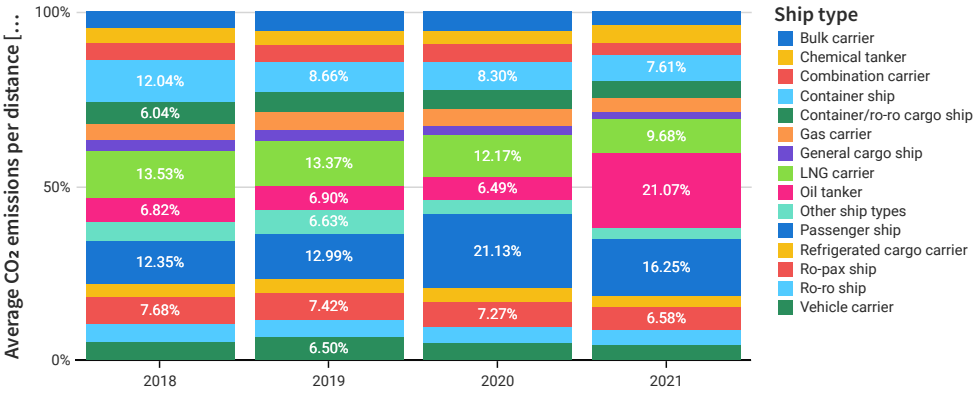
Emission Intensity

- We can look for trends or anomalies by comparing average emissions per n mile to average fuel consumption (displayed above).
- Higher fuel consumption correlates to higher emissions.
  - I.e. there are no ships that have high fuel consumption but low emissions.
- Perhaps there are opportunities to focus on fuel efficiency and reducing emissions for ships with the greatest emissions and fuel consumption.

Annual average CO<sub>2</sub> emissions per distance [kg CO<sub>2</sub> / n mile] by Year and Ship...



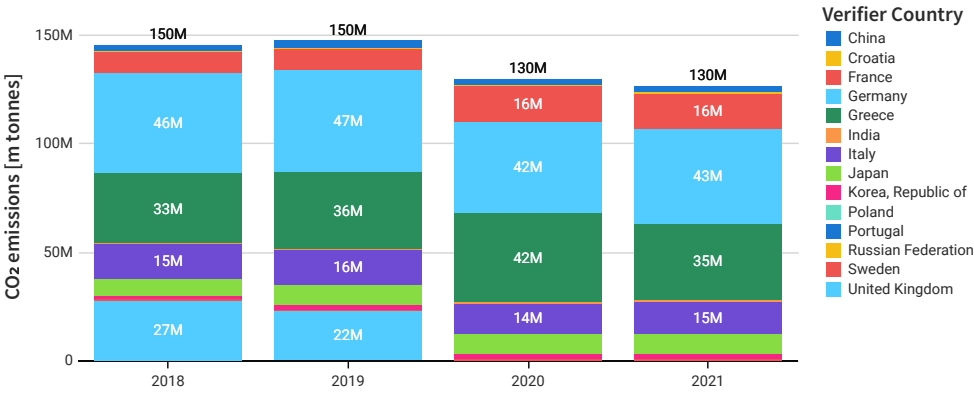
Annual average CO<sub>2</sub> emissions per distance [kg CO<sub>2</sub> / n mile] by Year and Ship...



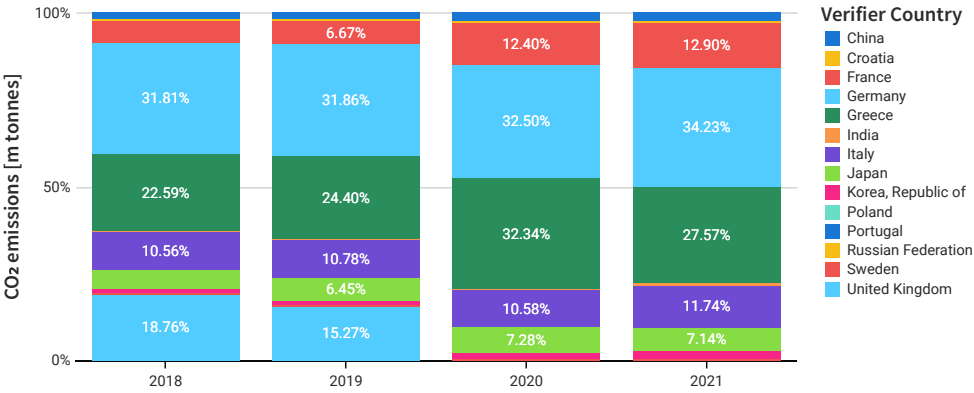
Geographic Analysis

- Greece consistently emits a third of total emissions, even with the drop in total emissions in 2020 and 2021.
- The UK's total emissions dropped to 0 due to them leaving the EU in 2020.
- France doubled emissions, possibly due to a lack of regulations.
- Follow-up: Investigate routes that are causing high emissions. Are there sanctions or unsafe regions causing higher emissions?

