

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

J. Depestele, H. Polet, H. Stouten, K. Van Craeynest, E. Vanderperren, and B. Verschueren.

Abstract

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.

Key words: beam trawler, fuel price, reduce fuel consumption.

Contact author: Hans Polet: Institute for Agriculture and Fisheries Research, Ankerstraat 1, B-8400 Ostend, Belgium [phone: (0032) 59 569 837, e-mail: hans.polet@ilvo.vlaanderen.be.

Table of contents

Historic evolution of the fleet	2
Beam trawling today	4
Options for transition	6
Upgrade the beam trawl fishery	7
Introduction of alternative fishing techniques for the existing vessel types.....	8
Alternative fishing gears and vessel types	10
Conclusions.....	12
References.....	12

HISTORIC EVOLUTION OF THE FLEET

Beam trawling has the reputation of being a very intensive fishing method, operating a heavy weighted fishing gear towed at high speed over the seafloor. In the early days of this fishing method, however, the gear was towed by hand in the surf or inshore by sailing vessels (Fig. 1) and was built as light as possible. The use of beam trawls dates back to the Middle Ages and was already then, despite the light construction, a controversial fishing method. A Flemish decree of March 19th 1539 mentioned the destructive effect of beam trawls on fish spawn and a French law of January 9th 1852 forbid the use of the trawl within 2 miles from the coastline (Hovart, 1994).

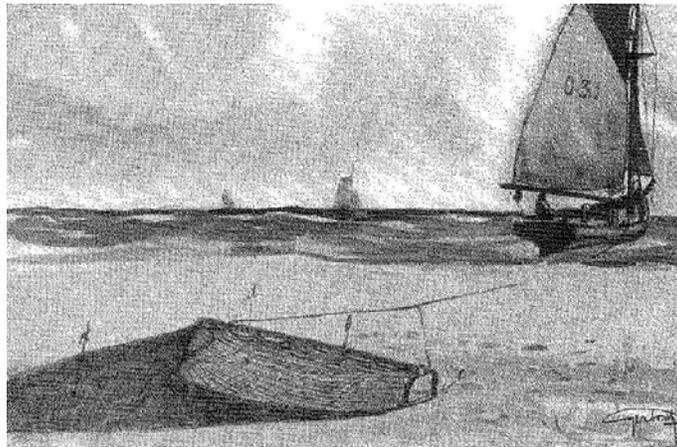


FIG. 1 – SAILING VESSEL TOWING A BEAM TRAWL (HOVART, 1994)

By the end of the 19th century, the beam trawl was commonly used in the Belgian fishing fleet which consisted only of rowing boats and sailing vessels (Polet et al., 1998). The trawls had a wooden beam with a length up to 10 m and iron beam trawl shoes, 90 cm high. The target species were flatfish and roundfish like cod and whiting. With the introduction of the steam engine by the end of the 19th century and later on the diesel engine, this fishing gear gradually disappeared from the commercial fishery. The first vessels equipped with a diesel engine were introduced about 1901 (Anon., 1912). They had an increasing success and were, after the 1950's the only type of vessel active in the Belgian sea-fishery (Fig. 2). As with steam trawlers, the otter trawl was the only gear used.

In the early 1960's the beam trawl was re-introduced in the Belgian (Fig. 2), Dutch and German fishery. Where this gear used to be a light wooden construction, at that time still used by German shrimp fishermen (Prawitt et al., 1996), it was now replaced by a double rig heavy steel gear often equipped with tickler chains and later with chain matrices. Since it was soon clear that the catchability of this gear increased with the number of tickler chains rigged in the netmouth and higher towing speed had no negative effect on the catches, there was a continuing trend for increasing engine powers (Fig. 2 & 3). Consequently the smaller vessels in this fleet almost disappeared in favour of larger vessels with engine powers up to 3000 kW. The number of otter trawlers went gradually down in favour of beam trawlers and had almost entirely disappeared from the Belgian fleet by the year 2000.

