Theme Session M
Increasing energy costs and impact on fishers activities and economics - another challenge for fishers and managers

ICES CM 2007/M:01

Biofuels for the fishing industry

Tom Rossiter

Over the past 36 months Fishermen have seen one of their key cost, the price of fuel rise by over 100% to it current level of about 30p/litre. Annalists expect the cost of oil to rise further (www.oilprice.net) in the short term driven by demand from China and India and the uncertainty surrounding the Middle East. In addition, fossil fuels are an ever diminishing resource and at some time in the future they will be exhausted. Therefore, demand for alternatives to fossil fuels are growing with time and amplified by the current "fuel crisis".

In response to these growing issues Seafish have been carrying out a project looking at the feasibility of using biofuels to power fishing boats. In essence there are two potential bio-fuel solutions. The first is Straight Vegetable Oil (SVO) which is oil derived from plant matter. Plants commonly used for this process include rapeseed in Europe and oilpalm in the Far East. This fuel has a natural high viscosity which affects its performance as a fuel and innovate technologies need to be employed to ensure that there is no short or long term negative effects.

The second bio-fuel source is bio-diesel which is derived from SVO via the process of transesterification. This process removes glycerine from the oil, thus reducing the viscosity to that of normal diesel oil making it suitable for use directly in diesel engines. Both fuels are currently used to power a small number of land bases vehicles in the UK and on the continent. Bio-diesel is also used as part of a blend in 'city diesel' which can be found on most fuel forecourts in the UK. The blending of bio-diesel with conventional diesel is key to the UK government meeting its commitment to reducing CO2 emissions by 20% by 2010. SVO and bio-diesel are both currently produced in the UK.

This paper will look examine the results from the project and offer guidance to the UK and other fishing industries on how best biofuels can be utilized in the future. The commerciality as well as practicality of operating on biofuels will be discussed.

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The potential of jig fishing as an energy efficient method for catching whitefish around Shetland

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Jig fishing, or automated handlining for whitefish, was last attempted commercially in Shetland in the early 1990s however; the metier did not become established. The recent difficulties, including high fuel costs, encountered by the demersal trawl sector combined with advances in jigging machine technology indicated that the method should be re-evaluated for inshore vessels. During this study 568 boxes of fish valued at £29,000 were landed from 119 days fishing over a 15 month period. Fuel costs while jig fishing were significantly lower than when otter trawling but highest catches occurred outside 12 miles from shore so fishing was very weather dependant. The principal species caught were saithe (*Pollachius virens*) and pollack (*Pollachius pollachius*), with small quantities of cod (*Gadus morhua*), ling (*Molva molva*) and tusk (*Brosme brosme*) also being caught. The reduced running costs combined with the potential income indicate that this metier has the potential to be successfully implemented by inshore fishermen, at least on a seasonal basis.

Keywords: Jig fishing, energy, fuel, whitefish, Shetland.

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Efficient spatial allocation of fishing effort and partnership arrangement: A managerial solution to overcome rising fuel cost and other hardships for small-scale fisheries

Hirotsugu Uchida

Adverse conditions hit particularly hard on small-scale fisheries and fishermen involved. Recent sharp rise in fuel cost is battering such fisheries already struggling from declining stocks and harvests. The threat of economical sustainability can potentially undermine the entire effort for achieving sustainable fisheries, and for this reason energy saving measures that can be adopted and affordable to small-scale fisheries are in urgent need. With this in mind, this paper investigates the management measures adopted by a group of coastal fishing communities in Hokkaido, Japan, targeting walleye pollack (*Theragra chalcogramma*). Faced with low stock level and surging fuel price, this group adopted a radical managerial measure that can be referred as "partnership arrangement." Rather than permitting individualistic operations, as was the status quo, they adopted group-wide joint operations in aim to maximize the group's aggregated revenue, and each participant receives a predetermined share of the total revenue. This allowed the group to adopt various cost-saving measures, one being a spatially efficient allocation of vessels across the fishing grounds so as to minimize the vessels' travelling distance. Last year their harvest volume declined but the profit increased slightly; a step forward to achieving sustainable fishery. While social characteristics are influential factors in community-based fishery management, the key success-factors and management objectives in this fishery are purely economical and thus universal. This paper shows lessons that can be learned from this fishery for achieving sustainable fisheries with rising costs, and the role of scientific information during the development phase of this management regime.

