A quest to diversify the Belgian fleet: an economic evaluation.

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Abstract

This paper summarizes two recent economic studies which undertook a first attempt in evaluating possible alternative vessel types and fishing methods for diversifying the Belgian overspecialised fleet. This diversification is necessary because the current beam trawling fleet lacks economic stability.

The first study starts with unveiling the differences in 1) catch composition, 2) fuel efficiency and 3) profitability of different kinds of beam trawlers and set netters. Further on, this study examines how set netters perform relatively to beam trawlers. The second study evaluates the option of introducing handlining to the Belgian fleet. Special attention is drawn the comparson of differences in costs structure between handliners and eurocutters. The results of these two studies indicate that set netters and handliners can be profitable, but further research is needed.

Key words: Economic analysis, passive fisheries, fishing fleet structure, fleet conversion.

1. Introduction

Almost the entire Belgian fleet consists of beam trawlers. Within the fleet of Belgian beam trawlers, three major important vessel types can be distinguished:

1) *Shrimp beam trawler:* a beam trawler which spends the most of his fishing hours targeting shrimps (15 vessels in 2005).
2) *Large beam trawler:* a beam trawler which has a minimum of 662 kW and is no shrimp beam trawler (52 vessels in 2005).
3) *Eurocutter:* a beam trawler which has a) an engine power between 201 kW and 221 kW, b) a length over all (LOA) of maximum 24 meters, and c) is no shrimp beam trawler (30 vessels in 2005).

These vessel types tow heavy fishing gear over the sea-bed which results in a relatively high fuel cost. Approximately 25% of the revenues of the Belgian fleet goes to fuel. Today, many trips at sea result in a financial loss for the owners of beam trawlers and it is clear that "the beam trawler fleet is on the edge of not being profitable" (Polet et al., 2006: 32).

However, there are examples of Belgian fishing vessels which seemingly carry out a very profitable fishery based on passive fishing methods. Therefore, it is necessary that these potential alternatives are studied thoroughly so that realistic future investment options (in terms of vessel type and fishing method) can be presented to the industry, resulting in a possible starting point for restructuring the Belgian fleet.

2. Objective

This paper is a first step in a broader economic study of evaluating possible alternative vessel types and fishing methods for the Belgian overspecialised fleet. It evaluates the performance of the current Belgian vessel types which are large beam trawlers, eurocutters, shrimp beam trawlers, set netters and one handliner. In the long run, the compilation of these and future economic studies will hopefully present more realistic investment options to the industry which can result in an economically beneficial conversion of the Belgian fleet.

This paper consists of two studies. Central to the first study is a comparison on how the Belgian set netters perform relatively to the Belgian beam trawlers. The second study evaluates the option of introducing handlining to the Belgian fleet.

3. The performance of set netters relatively to beam trawlers

a. Research questions

Three research questions are addressed in this study:

- Are their differences between set netters and beam trawlers in catch composition?
- Are their differences between set netters and beam trawlers in fuel efficiency?

- Are their differences between set netters and beam trawlers in profitability?

b. Methodology

Multivariate statistical analyses (ANOVA) were performed to address these research questions. Data was collected from individual vessels on catch composition, effort allocation and financial situation for the year 2005. These data were compiled from two institutes. There is a very useful database called 'Belsamp' hosted at the biological section of the Institute for Agriculture and Fisheries Research containing detailed data per individual vessel on catch composition and effort allocation. For financial data on individual vessel level, the Belgian Sea Fishery Service of the Flemish government was addressed. They collect financial data of the Belgian sea fisheries fleet by survey (on a voluntary yearly basis) (table 1). Crucial in noticing is the low number of set netters currently active in Belgian sea fisheries. As a result, this low number of set netters will often undermine the significance of the statistical analyses.

Table 1 – Population and economic sample of the Belgian fleet for the year 2005

	Population	**Economic sample**
Eurocutter	30	15
Large beam trawler	52	34
Set netter	3	3
Shrimp beam trawler	15	8
Other	19	9
Total	119	69

c. Results

i. Catch composition

To formulate an answer on the first research question, the catch compositions of the vessel types need to be compared with each other. Although controversial, this study uses data on landed weight as an equivalent for catches. The results are given in tables for each vessel type and include each species which represents more than 2% of the total catch. These tables consist of 1) catches in kilograms, 2) catches in percentages of the total catch (relative catch), and 3) kilograms of a species in one ton caught mixed fish.