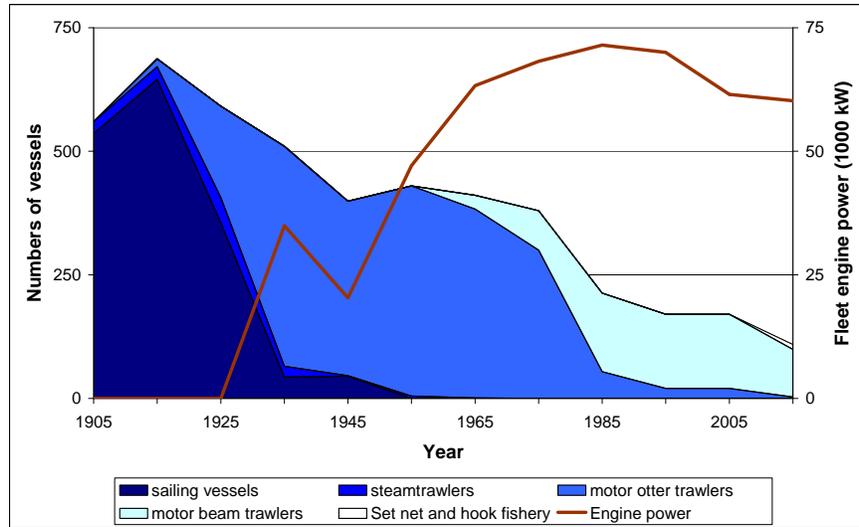


FIG. 2 – HISTORIC EVOLUTION OF THE BELGIAN FISHING FLEET IN NO.’S OF VESSELS BY VESSEL TYPE AND BY TOTAL FLEET ENGINE POWER (POLET ET AL., 1998)

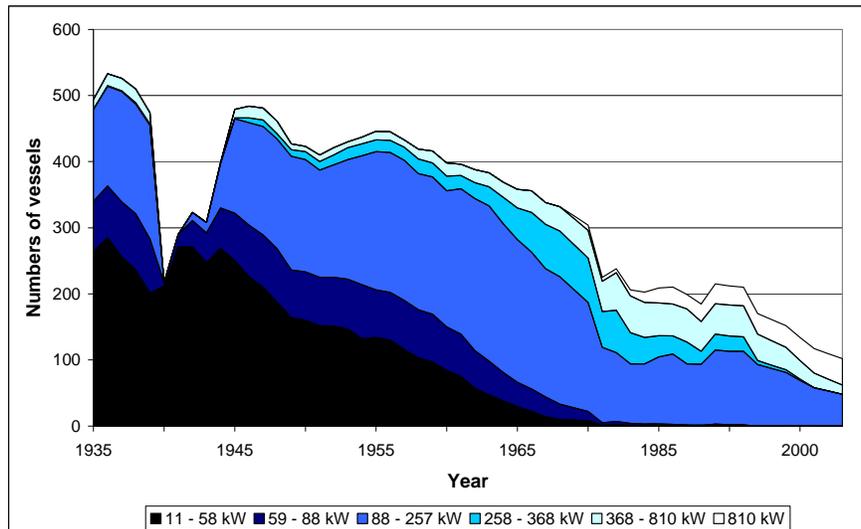


FIG. 3 – HISTORIC EVOLUTION OF THE BELGIAN TRAWLER FLEET IN NO.’S OF VESSELS BY ENGINE POWER CLASS (POLET ET AL., 1998)

To limit the increasing intensification of the fleets, the maximum engine power has been legally limited to 883 kW (recently increased to 1200 kW) for Belgium and 1500 kW for the Netherlands and to 221 kW for beam trawlers fishing within the 12-miles zone. Fig. 3, however, clearly demonstrates that there has been a continuous trend to more intensive fishing, with the smaller and medium sized vessels gradually disappearing from the fleet. Fig. 4 indicates the vast share of the large vessels in the total fuel consumption of the Dutch fleet, despite the fact that the smaller vessels outnumber the large fleet segment.

The gradual move to powerful vessels focusing on the beam trawl has led to a very uniform fleet in terms of fishing method and target species. This double specialisation makes the fleet very vulnerable in a quickly changing world.

