


# Emission abatement options and potential secondary impacts

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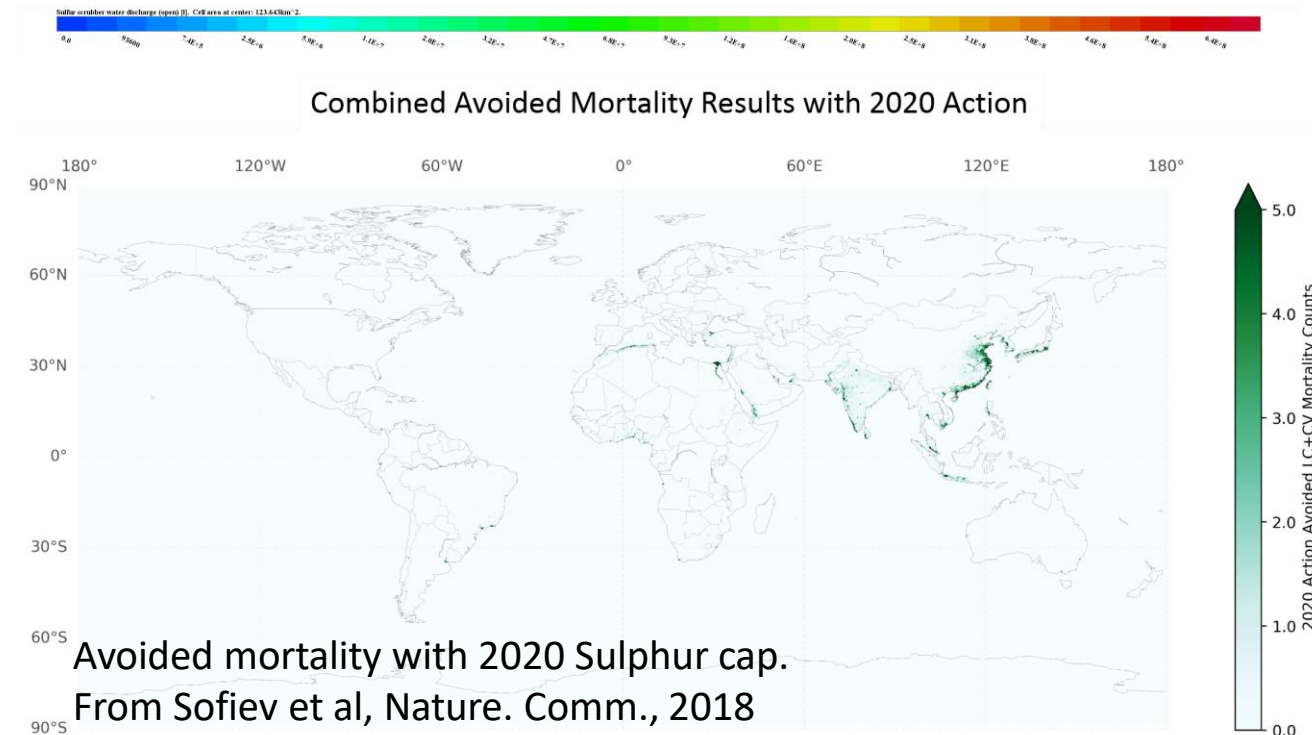
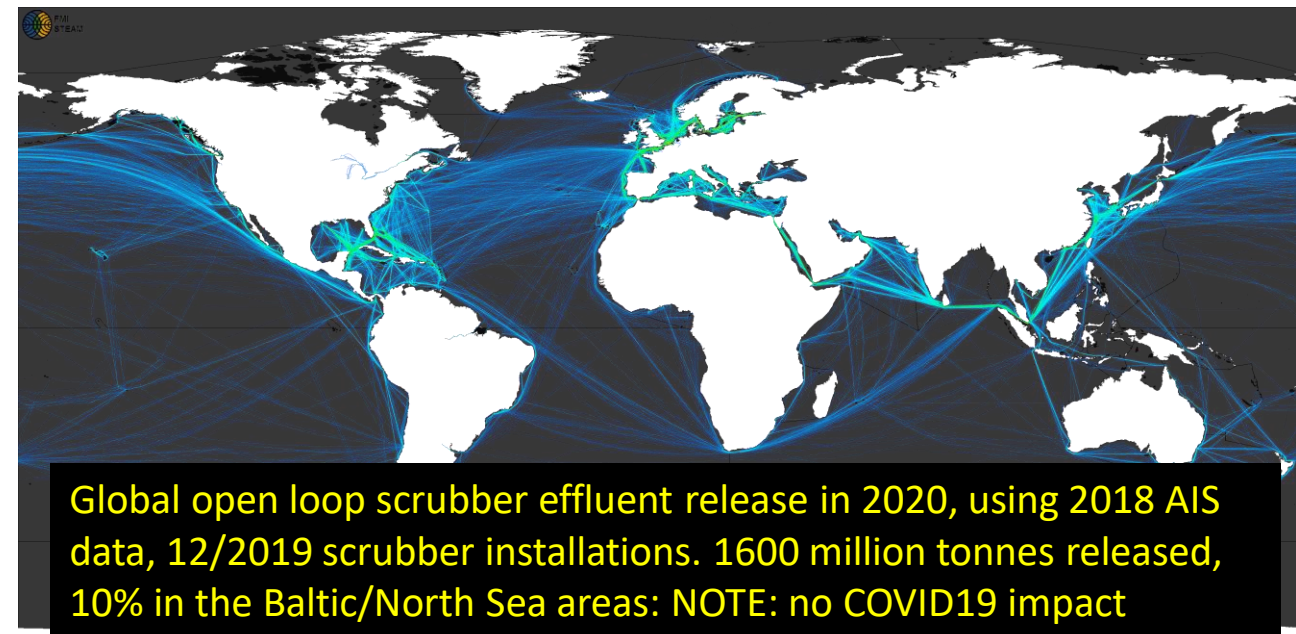
CSHIPP online webinar  
Nov 27<sup>th</sup> 2020

