EXPERIENCE OF VESSEL DECOMMISSIONING IN DANISH FISHERIES

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ABSTRACT

The fishing capacity issue has lately received considerable global attention. The application of an embracing structural policy in the European Union (EU) during the 1980s and 90s has indicated the desire of fisheries managers and administrators to rebalance the level of capacity of fishing fleets with resource availability. A previous study is drawn upon to shed light on the impact of vessel decommissioning on the Danish fleet during 1987-93.The Danish administration has since continued to structurally adjust the national fishing fleet under the guidance of the EU structural policy framework. The official capacity figures corresponding to EU multiannual guidance programmes (MAGPs) targets are presented. A specific analysis of national capacity regulations and adjustment policies, including vessel decommissioning, construction and modernisation, is undertaken for the 1992-99 period. The impact of these regulations and policies on the national fleet size and structure is analysed, as well as examining the resulting capital (insurance value) development. Finally, characteristics of decommissioned vessels for 1995-2002 are examined and production indicators are considered. Concluding remarks are drawn.

Keywords: Fishing capacity, fleet adjustment, MAGP, vessel decommissioning, Danish fishing fleet

INTRODUCTION

The overall objective of the long-term application of capacity adjustment policy has been to make the fishing sector economically viable, whilst contributing to a more selective and sustainable utilisation of available resources. Another important objective has been to secure sound economic and social conditions for the enterprises and the persons employed in the sector, and to create a reasonable and stable income level. In order to satisfy these objectives, the aim of capacity adjustment has been to reduce the size of the fleet in line with national capacity regulations and European Union (EU) capacity adjustment initiatives. Although this will contribute to having a negative effect on employment in the short term, reducing the fleet is seen as an essential condition for a positive evolution in the remainder of the fishing fleet.

A fundamental structural change in the Danish fisheries sector has been required, mainly because of scarcity of resources in EU waters and increased competition for markets. During the late 1980s and early 90s, the situation for the most important stocks for the Danish fishing fleet deteriorated, most notably cod. The Danish authorities were therefore extremely restrictive as regards granting permission for entry of new vessels into the fishing fleet. The banking sector was furthermore very reluctant to finance renewal of vessels. The result has been that the Danish fishing fleet is now comparatively old and has an average age of over 30 years. Danish capacity reduction measures have primarily focused on decommissioning of fishing vessels, although the EU framework has allowed countries to reduce their fleets both in terms of capacity and effort (through vessel activity restrictions).

The modernisation of the Danish fishing fleet has been regarded to be of crucial importance to employment in the many small and medium-sized shipyards in Denmark, not least because of the limitations imposed on vessel construction. At the same time, modernisation of the fleet has been viewed as a key factor in ensuring continued improvement in the quality of fish landed, which in turn leads to increasing value-added in the future. However, restrictions on the size of the fleet have continued to ensure that the capacity adjustments undertaken have not been cancelled out by additions to the fleet. It is nevertheless considered that creating incentives to invest in fishing vessels, indirectly improving their economic performance, is contradictory to the approach of streamlining fleet sizes to address the overcapacity problem.

DANISH VESSEL DECOMMISSIONING (1987-93)

Frost *et al* (1995) show that during the period 1987-93 a total of 797 vessels, representing almost 40,000 gross tonnage or 29% of the fleet size in 1987, was decommissioned with national and EU aid. The Danish seine and trawler fleets were particularly subject to decommissioning, with 41% and 33% reductions respectively. This reduction was larger than that imposed by EU targets, and approximately 2,000 jobs were lost. Frost *et al* (1995) further conclude that:

- The combination of debt and taxation rules meant that unless a fisherman's debt was very low, voluntary exit of a fisherman was deemed unlikely. Hence, the removal of fishermen was assumed to be the result of being forced out by creditors and banks, who seemingly preferred to collect a smaller short-term loss rather than a larger loss in the future. This compelled fishermen to accept substantial losses, with the remaining fishermen and their creditors reaping the rewards of adjustment.

- The decommissioning scheme was funded 50/50 by the European Commission and Denmark. Given that the grants were taxable at a rate of some 50%, the Danish funded component simply led to a redistribution of central funds to the provincial areas. That is, the net value of grants was only 50%, and hence the Danish state did not have any net expenses from the scheme, and only public redistribution of finances took place.

DANISH RESPONSE TO MAGPS (1992-2002)

Under the EU framework of Multiannual Guidance Programmes (MAGPs), administrators have sought to encourage a sustainable balance between the capacity of the EU fishing fleets and the available resources (Lindebo 2000). The MAGP, a comprehensive capacity adjustment programme, has aimed to remove excess capacity from fisheries through vessel decommissioning and effort reduction.

Reduction in fleet capacity during the 1992-96 period was pronounced with a 25% reduction in gross registered tonnage (GRT) and a 21% reduction in engine power kilowatts (kW) of the Danish fleet under MAGP III (cf. Table 1 below). This can be compared to total EU fleet reductions of 18% and 12% respectively for the same period.

TABLE 1. **Danish fleet developments against MAGP targets, 1992-96**

	---------- Tonnage (GRT) ----------		---------- Power (kW) ----------	
End of year	Objectives	Situation fleet register	Objectives	Situation fleet register
1991	119,118	109,406	514,716	496,690
1992	116,804	101,458	504,422	460,634
1993	112,766	88,546	487,131	410,245
1994	108,727	87,368	469,840	418,346
1995	104,689	84,386	452,550	404,941
1996	105,109	81,148	480,043	390,226
% Change	1992 to 1996 development: -25		1992 to 1996 development: -21	
Sit.96/Obj.96		77%		81%

Source: COM(97) 352 final

A slowdown in capacity reduction was seen under MAGP IV (1997-2002), given that Denmark was well below MAGP objectives before the commencement of the programme. However, the transition of converting GRT into gross tonnage (GT) and kW registration also led to numerous discrepancies in the reported data, as seen if Tables 1 and 2 are compared. Nevertheless, fleet reductions of 3-5% were observed for the period, again in excess of EU requirements. Notably, the reductions have also complied with reductions for all individual fleet segments in the Danish fleet.