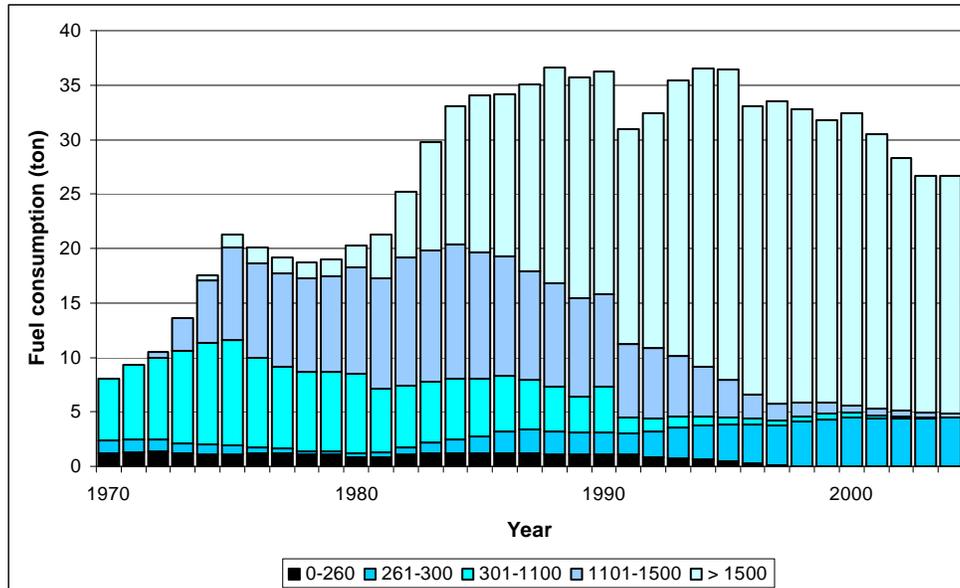


FIG. 4 - TOTAL FUEL CONSUMPTION OF THE BEAM TRAWLER FLEET BY ENGINE POWER CLASS (SMIT AND BUISMA, 2006).

BEAM TRAWLING TODAY

This historic evolution clearly indicates that fishing methods and vessels types can flourish in a time frame with certain conditions, but as soon as the conditions change, can quickly disappear and be replaced with new fisheries. Beam trawling is more and more being confronted with changing conditions that weaken its viability. The main problems that beam trawling is facing are:

- high consumption and increasing prices of resources like fuel, steel and netting material (Anon.(a), 2006 ; Den Heijer and Keus, 2001),
- significant seafloor impact (Lindeboom and De Groot, 1998) and high discards (Anon., 2007),
- a negative public image,
- the fishery produces a highly mixed catch which makes it vulnerable to recovery plans of threatened stocks and
- a relatively low quality of the fish compared to alternative fishing methods like otter trawling and Danish seine (Den Heijer and Keus, 2001).

The fuel cost is the main factor with an immediate threat to the economic viability of the fleet. The cause of the high fuel consumption is the high towing speed (up to 7 kn) and the high part of the trawl in the total towing resistance - 90 to 95% for the beam trawl compared to only 60% in otter trawling (Den Heijer and Keus, 2001). Despite the high fuel costs, economic records (Anon. 2006) indicate that the Belgian beam trawler fleet has been very profitable since the gear reappeared in the 1960's, especially owing to the high value of the target species and the wide mix of by-catch species. In 2004 and 2005, however, net operating profit of most beam trawlers has become negative (Anon. (a), 2006). The high variability of the fuel cost and fish prices makes it impossible to predict,

even in the short term, whether vessels will operate with economic profit or loss. The question should, however, be addressed whether it is wise to let a complete fishing fleet depend so strongly on an unpredictable resource like fuel.

An evaluation of the accounts of Belgian fishing companies (Anon (a), 2006) has shown that for an average large beam trawler with an engine power of 850 kW, the cost for fuel was about 40% of the total gross revenue in 2005. In 2006, this went up to 50%, meaning that with this fishery half of the value of the Belgian quota is spent on fuel and does not contribute to the fishing industry. Thrane (2004) calculated that to catch 1 kg of fish with a beam trawl, more than 2.5 liters of fuel was needed, compared to respectively 1 liter, 0.2 liter and 0.24 liter with an otter trawl, a Danish seine and a gill net (Fig. 5).

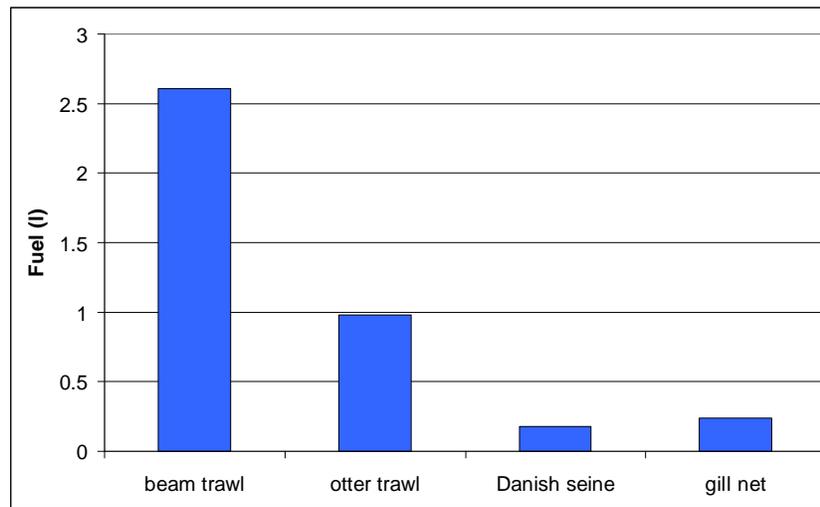


FIG. 5 - FUEL CONSUMPTION IN LITERS FOR 1 KG OF FISH (THRANE, 2004)

Belgian fisheries statistics (Anon. (a), 2006) indicate that the large beam trawler segment performed less well in economic terms compared to any other segment in the Belgian fleet and that the two most important segments of the fleet, i.e. the Eurocutter beam trawlers and large beam trawlers operated with a net loss (Table 1).