# Big topics with a lot of changes coming

- Air Quality
    - Emission Control Areas
    - Sulphur cap
    - NOx control
  - Greenhouse gases
    - Shift towards low/zero carbon fuels
    - Black Carbon
  - Underwater noise
    - Noise vs speed
    - Noise vs energy efficiency
- 

# Air quality

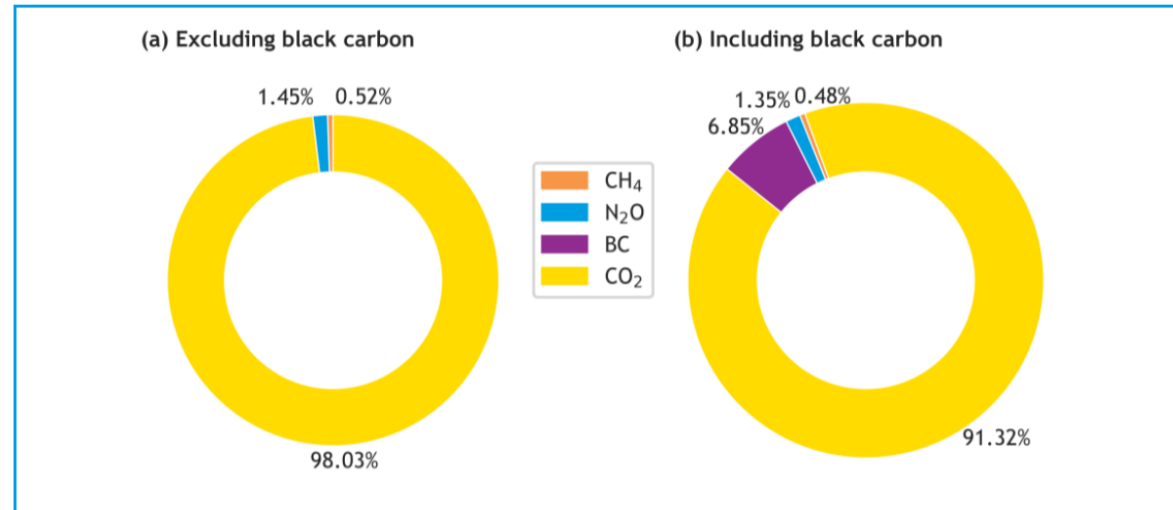
- Introduction of SECA/NECAs, options to comply
  - Low sulphur fuels
  - Emission abatement
    - SOx scrubbers
    - Selective Catalytic Reduction
  - LNG
- Health and climate impacts
- **Scrubbers create a new pollution stream**
- **Ammonia and methane slip**
  - IMO GHG4: In 2018, LNG use 11 million tonnes/a with 150 tonnes/a slip
    - 1.4% of LNG released through methane slip