Table 2 and 3 illustrate the catch composition of an average eurocutter and an average large beam trawler for the year 2005. In comparing those, next conclusions can be drawn:

- Large beam trawlers have the same main targets species (sole and plaice) as eurocutters, expanded with cod and ray.
- Eurocutters target shrimps seasonally, large beam trawlers do not.
- Both have over 10 species which present 2% or more of the total catch, of which 11 species are caught by both vessel types.
- Over 9% of the total catch of both vessel types consist of species which present less than 1% of the total catch.

Thus, eurocutters and large beam trawlers are certainly highly mixed fisheries, aiming at the same target species.

Table 2 – Catch composition of an average Belgian eurocutter for the year 2005

	Catch (kg)	Relative catch (in %)	Kg/ton mixed fish
Dover sole	25'927	26	263
Plaice	17'826	18	181
Brown shrimp	7'778	8	79
Great scallop	5'192	5	53
Ray	5'117	5	52
Flounder	4'536	5	46
Dab	4'174	4	42
Dogfish	3'822	4	39
Tub gurnard	3'099	3	31
Bib	2'985	3	30
Cuttlefish	2'237	2	23
Lemon sole	2'145	2	22
Brill	1'895	2	19
Whiting	1'561	2	16
Turbot	1'551	2	16
Others	8'662	9	88

Table 3 – Catch composition of an average Belgian large beam trawler for the year 2005

	Catch (kg)	Relative catch (in %)	Kg/ton mixed fish
Plaice	74'105	25	245
Dover sole	55'778	18	185
Cod	31'183	10	103
Ray	30'001	10	99
Lemon sole	19'088	6	63
Cuttlefish	8'245	3	27
Tub gurnard	6'800	2	22
Dab	6'536	2	22
Haddock	5'983	2	20
Dogfish	5'335	2	18
Brill	5'286	2	17
Great scallop	5'275	2	17
Turbot	5'196	2	17
Others	43'466	14	144

Since shrimp beam trawlers target shrimps, there are many differences between the catch composition of a Belgian shrimp beam trawler (table 4) and that of Belgian eurocutters and large beam trawlers. Shrimps cover 70% of the total catch of an average shrimp beam trawler. The other species are often considered as "by-catch". Thus, shrimp beam trawlers are more selective than eurocutter and large beam trawlers.

The catch composition of an average Belgian set netter for the year 2005 (table 5) is quite different from all beam trawler types. Although they target Dover sole like the eurocutters and large beam trawlers, they also target cod and sea bass. Similar to shrimp beam trawlers, their by-catch is low resulting in only seven species which are representing 2% or more of the total catch. Therefore, set netters are very selective.

Table 4 – Catch composition of an average Belgian shrimp beam trawler for the year 2005

	Catch (kg)	Relative catch (in %)	Kg/ton mixed fish
Brown shrimp	32'699	70	700
Flounder	4'496	10	96
Dover sole	3'297	7	71
Plaice	2'108	5	45
Cod	980	2	21
Dab	740	2	16
Others	2423	5	52

Table 5 – Catch composition of an average Belgian set netter for the year 2005

	Catch (kg)	Relative catch (in %)	Kg/ton mixed fish
Dover sole	18'276	41	409
Sea bass	8'258	18	185
Cod	7'394	17	166
Dogfish	2'968	7	66
Pollack	2'679	6	60
Plaice	1'253	3	28
Dab	713	2	16
Others	3'123	7	70

In conclusion, there are differences in catch composition (in landed weight) between set netters and beam trawlers.

ii. Fuel efficiency: fuel costs per days at sea

In addressing the second research question, an ANOVA-analysis on fuel costs per days at sea across the different vessel types unveils a significant effect of the independent variable "vessel type" on the dependant variable "fuel costs per days at sea" (see table 6 and 7).

Table 6 – Fuel costs per days at sea across different vessel types (year 2005, in euro)

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Eurocutter	15	683,81	267,08	68,96	210	1015
Large beam trawler	34	1944,27	348,97	59,85	1420	2944
Shrimp beam trawler	8	290,22	113,51	40,13	134	511
Set netter	3	156,25	126,35	72,95	62	300
Other	9	730,78	352,95	117,65	147	1143
Total	69	1242,46	773,77	93,15	62	2944

Table 7 – ANOVA on fuel cost per days at sea across different vessel types (year 2005, in euro)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	34577268,342	4	8644317,085	90,161	,000
Within Groups	6136091,358	64	95876,427		
Total	40713359,699	68			

Further, post-hoc tests allow pairwise comparison of the different vessel types for fuel costs per days at sea. Since the Levene statistic is not significant at the 5% level (table 8), the Games-Howell test is chosen (table 9), indicating that:

- The average fuel cost per days at sea of a eurocutter (684 euro) is significantly lower than the large beam trawlers (1944 euro) and significantly higher than shrimp beam trawlers (290 euro).
- The average fuel cost per days at sea of large beam trawlers (1944 euro) is significantly higher than the eurocutters (684 euro), shrimp beam trawlers (290 euro) and set netters (156 euro).
- Shrimp beam trawlers (290 euro) have significantly less fuel costs per days at sea then eurocutters (684 euro) and large beam trawlers (1944 euro).
- Set netters (156 euro) have less fuel costs per days at sea than eurocutters (684 euro) and large beam trawlers (1944 euro). However, their fuel costs per days at sea do not significantly differ from those of shrimp beam trawlers (156 euro).