The fuel efficiency (Fig. 6) for beam trawlers is much lower compared to the few Belgian vessels operating passive fishing gear. As fuel prices further rose in 2006, this difference has undoubtedly further increased.

TABLE 1: SELECTION OF STATISTICS OF TWO BELGIAN FLEET SEGMENTS ((ANON. (A), 2006).

Fleet segment	Days at sea		Yearly value of the landings (by vessel ; Euro)		Net profit/loss before tax (by vessel ; Euro)	
	2004	2005	2004	2005	2004	2005
Beam trawl, Eurocutter (≤ 221 kW)	178	195	503.889	581.256	-8.217	-3478
Beam trawl (> 662 kW)	253	240	1.241.679	1.243.518	-71.087	-151.494

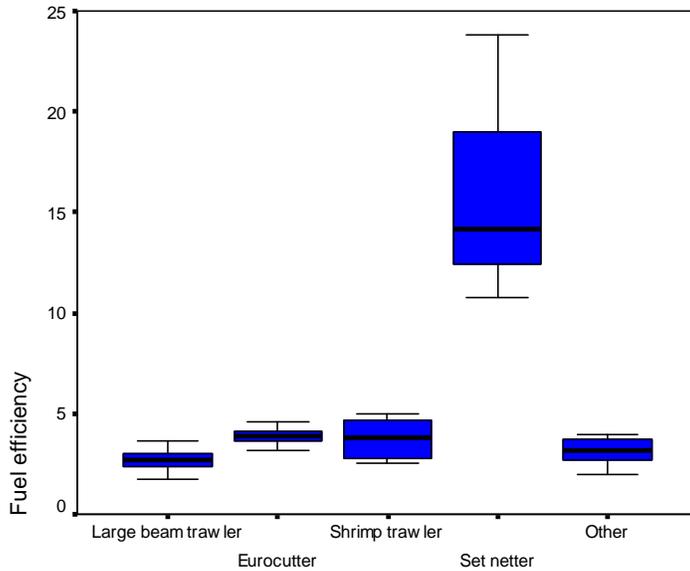


FIG. 6 – FUEL EFFICIENCY FOR SELECTED BELGIAN VESSEL TYPES (UNPUBLISHED DATA, EU-PROJECT DEGREE). FUEL EFFICIENCY = REVENUES / TOTAL FUEL COST.

From these considerations, it is obvious that in the present (and probably future) conditions, there are better ways of fishing than beam trawling, both in economic as in ecological terms. Although many stakeholders in the Belgian fishery do not accept it, beam trawling seems to have difficulty to cope with the new conditions and may be close to not being viable. If the Belgian fishery wants to survive, it is necessary that a long term vision and strategy is set up to guide the fishery towards a sustainable fishery.

OPTIONS FOR TRANSITION

Ben Daalder, head of a large Dutch producer's organization, claimed at a speech to the Belgian fishing industry in December 2006 in Oostende, Belgium: "The value of the beam trawler fleet is merely the value of the steel". It is indeed the case that it is very difficult to sell beam trawl vessels. A successful conversion of the Belgian fleet in the short term is therefore not possible without huge financial losses and should take a more gradual approach, i.e.:

1. upgrade the beam trawl fishery, i.e.
 - i. improve the cost efficiency,
 - ii. reduce the environmental impact,
 - iii. improve the species selectivity of the trawl and reduce discards,
 - iv. improve the quality of the produce and
 - v. improve the public image of the industry
2. introduce alternative fishing techniques for the existing vessel types and
3. demonstrate and introduce alternative fishing methods and vessel types.

Below, some examples of supporting research for a conversion of the fleet are given.

Upgrade the beam trawl fishery

The beam trawl is in terms of gear design a very simple gear. The necessary intense seafloor contact and the inherent mixed character of the catches, though, make it a very difficult gear to improve in terms of discards and environmental impact. A summary of most of the Belgian research of the last two decades to improve the beam trawl can be found in Fonteyne et al. (1997), Fonteyne et al. (2005) and Polet (2003). This work, together with new unpublished work has led to the definition of a so called alternative beam trawl. The alterations for this trawl are given in Table 2.

