Preliminary results

Impact of Ships' Biofouling on Greenhouse Gas Emissions

GloFouling PARTNERSHIPS
Global Industry Alliance

gef UNDP IMO INTERNATIONAL MARITIME ORGANIZATION

The perceived impact of biofouling is likely to have been historically underestimated

GHG emissions caused by biofouling on ships

Maritime trade is critical for the movement of goods and people around the globe. Whilst shipping is one of the most economical and environmentally friendly modes of transport available, it contributes to roughly 3% of the global greenhouse gas (GHG) emissions every year due to the size of the sector.

In order to reduce the GHG emissions from the maritime industry the International Maritime Organization (IMO) has adopted a series of legally-binding ship design and operational performance indices that must be achieved by individual vessels. The aim is to ensure that ship operators consider options to improve the efficiency of their vessels throughout their lifecycle. One of the most significant factors impacting the efficiency of all ships in service is associated with the resistance generated by the underwater area. Maintaining a smooth and clean hull free from biofouling is of paramount importance.

Biofouling, which is the build-up of microorganisms, plants, algae or small animals, is known to increase the roughness of the colonised surfaces. When those surfaces form the underwater parts of a ships' hull, the increased roughness will increase a ship's hydrodynamic drag. The immediate effect is a loss in ship speed at a constant power - or a power increase to maintain a constant speed. Both of these have negative economic and environmental impacts through increased fuel consumption and atmospheric emissions, including GHG.

This Report on the Impact of Ships' Biofouling on Greenhouse Gas (GHG) Emissions responds to a decision in 2020 of the Global Industry Alliance (GIA) for Marine Biosafety to address the poor understanding amongst the shipping industry of the relationship between ships' biofouling with fuel consumption and resulting GHG emissions. The focus of this initiative is two-fold:

- analyse the impact of biofouling accumulation on the energy efficiency of ships, and
- analyse the sustainable solutions currently available to ship owners to effectively reduce GHG emissions through the minimisation of biofouling.

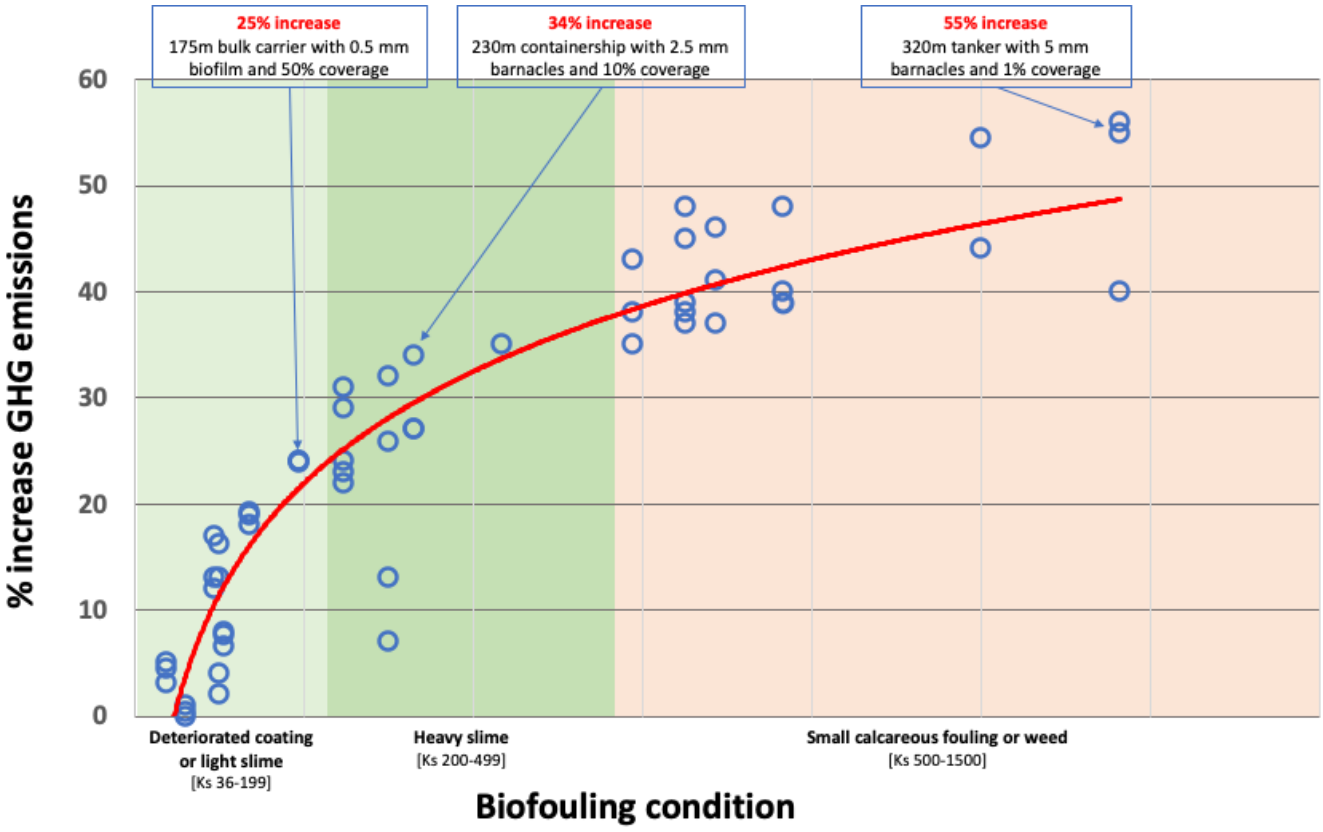
The results will be based on an updated assessment of the current state of knowledge, complemented with newly developed research.

