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FUEL CONSUMPTION OF THE ICELANDIC FISHING FLEET.

by

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ABSTRACT

In this paper some results of a research on fuel consumption of the Icelandic fishing fleet is described. The purpose of this research was to obtain basic data on fuel consumption for different types of vessels and fishing methods. Special attention was paid to fuelsaving in running operations and to introduce an instrument for that purpose.

INTRODUCTION

Research on energy and fuel consumption of the Icelandic fishing fleet started in 1976. The main purpose was to obtain basic data on fuel consumption for different sizes and types of vessels and fishing methods. Such information can be of use both in vessel design, selection of propulsion and power machinery etc., and in fuelsaving during operation. A secondary purpose was to introduce an instrument which displayd the necessary information for the skippers to make economical use of energy, especially in connection with selection of speed.

Basic data on fuel consumption for different vessels and methods has been collected both from direct measurements on board the fishing vessels and total figures from the shipowners. In the following papers some of the results obtained about fuel consumption of the Icelandic fishing fleet will be presented.

TOTAL FUEL CONSUMPTION

In 1978 total fuel consumption of the Icelandic fishing fleet was 187.5 million liters. In table 1 the fuel consumption of different types of vessels and fishing methods are listed. Furthermore the percentages of total landed value of each "class" is listed.

Table 1: Fuel consumption of different types of vessels in 1978.

Vessels & fishing methods	Fuel consumption		Total landed value
	mill.litres	%	%
Stern trawlers, bottom trawling [x]	100.0	53.3	39.9
Decked vessels, longlining	13.1	7.0	7.9
" " gillnetting	16.9	9.0	12.4
" " bottom trawling [x]	15.4	8.2	6.2
" " purse sein.(capelin)	22.1	11.8	19.0
Other fishing mothods	20.0	10.7	14.6
Total	187.5	100.0	100.0

[x] Only demersal species.

In 1978 the fuel costs amounted to approximately 11.5% of the total landed value.

FUEL CONSUMPTION IN RELATION TO POWER AND CATCH

Table 2 shows total fuel consumption, total installed horsepower in the fishing fleet, and catch for the years 1972-1978. The catch figures are demersal equivalent, i.e. catch of pelagic species such as capelin, herring etc. and other species are weighted by a factor to get equivalent value to demersal species.

Table 2: Total fuel, installed horsepower and total catch in 1972-78.

Year	Fuel consumption mill.litres	Installed horsepower hp	Catch (metric) tons	Coeffic. l/hp	Coeffic. l/ton
1972	130.2	273.000	509.800	477	255
1973	134.2	304.000	544.500	441	246
1974	156.3	341.000	556.100	458	281
1975	159.8	363.000	576.100	440	277
1976	158.8	371.000	587.700	428	270
1977	169.4	387.000	663.300	438	255
1978	187.5	415.000	698.500	452	268

Coefficients in the table 2 indicates litres fuel pr. horsepower innstalled and litres fuel pr. ton catch. The first one is varying from 428 to 477 l/hp but the second one varying from 246 to 281 l/ton. These figures indicates good linear relationship both between fuel consumed and the installed horsepower, and also fuel consumed and catch figures.

RESULTS FROM STERN TRAWLERS, BOTTOM TRAWLING

In tables 3 and 4 are averages of measurements on board four stern trawlers. These trawlers are ranging in size, from 47 to 69 m overall length. The range in main engine hp is from 1750 hp to 2820 hp.

Table 3: Total cruise, average engine power 2264 hp.

Item	Total time		Average fuel consumpt.	Average used power	Total fuel	
	hours	%	l/h	hp	litres	%
Running to fish. grounds	8.7	3.7	274	1483	2382	4.4
Fishing	179.0	76.6	209	1132	37481	70.0
Running betw.fish.grounds	38.5	16.5	303	1635	11656	21.8
Running to port	7.4	3.2	275	1488	2032	3.8
Total pr. cruise	233.6	100.0	229	1239	53551	100.0

Table 4: Fishing operations, average catch 127 tons.

Item	Total time		Average fuel consumpt.	Average used power	Total fuel	
	hours	%	l/h	hp	litres	%
Shooting	4.9	2.7	271	1463	1329	3.5
Trawling	143.9	80.4	210	1135	30226	80.7
Hauling	6.4	3.6	235	1269	1507	4.0
On board handling	23.8	13.3	186	1004	4419	11.8
Total fishing	179.0	100.0	209	1132	37481	100.0

The above tables show that fishing operations account for approximately 70% of the total fuel consumption, but running for 30%. About 81% of the total fuel consumption in fishing stems from trawling operations.

For this fishing method the greatest possibilities in fuelsaving are in lesser resistance of the gear, and also in correct selection of the speed of vessels during running operations.

RESULTS FROM PURSE-SEINERS, CAPELIN

The following figures are based on results from seven purse-seiners during the capelin season and are average figures. These purse-seiners are ranging in size, from 40-54 m overall length, and the range in main engine hp is from 660 hp to 2100 hp (average main engine hp is 1246 hp).

