5.3.3.1 EU request on Trevose closure

1.1 The closure

Over a short time-frame, spatial and temporal closures have been in place in the Celtic Sea. The main objective of this industry initiative was to reduce fishing mortality on Celtic Sea cod. During the first quarter of 2005, three rectangles in the Celtic Sea (30E4, 31E4, and 32E3, Figure 1) were closed for fishing except for vessels using pots and creels, or nets with mesh size less than 55 mm. During March 2005, derogation was also given to beam trawlers. During February and March 2006 and 2007, the same three rectangles in the Celtic Sea were closed for fishing except for vessels using pots and creels, or nets with mesh size less than 55 mm. In 2006 and 2007, the part of rectangle 30E4 within 6 nautical miles of the coastal baseline was no longer included in the closure.

The stock unit of cod encompasses ICES Divisions VIIe–k. The area of the three closed rectangles is about 2.5% of the total stock unit area. However, the highest concentrations of cod are found in ICES Divisions VIIfg. The area of the closed rectangles is about 17% of VIIfg. Before the introduction of the closure, landings from rectangles 30E4, 31E4, and 32E3 during the first quarter were on average 18% of the total VIIe–k cod landings.

1.2 The request

ICES received a request from the NWWRAC via the Commission to evaluate the Trevose closure. The basic questions in the request can be summarized as follows.

1. What is the impact of the Trevose closure on the fishery behaviour?
2. What is the impact of the Trevose closure on the status of the demersal stocks affected?
3. What are the main data deficiencies to evaluate the status of Celtic Sea cod?

Main conclusions:

1. There are different responses from the fisheries to the closure of ICES rectangles 30E4, 31E4, and 32E3. French fishing effort of vessels targeting gadoids in the Celtic Sea has decreased considerably since 1999. Although this effort reduction was already initiated before the first year of the closure, the closure has probably been an incentive to a further reduction in effort. The closed rectangles did probably only have limited impact on the Irish fishing activity, which is typically more in the western Celtic Sea. In the more eastern Celtic Sea fishing grounds, there has been some displacement of vessels away from spawning aggregations of cod (e.g. a number of UK vessels), but also some displacement in time (e.g. a number of Belgian vessels). Total effort series are presented in Figure 2 for ICES Divisions VIIe–k and in Figure 3 for ICES Divisions VIIfg..

2. It is not possible to give a quantitative assessment of the impact of this closure on the demersal stocks in the area. Several years of observations are required before any conclusions can be drawn. But in the event of a changed stock status, it will be difficult to quantitatively disentangle the effect of the closure from other factors.

   The potential effects of the Trevose closure can be summarized as follows:

   - Historically, landings and Lpue of Celtic Sea cod has been highest in rectangle 30E4 during the first quarter (and especially during March). The other two closed rectangles also have high Lpue values, but similar Lpues are found in surrounding rectangles. The displacement of fishing activities away from spawning aggregations is therefore expected to have reduced fishing mortality on mature cod during the spawning season, but the effects on other parts of the cod stock in the area are unknown.

   - The closure includes the main cod spawning area in the eastern Celtic Sea. Due to the specific behaviour of cod with large aggregations of adult fish during spawning time (March–April), the closure of the spawning areas to all forms of cod fishing will reduce the disturbance of spawning fish. While the effect of this is expected to be positive, it is unquantifiable at present. However, the spawning ground in the western Celtic Sea is not covered by the closure. In addition, no measures are currently in place to protect recruitment.

   - Other stocks that might be affected by the closure include, *Nephrops*, anglerfish, hake, haddock, whiting, megrim, plaice, and sole. It is unlikely that the closure will have beneficial effects for the stocks of *Nephrops*, anglerfish, hake, and megrim. Landings from the closed rectangles have always been low compared to the total landings of these stocks. The closure has also resulted in some displacement of French fishing activity into the anglerfish/megrim fishery in the Celtic Sea. The closure is expected to have less impact on haddock and whiting than on cod, because the catch rates are not consistently

higher in the closed rectangles compared to surrounding rectangles. The closure overlaps with the main fishing grounds for sole and plaice, but the effect on these stocks is currently unclear.