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An evaluation and comparison of different fuel price scenarios on Belgian fishing fleet dynamics.

Hendrik Stouten, K. Van Craeynest, A. Heene, X. Gellynck, J. Depestele, E. Vanderperren, B. Verschueren, and H. Polet

This paper evaluates the effect of three important fuel price scenarios on Belgian fleet dynamics. These scenarios are tested by means of a micro-economical microworld, including sensitivity analysis. The scenarios are unveiling the effect of: 1) different stable fuel prices (scenario 1), 2) different linear increasing fuel prices (scenario 2), and 3) the current fuel price with different levels of uncertainty (fluctuations) (scenario 3) on Belgian fleet dynamics.

For this research a micro-economical approach was chosen because it allows policy makers to gain more insight in how different fuel price scenarios can determine the dynamics of individual boat owners and how this translates to the fleet structure. This approach enables evaluating the performance of individual companies and vessels following from the impact of fuel prices on management decisions.

The sensitivity analysis will result in an overview of the 'behaviour over time' of economic efficiency per sub fleet for each scenario. Consequently, the graphs will allow comparing the different fuel prices scenarios more constructively and visually.

Key words: fisheries management, fuel price, microworld, system dynamics.

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A comparative NOx emission study of two propulsion systems on board purse seiners

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Motivated by a future NOx environmental tax for the Norwegian fishing fleet, this paper describes a comparison study between hybrid and conventional machinery solution installed on modern purse seine vessels with regard to energy efficiency, CO2 and NOx emission.

Conventional machinery solutions, using propeller shaft fixed to the vessel engine, have low engine speed flexibility due to electricity production from propeller shaft mounted generator. Hybrid machinery solutions, being able to combine diesel electric and conventional propulsion, increases flexibility and make it possible for favorable engine speed alternatives to reduce NOx emission.

The modern purse seines MS "Gardar" and MS "Teigenes", equipped respectively with conventional and hybrid machinery systems, are sister ships having the same propeller solution installed. To eliminate

difference in hull parameters and making a comparison possible, initial measuring of propeller effect and exhaust emission during bollard pull and free speed conditions. To measure propeller, effect strain gauges placed on the propeller shaft were used. Exhaust emission was initially measured by using special instruments, while onboard computers were used for logging of engine data over a 6 month period of time.

Keywords: NOx, CO2, energy efficiency, propulsion system, purse seiner.

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ICES CM 2007/M:06

Is there a way out for the beam trawler fleet with rising fuel prices?

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Beam trawling is a very intensive fishing method with very high consumption of fuel and materials like steel and netting. The steeply rising prices of these basic materials weigh heavily on the net financial result of the vessel owners. The observation that between 30 and 50% of the gross revenue of beam trawlers goes to fuel indicates that measures are necessary to reduce this cost.

In the short term, it is possible to reduce the fuel consumption of beam trawlers by some simple and often cheap measures. In the medium term, a switch of fishing gear on the same vessel can be a way out to let the vessel owner continue his fishing company and earn sufficient income to allow future investment in a more sustainable fishery.

This paper describes the measures that have been taken and the plans for the near future to keep the beam trawl fishery profitable in the short to medium term.

Keywords: beam trawler, fuel price, reduce fuel consumption.

