
**MEDITERRANEAN ACTION PLAN (MAP)
REGIONAL MARINE POLLUTION EMERGENCY RESPONSE CENTRE FOR THE
MEDITERRANEAN SEA (REMPEC)**

Sixteenth Meeting of the Focal Points of the Regional
Marine Pollution Emergency Response Centre for the
Mediterranean Sea (REMPEC)

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Agenda Item 8: Reduction of GHG emissions from ships

**Impact of Biofouling on the Energy Efficiency of Ships and the GHG Abatement Potential of Biofouling
Management Measures in the Mediterranean region**

For environmental and cost-saving reasons, this document will not be printed and is made available in electronic format only. Delegates are encouraged to consult the document in its electronic format and limit printing.

Note by the Secretariat

The present document presents the Study Analysing the Impact of Biofouling on the Energy Efficiency of Ships and the GHG Abatement Potential of Biofouling Management Measures in the Mediterranean region.

The Meeting will be requested to consider the recommendations and propose the best way forward.

Background

1 The Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC) commissioned a Study analysing the impact of biofouling on the energy efficiency of ships and the greenhouse gas (GHG) abatement potential of biofouling management measures in the Mediterranean Sea region (“the Study”). It presents available information considering the impact of biofouling on ship energy efficiency and the relationship to GHG emissions released and subsequent potential GHG reduction through biofouling management. The Study evaluates current international practices, the effectiveness of biofouling management technologies, and develops possible future guidance / policy recommendations to enhance GHG emissions reduction efforts with biofouling management within the Mediterranean Sea context. The Study is provided in document REMPEC/WG.61/INF.16.

2 Biofouling on ships' hulls significantly contributes to increased fuel consumption and GHG emissions. Additionally, it facilitates the spread of NIMS, threatening marine biodiversity. The Mediterranean Sea, as a major global shipping route, faces particular challenges in managing these issues across multiple regulatory boundaries.

3 This document has been prepared using the research from the Study and outlines a strategy for addressing biofouling management in the Mediterranean Sea, with the aim of reducing greenhouse gas (GHG) emissions and concurrently managing the spread of non-indigenous marine species (NIMS). The recommendations focus on regional cooperation, standardisation of practices, and the implementation of international guidelines, all designed to enhance the environmental protection of the Mediterranean Sea region while promoting sustainable shipping practices.

Main Findings

Global Policy Context

4 The IMO's 2023 Biofouling Guidelines serve as a primary reference for various international and national biofouling management regulations aimed at minimising the transfer of NIMS through biofouling and reducing GHG emissions. While these guidelines are not mandatory, leading to varied implementation across regions, some countries have established stringent regulations e.g. Australia and New Zealand. The GEF-UNDP-IMO GloFouling Partnerships Project emphasises the importance of effective biofouling management for addressing both invasive species and GHG emissions. The IMO is also promoting global efforts to achieve a 50% reduction in shipping GHG emissions by 2050, with biofouling identified as a key area for management improvement through the Carbon Intensity Indicator (CII) assessment.

Impact on shipping Efficiency

5 Shipping is the most efficient method of global goods transport, but biofouling can significantly impede vessel efficiency thus raising GHG emissions. Both later stage macrofouling primary stage slime layer development can substantially increase hydrodynamic resistance leading to increased power and fuel demand. Effective biofouling management can lead to significant energy savings and emission reductions, particularly beneficial in busy shipping regions like the Mediterranean Sea. However, the precise impact of biofouling on GHG emissions is not fully quantified due to multiple influencing factors such as vessel design, prevailing conditions, and a lack of comprehensive data, making it challenging to translate findings into actionable outcomes to manage biofouling and reduce GHG levels.

Biofouling Management

6 The evolution of biofouling management in shipping, from historical methods to current practices and future innovations, are discussed in the Study. The gradual shift from biocidal coatings to options such as foul release coatings (FRCs) and hard coatings is highlighted. The Study emphasises the limited data on the effects of different coating types on GHG emissions, but that data considering the efficacy of smooth cleaned hulls can achieve in reducing fuel use show readily achievable levels can be up to 10%. Various approaches to biofouling management are explored, including the management of and restrictions on in-water cleaning (IWC) and the promotion of proactive hull grooming involving regular tailored cleaning at the slime layer stage to stop facilitation of denser fouling and to minimise hydrodynamic resistance. The need for balanced, effective, and environmentally responsible biofouling management is stressed, along with the importance of developing appropriate infrastructure and regulations for the growing in-water hull cleaning industry. Guidelines have been suggested by the shipping industry (i.e. BIMCO) and regulators as a potential model to be followed for effective management of the industries operations and an international standard for IWC (ISO 6319) is currently being developed.

GHG Reduction Potential

7 Research suggests that a global approach to effective biofouling management could reduce shipping-related GHG emissions by up to 19%, equivalent to up to 198 million tons of CO₂ annually. The Mediterranean Sea, a key shipping route between Asia and Europe, experiences significant maritime traffic and associated air quality issues. Non-native fouling species in the region exacerbate the problem. A GEF-UNDP-IMO study indicated that proactive hull cleaning, particularly the "clean before you leave" approach, could significantly reduce hydrodynamic resistance and CO₂ emissions in the region. One study on a Mediterranean ferry showed that a clean hull saved in the region of 15 kg of fuel per mile. Researchers commented though that policy changes would be required before this became the norm. Additional strategies to reduce GHG emissions include on-board carbon capture, slow steaming, alternative fuels, weather-based route planning, and electric power plants. A multiple criteria analysis undertaken as part of the study suggests that proactive cleaning for foul release coatings (FRCs) and potentially hard coatings is optimal for managing biofouling and reducing GHG levels from shipping.