3. Improved data collection is required to improve the quality of the assessment for cod, and to assess the utility of this measure. ICES encourages the fishing industry to assist in this process. A prerequisite is an adequate assessment of the discarding and highgrading practices in order to get better information on the changes in selectivity and recruitment estimates. Valuable information to serve this purpose could be derived from well designed discard sampling programmes carried out in close collaboration with the fishing industry.

   Although the consistency is good between surveys operating in the area, the catch efficiency for cod in the surveys is low. This results in high variability in the abundance and fishing mortality estimates of these surveys.

2. Impact of the closure on the fishery behaviour

The Belgian, English, French and Irish demersal fisheries are those most affected by the closure. The Spanish fisheries also operates in the Celtic Sea, but the closed rectangles have not been traditional fishing grounds for these fisheries. The main impact of the Trevose closure on the fishery behaviour is summarized below.

Effects on the Belgian beam trawl fleet

Belgium has mainly beam trawlers operating in the Celtic Sea. There are a small number of Belgian vessels fishing with otter-trawls, but their total effort is negligible compared to the total beam trawl effort. The main changes in the Belgian beam trawl fleet behaviour/structure in the Celtic Sea since the early 2000s are:

- Due to effort limitations in the Eastern English Channel in 2004 and 2005, the number of Belgian beamers operating in, and their total effort in the Celtic Sea increased during these two years. In 2006 the effort limitations in the Eastern English Channel were alleviated for beam trawlers and the number of Belgian beamers and their total effort in the Celtic Sea decreased again to the level before 2004.

- The average number of hours fished per year per vessel decreased since the introduction of the temporal box closure in 2005. Belgian effort was also displaced mainly to periods just after the closure.

- Nine Belgian vessels (accounting for approximately 17.6% of the total kW-days in the Celtic Sea) were decommissioned between August 2005 and November 2006. The full impact of this decommissioning will occur from 2007 onwards.

The direct impact of the closure on the fishery behaviour of the Belgian beam trawl fleet is mainly the displacement in effort in space and, predominantly, in time, but not on the overall effort. After all, the closed rectangles are major flatfish fishing grounds, the target species for the Belgian beam trawlers (See also point 5 under Effects on the UK demersal fleets).

Catch rates of cod for the Belgian beam trawlers are traditionally the highest in rectangle 30E4 in March. Closing that rectangle in March (as has been the case since 2006), does have an impact on the efficiency of cod catches for the Belgian beam trawlers. But knowing that the Belgian beam trawlers account on average for < 5% of the total international cod landings, this will probably have only minor effect on the total fishing mortality of cod.

Effects on the French demersal fleets

French trawlers account for the majority of the cod catches. French vessels take on average three quarters of the international cod landings. French fishing effort (time fishing in VIIfg) has been dramatically reduced over the 1999–2006 period by around 65% for the gadoids métiers. This reduction is mostly due to a decrease in the number of vessels involved rather than to a reduction in the mean fishing time per vessel.

Although the effort reduction was already initiated before the closure was in place, it is indubitable that the closure of the cod box has been a strong incentive to a further reduction in effort and especially to those vessels which target gadoids.

The most precise French statistics available from logbooks are at the scale of ICES rectangle, month, and métier .VMS data from UK used at 2006 SSDS WG have shown that fishing effort is not uniformly displayed in an ICES rectangle, probably depending on the nature of fishing grounds and on the species or the group of species targeted. The latter information cannot be known *a posteriori* at a smaller scale than a rectangle.

Although the fleet still operates in the Celtic Sea, it also moved to other fishing grounds outside the Celtic Sea (mainly VIIe). A substantial part of the French gadoid trawlers changed to other, mainly benthic métiers. Species now caught by this fleet include anglerfish, megrim, and elasmobranchs. The impact on the fishing pressure on these species has not been evaluated.

Effects on the Irish demersal fleets

A preliminary analysis of the impact of the closed rectangles in the Celtic Sea on Irish landings and effort showed that the closed rectangles have had limited impact on the Irish fishing activity since 2005. It was also evident that the relative importance of these rectangles to overall Irish landings has never been particularly high.

