

NORTH⁵⁷

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Looking beyond CO₂



Report from the third Lighthouse ECO SHIP theme day

LIGHTHOUSE
N 57° 42.4' E 011° 56.2'

ECO SHIP

Future focus for maritime en

THE MAY 27TH LIGHTHOUSE ECO SHIP THEME DAY

The third Eco Ship day was held under the theme "Environmental issues - there is more than CO₂"

In recent years the common focus on environmental impact has been on global warming with the Copenhagen meeting in 2009 as a peak of international interest.

Focus has shifted over the years from water pollution to acidification of soil and water, depletion of the ozone layer, use of non-renewable resources and more recently to global warming. Of course, these environmental impacts and concerns all exist side by side although the degree of impact can change over time. Public concern focuses on one impact at a time, and this affects efforts to decrease other impacts simultaneously.

The regulations aiming at decreasing environmental impacts have been developed on national levels as well as through international conventions over a number of years. Regulations governing shipping are mainly handled in international contexts, for instance in the IMO (International Maritime Organisation), and this process has been slow compared to national regulations. In the EU, a recent study has concluded that if no measures are taken on NO_x limitation, the emissions in Europe related to shipping will exceed the total emissions from land based sources by 2016. Recently IMO agreements have been reached on restrictions in sulphur contents in marine fuel and emissions of

nitrogen oxides from newly built ships. These will be introduced gradually until 2016. In shipping focus is on emissions of sulphur and nitrogen oxides rather than global warming and CO₂.

The immediate problems within the sector will of course affect the focus of research, but there is also a need not only for basic understanding in order to be able to handle future upcoming issues but also to decrease the total environmental impact and to be able to take environment into account in design, rebuilding and operation of ships.

The seminar program of the Eco Ship day aimed to give insights into research questions that are treated within Eco Ship today and to initiate a dialogue on future needs and issues for maritime environmental research. The basis for dialogue was set by two keynote presentations on aquatic studies and on visions and strategy for achieving a future zero emission shipping.

Studying impacts on the aquatic ecosystem

This presentation was given by Ida-Maja Hassellöv, focusing on how scientists can evaluate and quantify the impact of pollutants on the aquatic ecosystem. This system is complex and the preservation of the function of the food-web, from microorganisms to large species like fish, is crucial to the survival of the system. The sediments play an

important role in the circulation of nutrients and trace elements. Maintenance of high biodiversity in the sediments is important.

In order to evaluate the effect of pollutants, e.g. oil or organic pollutants, on the sediments, studies at different system levels can be used. A common practice is to use single species and determine the concentration of pollutant that causes death of 50 % of the population, LD50. These methods are rapid, but the results may be difficult to extrapolate to an ecosystem level. More sophisticated, but also more time-consuming methods involve activity studies of a natural composition of species in a sediment community, e.g. by measuring fluxes of nutrient and oxygen over the sediment-water interface, see Figure 1. Biodiversity, or the sediment community structure, can be analyzed by counting individuals of different species. To enhance the usefulness of these analyses, current work emphasizes development of digital image-analysis.

ZERO - a road map to the zero emission vision

The second keynote presentation was given by Carl Fagergren at Wallenius Marine, where a road map to guide strategic decisions within the company is being developed. Wallenius have been working on a long-term road map by identifying and evaluating the potential

Environmental research

Eco Ship is led by Associate Prof. Karin Andersson. Mission: Providing knowledge and tools for sustainable shipping systems. Eco Ship focuses on sustainable resource use and minimization of environmental impact from shipping and maritime activities. This encompasses optimization of ship design and propulsion, energy efficiency and energy management at ship level and in the logistics chain as well as the impact of different regulatory tools, international conventions and organizational measures.

in technology to eliminate emissions from the fleet. The result is a set of scenarios for the long-term development of the fleet. This company specific study was discussed in the reference group meeting that followed the seminar, and the possibility to make a Lighthouse study on this theme will be further investigated.