TABLE 2. **Danish fleet developments against MAGP targets, 1997-2002**

	Tonnage (GT)		Power (kW)	
End of year	Objectives	Situation fleet register	Objectives	Situation fleet register
1997		105,745		376,916
1998		105,595		370,350
1999	135,292	107,805	473,372	367,801
2000	133,916	101,822	468,404	372,682
2001	132,540	99,662	463,437	364,030
June 2002	133,270	101,081	461,507	363,202
% Change	1997 to 2002 development: -4.4		1997 to 2002 development: -3.6	
Sit.02/Obj.02		76%		79%

Source: COM(1999) 175 fin, COM(2000) 738 fin, COM(2001) 541 fin, COM(2002) 446 fin , COM(2002) 483 fin

The financial framework of the structural adjustment of fishing fleets has been integrated under the Financial Instrument for Fisheries Guidance (FIFG). The explicit task of the FIFG has been to achieve a sustainable balance between resources and their exploitation, a strengthening of the competitiveness of structures, and the development of economically viable enterprises. Regulations have required each country, in this case Denmark, to draw up a single programming document that outlines a strategic plan for fisheries, together with an aid application. The actual aid packages for the Danish fishing fleet during 1994-2002 are portrayed in Tables 3 and 4 below. The funds for renewal and modernisation are rather striking, and the extent of private funds especially seems to suggest that there have been investment incentives to increase catching potentials of vessels.

TABLE 3. **Actual aid for Danish fleet measures, 1994-99 (€ million)**

	EU FIFG funds	National funds	Private funds	Total funds	Number of Projects	Tonnage (GT)	Power (kW)
Vessel decommissioning	21.42	20.35	-	41.77	366	10,988	50,840
Joint enterprises	0.46	0.46	-	0.92	1	390	810
Vessel construction	4.81	0.97	13.44	19.22	21	4,286	7,725
Vessel modernisation	24.75	4.97	69.53	99.25	1,454	-	-
Total	51.44	26.75	82.97	161.16	-	-	-

Source: Directorate for Development (2003a)

TABLE 4. **Actual aid for Danish fleet measures, 2000-02 (€ million)**

	EU FIFG funds	National funds	Private funds	Total funds	Number of Projects	Tonnage (GT)	Power (kW)
Vessel decommissioning	19.66	19.66	-	39.32	206	9,100	21,262
Vessel construction	5.74	1.92	30.64	38.30	55	3,893	11,915
Vessel modernisation	9.53	3.18	50.82	63.53	1,023	-	-
Total	34.93	24.76	81.46	141.15	-	-	-

Source: Directorate for Development (2003b)

DANISH FLEET ADJUSTMENT (1992-2002)

Structural instruments

The management and control of fishing capacity of the national fleet has been the task of the Directorate of Fisheries. National guidelines and regulations have worked in conjunction with EU capacity regulations in order to seek a fleet capacity that is balanced with resource availability. Capacity management regulation has nationally been under the auspices of *inter alia* Guidelines for adjustment of fleet harvesting capacity 1992, Guidelines permitting vessel replacement, modernisation and engine power change 1995, and Ministerial Announcements No. 257 of 3 April 1997 and No. 1120 of 15 December 1997 concerning vessels that are used in commercial fisheries (with more recent amendments). These have helped to outline the rules and regulations imposed on capacity entry and exit for

the Danish fleet, for both funded and non-funded vessel decommissioning, modernisation and construction, differentiated on gear and size of vessels.

Vessel decommissioning was carried out under the following categories:

- Permanent vessel decommissioning
- Reassignment for purposes other than fishing
- Joint enterprises and export to third countries

Public support for the permanent removal of vessels of less than 25 GRT was only given if the vessels concerned were decommissioned. All vessels that were removed through these measures had to be deleted from the national registers as well as the EU register of fishing vessels. The EU covered 50% of the grant for vessel decommissioning, with the remaining 50% covered by national means.

The aim of vessel decommissioning was to adjust the size of the fishing fleet to the actual catching possibilities and to create a basis for future, long-term renewal of the fleet. Conditions for eligibility included the number of days fished during the last two years, the age of the vessel (at least 10 years old), and the grant size was dependant on vessel tonnage and age[1]. The reassignment of vessels for purposes other than fishing also fell under this category, encouraging the permanent cessation of fishing vessel activities. The aim of joint enterprises and export to third countries was to assist with the fleet size adjustment to the actual catching possibilities by transferring Danish vessels to fisheries in third countries. Grants were given to vessels that were permanently transferred to third country fisheries through the establishment of a joint enterprise between one or more Danish partner with one or more partners in a third country. Conditions included a minimum vessel size of 25 GRT and that the vessel had been fishing for at least 5 years under the Danish flag. The size of the grant was once again dependant on vessel tonnage and age. During the period vessel removal was largely carried out by means of decommissioning. The difficulty of control following the creation of joint enterprises and export to third countries meant that administrators were reluctant to support such measures. Additionally, the reassignment for purposes other than fishing attracted limited interest (personal communication with Directorate for Development, March 2000).

The aim of funding vessel construction was to promote renewal and permanently adjust the structure of the fishing fleet[2]. Funding for vessel construction was only made available on the condition that the vessel owner removed capacity from the fishery, with the extent of the allocated grant depending on the investment cost, the tonnage of the new vessel, and the amount of capacity (tonnage) that was removed in conjunction with the new investment. The maximum grant cover was 30% of the proposed investment, 25% of which was covered by the EU with the remaining 5% covered by national means. Grants were also given to projects that specifically enhanced on-board safety, promoted more selective and environmentally friendly fishing practises, and bettered fish handling and quality. In 2000, the grant was reduced to 20% of the overall investment cost.

The strict capacity regulation in force meant that funded vessel construction was limited to only a handful of projects during the period. Vessel owners have therefore tended to seek funding for modernisation in order to improve their status in the fishery (personal communication with Directorate for Development, March 2000). Vessel construction has however been more prominent in the new millennium (cf. Table 4) under strict entry:exit capacity restrictions (i.e. exiting capacity had to be 30% greater than entering capacity).