Effects on the UK demersal fleets

The Trevose cod closure affects a small fleet of UK vessels using otter-trawls, beam trawls, nets, and lines. Many are inshore vessels <10 m long. The total annual effort of vessels that have fished in the closure area since 2000 represents about a third of the total vessel-days for UK vessels operating in VIIe–k. Their cod landings represent about half the UK total for VIIe–k.

The UK fisheries catch a diverse range of species in the Southwest. Cod made up only 5% of the demersal catches of otter-trawl, beam trawl, and fixed-net vessels in VIIf&g during 2000–2007, and 2.5% in VIIe–k.

During 2000–2004 (prior to the introduction of the closure), the closed rectangles yielded only 4–10% of the reported UK cod landings from VIIe–k. The total annual UK cod landings from VIIe–k comprised 6–11% of the international cod landings in this period.

The cod closure in 2005–2007 displaced UK vessels away from spawning aggregations of cod and into surrounding areas with typically lower catch rates of cod. This must have reduced the overall efficiency of these vessels for catching cod.

Many vessels (particularly beam trawlers) fished close to the borders of the closed rectangles during the closure, and fished intensively inside the rectangles when they were re-opened. In 2007 it was noted that catch rates of sole were initially high on re-opening, but fell off rapidly. This may reflect dispersal from spawning grounds as well as the effects of fishing. In 2006 and 2007, cod had already dispersed by the time the rectangles were re-opened in April, and catch rates were relatively low.

In 2006, ICES (ACFM) recommended measures should be put in place to prevent effort increasing outside the closure. However, there is no clear evidence of a general increase in fishing effort (days fished) of UK vessels during the non-closure period to make up for any shortfall in cod catches during the closure in 2005–2007.

The closure is likely to have resulted in a small (although positive) benefit to managing UK fishing activities in line with the quotas for cod since 2005. However, it is difficult to disentangle the benefits from other factors affecting trends in the fisheries throughout VIIe–k.

The closure on its own does not exclude enough UK fishing effort to achieve the relative reduction in fishing mortality advised by ICES but could contribute to a broader package of measures.

3. Impact of the closure on some affected demersal stocks

As well as the impact of the closure on the fleet behaviour, it would also be interesting to have an idea of the impact of the closure on the demersal stocks affected. Such an analysis is not straightforward and, as repeated in several documents on this issue '*it is almost impossible to assess – a posteriori – the impact of a management measure since lots of other things may have changed simultaneously*'.

3.1 Impact of the closure on Celtic Sea cod

Before the introduction of the closure, the closed rectangles accounted for on average 18% of the cod landings. ICES simulated the effect of the changes in behaviour of some fleets on the Celtic Sea cod landings and concluded that the closure has a potential of a 13% reduction of these landings in the year of implementation. One could therefore argue that the closure should have led to a 13% reduction in fishing mortality, compared to what might have happened in the absence of the Trevose closure. Besides, the egg surveys carried out by CEFAS in the 1990s showed a well-defined spawning ground for cod off North Cornwall (Trevose), in the rectangles closed to fishing. Consequently, an analysis of the effect of the closure on the cod stock should start with analysing trends in landings, fishing mortality, and recruitment. Note again that changes in any of these parameters from 2005 onwards cannot, by definition be attributed to the

(in)direct effect of the closure alone since there are surrounding factors (e.g. changes in fleet behaviour, environmental changes, etcetera) that also influence these parameters.

Trends in landings

In 2004, one year before the closure was introduced, a marked drop in landings occurred (−31% compared to 2003). In 2005 and 2006, landings were 15 and 10% lower compared to 2004.

Trends in fishing mortality

The absolute estimate of fishing mortality in 2006 is considered to be uncertain because of the strong retrospective underestimation of fishing mortality and is therefore not further referred to. Fishing mortality (reference ages 2–5) decreased by 11% from 2003 to 2004. In 2005, the first year of the closure, fishing mortality decreased by 4% compared to 2004. Although the absolute levels of fishing mortality for 2003–2005 are probably underestimated, their relative change is more reliable. Note that the percentage decrease in fishing mortality differs considerably according to the reference ages taken.