Key Recommendations

8 The Study makes a number of recommendations that if implemented are expected to result in:

- .1 significant reduction in GHG emissions from shipping in the Mediterranean Sea;
- .2 enhanced protection of marine biodiversity through reduced NIMS transport;
- .3 improved regional cooperation on environmental issues; and
- .4 standardised and more effective biofouling management practices across the region.

9 The following recommendations are made:

- .1 ratification of the IMO Anti-fouling System (AFS) Convention by all Contracting Parties to the Barcelona Convention (CPs);
- .2 assessment of implications and CPs uptake of guidance towards formally adopting the IMO Biofouling Guidelines for vessels short shipping and transiting the Mediterranean Sea;
- .3 development of standardised, auditable biofouling management policies;

- .4 implementation of "Clean Before You Leave" guidance for vessels due to enter the Mediterranean Sea;
- .5 national audits and standardisation of In-Water Cleaning (IWC) facilities; and
- .6 promotion of smooth coatings and alternative technologies for reducing hull friction.

Possible Action Plan

Short-term Actions (circa 2 years)

10 Assess the ratification status of the AFS Convention among CPs, with the intention to get all CPs to become Parties to the AFS Convention. This should include actions to:

- .1 identify and engage key stakeholders, including national maritime authorities and relevant international bodies;
- .2 conduct initial consultations to align objectives and expectations; and
- .3 develop a report summarising stakeholder input and agreed objectives.

Short- to medium-term (circa 2 to 4 years)

11 Develop models to calculate biofouling influence on GHG emissions management. This will lead to:

- .1 gather available data and summarise existing research studies; and
- .2 develop and refine models using real-world data.

12 Evaluate the potential for applying IMO Biofouling Guidelines, which may lead to:

- .1 assess technical and regulatory feasibility in the Mediterranean Sea;
- .2 draft a roadmap for the application of the guidelines; and
- .3 negotiate and formalise agreements amongst CPs.

Medium-term (till 2030)

13 Implement IMO Biofouling Guidelines regionally, by:

- .1 gathering input from CPs on potential challenges and implementation timelines;
- .2 drafting guidance with specific provisions for both transitory traffic and short shipping; and
- .3 monitoring and reporting on guideline adoption progress.

- 14 Establish standardised and auditable biofouling management policies, that may lead to:
 - .1 draft policies based on best practices (e.g., USA EPA Vessel General Permits approach);
 - .2 obtain agreement from all CPs on the standardised policy; and
 - .3 develop and implement auditing mechanisms to ensure compliance.
- 15 Develop a regionally harmonised "Clean Before You Leave" guidance approach, that may include:
 - .1 drafting of a framework outlining requirements for biofouling management prior to entering the Mediterranean Sea;
 - .2 presenting the draft to CPs for review and refinement; and
 - .3 formalise through regional agreements or integration into national regulations.

Medium- to Long-term (till 2030 and beyond)

- 16 Conduct national audits and standardization of IWC facilities:
 - .1 develop an audit framework and guidelines for assessing IWC facilities;
 - .2 collate audit results and develop national records of IWC facilities; and
 - .3 provide technical assistance to IWC facilities on meeting BIMCO (or similar) standards.
- 17 Promote smooth coatings and alternative technologies:
 - .1 review existing research on FRC and hard coatings efficacy;
 - .2 organise stakeholder workshops to discuss findings and potential benefits; and
 - .3 commission pilot studies and work towards a regulatory framework for FRC / hard coatings.

Capacity Building and Technical Assistance

- 18 The successful implementation of the recommended action plan needs to be accompanied by a capacity building and technical assistance programme, with the aim to:
 - .1 design and deliver training courses on biofouling prevention and management;
 - .2 offer certifications to trained personnel;
 - .3 pilot innovative technologies; and
 - .4 provide technical support and incentives for early adopters.

Stakeholder Engagement and Awareness

- 19 The involvement of all stakeholders is crucial to:
- .1 engage with all relevant stakeholders, including ship owners, port authorities, and environmental NGOs;
 - .2 organise workshops to discuss benefits and challenges of biofouling management;
 - .3 develop communication strategies to raise awareness;
 - .4 launch campaigns on the importance of biofouling management; and
 - .5 collaborate with media to promote best practices.

Conclusion

20 This comprehensive approach to biofouling management in the Mediterranean Sea represents a crucial step towards reducing GHG emissions and protecting marine ecosystems. By fostering regional cooperation, standardising practices, and implementing cutting-edge technologies, the Mediterranean region and its partners can lead the way in sustainable shipping practices and environmental protection.

Actions requested by the Meeting

- 21 **The Meeting is invited to:**
- .1 **take note** of the information provided in the present document; and
 - .2 **comment** as deemed appropriate, particularly on the recommendations contained therein.