The aim of allocating grants for vessel modernisation was to rationalise the fishery, to improve the storage and quality of fish products, to promote more selective and environmentally friendly (including energy saving) fishing practises, to improve the working and safety conditions on board or to allow better fisheries surveillance[3]. Vessels had to be less than 30 years old to be eligible for a grant, unless the project promoted better safety conditions or improved fisheries surveillance. Approved projects were granted support for up to 30% of the investments that included an EU grant of 25% and a national grant of 5%, where investments had to be of at least € 3,360. As for construction grants, in 2000 the grant was reduced to 20% of the overall investment cost. Where modernisation resulted in a capacity increase, grants allocated depended on the amount of the investment, the tonnage of the vessel, and the amount of capacity (tonnage) that was simultaneously removed. Modernisation that resulted in an increase in capacity, in terms of tonnage or engine power, could only be granted funding if capacity was simultaneously removed from the fishing fleet, whereas modernisation that was considered to be general vessel maintenance could not be funded. The majority of approved projects during the period mainly concerned energy saving measures

through the acquisition of new vessel engines and improvement of fish storage on board (personal communication with Directorate for Development, March 2000).

Capacity adjustment

National capacity adjustment records held by the Directorate of Fisheries and Directorate for Development have been updated to conform to the latest segmentation codes of the Danish fleet under MAGP IV. Vessel tonnage is given as a mixture of GT/GRT, only using GRT when GT is unavailable. Engine power is given as the official effect kW. The figures and tables below present the capacity adjustment process that has taken place during the period as a result of national and EU measures to adjust capacity of the Danish fishing fleet. Data for 1992-99 has been sourced from Directorate of Fisheries and Directorate for Development (cf. Lindebo 2000), with supplementary information from Directorate for Development (2003b) being used for the 2000-02 period.

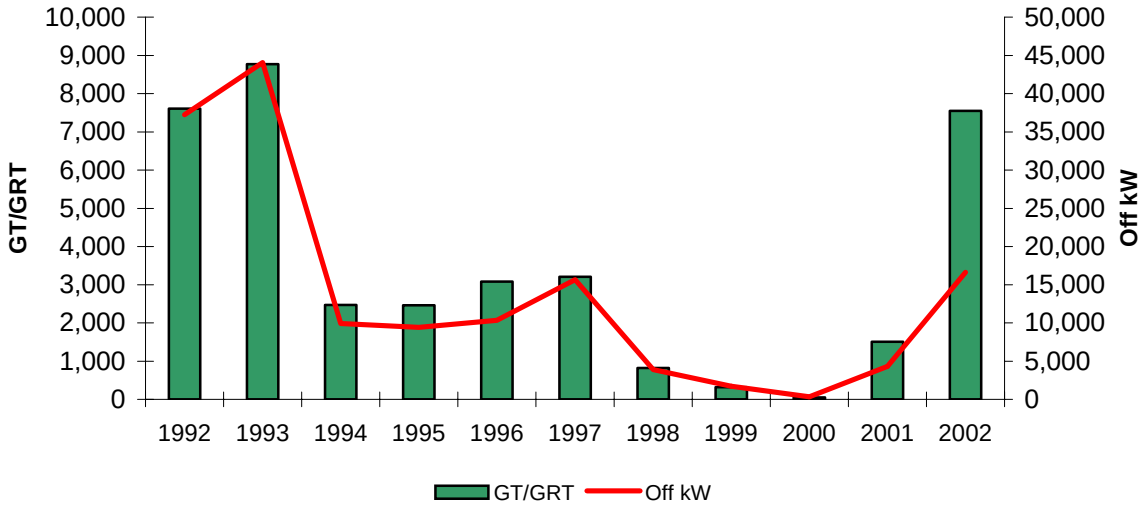

FIGURE 1. **Funded vessel decommissioning**

Almost 85% of the funded vessel decommissioning was from 4B3 fishing vessels (trawler and Danish seiner segment)[4], both in terms of tonnage and engine power. It is noticeable that most vessels were removed during the earlier part of the period, after which capacity reduction targets under the MAGPs had been more than satisfied. The more recent round of decommissioning is seen as a response to the worsening economic situation of many commercially important fish stocks such as cod. Funded vessel construction only led to an overall capacity increase of 560 GT/GRT and 400 kW over the 1992-99 period, due to the strict conditions imposed on funding for this purpose. The capacity of newly constructed vessels totalled 845 GT/GRT and 1,720 kW, whilst the corresponding exit was 280 GT/GRT and 1,320 kW. Vessels from the 4B3 fleet segment accounted for 85% and 60% of the overall GT/GRT and kW changes respectively. During 2000-02, 55 new vessels of 3,900 GT entered the fishery as new constructions with a simultaneous outtake of 4,600 GT (representing some 120% of constructed vessels). In terms of engine power, 11,915 kW entered and 15,000 kW was taken out (representing 125%).

Vessel modernisation accounted for an additional capacity increase of 2,900 GT/GRT and 2,150 kW during the 1992-99 period, although no funded modernisation took place before 1995 or in 1999. It is noted that most funded modernisation involved vessels where no capacity increase resulted. The importance of vessel modernisation is, however, reflected in the actual aid figures for the Danish fleet (see Tables 3 and 4). Non-funded modernisation with capacity increase for the 1997-99 period led to an increase of 2,260 GT/GRT, composed almost entirely (99%) of 4B3 vessels. General entry and exit of vessels from the fishing vessel register has also taken place without public funding. The reason for register entries and exits may have included permanent cessation of fishing (through retirement, bankruptcy, shipwrecking etc.), new entrants to the fishery, vessel modernisation, changes to a vessel's exploitation pattern (e.g. new gear, fishing area or target species etc.), and change of ownership/skipper, resulting in an amendment to the vessel's national ID number, fleet segment classification, etc. Modernisation and change of ownership/skipper are thought to be greatest contributors to changes in the register. Perhaps the most noticeable

development is where previously non-registered vessels entered the register in 1994. It is apparent that these new vessels were small in terms of tonnage and had a bigger impact on the overall engine power of the fleet.