Note that there are some indications that the largest cod are found in the densest aggregations within the area protected by the box. The average length of cod decreases from the centre of these aggregations. This might (have) change(d) the exploitation pattern on cod. It is too soon to draw any firm conclusions from this, but the possible change in exploitation pattern should be monitored in the future.

Trends in recruitment

The closure includes the main cod spawning area in the eastern Celtic Sea. Due to the specific behaviour of cod with large aggregations of adult fish during spawning time (March–April), the closure of the spawning areas to all forms of cod fishing will reduce the disturbance of spawning fish. While the effect of this is expected to be positive, it is unquantifiable at present. However, the spawning ground in the western Celtic Sea is not covered by the closure. In addition, no measures are currently in place to protect recruitment.

In short, the closure is not designed to enhance recruitment. Though the closed rectangles might protect cod during spawning, there are no measures so far to protect the recruiting cod. Nevertheless, recruitment has been very weak over the last years. The most recent estimates that are available are those of the 2005 year class (born during the first year of the closure) and the indication of another weak year class (see also comments on data deficiencies with regard to recruitment estimation).

3.2 Impact of the closure on other demersal stocks

Other important demersal stocks in the Celtic Sea are elasmobranchs, *Nephrops*, anglerfish, hake, haddock, whiting, megrim, plaice, and sole. It is unlikely that the closure will have beneficial effects for the stocks of *Nephrops*, anglerfish, hake, and megrim. Landings from the closed rectangles have always been low compared to the total landings of these stocks. It is also not clear whether fishing pressure has increased on these species (e.g. it is known that some fleets changed their target behaviour).

Haddock and whiting are predominantly fished by Irish and French fleets. As mentioned before the closure did not have a major impact on the Irish fleet behaviour. The analysis of the closure impact on haddock and whiting is therefore mainly based on French landings and effort statistics. Haddock and whiting landings from rectangles that are now closed were substantial before 2005. Over the period 1999–2004, an average of 7% and 14% of the total annual landings of haddock VIIb–k and whiting VIIe–k were caught during the first quarter in the rectangles that are now closed. However, unlike cod, the relative amount of landings by month has not changed since the introduction of the closure. After all, catch rates of haddock and whiting are not consistently higher in the closed rectangles compared to surrounding rectangles and thus, the overall efficiency of the fisheries for catching haddock and whiting has not changed since the closure. In this respect the closure does not have a direct beneficial effect for the stock of haddock in VIIb–k and of whiting in VIIe–k.

Most Celtic Sea plaice is landed by Belgian vessels (around 50% of the total landings in 2006). France, Ireland, and the UK take the remainder of the landings. During the first quarter, plaice landings from the closed rectangles (especially the most southern rectangle) have been substantial before the introduction of the closure. However, landing rates in the surrounding rectangles could be as high as in the closed rectangles. In addition, landing rates in other periods than the first quarter can be as high. Some fleets have redistributed their effort to surrounding rectangles, while others mostly redistributed their effort in time. The effect on the plaice stock of this changed behaviour is unclear and must be analysed in more detail.

Most Celtic Sea sole is landed by Belgian vessels (on average 2/3 of the total landings), followed by UK vessels (1/4), and the remainder is taken by French and Irish vessels. Rectangles 30E4 and 31E4 are the main fishing grounds for sole. Traditionally a substantial amount of sole is caught during the first quarter of the year. Catch rates of sole are highest in these rectangles 30E4 and 31E4, but can also be high in some surrounding rectangles (especially near the borders). Since the introduction of the closure, many of the beam trawlers fished close to the borders of the closed rectangles during the closure, and fished intensively inside the rectangles just before the closure and/or when they were re-opened. In 2007 it was noted that catch rates of sole were initially high on re-opening, but fell off rapidly. This may reflect dispersal from spawning grounds as well as the effects of fishing. The effect on the sole stock of this changed behaviour is unclear and must be analysed in more detail.

It is known that the spawning grounds for plaice and sole in the eastern Celtic Sea largely overlap with rectangles 30E4 and 31E4. Spawning takes place from December to March (peak period February–March) for plaice, and from March to May for sole. The closure of the spawning areas avoids disruption of spawning and is therefore likely to have positive effects on the spawning success. However, the closure does not cover the total spawning ground and time and no measures are currently in place to protect recruitment.