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Design concept for low energy fishing vessel

Nils Harald Bjørshol

During the last decade the cost of fuel has increased about 3 times hence more efficient use of the fuel is needed to maintain economy in the fishing fleet. Better fuel efficiency will also reduce the pollution of the environment and the global warming. Increased focus on global warming and pollution of the atmosphere has triggered the research on cleaner and more efficient diesel engine technology, however the design of fishing vessels is suffering from focus on investment cost which results in cheap and less efficient solutions. One positive effect of the increase in fuel cost is that investments in energy recovery and energy efficiency measures will have a shorter payback period. A potential saving area arises from the fact that a modern diesel engine only converts about 40 % of the thermal energy in the fuel into mechanical energy; the rest is normally dissipated to the sea and to the atmosphere. This paper describes how heat from fishing vessel diesel engines can produce useful space heating, tap water heating as well as electric energy. The technology used for producing electric energy from exhaust and cooling water heat is by ORC, organic Rankine cycle. The working medium in the cycle is an organic refrigerant that is evaporated at moderate temperature and expanded through a turbine driving an electric generator. The paper shows how much energy that can be recovered by using these methods and how to design the heat recovery and conversion system into an integrated part of the engine exhaust and cooling system. Finally the paper states what economic and environmental effects can be expected.

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ICES CM 2007/M:09

Analyzing fishermen behaviour face to increasing energy costs – A French case study

Le Floc'h Pascal, Boncoeur Jean, Daurès Fabienne, and Thébaud Olivier

Increasing fuel price is becoming a major consideration in fisheries due to its contribution in total cost to produce fish. Fishermen have to reallocate production inputs according to their price, and /or accept substantial modifications in revenues. However, the impact of increasing fuel cost has to be analyzed in relation to the type of fishing gear used. The results are indeed different for trawlers (active gear) compared to netters/liners/potters (passive gear). This paper addresses to cost and earnings changes since 1998 to 2005

for active and passive fleets located in Brittany (France). In particular, fuel expenses are examined under a special French regime implemented in 2004 and called “Fund for the prevention of risks to fishing”. If this fund has been created by producer organisations to compensate the fluctuations of energy prices, the regime is considered as a subsidies scheme fuelled by the State (C 91/30 EN Official Journal of the European Union, 19.04.2006). This financial support is a major element in the examination of fishermen behaviour in France. It is shown paradoxically that fishing vessels can increased their fuel consumption in a context of a high rising fuel cost, thanks to such a State aid.

First, we examine costs and earnings for a set of vessels, namely the commercial fishing fleet of the French region of Brittany. A bookkeeping database, managed by the Regional Economic Observatory, is used to compute economic indicators, separating active and passive fleets. Second, the impact of fuel cost is characterized under the State aid scheme. Third, fishermen behaviours are analyzed. In this respect, a model based on adaptative expectations is suggested and seems to suit well to represent fishing strategies changes in a context of increasing energy costs. We conclude by a discussion of the impacts of fuel costs in fisheries.

Keywords: JEL Classification : C15 - Simulation Methods , C81 - Microeconomic Data, D21 - Firm Behavior, Q22 Fishery .

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ICES CM 2007/M:10 Poster

Alternative fisheries for *Nephrops* in Greece: less damaging and more fuel efficient?

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Fisheries socio-economic data collection (including fuel consumption, fuel costs and revenues) has started very recently in Greece following the EC Regulation 1639/01. Currently data are only available for 2004-2006 per major gear type (e.g. otter trawls, purse seines, coastal passive gears) and vessel length. Within the framework of the existing data collection it is very difficult to extract information on the level of target species (e.g. fuel consumption per kg product or kg discards produced) as there is no possibility of effort breakdown by species (effort expressed as days at sea per gear type and vessel segment). In comparing otter trawls with passive gears (mostly gill/trammel nets) for every ton product (reported landings) 1.7-2.1 and 0.9-1.7 ton fuel is consumed. Additive to these economic and environmental costs is the production of discards (44 % as opposed to 10-20 % of total catch for trawls and passive gears respectively). *Nephrops* is fished as part of the mixed demersal trawl catch and in few cases by nets or traps. Trap fishing is currently limited in geographic extent to areas closed to trawling. This work presents the merits of trap fishing as an alternative fishing method for *Nephrops* (in terms of catch, by-catch, discards, catch quality, species and size selectivity) and discusses the potential as a targeted more energy efficient, less damaging fishery, but limited primarily by conflict/incompatibility with other fisheries and the current management framework.

Keywords: alternative fisheries, *Nephrops*, trapping.

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