Number of days in operation	80	(100.0 %)
Number of days running	22.2	(27.7 %)
Number of days fishing	38.3	(47.9 %)
Number of days in port	19.5	(24.4 %)
Number of shootings	131	
Number of landings	20	
Total catch	8760 tons	
Total fuel consumption	172870 litres	
Fuel consumption pr. ton catch ..	19.7 l/ton	
Fuel consumption pr. day	2160 l/day	

The total fuel consumption can be divided into following items:

Fuel during running	57.3 %
Fuel during fishing (shooting)	5.9 %
Fuel during fishing (fishfinding etc.)	30.8 %
Fuel in port	6.0 %

The above figures indicates that about 57% goes into direct running. During direct fishing, that means the gear in sea, the consumption is approximately 6%, but the item fishfinding, running between fishing grounds etc., consumes 31%.

For this fishing methods the greatest possibilities in fuelsaving lies in the selection of economical speed, better fish-finding technique, and use of electricity from ashore.

RESULTS FROM GILLNETT FISHING

Recent study of fuel consumption in a 250 BRT gillnetter whith 800 hp main engine was as following:

Number of cruises 21
Number of days in operation 40
Total catch ..... 290 tons
Total fuel consumption ..... 48160 litres
Fuel consumption pr. day ..... 1204 l/day

The total fuel consumption can be divided into following items:

Fuel during running ..... 75 %
Fuel during fishing ..... 23 %
Fuel in port ..... 2 %

The above figures indicate that 75% of the total fuel consumption is during running and 23% is used during fishing. Compared with the stern trawlers (table 3) the fuel consumption pr. day for this gillnetter is only about one-fourth of the stern trawlers.

The possibilities in fuel saving for gillnetting are in longer trips, i.e. shortening the running time, and selecting the most economical running speed. The same figures are valid for long-lining. Mechanized longlining in Icelandic fishing vessels would be of great help in fuelsaving but no success has been achieved so far in that field.

DEMERSAL FISHING WITH DIFFERENT METHODS

Following average figures (table 5) are valid for fuel-rate (in l/day and l/hp day) and catch-rate (in kg fish/man day) in 1978 under different fishing methods.

Table 5: Fuel-rate and catch-rate for different methods.

Fishing methods	BRT	Hp	l/day	l/day hp	kg fish/ man-day
Longlining	78	420	454	1.08	234
Gillnetting	76	395	446	1.13	301
Bottom trawling(deck.vess.)	108	510	801	1.57	290
Bottom trawling (st.trawl.)	473	1914	4173	2.18	662

AREAS FOR FUELSAVING

Many possibilities exist in fuelsaving for the fishing, but they will not be covered in detail in this paper. Some examples will be mentioned here, other than well known factors at the design step, like good performance of hull resistance, propeller efficiency, and choice of main engine.

The speed of fishing vessel is of a great importance in fuel consumption. Results from measurements in Icelandic fishing vessels have, in many cases, given about 50% increase in fuel consumption for a 10% increase in speed in the "top range". Running to, from and between grounds, is for all kind of fishing vessels in Iceland the most energy consuming factor in relation to time. Cutback of running time will be of a great importance in fuelsaving. For the fishing vessels, which use longlines and gillnets, and make one day trips, longer trips will save much fuel, as these fishing methods use very little during fishing. Based on these measurements, calculations for the whole Icelandic fishing fleet show, that about 40% of total fuel consumed in 1978 are for propulsion in running operations. The total quantity is about 75 million litres. A 5% reduction in the free running speed have been estimated to give about 17% reduction in fuel consumption. That means about 7% saving in total fuel consumption.

The most energy intensive fishing method is trawling. Calculations indicate that, in the year 1978, about 68 million litres were used for the trawling operation (all sorts of trawling), i.e. about 36% of total consumption. There is no doubt that a flume tank to facilitate trawl disign, and training of skippers, will be of great help keeping fuel use down.

Heating of accomodation is different in Icelandic fishing vessels and a great difference in fuel economy exist. Heating with electricity is the most fuelwasting method. Calculations that have been made show, that to heat an Icelandic stern trawler of average size with electrical heating (radiators), results in a total fuel consumption of about 47000 litres pr. year. Use of central heating oilboiler will reduce this item about 50% and by using cooling

water of the main engine it is possible to reduce this item much more, thus fuel consumption for heating will be just a little fracture of that for el-heating. Most of the Icelandic stern trawlers were in the earlier days fitted with el-heating, and only quite a few used cooling water for central heating of accomodation. Recently about 10 stern trawlers were refitted to cooling water heating of accomodation.

There is no doubt that there are opportunities for considerable economizing on energy in the fishing operations. The Technical Division of the Fisheries Association of Iceland is doing further work in that field, the results have proved the importance of these studies. Another way to reduce fuel costs is the use of cheaper fuel, i.e. heavy fuel instead of marine diesel oil. During the last few years the necessary gear to make use of this opportunity has been installed in most of the Icelandic stern trawlers.

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