The following figures show the resulting net effect of funded and non-funded capacity adjustment during the 1992-99 period[5].

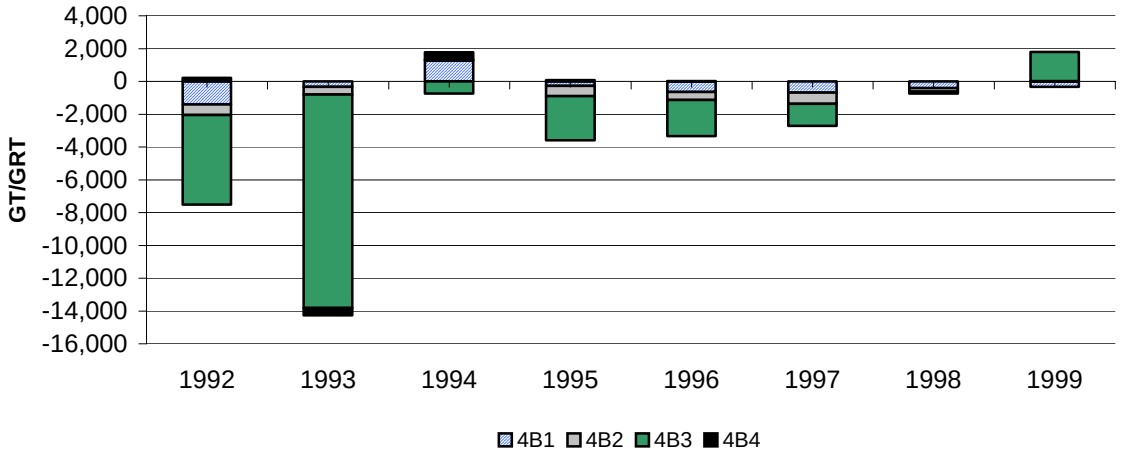

FIGURE 2. **Net GT/GRT change, 1992-99**

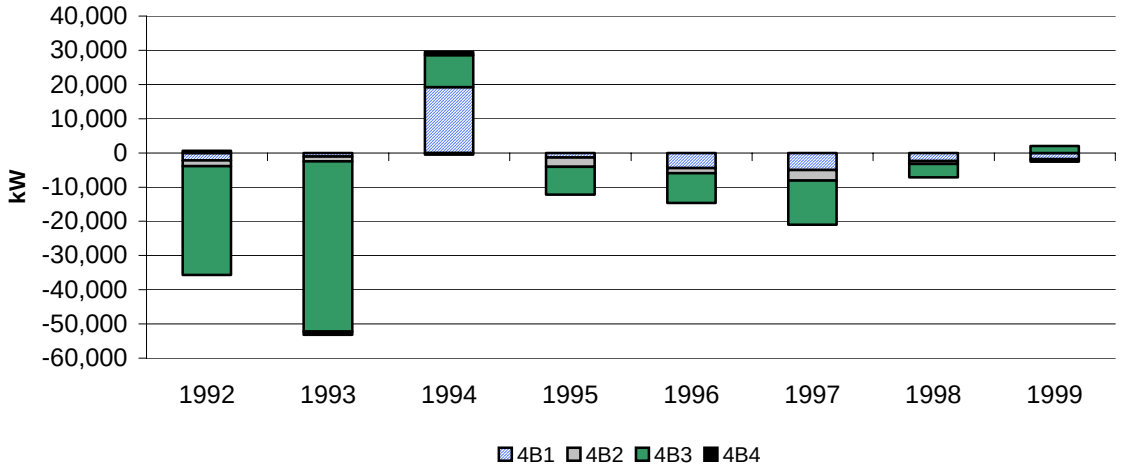

FIGURE 3. **Net kW change, 1992-99**

The 1992-93 period saw a marked reduction in capacity, largely as a result of vessel decommissioning. The 1994 figure shows an increase in tonnage, engine power and vessel number, following the decision by the Directorate of Fisheries to include all fishing vessels in the register. This development is clearly shown in the figures above, with 4B1 vessels accounting for the majority of the capacity increase in 1994. The 1996-98 period saw a comparative stabilisation of the fleet capacity in terms of tonnage, with steady decreases in both engine power and vessel number. In 1999 there were slight increases in both fleet tonnage and engine power. It is clear that despite the 'administrative' changes that occurred during 1994-95, the majority of fleet capacity development during the period has been due to vessels in the 4B3 (trawl and Danish seine) segment. This is hardly surprising as 4B3 segment vessels dominated the Danish fleet in 1999, at least in terms of tonnage and engine power. However, small-scale 4B1 vessels now represent almost three quarters of the number of vessels in the fleet.

Capital adjustment

It may be of interest to examine the capital involved in the capacity adjustment process. That is, what has been the net capital change over the period and how does this compare to the fleet development in physical terms that has already been addressed. The capital (insurance value) data set is sourced from the Directorate of Fisheries database. Figure 4 below portrays the capital development breakdown of the fleet for the 1992-99 period. The capital adjustment process of the fleet has mostly concerned the 4B3 vessels (between 84-87% for all categories). The figure also indicates that the value of the grant does not seem to cover the insurance value of the fishing vessels that are removed from the fishery. Although the figure indicates that the insurance value of newly entered vessels peaked in 1997, this will have largely been offset by the insurance values of vessels removed in the same year.