The approach that has been taken for the alternative beam trawl is:

1. Experimental work on research and commercial vessels
2. Pilot project on the commercial vessel O.89 ; > 1 year of commercial application with positive outcome and profitable fishery (Polet et al, 2006)
3. Identify group of innovators (at least 10 vessels) for voluntarily uptake in cooperation with producer's organization ; planned for autumn 2007
4. Publicity campaign to improve public image and to promote further uptake by the industry

TABLE 2: ALTERATIONS FOR THE ALTERNATIVE BEAM TRAWL

Alteration	Aim	Result
roller gear	reduction of fuel consumption	+/- 10% less fuel (preliminary result)
large meshes in top panel	reduction of fuel consumption improve species selectivity	+/- 5% less fuel (preliminary result) significant reduction of roundfish catches (whiting, haddock,...)
Benthos release panel	reduction of discards	significant reduction of invertebrates and non-commercial fish discards (Fonteyne & Polet, 2002; Reville and Jennings, 2005)
T90-cod-end (or alternative)	reduction of discards	significant reduction of discards of commercial fish species
Thinner netting material	reduction of fuel consumption	option for later work
Altered trawl beam	reduction of fuel consumption	option for later work
Fly-beam	reduction of fuel consumption	in stage of development in the Netherlands
Lighter chains	reduction of fuel consumption and seafloor impact	in stage of development in the industry

Further advantages of the trawl are a better fish quality (fishermen's observation) and less sorting work. There are still some issues to be solved in terms of practical application, i.e. the devices do not always perform the same way on different fishing grounds or vessel types. It is the intention to allow the fishermen to change the gear within certain limits, in order to adapt it to their specific circumstances. In the end it is the intention to evaluate the gears by their catches and not to enforce their technical specifications.

Other initiatives that are taken to reduce the fuel consumption of fishing vessels are given in Table 3:

TABLE 3: OTHER INITIATIVES TO REDUCE FUEL CONSUMPTION

Alteration	Aim	Result
fuel consumption meter	responsible use of fuel by crew	5 to 15% less fuel (fishermen's observation – scientific follow-up planned)
fuel additives	reduction of fuel consumption	less fuel (fishermen's observation – scientific follow-up planned)
added propulsion by wind energy	reduction of fuel consumption	application possible in specific circumstances

The combination of all these initiatives should allow the fleet to further operate in economically viable conditions until a conversion is possible to a long term sustainable fishery. Whether the beam trawl will still be part of that fishery remains to be seen, but it's role will certainly be strongly reduced.

Introduction of alternative fishing techniques for the existing vessel types

Many beam trawl vessels are specifically built to tow the beam trawl and have very little options for operating other fishing gear. A switch to passive fishing gear like set nets and hook & line fishery is generally accepted to be very difficult. In Depestele et al. (2006) it is stated that experiments with longlines on board a beam trawler clearly indicated that the vessel is not suited for this fishery. A purpose built vessel is necessary to make this type of fishery viable.

Options for alternative trawl net fisheries are twin, triple or quadruple otter trawling, Danish seine fishery and outrigger otter trawling. The former two options require a significant investment for making a beam trawl vessel suitable for this fishery. Figures are given in Table 4.

TABLE 4: INVESTMENTS NECESSARY FOR ALTERNATIVE TRAWL FISHERIES ABOARD BEAM TRAWLERS

	Total cost (Euro)
Twin otter trawling – small fleet segment	245.000 (Den Heijer and Keus, 2001)
Twin otter trawling – large fleet segment	530.000 (Den Heijer and Keus, 2001)
Danish seining – large fleet segment	800.000 (pers. comm. Dutch vessel owner)
Outrigger otter trawling – small fleet segment	20.000
Outrigger otter trawling – large fleet segment	30.000

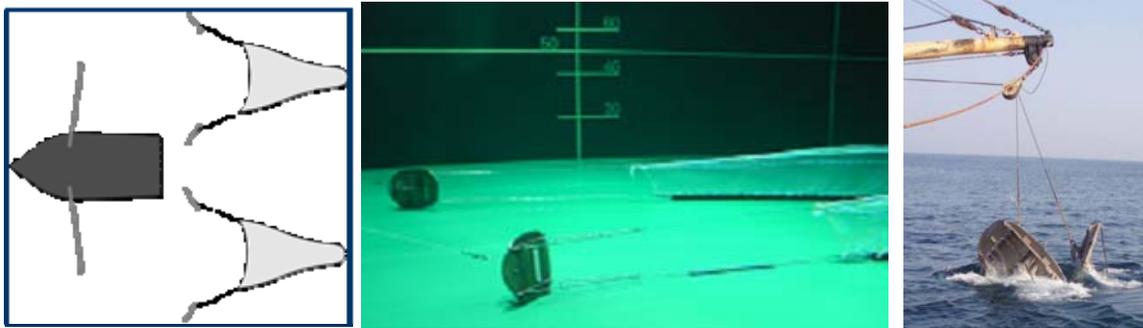


FIG. 7 – THE OUTRIGGER FISHERY

Den Heijer and Keus (2001) reported a reduction in fuel consumption of over 30% with the twinrig and a better appreciation of the fish quality in the auction. The Danish seine gives an even further reduction in fuel consumption and a superb fish quality (pers. comm. Dutch fishermen). Because of the high investment necessary for twinrig or Danish seine fishery, though, it was decided to give priority to the outrigger fishery as an option for the Belgian fleet.