Table 8 – Test of homogeneity of variances for fuel costs per days at sea across different vessel types (year 2005)

Levene Statistic	df1	df2	Sig.
2,228	4	64	,076

Table 9 – Multiple comparisons (Games-Howell) for fuel cost per days at sea across different vessel types (year 2005, in euro) ("Others" are left out of this table)

(I) typology Degree	(J) Typology Degree	Mean Difference (I-J)	Std. Error	Sig.
Eurocutter	Large beam trawler	-1260,45	95,98	,000
	Set netter	527,56	195,83	,009
	Shrimp beam trawler	393,59	135,56	,001
Large beam trawler	Eurocutter	1260,45	95,98	,000
	Set netter	1788,01	186,49	,000
	Shrimp beam trawler	1654,04	121,67	,000
Shrimp beam trawler	Eurocutter	-527,56	195,83	,009
	Large beam trawler	-1788,01	186,49	,000
	Set netter	-133,97	209,63	,570
Set netter	Eurocutter	-393,59	135,56	,001
	Large beam trawler	-1654,04	121,67	,000
	Shrimp beam trawler	133,97	209,63	,570

The minimum and maximum values of the fuel costs per days at sea from the ANOVA in table 6 (column 6 and 7) can be compared to the data from the UK Sea Fishery fleet (table 10). The study indicates on average lower fuel costs per days at sea for each of the four Belgian vessel type compared to the UK fleet. Nevertheless, drawing conclusions from these findings is difficult since 1) the data intervals of the estimated fuel costs per days at sea of the UK are large and there are no averages given, and 2) the vessel types do not correspond perfectly.

Table 10 – Fuel costs per days at sea across different vessel types in the UK (year 2005, in euro) (Adjusted to euro from (Curtis et al., 2006: 9))

Segment	Estimated fuel cost per days at sea
Beam trawler	1466 – 3664
Whitefish trawl > 24 m	1466 – 2199
Whitefish trawl < 24 m	733 – 1466
Twin-rig nephrops trawl	733 – 1466
Scallop dredgers	733 – 2199
Seine netters	293 – 586
Under 10m mobile gear	73 – 293
Under 10m static gear	7 – 147

In conclusion, research question two can be answered positively. However, there are no significant differences between the fuel efficiency of a shrimp beam trawler and a set netter. This can partly be explained by the fishing tactics of both vessel types. The low fuel costs per days at sea for shrimp beam trawlers is due to their short steaming distance since they are coastal fishermen. Set netters have a more diverse pattern in fishing tactics. They visit many fishing grounds which often are further out of shore and they stay longer at sea.

iii. Profitability

A descriptively summary of the key financial data for the year 2005 across the different vessel types is given in figure 1.

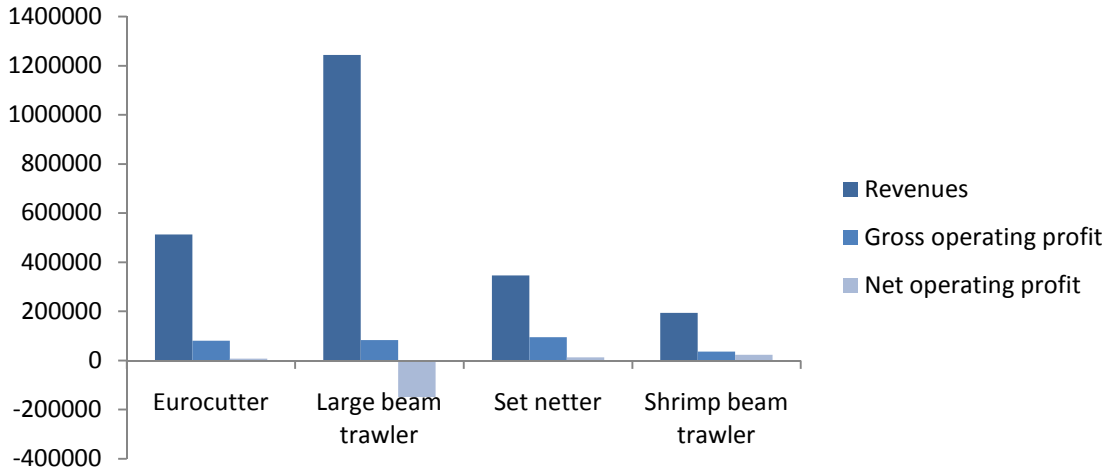

Figure 1 – Comparing revenues against Gross and Net Operating Profit across vessel types (year 2005, in euro)

Figure 1 unveils the huge differences between revenues and net operating profit. These differences are mainly due to two reasons: 1) the high total costs, and 2) the high depreciations vessel owners have to cope with.