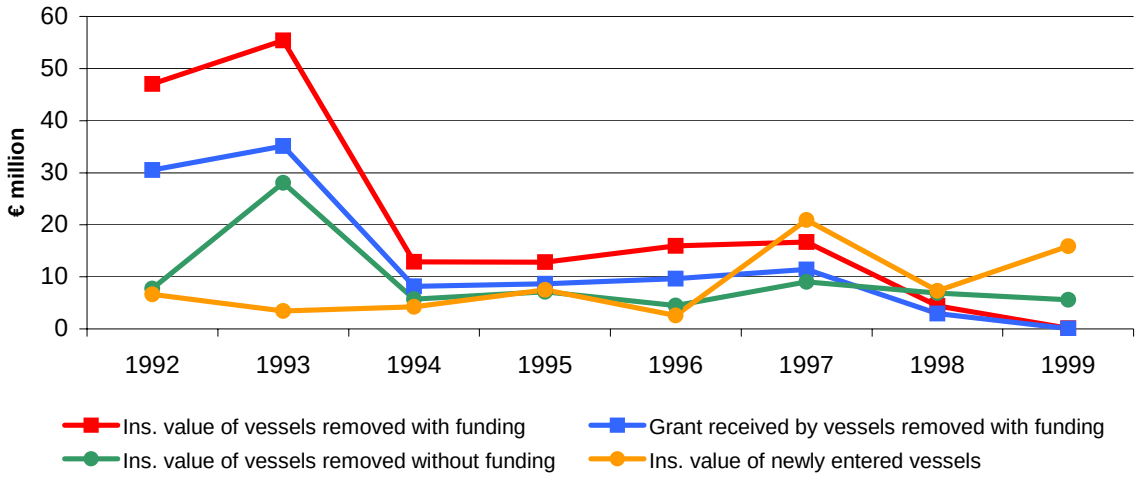

FIGURE 4. **Capital development, 1992-99**

Compared to the fleet adjustment process that has taken place in physical terms (cf. Figures 2 and 3), the capital development seems to provide a similar picture. Recent fishing vessel register data from the online database give additional insight into the overall capacity and capital changes for the 2000-02 period. Figures 5 and 6 below show that substantial reductions, in both physical (vessel tonnage) and capital (insurance value) terms, took place during 1992-93. The introduction of the smaller 4B1 vessels into the register in 1994 had little impact on the continued reduction of overall physical capacity and insurance value of the fleet up until 1996. There has been a steady decrease in the capital value of fishing vessels between 1992-96, although the 1996-2002 period has seen an increase in capital of over 15% in terms of insurance values. Vessel capitalisation in the 4B3 and 4B4 segments is the main reason for this increase.

