

# **Influencing The Environment Through Gear Box Reduction Ratio Selection**

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## **Submission:**

### **Background**

Continuous efforts in marine industry are directed towards increasing energy efficiency and reducing environmental impact of ships. These efforts target mainly large ocean-going vessels. Due to higher power of their installed engines, their emission are higher as well. Small vessels in comparison produce lower emissions, but they should not be neglected. Smaller ships, like ro-ro passenger or fishing vessels spend significantly more time in coastal areas. These areas are highly sensitive, so these emissions should not be treated lightly. In order to reduce the impact of such vessels on the marine environment, different approaches are analyzed. These often include very sophisticated innovative energy efficient technologies which have limited impact and are rarely applied in commercial vessels. Preliminary analyses of fishing vessels' power systems in the Adriatic Sea indicate that a simple gear box reduction ratio change can significantly improve vessel's operation characteristic, reduce fuel consumption and harmful emissions to air. The aim of this paper is to provide a tool for fishing vessels operating in the West Indian Ocean which fishermen can readily use in order to determine whether their vessels require a gear box change.

### **Method**

To fulfil this aim the holistic approach can and should be applied because it allows identification of the "weak link" in the ship power system. This is particularly important for ships which were not designed to be as efficient as possible, but rather to be cheap, which is true for most fishing vessels. The majority of the fishing vessels emissions to air depend on the operation of diesel engines used to produce the required power. The system requiring the most power on-board is the propulsion system which usually consists of diesel engine(s), shaft-line, gear box and propeller. In fishing vessels a special care is dedicated to engine and propeller, probably due to their higher cost, but gear box is often neglected.

### **Results**

The analysis in this paper shows how inappropriate gear box ratio selection can deteriorate the operation of the propulsion system leading to lower efficiency and hence higher required power, fuel consumption and emissions. For a set of typical fishing vessels operating in the West Indian Ocean optimal gear box ratios for different operations is determined with the aim to reduce the required engine power. This then provides a range of gear box ratios for fishing vessels. Based on the requirements during the fishing operation and the current gear box ratio it is possible to determine whether the gear box should be changed. The paper finally estimates the potential reduction in harmful emissions to air based on the engine power reduction in different operation.

## **Conclusion**

Gear box selection, even though often perceived as less important, often plays a significant role in the propulsion system operational characteristics. Inappropriate gear box ratio leads to engine overload or underload which impacts not only the engine, but also increases significantly fuel oil consumption and harmful emission to air. With the tool provided in this paper it is possible to determine whether the gear box should be changed and how this can impact both the vessel operation and the environment.