The following approach was chosen for a pilot project (Vanderperren, 2007):

1. Formation of a gear expert team of fishermen with experience in otter trawling for guidance of the scientific team and skippers and crew
2. Involvement of the single vessel already operating the outrigger fishery successfully (Z.85)
3. Experimental work on commercial vessels to select otter board types, net types and options for the groundgear
4. Exploration of fishing grounds by a commercial vessel O.33; > 1 year of commercial application with variable outcome
5. Identify group of innovators for further uptake in the commercial fishery ; on-going
6. Publicity campaign to promote further uptake by the industry ; planned

For the small fleet segment, the results were very positive (Vanderperren, 2007). The outrigger trawl fishery gives a reduction in fuel consumption of 40% for this segment and a strongly reduced investment and maintenance cost for the gear. The vessel Z.85 has proven for several years now that this fishery is profitable, also in times of rising fuel prices.

For the large fleet segment, the reduction in fuel consumption is 50% for the chain matrix fishery and up to 70% for the tickler chains fishery (Vanderperren, 2007). During the pilot project, these large vessels could carry out a profitable fishery but mainly because they were allowed to fish within the 12-miles zone. The vessel O.33 that carried the exploration of fishing grounds outside the 12-miles zone, operated with variable outcome and several seatrips were not profitable. The disadvantage of the outrigger fishery with these large vessels is the limit to the horizontal opening of the fishing gear, i.e. until the inner otter boards touch and entangle. Apparently, for the small fleet segment, the horizontal opening that can be reached is close to the optimal for the engine power of the vessels. With rising engine power there is a disproportion between engine power and gear size and a threshold is reached when the vessel is no longer profitable or not competitive with smaller vessels operating e.g. twinrigs. Further work is needed to determine the relationship between engine power, vessel size and profitability for the outrigger fishery.

Another problem that hinders a more general application of the outrigger fishery is the catch composition. Fig. 8 (left) shows the relative catch composition in 2005 for the beam trawl and the otter trawl fishery in Belgium. It is clear that the otter trawl is far less efficient in catching sole compared to the beam trawl. This can become problematic because of the high importance of sole in the total value of the Belgian quota (Fig. 8 – right)

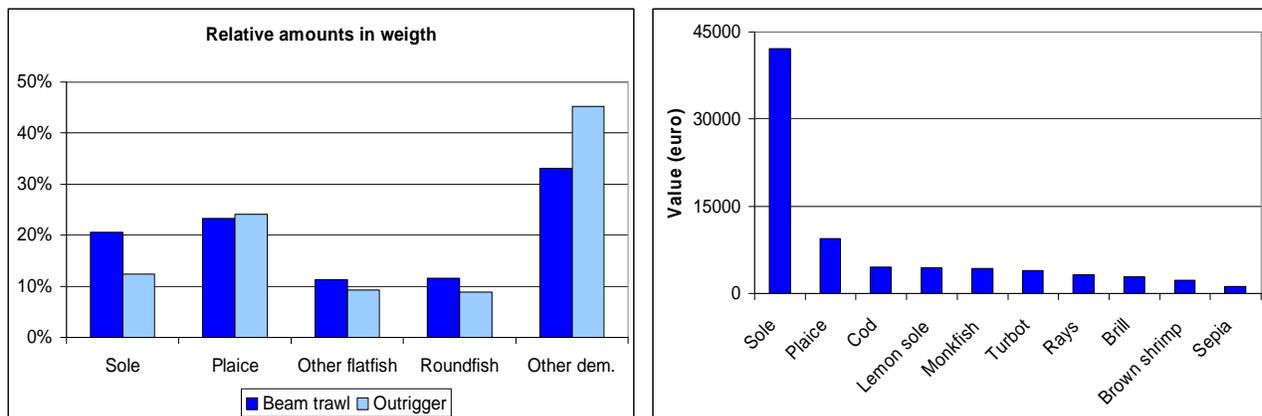


FIG. 8 – THE RELATIVEAMOUNTS OF FISH SPECIES IN THE CATCH FOR BEAM TRAWLERS AND OUTRIGGER TRAWLERS IN 2005 – LEFT AND TOP 10 IN VALUE OF LANDINGS OF THE BELGIAN SEA FISHERY IN 2005 - RIGHT (BELGIAN LANDINGS STATISTICS – DEPARTEMENT LANDBOUW EN VISSERIJ. AFDELING LANDBOUW- EN VISSERIJBELEID, ZEEVISSERIJ)