Elasmobranchs are an important bycatch in most demersal fisheries operating in the Celtic Sea. At present it is not obvious what the effect of the closure on these elasmobranch stocks is.

4 Major data deficiencies

Currently, one of the major obstacles to evaluating the impact of the Trevose closure on cod is the difficulty in quantifying the trends in partial fishing mortality of cod for vessels impacted by the closure since 2005, and in linking these to changes in fishing effort and fishing practices known to have been caused by the closure. Furthermore, the quality of the assessment of Celtic Sea cod needs to be improved. It is not known if the retrospective bias in fishing mortality estimates is due to data deficiencies or to aspects of cod biology, stock structure, or population dynamics not captured by the stock assessment model.

Discards are currently not included in the assessments of Celtic Sea demersal fish, preventing an adequate evaluation of changes in selectivity that may have been caused by the Trevose closure. Discard sampling programmes are now in place for most fleets catching Celtic Sea cod, but the sampling intensity for some major fleets can be quite low. Preliminary results from these programmes show that discard rates of cod can vary between 35% and 65% in number, depending on area and season. Discarding is mainly of small cod, but for some years highgrading can also be important.

Highgrading of cod by French fleets was mainly an issue in 2003–2005 and the catch numbers have been corrected accordingly for these years. However, during these years no observers were onboard the fleets when highgrading occurred (the French discard sampling programme commenced during the second semester of 2005) and the correction was based on length composition comparisons with other fleets. Mainly cod between 35 cm and 46 cm were highgraded. Consequently, the estimates of the recruiting ages in the most recent years are influenced by the approach taken.

Other than the highgrading corrections, discard estimates are not included in the assessment. This is due to a combination of the low sampling rates and the available time-series of discards, which is too short. Given that mainly small cod are discarded, this has an impact on recruitment estimation. In addition, the available surveys have low catch rates in general, leading to a high variability in the abundance and fishing mortality estimates. However, the abundance trends from the French and Irish surveys are consistent.

The catch predictions are very dependent on the assumed recruitment. For example, this year the landings in 2008 and the SSB in 2009 are for 38% and 49% dependent and assumed recruitment. Anecdotal information from the industry on their perception of the catch rates of small cod is frequently available to ICES, but usually data to backup this information is lacking. Valuable information to serve this purpose could be derived from well-designed discard sampling programmes.

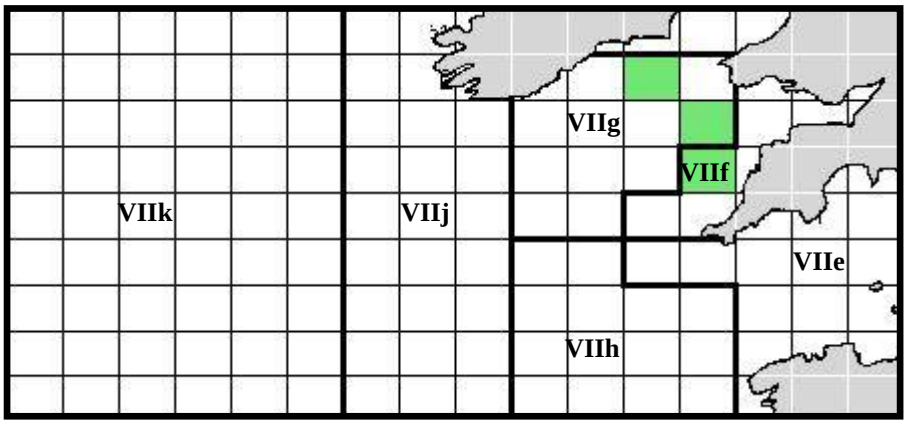

Figure 1 Stock unit of VIIe–k cod, and closed rectangles in ICES Divisions VIIfg (green).