Total CO<sub>2</sub> emissions [m tonnes] by Year and Verifier Country



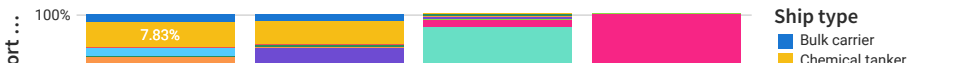
Total CO<sub>2</sub> emissions [m tonnes] by Year and Verifier Country

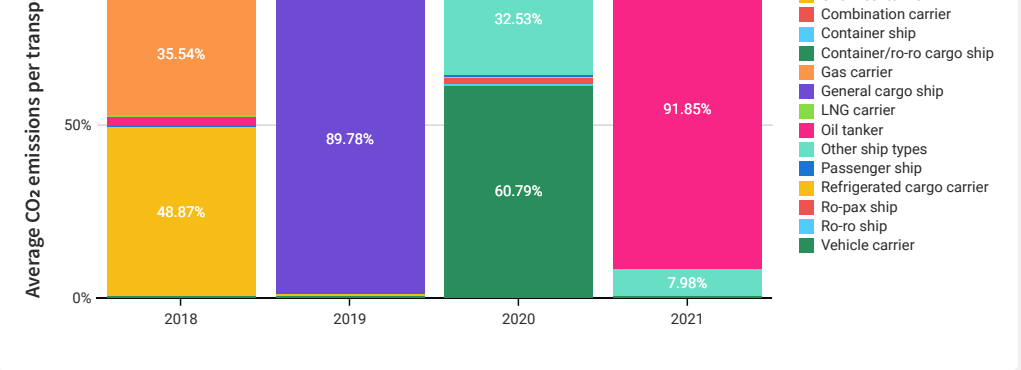
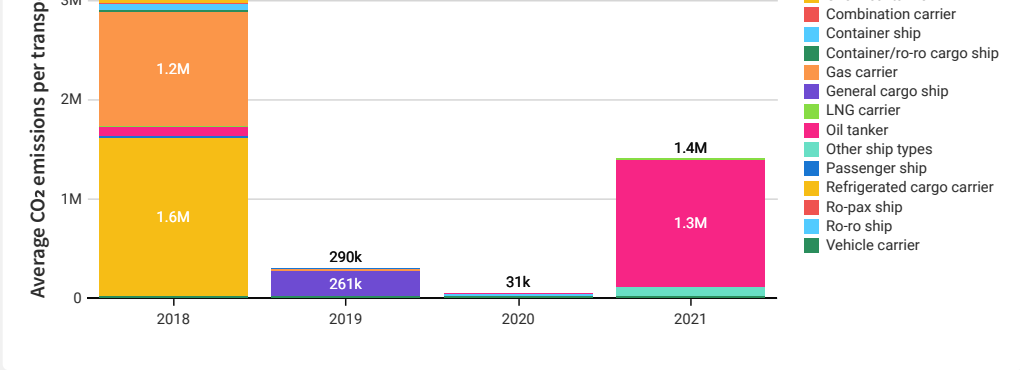


Annual average CO<sub>2</sub> emissions per transport work [g CO<sub>2</sub> / m tonnes · n miles...



Annual average CO<sub>2</sub> emissions per transport work [g CO<sub>2</sub> / m tonnes · n miles...

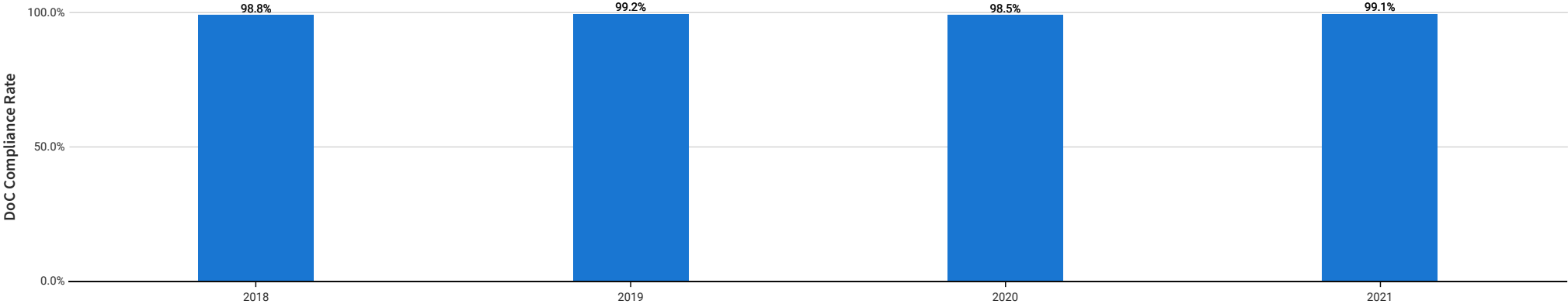




### Compliance Assessment

- Ships are consistently reporting their emissions accurately and on time indicating enforcement and/or incentives are working.

### DoC Compliance Rate by Year



The EIV value measures the ship's environmental performance relative to an efficient reference level by comparing the ship's actual emissions with a benchmark or target value.

- As a whole, ships have become more technically efficient, especially LNG carriers.

### Average technical efficiency [g CO<sub>2</sub>/t\*nm] by Year and Ship Type