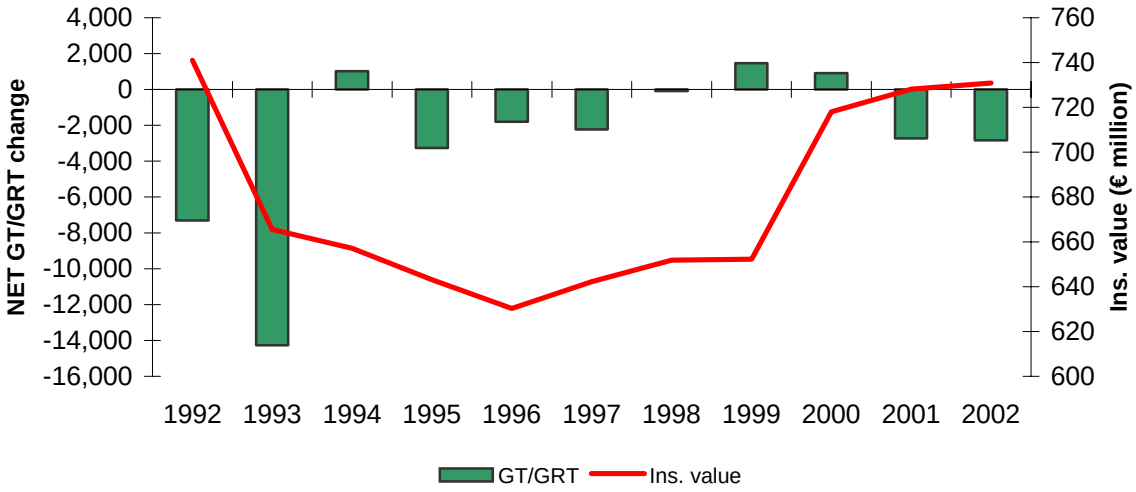

FIGURE 5. **Fleet capacity (GT/GRT) and capital development, 1992-2002**

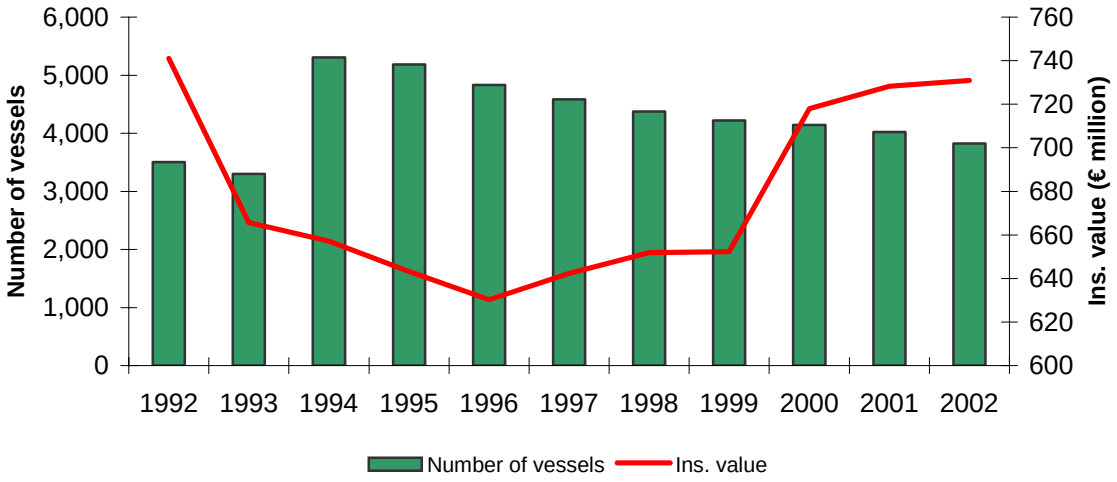

FIGURE 6. **Fleet capacity (vessels) and capital development, 1992-2002**

The steady increase in fleet insurance value since the mid-1990s can be explained by the shift away from capacity reduction, as a result of MAGP IV targets already being met. The main factor for the capital increase is thought to be the continued investment (i.e. modernisation) in existing vessels of the dominant 4B3 and 4B4 segments. This is further supported by the fact that although the number of vessels has decreased since 1994, the vessels removed have probably been marginal players in the fishery, of relatively little capital value. In fact, almost 88% of the number of vessels removed from the register since 1994 have been 4B1 and 4B2 vessels. Vessels from the 4B3 and 4B4 segments, on the other hand, represented over 85% of the total insurance value of the Danish fleet in 1999. The capacity/capital figures for 1997-2002 further indicate that the structural policy is tending towards modernisation and renewal of vessels, especially of the 4B3 and 4B4 segments, leading to an overall increase in fleet capitalisation.

CHARACTERISTICS OF DECOMMISSIONED VESSELS (1995-2002)

In a separate analysis to the abovementioned fleet adjustments, further information has been gathered from the Directorate of Fisheries database to shed light on characteristics of funded decommissioned vessels during 1995-2002. The data shows how the level of decommissioning declined towards the end of the 1990s, but then escalated

in 2001-02. Interestingly, the trends in tonnage, length and financial factors of decommissioning follow a similar trend during the period (cf. Figure 7).

TABLE 5. **Trends in vessel decommissioning, 1995-2002**

	1995	1996	1997	1998	1999	2000	2001	2002	Total
Vessels	52	70	136	42	18	2	8	94	422
GT	2,289	2,864	2,740	698	256	51	1,734	2,972	13,606
Length (m)	857	1,110	1,717	475	190	30	270	1,421	6,070
Grants (€ million)	8.68	10.02	11.43	2.98	1.10	0.24	5.06	15.15	54.67
Ins. value (€ million)	12.89	16.15	16.28	3.78	1.33	0.36	7.70	20.93	79.41

Source: Directorate of Fisheries online database

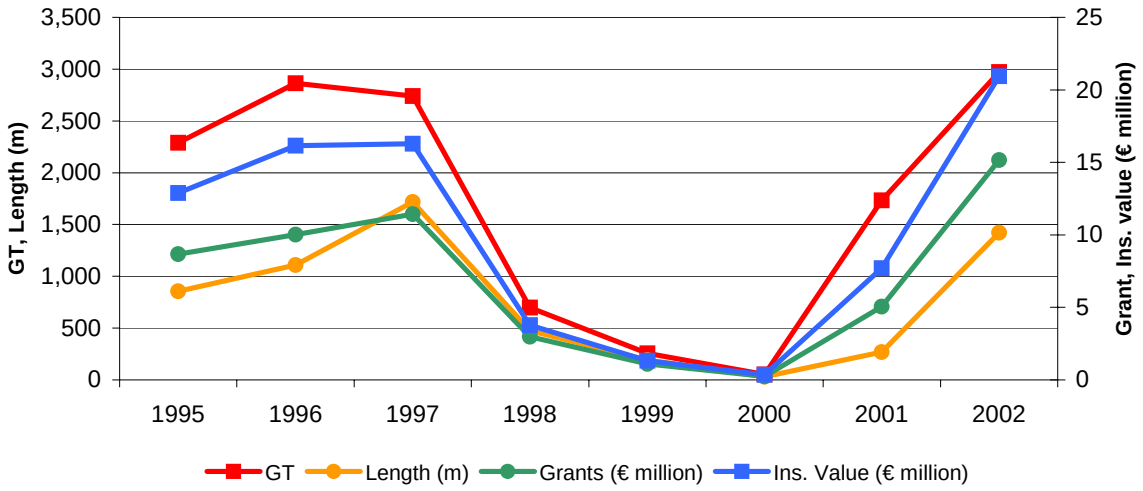

FIGURE 7. **Trends in vessel decommissioning, 1995-2002**

The average characteristics of decommissioned vessels during the period can also be examined on a fishing gear basis (cf. Table 6). This seems to support the trends given in the previous section, where small netters and liners (segment 4B1) seemed to see the largest reductions in terms of vessel number, but due to their small size, were not responsible for as significant capital reductions. Trawlers and seiners (segment 4B3) were of much greater physical size, with greater capital investments in fishing technologies, and therefore contributed to the majority of capital removal from the fishery. The scope of the paper does not, however, allow for more detailed analysis into the contributions of these individual vessels to the overall fishery in terms of catches and revenues. Furthermore, no obvious winners and losers could be identified.

TABLE 6. **Average characteristics of decommissioned vessels, 1995-2002**

	Seine	Trawl	Net/line	Total
Vessels	59	150	213	422
GT	34.1	55.6	15.3	32.2
Length (m)	16.6	17.8	11.3	14.4
Grants (€ million)	0.15	0.20	0.07	0.13
Ins. value (€ million)	0.22	0.30	0.10	0.19

Source: Directorate of Fisheries online database

EFFECTS OF THE DECOMMISSIONING SCHEME

During 1992-2002 the fleet tonnage has decreased, although administrative tonnage conversions and changes in vessel registration have led to fluctuations (cf. Figure 8). During the same period catches have stabilised and steadily decreased since the mid 1990s. There is therefore little evidence to suggest that reductions in fleet sizes during the period have resulted in improved catching opportunities. Through further investigation, catch rates in nominal effort terms have declined from 17.7 tonnes per GT in 1992 to 14.5 tonnes in 2002, with a peak of over 20 tonnes per GT in 1995 (cf. Table 7). Conversely, catch rates in value terms have increased from 31.6 DKK per GT in 1992 to 36.9 DKK in 2002, with slight declines up until the mid-1990s. This seems to depict that despite fleet reductions over the period, catch rates in volume terms have not improved, whereas increases in fish prices have led to improved catch rates in value terms over the period. This trend is supported by analysing catch rates in effective effort terms, where catches per insurance value are considered[6]. This defends the notion that despite fleet reductions in Denmark, the underlying catch opportunities and quota levels in EU waters have not allowed the remaining vessels to significantly improve their aggregate catch rates.

