

A Novel Approach for the Holistic Environmental Assessment of Ships

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Extended Conference Abstract

1. RESEARCH BACKGROUND

Shipping has an impact on the environment due to the intentional and accidental release of pollutants. Maritime legislation with regards to the environment has tightened in recent years since the introduction of the MARPOL 73/78 regulations, however there is often a significant time gap between when the regulations are adopted and when they legally enter force. The emergence of private voluntary environmental initiatives has occurred in an attempt to bridge this gap, reduce environmental impacts and raise the environmental profile of ships, however there are inconsistencies in the methodologies used to define ship performance and the criteria used to make the assessment. It has also been suggested (Lister *et al.*, 2015; SSI, 2013) that the number and diversity of initiatives available for use in the shipping sector can cause confusion and even hinder progress towards greater sustainability due to the widely different audiences they are designed to target.

Some of the existing initiatives provide an indication of a ship's performance based on one or a selection of environmental factors and may be considered as 'environmental indices' (Svensson & Andersson, 2011), others are designed as an incentive system where environmental improvements to ships or shipping practices are rewarded, often with certification, an award, or economic gains. Many existing initiatives are designed to assess a single environmental pollutant or issue, while others have been designed to incorporate a more holistic view of performance. Some cover a wide range of environmental issues but are unable to provide useful comparisons of performance between ships due to the methods used to measure ship performance.

Previous work by Murphy *et al.*, (2013) suggests that there are weaknesses in some existing indices, suggesting that the rationale behind the outputs of such schemes is not transparent due to the weighting factors of environmental indicators and the methods used to calculate aggregated scores.

2. AIM

This research expands on the work carried out by Murphy *et al.*, (2013) by conducting a critical analysis of existing environmental indices, to identify the weaknesses and limitations of the methods used to provide ships with an environmental rating. An alternative approach is suggested, which is holistic and flexible across a range of vessel types with the potential to be developed into an environmentally ambitious index.

3. INDICES ASSESSMENT METHOD

3.1 Identification of Indices

Relevant literature (Fridell *et al.*, 2013; Svensson & Andersson, 2011; Hamburg Port Training Institute GmbH, 2007; Pike *et al.*, 2011; & SSI, 2013) is used to identify which of the existing environmental initiatives in shipping can be considered as indices, by developing an inventory divided into four categories: Indices; Incentives; Regulation; and Other (includes research projects, new technologies etc.). The initiatives are also categorised according to the location in which they are applicable, the type of vessels they apply to, the intended user, and broad environmental scope (i.e. address single or multiple pollutants). Indices considered to be 'holistic' (those which address multiple pollutants) are identified and analysed further.

3.2 Indices Analysis

The holistic indices are analysed in detail to determine:

- Environmental scope – the environmental pollutants (indicators) they assess.
- Relative weighting of the indicators - the extent to which the environmental indicators are considered important, and why.
- Environmental ambition - the extent to which the indices encourage improvements in a ships environmental performance relative to regulatory requirements.

The indices are analysed and limitations with the current methods are identified.

3.3 Proposed new approach

A new approach is proposed which eliminates the limitations identified in the indices analysis. The proposed approach is intended as a framework for the development of a more effective index which covers a wider range of environmental issues, can be applied to multiple different vessel types, and uses a flexible approach to assessing ship performance.

4. RESULTS

An inventory of 67 different environmental initiatives was compiled using the literature (Fridell *et al.*, 2013; Svensson & Andersson, 2011; EMSA, 2007; Pike *et al.*, 2011; & SSI, 2013). Only 3 of the initiatives are considered 'holistic indices', these are the Clean Shipping Index (CSI), Clean Cargo Working Group performance metrics tool (CCWG) and the Environmental Ship Index (ESI).

Analysis shows that these indices lack transparency and rationale in terms of the methods used to rate a ships environmental performance. The indices use multiple indicators to provide an environmental assessment, however it is not clear as to how and why. For example, the ESI uses a NO_x indicator that accounts for up to 60% of the total score, without consideration of the impacts of NO_x on the environment. In contrast, the CO₂ indicator accounts for only 3% of the total score, which suggests that NO_x emissions are a more important environmental issue than CO₂. The indices are also limited in their applicability to different ship types and locations, and lack the environmental ambition to drive environmental performance beyond the regulatory requirements due to their narrow environmental scope and limited scoring range. It was found that the indices can be biased

towards certain environmental indicators, and hence the methods employed do not provide a true representation of a ships holistic environmental performance.

In light of above, a framework has been developed which eliminates the limitations of the existing indices. The framework is based on an environmental risk assessment approach of assessing environmental impact significance. The approach provides the flexibility to be ship specific, hence it can be applied to a range of vessel types where impacts on the environment may vary depending on ship size, fuel type, cargo type, location etc. The environmental impacts of e.g. a wet bulk tanker are likely to be significantly different to a small fishing vessel, therefore an effective environmental index should take this into account.

The approach allows for a ship to be assessed using a broad scope through the systematic identification and analysis of environmental interactions and impacts. The impacts are analysed in terms of significance on a per ship type basis so that they can be prioritised for a specific vessel type. The framework represents a holistic, flexible approach which could form the basis of an environmentally ambitious index for ships

5. CONCLUSION

An inventory of 67 shipping environmental initiatives was compiled and categorised. It was found that only three of the initiatives were classified as holistic indices. Analysis of the indices highlights weaknesses with the methodologies used to assess ship performance, including a lack of environmental ambition and rationale, as well as limited environmental scope. It was also found that some of the indices were biased towards certain indicators, and hence do not provide an effective evaluation of a ships overall environmental performance.

A more flexible, effective approach is suggested, providing an assessment of environmental performance which is ship specific, and is based on prioritising impacts on the environment based on the characteristics of the ship. The approach provides a framework for the development of a more holistic, effective and environmentally ambitious index for ships.

6. REFERENCES

- Fridell, E. Winnes, H. & Bergholtz, J. (2013). An analysis of environmentally differentiated port fees. *Ports of Stockholm: Swedish Environmental Institute*. Clean Baltic Sea Shipping – CLEANSHIP Task 4.6.
- Hamburg Port Training Institute GmbH (2007) Study on ships producing reduced quantities of ships generated waste – present situation and future opportunities to encourage the development of cleaner ships. *European Maritime Safety Agency (EMSA/OP/05/05)*.
- Lister, J. Poulsen, R. T. & Ponte, S. (2015) Orchestrating transnational environmental governance in maritime shipping. *Global Environmental Change*. Vol. 34 pp. 185-195.
- Murphy, A. J. Landamore, M. J. Pazouki, K. & Gibson, M. (2013) Modelling ship emission factors and emission indices. *Low carbon shipping conference, London, 2013*.
- Pike, K. Butt, N. Johnson, D. & Walmsley, S. (2011) Global Sustainable Shipping Initiatives: Audit and Overview 2011. A Report for the WWF. *Surrey: WWF UK*.

Sustainable Shipping Initiative (2013) Sustainability Rating Schemes in Shipping - A resource for logistics managers, charterers and ship owners [online] available from: <http://ssi.brenock.com/> (29/02/2016).

Svensson, E. & Andersson, K. (2011) Inventory and Evaluation of Environmental Performance Indices for Shipping. *Gothenburg: Chalmers University of Technology* (Report No. R 11:13, ISSN 1652-9189).