Eco Ship activities and projects

Propulsion related research in the Rolls-Royce UTC

Rickard Bensow, Hydromechanics, Chalmers, presented research projects carried out within the framework of a University Technology Centre with funding from Rolls-Royce. This is one of a number of UTCs worldwide and was the first to be started outside the UK in 2002. Modelling of cavitation in propellers is one area where the UTC research is world leading. The understanding of these phenomena is important to making propellers and propeller design energy efficient.

Ship emissions in Gothenburg,

Hulda Winnes, Maritime Environment, Chalmers, described an ongoing study on local emissions and the effect of coming regulations. Gothenburg is located in a valley where the air quality is often poor due to atmospheric inversion and large emissions to air. Shipping is one important contributor to the emissions

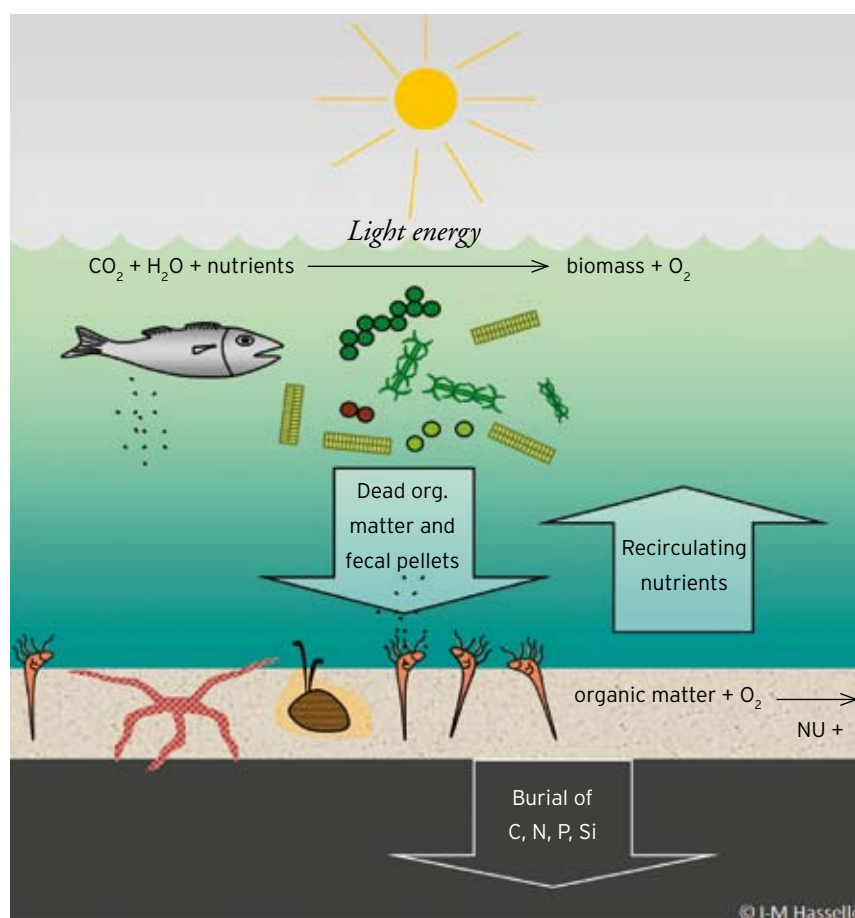


Figure 1. Some interactions in a marine ecosystem, including fluxes over the sediment-water interface.

accounting for almost 70 % of the SO_2 , close to half of the NO_x and almost 20 % of the particles.

The effects on health and environment are leading to different societal costs such as shorter life expectancy. In this project the contribution to societal costs from ships calling at Port of Gothenburg is assessed. Due to large differences in the estimated costs from different studies, the absolute value of ship caused damage is uncertain, but

can be estimated to be between 10 and 100 million €. If regulatory measures are implemented, this figure can be reduced considerably. The sulphur directive limiting the sulphur contents to 0,1 % is a very effective way of decreasing the societal cost.