# Greenhouse gases

- Black Carbon emissions are function of
  - Fuel
  - Engine technology (old vs new)
  - Operational features (how engines are run)
- **Fuel quality restriction may not be enough**
- Shift to LNG, reduction of BC?
  - May add to the methane slip if not limited
- Is aftertreatment an option?

Figure 78 - Comparison of the contribution of individual species to voyage-based international greenhouse gas emissions (in CO<sub>2</sub>e) in 2018, highlighting the impact the inclusion of black carbon has.



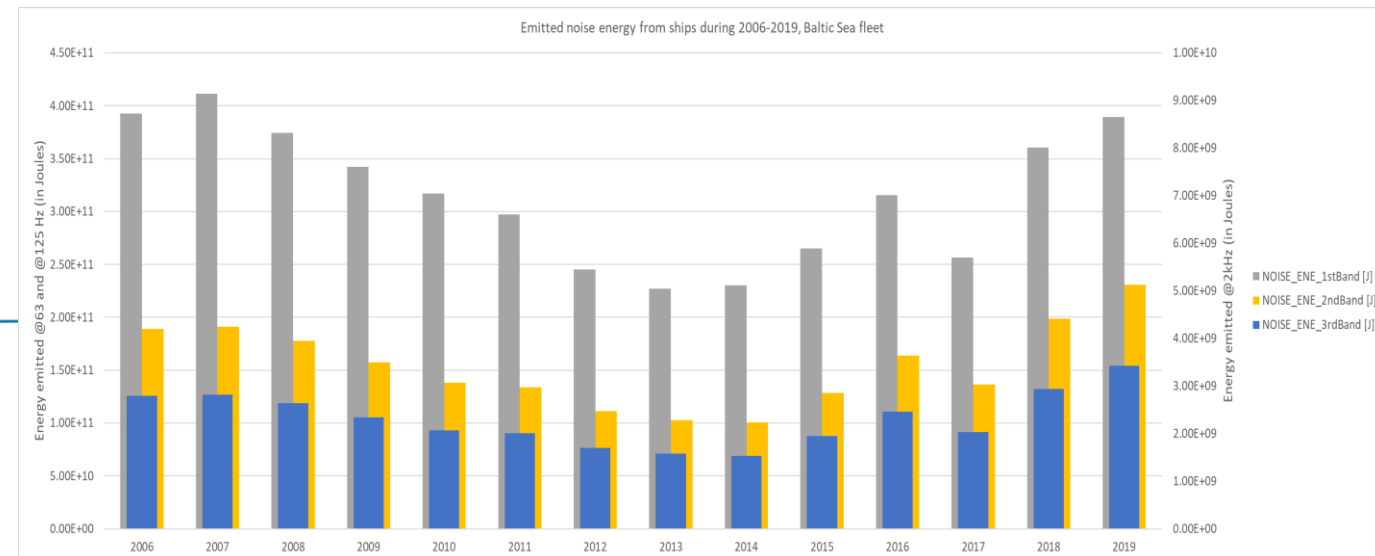
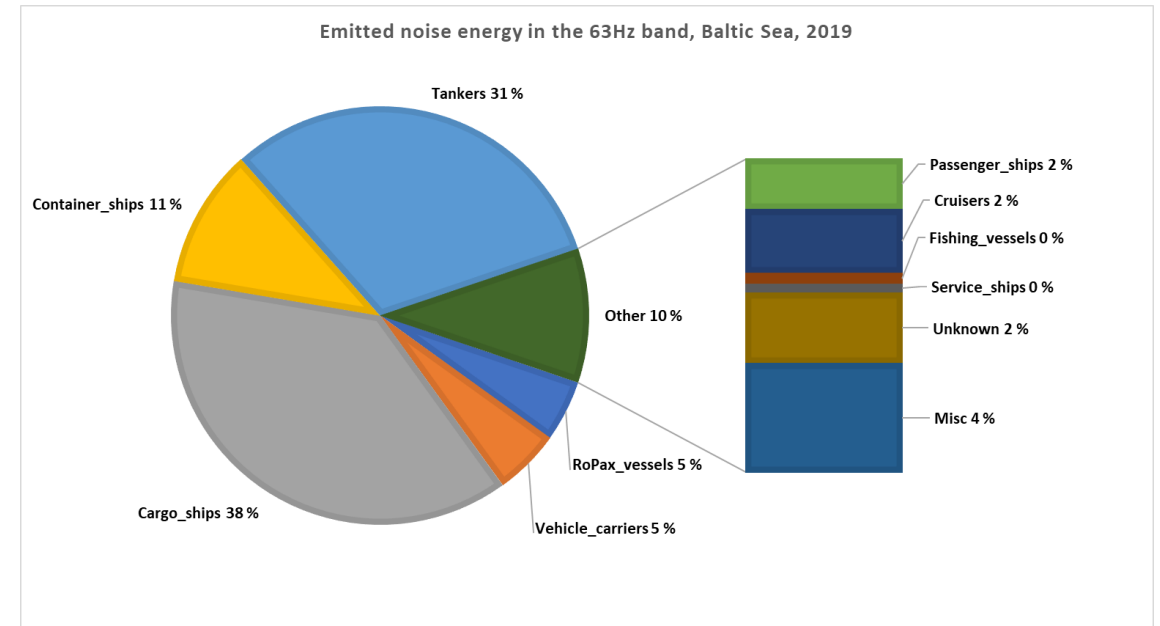
IMO GHG4, 2020

# Greenhouse gases, 2

- Can existing infrastructure still be used?
- Fuels possible both for combustion engines and fuel cells
  - Methane
  - Methanol
  - Ammonia
- Drop-in fuels with fossil, bio and synthetic production paths
  - 5-10 times more expensive than fossil fuels
- **Some points of concern**
  - Ammonia: Increase in NO<sub>x</sub> emissions**
  - Fuel toxicity**
- Synthetic production has hydrogen as intermediary step
  - When/if hydrogen fuel cells become a viable option, move away from internal combustion engine
- Timeline?
  - Fossil-based step towards these fuels in 0-2 years
- These vessels will still sail in 2050 → GHG targets → Must switch to sustainable fuels

# Underwater noise

- Upcoming topic, increased effort to generate science background for mitigation options
- Technical measures to reduce noise
  - VARD Report 368-000-01, "Ship underwater radiated noise"
- **Energy efficiency vs noise**
  - NOx vs CO<sub>2</sub>; the diesel dilemma, something similar here?
- Scattered monitoring effort, permanent noise observation network needed
- Impact studies with animals
  - Level of discomfort
  - Behavioral changes
  - Physical injury or death
- Precautionary approach
  - Control sources if impacts are poorly known?





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