ALTERNATIVE FISHING GEARS AND VESSEL TYPES

Depestele et al. (2006) and unpublished data from the EU-project DEGREE¹ have shown that passive fishing gears may be a viable alternative for part of the Belgian fishing fleet. These fisheries typically have low exploitation costs, often good quality catches and relatively low environmental impact. In order to demonstrate the economic viability of this type of fishery, a pilot project was started to screen the handline fishery for sea bass

¹ EU-project DEGREE - Sixth Framework Programme FP6-022576, “Development of fishing Gears with Reduced Effects on the Environment”

on a Belgian catamaran coastal vessel N.95 and explore the possibility for longlining in the Belgian waters.

The following approach was chosen for the pilot project (Depestele et al., 2006):

1. Involvement in the project of the single one commercial vessel in Belgium operating the handline fishery
2. Experimental work (> 6months) on the commercial vessel to monitor the catches, revenues and costs and to learn about the fish behaviour
3. Explore the possibility of longlining
4. Identify group of innovators for further uptake in the commercial fishery ; on-going
5. Publicity campaign to promote further uptake by the industry : planned

The handline fishery for sea bass was successful. Based on the experiences of the skipper and crew, a description could be made of factors important in this fishery, e.g. the influence of noise, the choice of the location on the fishing ground, the necessary knowledge of the fish behaviour. The cost structure of this type of vessel is shown in Fig. 9, in comparison with that of a typical beam trawler fishing in the same area. The strongly reduced costs for fuel and materials benefit the crew's wages. Another advantage of this type of fishery is the fishermen's social life – with bad weather the vessel stays in the harbour.

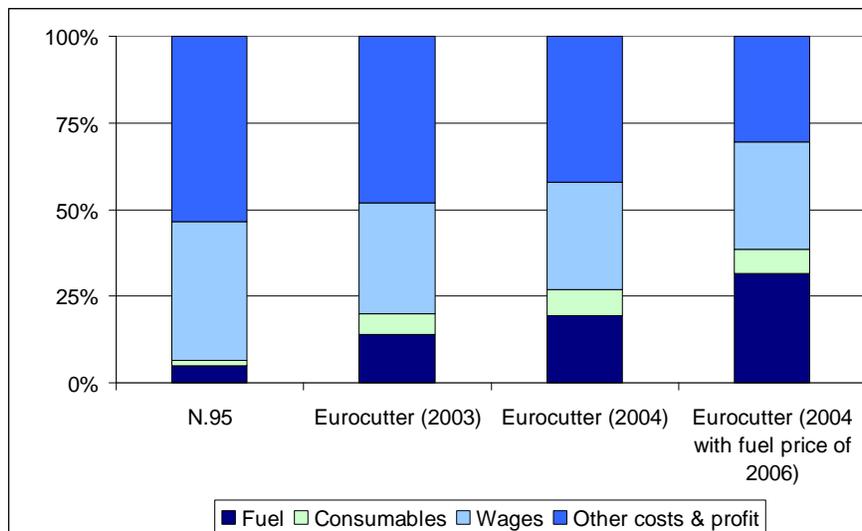


FIG. 9 – AVERAGE COSTS OF THE N.95 AND AN AVERAGE EUROCUTTER (221 kW BEAM TRAWLER) AS A PERCENTAGE OF THE REVENUES.

It has never been the intention to claim that this type of fishery would be an alternative for the whole fleet, but the importance of this project is that it has proven that passive fishing methods can be economically viable in the Belgian context.

CONCLUSIONS

Beam trawling has played an important role in the Belgian sea fishery and has given the fishing community good profits in the last four decades. Changing conditions have brought this fishery on the edge of being profitable and acceptable in terms of responsible fishing. Due to the over-specialisation of the Belgian fleet (> 95% beam trawlers), alternatives need to be sought and a vision and strategy for the future is necessary for the fleet to survive and to convert to a fleet structure that can carry out a sustainable fishery both in economic and ecological terms.

The alternative beam trawl, other technical adaptations and alternative fishing methods aboard the same vessels can extend the economic life of the existing vessels. It will, however, be necessary to look at alternative vessel types and (especially passive) fishing methods and determine an alternative fleet structure with a better cost structure, less environmental impact and discard production and a better public image.

It has never been the intention to claim that passive fishing gear is “the” answer as an alternative for the whole fleet, but the importance of this project is that it has proven that this fishery is economically viable in the Belgian context. Besides the handline fishery described above, other passive fisheries have proven to be viable, trammel and gill nets for instance that are very efficient in catching the main target species in Belgium, i.e. sole. Further plans exist to promote these types of fisheries and to study how a future fleet could be composed (in terms of fishing method and vessel type) with a maximized profit, minimal environmental impact and discards and acceptable social life for the fisherman.