Regulation methods for the limitation of vessel-source air pollution

In his doctoral project Philip Linné, Maritime Law, Gothenburg University,

Business Ship

Mission: Providing knowledge and tools for improved and sustainable business practices in the maritime sector.

Multi-disciplinary research from Business Ship at the School of Business, Economics and Law at the University of Gothenburg puts shipping into a wider business context of international trade, logistics, finance, laws and regulation.

Cargo Ship

Mission: Providing knowledge and tools for how to shape ships for safe, sustainable and transport-efficient transportation

Cargo Ship deals with education and research, with a focus on marine structures, marine transport solutions and their characteristics and roles in the transport chain. Focus is on the ship as a cargo carrier with transport efficiency as the overall driver, considering, among other factors, safety, sustainable development, global welfare and environmental impact.

Ergo Ship

Mission: Shaping ships for people by providing Human Factors knowledge, methods and tools.

Ergo Ship research concerns evaluation and analysis of work onboard, and the planning and user-centred design of control centres on ships, mainly the ship's bridge and engine control room. We perform research onboard and in simulators. This cross-disciplinary research falls within the Human Factors discipline, bringing together technology, humans and organisational issues and is performed in close cooperation with seafarers and the shipping industry.

Safe Ship

Mission: To establish and promote measures for safe and secure shipping.

Safe Ship uses a systematic approach in order to create a holistic view of safety. Safety in this context is divided into the following areas: regulation and control, organisation, training, ship and equipment design and operations. Each area addresses different activities and functions in the safety chain and can be organized as proactive measures, accident response, and post-accident response. Examples of important research areas are safe navigation; safe maneuvering; damage stability; safe return to port; emergency response; and crisis management. Important tools are case studies, risk analysis, and simulator studies.

is trying to categorize the regulatory tools for decreasing air pollution from shipping. The regulatory instruments may be classified in "sticks" which are legal instruments as quantitative limitations or performance standards, "carrots" which are economic instruments like taxes or fees, tradable permits or subsidies or "sermons" that are informational instruments like government information, eco labels or environmental audits. This means that the method can be a command like the emission control areas, a competition like tradable permits, consensus based like the HELCOM agreement, communicative like best performance indexes or related to providing services like shore side electricity.

Why consider NO_x?

Mathias Magnusson, Maritime Environment, Chalmers and the Swedish Maritime Administration, described a project in collaboration with the competence centre for catalysis, KCK. The regulations of NO_x emissions call for abatement technology that can be applied to existing engines. The available technology that gives the highest reduction is the Selective Reduction Catalysis, SCR. It converts NO_x back to nitrogen gas, which is the main component of the atmosphere. The technology is widely tested on land based combustion plants and also in diesel trucks. However, in marine applications there have been problems with "poisoning" and clogging of the catalyst surface. This project investiga-

tes the operating conditions in order to improve the SCR performance in marine systems.

Marine fuels from a life cycle perspective

Selma Bengtsson, Maritime Environment, Chalmers, presented a study on the environmental impact from some fossil marine fuels in a life cycle perspective, i. e. from the well to useful energy for propulsion. Here heavy fuel oil (HFO) was compared to marine gas oil (MGO), liquefied natural gas (LNG) and synthetic diesel oil made from natural gas (GTL). The function compared was one ton of cargo transported by a RoRo vessel in the North Sea area. The conclusion is that the difference in greenhouse gas emissions between the fuels is quite small, although the lowest impact comes from locally produced (North Sea) LNG and the highest from GTL. This means that fossil fuels are quite similar as far as global warming is concerned, although a "clean" fuel like LNG may give somewhat lower emissions. The great uncertainty in methane emissions, both from the engine (methane slip) and in the chain from well to ship is a problem. Distribution losses of some percent of the fuel may make the contribution to global warming at the same level for LNG as for diesel fuel.

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Read about coming events and current projects at www.lighthouse.nu

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