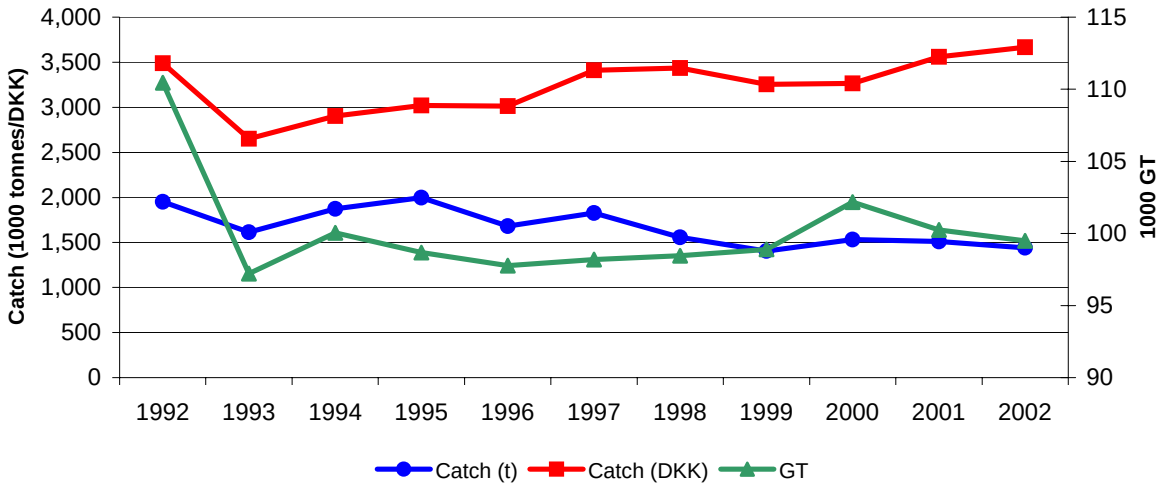

FIGURE 8. **Catch and fleet tonnage development, 1992-2002**

TABLE 7. **Aggregate catch rates, 1992-2002**

	---------- Catch per GT ----------		---- Catch per Insurance value (million DKK) ----	
Year	Tonnes	DKK	Tonnes	DKK
1992	17.7	31.6	354	633
1993	16.6	27.3	326	535
1994	18.7	29.0	383	594
1995	20.3	30.6	418	632
1996	17.2	30.8	359	643
1997	18.6	34.7	382	714
1998	15.8	34.9	321	708
1999	14.2	32.9	287	664
2000	15.0	32.0	283	603
2001	15.1	35.5	276	651
2002	14.5	36.9	264	671

Source: Directorate of Fisheries (2002) and online database, calculated from raw data

Although it is profoundly difficult to directly link fleet reduction with the evolution of capacity and efficiency of Danish vessels, a capacity analysis using Data Envelopment Analysis (DEA) may provide valuable information on the status of fleet segments in static and dynamic settings. The estimation of capacity output shows the extent to which each vessel should expand its catch output compared to best practice vessels on the production possibility

frontier with similar input levels, and can be obtained by solving a linear programming model following the approaches of Färe *et al* (1994) and Kirkley and Squires (1999). Annual aggregated catch and vessel input data for Danish trawlers have been analysed and capacity utilisation scores for the trawler segment for 1996-2002 are depicted below. Here, the capacity utilisation scores range from 0 to 1, where 1 represents full capacity utilisation (or efficiency).

TABLE 8. **Capacity utilisation scores – Danish trawlers**

	1996	1997	1998	1999	2000	2001	2002
Mean	0.51	0.61	0.61	0.64	0.69	0.72	0.67
Median	0.38	0.56	0.54	0.64	0.70	0.72	0.68
St. dev.	0.28	0.27	0.28	0.27	0.23	0.25	0.26
R-sum test	-	0.0016	0.4146	0.1838	0.0959	0.1452	0.1002
Obs	117	105	104	100	126	134	130

The scores seem to indicate that the trawler segment has seen slight improvements in efficiency over the period, but not to any significant extent. The moderate increase in scores may be as a result of the decommissioning of less efficient vessels during the period, but it is not inconceivable that other factors may also be involved. For example, technological progress can expect to result in an outward frontier shift, and hence average vessel efficiency will be lower when compared to the new frontier.

The issue of technological progress is of vital important with regards to capacity reduction initiatives. During the period 1991 to 30 June 2002, the EU fleet realised reductions of approximately 20%, both in terms of vessel tonnage and engine power[7], although to varying degrees across member states and fleet segments. These reductions, however, do not account for technological progress and hence it can be argued that the real extent of capacity reductions have not materialised. For example, if constant returns are assumed, an annual 2% increase in productivity due to technological progress over ten years will need to be offset by a 22% reduction in fishing capacity if *status quo* is to be maintained[8]. Furthermore, since an annual 2% increase is regarded a rather modest estimate, and that all production inputs are not under control allowing input substitution, a 20% nominal reduction in tonnage and engine power over ten years should not be regarded as a highly notable achievement.

A study commissioned by the European Commission suggests that the impact of technological progress on fishing effort can be significant and is highly variable, both in spatial and dynamic terms (Banks *et al* 2001). The study draws on case studies from the Danish Baltic cod trawl fishery, as well as from Scottish, French and Dutch fisheries. The study concludes that although technological progress may undermine reductions in nominal capacity through the increase in productivity, the variations observed for the different fleets, and indeed dynamic variations for the same fleet, suggest that a standard 'correction factor' is not feasible, although a factor of 2% is commonly quoted for fisheries. The Danish fleet has seen technological progress estimated to be around 1.8% per annum on average during 1987-99, with estimates as high as 2.8% per annum during more favourable stock conditions in the 1987-93 period. Subsequent declines in the commercially important cod stock seemingly led to a slowdown in technological investments in the mid to late 1990s. Furthermore, the management system in place is regarded as highly influential in determining the level of technological progress and subsequent increase in productivity. For example, effort regulation is seen to enhance investment behaviour in new technologies, whereas ITQ-based systems tend to lower incentives to invest (Banks *et al* 2001).