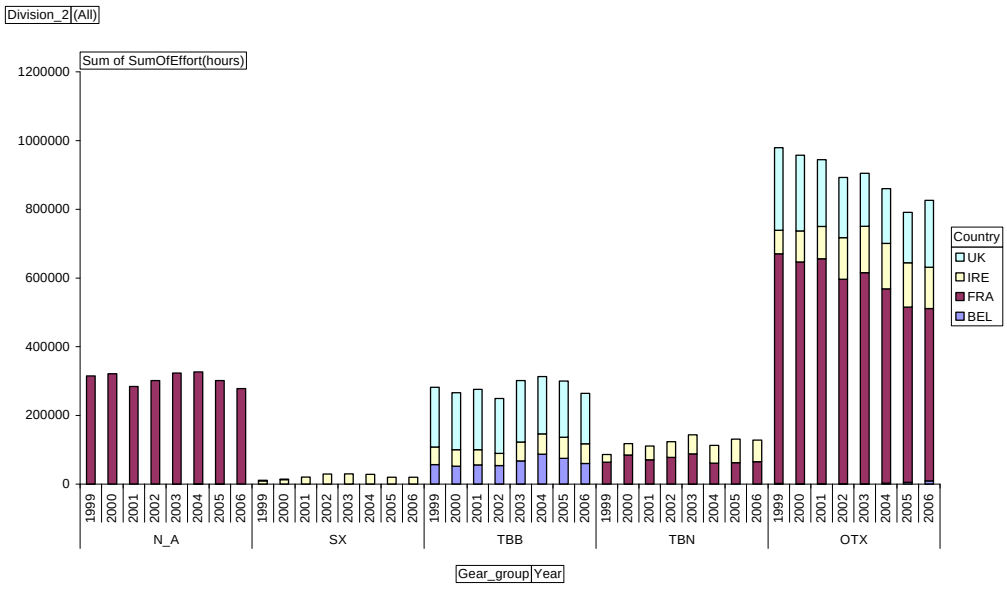

Figure 2 Total effort (fishing hours) in ICES Divisions VIIe–k by gear type (gillnets not included) for Belgium, France, Ireland, and the United Kingdom.

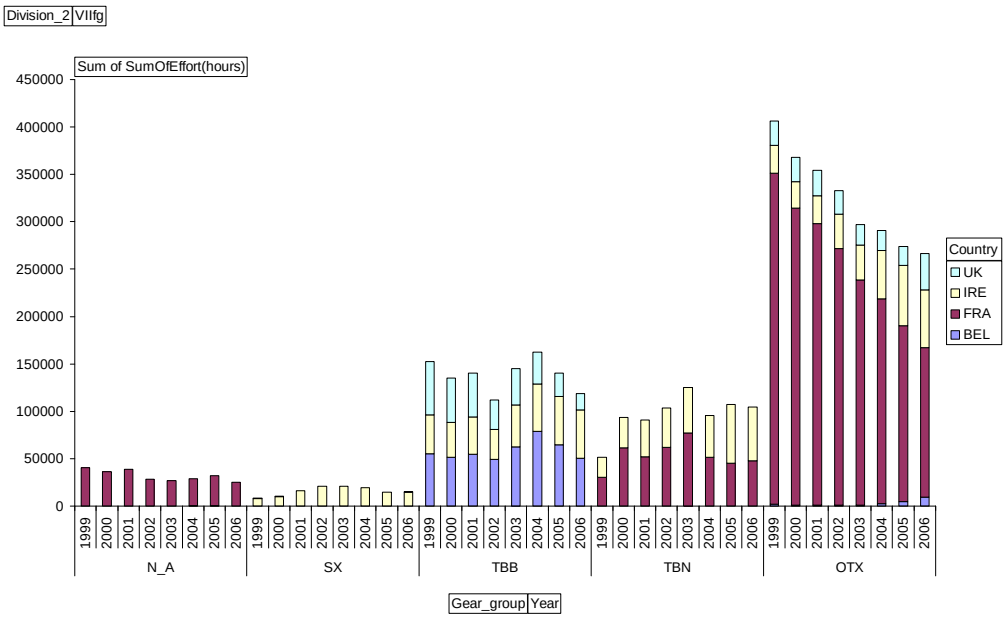

Figure 3 Total effort (fishing hours) in ICES Divisions VIIfg by gear type (gillnets not included) for Belgium, France, Ireland, and the United Kingdom.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, 26 June–5 July 2007 (ICES CM 2007/ACFM:28).