Since a positive gross operating profit (GOP) indicates on a yearly basis how well a vessel performs in his daily operations, an ANOVA analysis is conducted on the GOP across different vessel types. This analysis unveils no significant effect of "vessel type" on "GOP" (table 11 and 12). As a result, there are no differences in GOP between the vessel types. Consequently, the GOP per vessel types does not differ from each other. Therefore, given the lower amount of revenues (figure 1) and landings (tables 2, 3, 4 and 5), set netters have the same GOP as beam trawlers. Additionally, their investments are lower resulting in higher return on investments for set netters compared to beam trawlers (figure 2).

Table 11 – Gross Operating Profit across different vessel types (year 2005, in euro)

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Eurocutter	15	80584,15	59812,59	15443,54	-34562	186520
Large beam trawler	34	83087,13	126133,97	21631,80	-144220	528738
Set netter	3	95523,56	95167,60	54945,04	11979	199119
Shrimp beam trawler	8	36710,59	46090,93	16295,61	-15255	112558
Other	9	107525,07	103813,20	34604,40	-22712	274175
Total	69	80894,29	102692,97	12362,78	-144220	528738

Table 12 – ANOVA on Gross Operating Profit across different vessel types (year 2005, in euro)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22807364744,001	4	5701841186,000	,526	,717
Within Groups	694310126090,064	64	10848595720,157		
Total	717117490834,065	68			

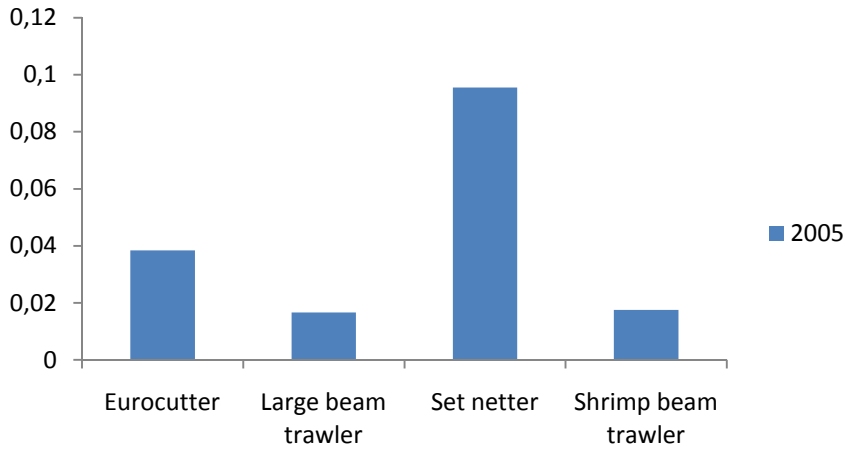

Figure 2 – Comparing return on investment across the different vessel types (year 2005, in euro).

4. Handlining versus beam trawling

a. Research question

This second study examines if the revenues and costs structure of handliners differs from the revenues and costs structure of an average Belgian eurocutter.

b. Methodology

A Belgian vessel (N 95) undertook 24 trips resulting in 71 days at sea (project between May 1, 2006 and October 31, 2006) in which handlining was used as a fishing method to target sea bass. During this period data were collected per days at sea on revenues and the three most important costs in Belgian fisheries 1) fuel costs, 2) material costs, and 3) labour costs.

These data are compared with data from an average Belgian eurocutter collected by the Belgian Sea Fisheries Service by means of an economic sample on a yearly basis. To allow pairwise comparison, both the collected data per days at sea for handlining and the data for an average eurocutter needed to be converted towards a same measurement unit. This study opted for calendar day.

c. Results

Figure 3 compares the revenue per calendar day of the handliner to the revenue per calendar day of an average eurocutter in 2003, 2004 and 2005. The figure indicates a clear difference in revenue per calendar day between the handliner (750 euro) and the average eurocutter (approximately 1500 euro). The revenues of a eurocutter are roughly speaking twice that of the handliner.