The overshooting of the Danish MAGP targets can be interpreted as the Danish policy being a success. A feature of this policy has been to limit the possibility to insert a vessel or extend existing vessels in certain directions without taking the same amount of capacity out of the fleet. Given that the programme has been voluntary, the overshooting may be due to the lack of profitability in the fleet. Also at the beginning of the programme the need for a reduction might have been accumulated and therefore relatively significant (e.g. many older fishermen). Frost *et al* (1995) emphasise that the exit of fishermen under the decommissioning scheme was mainly as a result of strong financial incentives, with gains from exiting the fishery outweighing gains of staying in the fishery.

While the purpose of MAGP has been to reduce fleet capacity it is surprising that the medium and long run issues of this decommissioning programme (which does not correct the production externality) are only dealt with through the management and control of individual vessel capacities. The development in the insurance value of the fleet,

however, indicates that this has not been successful in terms of capital development. From theory, this management approach is known to be cost inefficient. Also, by applying subsidies and private investment for the purposes of modernisation and construction (cf. Tables 3 and 4), additional capital flows into the fishery leading to further welfare losses. The Danish fleet consists of vessels that in general are able to switch fishery during the fishing seasons. Given that several of these fisheries are not access regulated, the result is that the policy has not reduced overcapacity in the most profitable fisheries and consequently too much effort is still attracted in certain fisheries. Further, one of the main purposes of the MAGP has been to relieve the pressure on the fish stocks and balance the capacity with the fishing possibilities produced by the fish stocks. Given the poor development of the vital demersal fish stocks in EU waters, this objective has failed.

CONCLUDING REMARKS

The Danish fishing fleet has been restructured over the last decades, where the main emphasis has been to reduce the size of the fleet through vessel decommissioning. This was especially apparent in the early 1990s. Very strict capacity regulations and funding criteria have limited the impact of construction and modernisation initiatives and have thus supported the vessel decommissioning process. The capacity of the fleet has a result been reduced by between 30% and 40% over the last decade, and is from a pure capacity reduction point of view deemed a success. The Danish industry representatives now criticise the strict regulations on fleet renewal, as they feel that their extensive cutbacks, in excess of requirements, should be rewarded by more investments and improved competitiveness in EU fisheries. A return of the decommissioning programmes in recent years has been the result of recovery plans of commercially important fish stocks and overall declining trends in profitability.

The success of the decommissioning programme has heavily relied on fishermen being drawn out of the fishery for future financial gain, as opposed to what they would otherwise have gained if they had remained in the fishery (Frost *et al*, 1995). Pressure from banks and external creditors can be regarded as equally influential. Decommissioning is also expected to have removed the marginal players first, with remaining vessels reaping the rewards of higher stakes in the overall catching opportunities, leading to relatively unchanged fishing pressures on fish stocks. This, however, cannot be explicitly substantiated by the analyses in this paper.

Capacity decommissioning is expected to result in the improved profitability of individual vessels, a reduction in fishing mortality and improved fish stock growth. However, with continuing declines in fish stocks in the EU region, it remains unclear whether capacity reductions have led to improved rents from the fishery, especially given the international dimension of most fisheries. This is supported by poor developments in physical catch rates observed during the 1992-2002 period, when the Danish fleet was actively reducing in size. Further evidence from analysing capacity utilisation of trawlers indicates that no substantial improvements in fleet efficiency have resulted. Furthermore, despite physical capacity being capped, the capital invested in vessels through modernisation can be expected to continue to increase, as it has done since 1996. This increase in capitalisation is in essence a sign that vessels in the future will continue to increase their catching potential.

In February 2004 the Danish Minister for Fisheries announced the commencement of a new round of funded decommissioning in the order of €6.7 million, half of which is funded by the EU. The justification is to alleviate the economic hardships currently experienced in Danish fisheries, especially resulting from reduced quotas, cod recovery plans and moderate fish prices, and prioritises the removal of old vessels and fishermen. The new round of grants aims to "allow fishermen with economic difficulties the opportunity to leave the fishery on reasonable terms" (FVM 2004). Simultaneously, a further €2.1 million (€1.6 million funded by the EU) is offered for vessel construction[9] to encourage modernisation of an ageing fleet and improved profitability, through better catch quality and higher prices. It is unsettling to note that whilst the European Commission sought to establish a framework under the common fisheries policy reform process in 2002 to remove aid for fleet renewal, it is apparent that funded vessel renewal will continue[10] until being phased out in 2005. This seems to provide further evidence that administrators are maintaining the notion of funded scrapping and building of vessels, which should be regarded as highly unsatisfactory, given that the overall objective is ultimately to re-establish the balance between fishing fleets and available resources.

ENDNOTES

1. Ministerial Announcement No. 669 of 14 July 1994
2. Ministerial Announcement No. 772 of 14 October 1999
3. Ministerial Announcement No. 354 of 17 June 1998
4. 4B1: Vessels (<12 m), except trawlers and Danish seiners, 4B2: Vessels (=>12 m), except trawlers and Danish seiners, 4B3: Trawlers and Danish seiners, 4B4: Purse seiners and pelagic trawlers
5. Similar breakdown of data for the 2000-02 period is unavailable
6. However, catch per unit insurance value is still a partial productivity measure. But because more dimensions of effort are included in the insurance value, we call it effective effort
7. COM(97) 352 final and COM(2002) 483 final
8. Productivity increase of 22% is calculated by $P^*(1.02)^{10}$
9. Funding for construction of vessels > 100GT is conditional on 35% more capacity is withdrawn than the capacity of the new vessel. Funding of smaller vessels of < 100 GT and vessels > 100 GT without funding require only an equal amount of capacity to be withdrawn
10. In accordance with Council Regulations (EC) 2369/02 and 2371/02 of the CFP reform

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