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Scheduling for maximum profit in the Icelandic cod industry

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1. Summary

The fishing industry has always been important to Icelanders. During the last years the demand for fish has been changing together with a stagnating or decreasing quotas in the cod stock. This has moved focus to the importance of utilizing the cod stock in a sustainable way and maximizing the value of the catch. An aggregate plan for one year has been made where it is outlined where a trawler should go for fishing within the Icelandic territorial waters. This paper presents a model for scheduling short time trawler fishing and production planning given the results from the aggregate plan. The model is subject to the flow in the processing and the expected catch from the trawler and the deterioration of the fish. The model is a mixed integer linear programming model where the total operational profit of catching and processing is maximized. The objective is to develop a model that can be used in the fishing industry as a support tool for management. The model will be tried on a fishery to show is usability. A sensitivity analysis will also be carried through.

Keywords: quota, trawler, scheduling, properties of cod, value chain

2. Extended Abstract

Despite growth in other industry sections, such as tourism and banking, the fishing industry is still very important in Iceland. It has bee estimated that fishery together with multiplication influence counts for 30% of domestic production (Árnason, 2004).

During the last years the food market has been changing in countries that buy fish from Iceland. Frozen fish products are now less valuable but the value of the fresh fish has been increasing. This fact, as well as stagnating or decreasing quotas, because of the limited size of the Icelandic cod stock has moved focus to the importance of utilizing the cod stock in a sustainable way and maximize the value of the catch.

A Decision Support System (DSS) has been developed in light of the above. This paper is therefore part of an extensive research work reaching back to the year 2001.

Many fishing companies have participated in this research by giving access to information and advice.

The use of the fillets is very important when it comes to profitability of the cod. A link between the cod flesh and how much of the fillets can be used has been established (Rikharðsson and Birgisson, 1996). Factors, having effects on properties of the flesh, such as nematodes, bloodspots, bruising and gaping of the fillets are costly. Those properties vary depending on season and fishing areas (Margeirsson, 2003).

To begin with, an aggregate plan was made for one year (Guðmundsson, 2006). The year was divided into four seasons and the Icelandic fishing territories into 13 areas using data. This was done to simplify data analysis (from Margeirsson, 2003). The plan outlines where the trawler should go for fishing within the Icelandic territorial waters depending on the properties of the cod. As can be seen in picture 1 there is a considerable difference in the fillet yield between the areas.

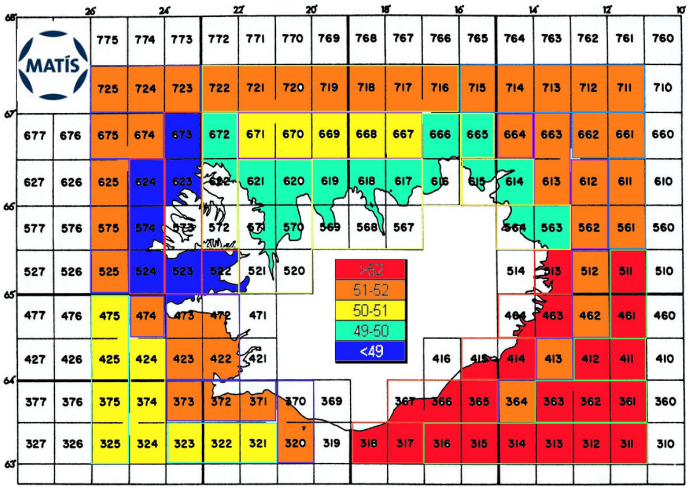

Figure - Use of cod fillets (%) during the time period December to February

The short time scheduling, now under development, is a daily schedule for each of the above mentioned seasons. The results from the aggregate plan are used as an input in the model. The operational profit of the fishery, i.e. catching and processing is maximized. This is done subject to the deterioration of the fish, the flow in the processing and the expected catch from the trawler. The deterioration affects how much of the cod fillets can be used and in what products. Rikhardsson and Birgisson (1996) did research on how the deterioration affects the fish fillets as the fish gets older. For the flow in the fishery it will be possible to produce different products having different value in sale. This gives the fishery the possibility to divert to the processing of lower value products if the strain in the fishery is high. In the model there are no constraints in regards to the demand in the market and it is considered that generally all the catch can be sold.

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