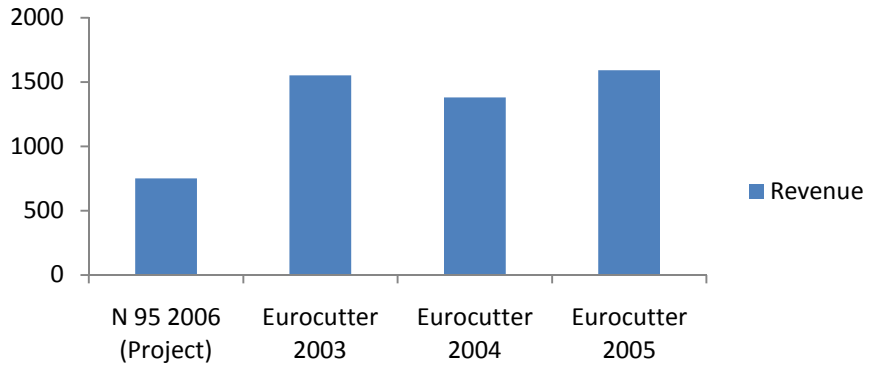

Figure 3 – Comparing the average revenue per calendar day of the N 95 to the average revenues per calendar day of an average eurocutter (2003, 2004, 2005) in euro.

Figure 4 has been created to compare the costs structure of the handliner to the cost structure of an average eurocutter (2003, 2004, 2005, 2005 fuel price converted to average fuel prices 2006) in which the amount of costs are expressed as percentages of their average revenues (per calendar day). Fuel and material costs of the handliner are in terms of percentages of the revenues exceedingly lower than those of eurocutters (2003, 2004 and 2005). Even with a higher payment percentage of wages to the crew (40% of the revenues for the handliner in contracts to 30% for eurocutters), the cumulative percentage of the three most important costs in Belgian sea fisheries are still below that of eurocutters. If the percentages for a eurocutter in 2005 are computed based on the average fuel prices in 2006 (average fuel price per liter in 2006: 0,49 euro), the share of fuel costs in the revenues still rise leaving even less margin for being profitable. When these findings are being compared to the cost structure of the N 95 during the project (figure 3), the handlining clearly appears to have a more beneficial cost-benefit relationship then eurocutters.

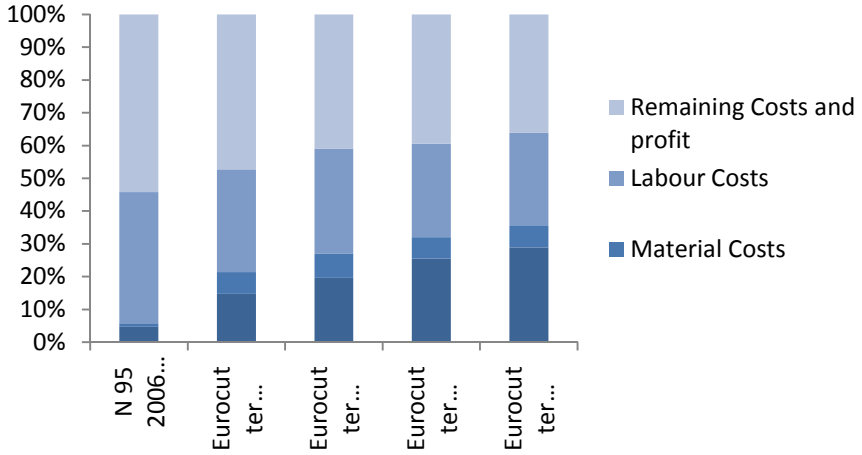

Figure 4 – Comparing the costs structure of the handliner to the cost structure of an average eurocutter (2003, 2004, 2005, 2005 fuel price converted to average fuel prices 2006 (fuel price per litre 2006: 0,49 euro)) in which the amount of costs are expressed as percentages of the average revenues (per calendar day).

5. Conclusions

Although this paper is only a first step towards a broader economic study in evaluating possible alternative vessel types and fishing methods for the Belgian overspecialised fleet, these analyses prudently bring to light that set netters and handliners can operate profitable in the Belgian context. This profitability is due to a different cost structure compared to beam trawlers, whereas passive fishing methods result in lower fuel and material costs.

Besides this beneficial cost structure, they also target species which are not being targeted by eurocutters. Handliners have the advantage of targeting sea bass which offers a reasonable price, whereas set netters can benefit from their flexibility in targeting species. On the one hand they can target Dover sole and compete with other beam trawlers, on the other hand they have an opportunity to start targeting more "niche"-species like handliners do (e.g. sea bass). These last points open a lot of further research opportunities.

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