REFERENCES

- Anon., 1912. Jaarverslag der Commissie voor Zeevisserij; Provincie West-Vlaanderen.
- Anon., 1997. Report of the Gear expert meeting, Ålesund, Norway, 4 – 6 June 2007.
- Anon. (a), 2006. Uitkomsten van de Belgische zeevisserij. Departement Landbouw en Visserij. Afdeling Landbouw- en Visserijbeleid, Zeevisserij. (in Dutch)
- Anon. (b)., 2006. Aanvoer en besomming in de Belgische zeevisserij. Departement Landbouw en Visserij. Afdeling Landbouw- en Visserijbeleid, Zeevisserij. (in Dutch)
- Den Heijer, W.M. and Keus, B., 2001. Bestaande vistuigen als mogelijk alternatief voor de boomkor. Rijksinstituut voor Kust en Zee, Rapport RIKZ 2001.037. (in Dutch)
- Depestele, J., Stouten, H., Van Craeynest, K., Van Craeynest, N., Vanderperren, E. and Polet, H., 2006. Eerste resultaten van de tweede fase van het Project Alternatieve Visserij. Interim projectreport, ILVO-Fishery, Oostende, Belgium. (in Dutch)
- Fonteyne, R., Polet, H., Van Marlen, B., Macmullen, Ph. and Swarbrick, J., 1997. Optimisation of a species selective beam trawl. ICES Fish. Technol. Fish. Behav. Work. Group Meeting, Hamburg, Duitsland, april 1997.

- Fonteyne, R., Polet, H. & Depestele, J., 2005. Mitigation of the environmental impact of beam trawls. in: Proceedings of the Seventh International Workshop on Methods for the Development and Evaluation of Maritime Technologies. Busan, Korea, 23-26 November 2005.
- Hovart, P., 1994. 150 jaar zeevisserijbeheer, 1830-1980. Mededelingen van het Rijksstation voor Zeevisserij, publicatienr. 235 – D/1994/0889/1. (in Dutch)
- Polet, H., Ball, B., Blom, W., Ehrich, S., Ramsay, K. and Tuck, I., 1998. Fishing gears used by different fishing fleets.
In “The effects of different types of fisheries on the North Sea and Irish Sea benthic ecosystems”. NIOZ-Rapport 1998-1, RIVO-DLO Rapport C003/98
- Polet, H., 2003. Evaluation of by-catch in the Belgian brown shrimp (*Crangon crangon* L.) fishery and of technical means to reduce discarding. PhD thesis at University of Ghent.
- Polet, H., Depestele, J., Vanderperren, E., Buyvoets, E., Vanden Berghe, C. en Vancraeynest, N. (2006). Projectverslag SDVO project “Tweelingboomkor” en SDVO project “Alternatieve boomkor”. Tussentijds rapport. Studie uitgevoerd met financiële steun van de Stichting Duurzame Visserijontwikkeling vzw. Interim projectreport, ILVO-Fishery, Oostende, Belgium. (in Dutch)
- Lindeboom, H.J. and de Groot, S.J., 1998. Impact II – The effects of different types of fisheries on the North Sea and Irish Sea benthic ecosystems. NIOZ rapport 1998 – 1
- Prawitt, O., Kuhlmann, H. and Neudecker, T., 1996. Report on the technical fleet inventory of the German brown shrimp fishing fleet. Document produced as part of the EU-study no. 94/044, Research into the Crangon Fisheries Unerring Effect.
- Revill, A. and Jennings, S. 2005. The capacity of benthos release panels to reduce the impacts of beam trawls on benthic communities. Fisheries Research, 75: 73-85.
- Smit, J. and Buisman, E., 2006. Economisch krachtenveld in de transitie naar een duurzame kottervisserij. LEI, Den Haag, the Netherlands, rapport 2.06.14; ISBN-10: 90-8615-119-1; ISBN-13: 978-90-8615-119-6. (in Dutch)
- Stouten, H. and Polet, H., 2007. Degree: the economic performance of the Belgian beam trawlers and set netters. Project report to EU-project FP6-022576.
- Thrane, M., 2004. Environmental Impacts from Danish Fish Product. PhD dissertation, Department of Development and Planning, Aalborg University, Denmark.
- Vanderperren, E., 2007. Outrigger II “Introductie van bordenvisserij in de boomkorvloot met het oog op brandstofbesparing”. Interim projectreport, ILVO-Fishery, Oostende, Belgium. (in Dutch)