Unmanaged ship's biofouling: quantifying the potential impact

The measurement of ship performance is challenging due to the wide variety of ship types and the conditions under which they need to operate. The first part of this report aims to summarise the existing literature which links biofouling and GHG emissions. The chart below displays graphically the outcome of this exercise by showing the results of all the studies that have analysed and compared the impact of hull biofouling on the increased surface roughness on the energy efficiency of ships.

CHART: IMPACT OF SHIP HULL BIOFOULING ON GHG EMISSIONS

Compendium of results from published research studies



At the lower end, studies consistently point out the inherent ability of biofilms and slime to induce an effective roughness that is well in excess of what its physical structure would traditionally suggest. For example, a layer of slime as thin as 0.5 mm covering up to 50% of a hull surface can trigger an increase of GHG emissions in the range of 20 to 25%, depending on ship characteristics, speed and other prevailing conditions.

A layer of slime, typically microalgae.

For more severe biofouling conditions, such as a **light layer of small calcareous growth** (barnacles or tubeworms), an average length container ship can see an **increase in GHG emissions of up to 55%,** dependent on ship characteristics and speed.

Overall, the report clearly shows how the perceived impact of biofouling is likely to have been historically underestimated by the shipping community

Barnacle growth on a ship hull.

Biofouling control strategies

The second part of the report will include newly-developed research focused on analysing the effect of currently available industry practices for biofouling management, such as the importance of selecting the most appropriate fouling control coating, hull cleaning, propeller polishing and the use of ultrasonic antifouling systems. Whilst some ship owners minimise biofouling through the use of the best available technologies, there is an opportunity for this best practice to be adopted by the entire industry.

Fortunately, there are a range of commercially available options today that can significantly reduce the impact of biofouling on shipping and thereby enhance the performance of ships. Those include using optimised biofouling control coatings, in-water cleaning technologies and ultrasonic systems, all of which can form part of a holistic hull management approach by the ship operator.

Combined with recent surveys on the true level of biofouling prevalent within the shipping fleet, the preliminary results of this report clearly highlight the importance of biofouling mitigation measures, as an essential component in the toolbox for GHG emissions reduction by the shipping industry. This is especially true in the short to medium term, where biofouling management may be used as a means of compliance with IMO carbon intensity requirements, while the development and deployment of other GHG reduction strategies based on new low-carbon and zero-carbon fuels or technologies comes to fruition.

The final version of the Report is expected to be published in February 2022.

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